



# NSAI

## ECE TYPE-APPROVAL CERTIFICATE

**E24**

Communication Concerning:<sup>2</sup> ~~Approval granted~~  
~~Approval extended~~  
~~Approval refused~~  
~~Approval withdrawn~~  
~~Production definitively discontinued~~

Of a type of ~~vehicle~~/component/~~separate technical unit~~<sup>2</sup> with regard to Regulation No. 10.  
Of a type of electrical/electronic sub-assembly<sup>2</sup> with regard to Regulation No.10.

Approval No: **E24\*10R06/02\*4791\*00**

Reason for extension:

*-N/A*

1. Make (trade name of manufacturer):

***DFI, ITOX***

2. Type and general commercial description:

***VP070-M8M***  
*Panel PC*

Variant(s):

***See information document for details***

3. Means of identification of type, if marked on the ~~vehicle~~/  
component/separate technical unit<sup>2</sup>:

***Variant designation***

3.1 Location of that marking:

***On the back of the unit***

4. Category of vehicle:

*N/A*

5. Name and address of manufacturer:

***DFI Inc.***  
***10F., No. 97, Sec. 1, Xintai 5th Rd., Xizhi***  
***Dist., New Taipei City 22175, Taiwan***

6. In the case of components and separate technical units,  
location and method of affixing of the approval mark:

***Label affixed on the back of the unit***

7. Address(es) of assembly plant(s):

***DFI Inc.***  
***No.157, Shanying Rd., Gueishan Dist.,***  
***Taoyuan City 333424, Taiwan***



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- |  |  |
|--|--|
| 8. Additional information (where applicable):                | <i>See appendix below</i>                                    |
| 9. Technical service responsible for carrying out the tests: | <b>SGS-YUV Saar GmbH</b><br><b>Am TUV 1 D-66280 Sulzbach</b> |
| 10. Date of test report:                                     | <b>15.06.2023</b>  |
| 11. Number of test report:                                   | <b>TMXD2305001898DV</b>                                      |
| 12. Remarks (if any):  | <i>See Appendix below</i>                                    |
| 13. Place:   | <b>Dublin</b>  |
| 14. Date:  | <b>27<sup>th</sup> July, 2023</b>                            |
| 15. Signature:   |  |



16. The index to the information package lodged with the approval authority, which may be obtained on Request, is attached.

- 
1. Distinguishing number of the country which issued/extended/refused or withdrawn approval. (see Regulation, provisions on approval).
  2. Strike out what does not apply.



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Approval No: E24\*10R06/02\*4791\*00

## Appendix

To type-approval communication concerning the type approval of an electrical/electronic sub-assembly under Regulation No.10.

1. Additional information
  - 1.1. Electrical system rated voltage: *DC 12V~24V, negative ground*
  - 1.2. This ESA can be used on any vehicle type with the following restrictions: *See manufacturer's specifications.*
    - 1.2.1 Installation conditions, if any: *See manufacturer's specifications.*
  - 1.3. This ESA can only be used on the following vehicle types: *N/A*
    - 1.3.1 Installation conditions, if any: *N/A*
  - 1.4. The specific test method(s) used and the frequency ranges covered to determine immunity were: *N/A*
  - 1.5. Laboratory accredited to ISO 17025 and recognized by the Approval Authority responsible for carrying out the tests: *SGS-YUV Saar GmbH*
2. Remarks: *N/A*

Appendix to type-approval communication concerning the type approval of a vehicle under Regulation No.10.

1. Additional information
2. Electrical system rated voltage: *N/A*
3. Type of bodywork: *N/A*
4. List of electronic systems installed in the tested vehicle(s) not limited to the items in the information document: *N/A*
  - 4.1. Vehicle equipped with 24 GHz short-range radar equipment (yes/no/optional)<sup>2</sup>: *N/A*
5. Laboratory accredited to ISO 17025 and recognized by the Approval Authority responsible for carrying out the tests: *N/A*
6. Remarks: *N/A*



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Approval No: E24\*10R06/02\*4791\*00

## Index to the Information Package

Date of issue:	<i>27<sup>th</sup> July, 2023</i>
Date of latest amendment:	<i>N/A</i>
Reason for extension/revision:	<i>N/A</i>
1. Additional conditions, and advisory notes on legal alternatives.	
2. Test report(s)	
- numbers(s):	<i>TMXD2305001898DV</i>
- date of issue:	<i>15.06.2023</i>
- date of latest amendment:	<i>N/A</i>
3. Information document	
- number(s):	<i>IF_TMXD2305001898DV</i>
- date of issue:	<i>15.06.2023</i>
- date of latest amendment:	<i>N/A</i>
Documentation:	<i>237 pages</i>



# NSAI

Approval No: E24\*10R06/02\*4791\*00

## Appendix: **Additional conditions, and advisory notes on legal alternatives**

### A: Additional conditions:

1. The attached technical report, with any of its attachments, forms part of this Type Approval certificate.
2. Each device from series production shall be to the measurements specified in the attached drawings, and shall be manufactured only from the materials specified in the Approval documents.
3. Changes in the type are permitted only with the explicit permission of NSAI. Breaches of this requirement will lead to a withdrawal of the Type Approval, and in addition may be subject to criminal prosecution.
4. At regular intervals, any tests or associated checks prescribed by the applicable legislation to verify continued conformity with the approved type shall be carried out. The manufacturer shall demonstrate compliance with this by submitting to NSAI evidence of adequate arrangements and documented control plans for each type approved.
5. Any set of samples or test pieces showing evidence of non-conformity shall give rise to further sampling and testing and all steps shall be taken to restore conformity of production.
6. This Type Approval will expire when it is surrendered by the holder, or withdrawn by NSAI, or when the approved type no longer conforms to legal requirements. The recall of the Type Approval can be issued by NSAI when the conditions required for the issuing or continuation of the Type Approval are no longer current, or when the Approval holder is in breach of the duties attached to the Type Approval, or when it is established that the approved type no longer meets the requirements of traffic safety.
7. Changes in the company name, address or manufacturing site, as well as in any of the sales or other agents specified in the issuing of the approval must immediately be notified to NSAI.
8. The duties imposed by the issuing of this certificate are not transferable. The legal protection of third parties is not affected by this certificate.
9. When the manufacture or sale of the system, component or separate technical unit has not been started within one year of the date of issue of this certificate, then NSAI is to be informed. This requirement also applies when the manufacture or sale has been halted for more than one year, or when it ought to have been halted for more than one year. The initial commencement of manufacture or sale, or the resumption of manufacture or sale, shall then be notified to NSAI within one month of commencement or resumption.

### B: Legal Options:

Any objection to the requirements set out in this certificate shall be made within one month of the date of issue. The objection shall be made, in writing, to NSAI in Dublin.

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# Technical Report / *Technischer Bericht*

V00

Test standard / *Prüfgrundlage*:  
**UN-R 010**

Level of amendment / *Änderungsstand*:  
**06 Series of Amendments, Supplement 2**

Title / *Titel*  
**Electromagnetic compatibility**

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Manufacturer / *Hersteller*:  
**DFI Inc.**

Type / *Typ*:  
**VP070-M8M**

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Subject of testing / *Gegenstand der Prüfung*:  
**Component**

**0**      **General / Allgemeine Angaben:**

- |       |  |   |
|-------|--|---|
| 0.1   | Make<br>(trade name of manufacturer) /<br><i>Fabrikmarke (Firmenname des Herstellers):</i>   | DFI, ITOX   |
| 0.2   | Type /<br><i>Typ:</i>  | VP070-M8M<br><br>Variant A: VP070-M8M<br>Variant B: VP070-M8M????????????<br>(? = A ~ Z, a ~ z, 0 ~ 9, -, blank, or any character)<br>Explanation: for marketing purpose only |
| 0.2.1 | Commercial description(s) /<br><i>Handelsname(n):</i>  | Panel PC  |
| 0.3   | Means of identification of type, if<br>marked on the vehicle / component<br>/ technical unit /<br><i>Merkmale zur Typidentifizierung,<br/>sofern am Fahrzeug / Bauteil /<br/>an der selbständigen technischen<br/>Einheit vorhanden:</i> | Variant designation   |
| 0.3.1 | Location of that markings /<br><i>Anbringungsstelle dieser Merkmale:</i>   | On the back of the unit   |
| 0.4   | Category of vehicle /<br><i>Fahrzeugklasse:</i>  | -   |
| 0.5   | Manufacturer's name and address /<br><i>Name und Anschrift des Herstellers:</i>  | DFI Inc.<br>10F., No. 97, Sec. 1, Xintai 5th Rd., Xizhi Dist.,<br>New Taipei City 22175, Taiwan, R.O.C.   |
| 0.8   | Name(s) and address(es) of<br>assembly plant(s) /<br><i>Name(n) und Anschrift(en) der<br/>Fertigungsstätte(n):</i>   | DFI Inc.<br>No.157, Shanying Rd., Gueishan Dist.,<br>Taoyuan City 333424, Taiwan  |
| 0.9   | Name and address of<br>representative /<br><i>Name und Anschrift des<br/>Beauftragten:</i>   | -   |
|       | Location of the approval mark /<br><i>Anbringungsstelle des<br/>Genehmigungszeichens:</i>  | Label affixed on the back of the unit   |

**1** Appendices /  
Anhänge:1.1 Test Record /  
Prüfprotokoll: See appendix A /  
Siehe Anhang A1.2 List of modifications /  
Liste der Änderungen: See appendix B /  
Siehe Anhang B**2** Attachments /  
Anlagen:2.1 Information folder /  
Beschreibungsmappe: No. / Nr.: IF\_TMXD2305001898DV  
Date of issue /  
Ausgabedatum: 15.06.2023



**3 Statement of conformity / Schlussbescheinigung:**

The information folder as mentioned under no. 2.1 and the type described therein are in compliance with the test standard mentioned above. With regard to the required level of performance to be achieved, the test specimen were representative for the type to be approved. /

*Die unter Nr. 2.1 angegebene Beschreibungsmappe und der darin beschriebene Typ entsprechen der oben aufgeführten Prüfgrundlage. Die verwendeten Prüfmuster waren im Hinblick auf das erforderliche Leistungsniveau für den zu genehmigenden Typ repräsentativ.*

The tests were carried out in accordance to the relevant requirements of the  
*Die Durchführung der Prüfungen entsprach den relevanten Anforderungen der*

EN ISO/IEC 17025

EN ISO/IEC 17020

**Test Laboratory / Prüflaboratorium  
 SGS-TÜV Saar GmbH**

notified by / benannt durch

KBA Kraftfahrt-Bundes- amt, Germany  <b>No. KBA-P 00084-10</b>	NSAI National Standards Authority of Ireland  <b>No. 101</b>	RDW Rijksdienst voor het Wegverkeer, The Netherlands  <b>No. 99050064 00</b>	TRANSPORT STYRELSEN, Sweden  <b>No. TT 0015</b>
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Formal review (conformity check) by /  
*Formale Konformitätsprüfung durch:*

Authorized by expert /  
*Freigabeverantwortlicher Sachverständiger:*



Victor Wen

Calvin Tzou

Taipei / *Taipeh*, 15.06.2023

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To assess the conformity, the laboratory refers to the "scope classification" of the Kraftfahrt-Bundesamt (KBA) – Federal Motor Transport Authority (in its valid version at the time of testing) and the specified consideration of the measurement uncertainty for the related test procedure.

In case the measurement uncertainty does not need to be considered according to the scope classification, the laboratory considers the result conform if its measured value is within the specification.

In case the measurement uncertainty does need to be considered according to the scope classification, the laboratory considers the result conform if its value incl. its measurement uncertainty is within the specification.

	<b><u>Test record / Prüfprotokoll</u></b>	UN-R10 (SA06, supplement 2)
<b>1</b>	<b><u>Test conditions / Prüfbedingungen</u></b>	
1.1	Test component / <i>Geprüftes Bauteil</i>	
1.1.1	Function description / <i>Funktionsbeschreibung</i>	Panel PC
1.1.2	Type / <i>Typ</i>	VP070-M8M
1.1.3	ESA(s) / variant(s) / <i>EUB(s) / Ausführung(en)</i>	Variant A: VP070-M8M
1.1.4	Tested operating mode(s) / <i>geprüfte(r) Betriebszustand(-zustände)</i>	See test report of the enclosure./ <i>Siehe Prüfbericht in der Anlage.</i>
1.1.5	Tested rated voltage(s) / <i>geprüfte Nennspannung(en)</i>	DC 12V/24V
1.1.6	The approval object is ... / <i>Bei dem Genehmigungsobjekt handelt es sich um ...</i>	
	an ESA that is not related to a connection system for charging a REESS / <i>eine EUB, die nicht im Zusammenhang mit einem Anschlusssystem zum Laden eines REESS steht</i>	<input checked="" type="checkbox"/> yes / <i>ja</i> <input type="checkbox"/> no / <i>nein</i>
	a complete connection system for charging a REESS / <i>ein vollständiges Anschlusssystem zum Laden eines REESS</i>	<input type="checkbox"/> yes / <i>ja</i> <input checked="" type="checkbox"/> no / <i>nein</i>
	a component of a connection system for charging a REESS / <i>eine Komponente eines Anschlusssystems zum Laden eines REESS</i>	<input type="checkbox"/> yes / <i>ja</i> <input checked="" type="checkbox"/> no / <i>nein</i>
	Have the HV voltages and HV currents been taken into account in the tests and measurements? / <i>Wurden die HV-Spannungen und HV-Ströme bei den Prüfungen bzw. Messungen berücksichtigt?</i>	<input type="checkbox"/> yes / <i>ja</i> <input type="checkbox"/> no / <i>nein</i> <input checked="" type="checkbox"/> n.a.
	a light source or a part of a light source acc. to item 3.2.10 of the Regulation / <i>Handelt es sich um ein Gerät, das die Anforderungen des Punktes 3.2.10 der Regelung erfüllt? (Beleuchtung)</i>	<input type="checkbox"/> yes / <i>ja</i> <input checked="" type="checkbox"/> no / <i>nein</i>
	Approval number or number of test report / <i>Genehmigungsnummer oder Nummer des Prüfberichts</i>	<input checked="" type="checkbox"/> n.a.

- 
- 1.1.7 Do the devices of the type have immunity related functions? / *Haben die Geräte des Typs Funktionen im Zusammenhang mit der Störfestigkeit?*  
 Reason if necessary / *Ggf. Begründung:*
- yes / *ja*  
 no / *nein*
- n.a.
- ESA not safety-related according to item 2.12 of the Regulation. / *EUB nicht sicherheitsrelevant nach Punkt 2.12 der Regelung.*
- The device is a Panel PC. The built-in IMU sensor helps to record vehicle moving status. 4G, Wi-Fi, and GPS, as well as rich I/O and built-in SIM card/SD card are provided for flexible connectivity and expandability. The above function is to store or transmit the vehicle location or data to the operation center, Functions and features of this product does not affect the safety of driving and passenger. Variant A: VP070-M8M full test was performed.
- 1.1.8 Do the devices of the type have to be in operation during the engine start phase? / *Müssen die Geräte des Typs während der Motorstartphase in Betrieb sein?*
- yes / *ja*  
 no / *nein*
- 1.1.9 Photo documentation of the examinee including existing labels / *Fotodokumentation des Prüflings inkl. vorhandener Aufschriften*
- See test report of the enclosure./ *Siehe Prüfbericht in der Anlage.*
- 1.1.10 Remarks / *Bemerkungen:*
- n.a.

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1.2 Test equipment / *Prüfeinrichtungen*

Parameter of the test area / *Prüfortparameter:*

The equipment, on which the tests were carried out, fulfilled the requirements of the Regulation. / *Die Prüfungen wurden auf Anlagen durchgeführt, die den Anforderungen der Regelung entsprechen.*

**2 Test Results / Prüfergebnisse**

- |         |   |  |
|---------|---|--|
| 2.1     | Test results in configurations <u>other</u> than „REESS charging mode coupled of the power grid / <i>Prüfergebnisse für <u>andere</u> Konfigurationen als “REESS im Ladebetrieb mit dem Versorgungsnetz gekoppelt”</i>  | <input checked="" type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input type="checkbox"/> n.a.   |
|         | Remarks / <i>Bemerkungen:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.1.1   | Measurement of <u>radiated broadband</u> electromagnetic emissions from electrical/ electronic subassemblies according to item 6.5 of the Regulation / <i>Messungen von <u>gestrahlten breitbandigen</u> elektromagnetischen Störungen aus elektrischen/ elektronischen Unterbaugruppen gemäß Punkt 6.5 der Regelung:</i> | <input checked="" type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input type="checkbox"/> n.a.   |
| 2.1.1.1 | Measurement procedure / <i>Messverfahren:</i>   | Quasi-peak-detector<br><i>Quasi-Spitzenwert-Detektor</i>   |
| 2.1.1.2 | Measurement setup / <i>Messaufbau:</i>  | Anechoic chamber<br><i>Absorberhalle</i>   |
| 2.1.1.3 | Measurement results / <i>Messergebnisse:</i>  | The measured values, expressed in dB $\mu$ V/m, are below the reference limits. See test report of the enclosure./ <i>Die gemessenen Werte bleiben, ausgedrückt in dB <math>\mu</math>V/m, unter den Grenzwerten. Siehe Prüfbericht in der Anlage.</i> |
| 2.1.1.4 | Photo documentation of the measurement setup (if applicable) / <i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>  | See test report of the enclosure./ <i>Siehe Prüfbericht in der Anlage.</i>   |
| 2.1.1.5 | Remarks / <i>Bemerkungen:</i>   | <input checked="" type="checkbox"/> n.a.   |

- |         |   |   |
|---------|---|---|
| 2.1.2   | Measurement of <u>radiated narrowband</u> electromagnetic emissions from electrical/ electronic subassemblies according to item 6.6 of the Regulation /<br><i>Messungen von <u>gestrahlten schmalbandigen</u> elektromagnetischen Störungen aus elektrischen/ elektronischen Unterbau-gruppen gemäß Punkt 6.6 der Regelung:</i> | <input checked="" type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input type="checkbox"/> n.a.  |
| 2.1.2.1 | Measurement procedure /<br><i>Messverfahren:</i>  | Average-detector<br><i>Mittelwert-Detektor</i>  |
| 2.1.2.2 | Measurement setup /<br><i>Messaufbau:</i>   | Anechoic chamber<br><i>Absorberhalle</i>  |
| 2.1.2.3 | Measurement results /<br><i>Messergebnisse:</i>   | The measured values, expressed in dB $\mu$ V/m, are below the reference limits. See test report of the enclosure./<br><i>Die gemessenen Werte bleiben, ausgedrückt in dB <math>\mu</math>V/m, unter den Grenzwerten. Siehe Prüfbericht in der Anlage.</i> |
| 2.1.2.4 | Photo documentation of the measurement setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>   | See test report of the enclosure./<br><i>Siehe Prüfbericht in der Anlage.</i>   |
| 2.1.2.5 | Remarks / <i>Bemerkungen:</i>   | <input checked="" type="checkbox"/> n.a.  |

- |  |   |
|--|---|
| <p>2.1.3 Testing for <u>emission of transient conducted disturbances</u> of electrical/electronic subassemblies on 12/24 V supply lines according to item 6.7 of the Regulation / <i>Prüfung der <u>leitungsgeführten Störaussendungen</u> von elektrischen/elektronischen Unterbaugruppen auf 12/24 V Versorgungsleitungen gemäß Punkt 6.7 der Regelung</i></p> | <p> <input checked="" type="checkbox"/> fulfilled / <i>erfüllt</i><br/> <input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br/> <input type="checkbox"/> n.a.         </p> |
| <p>2.1.3.1 Test results / <i>Prüfergebnisse:</i></p>   | <p>           The limits are kept. See test report of the enclosure. / <i>Die Grenzwerte wurden eingehalten. Siehe Prüfbericht in der Anlage.</i> </p>                                |
| <p>2.1.3.2 Photo documentation of the measurement setup (if applicable) / <i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i></p>  | <p>           See test report of the enclosure. / <i>Siehe Prüfbericht in der Anlage.</i> </p>  |
| <p>2.1.3.3 Remarks / <i>Bemerkungen:</i></p>   | <p> <input checked="" type="checkbox"/> n.a.         </p>   |

- |         |   |  |
|---------|---|--|
| 2.1.4   | Testing for <u>radiated immunity</u> of electrical/ electronic subassemblies to electromagnetic radiation according to item 6.8 of the Regulation /<br><i>Prüfung der <u>gestrahlten Störfestigkeit</u> von elektrischen/ elektronischen Unterbaugruppen gegenüber eingestrahlten elektromagnetischen Feldern gemäß Punkt 6.8 der Regelung:</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.1.4.1 | Test procedure /<br><i>Prüfverfahren:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.1.4.2 | Test setup /<br><i>Prüfaufbau:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.1.4.3 | Test results /<br><i>Prüfergebnisse:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.1.4.4 | Photo documentation of the measurement setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.1.4.5 | Remarks / <i>Bemerkungen:</i>   | <input type="checkbox"/> n.a.  |

ESA not safety-related according to item 2.12 of the Regulation. /  
*EUB nicht sicherheitsrelevant nach Punkt 2.12 der Regelung.*

The device is a Panel PC. The built-in IMU sensor helps to record vehicle moving status. 4G, Wi-Fi, and GPS, as well as rich I/O and built-in SIM card/SD card are provided for flexible connectivity and expandability. The above function is to store or transmit the vehicle location or data to the operation center, Functions and features of this product does not affect the safety of driving and passenger. It belongs to the non-immunity related functions device, according to item 2.12 of the Regulation.



- |         |   |   |
|---------|---|---|
| 2.1.5   | Testing for <u>immunity to transient disturbances</u> conducted along on 12/24 V supply lines of electrical/electronic subassemblies according to item 6.9 of the Regulation /<br><i>Prüfung der <u>Störfestigkeit gegen leitungsgeführte transiente Störungen</u> auf 12/24 V Versorgungsleitungen von elektrischen/elektronischen Unterbaugruppen gemäß Punkt 6.9 der Regelung:</i> | <input checked="" type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input type="checkbox"/> n.a.                                |
| 2.1.5.1 | Test results /<br><i>Prüfergebnisse:</i>  | During the test was no unacceptable degradation. See test report of the enclosure./<br><i>Während der Prüfung trat keine unzulässige Beeinträchtigung auf. Siehe Prüfbericht in der Anlage.</i> |
| 2.1.5.2 | Photo documentation of the measurement setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>   | See test report of the enclosure./<br><i>Siehe Prüfbericht in der Anlage.</i>   |
| 2.1.5.3 | Remarks / <i>Bemerkungen:</i>   | <input checked="" type="checkbox"/> n.a.  |

- |         |  |  |
|---------|--|--|
| 2.2     | Test results in configurations „REESS charging mode coupled of the power grid /<br><i>Prüfergebnisse für Konfigurationen "REESS im Ladebetrieb mit dem Versorgungsnetz gekoppelt"</i>  | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
|         | Remarks / <i>Bemerkungen:</i>  | <input type="checkbox"/> n.a.<br><br>Test component not related to REESS / <i>Geprüftes Bauteil nicht in Zusammenhang mit REESS</i>                              |
| 2.2.1   | Measurement of <u>radiated broadband</u> electromagnetic emissions from electrical/ electronic subassemblies according to item 7.10 of the Regulation /<br><i>Messungen von <u>gestrahlten breitbandigen</u> elektromagnetischen Störungen aus elektrischen/ elektronischen Unterbaugruppen gemäß Punkt 7.10 der Regelung:</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.1.1 | Measurement procedure /<br><i>Messverfahren:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.1.2 | Measurement setup /<br><i>Messaufbau:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.1.3 | Measurement results /<br><i>Messergebnisse:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.1.4 | Photo documentation of the measurement setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.1.5 | Remarks / <i>Bemerkungen:</i>  | <input checked="" type="checkbox"/> n.a.   |

- |         |  |  |
|---------|--|--|
| 2.2.2   | Measurement of emissions of <u>harmonics</u> on AC power lines from electrical/ electronic subassemblies according to item 7.11 of the regulation / <i>Messungen der <u>Oberwellen</u> auf AC-Versorgungsleitungen von elektrischen/ elektronischen Unterbaugruppen gemäß Punkt 7.11 der Regelung</i>  | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.2.1 | Measurement results / <i>Messergebnisse:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.2.2 | Photo documentation of the measurement setup (if applicable) / <i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.2.3 | Remarks / <i>Bemerkungen:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.3   | Measurement of <u>emission of voltages changes, voltage fluctuation and flicker</u> on AC power lines from ESAs according to item 7.12 of the Regulation / <i>Messungen von <u>Spannungsänderungen, Spannungsschwankungen und Flicker</u> auf AC-Versorgungsleitungen von elektrischen/ elektronischen Unterbaugruppen gemäß Punkt 7.12 der Regelung</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.3.1 | Measurement results / <i>Messergebnisse:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.3.2 | Photo documentation of the measurement setup (if applicable) / <i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.3.4 | Remarks / <i>Bemerkungen:</i>  | <input checked="" type="checkbox"/> n.a.   |

- |         |  |  |
|---------|--|--|
| 2.2.4   | Measurement of <u>emission of radiofrequency conducted disturbances</u> on AC or DC power lines from ESAs according to item 7.13 of the Regulation /<br><i>Messungen von <u>hochfrequenten Störungen</u> auf AC- oder DC-Versorgungsleitungen von elektrischen/ elektronischen Unterbaugruppen gemäß Punkt 7.13 der Regelung</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.4.1 | Measurement procedure /<br><i>Messverfahren:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.4.2 | Measurement results /<br><i>Messergebnisse:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.4.3 | Photo documentation of the measurement setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.4.4 | Remarks / <i>Bemerkungen:</i>  | <input checked="" type="checkbox"/> n.a.   |

- |         |   |  |
|---------|---|--|
| 2.2.5   | Measurement of <u>emission of radiofrequency conducted disturbances on network or telecommunication access</u> from ESAs according to item 7.14 of the Regulation /<br><i>Messungen von <u>hochfrequenten Störungen auf Netzwerk- oder Kommunikationsleitungen von elektrischen/ elektronischen Unterbaugruppen gemäß Punkt 7.14 der Regelung</u></i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.5.1 | Measurement procedure /<br><i>Messverfahren:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.5.2 | Measurement results /<br><i>Messergebnisse:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.5.3 | Photo documentation of the measurement setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.5.4 | Remarks / <i>Bemerkungen:</i>   | <input checked="" type="checkbox"/> n.a.   |

- |         |   |  |
|---------|---|--|
| 2.2.6   | Measurement of <u>immunity</u> of ESAs to <u>electrical transient/burst disturbances</u> conducted along AC and DC power lines according to item 7.15 of the regulation / <i>Prüfung der <u>Störfestigkeit</u> von elektrischen/elektronischen Unterbaugruppen gegenüber <u>schnellen Transienten/Burst</u> auf AC- und DC-Versorgungsleitungen gemäß Punkt 7.15 der Regelung</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.6.1 | Photo documentation of the measurement setup (if applicable) / <i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.6.2 | Test results / <i>Prüfergebnisse:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.6.3 | Remarks / <i>Bemerkungen:</i>   | <input checked="" type="checkbox"/> n.a.   |

- |         |   |  |
|---------|---|--|
| 2.2.7   | Measurement of <u>immunity</u> of ESAs to <u>surge</u> conducted along AC and DC power lines according to item 7.16 of the Regulation / <i>Prüfung der <u>Störfestigkeit</u> von elektrischen/ elektronischen Unterbaugruppen gegenüber <u>Surge-Impulsen</u> auf AC- und DC-Versorgungsleitungen gemäß Punkt 7.16 der Regelung</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.7.1 | Photo documentation of the measurement setup (if applicable) / <i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.7.2 | Test results / <i>Prüfergebnisse:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.7.3 | Remarks / <i>Bemerkungen:</i>   | <input checked="" type="checkbox"/> n.a.   |

- |         |  |  |
|---------|--|--|
| 2.2.8   | Testing for <u>emission of transient conducted disturbances</u> of electrical/electronic subassemblies on 12/24 V supply lines according to item 7.17 of the Regulation /<br><i>Prüfung der <u>leitungsgeführten Störaussendungen</u> von elektrischen/elektronischen Unterbaugruppen auf 12/24 V Versorgungsleitungen gemäß Punkt 7.17 der Regelung</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.8.1 | Test results /<br><i>Prüfergebnisse:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.8.2 | Photo documentation of the measurement setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.8.3 | Remarks / <i>Bemerkungen:</i>  | <input checked="" type="checkbox"/> n.a.   |



- |         |  |  |
|---------|--|--|
| 2.2.9   | Testing for <u>radiated immunity</u> of electrical/<br>electronic subassemblies to electromagnetic<br>radiation according to item 7.18 of the Regu-<br>lation /<br><i>Prüfung der <u>gestrahlten Störfestigkeit</u> von<br/>         elektrischen/ elektronischen Unterbau-<br/>         gruppen gegenüber eingestrahlten elektro-<br/>         magnetischen Feldern gemäß Punkt 7.18 der<br/>         Regelung:</i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.9.1 | Test procedure /<br><i>Prüfverfahren:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.9.2 | Test setup /<br><i>Prüfaufbau:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.9.3 | Test results /<br><i>Prüfergebnisse:</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.9.4 | Photo documentation of the measurement<br>setup (if applicable) /<br><i>Fotodokumentation des Messaufbaus (sofern<br/>         erforderlich):</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.9.5 | Remarks / <i>Bemerkungen:</i>  | <input checked="" type="checkbox"/> n.a.   |

- |   |  |
|---|--|
| 2.2.10 Testing for <u>immunity to transient disturbances</u> conducted along on 12/24 V supply lines of electrical/electronic subassemblies according to item 7.19 of the Regulation / <i>Prüfung der <u>Störfestigkeit gegen leitungsgeführte transiente Störungen auf 12/24 V Versorgungsleitungen von elektrischen/elektronischen Unterbaugruppen gemäß Punkt 7.19 der Regelung:</u></i> | <input type="checkbox"/> fulfilled / <i>erfüllt</i><br><input type="checkbox"/> not fulfilled / <i>nicht erfüllt</i><br><input checked="" type="checkbox"/> n.a. |
| 2.2.10.1 Test results / <i>Prüfergebnisse:</i>  | <input checked="" type="checkbox"/> n.a.   |
| 2.2.10.2 Photo documentation of the measurement setup (if applicable) / <i>Fotodokumentation des Messaufbaus (sofern erforderlich):</i>   | <input checked="" type="checkbox"/> n.a.   |
| 2.2.10.3 Remarks / <i>Bemerkungen:</i>  | <input checked="" type="checkbox"/> n.a.   |

3 **Other Information /  
Allgemeine Angaben**

3.1 Date of test / Datum der Prüfung: 17.05.2023 – 27.05.2023

3.2 Place of test / Ort der Prüfung: Compliance Certification Services Inc.  
Xindian Lab.  
No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, Taiwan.

4 **Remarks /  
Bemerkungen:**

n.a.  
Witnessed by: Victor Wen

Hardware version:  
R2

The device is a Panel PC. The built-in IMU sensor helps to record vehicle moving status. 4G, Wi-Fi, and GPS, as well as rich I/O and built-in SIM card/SD card are provided for flexible connectivity and expandability. The above function is to store or transmit the vehicle location or data to the operation center, Functions and features of this product does not affect the safety of driving and passenger. Variant A: VP070-M8M full test was performed.



**List of modifications /**  
**Liste der Änderungen:**

- |   |   |   |
|---|---|---|
| 1 | Correction of /<br><i>Es wird berichtigt:</i> | - |
| 2 | Modification of /<br><i>Es wird geändert:</i> | - |
| 3 | Addition of /<br><i>Es wird hinzugefügt:</i>  | - |
| 4 | Deletion of /<br><i>Es entfällt:</i>          | - |

- End of Technical Report / *Ende des Technischen Berichts* -

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# Test Report

V00

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES  
WITH REGARD TO ELECTROMAGNETIC COMPATIBILITY

Test standard:

**UN-R 010**

Level of amendment:

**06 Series of Amendments, Supplement 2**

Title

**Electromagnetic compatibility**

---

Manufacturer:

**DFI Inc.**

Type:

**VP070-M8M**

---

Subject of testing / *Gegenstand der Prüfung:*

**Component**

**0 General :**

- |     |  |   |
|-----|--|---|
| 0.1 | Make<br>(trade name of manufacturer)   | DFI, ITOX   |
| 0.2 | Type                                   | VP070-M8M<br>Variant A: VP070-M8M   |
| 0.3 | Manufacturer's name and address        | DFI Inc.<br>10F., No. 97, Sec. 1, Xintai 5th Rd., Xizhi Dist.,<br>New Taipei City 22175, Taiwan, R.O.C. |
| 0.4 | Present persons<br>(Testing/Witnessed) | Testing: Angus Chen<br>Witnessed: Victor Wen  |

- 1 **Test object**
- 1.1 **Representative ESA:** Yes
- 1.2 **Description of this ESA:**  
The tested ESA is a DC 12V/24V Panel PC, The built-in IMU sensor helps to record vehicle moving status. 4G, Wi-Fi, and GPS, as well as rich I/O and built-in SIM card/SD card are provided for flexible connectivity and expandability. The above function is to store or transmit the vehicle location or data to the operation center.  
Variant A: VP070-M8M full test was performed.  
Variant B: VP070-M8M??????????????  
(?=A~Z,a~z,0~9," - " or blank ,any character)  
For marketing purpose only
- 1.3 **Nominal operating voltage:** DC 12V/24V
- 1.4 **Operation mode:**  
Possible mode(s):  
Mode 1: Normal Operation (DC 12V)  
Mode 2: Normal Operation (DC 24V)  
  
Tested mode(s):  
Mode 1: Normal Operation (DC 12V)  
Mode 2: Normal Operation (DC 24V)  
  
Normal Operation means during test, Setup whole system for test, refer to Appendix 1, Page 2 of 21 and Page 3 of 21 setup diagram. Turn on power and perform operations software to test (Step: 1. Lan port; 2. CAN BUS; 3. COM 1; 4. COM 2; 5. USB; 6. Wi-Fi; 7. BT; 8. LTE).
- 1.5 **Remarks:** ESA not safety-related according to item 2.12 of the Regulation. /  
*EUB nicht sicherheits relevant nach Punkt 2.12 der Regelung.*

**2      Test record**

**2.1      Test equipment:**

The equipment, on which the tests are carried out, fulfilled the requirements of the above mentioned directive.

**Executed tests:**

- Measurement of radiated broadband electromagnetic emissions from electrical/electronic subassemblies according to UN-R 010, 06 Series of Amendments, Annex 7.
- Measurement of radiated narrowband electromagnetic emissions from electrical/electronic subassemblies according to UN-R 010, 06 Series of Amendments, Annex 8.
- Testing for immunity to and emission of transients of electrical/electronic subassemblies according to UN-R 010, 06 Series of Amendments, Annex 10.

**Environment:**

- Temperature:                    21.9 – 24.3 °C
- Relative humidity:            53 - 55 %
- Details of mains power:    DC 13.5V/27V

**2.2      Test Results:**

At all performed tests, the requirements of the Regulation UN-R 010, 06 Series of Amendments, were fulfilled.  
The detailed results are given in the appendix 1 to 3

**2.3      Other information:**

Compliance Certification Services Inc.  
Xindian Lab.

**Place of testing:**

No.163-1, Jhongsheng Rd., Xindian Dist.,  
New Taipei City, Taiwan.

**Test period:**

Start: 17.05.2023  
End: 27.05.2023

**2.4      Remarks:**

n.a.



**3**      **Appendix:**

- |                                 |  |
|---------------------------------|--|
| <b>1. Appendix test result:</b> | Measurement of radiated broadband and narrowband electromagnetic emissions from electrical/electronic subassemblies according to UN-R 010, 06 Series of Amendments, Annex 7 and 8. |
| <b>2. Appendix test result:</b> | Testing for immunity of electrical/electronic subassemblies against disturbances conducted along supply lines according to UN-R 010, 06 Series of Amendments, Annex 10, item 2.    |
| <b>3. Appendix test result:</b> | Measurement of conducted emission of transients along supply lines of electrical/electronic subassemblies according to UN-R 010, 06 Series of Amendments, Annex 10, item 3.        |
| <b>4. Appendix:</b>             | Photo documentation of the ESA.  |
| <b>5. Disclaimer:</b>           | Disclaimer document.   |

4. **Statement of conformity:**

With regard to the required level of performance to be achieved, the tested items were representative for the type to be approved (see 1.2).

The tests were carried out in accordance with the relevant requirements of ISO/IEC 17025:2017.

This Test Report comprises pages 1 to 6 and 7 to 63 pages of appendix.

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Report No.: TRS\_TMxD2305001898DV

Place: Taipei

Date: 15.06.2023

Technical Responsibility for Area of Testing

Name / name: Victor Wen  
EMC Expert



Test Operator

Name / name: Angus Chen  
EMC Lab. test engineer



**Measurement of radiated broadband and narrowband electromagnetic Emissions from electrical/electronic subassemblies according to UN-R 010, 06 Series of Amendments, Annex 7 and 8**

**Appendix 1**

<b>Test Procedure:</b>	CISPR 25: Second edition 2002 and corrigendum 2004.
<b>Antenna distance:</b>	1m
<b>Antenna height:</b>	1m
<b>Mounting of ESA:</b>	On a wooden table (height 0.9 m) with metal plate. Wiring harness and ESA placed on insulating material with a thickness of 5 cm (see pictures).
<b>Detector:</b>	Average (narrowband) Quasi-peak (broadband)
<b>Operation mode:</b>	The test was performed with DC 13.5V/27V test voltage
<b>Test results:</b>	<p>Indicate the maximum values of the measuring over the frequency domain of 30 -1000 MHz (horizontal and vertical polarization / bandwidth 120 kHz, 50 kHz steps, 1s(QP) / 5ms(Avg) dwell time); they have to be compared with the limits</p> <p><u>Results:</u></p> <p>The measurement results are below the specified limits for the ESAs, so the test is passed.</p>
<b>Remark:</b>	Tested with requirements for a DC 12V/24V device

**Test equipment:**

**Equipment Used for Radiation Emission Measurement**

966 Chamber D (CISPR 25)					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI	101202	08/05/2022	08/04/2023
Antenna	Schwarzbeck	BBA 9106 (VHBB 9124)	749RX	01/07/2023	01/06/2024
Antenna	Schwarzbeck	VUSLP 9111	405RX	01/07/2023	01/06/2024
N-Type Cable	EMEC	CFD400E-LW	SD-R084	04/14/2023	04/13/2024
Pre-Amplifier	EMCI	EMC330H	980111	08/11/2022	08/10/2023
Thermo-Hygro Meter	Wisewind	N/A	SD-R027	08/23/2022	08/22/2023
LISN	Schwarzbeck	NNBM 8124	01734	01/11/2023	01/10/2024
LISN	Schwarzbeck	NNBM 8124	01735	01/11/2023	01/10/2024
Software	EZ-EMC Ver.CCS-03A1				

**The measurement uncertainty**

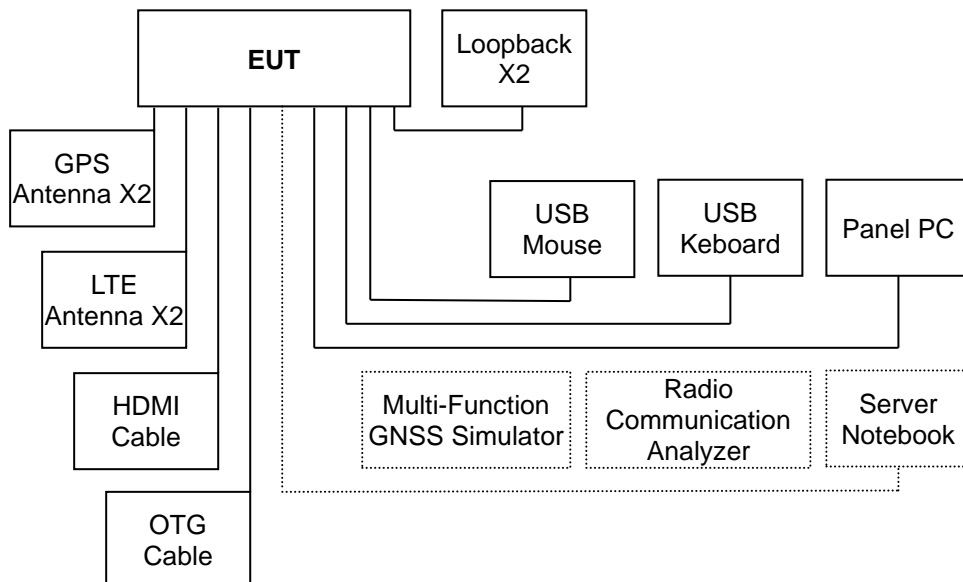
Test Site	Frequency (MHz)	Expanded Uncertainty
966 Chamber	30 ~ 200	± 6.0dB
	200 ~ 1000	± 6.0dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

**Setup diagram:**

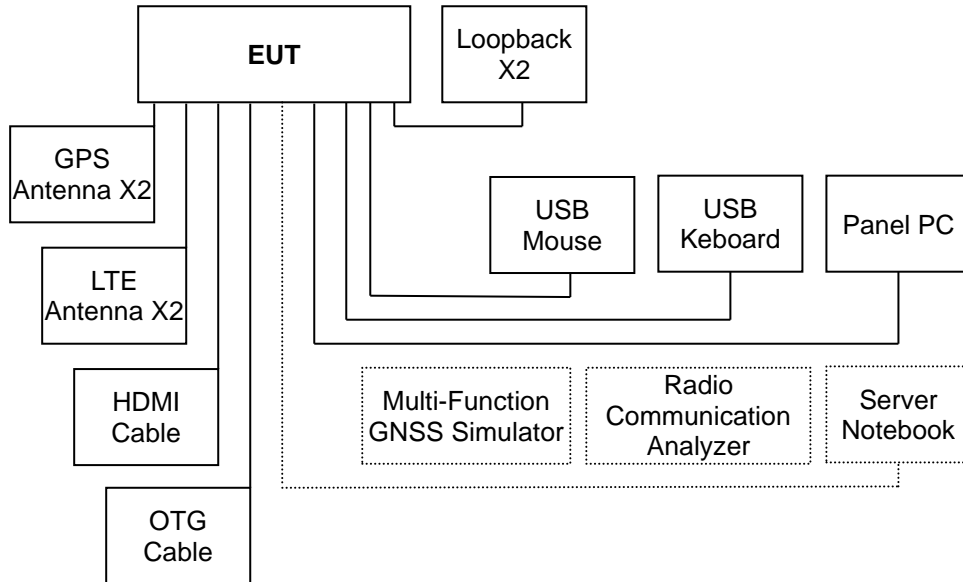
Mode 1:

Normal Operation (DC 12V)



**Mode 2:**

Normal Operation (DC 24V)



**Simulator stable state:**

During test, Setup whole system for test, refer to Appendix 1, Page 2 of 21 and Page 3 of 21 setup diagram. Turn on power and perform operations software to test (Step: 1. Lan port; 2. CAN BUS; 3. COM 1; 4. COM 2; 5. USB; 6. Wi-Fi; 7. BT; 8. LTE)

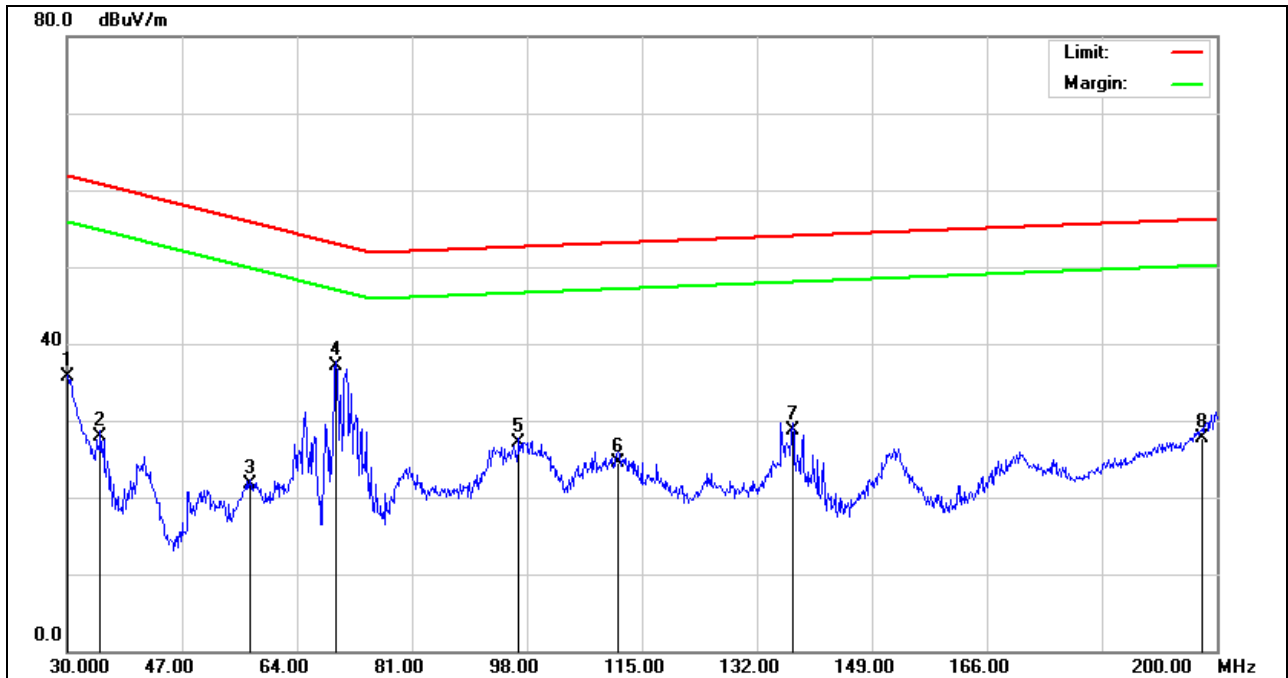
**Measurement graphs and final result**

**Variant A: VP070-M8M**

**Mode 1: Normal Operation (DC 12V)**

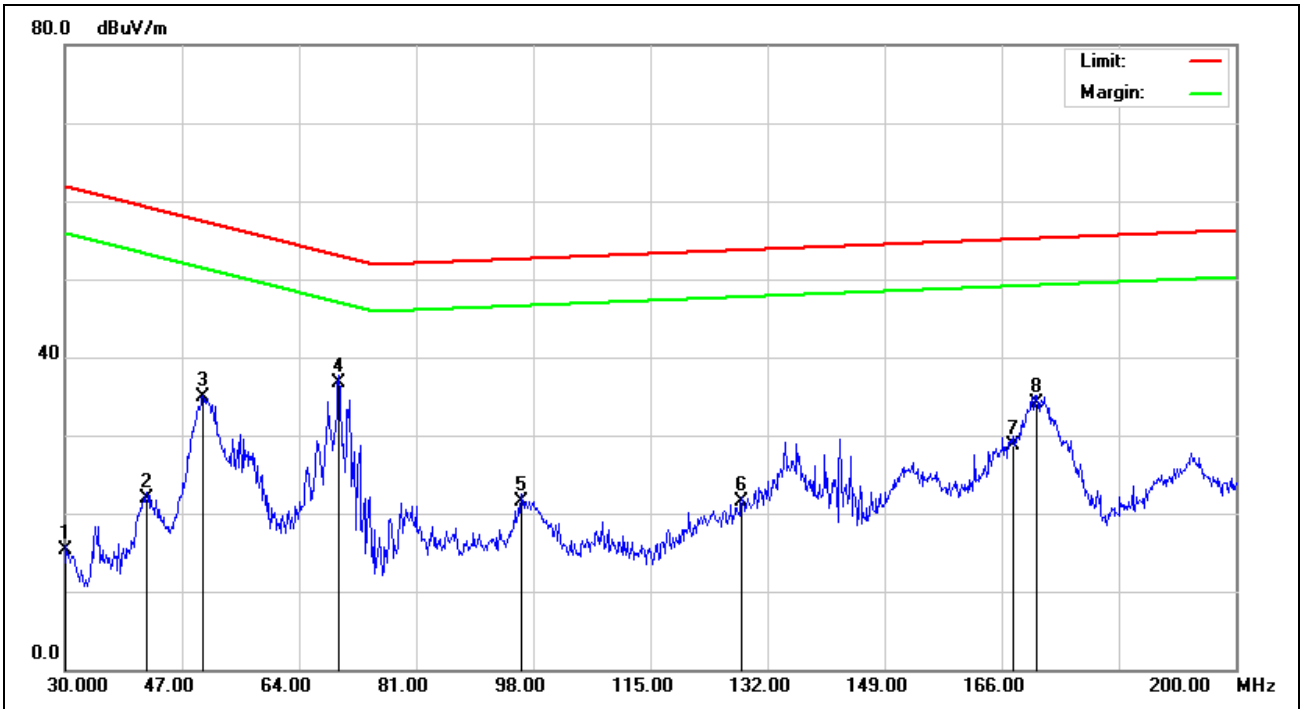
**BROADBAND:**

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Vertical</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 13.5V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>30MHz to 200MHz</b>



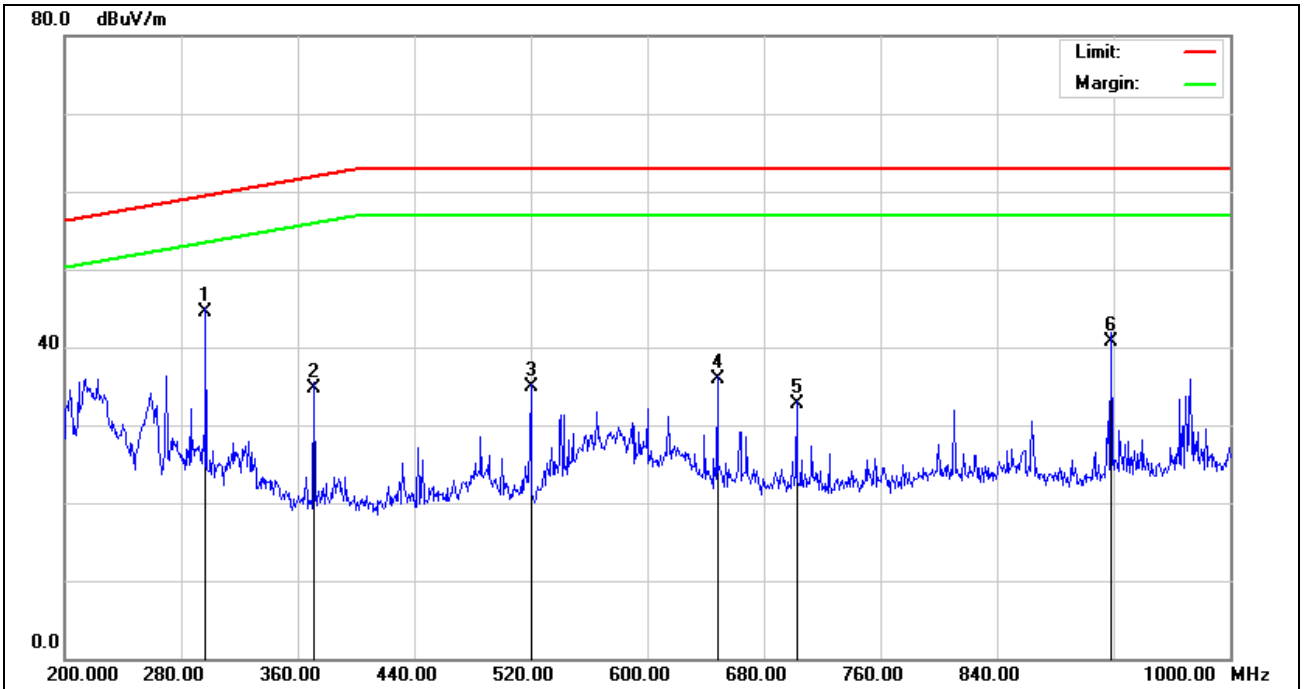
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	30.1700	53.60	-17.92	35.68	61.96	-26.28	QP	V	
2	34.9300	45.80	-17.99	27.81	60.90	-33.09	QP	V	
3	57.0300	41.00	-19.23	21.77	55.99	-34.22	QP	V	
4	69.7800	57.20	-20.19	37.01	53.16	-16.15	QP	V	
5	96.8100	46.80	-19.78	27.02	52.74	-25.72	QP	V	
6	111.4300	43.60	-19.11	24.49	53.23	-28.74	QP	V	
7	137.2700	46.50	-17.87	28.63	54.11	-25.48	QP	V	
8	197.7899	42.30	-14.61	27.69	56.16	-28.47	QP	V	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 13.5V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>30MHz to 200MHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	30.1700	33.20	-17.92	15.28	61.96	-46.68	QP	H	
2	41.9000	40.10	-18.15	21.95	59.36	-37.41	QP	H	
3	50.0600	53.40	-18.50	34.90	57.54	-22.64	QP	H	
4	69.7800	56.90	-20.19	36.71	53.16	-16.45	QP	H	
5	96.3000	41.40	-19.80	21.60	52.72	-31.12	QP	H	
6	128.2600	39.80	-18.20	21.60	53.80	-32.20	QP	H	
7	167.7000	45.10	-16.45	28.65	55.14	-26.49	QP	H	
8	171.1000	50.40	-16.24	34.16	55.25	-21.09	QP	H	

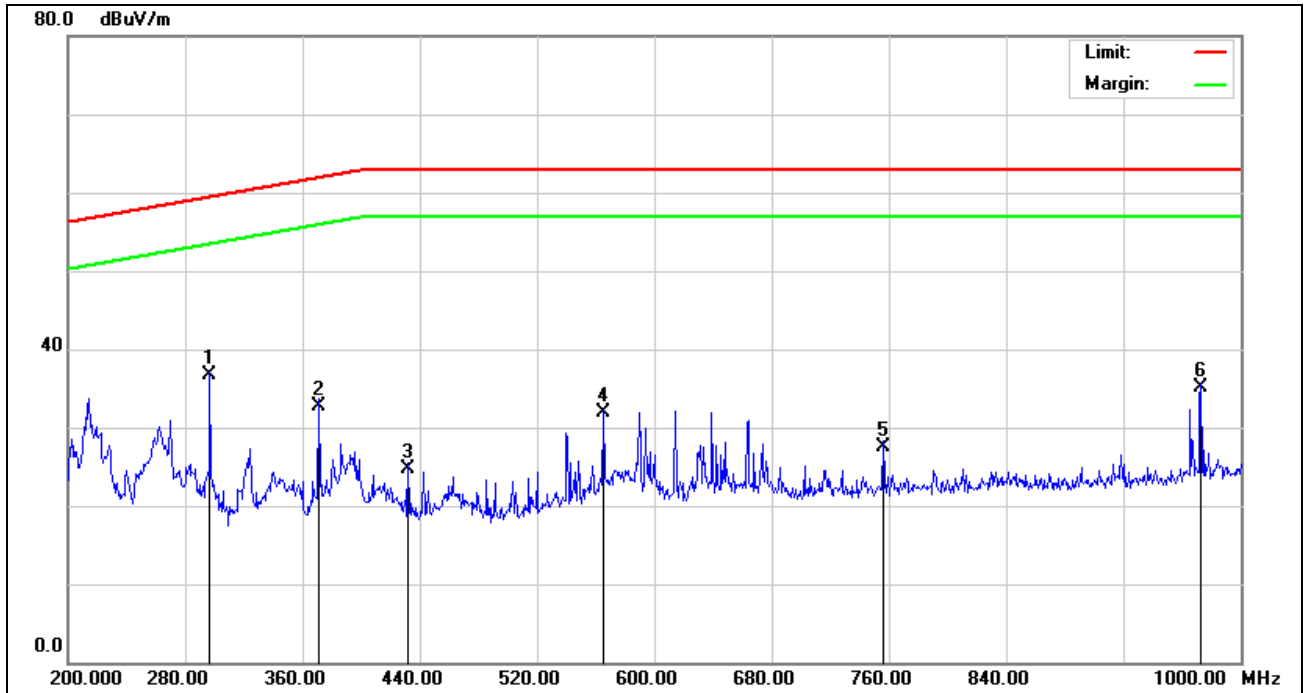
<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Vertical</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 13.5V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	296.8000	59.00	-14.53	44.47	59.51	-15.04	QP	V	
2	371.2000	47.20	-12.42	34.78	62.03	-27.25	QP	V	
3	520.0000	45.50	-10.60	34.90	63.00	-28.10	QP	V	
4	648.0000	44.90	-8.99	35.91	63.00	-27.09	QP	V	
5	702.4000	40.70	-7.92	32.78	63.00	-30.22	QP	V	
6	918.4000	46.50	-5.80	40.70	63.00	-22.30	QP	V	



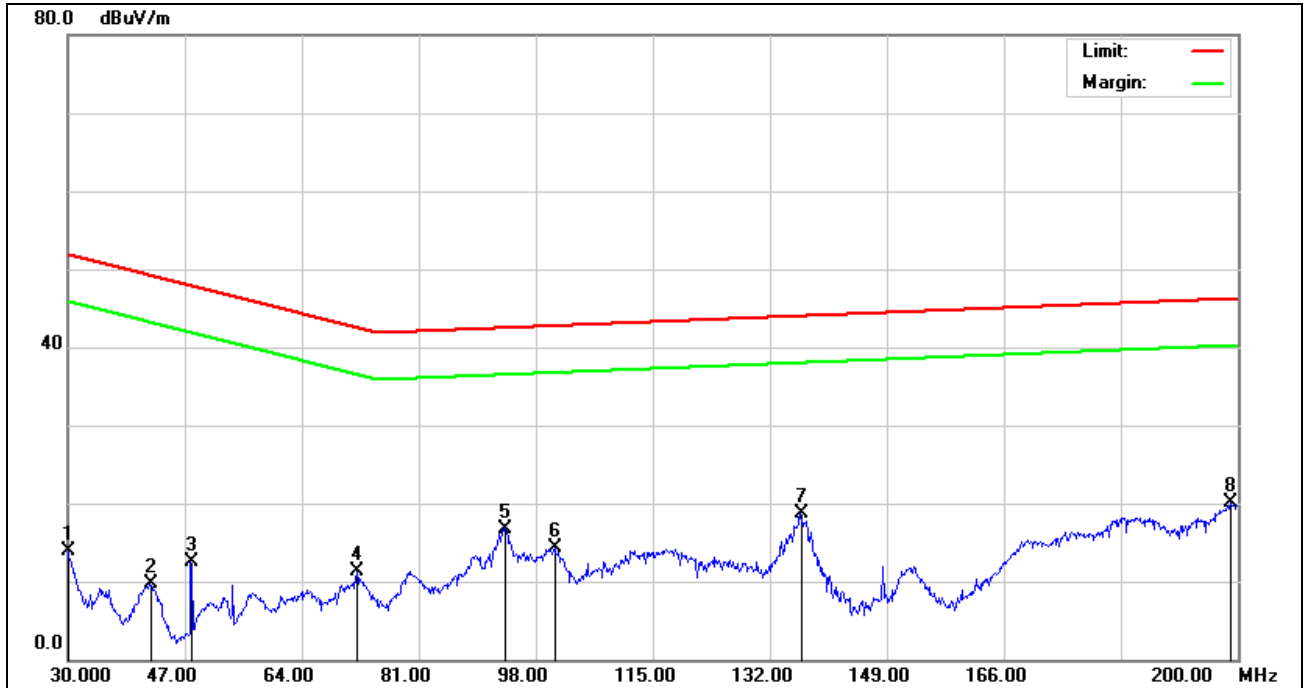
<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 13.5V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	296.8000	51.20	-14.53	36.67	59.51	-22.84	QP	H	
2	371.2000	45.20	-12.42	32.78	62.03	-29.25	QP	H	
3	432.0000	36.40	-11.73	24.67	63.00	-38.33	QP	H	
4	565.6000	41.80	-9.97	31.83	63.00	-31.17	QP	H	
5	756.0000	34.20	-6.63	27.57	63.00	-35.43	QP	H	
6	972.8000	39.90	-4.73	35.17	63.00	-27.83	QP	H	

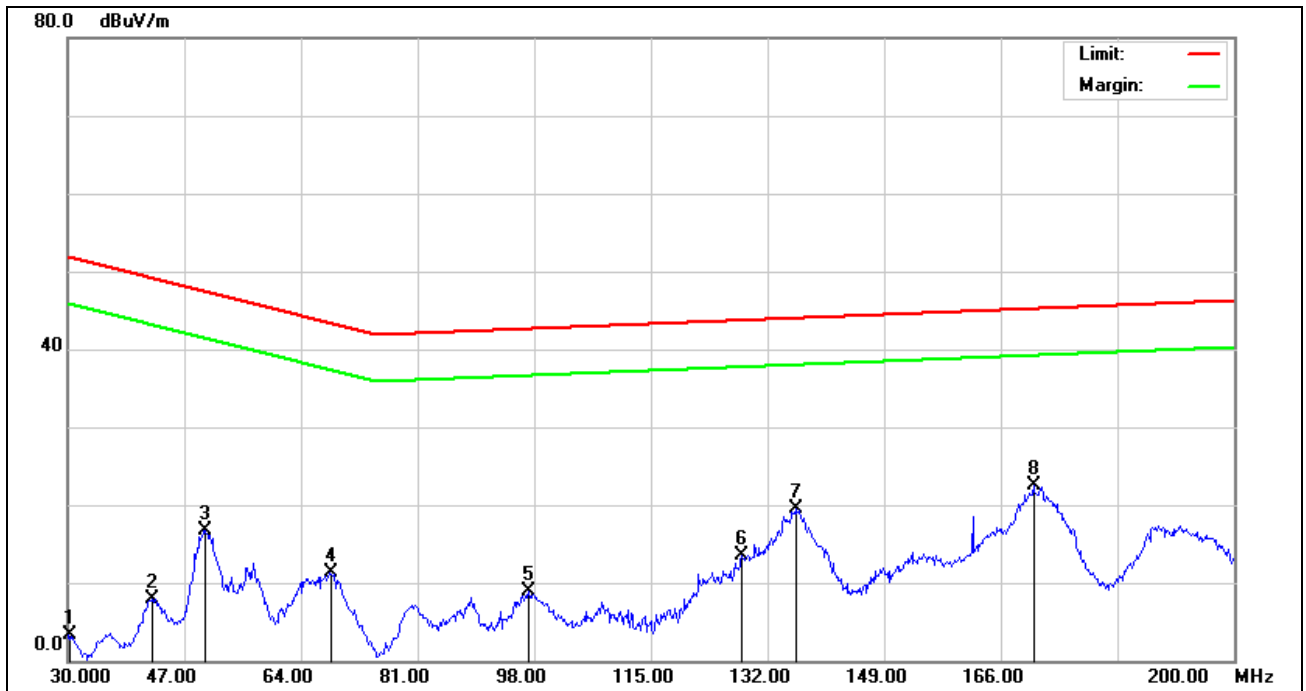
**NARROWBAND:**

Model No.	VP070-M8M	Polarization:	Vertical
Test item:	Radiation Test	Power Source:	DC 13.5V
Temp.(°C)/Hum.(%):	24.3(°C)/55%	Engineer Signature:	Angus Chen
Date of Test:	2023/5/27	Test Frequency:	30MHz to 200MHz



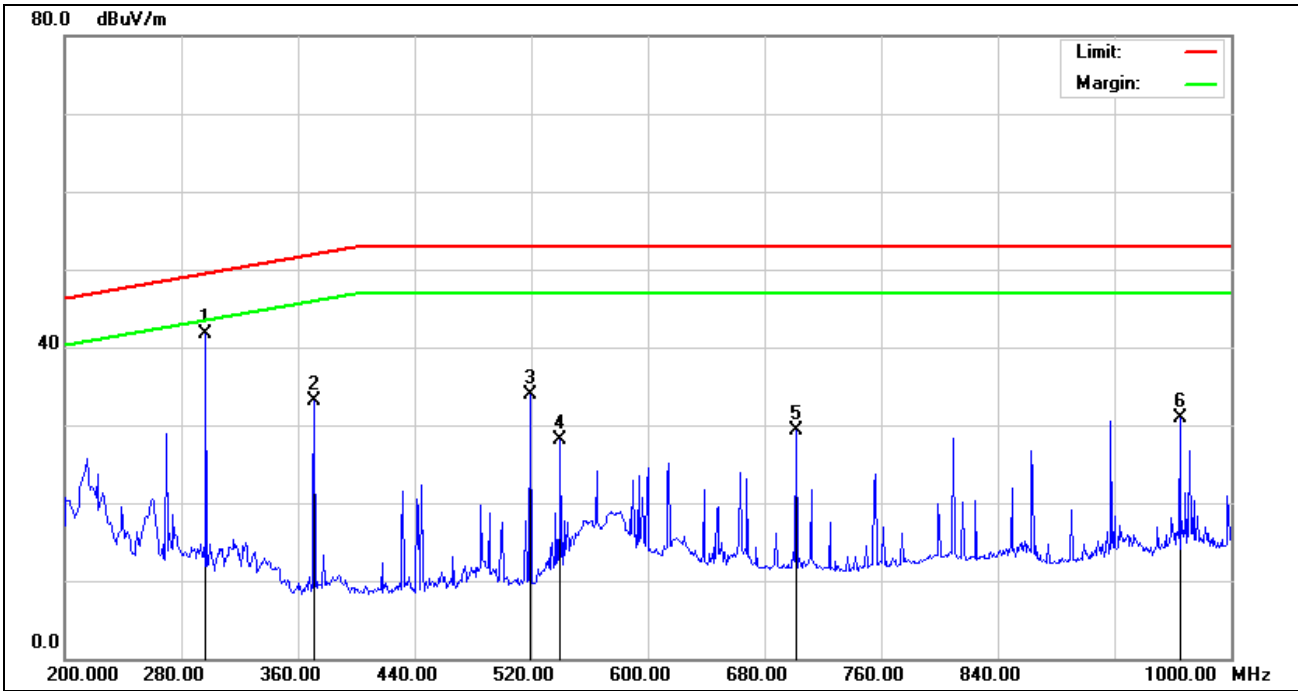
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	30.0000	31.80	-17.92	13.88	52.00	-38.12	AVG	V	
2	42.0400	27.88	-18.15	9.73	49.32	-39.59	AVG	V	
3	48.0000	30.87	-18.36	12.51	48.00	-35.49	AVG	V	
4	72.0400	31.57	-20.24	11.33	42.66	-31.33	AVG	V	
5	93.6800	36.74	-19.94	16.80	42.63	-25.83	AVG	V	
6	100.7600	33.84	-19.59	14.25	42.87	-28.62	AVG	V	
7	136.5600	36.67	-17.89	18.78	44.08	-25.30	AVG	V	
8	199.0000	34.66	-14.54	20.12	46.20	-26.08	AVG	V	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 13.5V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>30MHz to 200MHz</b>



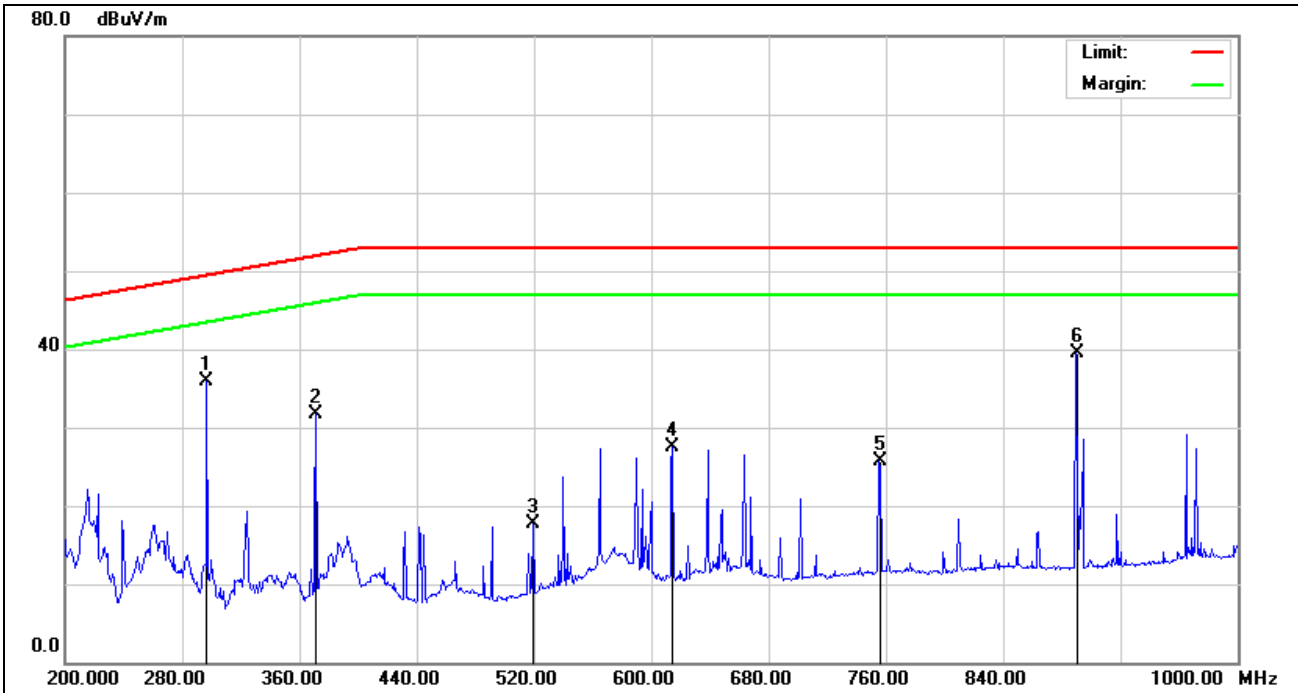
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	30.2800	21.14	-17.93	3.21	51.94	-48.73	AVG	H	
2	42.4000	26.15	-18.15	8.00	49.24	-41.24	AVG	H	
3	50.0800	35.25	-18.50	16.75	47.54	-30.79	AVG	H	
4	68.3200	31.38	-20.09	11.29	43.48	-32.19	AVG	H	
5	97.2400	28.72	-19.76	8.96	42.75	-33.79	AVG	H	
6	128.3200	31.73	-18.20	13.53	43.80	-30.27	AVG	H	
7	136.2000	37.38	-17.90	19.48	44.07	-24.59	AVG	H	
8	170.8400	38.72	-16.26	22.46	45.24	-22.78	AVG	H	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Vertical</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 13.5V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	297.0000	56.21	-14.51	41.70	49.51	-7.81	AVG	V	
2	371.2400	45.61	-12.42	33.19	52.03	-18.84	AVG	V	
3	519.7600	44.49	-10.60	33.89	53.00	-19.11	AVG	V	
4	540.0400	38.49	-10.31	28.18	53.00	-24.82	AVG	V	
5	701.9999	37.33	-7.93	29.40	53.00	-23.60	AVG	V	
6	965.2399	35.77	-4.91	30.86	53.00	-22.14	AVG	V	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 13.5V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>

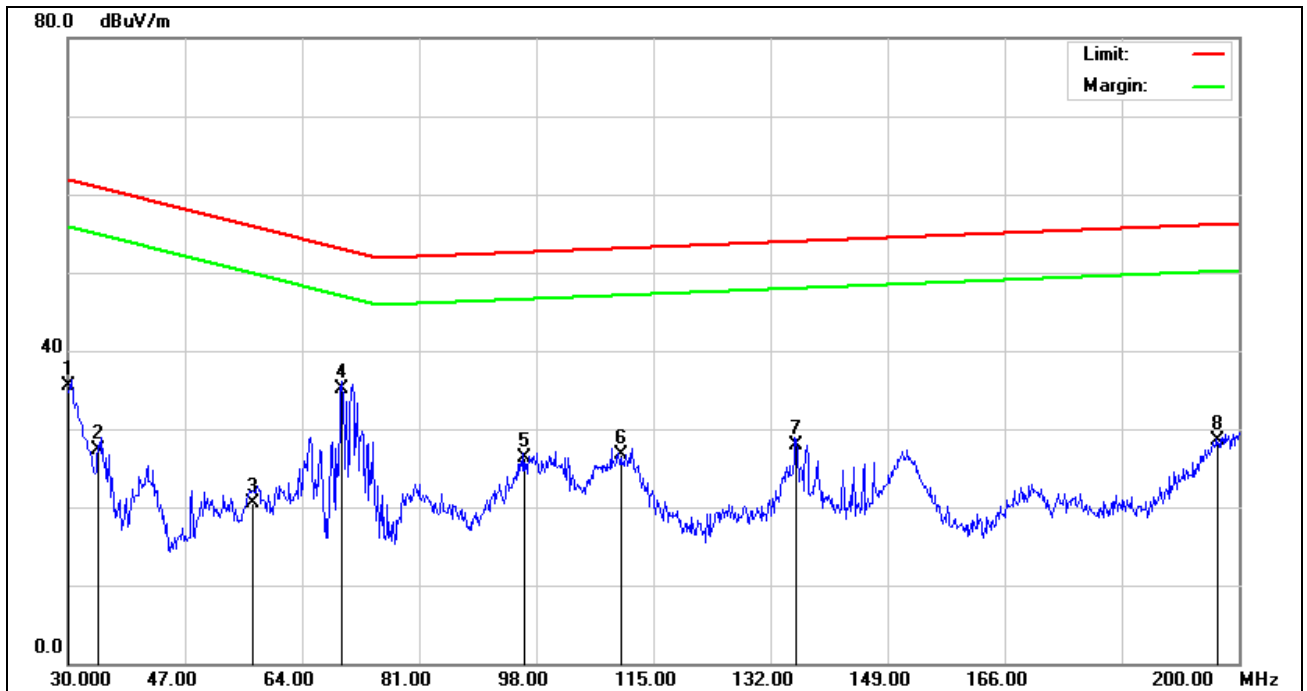


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	297.0000	50.42	-14.51	35.91	49.51	-13.60	AVG	H	
2	371.2400	44.19	-12.42	31.77	52.03	-20.26	AVG	H	
3	519.7600	28.33	-10.60	17.73	53.00	-35.27	AVG	H	
4	614.4000	36.88	-9.38	27.50	53.00	-25.50	AVG	H	
5	756.0000	32.39	-6.63	25.76	53.00	-27.24	AVG	H	
6	890.4000	45.65	-6.12	39.53	53.00	-13.47	AVG	H	

**Mode 2: Normal Operation (DC 24V)**

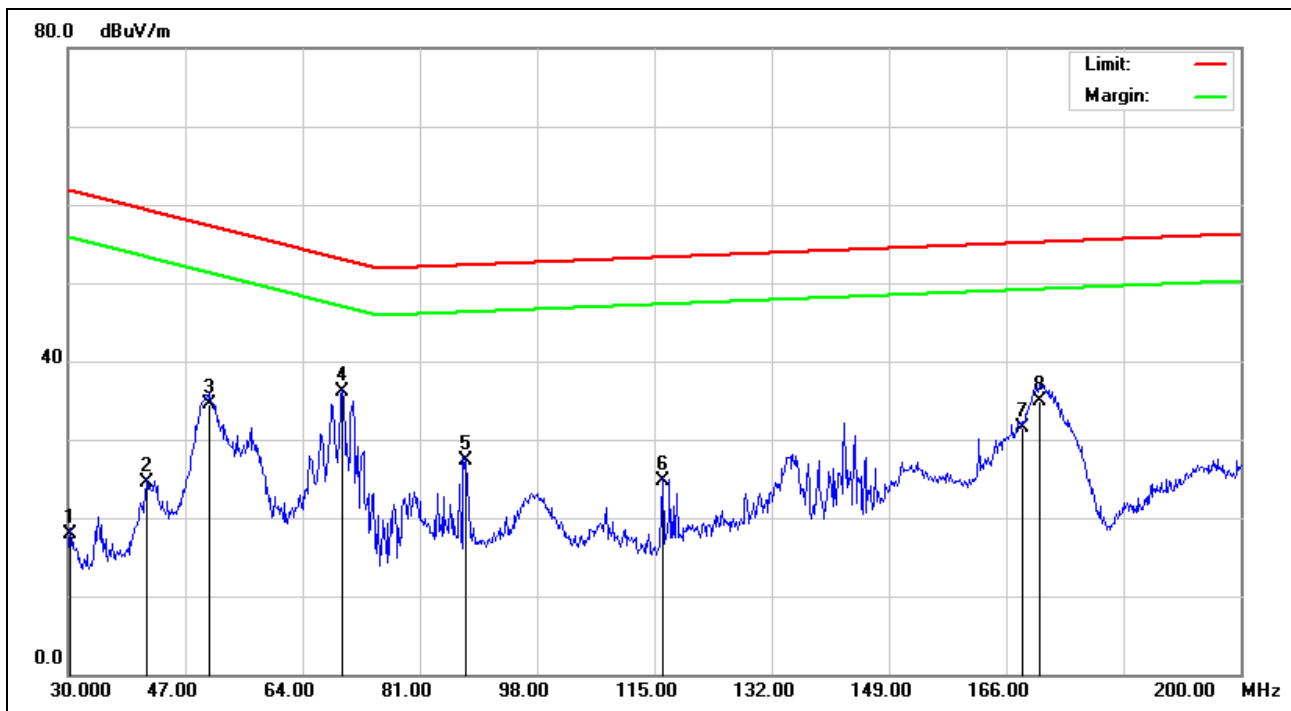
**BROADBAND:**

Model No.	VP070-M8M	Polarization:	Vertical
Test item:	Radiation Test	Power Source:	DC 27V
Temp.(°C)/Hum.(%):	24.3(°C)/55%	Engineer Signature:	Angus Chen
Date of Test:	2023/5/27	Test Frequency:	30MHz to 200MHz



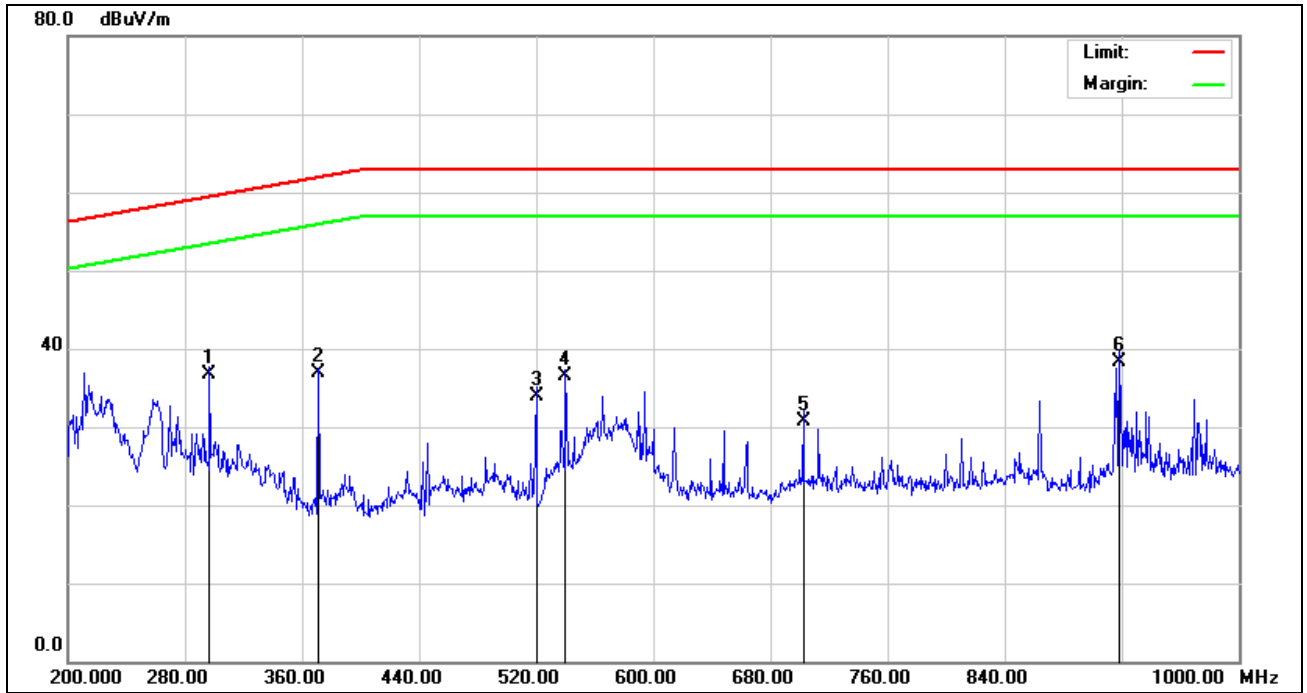
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	30.1700	53.40	-17.92	35.48	61.96	-26.48	QP	V	
2	34.5000	45.20	-17.98	27.22	61.00	-33.78	QP	V	
3	56.9400	39.80	-19.23	20.57	56.01	-35.44	QP	V	
4	69.8800	55.30	-20.19	35.11	53.14	-18.03	QP	V	
5	96.3800	46.10	-19.79	26.31	52.72	-26.41	QP	V	
6	110.3500	45.80	-19.15	26.65	53.20	-26.55	QP	V	
7	135.8000	45.90	-17.92	27.98	54.06	-26.08	QP	V	
8	196.9700	43.20	-14.66	28.54	56.13	-27.59	QP	V	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 27V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>30MHz to 200MHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	30.3400	35.90	-17.93	17.97	61.92	-43.95	QP	H	
2	41.3900	42.60	-18.15	24.45	59.47	-35.02	QP	H	
3	50.5700	53.10	-18.55	34.55	57.43	-22.88	QP	H	
4	69.7800	56.20	-20.19	36.01	53.16	-17.15	QP	H	
5	87.6300	47.40	-20.19	27.21	52.43	-25.22	QP	H	
6	116.1900	43.60	-18.89	24.71	53.39	-28.68	QP	H	
7	168.3800	47.90	-16.41	31.49	55.16	-23.67	QP	H	
8	170.9299	51.20	-16.25	34.95	55.25	-20.30	QP	H	

