

0RQB-Q2T06

Isolated DC-DC Converter

The 0RQB-Q2T06 is an isolated DC/DC converter that operates from a nominal 48 VDC source. This unit will provide up to 390 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, over current protection and under voltage lockout.

These converters are provided in an industry standard quarter brick package.



Key Features & Benefits

- 36 - 75 VDC Input
- 6.5 V / 60 A Output
- 1/4th Brick
- Isolated
- Output Over-Voltage Shutdown
- High Efficiency
- Over Temperature Protection
- High Power Density
- OCP/SCP
- Fixed Frequency (300 kHz)
- Remote On/Off
- Low Cost
- Basic Insulation
- Input Under-Voltage Lockout
- Input Over-Voltage Lockout
- Approved to UL/CSA 60950-1
- 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-Q2T065G 0RQB-Q2T06LG	6.5 VDC	36 - 75 VDC	60 A	390 W	95%

PART NUMBER EXPLANATION

0	R	QB	-	Q2	T	06	x	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Status	Package
Through Hole Mount	RoHS	1/4 th brick		390 W	36 – 75 V	6.5 V	5 - Active High, with Baseplate L - Active Low, with Baseplate	Tray Package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous Input Voltage		-0.3	-	80	V
Input Transient Voltage	100 ms maximum	-	-	100	A
Remote On/Off		-0.3	-	18	V
I/O Isolation Voltage		-	-	1500	V
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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		36	48	75	V
Input Current (full load)		-	-	13.0	A
Input Current (no load)		-	80	130	mA
Remote Off Input Current		-	15	20	mA
Input Reflected Ripple Current (rms)	Tested with simulated source impedance of 10 μ H, 5 Hz to 20 MHz; use a 100 μ F/100 V electrolytic capacitor with ESR = 1 ohm max. at 200 kHz at 25 °C	-	5	10	mA
Input Reflected Ripple Current (pk-pk)		-	20	40	mA
I ² t Inrush Current Transient		-	-	1	A ² s
Turn-on Voltage Threshold		33	34.5	36	V
Turn-off Voltage Threshold		32	33.5	34.5	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 20A on system board. Refer to the fuse manufacture's datasheet for further information.

NOTES: 1. This converter has internal L-C(0.72 μ H-1 μ F-9.4 μ F) filter.

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

4. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	$V_{in} = 48\text{ V}$, $I_o = 50\%$ Load	6.37	6.50	6.63	V
Load Regulation		-	± 15	± 30	mV
Line Regulation		-	± 15	± 60	mV
Regulation Over Temperature (-40 °C to 85 °C)		-	± 30	± 65	mV
Output Current Range		0	-	60	A
Output DC Current Limit		64	72	78	A
Short Circuit Surge Transient		-	-	6	A ² s
Output Ripple and Noise (pk-pk)	0 - 20 MHz BW, with a 1 μF ceramic capacitor and a 470 μF Tantalum cap at output	-	50	120	mV
Output Ripple and Noise (rms)		-	10	25	mV
Ripple and Noise (pk-pk) under worst case	Over entire operating input voltage range, load and temp. conditions	-	-	150	mV
Rise Time		-	25	-	ms
Turn on Time	Enable form V_{in}		40	50	ms
	Enable form ON/OFF	-	40	50	ms
Overshoot at Turn on		-	0	3	%
Output Capacitance		0	-	10000	μF
Transient Response					
ΔV 50% ~ 75% of Max Load	Overshoot	-	-	400	mV
	Settling Time	$di/dt = 0.1\text{ A}/\mu\text{s}$, $V_{in} = 48\text{ VDC}$, $T_a = 25^\circ\text{C}$, with a 1 μF ceramic capacitor and a 470 μF Tantalum cap at the output	-	300	μs
ΔV 75% ~ 50% of Max Load	Overshoot	-	-	400	mV
	Settling Time	-	-	300	μs
ΔV 50% ~ 75% of Max Load	Overshoot	-	-	500	mV
	Settling Time	$di/dt = 1\text{ A}/\mu\text{s}$, $V_{in} = 48\text{ VDC}$, $T_a = 25^\circ\text{C}$, with a 1 μF ceramic capacitor and a 470 μF Tantalum cap at the output	-	300	μs
ΔV 75% ~ 50% of Max Load	Overshoot	-	-	500	mV
	Settling Time	-	-	300	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 = 48 V, full load	94	95	-	%
Switching Frequency		-	300	-	kHz
Over Temperature Protection		-	125	-	°C
Over Voltage Protection (Static)	This voltage is achieved by trimming up output slowly	-	8.5	-	V
FIT	Calculated Per Bell Core SR-332 (Vin = 48 V, Vo = 6.5 V, Io = 30 A, 500 LFM, Ta = 25 °C, FIT = 10 ⁹ /MTBF)		478	-	
Weight		-	71	-	g
Dimensions (L x W xH)		2.28 x 1.45 x 0.54			inch
		57.91 x 36.83 x 13.70			mm
Isolation Characteristics					
Input to Output		-	-	1500	V
Input to Case		-	-	1500	V
Output to Case		-	-	500	V
Isolation Resistance		10M	-		ohm
Isolation Capacitance		-	1000	-	pF

