0RQB-S0M11L

Isolated DC-DC Converter

The 0RQB-S0M11L is an isolated DC/DC converter that operates from a nominal 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 700 W of output power from a nominal 54 VDC input.

This converter is provided in a 1/4th brick package.

RoHS Compliant

Key Features & Benefits

- 48.6 - 60 VDC Input
- 11.2 VDC / 62.5 A Output
- Isolated
- Input Under-Voltage Protection
- High Efficiency
- Output Over-Voltage Protection
- Fixed Frequency (300 kHz)
- OCP/SCP
- High Power Density
- Over Temperature Protection
- Low Cost
- Remote ON/OFF
- Approved to UL/CSA 62368-1
- Approved to UL/CSA 60950-1
- Approved to IEC/EN 62368-1
- Approved to IEC/EN 60950-1
- 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
0RQB-S0M11LG	11.2 VDC	48.6 - 60 VDC	62.5 A	700 W	97.2%

PART NUMBER EXPLANATION

0	R	QB	-	S0	M	11	L	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package
Though Hole Mount	RoHS	1/4th Brick		700 W	48.6 – 60 V	11.2 V	Active Low with Baseplate	Tray Package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous Input Voltage		-0.3	-	65	V
Remote On/Off		-0.3	-	10	V
Ambient Temperature		-20	-	85	°C
Storage Temperature		-40	-	100	°C
Altitude		-	-	4000	m

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

3. INPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		48.6	54	60	V
Input Current (full load)		-	-	16	A
Input Current (no load)		-	115	160	mA
Remote Off Input Current		-	4	8	mA
Input Reflected Ripple Current (pk-pk)		-	450	700	mA
Input Reflected Ripple Current (rms)		-	2	3	A
I^2t Inrush Current Transient		-	-	1	A^2s
Turn-on Voltage Threshold		45	46.5	48	V
Turn-off Voltage Threshold		42	43.5	45	V

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

Recommend a fast-acting fuse with maximum rating of 20 A on system board. Refer to the fuse manufacture's datasheet for further information.

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

4. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	Vin = 54 V, Io = 100% load	11.144	11.200	11.256	V
Output Voltage range	Vin = 48.6 ~ 60 V, Io = 0 ~ 100% load (Output voltage may step down 1.4 V when input voltage exceeds operating input voltage before UVLO)	11.088	-	11.312	V
Load Regulation	Vin = 54 V, Io = 0 ~ 100% load	-	30	100	mV
Line Regulation	Vin = 48.6 ~ 60 V, Io = 100% load	-	30	100	mV
Output Ripple and Noise (pk-pk)	Vin = 54 V, Io = 100% load, Cout = 750 µF minimum, approximately 50% ceramic, 50% Oscon or POSCAP. Measured at output pins, bandwidth = 20 MHz	-	50	150	mV
Output Ripple and Noise (rms)		-	10	20	mV
Ripple and Noise (pk-pk) under worst case	Over entire operating input voltage range, load and ambient temperature condition	-	-	200	mV
Output Current Range		0	-	62.5	A
Output DC Current Limit		66	72	78	A
Short Circuit Surge Transient		-	-	2	A^2s
Rise Time		-	-	15	ms
Turn on Time	Ton (Enable form Vin)	-	25	35	ms
	Ton (Enable form ON/OFF)	-	25	35	
Overshoot at Turn on		-	0	3	%
Output Capacitance		0	-	4500	µF
Transient Response					
△V 50% - 75% of Max Load	di/dt = 1 A/µs, Vin = 54 VDC, Ta = 25°C, with a 1 µF ceramic capacitor and a 2200 µF AL. cap at output	-	350	500	mV
Settling Time		-	100	200	µs
△V 75% - 50% of Max Load		-	350	500	mV
Settling Time		-	100	200	µs

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

5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Vin = 54 V, Io = 100% load	95.8	97.2	-	%
Switching Frequency		280	300	320	kHz
FIT	Calculated Telcordia SR-332, Issue2 (Vin = 54 V, Vo = 11.6 V, Io = 50 A, Ta = 25°C, FIT = 10^9/MTBF)		276		-
Over Temperature Protection		-	125	-	°C
Over Voltage Protection		-	-	14	V
Weight		-	75	-	g
Dimensions (L × W × H)			2.30 × 1.45 × 0.57		inch
			58.42 × 36.83 × 14.48		mm
Isolation Characteristics					
Isolation Capacitance		-	2700	-	pF
Isolation Resistance		10M	-	-	Ohm
Input to Output		500	-	-	VDC