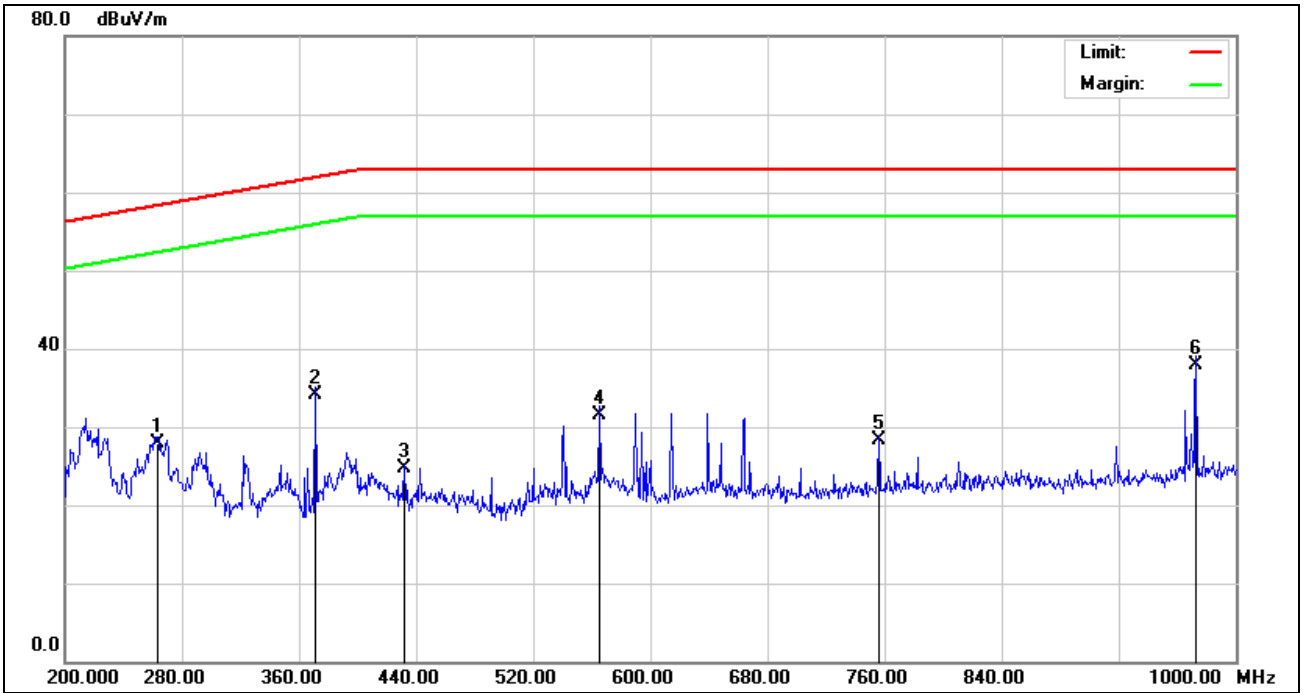
<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Vertical</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 27V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	296.8000	51.20	-14.53	36.67	59.51	-22.84	QP	V	
2	371.2000	49.30	-12.42	36.88	62.03	-25.15	QP	V	
3	520.0000	44.60	-10.60	34.00	63.00	-29.00	QP	V	
4	540.0000	46.90	-10.31	36.59	63.00	-26.41	QP	V	
5	702.4000	38.70	-7.92	30.78	63.00	-32.22	QP	V	
6	918.4000	44.20	-5.80	38.40	63.00	-24.60	QP	V	



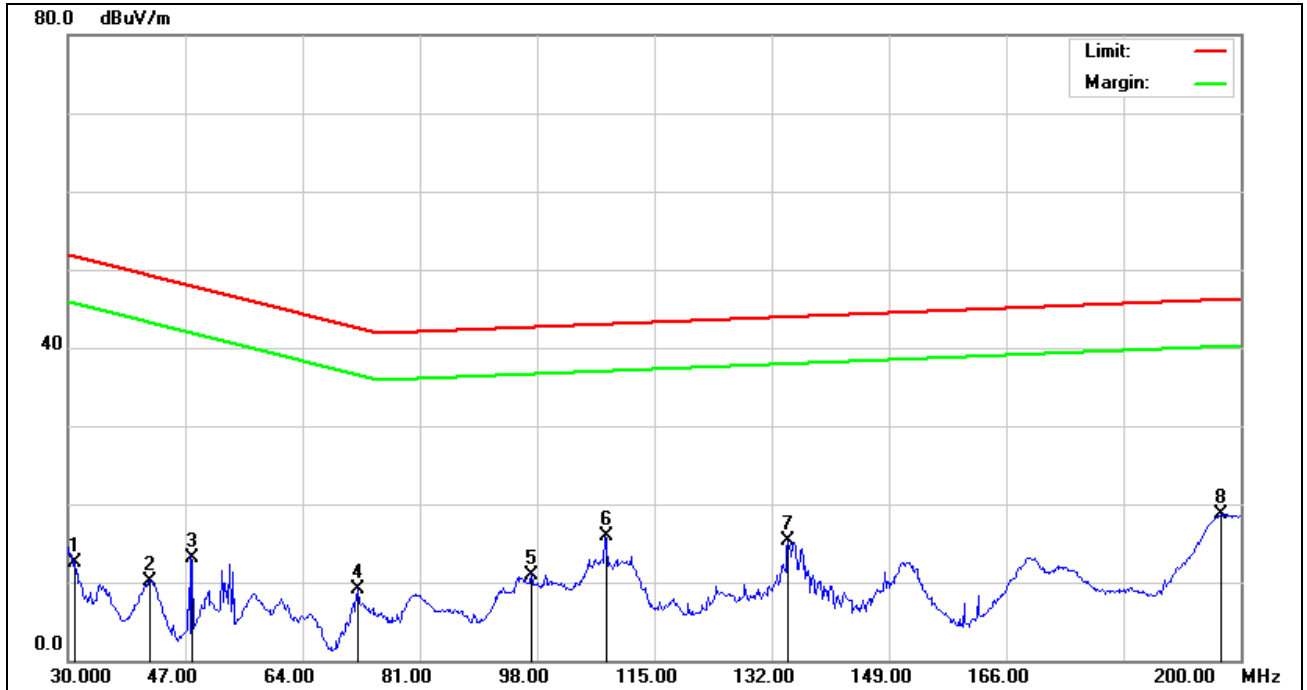
<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 27V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (QP)	P/F (V/H)	Remark
1	263.1999	42.90	-14.96	27.94	58.37	-30.43	QP	H	
2	371.1999	46.60	-12.42	34.18	62.03	-27.85	QP	H	
3	432.0000	36.40	-11.73	24.67	63.00	-38.33	QP	H	
4	565.6000	41.50	-9.97	31.53	63.00	-31.47	QP	H	
5	756.0000	34.90	-6.63	28.27	63.00	-34.73	QP	H	
6	972.7999	42.70	-4.73	37.97	63.00	-25.03	QP	H	

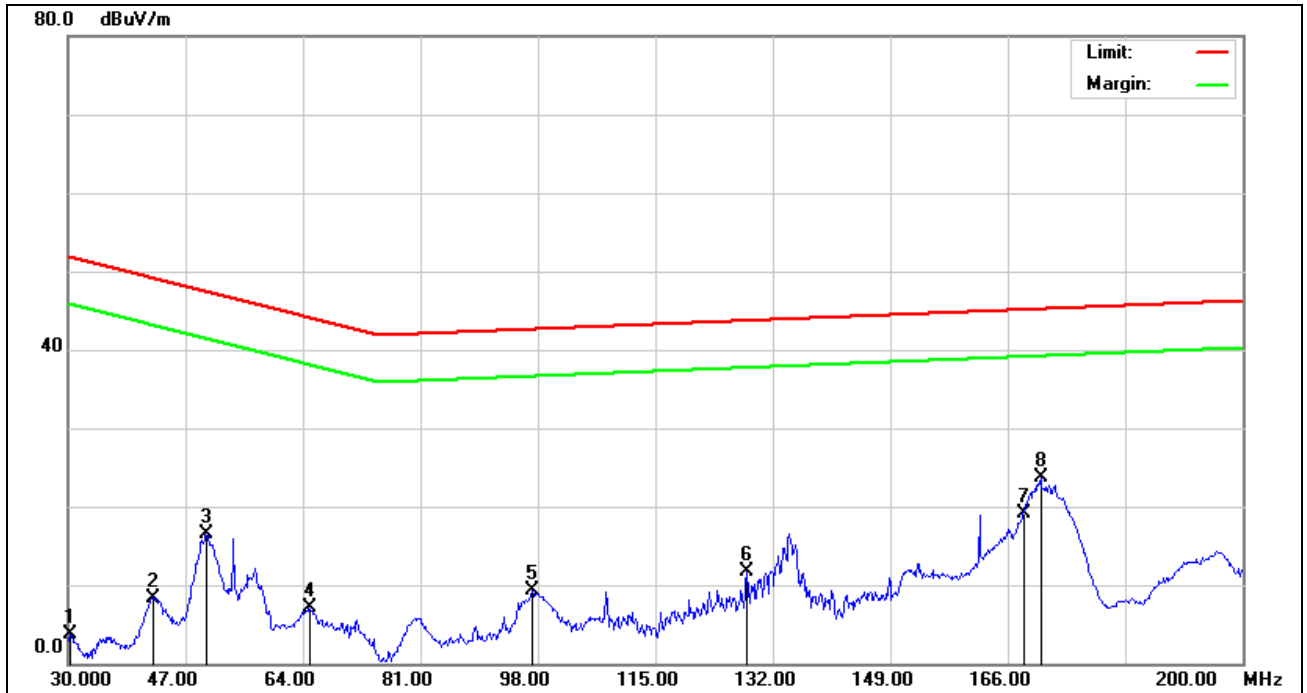
**NARROWBAND:**

Model No.	VP070-M8M	Polarization:	Vertical
Test item:	Radiation Test	Power Source:	DC 27V
Temp.(°C)/Hum.(%):	24.3(°C)/55%	Engineer Signature:	Angus Chen
Date of Test:	2023/5/27	Test Frequency:	30MHz to 200MHz



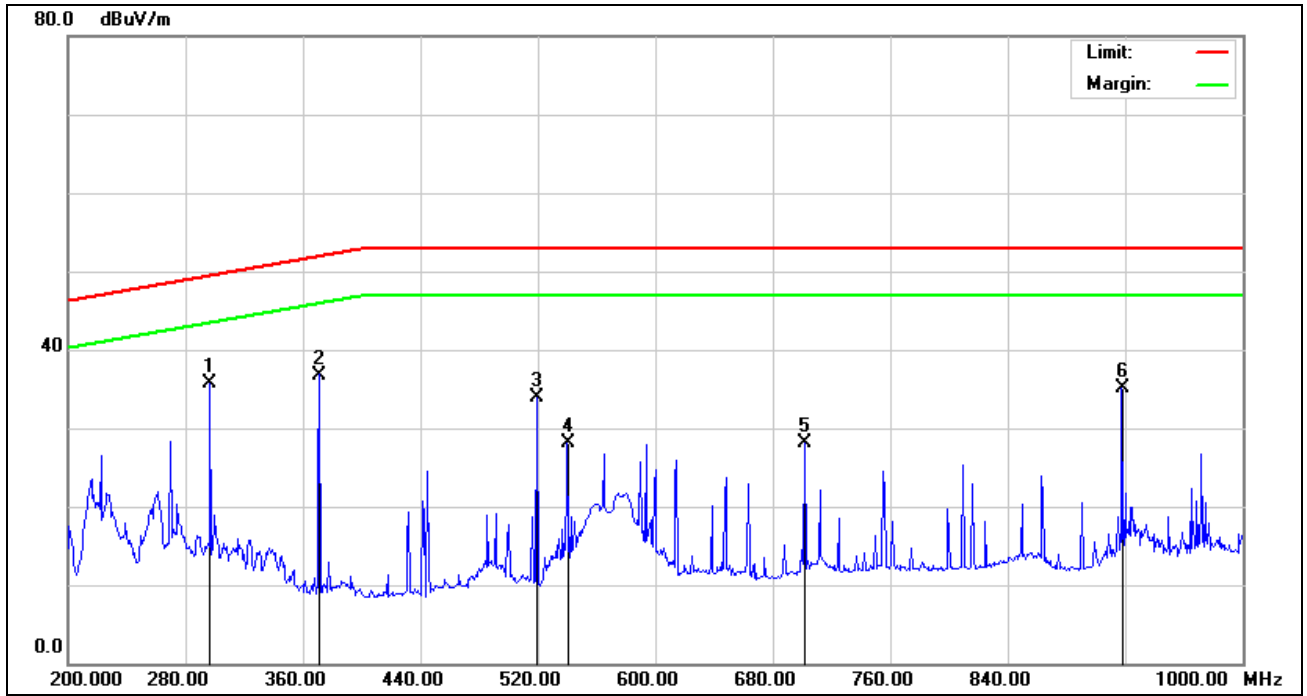
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	31.0400	30.37	-17.93	12.44	51.77	-39.33	AVG	V	
2	42.0000	28.32	-18.15	10.17	49.33	-39.16	AVG	V	
3	48.0000	31.56	-18.36	13.20	48.00	-34.80	AVG	V	
4	72.0000	29.43	-20.24	9.19	42.67	-33.48	AVG	V	
5	97.2400	30.76	-19.76	11.00	42.75	-31.75	AVG	V	
6	108.0000	35.21	-19.27	15.94	43.12	-27.18	AVG	V	
7	134.4800	33.21	-17.96	15.25	44.01	-28.76	AVG	V	
8	197.1200	33.43	-14.65	18.78	46.13	-27.35	AVG	V	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 27V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>30MHz to 200MHz</b>



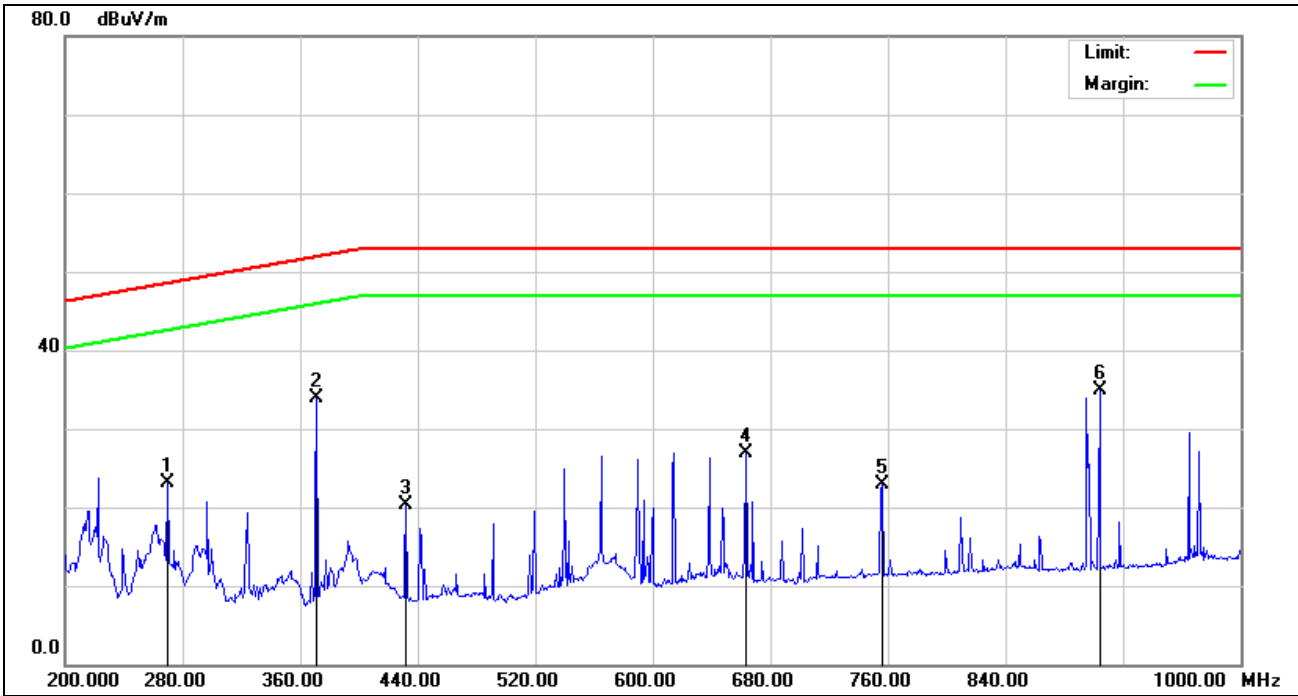
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	30.4400	21.65	-17.93	3.72	51.90	-48.18	AVG	H	
2	42.4000	26.55	-18.15	8.40	49.24	-40.84	AVG	H	
3	50.0400	34.90	-18.49	16.41	47.55	-31.14	AVG	H	
4	64.9600	26.93	-19.88	7.05	44.23	-37.18	AVG	H	
5	97.2400	29.14	-19.76	9.38	42.75	-33.37	AVG	H	
6	128.2800	29.92	-18.20	11.72	43.80	-32.08	AVG	H	
7	168.3600	35.49	-16.41	19.08	45.16	-26.08	AVG	H	
8	170.8800	39.89	-16.26	23.63	45.25	-21.62	AVG	H	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Vertical</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 27V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	297.0000	50.15	-14.51	35.64	49.51	-13.87	AVG	V	
2	371.2400	49.22	-12.42	36.80	52.03	-15.23	AVG	V	
3	519.7600	44.54	-10.60	33.94	53.00	-19.06	AVG	V	
4	540.6800	38.31	-10.30	28.01	53.00	-24.99	AVG	V	
5	702.0400	36.09	-7.93	28.16	53.00	-24.84	AVG	V	
6	918.0400	40.83	-5.81	35.02	53.00	-17.98	AVG	V	

<b>Model No.</b>	<b>VP070-M8M</b>	<b>Polarization:</b>	<b>Horizontal</b>
<b>Test item:</b>	<b>Radiation Test</b>	<b>Power Source:</b>	<b>DC 27V</b>
<b>Temp.(°C)/Hum.(%):</b>	<b>24.3(°C)/55%</b>	<b>Engineer Signature:</b>	<b>Angus Chen</b>
<b>Date of Test:</b>	<b>2023/5/27</b>	<b>Test Frequency:</b>	<b>200MHz to 1GHz</b>



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (AVG)	P/F (V/H)	Remark
1	270.0000	38.02	-14.97	23.05	48.60	-25.55	AVG	H	
2	371.2400	46.31	-12.42	33.89	52.03	-18.14	AVG	H	
3	432.0000	32.06	-11.73	20.33	53.00	-32.67	AVG	H	
4	663.5600	35.66	-8.70	26.96	53.00	-26.04	AVG	H	
5	756.0400	29.62	-6.63	22.99	53.00	-30.01	AVG	H	
6	904.2800	40.90	-6.03	34.87	53.00	-18.13	AVG	H	

Photo documentation of test set-up

Variant A: VP070-M8M

Mode 1: Normal Operation (DC 12V)

**Biconical Antenna test set up photo in the anechoic chamber**

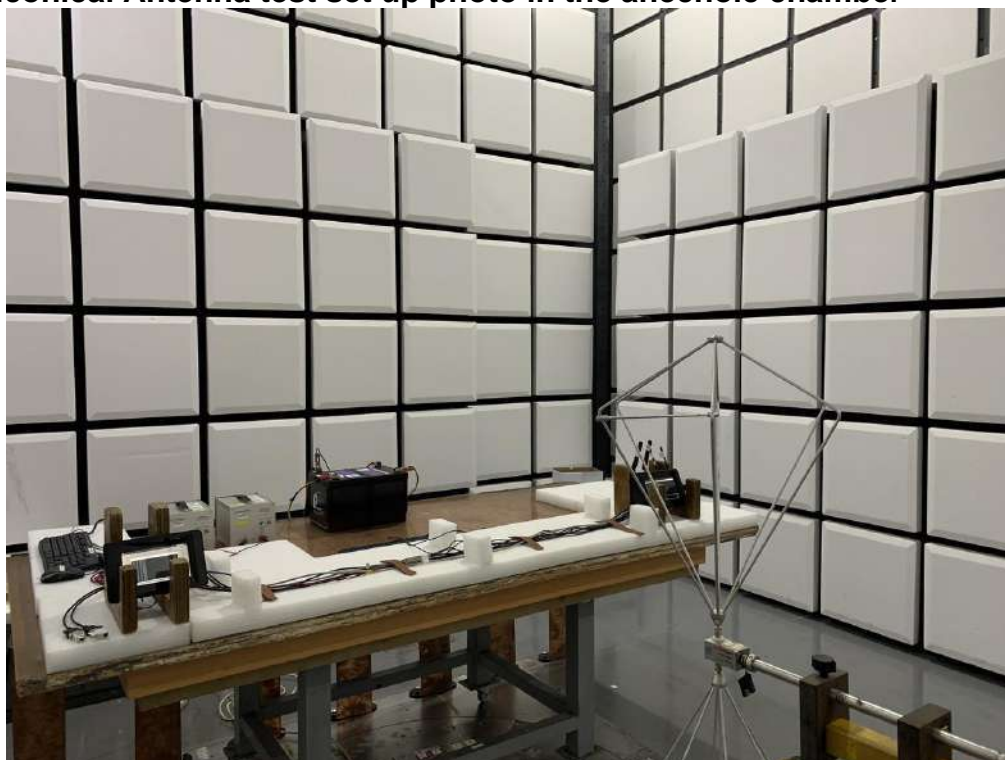


**Log-periodic Antenna test set up photo in the anechoic chamber**



**Mode 2: Normal Operation (DC 24V)**

**Biconical Antenna test set up photo in the anechoic chamber**



**Log-periodic Antenna test set up photo in the anechoic chamber**



**Testing for immunity of electrical/electronic subassemblies against disturbances conducted along supply lines according to UN-R 010, 06 Series of Amendments, Annex 10, Chapter 2.**

Appendix 2

**Test Procedure:** ISO 7637-2: Second edition 2004

**Immunity Test Level:** Level III

**Requirements:**

DC 12V

**Suggested test levels for 12 V system**

Test pulse <sup>a</sup>	Selected test level <sup>b</sup>	Test level, $U_s$ <sup>c</sup>				Minimum number of pulses or test time <sup>f</sup>	Burst cycle/pulse repetition time	
		I	II	III min.	IV max.		min.	max.
1		9	9	- 75	- 100	5 000 pulses	0,5 s	5 s
2a		9	9	+ 37	+ 50	5 000 pulses	0,2 s	5 s
2b		9	9	+ 10	+ 10	10 pulses	0,5 s	5 s
3a		9	9	- 112	- 150	1 h	90 ms	100 ms
3b		9	9	+ 75	+ 100	1 h	90 ms	100 ms
4		9	9	- 6	- 7	> 1 pulse	d	d
5 <sup>e</sup>		9	9	+ 65	+ 87	> 1 pulse	d	d

<sup>a</sup> Test pulses as in 5.6.  
<sup>b</sup> Values agreed to between vehicle manufacturer and equipment supplier.  
<sup>c</sup> The amplitudes are the values of  $U_s$  as defined for each test pulse in 5.6.  
<sup>d</sup> Since the minimum number of test pulses is 1, no pulse cycle time is given. When several pulses are to be applied, a minimum delay of 1 min between pulses shall be allowed.  
<sup>e</sup> See 5.6.5 c). The test levels reflect the situation of load dump at generator rated speed. If a central load dump protection is used, apply test pulse 5b as defined in Figure 12 and use the values in Table 10.  
<sup>f</sup> The number of pulses/time is for durability test purposes.  
<sup>g</sup> The former levels I and II were deleted because they do not ensure sufficient immunity in road vehicles.

DC 24V

**Suggested test levels for 24 V system**

Test pulse <sup>a</sup>	Selected test level <sup>b</sup>	Test level, $U_s$ <sup>c</sup>				Minimum number of pulses or test time <sup>f</sup>	Burst cycle/pulse repetition time	
		I	II	III min.	IV max.		min.	max.
1		9	9	- 450	- 600	5 000 pulses	0,5 s	5 s
2a		9	9	+ 37	+ 50	5 000 pulses	0,2 s	5 s
2b		9	9	+ 20	+ 20	10 pulses	0,5 s	5 s
3a		9	9	- 150	- 200	1 h	90 ms	100 ms
3b		9	9	+ 150	+ 200	1 h	90 ms	100 ms
4		9	9	- 12	- 16	> 1 pulse	d	d
5 <sup>e</sup>		9	9	+ 123	+ 173	> 1 pulse	d	d

<sup>a</sup> Test pulses as in 5.6.  
<sup>b</sup> Values agreed to between vehicle manufacturer and equipment supplier.  
<sup>c</sup> The amplitudes are the values of  $U_s$  as defined for each test pulse in 5.6.  
<sup>d</sup> Since the minimum number of test pulses is 1, no pulse cycle time is given. When several pulses are to be applied, a minimum delay of 1 min between pulses shall be allowed.  
<sup>e</sup> See 5.6.5 c). The test levels reflect the situation of load dump at generator rated speed. If a central load dump protection is used, apply test pulse 5b as defined in Figure 12 and use the values in Table 10.  
<sup>f</sup> The number of pulses/time is for durability test purposes.  
<sup>g</sup> The former levels I and II were deleted because they do not ensure sufficient immunity in road vehicles.

Note: Pulse 5 not applicable according to UN-R 010 requirement.



**Test results:**

Puls / Pulse	Required functional status for not safety-relevant ESA	Result Mode 1 (DC 12V)	Result Mode 2 (DC 24V)
1	D	D	D
2a	D	A	A
2b	D	D	D
3a	D	A	A
3b	D	A	A
4	D	D	A

During test, monitoring the operation function (1. Lan port; 2. CAN BUS; 3. COM 1; 4. COM 2; 5. USB; 6. Wi-Fi; 7. BT; 8. LTE) status of EUT..

Classification of functional status

All classifications are for the total device/system functional status.

Class A: all functions of a device/system perform as designed during and after exposure to disturbance.

Class B: all functions of a device/system perform as designed during exposure. However, one or more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed. Memory functions shall remain class A.

Class C: one or more functions of a device/system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.

Class D: one or more functions of a device/system do not perform as designed during exposure and do not return to normal operation until exposure is removed and the device/system is reset by simple "operator/use" action.

During test, the EUT loss of power and can not auto recover.

After test, the EUT is reset by simple operator action then can return to normal intended function.

Class E: one or more functions of a device/system do not perform as designed during and after exposure and cannot be returned to proper operation without repairing or replacing the device/system.

Note : The word "function" in this context refers only to the function performed by the electronic system

**Remark:** The device was tested with requirements to Pulse 1, 2a, 2b, 3a, 3b, 4 for DC 12V/24V system.

Test Overview – Immunity against transient disturbances	
Test Procedure	ISO 7637-2: Second edition 2004
Operator:	Angus Chen
Manufacturer	DFI Inc.
Variant A	VP070-M8M
Operating Mode	Mode 1: Normal Operation (DC 12V)
Date of Test	23.05.2023
Nominal Voltage	12.0 Volt (DC)
Test Voltage	13.5 Volt (DC)
Shunt resistor Rs	No Shunt
Test Level	Level III
Test Results	Pulse 1: Pass, Class D is fulfilled
	Pulse 2a: Pass, Class A is fulfilled
	Pulse 2b: Pass, Class D is fulfilled
	Pulse 3a: Pass, Class A is fulfilled
	Pulse 3b: Pass, Class A is fulfilled
	Pulse 4: Pass, Class D is fulfilled

Pulse	Us/Vs	Ri	Test parameters	No. of Pulses or time	Rep. ime, Delay	Figure
	12 V					
ISO 7637-2: 2004 – Pulse 1	-75 V	10 Ω	td = 2 ms tr = 1 μs t1 = 0.5 s, t2 = 200 ms t3 = 100 μs	5000 P.	0.5 s	
ISO 7637-2: 2004 – Pulse 2a	+37 V	2 Ω	td = 0.05 ms tr = 1 μs t1 = 0.2 s	5000 P.	0.2 s	
ISO 7637-2: 2004 – Pulse 2b	+10 V	0 Ω	td = 0.2 s t12 = 1 ms tr = 1 ms, t6 = 1 ms	10 P.	0.5 s	
ISO 7637-2: 2004 – Pulse 3a	-112 V	50 Ω	td = 0.1 μs tr = 5 ns t1 = 100 μs, t4 = 10 ms t5 = 90 ms	1 Hour	90 ms	
ISO 7637-2: 2004 – Pulse 3b	+75 V	50 Ω	td = 0.1 μs tr = 5 ns t1 = 100 μs, t4 = 10 ms t5 = 90 ms	1 Hour	90 ms	
ISO 7637-2: 2004 – Pulse 4	-6 V	0 Ω	Ua = -2.5 V t7 = 15 ms, t8 = 50 ms, t9 = 0.5 s, t10 = 5 ms, t11 = 5 ms	1 P.	0 s	

Test Overview – Immunity against transient disturbances	
Test Procedure	ISO 7637-2: Second edition 2004
Operator:	Angus Chen
Manufacturer	DFI Inc.
Variant A	VP070-M8M
Operating Mode	Mode 2: Normal Operation (DC 24V)
Date of Test	25.05.2023
Nominal Voltage	24.0 Volt (DC)
Test Voltage	27.0 Volt (DC)
Shunt resistor Rs	No Shunt
Test Level	Level III
Test Results	Pulse 1: Pass, Class D is fulfilled
	Pulse 2a: Pass, Class A is fulfilled
	Pulse 2b: Pass, Class D is fulfilled
	Pulse 3a: Pass, Class A is fulfilled
	Pulse 3b: Pass, Class A is fulfilled
	Pulse 4: Pass, Class A is fulfilled

Pulse	Us/Vs	Ri	Test parameters	No. of Pulses	Delay	Figure
	24V					
ISO 7637-2 (2004) – Pulse 1	-450V	50 Ohms	td = 2ms, t1 = 0.5secs, t2 = 200ms	5000 P.	0.0 s	
ISO 7637-2 (2004) – Pulse 2a	37V	2 Ohms	td = 50us, t1 = 0.2secs	5000 P.	0.0 s	
ISO 7637-2 (2004) – Pulse 2b	20V	0 Ohms	td = 200ms,	10 P.	60.0 s	
ISO 7637-2 (2004) – Pulse 3a	-150V	50. Ohms	t1 = 10kHz, t4 = 10ms, t5 = 0.09 Seconds	1 Hours	0.0 s	
ISO 7637-2 (2004) – Pulse 3b	150V	50 Ohms	t1 = 10kHz, t4 = 10ms, t5 = 0.09 Seconds	1 Hours	0.0 s	
ISO 7637-2 (2004) – Pulse 4	-12V	0.0 Ohms	Ua = -4.0V, t7 = 30.0ms, t8 = 30.0ms, t9 = 10.0s, t10 = 5.0ms, t11 = 50.0ms	1 P.	60.0 s	

**Test equipment:**

**Equipment Used for Transient Immunity Measurement**

<b>Transients And Surge In The Vehicular Environment Test Site (ISO 7637-2)</b>					
<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due</b>
Transient Immunity Tests	Teseq	NSG 5500	1543	12/29/2022	12/28/2023
Power Amplifier	Teseq	PA 5840	4106	12/29/2022	12/28/2023
Software	Autostar7 V2.0.0.0				

**Photo documentation of test set-up**

**Variant A: VP070-M8M**

**Mode 1: Normal Operation (DC 12V)**

**Pulse 1, 2a, 2b, 3a, 3b, 4**



**Mode 2: Normal Operation (DC 24V)**

**Pulse 1, 2a, 2b, 3a, 3b, 4**



Measurement of conducted emissions of transients along supply lines of electrical/electronic subassemblies according to UN-R 010, 06 Series of Amendments, Annex 10, item 3.

Appendix 3

**Test Procedure:** ISO 7637-2: Second edition 2004

**Tested by:** Angus Chen

**Tested date:** 23.05.2023

**Remark:** The device were tested with requirements to a DC 12V/24Vsystem

**Test results:**

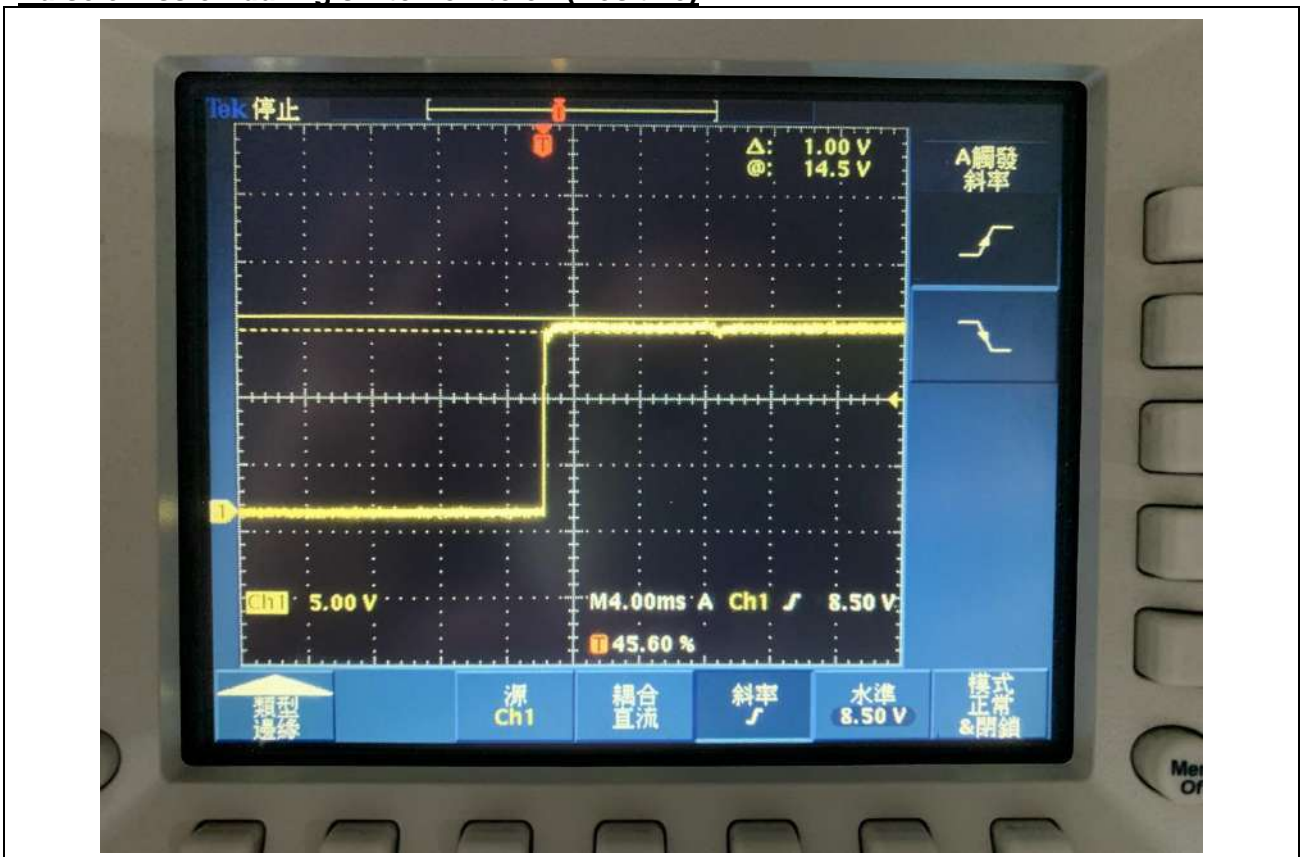
**Variant A: VP070-M8M**

**Mode 1: Normal Operation (DC 12V)**

**Fast**

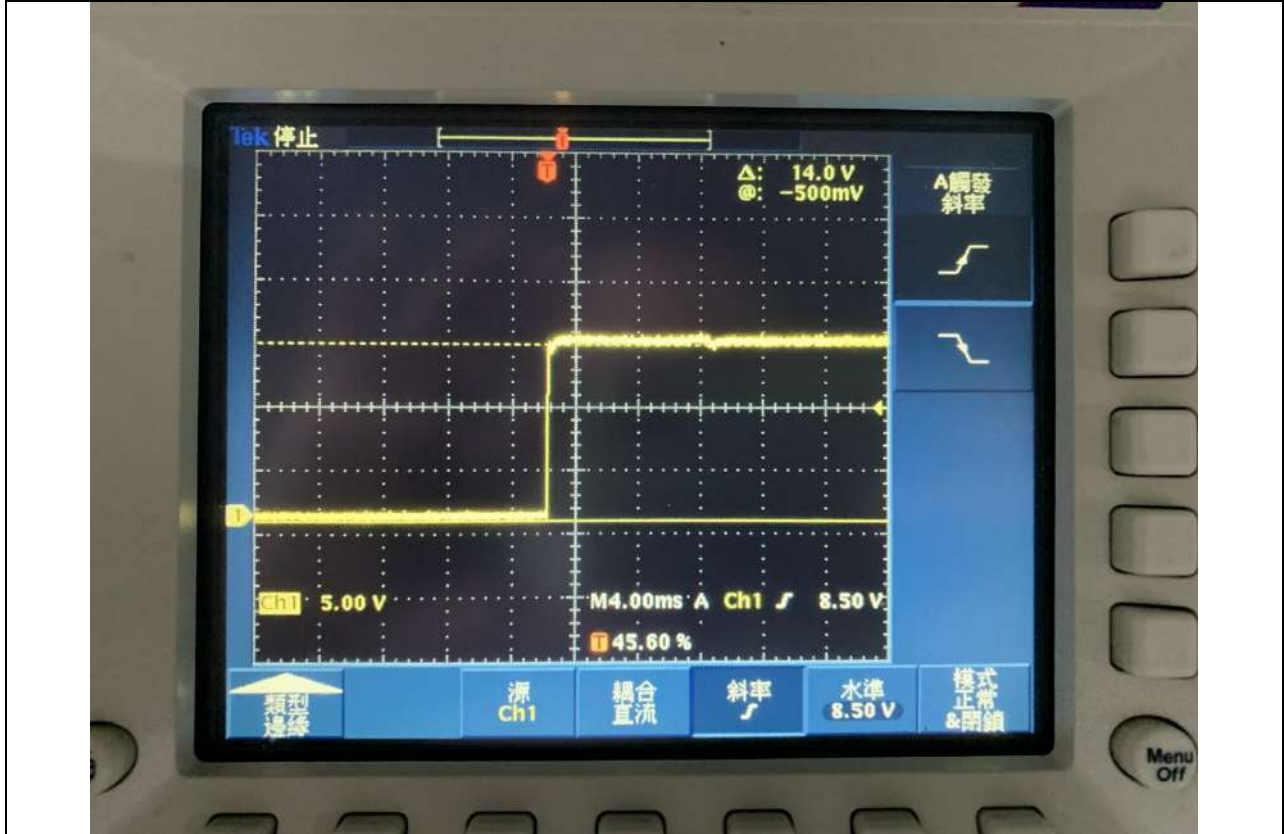
**DC 12V**

**Pulse emission during switch-off to on (Positive)**

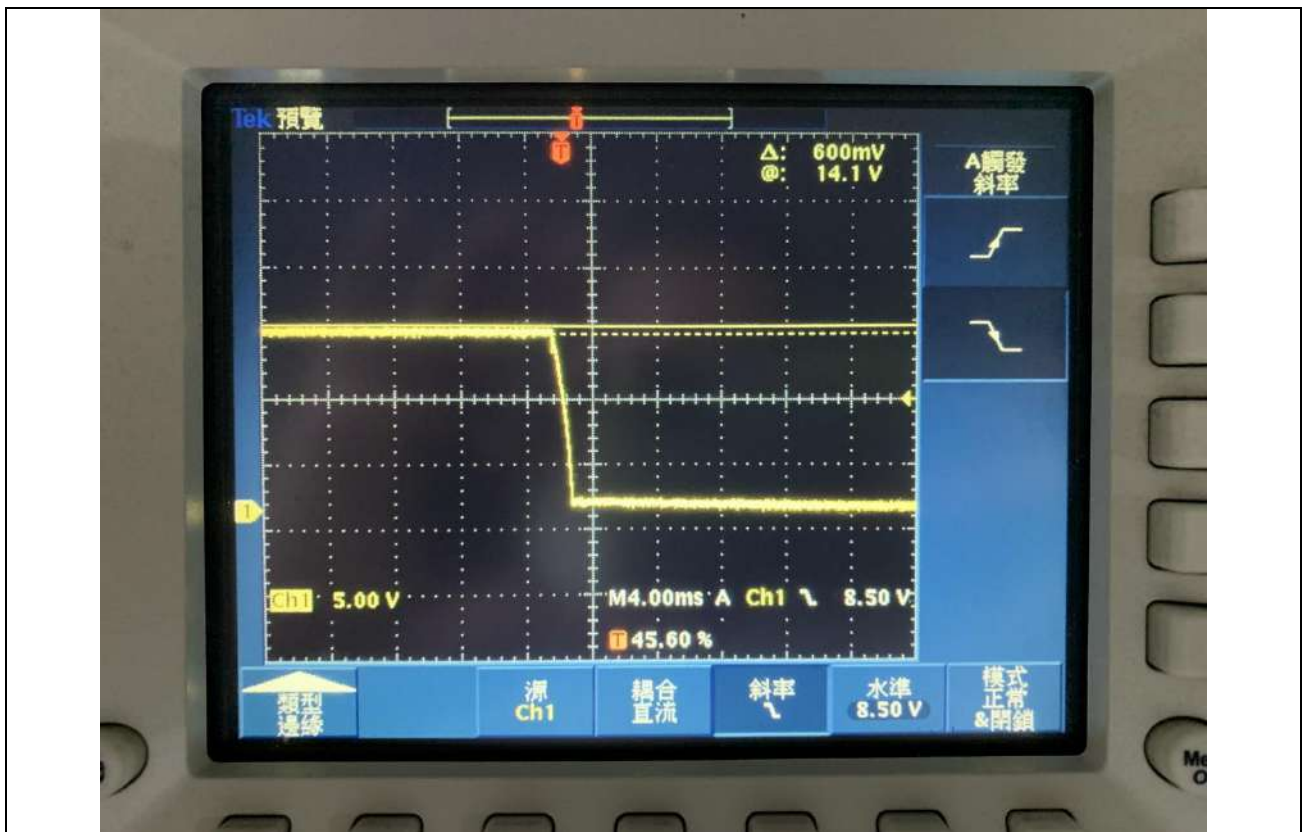




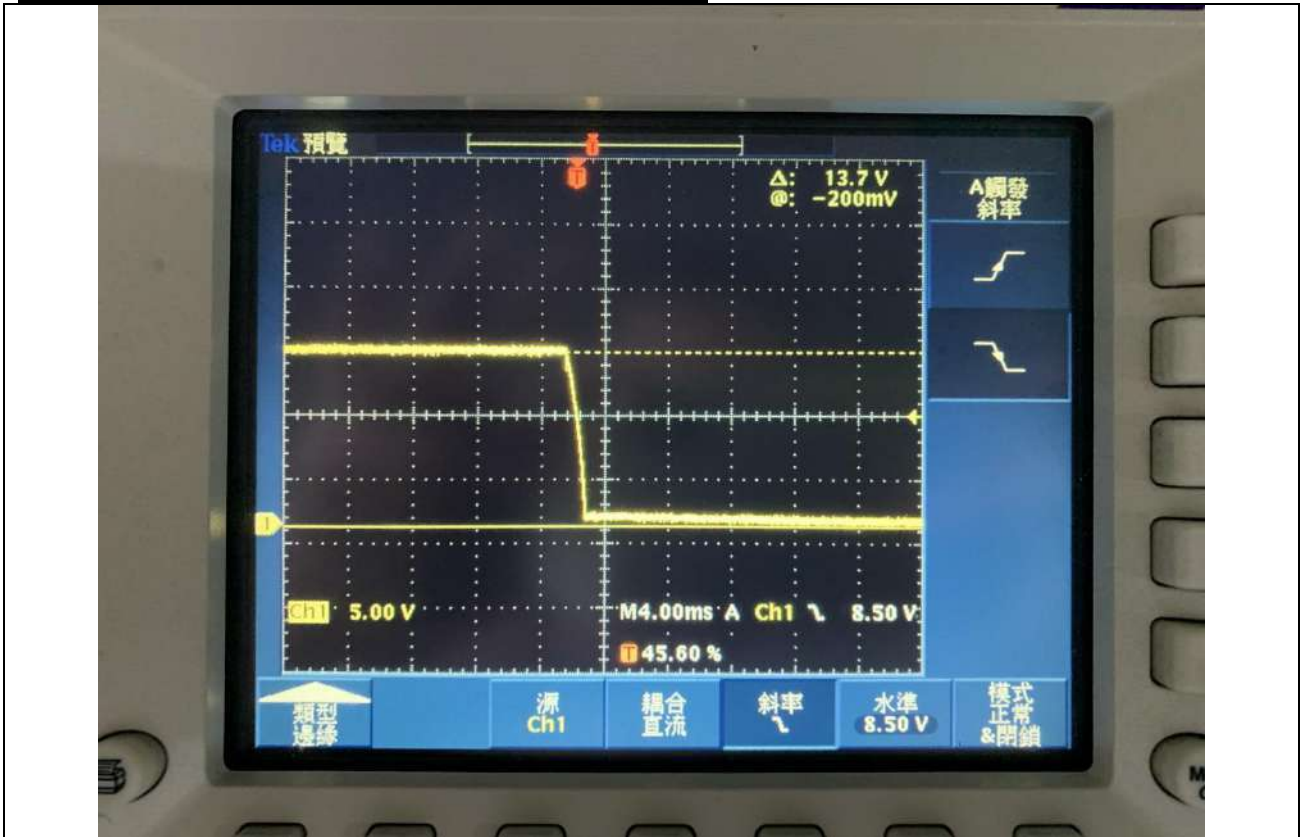
**Pulse emission during switch-off to on (Negative)**



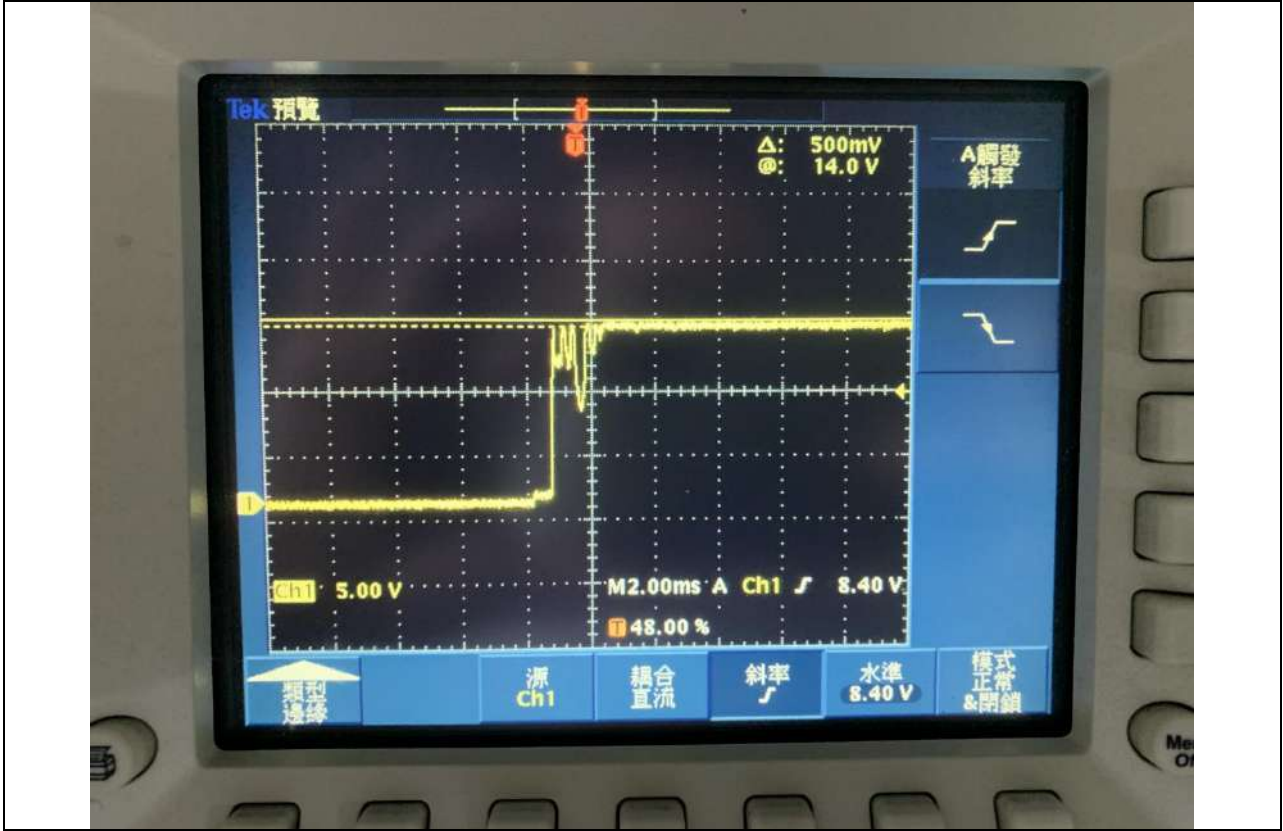
**Pulse emission during switch-on to off (Positive)**



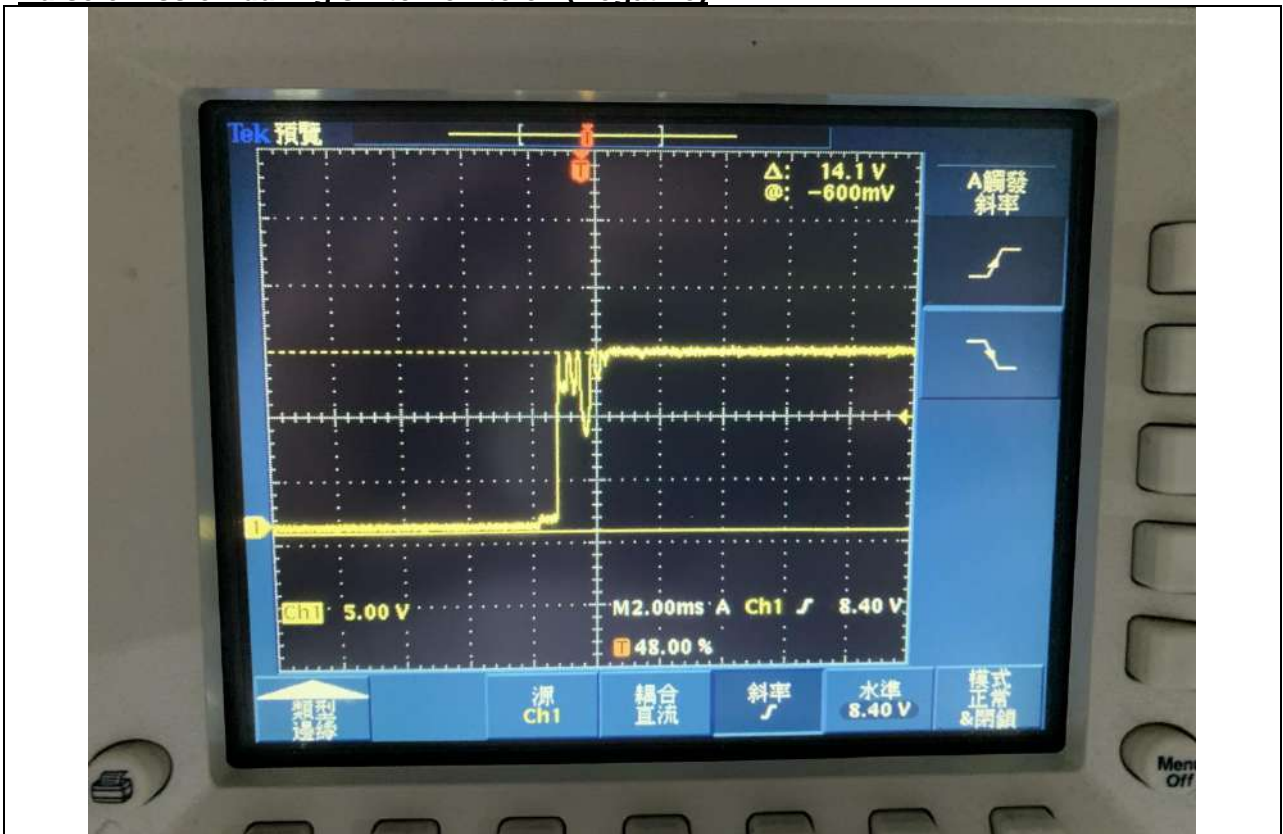
### Pulse emission during switch-on to off (Negative)



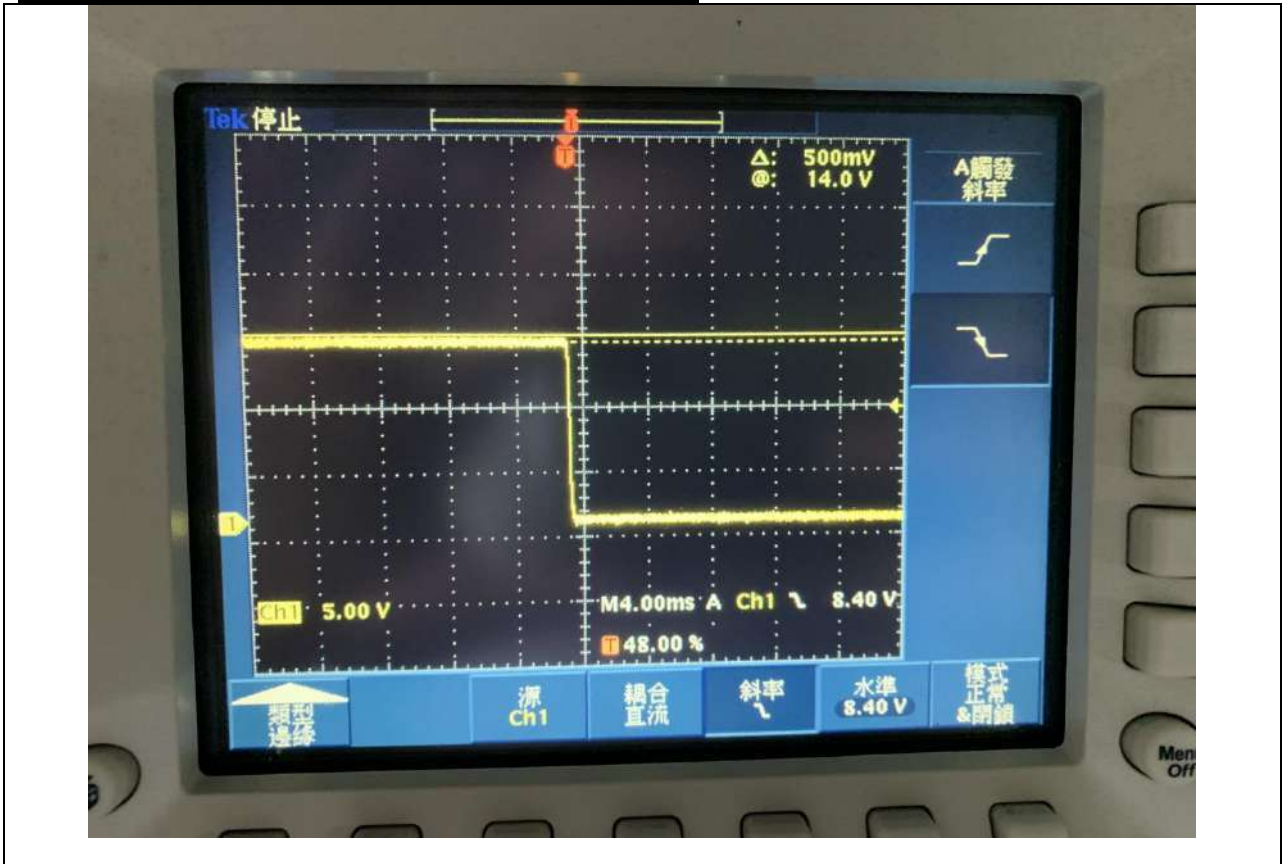
**Slow**  
**Pulse emission during switch-off to on (Positive)**



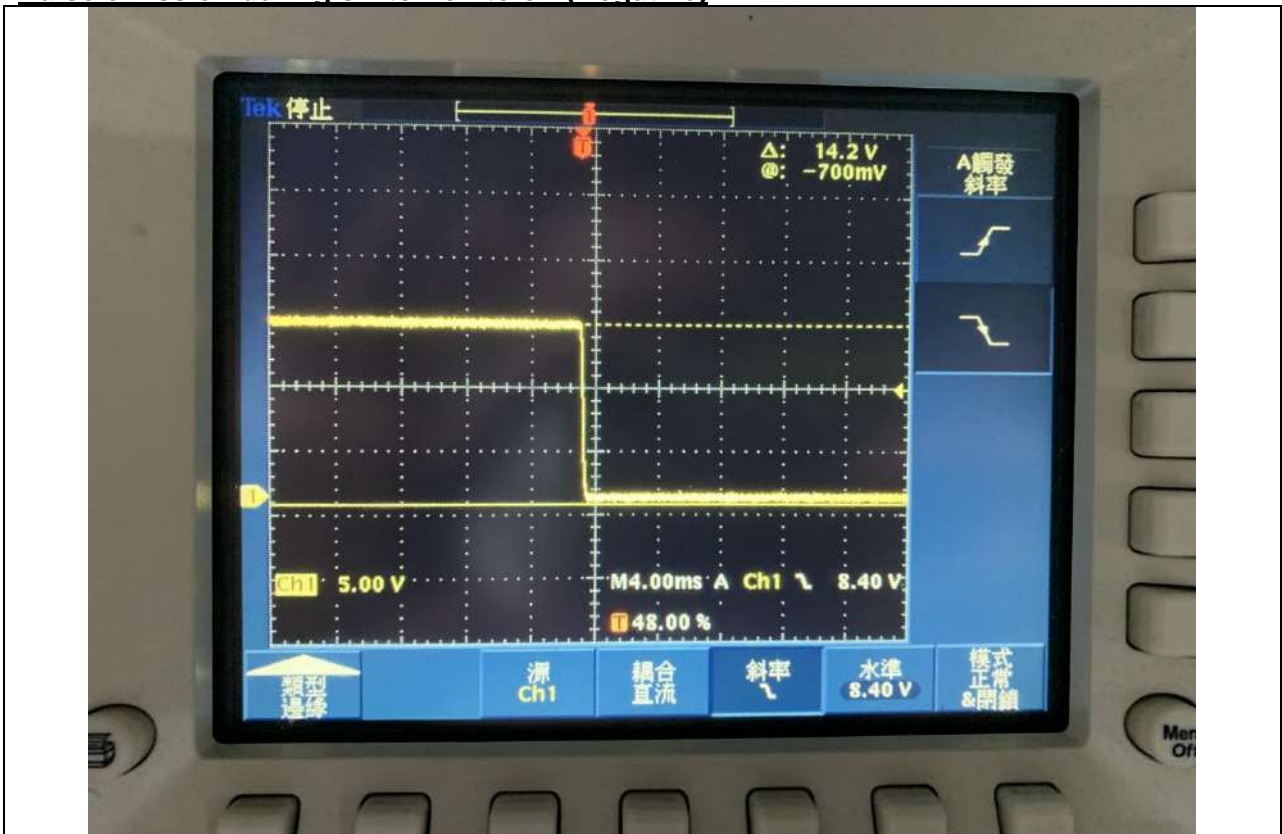
**Pulse emission during switch-off to on (Negative)**



**Pulse emission during switch-on to off (Positive)**



**Pulse emission during switch-on to off (Negative)**



**Mode 2: Normal Operation (DC 24V)**

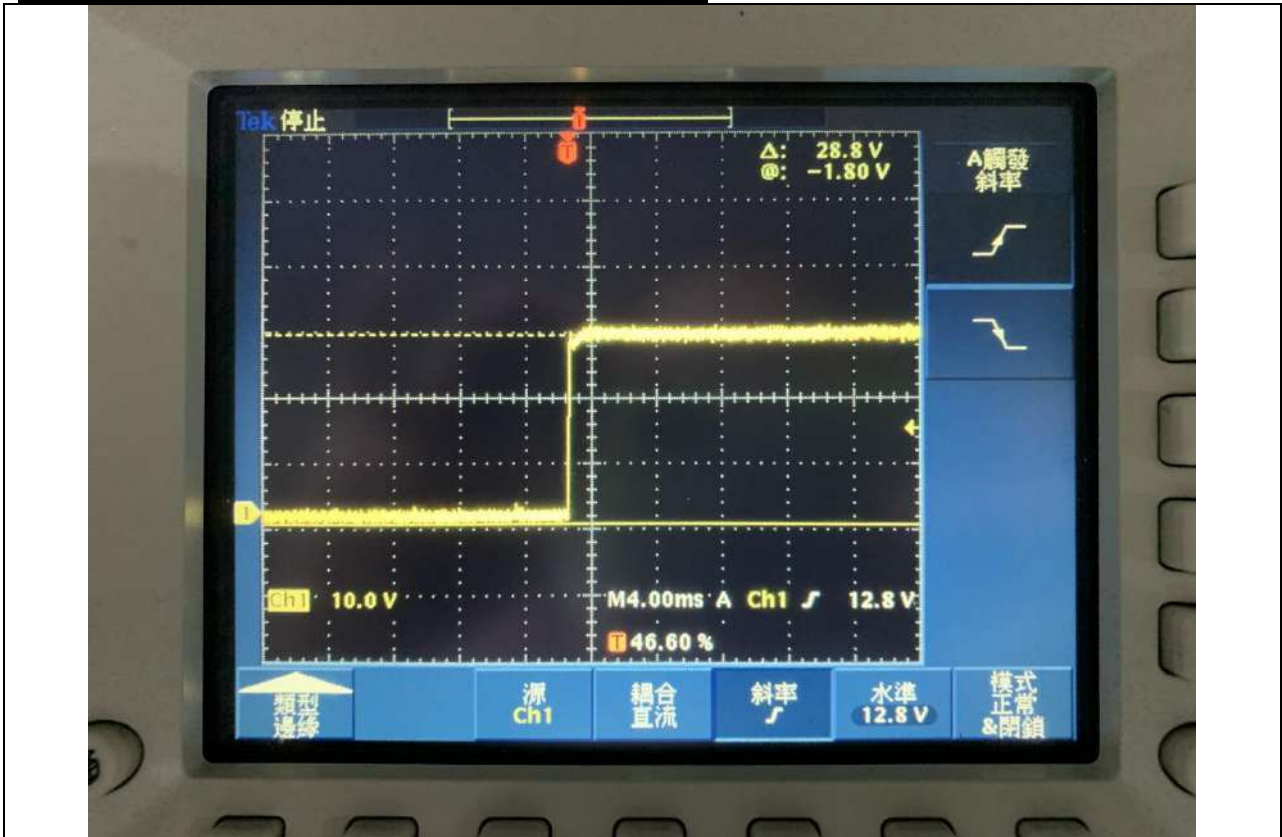
**Fast**

**DC 24V**

**Pulse emission during switch-off to on (Positive)**



**Pulse emission during switch-off to on (Negative)**



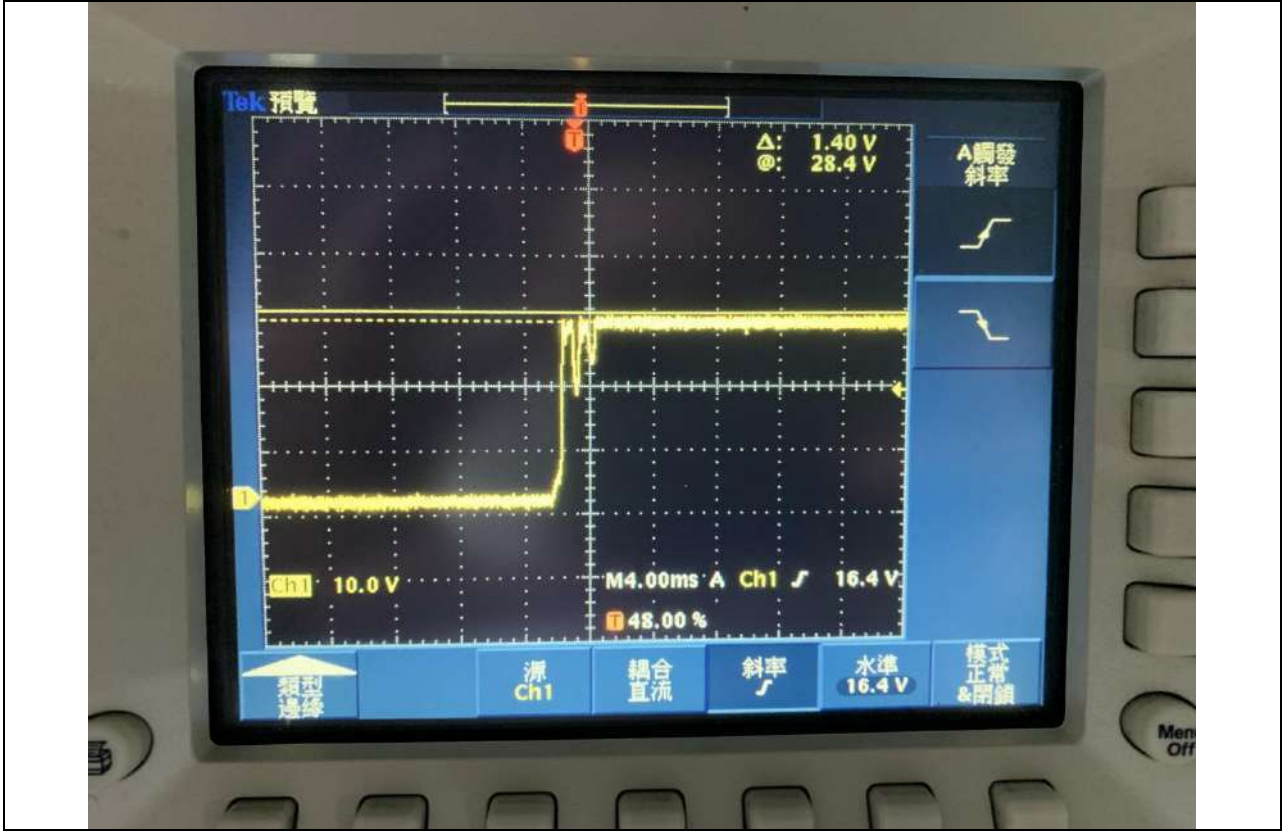
**Pulse emission during switch-on to off (Positive)**



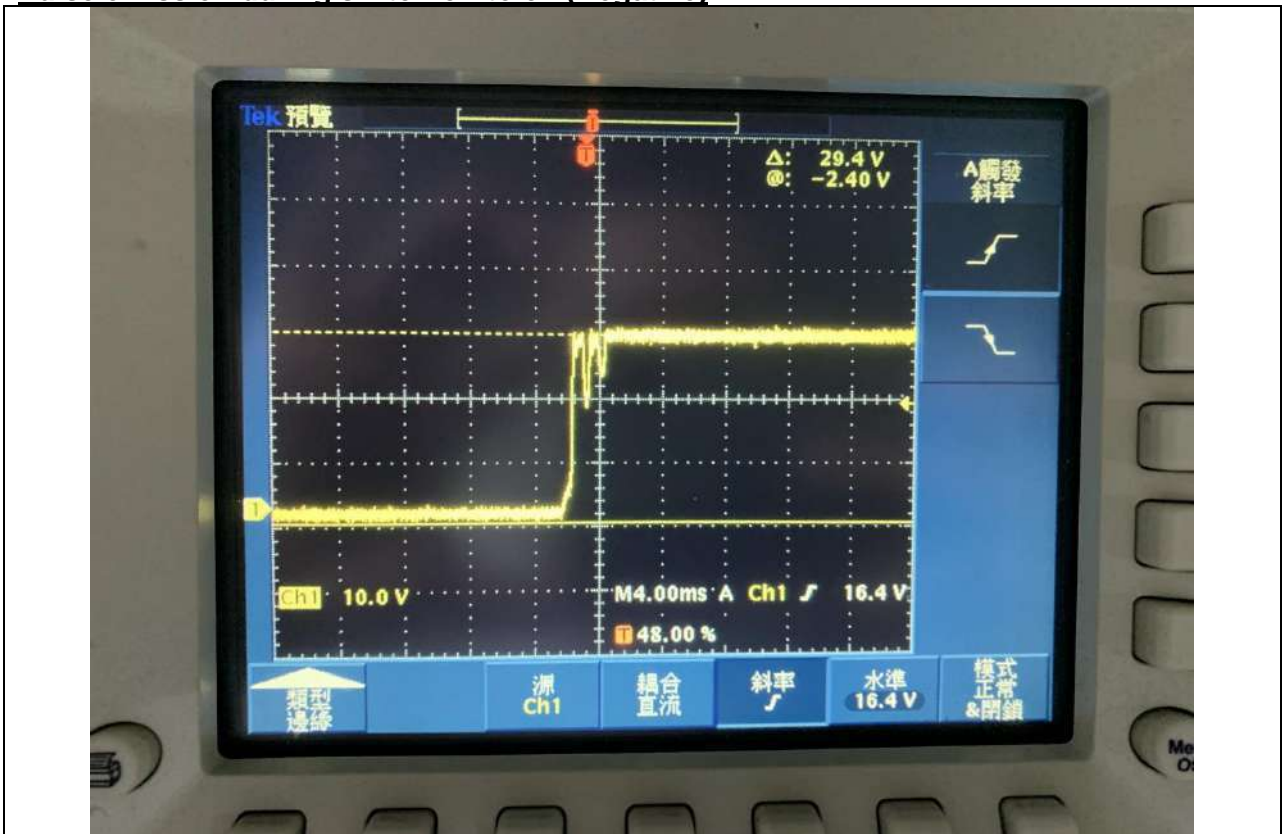
### Pulse emission during switch-on to off (Negative)



**Slow**  
**Pulse emission during switch-off to on (Positive)**

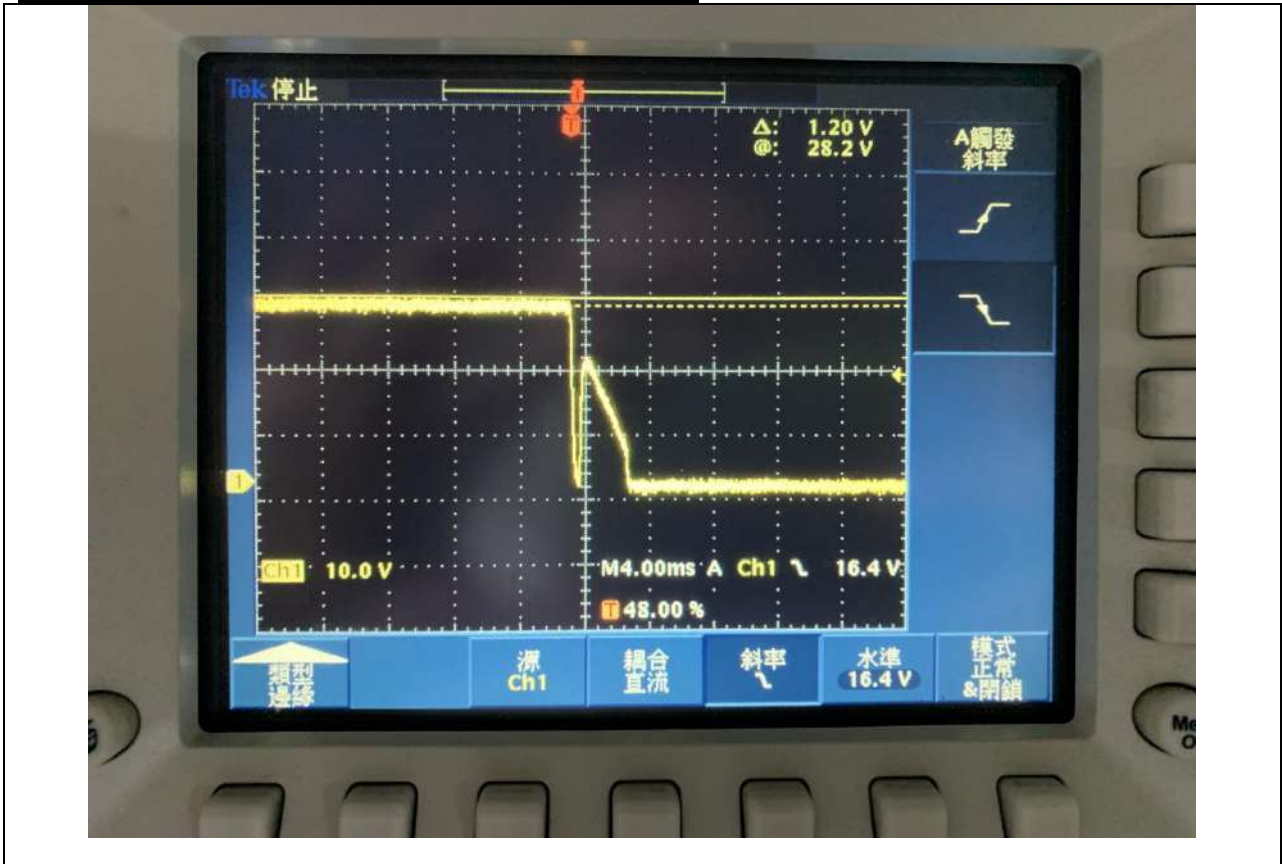


**Pulse emission during switch-off to on (Negative)**

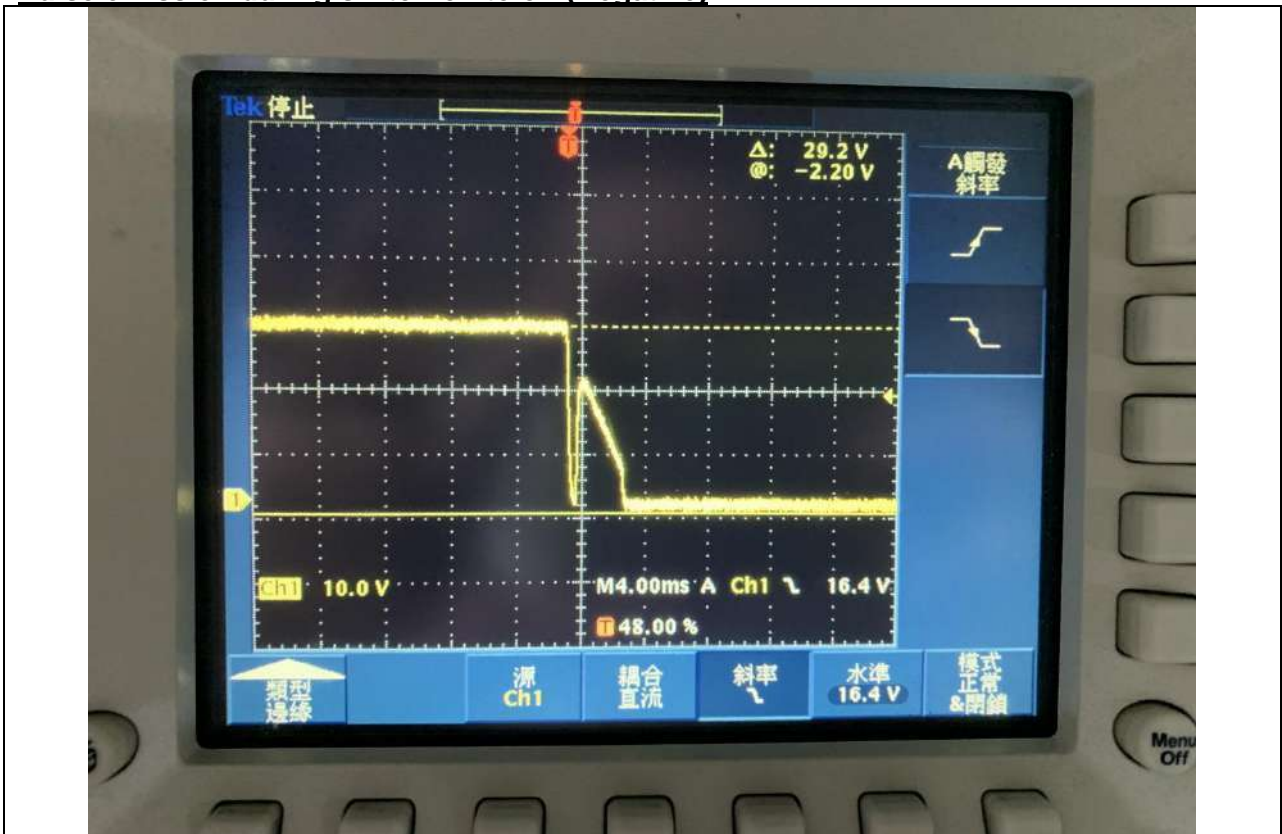




**Pulse emission during switch-on to off (Positive)**



**Pulse emission during switch-on to off (Negative)**



**Result Overview:**

**Variant A: VP070-M8M**

**Mode 1: Normal Operation (DC 12V)**

12V (Mode 1)				
Limit Value [V]	Measured Value [V]			
	Fast, ON	Fast, OFF	Slow, ON	Slow, OFF
+75	+1.0	+0.6	+0.5	+0.5
-100	-14.0	-13.7	-14.1	-14.2

**Mode 2: Normal Operation (DC 24V)**

24V (Mode 2)				
Limit Value [V]	Measured Value [V]			
	Fast, ON	Fast, OFF	Slow, ON	Slow, OFF
+150	+1.6	+1.4	+1.4	+1.2
-450	-28.8	-28.2	-29.4	-29.2

**Test equipment:**

**Equipment Used for Transient Emissions Measurement**

<b>Transients And Surge In The Vehicular Environment Test Site (ISO 7637-1/-2)</b>					
<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due</b>
Artificial Network	Teseq	AN 5501	1417	12/31/2022	12/30/2023
Digital Phosphor Oscilloscope	TEKTRONIX	TDS 3054C	C013600	05/24/2023	05/23/2024
Automotive Emission System	Teseq	SC 5501	1417	12/31/2022	12/30/2023
High Voltage Probe	Tektronix	Tek P5100	SD-S053	05/24/2023	05/23/2024

### Photo documentation of test set-up

Variant A: VP070-M8M

Mode 1: Normal Operation (DC 12V)