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

6. EFFICIENCY DATA

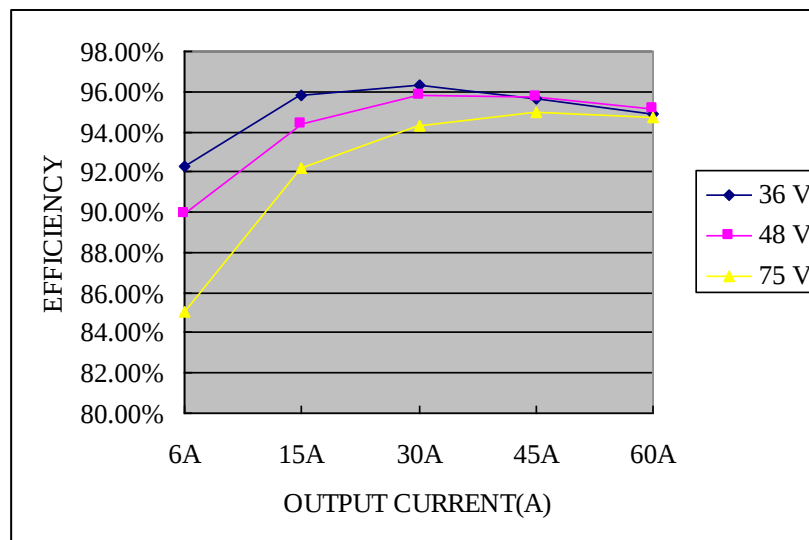


Figure 1. Efficiency data

7. REMOVE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Remote On/off						
Signal Low (Unit On)	Active Low	0RQB-Q2T06L. The remote on/off pin open, Unit off	-0.3	-	0.8	V
Signal High (Unit Off)			2.4	-	18	
Signal Low (Unit Off)	Active High	0RQB-Q2T065. The remote on/off pin open, Unit on	-0.3	-	0.8	V
Signal High (Unit On)			2.4	-	18	
Current Sink			0	-	1	mA

