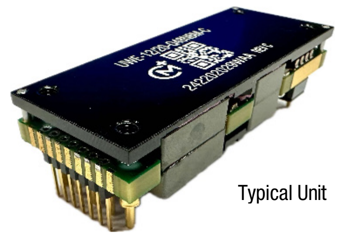


Typical Unit

- Input Range of 18-60V (48V nominal)
- Output Voltage of 12V @ 20A
- Adjustable Output Voltage: 10.8-12.6V
- Efficiency up to 95.5%
- Industry-Standard 1/8 Brick Package
- PMBus® Interface (optional)
- Low Output Ripple & Noise
- Over Current/Voltage/Temperature Protection
- Remote On/Off (negative logic – standard configuration)
- Integrated Baseplate for Thermal Performance
- 2,250Vdc Isolation (I/O)

PRODUCT OVERVIEW

UWE-12/20-Q48NBM-C is a 240W, isolated, highly-efficient, digitally controlled DC-DC board-mount power converter 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.

This series is designed and manufactured in an industrial environment.

ORDERING GUIDE

Part Number[1]	V_{IN}	V_{OUT}	P_{OUT}	L inch(mm)	W inch(mm)	H inch(mm)
UWE-12/20-Q48NBM-C	18-60Vdc	12Vdc	240W	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.

INPUT VOLTAGE

Parameter	Conditions	Min.	Typ.	Max.	Units
External Input Fuse		-	30	-	A
Internal Filter Type		-	Pi	-	
Input Reverse Polarity Protection		-	N/A	-	
Operating Input Voltage Range		18	48	60	Vdc
Turn-On Voltage1	Vin rises to build the Vout	15	16.5	18	Vdc
Turn-Off Voltage1	Vin fails to shutdown the Vout	14	15.5	17	Vdc
Turn-On Voltage2	Vin fails to build the Vout	61	63	65	Vdc
Turn-Off Voltage2	Vin rises to shutdown the Vout	63	65	67	Vdc
Turn-On/Turn-Off Hysteresis			N/A		Vdc
Voltage Transients	100ms duration			80	Vdc
Overvoltage Shutdown Recover		60	63	65	Vdc

INPUT CURRENT

Parameter	Conditions	Min.	Typ.	Max.	Units
Full Load Conditions	Vin @ minimum			15	A
Inrush Transient	Vin @ nominal		N/A		A^2·Sec
No Load Input Current	Vin @ nominal, Iout = 0 A, Unit = ON			500	mA
Shut-Down Mode Input Current	Off, UV, OT			100	mA

GENERAL & SAFETY					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Efficiency	Vin = 24V, half load		95.5		%
	Vin = 24V, full load		94		
	Vin = 48V, half load		94		
	Vin = 48V, full load		93.5		
Variable Frequency Control	Default		200		kHz

TURN ON TIME					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Turn-On Delay-1	Defined as time between Vin reaching Turn-On voltage and Vout reaching 10% of final value. Enable is asserted before Vin reaches Turn-On voltage.	20	50	80	ms
Turn-On Delay-2	Defined as time between Enable and Vout reaching 10% of final value.	0	5	15	
Output Voltage Rise Time	Defined as time between Vout at 10% of final value and Vout at 90% of final value.	10	20	50	

ISOLATION					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Input to Output Test Voltage				2250	Vdc
Input to Baseplate Test Voltage				1500	
Baseplate to Output Test Voltage				1500	
Arc Sense Level		Level 5			
Insulation Safety Rating		Functional		-	
Isolation Resistance		10			Mohm
Isolation Capacitance		1500			pF
Calculated MTBF		5000		-	kHours

OUTPUT					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Total Output Power		0		240	W
Voltage					
Initial Output Voltage	VIN = 48 V, Iout = 0 A, temp = 25 °C	11.98	12.00	12.02	Vdc
Output Voltage Tolerance Band		11.64	12.00	12.36	Vdc
Load Regulation		-0.24		0.24	V
Line Regulation		-0.12		0.12	V
Output Adjust Range	Hardware TRIM without "S" suffix	10.8		12.6	Vdc
Trim Down: Trim (pin #J6) to -Vout Sense (pin #J5)	Rt down (kΩ) = 5.11/((Vonom-Vo)/Vonom)-10.22-2,	-10		-	%
Trim Up: Trim (pin #J6) to +Vout Sense (pin #J7)	Rt up(kΩ)= 5.11*Vonom*(1+Δ)/(1.225*Δ)-5.11/Δ-10.22-2, Δ=I(Vonom-Vo)/VonomI			5	
Dynamic Load Response			300	500	µSec
Dynamic Load Peak Deviation	Load step = 50% of Pout Max from 25-75-25%. External capacitance tested with a 1.0 µF ceramic, 10 µF tantalum, and 470 µF low ESR polymer capacitor across the load. Low ESR polymer capacitor is X-CON Electronics ULR477M1CF1ATV or equivalent.		±450	600	mV
Pre-Bias Voltage		0		Vout	Vdc
Current					
Output Current Range		0		20	A
Minimum Load			No minimum load		A
90% of Vnom, after warmup, configurable via PMBus+					
Short Circuit					
Short Circuit Current (hiccup technique, auto-recovery within 1% of Vout)			0.4	1	
Short Circuit Duration (or remove short for recovery)			Continuous		
Output shorted to ground, no damage					
Short circuit protection method			Latch off		

REGULATION					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Line Regulation		0		240	mV
Vin = 22-60 V, Vout = full load					
Load Regulation		0		240	
Iout = min. to max., Vin = 48 V, IVout@min_load-Vout@max_loadI					
Ripple & Noise		0	150	240	
Vin = Vin_min. to Vin_max and Io = Io_min to Io_max, tested with a 1.0 µF ceramic, 10 µF tantalum and 470 µF low ESR polymer capacitor across the load. 470µF low ESR polymer capacitor is X-CON Electronics ULR477M1CF1ATV or equivalent.					
Output Capacitance per Unit		470		10000	µF
• Typically 50% ceramic, 50% POSCAP, POSCAP recommendation is X-CON Electronics ULR477M1CF1ATV or equivalent. • Operating Configuration 1: For single unit configuration, Enable can be asserted before or after Vin rises above the Turn-On Voltage. • Operating Configuration 2: For parallel unit configuration, Enables must be asserted simultaneously at least 25ms after Vin rises above the Turn-On Voltage.					

PMBUS					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
VIN_CALIBRATION		-6		6	%
VOUT_CALIBRATION		-2		2	%
IOUT_CALIBRATION :(0~50% Iout)		-3		3	A
IOUT_CALIBRATION :(50%~100% Iout)		-5		5	%

PMBUS MONITORING ACCURACY					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
VIN_READ		-6		6	%
VOUT_READ		-2		2	%
IOUT_READ:(0~50% Iout)		-3		3	A
IOUT_READ:(50%~100% Iout)		-5		5	%
TEMP_READ		-10		10	°C

PROTECTION					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Vout Undervoltage Shutdown					Vdc
Vout Overvoltage Shutdown			14.5		
Vin Undervoltage Shutdown		12.5	13.5	14.5	
Vin Overvoltage Shutdown		62.0		66.0	
Output Over-Current			24		A
Over-Temperature (baseplate hotspot)			120		°C

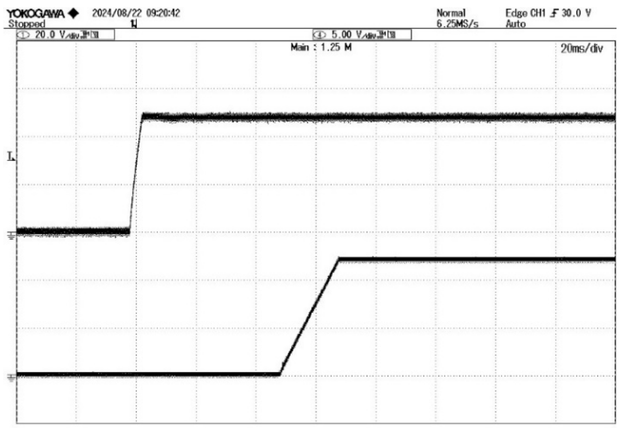
FEATURES AND OPTIONS					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
"P" Suffix					
Enable Pin Off Voltage Levels		-0.1		0.8	Vdc
Enable Pin On Voltage Levels		3.5		13.5	
Enable Pin Current (into pin, ext. pull-up to 10V)			0.1	0.2	mA
"N" Suffix					
Enable Pin Off Voltage Levels		3.5		13.5	Vdc
Enable Pin On Voltage Levels		-0.1		0.8	
Enable Pin Current (into pin, ext. pull-up to 10V)			0.1	0.2	mA
Remote Sense Compliance				10	%
[1]Enable signal is referenced to Vin(-)					
Power-Good Signal					
Output Voltage Low (trigger limits)		8.2		8.6	V
Output Voltage High (trigger limits)		10		10.4	
Output Voltage Hysteresis		0.2			
High State Voltage		3		5.5	µA
High State Leakage Current (into pin)		0		10	V
Low State Voltage		0		0.8	mA
Low State Current (into pin)		0		5	ms
Power Good Signal De-Assert Response Time		0	-	3	
Power Good Signal Assert Response Time				3	
Overtemp Warning			10°C below OTP threshold		°C

