

FEATURES

- 40-60V Input Voltage Range (54V nominal)
- Up to 97% Efficiency
- Industry Standard Eighth-Brick Package
- Output Voltage/Current: 12V/50A
- Low Output Ripple & Noise
- Operating Temperature Range: -40°C to +85°C
- Integrated Baseplate for Thermal Performance
- Over Current/Voltage/Temperature Protection
- PMBus™ interface (optional)
- Planned Certifications: cCSAus, CB



SAFETY APPROVALS (Pending)

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

PRODUCT OVERVIEW

MPE600-12V50-L48NBMC is a series of 600W, highly efficient, digitally controlled DC-DC board-mount power converters with a single 12Vdc output. PMBus® digital communication capability, included in all base models, 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.

ORDERING GUIDE¹

Part Number ¹	V _{IN}	V _{OUT}	P _{OUT}	L inch(mm)	W inch(mm)	H inch(mm)
MPE600-12V50-L48NBMC	40-60	12	600W	2.3 (58.42)	0.9 (22.86)	0.5 (12.7)

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

ABSOLUTE MAXIMUM RATINGS¹

Parameter	Conditions	Min.	Nom.	Max.	Units
Input Voltage		-0.5	-	65	Vdc
On/Off Remote Control		0	-	20	
Output Power ²		0	-	800	W
Operating Temperature Range		-40	-	85	°C
Storage Temperature Range	V _{in} =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		
Vin Undervoltage Shutdown		34	35	36		
Vin Undervoltage Shutdown Recover		36	37	38		
Vin UVP Hysteresis		1	-	3		
Vin Overvoltage Shutdown		62	64	66		
Vin Overvoltage Shutdown Recover		60	62	64		
Vin OVP Hysteresis		1	-	3		
Vout Overvoltage Shutdown		-	14	-		
Input Capacitance	Per unit Chemi-EGXF800ELL471MU25S or equivalent.	470	-	-		µF
Input Current		-	-	35		A
Inrush Current ²		-	-	50		% of I _{in}
Ripple Current		-	-	1.25	mA _{RMS} /W	

OUTPUT VOLTAGE CHARACTERISTICS

Parameter	Conditions	Min.	Nom.	Max.	Units
Peak Efficiency	V _{in} =40V, 70% of Max P _{out} , T _a =25°C	-	97	-	%
Efficiency	V _{in} =54V, 50% of Max P _{out} , T _a =25°C	-	95.7	-	
	V _{in} =54V, 100% of Max P _{out} , T _a =25°C	-	96	-	
	V _{in} =48V, 50% of Max P _{out} , T _a =25°C	-	96.2	-	
	V _{in} =48V, 50% of Max P _{out} , T _a =25°C	-	96.4	-	
Output Voltage Set Point ⁴ (w/o "S")	V _{in} =54V, P _{out} =0W, T _a =25°C	11.94	12	12.06	Vdc
Output Voltage Set Point ⁴ (with "S")	V _{in} =54V, P _{out} =0W, T _a =25°C	11.94	12	12.06	
Output Voltage Tolerance Band	V _{in} =40-60V, 0-100% of load	11.76	-	12.24	
Output Current		0	-	50	A
Output Over-Current		60	70	75	
Output Power		-	-	600	W
Ripple and Noise	20MHz bandwidth	-	-	130	mVp-p
Output Capacitance	50% ceramic, 50% Oscon or POSCAP	1000	-	10,000	µF
Load Regulation		-	-	35	mV
Line Regulation		-	10	30	
Peak Efficiency					%

¹ I_{in} is defined as the steady-state operating current when Unit is operating at V_{in} Max and P_{out} Max. While V_{out} is rising, P_{out} is ≤25% of rated power with a resistive load.

² Measured at input pin with maximum specified C_{in} and <500µH inductance between voltage source and C_{in}.

