0RQB-30Y05L

Isolated DC-DC Converter

The 0RQB-30Y05L is an isolated DC/DC converter providing 30 W of output power from a wide input range (24 V, 48 V, 72 V, 96 V, 110 V typical). Standard features include remote on/off, input under-voltage protection, output over-voltage protection, over current and short circuit protection.

This converter can also provide a 5 V/5 mA auxiliary supply. When a large hold-up capacitor is added, the converter can still work up to 12 ms when the input supply is interrupted. Conformal coated PCB is used for environmental ruggedness.

RoHS Compliant

Key Features & Benefits

- 24 / 48 / 72 / 96 / 110 VDC Input
- 5 VDC / 6 A Output
- Reinforced Isolation
- Input Under-Voltage Protection
- High Efficiency
- Output Over-Voltage Protection
- Hold-up Function
- Over Current and Short Circuit Protection
- Remote ON/OFF
- Over Temperature Protection
- Conformal Coated
- 5V Auxiliary Supply at Primary Side
- Wide Input Range (24 V,48 V,72 V,96 V,110 V typical)
- Approved to EN 62368-1
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

Applications

- Industrial
- Railway

1. MODEL SELECTION

MODEL NUMBER ACTIVE LOW	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RQB-30Y05LG	5 VDC	24 / 48 / 72 / 96 / 110 VDC	6 A	30 W	82%

PART NUMBER EXPLANATION

0	R	QB	-	30	Y	05	L	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic & HSK Feature	Package Type
Through Hole Mount	RoHS	DOSA Quarter Brick		30 W	24 / 48 / 72 / 96 / 110 V	5 V	Active Low, with Baseplate	Tray Package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		0.5	-	160	V
Remote On/Off		-0.3	-	15	V
Thermal Resistance	Baseplate to heatsink, flat greased surface	-	0.24	-	°C/W
	Baseplate to ambient	-	4	-	
Operating Temperature	Temp. measured at the center of the baseplate, full load	-40	-	105	°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 Range 1	Fully functioning for long term operation.	16.8	24 48 72 96 110	137.5	V
Operating Input Voltage Range 2	Fully functioning for 0.1 s operation. Full function is not guaranteed but undamaged for 1 s operation.	12.9 137.5	- -	16.8 154	V
Input Current		-	-	3.0	A
Input Voltage Rising Slope		-	-	2	V/ms
Input Current (no load)		-	100	150	mA
Remote Off Input Current		-	-	40	mA
Input Reflected Ripple Current (pk-pk)	With simulated source impedance of 10 µH, 5 Hz to 20 MHz. Use two 100 µF/250 V electrolytic capacitors with ESR = 0.5R max, at 200 kHz @ 25°C.	-	-	300	mA
Input Reflected Ripple Current (rms)		-	-	100	mA
Under-voltage Turn on Threshold	Lockout turn on	14.5	15.2	16	V
Under-voltage Turn off Threshold	Lockout turn off, non-latching	11.7	12.2	12.7	V
Recommended input fast-acting fuse on system board	**CAUTION:** This converter is not internally fused. An input line fuse must be used in application.	-	6	-	V

4. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point		4.9	5	5.1	V
Line Regulation		-	-	10	mV
Load Regulation		-	-	20	mV
Regulation Over Temperature		-	-	±100	mV
Output Current Range		0	-	6	A
Output Ripple and Noise (pk-pk)	With a 100 µF ceramic and a 100 µF electrolytic capacitors at output.	-	50	80	mV
Output Ripple and Noise (rms)		-	10	15	mV
Output DC Current Limit	Enter a hiccup mode, non-latching.	7	-	10	A
Turn on Time	Enable from Vin	-	-	1500	ms
	Enable from ON/OFF	-	-	200	
Rise Time		-	25	50	ms
Overshoot at Turn on		-	0	3	%
Undershoot at Turn off		-	0	3	%
Output Capacitance	Typically 50% ceramic and 50% electrolytic capacitors.	200	-	1000	µF
5V Auxiliary Supply Source Current		-	-	5	mA
Transient Response					
△V 50% ~ 75% of Max Load	di/dt = 0.1 A/µs, with a 100 µF ceramic and a 100 µF electrolytic capacitors near the brick output.	-	200	250	mV
Settling Time		-	0.5	0.75	ms
△V 75% ~ 50% of Max Load		-	200	250	mV
Settling Time		-	0.5	0.75	ms

