0RQ2-Q2T12B

Isolated DC-DC Converter

The 0RQ2-Q2T12B is an isolated DC/DC converter that operates from a nominal 48 Vdc source. This unit provides up to 420 W of output power from a nominal 48 Vdc input.

This unit is designed to be highly efficient and low cost. Features include remote on/off, short circuit protection, over current protection, under-voltage lockout, over-temperature protection, and so on.

The converter is provided in an industry standard quarter brick package.

Key Features & Benefits

- 36-75 VDC Input / 12 VDC @ 35 A Output / 1/4th Brick Converter
- Fixed Frequency
- High Efficiency
- Input Under Voltage Lockout
- Input Over Voltage Lockout
- OCP/SCP
- Over Temperature Protection
- Over voltage protection
- Approved to IEC/UL/CSA 62368-1
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

RoHS Compliant

Applications

- Industrial
- Telecommunications

1. I/O ASSIGNMENT SUMMARY

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RQ2-Q2T12B	12 VDC	36 VDC – 75 VDC	35 A	420 W	96%

NOTE: 1. Add “G” suffix at the end of the model number to indicate Packaging.

PART NUMBER EXPLANATION

0	R	Q2	-	Q2	T	12	B	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Logic and Optional Features	Package Type
Through hole mount	RoHS	Q2		420 W	36 – 75 V	12 V	B - Active low, with baseplate	G – Tray package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Input Voltage	Continuous	-0.3	-	75	V
	Operating transient ⩽ 100mS	-	-	100	
	Non- operating continuous	85	-	100	
Remote On/Off		-0.3	-	18	V
Current Sink		0	-	10	mA
Isolation Voltage	input to output	-	-	1500	V
Operating Temperature	Ambient temperature	-40	-	85	°C
Storage Temperature		-55	-	125	°C
Altitude		-	-	2000	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

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage	Vin	36	48	75	V
Input Current (full load)	Iin	-	-	13.0	A
Input Current (no load)		-	70	200	mA
Remote Off Input Current		-	15	20	mA
Input Reflected Ripple Current i_s (rms)	Vin= 48V, Io= Iomax; with 12µH source impedance and 100uF at input; a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output	-	10	30	mA
Input Reflected Ripple Current i_s (pk-pk)		-	40	100	mA
Input Capacitance		100	-	-	uF
Under-voltage Turn on Threshold	Lockout turn on	-	34.5	35.5	V
Under-voltage Turn off Threshold	Lockout turn off, non-latching	32.5	33.5	-	V

CAUTION: This converter is not internally fused. An input line fuse must be used in application. Recommended input fast-acting fuse on system board

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	Test condition of the output set point: Vin=48V, Io=0% load at 25C ambient	11.97	12.00	12.03	V
Output Voltage Regulation	(Over all operating input voltage (40V-75V), resistive load, and temperature conditions until end of life)	11.76	-	12.24	V
Output Voltage Regulation					
Load Regulation	Vin=48V, Io=0~100% load	-	20	70	mV
Line Regulation	Vin=36~40V, Io=100% load	-	800	-	mV
	Vin=40~75V, Io=100% load	-	20	80	
Regulation Over Temperature	Vin=40~75V, Io=100%load over all ambient temperature condition	-	100	240	mV
Output Ripple and Noise (pk-pk)	Vin=48V, Io=100%load at 25°C ambient, 5Hz-20MHz BW, with a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output	-	100	200	mV
Output Ripple and Noise (rms)		-	25	40	mV
Output Current Range		0	-	35	A
Output DC Current Limit	hiccup mode	42	45	48	A
Rise time	Trise=Time for Vo to rise from 10% to 90% of Vo,set, For Co >5000uF, Io must be < 50% Io, max during Trise	-	-	15	ms
Turn-On Delay	Tdelay=Time until Vo = 10% of Vo,set Enable with Vin	-	28	60	ms
	Tdelay=Time until Vo = 10% of Vo,set Enable with on/off	-	28	60	ms
Overshoot at Turn on		-	0	3	%
Undershoot at Turn off		-	0	3	%
Output Capacitance	For Co >5000uF, Io must be < 50% Io, max during Trise	270	-	10000	uF
Transient Response					
ΔV 50%~75% of Max Load	di/dt=1A/10µs, Vin=48Vdc, Ta=25°C, Tested with a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output	-	500	-	mV
Settling Time		-	700	-	us
ΔV 75%~50% of Max Load		-	500	-	mV
Settling Time		-	700	-	us

