0RQP-X0S10D

Isolated DC-DC Converter

The 0RQP-X0S10D is an isolated DC/DC converter that operates from a nominal 50/54 Vdc source. This converter is intended to provide isolation and step down to generate a regulated intermediate bus for the purpose of powering non-isolated Point-of-Load (POL) converters.

This unit will provide up to 1000 W of output power from a nominal 50/54 Vdc input.

The output of the converter has the droop function which allow the modules operating in parallel with high output current sharing precision. This converter is provided in a 1/4 brick package.

RoHS Compliant

Key Features & Benefits

- 45–57 VDC Input / 10.4 VDC @ 96.2 A Output /1/4th Brick Converter
- Isolated
- Fixed Frequency
- High Efficiency
- High Power Density
- Input Under Voltage Lockout
- OCP/SCP
- Output Over-voltage Protection
- Over Temperature Protection
- Low Cost
- Remote On/Off
- Parallel operation
- Power Management Bus Communications
- Power Good Indication
- Approved to UL/CSA/IEC 62368-1(TBC)
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

Applications

- Networking
- Computers and peripherals
- Telecommunications

1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RQP-X0S10D	10.4 VDC	45 VDC – 57 VDC	96.2 A	1000 W	97.3%

NOTE: Add "G" suffix at the end of the model number to indicate Tray Packaging.

PART NUMBER EXPLANATION

0	R	QP	-	X0	S	10	D	y
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
Through hole mount	RoHS	1/4th Brick		1000 W	45 – 57 V	10.4 V	D – Active Low, with baseplate	G – Tray package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	60	V
Remote On/Off		-0.3	-	16	V
Ambient Temperature	Long-Term Operating. All components on the Unit meet IPC-9592 (latest revision) derating guidelines.	-5	-	85	°C
	Short-Term Operating (96 hours/year). Unit's component temperatures exceed IPC-9592 (latest revision) derating guidelines but not exceed component temperature ratings.	-20	-	90	°C
Altitude	Maximum operating temperature will be decreased 1°C per 1000 Feet of altitude above sea-level	-500	-	13120	feet
Storage Temperature		-40	-	100	°C

NOTE: Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

3. INPUT SPECIFICATIONS

All specifications are typical at 25°C unless otherwise stated.

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		45	50/54	57	V
Input Current (full load)		-	-	25	A
Input Current (no load)		-	130	-	mA
Remote Off Input Current		-	10	-	mA
Input Reflected Ripple Current (rms)	800uF Nichicon UPM1J470MPH or equivalent	-	-	10	mA
Input Reflected Ripple Current (pk-pk)		-	-	50	mA
Input Turn on Voltage Threshold		42.5	44	45.0	V
Input Turn off Voltage Threshold		39	41	42.5	V
Input C-L-C filter					
Recommended input fast-acting fuse on system board	CAUTION: This converter is not internally fused. An input line fuse must be used in application.	-	28	-	A

CAUTION: This converter is not internally fused. An input line fuse must be used in application.

4. OUTPUT SPECIFICATIONS

All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	Vin = 52V, Pout=500W	10.55	10.6	10.65	V
	Vin=45-57V	10.3	-	11	V
Load Regulation	Vin=50V, Io=0~100% load	-	0.4	0.53	V
Line Regulation	Vin=45-57V, Io=100% load	-	30	40	mV
Regulation Over Temperature	Vin=50V, Io=100% load, Ta=-20~85C	-	100	-	mV
Ripple and Noise (pk-pk)	Cout = 750uF minimum, approximately 50% ceramic, 50% Oscon or POSCAP.	-	-	150	mV
Ripple and Noise (rms)		-	-	30	mV
Output Current Range		0	-	96.2	A
Output DC Current Limit	hiccup mode, non-latching.	107	-	-	A
Rise time	Defined as time between Vout at 10% of final value and Vout at 90% of final value.	-	-	15	ms
Turn on Time	Defined as time between Vin reaching Turn-On voltage and Vout reaching 10% of final value.	20	-	30	ms
	Defined as time between Enable and Vout reaching 10% of final value.	-	-	5	ms
Overshoot at Turn on		-	-	3	%
Output Capacitance	Typically 50% ceramic, 50% Oscon or POSCAP.	0	-	6250	uF
Transient Response					
ΔV 50%~75% of Max Load	1A/us, 4000uF capacitors are near the birck output.	-	-	350	mV
Settling Time		-	-	-	us
ΔV 75%~50% of Max Load		-	-	350	mV
Settling Time		-	-	-	us

5. OUTPUT PLOT VS INPUT

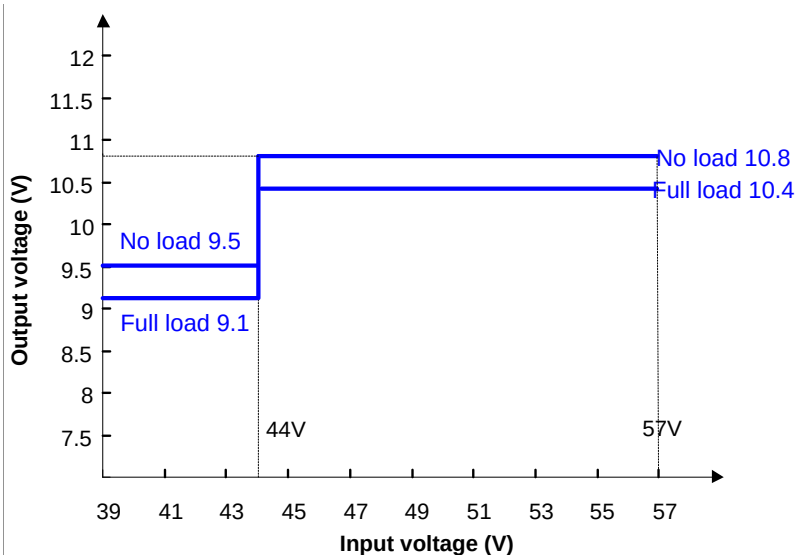


Figure 1. Output plot vs input

PARAMETER	MIN	TYPICAL	MAX	UNITS
Turn on Voltage Threshold	42.5	44	45	V
Turn off Voltage Threshold	39	41	42.5	V

6. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency		-	97.3	-	%
Switching Frequency	Primary FETs	-	150	-	kHz
MTBF	Vin=50V Vo=10.48V 80%load Ta=40 200LFM	2	6	-	Mhrs
Over Temperature Protection	Reset will occur when over-temperature condition is removed.	-	130	-	℃
Output Over Voltage Protection		-	-	13.5	V
Weight		-	87.4	-	g
Dimensions Inches (L × W × H) Millimeters (L × W × H)			2.30 x 1.56 x 0.57 58.42 x 39.62 x 14.50		Inches Millimeters
Isolation Characteristics					
Input to Output		-	-	500	V
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

7. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Signal Low (Unit On)	Active Low	Remote On/Off pin is open, the module is off.	-0.3	-	0.8	V
Signal High (Unit Off)			2.4	-	16	V
Current (Out of pin)		Module is on, Venab= -0.3-0.8V	-	-	200	µA
		Module is off, Venab=2.4V	10	-	-	µA
Current (into pin)		Remote on/off pin is pulled up to 10V.	-	-	300	µA
		Remote on/off pin is pulled up to 15V.	-	-	500	µA
Open circuit voltage			-	-	15	V