RELIABILITY & SAFETY					
Parameter	Conditions	Min.	Nom.	Max.	Units
Isolation Voltage	Input to Output Test Voltage	-	-	2250	Vdc
	Input to Baseplate Test Voltage	-	-	1500	
	Baseplate to Output Test Voltage	-	-	1500	
Switching Frequency		-	220	-	kHz
Output Voltage Set Point	Vin=54V, Pout=0W, Tc=25°C	11.94	12	12.06	Vdc
Safety Rating	Functional	-	-	-	-
Isolation Capacitance		-	1500	-	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	600	600W
Output Voltage	12V	12Vout
Output Current	50A	50A
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					
Parameter	Conditions	Min.	Nom.	Max.	Units
Turn-On Delay-1 (from Vin reaching Turn-On voltage, Vin slew rate is 1V/ms)	Vin slew rate is 1V/ms	-	-	15	ms
Turn-On Delay-2 (from Enabled asserted)		-	-	10	
Restart Delay		-	-	250	
Output Voltage Rise Time		-	-	20	
Pre-Bias Voltage		0	-	Vout	Vdc

PROTECTION					
Parameter	Conditions	Min.	Nom.	Max.	Units
Over-Temperature (internal temperature sensor)		115	-	130	°C
Current Sharing Accuracy		-	-	10	%

Note: The protection threshold can be configurate through PMBus. See the PMBus section for details.

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	
Enable Pin Current (into pin, ext. pull-up to 15V) ^{1, 2, 3}		-	-	0.5	mA
Enable Pin Current (into pin, ext. pull-up to 10V) ^{1, 2, 3}		-	-	0.3	

¹ Enable signal is referenced to Vin(-).

² Unit disabled using the 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}		-	-	150	μS
Dynamic Load Peak Deviation ^{1,2}		-	-	±740	mV
Response to Vin Step ³		-	-	1.25	Vdc

¹ 25-75-25% load step of Pout Max at 3A/μS, settling time to within 1% of Vout, measurement method.
² With a 2000μF 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)		7	-	9	Vdc
Output Voltage Hysteresis		0.2	0.3	-	
High State Voltage		0	-	5.5	μA
High State Leakage Current (into pin)		0	-	10	
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
Power Good Signal Assert Response Time		0	-	3	

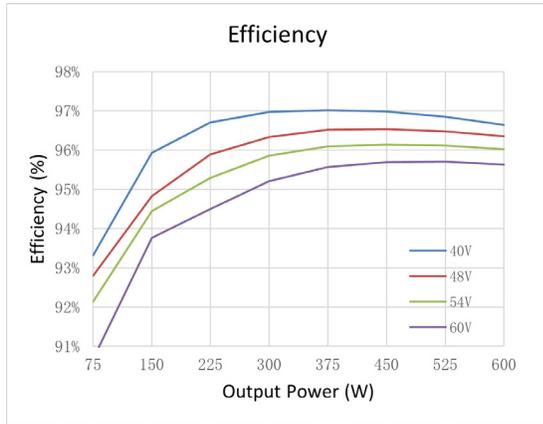
¹ The power good logic can be changed via PMBus.

ENVIRONMENTAL CHARACTERISTICS					
Parameter	Conditions	Min.	Nom.	Max.	Units
Operating Temperature - Ambient		-40	-	85	°C
Storage Temperature		-50	-	125	
Altitude, Operating		-500	-	13,120	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, EN55032/CISPR32, Part 15 (with external filter)					

GENERAL INFORMATION					
Parameter	Conditions	Min.	Typ.	Max.	Units
Mechanical Dimensions (L x W x H)			2.3 x 0.9 x 0.5		inches
			58.42 x 22.86 x 12.7		mm
Product Weight (per unit)			1.7		ounces
			48		grams
Pin Length			0.180		inches
			4.57		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