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

6. EFFICIENCY DATA

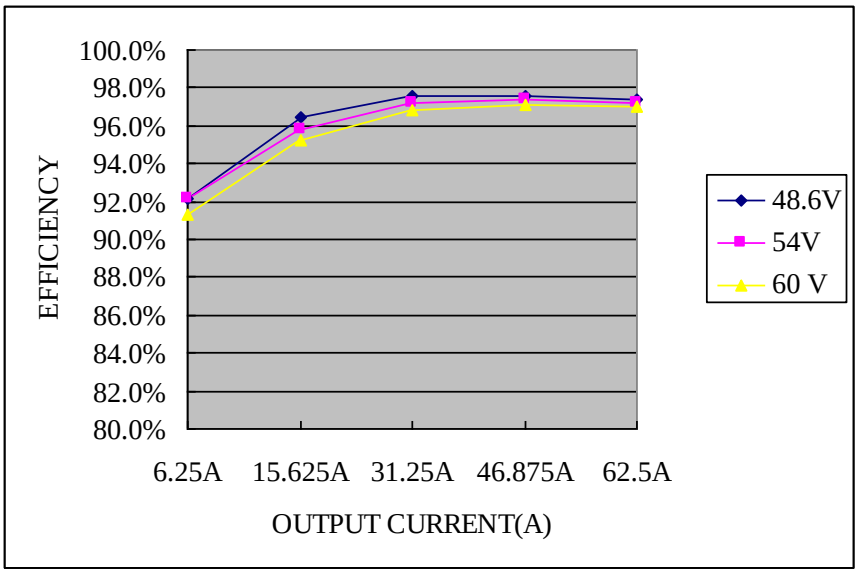

Figure 1. Efficiency data

7. OUTPUT PLOT VS INPUT

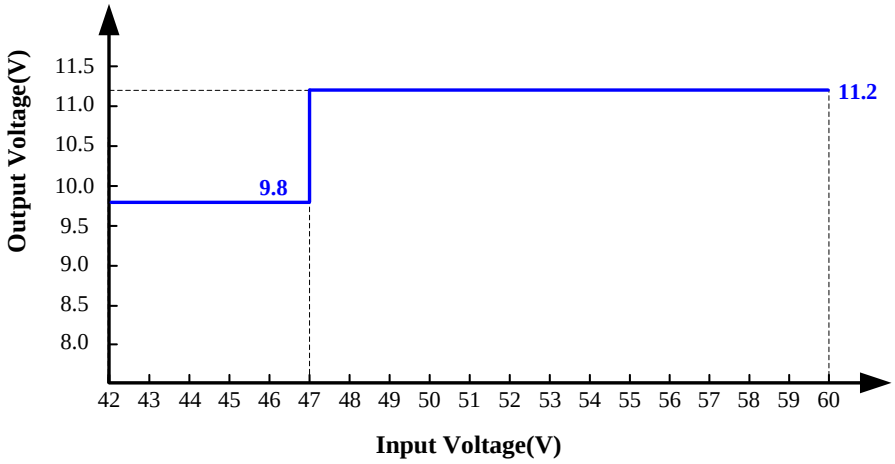

Figure 2. Output plot vs input

8. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Remote On/off						
Signal Low (Unit On)	Active Low	The remote on/off pin open, Unit off	-0.3	-	0.8	V
Signal High (Unit Off)			2.4	-	10	
Current Sink		-	0	-	0.5	mA

Recommended Remote On/Off Circuit for Active Low

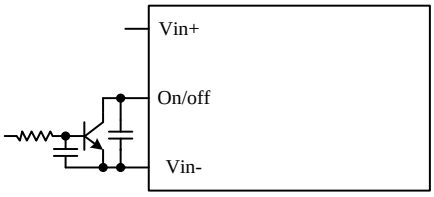

Figure 3. Control with open collector/drain circuit

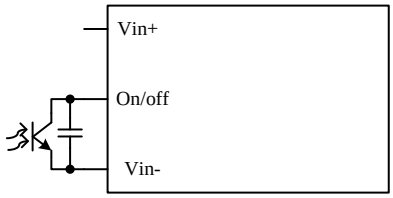

Figure 4. Control with photocoupler circuit

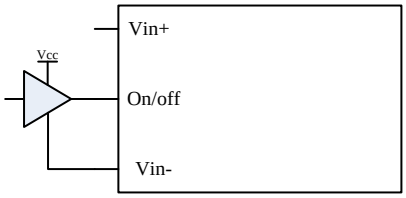

Figure 5. Control with logic circuit

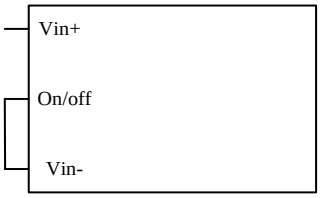

Figure 6. Permanently on

9. RIPPLE AND NOISE WAVEFORM

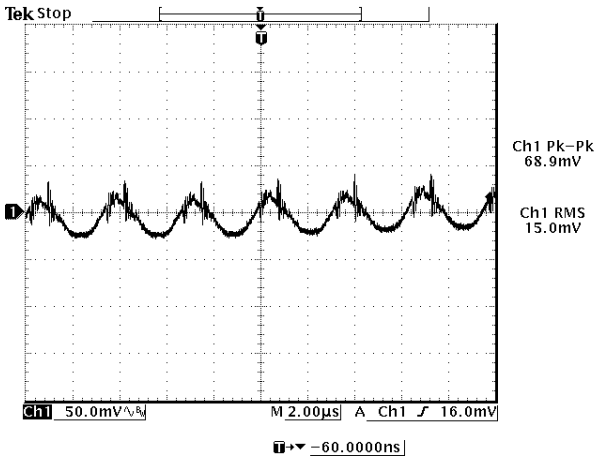

Figure 7. Ripple and noise waveform

NOTE: Ripple and noise at full load, 54 VDC input, 11.2 VDC/62.5 A output and Ta=25 ˚C, and with a 1 µF ceramic cap and a 10 µF Tantalum cap at output.