5. OUTPUT PLOT VS INPUT

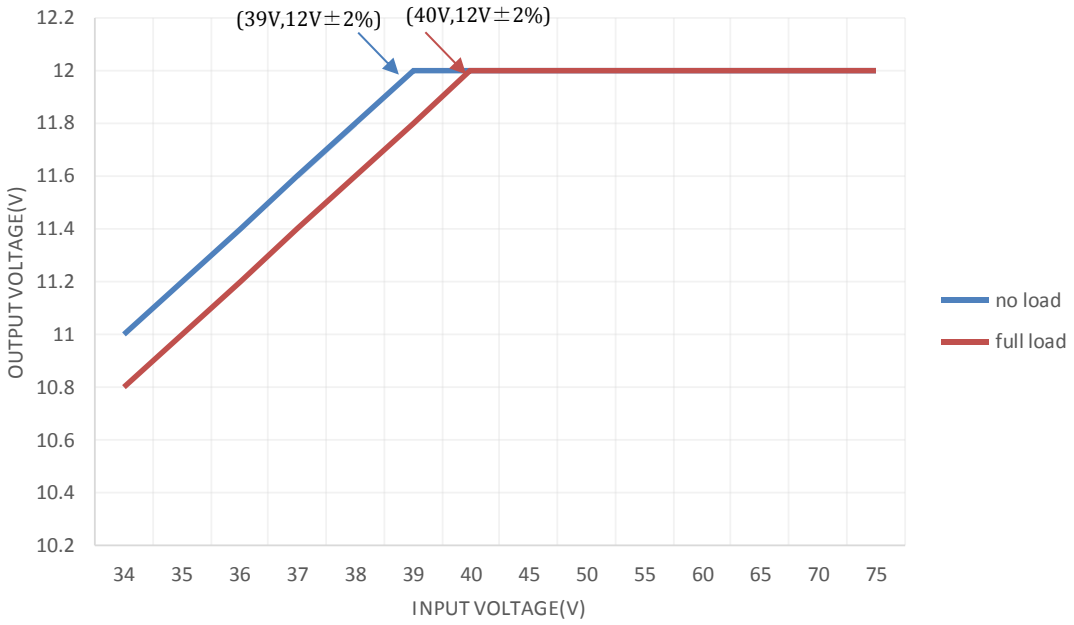


Figure 1. Output plot vs input

Note:

PARAMETER	MIN	TYP	MAX	UNIT
Turn-on Voltage Threshold	-	34.5	35.5	V
Turn-off Voltage Threshold	32.5	33.5	-	V

6. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Vin=48V, full load	-	96	-	%
Switching Frequency		-	260	-	kHz
MTBF	Calculated Per Bell Core SR-332 (Vin=48 V, Vo=12 V, Io=80%Iomax A, Ta = 40°C, Airflow=200LFM, FIT=10^9/MTBF)	-	3.61	-	M hrs
FIT		-	277	-	10^9/Hours
Over Temperature Protection		-	140	-	°C
Over Voltage Protection (Static)	Auto-restart following shutdown	13.5	-	13.8	V
Weight		-	85	-	g
Dimensions Inches (L × W × H) Millimeters (L × W × H)	For base plate version		2.30 x 1.45 x 0.57 58.42 x 36.83 x 14.48		INCH mm
Isolation Characteristics					
Input to Output		-	-	1500	Vdc
Input to baseplate		-	-	1500	Vdc
Output to baseplate		-	-	500	Vdc
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	-	3300	pF

