muRata
INNOVATOR IN ELECTRONICS

FEATURES

- 40-60V Input Voltage Range (54V nominal)
- Up to 98% Efficiency
- Eighth-Brick Package with Baseplate
- Output Voltage/Current: 12V/67A
- Power Good Signal
- Operating Temperature Range: -40°C to +85°C
- Current Sharing of two or more modules
- Over Current/Voltage/Temperature Protection
- PMBus™ interface

RoHS COMPLIANT

25

SAFETY APPROVALS

- UL 62368-1 3rd Edition
- CSA C22.2 No. 62368-1-19
- IEC 62368-1:2018

CSA ® C US

UKCA

CE

PRODUCT OVERVIEW

MPE800-12V67-L48NBMC is an 800W, non-isolated, high efficiency, digitally controlled DC-DC board-mount power converter to be offered with a regulated 12Vdc/67A output.

PMBus® digital communication capability supports a comprehensive command list providing capability for the system/host to configure control and monitor status. Robust hardware fault protection from overvoltage, overtemperature and overload conditions is provided and supports operation over a wide temperature range. Active current sharing makes it possible to scale power up by parallel module configuration for high power and/or redundant deployments.

The MPE800-12V67-L48NBMC offers a competitive advantage in server, storage, and network applications requiring high power density, efficiency, and reliable DC-DC power conversion.

ORDERING GUIDE[1]

Part Number[1]	V_{IN}	V_{OUT}	P_{OUT}	L inch(mm)	W inch(mm)	H inch(mm)
MPE800-12V67-L48NBMC	54	12	800W	2.30 (58.42)	0.90 (22.6)	0.55 (14.0)

[1] See the Part Number Structure table on page 2 for more information.

ABSOLUTE MAXIMUM RATINGS[1]

Parameter	Conditions	Min.	Nom.	Max.	Units
Input Voltage, Continuous		40	-	60	Vdc
Isolation Voltage	Input to output	-	-	0	
On/Off Remote Control		0	-	20	
Output Power[2]		0	-	800	W
Output Current				67	A
Operating Temperature Range		-40	-	85	°C
Storage Temperature Range	Vin=Zero (no power)	-55	-	125	

[1] Absolute maximum are stress ratings. Exposure of devices to greater than any of these conditions might adversely affect long-term reliability. [2] See thermal consideration section.

INPUT VOLTAGE CHARACTERISTICS

Parameter	Conditions	Min.	Nom.	Max.	Units
Input Voltage, Operating[1]		40	54	60	Vdc
Start-up Voltage		36	37	38	
Undervoltage Shutdown		34	35	36	
Vin UVP Hysteresis		1		3	
Overvoltage Shutdown		62	64	66	
Overvoltage Shutdown Recover		60	62	64	
Vin OVP Hysteresis		1		3	
Input Capacitance	Per unit Chemi-EGXF800ELL471MU25S or equivalent.	470	-	-	µF
Input Current		-	-	35	A
Inrush Current[2]		-	-	50	% of Iin
Ripple Current[3]		-	-	1.25	mA$_{RMS}$/W

OUTPUT VOLTAGE CHARACTERISTICS

Parameter	Conditions	Min.	Nom.	Max.	Units
Output Voltage Set Point[4] (w/o "S")	Vin=54V, Pout=0W, Ta=25°C	11.94	12	12.06	Vdc
Output Voltage Set Point[4] (with "S")	Vin=54V. Pout=0W, Ta=25°C	11.94	12	12.06	
Output Voltage Tolerance Band	Over sample, line, load, temperance and life.	11.7		12.4	
Output Current		0	-	67	A
Output Over-Current		74	-	95	A
Output Power				800	W
Ripple and Noise[3]	20MHz bandwidth	-	50	120	mV
Output Capacitance	50% ceramic, 50% Oscon or POSCAP (HHXJ1160ARA821MJA0G or equivalent).	1500	10000	-	µF
Load regulation (Without "S" suffix - standalone version)			64	125	mV
Load regulation (With "S" suffix - load sharing version)			64	125	
Line regulation (Vin=40-52V, 0-100% of Load)			10	35	

NOTES:

[1] Iin is defined as the steady-state operating current when Unit is operating at Vin Max and Pout Max. While Vout is rising, Pout is ≤25% of rated power with a resistive load.

[2] Measured at input pin with maximum specified Cin and <500µH inductance between voltage source and Cin.

[3] Cout = 1µF/W minimum, approximately 50% ceramic, 50% Oscon or POSCAP. bandwidth = 20MHz.

RELIABILITY & SAFETY					
Parameter	**Conditions**	**Min.**	**Nom.**	**Max.**	**Units**
Peak Efficiency	Vin=40V, 50% of Max Pout,Ta=25°C	-	98	-	%
Efficiency	Vin=54V, 50% of Max Pout,Ta=25°C	-	97	-	
	Vin=54V, 100% of Max Pout,Ta=25°C	-	97.3	--	
Switching Frequency			180		kHz
Safety Rating	Functional Insulation	-	--	-	-
Isolation Capacitance		-	-	0-	pF
Calculated MTBF	Telcordia SR-332 @ 90°C baseplate temperature	6	-	-	Mhrs

PART NUMBER STRUCTURE		
Product Family	M P	MP = Murata Power
From Factor	E	E = Eighth Brick
Output Power	800	800W
Output Voltage	12V	12Vout
Output Current	67	67A
Input Voltage Range	L48	L48=40-60Vin
On/Off Control Logic	N	N = Negative Logic (Default)
Mechanical Configuration	B	B = Baseplate
PMBus Option	M	M = with PMBus interface, Blank=without PMBus
RoHS	C	C = RoHS Compliant

TURN-ON/TURN-OFF CHARACTERISTICS

	Conditions	Min.	Nom.	Max.	Units
Turn-On Delay-1 (from Vin reaching Turn-on Voltage)[1]	Vin slew rate is 1V/ms	35	-	55	
Turn-On Delay-2 (from Enabled Asserted)[2]		-	-	5	ms
Restart Delay		-	-	250	
Output Voltage Rise Time		-	-	15	
Pre-Bias Voltage		0	-	V_{out}	Vdc

[1] The S version supports load sharing.
[2] From Enabled Asserted.

$$Turn - On\ Delay - 1 = 47.5 - \frac{15}{X} \quad \text{(X means Vin slew rate, unit is V/ms)}$$

Start-up timing - (Vout vs. Vin and On/Off Control)
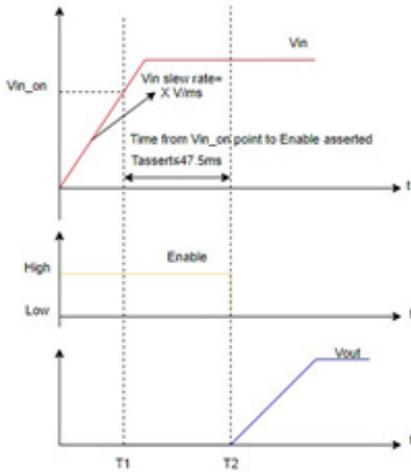
PROTECTION

Parameter	Conditions	Min.	Nom.	Max.	Units
Output Over-Current (hiccup mode)		110	-	130	%
Over-Temperature (internal tempersure sensor)		115	-	130	°C
Current Sharing Accuracy				10	%

(3+ units from the same supplier operated in parallel ("S" option). All units' output power must share within 10% of each other when unit operating at the highest power level is operating at PoutMax).

OUTPUT ENABLE (NEGATIVE LOGIC)

Parameter	Conditions	Min.	Nom.	Max.	Units
Unit OFF: On/Off Pin open [1, 2, 3]		2.4	-	20	Vdc
Unit ON: On/Off Pin low [1, 2, 3]		-0.1	-	0.8	Vdc
Enable Pin Current (into pin, ext. pull-up to 15V)		-	-	0.5	mA
Enable Pin Current (into pin, ext. pull-up to 10V)		-	-	0.3	mA

[1] Enable signal is referenced to $V_{in}(-)$.
[2] Unit disabled via Control Pin, open collector configuration.
[3] The enable logic can be changed via PMBus.