ENVIRONMENTAL CHARACTERISTICS					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Operating Ambient Temperature		-40		85	°C
Storage Temperature		-55		125	
Altitude, Operating		-500		13120	feet
Relative Humidity	Operating, Non-Condensing	10		90	%
	Non-Operating, Non-Condensing	10		95	

MECHANICAL					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Units**
Outline Dimensions			NaN		
Outline Dimensions with baseplate		2.30 x 0.9			Inches
		58.42 x 22.86			mm
Weight (open frame)			NaN		
Weight with baseplate			43		g
Through Hole Pin Diameter			0.04/0.06		Inches
Digital Interface Pin Diameter			0.02		
Through Hole Pin Material			Cu		
TH Pin Plating Metal and Thickness (Nickel subplate)					μ-inches
TH Pin Plating Metal and Thickness (Gold overplate)					
EMI/RFI Shielding					

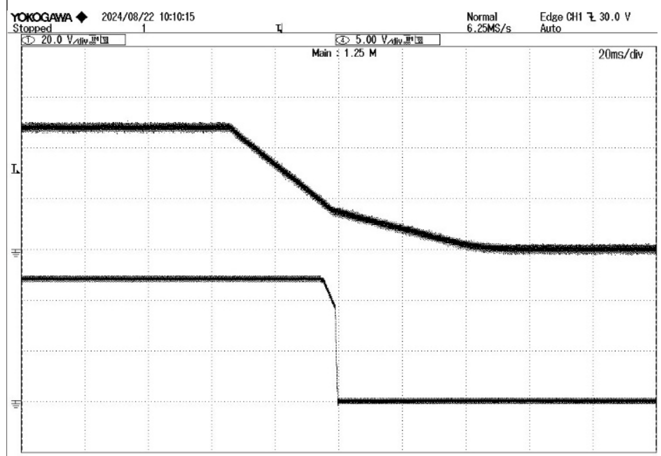
PERFORMANCE DATA

Start-Up Voltage (48Vin)



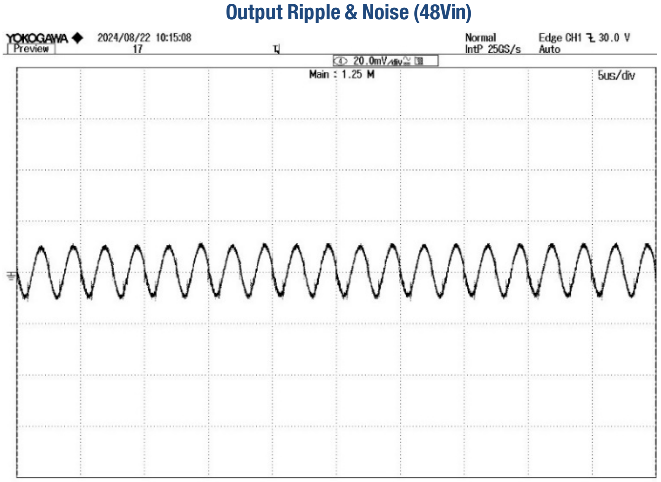
Start-up enabled by connecting VI at: TP1 = +25°C VI = 48 V IO = 20A resistive load	Top trace: Input voltage (20 V/div.) Bottom trace: Output voltage (5 V/div.) Time scale: (20ms/div.)

Shut Down Voltage (48Vin)



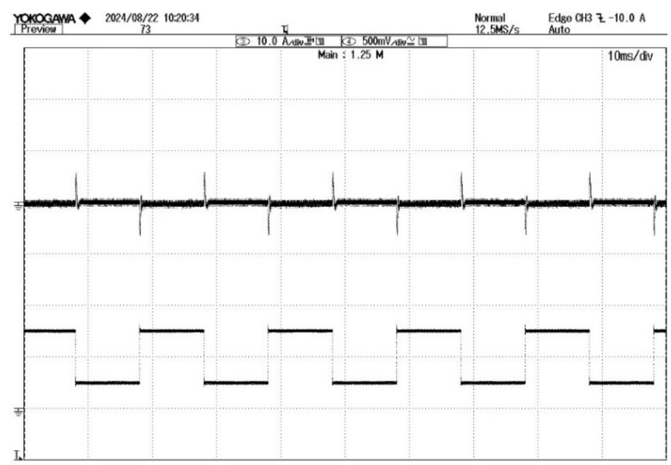
Shut down enabled by disconnecting VI at: TP1 = +25°C VI = 48 V IO = 20A resistive load	Top trace: Input voltage (20 V/div.) Bottom trace: Output voltage (5 V/div.) Time scale: (20ms/div.)

Output Ripple & Noise (48Vin)



TP1 = +25°C VI = 48 V IO = 20A resistive load	Trace: Output voltage (20 mV/div.) Time scale: (5μs/div.) 20 MHz bandwidth filter 10 μF+0.1 μF

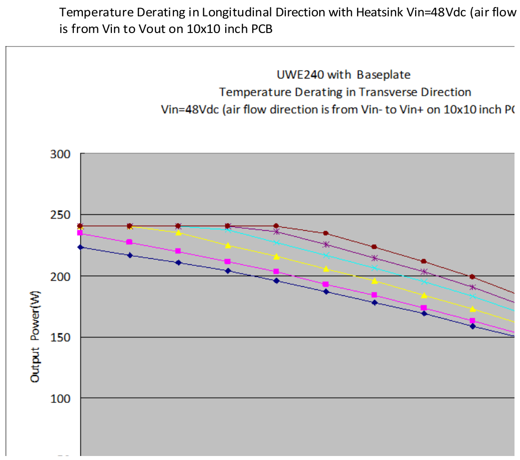
Load Transient Waveform (1A/uS, 48Vin)



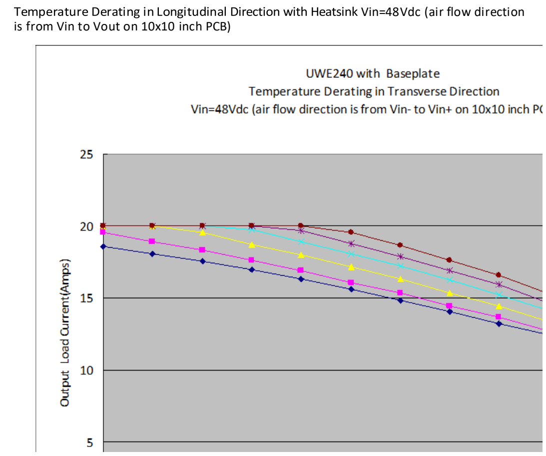
Output voltage response to load current step change (75% - 25%-75%) TP1 = +25°C, VI = 48 V	Top trace: Output voltage (500mV/div.) Bottom trace: Output current (10A/div.) Time scale: (10ms/div.)