7. EFFICIENCY DATA

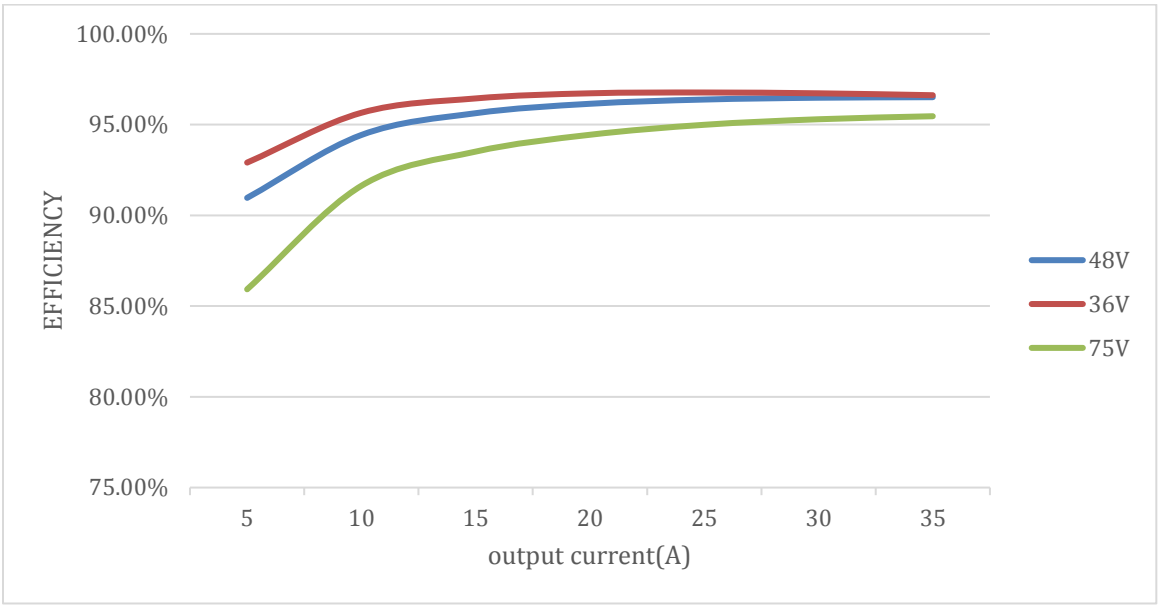


Figure 2. Efficiency data

8. REMOVE 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	-	18	V
Current Sink			0	-	1	mA

Recommended Remote On/Off Circuit for Active Low

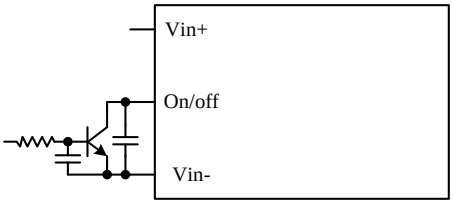


Figure 3. Control with open collector/drain circuit

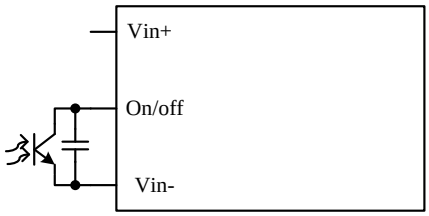


Figure 4. Control with photocoupler circuit

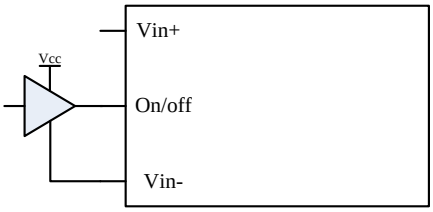


Figure 5. Control with logic circuit

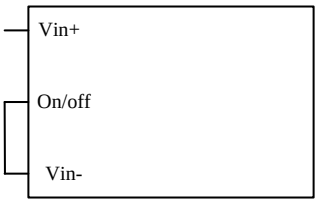


Figure 6. Permanently on

9. RIPPLE AND NOISE WAVEFORM

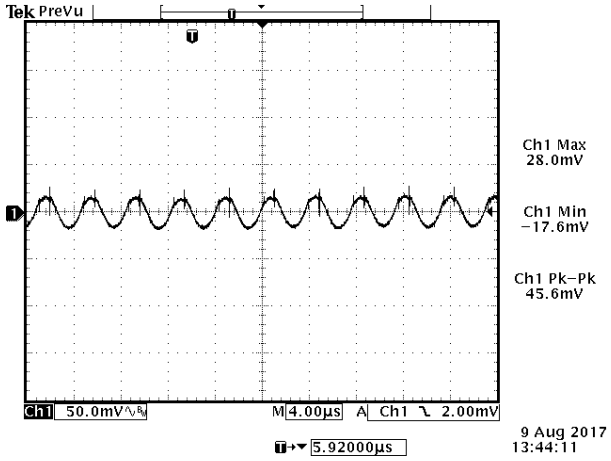


Figure 7. Ripple and noise waveform

Note: 48Vdc input, 12Vdc/35A output and Ta=25 deg C, and a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output.

10. THERMAL DERATING CURVES

Maximum junction temperature of semiconductors derated to 125 degree C.

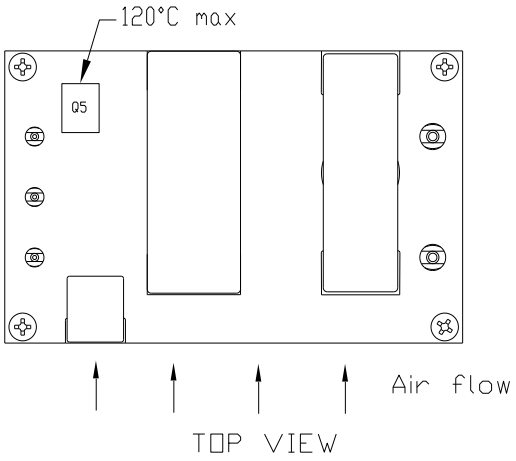


Figure 8. Airflow direction

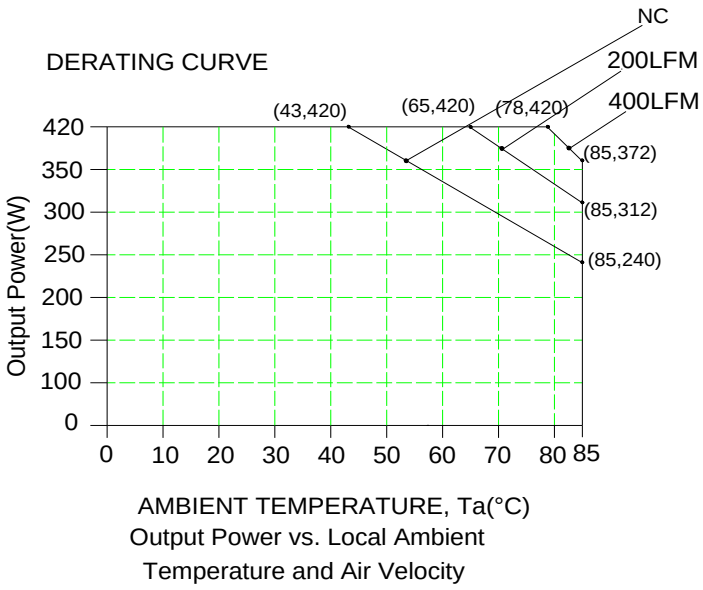
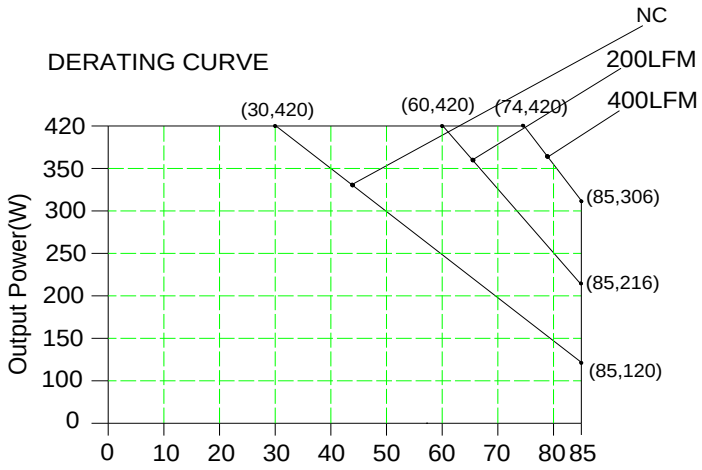