10. STARTUP & SHUTDOWN

Turn on rise time

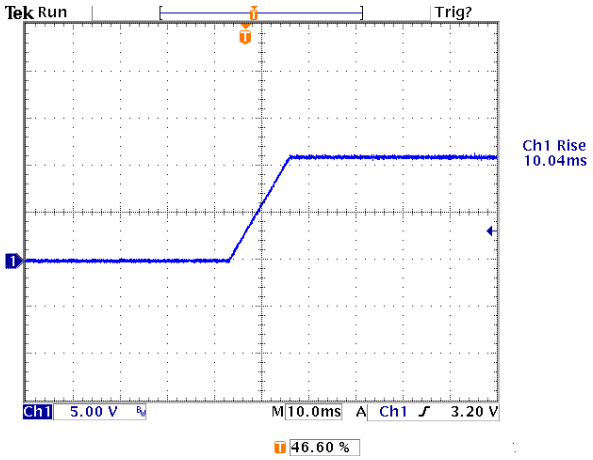

Figure 8. Vin = 54 V, Io = 62.5 A

Turn on delay time

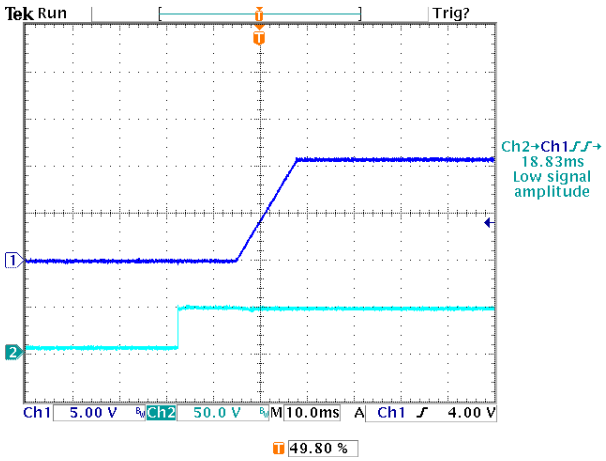

Figure 9. Startup from Vin
Ch1: Vo
Ch2: Vin
Vin = 54 V, Io = 62.5 A

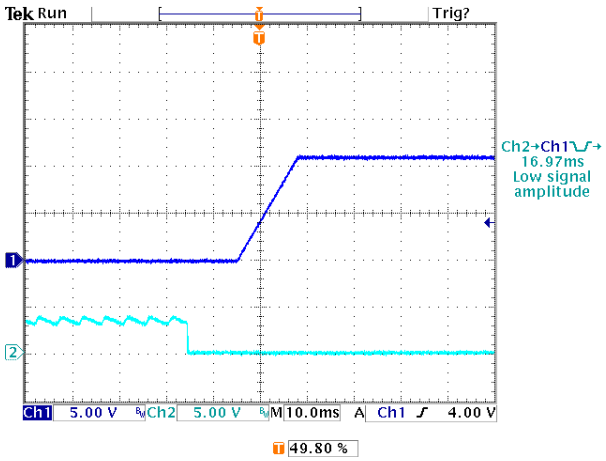

Figure 10. Startup from on/off
Ch1: Vo
Ch3: on/off
Vin = 54 V, Io = 62.5 A

Shutdown

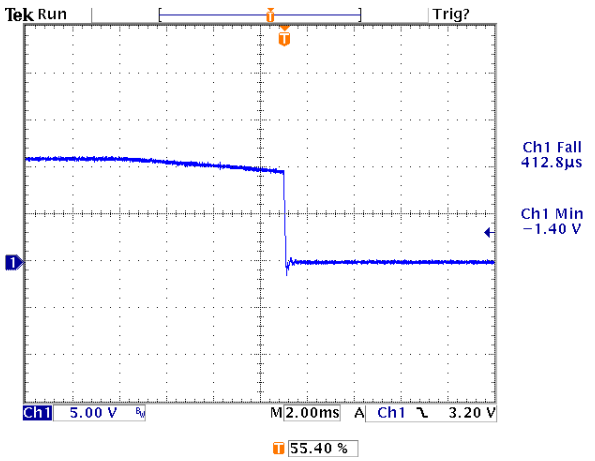

Figure 11. Shutdown from Vin
Ch1: Vo
Ch2: Vin
Vin = 54 V, Io = 62.5 A

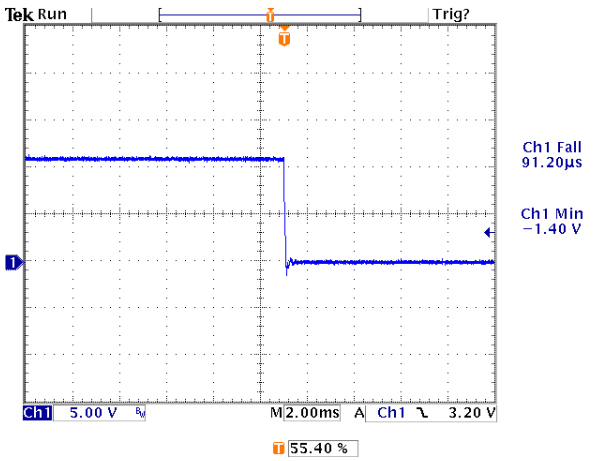

Figure 12. Shutdown from on/off
Ch1: Vo
Ch2: Vin
Vin Vin = 54 V, Io = 62.5 A

11. TRANSIENT RESPONSE WAVEFORMS

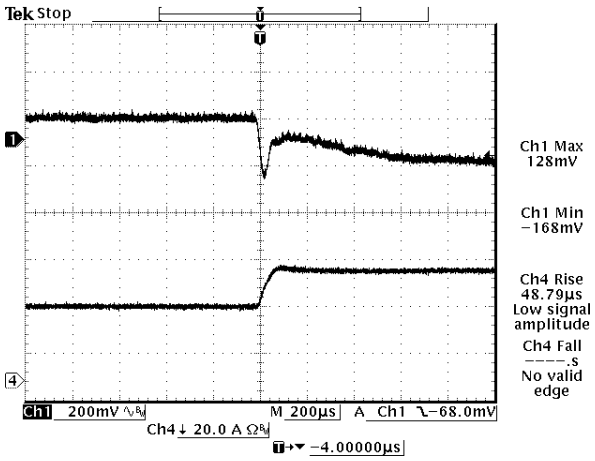

Figure 13. 50%-75% Load Transients
at Vin = 54 V @ Ta = 25°C

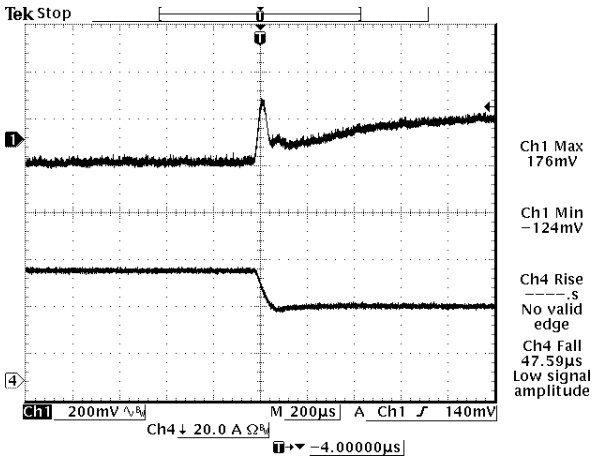

