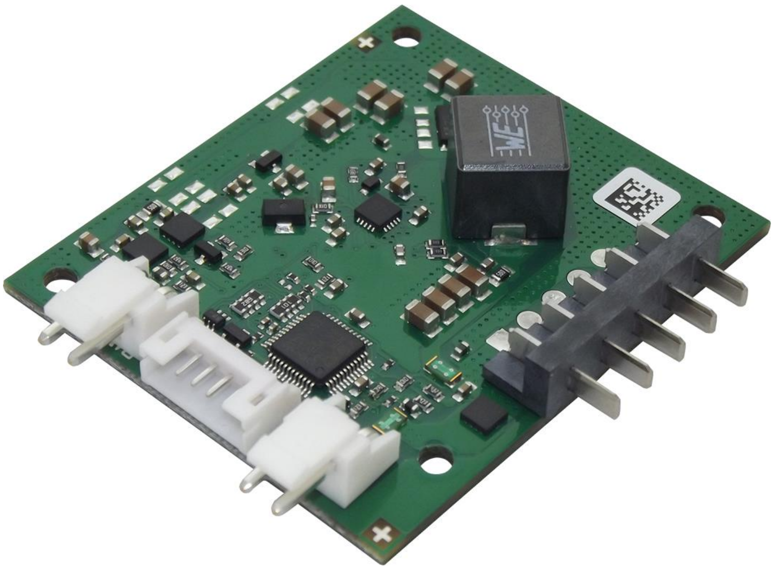
RRC-PMM240

Power Management Module
for Mobile Applications
P/N:100576



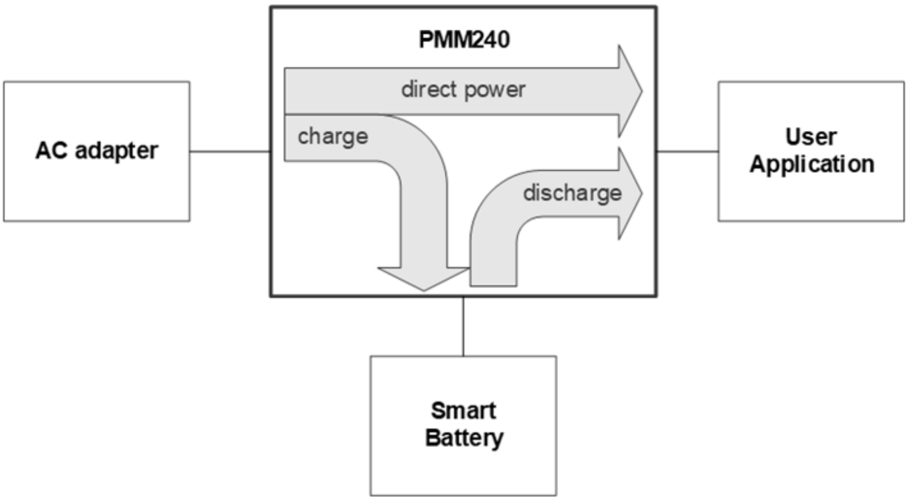
1. Features

- Automatic Selection of Power Source: Either AC Adapter or Smart Battery
- Turbo Mode: AC Adapter and Battery can Provide Power Together
- Mates with standard smart batteries, RRC20xx-series
- Up to 240 W Output Power
- Up to 82 W Charging Power
- Wide Input Voltage Range: 7.5 V to 24.0 V
- Charge Voltage up to 19.2 V
- Charge Current up to 6.2 A
- Programmable Input Current and Charge Current Limit
- 2x Status Signals show AC Adapter & Battery Status
- Soft Start
- SMBus Passthrough to Application

2. Applications

- Power Management & Smart Battery Charging
- Industrial and Medical Equipment
- Portable Equipment
- Uninterruptible Power Supply

3. Overview



The PMM240 is a high-efficiency battery charger for smart batteries. It considers the battery's temperature- and lifetime-adjusted parameters for charging current and voltage and automatically adjusts those as per the JEITA standard.

With an AC adapter connected, the PMM240 charges a battery and powers the user application simultaneously. After the AC adapter is disconnected, the battery discharges through the PMM240 to power the user application.

The PMM240 features dynamic power management to limit the input power and avoid AC adapter overloading. As the system power use increases during battery charging, the charging current gets reduced to maintain the total input current below the adapter rating.

The PMM240 also features "turbo boost": The battery can supply power to the user application together with the AC adapter. Thus, it is possible to supply more power than the AC adapter alone could deliver.

The User Application can communicate with the PMM240 and the battery via SMBus. Also, two 3.3 V compatible GPIO pins indicate battery, AC adapter, and error status.

Upon first use, please follow the instructions in the PMM240 Application Note, chapter 2 "Getting started with the PMM240". You can find the Application note at https://www.rrc-ps.com/pmm240-calculator, or ask your local salesperson for it.

4. Table of Contents

5. Pin Configuration and Functions

Figure 1 shows connector locations and pin-1-orientation of the DC input, DC output, and User Interface (UI) connectors.

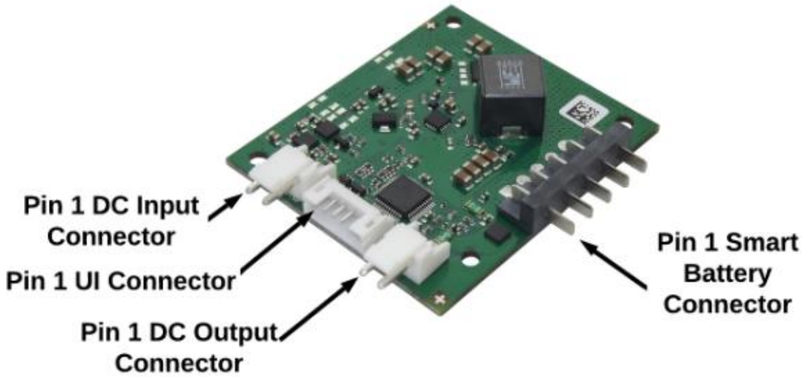


Figure 1 – Connectors sequence of PMM240

You can find part numbers of the connectors in section 12.3 on page 18.