PERFORMANCE DATA

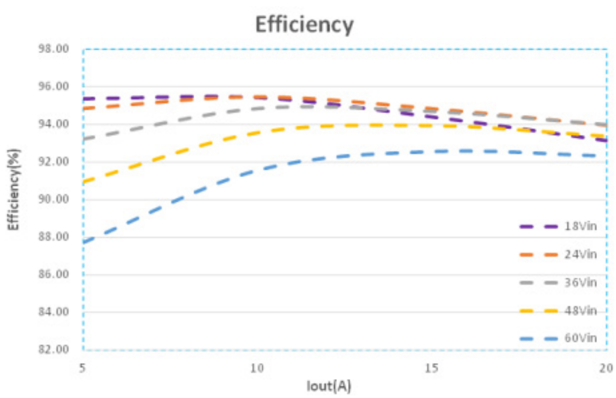
Output Power vs. Temperature



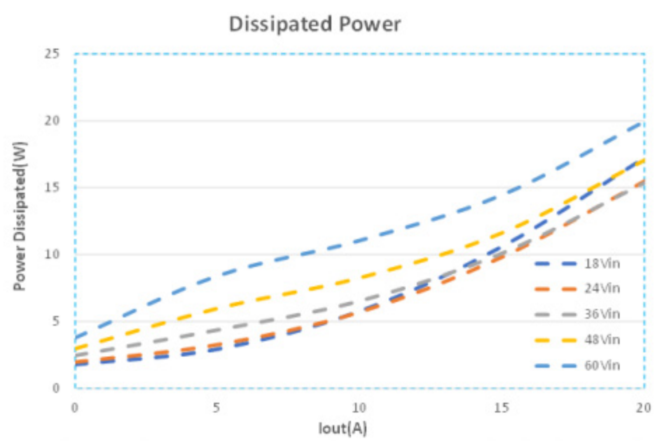
Output Load Current vs. Temperature



Efficiency vs. Load Current & Input Voltage @25°C

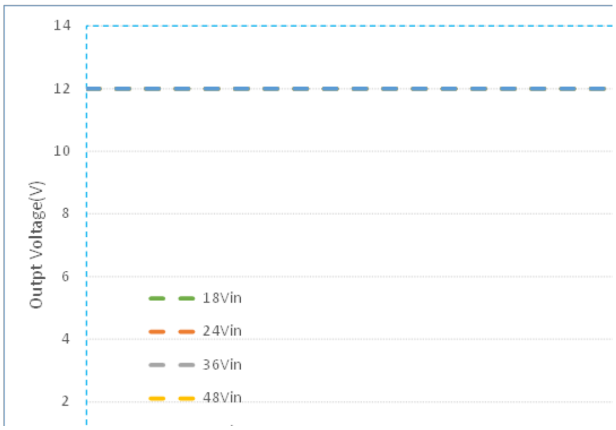


Dissipated Power vs. Load Current & Input Voltage @25°C

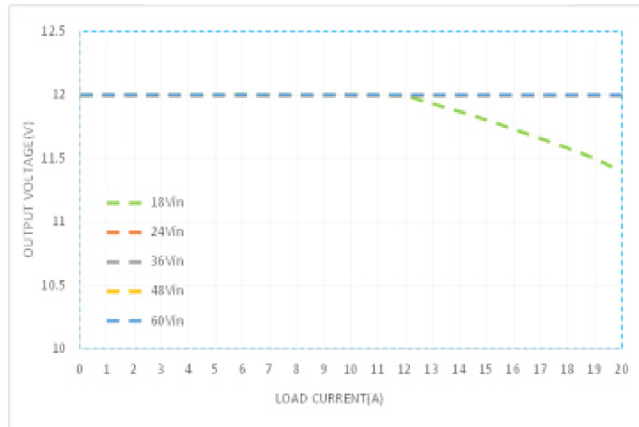


PERFORMANCE DATA

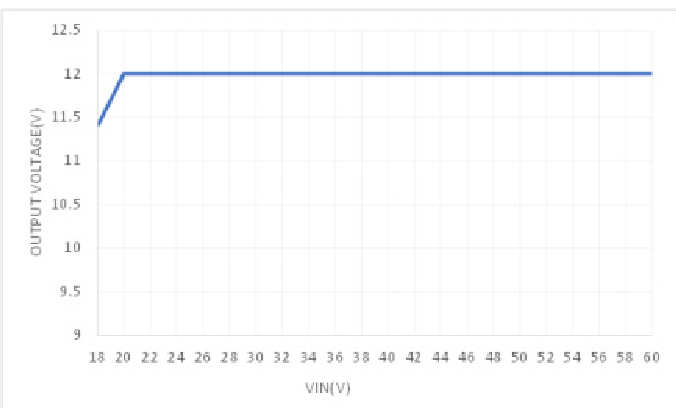
Current Limit Characteristics @ 25°C



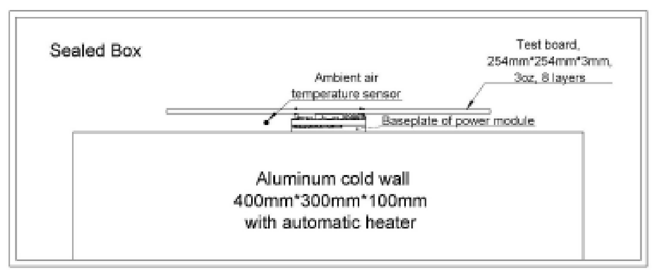
Output Voltage vs. Load Current @ 25°C



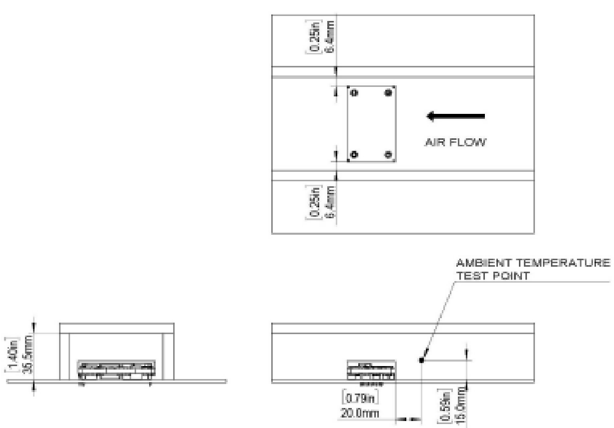
Maximum Adjustable Output Voltage



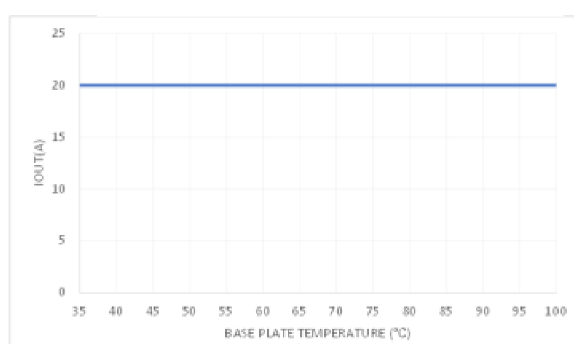
Cold Wall Test Set-up



Wind Tunnel Test Set-up

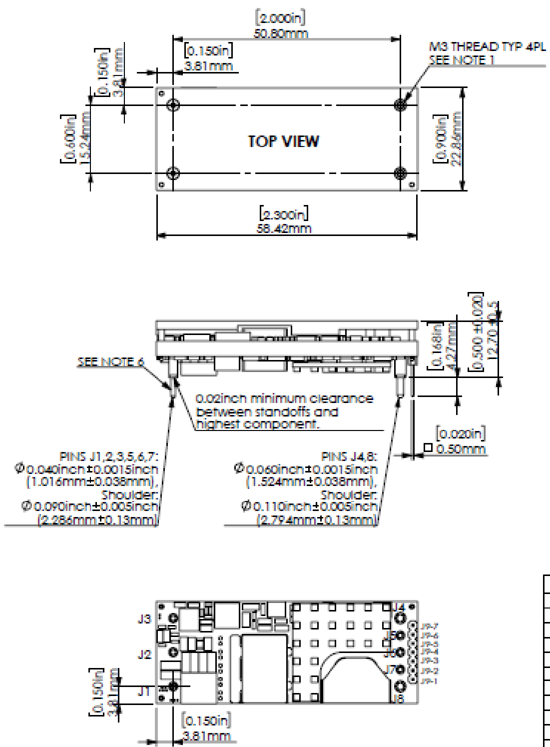


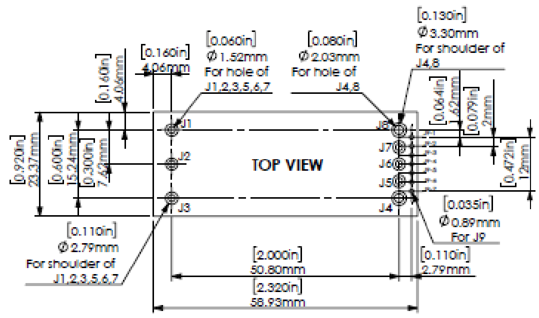
Output Current Derting – Cold Wall Sealed Box



Available Output Current vs. Baseplate Temperature (°C) , Vin=48V

MECHANICAL SPECIFICATIONS





Pin	Designation
J1	Vin+
J3	Vin-
J2	On/Off
J4	Vout-
J5	Sense-
J6	Trim/C1
J7	Sense+
J8	Vout+
J9-1	Addr0
J9-2	Addr1
J9-3	Clock
J9-4	SMBAlert
J9-5	Data
J9-6	GND

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

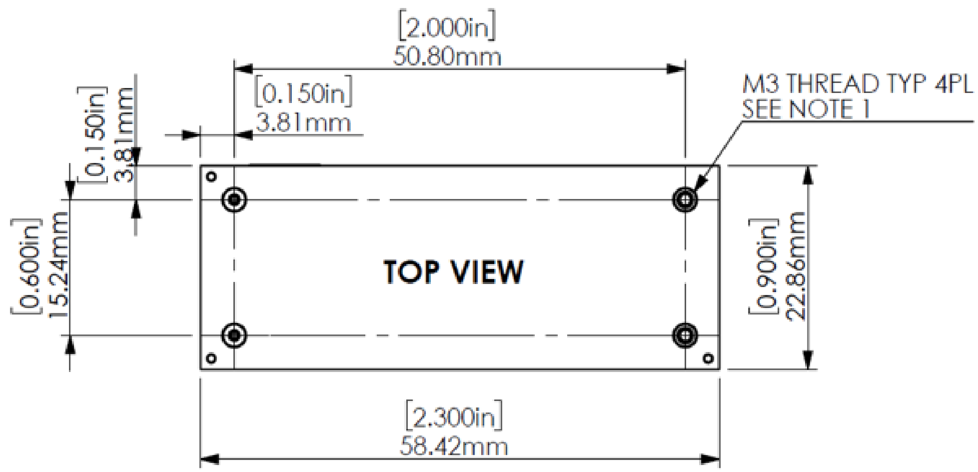
6: STANDARD PIN LENGTH: 0.180inch,
FOR L1 PIN LENGTH OPTION IN MODEL NAME,
USE L1 PIN WITH PIN LENGTH TO 0.110inch,
FOR L2 PIN LENGHT OPTION IN MODEL NAME,
USE L2 PIN WITH PIN LENGTH TO 0.145inch.