Recommended remote on/off circuit for active low

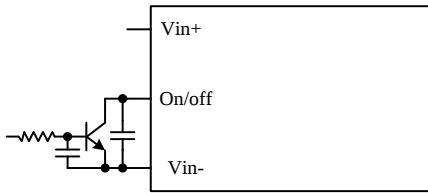


Figure 2. Control with open collector/drain circuit

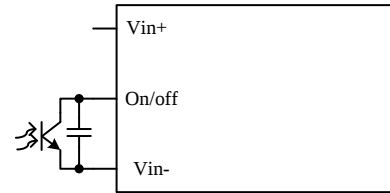


Figure 3. Control with photocoupler circuit

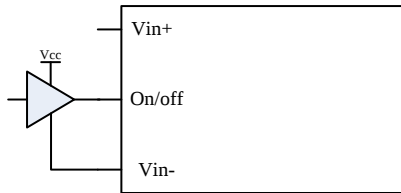


Figure 4. Control with logic circuit

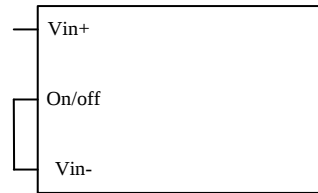


Figure 5. Permanently on

Recommended remote on/off circuit for active high

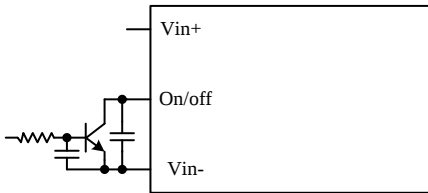


Figure 6. Control with open collector/drain circuit

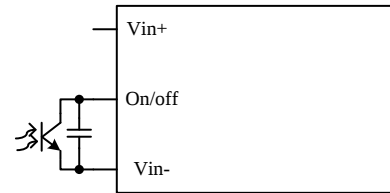


Figure 7. Control with photocoupler circuit

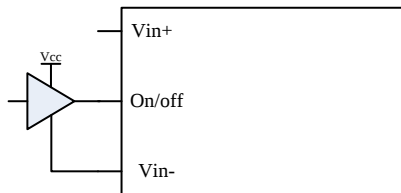


Figure 8. Control with logic circuit

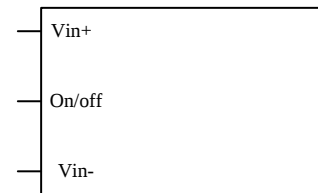


Figure 9. Permanently on

8. RIPPLE AND NOISE WAVEFORM

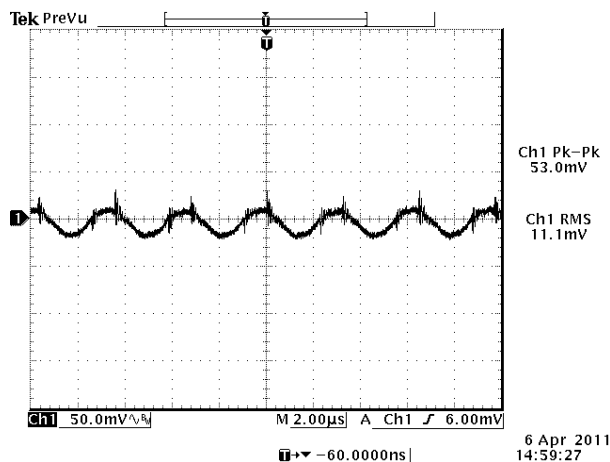


Figure 10. 48 VDC input, 6.5 VDC / 60 A

NOTE: Ripple and noise at full load, with a 1 μ F ceramic cap and a 470 μ F Tantalum cap at output, $T_a = 25^\circ\text{C}$.

9. TRANSIENT RESPONSE WAVEFORMS

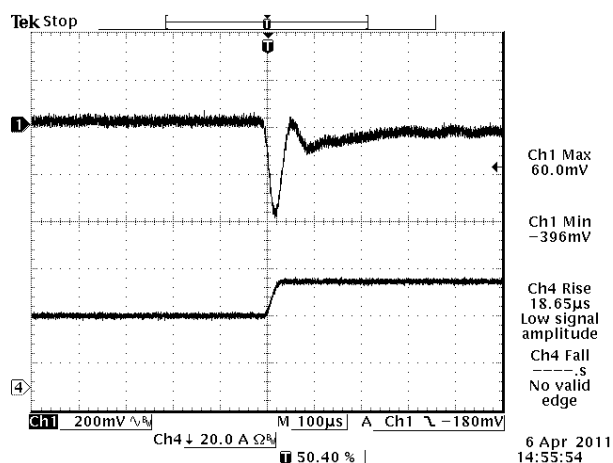


Figure 11. $V_{out} = 6.5\text{ V}$, 50% to 75% Load Transients

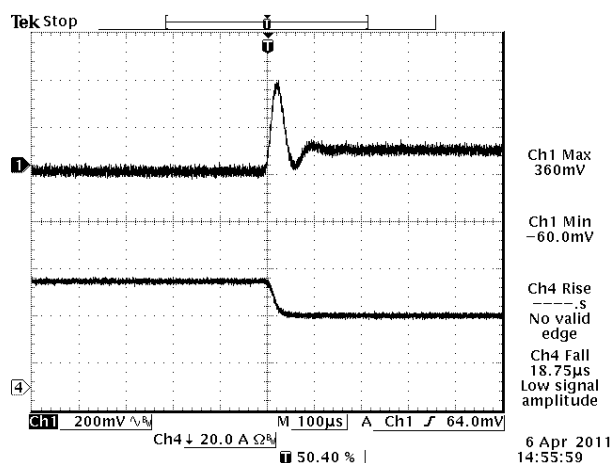


Figure 12. $V_{out} = 6.5\text{ V}$, 75% to 50% Load Transients

NOTE: Transients response at $di/dt = 0.1\text{ A}/\mu\text{s}$, with 1 μ F ceramic cap and 470 μ F aluminum cap at output, and $T_a = 25^\circ\text{C}$.

10. STARTUP & SHUTDOWN

Rise time

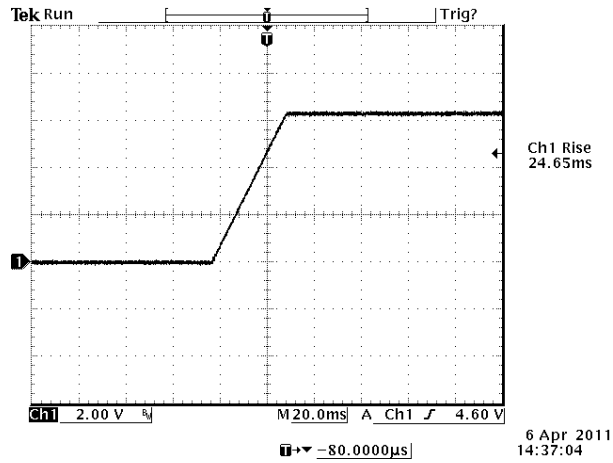


Figure 13. $V_{out} = 6.5\text{ V} / 60\text{ A}$ at $V_{in} = 48\text{ V}$
@ $T_a = 25^\circ\text{C}$ $C_{ext} = 0\text{ }\mu\text{F}$