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

5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Vin = 24 V, Iout = 6 A	81	82	-	%
	Vin = 48 V, Iout = 6 A	82	83	-	
	Vin = 72 V, Iout = 6 A	82	83	-	
	Vin = 96 V, Iout = 6 A	82	83	-	
	Vin = 110 V, Iout = 6 A	83	84	-	
Switching Frequency	1st stage	-	150	-	kHz
	2nd stage	-	250	-	
FIT*	Calculated Per IEC 62380 TR 1 (UTEC 80-810) (Vin=24 V, Vo=5V, Io=6A, Tac = 50°C, Ta=35°C)	-	176.66	-	Mhours
MTBF*		-	5.66	-	
Dimensions (L × W ×H)			2.30 x1.45 x 0.59		inch
			58.42 x 36.83 x15.0		mm
Weight		-	62	-	g
Over Temperature Protection		-	125	-	°C
Over Voltage Protection (Static)		-	6	-	V
Isolation Characteristics					
Isolation Capacitance		-	-	2200	pF
Isolation Resistance		10M	-	-	ohm
Input to Output		-	-	2250	V
Input to Heatsink		-	-	2250	V
Output to Heatsink		-	-	2250	V

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

6. EFFICIENCY DATA

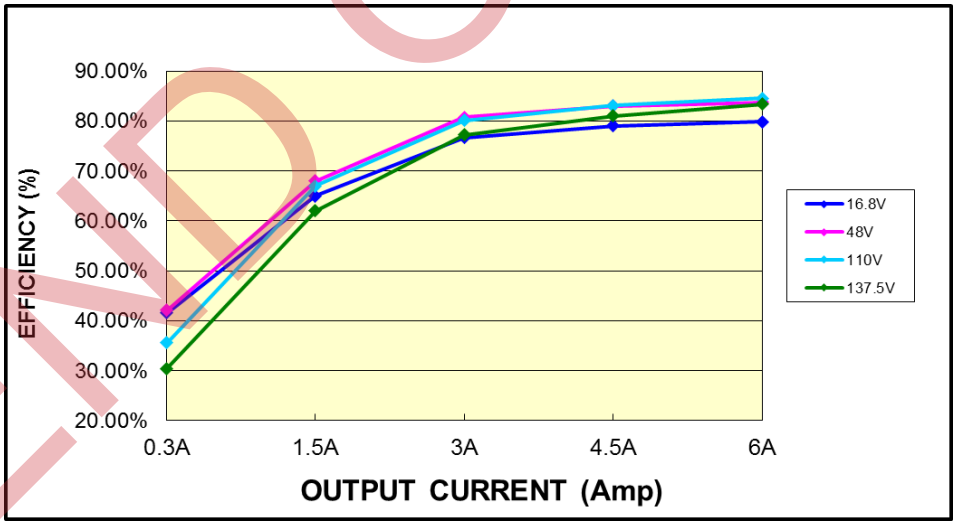

Figure 1. Efficiency

7. 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	-	15	
Current Sink			0	-	1	mA