DYNAMIC CHARACTERISTICS

Parameter	Conditions	Min.	Nom.	Max.	Units
Dynamic Load Response [1, 2]		-	-	600	µS
Dynamic Load Peak Deviation [1, 2]		-	-	±325	mV
Response to Vin Step [1]		-	-	1.25	Vdc

[1] 25-75-25% load step of Pout Max at 1A/µS, settling time to within 1% of Vout, measurement method.
[2] With a 5000µF output capacitance, 50% ceramic, 50% OSCON or POSCAP.
[3] The occurring max 0.1V/µS rate within Vin operating range, Pout = 10% - 100% Rated Power, Cout = Cout Max /2.

POWER-GOOD SIGNAL[1]

Parameter	Conditions	Min.	Nom.	Max.	Units
Output Voltage Low (trigger limits)		8.5	9	9.5	Vdc
Output Voltage Hysteresis		0.2	0.3	-	Vdc
High State Voltage		0	-	5.5	Vdc
High State Leakage Current (into pin)		0	-	10	µA
Low State Voltage		0	-	0.8	Vdc
Low State Current (into pin)		0	-	5	mA
Power Good Signal De-assert Response Time		0	-	3	ms

[1] The power good logic can be changed via PMBus.

ENVIRONMENTAL CHARACTERISTICS

| Parameter	Conditions	Min.	Nom.	Max.	Units
Operating Temperature - Ambient		-40	-	85	°C
Storage Temperature		-50	-	125	°C
Altitude, Operating		-500	-	13120	feet
Relative Humidity, Operating, Non-Condensing		10	-	90	%
Relative Humidity, Non-Operating, Non-Condensing		10	-	95	%
Thermal Protection/Shutdown			120		°C
Electromagnetic Interference, (external filter required)			B		Class
Conducted, EN55022/CISPR22, Part 15 (with external filter)					

GENERAL INFORMATION

Parameter	Conditions	Min.	Typ.	Max.	Units
Mechanical Dimensions (L x W x H)			2.30 x 0.90 x 0.55		inches
			58.42 x 22.86 x 14.0		mm
Product Weight (per unit)			1.8		ounces
			56		grams
Pin Length			0.21		inches
			5.33		mm
Pin Diameter			0.04/0.06		inches
			1.0/1.5		mm
Pin Material			Copper with gold plating over nickel under plating		
Baseplate Material			Black anodized aluminum		

PERFORMANCE CURVES

Efficiency vs. Output Power

Efficiency vs Output Power

Power Consumption vs. Output Power
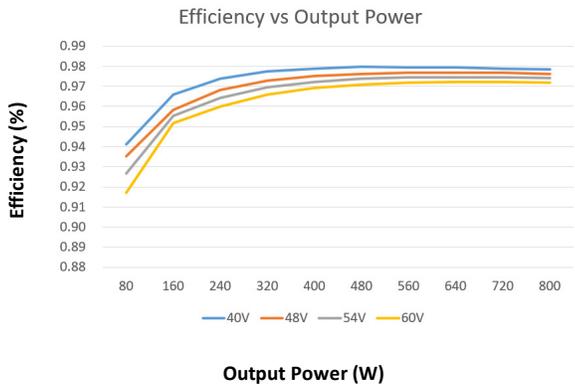
Power Consumption vs Output Power
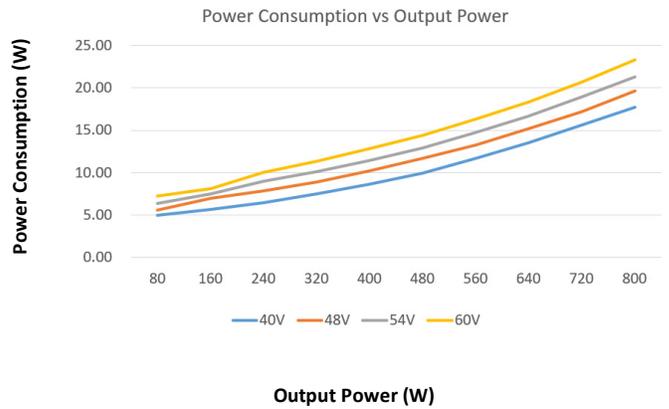
Ripple & Noise Waveform (Vin = 54V, Iout = 67A)

Max(C2) 13.2mV   Min(C2) -14.0mV   P-P(C2) 27.2mV   Rms(C2) 5.26761mV
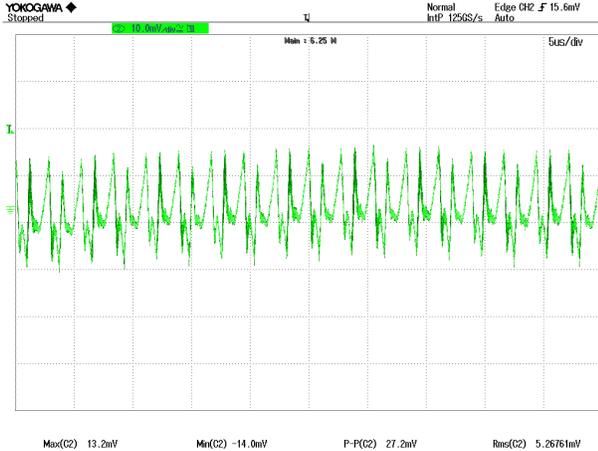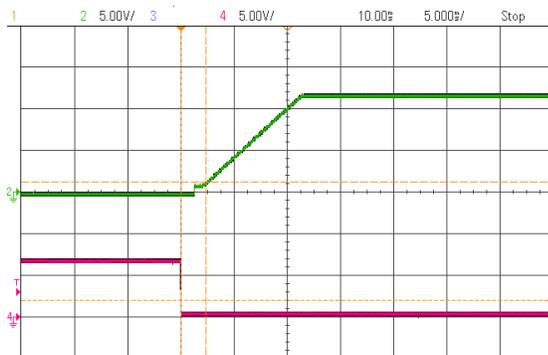
Output Cap 1500uF

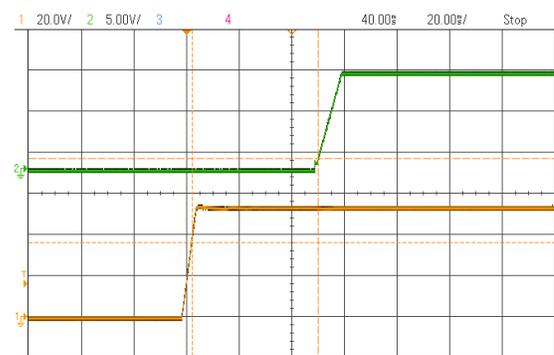### Transient Response (Vin = 54V, 50%-75%-50% Load, 1A/µS)
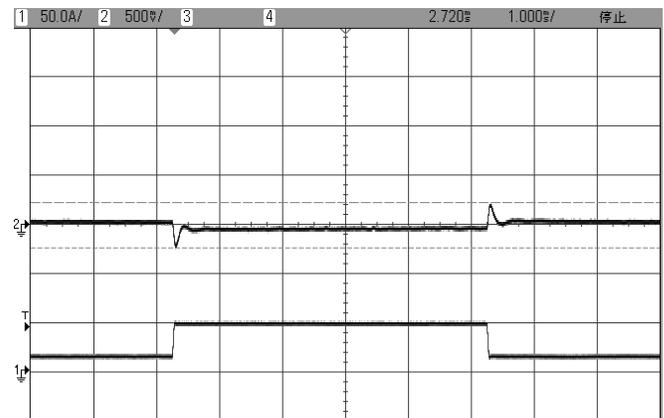
Output Cap 5000uF