Connector	Description	
DC Input	Connect to AC Adapter using a JST VHR-2N mating connector or compatible. Reverse polarity protected.	
	Pin 1: + Pin 2: -	
DC Output	Delivers power to the User Application. Connect using a JST VHR-2N mating connector or compatible.	
	Pin 1: + Pin 2: -	
Smart Battery	Connect to Smart Battery. Do *not* reverse the polarity.	
	Pin 1: Bat (+)	Positive voltage pin.
	Pin 2: SMBus Clock (SCL)	Clock connection for SMBus.
	Pin 3: SMBus Data (SDA)	Data connection for SMBus.
	Pin 4: ID (T) Identifier	Recognizes Smart Battery if a resistance of 300 Ω +/- 5% is detected.
	Pin 5: Bat (-)	Ground voltage pin.
User Interface (UI)	Exchange information between the User Application, the PMM240, and the battery. Connect to User Application using JST PHR-6 mating connector or compatible.	
	Pin 1: SMBus VCC	Input Pin; connect to 5 V if you have 5 V SMBus communication. Don't connect for standard 3.3 V SMBus communication.
	Pin 2: SMBus SDA	SMBus data I/O. Connect to SMBus data line from User Application[1].
	Pin 3: SMBus SCL	SMBus clock I/O. Connect to SMBus clock line from User Application[1].
	Pin 4: GPIO1	Battery charge status and battery error. For details, see section 7.3.
	Pin 5: GPIO2	AC Adapter present and charger error. For details, see section 7.3.
	Pin 6: GND	Ground voltage pin.

[1] Don't connect a pullup resistor, or you need to add an SMBus isolator (e. g. ISO1540) between the User Application and the PMM240.
Make sure that the User Application SMBus lines are configured open drain.

6. Specifications

6.1. Absolute Maximum Ratings

Stresses beyond those listed below may cause permanent damage to the device. These are stress ratings only, which do not imply the device's functional operation at these or any other conditions beyond those indicated under *Recommended Operation Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

All voltages are with respect to their corresponding (-) Pin or GND, respectively.

	Description	Min	Max	Unit
Voltage	DC Input +	-0.3	30.0	V
	BAT + or V_{BAT}	-0.5	30.0	
	SMBus Clock SCL	-0.3	6.4	
	SMBus Data SDA	-0.3	6.4	
	ID (T)	-0.3	7.5	
	SMBus VCC	-25.0	26.5	
	GPIO 1	-0.3	7.0	
	GPIO 2	-0.3	7.0	
Current	DC Input (fuse protected at 12 A)		12	A
	Battery Current (fuse protected at 10 A)		10	
	GPIO output	-5	25	mA
Storage Temperature		-25	85	°C
Operating Temperature		-25	60	°C

6.2. Lifetime

	Description	Max	Unit
MTTF	Mean Time To Failure, operating conditions: 5 h charge and 19 h standby or discharge time per day @ 25°C	$5.2 \cdot 10^6$	hours

6.3. Recommended Operating Conditions

All voltages are with respect to their corresponding (-) Pin or GND, respectively.

	Description	Min	Max	Unit
Voltage	[2]DC Input +	V_{BAT} + 1	24	V
	SMBus Clock SCL	2.6	5.5	
	SMBus Data SDA	2.6	5.5	
	SMBus VCC	0	5.5	
Current	GPIO output	0	2.5	mA
Storage Temperature		-20	60	°C
Operating Temperature		-20	60	°C
Relative Humidity, non-condensing		5	95	%
Ambient Pressure		500	1070	hPa
Altitude		-/-	5000	m

[2] DC Input must be at least 16 V for Turbo Boost Mode support. V_{BAT} is the battery voltage.

6.4. Electrical Characteristics

7,5 ≤ V_{PSU} ≤ 24 V, -20 °C ≤ T_A ≤ 60 °C, typical values are at T_A = 25 °C, with respect to GND (unless otherwise noted)

Parameter	Description	Min	Typ	Max	Unit
Operating Conditions					
V_{PSU}	AC adapter voltage	7.5		24	V
Standby Current					
I_{SBY}	Battery connected, nothing else		1		mA
Charge Voltage					
Range		1.024		18	V
Accuracy	Charge voltage 16.8 V	-0.5		0.5	%
	Charge voltage 8.4 V	-0.6		0.6	
	Charge voltage 4.192 V	-0.7		0.7	
Charge Current & Charge Current Limit					
Default Value			4096		mA
Range		256		6200	mA
Step Width		128		148	mA
Accuracy	Charge current 0.256 A	-50		50	%
	Charge current 0.512 A	-33		33	
	Charge current 1.024 A	-20		20	
	Charge current 4.048 A	-5		5	
	Charge current 6.196 A	-4		4	
Input Current Limit (*)					
Default Value			8064		mA
Range		0		10000	mA
Step width		256		296	mA
Accuracy	Input current 1.024 A	-25		25	%
	Input current 2.048 A	-15		15	
	Input current 4.048 A	-5		5	
	Input current 8.192 A	-3		3	
Logic Outputs					
Voltage	GPIO 1 and 2, logic low @ 0 mA		0		V
	GPIO 1 and 2, logic low @ 10 mA		0.7		
	GPIO 1 and 2, logic high @ 0 mA		3.3		
	GPIO 1 and 2, logic high @ 10 mA		2.5		
Current	Output current	0		10	mA
SMBus					
Voltage	Input Low Voltage	-0.3	0	0.95	V
	Input High Voltage	2.4	3.0	5.5	
	Output Low Voltage	0,04	0,06	0,09	
	Output High Voltage	2.85	3.0	3.15	
	Output High Voltage if SMBus VCC > 3.3 V		SMBus VCC – 0.3 V		
Internal Soft Start					
I_{STEP}	Soft start current step		128		mA

(*) Input Current Limit does not limit the current flowing into the User Application. Refer to section 7.2.5 for details.

6.5. Timing

Parameter	Description	Min	Typ	Max	Unit
Overcurrent Protection					
t_{OCP}	Time until PMM240 switches off	2.3	4.2	6.6	ms
Internal Soft Start					
t_{STEP}	Soft start current step time		240		µs
Output voltage transition					
$t_{out,AC-BAT}$	Transition time from AC to battery		8		ms
SMBus Timing					
f_{SMBus}	Clock frequency	10		100	kHz
$t_{W(H)}$	SCL pulse width high	4.0		50	µs
$t_{W(L)}$	SCL pulse width low	4.7			µs
$t_{SU(START)}$	Setup time for START condition	4.7			µs
$t_{H(START)}$	START condition hold time after which first clock pulse is generated	4.0			µs
$t_{SU(STOP)}$	Setup time for STOP condition	4.0			µs
t_{BUF}	Bus free time between START and STOP condition	4.7			µs
$t_{timeout}$	SMBus release time-out (*)	25		35	ms

(*) Devices participating in a transfer will time out when any clock low exceeds the 25-ms minimum time-out period. Devices that have detected a time-out condition must reset the communication no later than the 35-ms maximum time-out period. Both a master and a slave must adhere to the maximum value specified, as it incorporates the cumulative stretch limit for both master (10 ms) and a slave (25 ms).