PIN DESCRIPTION

Pin #	Diameter(inches)	Length(inches)	Name	Function
J1	0.04	0.18	Vin+	Positive input voltage
J2	0.04	0.18	On/Off	Turns unit On (low) and Off (high or open)
J3	0.04	0.18	Vin-	Negative input voltage
J4	0.06	0.18	Vout-	Negative output voltage
J5	0.04	0.18	Sense-	Remote Sense ngative
J6	0.04	0.18	Trim/C1	TRIM function
J7	0.04	0.18	Sense+	Remote sense positive
J8	0.06	0.18	Vout+	Positive output voltage
J9-1	0.0283	0.17	Addr0	PMBus address pin 0
J9-2	0.0283	0.17	Addr1	PMBus address pin 1
J9-3	0.0283	0.17	Clock	PMBus clock line
J9-4	0.0283	0.17	SMBAlert	PMBus alert line
J9-5	0.0283	0.17	Data	PMBus data line
J9-6	0.0283	0.17	GND	GND (equivalent to Vout)
J9-7	0.0283	0.17	Pgood	Power Good

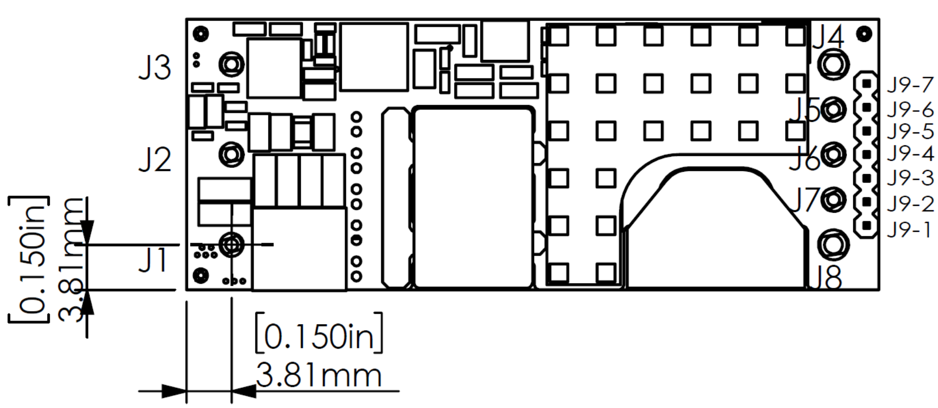
Tolerance on pin diameter is ± 0.002", tolerance on pin length is ± 0.010".
Unit's footprint on PCB has pin holes that are 40mils larger than the unit pin diameter. Design of the unit must prevent it from mounting lower on PCB than intended. If pin shoulders are used for this purpose, they must be a minimum (including tolerance) of 45mils larger than unit's nominal pin diameter. Shoulder design must allow out-gassing from pin holes during manufacturing process.

BASEPLATE DETAILS



Baseplate must have four heatsink mounting holes in the locations shown above.
Heatsink mounting holes must not be chamfered.
Heatsink mounting holes must be deep enough to allow for 110mils of screw penetration into baseplate, with a minimum of three-thread engagements.
M3 screw to bolt the unit's baseplate to other surfaces must not exceed 0.110"(2.8mm) depth below the surface of the baseplate.
Applied torque per screw should not exceed 5.3In-lb(0.6Nm).
Supplier must incorporate a means of preventing metal shavings from heatsink mounting holes from causing damage to the unit.
Tolerances: .xx ± 0.02", .xxx ± 0.010".

PIN NUMBERING/LOCATION

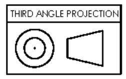


SHIPPING TRAYS AND BOXES

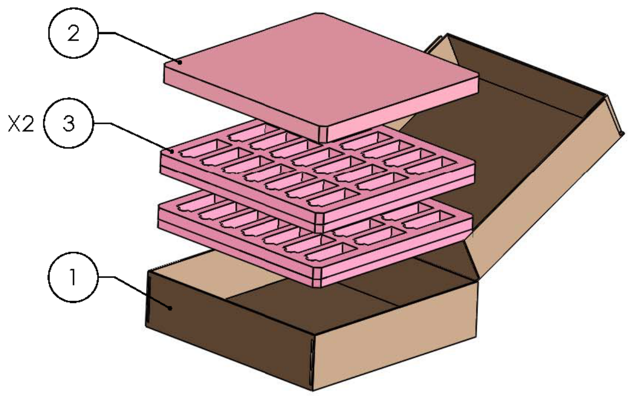
ITEM NO. (7770118)	PART NUMBER	DESCRIPTION	QTY
1	2300208	SHIPPING BOX, 10" X 10" X 2.50"	1
2	2300221	SHIPPING TRAY BASE (PAD) .75" THICK	1 (NOTE 8)
3	2300238	SHIPPING TRAY, 1/8 BRICK (21 CAVITY)	2
4	2300159	LABEL, 1.0" X 1.5" PAPER	1
5	5600-01098-0	LABEL, PRE-PRINTED ESD ATTENTION	1
6	5652-01166-0	LABEL,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

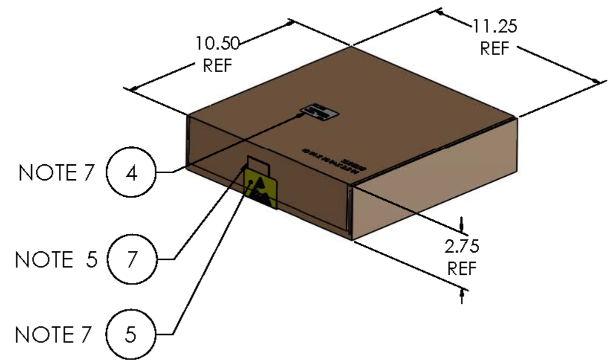
ITEMS ABOVE REFER TO 7770118 BOM AND ARE FOR REFERENCE ONLY, REFER TO APPROPRIATE BOM FOR COMPLETE LIST OF PARTS

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

MPQ = 42

TECHNICAL NOTES & APPLICATIONS OVERVIEW

Power Management Overview and PMBus Interface (Applicable Models)

A wide range of parameters can be read and configured by the system/host by using PMBus™ digital communications.

Each module is provided pre-configured for a wide range operation. Refer to the PMBus™ Interface section for details.

SMBAERT# Hardware Signal (Applicable Models)

SMBALERT# signal offers an alternate method for system/host notification that a fault or Warning has been detected (mirrors the STATUS_X fault/warn register bits) within the module and is useful in applications requiring real time fault notification independent or in addition to reading PMBus™ STATUS_X register fault bits which might not be read by system/host frequently enough to detect that a fault/ warning bit flag was set.

Internally driven low <0.4Vdc indicates a Vout, Iout, Vin, Temperature, or Power Good fault/warning has been detected and remains low until the fault/warning stimulus has been removed and the system/host clears the individual bit flag or issues "CLEAR_FAULTS" command.

Drive high, >2.4Vdc to indicate no fault conditions within power module are detected.

Soft-Start Power Up

The default rise time of the ramp up is 20ms. When starting by applying input voltage the control circuit boot-up time adds an additional 50ms delay. The soft-start power up of the module can be reconfigured using the PMBus interface.

Output Over Voltage Protection (OVP)

Both OVP limit and response can be configured via PMBus command (See PMBus Command 40h VOUT_OV_FAULT_LIMIT for details). The default output OVP limit is set to 20% above nominal output voltage and responds by immediately shutdown of main output and occur, output is latch to rectify the fault, need to restart enable or Vin.

Over Current Protection (OCP, Current limit)

The module includes current limiting circuitry for protection at continuous over load. The default setting for the product is latch mode. The current limit can be configured by PMBus command 0x46, IOUT_OC_FAULT_LIMIT, to be greater than the IOUT_OC_WARN_LIMIT (PMBus Command 0x4A). The maximum value that the current limit could be set is 24A.

Power Good

The module provides Power Good (PG) flag in the STATUS_WORD register that indicates the output voltage is within a specified tolerance of its target level and no fault condition exists. The Power Good pin default logic is negative and it can be configured by MFR_PGOOD_POLARITY.