Figure 9. Derating curve@ Vin = 36V

Output Current Derating for the Base

Plate version with a cover in the Transverse Orientation

THERMAL DERATING CURVES(CONTINUED)

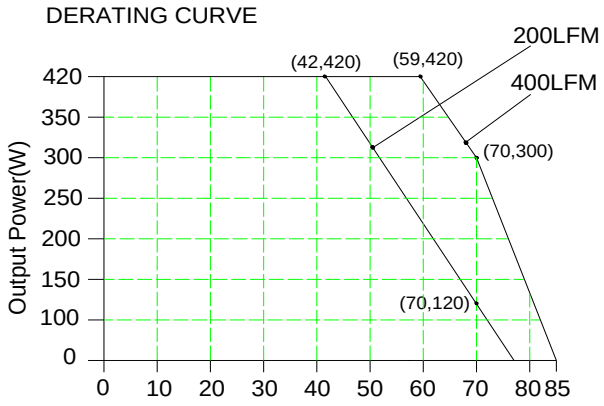


Output Power vs. Local Ambient Temperature and Air Velocity

Figure 10. Derating curve@ Vin = 48V

Output Current Derating for the Base

Plate version with a cover in the Transverse Orientation



Output Power vs. Local Ambient Temperature and Air Velocity

Figure 11. Derating curve@ Vin = 75V

Output Current Derating for the Base

Plate version with a cover in the Transverse Orientation

11. TRANSIENT RESPONSE WAVEFORMS

Transient Response test condition: di/dt=0.1A/us, a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output.

CHI: Vout, CH2: Vout

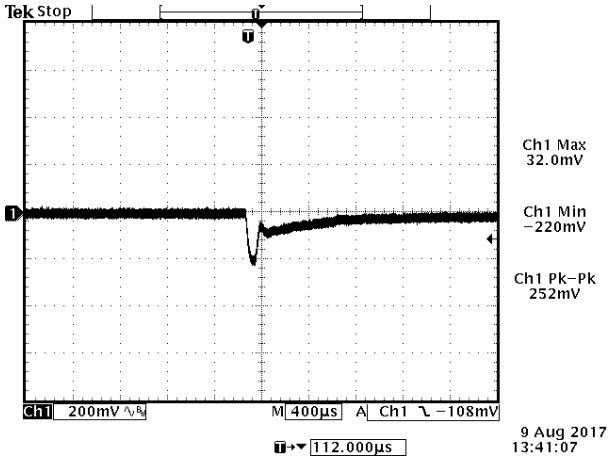


Figure 12.

Vout= 12V 50%-75% Load Transients at Vin=48V, Ta=25 deg C

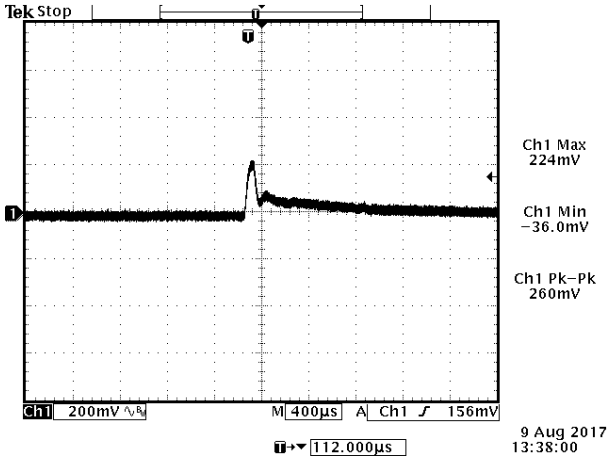


Figure 13.

Vout= 12V 75%-50% Load Transients at Vin=48V, Ta=25 deg C

12. INPUT NOISE

Input reflected ripple current

Testing setup

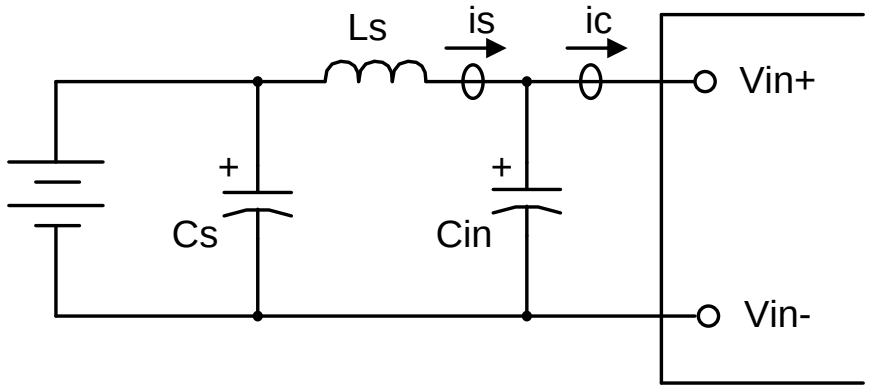


Figure 14.