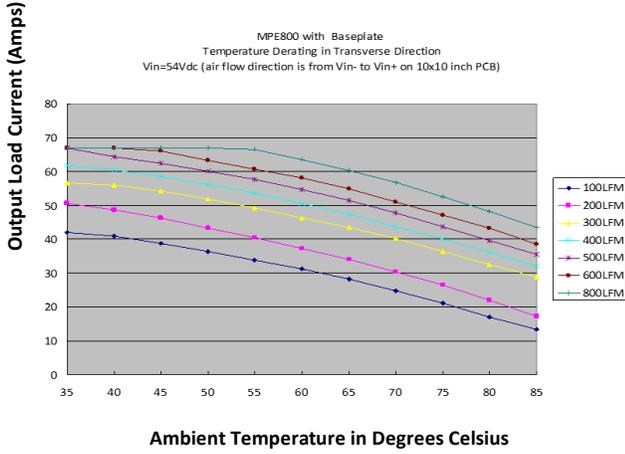### Enable Turn On – Negative Logic (Vin = 54V, Iout = 67A)
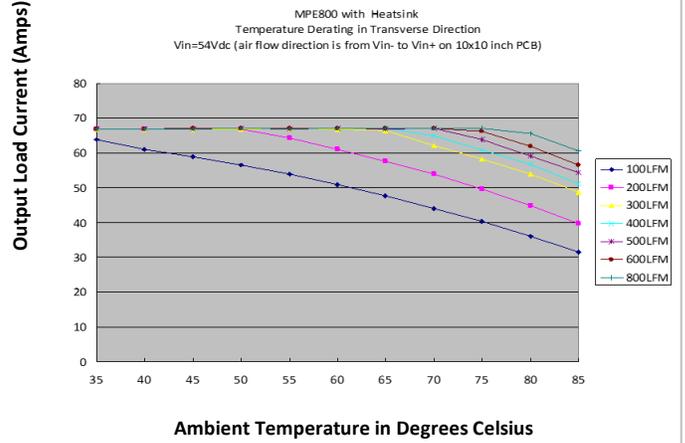

Output Cap 1500uF

Vin Turn On (Vin = 54V, Iout = 67A)
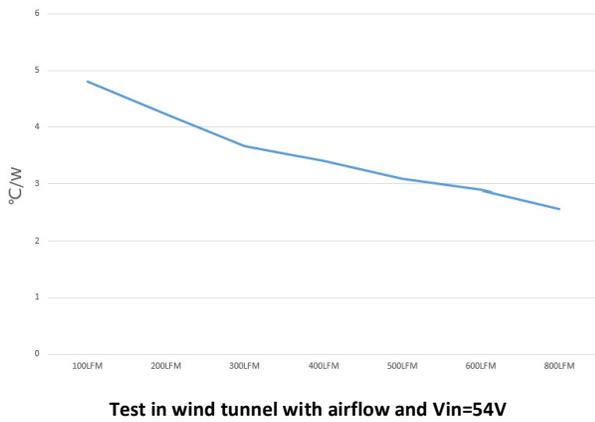

Output Cap 1500uF

PERFORMANCE CURVES

MPE800 with Baseplate

MPE800 with Baseplate
Temperature Derating in Transverse Direction
Vin=54Vdc (air flow direction is from Vin- to Vin+ on 10x10 inch PCB)

Output Load Current (Amps)

Ambient Temperature in Degrees Celsius

- 100LFM
- 200LFM
- 300LFM
- 400LFM
- 500LFM
- 600LFM
- 800LFM

MPE800 with Heatsink

MPE800 with Heatsink
Temperature Derating in Transverse Direction
Vin=54Vdc (air flow direction is from Vin- to Vin+ on 10x10 inch PCB)

Output Load Current (Amps)

Ambient Temperature in Degrees Celsius

- 100LFM
- 200LFM
- 300LFM
- 400LFM
- 500LFM
- 600LFM
- 800LFM

Thermal Resistance - Baseplate

°C/w

100LFM 200LFM 300LFM 400LFM 500LFM 600LFM 800LFM

Test in wind tunnel with airflow and Vin=54V

Thermal Resistance - Heatsink

°C/w

100LFM 200LFM 300LFM 400LFM 500LFM 600LFM 800LFM

Test in wind tunnel with airflow and Vin=54V
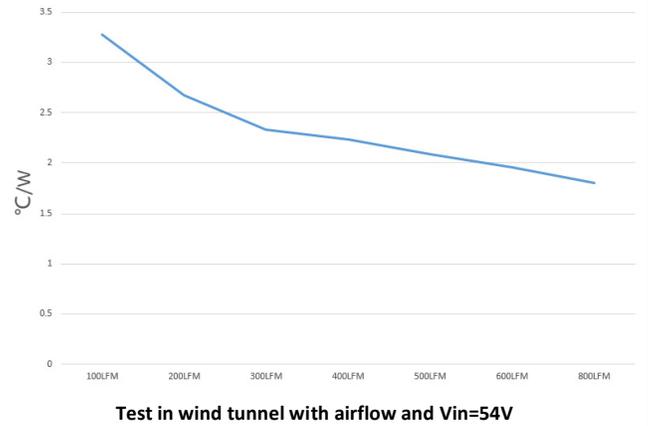
PMBus Monitoring Accuracy

Parameter	Conditions	Min.	Typ.	Max.	Units
PMBus General	PMBus Rev. 1.2; SMBALERT# is supported; PEC is supported; Linear data format is used.				
Bus Speed			100/400		kHz
Logic High Input		2.1		3.3	Vdc
Logic Low Input		0		0.8	Vdc
Logic High Output		2.3			Vdc
Logic Low Output				0.4	Vdc
PMBus Monitoring Accuracy					
VIN_READ		-4		4	%
VOUT_READ		-2		2	%
IOUT_READ	Vin=54V, Io=50% ~ 100% of Io, max.	-5		5	%
	Vin=54V, Io=5% ~ 50% of Io, max.	-1.8		1.8	A
TEMP_READ		-5		5	°C

PMBus Commands List

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number of Data Bytes	Default Value		Data Limits	Unit
01h	OPERATION	Write Byte	Read Byte	1	0x80			
02h	ON_OFF_CONFIG	Write Byte	Read Byte	1	0b000111x1			
03h	CLEAR_FAULTS	Send byte	N/A	0	N/A			
10h	WRITE_PROTECT	Write Byte	Read Byte	1	0x00			
11h	STORE_DEFAULT_ALL	Send byte	N/A	0	N/A			
12h	RESTORE_DEFAULT_ALL	Send byte	N/A	0	N/A			
15h	STORE_USER_ALL	Send byte	N/A	0	N/A			
16h	RESTORE_USER_ALL	Send byte	N/A	0	N/A			
19h	CAPABILITY	N/A	Read Byte	1	0b10110000			
1Ah	QUERY	N/A	Block Write-Block Read Process Call	1	N/A			
1Bh	SMBALERT8	N/A	Block Write-Block Read Process Call	2	N/A			
20h	VOUT_MODE	N/A	Read Byte	1	0x1A			
22h	VOUT_TRIM	Write Word	Read Word	2	0x0000	0	-3~2	V
28h	VOUT_DROPP	Write Word	Read Word	2	0x0000	0	0~25	mΩ
35h	VIN_ON	Write Word	Read Word	2	0xE928	37.0	> VIN_OFF	V
36h	VIN_OFF	Write Word	Read Word	2	0xE918	35.5	< VIN_ON	V
40h	VOUT_OV_FAULT_LIMIT	Write Word	Read Word	2	0x03C0	14.00	13.5~15.9	V
41h	VOUT_OV_FAULT_RESPONSE	Write Byte	Read Byte	1	0b10000000			
42h	VOUT_OV_WARN_LIMIT	Write Word	Read Word	2		13.00	13.00~15.75	V
46h	IOUT_OC_FAULT_LIMIT	Write Word	Read Word	2		81.0	0~110	A
47h	IOUT_OC_FAULT_RESPONSE	Write Byte	Read Byte	1	0xFD			
4Ah	IOUT_OC_WARN_LIMIT	Write Word	Read Word	2	0xF208	75.0	0~110	A