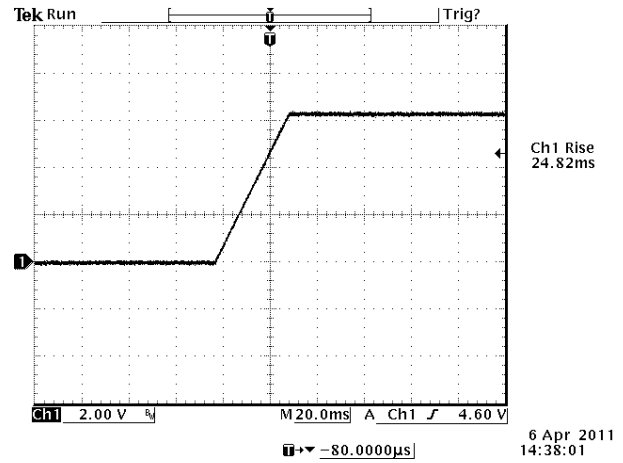


Figure 14. $V_{out} = 6.5\text{ V} / 60\text{ A}$ at $V_{in} = 48\text{ V}$
@ $T_a = 25^\circ\text{C}$ $C_{ext} = 10000\text{ }\mu\text{F}$

Startup time

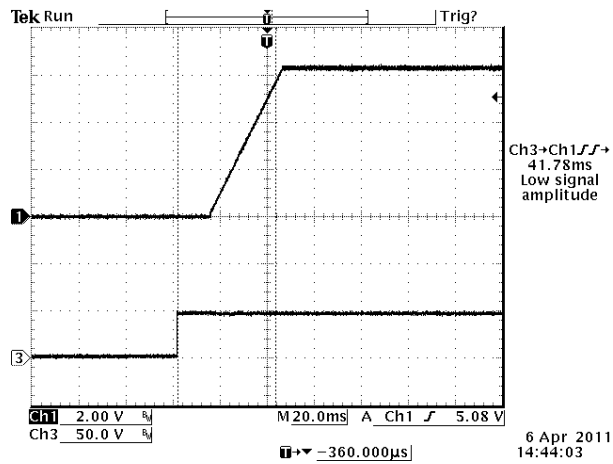


Figure 15. Startup from V_{in}
Ch1: V_o
Ch3: V_{in}
 $V_{out} = 6.5\text{ V} / 60\text{ A}$ at $V_{in} = 48\text{ V}$ @ $T_a = 25^\circ\text{C}$
 $C_{ext} = 10000\text{ }\mu\text{F}$

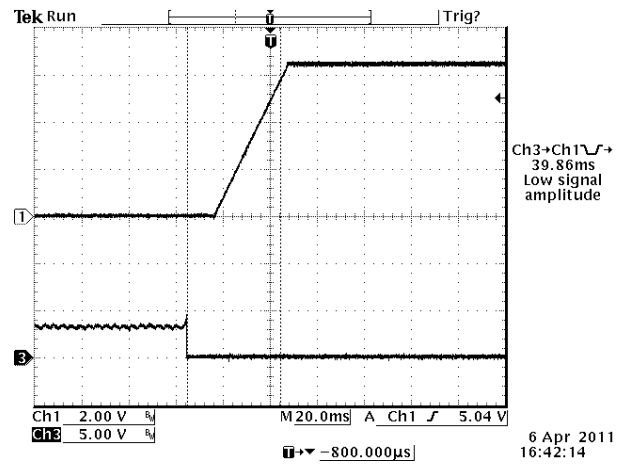


Figure 16. Startup from on/off
Ch1: V_o
Ch3: on/off
 $V_{out} = 6.5\text{ V} / 60\text{ A}$ at $V_{in} = 48\text{ V}$ @ $T_a = 25^\circ\text{C}$
 $C_{ext} = 10000\text{ }\mu\text{F}$

Shutdown

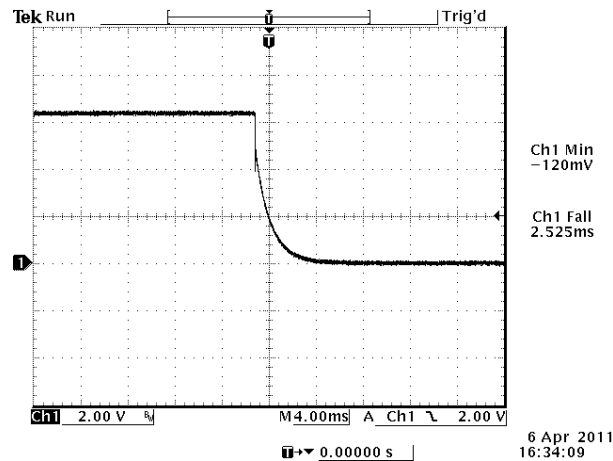


Figure 17. $V_{out} = 6.5\text{ V} / 60\text{ A}$ at $V_{in} = 48\text{ V}$ @ $T_a = 25^\circ\text{C}$ $C_{ext} = 10000\text{ }\mu\text{F}$

11. 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 4.8 A during hiccup.