Fast



Slow



## Mode 2: Normal Operation (DC 24V)

### Fast



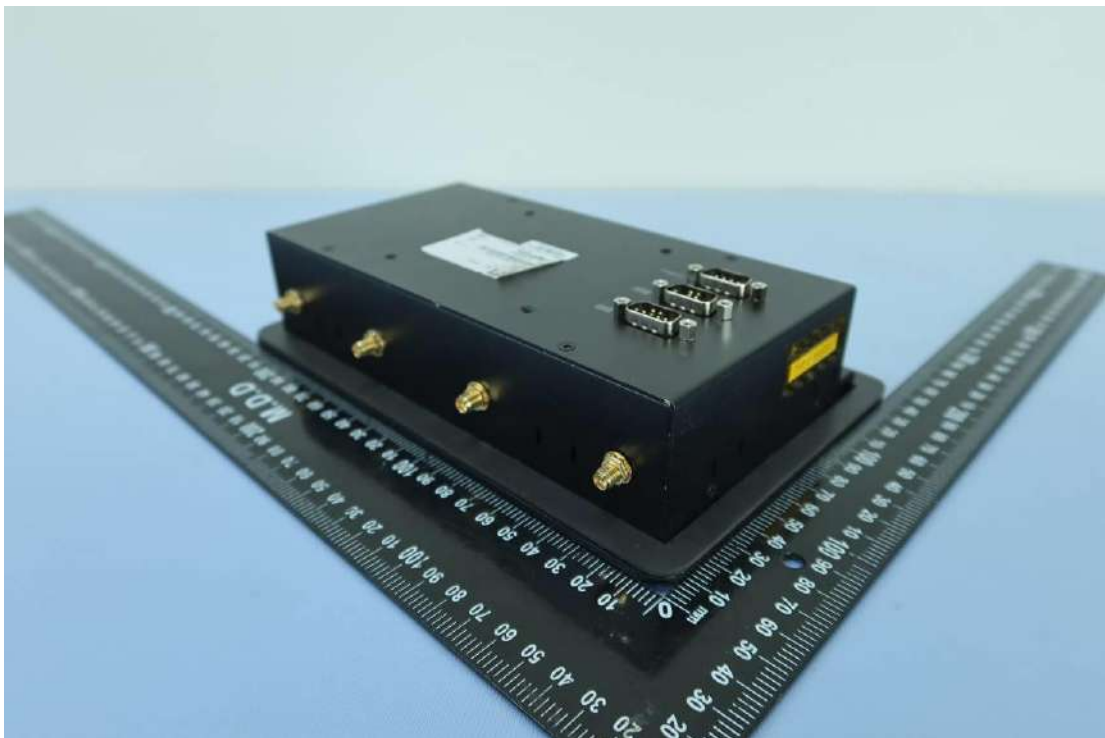
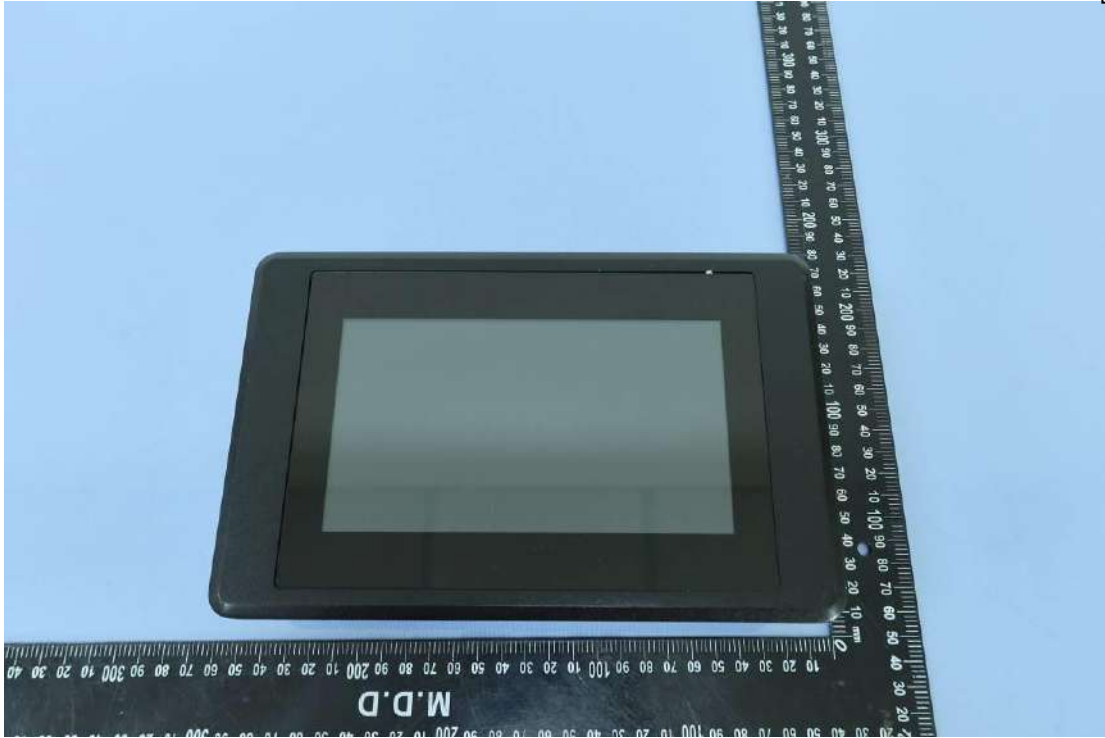
### Slow



Photo documentation of the ESA

Variant A: VP070-M8M

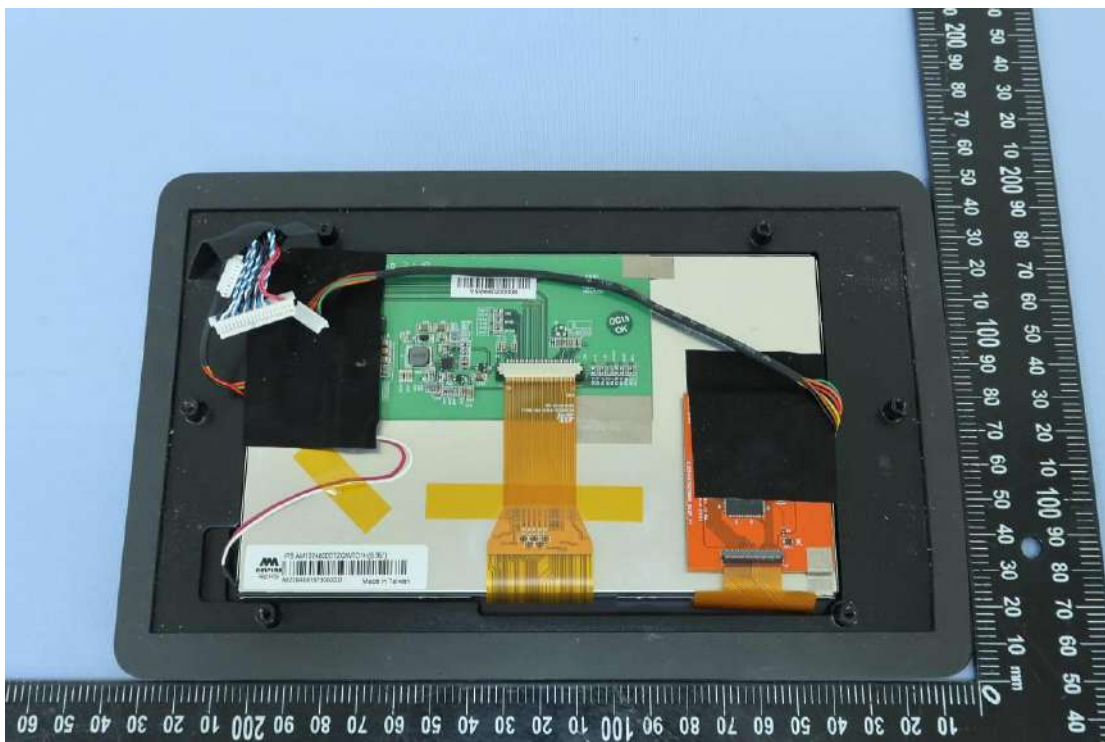
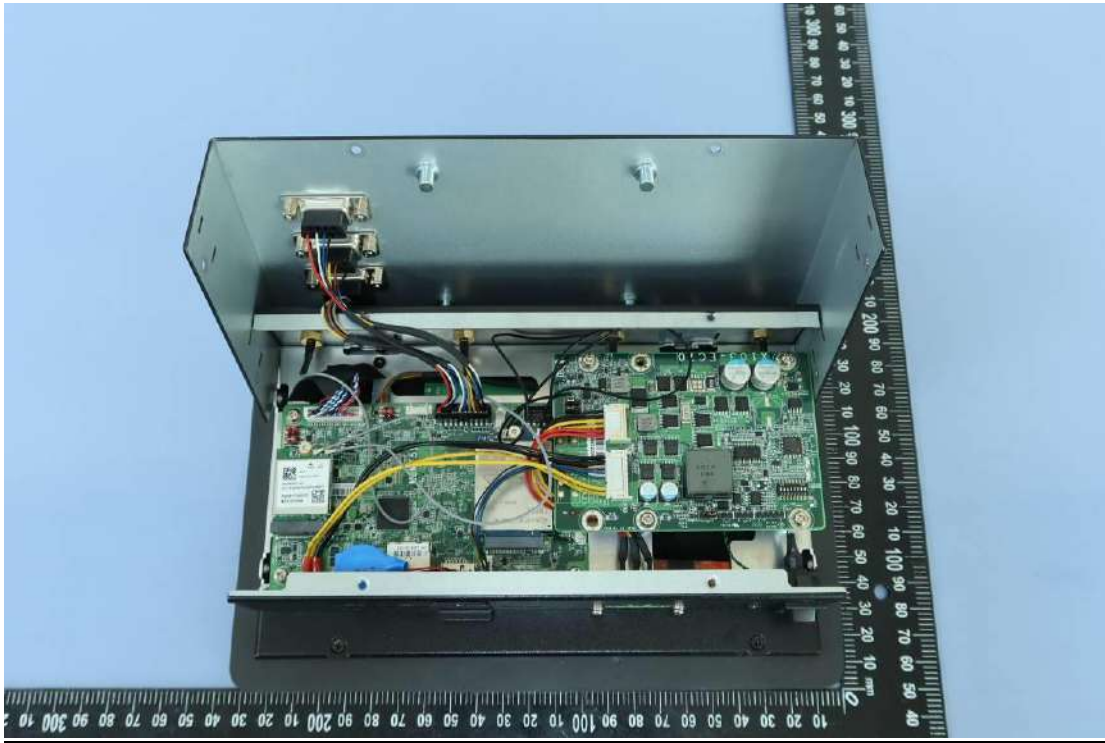
Appendix 4

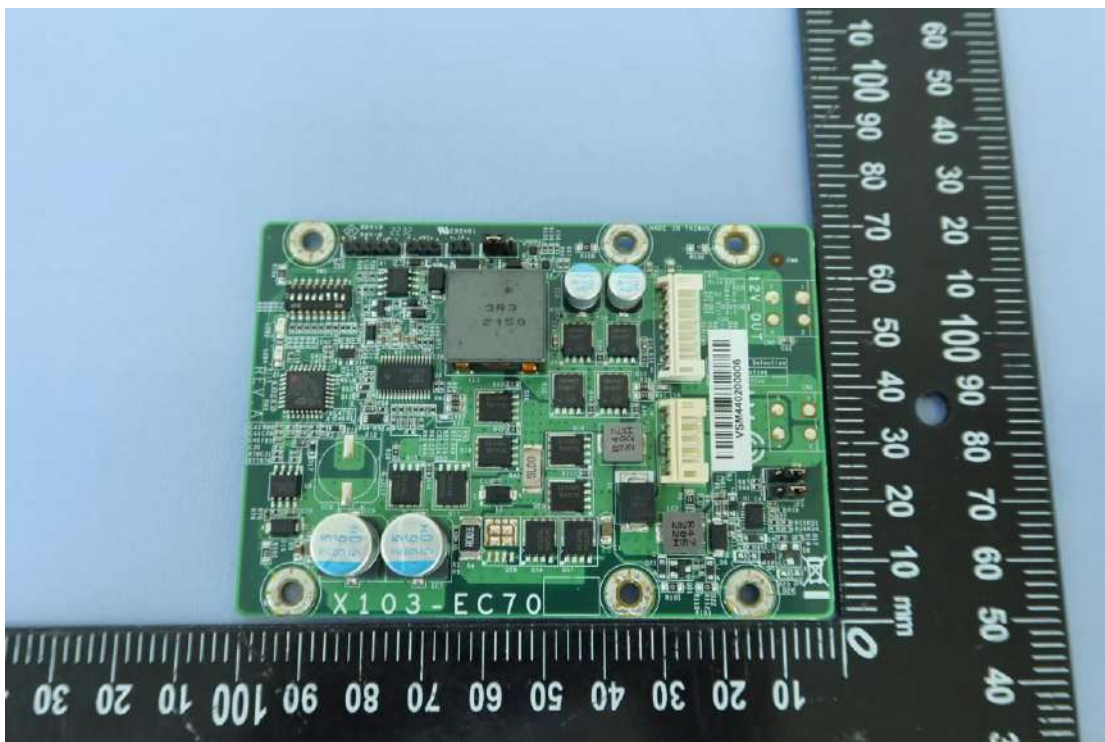


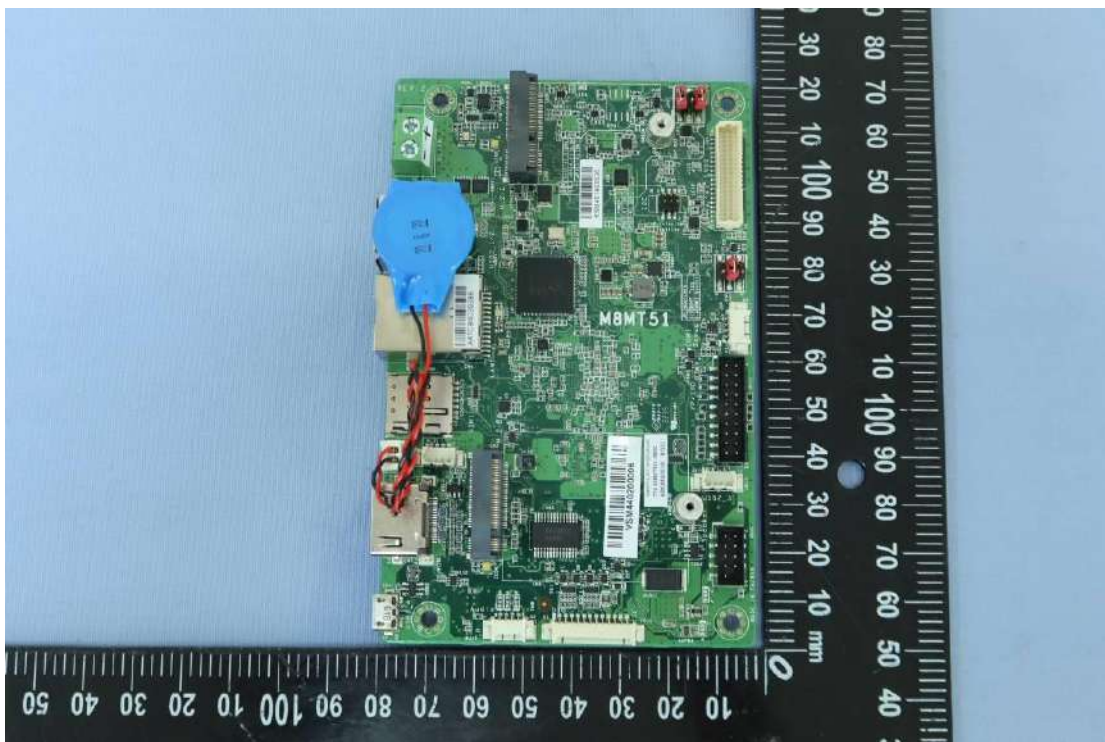
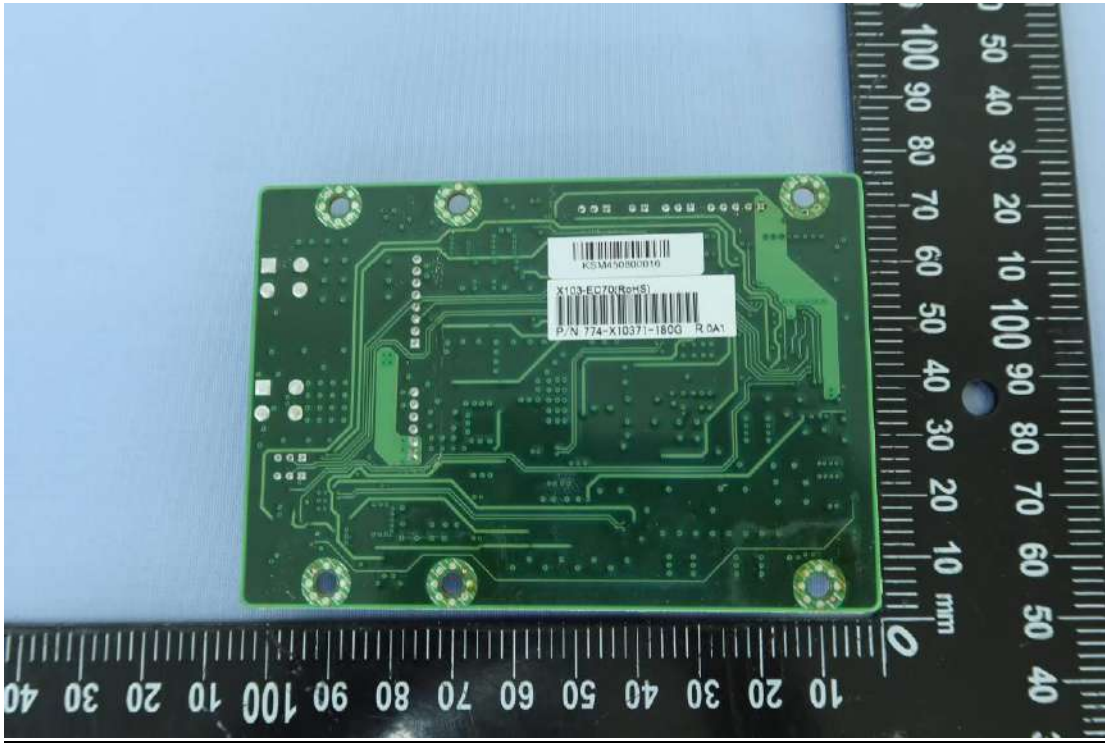


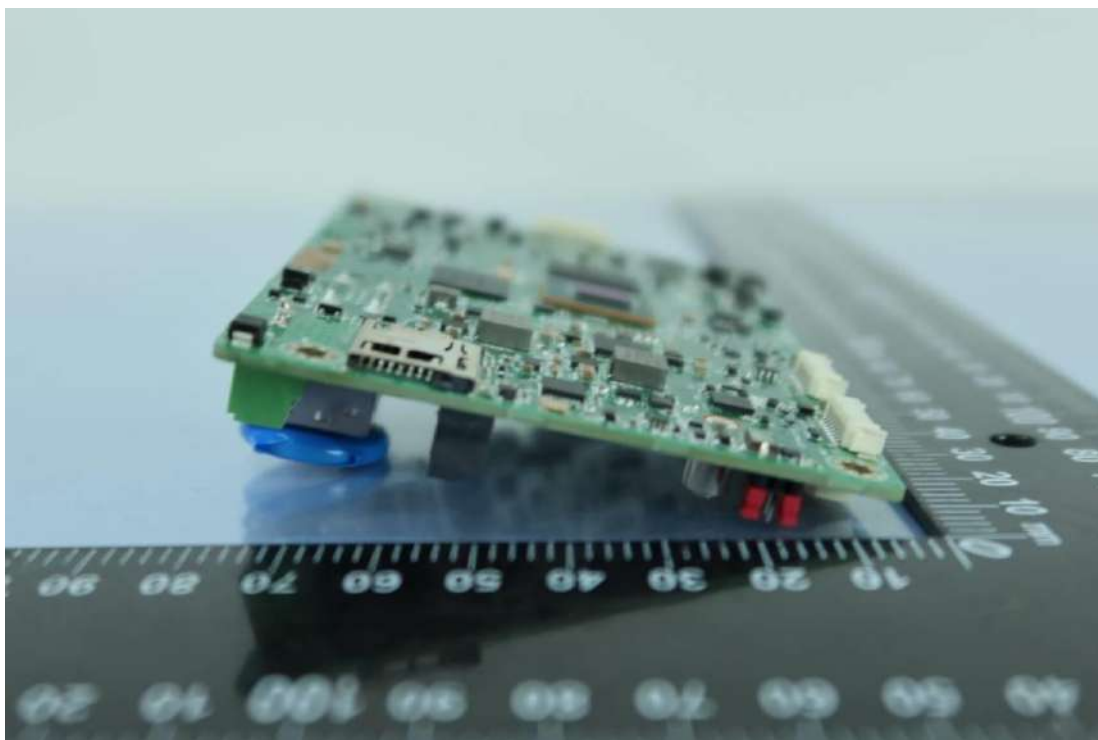
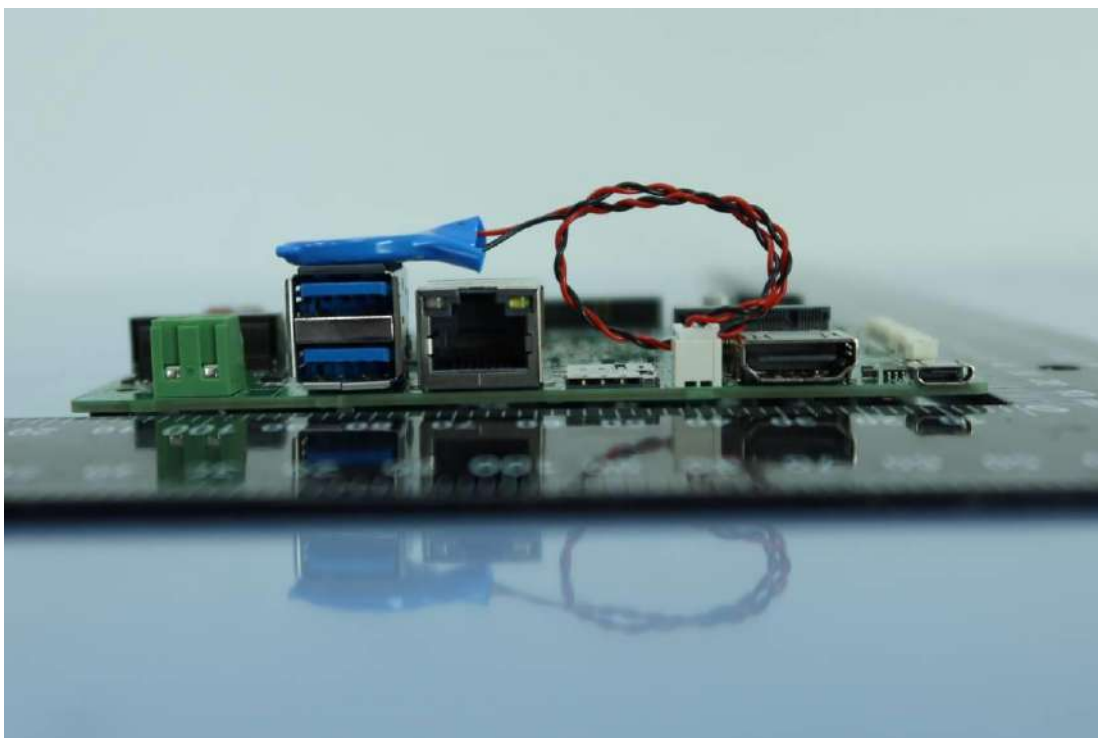


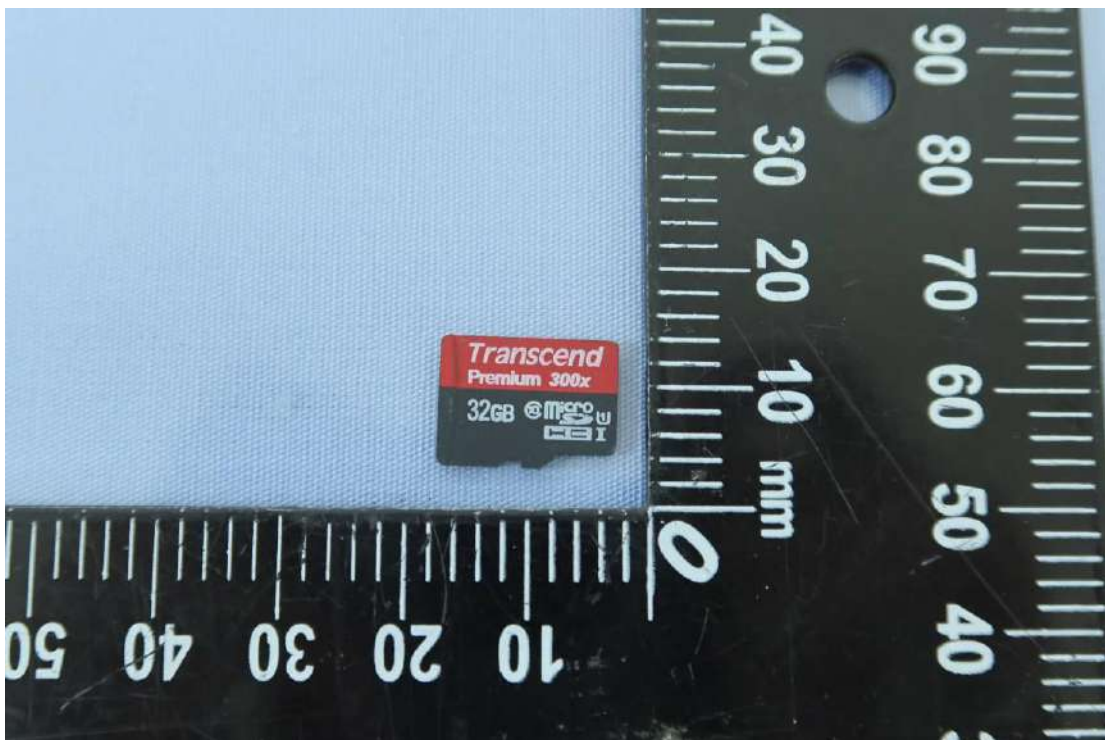
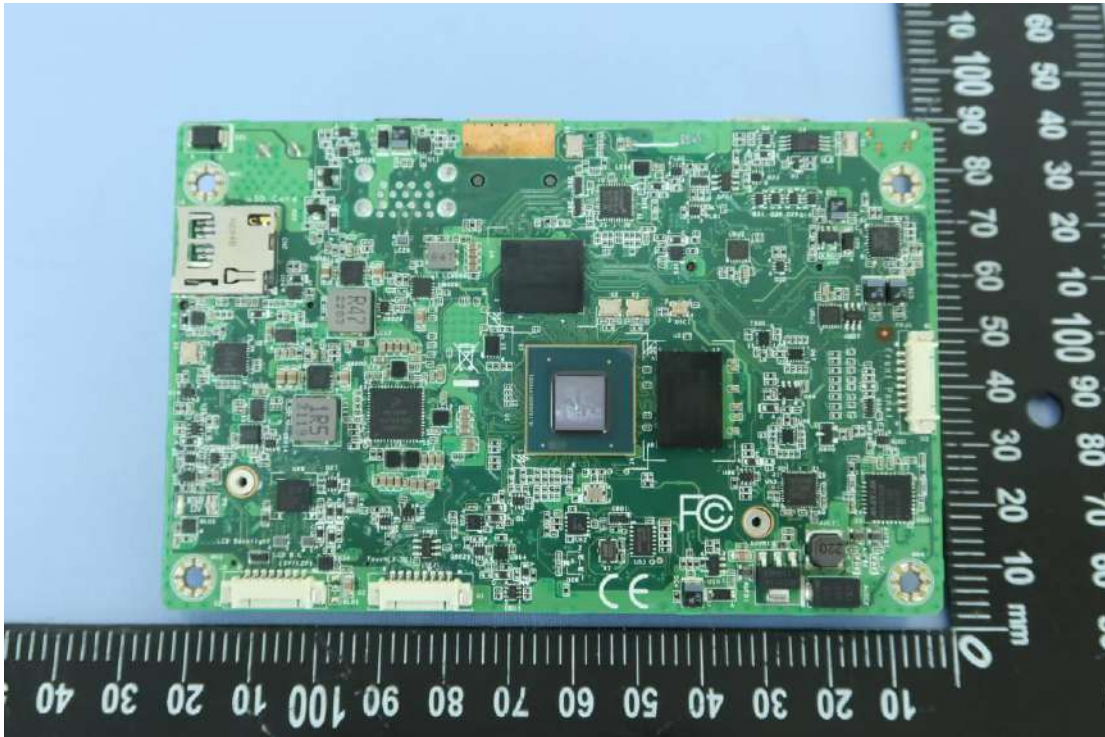


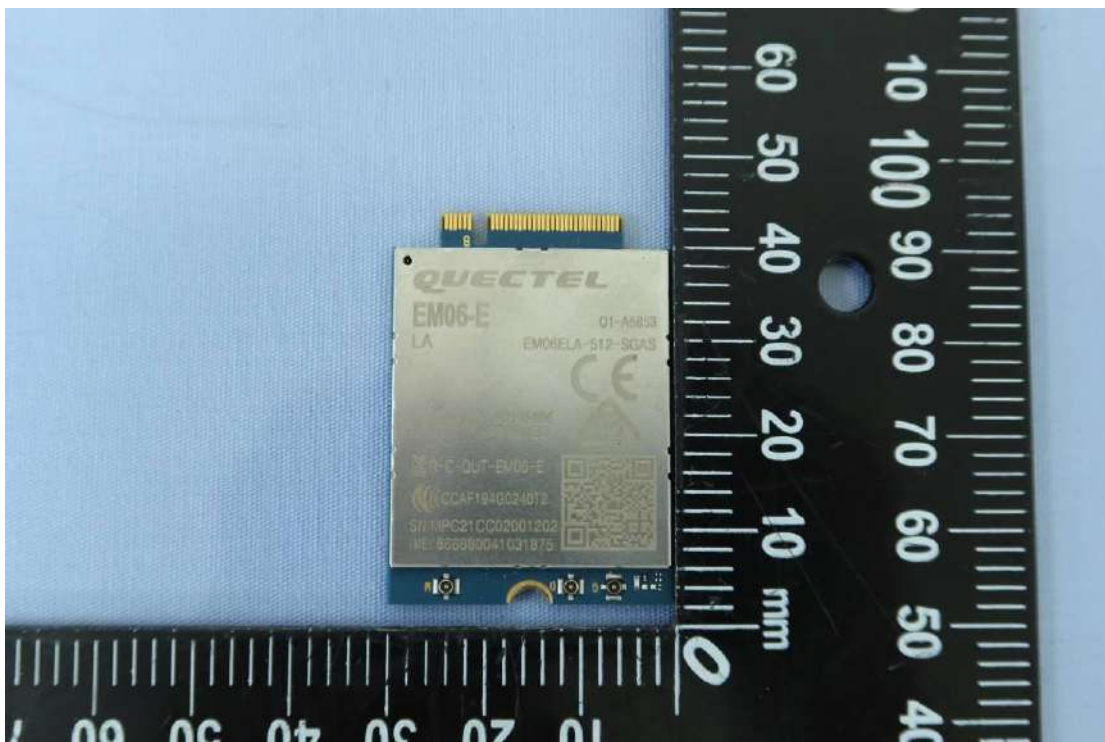
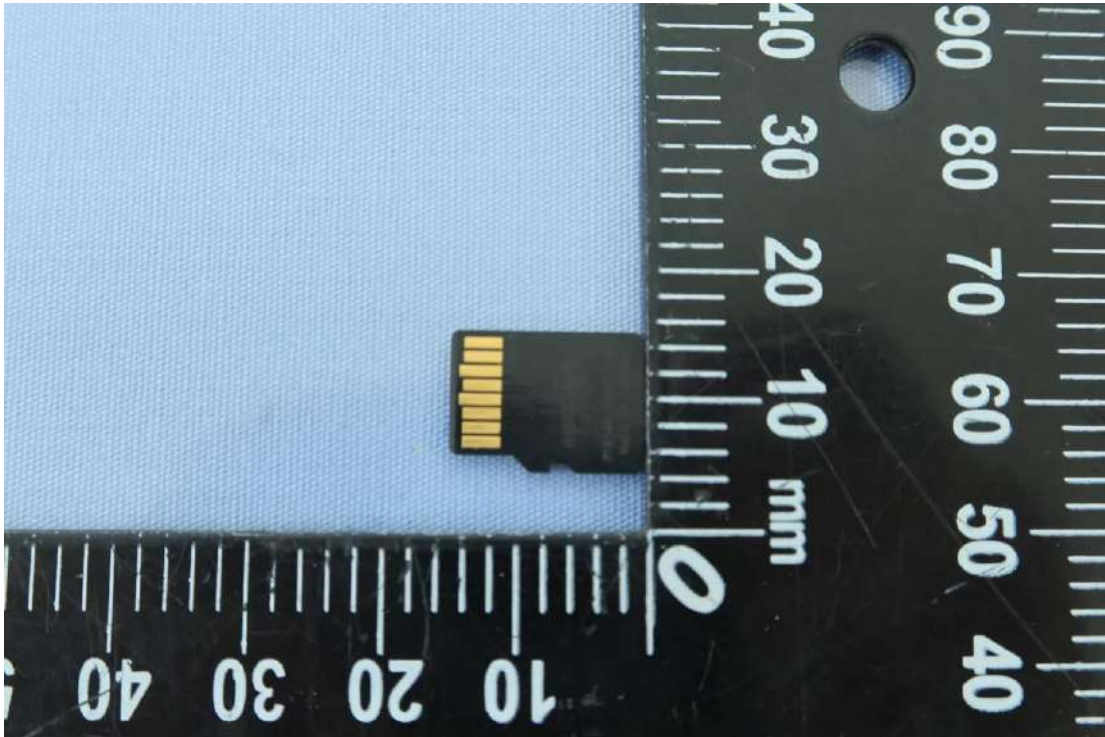


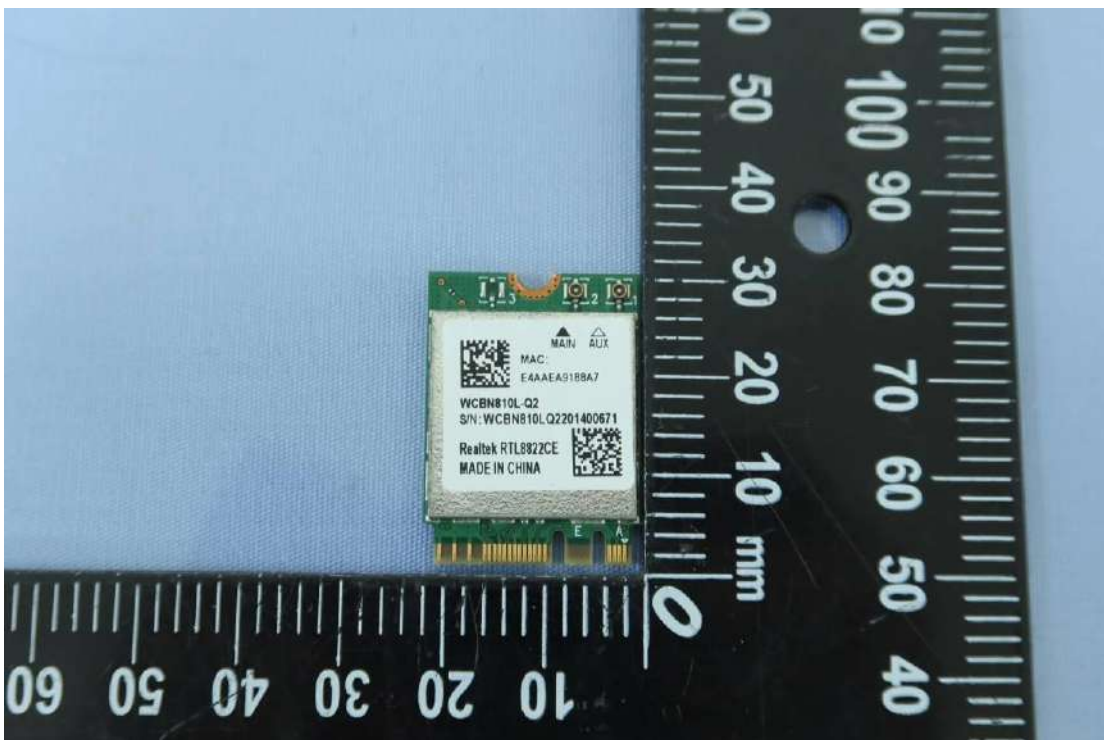
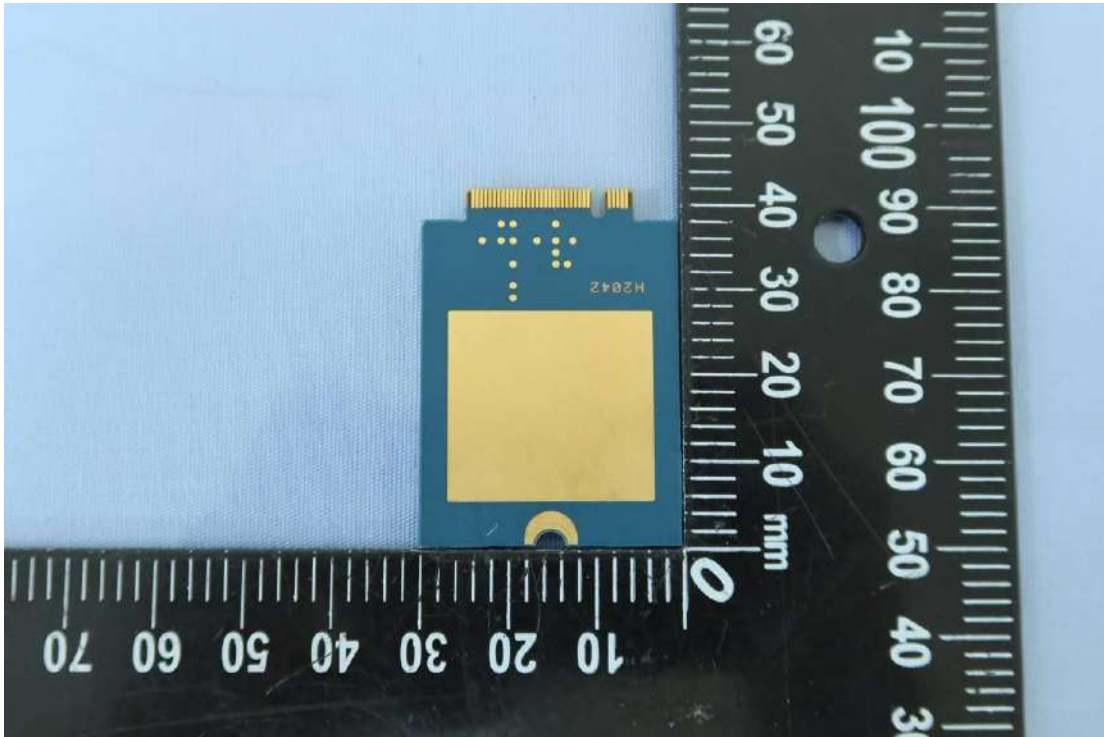


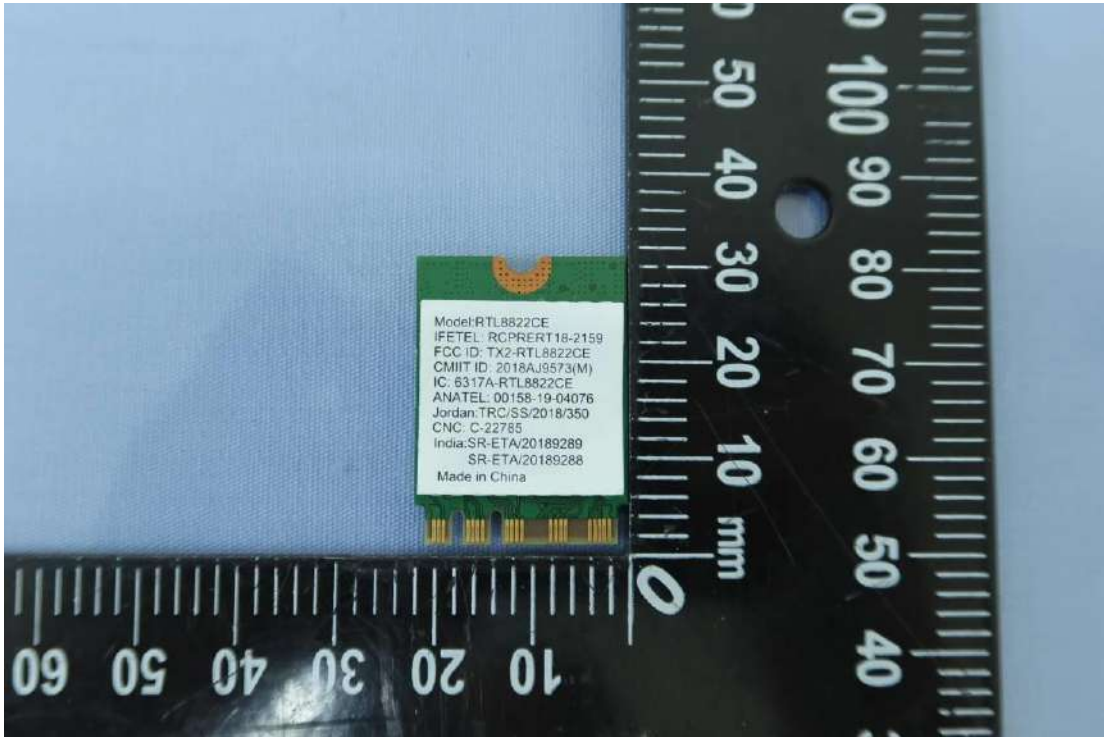




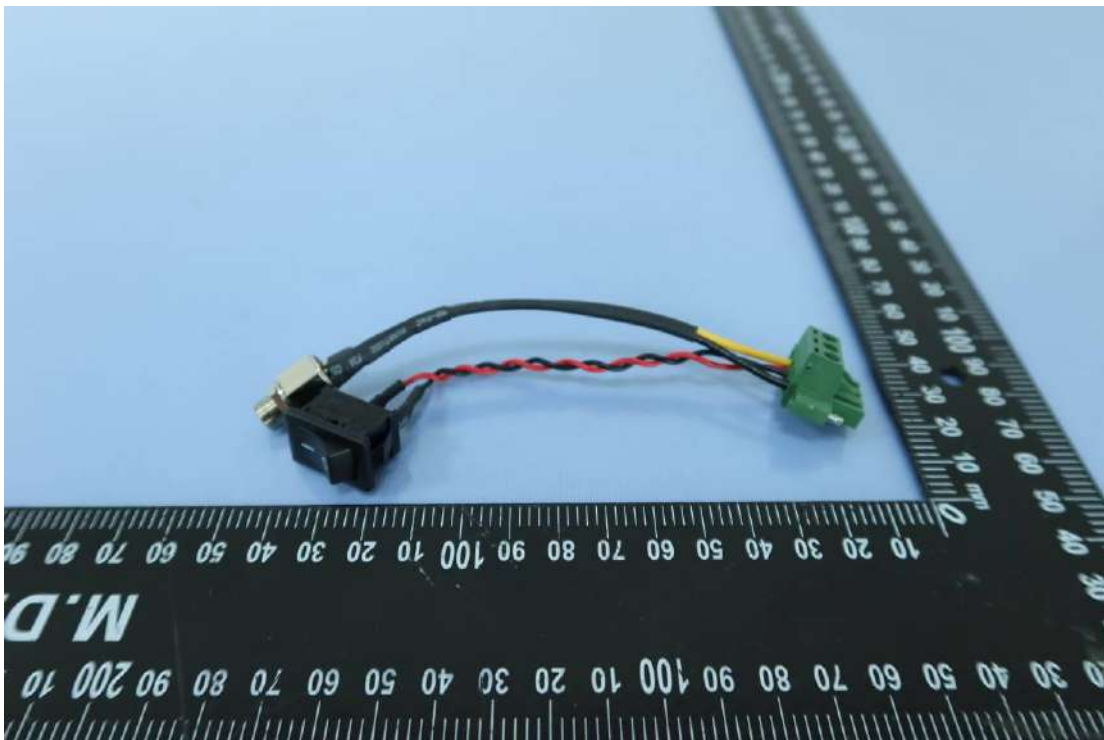


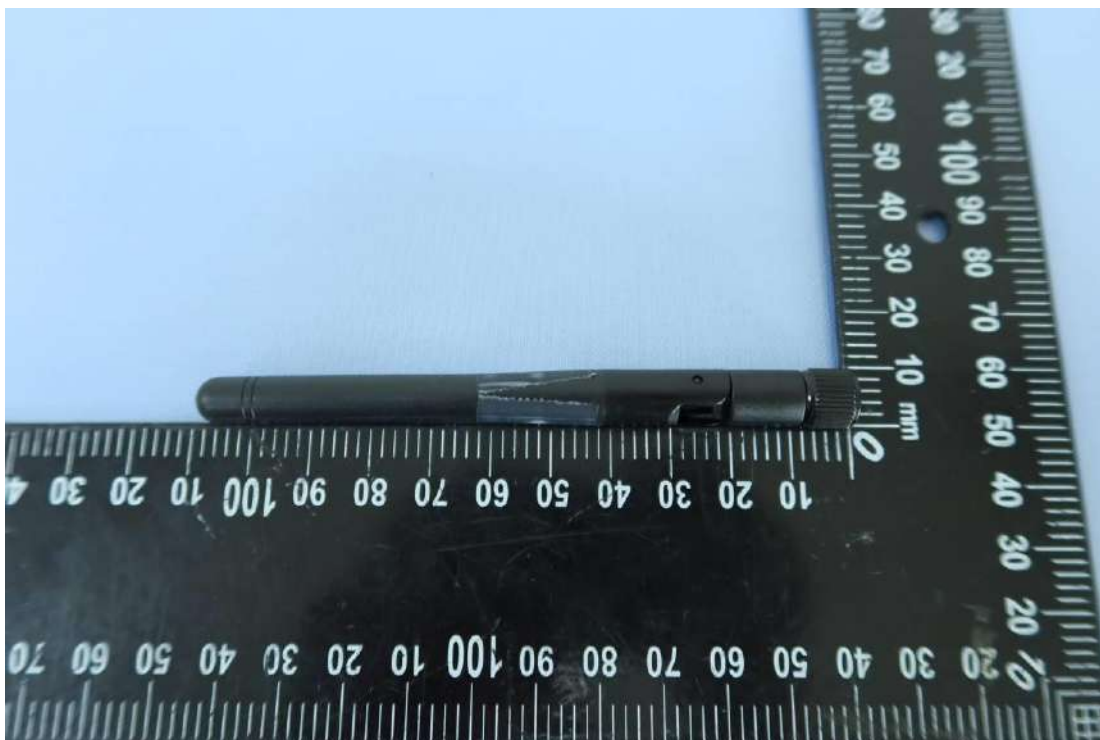
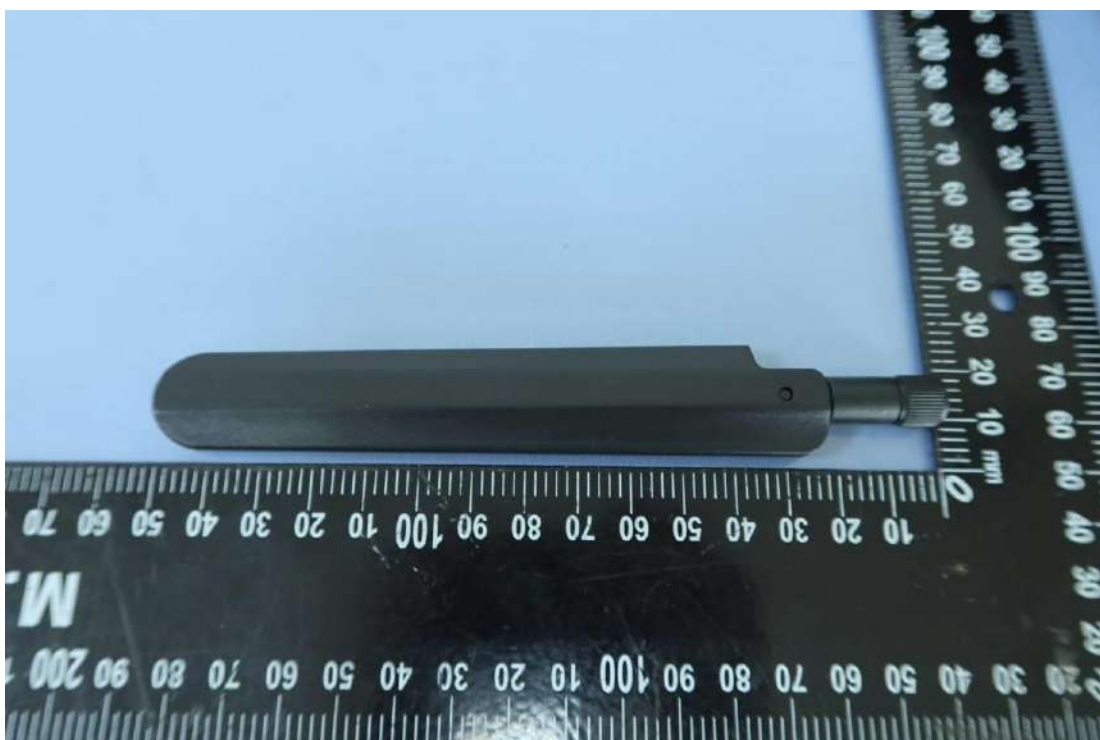














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## Beschreibungsbogen / Information Document

### UN Regelung Nr. 10 (UN-R 010) / UN Regulation No. 10 (UN-R 010)

#### Änderungsserie 06, Ergänzung 2 / 06 Series of Amendments, Supplement 2

<b>Nr.</b> <i>No.</i>	IF_TMxD2305001898DV
<b>Ausgabedatum</b> <i>Date of issue</i>	15.06.2023
<b>Letztes Änderungsdatum</b> <i>Date of last change</i>	-
1. <b>Marke (Handelsmarke des Herstellers)</b> <i>Make (Trade name of manufacturer)</i>	DFI, ITOX
2. <b>Typ</b> <i>Type</i>	VP070-M8M
<b>Ausführung(en)</b> <i>Variant(s)</i>	Variant A: VP070-M8M Variant B: VP070-M8M???????????? (? = A ~ Z, a ~ z, 0 ~ 9, -, blank, or any character)
	Explanation: for marketing purpose only
<b>Handelsbezeichnung(en)</b> <i>Commercial description(s)</i>	Panel PC
3. <b>Art der Kennzeichnung des Typs</b> <i>Means of identification of type</i>	Variant designation
3.1. <b>Stelle, an der die Kennzeichnung angebracht ist</b> <i>Location of that marking</i>	On the back of the unit
4. <b>Name und Anschrift des Herstellers</b> <i>Name and address of manufacturer</i>	DFI Inc. 10F., No. 97, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 22175, Taiwan
<b>Name und Adresse des bevollmächtigten Vertreters, sofern zutreffend</b> <i>Name and address of authorized representative, if any</i>	-
5. <b>Stelle an der das Genehmigungszeichen angebracht wird und Art der Anbringung</b> <i>Location and method of affixing of the approval mark</i>	Label affixed on the back of the unit
6. <b>Anschriften des Montagebetriebs (Anschriften der Montagebetriebe)</b> <i>Address(es) of assembly plant(s)</i>	DFI Inc. No.157, Shanying Rd., Gueishan Dist., Taoyuan City 333424, Taiwan
7. <b>Diese EUB wird als Bauteil/ST<del>E</del> genehmigt<sup>(1)</sup></b> <i>This ESA shall be approved as a component/ST<del>U</del><sup>(1)</sup></i>	

<sup>(1)</sup> Nichtzutreffendes streichen. / Delete where not applicable.

- |     |  |   |
|-----|--|---|
| 8.  | <b>Beschränkung hinsichtlich der Verwendung und Einbaubedingungen</b><br><i>Any restrictions of use and conditions for fitting</i>                                   | -   |
| 9.  | <b>Nennspannung der elektrischen Anlage</b><br><i>Electrical system rated voltage</i>  | <input type="checkbox"/> 12V <input type="checkbox"/> 24V <input checked="" type="checkbox"/> 12V/24V<br>Anschluss an Masse negativ / negative ground |
|     | <i>Nur zutreffend für Ladesysteme</i><br><i>Only applicable for charging systems:</i>  |   |
| 10. | Ladegerät an Bord / extern<br><i>Charger on board / external</i>   | n.a.  |
| 11. | Ladestrom: Gleichstrom / Wechselstrom<br>(Anzahl Phasen, Frequenz)<br><i>Charging current: direct / alternating current</i><br><i>(number of phases / frequency)</i> | n.a.  |
| 12. | Maximaler Nennstrom (jeder Modus, falls notwendig)<br><i>Maximal nominal current (in each mode if necessary)</i>   | n.a.  |
| 13. | Nominale Nennspannung<br><i>Nominal charging voltage</i>   | n.a.  |
| 14. | Grundfunktionen der EUB-Schnittstelle<br>(z.B. L1/L2/L3/N/PE/Control Pilot)<br><i>Basic ESA interface functions (ex. L1/L2/L3/N/PE/control pilot)</i>                | n.a.  |
| 15. | Minimaler $R_{sce}$ -Wert<br><i>Minimum <math>R_{sce}</math>-value</i>   | n.a.  |



## **VP070-M8M**

ARM-Based In-vehicle Fanless Touch Panel PC  
User's Manual

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## FCC and DOC Statement on Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

## Notice:

1. The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Shielded interface cables must be used in order to comply with the emission limits.

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## About this Manual

This manual can be retrieved from the website.

The manual is subject to change and update without notice, and may be based on editions that do not resemble your actual products. Please visit our website or contact our sales representatives for the latest editions.

## Warranty

1. Warranty does not cover damages or failures that arises from misuse of the product, inability to use the product, unauthorized replacement or alteration of components and product specifications.
2. The warranty is void if the product has been subjected to physical abuse, improper installation, modification, accidents or unauthorized repair of the product.
3. Unless otherwise instructed in this user's manual, the user may not, under any circumstances, attempt to perform service, adjustments or repairs on the product, whether in or out of warranty. It must be returned to the purchase point, factory or authorized service agency for all such work.
4. We will not be liable for any indirect, special, incidental or consequential damages to the product that has been modified or altered.

## About this Package

The package contains the following items. If any of these items are missing or damaged, please contact your dealer or sales representative for assistance.

- 1 x VP070-M8M System Unit
- 1 Switch Cable
- 12 Rubber Holders
- 1 ADDM UL Battery Addendum

Note: The items are subject to change in the developing stage.

The product and accessories in the package may not come similar to the information listed above. This may differ in accordance with the sales region or models in which it was sold. For more information about the standard package in your region, please contact your dealer or sales representative.

## Static Electricity Precautions

It is quite easy to inadvertently damage your PC, system board, components or devices even before installing them in your system unit. Static electrical discharge can damage computer components without causing any signs of physical damage. You must take extra care in handling them to ensure against electrostatic build-up.

1. To prevent electrostatic build-up, leave the system board in its anti-static bag until you are ready to install it.
2. Wear an antistatic wrist strap.
3. Do all preparation work on a static-free surface.
4. Hold the device only by its edges. Be careful not to touch any of the components, contacts or connections.
5. Avoid touching the pins or contacts on all modules and connectors. Hold modules or connectors by their ends.



### Important:

Electrostatic discharge (ESD) can damage your processor, disk drive and other components. Perform the upgrade instruction procedures described at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

## Safety Precautions

- Use the correct DC / AC input voltage range.
- Unplug the power cord before removing the system chassis cover for installation or servicing. After installation or servicing, cover the system chassis before plugging in the power cord.
- There is danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent specifications of batteries recommend by the manufacturer.
- Dispose of used batteries according to local ordinance.
- Keep this system away from humid environments.
- Make sure the system is placed or mounted correctly and stably to prevent the chance of dropping or falling may cause damage.
- The openings on the system shall not be blocked and shall be kept in distance from

other objects to make sure of proper air ventilation to protect the system from overheating.

- Dress the cables, especially the power cord, so they will not be stepped on, in contact with high temperature surfaces, or cause any tripping hazards.
- Do not place anything on top of the power cord. Use a power cord that has been approved for use with the system and is compliant with the voltage and current ranges required by the system's electrical specifications.
- If the system is to be unused or stored for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
- If one of the following occurs, consult a service personnel:
  - The power cord or plug is damaged.
  - Liquid has penetrated the system.
  - The system has been exposed to moisture.
  - The system is not working properly.
  - The system is physically damaged.
- The unit uses a three-wire ground cable which is equipped with a third pin to ground the unit and prevent electric shock. Do not defeat the purpose of this pin. If your outlet does not support this kind of plug, contact your electrician to replace the outlet.
- Disconnect the system from the electricity outlet before cleaning. Use a damp cloth for cleaning the surface. Do not use liquid or spray detergents for cleaning.
- Before connecting, make sure that the power supply voltage is correct. The device is connected to a power outlet which should be grounded connection.



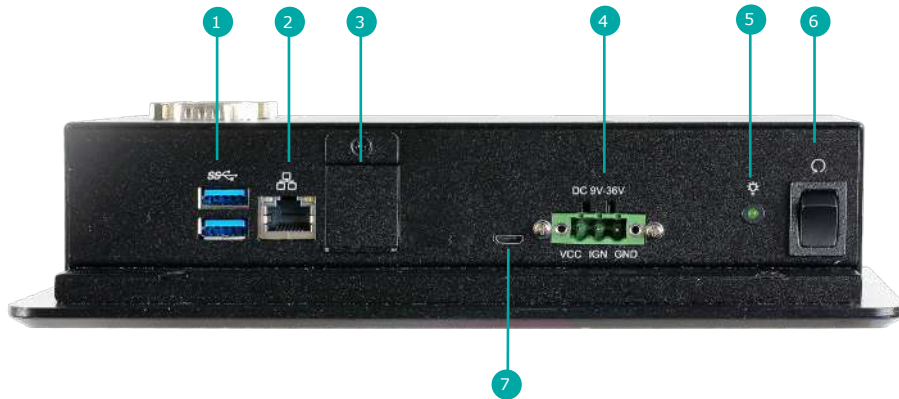
The system may burn fingers while running.

Wait for 30 minutes to handle electronic parts after power off.

## Chapter 1 - Introduction

### ► Overview

#### Bottom View



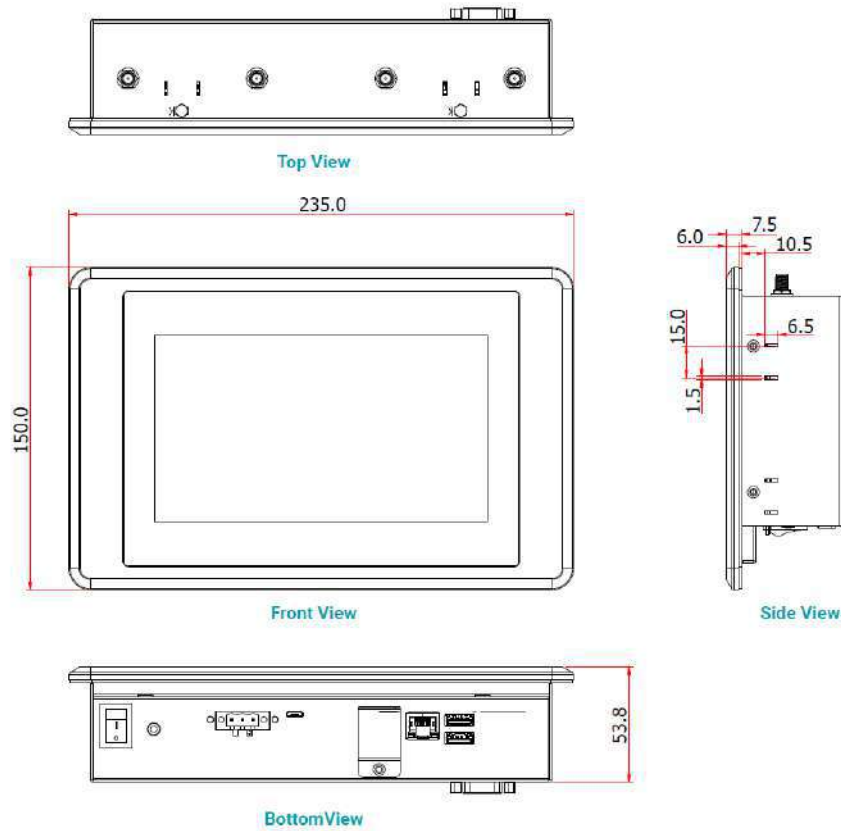
- 1 USB 3.1 Gen1
- 2 LAN
- 3 SIM
- 4 Power Input
- 5 Status LED
- 6 Reset Switch
- 7 OTG

#### Back View



- 8 COM
- 9 CANbus

► **Dimensions**



► **Key Features**

**ARM-Based System:**

Support Android 9.0 and Linux

**IP Rating:**

IP65 Front Panel Protection

**Rich I/O Connectivity:**

1 GbE, 2 COM, 1 CAN Bus, 2 USB 3.1 Gen1

**Application Focus:**

In-vehicle Driver HMI

DFI's VP070-M8M equipped with ARM processor is the most energy-efficient All-in-One PC served as driver HMI with significantly longer battery life and high resolution TFT LCD display with capacitive touch. IP65 rated protection, wide operating temperature range, and anti-vibration ensure the system can withstand the bumpy, mountainous environment. Power management features include a wide power input range, surge protection. The built-in IMU sensor helps to record vehicle moving status. 4G, Wi-Fi, and GPS, as well as rich I/O and built-in SIM card/SD card are provided for flexible connectivity and expandability. The above function is to store or transmit the vehicle location or data to the operation center.

## ► Specifications

<b>SYSTEM</b>	Processor	NXP i.MX 8M Dual/Quad Cortex-A53, 1.3GHz
	Max. Speed	1.3GHz
<b>MEMORY</b>	Technology	On board Memory 2GB/4GB (Default 2GB) Single Channel LPDDR4 up to 3200 MHz
	Max. Capacity	4GB
	Socket	Memory Down
<b>DISPLAY &amp; TOUCH SCREEN</b>	Display Type	7" PCAP TFT
	Max. Resolution	1024 x 600
	Brightness	425 cd/m <sup>2</sup>
<b>STORAGE</b>	Internal	Support eMMC 5.1 16GB on board (default) Support up to 64GB (optional)
	External	Micro SD card slot
<b>EXPANSION</b>	Interface	1 x M.2 2242/3042 B Key (USB 3.1 Gen1), Nano SIM Slot support 1 x M.2 2230 E Key (PCIex1/USB2.0)
<b>ETHERNET</b>	Controller	AR8035
<b>AUDIO</b>	Audio Codec	SGTL5000
<b>LED</b>	Indicators	1 x Status LED
<b>Sensor</b>	Sensor	6 axis IMU (3 Accelerometer + 3 Gyroscope)
	Ethernet (Gbe)	1 x Giga LAN
<b>I/O</b>	Serial	1 x RS-232/422/485 1 x RS-232 1 x CAN Bus
	USB	2 USB3.1 Gen1 1 x OTG, micro USB
	Audio	with Amplifier to support 2W speaker (optional) 1 x Line-out & 1 x MIC-in (internal header)
	Buttons	1 x Reset switch
<b>POWER</b>	Type	9~36V DC Power input, with ACC/IGN control
<b>OS SUPPORT</b>	Linux	Yocto 2.5 (optional)
	Android	Android 9.0 (default)

<b>MECHANISM</b>	Construction	Aluminum + SGCC
	IP Rating	IP65 Front Panel Protection
	Mounting	Panel Mount /VESA Mount
	Dimensions (W x H x D)	235 x 150 x 54mm
	Weight	2.9kg
<b>ENVIRONMENT</b>	Operating Temperature	-20 to 70°C
	Storage Temperature	-30 to 80°C
	Relative Humidity	10 to 90% RH (non-condensing)
<b>Standards and Certifications</b>	Shock	OP: Half-sine, 3G @ 11ms
		Non-OP: Half-sine, 5G @ 11ms
	Vibration	OP: Random, 1Grms @ 5~500Hz, 30min
		Non-OP: Sweep sine, 3Grms @ 10~500Hz, 30min
Certifications	CE, FCC, E-Mark R10, RoHS, UKCA	

## Chapter 2 - Hardware Installations

### ► Removing the Chassis Cover

Please observe the following guidelines and follow the instructions to open the system.

1. Make sure the system and all other peripheral devices connected to it have been powered off.
2. Disconnect all power cords and cables.

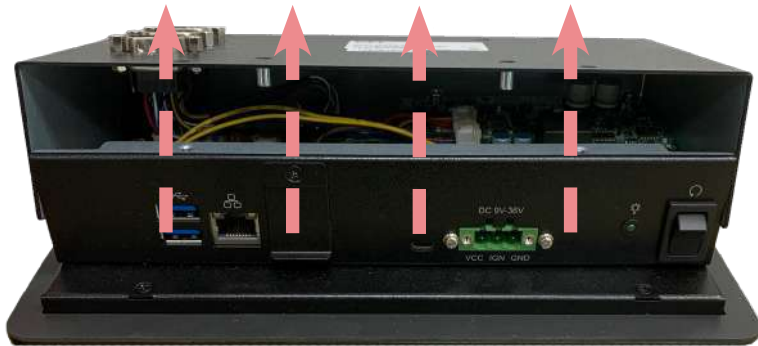
#### Step 1:

The 8 screws of the system are used to secure the cover to the chassis. Remove the screws and put them in a safe place for later use.



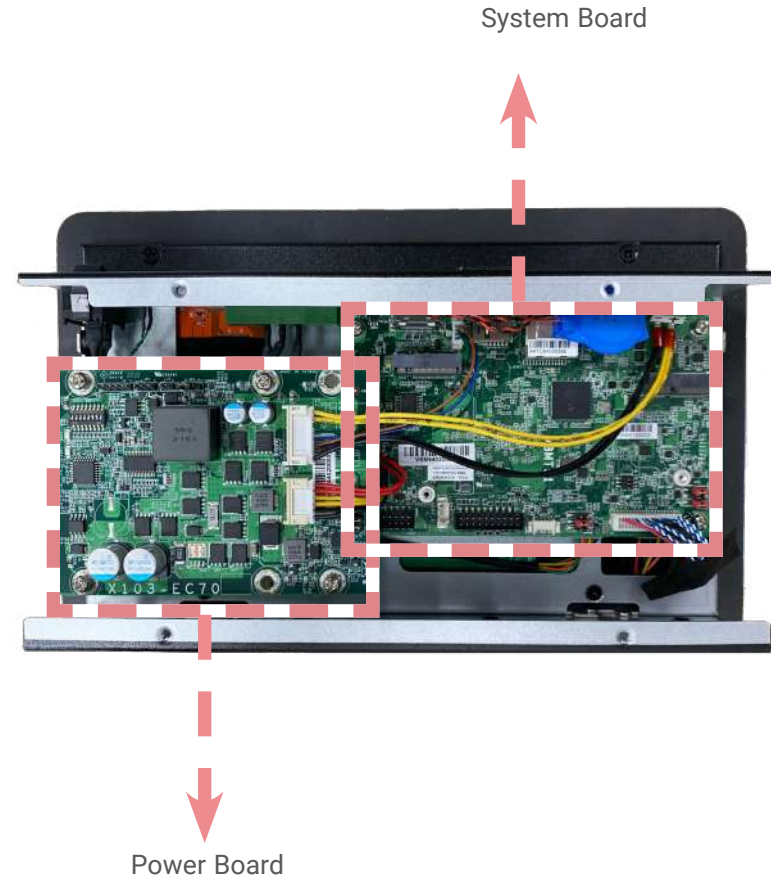
**Step 2:**

Slide the cover to open the system.



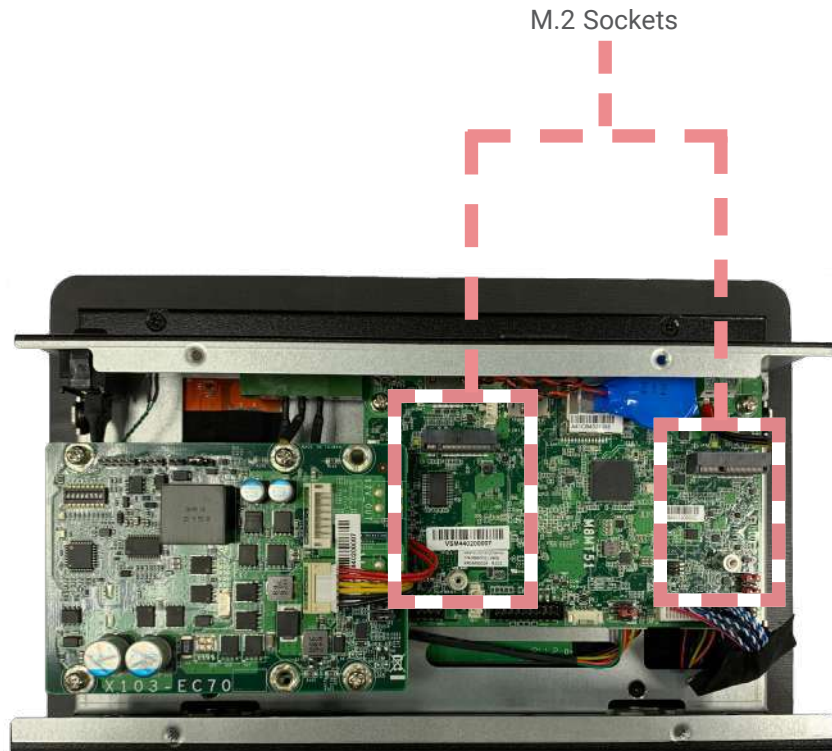
**Step 3:**

The boards can be easily accessed after the chassis cover is removed.





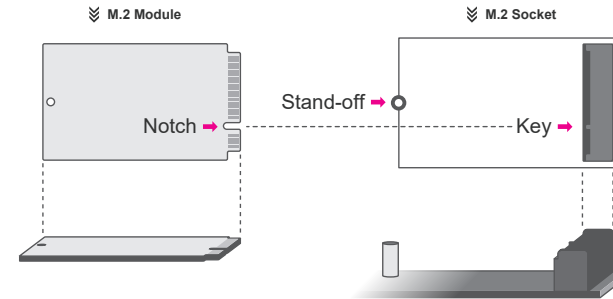
► **Installing an M.2 Card**



Please follow the steps below to install the card into the socket.

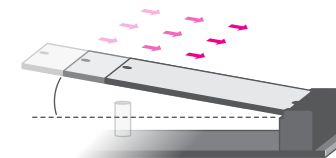
**Step 1:**

Insert the card into the socket at an angle while making sure the notch and key are perfectly aligned.



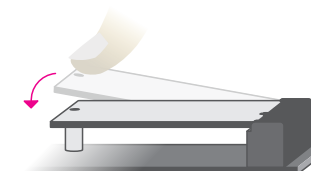
**Step 2:**

Press the end of the card far from the socket down until against the stand-off.



**Step 3:**

Screw tight the card onto the stand-off with a screw driver and a stand-off screw until the gap between the card and the stand-off closes up. The card should be lying parallel to the board when it's correctly mounted.



## ► Installing an Antenna

Before installing the antenna, please make sure that the following safety cautions are wellattended.

1. Make sure the PC and all other peripheral devices connected to it has been powered down.
2. Disconnect all power cords and cables.

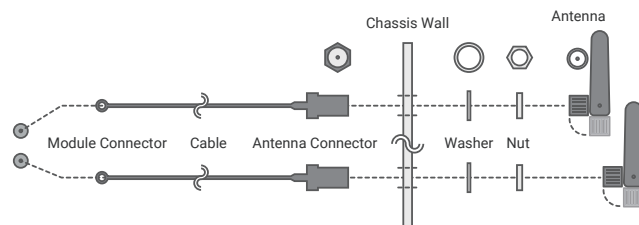
### Step 1:

There are antenna holes reserved on the side of the system and covered by rubber plugs. Please remove the plug prior to installing an antenna.



### Step 2:

Connect the internal cable to the board's antenna connector, screw the antenna connector through the antenna hole with washers and nuts, and screw on the antenna as illustrated below.



## ► Mounting Options

### Wall Mount

#### Step 1:

Select a place on the wall where you will mount the Panel PC.

#### Step 2:

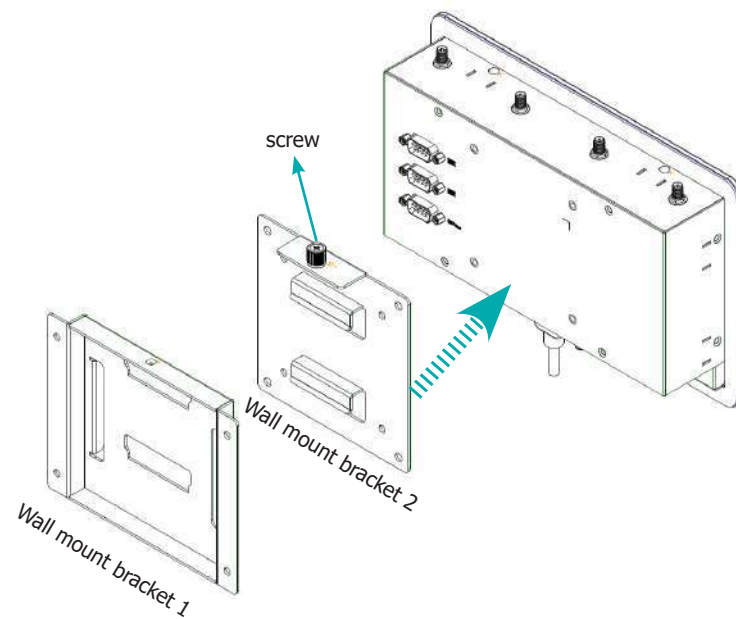
Use the provided mounting screws to attach **wall mount bracket 1** onto the wall.

#### Step 3:

Attach the other bracket (**wall mount bracket 2**) to the rear of the Panel PC.

#### Step 4:

Slide the Panel PC to **wall mount bracket 1** and attach the two brackets together with the hooks. Then tighten the screw to secure the assembly in place.



## Panel Mount

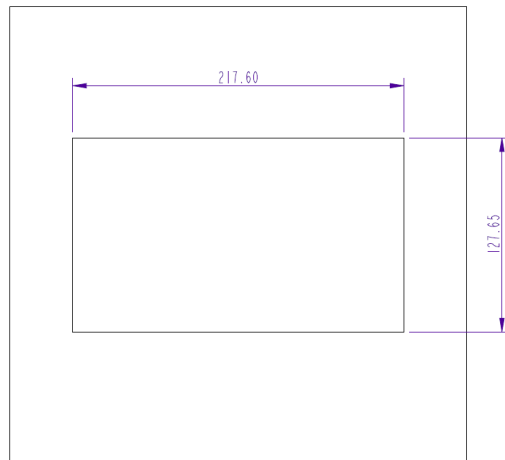
### Step 1:

Select a place on the panel (or wall) where you will mount the Panel PC.

### Step 2:

Cut out a shape on the panel that corresponds to the Panel PC's rear dimensions (217.6mm x 127.65mm) and ensure that the Panel PC can be fitted into the panel properly.

The flat panel thickness is less than 10mm. Be sure to route or trim down the thick wall to 10 mm or slightly less for the clamps to recess and be compatible with your wall or enclosure.



### Step 3:

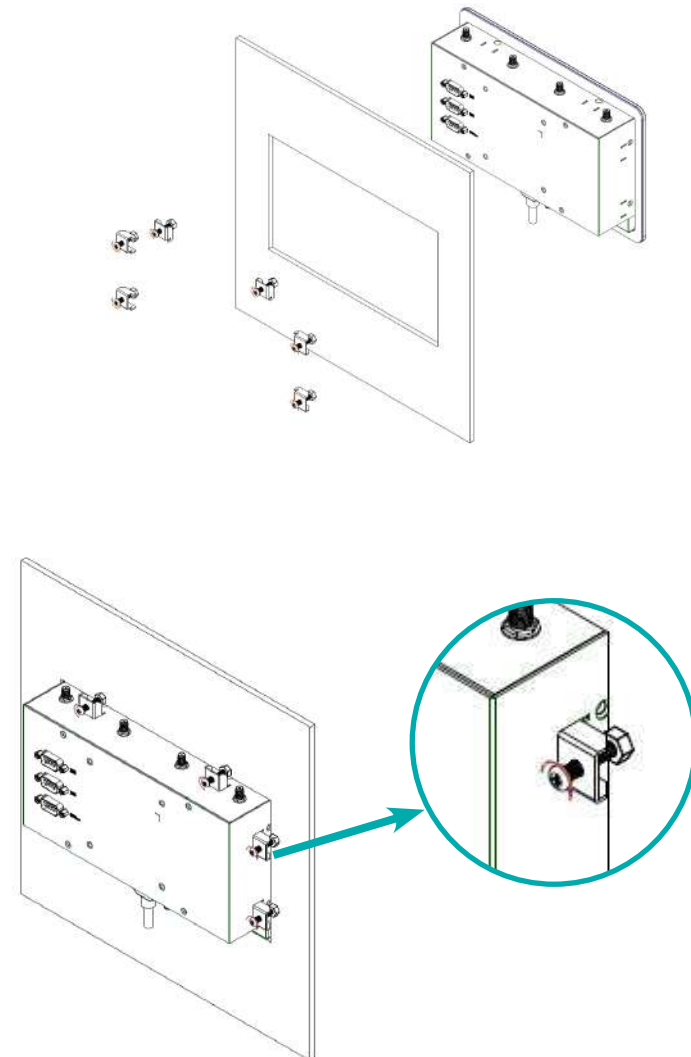
Insert the Panel PC from the outside surface of the panel into the mounting hole until it is properly fitted against the panel.

### Step 4:

Position the mounting clamps along the rear edges of the Panel PC and insert them into the slits around the Panel PC.

### Step 5:

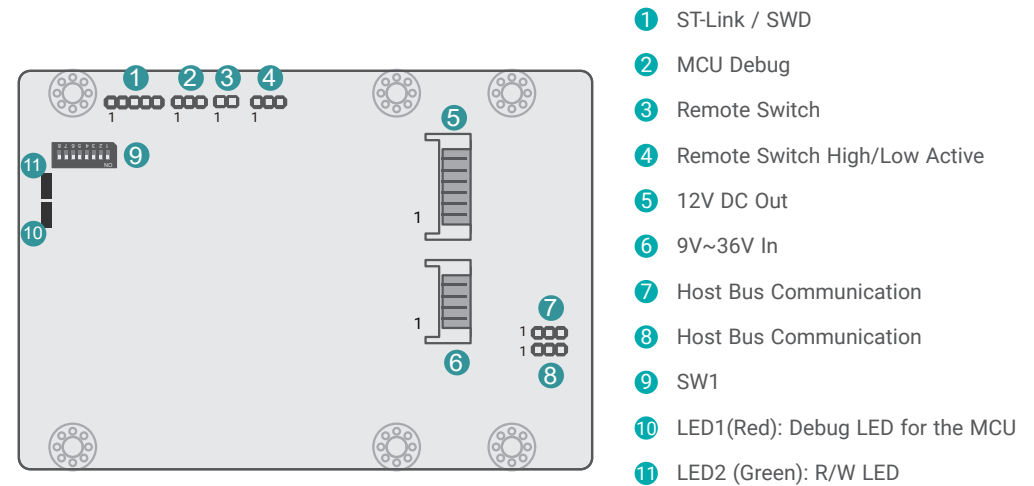
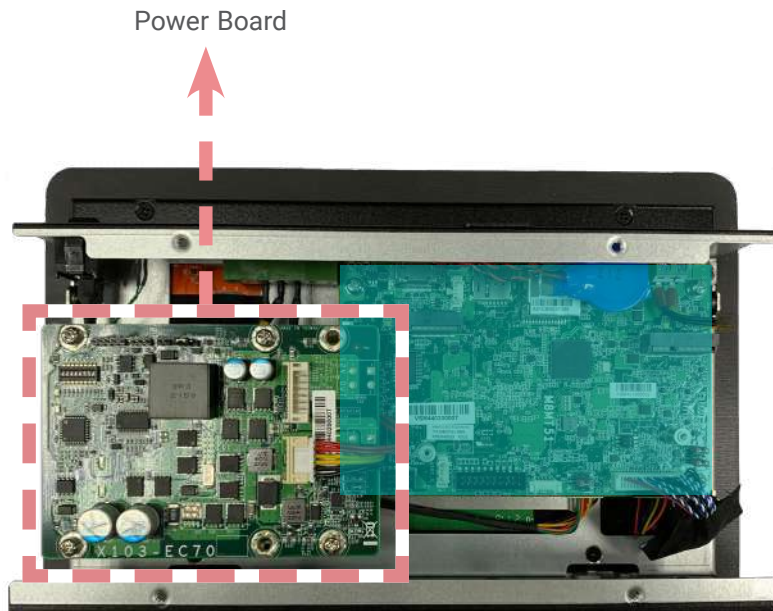
The first and second clamps must be positioned and secured diagonally prior to mounting the rest of the clamps. Tighten the clamp's screw using an electric screwdriver by pressing the white plastic cap onto the back of the panel. The illustration below shows that all clamps are properly mounted.