Recommended remote on/off circuit for active low

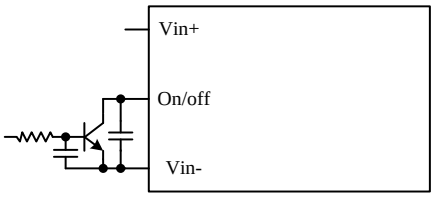


Figure 2. Control with open collector/drain circuit

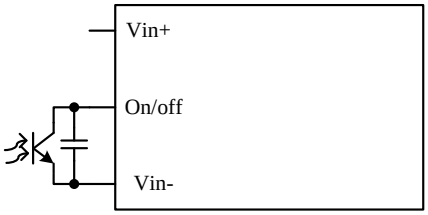


Figure 3. Control with photocoupler circuit

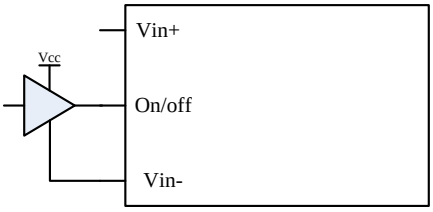


Figure 4. Control with logic circuit

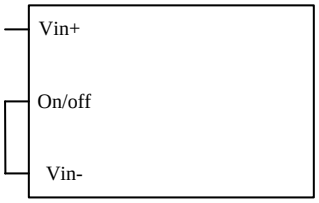


Figure 5. Permanently on

8. EFFICIENCY DATA

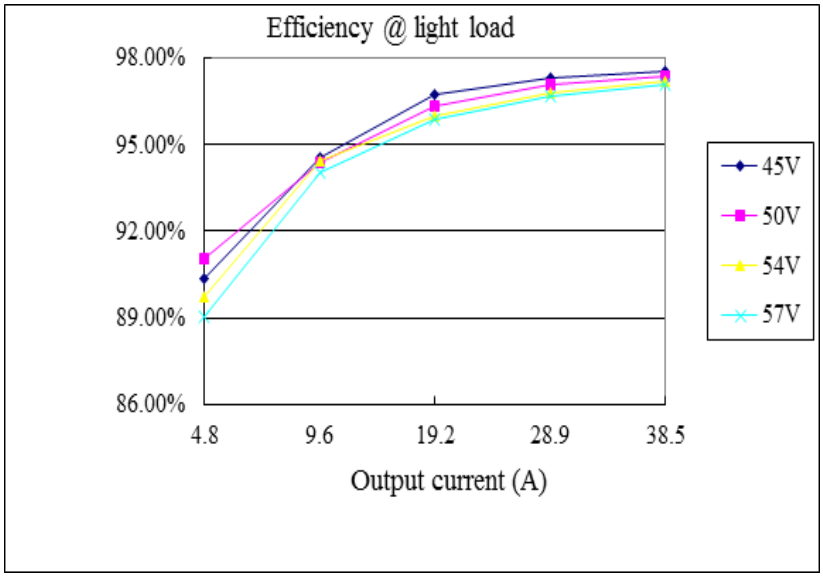


Figure 6. Efficiency @light load

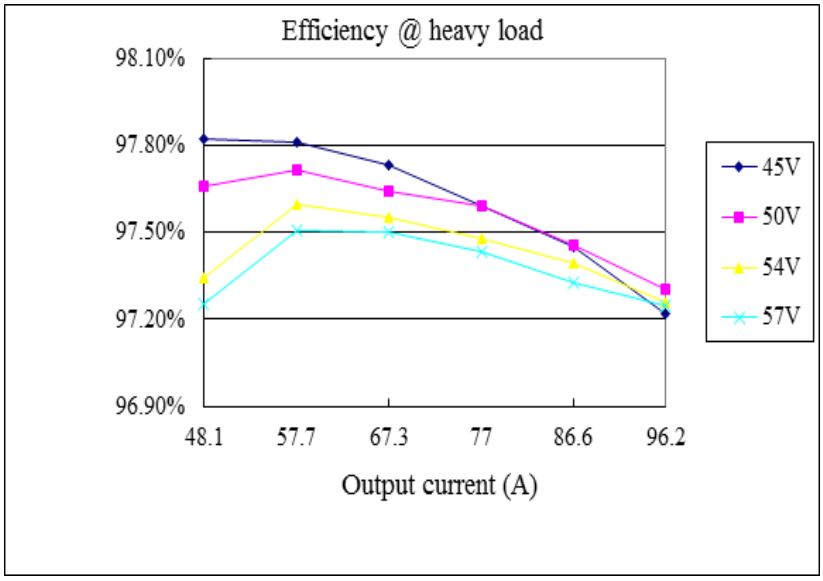


Figure 7. Efficiency @heavy load

Notes: The efficiency is measured at Ta=25°C**.**

9. THERMAL DERATING CURVE

Thermal Considerations

New high power architectures require an accurate thermal design. Design engineers have to optimize the module working conditions and ensure reliable operation. Convection cooling is the common mode to cool down the module. Heat transfer is dependent on a test setup and it is important to characterize the module in an environment similar to existent electronic applications. Reported thermal data reflects real operating conditions because the values are physically measured in a wind tunnel.

Thermal Test Setup

A module in electronic cards is typically located in a busy area without relevant space around it.

To simulate a real condition and avoid turbulence we add a cover with defined dimensions.

The distance has to be 6.35mm (0.25”inch) from the top of the module and 6.35mm (0.25”inch) on the left and right side of the module.

The values reflect most of the real applications and it is a common procedure in the power module market.

Ambient temperature and airflow are measured in front of the module at the distance of 76.2mm (3”inch).