6.6. Typical Characteristics

6.6.1. Charge Power

The PMM240 is continuously monitoring its temperature. As shown in Figure 2, the PMM240 reduces its charge power if the board surface temperature rises beyond 85 °C. Figure 3 shows a typical charge power derating curve with a 3SxP battery at two different input voltages (24 V and 14 V) when operating at different ambient temperatures.

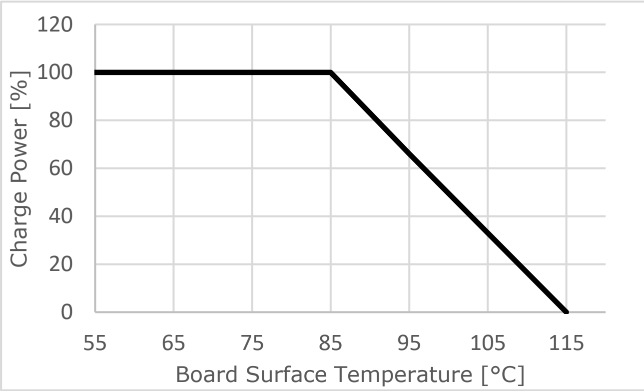


Figure 2 – Charge power derating

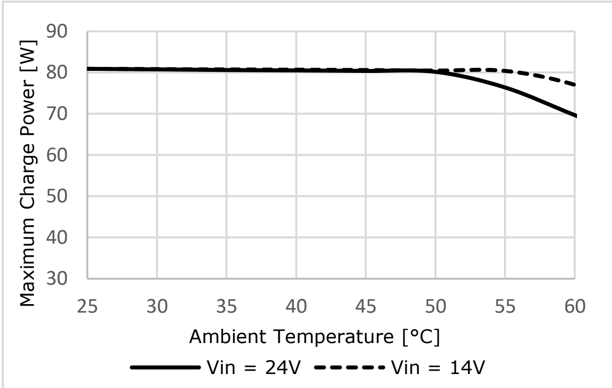


Figure 3 – Derating of charge power with 3SxP smart battery

6.6.2. Transition from AC to Battery

Upon disconnection of the AC adapter, the battery takes over. Figure 4 shows a typical transition of the PMM240 output voltage: For a short moment (6 to 10 ms typ.), the output voltage falls to about one diode forward voltage drop below the battery voltage before the output voltage rises to the battery voltage.

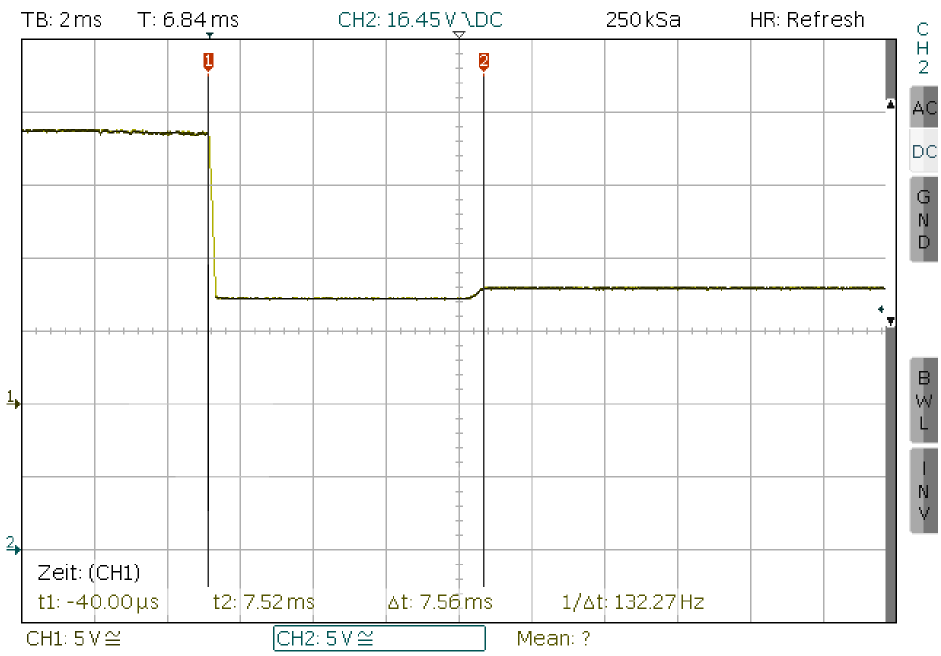


Figure 4 - PMM240 output voltage during a typical transition from AC to the battery.

7. Detailed Description

7.1. Functional Block Diagram

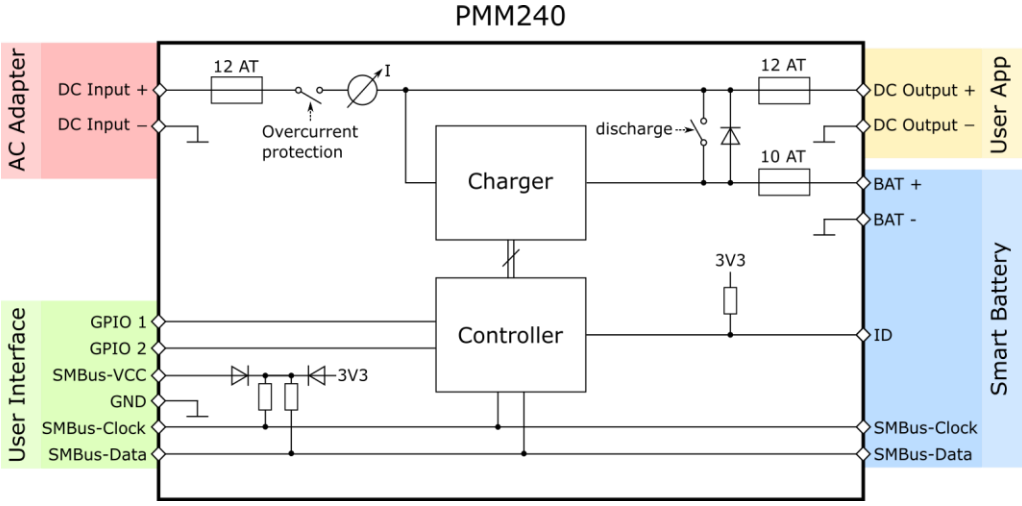


Figure 5 – Functional Block diagram

7.2. Feature Description

7.2.1. Battery Detection

The PMM240 automatically detects a smart battery. If the battery is deep-discharged or in shipping mode, the PMM240 provides wake-up charge.