## Chapter 3 - System Settings

### ► System Layout

#### Power Board

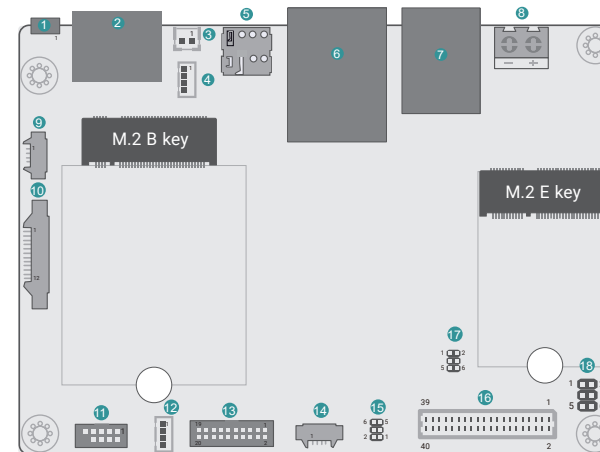
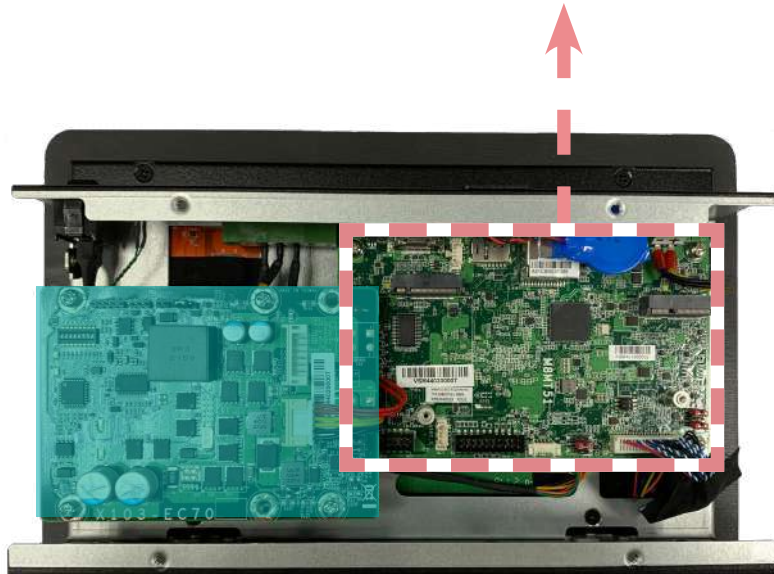


**Important:**

Electrostatic discharge (ESD) can damage your board, processor, disk drives, add-in boards, and other components. Perform installation procedures at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

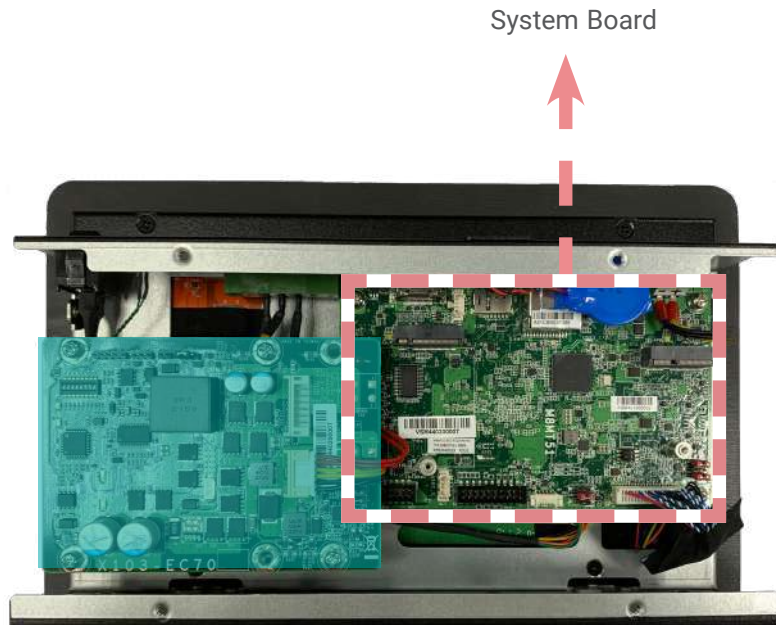
System Board

System Board



- 1 USB2\_4
- 2 HDMI
- 3 Battery
- 4 Power Link
- 5 SIM Slot
- 6 LAN
- 7 USB3.0
- 8 DC-IN
- 9 Audio
- 10 DIO
- 11 Speaker
- 12 USB2\_3
- 13 VP IO
- 14 COM1 Debug
- 15 Boot CFG
- 16 LVDS
- 17 I2C
- 18 LED Backlight

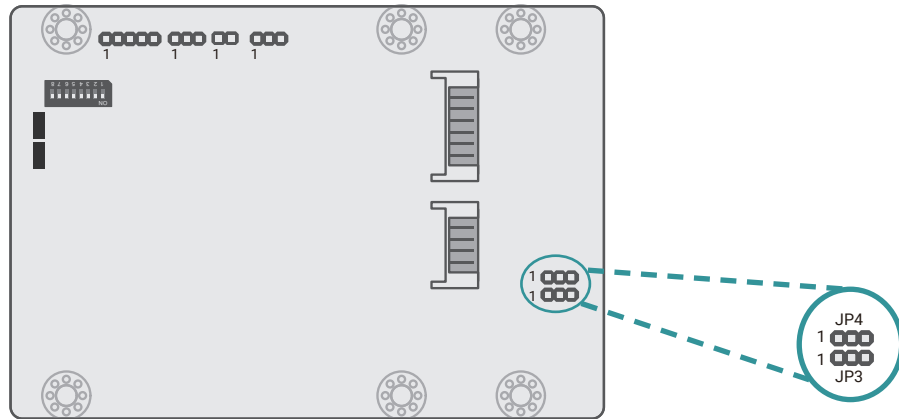
System Board - uSD Card Slot



19 uSD Card Slot

► Jumper Settings- Power Board

Host Bus Communication (JP3, JP4)



■ 1-2 On: Reserved



■ 2-3 On: TX/RX UART (default)

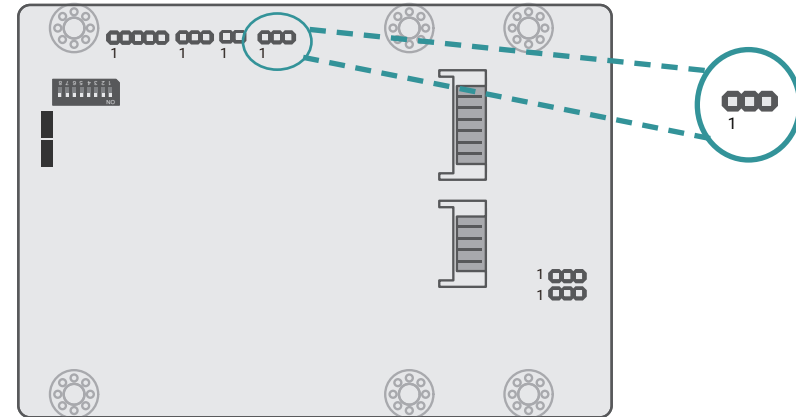


■ 1-2 On: High Active (default)



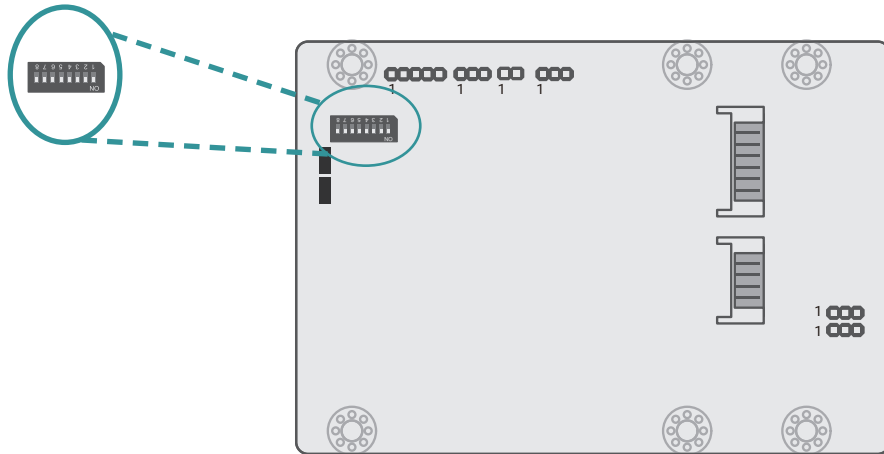
■ 2-3 On: Low Active

Remote Switch High/Low Active (JP2)





SW1

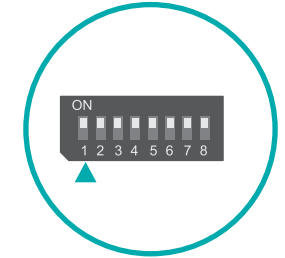


24V / 12V Select

1 Output Voltage

On 12V (default)

Off 24V

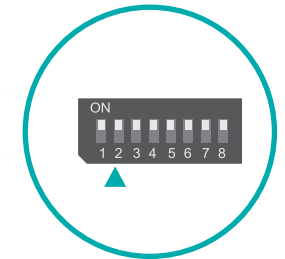


POWER ON Delay Switch

2 Delay On/Off

On On, delay duration defined by 4 and 5

Off Off, delay = 3 seconds by default

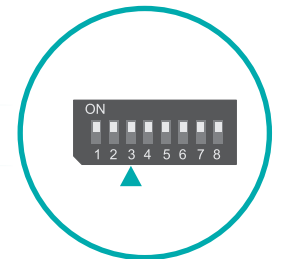


POWER OFF Delay Switch

3 Delay On/Off

On On, delay duration defined by 6, 7, and 8

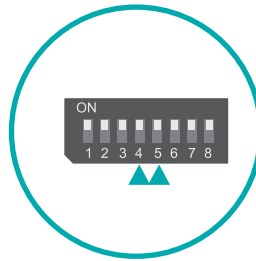
Off Off, delay = 0 second by default



**Important:**  
Power-off the system and then unplug the power cord prior to setting the switches. Failure to do so will cause severe damage to the system and components.

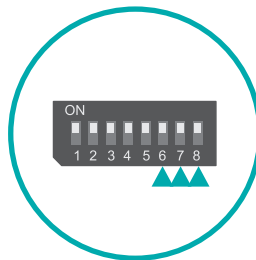
### POWER ON Delay Time Select

5	4	Delay Duration
On	On	10 seconds (default)
On	Off	30 seconds
Off	On	1 minute
Off	Off	5 minutes



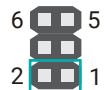
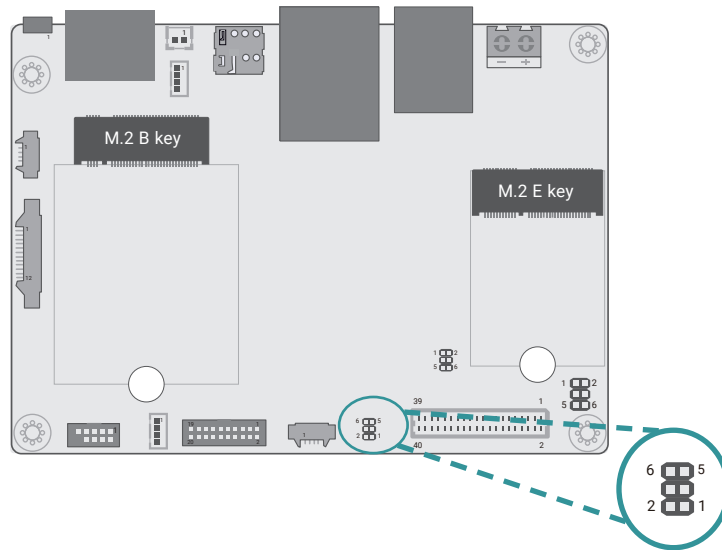
### POWER OFF Delay Time Select

8	7	6	Delay Duration
On	On	On	30 seconds (default)
On	On	Off	1 minute
On	Off	On	3 minutes
On	Off	Off	5 minutes
Off	On	On	10 minutes
Off	On	Off	15 minutes
Off	Off	On	30 minutes
Off	Off	Off	1 hour

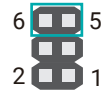


► **Jumper Settings- System Board**

Boot Config (JP1)

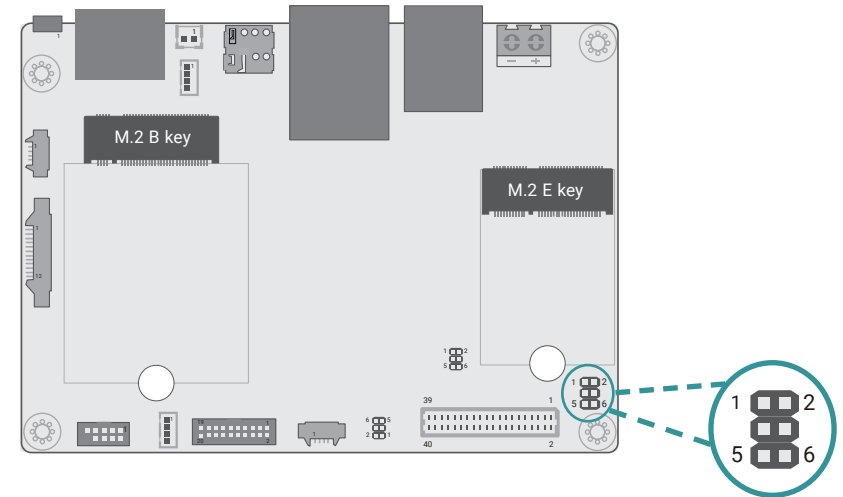


- 1-2 Off: Internal Boot (default)
- 1-2 On: Serial Downloader

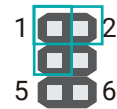


- 5-6 Off: EMMC@eSDHC3 (default)
- 5-6 On: uSD@eSDHC2

LED Backlight (JP5)

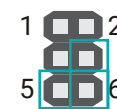


For VEN & VPWM



- 1-2 On: 3.3V (Default)
- 1-3 On: 5V

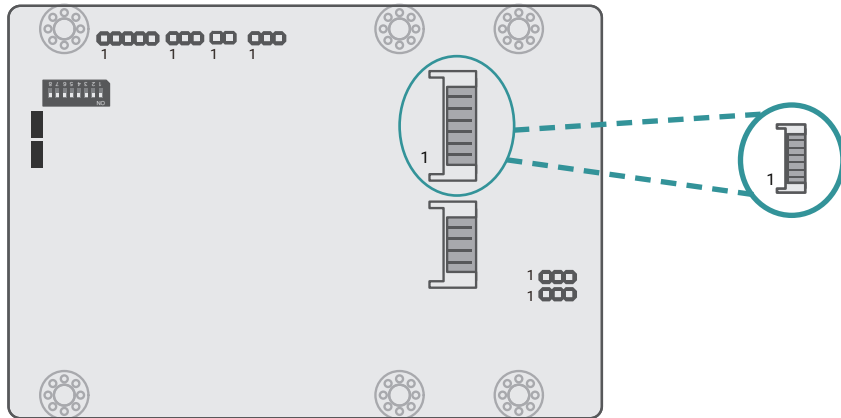
For VLED Backlight



- 5-6 On: Backlight Power 12V (default)
- 4-6 On: Backlight Power 5V

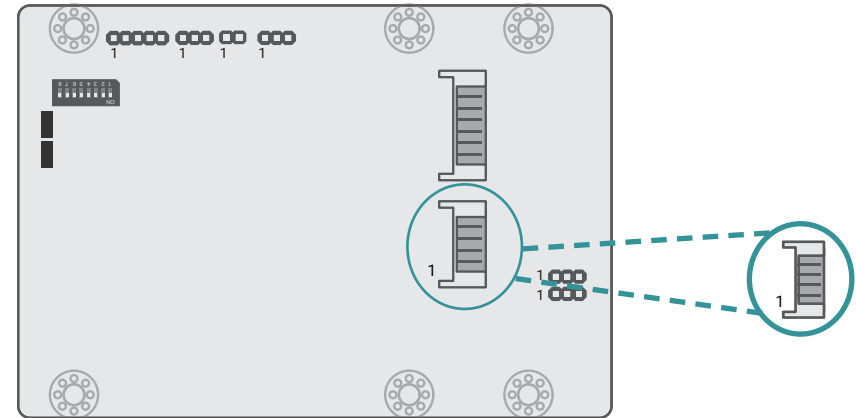
► **Pin Assignment- Power Board**

12V DC-Out (CN3)



Pin	Assignment
1	GND
2	GND
3	Power Button
4	Host TX
5	Host RX
6	12VSB
7	12VSB
8	12VSB

9V~36V In (J1)



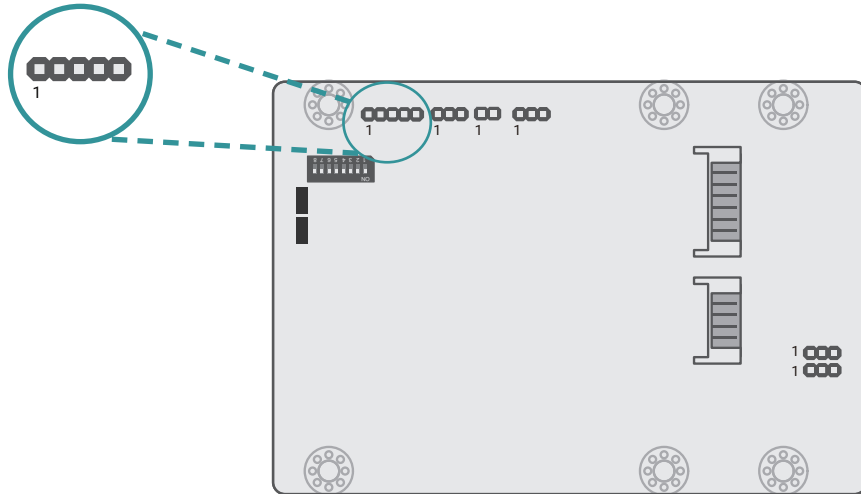
Pin	Assignment
1	V_In
2	V_In
3	Ignition
4	Ignition
5	GND
6	GND

The 9V~36V In box headers are for ignition and power input to the power board, which then converts to 12VDC for output to the system board.

**Jumper Settings**

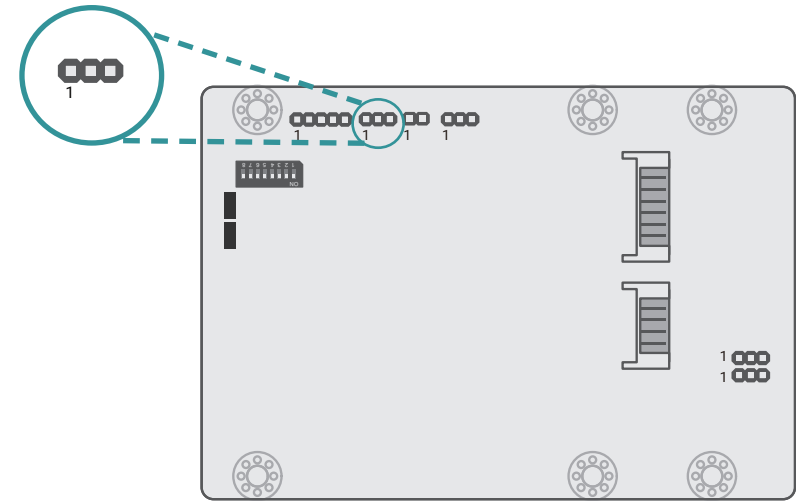
Power on/off, delay time, and other power related aspects can be configured via SW1 as previously instructed in this chapter.

MCU Connector (J2)



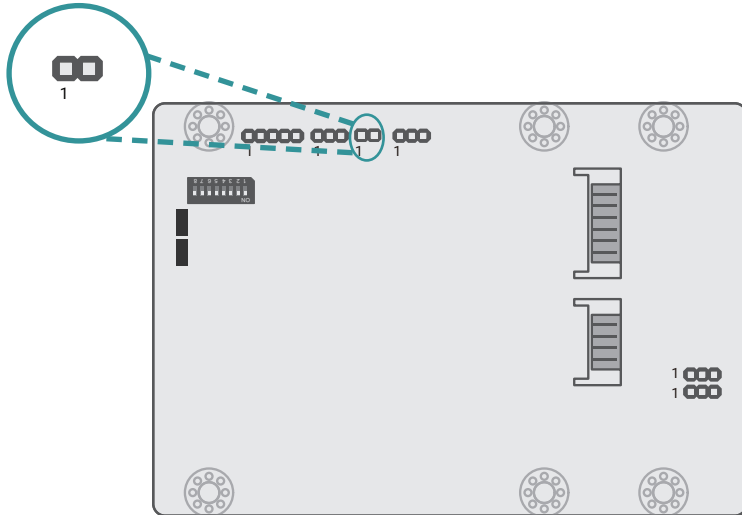
Pin	Assignment
1	3V
2	GND
3	SYS_SWDIO
4	SYS_SWCLK
5	STMCU_RST#

MCU Debug (JP1)



Pin	Assignment
1	UART_TX
2	UART_RX
3	GND

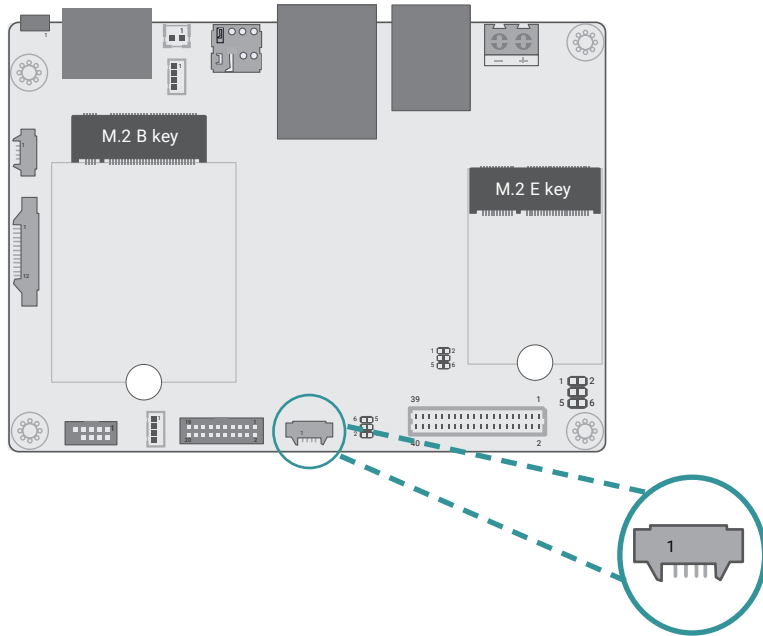
Remote Switch (J3)



Pin	Assignment
1	Power Button
2	GND

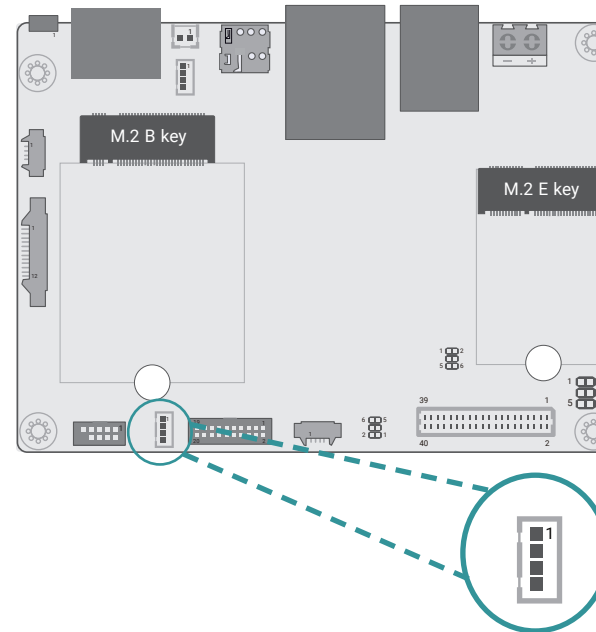
► **Pin Assignment- System Board**

COM1 Debug (J10)



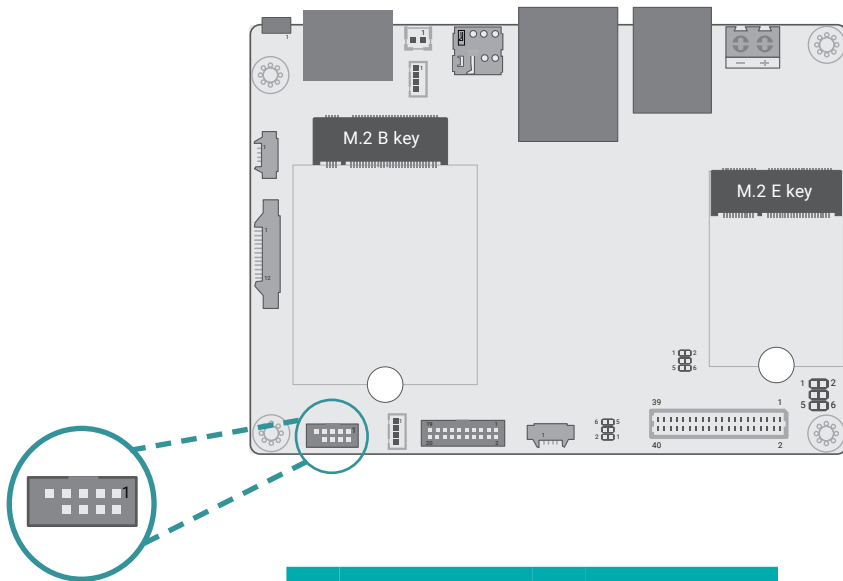
Pin	Assignment
1	+3.3V
2	UART1_RX
3	UART1_TX
4	GND

USB2\_3 (UBJ1)



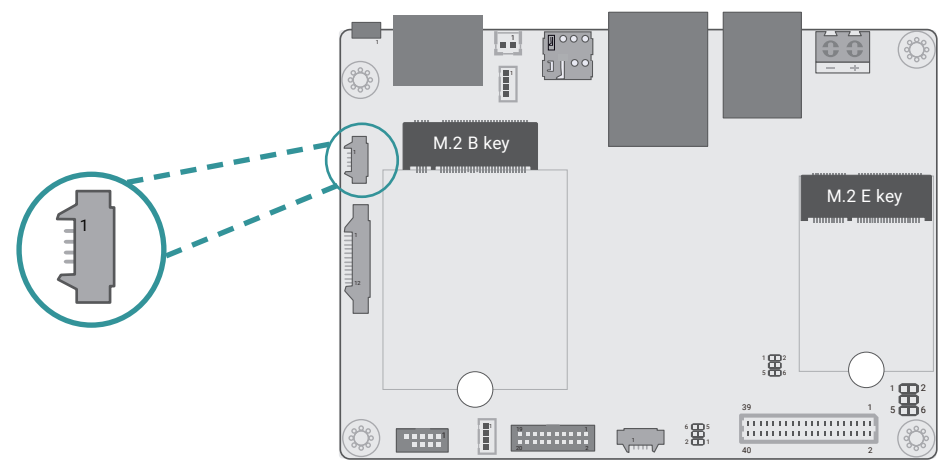
Pin	Assignment
1	+5V
2	USBDN
3	USBDP
4	GND

Speaker (AUJ1)



Pin	Assignment	Pin	Assignment
1	NC	2	SPK_R-
3	NC	4	SPK_R+
5	NC	6	SPK_L+
7	NC	8	SPK_L-
9	NC		

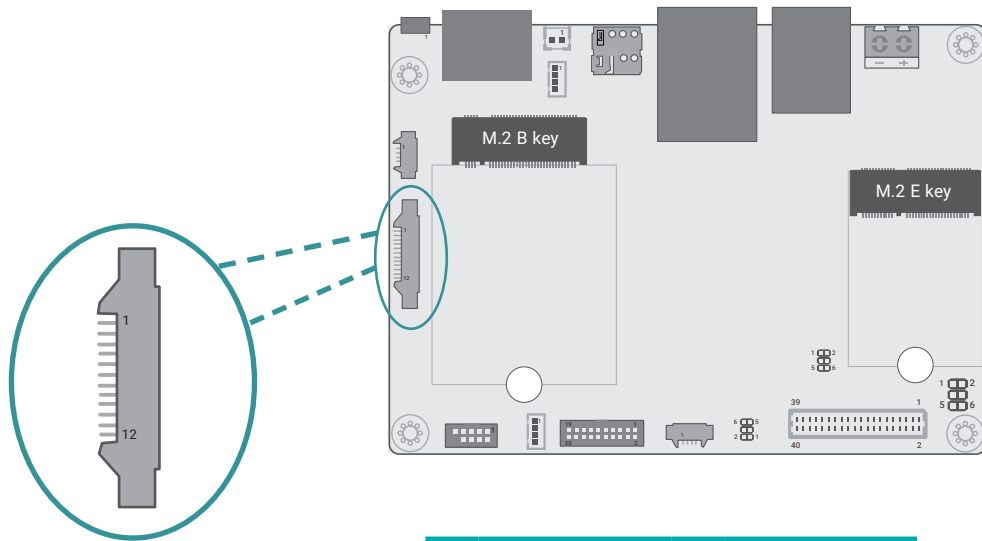
Audio (AUJ2)



Pin	Assignment
1	LOUT_L
2	LOUT_R
3	AGND
4	MIC_IN

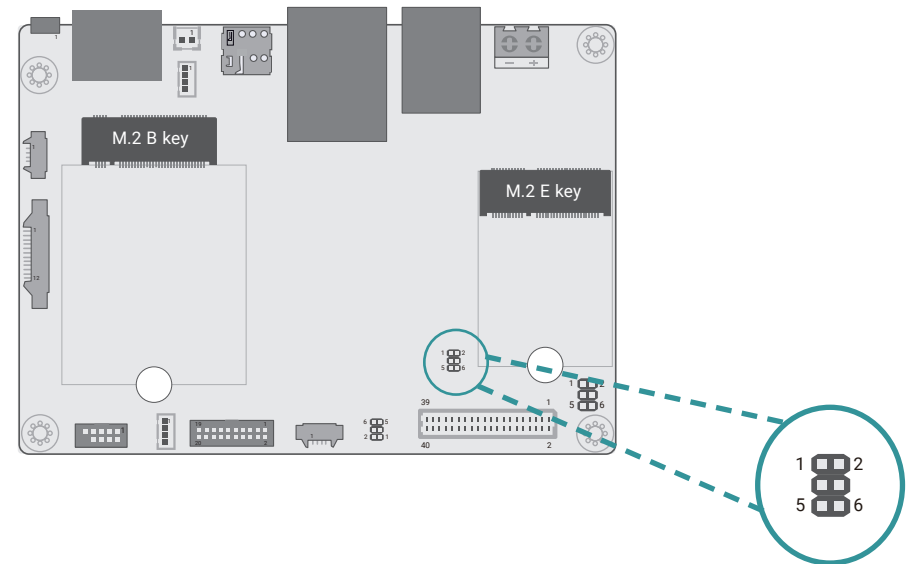


DIO (IOJ1)



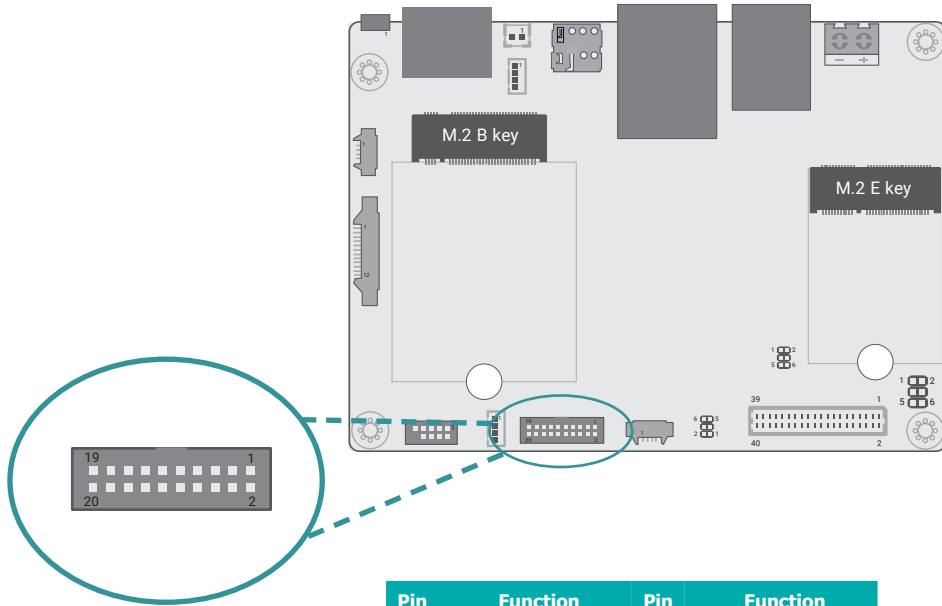
Pin	Assignment	Pin	Assignment
1	DIO0	2	DIO1
3	DIO2	4	DIO3
5	DIO4	6	DIO5
7	DIO6	8	DIO7
9	+5V	10	PWM
11	GND	12	GND

I2C (J8)



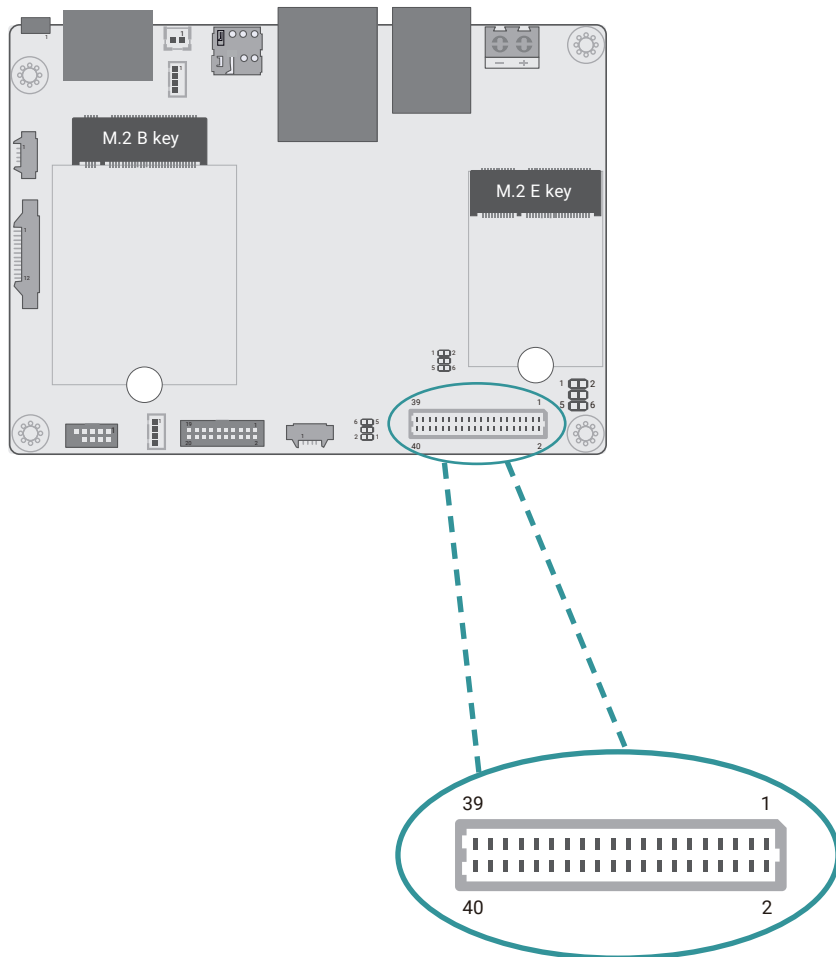
Pin	Assignment	Pin	Assignment
1	+3.3V_TP	2	GND
3	TP_SCL	4	TP_ALT#
5	TP_SDA	6	TP_RST#

VP IO (VPJ1)



Pin	Function	Pin	Function
1	+5V	2	CAN_GND
3	SOUTN3	4	CAN_H
5	LVDS_A2+	6	CAN_L
7	SINN3	8	UR1_TX_232
9	SINN4	10	UR1_RX_232
11	SOUTN4	12	RTSN2
13	DTRN4	14	CTSN2
15	RTSN4	16	SOUTN2
17	CTSN4	18	SINN2
19	GND	20	GND

LVDS (J11)



Pin	Function	Pin	Function
1	GND	2	GND
3	LVDS_A2-	4	LVDS_B3+
5	LVDS_A2+	6	LVDS_B3-
7	GND	8	GND
9	LVDS_A3-	10	LVDS_B2+
11	LVDS_A3+	12	LVDS_B2-
13	GND	14	GND
15	LVDS_A0-	16	LVDS_B1+
17	LVDS_A0+	18	LVDS_B1-
19	GND	20	GND
21	LVDS_A1-	22	LVDS_B0+
23	LVDS_A1+	24	LVDS_B0-
25	GND	26	GND
27	LVDS_A_CLK-	28	LVDS_B_CLK-
29	LVDS_A_CLK+	30	LVDS_B_CLK+
31	GND	32	GND
33	GND	34	GND
35	+VDD_3.3V	36	+VDD_5V
37	+VDD_3.3V	38	+VDD_5V
39	+VDD_3.3V	40	+VDD_5V

# VP070-M8M

## NXP i.MX 8M Dual/Quad Cortex ARM-Based In-vehicle Touch Panel PC

### KEY FEATURES



#### ARM-Based System

Support Android 9.0 and Linux



#### IP Rating

IP65 Front Panel Protection



#### Rich I/O Connectivity

1 GbE, 2 COM, 1 CAN Bus, 2 USB 3.1 Gen1



#### Application Focus

In-vehicle Driver HMI

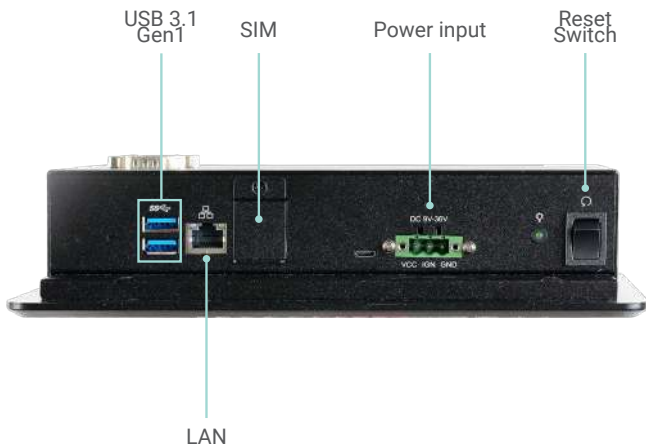


#### Smart Power Ignition Control

Power delay and protection time setting



### PANEL

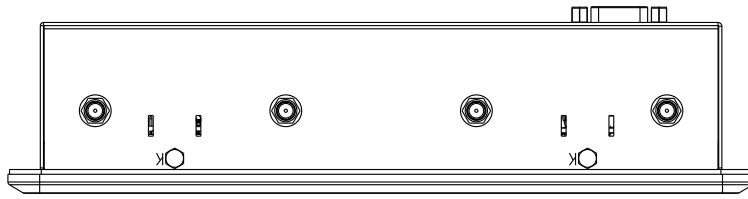


Bottom View

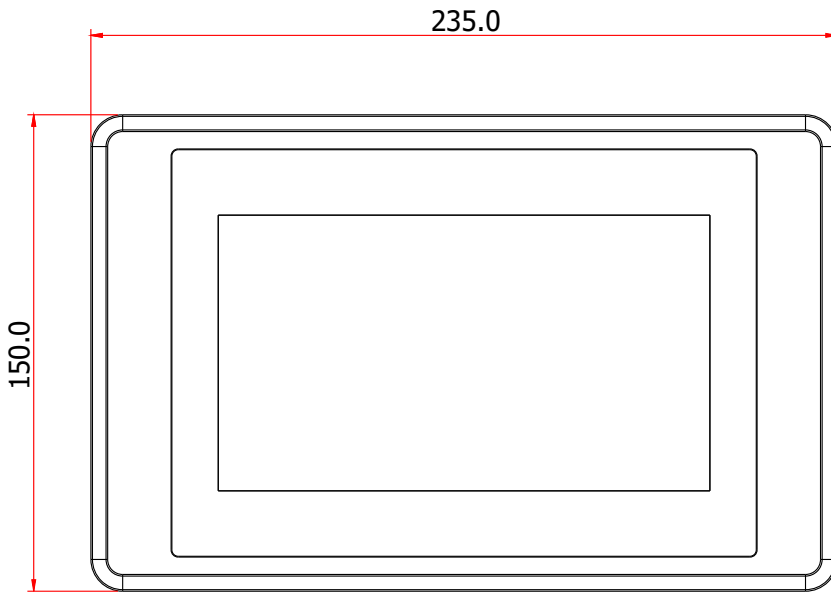


Back View

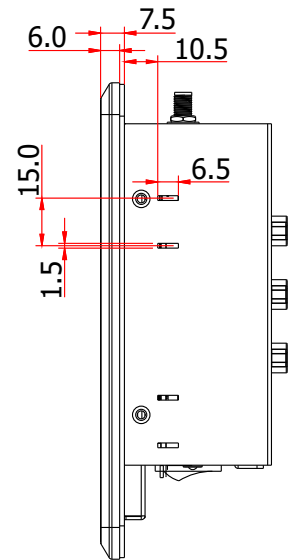
**DIMENSIONS**



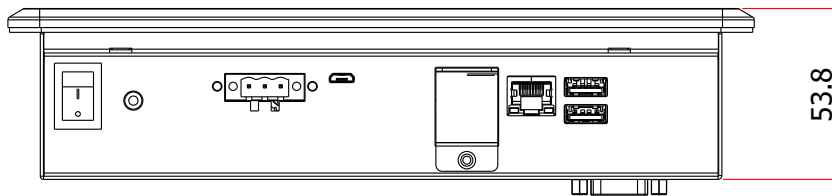
**Top View**



**Front View**



**Side View**



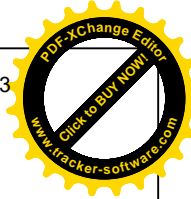
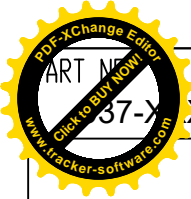
**Bottom View**

## SPECIFICATION

SYSTEM	Processor	NXP i.MX 8M Dual/Quad Cortex-A53
	Max. Speed	1.3GHz
MEMORY	Technology	On board Memory 2GB/4GB (Default 2GB) Single Channel LPDDR4 up to 3200 MHz
DISPLAY & TOUCH SCREEN	Display Type	7" PCAP TFT
	Max. Resolution	1024 x 600
	Brightness	425 cd/m <sup>2</sup>
STORAGE	Internal	Support eMMC 5.1 16GB on board (default) Support up to 64GB (optional)
EXPANSION	Interface	1 x M.2 2242/3042 B Key (USB3.1 Gen1), Nano SIM Slot support 1 x M.2 2230 E Key (PCIe x1/USB2.0)
AUDIO	Audio Codec	SGTL5000
ETHERNET	Controller	AR8035
SENSOR	Sensor	6 axis IMU (3 Accelerometer + 3 Gyroscope)
LED	Indicators	Power
I/O	Ethernet	1 x GbE
	Serial	1 x RS-232/422/485
		1 x RS-232
		1 x CAN Bus
	USB	2 x USB 3.1 Gen1 1 x OTG, micro USB
Audio	with Amplifier to support 2W speaker (optional) 1 x Line out, 1 x MIC in (internal header)	
Buttons	1 x Reset switch	
POWER	Type	9~36V DC Power input, with ACC/IGN control
OS SUPPORT	Linux	Yocto 2.5 (optional)
	Android	Android 9.0 (default)
MECHANISM	Construction	Aluminum + SGCC
	IP Rating	IP65 Front Panel Protection
	Mounting	Panel Mount /VESA Mount
	Dimensions (W x H x D)	235 x 150 x 54mm
	Weight	2.9kg
ENVIRONMENT	Operating Temp.	-20 to 70°C
	Storage Temp.	-30 to 80°C
	Relative Humidity	10 to 90% RH (non-condensing)
STANDARDS AND CERTIFICATIONS	Shock	OP: Half-sine, 3G @ 11ms Non-OP: Half-sine, 5G @ 11ms
		Vibration
	Certifications	CE, FCC, E-Mark R10, RoHS, UKCA

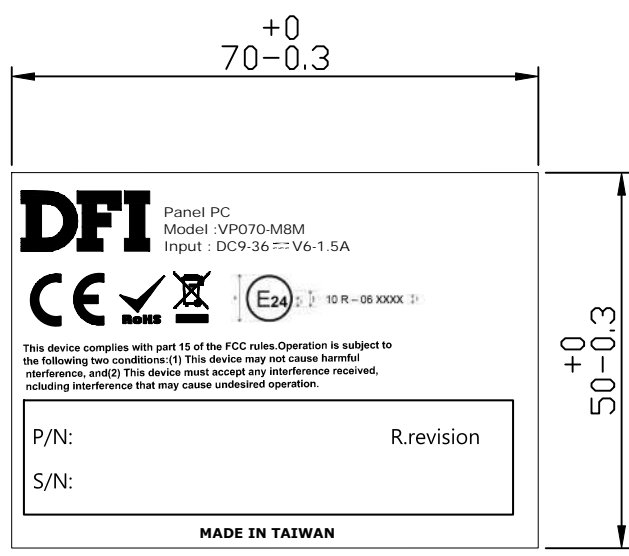
## PACKING LIST

• 1 VP070-M8M System Unit
• 1 Switch Cable
• 12 Rubber Holders
• 1 ADDM UL Battery Addendum



ART NO: 37-XXXX-000G

IF\_TMxD2305001898DV



Bar Code Number : \*adding later\*

- NOTE:**
1. 材質: 50# 白色特多龍, 加上光 (使用UL合格之材質)
  2. 印刷: 採背面印刷處理 (圖示為正面)
  3. 印刷顏色: 底色白 (字體圖形為黑色)
  4. 文字: 線條清晰不可缺畫斷線
  5. 字稿需經擔當工程師確認才可製版
  6. 背面印膠加離型紙

REV.	DATE	DESCRIPTION	CHANGE_BY	APPROVAL_BY	REMARKS
A00	03-Feb-2023	Initial	---	---	---

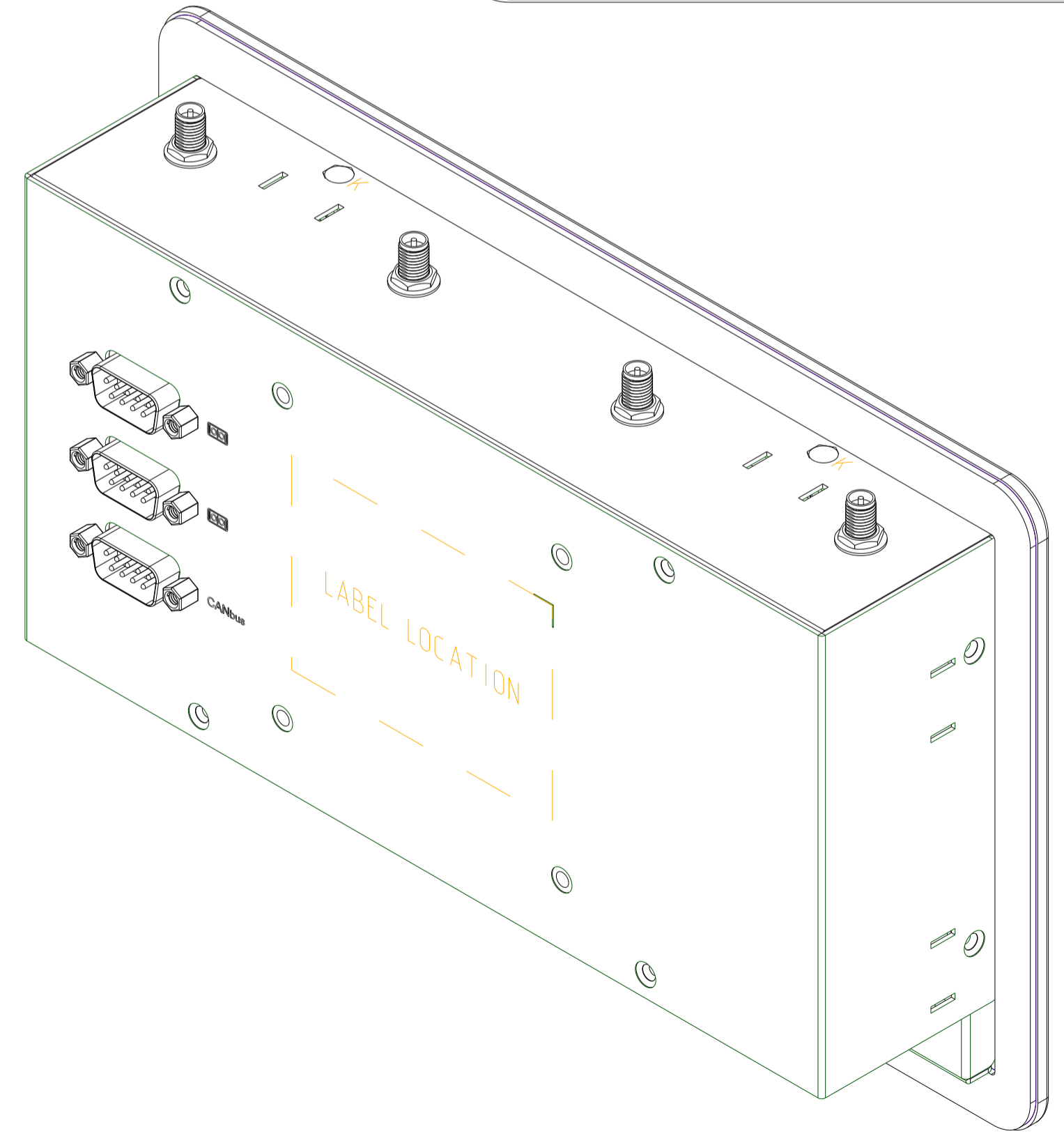
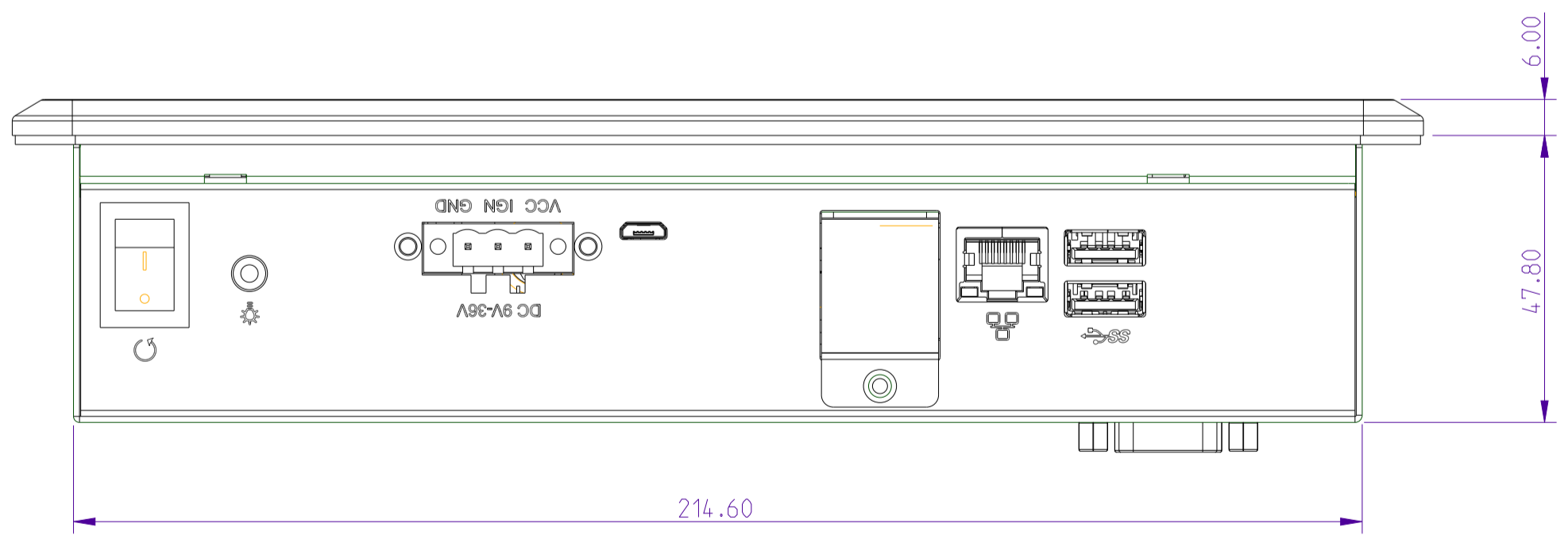
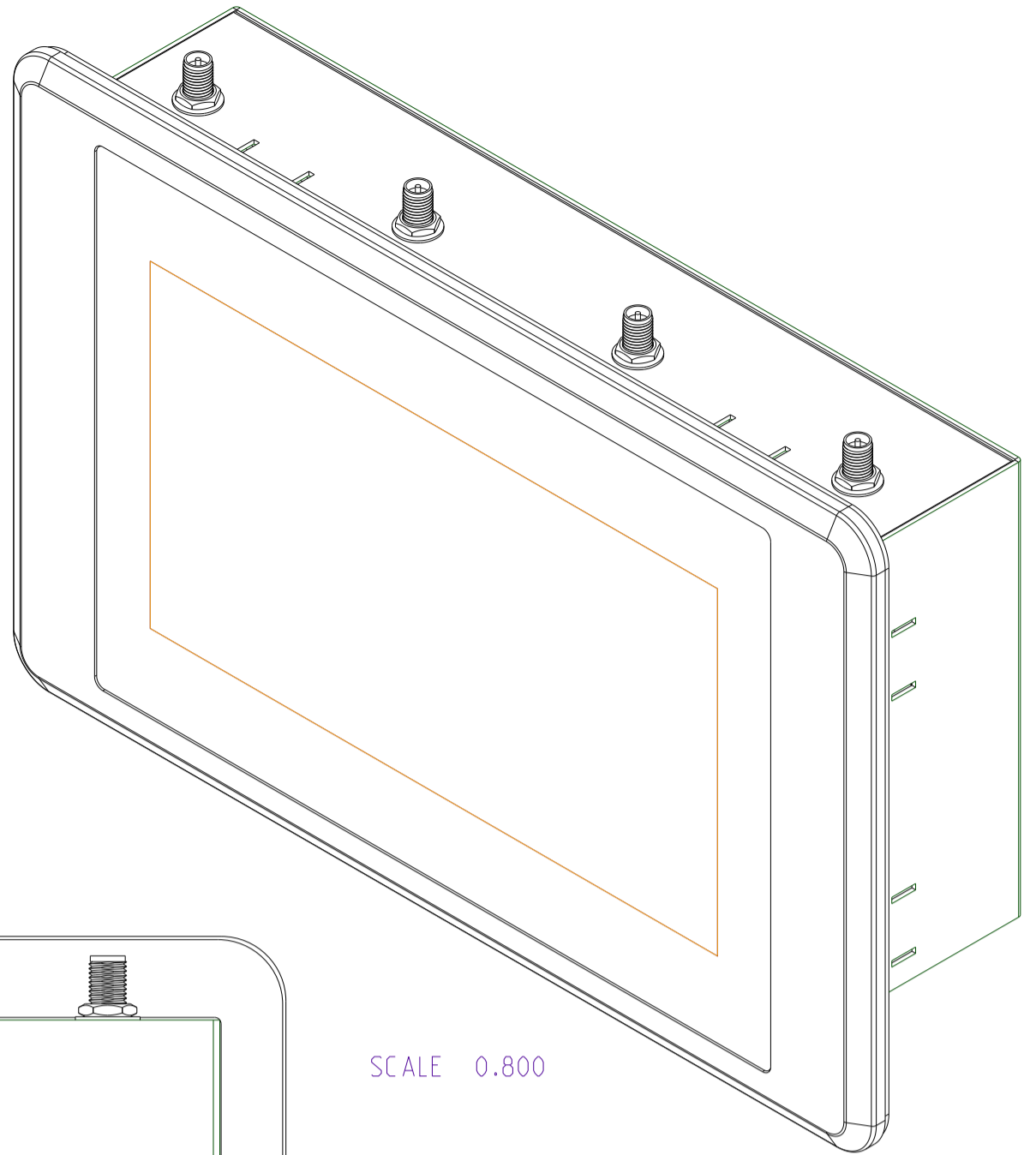
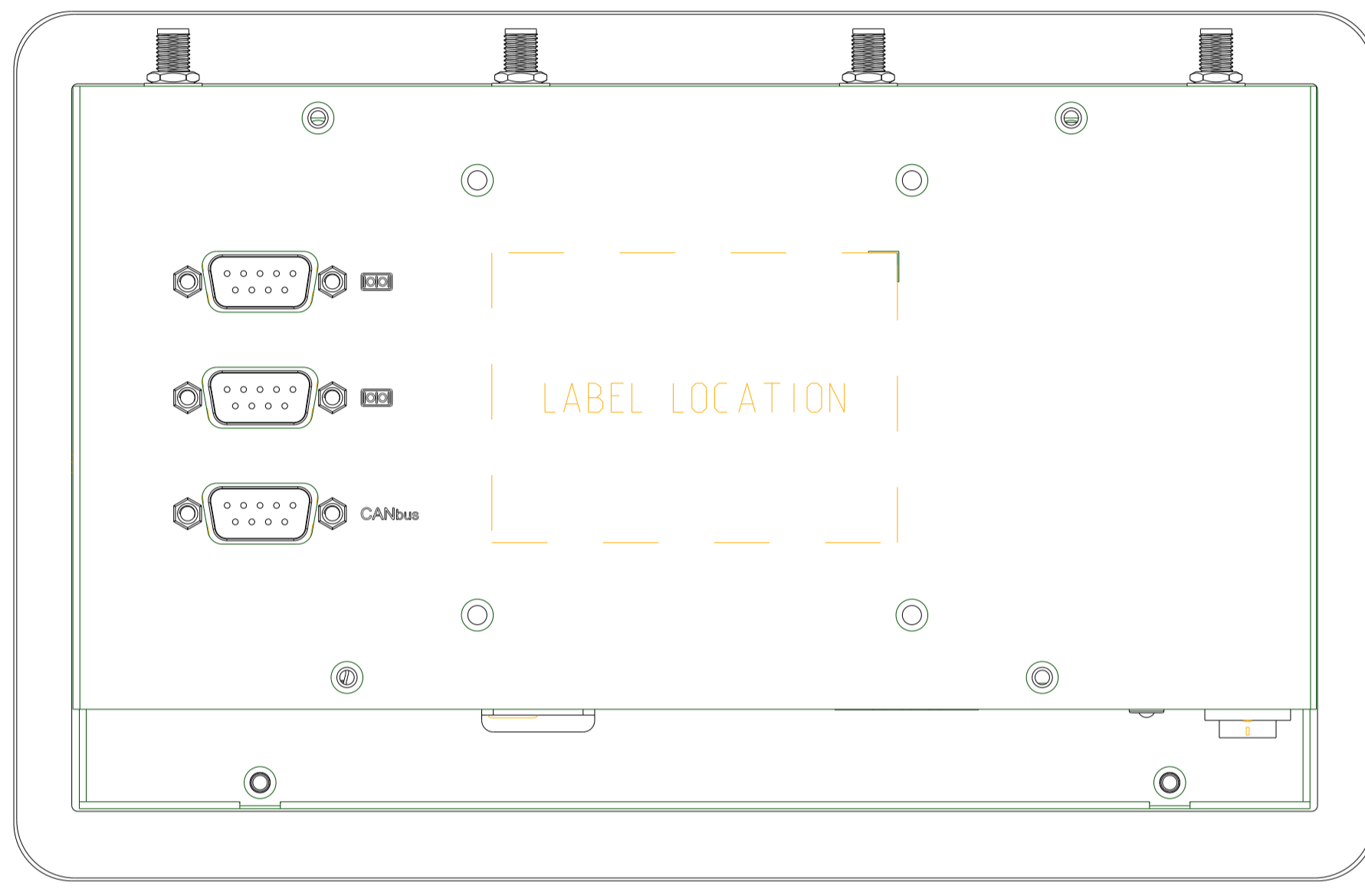
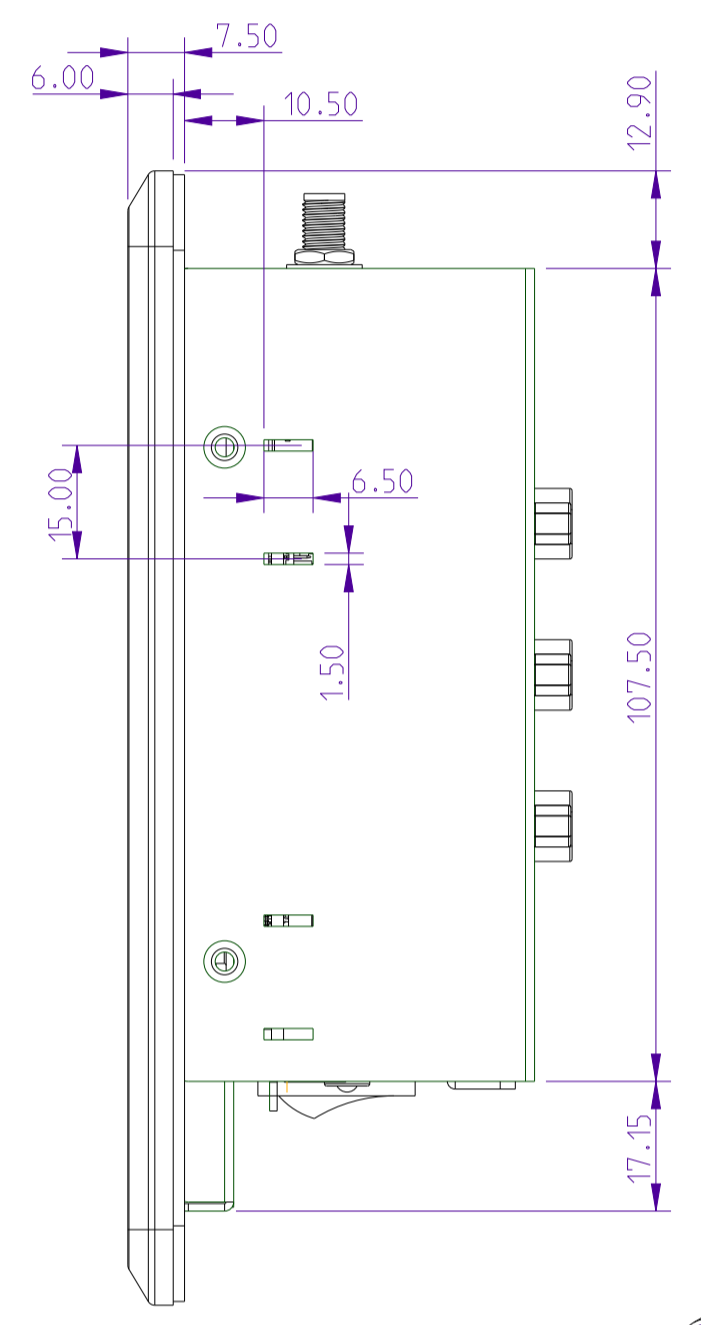
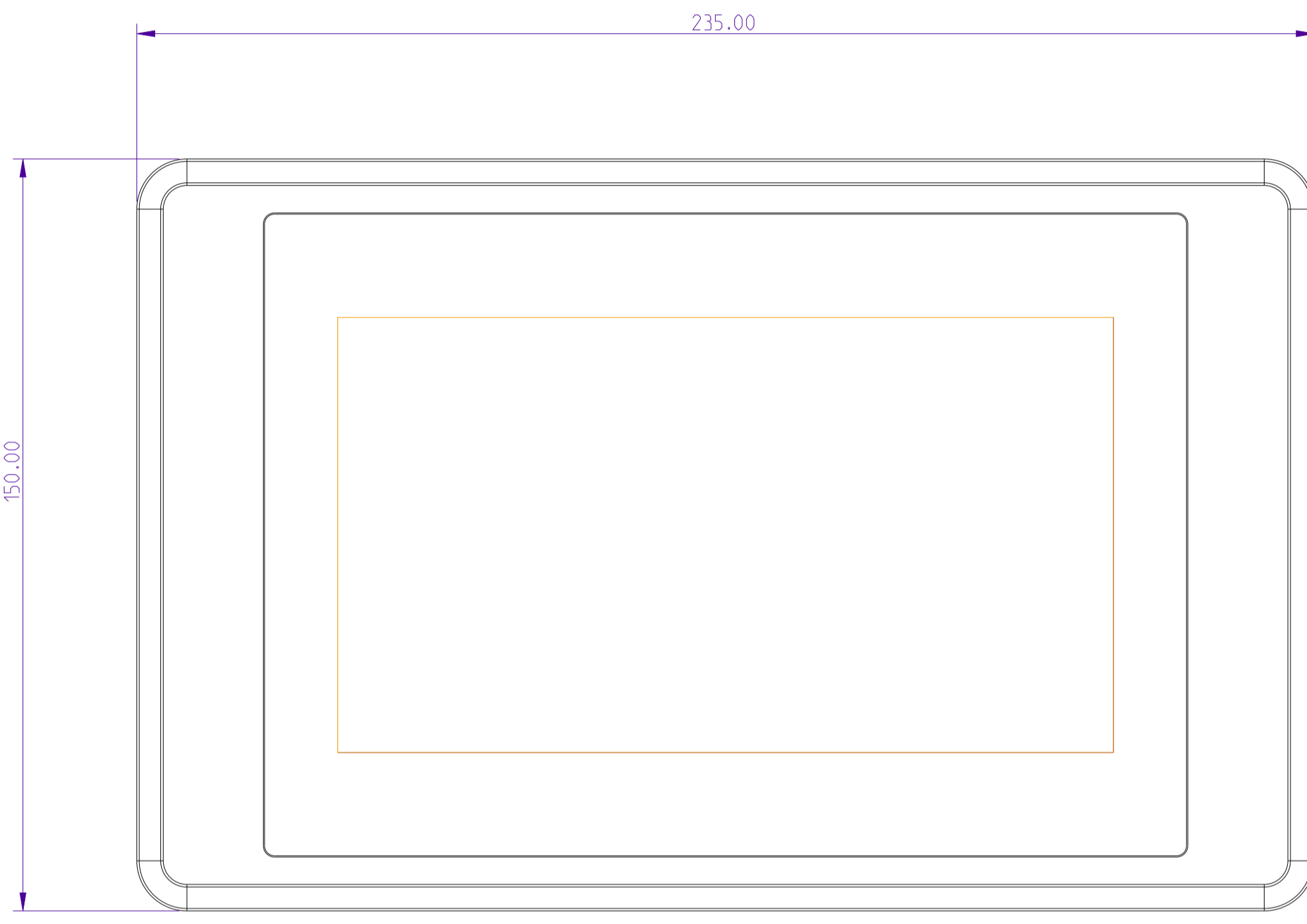
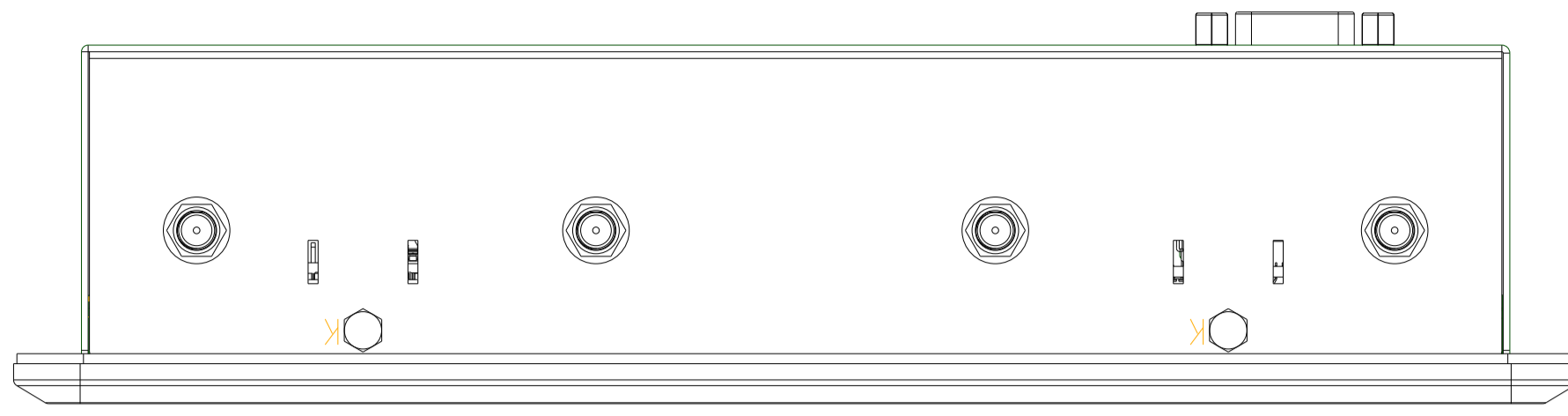
**NOTES:**  
 1. MATERIAL & FINISH SEE TABLE.  
 2. PARTS MUST BE APPROVE BY DFI DESIGN ENGR. DEPT. BEFORE MASS PRODUCTION.  
 3. MATER SURFACES TO BE FREE OF OIL AND RESIDUE.  
 4. DO NOT ALLOW SCRATCH ON THE SURFACE.  
 5. TOLERANCE SPECIFIED AS FOLLOW UNLESS OTHERWISE SPECIFIED.  
 6. COMPLETED ITEM SHALL BE ROHS COMPLIANT.  
**WELD REQUIREMENTS:**  
 1. WRAFT ANGLE 0.5° UNLESS OTHERWISE SPECIFIED.  
 2. FILLET RADI 0.5mm UNLESS OTHERWISE SPECIFIED.  
 3. UNFINISHED SURFACE TEXTURE SEE DRAWING MARK.  
 4. ALL EXTERNAL SURFACES FREE OF SINK MARKS, INJECTION MARKS, FLOW MARKS, WELDING LINES AND NICKS.  
 5. THE PART NUMBER AND CAVITY NUMBER HAVE TO BE ENGRAVED AT A PROPER LOCATION, AGREED BY DESIGN ENGR.  
 6. THE LOCATION OF GATE MUST BE APPROVE BY DFI DESIGN ENGR. DEPT. BEFORE THE TOOLING START.  
**METAL REQUIREMENTS:**  
 1. ALL EDGES AND SHARP CORNERS TO BE CONDITIONED FOR SAFE HANDLING.  
 2. INSIDE BEND RADI TO 0.5mm UNLESS OTHERWISE SPECIFIED.  
**PAINTING THICKNESS REQUIREMENTS:**  
 1. LIQUID PAINT: 25 ~ 45µm      2. POWDER PAINT: 50 + / - 25µm      3. HARDNESS: 3H  
**PLATING THICKNESS REQUIREMENTS:** 3~5µm

Units Kg/cm	Plastic	Aluminum	Brass	Low Carbon Steel	Stainless Steel	TOL±					
						A	B	C	D		
R2.6	1.0	1.3	1.8	2.0	2.3	0~6	0.05	0.10	0.20	0~30	0.15
M3	3.1	3.9	5.5	6.0	6.6	6~30	0.10	0.20	0.50	30~120	0.25
M4	7.6	9.5	13.5	15.0	16.7	30~120	0.15	0.30	0.80	120~315	0.35
M5	11.2	13.9	19.8	22.0	24.2	120~315	0.20	0.50	1.20	315~600	0.45
R2-56	12	15	21	23	26	315~1000	0.30	0.80	2.00	600~1000	0.55
R4-40	25	31	45	4.9	5.4	1000~	0.50	1.20	3.00	1000~	---
R6-32	4.4	5.5	8.3	9.1	10.0	ANGLE	1°	BURR	0.03	90° BEND	1°
R8-32	9.0	11.3	17.2	18.5	20.6	ROUND HOLE	0.1	OTHER BEND	15°		
R10-32	15.9	19.9	26.9	30.8	34.4						

SCALE	1.000	UNIT	mm	SIGNATURE	DATE	 <b>www.dfi.com</b>
COATING		MATERIAL		DRAWN: Max	18-May-2023	
PLATING		THICKNESS		CHECKED:	-----	TITLE: Safety Label
SIZE	PERSPECTIVE	APPROVE:			-----	MODEL: VP070M8M
A4	Sheet 1 of 1					REV. SEE TABLE

E24\*10R06/02\*4791\*00

PART NO:  
VP070P-M8M



NOTES:  
1. MATERIAL & FINISH SEE TABLE.  
2. PARTS MUST BE APPROVED BY DF1 DESIGN ENGR. DEPT. BEFORE MASS PRODUCTION.  
3. MATED SURFACES TO BE FREE OF OIL AND RESIDUE.  
4. DO NOT ALLOW SCRATCHES ON THE SURFACE.  
5. TOLERANCES SPECIFIED AS FOLLOWS UNLESS OTHERWISE SPECIFIED.  
6. DIMENSIONS SHALL BE COMPLIANT.  
MATERIAL REQUIREMENTS:  
1. DRAWT ANGLE 0.5° UNLESS OTHERWISE SPECIFIED.  
2. FILET RADIUS 0.5mm UNLESS OTHERWISE SPECIFIED.  
3. INDICATED SURFACE TEXTURES SEE DRAWING MARKS.  
4. ALL EXTERNAL SURFACES FREE OF SWIRL MARKS, FLOW MARKS, WELDING LINES AND NICKS.  
5. THE PART NUMBER AND CAVITY NUMBER HAVE TO BE ENGRAVED AT A PROPER LOCATION, AGREED BY DESIGN ENGR.  
6. THE LOCATION OF GATE MUST BE APPROVED BY DF1 DESIGN ENGR. DEPT. BEFORE THE TOOLING START.  
METAL REQUIREMENTS:  
1. ALL EDGES AND SHARP CORNERS TO BE CHAMFERED FOR SAFE HANDLING.  
2. INSIDE BEND RADIUS TO 0.5mm UNLESS OTHERWISE SPECIFIED.  
PAINTING THICKNESS REQUIREMENTS:  
1. LIQUID PAINT: 25 - 45µm 2. POWDER PAINT: 50 - 75µm 3. HARDNESS 3H  
PLATING THICKNESS REQUIREMENTS: 3-5µm

Unit:	Plastic	Aluminum	Brass	Low Carbon Steel	Stainless Steel
M2	1.0	1.3	1.8	2.0	2.3
M2.6	2.6	2.8	4.0	4.5	5.0
M3	3.1	3.9	5.5	6.0	6.6
M4	7.6	9.5	13.5	15.0	16.7
M5	11.2	13.9	19.8	22.0	24.2
#2-5/6	1.2	1.5	2.1	2.3	2.6
#4-4/0	2.5	3.1	4.5	4.9	5.4
#6-3/2	4.4	5.5	8.3	9.1	10.0
#8-3/2	9.0	11.3	17.2	18.5	20.6
#10-3/2	15.9	19.9	26.9	30.8	34.4

REV.	DATE	DESCRIPTION	CHANGE_BY	APPROVAL_BY	REMARKS
0	23-May-23	Initial	---	---	---

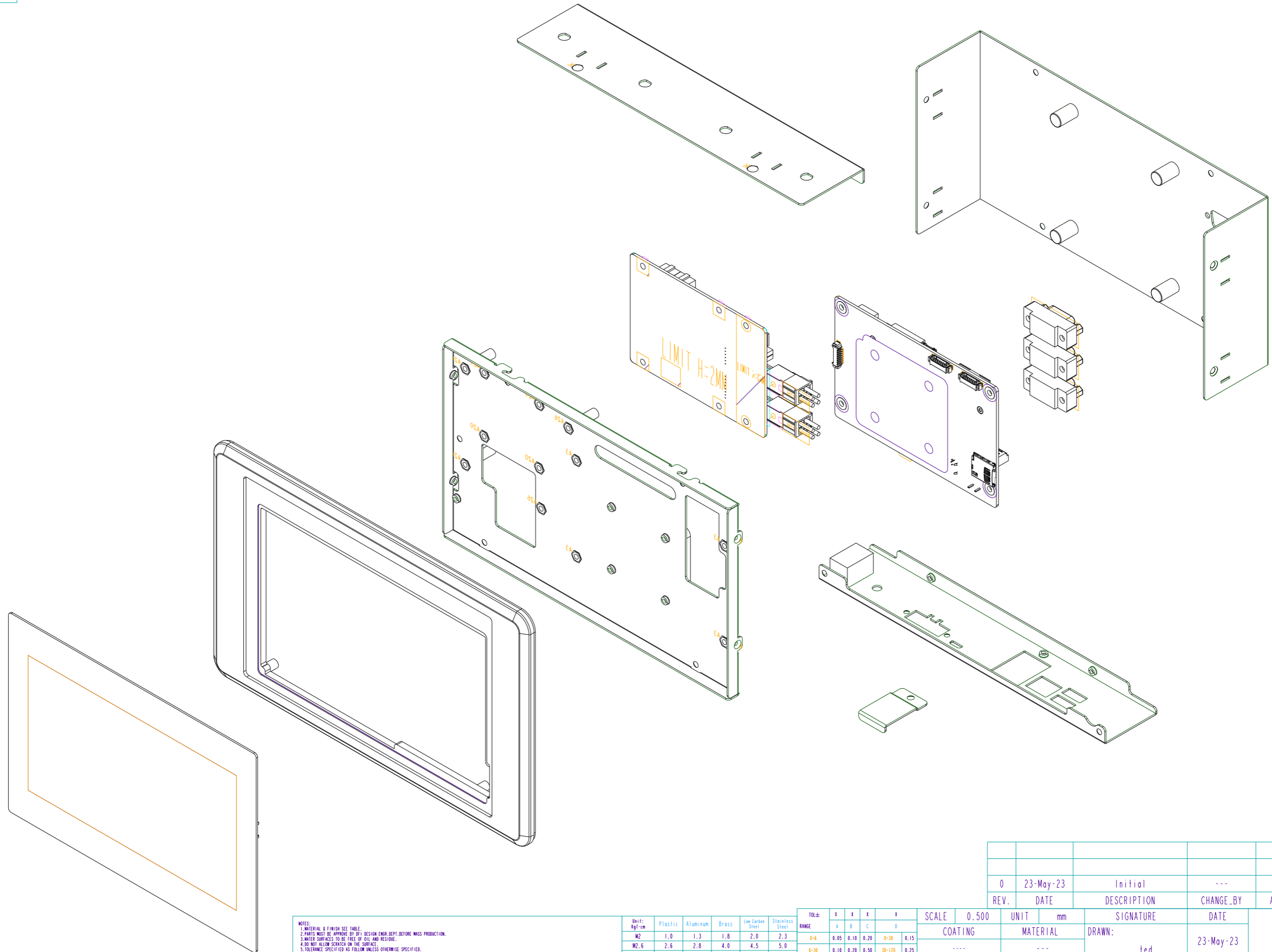
SCALE	1.000	UNIT	mm	SIGNATURE	DATE
COATING		MATERIAL		DRAWN: Ted	04-Oct-12
PLATING		THICKNESS		CHECKED:	-----
SIZE	A1	PERSPECTIVE		APPROVE:	-----

TITLE	MODEL	REV.
OUTLINE DIMENSION	VP070P-M8M	SEE TABLE



PART NO:  
VP070P-M8M



NOTES:  
 1. MATERIAL & FINISH SEE TABLE.  
 2. PARTS MUST BE APPROVED BY DFI DESIGN ENGR. DEPT. BEFORE MASS PRODUCTION.  
 3. WATER SURFACES TO BE FREE OF OIL AND RESIDUE.  
 4. DO NOT ALLOW SCRATCHES ON THE SURFACE.  
 5. TOLERANCES SPECIFIED AS FOLLOWS UNLESS OTHERWISE SPECIFIED.  
 6. COMPLETED ITEM SHALL BE RANS COMPLIANT.  
 WELD REQUIREMENTS:  
 1. DRAFT ANGLE 0.5° UNLESS OTHERWISE SPECIFIED.  
 2. FILLET RADIUS 0.2mm UNLESS OTHERWISE SPECIFIED.  
 3. INDICATED SURFACE TEXTURE: SEE DRAWING MARK.  
 4. ALL EXTERNAL SURFACES FREE OF SWIM MARKS, INJECTION MARKS, FLOW MARKS, WELDING LINES, AND NICKS.  
 5. THE PART NUMBER AND CAVITY NUMBER HAVE TO BE ENGRAVED AT A PROPER LOCATION, AGREED BY DESIGN ENGR.  
 6. THE LOCATION OF GATE MUST BE APPROVED BY DFI DESIGN ENGR. DEPT. BEFORE THE TOOLING START.  
 METAL REQUIREMENTS:  
 1. ALL EDGES AND SHARP CORNERS TO BE CONDITIONED FOR SAFE HANDLING.  
 2. INSIDE BEND RADIUS TO 0.2mm UNLESS OTHERWISE SPECIFIED.  
 PAINTING THICKNESS REQUIREMENTS:  
 1. LIQUID PAINT: 25 - 45µm    2. POWDER PAINT: 50 + /-25µm    3. HARDNESS: 3H  
 PLATING THICKNESS REQUIREMENTS: 3-5µm

Unit:	kgf-cm	Plastic	Aluminum	Brass	Low Carbon Steel	Stainless Steel
M2	1.0	1.3	1.8	2.0	2.3	
M2.6	2.6	2.8	4.0	4.5	5.0	
M3	3.1	3.9	5.5	6.0	6.6	
M4	7.6	9.5	13.5	15.0	16.7	
M5	11.2	13.9	19.8	22.0	24.2	
M2-56	1.2	1.5	2.1	2.3	2.6	
M4-40	2.5	3.1	4.5	4.9	5.4	
M6-32	4.4	5.5	8.3	9.1	10.0	
M8-32	9.0	11.3	17.2	18.5	20.6	
M10-32	15.9	19.9	26.9	30.8	34.4	

TOL±	A	B	C	D	SCALE	0.500	UNIT	mm	SIGNATURE	DATE
RANGE					COATING		MATERIAL		DRAWN:	23-May-23
0-6	0.05	0.10	0.20	0-30	---				ted	
6-30	0.10	0.20	0.50	30-120	PLATING		THICKNESS		CHECKED:	
30-120	0.15	0.30	0.80	120-315	---				APPROVE:	
120-315	0.20	0.50	1.20	315-600	SIZE	PERSPECTIVE				
315-600	0.30	0.80	2.00	600-1000	A3	Sheet 1 of 1				
600-1000	0.50	1.20	3.00	1000-...						
1000-...	0.80	2.00	5.00	...						
ANGLE	°	BURR	0.03	90° BEND						
ROUND HOLE	0.1	OTHER BEND	1.5°							



TITLE: EXPLODED DRAWING  
 MODEL: VP070P-M8M  
 REV. SEE TABLE

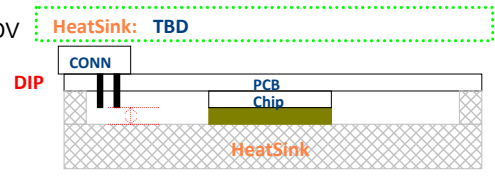
**Project Name: M8MT51(board) for System**

**Project Code : A213420**

**PCB Revision: R2**

**Base BOM Part Number: 774-M8MT511-080G**

IF\_TMxD2305001898DV



**774-M8MT511-080G/180G for VPO70P-M8M W36 & VC900-M8M**

**with Power Board - X103-EC70: 9V~36V DC Power Input with ACC/IGN control**

**Page Index:**

- 1 Title Page
- 2 Block Diagram
- 3 Power Delivery System
- 4 Power/Reset Sequence
- 5 Clock Topology
- 6 SMBUS Topology/Address
- 7 PCIe/HsIO/USB I/O CFG.
- 8 i.MX8M CPU\_PWR
- 9 i.MX8M CPU\_LPDDR4
- 10 i.MX8M CPU\_IO1/Boot-CFG
- 11 i.MX8M CPU\_IO2/MISC
- 12 i.MX8M CPU\_PHY
- 13 eMMC5.0/uSD3.0
- 14 USB3.0 & USB2.0
- 15 USB3.0 Hub(USB5807C)
- 16 HDMI2.0a TX
- 17 I2S Codec(SGTL5000)
- 18 RGMII GbE(AR8035)
- 19 M.2 2230(E) & 3042(B)
- 20 DSI to LVDS(SN65DSI85)
- 21 B.L./F.P./DIOs/I2C
- 22 RS232/422/485
- 23 UART-Link / CAN2.0
- 24 PMIC(MC34PF4210)
- 25 Amplifier(3W+3W)
- 26 DC\_IN & PWR-STBY
- 27 PWR-Main
- 28 Test Pad for Power Sequence
- 29 Revision History
- 30 Design Info.
- 31 POWER DISTRIBUTION.
- 32 A+G(LSM6DSOX)

Product Line	LCD Size	Touchscreen	-	Platform	Power Range
<b>VP</b>	<b>070</b>	<b>P</b>	-	<b>M8M</b>	<b>W36</b>
KS: Fanless Panel PC	070: 7"	R: Resistive Touch	AL: Apollo Lake	AC: AC	
TPC: Smart fan Panel PC	084: 8.4"	P: Projected Capacitive	BT: Bay Trail	D12: DC 12V	
BPC: Bar Type Panel PC	101: 10.1"	G: Glass	SD: Sky Lake	D24: DC 24V	
<b>VP: Vehicle Panel PC</b>	<b>121: 12.1"</b>		<b>M8M: NXP i.MX8M</b>	<b>W24: x to 24V DC</b>	
KSX: Extreme Panel PC	150: 15"			<b>W36: x to 36V DC</b>	



Type	Series	Total Expansion	PCIE Sols	-	Platform
<b>VC</b>	<b>9</b>	<b>0</b>	<b>0</b>	-	<b>M8M</b>
VC: Vehicle system	9	0:No expansion	0:No expansion		M8M: NXP i.MX8M

**774-X10371-180G**

**180G(Dual) 143-701301-400G MIMX8MD6CVAHZAB -40~105度(1.3GHz)**  
**080G(Quad) 143-701300-400G MIMX8MQ6CVAHZAB -40~105度(1.3GHz)**

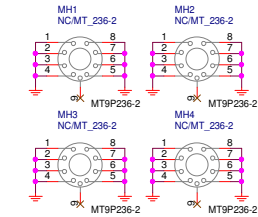
THICKNESS ±1.6mm ±10%			Er	Refer Layer	single end		different pair		different pair	
Stack up		42ohms±10%			50ohms±10%	85ohms±10%	90ohms±10%	100ohms±10%		
1	TOP	SolderMask 0.6	4							
1	TOP	0.5oz+Plating 1.5	4	L2	6 mil (42.90)	4.2 mil (50.59)	4.5 / 5.5 mil (85.00)	4 / 6 mil (90.52)	3.5 / 8.5 mil (100.59)	
2	GND1	Prepreg 3	4							
		1.0oz 1.3	4							
2		0.004" 1/1 4.00	4							
3	YCC1	Prepreg 5	4							
		1.0oz 1.3	4							
4	VCC2	Prepreg 5	4							
		1.0oz 1.3	4							
4		0.004" 1/1 4.00	4							
5	GND2	Prepreg 5	4							
		1.0oz 1.3	4							
6	IN1	Prepreg 5	4	L7	4.5 mil (42.72)	3 mil (51.33)	4.5 / 5 mil (82.15)	3.5 / 7 mil (91.01)	3 / 9.5 mil (99.84)	
		1.0oz 1.3	4							
7	GND3	Prepreg 5	4							
		1.0oz 1.3	4							
8	IN2	Prepreg 5	4	L9	4.5 mil (42.72)	3 mil (51.33)	4.5 / 5 mil (82.15)	3.5 / 7 mil (91.01)	3 / 9.5 mil (99.84)	
		1.0oz 1.3	4							
9	GND4	Prepreg 5	4							
		1.0oz 1.3	4							
10	IN3	Prepreg 5	4	L11	4.5 mil (42.72)	3 mil (51.33)	4.5 / 5 mil (82.15)	3.5 / 7 mil (91.01)	3 / 9.5 mil (99.84)	
		1.0oz 1.3	4							
11	GND5	Prepreg 3	4							
		1.0oz 1.3	4							
12	Bottom	0.5oz+Plating 1.5	4	L11	6 mil (42.90)	4.2 mil (50.59)	4.5 / 5.5 mil (85.00)	4 / 6 mil (90.52)	3.5 / 8.5 mil (100.59)	
		SolderMask 0.6	4							

**Layout:**  
 eMMC BGA update: C10 -> C12.  
 LPDDR4 BGA update: C14 -> C13.  
 \*Ball to Trace spacing >= 3.3-mil,  
 Ball to VIA spacing >= 3.3-mil,  
 VIA -> 14DB(~0.5A).