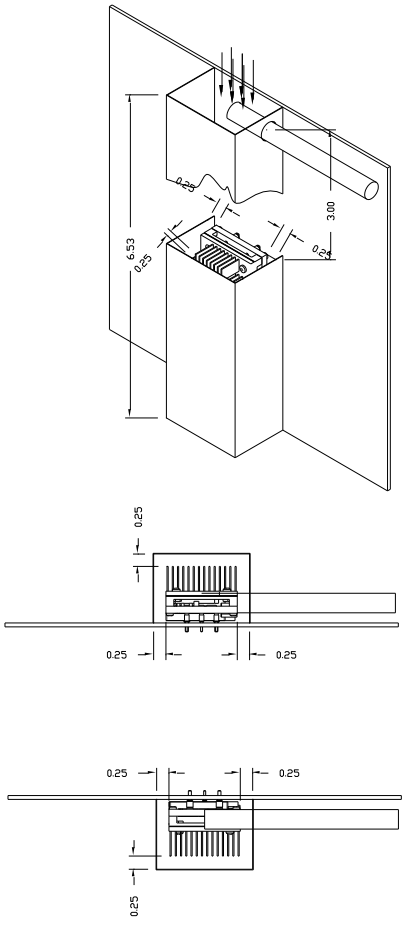


Figure 8. 0RQP-X0S10D + External heatsink

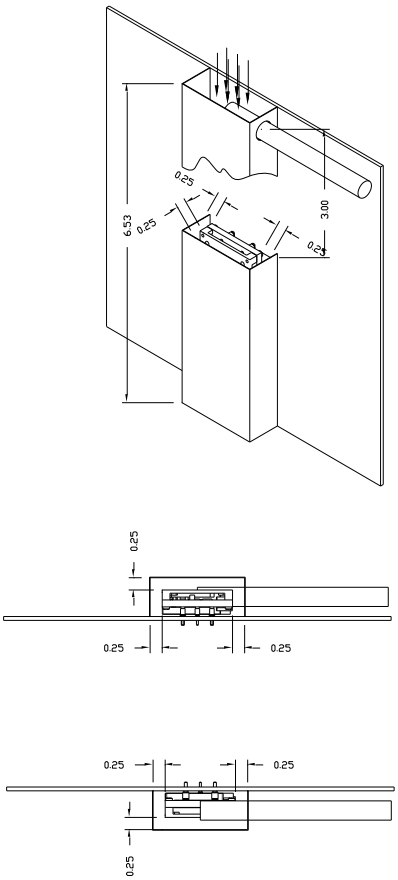


Figure 9. 0RQP-X0S10D

Tests setup drawing all measures are in inch

*The size of external heatsink is 2.30” x 1.45” x 0.61”, recommended model number: S08CAA02 from ALPHA

THERMAL DERATING CURVE(CONTINUED)

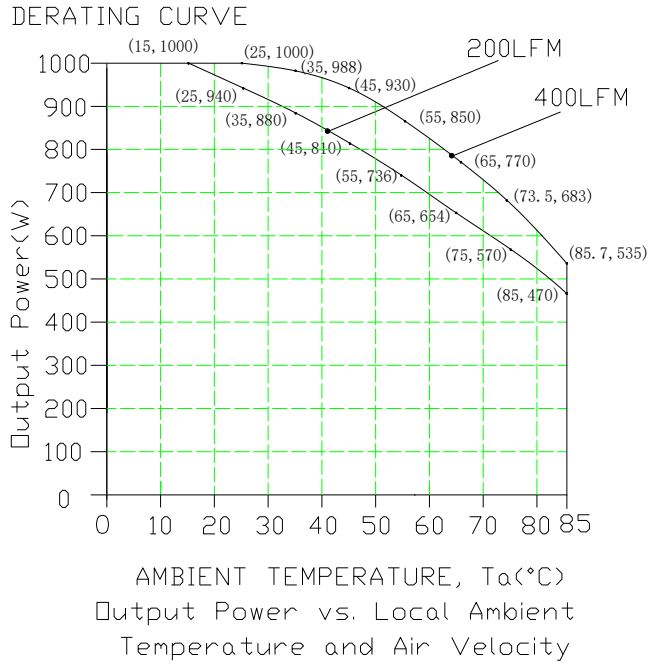


Figure 10. For 0RQP-X0S10D with Baseplate

Note: Output power vs. ambient temperature and air velocity @Vin=57V (Longitudinal Orientation, airflow from Vout to Vin)

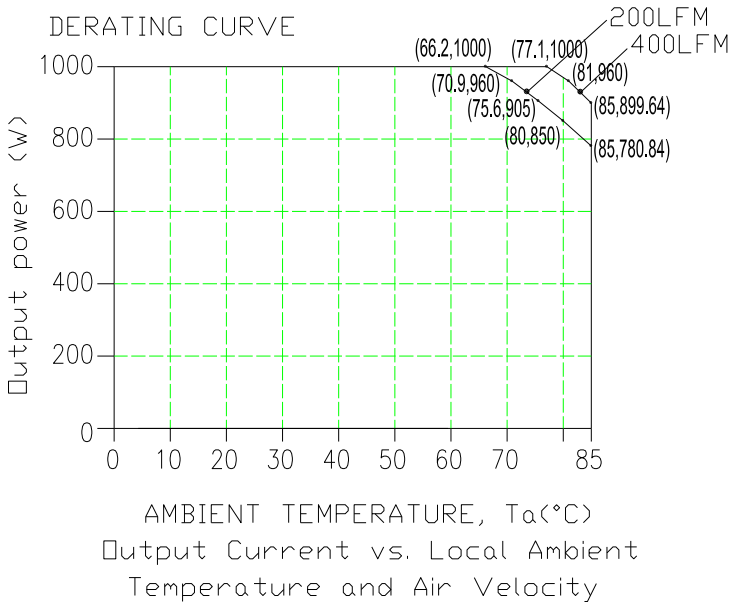


Figure 11. For 0RQP-X0S10D with Baseplate and external Heatsink

Note: Output power vs. ambient temperature and air velocity @Vin=57V (Longitudinal Orientation, airflow from Vout to Vin)

Heatsink information: S08CAA02 from ALPHA

10. RIPPLE AND NOISE

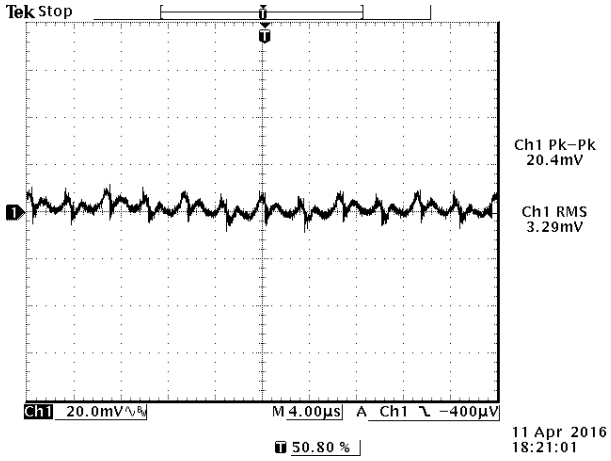


Figure 12. Ripple and noise waveform

Notes: Ripple and noise, 50Vdc input, 1000W output, Ta=25 deg C, with Cout = 3100uF (50% ceramic, 50% POSCAP).