CAUTION: This converter is not internally fused. To avoid danger to persons or equipment and to retain safety certification, you must connect an external fast-blow input fuse as listed in the specifications. Ensure that the PC board pad area and etch size are adequate to provide enough current so that the fuse blows with an overload.

Start Up Considerations

When power is first applied to the DC-DC converter, there is risk of startup difficulties if you do not have both low AC and DC impedance and adequate regulation of the input source. Ensure that your source supply does not allow the instantaneous input voltage to go below the minimum voltage. Use a moderate size capacitor close to the input terminals. You might need two or more parallel capacitors. A larger electrolytic or ceramic cap supplies the surge current and a smaller parallel low-ESR ceramic cap gives low AC impedance.

The input current is carried both by the wiring and the ground plane return. Ensure the ground plane uses adequate thickness copper. Run additional bus wire if necessary.

Input Fusing

Certain applications or 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 current-limited. For safety purposes, Murata Power Solutions recommends a fast blow fuse installed in the ungrounded input supply line.

Input Under-Voltage Shutdown and Start-Up Threshold

Converters will not begin to fully regulate 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 does 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. The over/under-voltage fault level and fault response and hysteresis can be configured via the PMBus interface. See commands 0x55 (VIN_OV_FAULT_LIMIT) and 0x59 (VIN_UV_FAULT_LIMIT) in the PMBus command list for additional details.

Start-Up Time

Turn-on time (see Specifications) is the time interval between the point when the rising input voltage crosses the start-up threshold and the output voltage rises to within 10% of regulation point. These converters include a soft start circuit to control Vout ramp time, thereby limiting the input inrush current.

The On/Off Remote Control interval from On command to Vout (final ±10%) 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 accuracy band. See PMBus command 0x60 (TON_DELAY) for additional configuration details.

Recommended Input Filtering

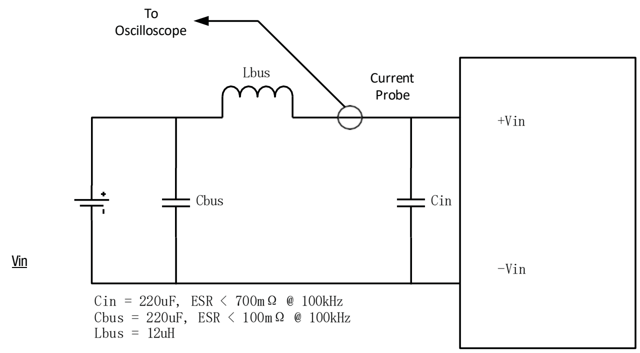
Ensure that the input source has low AC impedance to provide dynamic stability and that the input supply has little or no inductive content, including long distributed wiring to a remote power supply. The converter operates with no additional external capacitance if these conditions are met. For best performance, Murata Power Solutions recommends installing a low-ESR capacitor immediately adjacent to the converter's input terminals. The capacitor should be a ceramic type such as the Murata GRM32 series or a polymer type. More input bulk capacitance can be added in parallel (either electrolytic or tantalum) if needed.

Recommended Output Filtering

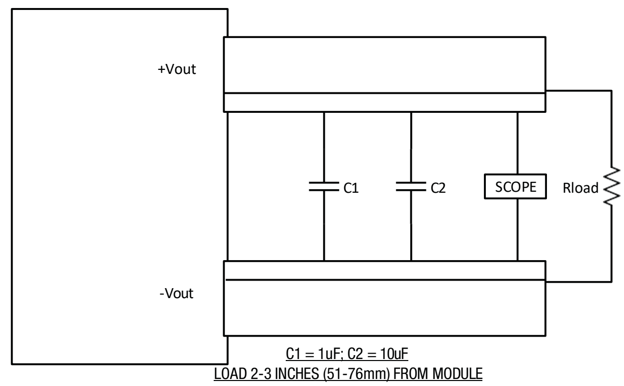
This series needs minimum polymer capacitor to keep loop stabilization. However, the user can install external output capacitance to further improve ripple or for improved dynamic response; however, low-ESR ceramic (Murata GRM32 series) or polymer capacitors must be used and mounted close to the converter using only as much capacitance as required to achieve your ripple and noise objectives. Excessive capacitance can make step load recovery sluggish or introduce instability. Never exceed the maximum rated output capacitance listed in the specifications.

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 following figures. The Cbus and Lbus components simulate a typical DC voltage bus.



Measuring Input Ripple Current



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.

Thermal Shutdown (OTP)

This series includes thermal sense and shutdown circuitry that protects itself from overtemperature conditions. Upon detection of overtemperature condition defined by PMBus command 0x4F "OT_FAULT_LIMIT", the module enters OTP and shuts down. Once the temperature falls below restart threshold, as defined in PMBus command list, (OT_FAULT_LIMIT, 0x4F and MFR_OT_ FAULT_HYS, 0xEA), the module automatically restarts. OTP fault limit and recovery hysteresis are configurable via PMBus.

CAUTION: If you operate too close to the thermal limits, the converter can shut down suddenly without warning. Ensure to thoroughly test the application to avoid unplanned thermal shutdown.

Temperature Derating Curves

The graphs in this data sheet illustrate 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 if the average is not 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 if 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 "natural convection" is defined as very flow rates which are not using fan- forced airflow. Depending on the application, "natural convection" is usually about 30-65 LFM but is not equal to still air (0 LFM).

Murata Power Solutions makes characterization measurements in a closed cycle wind tunnel with calibrated airflow. 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. It might be possible to estimate the effective airflow if you understand the enclosure geometry, entry/exit orifice areas, and the fan flow rate 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. Ensure to reduce the derating for higher altitude.

Output Short Circuit Condition

The short circuit condition is an extension of the "Current Limiting" condition. When the monitored peak current signal reaches a certain range, the PWM controller's outputs are shut off thereby turning the converter "off." This is followed by an extended time out period. The module defaults to latch mode and can be configured to hiccup mode through PMbus.

This period can vary depending on other conditions such as the input voltage level. Following this time out period, the PWM controller will attempt to re-start the converter by initiating a "normal start cycle" which includes soft start. If the "fault condition" persists, another "hiccup" cycle is initiated. This "cycle" can and will continue indefinitely until such time as the "fault condition" is removed, at which time the converter will resume "normal operation." Operating in the "hiccup" mode during a fault condition is advantageous in that average input and output power levels are held low preventing excessive internal increases in temperature.

Remote On/Off Control

The UWE series modules are equipped with an on/off control pin (internal pull up, TTL open-collector and/or CMOS open-drain compatible) and is configurable via PMBus interface. Output is 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 +13.5Vdc with respect to –Vin. The On/Off function allows the module to be turned on/off by an external device switch.

The restart delay for this module to turn On/Off by the On/Off control pin is 200ms.

On/Off can be configured by PMBus command 0xDD (MFR_PRIMARY_ON_ OFF_ CONFIG); default configuration does not ignore the control pin and therefore requires the On/Off control pin to be asserted to start the unit.

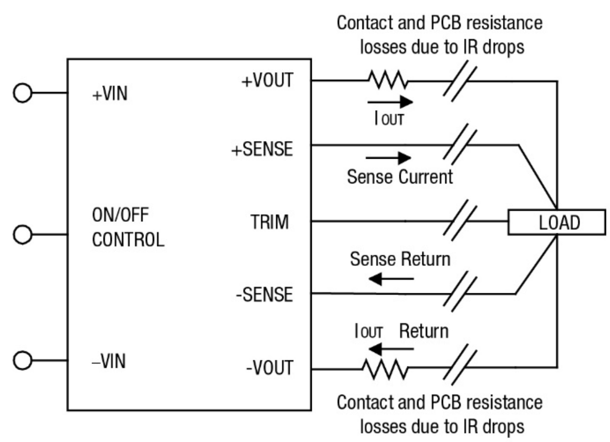
On/Off status is dependent on On/Off control and OPERATION (PMBus command) status; both must be ON to turn on; if one of them is OFF, unit will be turned off.

Output Capacitive Load

These converters require external minimum capacitance added to achieve rated specifications. Users should consider adding capacitance to reduce switching noise and/or to handle spike current load steps. Install only enough capacitance to achieve noise objectives. Excess external capacitance might cause degraded transient response and possible oscillation or instability.

Remote Sense Input

Use the sense inputs caution. Sense is normally connected at the load. Sense inputs compensate for output voltage inaccuracy delivered at the load. This is done by correcting IR voltage drops along the output wiring and the current carrying capacity of PC board etches. This output drop (the difference between Sense and Vout when measured at the converter) should not exceed 0.5V. Consider using heavier wire if this drop is excessive. Sense inputs also improve the stability of the converter and load system by optimizing the control loop phase margin.



Remote Sense Circuit Configuration

Note: The Sense input and power Vout lines are internally connected through low value resistors to their respective polarities so that the converter can operate without external connection to the Sense. Nevertheless, if the Sense function is not used for remote regulation, the user should connect +Sense to +Vout and – Sense to –Vout at the converter pins.