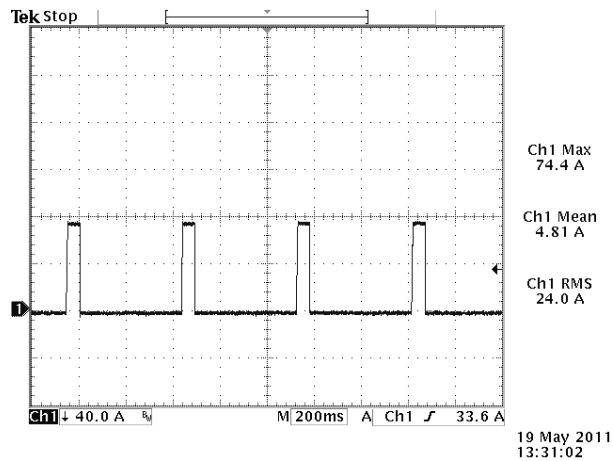


Figure 18. Output current waveform

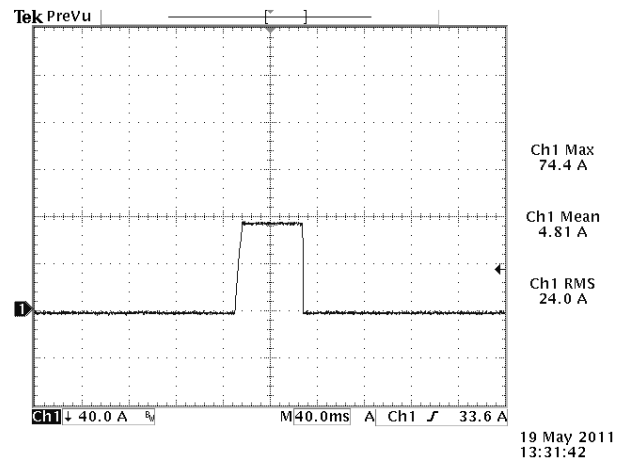


Figure 19. Expansion of on time portion

12. INPUT UNDER-VOLTAGE LOCKOUT

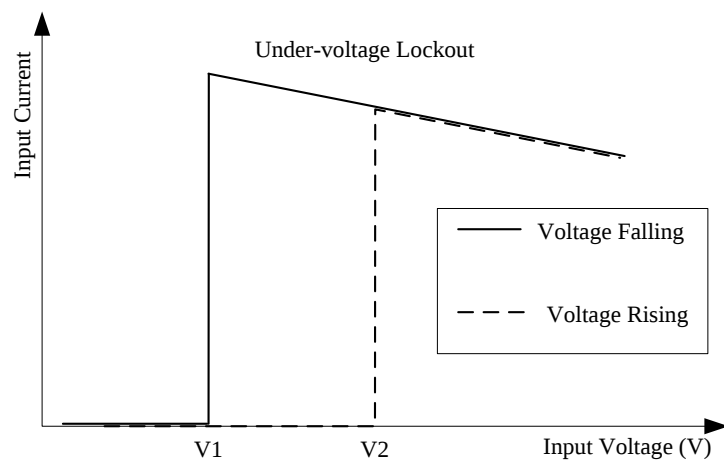


Figure 20. Input under-voltage lockout

$$V1 = 32 \text{ V}$$

$$V2 = 34 \text{ V}$$

13. THERMAL DERATING CURVE

With maximum junction temperature of semiconductors derated to 120°C.