11. TRANSIENT RESPONSE

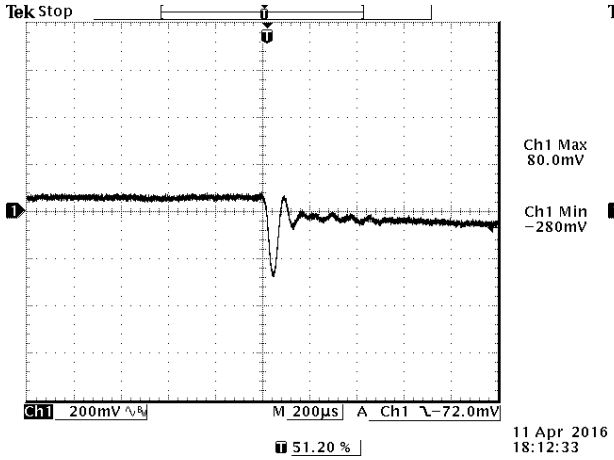


Figure 13. 50%-75% Load Transients at Vin=50V@Ta=25 ℃

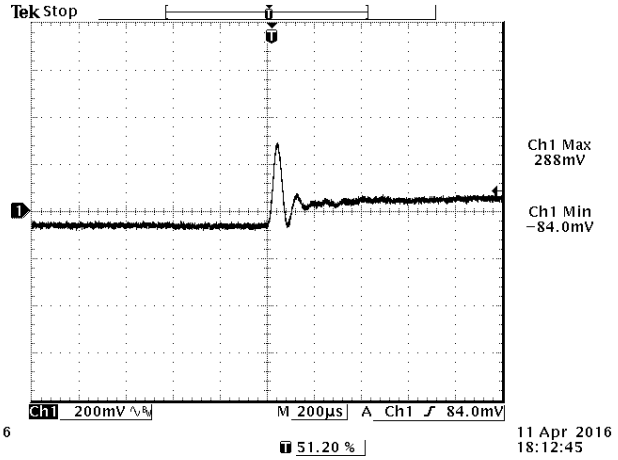


Figure 14. 75%-50% Load Transients at Vin=50V@Ta=25 ℃

12. INPUT NOISE

Input reflected ripple current

Testing set up

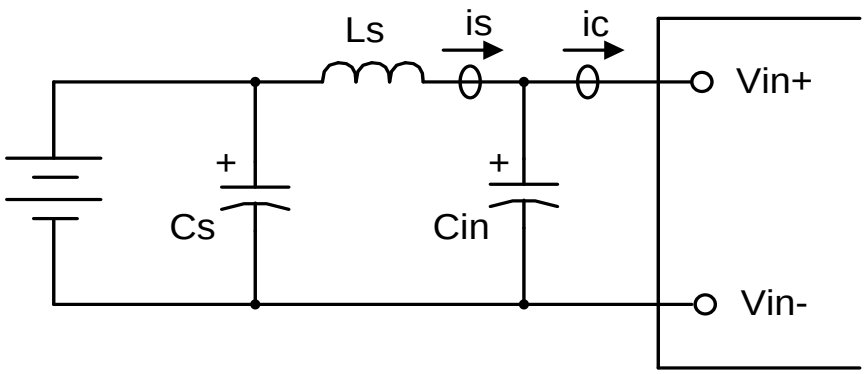


Figure 15.

Notes and values in testing.

is: Input Reflected Ripple Current

ic: Input Terminal Ripple Current

Ls: Simulated Source Impedance (10µH)

Cs: Offset possible source Impendence (100µF, ESR<0.2Ω @ 100kHz, 20C)

Cin: Electrolytic capacitor, should be as closed as possible to the power module to swallow ic ripple current and help with stability. Recommendation: 1000uF/100V

Below measured waveforms are based on above simulated and recommended inductance and capacitance.

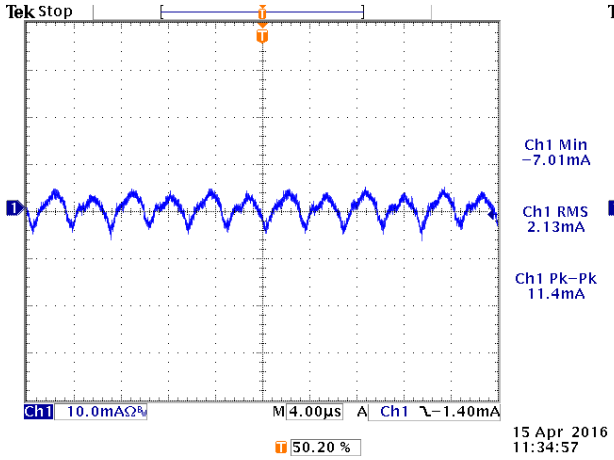


Figure 16. is (input reflected ripple current), AC component

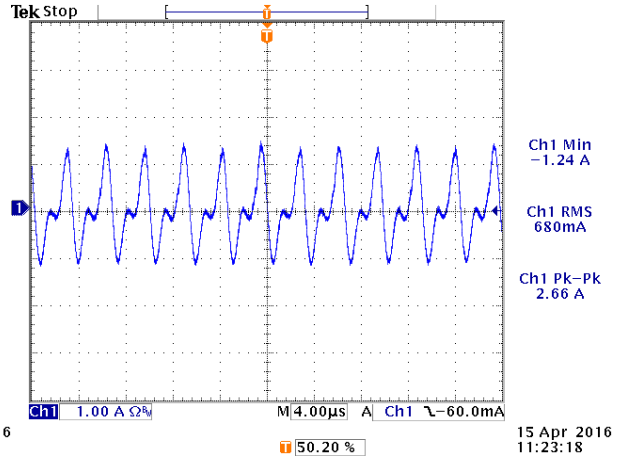


Figure 17. ic (input terminal ripple current), AC component

Test condition: *50Vdc input, 10.4Vdc/96.2A output and Ta=25 deg C, with 30 * 100 µF ceramic capacitor and 3200uF AL. cap at output.*

13. STARTUP & SHUTDOWN

Rise time

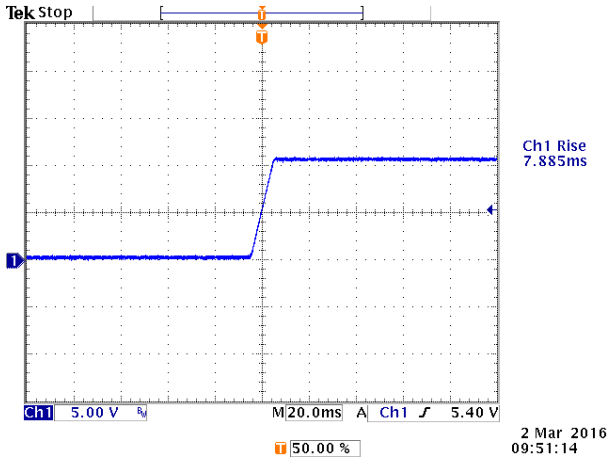


Figure 18. Rise time

Test Condition: *Vin=50V, Po=1000W, with 30 * 100 µF ceramic capacitor and 3200uF AL. cap at output.*