Notes and values in testing.

is: Input Reflected Ripple Current

ic: Input Terminal Ripple Current

Ls: Simulated Source Impedance (12µH)

Cs: Offset possible source Impedance (100µF, ESR<0.12Ω @ 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: 100µF, ESR<0.12Ω @ 100kHz, 20C.

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

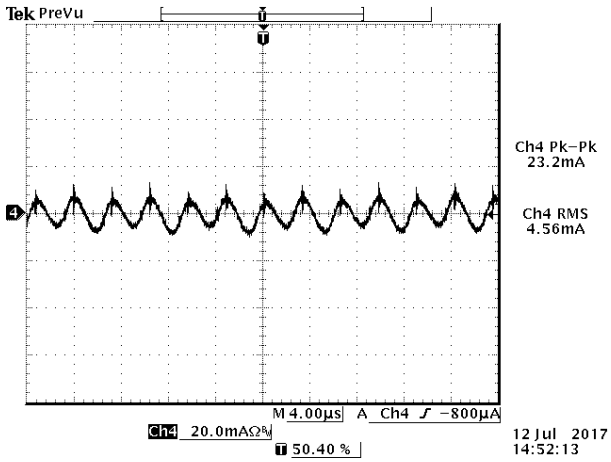


Figure 15.

is (input reflected ripple current), AC component

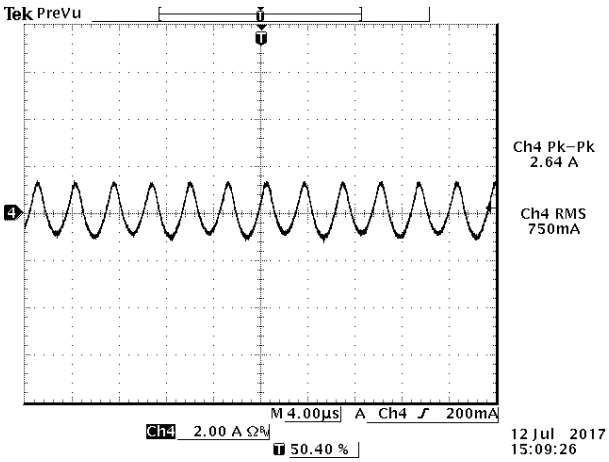


Figure 16.

ic (input terminal ripple current), AC component

Test condition: *48Vdc input, 12Vdc/35A output and Ta=25 deg C, with a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output.*

13. STARTUP & SHUTDOWN

Startup

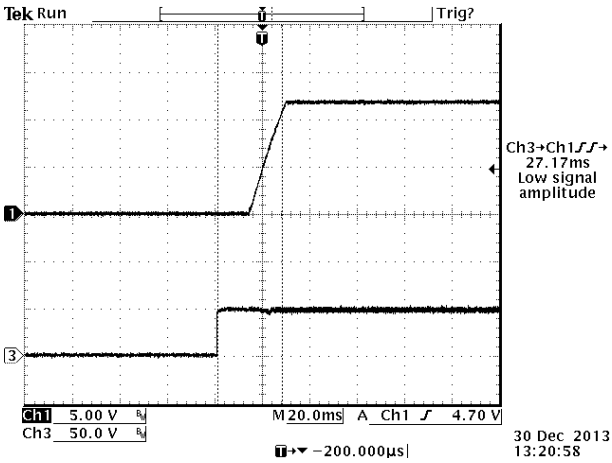


Figure 17.

48Vdc input, 12Vdc/35A output and Ta=25 deg C,

a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output.

CH1: Vout, CH3: Vin

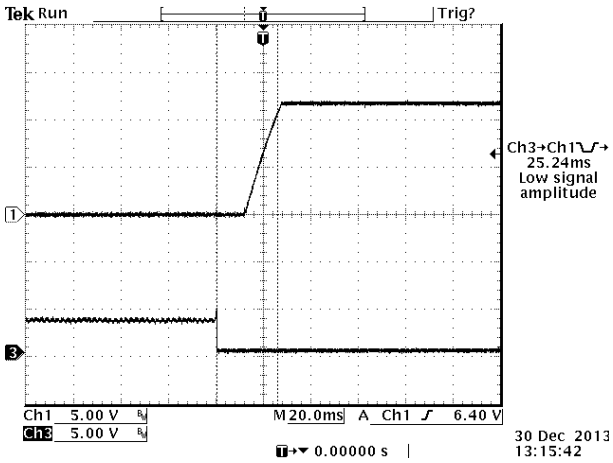


Figure 18.

48Vdc input, 12Vdc/35A output and Ta=25 deg C,

a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output.

CH1: Vout, CH3: Remote on/off (Active low)

Shutdown

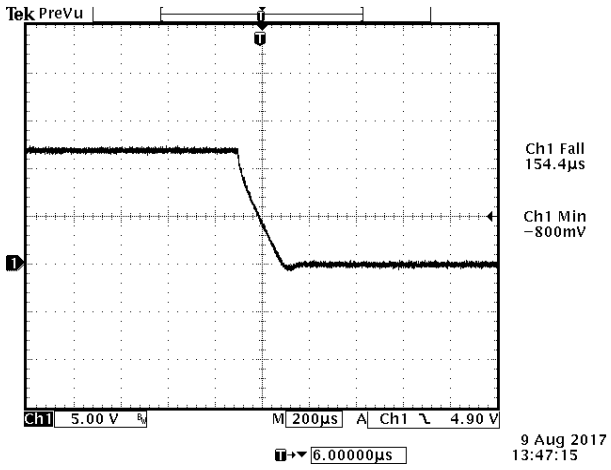


Figure 19.