**12-Layer**

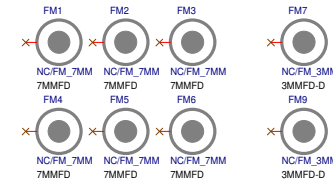
**PCB: 314-M8MT511-029G**  
**Stack up: CIRCUITECH(峻新)**

**Mouting Hole (236/126-mils)**

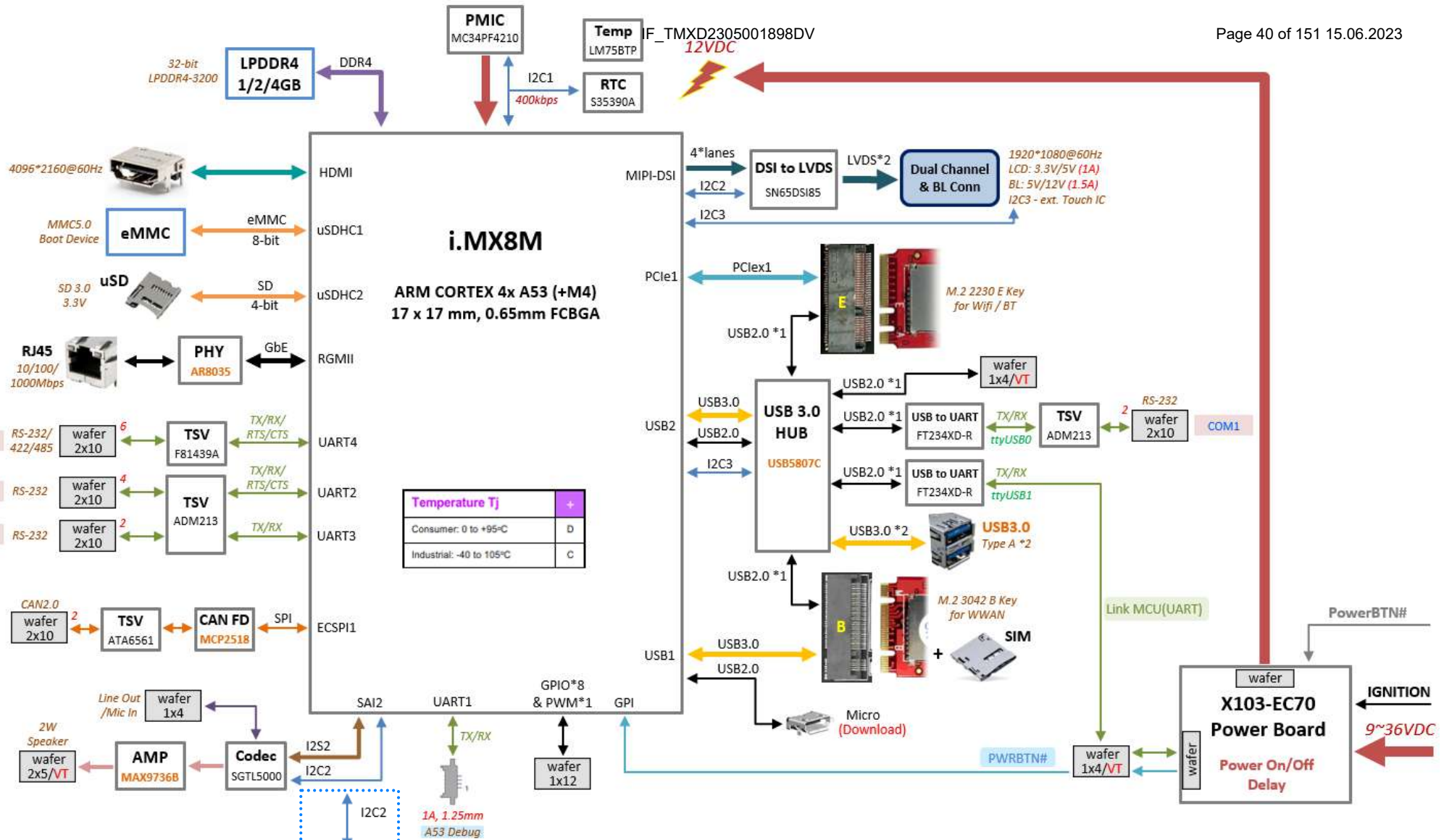


**Fiducial Mark**

**Fiducial Mark(基板)**



<b>DFI®</b>		
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**i.MX8M**  
**ARM CORTEX 4x A53 (+M4)**  
**17 x 17 mm, 0.65mm FCBGA**

Temperature Tj	
Consumer: 0 to +95°C	D
Industrial: -40 to 105°C	C

DFI-P/N	Commercial	Silicon Rev: 1.1 (B)
143-701500-401G	MIMX8MQ6DVAJZAB	Quad core & VPU+HDR+GPU & 0~95度(1.5GHz)
143-701501-400G	MIMX8MD6DVAJZAB	Dual core & VPU+HDR+GPU & 0~95度(1.5GHz)
143-701502-400G	MIMX8MQ5DVAJZAB	Quad Lite & GPU & 0~95度(1.5GHz)
DFI-P/N	Industrial	Silicon Rev: 1.1 (B)
143-701300-400G	MIMX8MQ6CVAHZAB	Quad core & VPU+HDR+GPU & -40~105度(1.3GHz)
143-701301-400G	MIMX8MD6CVAHZAB	Dual core & VPU+HDR+GPU & -40~105度(1.3GHz)

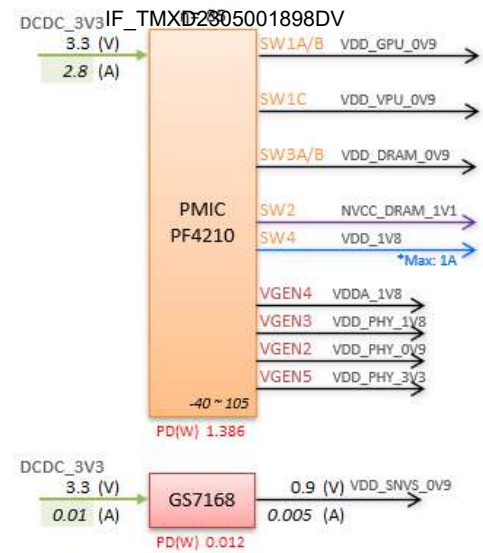
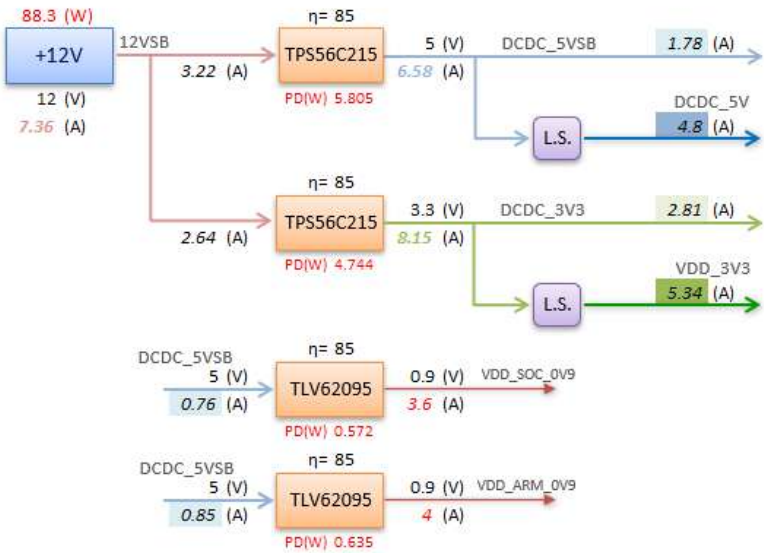
**DFI**

Title : **Block Diagram**

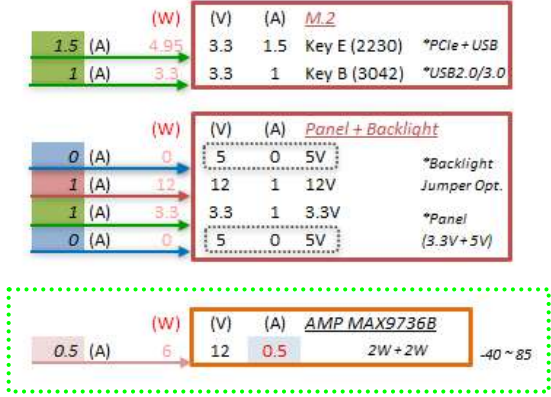
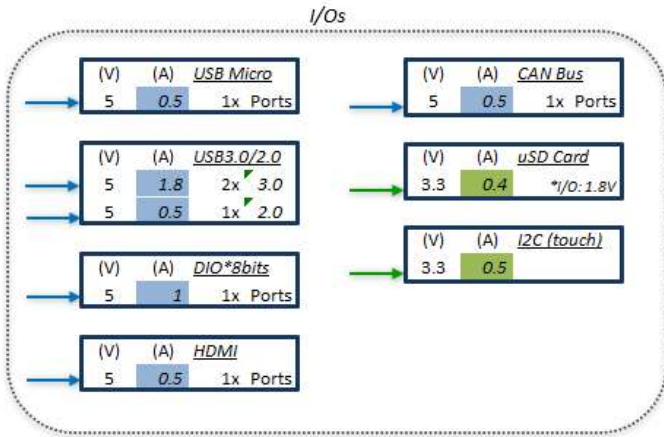
Size : Document Number : **M8MT51** Rev : **2**

Custom

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(W)	(V)	(A)	IMX	Page 412 of 151	15.06.2023
	VDD_SOC_0V9	3.24	0.9	3.6	@VDD_SOC/VDDA_OP9
	VDD_ARM_0V9	3.6	0.9	4	@VDD_ARM
	VDD_GPU_0V9	1.8	0.9	2	@VDD_GPU 1A/B
	VDD_VPU_0V9	0.9	0.9	1	@VDD_VPU 1C
	VDD_DRAM_0V9	2.5	1	2.5	@VDD_DRAM 3A/B
	NVCC_DRAM_1V1	1.1	1.1	1	@NVCC_DRAM 2
	VDD_1V8	0.18	1.8	0.1	@NVCC_SD1 4
	VDDA_1V8	0.54	1.8	0.3	@VDDA_1P8/DRAM
	VDD_PHY_1V8	0.05	1.8	0.05	@1.8V PHY
	VDD_PHY_0V9	0.23	0.9	0.25	@0.9V PHY
	VDD_PHY_3V3	0.33	3.3	0.1	@3.3V PHY
	VDD_3V3	0.66	3.3	0.2	@NVCC_3V3
	NVCC_DRAM_1V1	0.51	1.1	0.46	LPDDR4 (1024M32) VDD2+VDDQ 2
	VDD_1V8	0.02	1.8	0.01	VDD1 4
	VDD_1V8	0.72	1.8	0.4	eMMC5.1 (64G) VCCQ 2
	VDD_1V8	1.49	3.3	0.45	VCC *with HS400
	VDD_1V8	0.36	1.8	0.2	LVDS SN65DSI85 VCC 1920*1080
	VDD_1V8	0.56	3.3	0.17	LAN AR8035-AL1B VDD33/AVDD33
	VDD_1V8	0.07	3.3	0.02	Codec SGT15000 VDDIO/VDDA
	VDD_PHY_1V8	0.02	1.8	0.01	VDDD
	VDD_1V8	0.33	3.3	0.1	HUB 5807C VDD33
	VDD_1V8	0.72	1.2	0.6	VDD12



DFI

**Title :** Power Delivery System

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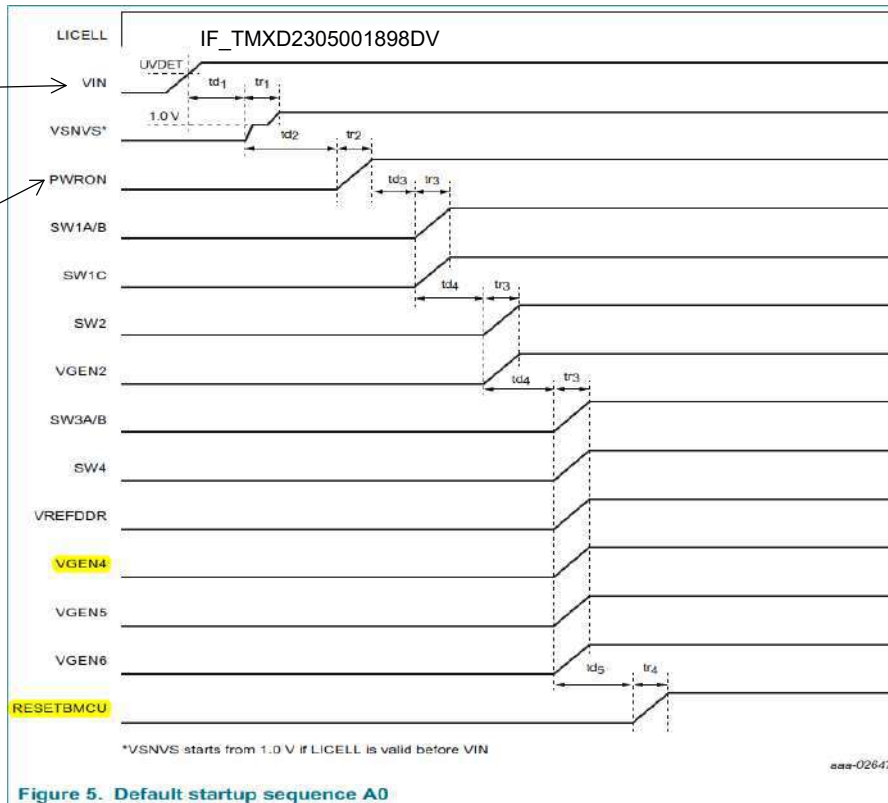
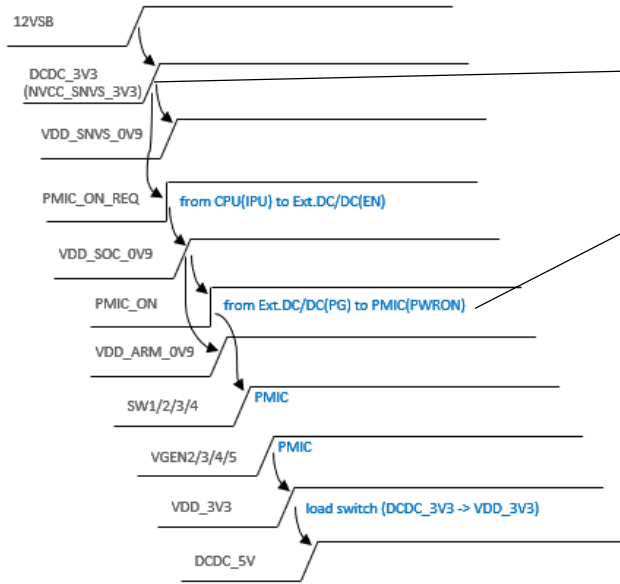


Figure 5. Default startup sequence A0

Table 9. Default startup sequence timing

Parameter	Description	Min	Typ	Max	Unit
t <sub>D1</sub>	Turn-on delay of VSNVS <sup>[1]</sup>	—	5.0	—	ms
t <sub>R1</sub>	Rise time of VSNVS	—	3.0	—	ms
t <sub>D2</sub>	User determined delay	—	1.0	—	ms
t <sub>R2</sub>	Rise time of PWRON	—	<sup>[2]</sup>	—	ms
t <sub>D3</sub>	Turn-on delay of first regulator SEQ_CLK_SPEED[1:0] = 00 SEQ_CLK_SPEED[1:0] = 01 <sup>[3]</sup> SEQ_CLK_SPEED[1:0] = 10 SEQ_CLK_SPEED[1:0] = 11	—	2.0 2.5 4.0 7.0	—	ms
t <sub>R3</sub>	Rise time of regulators <sup>[4]</sup>	—	0.2	—	ms
t <sub>D4</sub>	Delay between regulators SEQ_CLK_SPEED[1:0] = 00 SEQ_CLK_SPEED[1:0] = 01 SEQ_CLK_SPEED[1:0] = 10 SEQ_CLK_SPEED[1:0] = 11	—	0.5 1.0 2.0 4.0	—	ms
t <sub>R4</sub>	Rise time of RESETBMCU	—	0.2	—	ms
t <sub>D5</sub>	Turn-on delay of RESETBMCU	—	2.0	—	ms

[1] Assume LICELL voltage is valid before VIN is applied. If LICELL is not valid before VIN is applied, then VSNVS turn-on delay may extend to a maximum of 24 ms.  
 [2] Depends on the external signal driving PWRON.  
 [3] Default configuration.  
 [4] Rise time is a function of slew rate of regulators and nominal voltage selected.

CH	Net	Note
CH1	PMIC_ON	PMIC PWRON(#56)
CH2	VDDA_1V8	from PMIC(LDO-VGEN4)
CH3	VDD_3V3	Gate/Load Switch
CH4	POR_B	Global RST#



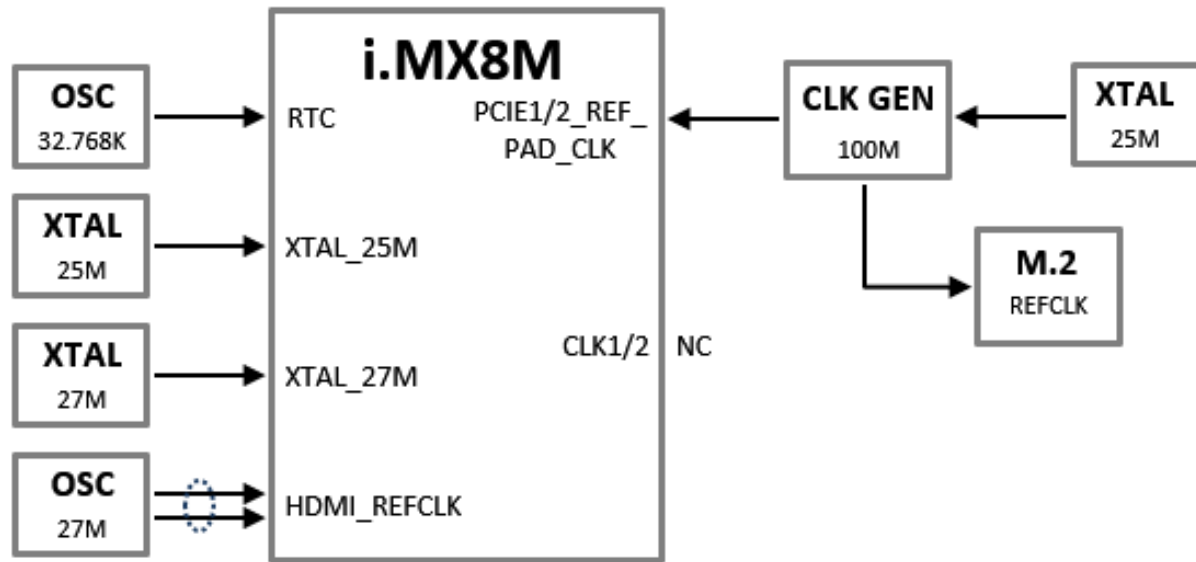
**DFI**

**Title :** Power/Reset Sequence

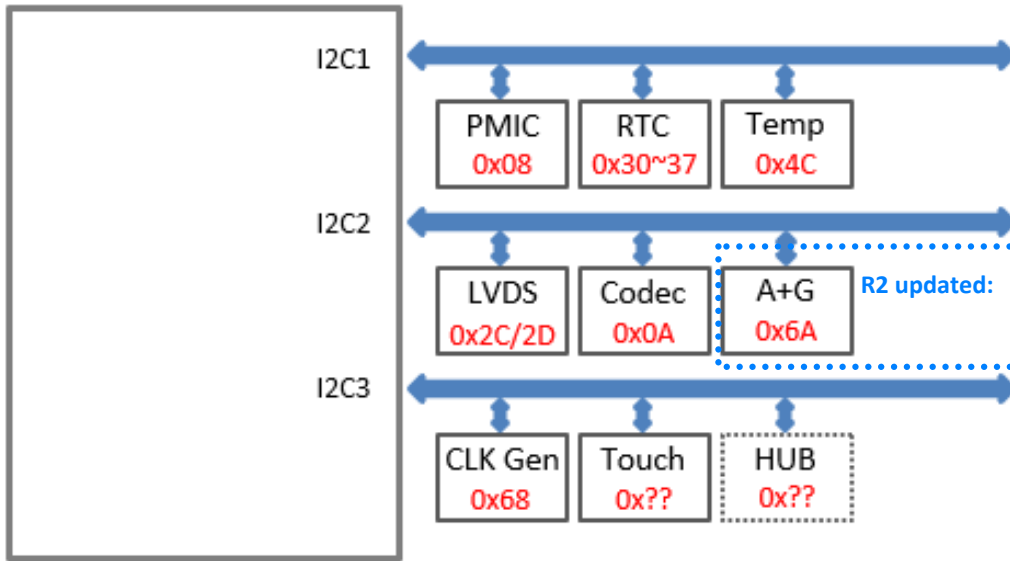
**Size :** Document Number : Rev : 2

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<b>DFI<sup>®</sup></b>		
Title : <b>Clock Topology</b>		
Size : A	Document Number : <b>M8MT51</b>	Rev : <b>2</b>
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RISC(ARM) 不看 R/W bit.  
e.g. EEPROM = 0x5X.

<b>DFI</b> <sup>®</sup>		
Title : SMBUS Topology/Address		
Size : A	Document Number : <b>M8MT51</b>	Rev : <b>2</b>
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<b>E24-10R06/02-4791-00</b>		

Table with columns: Pin Name (Package), IO PAD, Power Group, AI0, AI1, AI2, AI5. Lists various pins like GPIO1\_000 to GPIO1\_1015 and NAND\_ALE to NAND\_WP\_0.

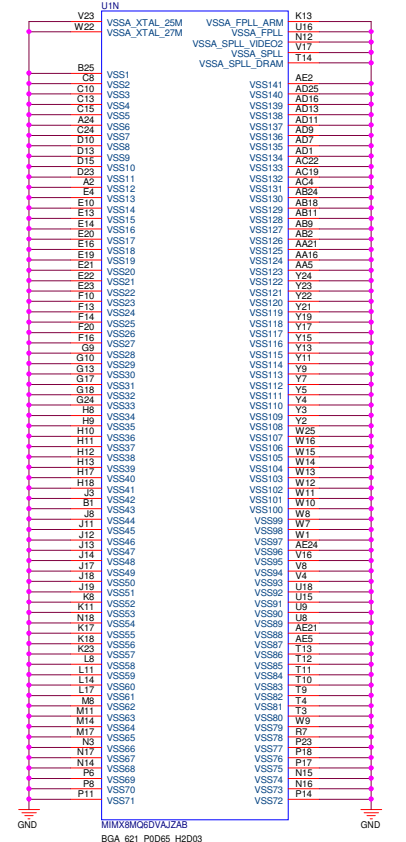
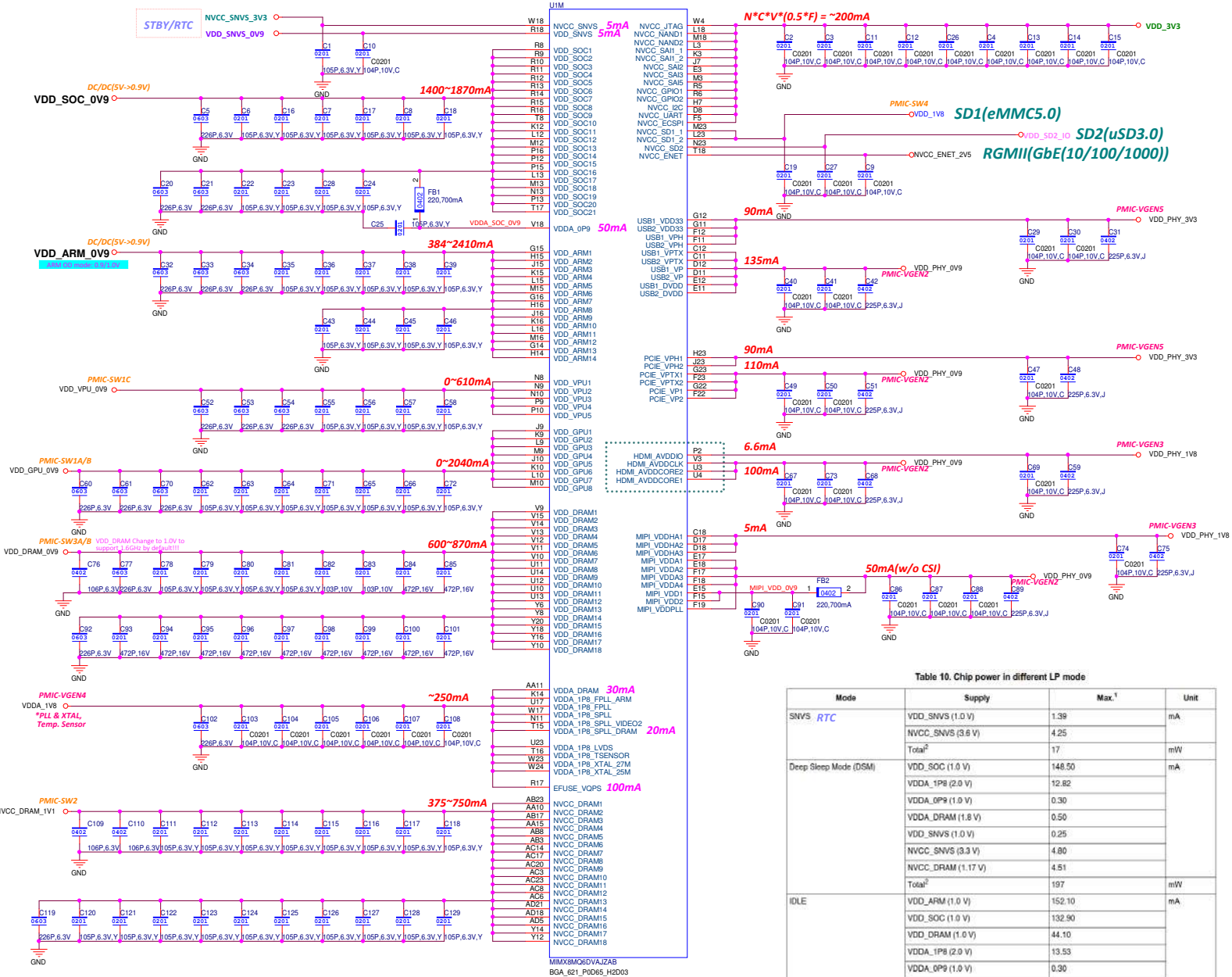
Table with columns: Pin Name, Power Group, AltX, CRB, M8M051, I/O, Ext.PU/PD, M8M051 Signal Desc. Lists pins like GPIO1\_000(16) to GPIO1\_1015(15) and NAND\_ALE(19) to NAND\_WP\_0(27).

Table with columns: Pin Name, Power Group, AltX, CRB, M8MT51, I/O, Ext.PU/PD, M8MT51 Signal Desc. Lists pins like NAND\_DQS(M20) to NAND\_WP\_0(M27).

R2 updated:

DFI logo, Title: PCIe/HSIO/USB I/O CFG., Size: Document Number: M8MT51, Rev: 2, E2410B06102-4791-100





**Table 27. i.MX 8MDQLQ DC IR drop requirements**

Supply input	Nominal voltage (V)	Max current (mA)	IR drop target	Corresponding power path resistance requirement
VDD_ARM	0.9	4000	< 2 %	< 4.5 mΩ
VDD_SOC	0.9	3600	< 2 %	< 5 mΩ
VDD_GPU	0.9	2000	< 2 %	< 9 mΩ
VDD_VPU	0.9	1000	< 2 %	< 18 mΩ
VDD_DRAM	0.9	2500	< 2 %	< 7.2 mΩ
NVCC_DRAM	1.1	1000	< 2 %	< 22 mΩ

Table 10. Chip power in different LP mode

Mode	Supply		Max. <sup>1</sup>	Unit
	Supply	Max. <sup>1</sup>		
SMVS_RTC	VDD_SNVS (1.0 V)	1.39		mA
	NVCC_SNVS (3.6 V)	4.25		
	Total <sup>2</sup>	17		mW
Deep Sleep Mode (DSM)	VDD_SOC (1.0 V)	148.50		mA
	VDDA_1P8 (2.0 V)	12.82		
	VDDA_0P9 (1.0 V)	0.30		
	VDDA_DRAM (1.8 V)	0.50		
	VDD_SNVS (1.0 V)	0.25		
	NVCC_SNVS (3.3 V)	4.80		
	NVCC_DRAM (1.17 V)	4.51		
	Total <sup>2</sup>	197		mW
IDLE	VDD_ARM (1.0 V)	152.10		mA
	VDD_SOC (1.0 V)	132.90		
	VDD_DRAM (1.0 V)	44.10		
	VDDA_1P8 (2.0 V)	13.53		
	VDDA_0P9 (1.0 V)	0.30		
	VDDA_DRAM (1.8 V)	1.32		
	VDD_SNVS (1.0 V)	0.25		
	NVCC_SNVS (3.3 V)	4.34		
	NVCC_DRAM (1.17 V)	13.12		
	Total <sup>2</sup>	389		mW
RUN	Total	1 to 4		W

<sup>1</sup> All the power numbers defined in the table are based on typical silicon at 25°C. Use case dependent.  
<sup>2</sup> Sum of the listed supply rails.

**Table 10. Chip power in different LP mode**

Function	Ball name	Recommendation if unused
INTEN	PH1E_AVDDIO	PH1E_AVDDIO, PH1E_AVDDIOA, PH1E_AVDDIOB, PH1E_AVDDIOCP2

**DFI**

**Title : i.MX8M CPU\_PWR**

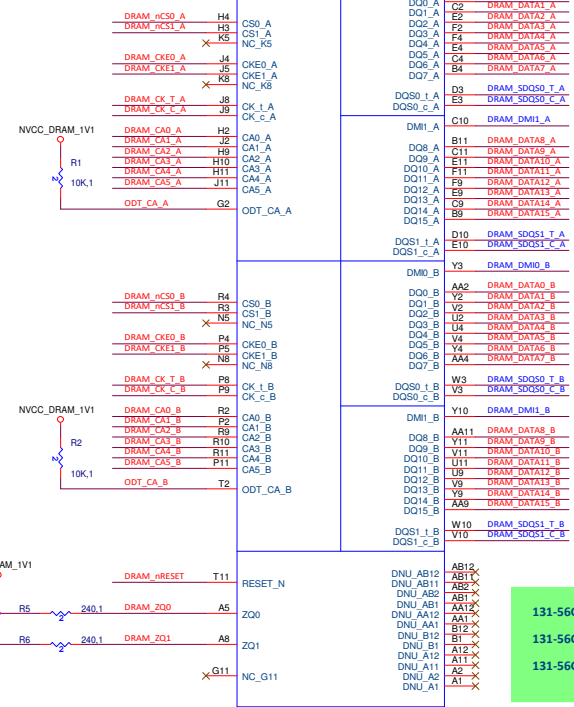
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**E24\*10R06\*02\*4791\*00**

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**i.MX8M - DDR**

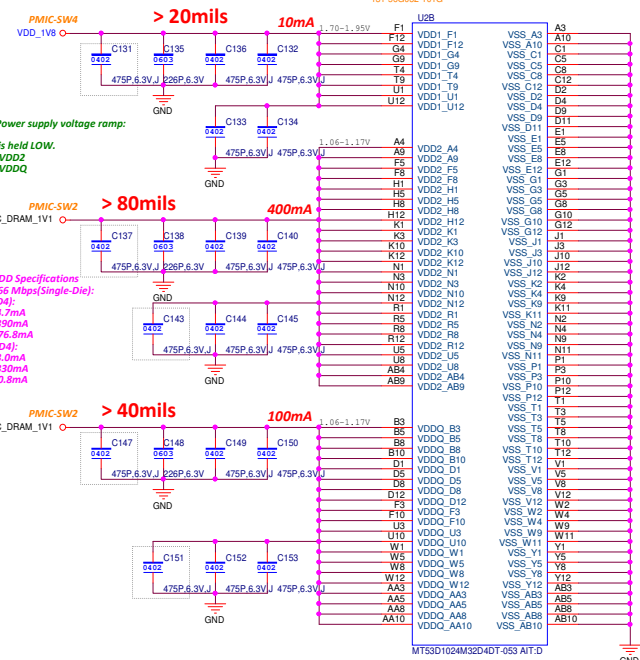
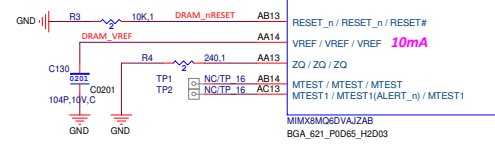
DRAM_CA0_A	AD17	CA0_A / A12 / A12(BC#)	DRAM_DQ00	AE93	DRAM_DATA0_A
DRAM_CA1_A	AE16	CA1_A / A11 / A11	DRAM_DQ01	AE94	DRAM_DATA1_A
DRAM_CA2_A	AD20	CA2_A / A7 / A7	DRAM_DQ02	AE95	DRAM_DATA2_A
DRAM_CA3_A	AE20	CA3_A / A8 / A8	DRAM_DQ03	AA92	DRAM_DATA3_A
DRAM_CA4_A	AD19	CA4_A / A6 / A6	DRAM_DQ04	Y25	DRAM_DATA4_A
DRAM_CA5_A	AE19	CA5_A / A5 / A5	DRAM_DQ05	AA95	DRAM_DATA5_A
DRAM_CS0_A	AE18	CS0_A / CS0_n / CS0#	DRAM_DQ06	AE95	DRAM_DATA6_A
DRAM_CS1_A	AC18	CS1_A / CS1_n / CS1#	DRAM_DQ07	AE92	DRAM_DATA7_A
DRAM_CKE0_A	AC16	CKE0_A / CKE0 / CKE0	DRAM_DQ08	AA92	DRAM_DATA8_A
DRAM_CKE1_A	AE17	CKE1_A / CKE1 / CKE1	DRAM_DQ09	AA93	DRAM_DATA9_A
DRAM_CK_T_A	AD14	CK_L_A / BG0 / BA2	DRAM_DQ10	AA92	DRAM_DATA10_A
DRAM_CK_C_A	AE14	CK_C_A / BG1 / A14	DRAM_DQ11	AA90	DRAM_DATA11_A
			DRAM_DQ12	AA18	DRAM_DATA12_A
			DRAM_DQ13	AA19	DRAM_DATA13_A
			DRAM_DQ14	AA17	DRAM_DATA14_A
			DRAM_DQ15		
DRAM_DM0	AD23	DRAM_DM0_A			
DRAM_DM1	AE60	DRAM_DM1_A			
DRAM_DQ00	AC24	DRAM_SDQ00_T_A			
DRAM_DQ01	AC25	DRAM_SDQ00_C_A			
DRAM_DQ01_P	AB91	DRAM_SDQ01_T_A			
DRAM_DQ01_N	AC21	DRAM_SDQ01_C_A			
DRAM_DATA0_B	AE3	DRAM_DATA0_B			
DRAM_DATA1_B	AD2	DRAM_DATA1_B			
DRAM_DATA2_B	AE4	DRAM_DATA2_B			
DRAM_DATA3_B	AD4	DRAM_DATA3_B			
DRAM_DATA4_B	AA2	DRAM_DATA4_B			
DRAM_DATA5_B	Y1	DRAM_DATA5_B			
DRAM_DATA6_B	AA1	DRAM_DATA6_B			
DRAM_DATA7_B	AB1	DRAM_DATA7_B			
DRAM_DATA8_B	AB4	DRAM_DATA8_B			
DRAM_DATA9_B	AA3	DRAM_DATA9_B			
DRAM_DATA10_B	AA8	DRAM_DATA10_B			
DRAM_DATA11_B	AA4	DRAM_DATA11_B			
DRAM_DATA12_B	AA3	DRAM_DATA12_B			
DRAM_DATA13_B	AA7	DRAM_DATA13_B			
DRAM_DATA14_B	AA9	DRAM_DATA14_B			
DRAM_DATA15_B	AA9	DRAM_DATA15_B			
DRAM_DM0_B	AD3	DRAM_DM0_B			
DRAM_DM1_B	AB6	DRAM_DM1_B			
DRAM_DM0_C	AC2	DRAM_SDQ00_T_B			
DRAM_DM1_C	AC1	DRAM_SDQ00_C_B			
DRAM_DM0_T	ABS	DRAM_SDQ01_T_B			
DRAM_DM1_T	ACS	DRAM_SDQ01_C_B			
DRAM_DM0_N					
DRAM_DM1_N					

## IF\_TMxD2305001898DV



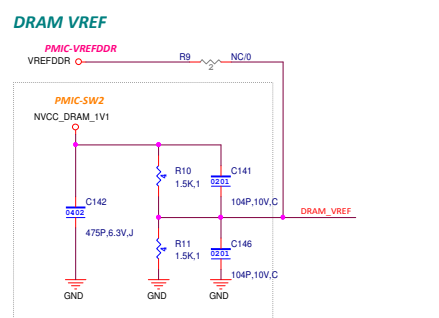
**Layout:** The impedance of DQ and DM0 signal traces should be controlled to 42-Ohm instead of 50-Ohm to maximize the timing margin at 3200 MT/s.

TN-53-06: LPDDR4/LPDDR4X Point-to-Point Design Guidelines:  
The central group includes chip select (CS0) and clock enable (CKE). Each data group contains DQ and DM0 signals.  
Address command signals: CA0-CA5/0.  
\*Designs should reference data bus signals.  
\*CA bus and clock should reference VDD.  
\*Signals should never reference VDD1.



- 131-56G032-100G LPDDR4-4266 [4GB] MTS3D1024M32D4T-046 AIT-D
- 131-56G032-101G LPDDR4-3733 [4GB] MTS3D1024M32D4T-053 AIT-D
- 131-56G016-400G LPDDR4-3733 [2GB] K4F6E354HM-MGJC

200X 00.363  
Dimensions apply to solder balls post-reflow on 00.35 SMD ball pads.



The DRAM\_VREF can be created by a simple voltage divider using 1.5K Ohm 1% resistors and 0.1 uF capacitors for stability. The relatively smaller-value resistors provide enough current to maintain a steady mid-point voltage. The calibration resistors used by the LPDDR4 chips and processor are 240 Ohm 1% resistors.

LPDDR4 Power supply voltage ramp:  
RESET\_n is held LOW.  
VDD1 >= VDD2  
VDD2 >= VDDQ

LPDDR4 IDD Specifications under 4266 Mbp/s (Single Die):  
Read (IDD4):  
VDD1= 4.7mA  
VDD2= 330mA  
VDDQ= 76.8mA  
Write (IDD4):  
VDD1= 3.0mA  
VDD2= 330mA  
VDDQ= 6.8mA

Micron Technology

Product Family: S3 - Mobile LPDDR4 5046M

Operating Voltage: 1.2V - 1.8V (VDDQ) = 0.65V \* VDDQ

Configuration:  
108M32 = 128 Mb x 32  
204M32 = 256 Mb x 32  
384M32 = 384 Mb x 32  
512M32 = 512 Mb x 32  
108M32 = 128 Mb x 32  
204M32 = 256 Mb x 32

Addressing:  
S1 = LPDDR4, 1 die  
S2 = LPDDR4, 2 die  
S4 = LPDDR4, 4 die

Design Revision: A, B, C, D

Operating Temperature:  
T0 = -40°C to +85°C  
T1 = -40°C to +105°C  
T2 = -40°C to +125°C

Automotive Certification (optional):  
AEC-Q100 (Automotive)

Cycle Time:  
108M32 = 127ps, t<sub>CK</sub> RL = 20pF  
204M32 = 256ps, t<sub>CK</sub> RL = 20pF  
384M32 = 384ps, t<sub>CK</sub> RL = 20pF  
512M32 = 512ps, t<sub>CK</sub> RL = 20pF

Package Codes:  
S0 = 200-ball WFBGA 10 x 14.5 x 0.8mm (100.55 0805)  
S1 = 200-ball WFBGA 10 x 14.5 x 0.8mm (090.55 0805)  
S2 = 200-ball WFBGA 10 x 14.5 x 0.8mm (090.55 0805)  
S3 = 200-ball WFBGA 10 x 14.5 x 0.8mm (090.55 0805)

**DFI**

Title: i.MX8M CPU LPDDR4

Size: | Document Number: | Rev: |

**E24\*10R0602\*4791\*00**

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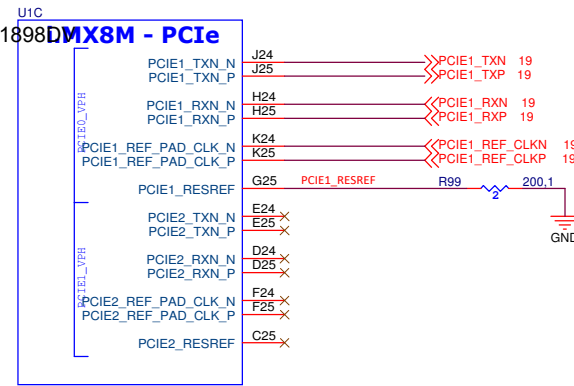
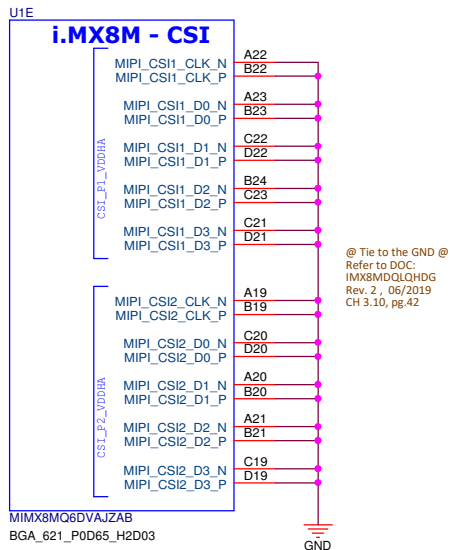




# PHY

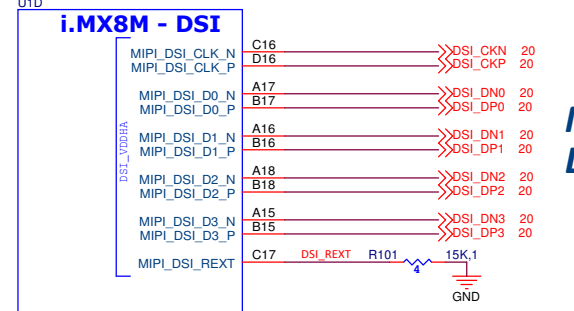
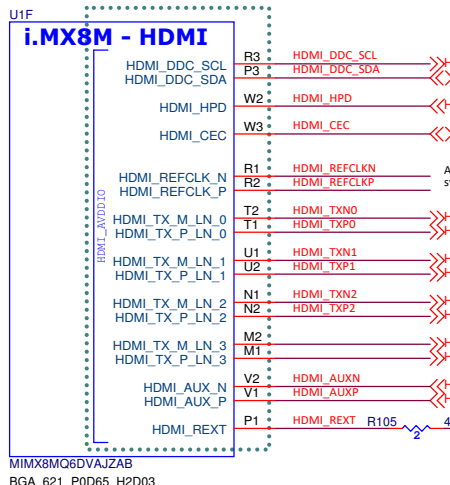
IF\_TMxD2305001898DMX8M - PCIe

USB\_RESREF: Attach a 200-Ohm(1%) 100-ppm/C precision resistor-to-ground on the board.  
MIPI\_DSI\_REXT: 15K-Ohm  
PCE: 200-Ohm(1%) 100-ppm/C precision resistor-to-ground on the board.  
HDMI:a 499-Ohm (1%) resistor-to-ground on the board.

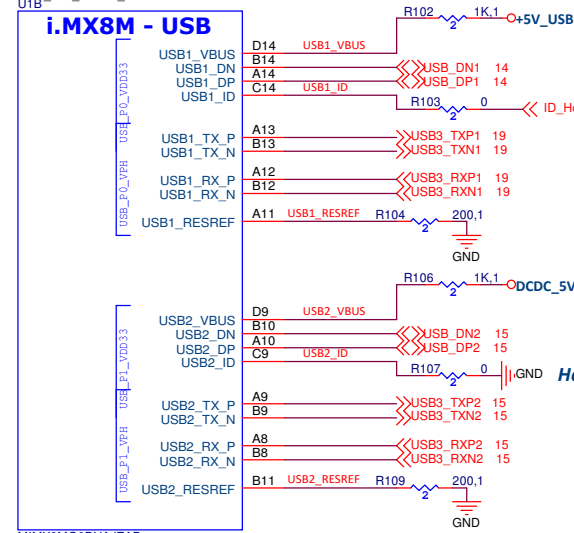


### PCie1(2.0, 1-lane)-M.2 Key E

### PCie2(2.0, 1-lane)-Reserved



### MIPI DSI(4-lane)-LVDS(Dual Ch.)



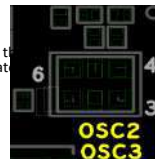
### Download low = Host, floating = Serial Download

### USB3.0-WWAN

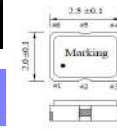
### USB3.0 HUB

### HDMI Tx (2.0a)

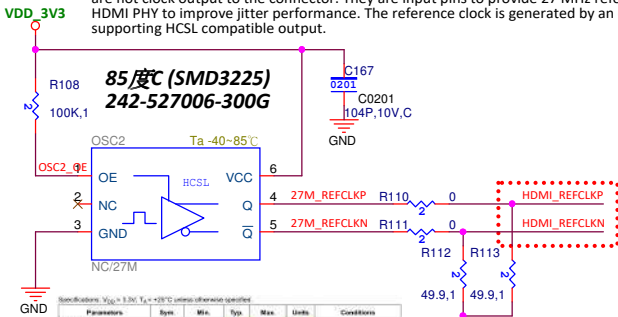
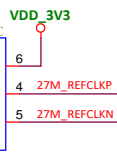
When configured as HDMI output, the two pins named HDMI\_REFCLK\_P and HDMI\_REFCLK\_N are not clock output to the connector. They are input pins to provide 27 MHz reference clock to the HDMI PHY to improve jitter performance. The reference clock is generated by an external oscillator supporting HCSL compatible output.



105度 (SMD2520)  
242-527006-200G



Co-Layout ~105deg  
OSC3 Ta -40~105°C



Parameters	Typ	Min	Max	Units	Conditions
Period jitter	0.25				200 kHz to 20 MHz @ 100.25 MHz
Integrated Phase Noise	0.38				100 kHz to 20 MHz @ 100.25 MHz
	1.7				10 MHz to 30 MHz @ 100.25 MHz

Function	Ball name	Recommendation if unused
HDMI	HDMI_DDC_SCL, HDMI_DDC_SDA, HDMI_HPD, HDMI_CEC, HDMI_REFCLK_P/N, HDMI_TX_P/N, HDMI_AUX_P/N, HDMI_REXT	Leave unconnected Tie to the ground

## DFI®

Title : **i.MX8M CPU\_PHY**

Size : Document Number : **M8MT51**

Customer : **DFI**

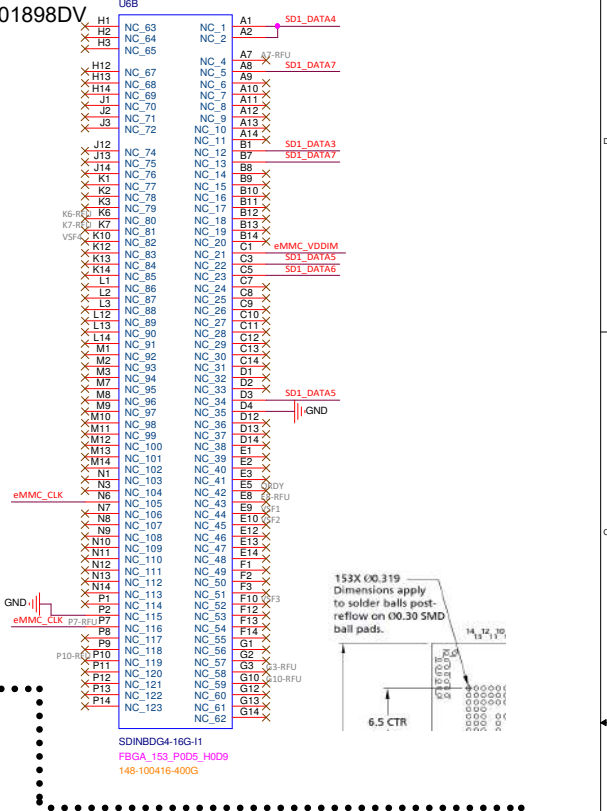
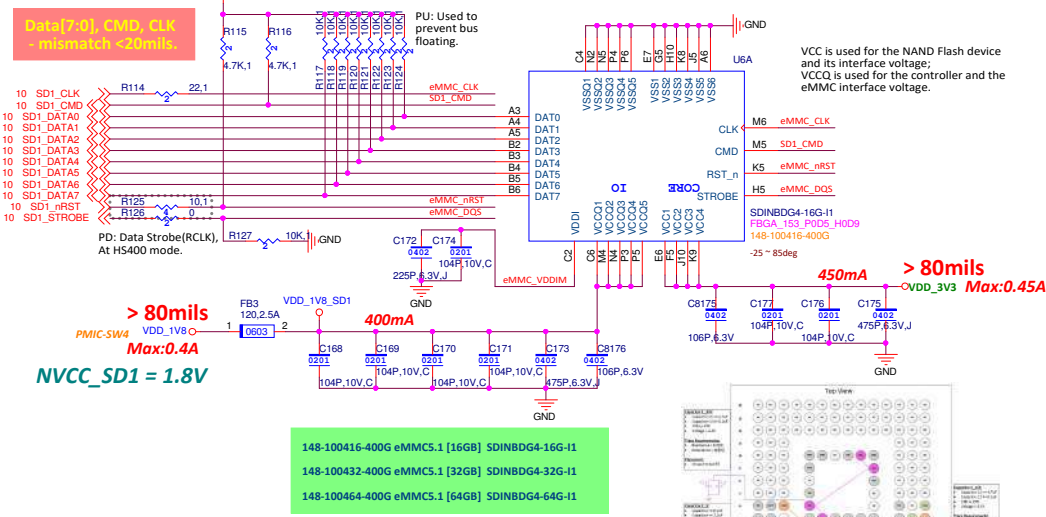
Rev : **2**

DFI 10R0802 4791\*00 Page : 12 / 32

# eMMC5.0

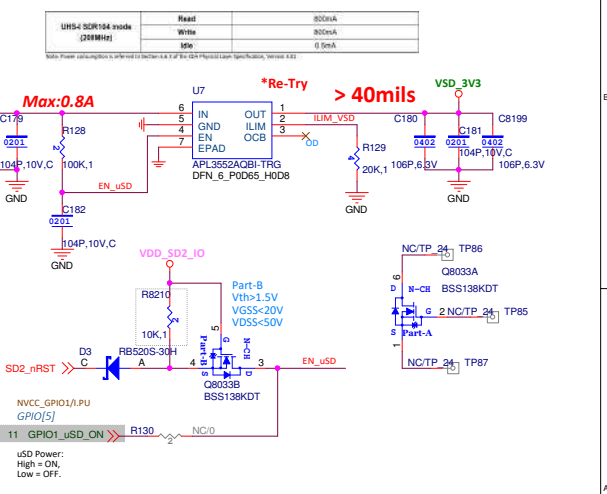
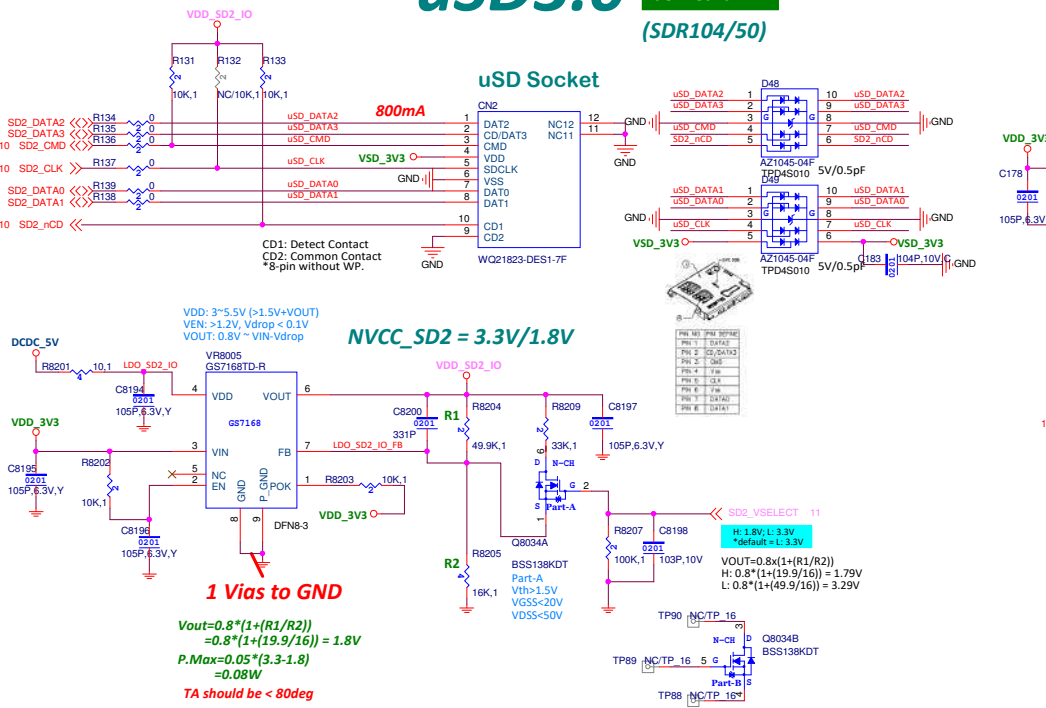
IF\_TMxD2305001898DV

NC: No Connect, shall be connected to ground or left floating.  
 RFU: Reserved for Future Use, shall be left floating for future use.  
 VSF: Vendor Specific Function, shall be left floating.



# uSD3.0

Silk printing: uSD Card (SDR104/50)



**DFI**

Title: eMMC5.0/uSD

Size: Document Number: M8MT51

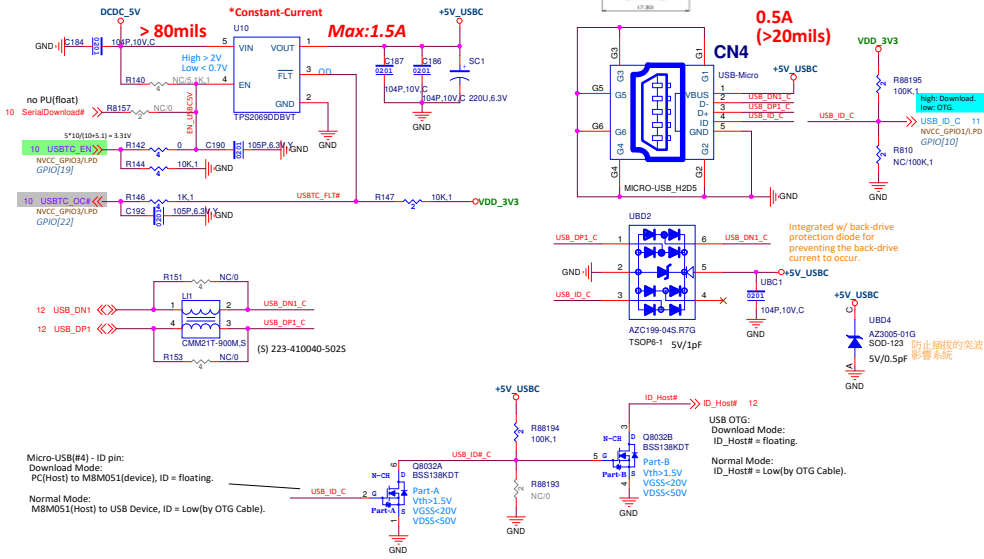
Date: Monday, August 15, 2022

Rev: E24 \* 10R06/02 \* 4791 \* 00

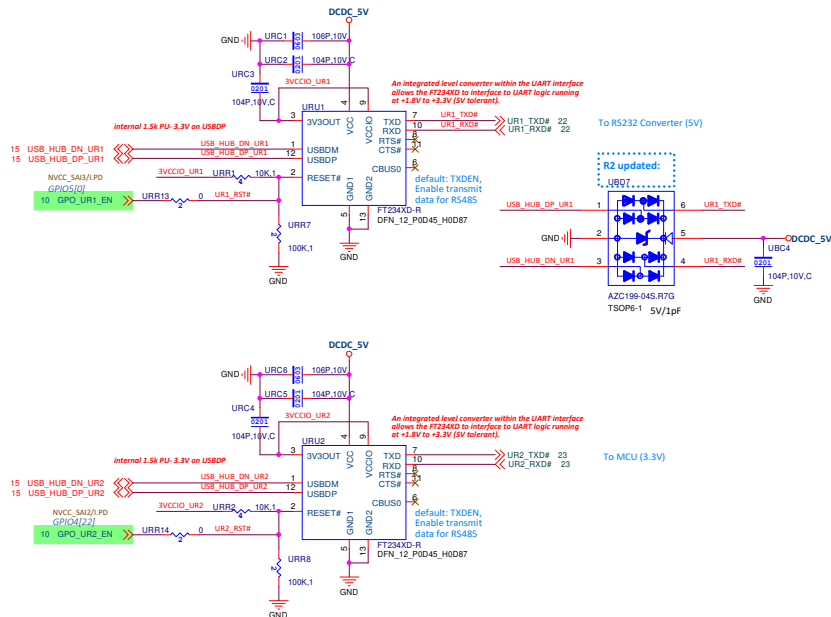
Page: 13 / 32

# USB 2.0 (Download)

GPO(hgh) to Enable OTG-Power



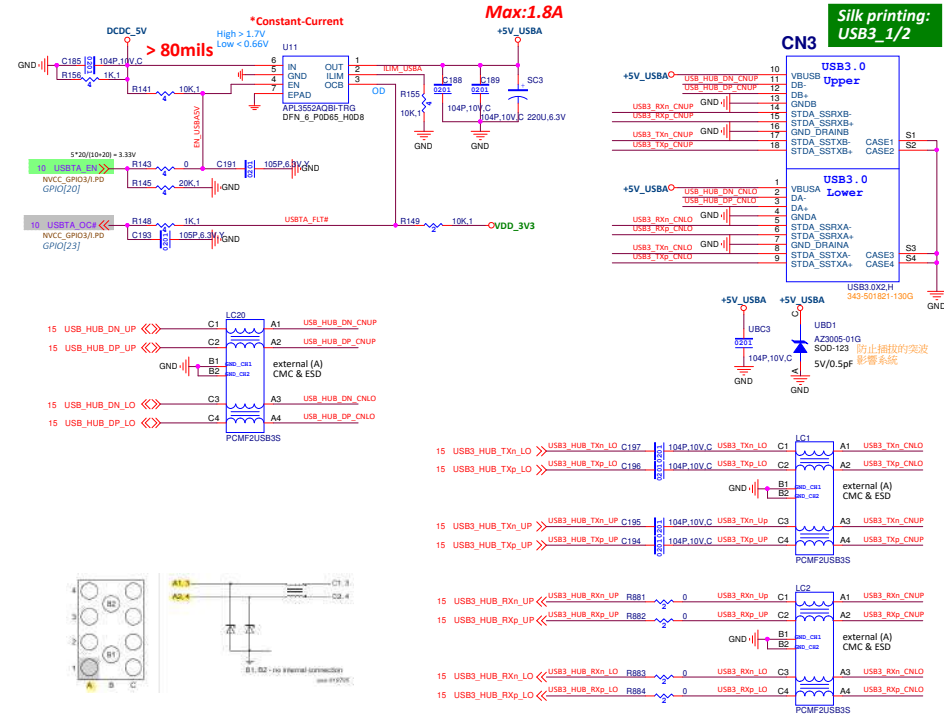
# USB 2.0 -> UART(TX/RX/RTS/CTS)



IF\_TMXP2305001898DV

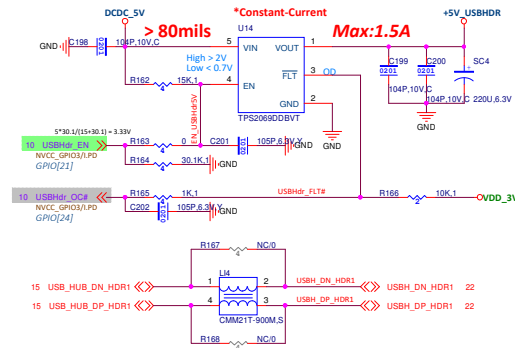
# USB 3.0-TypeA

Page 52 of 151 15.06.2023



# USB 2.0-HDR

Silk printing: USB2\_3



**DFI**

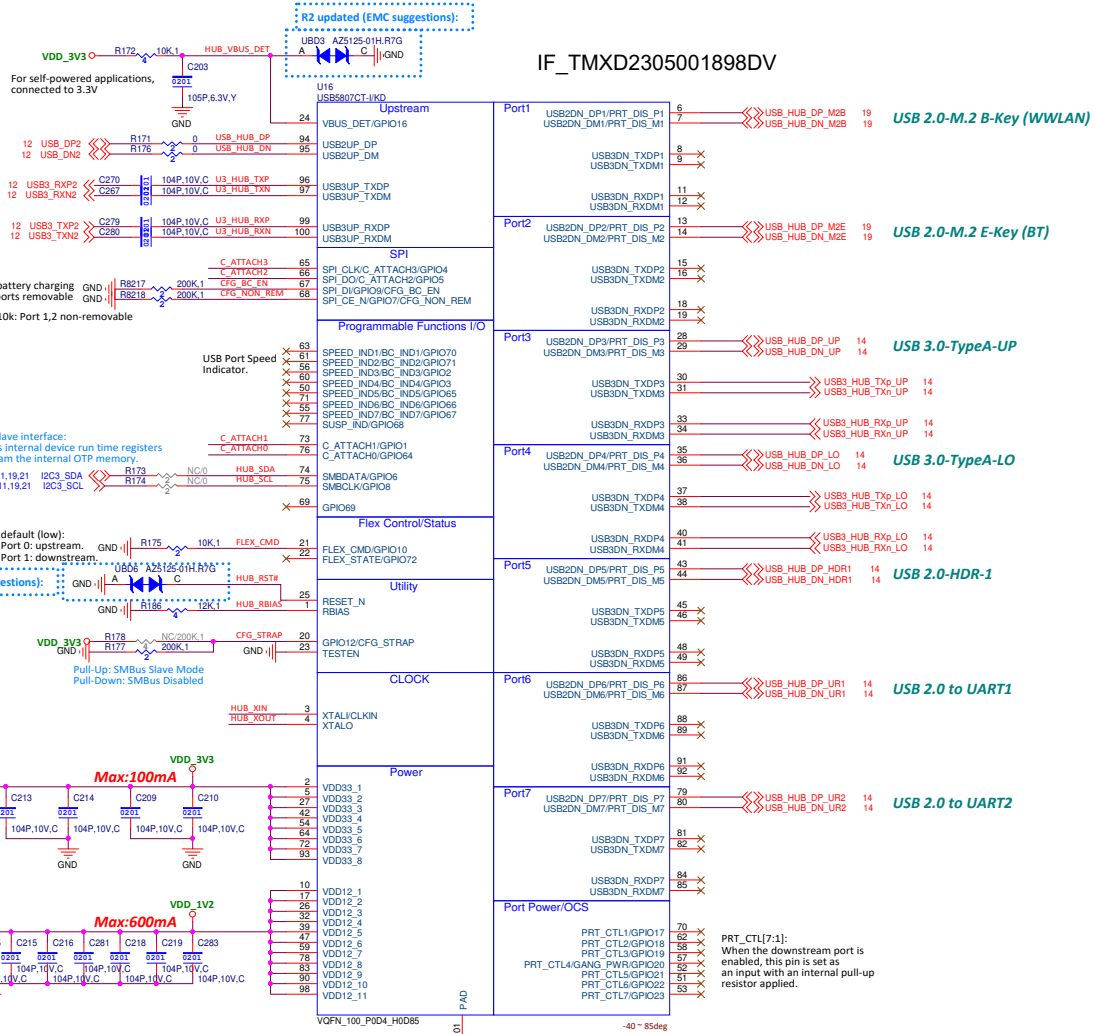
Title : USB3.0 / USB2.0

Size : Document Number : MBMT51

Rev : 2

E24\*10R06102\*4791\*00 Page 14 / 32

# USB3.0 HUB



When using legacy USB Type-A and Type-B connectors, pull these pins to 3.3V to permanently enable all USB 3.1 PHYs.



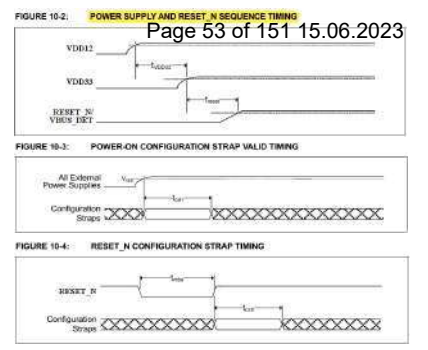
No battery charging  
 All ports removable  
 PD-10k: Port 1,2 non-removable

SMBus slave interface:  
 to access internal device run time registers  
 or program the internal OTP memory.

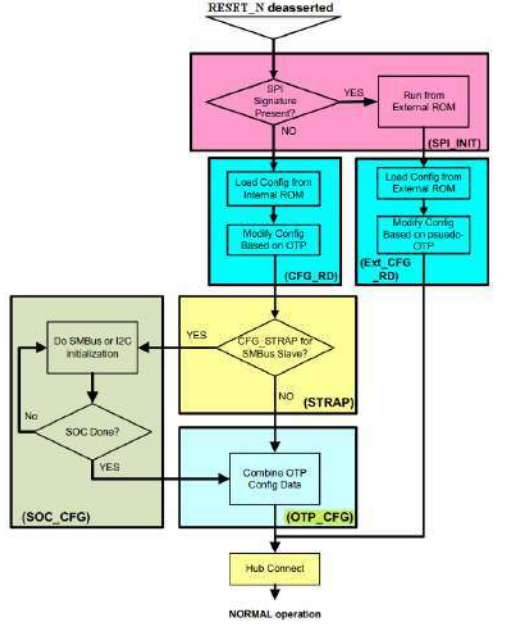
default (low):  
 Port 0: upstream  
 Port 1: downstream

Pull-Up: SMBus Slave Mode  
 Pull-Down: SMBus Disabled

PRT\_CTL[7:1]:  
 When the downstream port is enabled, this pin is set as an input with an internal pull-up resistor applied.



- 1) update SPI flash from USB Host(2.0).
- 2) update OTP ROM via USB Host(2.0).
- 3) update OTP ROM via SMBus Host(100KHz) - < SOC\_CFG stage (SMB PU-10K)



**USB5807C-I/KD 100 VQFN 12X12X0.9mm (I-grade)**  
**USB5807C/KD 100 VQFN 12X12X0.9mm (C-grade)**

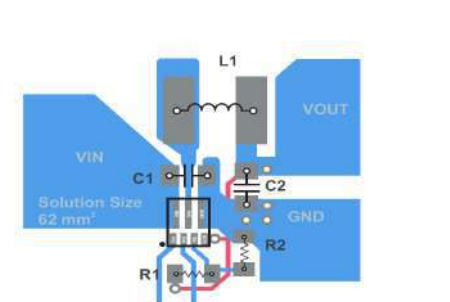
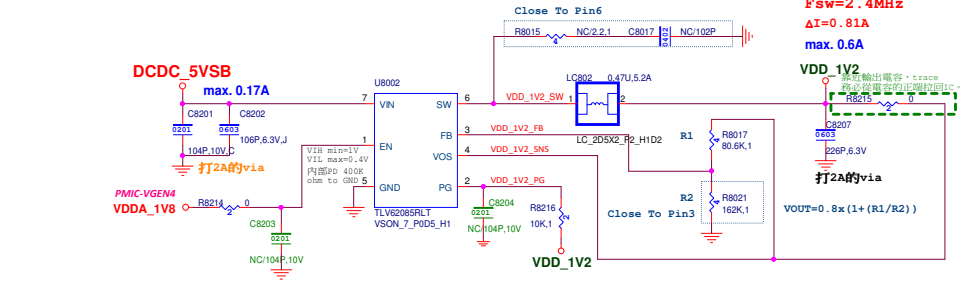


Figure 22. PCB Layout Recommendation



VDD33 should rise after or at the same rate as VDD12.  
 Similarly, RESET\_N and/or VBUS\_DET should rise after or at the same rate as VDD33.  
 VBUS\_DET and RESET\_N do not have any other timing dependencies.

**DFI**

Title : **USB3.0 Hub(USB5807C)**

Size : Document Number : **MP0551** Rev : **2**

**E24\*10R0602\*4791\*00**

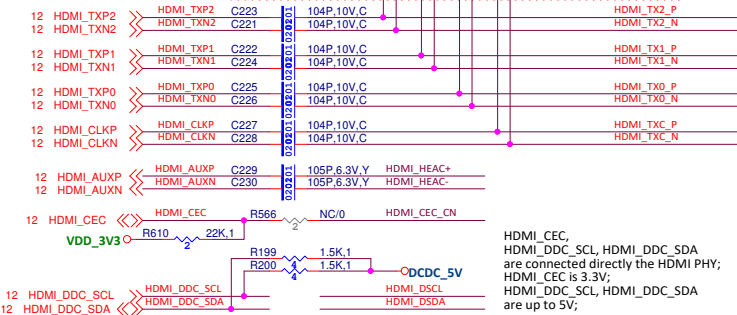
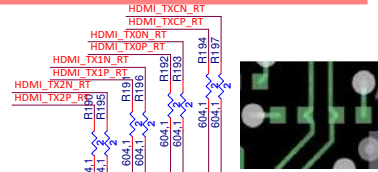
Date : Monday, August 15, 2022 Page : 13 / 32



# HDMI2.0a

TMXD2305001898DV

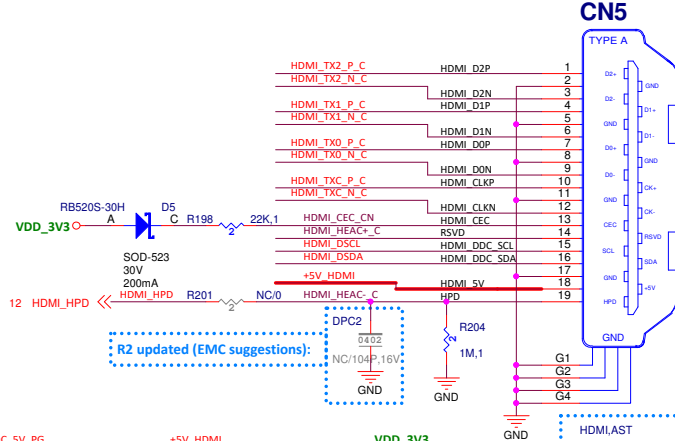
Layout: 604-Ohm directly on the signal trace



HDMI\_CEC, HDMI\_DDC\_SCL, HDMI\_DDC\_SDA are connected directly to the HDMI PHY; HDMI\_CEC is 3.3V; HDMI\_DDC\_SCL, HDMI\_DDC\_SDA are up to 5V;

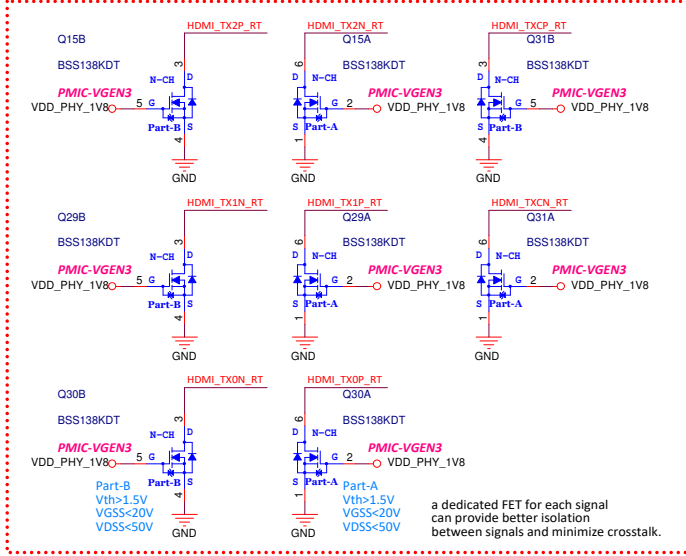
Layout: HDMI 100 ohm differential pairs

Silk printing: HDMI1

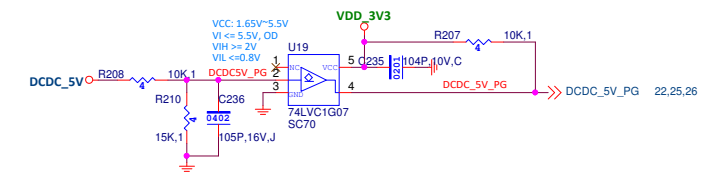
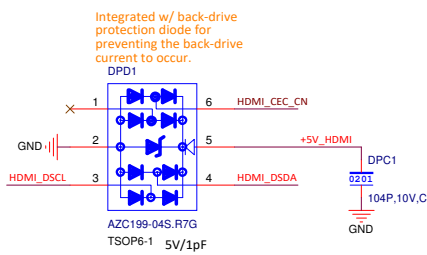
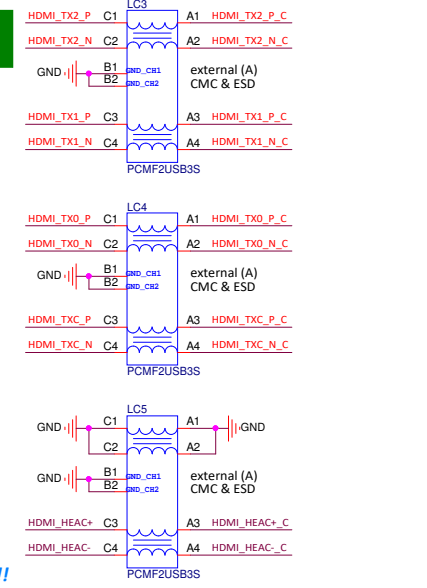
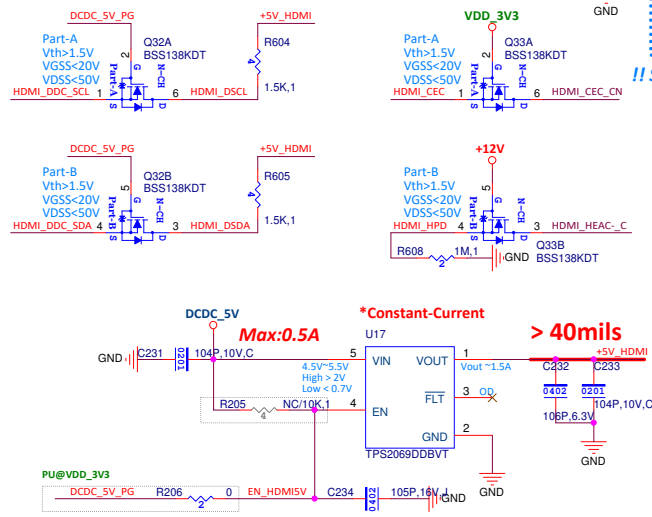


R2 updated (EMC suggestions):

!! SMD Type 無彈片 !!



a dedicated FET for each signal can provide better isolation between signals and minimize crosstalk.