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number of Data Bytes	Default Value		Data Limits	Unit
4Fh	OT_FAULT_LIMIT	Write Word	Read Word	2	0xF230	120	0~150	°C
50h	OT_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0			
51h	OT_WARN_LIMIT	Write Word	Read Word	2	0xF208	110	0~150	°C
55h	VIN_OV_FAULT_LIMIT	Write Word	Read Word	2	0xEA00	63.0	40~70	V
56h	VIN_OV_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0			
57h	VIN_OV_WARN_LIMIT	Write Word	Read Word	2	0xE9F0	61.0	40~70	V
58h	VIN_UV_WARN_LIMIT	Write Word	Read Word	2	0xE960	37.0	30~70	V
59h	VIN_UV_FAULT_LIMIT	Write Word	Read Word	2	0xE950	35.5	30~70	V
5Ah	VIN_UV_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0			
5Eh	POWER_GOOD_ON	Write Word	Read Word	2	0x0280	10.80	8.5~13.2	V
5Fh	POWER_GOOD_OFF	Write Word	Read Word	2	0x026C	9.00	8.5~13.2	V
61h	TON_RISE	Write Word	Read Word	2	0x000A	10	0~1024	ms
78h	STATUS_BYTE	Write Byte	Read Byte	1	N/A			
79h	STATUS_WORD	Write Word	Read Word	2	N/A			
7Ah	STATUS_VOUT	Write Byte	Read Byte	1	N/A			
7Bh	STATUS_IOUT	Write Byte	Read Byte	1	N/A			
7Ch	STATUS_INPUT	Write Byte	Read Byte	1	N/A			
7Dh	STATUS_TEMPERATURE	Write Byte	Read Byte	1	N/A			
7Eh	STATUS_CML	Write Byte	Read Byte	1	N/A			
88h	READ_VIN	N/A	Read Word	2	N/A			V
8Bh	READ_VOUT	N/A	Read Word	2	N/A			V
8Ch	READ_IOUT	N/A	Read Word	2	N/A			A
8Dh	READ_TEMPERATURE_1	N/A	Read Word	2	N/A			°C
94h	READ_DUTY_CYCLE	N/A	Read Word	2	N/A			
95h	READ_FREQUENCY	N/A	Read Word	2	N/A			kHz
96h	READ_POUT	N/A	Read Word	2	N/A			W
98h	PMBUS_REVISION	N/A	Read Byte	1	0x22			
99h	MFR_ID	N/A	Block Read	<=22	"Murata Power Solutions"			
9Ah	MFR_MODEL	Block Write*	Block Read	<=28	"MPE800-12V67-L48##########"			
9Bh	MFR_REVISION	Block Write*	Block Read	<=6	"S00.##"			
9Ch	MFR_LOCATION	Block Write*	Block Read	<=9	"DAS-WUHAN"			
9Dh	MFR_DATE	Block Write*	Block Read	<=10	"##/##/####"			
9Eh	MFR_SERIAL	Block Write*	Block Read	<=14	"000000001#####"			
A0h	MFR_VIN_MIN	N/A	Read Word	2	0xE900	32.0		V
A1h	MFR_VIN_MAX	N/A	Read Word	2	0xEA00	64.0		V
A2h	MFR_IIN_MAX	N/A	Read Word	2	0xF0C3	35.00		A
A3h	MFR_PIN_MAX	N/A	Read Word	2	0x1226	1300		W
A4h	MFR_VOUT_MIN	N/A	Read Word	2	0x028C	10.18		V

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number of Data Bytes	Default Value		Data Limits	Unit
A5h	MFR_VOUT_MAX	N/A	Read Word	2	0x0380	14.00		V
A6h	MFR_IOUT_MAX	N/A	Read Word	2	0xF1E0	95.0		A
A7h	MFR_POUT_MAX	N/A	Read Word	2	0x11F4	1140		W
A8h	MFR_TAMBIENT_MAX	N/A	Read Word	2	0xF154	85.0		°C
A9h	MFR_TAMBIENT_MIN	N/A	Read Word	2	0xF760	-40.0		°C
Adh	IC_DEVICE_ID	N/A	Block Read	26	"Microchip dsPIC33CK64MP103"			
DAh	MFR_EEPROM_ERASE	Write Word*	Read Word	2	N/A			
DDh	MFR_ON_OFF_CONFIG	Write Byte*	Read Byte	1	N/A			
DEh	MFR_POWER_GOOD_POLARITY	Write Byte	Read Byte	1	0b00000000			
DFh	MFR_BLACK_BOX_CONFIG	Write Byte	Read Byte	1	0b00000011			
E0h	MFR_READ_HISTORY EVENTS	N/A	Block Read	32	N/A			
E1h	MFR_SET_HISTORY_EVENT_OFFSET	Write Byte	Read Byte	1	N/A			
E8h	MFR_VIN_OV_HYS	Write Word*	Read Word	2	0xE810	2	0~10.0	V
E9h	MFR_VIN_UV_HYS	Write Word*	Read Word	2	0xE810	1.5	0~10.0	V
EAh	MFR_TEMPERATURE_OT_HYS	Write Word*	Read Word	2	0xF028	10.0	0~20.0	°C
F6h	MFR_CALIBRATION_STATUS	N/A	Read Byte	1	N/A			
F8h	CAL_READ_VOUT	Block Write*	Block Read	4	N/A			
F9h	CAL_READ_VIN	Block Write*	Block Read	4	N/A			
FAh	CAL_READ_IOUT	Block Write*	Block Read	4	N/A			
FBh	CAL_VOUT_ADJUST	Write Word	Read Word	2	N/A			
FCh	MFR_SUPERVISOR_PASSWORD	Block Write	N/A	N/A	N/A			

Notes:

* Only available in supervisor mode (default state is user mode, send password to command 0xFC to change to supervisor mode).

a) Unit restores the entire contents of the non-volatile user store memory when power up.

b) PEC is needed when write or send data to power module.

c) Max. bus speed: 400kHz.

d) Linear data format used.

e) Addressing: If PMBus address setting out of the address table, default PMBus address 64d is assigned instead.

MFR Commands

01-CFh Refer to PMBUS 1.2 SPEC

DAh   **MFR_EEPROM_ERASE**

Erase the data stroe in EEPROM

DDh   **MFR_ON_OFF_CONFIG**

Set the ON/OFF polarity

DEh   **MFR_POWER_GOOD_POLARITY**

Set the POWER GOOD signal polarity

DFh   **MFR_BLACK_BOX_CONFIG**

Config black box enable/disable and store mode

Bits	Meaning
7:2	RSVD
1	Overwrite function; 1: Enable 0: Disable
0	Black box function; 1:Enable 0: Disable

E0h   **MFR_READ_HISTORY_EVENTS**

Read the black box stored data

Bytes	Meaning	Bytes	Meaning
0	Event Number	16	Power On Timer Byte0
1	Status Word High Byte	17	Power On Timer Byte1
2	Status Word Low Byte	18	Power On Timer Byte2
3	Status Vout	19	Power On Timer Byte3
4	Status Iout	20	RSVD
5	Status Input	21	RSVD
6	Status Temperature	22	RSVD
7	Status CML	23	RSVD
8	READ_VIN High Byte	24	RSVD
9	READ_VIN Low Byte	25	RSVD
10	READ_VOUT High Byte	26	RSVD
11	READ_VOUT Low Byte	27	RSVD
12	READ_IOUT High Byte	28	RSVD
13	READ_IOUT Low Byte	29	RSVD
14	READ_TEMPERATURE High Byte	30	RSVD
15	READ_TEMPERATURE Low Byte	31	RSVD

E1h   **MFR_SET_HISTORY_EVENT_OFFSET**

Set and Read the event offset, if you read back is x, you have to write x - 1.