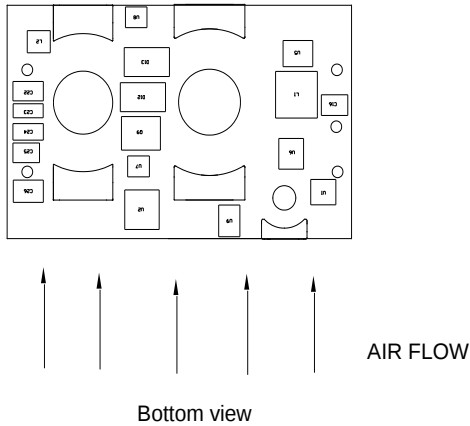


Figure 21. Airflow direction

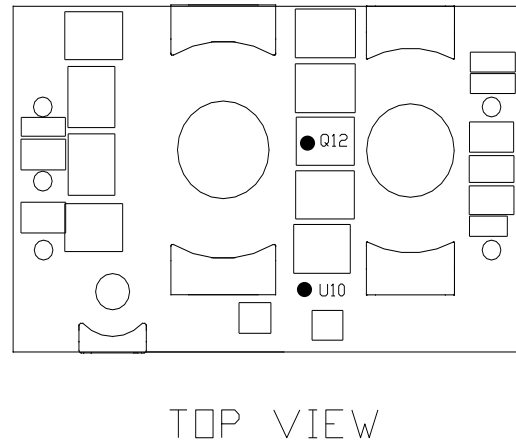


Figure 22. Temperature reference points on top side

The OTP is achieved by temperature sensor U10 and it is in non-latch mode when the hottest component Q12 reaches 120°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...).

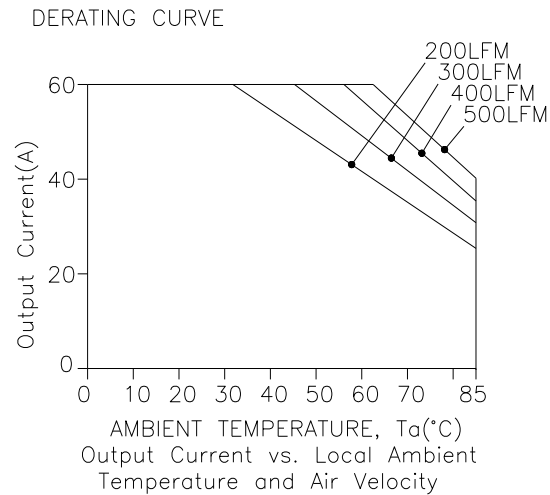


Figure 23. Thermal derating curve under 48V input

14. SAFETY & EMC

Safety:

1. Material flammability UL94V-0
2. Approved to UL/CSA 60950-1
3. Approved to IEC/EN 60950-1

EMC:

1. Surge: IEC61000-4-5
2. DC-DIP: IEC61000-4-29
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:

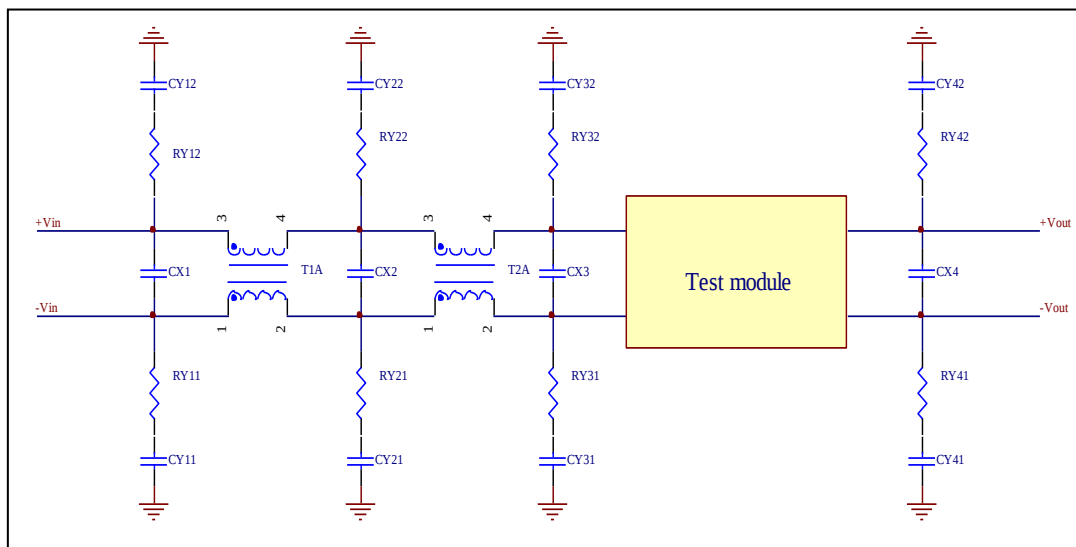


Figure 24.