Figure 14. 75%-50% Load Transients
at Vin = 54 V @ Ta = 25°C

NOTE: Transient Response at di/dt = 0.1 A/µs, with a 1 µF ceramic cap and a 2200 µF aluminum cap at the output.

12. OVER CURRENT PROTECTION

To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry which can endure current limiting for a few milliseconds. If the over current condition persists beyond a few milliseconds, the module will shut down into hiccup mode and restart once every 400 ms. The module operates normally when the output current goes into specified range. The typical average output current is 4.9 A during hiccup.

Output current waveform

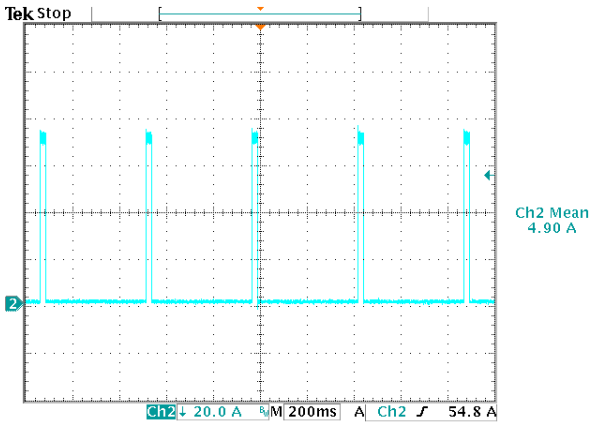

Figure 15. Vin = 50 V @ 25°C

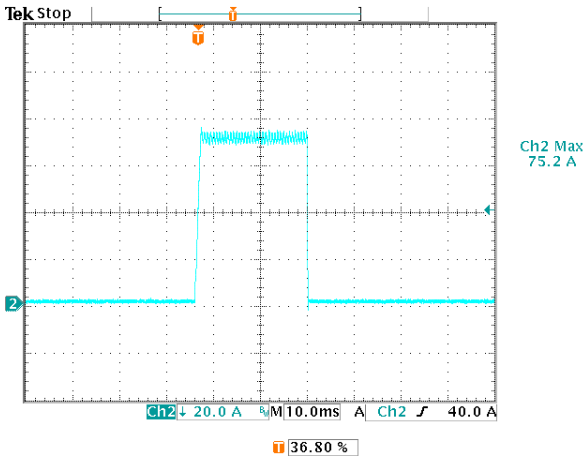

Figure 16. Expansion of on time portion of above figure CH2: Output current waveform