E8h   **MFR_VIN_OV_FAULT_HYS**

Hysteresis of VIN_OV_FAULT recover, Linear data format

E9h   **MFR_VIN_UV_FAULT_HYS**

Hysteresis of VIN_UV_FAULT recover, Linear data format

EAh   **MFR_OT_FAULT_HYS**

Hysteresis of OT_FAULT recover, Linear data format

F6h   **MFR_CALIBRATION_STATUS**

Refer to calibration procedure file

F8h   **CAL_READ_VOUT**

Refer to calibration procedure file

F9h   **CAL_READ_VIN**

Refer to calibration procedure file

FAh   **CAL_READ_IOUT**

Refer to calibration procedure file

FBh   **CAL_VOUT_ADJUST**

Refer to calibration procedure file

FCh   **MFR_SUPERVISOR_PASSWORD**

Set unit to supervisor mode or ROM mode, Refer to password table

Status Word and Byte

GREEN = Supported

STATUS_VOUT
7 VOUT_OV_FAULT
6 VOUT_OV_WARNING
5 VOUT_UV_WARNING
4 VOUT_UV_FAULT
3 VOUT_MAX Warning
2 TON_MAX_FAULT
1 TOFF_MAX_WARNING
0 VOUT Tracking Error

STATUS_IOUT
7 IOUT_OC_FAULT
6 IOUT_OC_LV_FAULT
5 IOUT_OC_WARNING
4 IOUT_UC_FAULT
3 Current Share Fault
2 In Power Limiting Mode
1 POUT_OP_FAULT
0 POUT_OP_WARNING

STATUS_TEMPERATURE
7 OT_FAULT
6 OT_WARNING
5 UT_WARNING
4 UT_FAULT
3 Reserved
2 Reserved
1 Reserved
0 Reserved

STATUS_CML
7 Invalid/Unsupported Command
6 Invalid/Unsupported Data
5 Packet Error Check Failed
4 Memory Fault Detected
3 Processor Fault Detected
2 Reserved
1 Other Communication Fault
0 Other Memory Or Logic Fault

STATUS_WORD
7 VOUT
6 IOUT/POUT
5 INPUT
4 MFR_SPECIFIC
3 POWER_GOOD#
2 FANS
1 OTHER
0 UNKNOWN
7 BUSY
6 OFF
5 VOUT_OV_FAULT
4 IOUT_OC_FAULT
3 VIN_UV_FAULT
2 TEMPERATURE
1 CML
2 CML

STATUS_OTHER
7 Reserved
6 Reserved
5 Input A Fuse/Breaker Fault
4 Input B Fuse/Breaker Fault
3 Input A OR-ing Device Fault
2 Input B OR-ing Device Fault
1 Output OR-ing Device Fault
0 Reserved

STATUS_INPUT
7 VIN_OV_FAULT
6 VIN_OV_WARNING
5 VIN_UV_WARNING
4 VIN_UV_FAULT
3 Unit Off For Low Input Voltage
2 IIN_OC_FAULT
1 IIN_OC_WARNING
0 PIN_OP_WARNING

STATUS_MFR_SPECIFIC
Manufacturer Defined
Manufacturer Defined
Manufacturer Defined
Manufacturer Defined
Manufacturer Defined
Manufacturer Defined
Manufacturer Defined
Manufacturer Defined

STATUS_FANS_1_2
7 Fan 1 Fault
6 Fan 2 Fault
5 Fan 1 Warning
4 Fan 2 Warning
3 Fan 1 Speed Override
2 Fan 2 Speed Override
1 Air Flow Fault
0 Air Flow Warning

STATUS_FANS_3_4
7 Fan 3 Fault
6 Fan 4 Fault
5 Fan 3 Warning
4 Fan 4 Warning
3 Fan 3 Speed Override
2 Fan 4 Speed Override
1 Reserved
0 Reserved

http://www.murata.com/products/power

PMBus Address List

The module has flexible PMBus addressing capability. By connecting different resistors from Address pin to GND pin, 14 possible addresses can be acquired. The 7-Bit PMBus address is defined by the value of the resistor as shown in the table below, and +/-1% resistor accuracy is acceptable. If there is any resistance exceeding the requested range, default address 126 is returned.
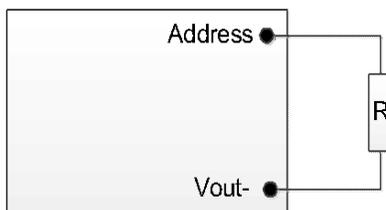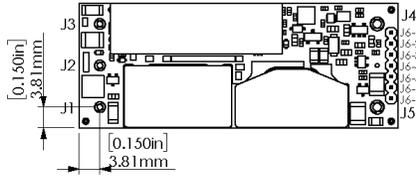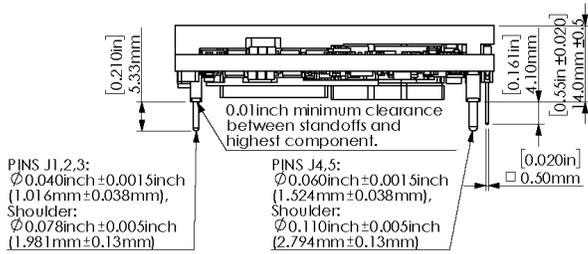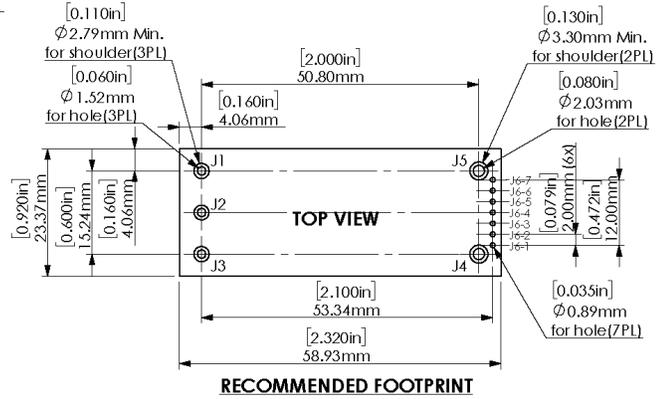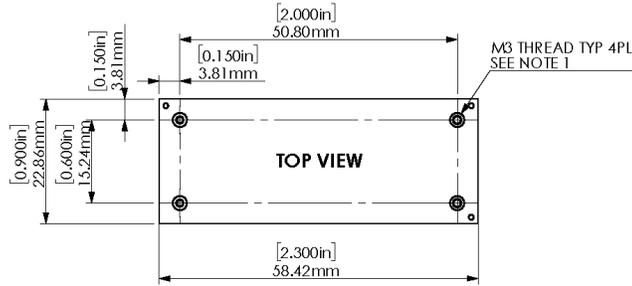

PMBus address is selected by applying an external resistor from the Address to Vout (-) as defined in the table below.

PMBus Address	Resistor Value (Kohm)
96	10
97	15
98	21
99	28
100	35.7
101	45.3
102	56.2
103	69.8
104	88.7
105	107
106	130
107	158
108	191
109	232
+/-1% resistor accuracy is acceptable	

If PMBus address setting is out of the address table, default PMBus address 64d is assigned instead.

PIN DEFINITION/DETAILS

Input/Output Pinout Table:

Pin #	Notes	Diameter (inches)	Length (inches)	Name	Function
J1	1, 2	0.040	0.21	Vin(+)	Positive input voltage
J2	1, 2	0.040	0.21	Enable	Turns unit On (low) and Off (high or open)
J3	1, 2	0.040	0.21	Vin(-)	Negative input voltage
J4	1, 2	0.060	0.21	Vout(-)	Negative output voltage
J5	1, 2	0.060	0.21	Vout(+)	Positive output voltage
J6-1		0.028	0.161	PG	
J6-2		0.028	0.161	GND	
J6-3		0.028	0.161	DATA	
J6-4		0.028	0.161	ALERT	
J6-5		0.028	0.161	CLOCK	
J6-6		0.028	0.161	ADDR0	
J6-7		0.028	0.161	I SHARE BUS	

1 Tolerance on pin diameter is ± 0.0015", tolerance on pin length is ± 0.010"

2 Unit's footprint on customer's PCB has pin holes that are 40mils larger than unit pin diameter. Design of the unit must prevent it from mounting lower on customer's PCB than intended. If pin shoulders are used for this purpose, they must be a minimum (including tolerance) of 45mils larger than unit's nominal pin diameter. Shoulder design must allow out-gassing from pin holes during customer's manufacturing process.