Startup time

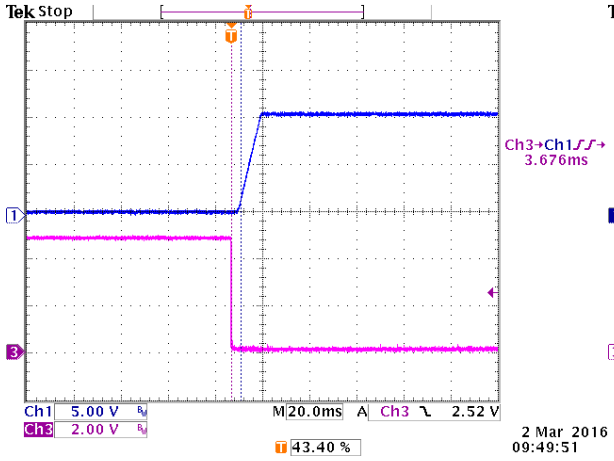


Figure 19.
Startup from Vin

Ch1: Vo

Ch3: Vin

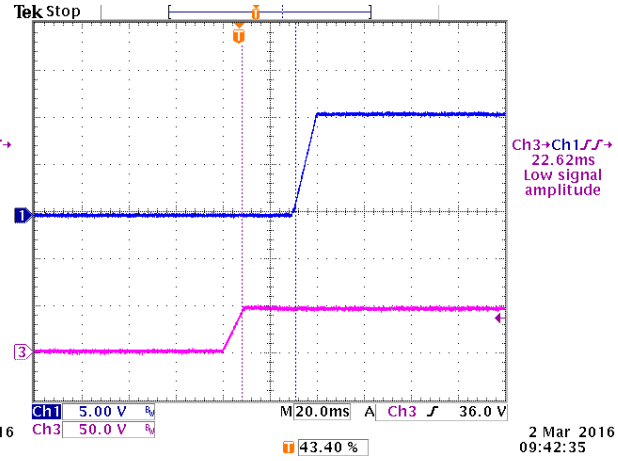


Figure 20.
Startup from on/off

Ch1: Vo

Ch3: on/off

Test Condition: *Vin=50V, Po=1000W, with 30 * 100 µF ceramic capacitor and 3200uF AL. cap at output.*

STARTUP & SHUTDOWN(CONTINUED)

Shutdown

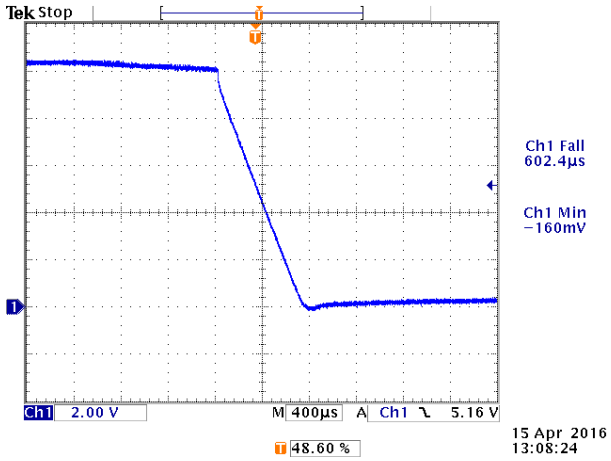


Figure 21. Shutdown

Test Condition: *Vin=50V, Po=1000W, with 30 * 100 µF ceramic capacitor and 3200uF AL. cap at output.*

14. OVER CURRENT PROTECTION

To provide protection in a fault output overload condition, the module is equipped with internal over current protection circuitry. If the overcurrent condition occurs, the module will shut down into hiccup mode and restart once every 250mS. The module operates normally when the output current goes into specified range.

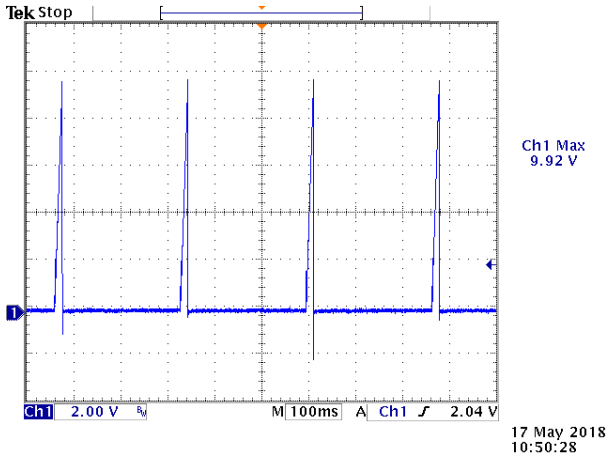


Figure 22. OCP

Vin=48V@Ta=25℃

CH1: Output Voltage

15. INPUT UNDER-VOLTAGE LOCKOUT

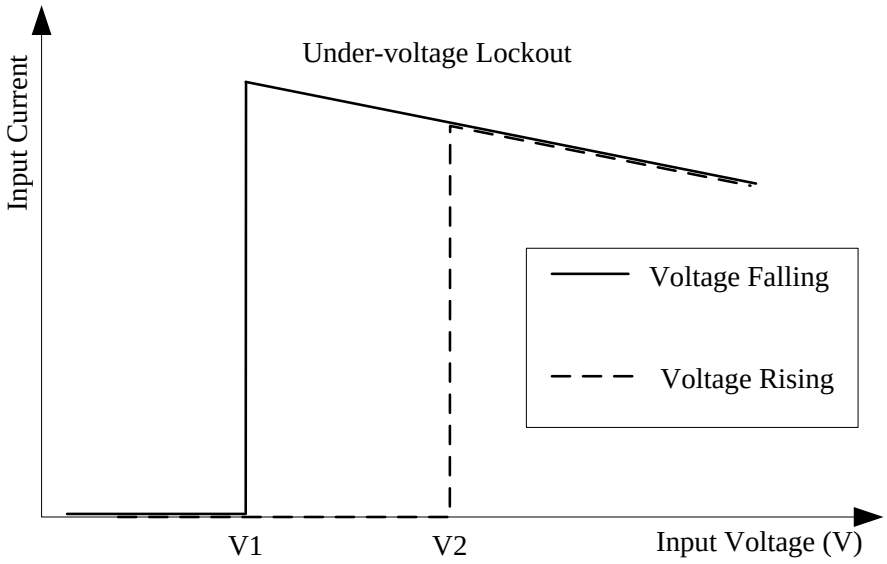


Figure 23. Input under-voltage lockout

V1=41V

V2=44V

16. POWER GOOD

1. The Power Good signal is a non-latching open-collector output that is Low during normal operation and is pulled High when any of the following conditions occur:

   • Over-Temperature

   • Over-Current

   • Vout is outside of the DC Output Band while Vin is within the Vin Operating Range

   • Vin is within the Vin Operating Range but the unit is not operating (to determine if 1 Unit used in a parallel configuration is not operating)

   • Vin is outside of the Vin Operating Range

2. The Power Good signal is referenced to Vout(-).

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Low (trigger limits)		8.2	-	8.6	V
Output Voltage High (trigger limits)		12.6	-	13.1	V
Input Voltage Low (trigger limits) Rising	PG signal indicats good when Vin is within operating range and indicats bad ~20ms before unit is shut-down due to UV or OV	42.5	-	45	V
Input Voltage High (trigger limits) Rising		58	-	61	V
Hysteresis		-	1	-	V
High State Voltage		0	-	5.5	V
High State Leakage Current (into Pin)		0	-	10	µA
Low State Voltage		0	-	0.8	V
Low State Current (into Pin)		0	-	5	mA
Power Good Signal De-assert Response Time	Duration between the fault occurring and the Power-Good Signal de-asserting	0	-	3	ms
Power Good Signal Assert Response Time	Duration between unit powering up with no faults and the Power Good Signal asserting	0	-	3	ms
Power Good Signal Duration	Duration the Power-Good signal stays de-asserted if a transient fault occurs	200		600	ms
Over Temperature Warning	For OT Warning, the PG signal will toggle as an impulse wave.		10degC below OTP threshold		ºC
OT Warning PG signal frequency		90	100	110	kHZ

17. POWER MANAGEMENT BUS

POWER MANAGEMENT BUS DIGITAL FEATURE DESCRIPTION

The module supports Power Management Bus to be monitored, controlled and configured by the system. More detailed Power Management Bus information can be found in the Power Management Bus Power Management Protocol Specification, Part I and part II, revision 1.3, which is shown in the System Management Interface Forum Web site: www.powerSIG.org. The supported Power Management Bus commands of the module are listed below in the Supported POWER MANAGEMENT BUS Commands section below.
The module supports three Power Management Bus signal lines: Data, Clock and one Address lines Addr1.Connection for the Power Management Bus interface should follow the High-Power DC specifications given in section 3.1.3 in the SMBus specification V2.0 or the Low Power DC specifications in section 3.1.2. The complete SMBus specification is shown in http://smbus.org.