**DFI**

Title: HDMI2.0a TX

Size: Document Number: **M8MT51** Rev: **1.0**

Custom: **F24\*10R06/02\*4791\*00**

Date: Monday, August 15, 2022 Page: 10 / 32

# I2S Codec

--- New Part / Package ---

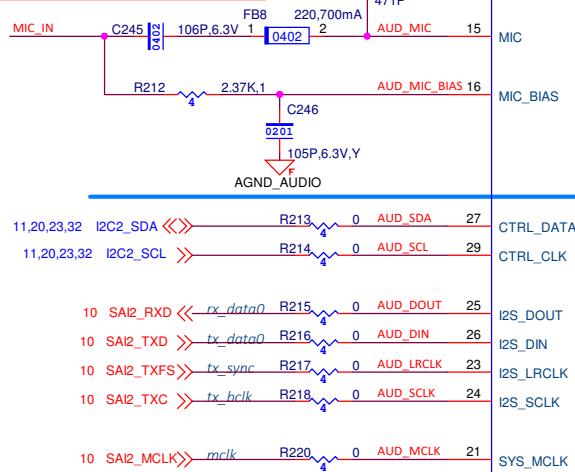
## I2C2

I2C Addr: 0x0A

For the 32 QFN version of the SGT15000, the I<sup>2</sup>C device address is 0n01010(R/W) where n is determined by I2C\_ADR0\_CS and R/W is the read/write bit from the I<sup>2</sup>C protocol.

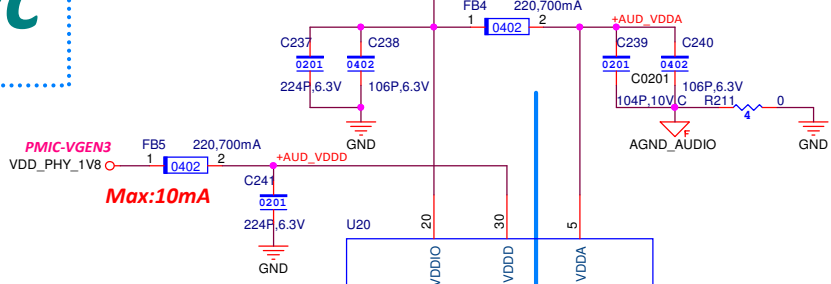
0n0-1010

Layout: Analog Trace, >8mils

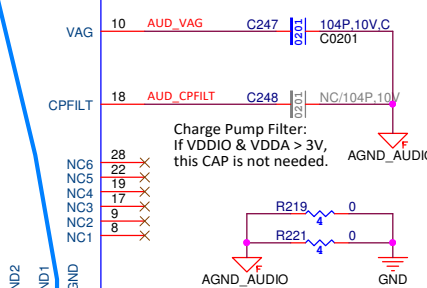
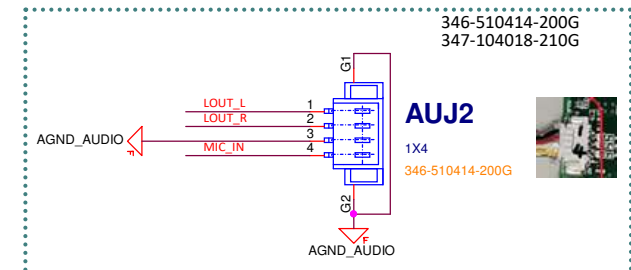
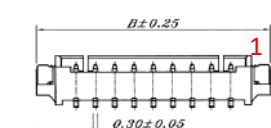
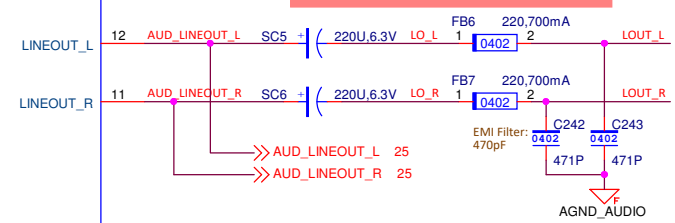


CTRL\_MODE LOW:I2C  
CTRL\_DATA SDA  
CTRL\_CLK SCL  
CTRL\_ADR0\_CS I2C Addr(n)

> 20mils VDD\_3V3 Max:20mA IF\_TMxD2305001898DV

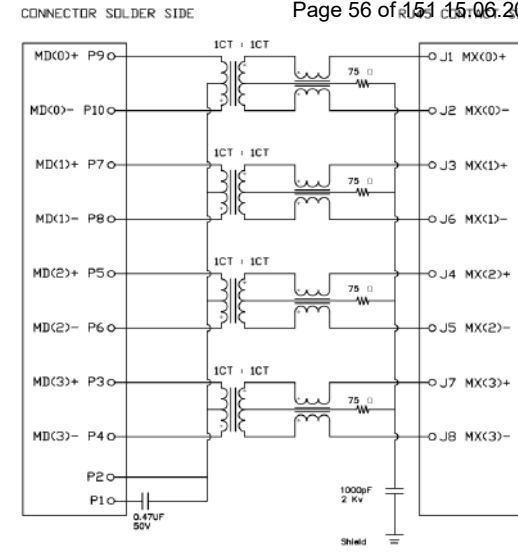
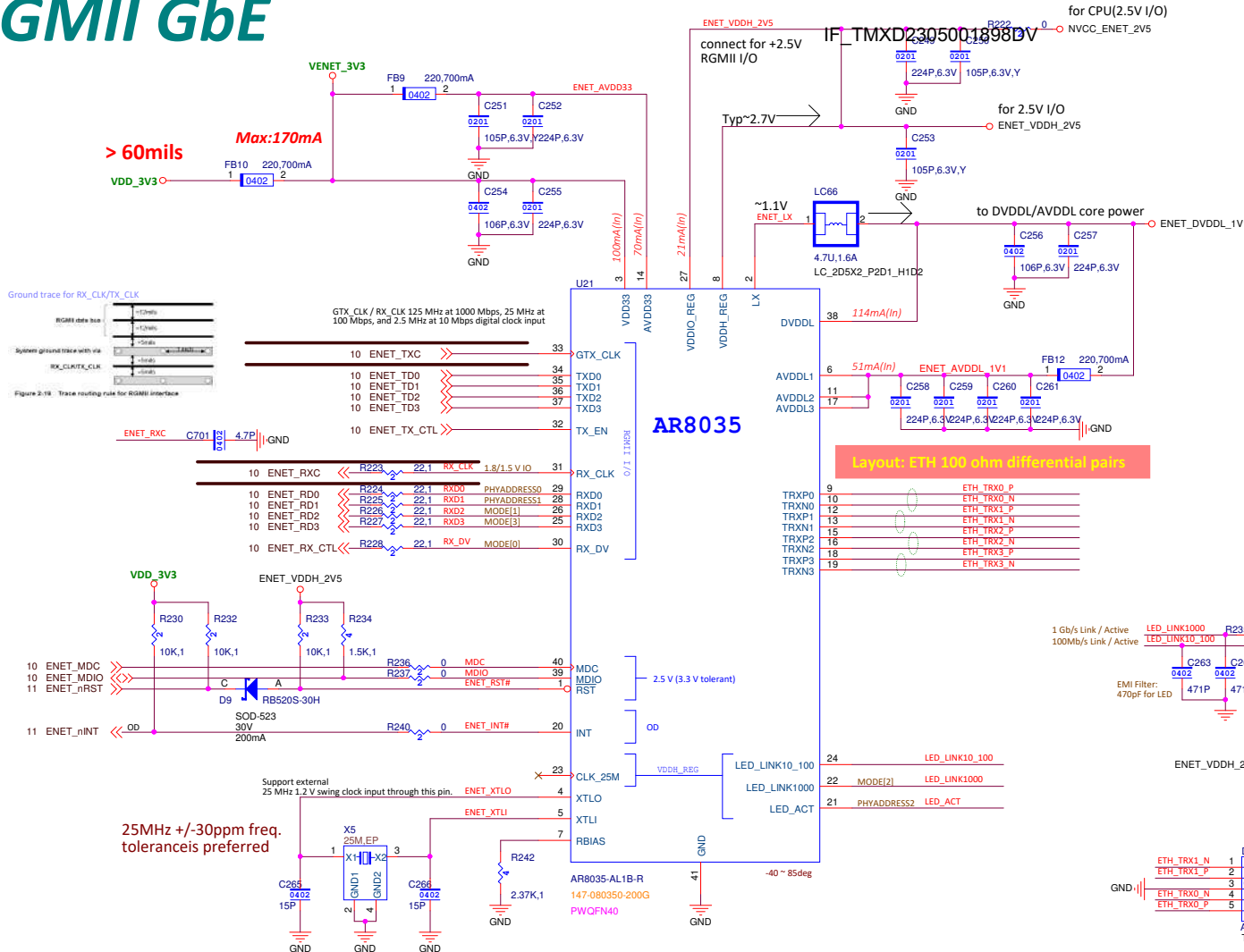


Layout: Analog Trace, >8mils



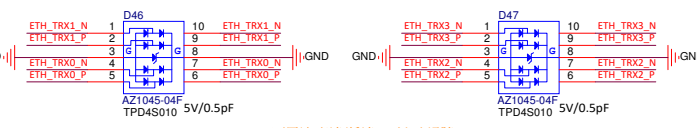
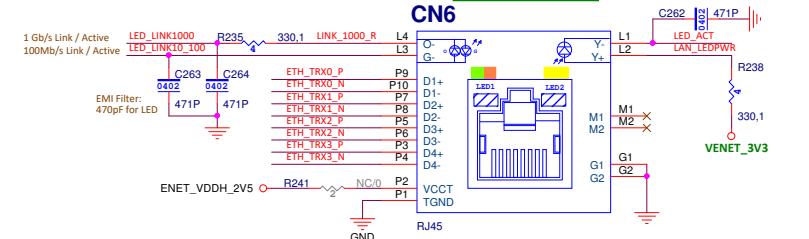
AGND: Star connected to the jack GND.  
\*via to GND plane at a single point.

<b>DFI</b>		
Title : I2S Codec(SGTL5000)		
Size : Document Number :	M8MT51	
Date : Monday, August 15, 2022	Page : 17 / 32	



Layout: ETH 100 ohm differential pairs

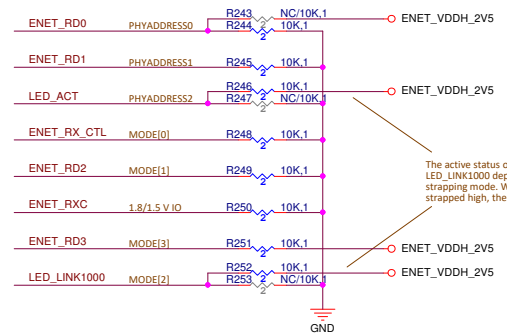
Silk printing: LAN1



PHY pin	PHY core configuration signal	Description	Default internal weak pull-up/down
RXD0	PHYADDRESS0	LED_ACT and RXD[1:0] set the lower three bits of the physical address.	0
RXD1	PHYADDRESS1	Upper two bits of the physical address are set to 0.	0
LED_ACT	PHYADDRESS2		1
RX_DV	MODE[0]	Mode select bit 0	0
RXD2	MODE[1]	Mode select bit 1	0
LED_1000	MODE[2]	Mode select bit 2	1
RXD3	MODE[3]	Mode select bit 3	0
RX_CLK	1.8V/1.5V	Select the RGMII I/O voltage level 1 = 1.8 V I/O 0 = 1.5 V I/O	0

1. 0 = Pull-down, 1 = Pull-up.  
 2. Power-on strapping pins are latched during power-up/reset or warm hardware reset.  
 3. Because the MAC device input pins can be driven high or low during power-up or reset, PHY power-on strapping status can be affected by the MAC side. In this case, set external 10 kΩ pull-down or pull-up resistor to ensure stable status.  
 4. All of the digital input pins are 3.3 V input tolerant. The O and I/O pins are powered with 2.6 V power. The input level of any I/O pins (except open-drain type) is limited to 3 V, which requires power-on strapping pull-up to VDDIO\_REG or VDDH\_REG but never to 3.3 V.  
 5. When using 2.5 V RGMII I/O voltage level, RX\_CLK can be pull-up or pull-down.

### Power-on Strapping Pins CFG



ADDR[2:0] = 100  
 Mode[3:0] = 1100

Table 2-4. LED Status

Symbol	10M Link	10M Active	100M Link	100M Active	1000M Link	1000M Active
LED_LINK10_100	OFF	OFF	ON	ON	OFF	OFF
LED_LINK1000	OFF	OFF	OFF	OFF	ON	ON
LED_ACT	ON	BLINK	ON	BLINK	ON	BLINK

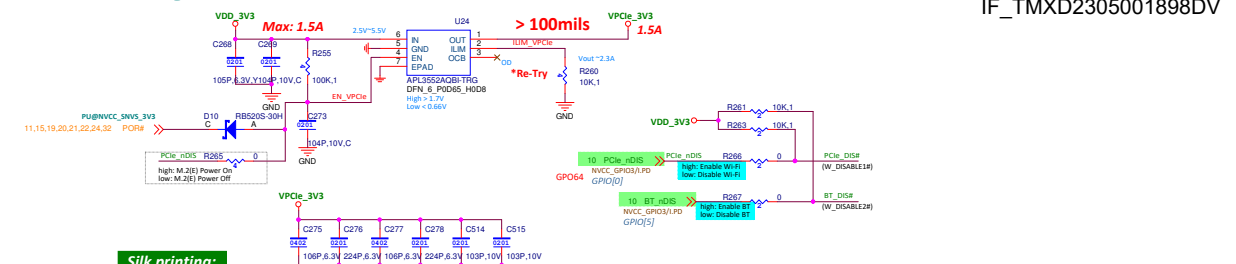
Mode [3:0]	Description
1100	RGMII PLL OFF INT
1110	RGMII PLL ON INT
Others	Reserved

PLL OFF indicates that AR8035 can shut down internal PLL in power saving mode. In PLL OFF mode, when AR8035 enters power saving mode (ibernation), CLK\_25M output drops periodically, which saves more power. In PLL ON mode, CLK\_25M output continues.

**DFI**  
**RGMII GbE(AR8031)**  
 Title :  
 Size : Document Number :  
 Customer : MBMT51  
 Date : 2023.06.22  
 Rev : 2  
 E24\*10R06702\*4791\*00

# M.2 Key-E

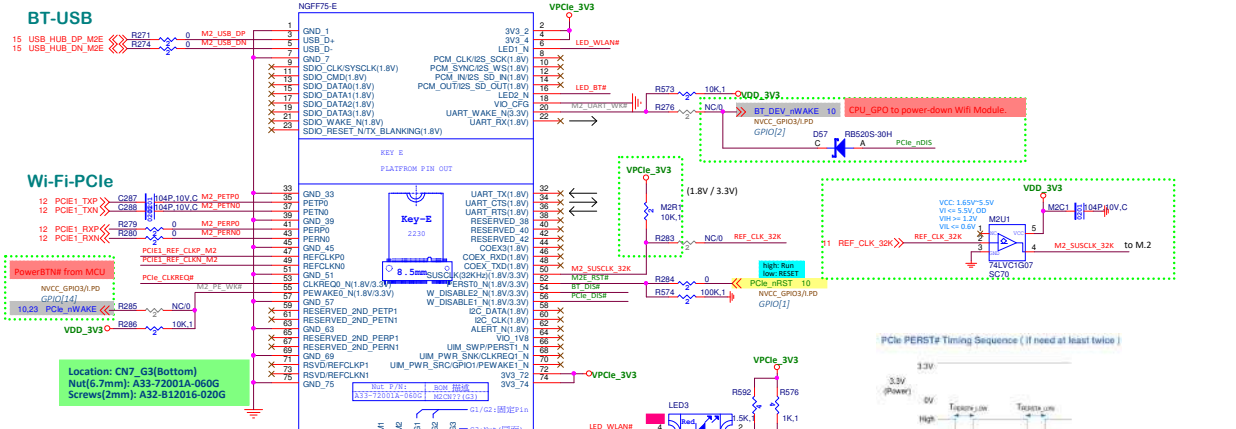
## PCIe PWR (Key E)



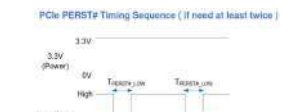
**Silk printing:**  
M.2-E

# 3.3V->1.8V Level Shifter

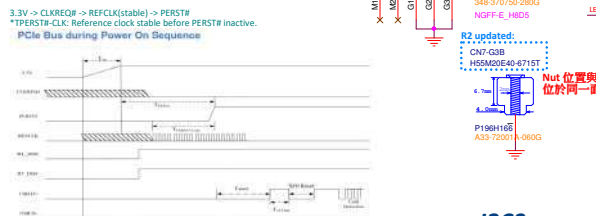
IF\_TMxD2305001898DV



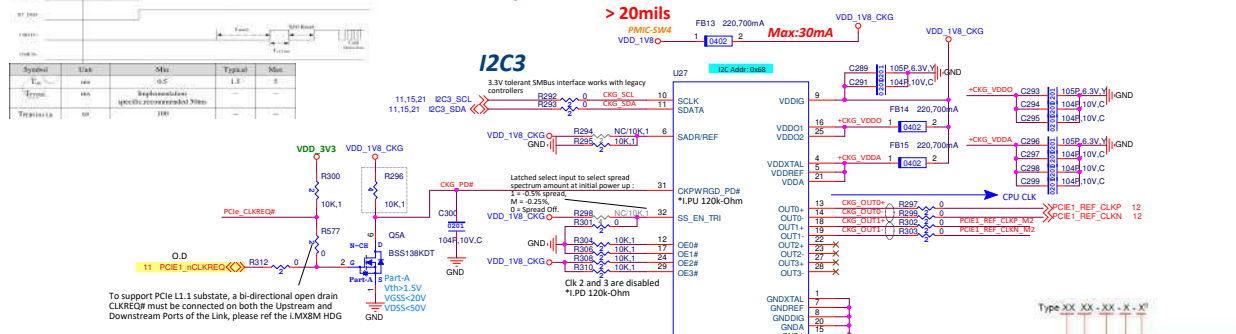
Location: CN7\_G3(Bottom)  
Nut(6.7mm): A33-7200JA-060G  
Screws(2mm): A32-B32016-020G



**Silk printing: --> 增加: 座標位置@座標檔**  
CN7-G3 (@BOT)



# CLOCK GENERATOR



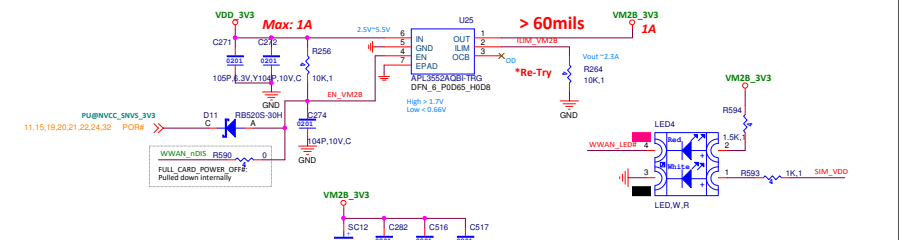
Symbol	Unit	Min	Typical	Max
V <sub>DD</sub>	V	0	3.3	3.3
I <sub>DD</sub>	mA	0	300	300

State of SAOR on first application of CKPWRD_PDE	SAOR	Address	Read/Write Bit
0	T10T00		x
1	T10T10		x

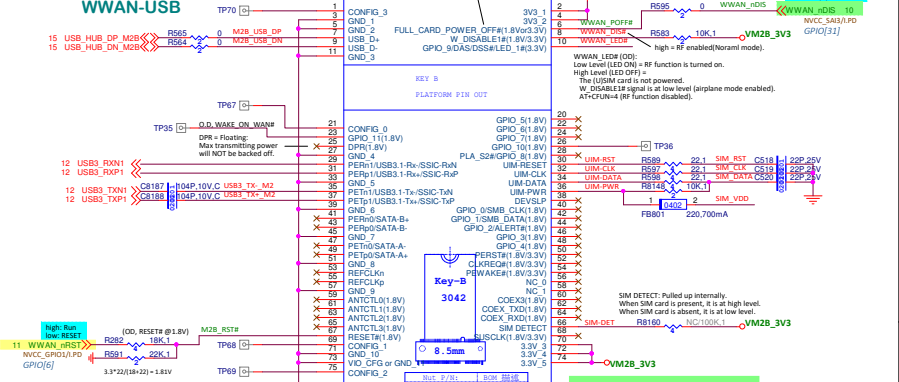
# M.2 Key-B

PCIe PWR (Key B)

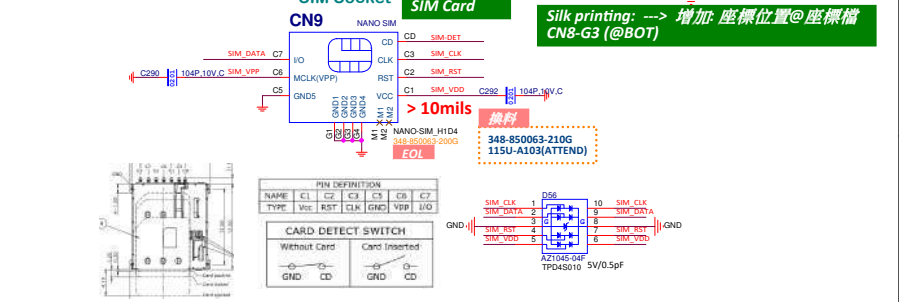
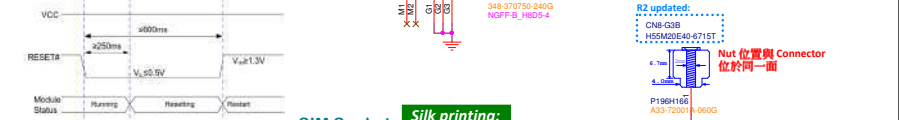
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**Silk printing:**  
M.2-B



Location: CN8\_G3(Bottom)  
Nut(6.7mm): A33-7200JA-060G  
Screws(2mm): A32-B32016-020G



**Silk printing:**  
SIM Card  
CN9

**Silk printing: --> 增加: 座標位置@座標檔**  
CN8-G3 (@BOT)

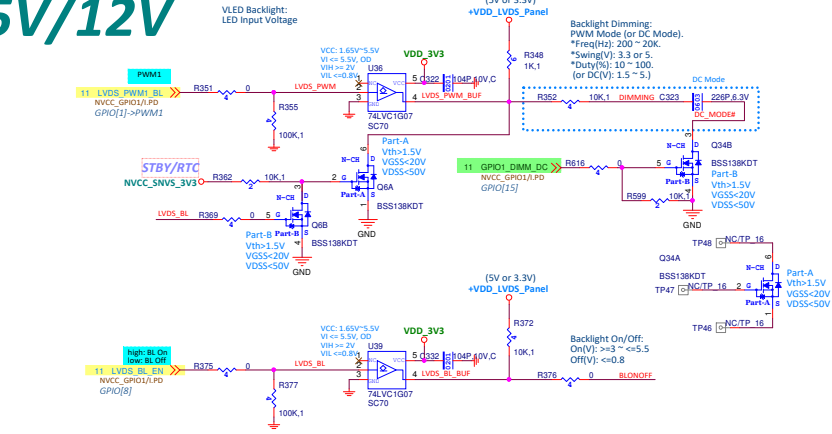
Pin No.	Pin	Interface
A	1-15	2x PCIe x1 / USB 2.0 (I2C / JTAG)
B	16-19	PCIe x2 SATA/SATAe (5/6) / SATAe (5/6) / SATAe (5/6) / SATAe (5/6)
C	20-22	Reserved for Future Use
D	23-25	Reserved for Future Use
E	26-31	2x PCIe x1 / USB 2.0 (I2C / SATA) / UART / PCM
F	32-35	Future Memory Interface (PM)
G	36-41	Generic I/O used for 5.0/2.5
H	42-43	Reserved for Future Use
I	44-51	Reserved for Future Use
J	52-53	Reserved for Future Use
K	54-55	Reserved for Future Use
L	56-57	Reserved for Future Use
M	58-60	PCIe x4 / SATA

DFI logo and product information: M.2 2230(E) & 3042(B), M8MT51, Date: Monday, August 15, 2022, Page: 19 / 32

**E24\*10R06/02\*4791\*00**



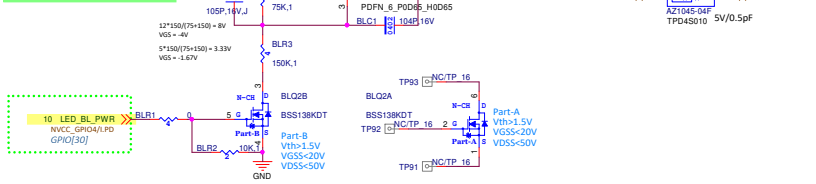
# LED Backlight 5V/12V



**Silk printing:**  
Control Signal Voltage  
JP5(1-3): 5V  
JP5(1-2): 3.3V \*

> 100mils  
**Silk printing:**  
B.L. Power  
JP5(5-6): 12V \*  
JP5(4-6): 5V

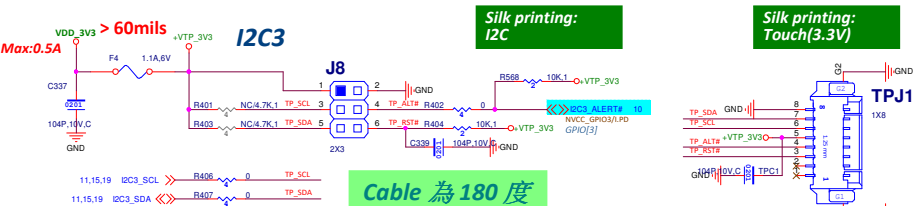
344-002003-610G  
Mini JUMPER RED 2.0mm



**Silk printing:**  
LED BL Power  
NCVC\_GPI01/FPD  
GPIO[30]

## I2C / Touch

RISC(ARM):  
i2c detect the EEPROM = 0x50~0x57.  
實際地址為 A0/A1, 7bit.



**Silk printing:**  
I2C

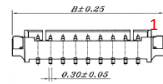
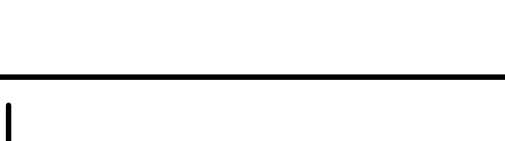
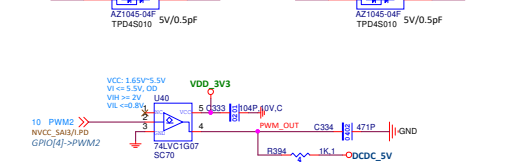
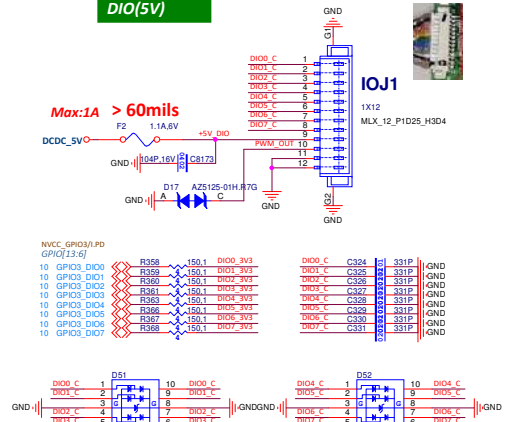
**Silk printing:**  
Touch(3.3V)

Cable 為 180 度

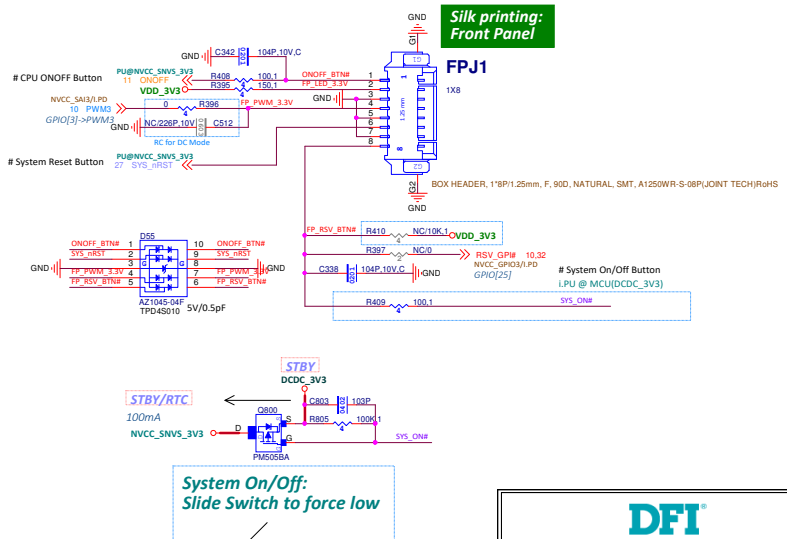
BOX HEADER, 1\*8P1.25mm, F, 90D, NATURAL, SMT, A1250WR-S-08PJUNION TECH|Rohs

## DFI TMXD2305001898DV

**Silk printing:**  
DIO(5V)



## Front Panel



**Silk printing:**  
Front Panel

System On/Off:  
Slide Switch to force low

**DFI**

Title : B.L./F.P./DIOs/I2C

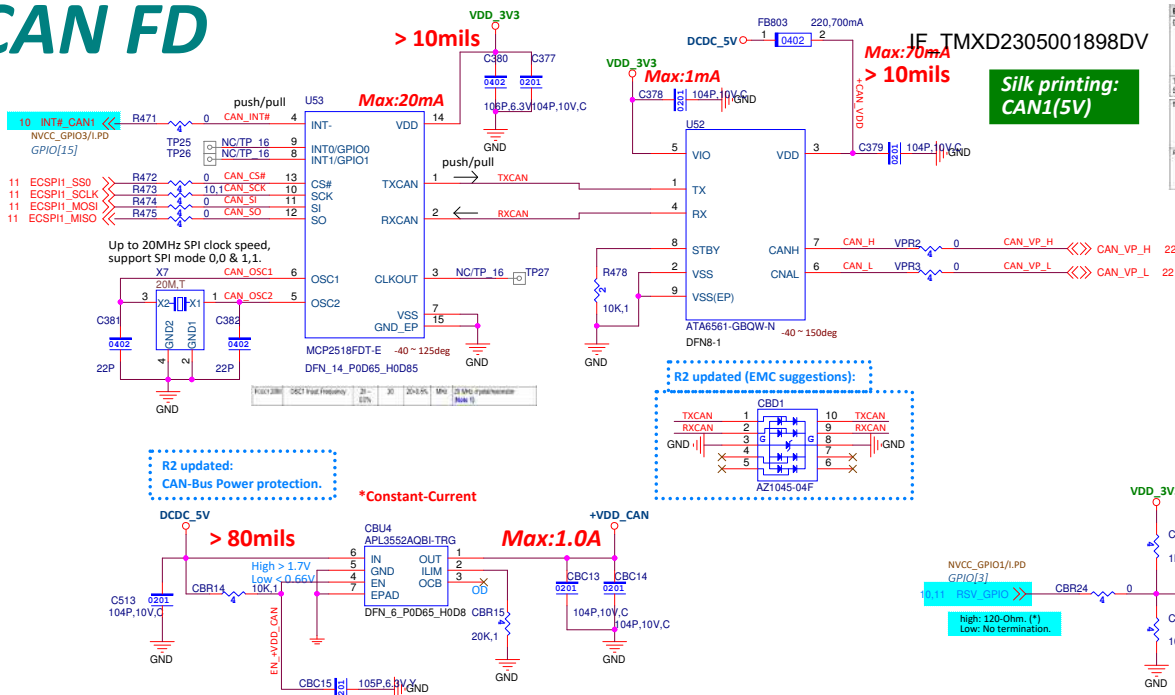
Size : Document Number :  
E24 \* 10R06/02 \* 4791 \* 00

Customer :  
Date : Monday, August 15, 2022

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Page : 21 / 32



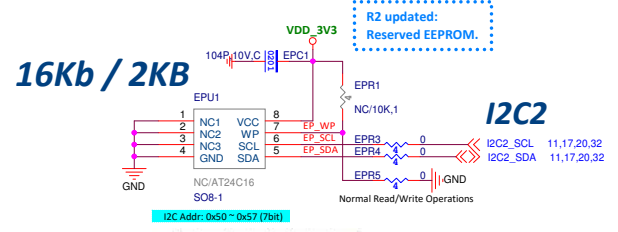
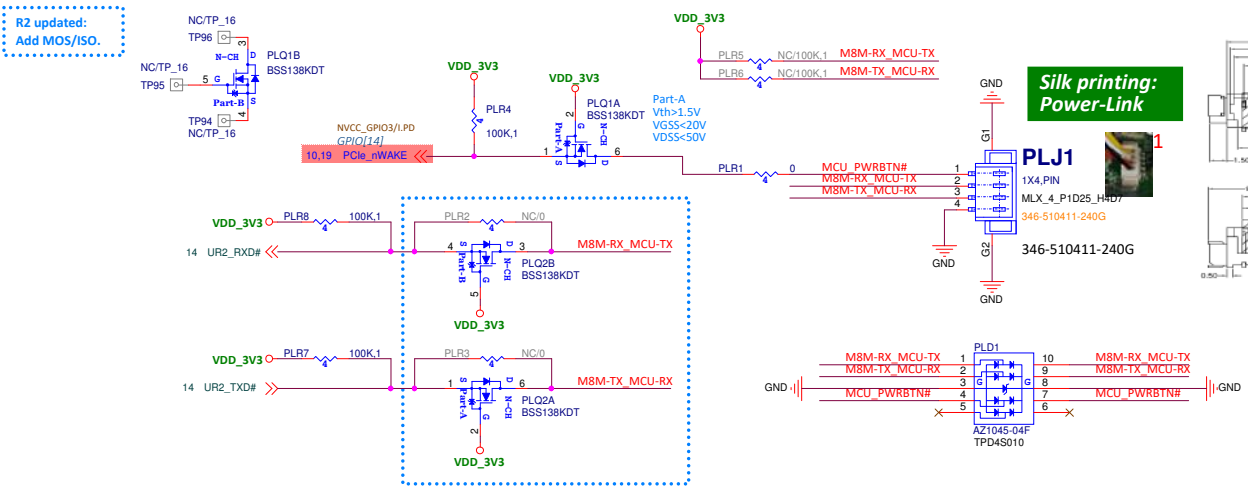
# CAN FD



Part Number	Unit / Bi Direction	Marking Code	Reverse Stand off Voltage (V)	Minimum Breakdown Voltage (V)	Maximum Peak Pulse Current (mA)	Maximum Clamping Voltage (V)	Maximum Reverse Leakage (uA)	Typical Capacitance (pF)	Maximum Capacitance (pF)
D9932-240A	Bi	CB2	24	26.7	0	40	1	15	18

# M8M UART-Link to Power Board

# EEPROM



<b>DFI</b>		
Title : UART-Link / CAN2.0		
Size : Document Number :	M8MT51	Rev : 2
Custom :		
Date : Monday, August 15, 2022	Page : 23 / 32	



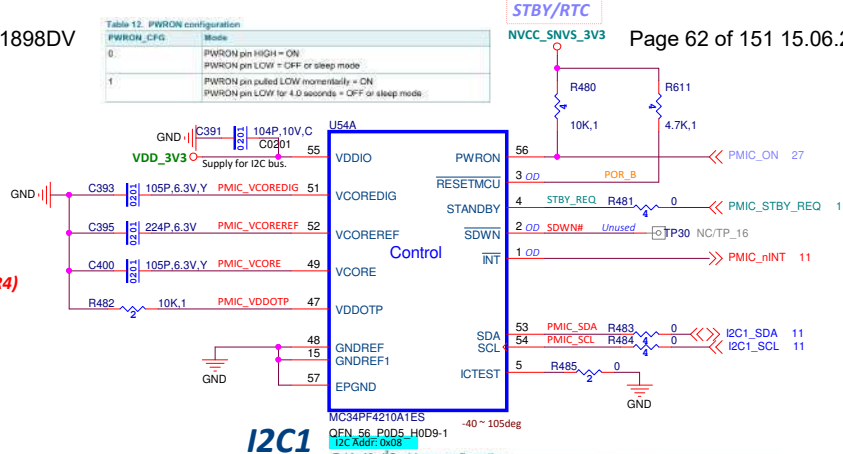
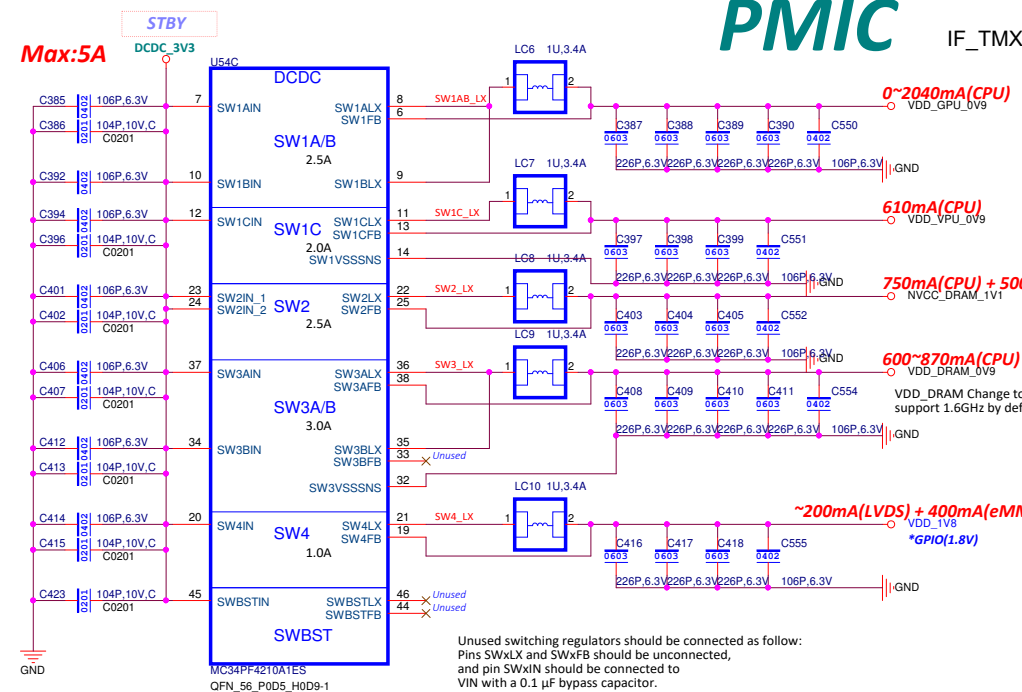


Table 12. PWRON configuration

PWRON_CFG	Mode
0	PWRON pin HIGH = ON PWRON pin LOW = OFF or sleep mode
1	PWRON pin pulled LOW momentarily = ON PWRON pin LOW for 4.0 seconds = OFF or sleep mode

Table 13. I<sup>2</sup>C address configuration

I2C_SLV_ADDR[3] hard coded	I2C_SLV_ADDR[2:0]	I <sup>2</sup> C device address (Hex)
1	000	0x08

The I2C device address can be programmed from 0x08 to 0x0F. This allows flexibility to change the I2C address to avoid bus conflicts.

Unused switching regulators should be connected as follow:  
Pins SWxLX and SWxFB should be unconnected, and pin SWxIN should be connected to VIN with a 0.1 μF bypass capacitor.

PWRON is an input signal to the IC generating a turn on event. It can be configured to detect a level, or an edge using the PWRON\_CFG bit.

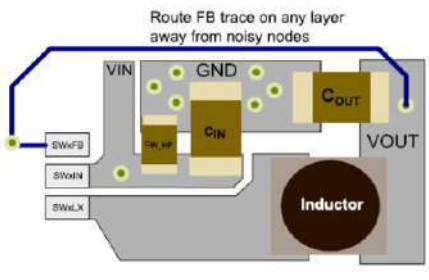
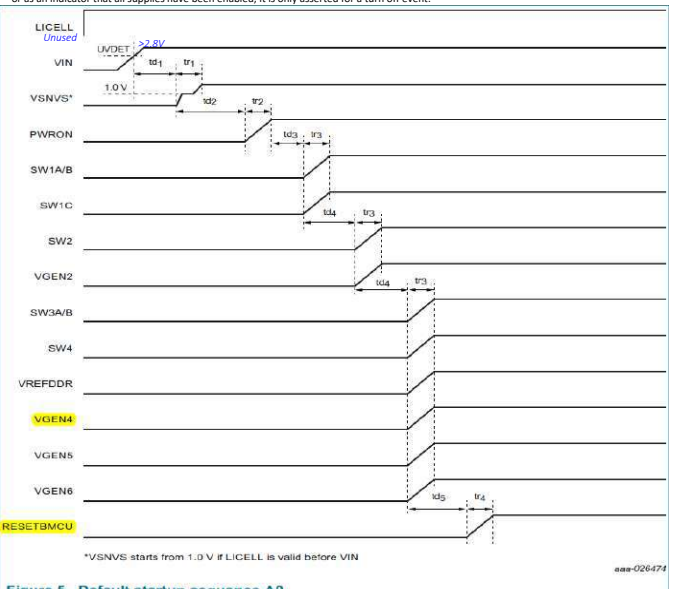
STANDBY is an input signal to the IC. When it is asserted, the part enters standby mode and when deasserted, the part exits standby mode. STANDBY can be configured as active high or active low using the STANDBYINV bit.

SDWN is an open drain, active low output notifying the processor of an imminent PMIC shut down. It is asserted low for one 32 kHz clock cycle before powering down and is then deasserted in the OFF state.

INTB is an open drain, active low output. It is asserted when any fault occurs, provided the fault interrupt is unmasked. INTB is deasserted after the fault interrupt is cleared by software, which requires writing a 1 to the fault interrupt bit.

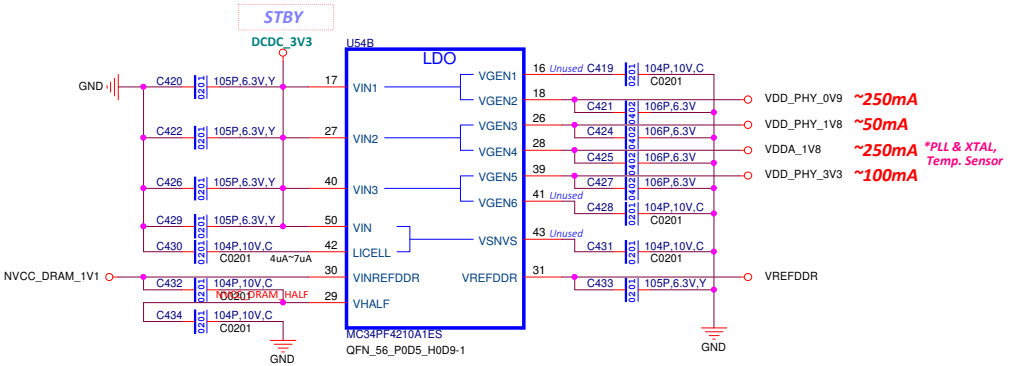
RESETCMU is an open drain, active low output configurable for two modes of operation. In default mode, it is deasserted 2.0 ms to 4.0 ms after the last regulator - if the startup sequence is enabled (see Figure 5).

In this mode, the signal can be used to bring the processor out of reset, or as an indicator that all supplies have been enabled; it is only asserted for a turn off event.



i.MX8M PWR

SEQ	PWR	MIN	TYP	MAX	Curr(mA)
1	NVCC_SNV5	3	3.3	3.6	2
2	VDD_SNV5	0.81	0.9	0.99	2
3	VDD_SOC/VDDA_OP9	0.81	0.9	0.99	3600
4	VDD_GPU	0.81	0.9/1.0	1.1	2000
4	VDD_VPU	0.81	0.9/1.0	1.1	1000
4	VDD_DRAM	0.81	1.0	1.05	2500
4	VDD_ARM	0.81	0.9/1.0	1.1	4000
5	VDDA_1P8_XXX	1.62	1.8	1.89	250
5	VDDA_DRAM	1.71	1.8	1.89	50
6	NVCC_DRAM	1.1/1.2/1.35	1.1	2170	
6	NVCC_3V3	3	3.3	3.6	100
6	NVCC_1V8	1.65	1.8	1.95	450
7	3.3V PHY	3.069	3.3	3.63	100
7	1.8V PHY	1.674	1.8	1.98	50
7	0.9V PHY	0.837	0.9	0.99	250



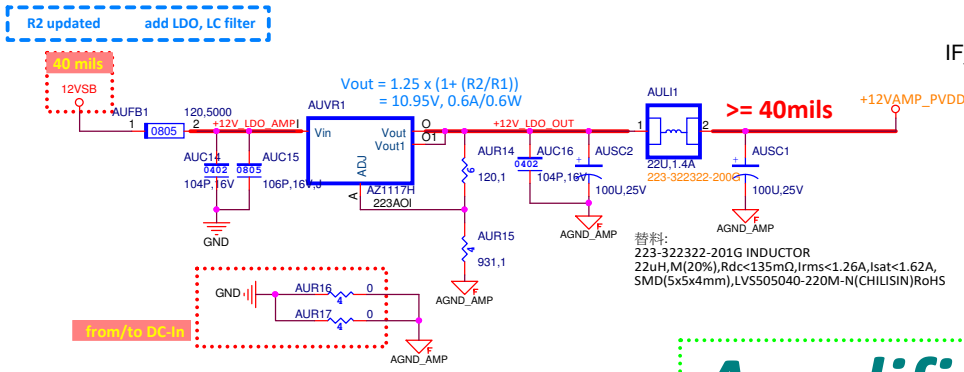
**DFI**

Title: **PMIC(MC34PF4210)**

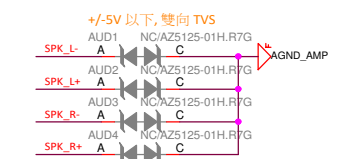
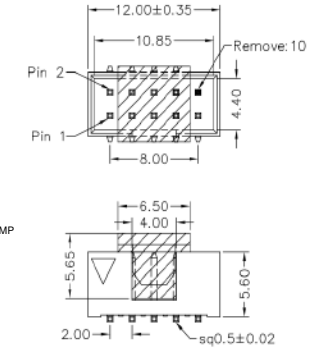
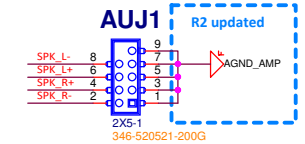
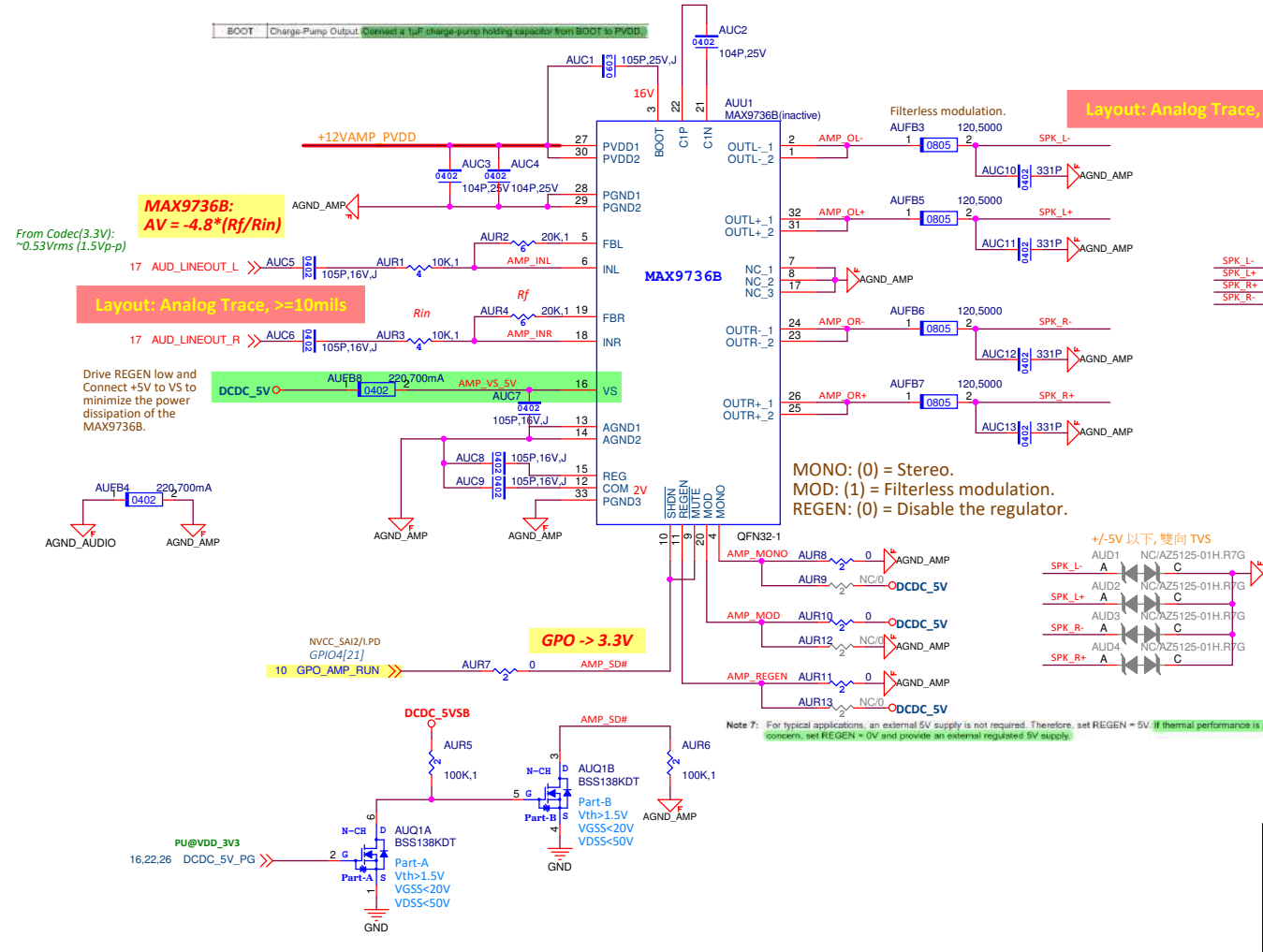
Size: Document Number: **M8MT51** Rev: **2**

Custom: **M8MT51**

Date: Monday, August 15, 2022 Page: 24 / 32



# Amplifier Max: 3W/4-Ohm

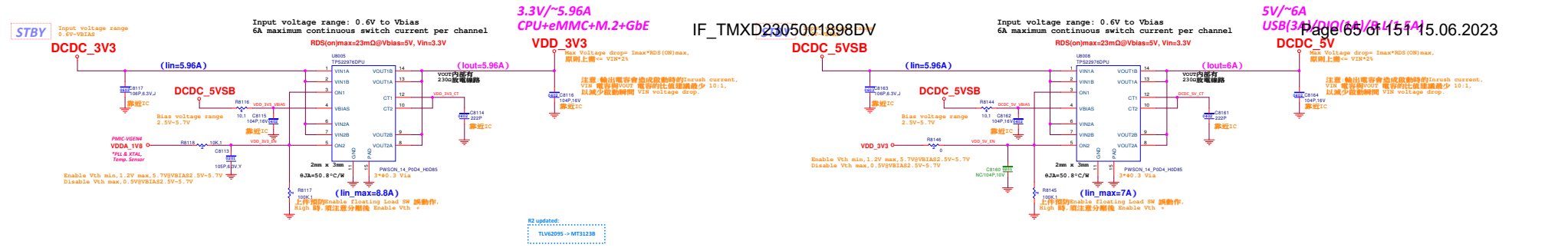


Note 7: For typical applications, an external 5V supply is not required. Therefore, set REGEN = 5V. If thermal performance is a concern, set REGEN = 0V and provide an external regulated 5V supply.

**DFI**

<b>Title :</b> Amplifier(Max: 3W/4-Ohm)		
<b>Size :</b> Document Number :	M8MT51	<b>Rev :</b> 2
<b>Custom</b>		
<b>Da E24110R06/02*4791*00</b>		





0.9V(Main-SOC)

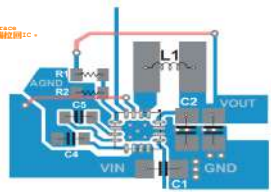
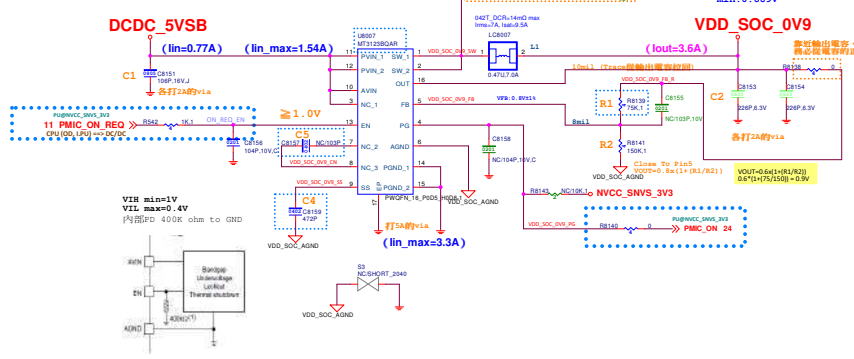


Figure 23. TLV62095 PCB Layout

0.9V(Main-ARM)

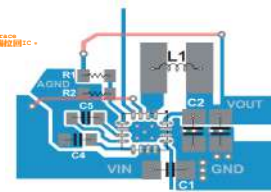
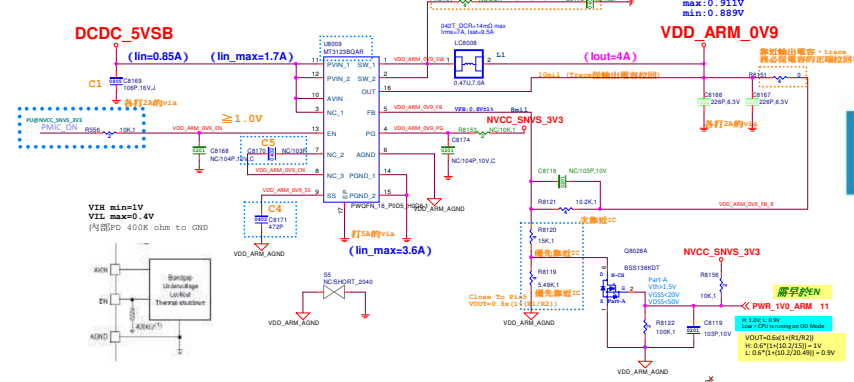


Figure 23. TLV62095 PCB Layout

Turn-On Time	$t_{on}$	$V_{in}=3.0V, R_L=100\Omega$	<	20	ns
Turn-Off Time	$t_{off}$	$V_{in}=3.0V, R_L=100\Omega$	<	40	ns

# Test Pad for Power Sequence

IF\_TMxD2305001898DV

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<b>Title :</b> Test Pad for Power Sequence		
<b>Size :</b> Custom	<b>Document Number :</b> M8MT51	<b>Rev :</b> 2
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# Revision History

Date	PCB Revision	Modified Page	Programmable Logic Impact (No or BIOS/EC/SW/FPGA)	Modify function and Purpose (What & Why)	Change Detail (How)	Update By or Note (Bug#)
2022/8/1	R2	22	No	Update COM4 power control circuit.	Add TSU2 for 5V with GPO to EN.	sherlock.hsia
2022/8/1	R2	22, 23	No	Update CAN-Bus Power protection.	Add CBU4...etc for OCP/避免Cable誤插燒毀.	sherlock.hsia
2022/8/1	R2	23	No	Reserved EEPROM.	Add EPU1...etc (I2C2).	sherlock.hsia
2022/8/1	R2	23	No	Add ISO/MOS for UART-Link to board board.	Add PLQ2...etc, 隔離Power Board端PU.	sherlock.hsia
2022/8/1	R2	25	No	Add LDO(LPF) for Amplifier +12V Power.	Add AUVR1...etc for PSRR, 改善 Audio Power.	sherlock.hsia
2022/8/1	R2	footprint	No	small-pitch SMT 製程考量, 簡化文字框/油墨量, 降低高度/厚度, 避免上錫不均, 影響錫量控制.	簡化 U1, U2, U6 文字框/油墨量.	sherlock.hsia
2022/8/1	R2	32	SW	Add A+G function.	Add AGU1...etc, LSM6DSOX via I2C2(reserved I2C3).	sherlock.hsia

		
Title : Revision History		
Size : B	Document Number : M8MT51	Rev : 2
Date : Monday, August 15, 2022		Page : 29 / 32

## Design Target:

ID	Category	Spec
1	Operating temperature	-5~65°C
3	Operating temp (Wide)	-30~80°C
2	MTBF	90000Hr
3	Service life	10Yr

## Reference Design:

ID	Reference Design	Reference Part
1	M8M051_RA_20210128	Main Board
2	NXP's EVB - SPF-38820_A1	Main Chip



Title : Design Info.

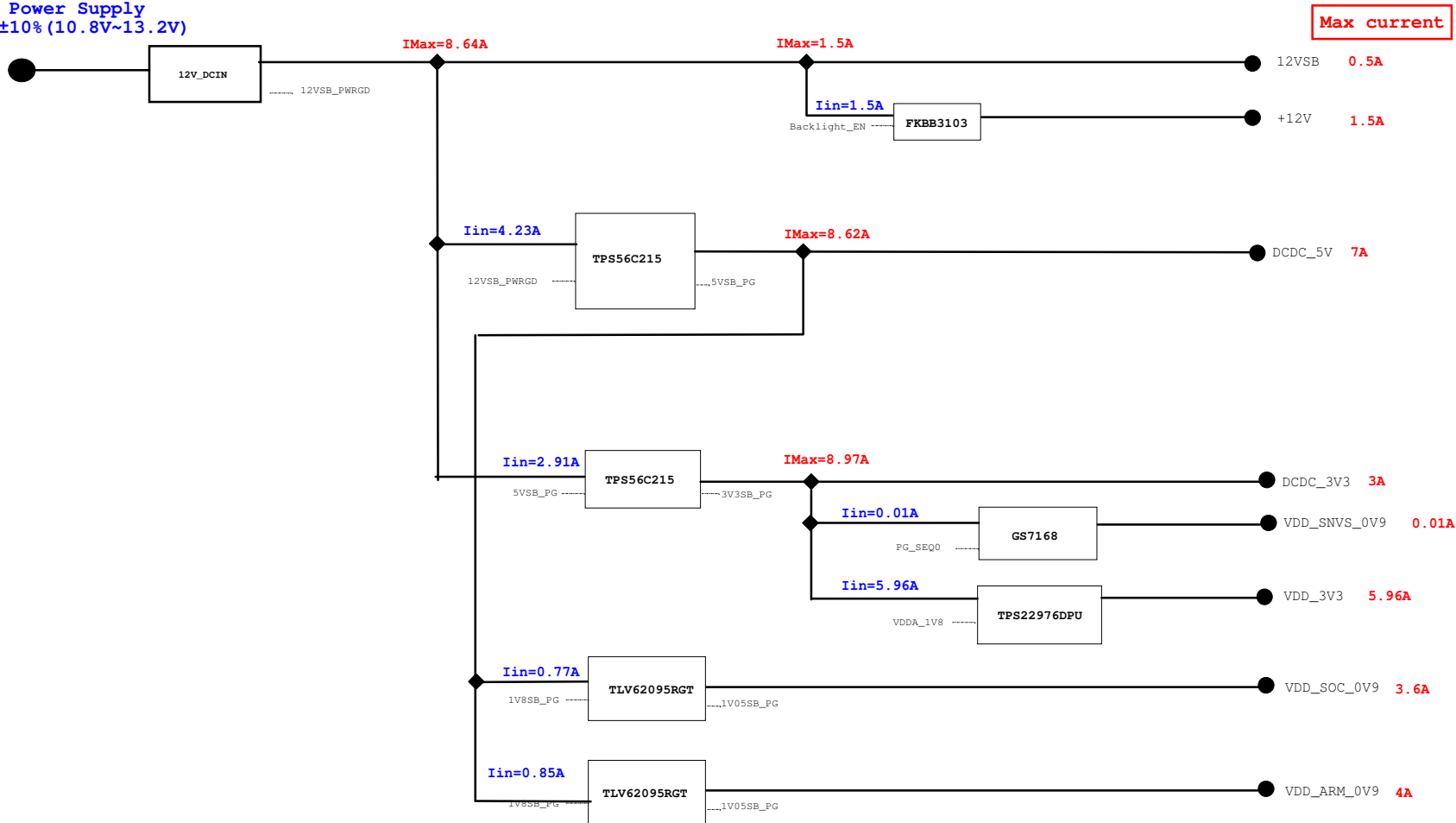
Size : Document Number : M8MT51 Rev : 2

Date : Monday, August 15, 2022 E24\*10R06/02-4791-00 Page 30 / 32

# Power Budget/Distribution

**Note : Max. current means possible peak instantaneous current but not max. continuous current.**

ATX Power Supply  
12V±10% (10.8V~13.2V)



<b>DFI</b>	
Title : POWER DISTRIBUTION	
Size : Document Number :	Rev : 2
Custom : M8MT51	
Date : Monday, August 15, 2022	
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# LSM6DSOX - 3D accelerometer and 3D gyroscope

IF\_TMXD2305001898DV

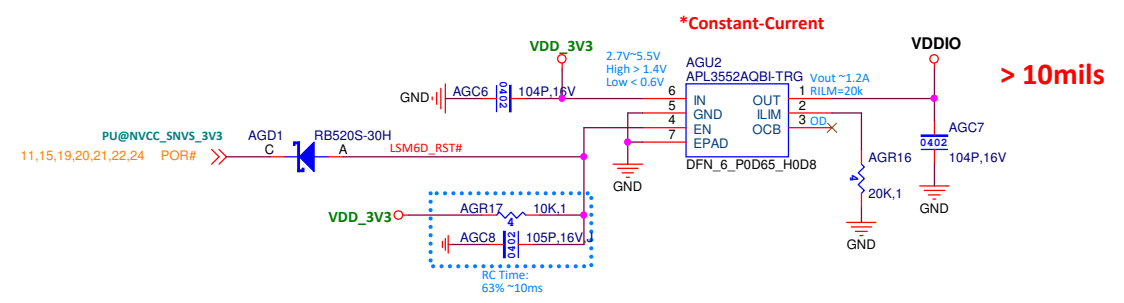
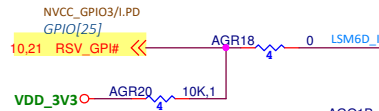
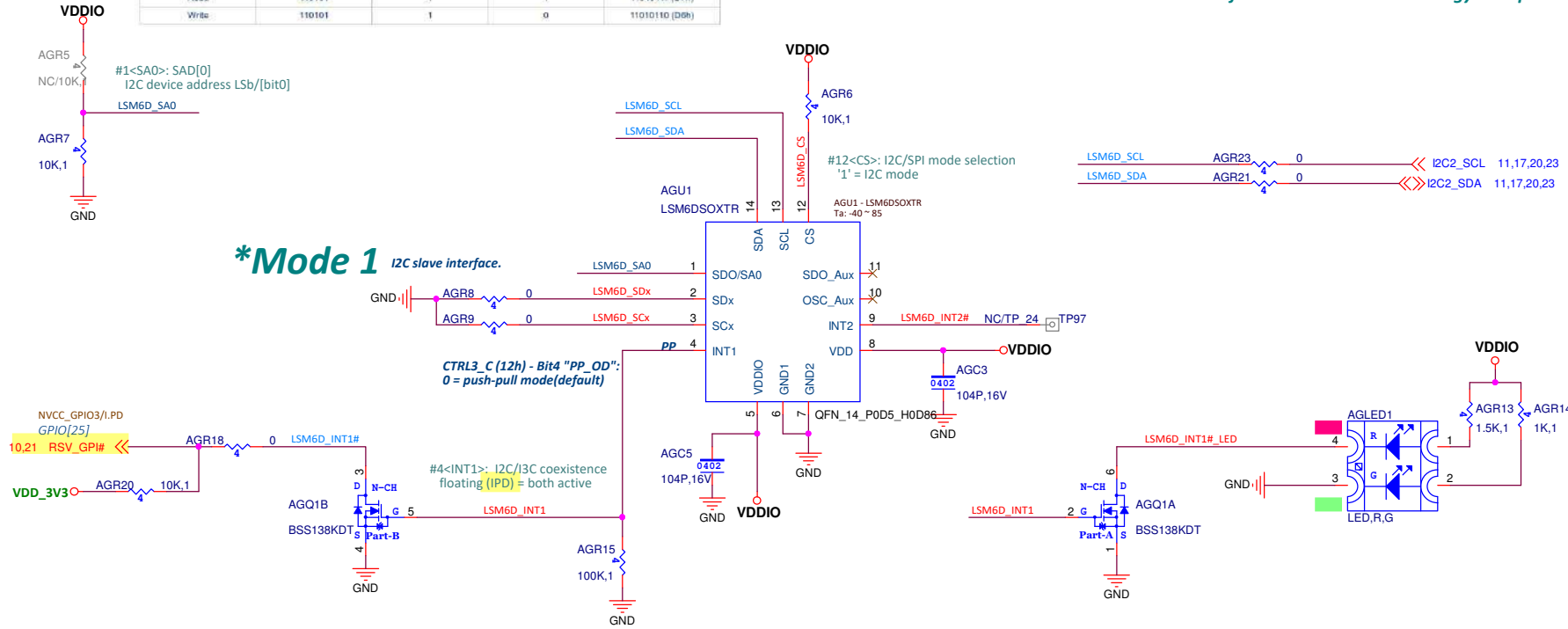
R2 updated add A+G

I2C Addr(0x6A): D5h/D4h, clock Max: 400KHz

Table 10. SAD+Read/Write patterns

Command	SAD[E:1]	SAD[0] = SAD	R/W	SAD+R/W
Read	110101	0	1	11010101 (D5h)
Write	110101	0	0	11010100 (D4h)
Read	110101	1	1	11010111 (D7h)
Write	110101	1	0	11010110 (D6h)

- Mode 1: I2C / MIPI I3CSM slave interface or SPI (3- and 4-wire) serial interface is available;
- Mode 2: I2C / MIPI I3CSM slave interface or SPI (3- and 4-wire) serial interface and I2C interface master for external sensor connections are available;
- Mode 3: I2C / MIPI I3CSM slave interface or SPI (3- and 4-wire) serial interface is available for the application processor interface while an auxiliary SPI (3- and 4-wire) serial interface for external sensor connections is available for the gyroscope ONLY;
- Mode 4: I2C / MIPI I3CSM slave interface or SPI (3- and 4-wire) serial interface is available for the application processor interface while an auxiliary SPI (3- and 4-wire) serial interface for external sensor connections is available for the accelerometer and gyroscope.



**Title :** A+G(LSM6DSOX)

**Size :** Document Number : M8MT51

**Rev :** 2

**Date :** Monday, August 15, 2022

**Page :** 32 / 32

# X103-EC70

## Power Modular

Revision 2

Project Code : S184710

IF\_TMXD2305001898DV

### Page Description

01\_COVER PAGE  
02\_BLOCK DIAGRAM  
03\_9~48V INPUT\_LT4363  
04\_12VSB\_LM5176  
05\_MCU\_STM32L051K8  
06\_HISTORY

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**DFI**<sup>®</sup>

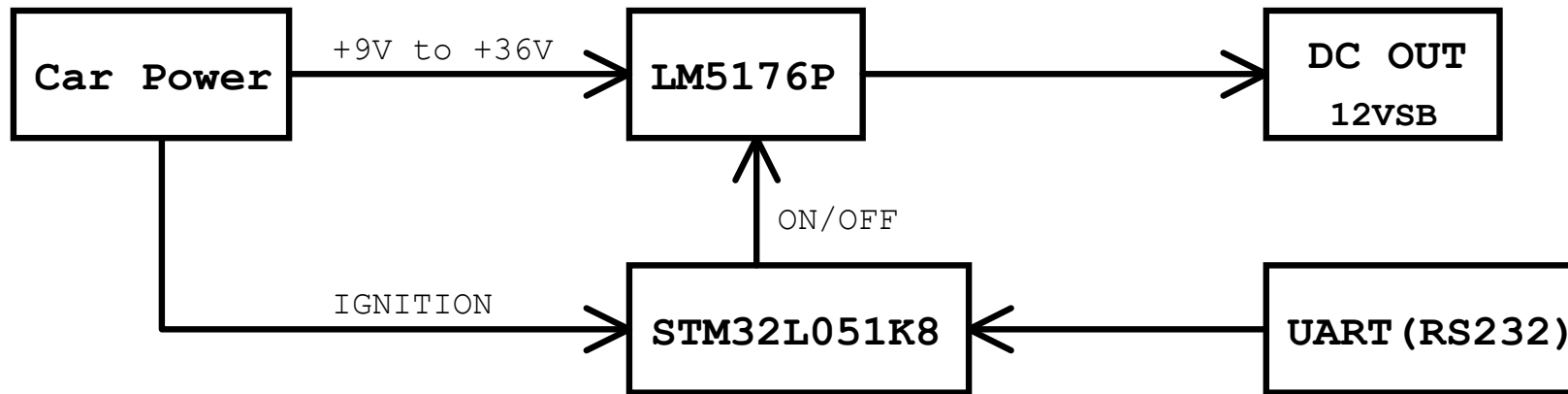
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Size : B Document Number : **X103-EC70** Rev : A

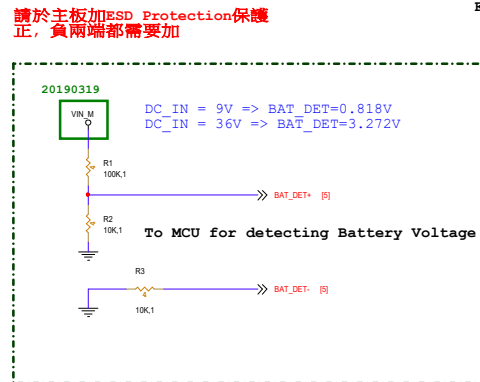
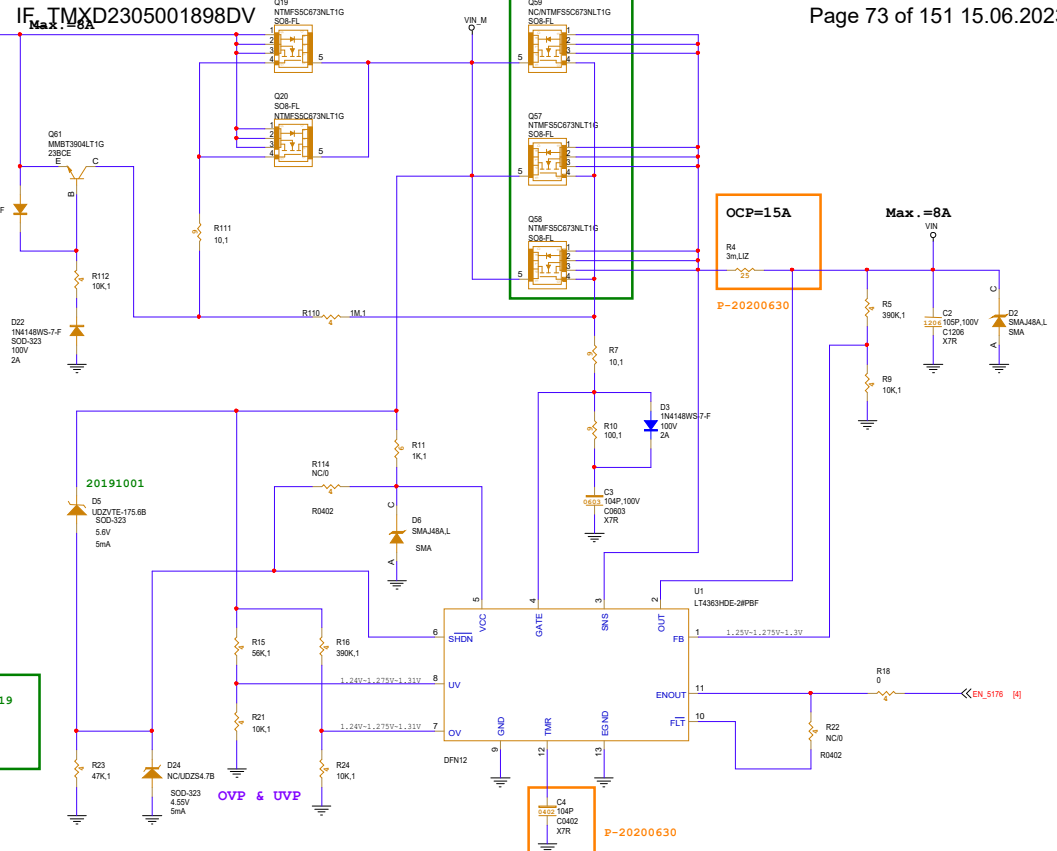
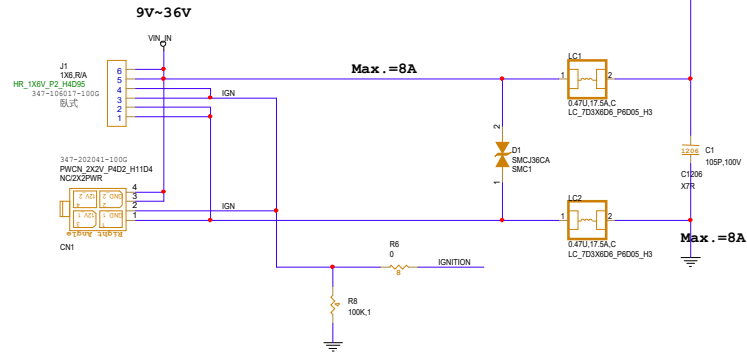
Date : Tuesday, June 30, 2020 Page : 1 / 6

**E24\*10R06/02\*4791\*00**

# BLOCK DIAGRAM FOR X103-EC70

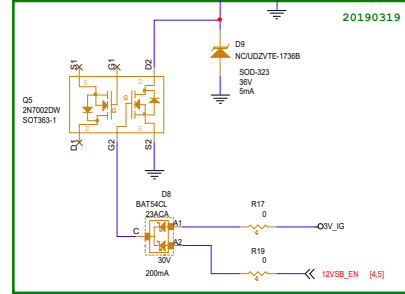
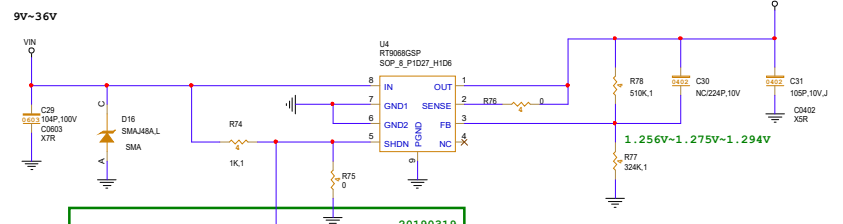
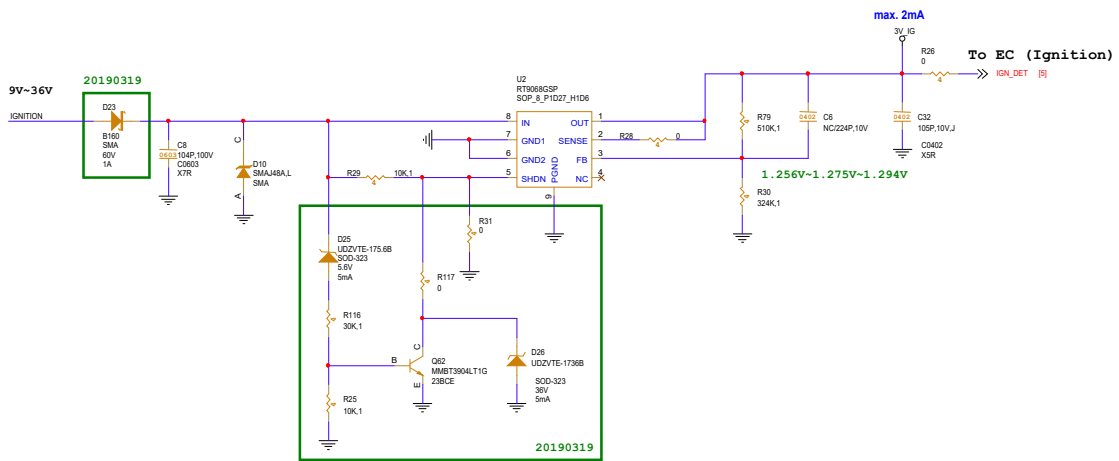


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Size : A	Document Number : <b>X103-EC70</b>	Rev : A
Date : Tuesday, June 30, 2020	E24*10R06/02-4791*00	Page 2 of 6



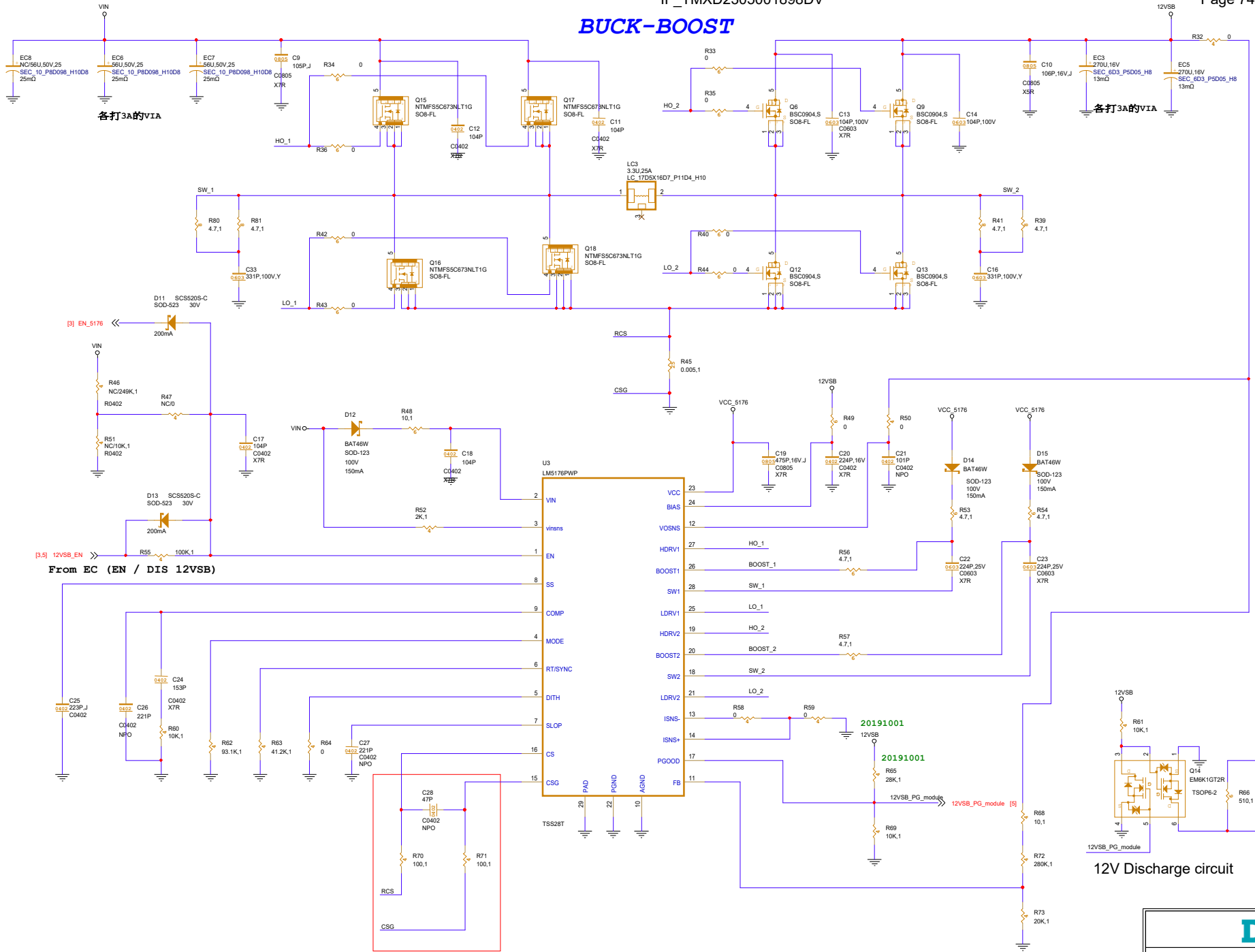
20190319  
Remove

OVP & UVP



<b>DFI</b>		
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Size :	Document Number :	X103-EC70
A2	Rev :	A