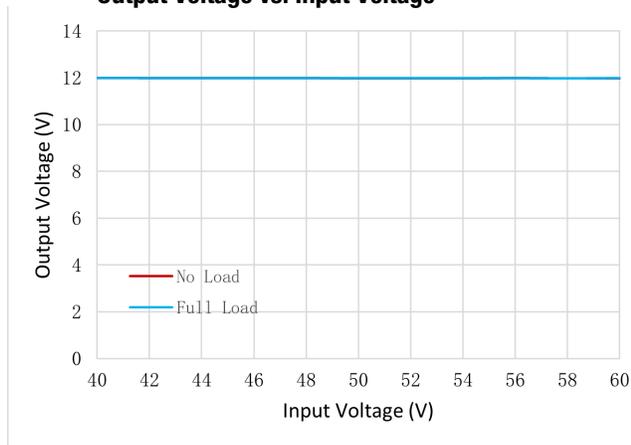
Efficiency vs. Output Power



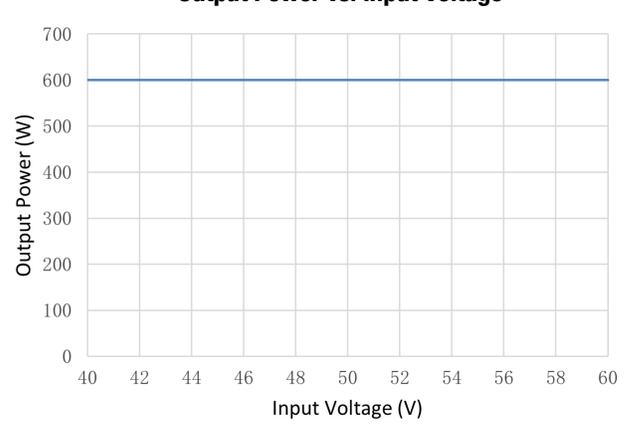
Power Loss



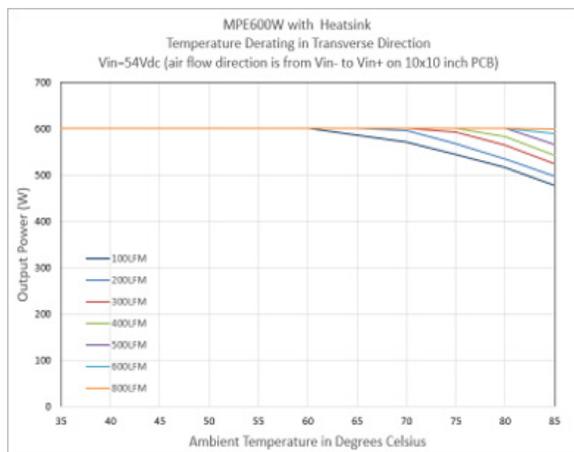
Output Voltage vs. Input Voltage



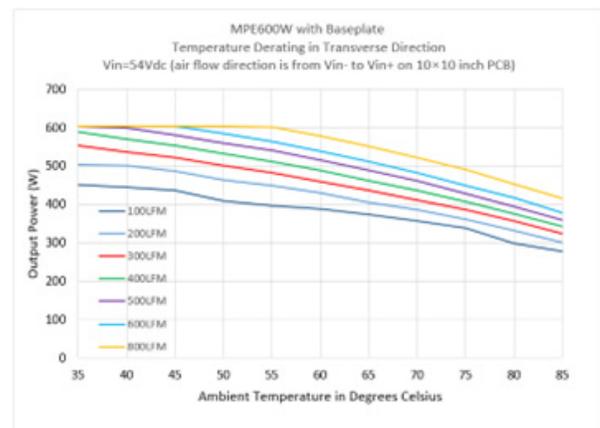
Output Power vs. Input Voltage



Output Power Derating 0.5 Heatsink (Vin=54V)

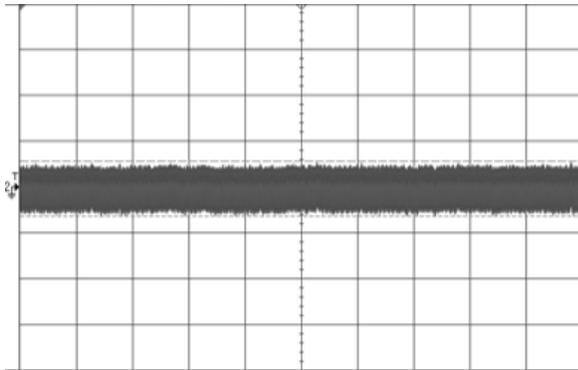


Output Power Derating Baseplate (Vin=54V)



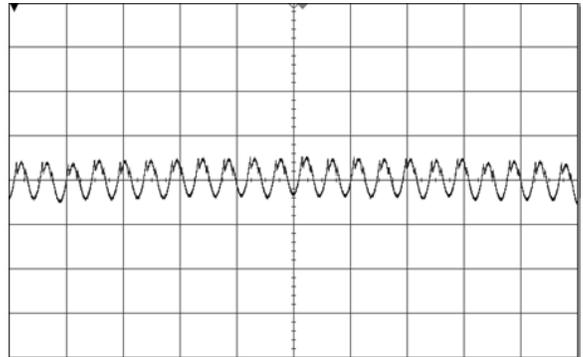
PERFORMANCE CURVES

Ripple & Noise Waveform (Vin = 54V, Iout = 50A)