The remote Sense lines carry minimal current. They are also capacitively coupled to the output lines and therefore are in the feedback control loop to regulate and stabilize the output. As such, they are not low impedance inputs and must be treated with care in PC board layouts. Sense lines on the PCB should run adjacent to DC signals, preferably Ground. In cables and discrete wiring, use twisted pair, shielded tubing or similar techniques.

Any long, distributed wiring or significant inductance introduced into the Sense control loop can adversely affect overall system stability. If in doubt, test your applications by observing the converter's output transient response during step loads. There should not be any appreciable ringing or oscillation. You can also adjust the output trim slightly to compensate for voltage loss in any external filter elements. Do not exceed maximum power ratings.

Observe the sense inputs tolerance to avoid improper operation:

[Vout(+) –Vout(-)] – [Sense(+) –Sense(-)] ≤ 10% of Vout

Output overvoltage protection is monitored at the output voltage pin, not the Sense pin. Therefore, excessive voltage differences between Vout and Sense together with trim adjustment of the output can cause the overvoltage protection circuit to activate and shut down the output.

Power derating of the converter is based on the combination of maximum output current and the highest output voltage. Therefore, the designer must ensure:

(Vout at pins) x (Iout) ≤ (Max. rated output power)

Soldering Guidelines

Murata Power Solutions recommends the specifications below when installing these converters. These specifications vary depending on the solder type.

Exceeding these specifications can cause damage to the product. Be cautious when there is high atmospheric humidity. Murata Poer Solutions strongly recommends to use a mild pre-bake (100° C for 30 minutes). Your production environment might differ; therefore, thoroughly review these guidelines with process engineers.

Wave Solder Operation for Through-Hole Mounted Products (THMT)	
For Sn/Ag/Cu based solders:	
Maximum Preheat Temperature	115
Maximum Pot Temperature	270
Maximum Solder Dwell Time	7 seconds
For Sn/Pb based solders:	
Maximum Preheat Temperature	105
Maximum Pot Temperature	250
Maximum Solder Dwell Time	6 seconds

Trimming the Output Voltage

The Trim Input pin is used to adjust the output voltage over the rated trim range (please refer to the Specifications). As illustrated in the trim equations and circuit diagrams below, trim adjustments use a single fixed resistor connected between the Trim input and either Vout Sense pin.

Trimming resistors should have a low temperature coefficient (±100 ppm/deg.C or less) and be mounted close to the converter keeping leads short. If the trim function is not used, leave the trim unconnected, the converter will default to its specified output voltage accuracy.

CAUTION: Avoid activating shutdown protection (OVP, OCP, OTP) by ensuring the output voltage or output power is not exceeded when setting the output voltage trim.

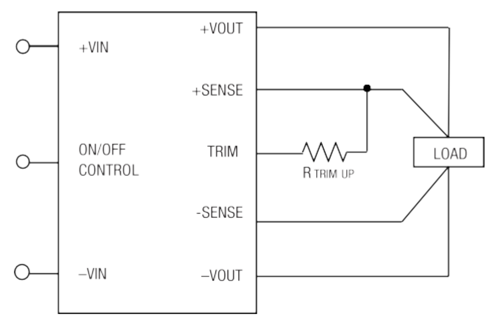
Keep the trim external connections as short as possible to avoid excessive noise that might otherwise cause instability or oscillation using shielding if needed.

Trim Equations

Trim Up: Connect Trim (Pin #J6) to +Vout Sense (Pin #J7)

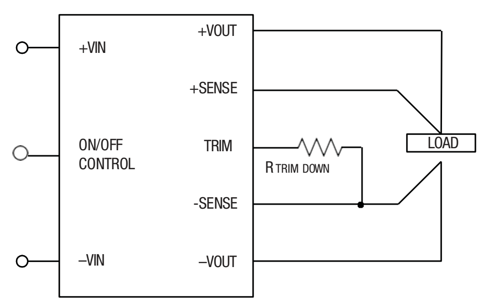
$$Rt\ up(k\Omega) = Vonom*(1+\Delta)/(1.225*\Delta)-1/\Delta-1.2$$

$$\Delta=|(Vonom-Vo)/Vonom|$$



Trim Down: Connect Trim (Pin #J6) to -Vout Sense (Pin #J5)

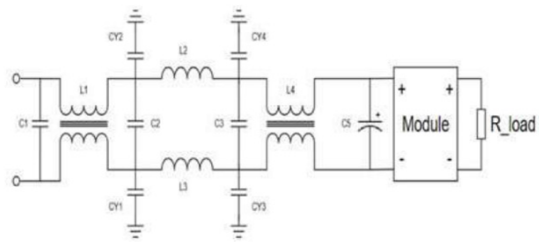
$$Rt\ down\ (k\Omega) = 1/((Vonom-Vo)/Vonom)-1.2$$



NOTE: Adjustment accuracy is subject to resistor tolerances and factory-adjusted output accuracy. Mount trim resistor close to converter. Use short leads.

Emissions Performance

Murata Power Solutions 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, make sure the output load is rated at continuous power while doing the tests. The recommended external input and output capacitors (if required) are included. Please refer to the fundamental switching frequency. This information is listed in the Product Specifications. An external discrete filter is installed and the circuit diagram is shown below.



Conducted Emissions Parts List

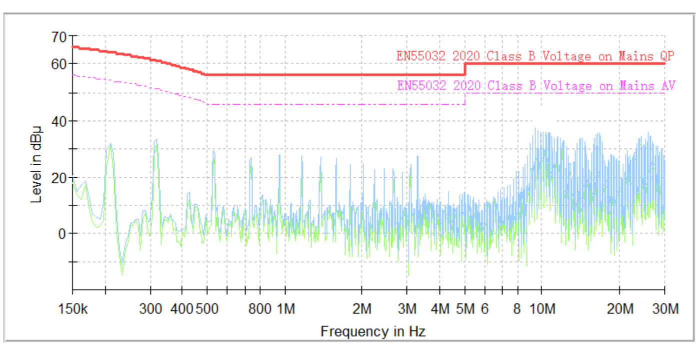
Reference	Description
C1	0.47uF
C2	0.47uF
C3	0.47uF
C5	220uF (e-lyt)
CY1, CY2	4*4.7nF
CY3, CY4	4*4.7nF
L1, L4	5mH
L2, L3	11uH

Conducted Emissions Test Equipment Used

Hewlett Packard HP8594L Spectrum Analyzer – S/N 3827A00153

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

Conducted Emissions Test Results – Negative Line



Conducted Emissions Performance, Negative Line CISPR 32, Class B, Full Load

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 will depend 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, we recommend using an engineer who is experienced at emissions suppression.

PMBus™ Digital Communications Protocol

This module offers a PMBus digital interface that enables the user to configure many characteristics of the device operation as well as to monitor the input and output voltages, output current and device temperature. The module can be used with any standard two-wire I²C or SMBus host device.

A system controller (host device) can monitor a wide variety of parameters through the PMBus interface and detect fault conditions by monitoring the SMBALERT# pin. which will be asserted when any number of pre-configured fault or warning conditions occurs. The system controller can also continuously monitor any number of power conversion parameters including, but not limited to the following:

- Input voltage
- Output voltage
- Output current
- Module temperature

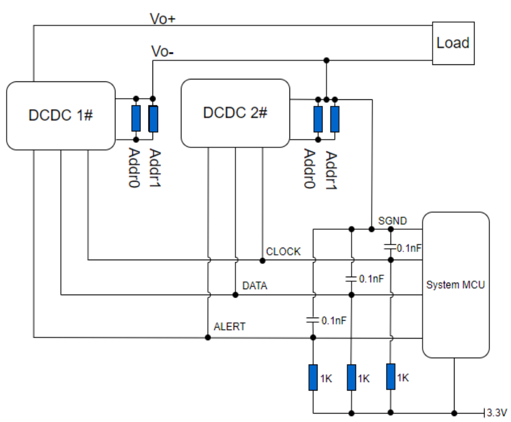
Software Tools for Design and Production

For these modules, Murata-Power Solutions provides software for configuring and monitoring via the PMBus interface. For more information, contact your local Murata- Power Solutions representative.

Standard PMBus™ characteristics

Complies with "Power Systems Management Protocol Specification Part 1 General Requirements Transport and Electrical requirements revision 1.2" & "Power Systems Management Protocol Specification Part 2 Command Language revision 1.2".
Linear data format is used for all supported parameters unless noted.
Up to 400kHz I2C communications bus speed is supported.
SMBALERT## is supported.
PEC is supported.
Clock stretching is supported.