Recommended Remote On/Off Circuit for Active Low

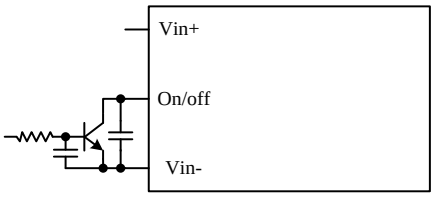

Figure 2. Control with open collector/drain circuit

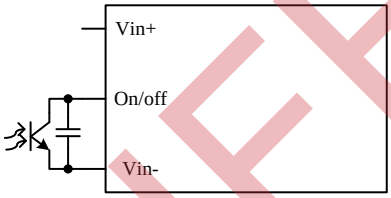

Figure 3. Control with photocoupler circuit

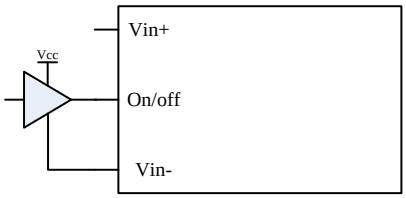

Figure 4. Control with logic circuit

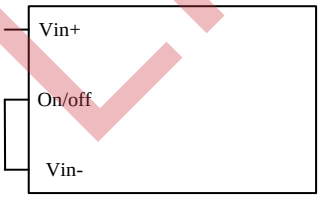

Figure 5. Permanently on

8. RIPPLE AND NOISE WAVEFORM

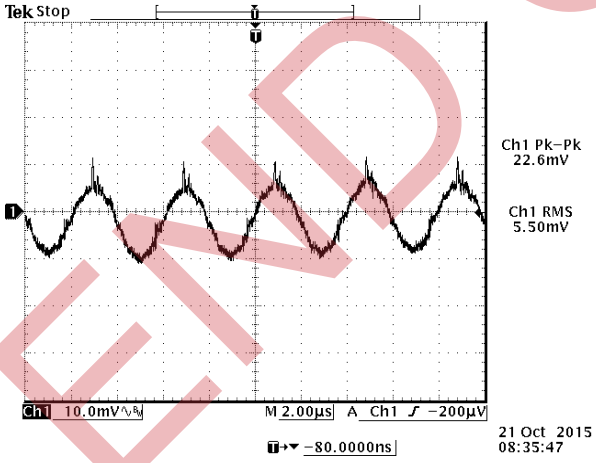

Figure 6.

NOTE: Ripple & noise at full load, 48 V input, with a 1 µF ceramic capacitor and a 10 µF tantalum capacitor at the output, and Ta = 25°C.

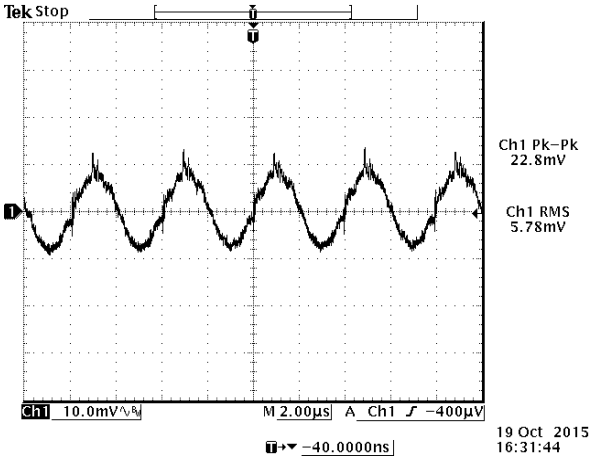

Figure 7.

NOTE: Ripple and noise, 110 VDC input, 5 VDC / 6 A output and Ta=25 °C, with 100 µF ceramic capacitor and 100 µF AL. cap at output.

9. INPUT NOISE

Input Reflected Ripple Current

Testing setup

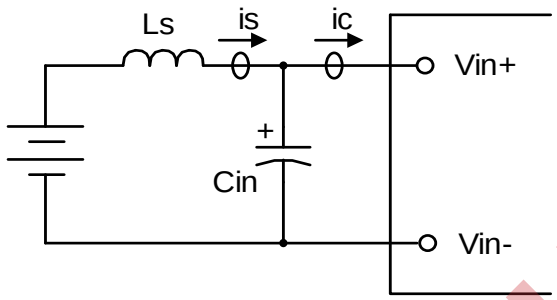

Figure 8.

Notes and values in testing:
is: Input Reflected Ripple Current
ic: Input Terminal Ripple Current
Ls: Simulated Source Impedance (10 µH)
Cin: Electrolytic capacitor, should be as closed as possible to the power module to damped ic ripple current and enhance stability. Recommendation: 2* 100 µF, ESR<0.5R @ 100 kHz, 20°C

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

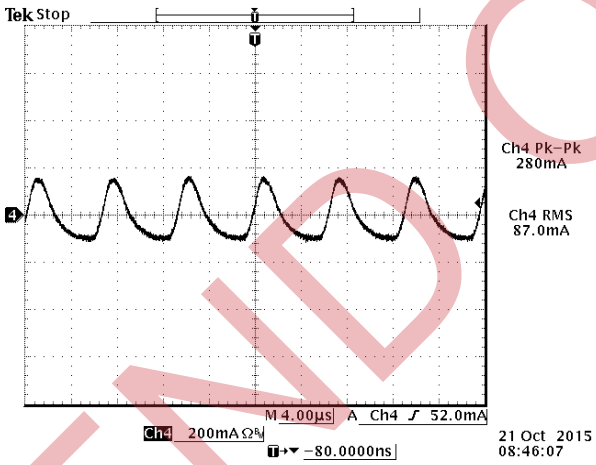

Figure 9. is (input reflected ripple current), AC component

Figure 10. ic (input reflected ripple current), AC component

NOTE: 48 VDC input, 5 VDC / 6 A output and Ta = 25 ˚C, with 100 µF ceramic capacitor and 100 µF AL. cap at output.