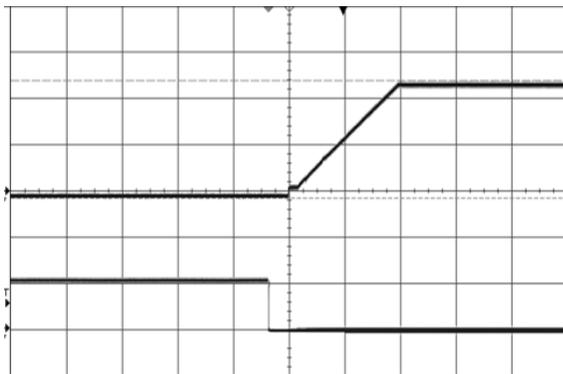
Vout: 50mV/div
Time: 20ms/div

Ripple & Noise Waveform (Vin=54V, Iout=50A)



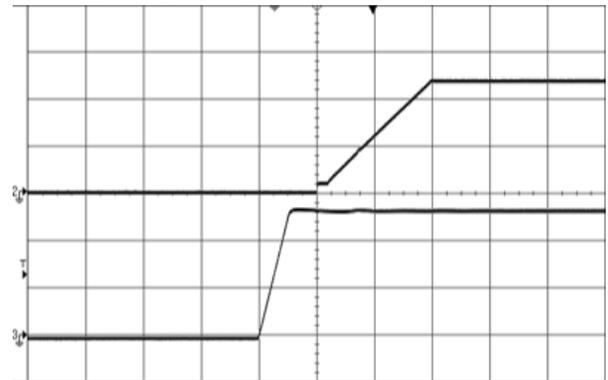
Vout: 50mV/div
Time: 5us/div

Enable Turn On – Negative Logic (Vin = 54V, Iout = 50A)



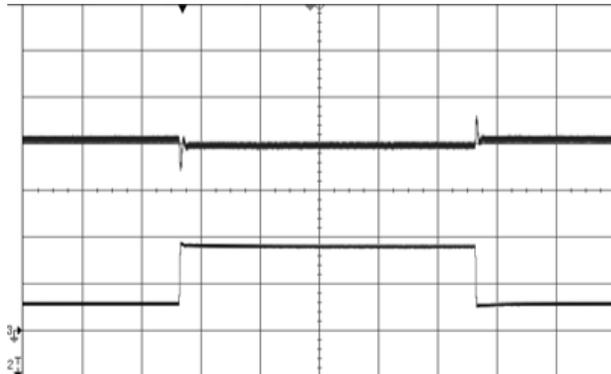
Top Trace: Vout, 5V/div
Bottom Trace: Venable, 2V/div
Time: 10ms/div

Vin Turn On (Vin = 54V, Iout = 50A)



Top Trace: Vout, 5V/div
Bottom Trace: Vin, 20V/div
Time: 10ms/div

Transient Response (Vin = 54V, 25% - 75% - 25% Load, 3A/μS)



Top Trace: Vout, 500mV/div
Bottom trace: Iout, 20A/div, Time: 1ms/div

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.	-1.3		1.3	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	Unit
01h	OPERATION	Write Byte	Read Byte	1	0x80	
02h	ON_OFF_CONFIG	Write Byte	Read Byte	1	0x1C	
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	0xD0	
1Bh	SMBALERT_MASK	N/A	Block Write-Block Read Process Call	2	N/A	
20h	VOUT_MODE	N/A	Read Byte	1	0x14	
21h	VOUT_COMMAND	Write Word	Read Word	2	0xC000	12 V
22h	VOUT_TRIM	Write Word	Read Word	2	0x0000	0 V
23h	VOUT_CAL_OFFSET	Write Word	Read Word	2	0x0000	0 V
24h	VOUT_MAX	Write Word	Read Word	2	0xD800	13.5 V
25h	VOUT_MARGIN_HIGH	Write Word	Read Word	2	0x0000	0 V
26h	VOUT_MARGIN_LOW	Write Word	Read Word	2	0x0000	0 V
27h	VOUT_TRANSITION_RATE	Write Word	Read Word	2	0xE810	2 mV/us
28h	VOUT_DROOP	Write Word	Read Word	2	0x0000	0 mΩ
29h	VOUT_SCALE_LOOP	Write Word	Read Word	2	Unit Specific	
2Bh	VOUT_MIN	Write Word	Read Word	2	0x0000	0 V
32h	MAX_DUTY	Write Word	Read Word	2	0xF180	96%
33h	FREQUENCY_SWITCH	Write Word	Read Word	2	0xF9B8	220 kHz
35h	VIN_ON	Write Word	Read Word	2	0xF080	37.0 V
36h	VIN_OFF	Write Word	Read Word	2	0xF004	35.0 V
39h	IOUT_CAL_OFFSET	Write Word	Read Word	2	0xE7F8	-0.5 A
40h	VOUT_OV_FAULT_LIMIT	Write Word	Read Word	2	0xE800	14.50 V
41h	VOUT_OV_FAULT_RESPONSE	Write Byte	Read Byte	1	0x80	
42h	VOUT_OV_WARN_LIMIT	Write Word	Read Word	2	0xD800	13.50 V
43h	VOUT_UV_WARN_LIMIT	Write Word	Read Word	2	0x1000	1.00 V
44h	VOUT_UV_FAULT_LIMIT	Write Word	Read Word	2	0x0000	0.00 V
45h	VOUT_UV_FAULT_RESPONSE	Write Byte	Read Byte	1	0x80	
46h	IOUT_OC_FAULT_LIMIT	Write Word	Read Word	2	0xEA30	70.0 A
47h	IOUT_OC_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0	
4Ah	IOUT_OC_WARN_LIMIT	Write Word	Read Word	2	0xE3A0	58.0 A