48Vdc input, 12Vdc/35A output and Ta=25 deg C, a 1µF ceramic, a 10uF tantalum and 470uF capacitor at output

CH1: Vout

14. OVER CURRENT PROTECTION

To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for a few milliseconds. If the overcurrent condition persists beyond a few milliseconds, 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.

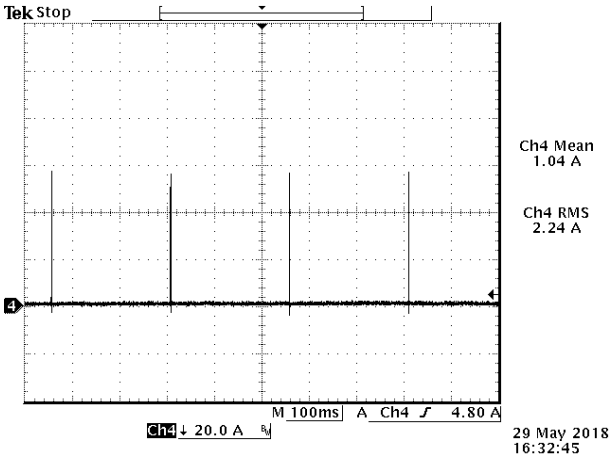


Figure 20.

CH4: output current

Test condition : *Vin=48V@Ta=25℃*

15. UNDER VOLTAGE LOCKOUT

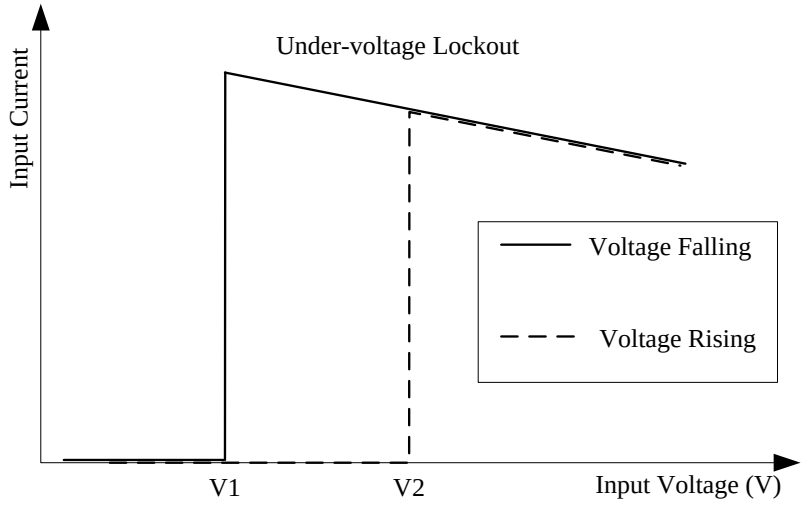


Figure 21. Under voltage lockout

V1 = 33.5V

V2 = 34.5V

16. SAFETY & EMC

Safety:

1. UL Certification UL62368-1

Setup:

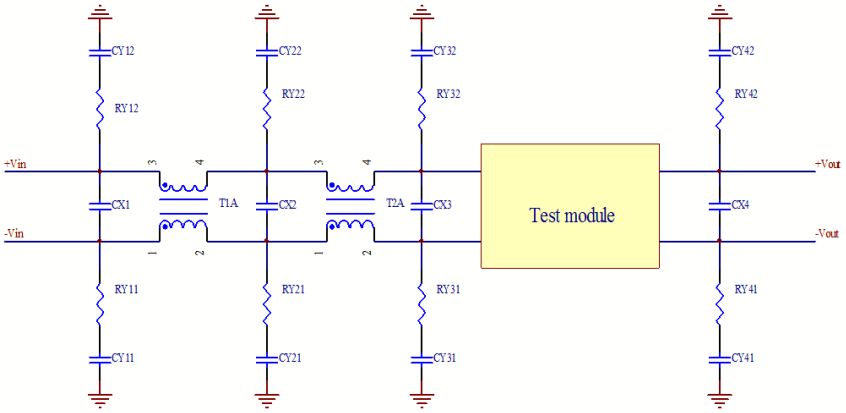


Figure 22.

T1A	CX1	RY11	RY12	CY11	CY12
-	-	-	-	-	-
T2A	CX2	RY21	RY22	CY21	CY22
1mH	10uF	-	-	-	-
-	CX3	RY31	RY32	CY31	CY32
-	100uF+10uF	0R	0R	10uF+0.1uF+10nF	10uF+0.1uF+10nF
-	CX4	RY41	RY42	CY41	CY42
-	100uF	-	-	-	-

SAFETY & EMC(CONTINUED)

Positive

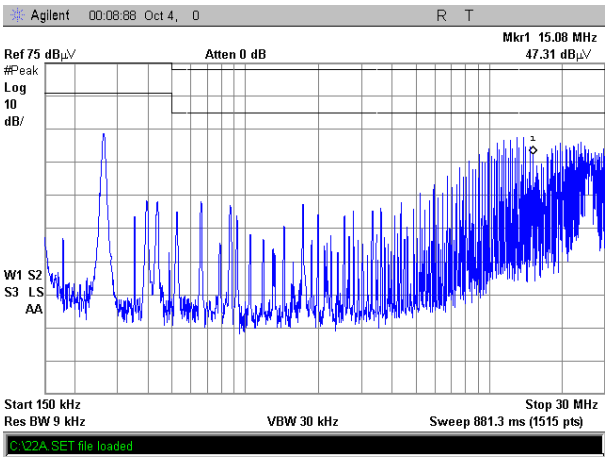


Figure 23.