7.2.2. Smart Charging

The PMM240 considers the battery's temperature- and lifetime-adjusted parameters for charging current and voltage and automatically adjusts those as per the JEITA standard. Therefore, it exchanges information with the battery via SMBus.

7.2.3. Automatic Switching between AC Adapter and Battery

The PMM240 switches automatically between battery and AC adapter. Approximately 150 ms after an AC adapter is detected, the system power source switches from battery to adapter. The PMM240 limits the inrush current from the AC adapter.

Upon removal of the AC adapter, the battery takes over immediately. Thus, the User Application stays powered. Because of a diode in the power path, the voltage drops to about V_{BAT} – 0.7 V. Only after a transition time of some milliseconds, a FET is turned on, and the DC output voltage corresponds to V_{BAT} (see section 6.6.2).

7.2.4. Automatic Soft-Start of the Charger Current

The PMM240 softly starts charging: The charge current starts at 256 mA, and the step size is 128 mA. Each step lasts around 240 µs until it reaches the programmed charge current limit.

7.2.5. Input Current Limit

The PMM240 features dynamic power management to limit the input power and avoid AC adapter overloading. While charging the battery, as the User Application's power needs increase, the charging current automatically reduces to maintain the total input current below the adapter rating. With the input current limit feature, the AC adapter output current requirements can be lowered, reducing system cost.

Note: The settings of the smart battery still determine the charging current. The Input Current Limit just serves to reduce the charging current if necessary.

If the AC adapter is overloaded, both the AC adapter and the PMM240 can be damaged. Thus, checking the "Input Current Limit" setting is *mandatory* before connecting a battery to the system.

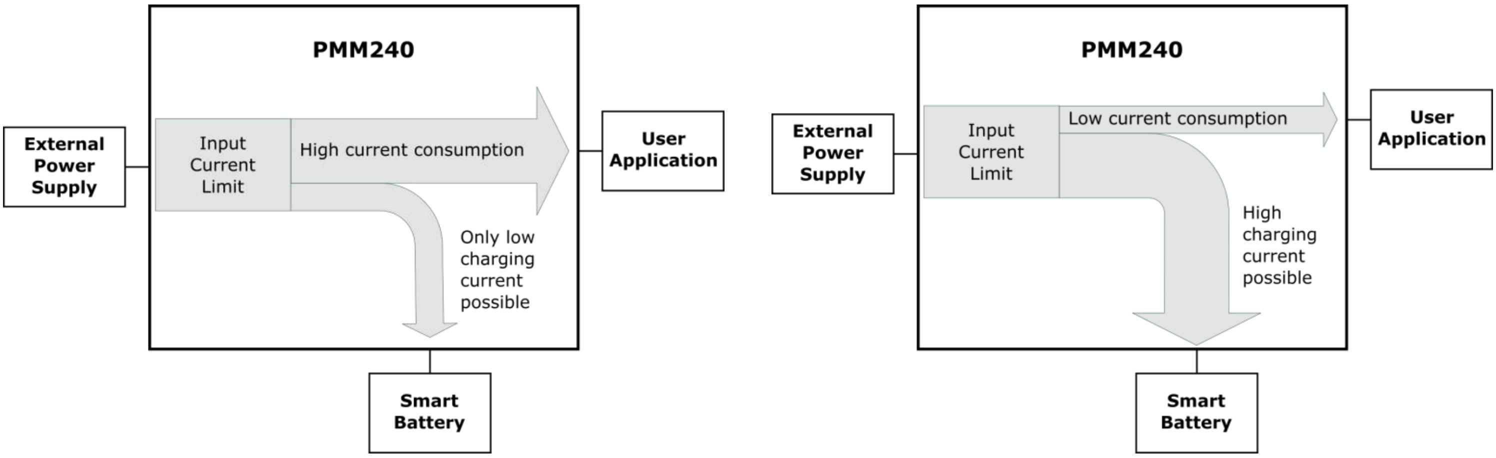


Figure 6 – The Input Current Setting adjusts the charging current depending on the User Application current consumption.

Note: The Input Current Limit does *not* limit the current passing into the User Application. It only adjusts the charging current. This means:

- The Power Supply should provide enough current to supply the User Application in all working conditions.
- That current shall not surpass 12 A, as the PMM240 is fuse protected with a slow 12 A fuse.
- If the User Application's current demand exceeds the Input Current Limit, additional current may be supplied via Turbo Mode (see section 7.2.7 for details). Yet, the current shall not surpass 12 A because of the fuse.

7.2.6. Charge Current Limit

Similar to the Input Current Limit, the charge current can also be limited to a maximum value. This may be useful if the charging time is not crucial, and the user prefers to charge the battery more slowly, thus reducing thermal stress.

7.2.7. Turbo Boost

Turbo Boost mode is activated if an external power supply with more than 16 V is connected to the PMM240 and if the battery is at least partially charged. In this mode, whenever the current demand by the application is higher than what the external power supply can deliver, the battery is discharged to the User Application simultaneously. This will protect the adapter from overloading. Please note that the PMM240 is fuse protected at 12 A – a higher load may permanently damage the PMM240.

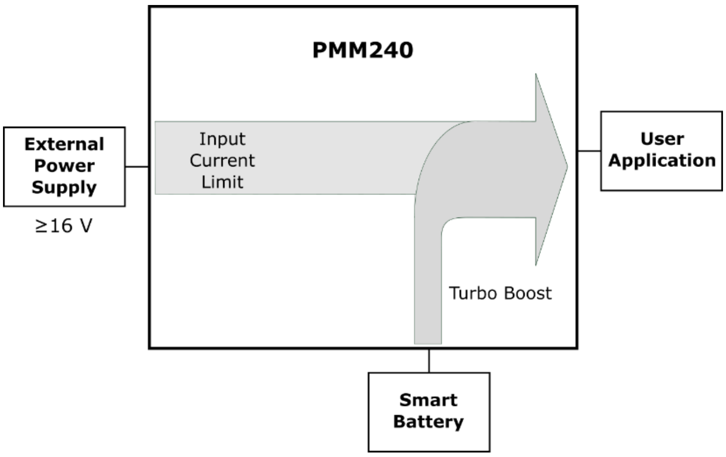


Figure 7 – Turbo Boost discharges battery into the application if the external power supply alone cannot cover the power demand.