MECHANICAL SPECIFICATIONS

TOP VIEW

[2.000in]
50.80mm

[0.150in]
3.81mm

M3 THREAD TYP 4PL
SEE NOTE 1

[0.150in]
3.81mm

[0.900in]
22.86mm

[0.600in]
15.24mm

[2.300in]
58.42mm

[0.210in]
5.33mm

[0.161in]
4.10mm

[0.55in ±0.020]
14.0mm ±0.5

0.01inch minimum clearance
between standoffs and
highest component.

PINS J1,2,3:
Ø0.040inch±0.0015inch
(1.016mm±0.038mm),
Shoulder:
Ø0.078inch±0.005inch
(1.981mm±0.13mm)

PINS J4,5:
Ø0.060inch±0.0015inch
(1.524mm±0.038mm),
Shoulder:
Ø0.110inch±0.005inch
(2.794mm±0.13mm)

[0.020in]
☐0.50mm

[0.110in]
Ø2.79mm Min.
for shoulder(3PL)

[0.060in]
Ø1.52mm
for hole(3PL)

[0.160in]
4.06mm

[2.000in]
50.80mm

[0.130in]
Ø3.30mm Min.
for shoulder(2PL)

[0.080in]
Ø2.03mm
for hole(2PL)

[0.920in]
23.37mm

[0.600in]
15.24mm

[0.160in]
4.06mm

J1   J5
J2   TOP VIEW
J3   J4

J6-7
J6-6
J6-5
J6-4
J6-3
J6-2
J6-1

[0.079in]
2.00mm (6x)

[0.472in]
12.00mm

[2.100in]
53.34mm

[2.320in]
58.93mm

[0.035in]
Ø0.89mm
for hole(7PL)

RECOMMENDED FOOTPRINT

[0.150in]
3.81mm

J3   J4
       J6-1
J2   J6-2
       J6-3
       J6-4
J1   J6-5
       J6-6
       J6-7
       J5

[0.150in]
3.81mm

Pin	Designation
J1	Vin+
J2	RC
J3	Vin-
J4	Vout-
J5	Vout+
J6-1	PG
J6-2	GND
J6-3	DATA
J6-4	ALERT
J6-5	CLOCK
J6-6	ADDR0
J6-7	I_SHARE_BUS

NOTES:
UNLESS OTHERWISE SPECIFIED:
1: M3 SCREW USED TO BOLT UNIT'S BASEPLATE TO OTHER SURFACES MUST
NOT EXCEED 0.110"(2.8mm) DEPTH BELOW THE SURFACE OF BASEPLATE.
APPLIED TORQUE PER SCREW SHOULD NOT EXCEED 5.3In-lb(0.6Nm)

2: FOR COSMETIC SPECIFICATION AND PRODUCTION
WORKMANSHIP STANDARD, PLS FOLLOW THE FILE No. 60887.

3: ALL DIMENSION ARE IN INCHE[MILLIMETER].
4: ALL TOLERANCES: x.xxin, ±0.02in(x.xmm, ±0.5mm),
                   x.xxxin, ±0.01in(x.xxmm, ±0.25mm).

PACKAGING INFORMATION

ITEM NO. (7770118)	PART NUMBER	DESCRIPTION	QTY
1	2300208	SHIPPING BOX, 10" X 10" X 2.50"	1
2	2300221	SHIPPING TRAY BASE (PAD) .75" THICK	1 (NOTE 8)
3	2300238	SHIPPING TRAY, 1/8 BRICK (21 CAVITY)	2
4	2300159	LABEL, 1.0" X 1.5" PAPER	1
5	5600-01098-0	LABEL, PRE-PRINTED ESD ATTENTION	1
6	5652-01166-0	LABEL, PAPER, 2.0" X 4.0'	1 (NOTE 6)
7	6200-01211-0	ESD TAPE, 3/4" WIDE	.33'

ITEMS ABOVE REFER TO 7770118 BOM AND ARE FOR REFERENCE ONLY, REFER TO APPROPRIATE BOM FOR COMPLETE LIST OF PARTS

THIRD ANGLE PROJECTION
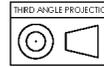
	REVISION STATUS		
REV	DESCRIPTION	ECO	DATE
A	DWG UNDER CHANGE CONTROL	---	5/08/2003
B	ADDED NOTE 2	26542	8/31/2006
C	REDRAWN WITH TABLE ADDED	35048	4/04/2008
D	REVISED PER ECO	43195	3/07/2011
E	ESD LABEL ADDED	43639	8/18/2011
F	REVISED PER ECO	53420	3/09/2015
G	REVISED PER ECO	53927	9/29/2016
H	REVISED PER ECO	58000	6/30/2017
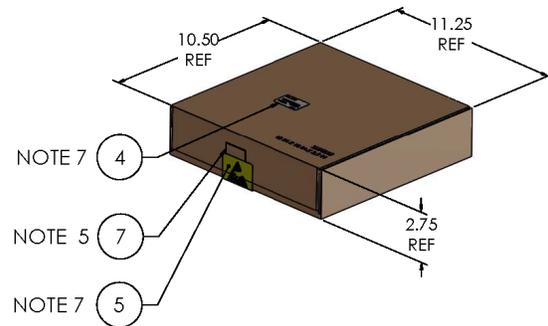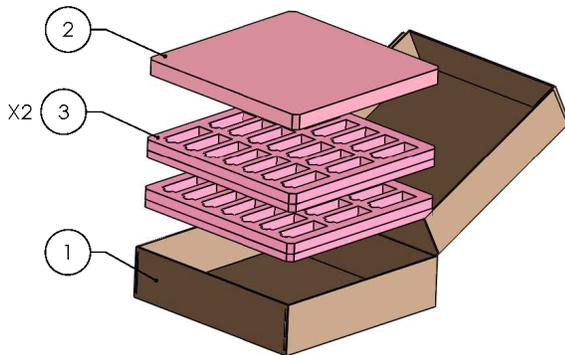
NOTES:

1. THIS DOCUMENT DEFINES THE GENERAL PACKING RULES FOR APPLICABLE SHIPPING KIT . INFORMATION FOR SEALING AND MARKING IS NOT PART OF THIS DOCUMENT.

2. REFER TO SHIPPING KIT BOM DETAILS.

3. INSERT UNITS INTO FOAM POCKETS IN TRAYS PER 61398 APPROX AS SHOWN

4. EACH FOAM TRAY (2300238) CONTAINS 21 UNITS. IN FULL MPQ QUANTITIES, TWO TRAYS EQUAL A TOTAL OF 42 (2x21) UNITS PER BOX.

5. FRONT FLAP SHALL BE SEALED WITH ESD TAPE SPECIFIED OR EQUIVALENT AFTER THE BOX IS CLOSED.

6. LABEL (ITEM 6) USED FOR MFR OVERPACK CARTON

7. APPLY ESD LABEL (ITEM 5) OVER TAPE USED TO SEAL BOX AND APPLY IDENTIFICATION LABEL (ITEM 4) APPROX AS SHOWN.

8. PAD (ITEM 2) MAY, AT MFR'S OPTION, BE EXCHANGED FOR THINNER PAD IF FOAM STACKUP EXCEEDS CARTON HEIGHT BY >1/8" OR ADDITIONAL PAD MAY BE ADDED IF STACKUP IS BELOW INSIDE CARTON HEIGHT BY >1/8"
ALTERNATE PADS: 1/4" THK=2300216, 3/8" THK=2300218, 1/2" THK=2300219, 3/4" THK=2300221

TECHNICAL NOTES

THROUGH-HOLE SOLDERING GUIDELINES

Murata Power recommends the following specifications when installing these converters. These specifications vary depending on the solder type. Exceeding these specifications can cause damage to the product. Your production environment can differ; therefore, thoroughly review these guidelines with your process engineers.