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number of Data Bytes	Default Value		Unit
4Fh	OT_FAULT_LIMIT	Write Word	Read Word	2	0x0076	118	°C
50h	OT_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0		
51h	OT_WARN_LIMIT	Write Word	Read Word	2	0x0069	105	°C
55h	VIN_OV_FAULT_LIMIT	Write Word	Read Word	2	0xEA00	64.0	V
56h	VIN_OV_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0		
57h	VIN_OV_WARN_LIMIT	Write Word	Read Word	2	0xE3E0	62.0	V
58h	VIN_UV_WARN_LIMIT	Write Word	Read Word	2	0xE250	37.0	V
59h	VIN_UV_FAULT_LIMIT	Write Word	Read Word	2	0xE230	35.0	V
5Ah	VIN_UV_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0		
5Eh	POWER_GOOD_ON	Write Word	Read Word	2	0x8800	8.50	V
5Fh	POWER_GOOD_OFF	Write Word	Read Word	2	0x8000	8.00	V
60h	TON_DELAY	Write Word	Read Word	2	0xF00C	3	ms
61h	TON_RISE	Write Word	Read Word	2	0xF050	20	ms
62h	TON_MAX_FAULT_LIMIT	Write Word	Read Word	2	0xF3FC	255	ms
63h	TON_MAX_FAULT_RESPONSE	Write Byte	Read Byte	1	0xC0		
64h	TOFF_DELAY	Write Word	Read Word	2	0x00	0	ms
65h	TOFF_FALL	Write Word	Read Word	2	0xF050	20	ms
66h	TOFF_MAX_WARN_LIMIT	Write Word	Read Word	2	0xF0FF	64	ms
6Ah	POUT_OP_WARN_LIMIT	Write Word	Read Word	2	0x13FF	4092	W
6Bh	PIN_OP_WARN_LIMIT	Write Word	Read Word	2	0x13FF	4092	W
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		
8Bh	READ_VOUT	N/A	Read Word	2	N/A		
8Ch	READ_IOUT	N/A	Read Word	2	N/A		
8Dh	READ_TEMPERATURE_1	N/A	Read Word	2	N/A		
94h	READ_DUTY_CYCLE	N/A	Read Word	2	N/A		
95h	READ_FREQUENCY	N/A	Read Word	2	N/A		
96h	READ_POUT	N/A	Read Word	2	N/A		
98h	PMBUS_REVISION	N/A	Read Byte	1	0x33		
99h	MFR_ID	N/A	Block Read	12	"Murata Power"		
9Ah	MFR_MODEL	Block Write*	Block Read	20	"MPE600-12V50-L48####"		
9Bh	MFR_REVISION	Block Write*	Block Read	12	"REV.B"		