During Turbo Boost mode, the AC adapter current is regulated at the input current limit level so that the adapter does not get overloaded. Due to the high current, the MOSFETs on the PMM240 heat up. If their temperature reaches 100°C, an alarm bit is set (see Table 4 in section 7.4.3). If this bit is set and the temperature does not decrease below 100°C within the next 30 s, the Turbo Boost Mode will switch off.

7.3. Status Information via GPIO

Two GPIO lines give status information. They can be used to drive status LEDs directly; in that case, the current should be limited to 10 mA using suitable series resistors. For more information, refer to the PMM240 application note.

GPIO1 status	Signification
Slow blinking (0.5 Hz)	Battery charging
high	Battery is fully charged
Fast blinking (2.5 Hz)	Battery error
low	No battery connected or detected, or Power Supply Voltage too low, or No Power Supply connected.

GPIO2 status	Signification
high	Power supply is present
Fast blinking (2.5 Hz)	Charger error
low	No Power supply connected

Table 1 – GPIO status definition

7.4. SMBus Communication Interface

The PMM240 communicates with the battery and the User Application via System Management Bus (SMBus). The following specifications are adopted:

- [SMBS] System Management Bus Specification (Rev 1.1, Dec 11, 1998)
- [SMDS] Smart Battery Data Specification (Rev 1.1, Dec 15, 1998)
- [SMCS] Smart battery Charger Specification (Rev 1.0, June 27, 1996)

No device other than the PMM240, the battery and the host microcontroller may share the bus. The PMM240 includes pull-up resistors (see Figure 5). The User Application cannot have additional pull-up resistors on these lines. If the User Application has pull-ups, remove them or add an SMBus Isolator (e. g. ISO1540) between the User Application and the PMM240.

The PMM240 is a level 3 charger; it can act as an SMBus master and actively poll the battery for charging parameters.

7.4.1. Sending a command

The PMM240 listens to I2C commands over the SMBus interface. Figure 8 shows the command structure; Table 2 shows details which are explained in more detail below.

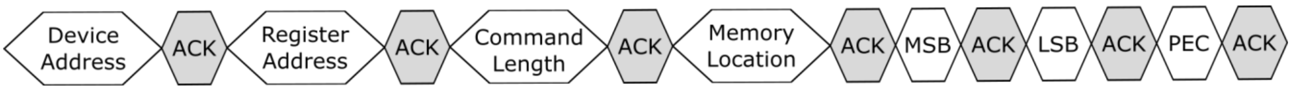


Figure 8 - An overview of the structure of the user commands

Byte	Description	Values
1: Device address	SMBus Charger Address	0x20 or 0x21 (see Table 3)
2: Register address	Command	See Table 4
3: Command length	Command Length in Bytes	0x03
4: Memory location	Store in RAM Store in EEPROM	0x00 0x01
5: MSB	Most Significant Byte	
6: LSB	Least Significant Byte	
7: PEC	CRC-8 over the leading 6 bytes, including address	

Table 2 – Configuration of user commands

7.4.2. SMBus Device Addresses

Table 3 shows the slave addresses of the different bus participants. To send a write or a read command, that 7-bit device address must be shifted to the left. The last, 8th bit declares a read or write.

Please note that the PMM240 does not share the same address with other smart battery chargers.

Description	7-bit Address	Write Address	Read Address
SMBus Host	_000 1000 (0x08)	0001 000**0** (0x10)	0001 000**1** (0x11)
Standard Smart Battery Charger	_000 1001 (0x09)	0001 001**0** (0x12)	0001 001**1** (0x13)
PMM240	_001 0000 (0x10)	0010 000**0** (0x20)	0010 000**1** (0x21)
Smart Battery	_000 1011 (0x0B)	0001 011**0** (0x16)	0001 011**1** (0x17)

Table 3 – SMBus device addresses

7.4.3. PMM240 Register Addresses

The PMM240 can be configured by the User Application using the following registers:

Function	Com-mand	Direction	Description	Value Range	Default
Charge Current Limit	0x3c	Write	16 bit value in mA	256 to 6,200 mA	4,096 mA
Input Current Limit	0x3d	Write	16 bit value in mA	0 to 10,000 mA	8,064 mA
Turbo Boost Status	0x3e	Read	Bit 0: Turbo Boost available Bit 1: Turbo Boost Alert: It is set if the temperature is >100°C. Then, Turbo Boost will be switched off within 30 s.	0 or 1	0

Table 4 – PMM240 register maps

The Current Limit values are given in milliampere (mA). The most significant byte is sent first, as shown in Figure 8.

"Input Current Limit" and "Charge Current Limit" are write-only registers. To verify your configuration, you need to measure the current under different load situations. For an example of setting the Input Current Limit, including the measurement needed to verify the setting, refer to the PMM240 Application Note, section "Getting started".

7.4.4. Command Length

The command length for setting the Current Limit is always 3 bytes (memory location + MSB + LSB).

7.4.5. Memory Location

Upon writing a command into the RAM, the Current Limit is applied directly. However, after a reboot, the RAM content is replaced by the EEPROM content.

Therefore, if you want to use the Current Limit after each reboot, write the corresponding command into the EEPROM. Note that in that case, the Current Limit won't be applied directly, but only after rebooting the PMM240.

7.4.6. Checksum (PEC)

The last byte of each command is a Packet Error Checking (PEC) byte. It corresponds to the CRC-8 checksum over the leading 6 bytes of the same command. The polynomial used is $x^8 + x^2 + x + 1$ (= 0x107, which is the standard polynomial used for CRC-8).

Further information on calculating the checksum is available in the PMM240 Application Note, or use the PMM240 calculator on our website https://www.rrc-ps.com/pmm240-calculator.