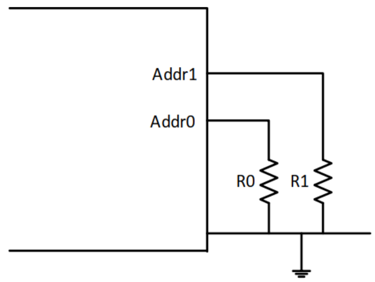
PMBus™ Monitoring Accuracy



Parameter	Conditions	Min.	Typ.	Max.	Units
PMBus					
PMBus General					
Bus Speed				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		-1.5		1.5	V
VOUT_READ		-2		2	%
IOUT_READ	Vin=48V, Io=50% ~ 100% of Io, max.	-5		5	%
	Vin=48V, Io=5% ~ 50% of Io, max.	-3		3	A
TEMP_READ		-10		10	°C

PMBus Addressing

This power module series offers three address configurations to support a wide range of applications. The address is set by externally connecting two resistors from each of the two address pins "Addr1" and "Addr0" to signal ground "Signed" and forms two octal (0 to 7) digits, each pin setting one digit. The resistor value for each digit is defined according to the desired configuration.



Addressing configuration 0 (default): If the calculated PMBus address is 0~12D, 40D, 44D, 45D or 55D, SA0 or SA1 lefts open, default PMBus address 127D is assigned instead.

Ambassadress = 8x (SA1 index) + (SA0 index)

Digit	Resistor Value RSA0/RSA1[kΩ]
0	10
1	15.4
2	23.7
3	36.5
4	54.9
5	84.5
6	130
7	200
Calculation: PMBus_Address = 8x (SA1 index) + (SA0 index)	

Addressing configuration 0 (default): If the calculated PMBus address is 0D, 11D, 12D, SA0 or SA1 lefts open, default PMBus address 119D is assigned instead.

Ambassadress = 8x (SA0 index) + (SA1 index)

Digit	Resistor Value RSA0/RSA1[kΩ]
0	10
1	22
2	33
3	47
4	68
5	100
6	150
7	220
Calculation: PMBus_Address = 8x (SA0 value) + (SA1 value)	

Addressing configuration 0 (default): If the calculated PMBus address is 0~12D, 40D, 44D, 45D or 55D, SA0 or SA1 lefts open, default PMBus address 88D is assigned instead.

Ambassadress = 16xAddr1 + Addr0

Digit	Resistor Value RSA0/RSA1[kΩ]
0	24.9
1	49.9
2	75
3	100
4	124
5	150
6	174
7	200
Calculation: PMBus_Address = 16 x Addr1 + Addr0	

NOTE: Follow these steps to change the power module address configuration:
Select the desired address configuration via PMBus command 0xF5.
Save configuration to non-volatile user store memory by writing command 0x15 "STORE_USER_ALL".
Recycle input power.

Supported PMBus™ Command List

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number Of Data Bytes	Default Value		Lower limit	Upper limit	Unit	Notes
01h	OPERATION	Write Byte	Read Byte	1	0x80					Only support 0x80 and 0x00
02h	ON_OFF_CONFIG	Write Byte	Read Byte	1	0x1F					Bit7:5 Reserved Bit4 0:Auto power up 1:Use control/Opertation Bit3:2 1:Control pin 2:Operation 3:Control pin & Opertaion Bit1 0:Active low (Pull pin low to start the unit) 1:Active high (Pull pin high to start the unit) Bit0 Reserved
03h	CLEAR_FAULTS	Send byte	N/A	0	N/A					
10h	WRITE_PROTECT	Write Byte	Read Byte	1	0x00					
11h	STORE_DEFAULT_ALL	N/A	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	0xB0					
1Ah	QUERY	N/A	"Block Write - Block Read Process Call"	1						
1Bh	SMBALERT_MASK	Write Word	"Block Write - Block Read Process Call"	2						
20h	VOUT_MODE	N/A	Read Byte	1	0x17					
21h	VOUT_COMMAND	Write Word	Read Word	2	0x1800	12	9.6	13.2	V	ROI specification require cover 10.8-12.6,DE spec±10%
22h	VOUT_TRIM	Write Word	Read Word	2	0		-2.4	1.2	V	Effective after turn off then to turn back on
28h	VOUT_DROOP	Write Word	Read Word	2		0/3.5	0	100	mΩ	
35h	VIN_ON	Write Word	Read Word	2		14.5	13	16	V	
36h	VIN_OFF	Write Word	Read Word	2		13.5	12.5	14.5	V	
40h	VOUT_OV_FAULT_LIMIT	Write Word	Read Word	2	0x1C00	14.5	9.6	15.6	V	
41h	VOUT_OV_FAULT_RESPONSE	Write Byte	Read Byte	1	0x80					7:6: All support 5:3: Only support latch or continuous hiccup 2:0: Set turn off delay when 7:6=01B, unit is 130ms
42h	VOUT_OV_WARN_LIMIT	Write Word	Read Word	2	0x1B00	13.500	9.600	15.600	V	
43h	VOUT_UV_FAULT_LIMIT	Write Word	Read Word	2	0x1066	8.200	0.000	15.600	V	
44h	VOUT_UV_FAULT_RESPONSE	Write Byte	Read Byte	1	0xF8					
45h	VOUT_UV_WARN_LIMIT	Write Word	Read Word	2	0x1599	10.800	0.000	15.600	V	
46h	IOUT_OC_FAULT_LIMIT	Write Word	Read Word	2	0xE1E0	24.00	20.00	0.00	A	

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number Of Data Bytes	Default Value		Lower limit	Upper limit	Unit	Notes
47h	IOUT_OC_FAULT_RESPONSE	Write Byte	Read Byte	1	0x80					7:6: 00B is continues operation without interruption, 01B/10B is not supported, 11B is supported. 5:3: Only support latch or continuous hiccup 2:0: Not supported
4Ah	IOUT_OC_WARN_LIMIT	Write Word	Read Word	2	0xE1C0	22.00	20.00	22.00	A	
4Fh	OT_FAULT_LIMIT	Write Word	Read Word	2	0x0078	130	90	150	°C	Default value of with "B" suffix: 120C
50h	OT_FAULT_RESPONSE	Write Byte	Read Byte	1	0xF8					7:6: 00B is continues operation without interruption, 01B is not supported (same behaviour as 00B), 10B/11B are supported. 5:3: Only support latch or continuous hiccup 2:0: Not supported
51h	OT_WARN_LIMIT	Write Word	Read Word	2	0x0071	110	90	130	°C	
55h	VIN_OV_FAULT_LIMIT	Write Word	Read Word	2	0xEA6C	64.00	60.00	64.00	V	
56h	VIN_OV_FAULT_RESPONSE	Write Byte	Read Byte	1	0xF8					
57h	VIN_OV_WARN_LIMIT	Write Word	Read Word	2	0xEA60	62.00	60.00	62.00	V	
58h	VIN_UV_WARN_LIMIT	Write Word	Read Word	2	0xE884	16.50	15.50	17.50	V	
59h	VIN_UV_FAULT_LIMIT	Write Word	Read Word	2	0xE880	15.50	14.50	16.50	V	
5Ah	VIN_UV_FAULT_RESPONSE	Write Byte	Read Byte	1	0xF8					
5Eh	POWER_GOOD_ON	Write Word	Read Word	2	0x1466	10.200	1.000	13.200	V	
5Fh	POWER_GOOD_OFF	Write Word	Read Word	2	0x10CC	8.400	1.000	13.200	V	
61h	TON_RISE	Write Word	Read Word	2	0x003C	20	10	50	ms	
68h	POUT_OP_FAULT_LIMIT	Write Word	Read Word	2	0x0168	288	240	288	W	
69h	POUT_OP_FAULT_RESPONSE	Write Byte	Read Byte	2	0x80					
6Ah	POUT_OP_WARN_LIMIT	Write Word	Read Word	2	0x014A	264	240	264	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				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				%	
96h	READ_POUT	N/A	Read Word	2	N/A				W	
95h	READ_FREQUENCY	N/A	Read Word	2	N/A				kHZ	