13. INPUT UNDER-VOLTAGE LOCKOUT

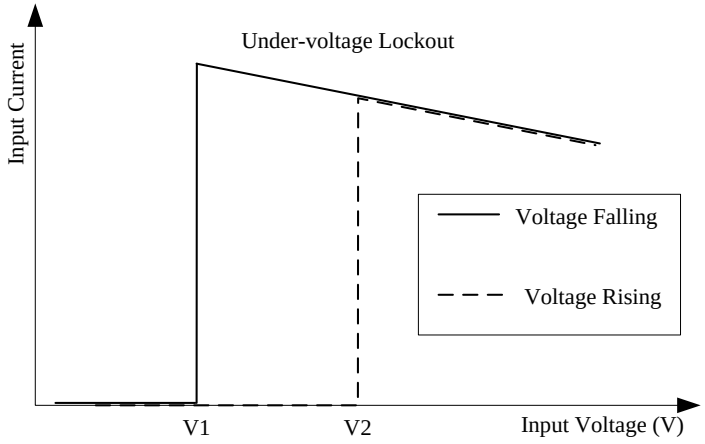

Figure 17. Input under-voltage lockout
V1 = 43.5 V
V2 = 46.5 V

14. THERMAL DERATING CURVES

The OTP is achieved by temperature sensor U10 and it's in non-latch mode when the hottest component U6 reaches 115°C with 200 LFM air flow correspondingly. It will restart automatically when the temperature falls to 105°C. The protecting point will be varied a little under different conditions (air flow, ambient temperature, input voltage, load...).

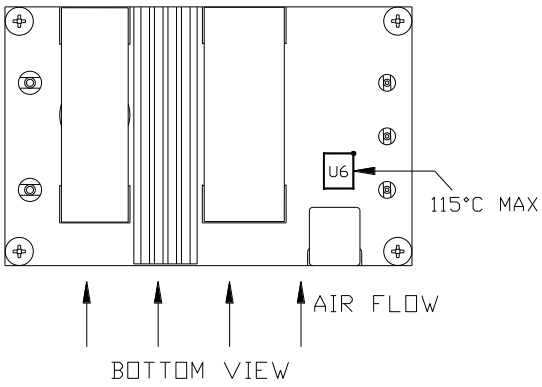

Figure 18. Airflow direction

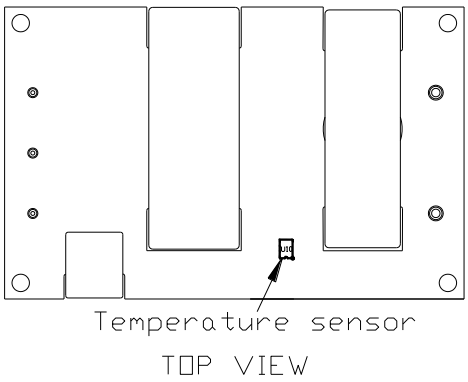

Figure 19. Temperature reference points on top side

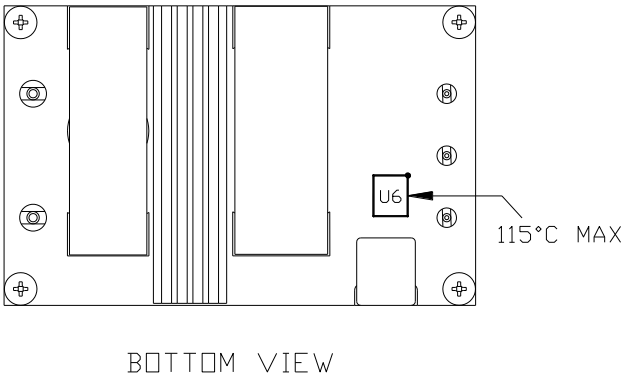

Figure 20. Temperature reference points on bottom side

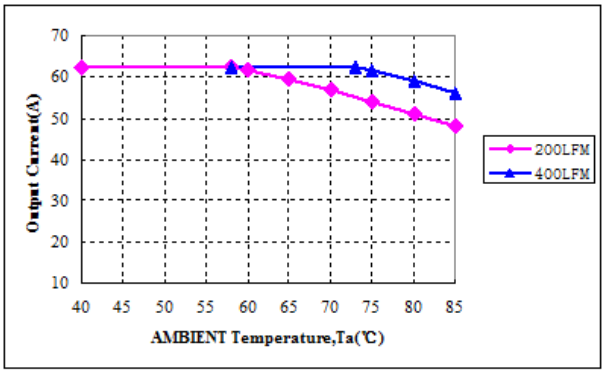

Figure 21. Derating Curves for 0RQB-S0M11L (Vin = 48.6 V)

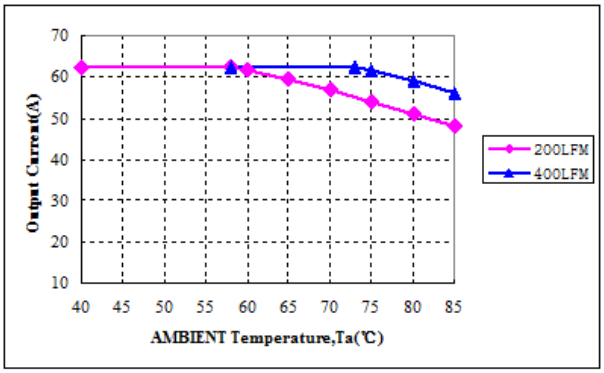

Figure 22. Derating Curves for 0RQB-S0M11L (Vin = 54 V)