7.4.7. Reading the Turbo Boost Status

To read the Turbo Boost Status, first send the command to the PMM240 write address without using a checksum:

Address: 0x20 Data: 0x3E

After a waiting time of approx. 250 ms you can read the response: 3 bytes on the PMM240 read address 0x21. The response consists of: Number of data bytes (always "1"), data ("0" or "1"), and the CRC8 checksum. For example:

Response:

- 0x01 0x00 0x15 (Turbo Boost off)
- 0x01 0x01 0x12 (Turbo Boost on)

7.5. Setting up the PMM240

7.5.1. Connecting the PMM240

1. Ensure that the User Application has no pull-up resistors on the SMB bus lines. If the User Application has pull-ups, remove them or add an SMBus Isolator (e. g. ISO1540) between the User Application and the PMM240.
2. Disconnect the battery (Connect it only at step 6).
3. Connect the PMM240 to an AC Adapter of your choice (refer to section 5 for connection diagram and section 8 for suggested AC adapters).
4. Connect the User Application.
5. Via the User Interface Connector, set the Input Current Limit first before connecting a battery (refer to section 7.5.2). This is necessary to prevent an AC adapter overload, which could damage the PMM240.

   Note that the SMBus VCC pin is an input pin. If your SMBus runs on 5 V logic instead of 3.3 V, connect an external 5 V voltage source to it.
6. After completing steps 1 to 4, then connect the battery.

7.5.2. Setting the Input Current Limit

The purpose of the Input Current Limit is described in section 7.2.5. To set the Input Current Limit, write a 16-bit value to register 0x3c. This value is expressed in mA, ranging from 256 mA to 10,000 mA. The step width depends on calibration values (see section 6.4, Step Width). The given value will always be rounded off to the next smaller possible value. For an example of setting the Input Current Limit, look in the PMM240 Application Note, section 2, "Getting started".

If the input current rises above its limit, the PMM240 reduces the charging current to allow the input current to drop. After a typical 260-µs delay time, the charger shuts down if the input current is still above the limit. When the load current becomes smaller, the charger soft-restarts to continue charging the battery.

7.5.3. Setting the Charge Current Limit

You can limit the charging current to reduce thermal stress on the battery. To set the Charge Current Limit, write a 16-bit value to register 0x3c. This value is expressed in mA, ranging from 256 mA to 6,200 mA. The step width depends on calibration values (see section 6.4). The given value will always be rounded off to the next smaller possible value.

8. Power Supply Recommendations

RRC offers the following AC adapters to work with the PMM240, and they are suited to charge all RRC20xx batteries. "M" devices are certified for medical applications, as well.

Device Name	Part number	Charging Power	Output voltage V_{PSU}	Output Current I_{PSU}
PS65	210919	65 W	19 V	3,42 A
PS65M	211249	65 W	19 V	3,43 A
PS90M	211380	90 W	24 V	3,75 A

Table 5 – AC adapters suited to charge all RRC batteries via a PMM240.

For any other power supply, the output voltage must be in the range of 7.5V – 24V, but at least 1 V higher than the battery's maximum charging voltage. Table 6 lists recommendations for output voltages of different smart batteries.

Battery architecture (ySxP) (y cells in series, x cells in parallel)	Typical DC voltage
2SxP (e.g. RRC2037, RRC2057)	12 V
3SxP (e.g. RRC2020, RRC2040)	15 V
4SxP (e.g. RRC2024, RRC2054)	19 V

Table 6 – Recommended input voltage for different batteries.

For best charger efficiency, prefer smaller DC input voltages. Table 7 shows that the charger efficiency slightly increases with less input voltage.

Efficiency @ DC voltage	RRC2057	RRC2054-2
12 V	95%	—
19 V	93%	97%
24 V	93%	97%

Table 7 – The PMM240 performs slightly more efficiently on lower input voltages.

Better efficiency translates into less temperature increase of the PMM240. Because of its size, the big coil in the middle of the PMM240 PCB has the most significant impact on temperature transfer towards other, nearby installed electronics or housing parts. Figure 9 shows the temperature increase of this coil during charging tests with an RRC2057 at different DC input voltages.

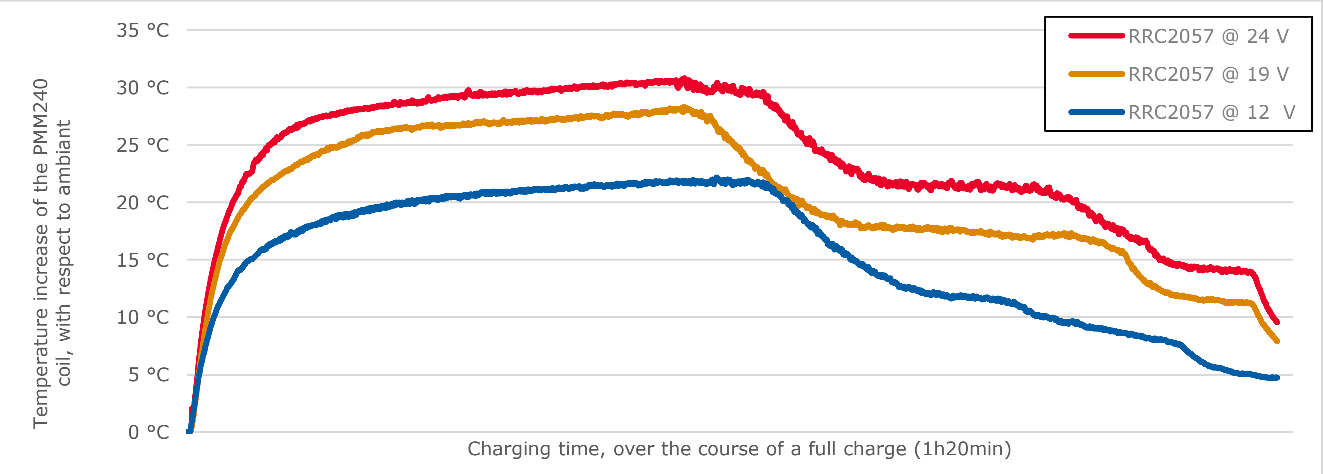


Figure 9 – Temperature increase of PMM240 coil during the charging process, with respect to ambient temperature.

9. EMC

The PMM240 complies with

- EN 60601-1-2:2007 + Corr.1:2010
- EN 55011:2009 + A1:2010

The emissions shown below have been measured with a PMM240 while charging an RRC2057 battery.