Negative

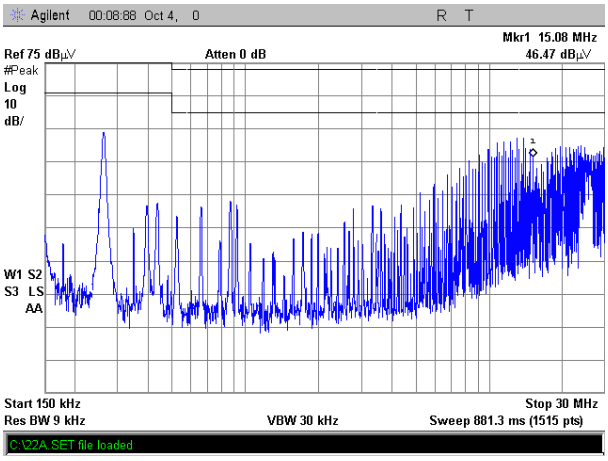


Figure 24.

17. SOLDERING INFORMATION

The 0RQ2-Q2T12B modules are designed to be compatible with reflow soldering process. The suggested Pb-free solder paste is Sn/Ag/Cu(SAC). The recommended reflow profile using Sn/Ag/Cu solder is shown in the following. Recommended reflow peak temperature is 245℃ while the part can withstand peak temperature of 260℃ maximum for 10seconds. This profile should be used only as a guideline. Many other factors influence the success of SMT reflow soldering. Since your production environment may differ, please thoroughly review these guidelines with your process engineers.

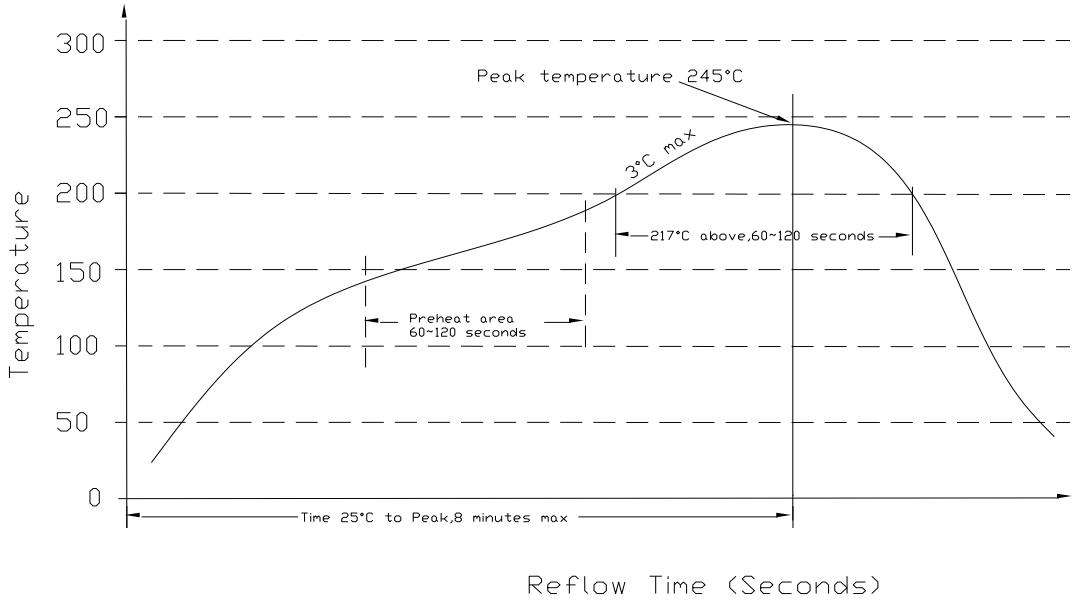


Figure 25. Soldering temperature

18. MSL RATING

The 0RQ2-Q2T12B modules have a MSL rating of 3.

19. STORAGE AND HANDING

The 0RQ2-Q2T12B modules are designed to be compatible with J-STD-033 Rev:A (Handling, Packing, Shipping and Use of Moisture /Reflow Sensitive surface Mount devices). Moisture barrier bags (MBB) with desiccant are applied. The recommended storage environment and handling procedure is detailed in J-STD-033.

20. PRE-BAKING

This component has been designed, handled, and packaged ready for Pb-free reflow soldering. If the assembly shop follows J-STD-033 guidelines, no pre-bake of this component is required before being reflowed to a PCB. Our packaging tray can only withstand temperature of 70°C max.