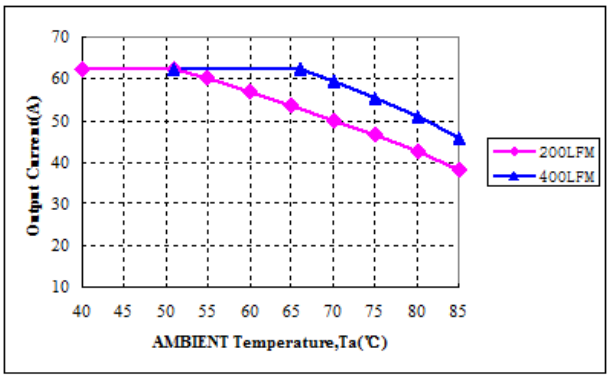

Figure 23. Derating Curves for 0RQB-S0M11L (Vin = 60 V)

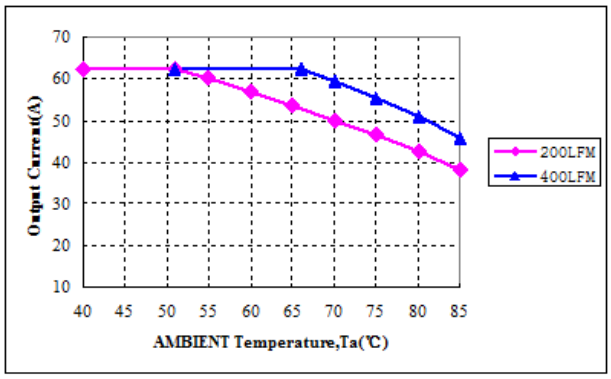

Figure 24. Derating Curves for 0RQB-S0M11L (Vin = 48.6 V), with a total 3.7 mm height of a 1.2 mm height baseplate and a 2.5 mm fin height heatsink assembly

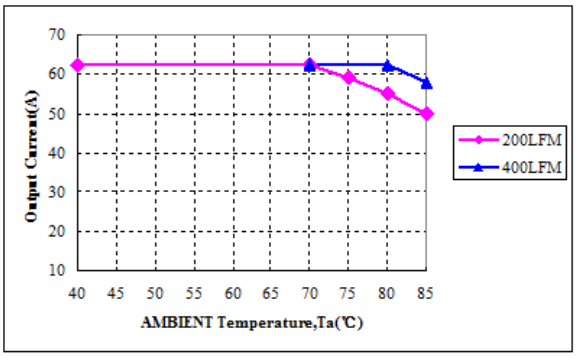

Figure 25. Derating Curves for 0RQB-S0M11L (Vin = 60 V), with a total 3.7 mm height of a 1.2 mm height baseplate and a 2.5 mm fin height heatsink assembly

15. SAFETY & EMC

SAFETY:

Approved to IEC/EN 62368-1

Approved to IEC/EN 60950-1

Approved to UL/CSA 62368-1

Approved to UL/CSA 60950-1

EMC:

1. Surge: IEC 61000-4-5
2. DC-DIP: IEC 61000-4-29
3. Conductive EMI: EN 55032 class A

Compliance to EN 55032 class A (both peak and average) with the following inductive and capacitive filter

Test Setup:

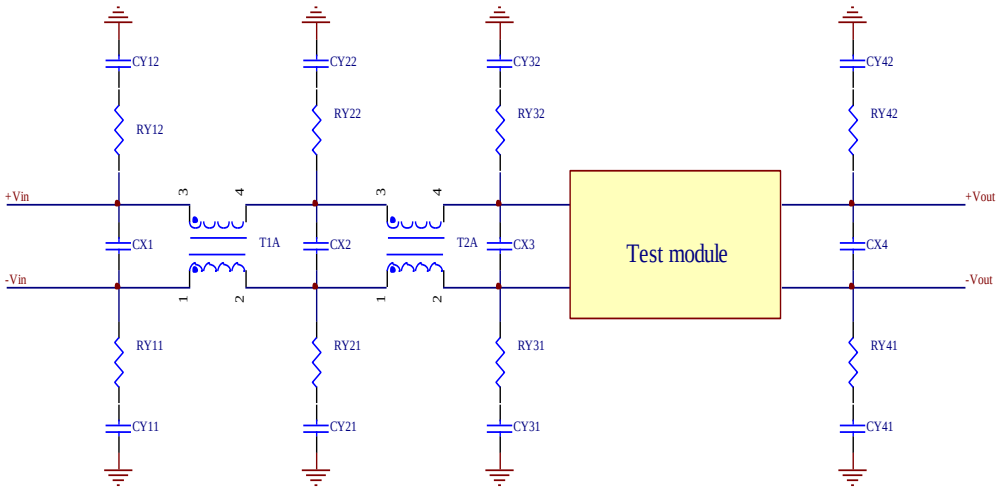

Figure 26. Test setup

ITEM	DESIGNATOR	PARAMETER
1	CX2	220μF/100V, AL cap
2	CX3	330μF/100V, AL cap
3	CY31	2*6.8nF/1000V, ceramic
4	CY32	2*6.8nF/1000V, ceramic
5	CY41	6.8nF/1000V, ceramic
6	CY42	6.8nF/1000V, ceramic
7	RY31	1206,0R, Resistor
8	RY32	1206,0R, Resistor
9	RY41	1206,0R, Resistor
10	RY42	1206,0R, Resistor
11	T2A	1.1mH, common mode
12	T1A, CX1, CX2, RY11, RY21, RY12, RY22, CY11, CY21, CY12, CY22	NIL

Positive

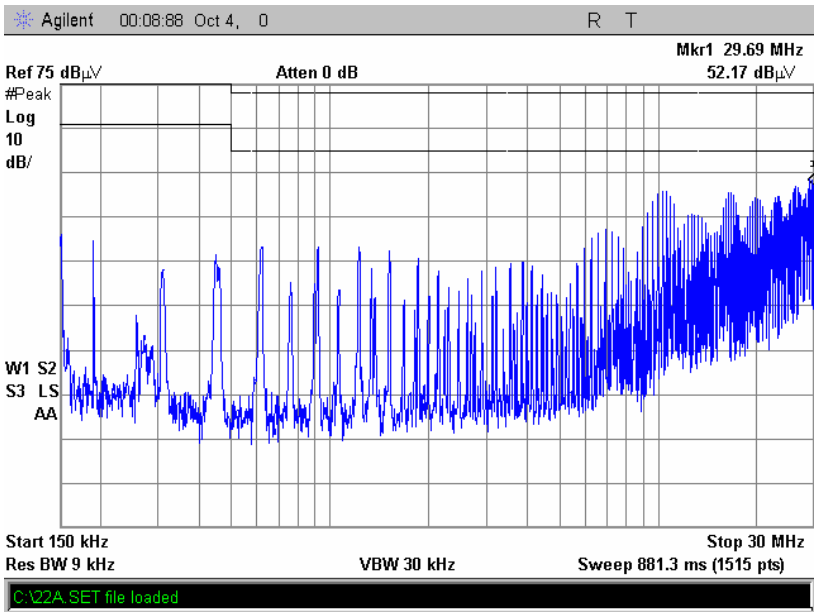

Figure 27.

Negative

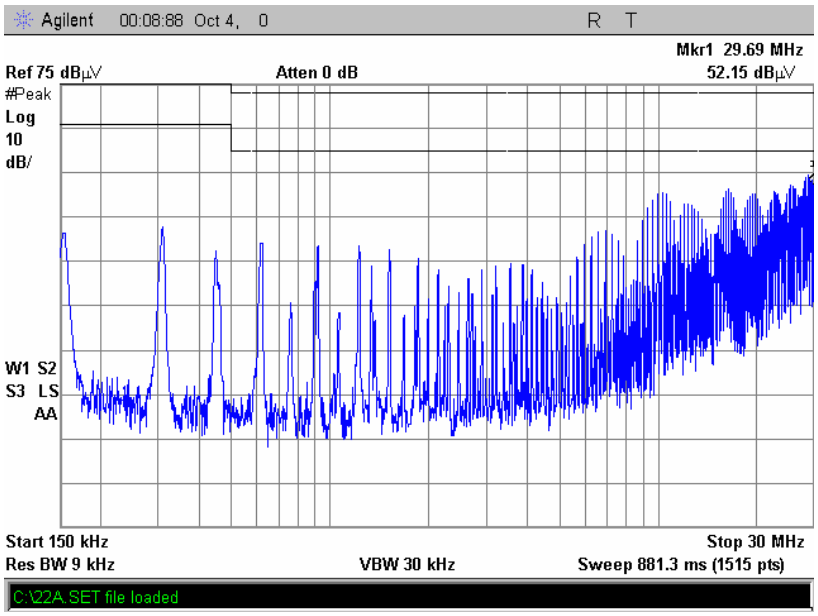

Figure 28.