POWER MANAGEMENT BUS ADDRESSING

The Module has configurable Power Management Bus addressing capability. By connecting different resistors from Addr1 pin to GND pin, 14 possible addresses can be acquired. The 7 bit Power Management Bus 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, address 127 will be returned.

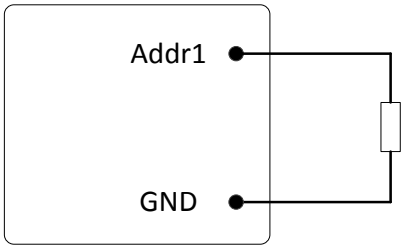


Figure 24.

Power Management Bus Address	Resistor (Kohm)
96	10
97	15
98	21
99	28
100	35.7
101	45.3
102	56.2
103	69.8
104	88.7
105	107
106	130
107	158
108	191
109	232

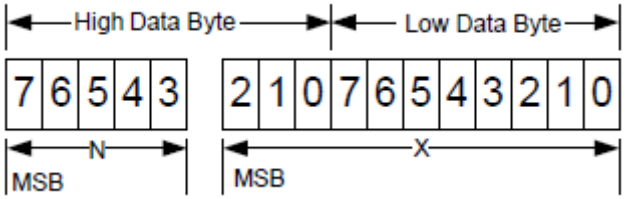
NOTE: Power Management Bus communication is only supported when vin normal and remote on. To ensure proper communication, only one slave is allowed on the I2C bus.

PARAMETER	NOTES	MIN	NOM	MAX	UNITS
Logic Input Low (VIL)	1	0		0.8	V
Logic Input High (VIH)	1	2.1		3.3	V
Logic Output Low (VOL)	2			0.65	V
Logic Output High (VOH)	3	2.3			V
Power Management Bus Operating Frequency Range			100/400		kHz
Output Current Reading Accuracy	4	-5		+5	%
	5	-3		+3	A
Output Voltage Reading Accuracy		-2		+2	%
Input Voltage Reading Accuracy		-4		+4	%
Temperature Reading Accuracy		-5		+5	℃

Notes	
1	Data, Clock pin
2	Data, Clock pin; IOL=4mA
3	Data, Clock pin; IOH=-4mA
4	Vin=54V, Io=50% ~ 100% of Iomax;
5	Vin=54V, Io=5% ~ 50% of Iomax;

Power Management Bus Data Format

For commands which is except to the output voltage, including input voltage, output current, temperature, PWM frequency, duty cycle, the controller will use the 2-byte linear format as defined by the Power management bus system management protocol. The linear data format contains 2 bytes which include a 5-bit two's complement exponent and an 11-bit two's complement mantissa. The communicated value Y is received and reported as $Y = X*2^N$



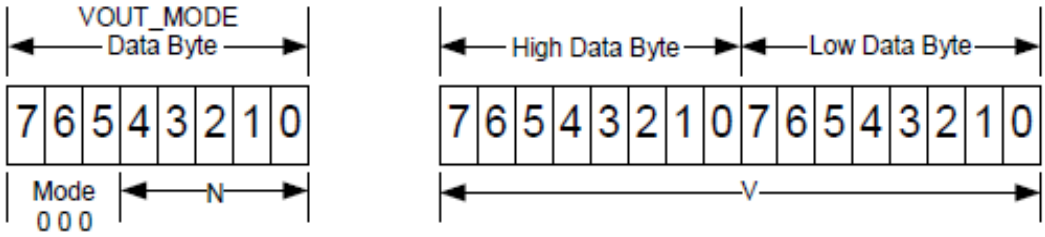
For example, to set the over temperature fault threshold 135 deg C by OT_FAULT_LIMIT command, the read/write data can be calculated refer to below:

The binary number of N is 0, whose decimal is 0.

$X = OT\_FAULT\_LIMIT / 2^{(0)} = 135$, whose binary is 0b00010000111.

Combine X and N, the binary is 0b0000000010000111. The hexadecimal of OT_FAULT_LIMIT is 0x0087.

The controller will receive output voltage parameters and report output voltage values using the Power management bus Vout linear format. The voltage will be in the form $Voltage = V*2^N$. The Mantissa and exponent in this equation will be read and reported using 3 bytes. The first byte is the VOUT_MODE byte which will always contain 000 in the 3 MSB's. The 5 LSB's are the exponent. The exponent N is fixed and equals -10. The other 2 bytes N will contain the Mantissa. In the above format N is a 5-bit two's complement binary integer and V is a 16-bit unsigned binary integer. All 16 bits are reported to be compatible with the Power management bus protocol.



For example, to set Vout to 12V by VOUT_COMMAND, the read/write data can be calculated refer to below process:

$V = Vout/2^{(-10)} = 12/2^{(-10)} = 12288$

Convert the decimal to hexadecimal 0x3000. So the VOUT_COMMAND is 0x3000.

SUPPORTED POWER MANAGEMENT BUS COMMANDS

The main Power Management Bus commands described in the Power Management Bus 1.3 specification are supported by the module. Partial Power Management Bus commands are fully supported; Partial Power Management Bus commands have difference with the definition in Power Management Bus 1.3 specification. All the supported Power Management Bus commands are detailed summarized in the below table.