ITEM	DESIGNATOR	PARAMETER
1	CX1	47μF/100V, AL cap
2	CX2	4*47μF/100V, AL cap
3	CY21	10nF/250V, Film cap
4	CY22	10nF/250V, Film cap
5	RY21	1206,0R, Resistor
6	RY22	1206,0R, Resistor
7	T1A	0.18mH, common mode
8	T2A, RY11, RY12, RY31, RY32, RY41, RY42, CY11, CY12, CY32, CY32, CY41, CY42, CX3, CX4	NIL

Positive

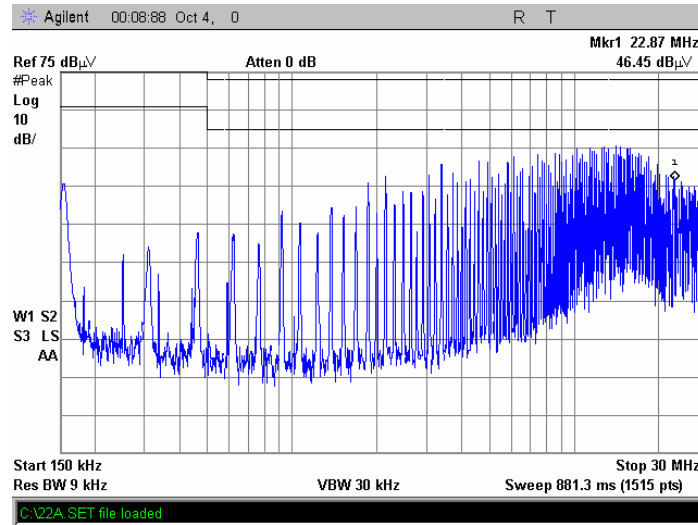


Figure 25.

Negative

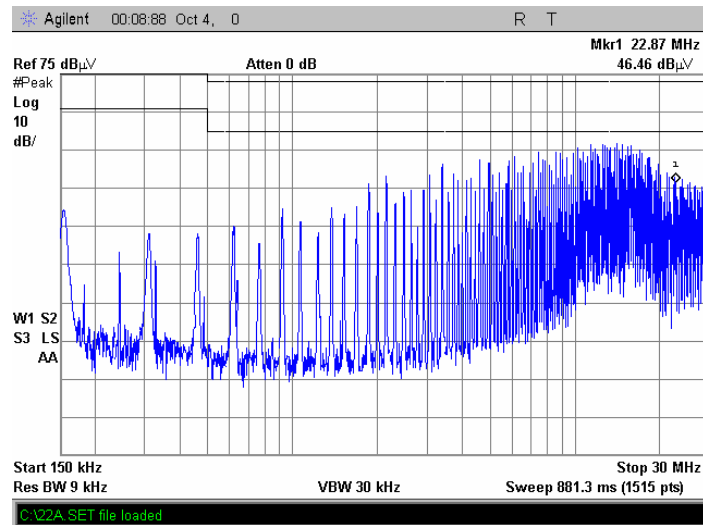


Figure 26.