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number of Data Bytes	Default Value		Unit
9Ch	MFR_LOCATION	Block Write*	Block Read	12	"DAS-WUHAN"		
9Dh	MFR_DATE	Block Write*	Block Read	12	"11/25/2024"		
9Eh	MFR_SERIAL	Block Write*	Block Read	20	"000000001###"		
A0h	MFR_VIN_MIN	N/A	Read Word	2	0x0000	0.0	V
A1h	MFR_VIN_MAX	N/A	Read Word	2	0x0041	65	V
A2h	MFR_IIN_MAX	N/A	Read Word	2	0x0019	25	A
A3h	MFR_PIN_MAX	N/A	Read Word	2	0x03E8	1000	W
A4h	MFR_VOUT_MIN	N/A	Read Word	2	0x0000	0.00	V
A5h	MFR_VOUT_MAX	N/A	Read Word	2	0xD800	13.50	V
A6h	MFR_IOUT_MAX	N/A	Read Word	2	0xEB20	100.0	A
A7h	MFR_POUT_MAX	N/A	Read Word	2	0x0320	800.0	W
A8h	MFR_TAMBIENT_MAX	N/A	Read Word	2	0x0055	85.0	°C
D1h	MFR_IOUT_OC_FAST_FAULT_LIMIT	Write Word*	Read Word	2	0XEAD0	90.0	A
DAh	MFR_ISHARE_THRESHOLD	Write Word*	Read Word	2	0xF00E	3.5	A
DEh	MFR_REG_WRITE	Write Byte	Read Byte	1	N/A		
DFh	MFR_REG_READ	Write Byte	Read Byte	1	N/A		
EAh	MFR_IOUT_APC	Write Word*	Read Word	2	Unit Specific		

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) Maximum 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 (see PMBUS 1.2 Specification)

DAh MFR_EEPROM_ERASE
Erase the data store in EEPROM

DDh MFR_ON_OFF_CONFIG
Set the ON/OFF polarity

Bits	Meaning
7:3	RSVD
2	Controls how the unit responds to the CONTROL pin 1:Unit requires the primary ON/OFF pin to be asserted to start the unit 0:Unit ignores the primary ON/OFF pin
1	Polarity of primary ON/OFF logic 1:Active high (Pull high or open to start the unit) 0:Active low (Pull pin low to start the unit)
0	RSVD

DEh MFR_POWER_GOOD_POLARITY
Set the POWER GOOD signal polarity

Bits	Meaning
7:1	RSVD
0	1: Negative logic, output low if Vout rises to specific value 0: Positive logic, output high if Vout rises to specific value

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

See the calibration procedure file.

F8h CAL_READ_VOUT

See the calibration procedure file.

F9h CAL_READ_VIN

See the calibration procedure file.

FAh CAL_READ_IOUT

See the calibration procedure file.

FBh CAL_VOUT_ADJUST

See the calibration procedure file.

FCh MFR_SUPERVISOR_PASSWORD

Set unit to supervisor mode or ROM mode (see the 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
5 VIN_UV_FAULT
2 IIN_OC_FAULT
1 IIN_OC_WARNING
0 PIN_OP_WARNING

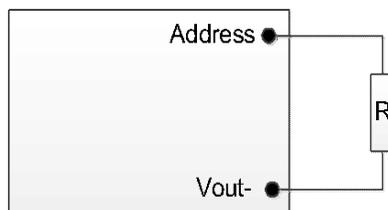
STATUS_MFR_SPECIFIC
Manufacturer Defined

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

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)
40	0.68
41	1
42	1.5
43	2.2
44	3.3
45	4.7
46	6.8
47	10
48	15
49	22
4A	33
4B	47
4C	68
4D	100
4E	150
4F	220
+/-1% resistor accuracy is acceptable	

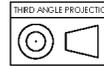
If PMBus address setting is out of the address table, default PMBus address 64d is assigned instead.

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	ADDR1	
J6-7		0.028	0.161	IMON	
1	Tolerance on pin diameter is $\pm 0.0015''$, tolerance on pin length is $\pm 0.010''$				
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.				

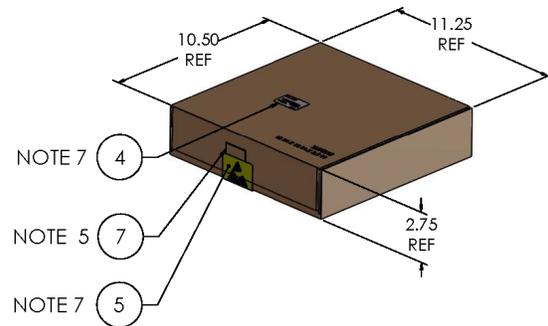
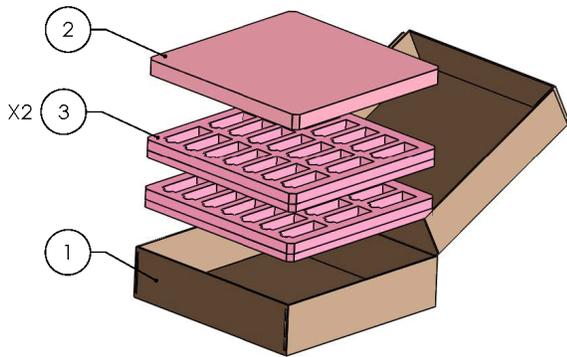
PACKAGING INFORMATION