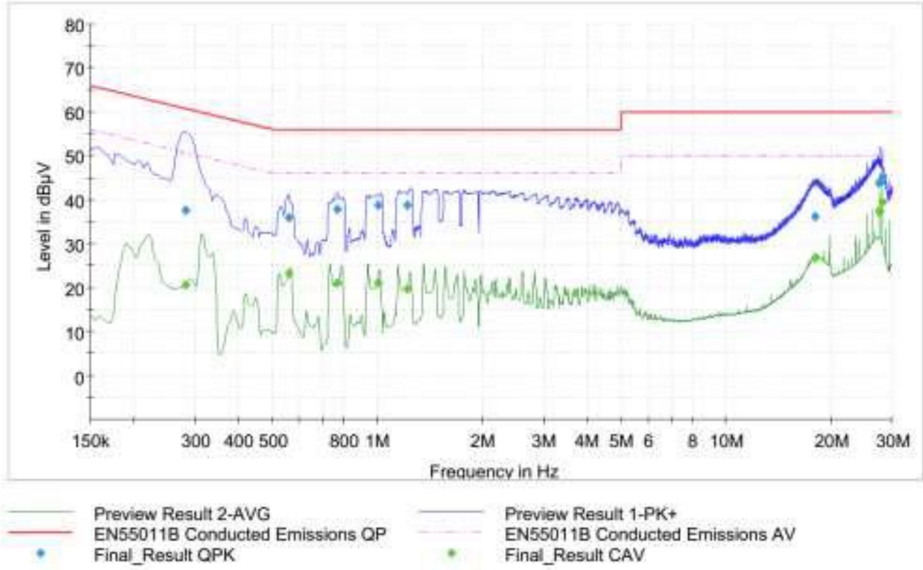


Figure 10 – Conducted emissions in front of the AC converter while charging an RRC2057 battery.

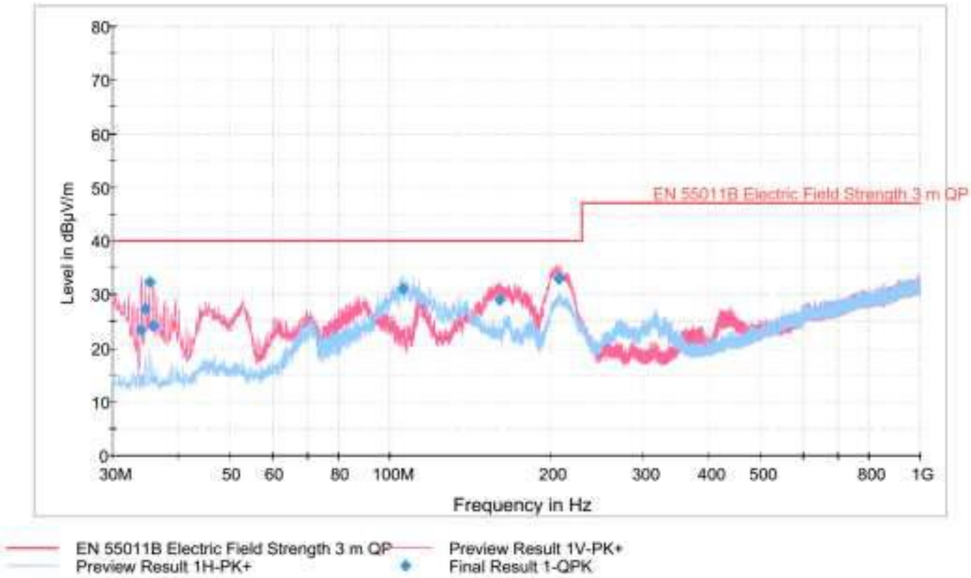


Figure 11 – Radiated emissions by PMM240 while charging an RRC2057 battery.

10. Safety

The PMM240 complies with

- ANSI/AAMI ES60601-1:2005(R)2012
- CSA CAN/CSA-C22.2 NO. 60601-1:14
- EN 60601-1:2006/A12:2014
- IEC 60601-1 Edition 3.1 (2012)
- IEC 62304:2006 (First Edition)

11. Regulatory Compliance / Certifications

The PMM240 complies with all applicable directives and appropriate standards (e.g., safety, EMC, environmental, recycling) for all below-stated countries.