Command	Code	Command Description	Type	Data format	Default value	Data units	Note
OPERATION	0x01	Configures the operational state of the module	R/W byte	Bit field	0x80	/	1
RESTORE_DEFAULT_ALL	0x12	Restore the factory settings to the non-volatile memory	Write	/	/	/	5
STORE_DEFAULT_ALL	0x15	Store the current settings to the non-volatile memory	Write	/	/	/	5
VOUT_MODE	0x20	Vo data format	Read byte	mode + exponent	0x16	/	/
VOUT_COMMAND	0x21	Set the output voltage normal value	R/W word	Vout linear	10.8	Volts	/
VOUT_MAX	0x24	Set an upper limit on the output voltage the module can command	Read word	Vout linear	12.5	Volts	/
VOUT_MARGIN_HIGH	0x25	Set the output voltage margin high value	Read word	Vout linear	13	Volts	/
VOUT_MARGIN_LOW	0x26	Set the output voltage margin low value	Read word	Vout linear	10	Volts	/
VOUT_MIN	0x2B	Set a lower limit on the output voltage the module can command	Read word	Vout linear	9.5	Volts	/
MAX_DUTY	0x32	Set the maximum duty cycle	Read word	Linear	50	%	/
FREQUNCY_SWITCH	0x33	Set the switching frequency	Read word	Linear	150	kHz	/
VOUT_OV_FAULT_LIMIT	0x40	Set the output over voltage fault threshold	R/W word	Vout linear	12.9	Volts	4
VOUT_OV_FAULT_RESPONSE	0x41	Instructs what action to take in response to an output overvoltage fault	R/W byte	Bit field	0xB8	/	1
IOUT_OC_FAULT_LIMIT	0x46	Set the output overcurrent fault threshold	R/W word	Linear	116	A	3,4
IOUT_OC_FAULT_RESPONSE	0x47	Instructs what action to take in response to an output overcurrent fault	R/W byte	Bit field	0xF8	/	1
OT_FAULT_LIMIT	0x4F	Set the over temperature fault threshold	R/W word	Linear	135	Deg C	3,4
OT_FAULT_RESPONSE	0x50	Instructs what action to take in response to an over temperature fault	R/W byte	Bit field	0xB8	/	1
STATUS_WORD	0x79	Returns the information with a summary of the unit's fault condition	Read word	Bit field	0	/	1,6
STATUS_VOUT	0x7A	Returns the information with a summary of the unit's output voltage condition	Read byte	Bit field	0	/	1,6
STATUS_IOUT	0x7B	Returns the information with a summary of the unit's output current condition	Read byte	Bit field	0	/	1,6
STATUS_TEMPERATURE	0x7D	Returns the information with a summary of the unit's temperature condition	Read byte	Bit field	0	/	1,6
STATUS_CML	0x7E	Returns the information with a summary of the unit's communication condition	Read byte	Bit field	0	/	1,6
READ_VIN	0x88	Returns the input voltage of the module	Read word	Linear	/	Volts	/
READ_VOUT	0x8B	Returns the output voltage of the module	Read word	Vout Linear	/	Volts	/
READ_IOUT	0x8C	Returns the output current of the module	Read word	Linear	/	A	/
READ_TEMPERATURE_1	0x8D	Returns the temperature of the module	Read word	Linear	/	Deg C	/
POWER MANAGEMENT BUS_REVISION	0x98	Reads the revision of the Power Management Bus	Read byte	Bit field	0x33	/	1

NOTES:

1. Refer to below detailed description
2. OPERATION command controls module on/off
3. Before write operation, it is necessary to read the register data and parse out the corresponding linear format N value, then convert write value based on N.
4. In order to ensure that the product works properly, the adjustment range of the protection limit value is limited, when the set value exceeds the upper or lower limits, the lower limit value is automatically set. The following table shows the upper and lower limits

Command	Code	The low limit	The upper limit
IOUT_OC_FAULT_LIMIT	0x46	20	150
OT_FAULT_LIMIT	0x4F	120	140

5. Read or write this command, PSU will shut down until next vin power cycle
6. ALL the fault bits set in all the status registers remain set, even if the fault condition is removed or corrected, until one of the following occur:
   1) A remote off then remote on cycle;
   2) The device receives a CLEAR_FAULTS command;
   3) Vin power is removed from the module

OPERATION (0x01)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7	Turn the module on/off	1	on	1
		0	off	
6	Not supported	/	/	0
5:4	Control the source of the output voltage command	00	VOUT_COMMAND	00
		01	VOUT_MARGIN_LOW	
		10	VOUT_MARGIN_HIGH	
		11	Not supported	
3:0	Reserved or Not supported	/	/	0000

VOUT_OV_FAULT_RESPONSE (0x41)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7:6	Response when fault happens	00	Not supported	10
		01	Not supported	
		10	The module shuts down and response according to the retry setting in bits [5:3]	
		11	Not supported	
5:3	Retry setting	000	Module does not attempt to restart until a RESET signal or OPERATION command or Bias power is removed	111
		001-110	Not supported	
		111	Attempts to restart continuously until it is commanded off	
2:0	Delay time	/	Not supported	000

IOUT_OC_FAULT_RESPONSE (0x47)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7:6	Response when fault happens	00	Not supported	11
		01	Not supported	
		10	Not supported	
		11	The module shuts down and response according to the retry setting in bits [5:3]	
5:3	Retry setting	000	Module does not attempt to restart until a RESET signal or OPERATION command or Bias power is removed	111
		001-110	Not supported	
		111	Attempts to restart continuously until it is commanded off	
2:0	Delay time	/	Not supported	000

OT_FAULT_RESPONSE (0x50)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7:6	Response when fault happens	00	Not supported	10
		01	Not supported	
		10	The module shuts down and response according to the retry setting in bits [5:3]	
		11	Not supported	
5:3	Retry setting	000	Module does not attempt to restart until a RESET signal or OPERATION command or Bias power is removed	111
		001-110	Not supported	
		111	Attempts to restart continuously until it is commanded off	
2:0	Delay time	/	Not supported	000

STATUS_WORD (0x79)				
HIGH BYTE				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7	VOUT	1	An output voltage fault has occurred	0
		0	Not occurred	
6	IOUT/POUT	1	An output current or output power fault has occurred	0
		0	Not occurred	
5	INPUT (Not supported)	1	An input overvoltage fault has occurred	0
		0	Not occurred	
4	Not supported	/	/	0
3	Power_Good	1	Power_Good signal is negated	0
		0	Power_Good signal is ok	
2:1	Not supported	/	/	0
0	UNKNOWN	1	A fault type not given in bits [15:1] of the SATUS_WORD has been detected	0
		0	Not occurred	

STATUS_WORD (0x79)				
LOW BYTE				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7	Busy	1	A fault was declared because the device was busy and unable to respond	0
		0	Not occurred	
6	Off	1	This bit is asserted if the unit is not providing power to the output, regardless of the reason, including simply not being enabled	0
		0	Not occurred	
5	VOUT_OV_FAULT	1	An output overvoltage fault has occurred	0
		0	Not occurred	
4	IOUT_OC_FAULT	1	An output overcurrent fault has occurred	0
		0	Not occurred	
3	VIN_UV_FAULT (Not supported)	1	An input under voltage fault has occurred	0
		0	Not occurred	
2	TEMPERATURE	1	A temperature fault has occurred	0
		0	Not occurred	
1	CML	1	A communication, memory or logic fault has occurred	0
		0	Not occurred	
0	NONE_OF_THE_ABOVE	1	A fault not listed in bits [7:1] of this byte has occurred	0
		0	Not occurred	

STATUS_VOUT (0x7A)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7	VOUT_OV_FAULT	1	Occurred	0
		0	Not occurred	
6	Not supported	/	/	0
5	Not supported	/	/	0
4	VOUT_UV_FAULT	1	Occurred	0
		0	Not occurred	
3:0	Not supported	/	/	0000

STATUS_IOUT (0x7B)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7	IOUT_OC_FAULT	1	Occurred	0
		0	Not occurred	
6:0	Reserved or Not supported	/	/	0000000

STATUS_TEMPERATURE (0x7D)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7	OT_FAULT	1	Occurred	0
		0	Not occurred	
6:0	Reserved or Not supported	/	/	0000000