# BUCK-BOOST



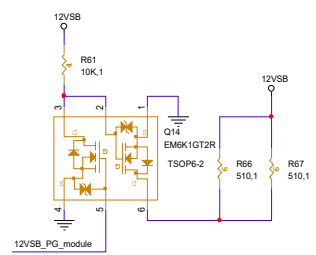
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[3] EN\_5176

From EC (EN / DIS 12VSB)

Closely to IC

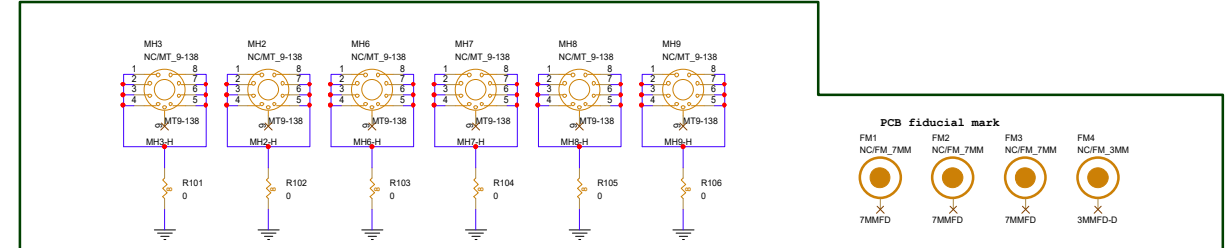
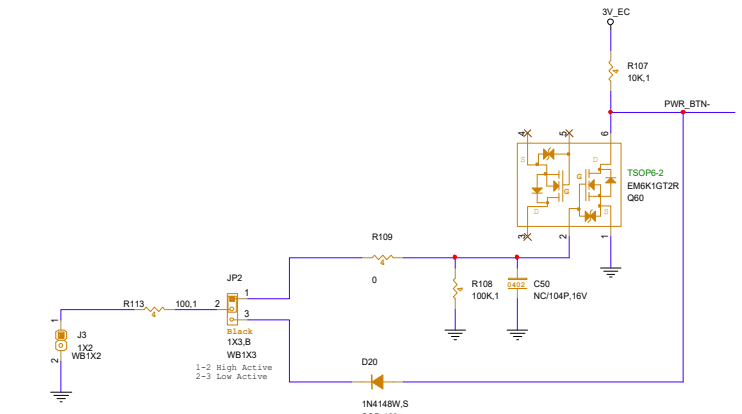
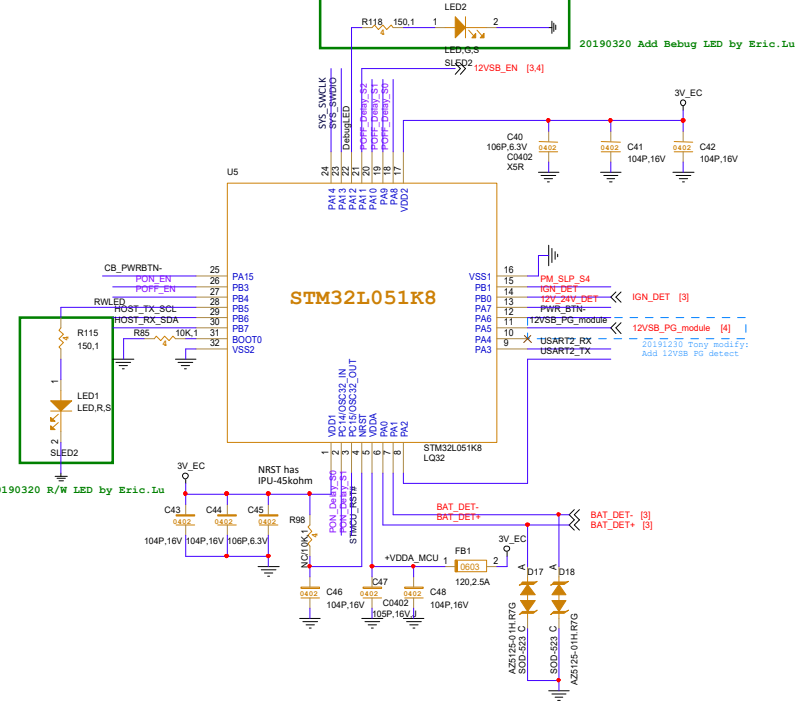


12V Discharge circuit

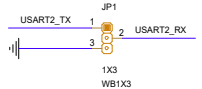
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 Size : Document Number : X103-EC70  
**E24\*10R06102\*4791\*00**  
 Date : Tuesday, June 30, 2020 Rev : 6

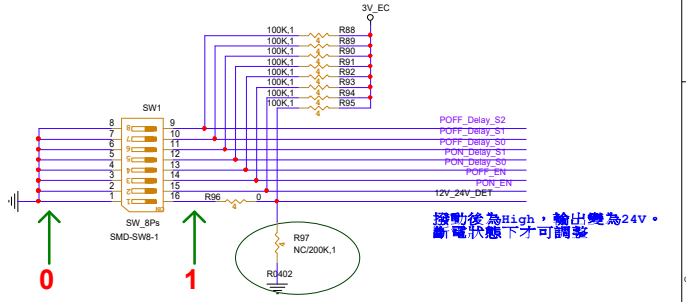
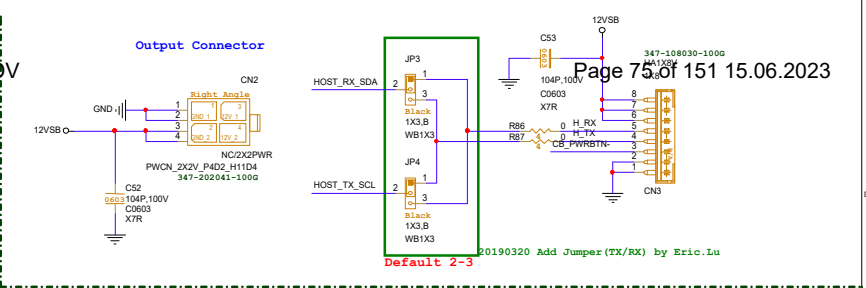
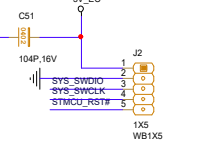
IF\_TMxD2305001898DV



MCU Debug



ST-Link / SWD



24V / 12V Select

24V_SEL Pin 1	Output Voltage
0 (ON)	12V
1	24V

POWER OFF Delay ON/OFF

POFF_EN Pin 3	ON/OFF
0 (ON)	Enable (Define on the Table)
1	Disable (Default delay 0 Sec)

POWER ON Delay ON/OFF

PON_EN Pin 2	ON/OFF
0 (ON)	Enable (Define on the Table)
1	Disable (Default delay 3 Sec)

POWER OFF Delay Time Select

POFF_Delay_S2 Pin 8	POFF_Delay_S1 Pin 7	POFF_Delay_S0 Pin 6	DELAY_TIME
0 (ON)	0 (ON)	0 (ON)	30 Sec @
0	0	1	1 min
0	1	0	3 min
0	1	1	5 min
1	0	0	10 Min
1	0	1	15 Min
1	1	0	30 Min
1	1	1	1 Hr

POWER ON Delay Time Select

PON_Delay_S1 Pin 5	PON_Delay_S0 Pin 4	DELAY_TIME
0 (ON)	0 (ON)	10 Sec @
0	1	30 Sec
1	0	1 min
1	1	5 min

DFI

Title : 05\_MCU\_STM32L051K8

Size : Document Number : E24\*10R06\*02\*4791\*00

Date : Tuesday, June 30, 2020

Rev : A

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2018/11/30 Revision 1 - EVT

2019/3/21 Revision 2 - EVT1

2019/10/03 Revision 3 - DVT

MODIFY HISTORY

Page	Modify Item	Issue	Rev.
1	3	<b>**Modify - 20190319</b> Circuit modify in the green box CN1 NC	Power-TOM BOM select
2	5	<b>**Modify - 20190321</b> Add R/W LED & Debug LED - LED1/LED2/R115/R118 Add Jumper(TX/RX) - JP3/JP4 R97 NC CN2 NC	For Debug by FOX  12V/24V select BOM select
1	3	<b>**Modify - 20191003</b> Change D5 8.2B to 5.6B -By Power Tom	9V can't not work
1	4	<b>**Modify - 20191003</b> Change R65 12K to 28K and PU power VCC_5176 to 12VSB - By power Tom	follow power module SCH

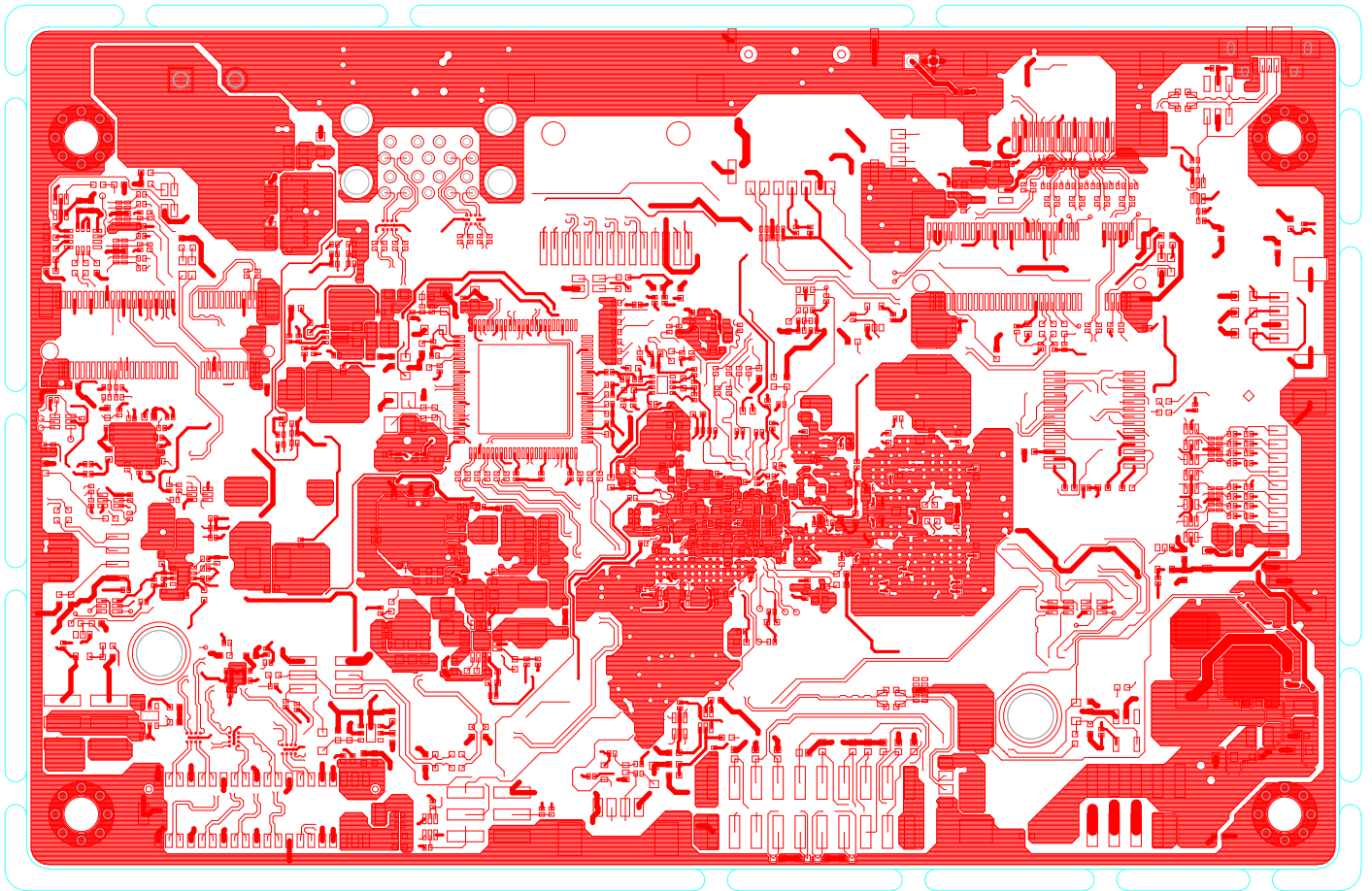
**DFI**

Title : 06\_HISTORY

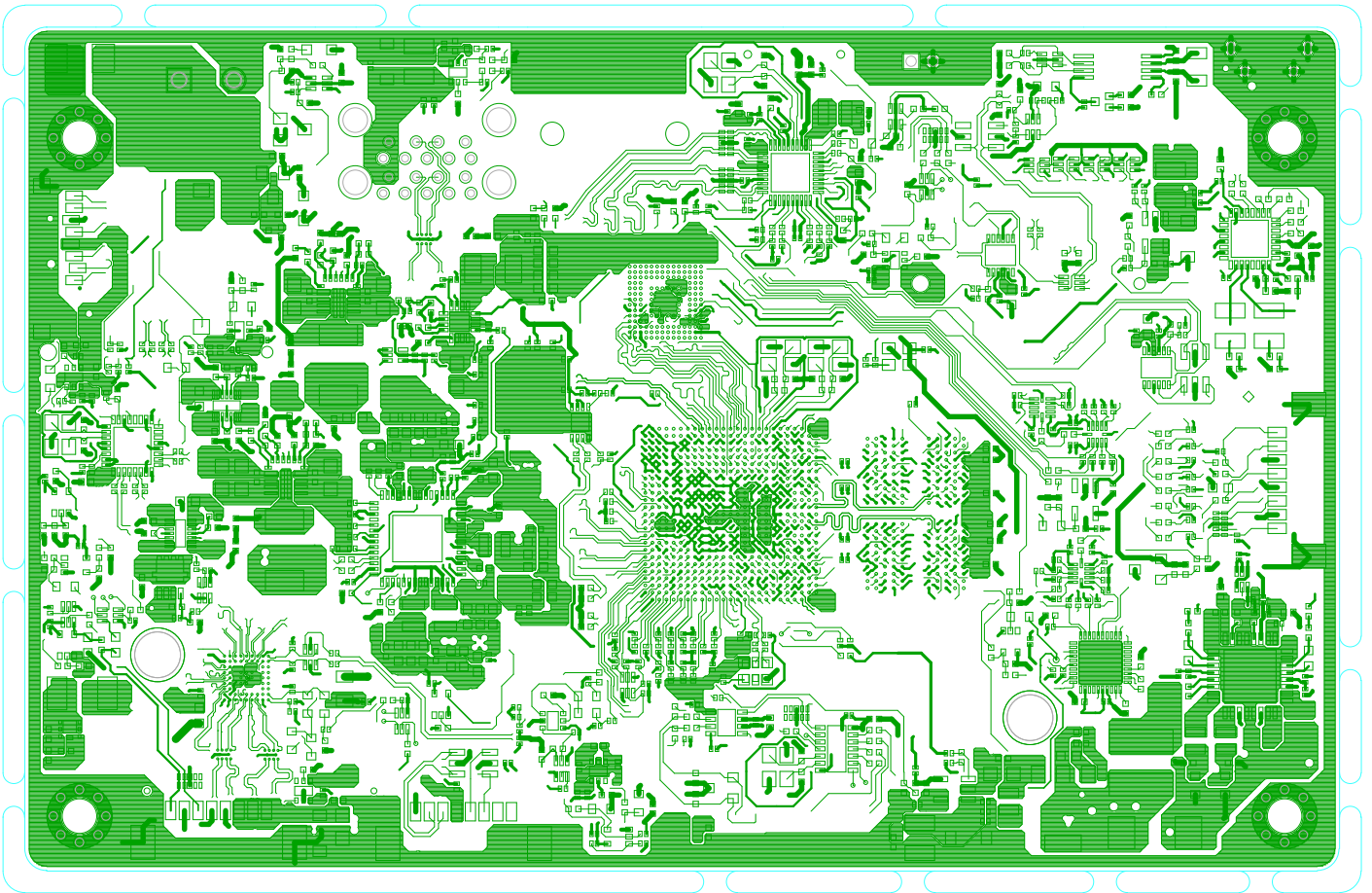
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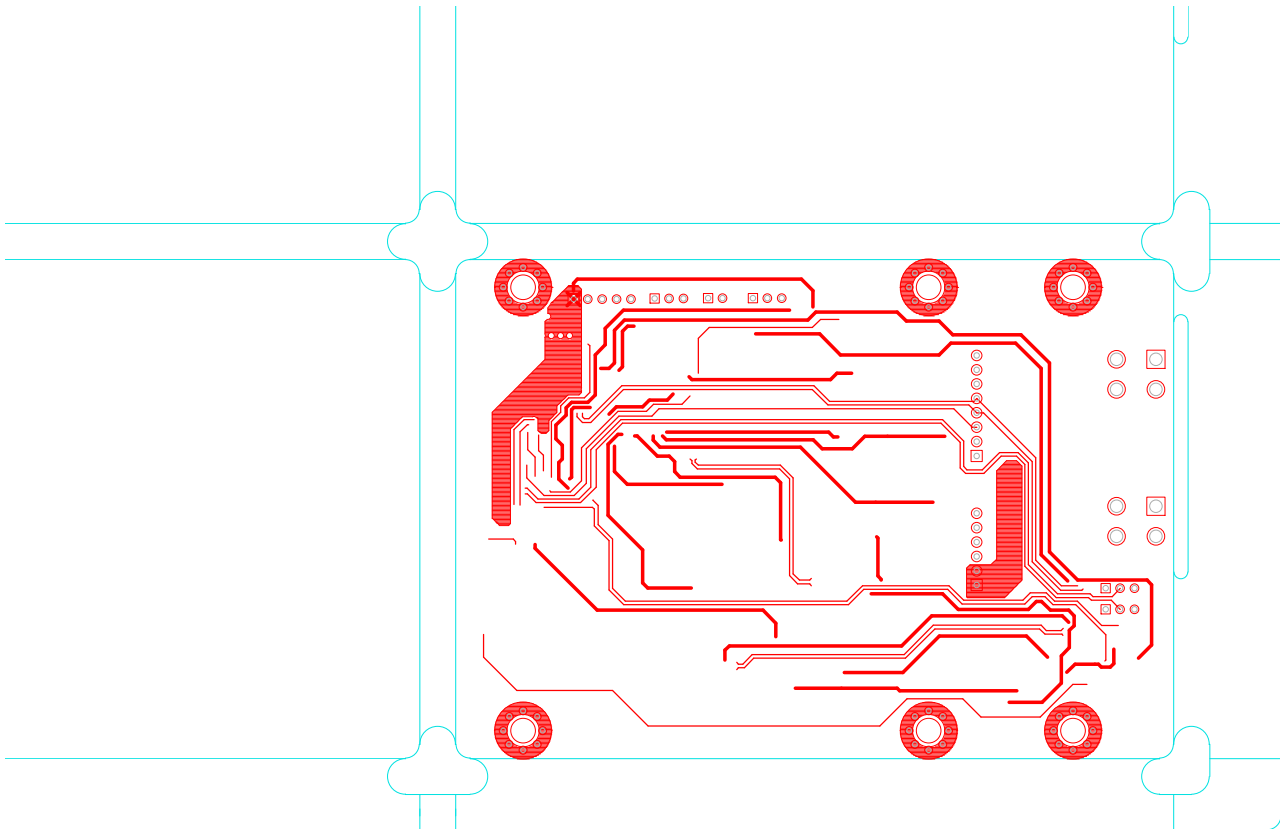
**E24\*10R06/02\*4791\*00**

Date : Tuesday, June 30, 2020 Page : 6 / 6

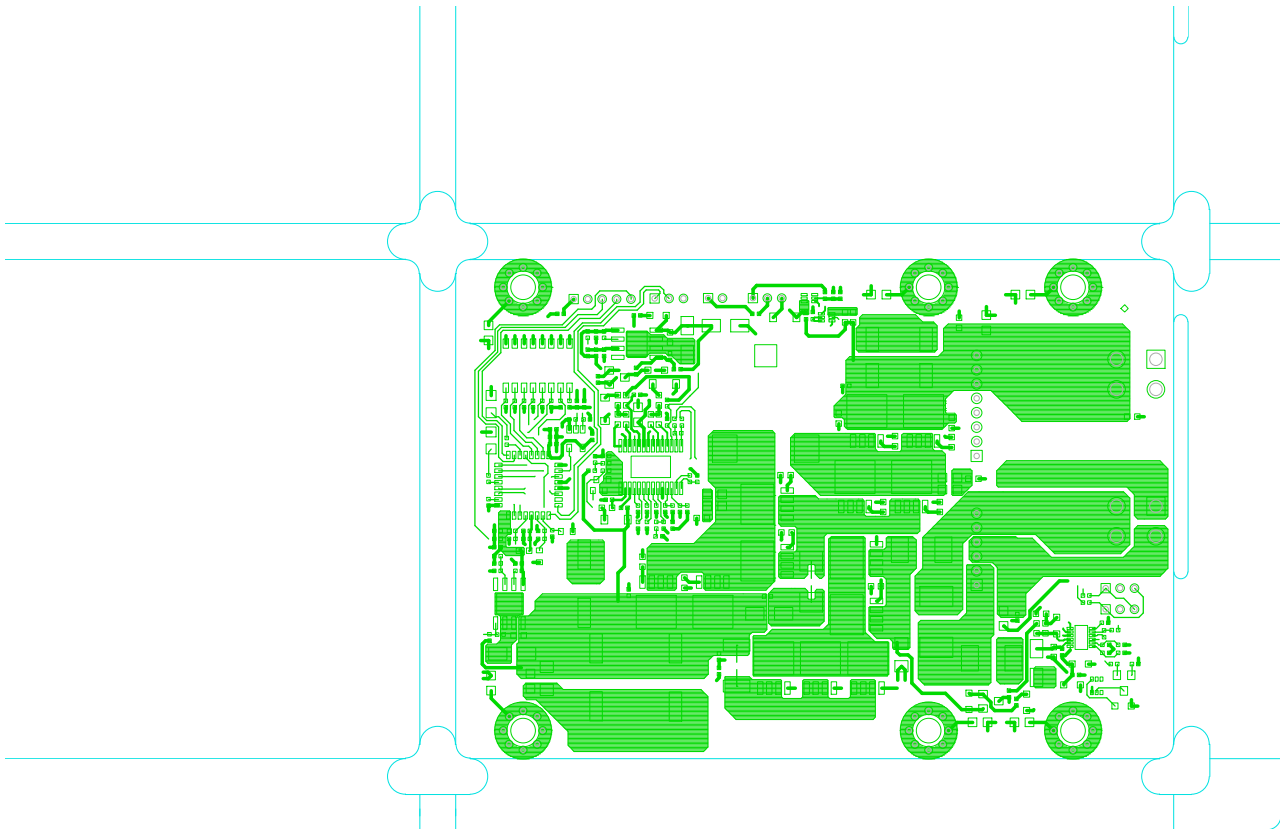




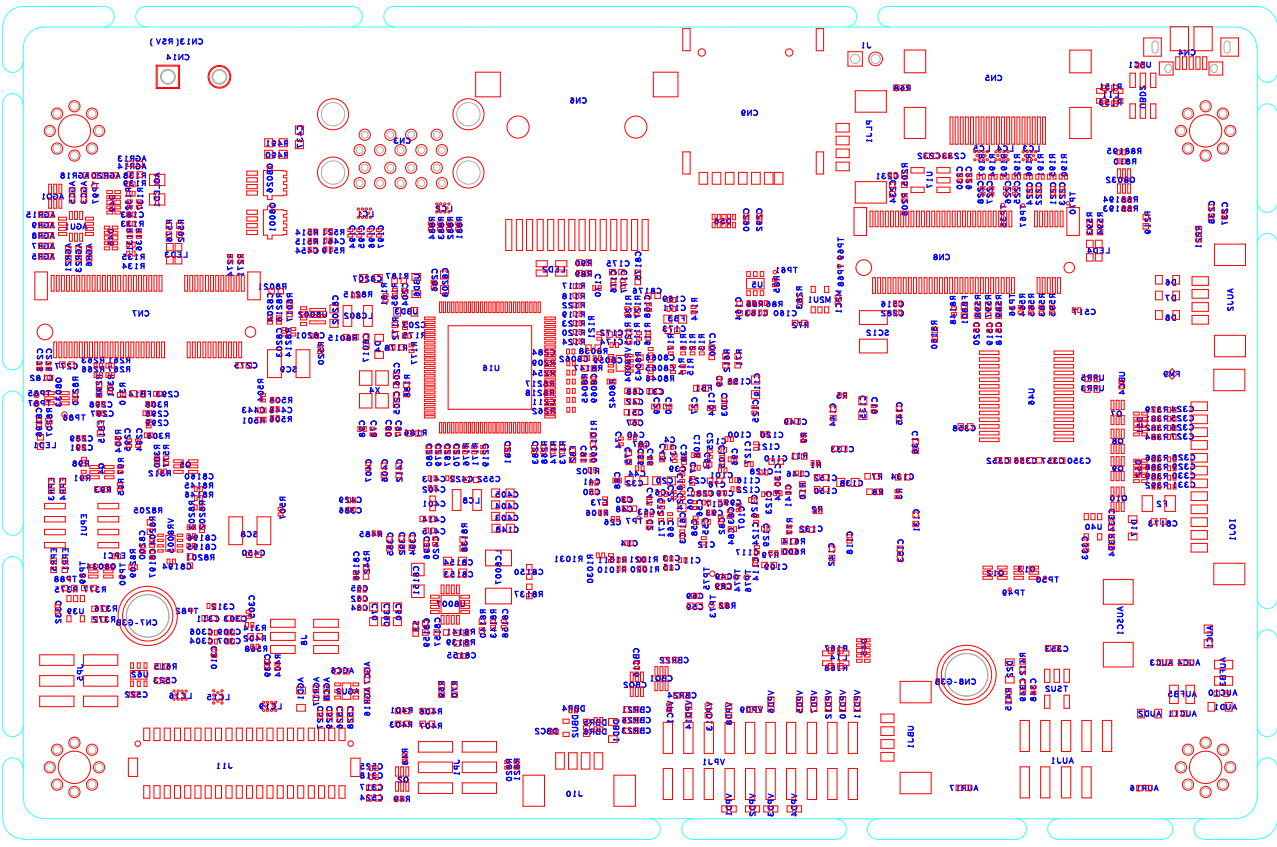




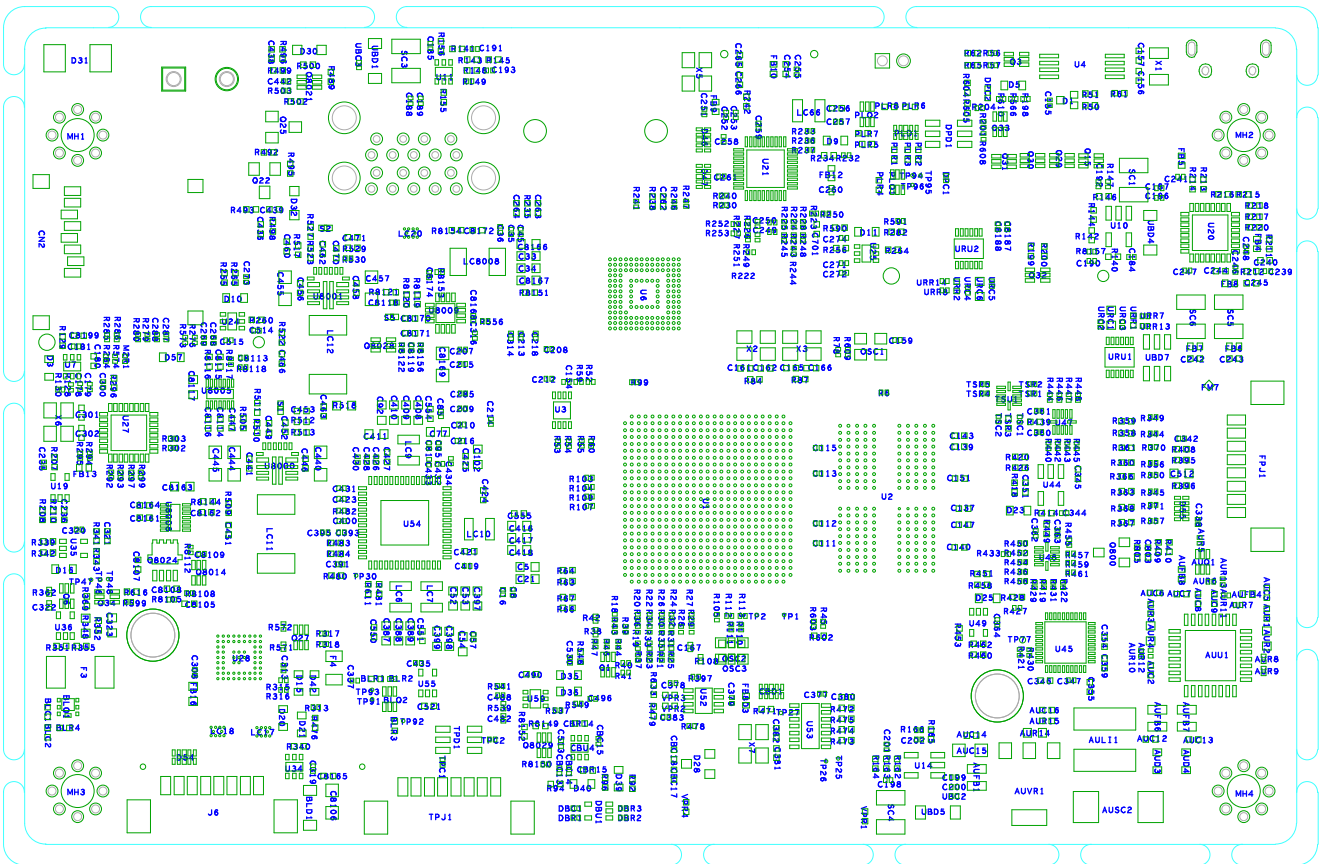
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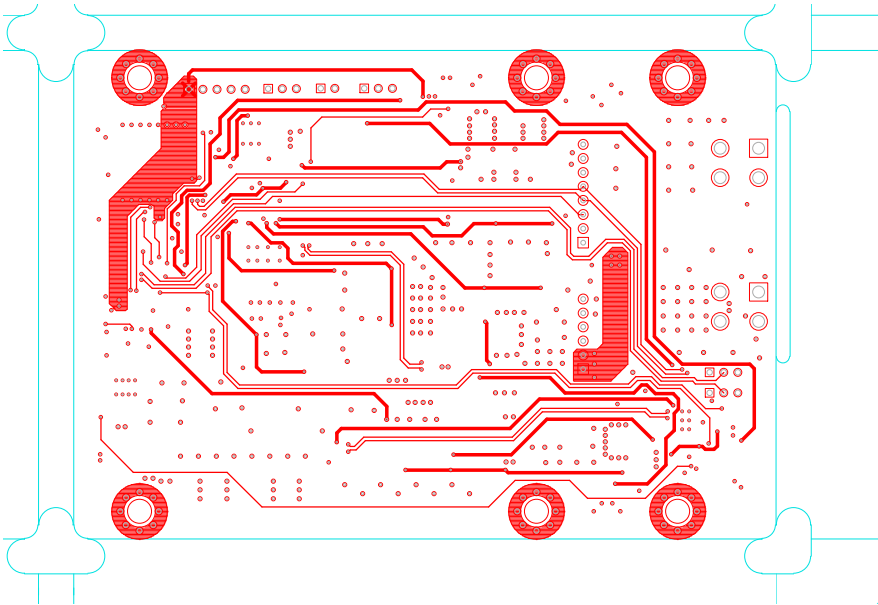


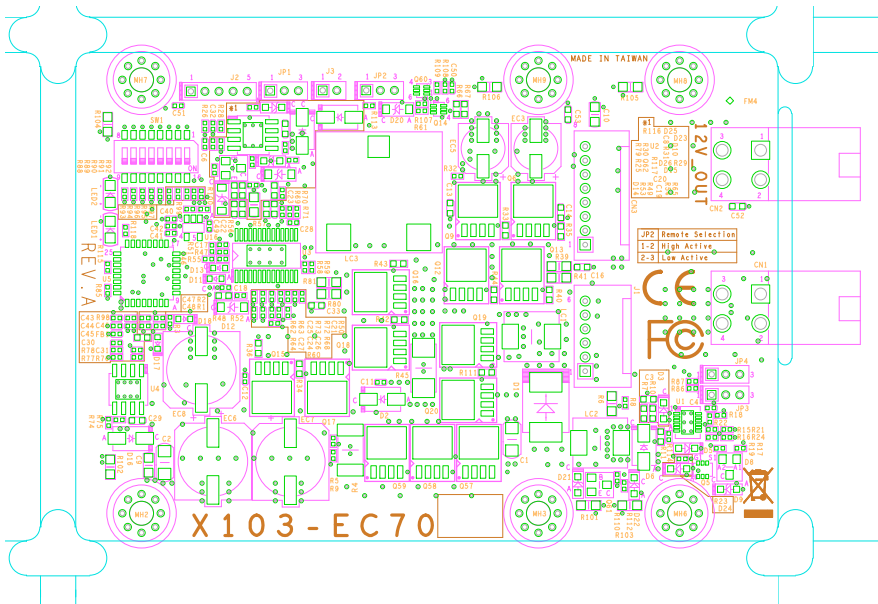
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LMC



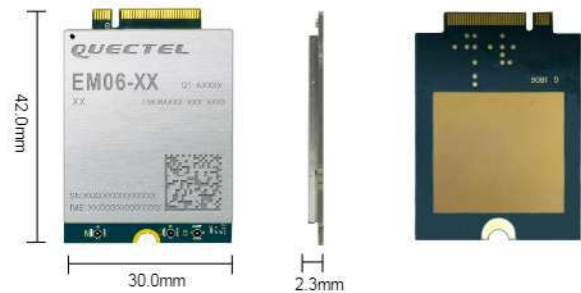






# Quectel EM06

## IoT/M2M-optimized LTE-A Cat 6 M.2 Module



Quectel EM06 is a series of LTE Advanced category 6 module optimized specially for M2M and IoT applications. Adopting the 3GPP Rel. 11 LTE technology, it delivers maximum data rates up to 300Mbps downlink and 50Mbps uplink.

Designed in the M.2 form factor, EM06 contains 3 variants (EM06-E, EM06-J and EM06-A) for different target regions and these variants nearly cover all the main stream carriers worldwide.

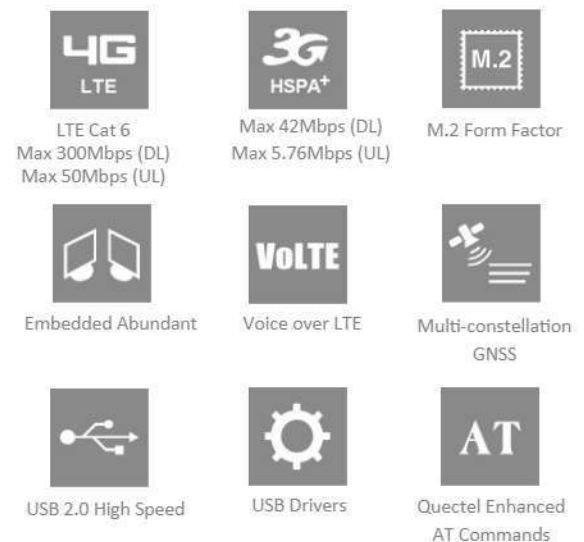
EM06 supports Qualcomm® IZat™ location technology Gen8C Lite (GPS, GLONASS, BeiDou/Compass, Galileo and QZSS). The integrated GNSS greatly simplifies product design, and provides quicker, more accurate and more dependable positioning capability.

A rich set of Internet protocols, industry-standard interfaces and abundant functionalities (USB drivers for Windows 7/8/8.1/10, Linux, Android) extend the applicability of the module to a wide range of M2M and IoT applications such as industrial router, home gateway, set top box, industrial laptop, consumer laptop, industrial PDA, rugged tablet PC, video surveillance and digital signage, etc.



### Key Benefits

- ✓ LTE-A Cat 6 module with M.2 form factor, optimized for M2M and IoT applications
- ✓ Support LTE-A carrier aggregation
- ✓ Worldwide LTE-A and UMTS/HSPA(+) coverage
- ✓ Multi-constellation GNSS receiver available for applications requiring fast and accurate fixes in any environment
- ✓ Feature refinements: supports DFOTA and DTMF
- ✓ MIMO technology meets demands for data rate and link reliability in modem wireless communication systems



Rev.: V1.6 | Status: Released



LTE Cat 6	EM06-E	EM06-J	EM06-A
Region/Operator	EMEA/APAC <sup>①</sup> /Brazil	Japan	North America/ Mexico
Dimensions (mm)	42.0 × 30.0 × 2.3	42.0 × 30.0 × 2.3	42.0 × 30.0 × 2.3
<b>Temperature Range</b>			
Operation Temperature	-30°C ~ +70°C	-30°C ~ +70°C	-30°C ~ +70°C
Extended Temperature	-40°C ~ +85°C	-40°C ~ +85°C	-40°C ~ +85°C
<b>Frequency Bands</b>			
LTE-FDD	B1/B3/B5/B7/B8/B20/B28/B32 <sup>②</sup>	B1/B3/B8/B18/B19/B26/B28	B2/B4/B5/B7/B12/B13/B25/B26/B29 <sup>③</sup> /B30/B66
LTE-TDD	B38/B40/B41	B41	B41
2xCA	B1+B1/B5/B8/B20/B28; B3+B3/B5/B7/B8/B20/B28; B7+B5/B7/B8/B20/B28; B20+B32 <sup>②</sup> ; B38+B38; B40+B40; B41+B41	B1+B1/B8/B18/B19/B26/B28; B3+B3/B8/B18/B19/B26/B28; B41+B41	B2+B2/B5/B12/B13/B29 <sup>③</sup> ; B4+B4/B5/B12/B13/B29 <sup>③</sup> ; B7+B5/B7/B12/B26; B25+B5/B12/B25/B26; B30+B5/B12/B29 <sup>③</sup> ; B66+B5/B12/B13/B29 <sup>③</sup> /B66; B41+B41
WCDMA	B1/B3/B5/B8	B1/B3/B6/B8/B19	B2/B4/B5
GNSS	GPS/GLONASS/BeiDou (Compass)/Galileo/QZSS (Optional)	GPS/GLONASS/BeiDou (Compass)/Galileo/QZSS (Optional)	GPS/GLONASS/BeiDou (Compass)/Galileo/QZSS (Optional)
<b>Certifications</b>			
Carrier	Europe: Deutsche Telekom* Australia: Telstra	Japan: KDDI	North America: Verizon/AT&T/Sprint
Regulatory	Global: GCF Europe: CE Taiwan (China): NCC Australia & New Zealand: RCM North Africa: ICASA	Japan: JATE/TELEC	Global: GCF North America: FCC/PTCRB Canada: IC
Others	RoHS/WHQL	RoHS/WHQL	RoHS/WHQL
<b>Data Transmission</b>			
LTE-FDD Data Rate (Mbps)	300 (DL)/50 (UL)	300 (DL)/50 (UL)	300 (DL)/50 (UL)
LTE-TDD Data Rate (Mbps)	226 (DL)/28 (UL)	226 (DL)/28 (UL)	226 (DL)/28 (UL)
DC-HSPA+ Data Rate (Mbps)	42 (DL)/5.76 (UL)	42 (DL)/5.76 (UL)	42 (DL)/5.76 (UL)
WCDMA Data Rate (Kbps)	384 (DL)/384 (UL)	384 (DL)/384 (UL)	384 (DL)/384 (UL)
<b>Interfaces</b>			
(U)SIM	x2	x2	x2
I2C	x1	x1	x1
PCM (Digital Audio)	x1	x1	x1
Antenna Tuner Control* (ANTCTL)	x4	x4	x4
USB 2.0	x1	x1	x1
W_DISABLE1#	x1	x1	x1
RESET#	x1	x1	x1
WAKE_ON_WAN#	x1	x1	x1
WWAN_LED#	x1	x1	x1
Antennas	x3 (Main, Diversity and GNSS Antennas)	x3 (Main, Diversity and GNSS Antennas)	x3 (Main, Diversity and GNSS Antennas)
<b>Voice</b>			
Speech Codec Modes	AMR/AMR-WB	AMR/AMR-WB	AMR/AMR-WB
Echo Arithmetic	Echo Cancellation/Noise Suppression	Echo Cancellation/Noise Suppression	Echo Cancellation/Noise Suppression
VoLTE	CSFB and VoLTE (Voice over LTE) (Optional)	CSFB and VoLTE (Voice over LTE) (Optional)	CSFB and VoLTE (Voice over LTE) (Optional)
<b>Enhanced Features</b>			
MIMO (2x2, 4x2, DL)	●	●	●
Digital Audio and VoLTE (Voice over LTE)	Optional	Optional	Optional
(U)SIM Card Detection	●	●	●
DTMF	●	●	●
Dual SIM Single Standby*	●	●	●
DFOTA	●	●	●
GNSS	●	●	●
<b>Drivers</b>			
USB Driver	Windows 7/8/8.1/10, Linux 2.6~5.4, Android 4.x/5.x/6.x/7.x/9.x	Windows 7/8/8.1/10, Linux 2.6~5.4, Android 4.x/5.x/6.x/7.x/9.x	Windows 7/8/8.1/10, Linux 2.6~5.4, Android 4.x/5.x/6.x/7.x/9.x
GNSS Driver	Android 4.x/5.x/6.x/7.x/8.x/9.x	Android 4.x/5.x/6.x/7.x/8.x/9.x	Android 4.x/5.x/6.x/7.x/8.x/9.x
RIL Driver	Android 4.x/5.x/6.x/7.x/8.x/9.x	Android 4.x/5.x/6.x/7.x/8.x/9.x	Android 4.x/5.x/6.x/7.x/8.x/9.x
NDIS Driver	Windows 7/8/8.1/10	Windows 7/8/8.1/10	Windows 7/8/8.1/10
MBIM Driver	Windows 8/8.1/10, Linux 3.18~5.4	Windows 8/8.1/10, Linux 3.18~5.4	Windows 8/8.1/10, Linux 3.18~5.4
GobiNet Driver	Linux 2.6~5.4	Linux 2.6~5.4	Linux 2.6~5.4
QMI_WWAN Driver	Linux 3.4~5.4	Linux 3.4~5.4	Linux 3.4~5.4
<b>Electrical Features</b>			
Supply Voltage Range	3.135V~4.4V, 3.7V Typ.	3.135V~4.4V, 3.7V Typ.	3.135V~4.4V, 3.7V Typ.
Power Consumption	50µA @Power off 4.1mA @Sleep Typ. 22.1mA @Idle	47µA @Power off 3.8mA @Sleep Typ. 19.5mA @Idle	50µA @Power off 3.8mA @Sleep Typ. 21.3mA @Idle

**Notes:**

1. \* means Under Development.

2. ● means supported.

① Excluding Japan and CMCC.

② LTE-FDD B29 and B32 support receiving only, and are only for secondary component carrier in 2xCA.

**RTL8822CE User's Manual**

**(Realtek RTL8822CE)**  
**Combo NGFF Type2230 Module User's Manual**

Preliminary Version

2018/10/09



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**RTL8822CE User's Manual**

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**ENVIRONMENTAL****Operating**

Operating Temperature: 0°C to +70 °C

Relative Humidity: 5-90% (non-condensing)

**Storage**

Temperature: -40°C to +80°C (non-operating)

Relevant Humidity: 5-95% (non-condensing)

**MTBF caculation**

Over 150,000hours

## RTL8822CE User's Manual

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### Warning

#### Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**FCC Caution:** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

#### **IMPORTANT NOTE:**

#### **FCC Radiation Exposure Statement:(For portable device with PIFA antenna)**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 0.5cm between the radiator & your body.

**RTL8822CE User's Manual**

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		Host
					2.4GHz	5GHz	
1	PSA	RFDPA171320EMLB301	Dipole Antenna	I-PEX	3.14	5	Mobile
2	LYNwave	ALA110-222050-300011	PIFA Antenna	I-PEX	3.5	5	Portable
							Mobile

**Table for Filed Antenna**

Per using this module for portable device please follow company tune up and operation description information to use this for portable device power.

For FCC SAR power table please find in page 24.

**USERS MANUAL OF THE END PRODUCT:**

In the users manual of the end product, the end user has to be informed to keep at least 0.5cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

**For Mobile device Host ( >20cm )****Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than 20cm between the radiator & your body.

**USERS MANUAL OF THE END PRODUCT:**

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference

**RTL8822CE User's Manual**

received, including interference that may cause undesired operation.

**LABEL OF THE END PRODUCT:**

The final end product must be labeled in a visible area with the following " Contains TX2-RTL8822CE ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

**Manual Information To the End User**

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated.

Additional testing and certification may be necessary when multiple modules are used.

**RTL8822CE User's Manual****Industry Canada Statement**

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		Host
					2.4GHz	5GHz	
1	PSA	RFDPA171320EMLB301	Dipole Antenna	I-PEX	3.14	5	Mobile
2	LYNwave	ALA110-222050-300011	PIFA Antenna	I-PEX	3.5	5	Portable
							Mobile

## Table for Filed Antenna

Per using this module for portable device please follow company tune up and operation description information to use this for portable device power.

For IC SAR power table please find in page 30.

This device complies with Industry Canada's licence-exempt RSSs.

Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

*Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with IC multi-transmitter product procedures.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without reassessment permissive change.

*Cet appareil et son antenne (s) ne doit pas être co-localisés ou fonctionner en association avec une autre antenne ou transmetteur.*

This radio transmitter (RTL8822CE) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (RTL8822CE) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.



## RTL8822CE User's Manual

Dynamic Frequency Selection (DFS) for devices operating in the bands 5250-5350 MHz, 5470-5600 MHz and 5650-5725 MHz.

*Sélection dynamique de fréquences (DFS) pour les dispositifs fonctionnant dans les bandes 5250-5350 MHz, 5470-5600 MHz et 5650-5725 MHz.*

The device for operation in the band 5150–5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

*les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux.*

The maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit.

*le gain maximal d'antenne permis pour les dispositifs utilisant les bandes 5250-5350 MHz et 5470-5725 MHz doit se conformer à la limite de p.i.r.e.*

The maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate.

*le gain maximal d'antenne permis (pour les dispositifs utilisant la bande 5725-5850 MHz) doit se conformer à la limite de p.i.r.e. spécifiée pour l'exploitation point à point et non point à point, selon le cas.*

For indoor use only.

*Pour une utilisation en intérieur uniquement.*

## RTL8822CE User's Manual

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### **IMPORTANT NOTE:**

#### **IC Radiation Exposure Statement: (for portable device with PIFA)**

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 0.5cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 0.5 cm de distance entre la source de rayonnement et votre corps.

### **IMPORTANT NOTE:**

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated.

Additional testing and certification may be necessary when multiple modules are used.

0.5cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the IC RSS-102 radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

### **USERS MANUAL OF THE END PRODUCT:**

In the users manual of the end product, the end user has to be informed to keep at least 0.5cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept

## RTL8822CE User's Manual

any interference received, including interference that may cause undesired operation.

### **LABEL OF THE END PRODUCT:**

The final end product must be labeled in a visible area with the following "Contains IC: 6317A-RTL8822CE".

The Host Model Number (HMN) must be indicated at any location on the exterior of the end product or product packaging or product literature which shall be available with the end product or online.

### **For Mobile device Host ( >20cm )**

#### **Radiation Exposure Statement:**

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than 20cm between the radiator & your body.

#### **Déclaration d'exposition aux radiations:**

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à plus de 20 cm entre le radiateur et votre corps.

## **NCC 警語**

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

1. 本模組於取得認證後將依規定於模組本體標示審驗合格標籤。
2. 系統廠商應於平台上標示「本產品內含射頻模組：

「XXXyyyLPDzzzz-x」字樣。

## RTL8822CE User's Manual

### Installing the Wireless PCIe NGFF2230 module

#### Hardware

Installing PCIe NGFF2230 module to PCIe NGFF2230 connector and connect two external Wi-Fi antennas on I-PEX connectors.



## RTL8822CE User's Manual

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### Un-installing the Wireless PCIe NGFF2230 module

#### Hardware

Remove 2 external Wi-Fi Antennas from the Wireless PCIe NGFF1630 module

board and remove the Wireless PCIe NGFF2230 module board from PCIe

NGFF2230 connector port



## RTL8822CE User's Manual

### Installing the Wireless PCIe NGFF2230 module

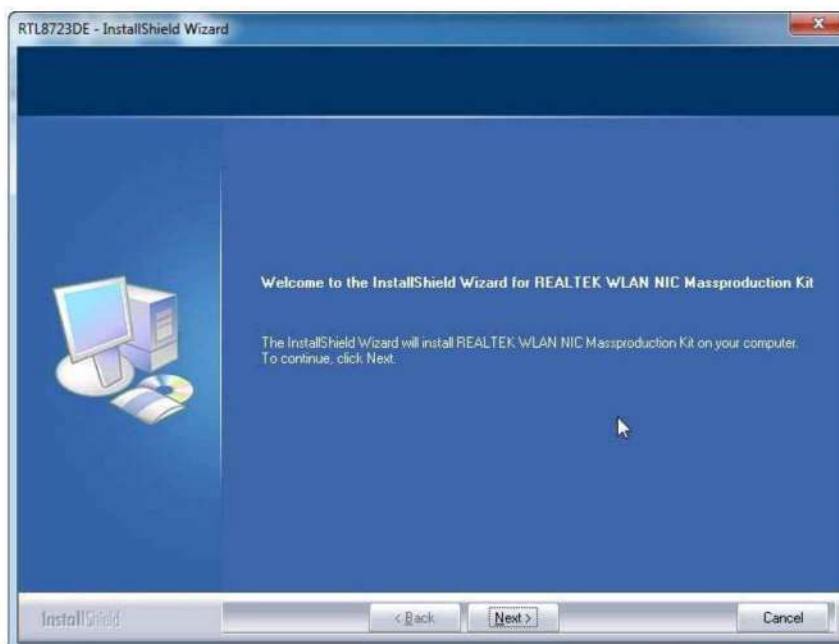
#### Software

Before you proceed with the installation, please notice following descriptions.

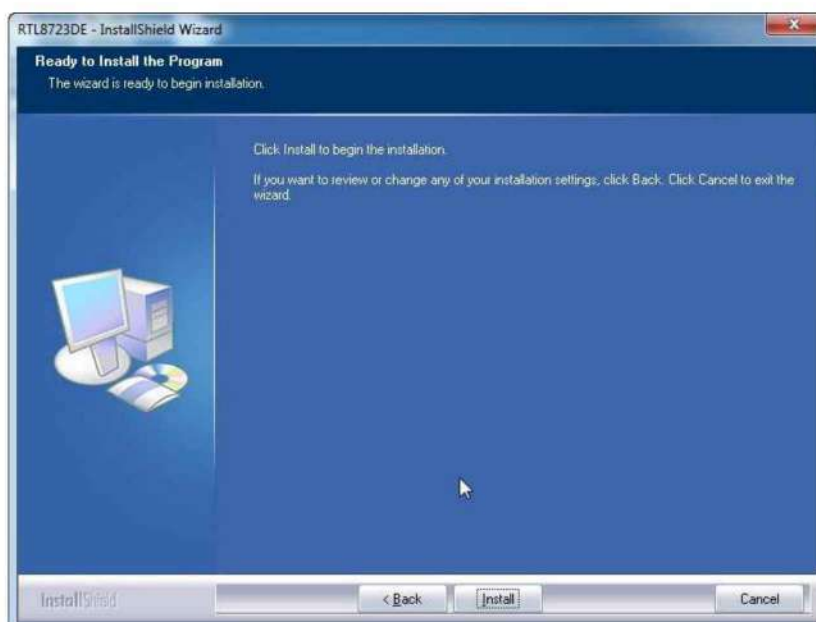
**Note1: The following installation was operated under Windows 7.**

**Note2: If you have installed the WLAN driver & utility before, please uninstall the old version first.**

A. Execute the "setup.exe", Click "Next" to process the installation



B. Click "Install" to process the installation

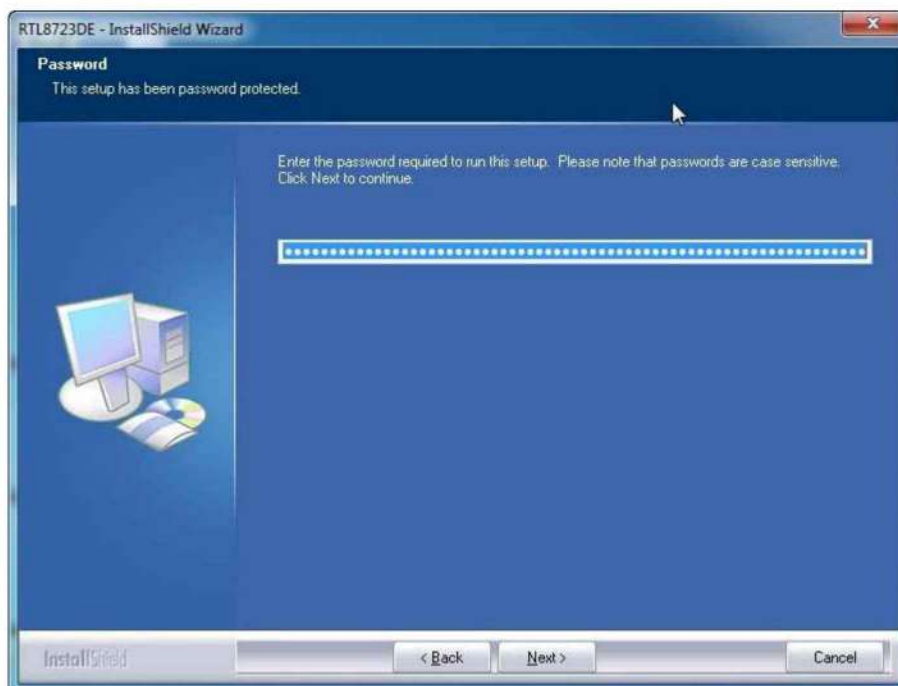


## RTL8822CE User's Manual

C. Click Install this driver software anyway



D. After step "C" please press Next button.

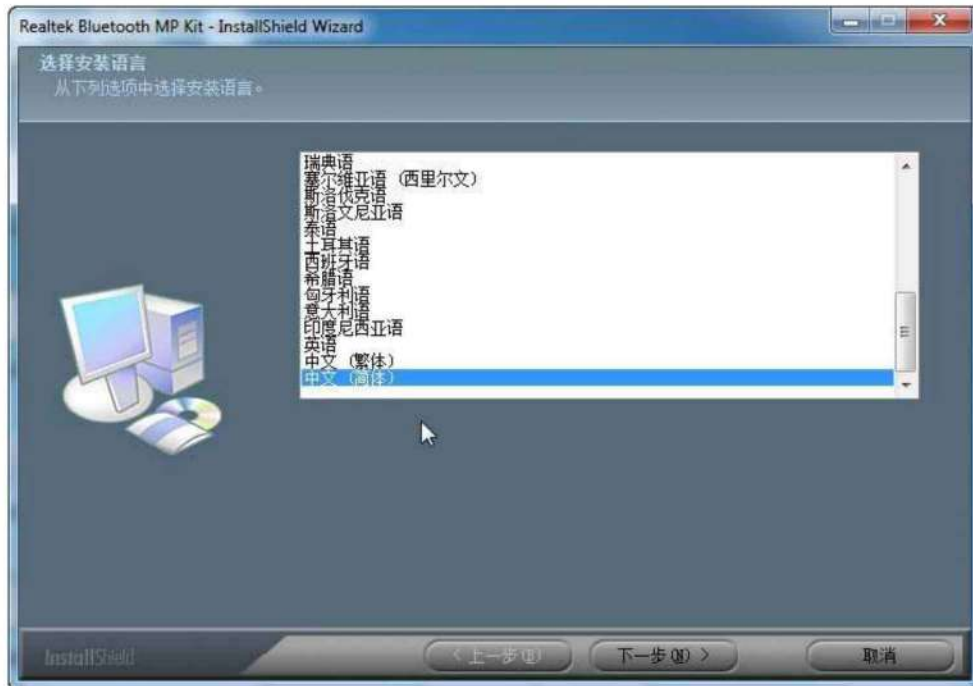


E. Please click "YES" to install BT package.

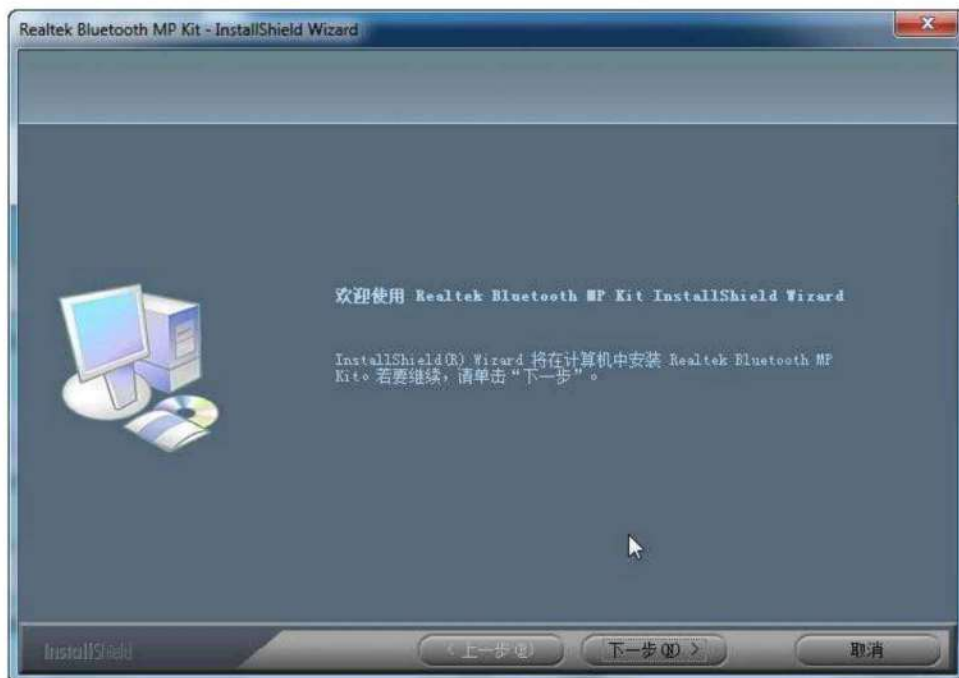


## RTL8822CE User's Manual

F. Please click “下一步”to continue.



G. Please click “下一步”to continue.



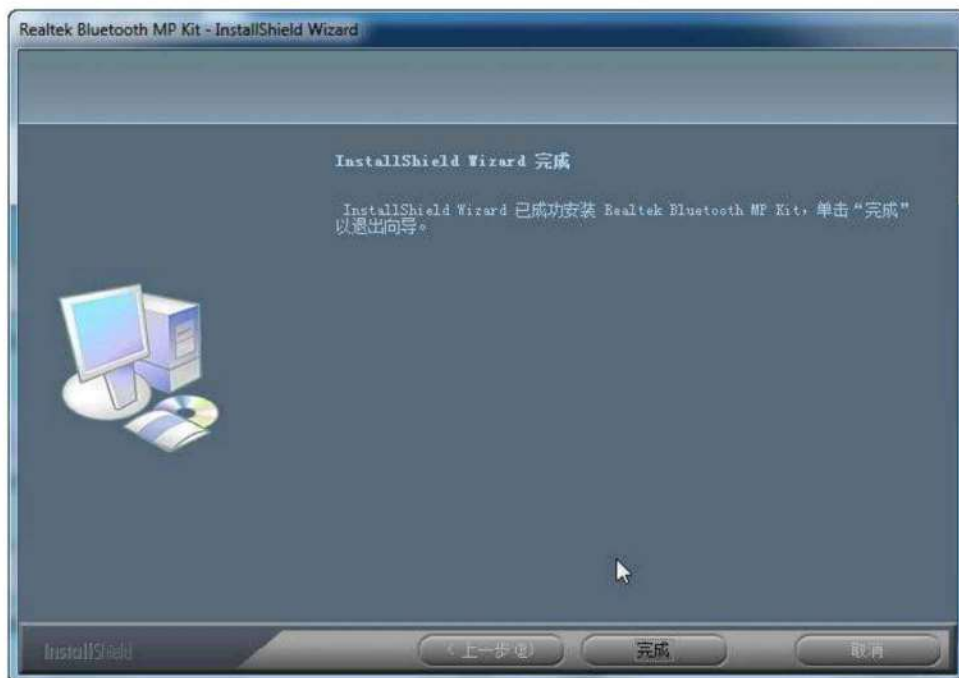


## RTL8822CE User's Manual

H. Please click “安装”to start installation.

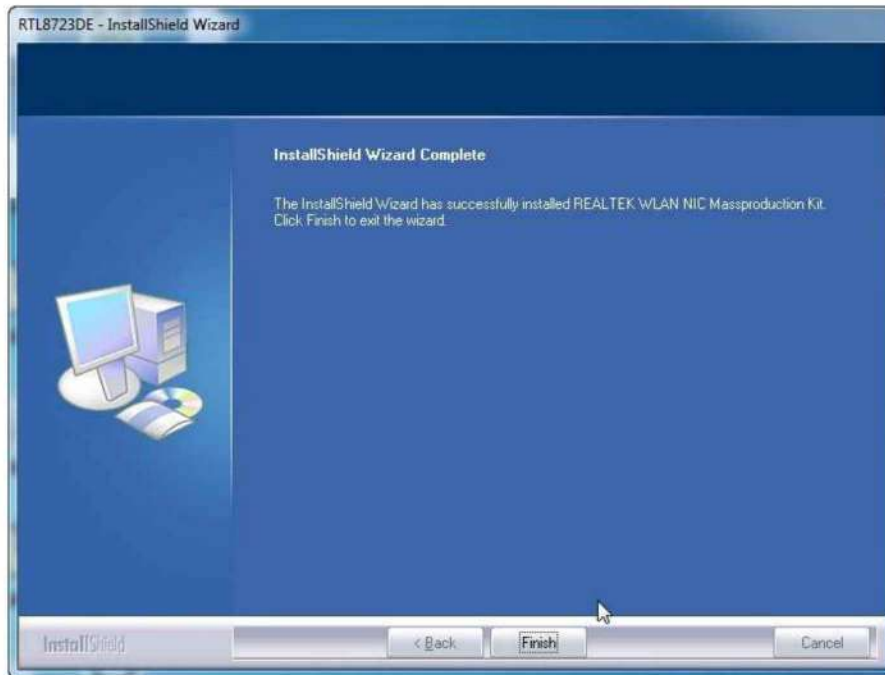


I. Please click “完成”to finish the installation.



## RTL8822CE User's Manual

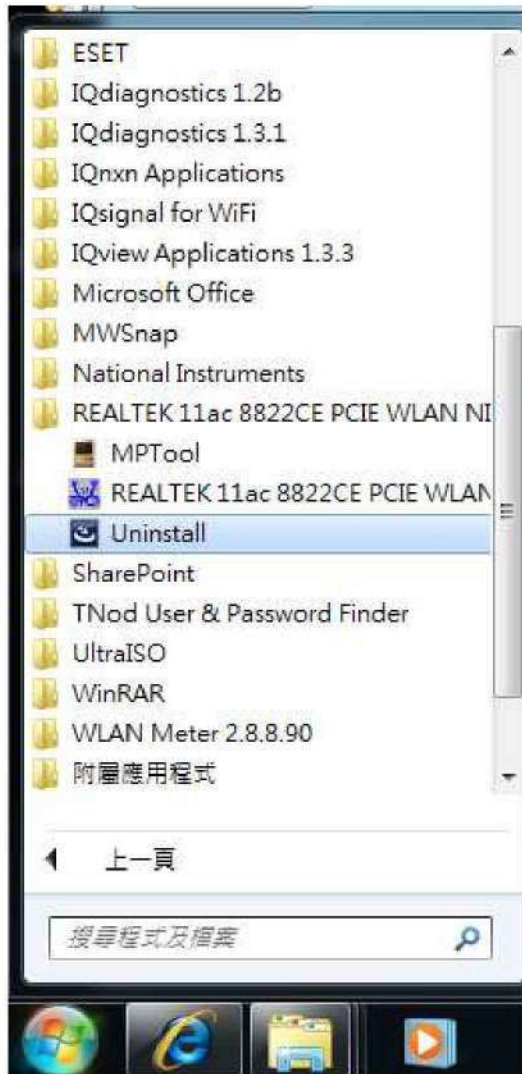
### J. Press Finish button to complete the install process



## Un-installing the Wireless PCIe NGFF2230 module

### Software

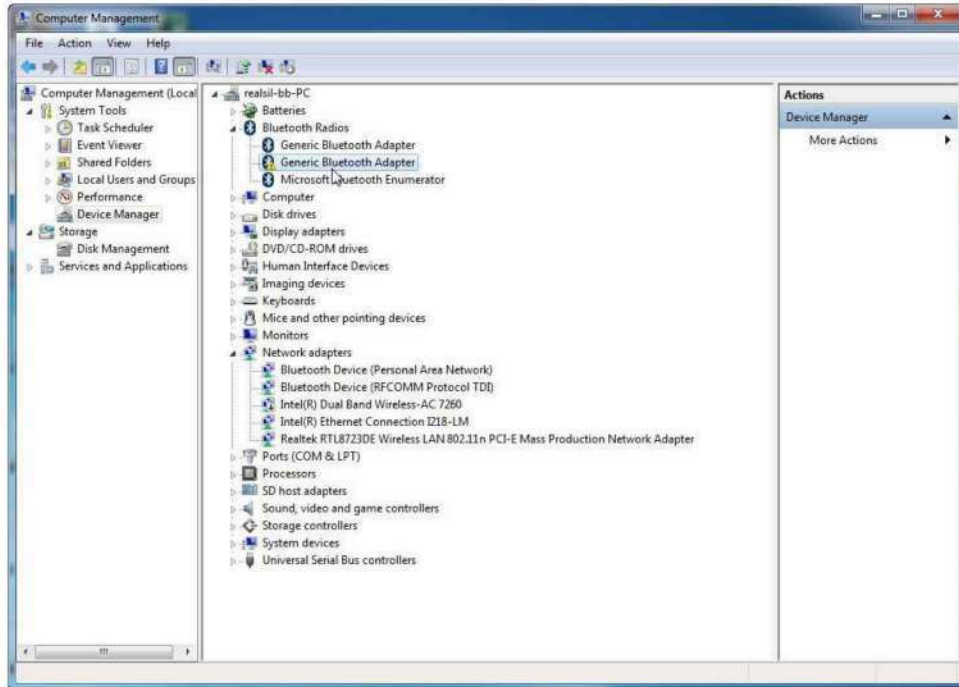
- A. Uninstall the RTL8822CE WLAN Driver from “Start”→ “All Programs”→ “REALTEK 11ac 8822CE PCIE WLAN NIC Massproduction kit”  
Please click “Uninstall” to remove RTL8822CE WLAN driver.



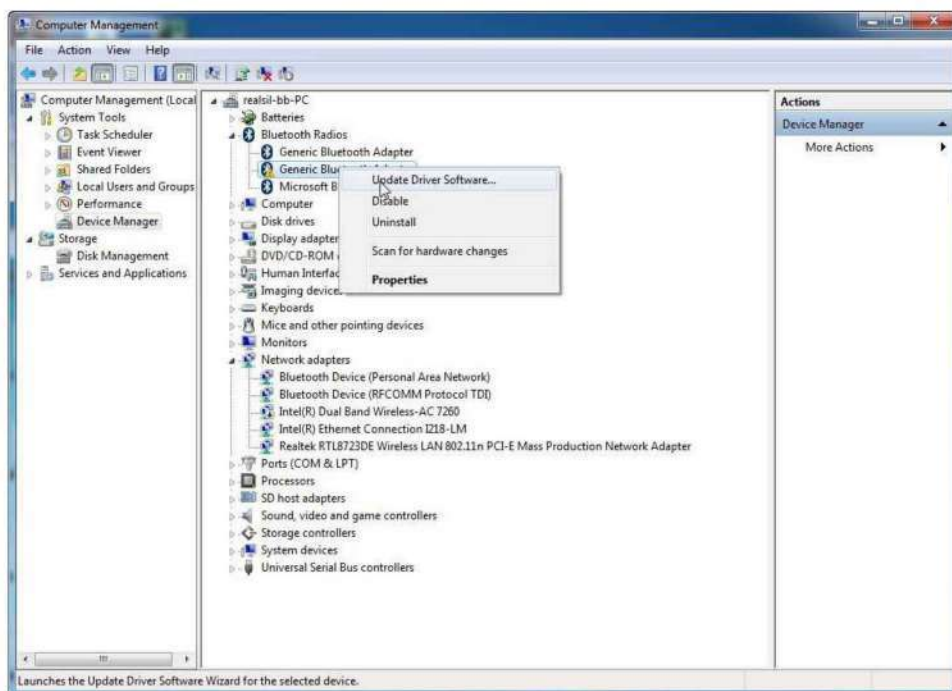
## Installing the Bluetooth USB Module

### Software

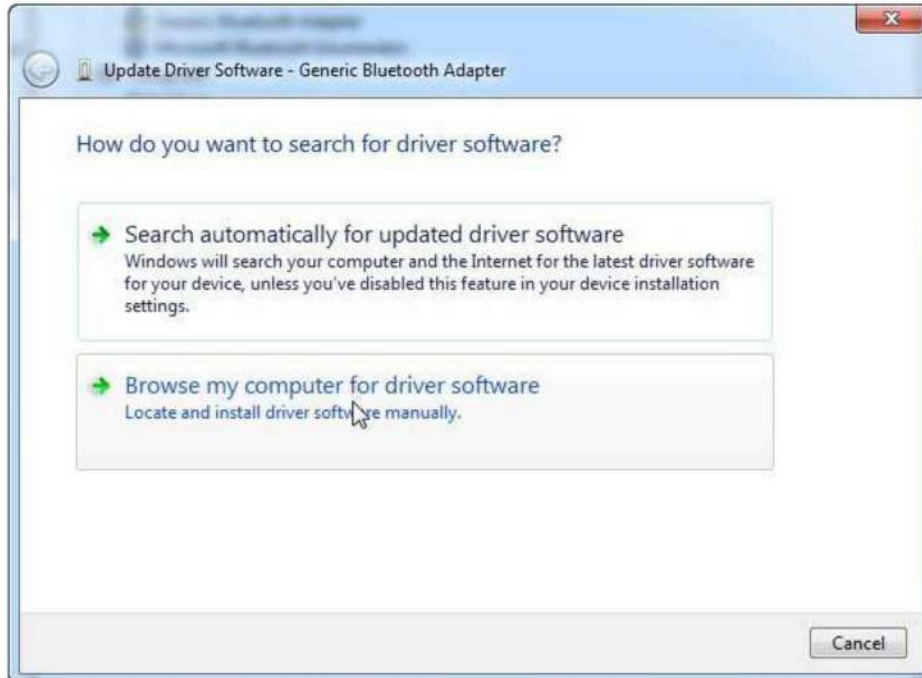
- A. Insert the NGFF2230 card into system connector.
- B. Boot on system then the “Generic Bluetooth Adapter” device will show up in device manager.



- C. Click right button on “RT Bluetooth Radio” and select “Update Driver”.



- D. After select “Update Driver Software ” then the Hardware Update Wizard will pop up, please select “Browse my computer for driver software” and press Next button.



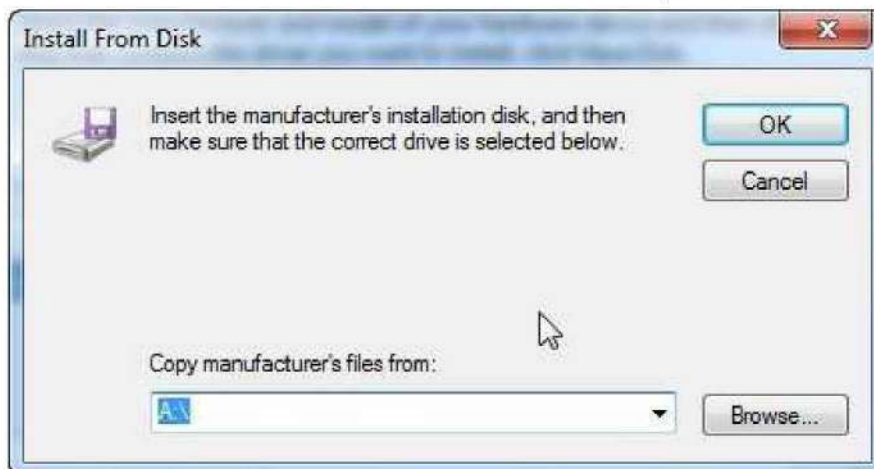
- E. After step “D” please Select “Let me pick from a list of device drivers on my computer ”.

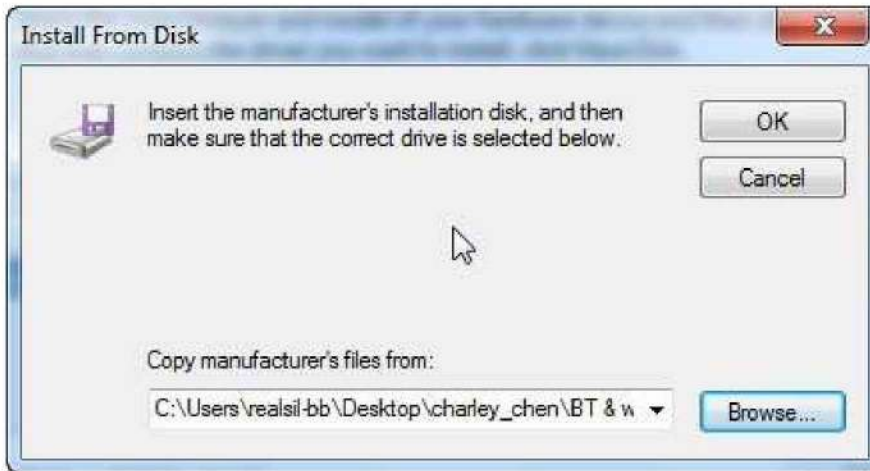


F. Finish step "E" then select "Have Disk.."

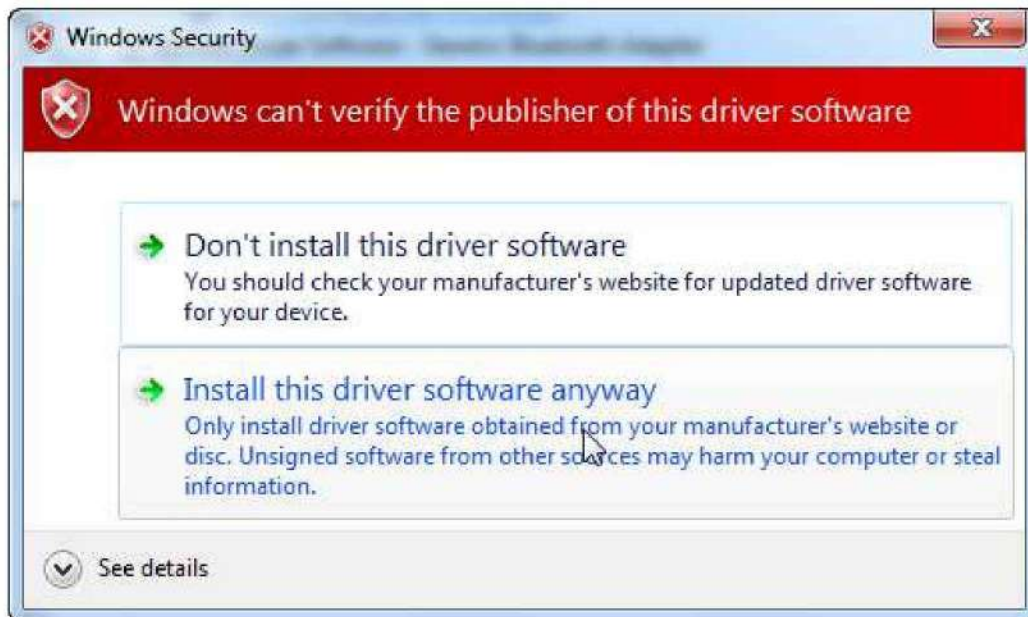


G. Now select browse to find the driver for device and press Next button.(The driver's locate is the same with WiFi driver )





H. Then click "Install this driver software anyway" to continue.



I. Press close button to complete the install process and you can see the Driver will be show up in Device Manager.







## RTL8822CE User's Manual

### FCC SAR Power Table(For portable device with PIFA antenna)

Maximum Output Power

Maximum Target conducted Power

The maximum conducted average power(Unit:dBm) including tune -up tolerance is shown below.