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



REVISION STATUS			
REV	DESCRIPTION	ECO	DATE
A	DRWG UNDER CHANGE CONTROL	---	5/08/2008
B	ADDED NOTE 2	26542	8/31/2008
C	RED RAWN WITH TABLE DDED	35048	4/04/2008
D	REVISED FB ECO	48195	3/07/2011
E	BD LABEL ADDED	43629	8/18/2011
F	REVISED FB ECO	53400	3/09/2016
G	REVISED FB ECO	52927	9/29/2016
H	REVISED FB ECO	58000	4/30/2017



NOTES:

- THIS DOCUMENT DEFINES THE GENERAL PACKING RULES FOR APPLICABLE SHIPPING KIT . INFORMATION FOR SEALING AND MARKING IS NOT PART OF THIS DOCUMENT.
- REFER TO SHIPPING KIT BOM DETAILS.
- INSERT UNITS INTO FOAM POCKETS IN TRAYS PER 61398 APPROX AS SHOWN
- EACH FOAM TRAY (2300238) CONTAINS 21 UNITS. IN FULL MPQ QUANTITIES, TWO TRAYS EQUAL A TOTAL OF 42 (2x21) UNITS PER BOX.
- FRONT FLAP SHALL BE SEALED WITH ESD TAPE SPECIFIED OR EQUIVALENT AFTER THE BOX IS CLOSED.
- LABEL (ITEM 6) USED FOR MFR OVERPACK CARTON
- APPLY ESD LABEL (ITEM 5) OVER TAPE USED TO SEAL BOX AND APPLY IDENTIFICATION LABEL (ITEM 4) APPROX AS SHOWN.
- 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 115°C.
Maximum Pot Temperature 270°C.
Maximum Solder Dwell Time 7 seconds

For Sn/Pb based solders:

Maximum Preheat Temperature 105°C.
Maximum Pot Temperature 250°C.
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.

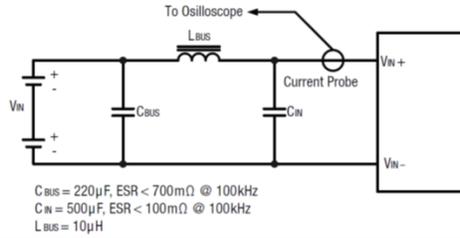


Figure 2. Measuring Input Ripple Current

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.

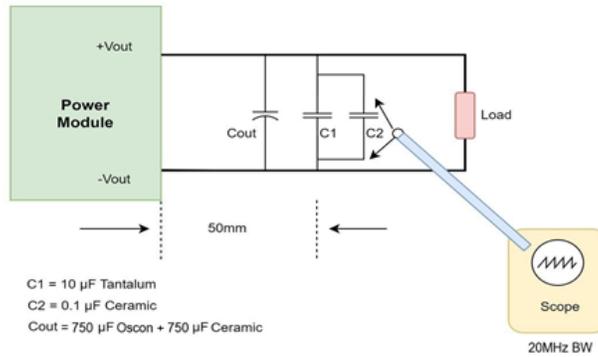


Figure 3. Measuring Output Ripple and Noise (PARD)

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 following table. 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
<p>Top View (baseplate)</p>		
<p>Bottom View (pin side)</p>		

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 increases 110% 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

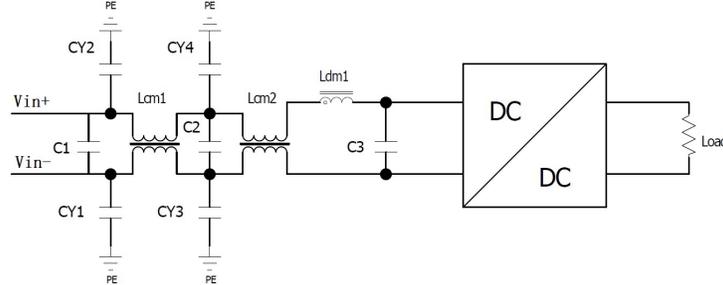
On the input side, a remote On/Off Control can be used with negative logic.