STATUS_CML (0x7E)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7	Invalid or unsupported command received	1	Occurred	0
		0	Not occurred	
6:0	Reserved or Not supported	/	/	0000000

POWER MANAGEMENT BUS_REVISION (0x98)				
Bit number	**Purpose**	**Bit value**	**Meaning**	**Default settings**
7:4	Indicate the revision of Power Management Bus specification Part I to which the device is compliant	0000	1.0	0011
		0001	1.1	
		0010	1.2	
		0011	1.3	
3:0	Indicate the revision of Power Management Bus specification Part II to which the device is compliant	0000	1.0	0011
		0001	1.1	
		0010	1.2	
		0011	1.3	

18. MECHANICAL DIMENSIONS

OUTLINE

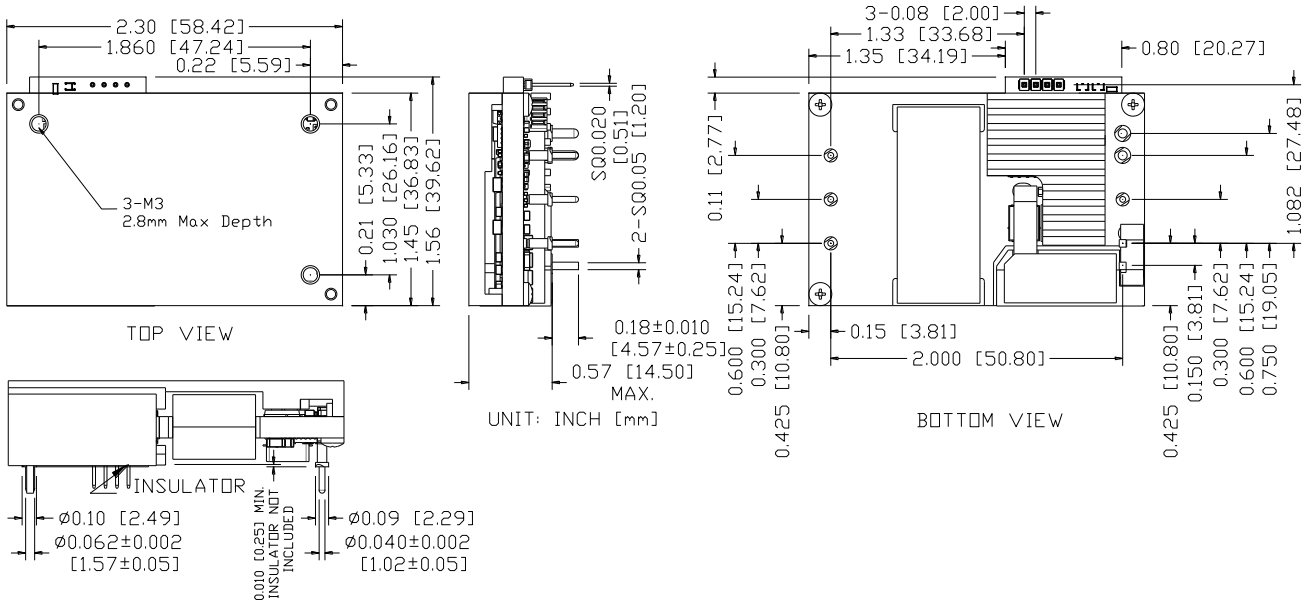


Figure 25. Outline

NOTE: This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 ºC for less than 5 seconds.

NOTES:

1) All Pins: Material - Copper Alloy;
   Finish – Tin plated
2) Undimensioned components are shown for visual reference only.
3) All dimensions in inches; Tolerances: x.xx +/-0.02 in [0.51 mm]. x.xxx +/-0.010 in [0.25 mm].

Note: If the module isn't powered, the Power management bus_CLK and Power management bus_DATA pin will be floated.

MECHANICAL DIMENSIONS(CONTINUED)

PIN DEFINITIONS

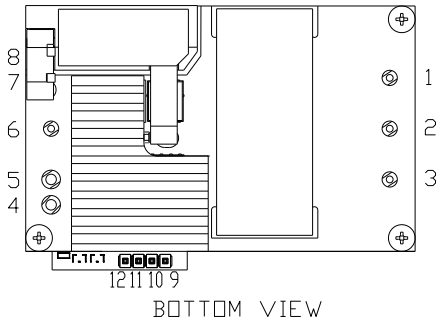


Figure 26. Pins

PIN	FUNCTION	DESCRIPTION	PIN SIZE	PIN	FUNCTION	DESCRIPTION	PIN SIZE
1	Vin (+)	Positive input voltage	0.04”	7	Vout(+)	Positive output	SQ0.05"
2	ON/OFF	Input to turn converter on and off	0.04”	8	Vout(+)	Positive output	SQ0.05"
3	Vin (-)	Negative input	0.04”	9	GND	Ground	SQ0.02”
4	Vout(-)	Negative output	0.062”	10	Data	Power Management Bus data	SQ0.02”
5	Vout(-)	Negative output	0.062”	11	Clock	Power Management Bus clock	SQ0.02”
6	PGOOD	Power-Good	0.04”	12	Address	Power Management Bus address	SQ0.02”

RECOMMENDED PAD LAYOUT

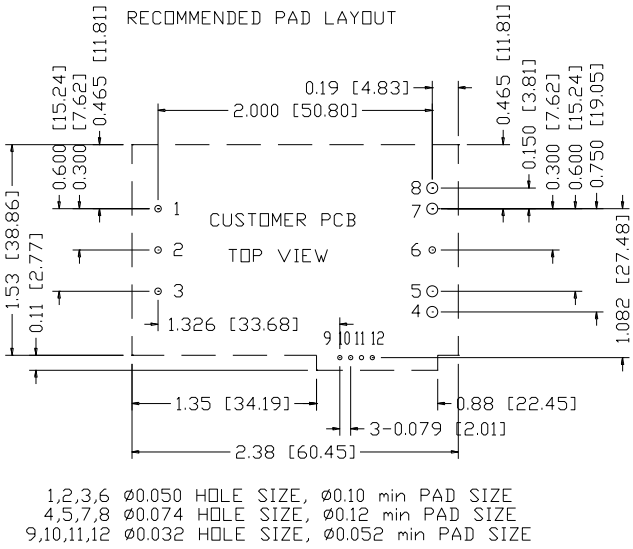


Figure 27. Recommended pad layout

19. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2017-10-30	AA	First release	J Yan
2018-04-10	AB	Update the MD	F Tao
2018-05-17	AC	Update Key Features, Model Selection, PN, Input Specs, Output Specs, Output Plot Vs Input, General Specs, MD, POWER MANAGEMENT BUS, Efficiency Data and TD, Add Over Current Protection	J.Yao
2018-05-21	AD	Correct the error in MD.	J.Yao
2019-01-15	AE	Update Power management bus	YL.Zheng
2019-06-18	AF	Update PMbus to power management bus. Add model photo.	F.Tao
2020-10-20	AG	Delete preliminary watermark. Update Power management bus.	XF.Jiang

For more information on these products consult: tech.support@psbel.com

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