21. MECHANICAL DIMENSIONS

OUTLINE

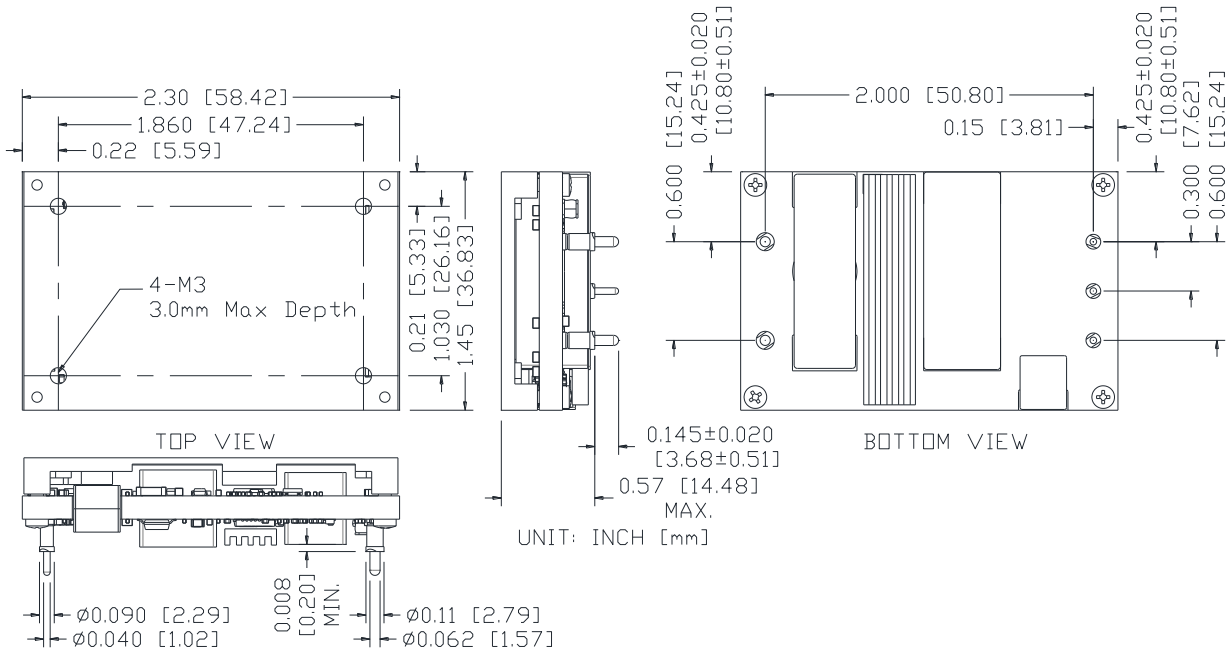


Figure 26. Outline

Note:

All Pins: Material - Copper Alloy;
Finish - Tin plated.

1) Undimensioned components are shown for visual reference only.

2) All dimensions in inches; Tolerances: x.xx +/-0.02 in [0.5 mm]. x.xxx +/-0.010 in [0.25 mm]. Unless otherwise stated.

MECHANICAL DIMENSIONS(CONTINUED)

PIN DEFINITIONS

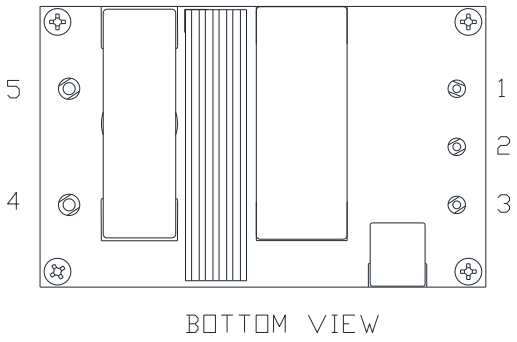


Figure 27. Pin

PIN	FUNCTION
1	Vin (+)
2	ON/OFF
3	Vin (-)
4	Vout (-)
5	Vout (+)

RECOMMENDED PAD LAYOUT

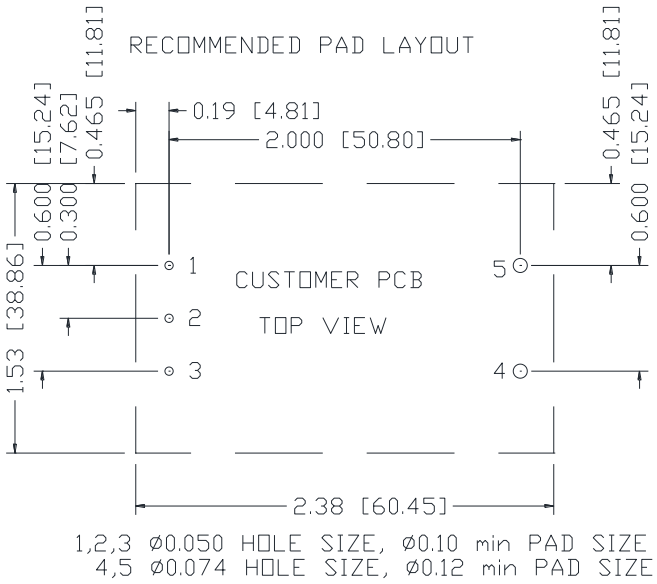


Figure 28. Recommended pad layout

22. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2017-08-14	AA	First release	S.Wang
2017-09-26	AB	Update output voltage regulation, add soldering information	S.Wang
2017-11-28	AC	Update Mechanical dimension, isolation characteristics, thermal derating curve	S.Wang
2018-05-30	AD	Update Isolation Voltage, Input Specs and output Specs. Add over current protection. Update THERMAL DERATING CURVES	S.Wang
2018-08-02	AE	Update the description for operating temperature	S.Wang
2019-06-18	AF	Update safety certification	F.Tao
2020-02-20	AG	Update Input Reflected Ripple Current and input capacitance	S.Wang

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.