Country:	Certificate:	Mark:
International	CB	-
Europe	CE	
USA / Canada	c UR us	

The PMM240 also complies with

- RoHS Directive 2011/65/EU + 2015/863 (RoHS 3)
- REACH Directive 1907/2006/EC

12. Mechanical Information

12.1. Dimensions

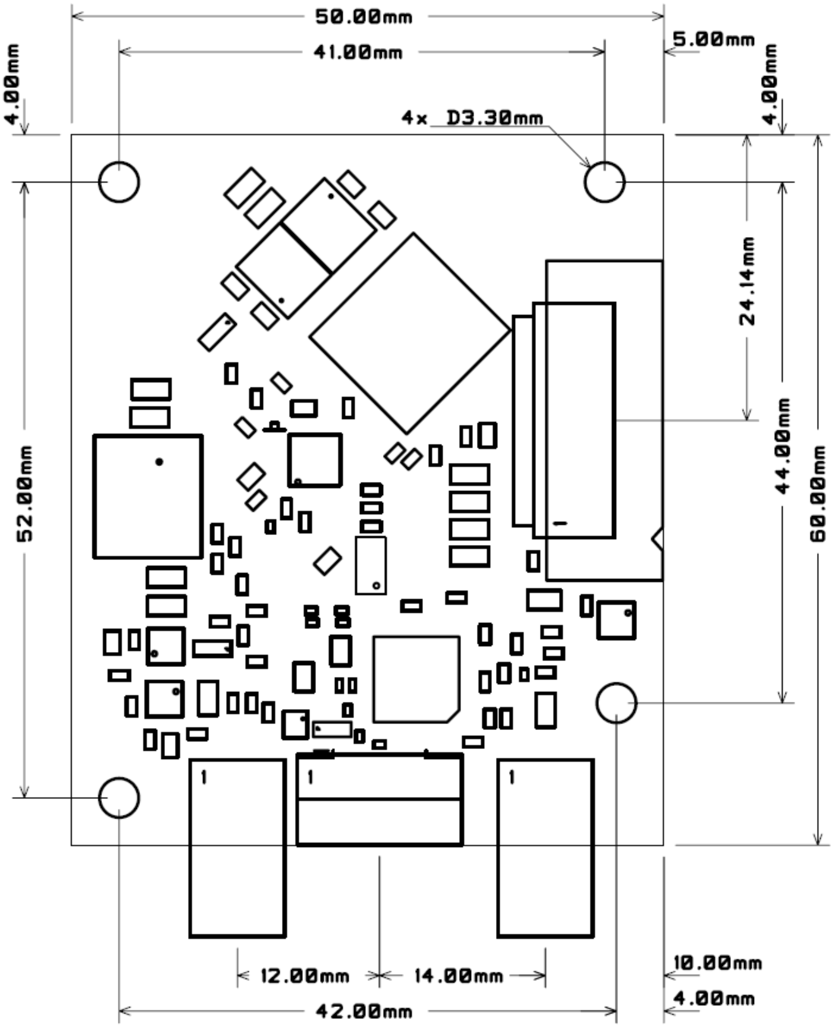


Figure 12 – PMM240 mechanical dimensions. All tolerances according to ISO2768-fK.

The height of the tallest component on the board is less than 10mm. We recommend reserving a height of at least 12 mm within the housing (2 mm PCB thickness + 10mm of the tallest component). Also, you should allow 3 mm clearance on the PCB's bottom side because of the through-hole components.

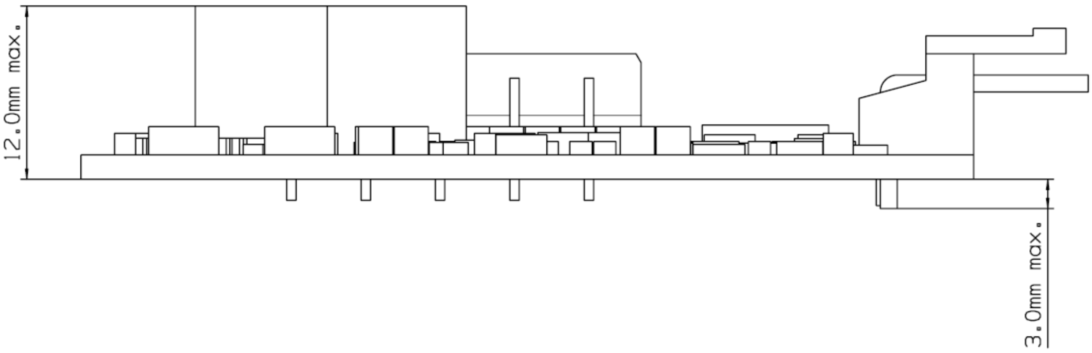


Figure 13 – PMM mechanical dimensions, side view

12.2. Mounting screws

Use plastic screws or plastic washers to fix the PMM240 on the mounting holes. Metal screws or metal washers may lead to short circuits. The green solder mask on the PMM240 is not insulating.

The washer or screw head diameter should be 3.5 mm max.

12.3. Connectors

For details on the connector pinout and purpose, refer to section 0.

Connector mating parts and alternatives:

- DC-Input and DC-Output:
  - JST VHR-2N
  - JST VHR-2M
  - TE 3-1123722-2
- User Interface:
  - JST PHR-6
  - JST PHR-6-Y
  - JST (D)PHR-6(L)
  - Adam Tech 2CH-C-06

12.4. Battery insertion

The PMM240 Battery Connector is not protected against reverse polarity. Figure 14 shows the correct insertion direction.

Note that the "+" sign on the PMM240 PCB next to the connector corresponds to the location of the "+" sign on the battery.

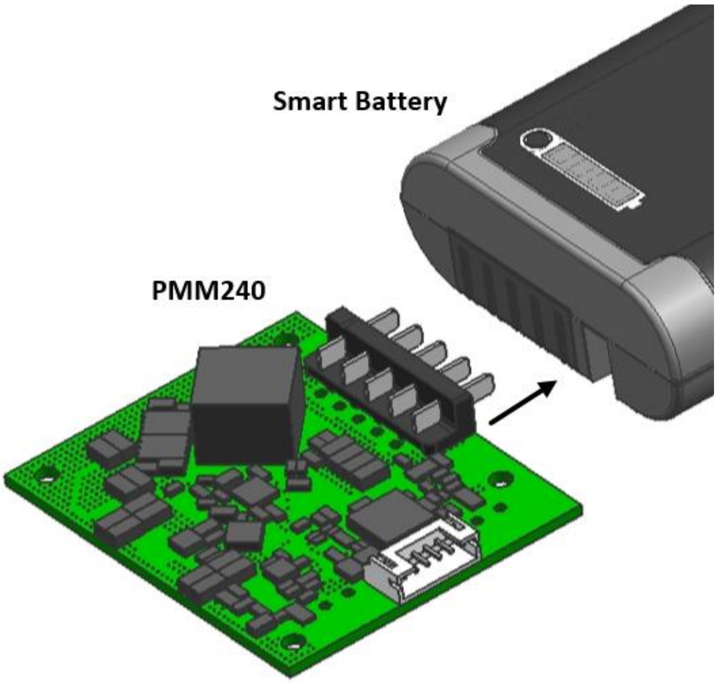


Figure 14 - Correct direction of connection

13. Documentation Support

For related documentation, see the following:

- PMM240 Application Note
- https://www.rrc-ps.com/pmm240-calculator, containing links to the Application Note and the Datasheet.
- System Management Bus Specification (Rev 1.1, Dec 11, 1998)
- Smart Battery Data Specification (Rev 1.1, Dec 15, 1998)
- Smart Battery Charger Specification (Rev 1.1, December 1, 1998)

If you cannot follow any of these links, or if they do not work anymore, please contact your local RRC salesperson.

14. Revision History

Revision	Valid from	Revisions	Author
A	08. Feb 2021	First release of the PMM240 specification document.	Bernhard Krämer
B	30. Apr 2021	Added MTTF, User Interface description corrected.	Bernhard Krämer
C	27. Jul 2021	Added information on charging efficiency and temperature increase. Improvements on tables 1, 3 & 4. Added explanation on the SMBus VCC pin. Verified release dates on documentation support.	Bernhard Krämer
D	31. Jan 2022	Fixed Table 1 & 4. Improved Figure 9. Added links to documents. Added connector alternatives. Added instructions on reading Turbo Boost flag.	Bernhard Krämer
E	14. Feb 2022	Section 7.4: Brought in more details about the SMBus communication and command structure.	Bernhard Krämer

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