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.



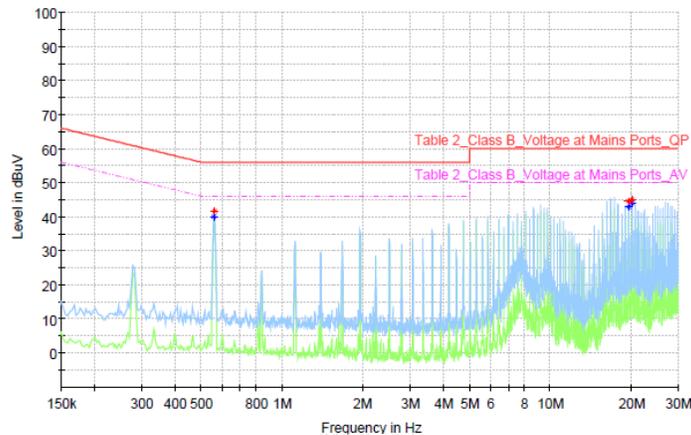
[1] Conducted Emissions Parts List

Reference	Description
C1	10 μ F*2
C2	10 μ F*2+4.7 μ F
C3	10 μ F*2+4.7 μ F+220 μ F(e-lyt)
CY1, CY2, CY3, CY4	22nF
Lcm1	3mH
Lcm2	1.4mH
Ldm1	22 μ H

[2] Conducted Emissions Test Equipment Used

- Hewlett Packard HP8594L Spectrum Analyzer – S/N 3827A00153
- 2Line V-networks LS1-15V 50 Ω /50Uh Line Impedance Stabilization Network

[3] Conducted Emissions Test Results – Negative Line



Conducted emissions performance, Negative Line
CISPR 32, 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.

Horizontal Wind Tunnel

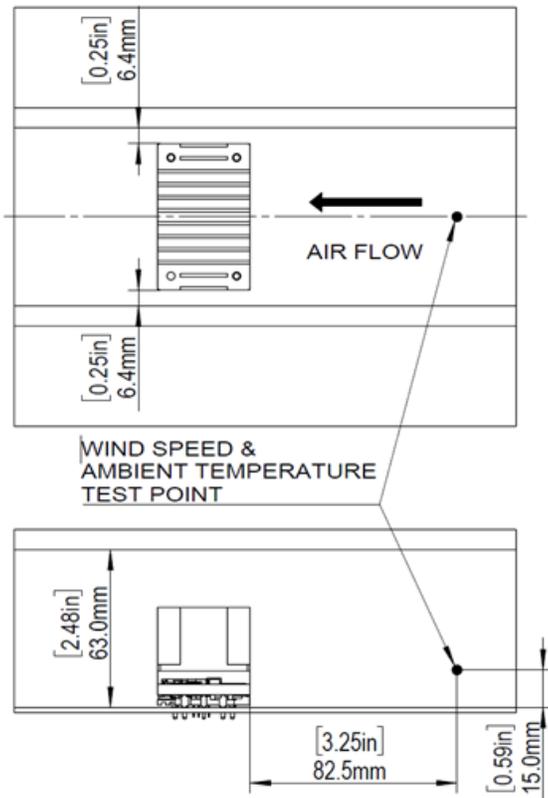


Figure 6. Wind Tunnel Test Setup

Murata Power Solutions employs a computer-controlled, custom-designed closed-loop horizontal wind tunnel, an infrared video camera system, and specialized test instrumentation for accurate airflow and heat dissipation analysis of power products, closely simulating real customer applications.

The system includes a precision low-flow anemometer, a variable-speed fan, power supply input and load controls, temperature gauges, and an adjustable heating element.

A thermal coupler monitors the thermal performance of the Unit Under Test (UUT) under static steady-state conditions.

Both through-hole and surface-mount converters are soldered onto a 10" × 8" host carrier board (6 layers, 3 oz.) to ensure realistic heat absorption and spreading. Longitudinal and transverse airflow studies are possible by rotating the carrier board, as significant differences in heat dissipation often occur between the two airflow directions.

The combination of adjustable airflow, ambient heat, and input/output currents and voltages allows for a wide range of measurement conditions.