#### Tri Antenna Port

##### <WLAN 2.4G>

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11b	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11g	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11ac (VHT20)	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11ac (VHT40)	3	2422	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	9	2452	15.5	15.5	17.0
	10	2457	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0

##### <WLAN 5.2G>

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	36	5180	12.5	12.5	15.5
	40	5200	12.5	12.5	15.5
	44	5220	12.5	12.5	15.5
	48	5240	12.5	12.5	15.5
802.11ac (VHT20)	36	5180	12.0	12.0	15.0
	40	5200	12.0	12.0	15.0
	44	5220	12.0	12.0	15.0
	48	5240	12.0	12.0	15.0
802.11ac (VHT40)	38	5190	12.0	12.0	15.0
	46	5230	12.0	12.0	15.0
802.11ac (VHT80)	42	5210	12.0	12.0	15.0



## RTL8822CE User's Manual

## &lt;WLAN 5.3G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	52	5260	12.5	12.5	15.5
	56	5280	12.5	12.5	15.5
	60	5300	12.5	12.5	15.5
	64	5320	12.5	12.5	15.5
802.11ac (VHT20)	52	5260	12.0	12.0	15.0
	56	5280	12.0	12.0	15.0
	60	5300	12.0	12.0	15.0
	64	5320	12.0	12.0	15.0
802.11ac (VHT40)	54	5270	12.0	12.0	15.0
	62	5310	12.0	12.0	15.0
802.11ac (VHT80)	58	5290	12.0	12.0	15.0

## &lt;WLAN 5.6G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	100	5500	13.0	13.0	16.0
	116	5580	13.0	13.0	16.0
	120	5600	13.0	13.0	16.0
	124	5620	13.0	13.0	16.0
	132	5660	13.0	13.0	16.0
	140	5700	13.0	13.0	16.0
	144	5720	13.0	13.0	16.0
802.11ac (VHT20)	100	5500	12.5	12.5	15.5
	116	5580	12.5	12.5	15.5
	120	5600	12.5	12.5	15.5
	124	5620	12.5	12.5	15.5
	132	5660	12.5	12.5	15.5
	140	5700	12.5	12.5	15.5
	144	5720	12.5	12.5	15.5
802.11ac (VHT40)	102	5510	12.5	12.5	15.5
	110	5550	12.5	12.5	15.5
	118	5590	12.5	12.5	15.5
	126	5630	12.5	12.5	15.5
	134	5670	12.5	12.5	15.5
	142	5710	12.5	12.5	15.5
802.11ac (VHT80)	106	5530	12.5	12.5	15.5
	122	5610	12.5	12.5	15.5
	138	5690	12.5	12.5	15.5

## &lt;WLAN 5.8G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	149	5745	11.5	11.5	14.5
	153	5765	11.5	11.5	14.5
	157	5785	11.5	11.5	14.5
	161	5805	11.5	11.5	14.5
	165	5825	11.5	11.5	14.5
802.11n (HT20)	149	5745	11.0	11.0	14.0
	153	5765	11.0	11.0	14.0
	157	5785	11.0	11.0	14.0
	161	5805	11.0	11.0	14.0
	165	5825	11.0	11.0	14.0
802.11n (HT40)	151	5755	11.0	11.0	14.0
	159	5795	11.0	11.0	14.0
802.11ac (VHT80)	155	5775	11.0	11.0	14.0



## RTL8822CE User's Manual

## &lt;Bluetooth&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-2)
Bluetooth EDR	0	2402	13.0	13.0
	39	2441	13.0	13.0
	78	2480	13.0	13.0
Bluetooth LE	0	2402	12.0	11.5
	19	2440	12.0	11.5
	39	2480	12.0	11.5

## Tri Antenna Port:

## &lt;WLAN 2.4G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11b	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11g	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11ac (VHT20)	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11ac (VHT40)	3	2422	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	9	2452	15.5	15.5	17.0
	10	2457	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0

## &lt;WLAN 5.2G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	36	5180	12.5	12.5	15.5
	40	5200	12.5	12.5	15.5
	44	5220	12.5	12.5	15.5
	48	5240	12.5	12.5	15.5
802.11ac (VHT20)	36	5180	12.0	12.0	15.0
	40	5200	12.0	12.0	15.0
	44	5220	12.0	12.0	15.0
	48	5240	12.0	12.0	15.0
802.11ac (VHT40)	38	5190	12.0	12.0	15.0
	46	5230	12.0	12.0	15.0
802.11ac (VHT80)	42	5210	12.0	12.0	15.0



## RTL8822CE User's Manual

## &lt;WLAN 5.3G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	52	5260	12.5	12.5	15.5
	56	5280	12.5	12.5	15.5
	60	5300	12.5	12.5	15.5
	64	5320	12.5	12.5	15.5
802.11ac (VHT20)	52	5260	12.0	12.0	15.0
	56	5280	12.0	12.0	15.0
	60	5300	12.0	12.0	15.0
	64	5320	12.0	12.0	15.0
802.11ac (VHT40)	54	5270	12.0	12.0	15.0
	62	5310	12.0	12.0	15.0
802.11ac (VHT80)	58	5290	12.0	12.0	15.0

## &lt;WLAN 5.6G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	100	5500	13.0	13.0	16.0
	116	5580	13.0	13.0	16.0
	120	5600	13.0	13.0	16.0
	124	5620	13.0	13.0	16.0
	132	5660	13.0	13.0	16.0
	140	5700	13.0	13.0	16.0
	144	5720	13.0	13.0	16.0
802.11ac (VHT20)	100	5500	12.5	12.5	15.5
	116	5580	12.5	12.5	15.5
	120	5600	12.5	12.5	15.5
	124	5620	12.5	12.5	15.5
	132	5660	12.5	12.5	15.5
	140	5700	12.5	12.5	15.5
802.11ac (VHT40)	102	5510	12.5	12.5	15.5
	110	5550	12.5	12.5	15.5
	118	5590	12.5	12.5	15.5
	126	5630	12.5	12.5	15.5
	134	5670	12.5	12.5	15.5
	142	5710	12.5	12.5	15.5
802.11ac (VHT80)	106	5530	12.5	12.5	15.5
	122	5610	12.5	12.5	15.5
	138	5690	12.5	12.5	15.5



## RTL8822CE User's Manual

## &lt;WLAN 5.8G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	149	5745	11.5	11.5	14.5
	153	5765	11.5	11.5	14.5
	157	5785	11.5	11.5	14.5
	161	5805	11.5	11.5	14.5
	165	5825	11.5	11.5	14.5
802.11n (HT20)	149	5745	11.0	11.0	14.0
	153	5765	11.0	11.0	14.0
	157	5785	11.0	11.0	14.0
	161	5805	11.0	11.0	14.0
	165	5825	11.0	11.0	14.0
802.11n (HT40)	151	5755	11.0	11.0	14.0
	159	5795	11.0	11.0	14.0
802.11ac (VHT80)	155	5775	11.0	11.0	14.0

## &lt;Bluetooth&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)
Bluetooth EDR	0	2402	13.0
	39	2441	13.0
	78	2480	13.0
Bluetooth LE	0	2402	12.0
	19	2440	12.0
	39	2480	12.0

## Measured Conducted Power Result

The measuring conducted average power

## Tri Antenna Port

## &lt;WLAN 2.4G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11b	1	2412	15.25	15.45	16.90
	6	2437	15.43	15.48	16.91
	11	2462	15.11	15.16	16.42
	12	2467	15.24	15.44	16.39
	13	2472	15.18	15.34	16.26

## &lt;WLAN 5.3G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	52	5260	12.30	12.29	15.43
	56	5280	12.23	12.20	15.28
	60	5300	12.38	12.37	15.18
	64	5320	12.33	12.25	15.23

## &lt;WLAN 5.6G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	100	5500	12.68	12.82	15.63
	116	5580	12.94	12.86	15.72
	120	5600	12.62	12.77	15.61
	124	5620	12.64	12.67	15.69
	132	5660	12.71	12.64	15.64
	140	5700	12.73	12.57	15.65
	144	5720	12.88	12.75	15.58



## RTL8822CE User's Manual

## &lt;WLAN 5.8G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	149	5745	11.28	11.37	14.33
	153	5765	11.36	11.19	14.32
	157	5785	11.41	11.28	14.43
	161	5805	11.25	11.25	14.35
	165	5825	11.33	11.31	14.32

## &lt;Bluetooth&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-2)
Bluetooth EDR	0	2402	12.84	12.33
	39	2441	12.65	12.28
	78	2480	12.65	12.53
Bluetooth LE	0	2402	11.63	11.34
	19	2440	11.51	11.23
	39	2480	11.20	10.82

## Dual Antenna Port

## &lt;WLAN 2.4G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11b	1	2412	15.25	15.45	16.90
	6	2437	15.43	15.48	16.91
	11	2462	15.11	15.16	16.42
	12	2467	15.24	15.44	16.39
	13	2472	15.18	15.34	16.26

## &lt;WLAN 5.3G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	52	5260	12.30	12.29	15.43
	56	5280	12.23	12.20	15.28
	60	5300	12.38	12.37	15.18
	64	5320	12.33	12.25	15.23

## &lt;WLAN 5.6G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	100	5500	12.68	12.82	15.63
	116	5580	12.94	12.86	15.72
	120	5600	12.62	12.77	15.61
	124	5620	12.64	12.67	15.69
	132	5660	12.71	12.64	15.64
	140	5700	12.73	12.57	15.65
	144	5720	12.88	12.75	15.58



## RTL8822CE User's Manual

## &lt;WLAN 5.8G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	149	5745	11.28	11.37	14.33
	153	5765	11.36	11.19	14.32
	157	5785	11.41	11.28	14.43
	161	5805	11.25	11.25	14.35
	165	5825	11.33	11.31	14.32

## &lt;Bluetooth&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)
Bluetooth EDR	0	2402	12.84
	39	2441	12.65
	78	2480	12.65
Bluetooth LE	0	2402	11.63
	19	2440	11.51
	39	2480	11.20

## IC SAR Power Table(For portable device with PIFA antenna)

## Power of portable device with PIFA antenna :

## Maximum Target Conducted Power:

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

## Tri Antenna Port

## &lt;WLAN 2.4G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11b	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11g	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11ac (VHT20)	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11ac (VHT40)	3	2422	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	9	2452	15.5	15.5	17.0
	10	2457	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0

## &lt;WLAN 5.2G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	36	5180	12.5	12.5	15.5
	40	5200	12.5	12.5	15.5
	44	5220	12.5	12.5	15.5
	48	5240	12.5	12.5	15.5
802.11ac (VHT20)	36	5180	12.0	12.0	15.0
	40	5200	12.0	12.0	15.0
	44	5220	12.0	12.0	15.0
	48	5240	12.0	12.0	15.0
802.11ac (VHT40)	38	5190	12.0	12.0	15.0
	46	5230	12.0	12.0	15.0
802.11ac (VHT80)	42	5210	12.0	12.0	15.0



## RTL8822CE User's Manual

## &lt;WLAN 5.3G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	52	5260	12.5	12.5	15.5
	56	5280	12.5	12.5	15.5
	60	5300	12.5	12.5	15.5
	64	5320	12.5	12.5	15.5
802.11ac (VHT20)	52	5260	12.0	12.0	15.0
	56	5280	12.0	12.0	15.0
	60	5300	12.0	12.0	15.0
	64	5320	12.0	12.0	15.0
802.11ac (VHT40)	54	5270	12.0	12.0	15.0
	62	5310	12.0	12.0	15.0
802.11ac (VHT80)	58	5290	12.0	12.0	15.0

## &lt;WLAN 5.6G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	100	5500	13.0	13.0	16.0
	116	5580	13.0	13.0	16.0
	132	5660	13.0	13.0	16.0
	140	5700	13.0	13.0	16.0
	144	5720	13.0	13.0	16.0
802.11ac (VHT20)	100	5500	12.5	12.5	15.5
	116	5580	12.5	12.5	15.5
	132	5660	12.5	12.5	15.5
	140	5700	12.5	12.5	15.5
	144	5720	12.5	12.5	15.5
802.11ac (VHT40)	102	5510	12.5	12.5	15.5
	110	5550	12.5	12.5	15.5
	134	5670	12.5	12.5	15.5
	142	5710	12.5	12.5	15.5
802.11ac (VHT80)	106	5530	12.5	12.5	15.5
	138	5690	12.5	12.5	15.5

## &lt;WLAN 5.8G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	149	5745	11.5	11.5	14.5
	153	5765	11.5	11.5	14.5
	157	5785	11.5	11.5	14.5
	161	5805	11.5	11.5	14.5
	165	5825	11.5	11.5	14.5
802.11n (HT20)	149	5745	11.0	11.0	14.0
	153	5765	11.0	11.0	14.0
	157	5785	11.0	11.0	14.0
	161	5805	11.0	11.0	14.0
	165	5825	11.0	11.0	14.0
802.11n (HT40)	151	5755	11.0	11.0	14.0
	159	5795	11.0	11.0	14.0
802.11ac (VHT80)	155	5775	11.0	11.0	14.0

## &lt;Bluetooth&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-2)
Bluetooth EDR	0	2402	13.0	13.0
	39	2441	13.0	13.0
	78	2480	13.0	13.0
Bluetooth LE	0	2402	12.0	11.5
	19	2440	12.0	11.5
	39	2480	12.0	11.5





## RTL8822CE User's Manual

## Dual Antenna Port

## &lt;WLAN 2.4G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11b	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11g	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
	13	2472	15.5	15.5	17.0
802.11ac (VHT20)	1	2412	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0
	12	2467	15.5	15.5	17.0
802.11ac (VHT40)	3	2422	15.5	15.5	17.0
	6	2437	15.5	15.5	17.0
	9	2452	15.5	15.5	17.0
	10	2457	15.5	15.5	17.0
	11	2462	15.5	15.5	17.0

## &lt;WLAN 5.2G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	36	5180	12.5	12.5	15.5
	40	5200	12.5	12.5	15.5
	44	5220	12.5	12.5	15.5
	48	5240	12.5	12.5	15.5
802.11ac (VHT20)	36	5180	12.0	12.0	15.0
	40	5200	12.0	12.0	15.0
	44	5220	12.0	12.0	15.0
	48	5240	12.0	12.0	15.0
802.11ac (VHT40)	38	5190	12.0	12.0	15.0
	46	5230	12.0	12.0	15.0
802.11ac (VHT80)	42	5210	12.0	12.0	15.0

## &lt;WLAN 5.3G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	52	5260	12.5	12.5	15.5
	56	5280	12.5	12.5	15.5
	60	5300	12.5	12.5	15.5
	64	5320	12.5	12.5	15.5
802.11ac (VHT20)	52	5260	12.0	12.0	15.0
	56	5280	12.0	12.0	15.0
	60	5300	12.0	12.0	15.0
	64	5320	12.0	12.0	15.0
802.11ac (VHT40)	54	5270	12.0	12.0	15.0
	62	5310	12.0	12.0	15.0
802.11ac (VHT80)	58	5290	12.0	12.0	15.0

## &lt;WLAN 5.6G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	100	5500	13.0	13.0	16.0
	116	5580	13.0	13.0	16.0
	132	5660	13.0	13.0	16.0
	140	5700	13.0	13.0	16.0
	144	5720	13.0	13.0	16.0
802.11ac (VHT20)	100	5500	12.5	12.5	15.5
	116	5580	12.5	12.5	15.5
	132	5660	12.5	12.5	15.5
	140	5700	12.5	12.5	15.5
	144	5720	12.5	12.5	15.5
802.11ac (VHT40)	102	5510	12.5	12.5	15.5
	110	5550	12.5	12.5	15.5
	134	5670	12.5	12.5	15.5
	142	5710	12.5	12.5	15.5
802.11ac (VHT80)	106	5530	12.5	12.5	15.5
	138	5690	12.5	12.5	15.5



## RTL8822CE User's Manual

## &lt;WLAN 5.8G&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)	Max. Tune up (Ant-1)	Max. Tune up (Ant-0 + Ant-1)
802.11a	149	5745	11.5	11.5	14.5
	153	5765	11.5	11.5	14.5
	157	5785	11.5	11.5	14.5
	161	5805	11.5	11.5	14.5
	165	5825	11.5	11.5	14.5
802.11n (HT20)	149	5745	11.0	11.0	14.0
	153	5765	11.0	11.0	14.0
	157	5785	11.0	11.0	14.0
	161	5805	11.0	11.0	14.0
	165	5825	11.0	11.0	14.0
802.11n (HT40)	151	5755	11.0	11.0	14.0
	159	5795	11.0	11.0	14.0
802.11ac (VHT80)	155	5775	11.0	11.0	14.0

## &lt;Bluetooth&gt;

Mode	Channel	Frequency (MHz)	Max. Tune up (Ant-0)
Bluetooth EDR	0	2402	13.0
	39	2441	13.0
	78	2480	13.0
Bluetooth LE	0	2402	12.0
	19	2440	12.0
	39	2480	12.0

**Measured Conducted Power:**

The measuring conducted average power (Unit: dBm) is shown as below.

**Tri Antenna Port****<WLAN 2.4G>**

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11b	1	2412	15.25	15.45	16.90
	6	2437	15.43	15.48	16.91
	11	2462	15.11	15.16	16.42
	12	2487	15.24	15.44	16.39
	13	2472	15.18	15.34	16.26

**<WLAN 5.3G>**

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	52	5260	12.30	12.29	15.43
	56	5280	12.23	12.20	15.28
	60	5300	12.38	12.37	15.18
	64	5320	12.33	12.25	15.23

**<WLAN 5.6G>**

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	100	5500	12.68	12.92	15.63
	116	5580	12.94	12.96	15.72
	132	5660	12.71	12.64	15.64
	140	5700	12.73	12.67	15.65
	144	5720	12.88	12.75	15.58

**<WLAN 5.8G>**

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	149	5745	11.28	11.37	14.33
	153	5765	11.36	11.19	14.32
	157	5785	11.41	11.28	14.43
	161	5805	11.25	11.25	14.35
	165	5825	11.33	11.31	14.32

**<Bluetooth>**

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-2)
Bluetooth EDR	0	2402	12.84	12.33
	39	2441	12.65	12.28
	78	2480	12.85	12.53
Bluetooth LE	0	2402	11.63	11.34
	19	2440	11.51	11.23
	39	2480	11.20	10.82



## RTL8822CE User's Manual

## Dual Antenna Port

## &lt;WLAN 2.4G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11b	1	2412	15.25	15.45	16.90
	6	2437	15.43	15.48	16.91
	11	2462	15.11	15.16	16.42
	12	2487	15.24	15.44	16.39
	13	2472	15.18	15.34	16.26

## &lt;WLAN 5.3G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	52	5280	12.30	12.29	15.43
	56	5280	12.23	12.20	15.28
	60	5300	12.38	12.37	15.18
	64	5320	12.33	12.25	15.23

## &lt;WLAN 5.6G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	100	5500	12.68	12.82	15.63
	118	5580	12.94	12.88	15.72
	132	5680	12.71	12.84	15.64
	140	5700	12.73	12.57	15.65
	144	5720	12.88	12.75	15.58

## &lt;WLAN 5.8G&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11a	149	5745	11.28	11.37	14.33
	153	5785	11.38	11.19	14.32
	157	5785	11.41	11.28	14.43
	161	5805	11.25	11.25	14.35
	165	5825	11.33	11.31	14.32

## &lt;Bluetooth&gt;

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)
Bluetooth EDR	0	2402	12.84
	39	2441	12.65
	78	2480	12.65
Bluetooth LE	0	2402	11.63
	19	2440	11.51
	39	2480	11.20



## **VP070-M8M**

ARM-Based In-vehicle Fanless Touch Panel PC  
User's Manual

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Changes after the publication's first release will be based on the product's revision. The website will always provide the most updated information.

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## Trademarks

Product names or trademarks appearing in this manual are for identification purpose only and are the properties of the respective owners.

## FCC and DOC Statement on Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

## Notice:

1. The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Shielded interface cables must be used in order to comply with the emission limits.

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## About this Manual

This manual can be retrieved from the website.

The manual is subject to change and update without notice, and may be based on editions that do not resemble your actual products. Please visit our website or contact our sales representatives for the latest editions.

## Warranty

1. Warranty does not cover damages or failures that arises from misuse of the product, inability to use the product, unauthorized replacement or alteration of components and product specifications.
2. The warranty is void if the product has been subjected to physical abuse, improper installation, modification, accidents or unauthorized repair of the product.
3. Unless otherwise instructed in this user's manual, the user may not, under any circumstances, attempt to perform service, adjustments or repairs on the product, whether in or out of warranty. It must be returned to the purchase point, factory or authorized service agency for all such work.
4. We will not be liable for any indirect, special, incidental or consequential damages to the product that has been modified or altered.

## About this Package

The package contains the following items. If any of these items are missing or damaged, please contact your dealer or sales representative for assistance.

- 1 x VP070-M8M System Unit
- 1 Switch Cable
- 12 Rubber Holders
- 1 ADDM UL Battery Addendum

Note: The items are subject to change in the developing stage.

The product and accessories in the package may not come similar to the information listed above. This may differ in accordance with the sales region or models in which it was sold. For more information about the standard package in your region, please contact your dealer or sales representative.



## Static Electricity Precautions

It is quite easy to inadvertently damage your PC, system board, components or devices even before installing them in your system unit. Static electrical discharge can damage computer components without causing any signs of physical damage. You must take extra care in handling them to ensure against electrostatic build-up.

1. To prevent electrostatic build-up, leave the system board in its anti-static bag until you are ready to install it.
2. Wear an antistatic wrist strap.
3. Do all preparation work on a static-free surface.
4. Hold the device only by its edges. Be careful not to touch any of the components, contacts or connections.
5. Avoid touching the pins or contacts on all modules and connectors. Hold modules or connectors by their ends.



### Important:

Electrostatic discharge (ESD) can damage your processor, disk drive and other components. Perform the upgrade instruction procedures described at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

## Safety Precautions

- Use the correct DC / AC input voltage range.
- Unplug the power cord before removing the system chassis cover for installation or servicing. After installation or servicing, cover the system chassis before plugging in the power cord.
- There is danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent specifications of batteries recommend by the manufacturer.
- Dispose of used batteries according to local ordinance.
- Keep this system away from humid environments.
- Make sure the system is placed or mounted correctly and stably to prevent the chance of dropping or falling may cause damage.
- The openings on the system shall not be blocked and shall be kept in distance from

other objects to make sure of proper air ventilation to protect the system from overheating.

- Dress the cables, especially the power cord, so they will not be stepped on, in contact with high temperature surfaces, or cause any tripping hazards.
- Do not place anything on top of the power cord. Use a power cord that has been approved for use with the system and is compliant with the voltage and current ranges required by the system's electrical specifications.
- If the system is to be unused or stored for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
- If one of the following occurs, consult a service personnel:
  - The power cord or plug is damaged.
  - Liquid has penetrated the system.
  - The system has been exposed to moisture.
  - The system is not working properly.
  - The system is physically damaged.
- The unit uses a three-wire ground cable which is equipped with a third pin to ground the unit and prevent electric shock. Do not defeat the purpose of this pin. If your outlet does not support this kind of plug, contact your electrician to replace the outlet.
- Disconnect the system from the electricity outlet before cleaning. Use a damp cloth for cleaning the surface. Do not use liquid or spray detergents for cleaning.
- Before connecting, make sure that the power supply voltage is correct. The device is connected to a power outlet which should be grounded connection.



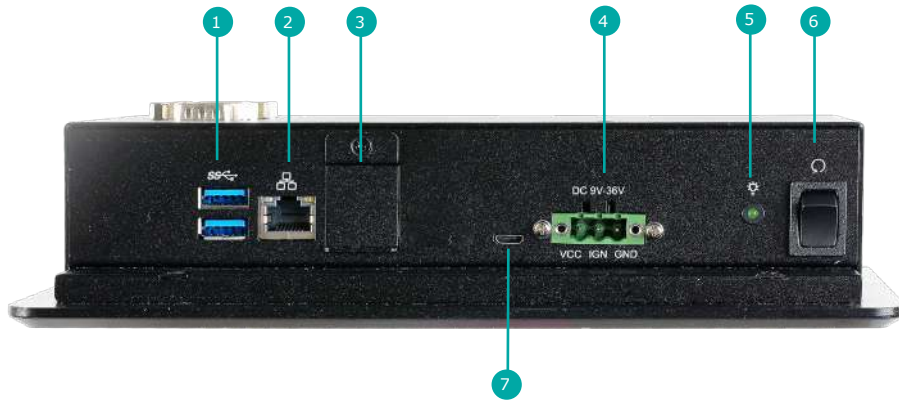
The system may burn fingers while running.

Wait for 30 minutes to handle electronic parts after power off.

## Chapter 1 - Introduction

### ► Overview

Bottom View



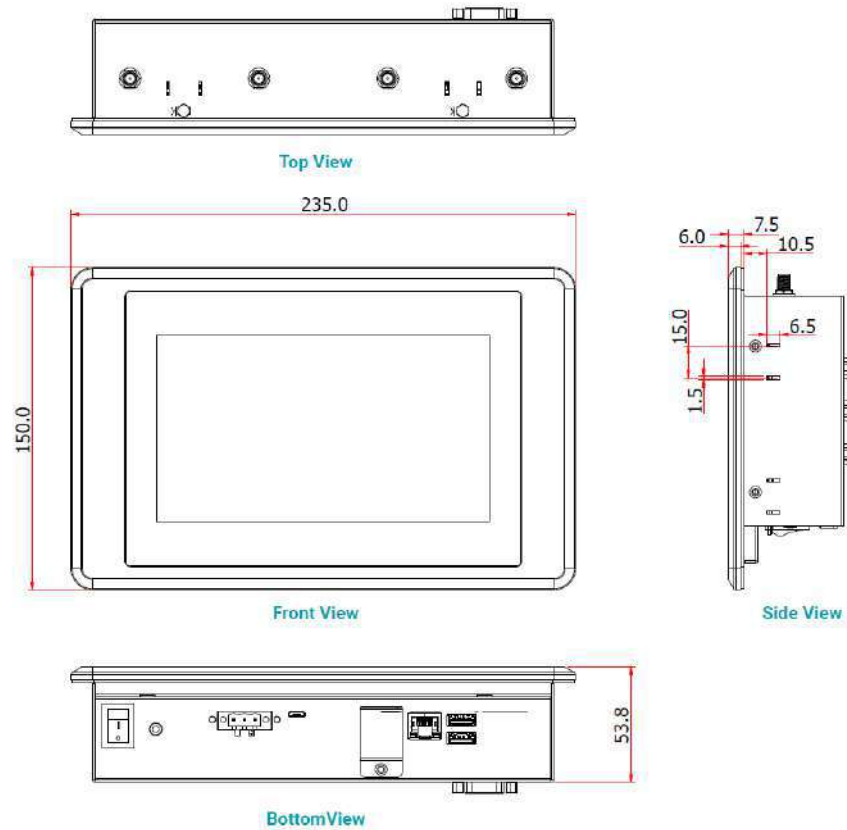
- 1 USB 3.1 Gen1
- 2 LAN
- 3 SIM
- 4 Power Input
- 5 Status LED
- 6 Reset Switch
- 7 OTG

Back View



- 8 COM
- 9 CANbus

## ► Dimensions



## ► Key Features

**ARM-Based System:**

Support Android 9.0 and Linux

**IP Rating:**

IP65 Front Panel Protection

**Rich I/O Connectivity:**

1 GbE, 2 COM, 1 CAN Bus, 2 USB 3.1 Gen1

**Application Focus:**

In-vehicle Driver HMI

**Smart Power Ignition Control:**

Power delay and protection time setting

DFI's VP070-M8M equipped with ARM processor is the most energy-efficient All-in-One PC served as driver HMI with significantly longer battery life and high resolution TFT LCD display with capacitive touch. IP65 rated protection, wide operating temperature range, and anti-vibration ensure the system can withstand the bumpy, mountainous environment. Power management features include a wide power input range, surge protection, and smart ignition power control. 4G, Wi-Fi, and GPS, as well as rich I/O and built-in SIM card/SD card are provided for flexible connectivity and expandability.

**► Specifications**

<b>SYSTEM</b>	Processor	NXP i.MX 8M Dual/Quad Cortex-A53, 1.3GHz
	Max. Speed	1.3GHz
<b>MEMORY</b>	Technology	On board Memory 2GB/4GB (Default 2GB) Single Channel LPDDR4 up to 3200 MHz
	Max. Capacity	4GB
	Socket	Memory Down
<b>DISPLAY &amp; TOUCH SCREEN</b>	Display Type	7" PCAP TFT
	Max. Resolution	1024 x 600
	Brightness	425 cd/m <sup>2</sup>
<b>STORAGE</b>	Internal	Support eMMC 5.1 16GB on board (default) Support up to 64GB (optional)
	External	Micro SD card slot
<b>EXPANSION</b>	Interface	1 x M.2 2242/3042 B Key (USB 3.1 Gen1), Nano SIM Slot support 1 x M.2 2230 E Key (PCIex1/USB2.0)
<b>ETHERNET</b>	Controller	AR8035
<b>AUDIO</b>	Audio Codec	SGTL5000
<b>LED</b>	Indicators	1 x Status LED
<b>Sensor</b>	Sensor	6 axis IMU (3 Accelerometer + 3 Gyroscope)
	Ethernet (Gbe)	1 x Giga LAN
<b>I/O</b>	Serial	1 x RS-232/422/485 1 x RS-232 1 x CAN Bus
	USB	2 USB3.1 Gen1 1 x OTG, micro USB
	Audio	with Amplifier to support 2W speaker (optional) 1 x Line-out & 1 x MIC-in (internal header)
	Buttons	1 x Reset switch
<b>POWER</b>	Type	9~36V DC Power input, with ACC/IGN control
<b>OS SUPPORT</b>	Linux	Yocto 2.5 (optional)
	Android	Android 9.0 (default)

<b>MECHANISM</b>	Construction	Aluminum + SGCC
	IP Rating	IP65 Front Panel Protection
	Mounting	Panel Mount /VESA Mount
	Dimensions (W x H x D)	235 x 150 x 54mm
	Weight	2.9kg
<b>ENVIRONMENT</b>	Operating Temperature	-20 to 70°C
	Storage Temperature	-30 to 80°C
	Relative Humidity	10 to 90% RH (non-condensing)
<b>Standards and Certifications</b>	Shock	OP: Half-sine, 3G @ 11ms
		Non-OP: Half-sine, 5G @ 11ms
	Vibration	OP: Random, 1Grms @ 5~500Hz, 30min
		Non-OP: Sweep sine, 3Grms @ 10~500Hz, 30min
Certifications	CE, FCC, E-Mark R10, RoHS, UKCA	

## Chapter 2 - Hardware Installations

### ► Removing the Chassis Cover

Please observe the following guidelines and follow the instructions to open the system.

1. Make sure the system and all other peripheral devices connected to it have been powered off.
2. Disconnect all power cords and cables.

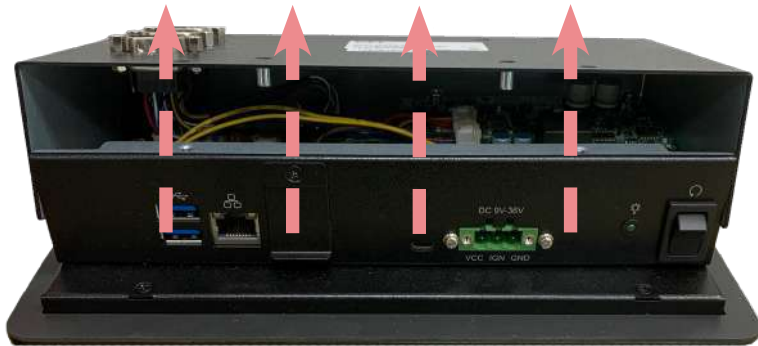
#### Step 1:

The 8 screws of the system are used to secure the cover to the chassis. Remove the screws and put them in a safe place for later use.



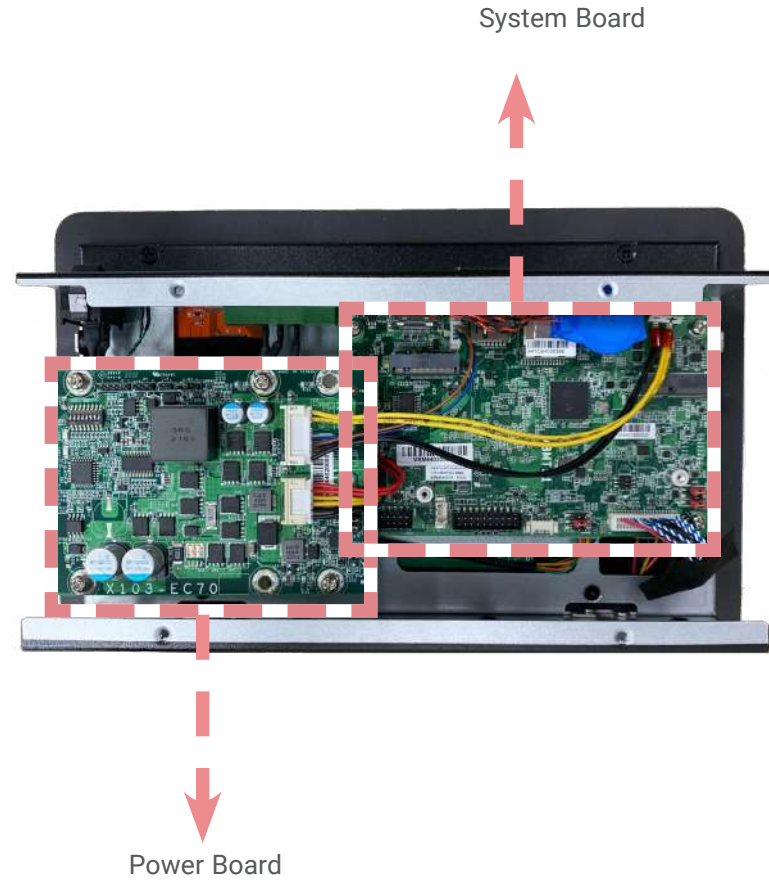
**Step 2:**

Slide the cover to open the system.

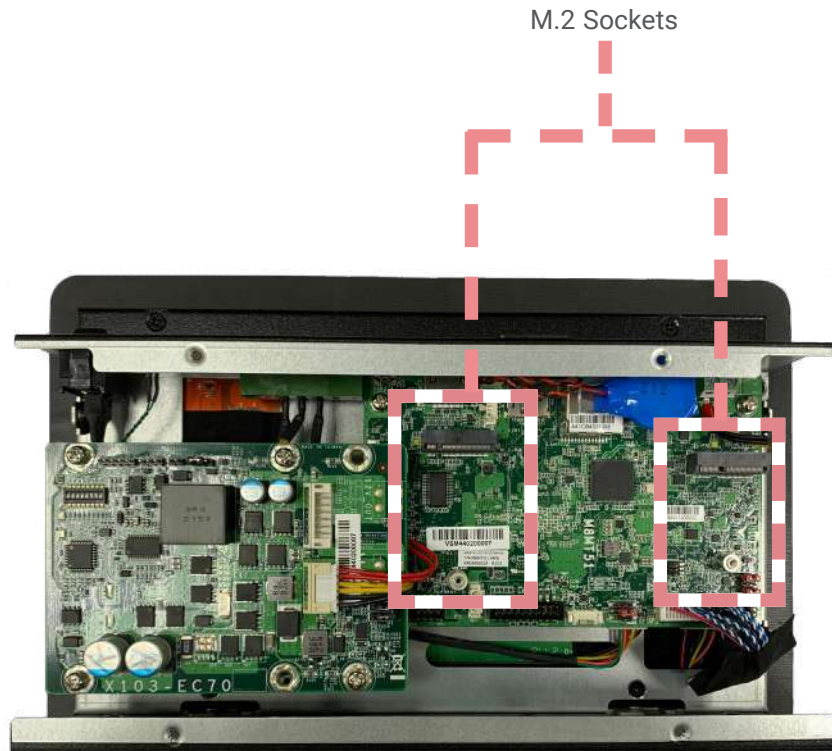


**Step 3:**

The boards can be easily accessed after the chassis cover is removed.



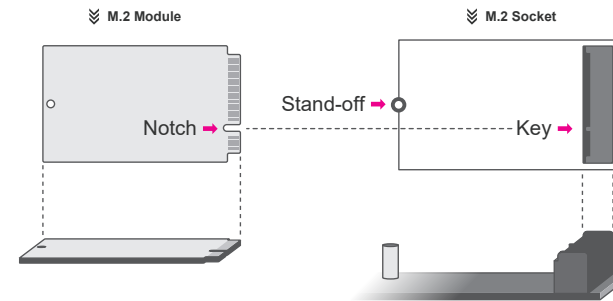
► **Installing an M.2 Card**



Please follow the steps below to install the card into the socket.

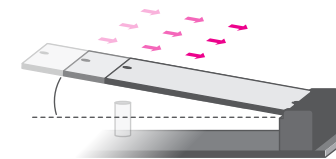
**Step 1:**

Insert the card into the socket at an angle while making sure the notch and key are perfectly aligned.



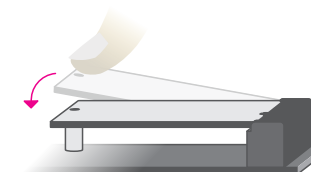
**Step 2:**

Press the end of the card far from the socket down until against the stand-off.



**Step 3:**

Screw tight the card onto the stand-off with a screw driver and a stand-off screw until the gap between the card and the stand-off closes up. The card should be lying parallel to the board when it's correctly mounted.





## ► Installing an Antenna

Before installing the antenna, please make sure that the following safety cautions are wellattended.

1. Make sure the PC and all other peripheral devices connected to it has been powered down.
2. Disconnect all power cords and cables.

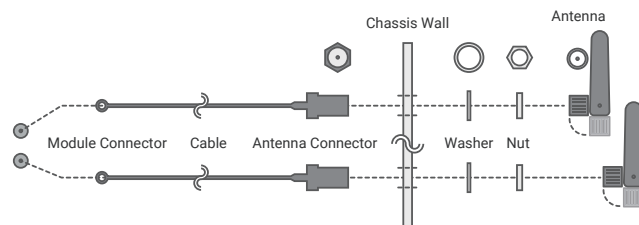
### Step 1:

There are antenna holes reserved on the side of the system and covered by rubber plugs. Please remove the plug prior to installing an antenna.



### Step 2:

Connect the internal cable to the board's antenna connector, screw the antenna connector through the antenna hole with washers and nuts, and screw on the antenna as illustrated below.



## ► Mounting Options

### Wall Mount

#### Step 1:

Select a place on the wall where you will mount the Panel PC.

#### Step 2:

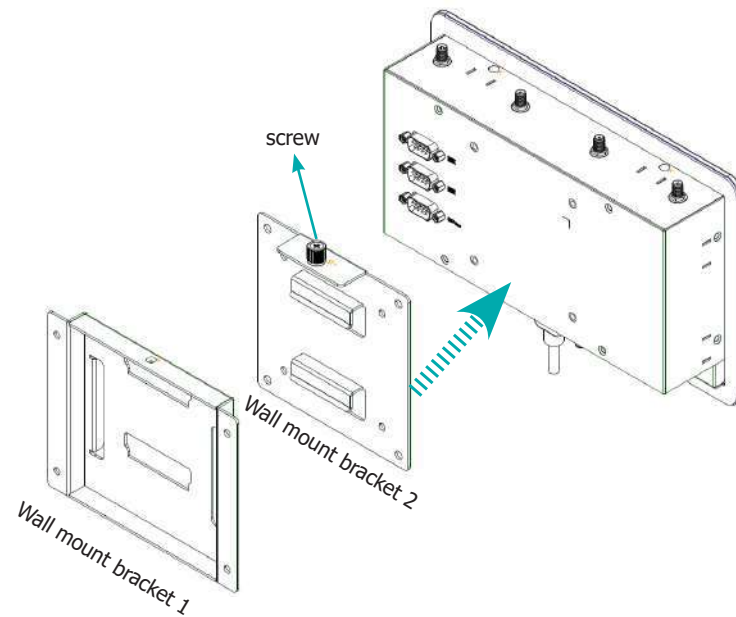
Use the provided mounting screws to attach **wall mount bracket 1** onto the wall.

#### Step 3:

Attach the other bracket (**wall mount bracket 2**) to the rear of the Panel PC.

#### Step 4:

Slide the Panel PC to **wall mount bracket 1** and attach the two brackets together with the hooks. Then tighten the screw to secure the assembly in place.



## Panel Mount

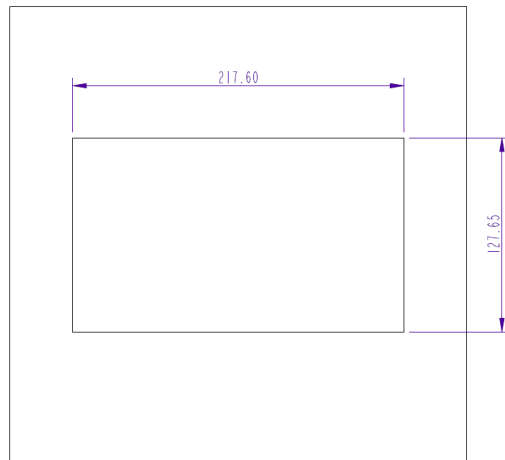
### Step 1:

Select a place on the panel (or wall) where you will mount the Panel PC.

### Step 2:

Cut out a shape on the panel that corresponds to the Panel PC's rear dimensions (217.6mm x 127.65mm) and ensure that the Panel PC can be fitted into the panel properly.

The flat panel thickness is less than 10mm. Be sure to route or trim down the thick wall to 10 mm or slightly less for the clamps to recess and be compatible with your wall or enclosure.



### Step 3:

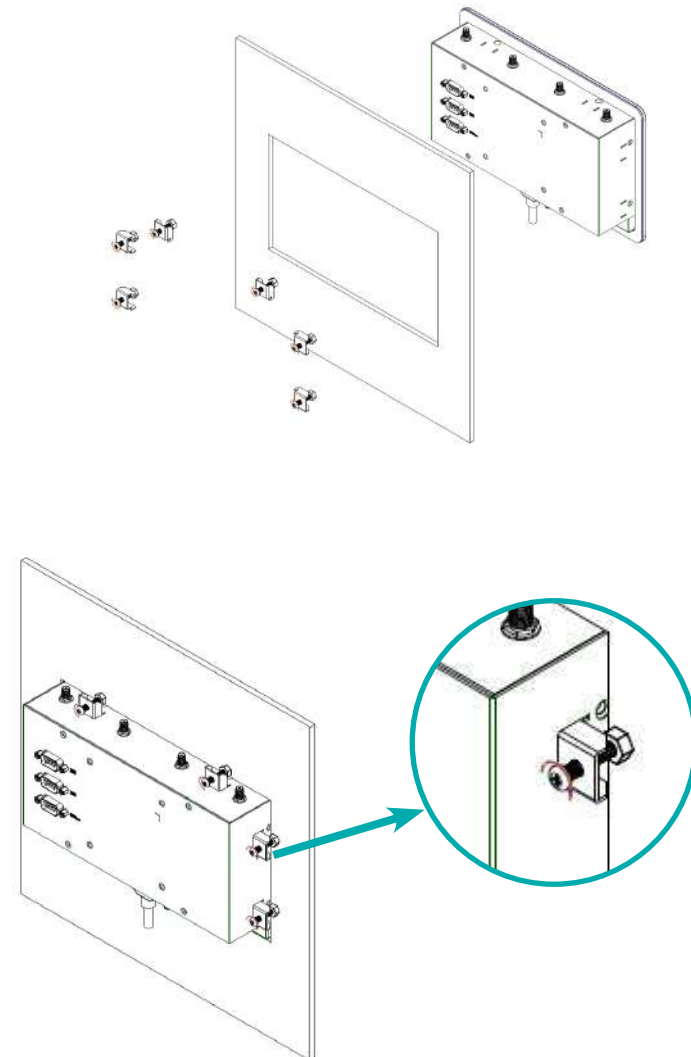
Insert the Panel PC from the outside surface of the panel into the mounting hole until it is properly fitted against the panel.

### Step 4:

Position the mounting clamps along the rear edges of the Panel PC and insert them into the slits around the Panel PC.

### Step 5:

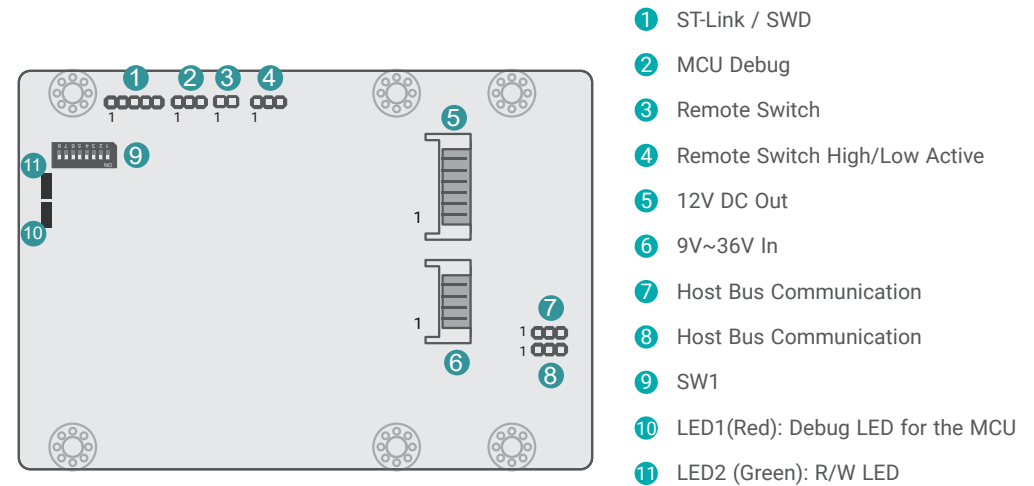
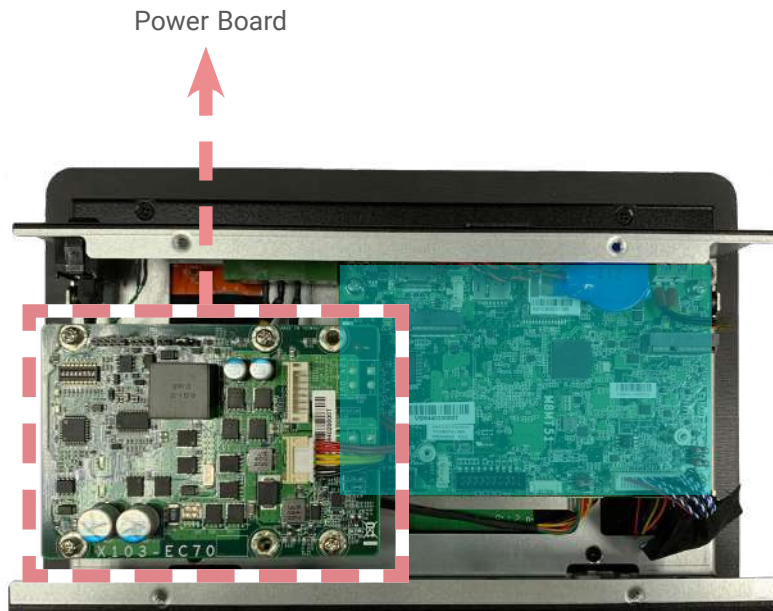
The first and second clamps must be positioned and secured diagonally prior to mounting the rest of the clamps. Tighten the clamp's screw using an electric screwdriver by pressing the white plastic cap onto the back of the panel. The illustration below shows that all clamps are properly mounted.



## Chapter 3 - System Settings

### ► System Layout

#### Power Board

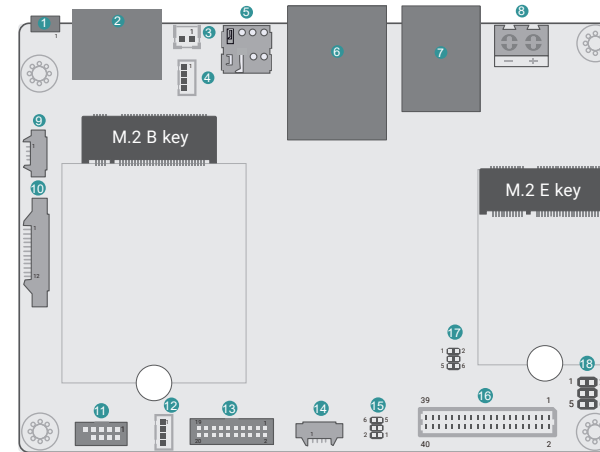
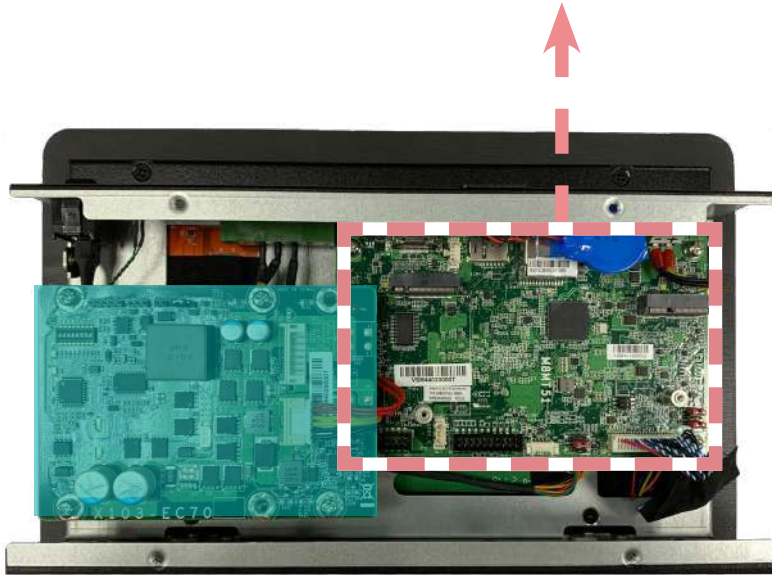


**Important:**

Electrostatic discharge (ESD) can damage your board, processor, disk drives, add-in boards, and other components. Perform installation procedures at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

System Board

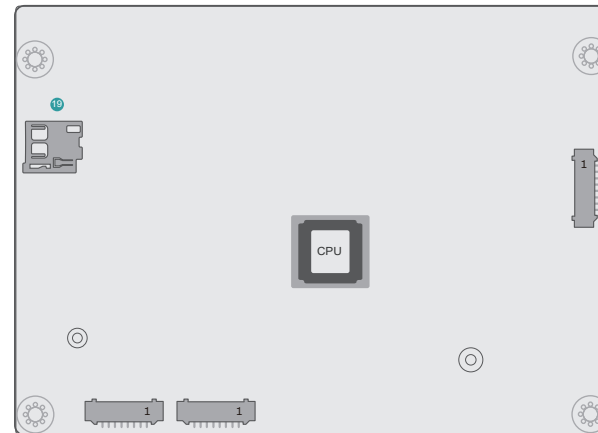
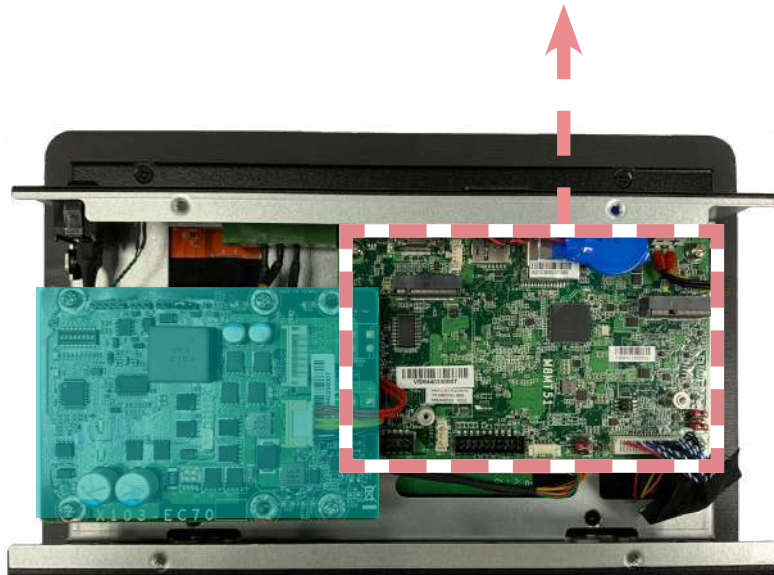
System Board



- 1 USB2\_4
- 2 HDMI
- 3 Battery
- 4 Power Link
- 5 SIM Slot
- 6 LAN
- 7 USB3.0
- 8 DC-IN
- 9 Audio
- 10 DIO
- 11 Speaker
- 12 USB2\_3
- 13 VP IO
- 14 COM1 Debug
- 15 Boot CFG
- 16 LVDS
- 17 I2C
- 18 LED Backlight

System Board - uSD Card Slot

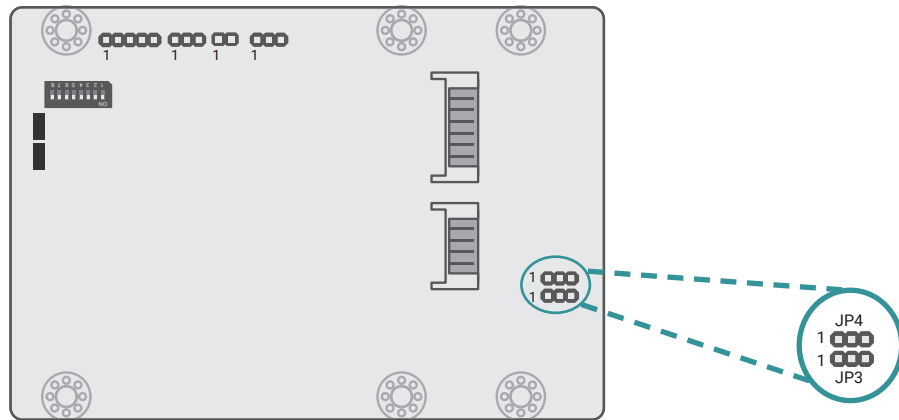
System Board



19 uSD Card Slot

► **Jumper Settings- Power Board**

Host Bus Communication (JP3, JP4)



■ 1-2 On: Reserved



■ 2-3 On: TX/RX UART (default)

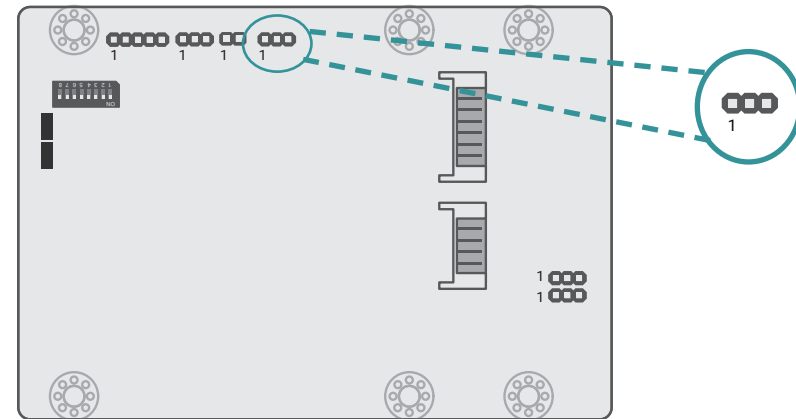


■ 1-2 On: High Active (default)

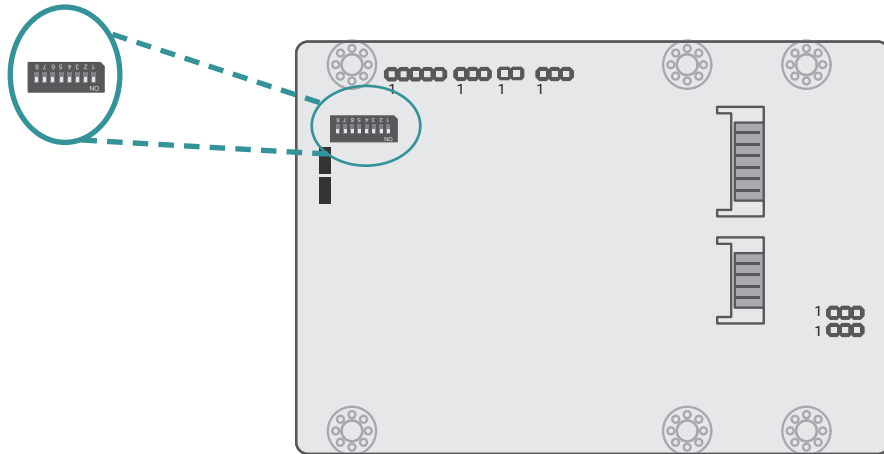


■ 2-3 On: Low Active

Remote Switch High/Low Active (JP2)



SW1

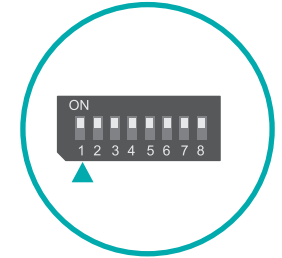


24V / 12V Select

1 Output Voltage

On 12V (default)

Off 24V

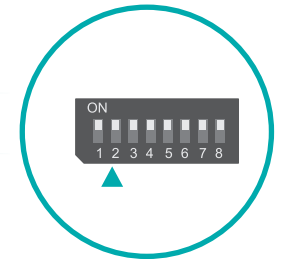


POWER ON Delay Switch

2 Delay On/Off

On On, delay duration defined by 4 and 5

Off Off, delay = 3 seconds by default

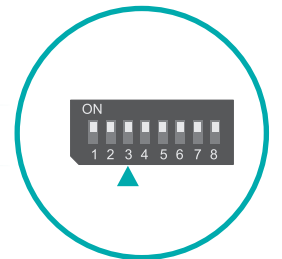


POWER OFF Delay Switch

3 Delay On/Off

On On, delay duration defined by 6, 7, and 8

Off Off, delay = 0 second by default

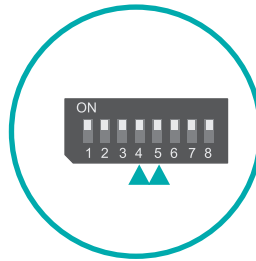


**Important:**  
Power-off the system and then unplug the power cord prior to setting the switches. Failure to do so will cause severe damage to the system and components.



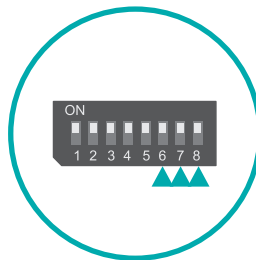
### POWER ON Delay Time Select

5	4	Delay Duration
On	On	10 seconds (default)
On	Off	30 seconds
Off	On	1 minute
Off	Off	5 minutes



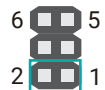
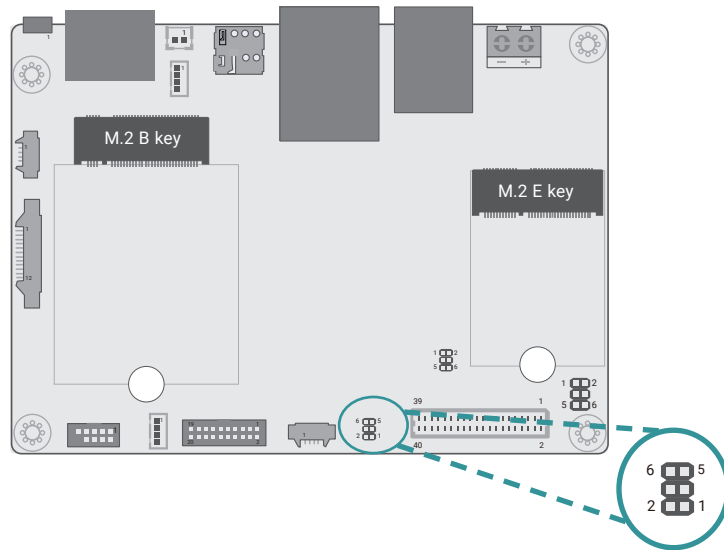
### POWER OFF Delay Time Select

8	7	6	Delay Duration
On	On	On	30 seconds (default)
On	On	Off	1 minute
On	Off	On	3 minutes
On	Off	Off	5 minutes
Off	On	On	10 minutes
Off	On	Off	15 minutes
Off	Off	On	30 minutes
Off	Off	Off	1 hour

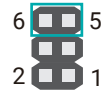


► **Jumper Settings- System Board**

Boot Config (JP1)

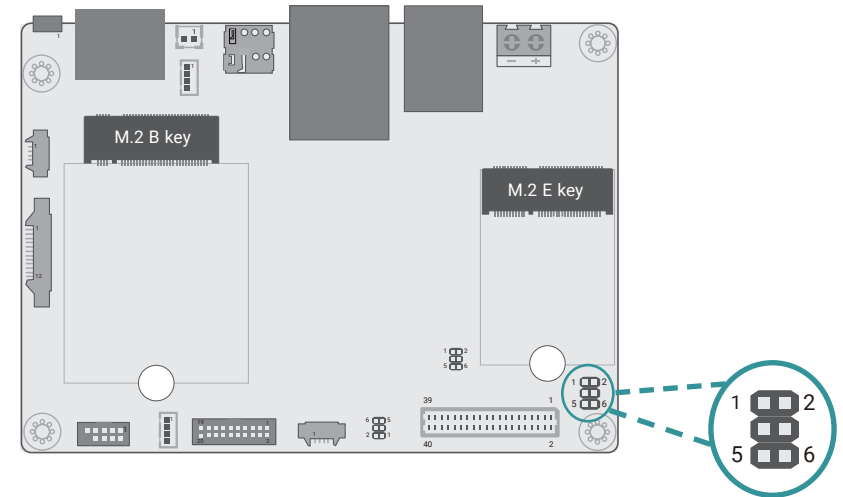


- 1-2 Off: Internal Boot (default)
- 1-2 On: Serial Downloader

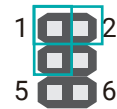


- 5-6 Off: EMMC@eSDHC3 (default)
- 5-6 On: uSD@eSDHC2

LED Backlight (JP5)

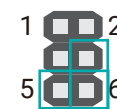


For VEN & VPWM



- 1-2 On: 3.3V (Default)
- 1-3 On: 5V

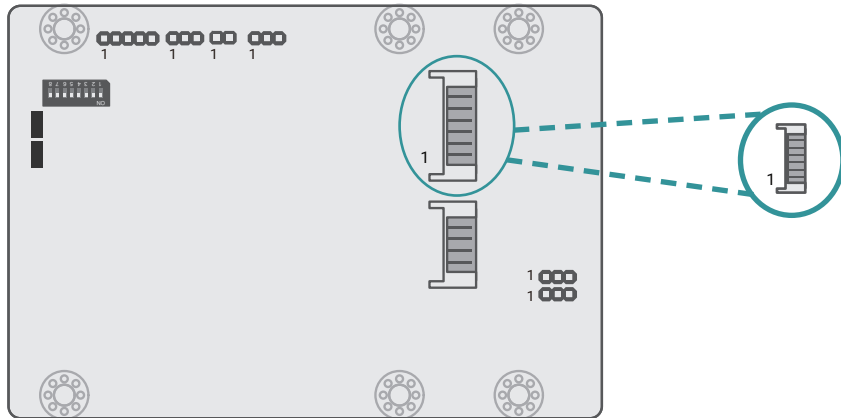
For VLED Backlight



- 5-6 On: Backlight Power 12V (default)
- 4-6 On: Backlight Power 5V

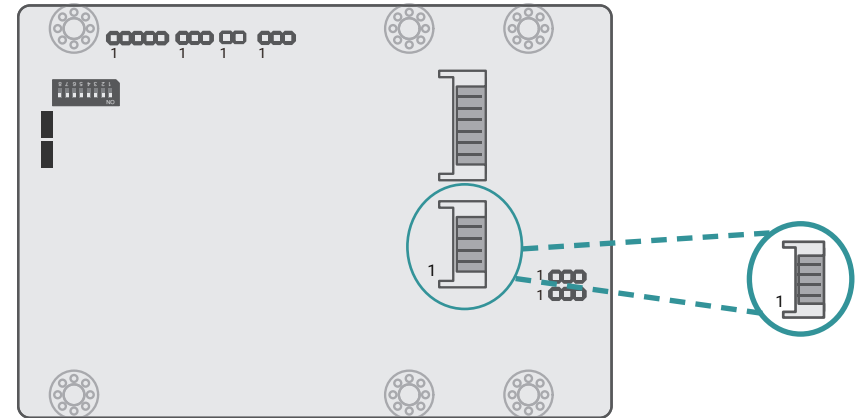
► Pin Assignment- Power Board

12V DC-Out (CN3)



Pin	Assignment
1	GND
2	GND
3	Power Button
4	Host TX
5	Host RX
6	12VSB
7	12VSB
8	12VSB

9V~36V In (J1)



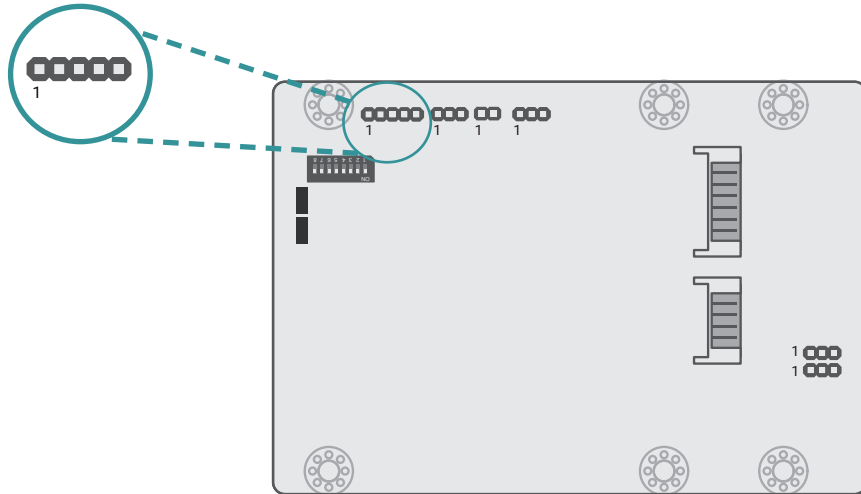
Pin	Assignment
1	V_In
2	V_In
3	Ignition
4	Ignition
5	GND
6	GND

The 9V~36V In box headers are for ignition and power input to the power board, which then converts to 12VDC for output to the system board.

**Jumper Settings**

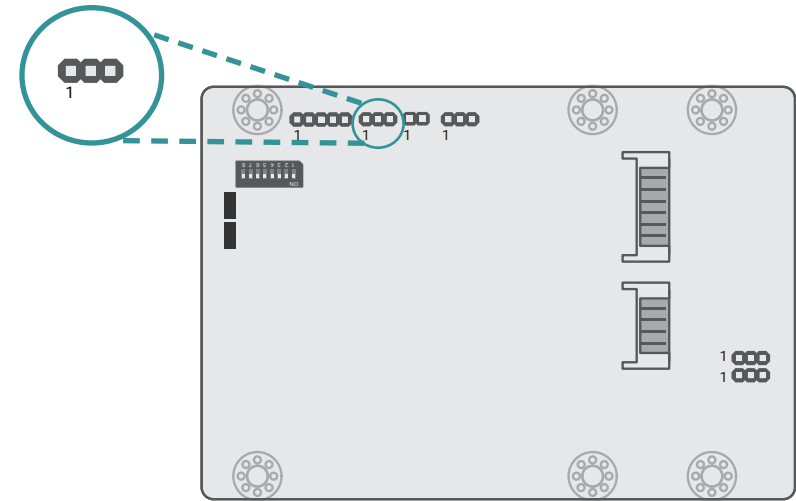
Power on/off, delay time, and other power related aspects can be configured via SW1 as previously instructed in this chapter.

MCU Connector (J2)



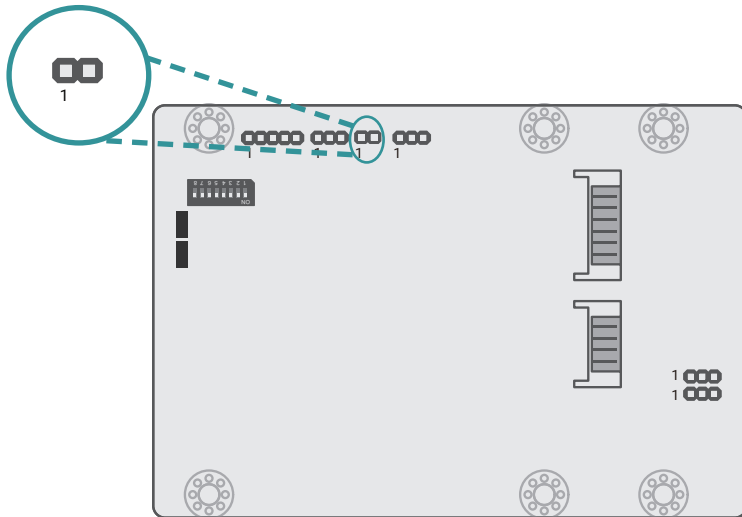
Pin	Assignment
1	3V
2	GND
3	SYS_SWDIO
4	SYS_SWCLK
5	STMCU_RST#

MCU Debug (JP1)



Pin	Assignment
1	UART_TX
2	UART_RX
3	GND

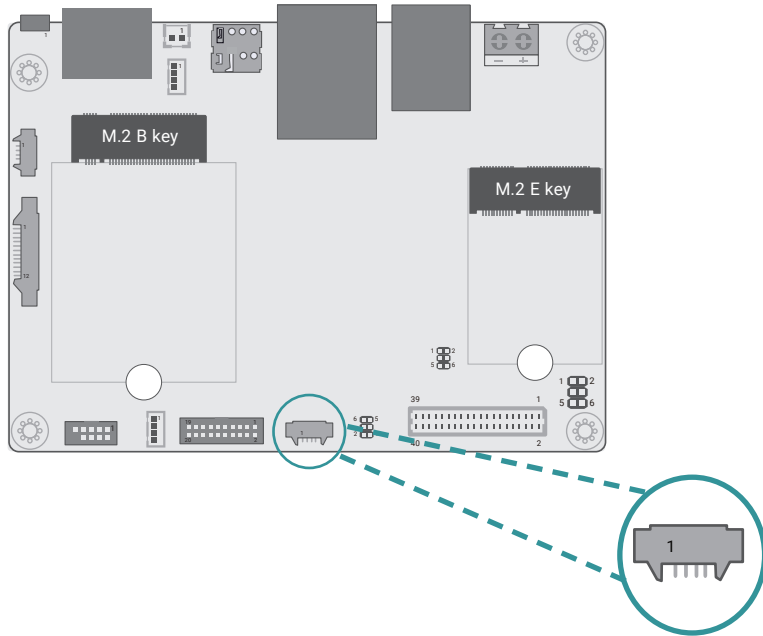
Remote Switch (J3)



Pin	Assignment
1	Power Button
2	GND

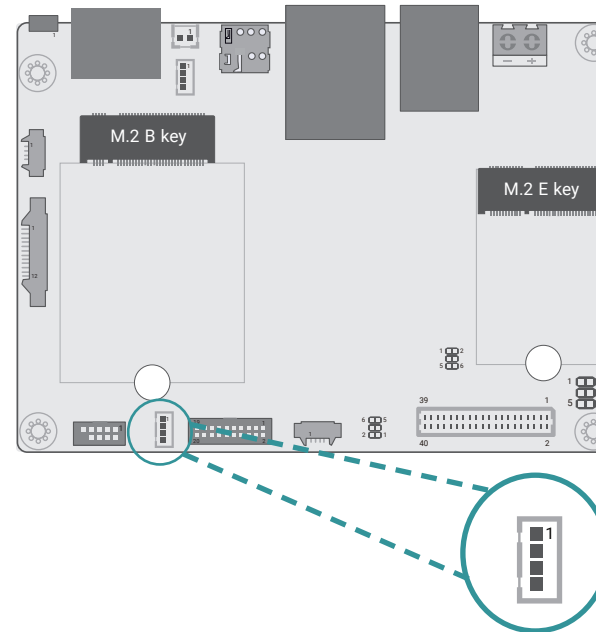
► **Pin Assignment- System Board**

COM1 Debug (J10)



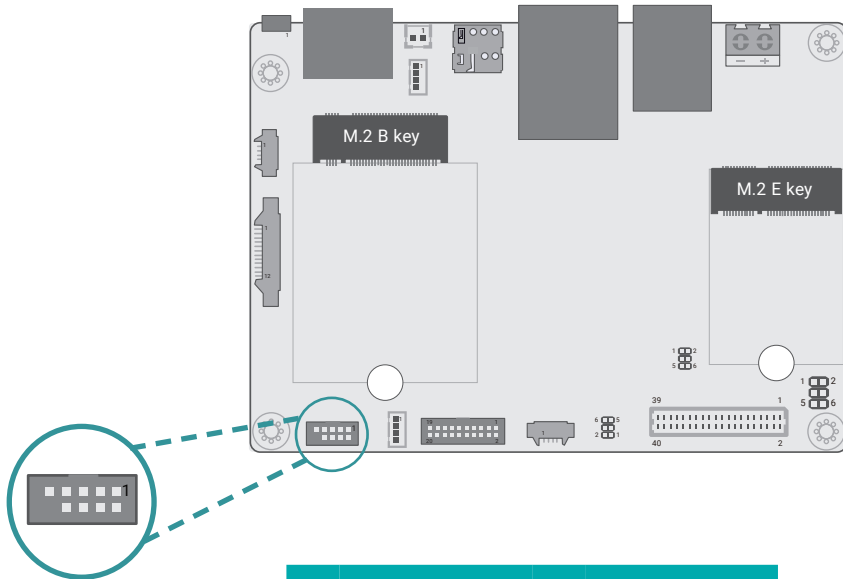
Pin	Assignment
1	+3.3V
2	UART1_RX
3	UART1_TX
4	GND

USB2\_3 (UBJ1)



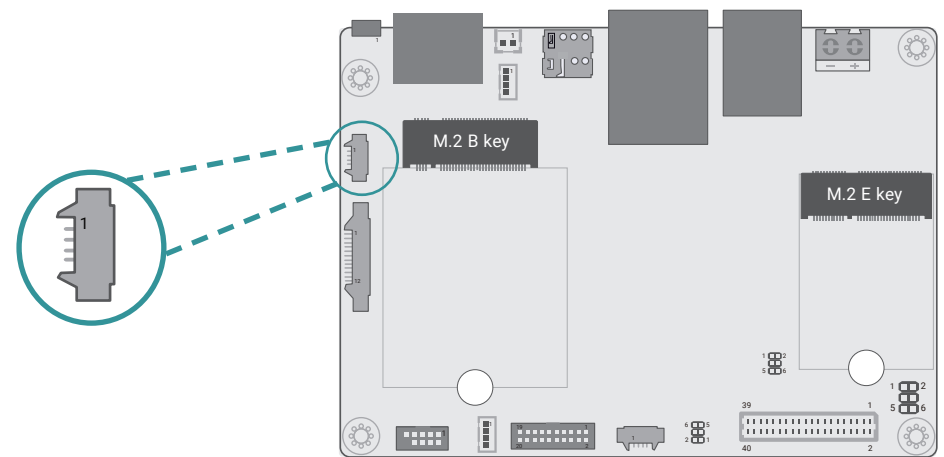
Pin	Assignment
1	+5V
2	USBDN
3	USBDP
4	GND

Speaker (AUJ1)



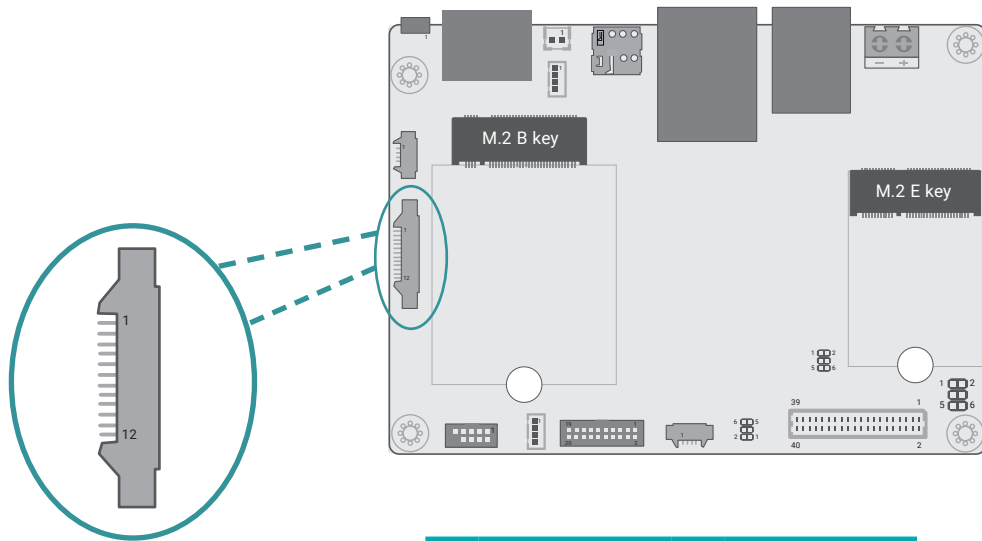
Pin	Assignment	Pin	Assignment
1	NC	2	SPK_R-
3	NC	4	SPK_R+
5	NC	6	SPK_L+
7	NC	8	SPK_L-
9	NC		

Audio (AUJ2)



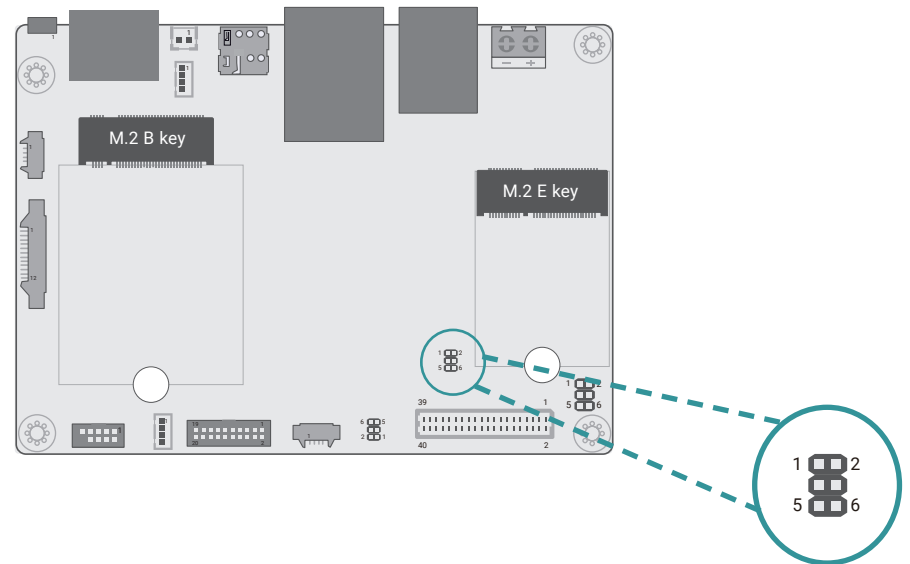
Pin	Assignment
1	LOUT_L
2	LOUT_R
3	AGND
4	MIC_IN

DIO (IOJ1)



Pin	Assignment	Pin	Assignment
1	DIO0	2	DIO1
3	DIO2	4	DIO3
5	DIO4	6	DIO5
7	DIO6	8	DIO7
9	+5V	10	PWM
11	GND	12	GND

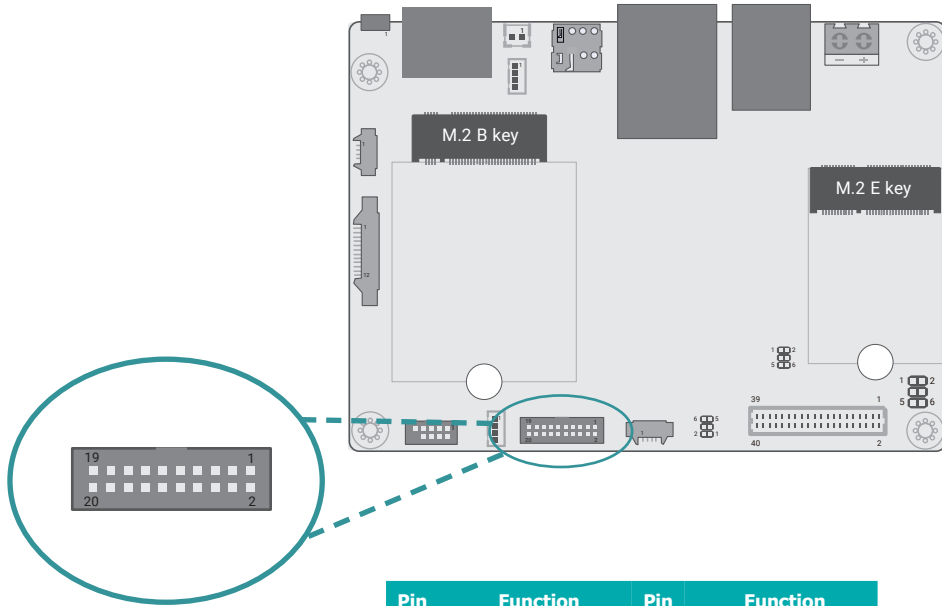
I2C (J8)



Pin	Assignment	Pin	Assignment
1	+3.3V_TP	2	GND
3	TP_SCL	4	TP_ALT#
5	TP_SDA	6	TP_RST#

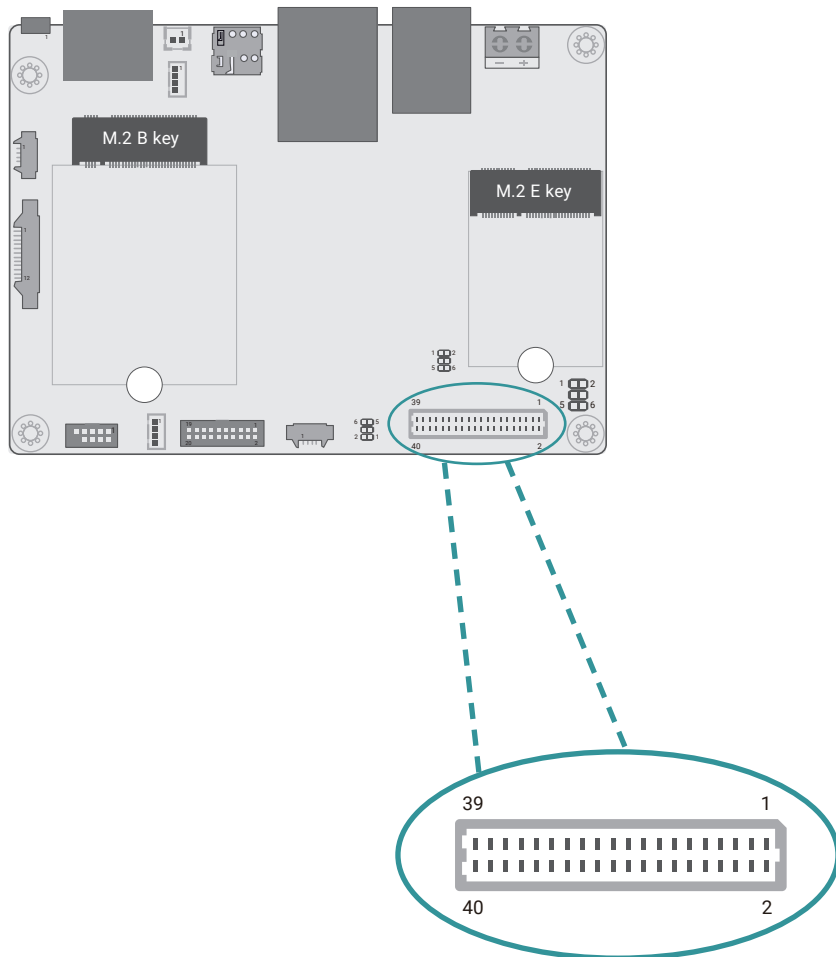


VP IO (VPJ1)



Pin	Function	Pin	Function
1	+5V	2	CAN_GND
3	SOUTN3	4	CAN_H
5	LVDS_A2+	6	CAN_L
7	SINN3	8	UR1_TX_232
9	SINN4	10	UR1_RX_232
11	SOUTN4	12	RTSN2
13	DTRN4	14	CTSN2
15	RTSN4	16	SOUTN2
17	CTSN4	18	SINN2
19	GND	20	GND

LVDS (J11)



Pin	Function	Pin	Function
1	GND	2	GND
3	LVDS_A2-	4	LVDS_B3+
5	LVDS_A2+	6	LVDS_B3-
7	GND	8	GND
9	LVDS_A3-	10	LVDS_B2+
11	LVDS_A3+	12	LVDS_B2-
13	GND	14	GND
15	LVDS_A0-	16	LVDS_B1+
17	LVDS_A0+	18	LVDS_B1-
19	GND	20	GND
21	LVDS_A1-	22	LVDS_B0+
23	LVDS_A1+	24	LVDS_B0-
25	GND	26	GND
27	LVDS_A_CLK-	28	LVDS_B_CLK-
29	LVDS_A_CLK+	30	LVDS_B_CLK+
31	GND	32	GND
33	GND	34	GND
35	+VDD_3.3V	36	+VDD_5V
37	+VDD_3.3V	38	+VDD_5V
39	+VDD_3.3V	40	+VDD_5V