CMD	Command Name	SMBus Transaction Type: Writing Data	SMBus Transaction Type: Reading Data	Number Of Data Bytes	Default Value		Lower limit	Upper limit	Unit	Notes
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	<=18	N/A					
9Bh	MFR_REVISION	Block Write*	Block Read	<=6	N/A					
9Ch	MFR_LOCATION	Block Write*	Block Read	<=9	N/A					
9Dh	MFR_DATE	Block Write*	Block Read	<=10	N/A					
9Eh	MFR_SERIAL	Block Write*	Block Read	<=9	N/A					
A0h	MFR_VIN_MIN	N/A	Read Word	2	0xE890	18.00			V	
A1h	MFR_VIN_MAX	N/A	Read Word	2	0xEA58	75.00			V	
A2h	MFR_IIN_MAX	N/A	Read Word	2	0xDA80	20			A	
A3h	MFR_PIN_MAX	N/A	Read Word	2	0x014F	335			W	
A4h	MFR_VOUT_MIN	N/A	Read Word	2	0x1333	9.600			V	
A5h	MFR_VOUT_MAX	N/A	Read Word	2	0x1A66	13.200			V	
A6h	MFR_IOUT_MAX	N/A	Read Word	2	0xE8C8	25.00			A	
A7h	MFR_POUT_MAX	N/A	Read Word	2	0x012C	300			W	
A8h	MFR_TAMBIENT_MAX	N/A	Read Word	2	0x0055	85			°C	
A9h	MFR_TAMBIENT_MIN	N/A	Read Word	2	0X078D	-40			°C	
ADh	IC_DEVICE_ID	N/A	Block Read		dsPIC33CK64MP102					
C0h	MFR_MAX_TEMP_1	N/A	Write Word	2	0x0082	130			°C	
DAh	Erase EEPROM	Write Word	N/A	2	N/A					
DDh	MFR_ENABLE_POLARITY_CONFIG	Write Byte*	Read Byte	1	0x02					Default value of negative logic: 0x00. Default value of positive logic: 0x02
DEh	MFR_PGOOD_POLARITY	Write Byte	Read Byte	1	0x01					Default value of negative logic: 0x00. Default value of positive logic: 0x01
DFh	MFR_BLACKBOX_CONFIG_BYTE	Write Byte*	Write Byte	1	0x03					Bit0: Blackbox Enable Bit1: Rewrite Enable
E0h	MFR_BLACKBOX_EVENT	N/A	Block Read	32						
E1h	MFR_BLACKBOX_OFFSET	Write Byte*	Write Byte	1						
E8h	MFR_VIN_OV_FAULT_HYS	Write Word*	Read Word	2	0xE808	2.00	0.20	3.00	V	
E9h	MFR_VIN_UV_FAULT_HYS	Write Word*	Read Word	2	0xE808	2.00	0.20	3.00	V	
EAh	MFR_OT_FAULT_HYS	Write Word*	Read Word	2	0x000A	10	5	50	°C	
F5h	MFR_PMBUS_ADDRESS_CONFIG	Write Byte*	N/A	32	N/A					
F6h	MFR_CALIBRATION_STATUS	N/A	Read Byte	1	0x07					
F9h	MFR_VIN_SENSE_CALIBRATION	Write byte*	N/A	1	N/A					
FAh	MFR_IOUT_SENSE_CALIBRATION	Write Word*	N/A	2	N/A					
FBh	MFR_VOUT_SET_POINT_CALIBRATION	Write Word*	N/A	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).
1. Unit restores the entire contents of the non-volatile User Store memory when power up.
2. PEC is supported.
3. Max bus speed: 400kHz.
4. SMBALERT# is supported.
5. Linear data format used.

MFR Commands

DAh Erase EEPROM

BITS	VALUE	ERASE MODE	MEANING
15:12	0001	The erase object is all content.	**Erase all Content**
	0010	The erase object is block.	**Erase block**
	0011	The erase object is page.	**Erase page**
11:8	0000	Select block 0, or block 1 to be erased.	**Erase block 0**
	0001		**Erase block 1**
7:1	0000	Select the specific page from page 0 to page 15 to be erased.	**Erase page 0**
	0001		**Erase page 1**
	0010		**Erase page 2**
	…....		**……**
	1101		**Erase page 13**
	1110		**Erase page 14**
	1111		**Erase page 15**

Block 0	Block 1
Page 0	Page 0
Page 1	Page 1
Page 2	Page 2
…....	…....
Page 13	Page 13
Page 14	Page 14
Page 15	Page 15

EEPROM Data Structure

DDh MFR_PRIMARY_ON_OFF_CONFIG

BITS	PURPOSE	VALUE	MEANING
7:3		00000	Reserved
2	Controls how the unit responds to the CONTROL pin	0	Unit ignores the primary ON/OFF pin
		1	Unit requires the primary ON/OFF pin to be asserted to start the unit
1	Polarity of primary ON/OFF logic	0	Active low (Pull pin low to start the unit)
		1	Active high (Pull high or open to start the unit)
0		0	Reserved

DEh MFR_PGOOD_POLARITY

BITS	PURPOSE	VALUE	MEANING
7:1		000000	Reserved
0	Power good polarity of pin 12	0	Negative logic, output low if Vout rises to specific value
		1	Positive logic, output high if Vout rises to specific value

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.

F3h MFR_FAULT_STATUS

Real-time fault status

Bits	Meaning
15	VIN_OV_FAULT
14	VIN_UV_FAULT
13	RSVD
12	RSVD
11	RSVD
10	VOUT_OV_FAULT
9	VOUT_OV_FAST_F AULT
8	RSVD

Bits	Meaning
7	IOUT_OC_FAULT
6	IOUT_SHORT_FAULT
5	OUTPUT_POWER_FAULT
4	OT_FAULT
3	PRI_ENABLE_OFF
2	PMBUS_OPERATION_OFF
1	RSVD
0	MINI_OFF_TIME

F4h MFR_FAULT_COUNTER

Bits 15:0	How many faults occurred. Max counter 65535 starts over from 0 if exceeds this number. Duplicate failure is not counted. For example, continuous hiccup is counted as 1 time fault.

F5h MFR_EVENT_LOG

F6h MFR_CALIBRATION_STATUS

Refer to calibration procedure file.

F9h MFR_VIN_SENSE_CALIBRATION

Refer to calibration procedure file.

Step.x	Vin calibrate point (V)	Write Byte
Step 1	17	0x01
Step 2	38	0x02
Step 3	58	0x03
Step 4	76	0x04

FAh MFR_IOUT_SENSE_CLIBRATION

Refer to the calibration procedure file.

FBh MFR_VOUT_SET_POINT_CALIBRATION

Refer to the calibration procedure file.

FCh MFR_SUPERVISOR_PASSWORD

Set the unit to supervisor mode or ROM mode. See the password table.

Status Register Bit Names

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
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
0 NONE OF THE ABOVE

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

Command Language and Configuration Details

01-CFh Refer to PMBUS 1.2 SPEC

DDh MFR_PRIMARY_ON_OFF_CONFIG

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0		0	Reserved

DEh MFR_PGOOD_POLARITY

Bits	Purpose	Value	Meaning
7:1		0000000	Reserved
0	Power good polarity of pin 12	0	Negative logic, output low if Vout rises to specific value
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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

F9h MFR_VIN_SENSE_CALIBRATION

Refer to calibration procedure file

FAh MFR_IOUT_SENSE_CALIBRATION

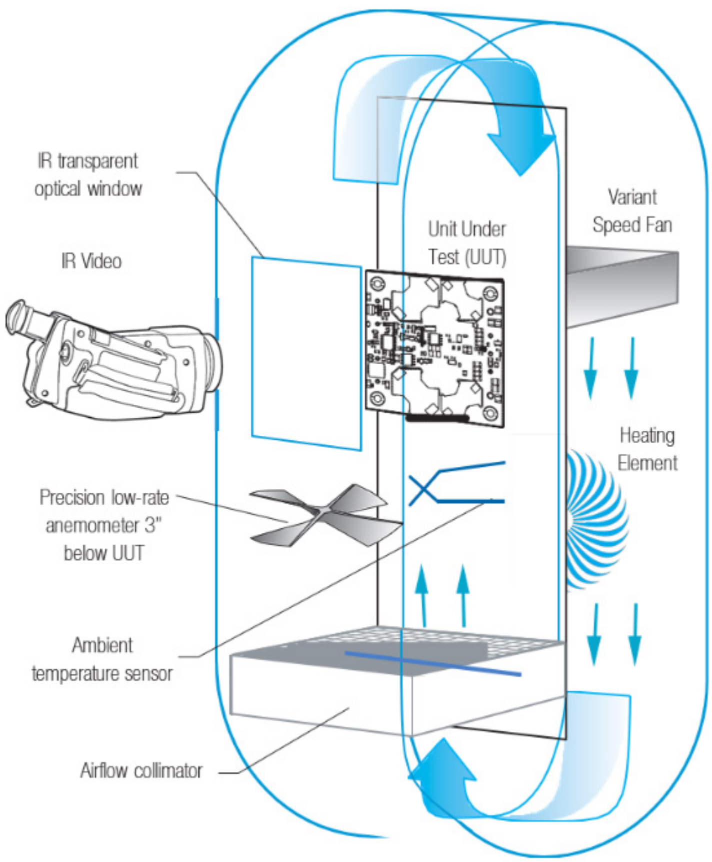
Refer to calibration procedure file

FBh MFR_VOUT_SET_POINT_CALIBRATION

Refer to calibration procedure file

FCh MFR_SUPERVISOR_PASSWORD

Set unit to supervisor mode or ROM mode. See the password table.



Vertical Wind Tunnel

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 which is transparent to infrared wavelengths.

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 by minimizing airflow turbulence. 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.

Murata Power Solutions, Inc.
129 Flanders Rd.
Westborough, MA 01581 USA
ISO 9001 and 14001 REGISTERED