Wave Solder Operations for through-hole mounted products (THMT)

For Sn/Ag/Cu based solders:
Maximum Preheat Temperature   115ºC.
Maximum Pot Temperature   270ºC.
Maximum Solder Dwell Time   7 seconds

For Sn/Pb based solders:
Maximum Preheat Temperature 105ºC.
Maximum Pot Temperature 250ºC.
Maximum Solder Dwell Time 6 seconds

Input Fusing

Certain applications and safety agencies might require fuses at the inputs of power conversion components. Fuses should also be used when there is the possibility of sustained input voltage reversal which is not currently limited. For greatest safety, Murata recommends a fast blow fuse installed in the ungrounded input supply line with a value which is approximately twice the maximum line current, calculated at the lowest input voltage. The installer must observe all relevant safety standards and regulations. For safety agency approvals, install the converter in compliance with the end-user safety standard.

Input Under-Voltage Shutdown and Start-Up Threshold

Under normal start-up conditions, converters will not begin to regulate properly until the rising input voltage exceeds and remains at the Start-Up Threshold Voltage (see Specifications). Once operating, converters will not turn off until the input voltage drops below the Under-Voltage Shutdown Limit. Subsequent restart will not occur until the input voltage rises again above the Start-Up Threshold.

This built-in hysteresis prevents any unstable on/off operation at a single input voltage. Be aware of input sources near the Under-Voltage Shutdown whose voltage decays as input current is consumed (such as capacitor inputs), the converter shuts off and then restarts as the external capacitor recharges. Such situations could oscillate. To prevent this, ensure the operating input voltage is above the UV shutdown voltage at all times.

Start-Up Delay

Assuming that the output current is set at the rated maximum, the Vin to Vout Start-Up Time (see Specifications) is the time interval between the point when the rising input voltage crosses the Start-Up Threshold and the fully loaded regulated output voltage enters and remains within its specified regulation band. Actual measured times will vary with input source impedance, external input capacitance, input voltage slew rate and final value of the input voltage as it appears at the converter.

These converters include a soft start circuit to moderate the duty cycle of the PWM controller at power up, thereby limiting the input inrush current. The On/Off Remote Control interval from inception to Vout regulated assumes that the converter already has its input voltage stabilized above the Start-Up Threshold before the On command. The interval is measured from the On command until the output enters and remains within its specified regulation band. The specification assumes that the output is fully loaded at maximum rated current.

Input Source Impedance

To ensure peak performance and stability of this module in all applications, the input source impedance and load conditions must be understood. The input source and load conditions will affect the performance of the module in the application. The input source must have a low impedance and to ensure this, a minimum input capacitor of 470uF is recommended, mounted as close as possible to the input pins of the module.

The type of capacitor should also be considered, an electrolytic capacitor will degrade at lower temperatures therefore, the chosen capacitor should allow for temperature variations during operation of the module and maintain 470uF. If the input source is inductive, additional low ESR ceramic capacitors in the range of 22-100pF will be required across the Vin terminals to ensure stable operation. The output load also influences the minimum input capacitor requirements. Higher power, dynamic loading conditions might require higher input capacitance to ensure stable operation.

I/O Filtering, Input Ripple Current and Output Noise

All models in this converter series are tested and specified for input reflected ripple current and output noise using designated external input/output components, circuits and layout as shown in the figures below. External input capacitors (Cin in the figure) serve primarily as energy storage elements, minimizing line voltage variations caused by transient IR drops in the input conductors. Users should select input capacitors for bulk capacitance (at appropriate frequencies), low ESR and high RMS ripple current ratings. In the figure below, the Cbus and Lbus components simulate a typical DC voltage bus. Your specific system configuration might require additional considerations. Note that the values of Cin, Lbus and Cbus vary according to the specific converter model.
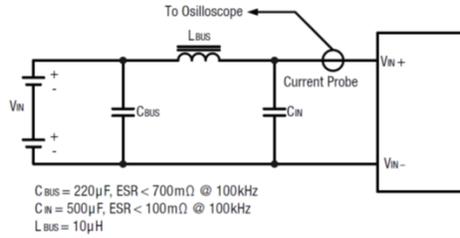
Figure 2. Measuring Input Ripple Current

In critical applications, output ripple and noise (also referred to as periodic and random deviations (PARD) can be reduced by adding filter elements such as multiple external capacitors. Be sure to calculate component temperature rise from reflected AC current dissipated inside the capacitor ESR.
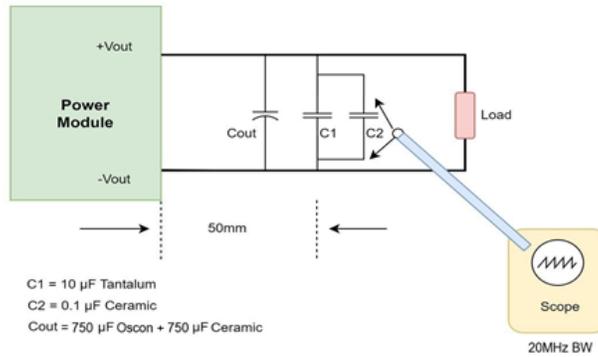

Figure 3. Measuring Output Ripple and Noise (PARD)

Minimum Output Loading Requirements

All models regulate within specification and are stable under no load to full load conditions. Operation under no load might however slightly increase output ripple and noise.

Product Operating Temperature

Product operating temperature is used to monitor the temperature of the product, and proper thermal conditions can be verified by measuring the temperature at position. Temperature at these positions (Tref_point) should not exceed the maximum temperature in the table below. The number of measurement points can vary with different thermal design and topology. Temperatures above maximum Tref_point, measured at the reference point are not allowed and can cause permanent damage.

Position	Description	Maximum Temperature
Reference point	PCB Pin side	Tref_point = 120°C

Thermal Shutdown

To protect against thermal overstress, these converters include thermal shutdown circuitry. If environmental conditions cause the temperature of the DC/DC's to rise above their operating temperature range (up to the shutdown temperature) an on-board electronic temperature sensor will power down the unit. When the temperature decreases below the turn-on threshold, the converter will automatically restart. There is a small amount of hysteresis to prevent rapid on/off cycling. The temperature sensor is typically located adjacent to the switching controller, approximately in the center of the unit. See the Performance and Functional Specifications.

CAUTION: If you operate too close to the thermal limits, the converter might shut down suddenly without warning. Be sure to thoroughly test your application to the fan flowrate specifications.

Temperature Derating Curves

The graphs in this datasheet illustrate a typical operation under a variety of conditions. The Derating curves show the maximum continuous ambient air temperature and decreasing maximum output current, which is acceptable under increasing forced (airflow measured in Linear Feet per Minute "LFM"). Note that these are AVERAGE measurements. The converter accepts brief increases in current or reduced airflow as long as the average is not exceeded.

Note that the temperatures are of the ambient airflow, not the converter itself which is obviously running at higher temperature than the outside air. Also note that very low flow rates (below about 25 LFM) are similar to "natural convection," that is, not using fan-forced airflow.

Murata Power Solutions performs characterization measurements in a closed cycle wind tunnel with calibrated airflow. Both thermocouples and an infrared camera system are used to observe thermal performance. As a practical matter, it is quite difficult to insert an anemometer to precisely measure airflow in most applications. Sometimes it is possible to estimate the effective airflow if you thoroughly understand the enclosure geometry, entry/exit orifice areas and the fan flowrate specifications.

CAUTION: If you exceed these derating guidelines, the converter might have an unplanned Over-Temperature shut down. Also, these graphs are all collected near Sea Level altitude. Be sure to reduce the derating for higher altitude.

Output Over Current Protection

Once the output current increases110% to 130% of its maximum rating, the DC/DC converter enters overcurrent protection mode. After detecting the overcurrent condition, the DC/DC converter turns off the PWM after a delay time, the output voltage drops to 0V, and then the DC/DC converter attempts to restart three times. During these three restart times, if the output overcurrent status no longer exists, the DC/DC converter starts normally. If the overcurrent condition persists, the DC/DC converter latches after three restarts. The DC/DC converter does not come out of latch until Vin is below the startup voltage. If the output current is too high, the converter enters short-circuit protection.