15. MECHANICAL DIMENSIONS

OUTLINE

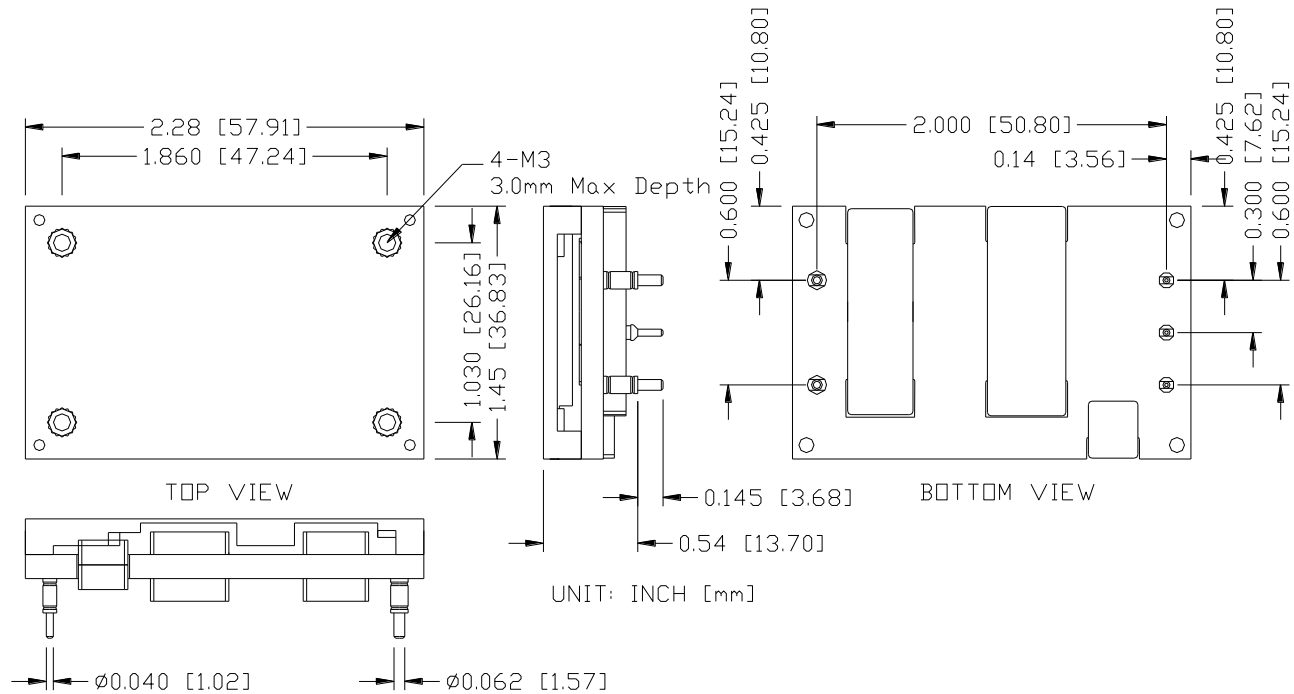


Figure 27. Outline

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.

NOTES:

- 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

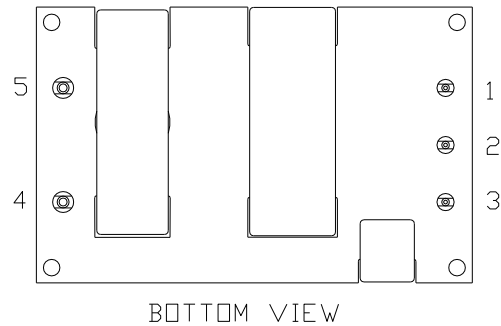
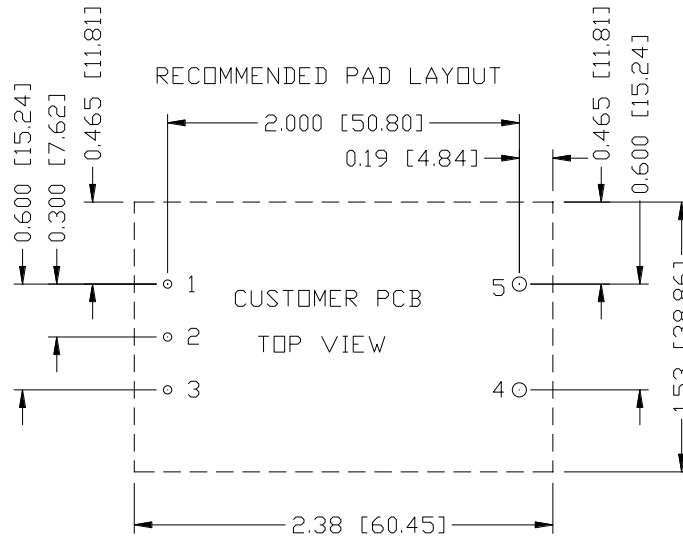


Figure 28. Pins

PIN	FUNCTION	PIN SIZE
1	Vin (+)	0.04"
2	Enable	0.04"
3	Vin (-)	0.04"
4	Vout (-)	0.06"
5	Vout (+)	0.06"

RECOMMENDED PAD LAYOUT



1,2,3, $\varnothing 0.050$ HOLE SIZE, $\varnothing 0.100$ min PAD SIZE
 4,5 $\varnothing 0.074$ HOLE SIZE, $\varnothing 0.120$ min PAD SIZE

Figure 29. Recommended pad layout

16. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2009-06-16	A	First release	J.We
2009-06-23	B	Delete output trim and remote sense function, update mechanical drawing	J.We
2009-06-30	C	1. Update input C-L-C filter; 2. Change Max output cap from 5600μF to 10000μF; 3. Add transient response of di/dt=1A/μs; 4. Change output current from 65A to 60A.	J.We
2009-09-25	D	1.Changge Switching frequency from 250K to 300K, 2.No load Input current. 3.remote off input current. 4.load regulation. 5.line regulation. 6.regulation over temperature. 7.Output DC current limit. 8.Turn on time. 9.Rise time. 10.Add efficiency, TD, NR, TR	YP.Zhou
2009-10-19	E	1.Add I ² t Inrush Current Transient; 2.Add Short Circuit Surge Transient; 3.Add MTBF data; 4.Update Derating curve under normal input; 5. Add OCP, OVP, OTP, Safety & EMC	YP.Zhou
2009-10-23	F	1. Update test condition of MTBF; 2. Update waveform for OVP	YP.Zhou
2010-03-02	G	Update mechanical drawing.	JZ.Wang
2012-10-12	H	1.Update design to improve efficiency and EMC performance; 2. Update mechanical drawing.	JZ.Wang
2013-1-24	I	Add UL.	JZ.Wang
2014-5-26	J	Update Input Specifications, Output Specifications	S.Wang
2018-05-30	AK	Update Key Features, PN. Explanation, ABS Max and General Specs	S.Wang
2021-05-19	AL	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.