16. MECHANICAL DIMENSIONS

OUTLINE

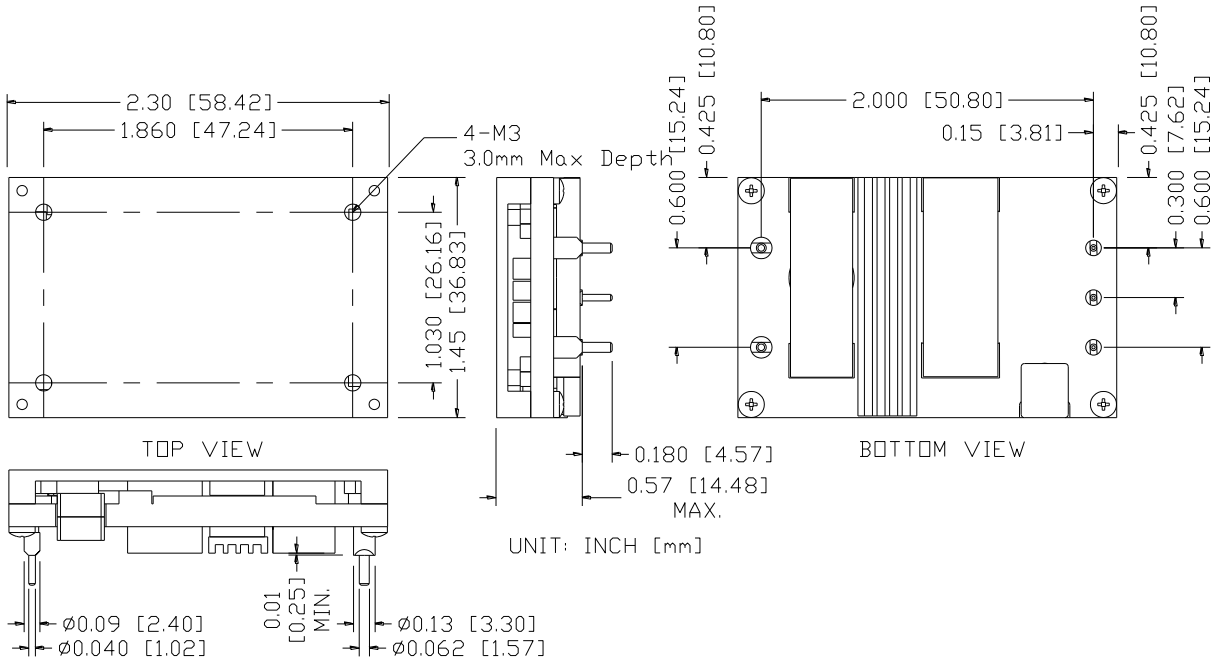

Figure 29. Outline

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 °C for less than 5 seconds.

NOTE:

1) All Pins: Material - Copper Alloy;
   Finish – 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.
2) Un-dimensioned components are shown for visual reference only.
3) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.5 mm]; x.xxx +/-0.010 inch [0.25 mm].

PIN DEFINITIONS

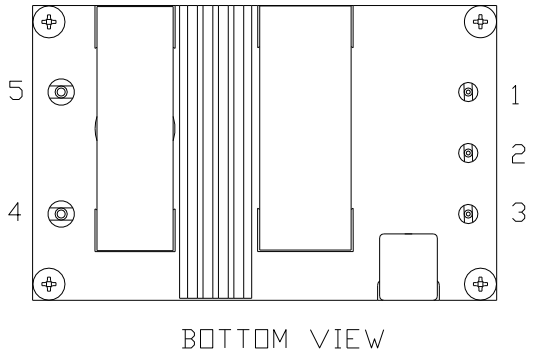

Figure 30. Pins

PIN	FUNCTION	DIA.	LENGTH
1	Vin(+)	0.040''	0.180''
2	Enable	0.040''	0.180''
3	Vin(-)	0.040''	0.180''
4	Vout(-)	0.062''	0.180''
5	Vout(+)	0.062''	0.180''

RECOMMENDED PAD LAYOUT

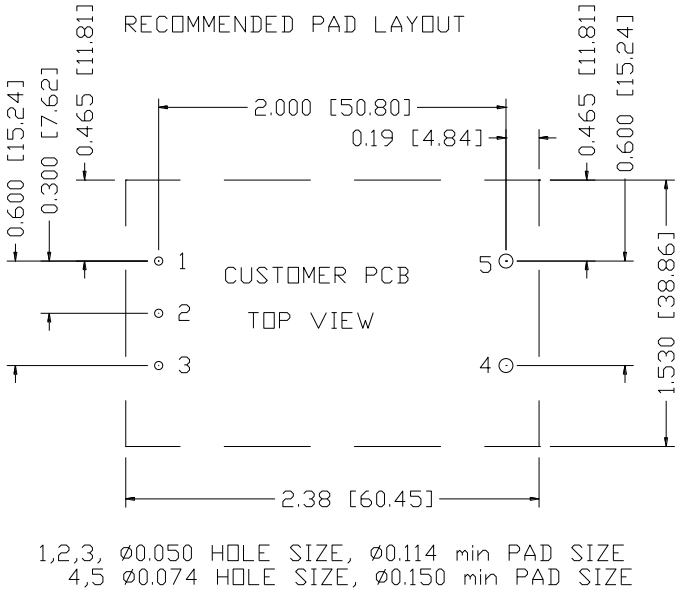

Figure 31. Recommended pad layout

17. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2013-11-05	A	First release	Z.Tang
2014-04-23	B	Update Features.TD	Z.Tang
2014-07-18	C	Update Safety & EMC	Z.Tang
2018-05-30	AD	Update PN. Explanation and Input Specs	Z.Tang
2020-10-14	AE	Delete 0RQB-S0M110. Update safety information and altitude.	XF.Jiang
2021-05-19	AF	Add object ID. Update recommended pad layout.	XF.Jiang

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

NUCLEAR AND MEDICAL APPLICATIONS - Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.
TECHNICAL REVISIONS - The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

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