Output Short Circuit Protection

If the output current is too high, the converter enters output short-circuit protection mode. In output short circuit protection mode, the DC/DC converter immediately turns off the PWM, the output voltage drops to 0V, and then the DC/DC converter attempts to restart three times. During these three restart times, if the output current is not higher than the output short-circuit protection threshold, the DC/DC converter starts normally. If the output current continues to be higher than the output short-circuit protection threshold, the DC/DC converter latches after three restarts. The DC/DC converter does not come out of latch until Vin is below the startup voltage.

Remote On/Off Control

On the input side, a remote On/Off Control can be used with negative logic.

Negative: Models with negative logic are on (enabled) when the On/Off is grounded or brought to within a low voltage (see Specifications) with respect to –Vin. The device is off (disabled) when the On/Off is left open or is pulled high to approximately +15V with respect to –Vin.

Emissions Performance

Murata Power measures its products for conducted emissions against the EN 55032 and CISPR 32 standards. Passive resistance loads are employed and the output is set to the maximum voltage. If you set up your own emissions testing, ensure the output load is rated at continuous power while doing the tests.

The recommended external input and output capacitors (if required) are included. Refer to the fundamental switching frequency. This information is detailed in the Product Specifications. An external discrete filter is installed and the circuit diagram is shown below.
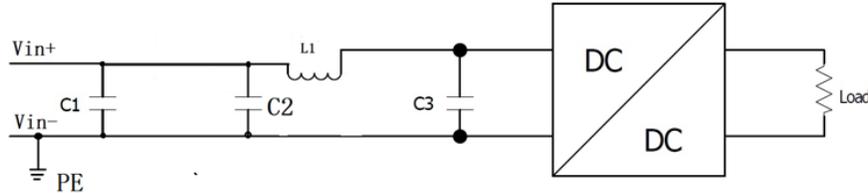
[1] Conducted Emissions Parts List

Reference	Description
C1	270µF*2 (solid capacitor)
C2	10µF* (MLCC) +4.7µF*2 (MCLL)
C3	4.7µF*2 (MLCC) +1.2mF (solid capacitor)
L1	22µH

[2] Conducted Emissions Test Equipment Used

Hewlett Packard HP8594L Spectrum Analyzer – S/N 3827A00153

2Line V-networks LS1-15V 50Ω/50Uh Line Impedance Stabilization Network

[3] Conducted Emissions Test Results – Negative Line
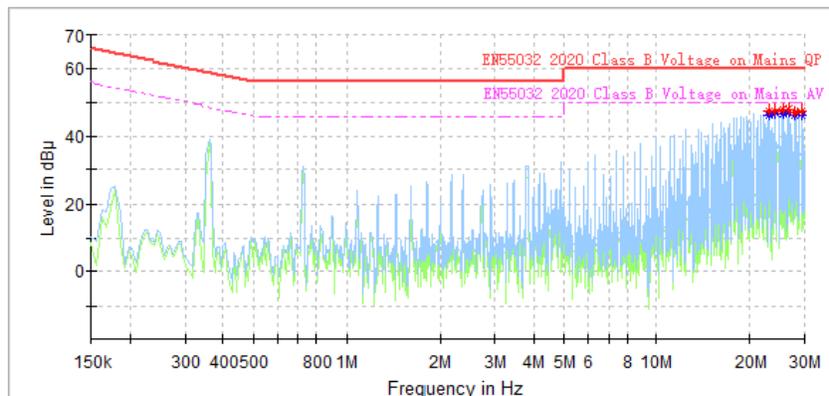
Conducted emissions performance, Negative Line
EN55032, Class B, full load

[4] Layout Recommendations

Most applications can use the filtering which is already installed inside the converter or with the addition of the recommended external capacitors. For greater emissions suppression, consider additional filter components and shielding. Emissions performance depends on the user's PC board layout, the chassis shielding environment, and choice of external components. Since many factors affect both the amplitude and spectra of emissions, Murata Poer Solutions recommends using an engineer who is experienced at emissions suppression.

Vertical Wind Tunnel

Murata Power Solutions employs a computer controlled custom designed closed loop vertical wind tunnel, infrared video camera system, and test instrumentation for accurate airflow and heat dissipation analysis of power products.

The system includes a precision low flow-rate anemometer, variable speed fan, power supply input and load controls, temperature gauges, and adjustable heating element.
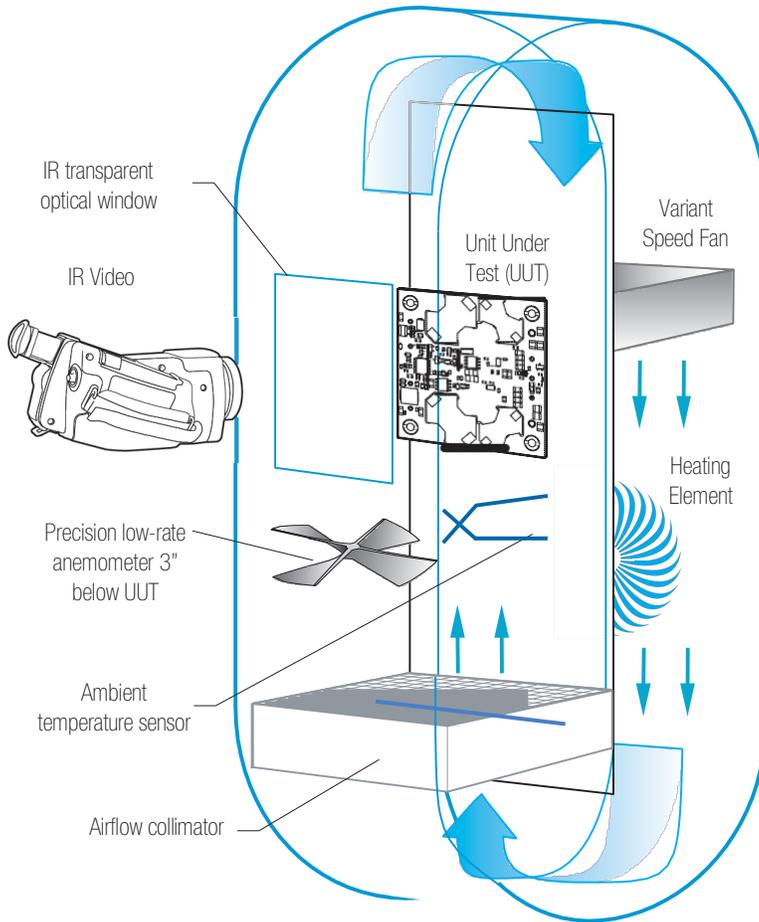
The IR camera monitors the thermal performance of the Unit Under Test (UUT) under static steady-state conditions. A special optical port is used +

Both through-hole and surface mount converters are soldered down to a 10" x 10" host carrier board, for realistic heat absorption and spreading. Both longitudinal and transverse airflow studies are possible by rotation of this carrier board since there are often significant differences in the heat dissipation in the two airflow directions.

The combination of adjustable airflow, adjustable ambient heat, and adjustable Input/Output currents and voltages mean that a very wide range of measurement conditions can be studied.

The collimator reduces the amount of turbulence adjacent to the UUT. Such turbulence influences the effective heat transfer characteristics and gives false readings. Excess turbulence removes more heat from some surfaces and less heat from others, possibly causing uneven overheating.

Both sides of the UUT are studied since there are different thermal gradients on each side. The adjustable heating element and fan, built-in temperature gauges, and no-contact IR camera mean that power supplies are tested in real-world conditions.

IR transparent optical window

IR Video

Precision low-rate anemometer 3" below UUT

Ambient temperature sensor

Airflow collimator

Unit Under Test (UUT)

Variant Speed Fan

Heating Element

Figure 6. Vertical Wind