10. TRANSIENT RESPONSE

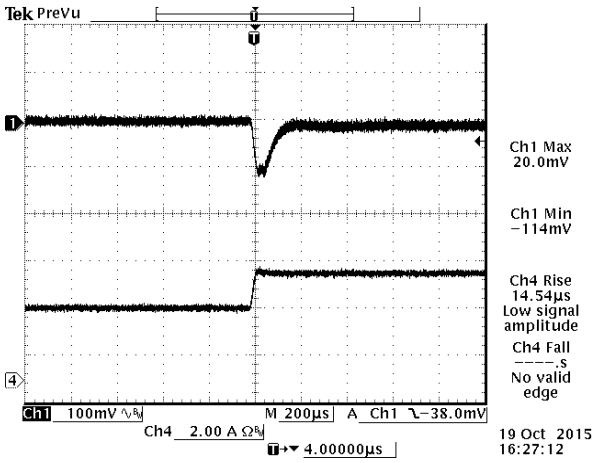

Figure 11. 50%-75% Load Transients at Vin = 48 V @ Ta = 25°C

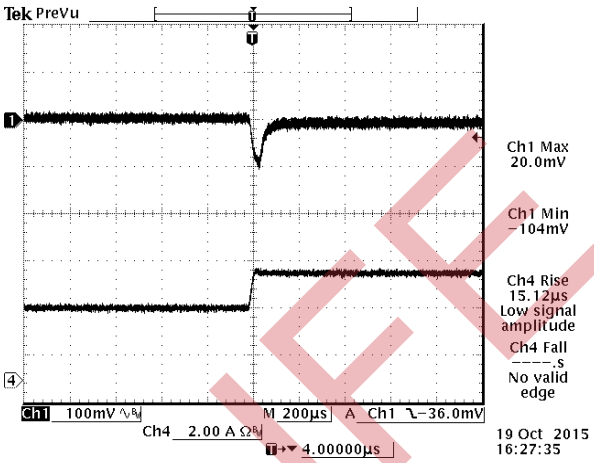

Figure 12. 50%-75% Load Transients at Vin = 110 V @ Ta = 25°C

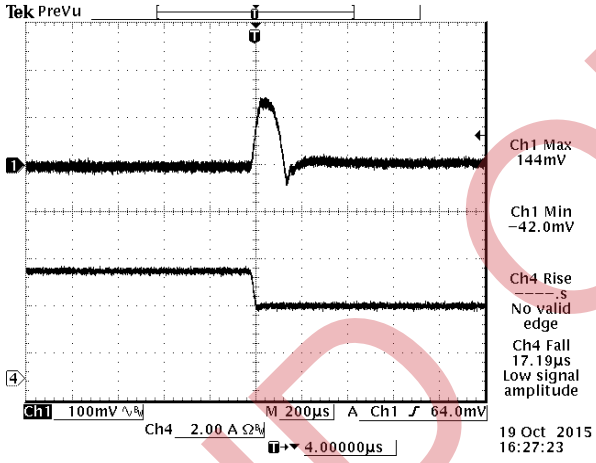

Figure 13. 75%-50% Load Transients at Vin = 48 V @ Ta = 25°C

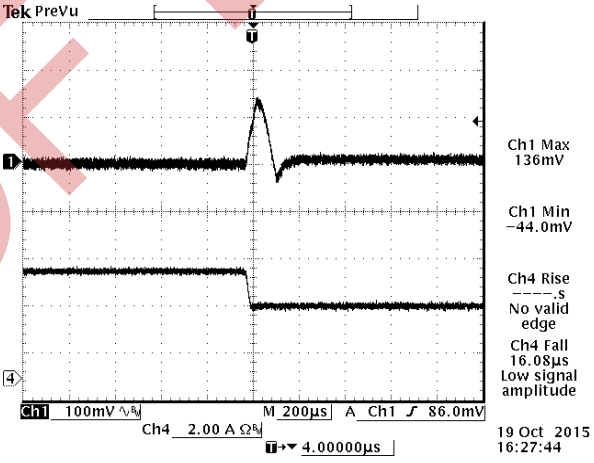

Figure 14. 75%-50% Load Transients at Vin = 110 V @ Ta = 25°C

11. STARTUP & SHUTDOWN

Turn on rise time:

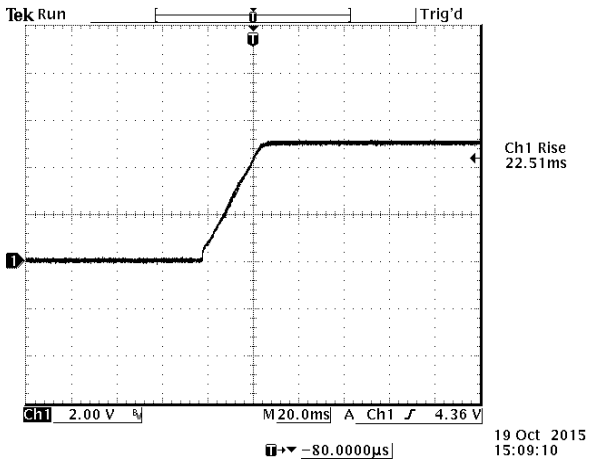

Figure 15. Vin = 48 V, Io = 6 A, Vo = 5 V

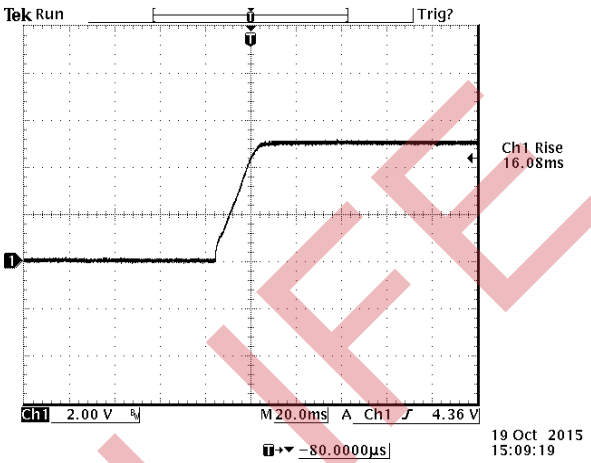

Figure 16. Vin = 110 V, Io = 6 A, Vo = 5 V

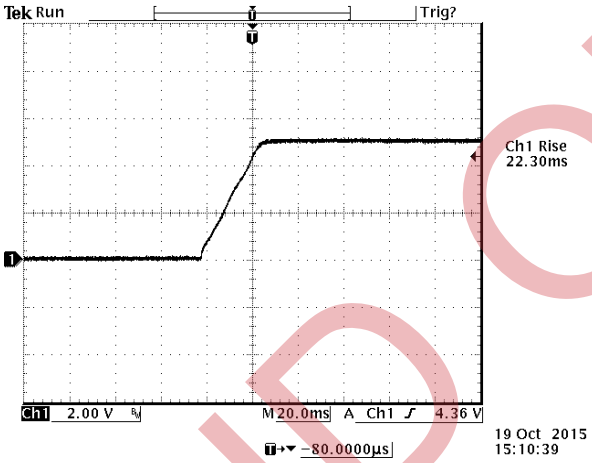

Figure 17. Vin = 48 V, Io = 6 A, Vo = 5 V, with Cext = 1000 µF

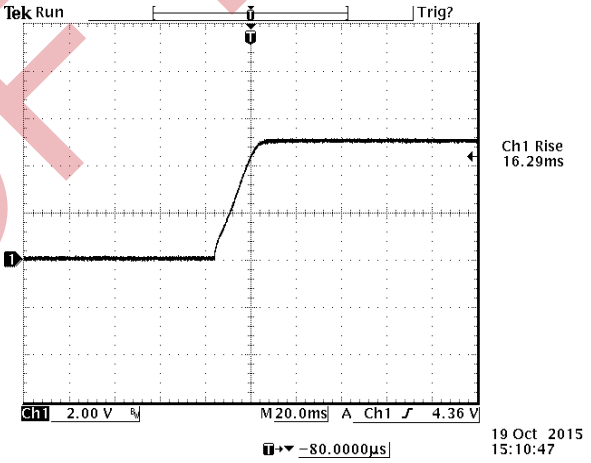

Figure 18. Vin = 48 V, Io = 6 A, Vo = 5 V, with Cext = 1000 µF

Turn on delay time:

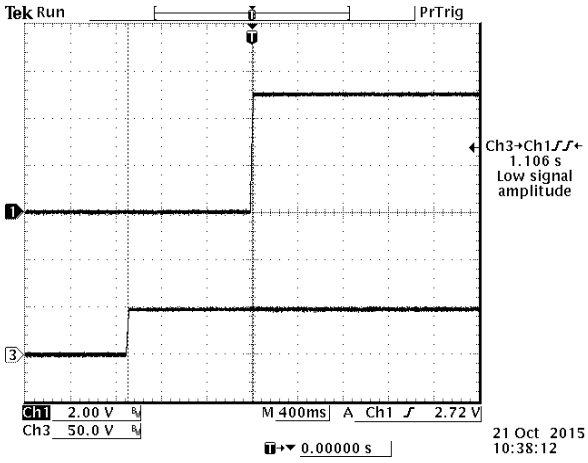

Figure 19. Startup from Vin
Ch1: Vo
Ch3: Vin
Vin = 48 V, Io = 6 A, Vo = 5 V

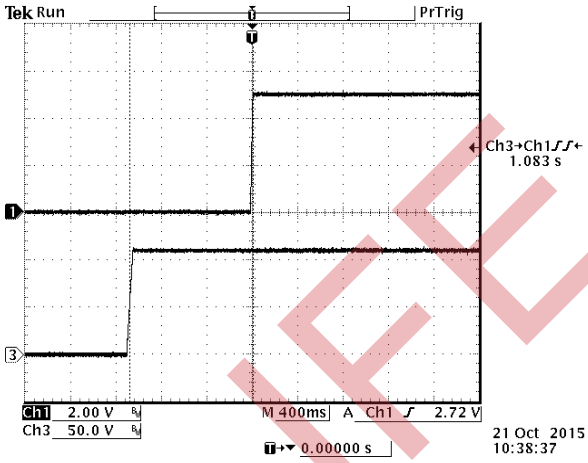

Figure 20. Startup from Vin
Ch1: Vo
Ch3: Vin
Vin = 110 V, Io = 6 A, Vo = 5 V

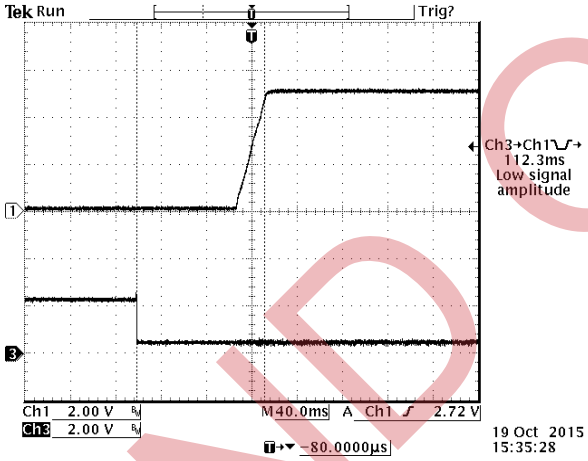

Figure 21. Startup from on/off
Ch1: Vo
Ch3: on/off
Vin = 48 V, Io = 6 A, Vo = 5 V

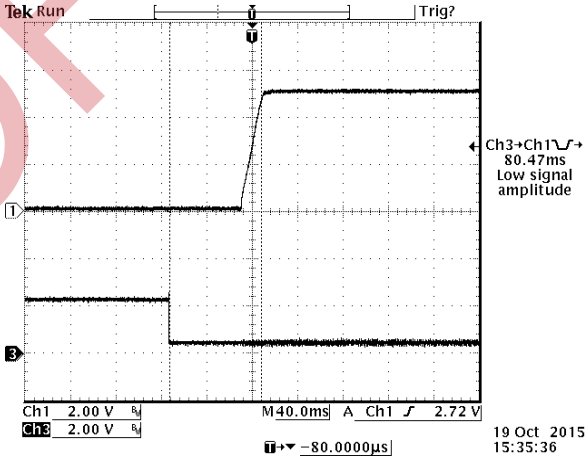

Figure 22. Startup from on/off
Ch1: Vo
Ch3: on/off
Vin = 110 V, Io = 6 A, Vo = 5 V

Shutdown

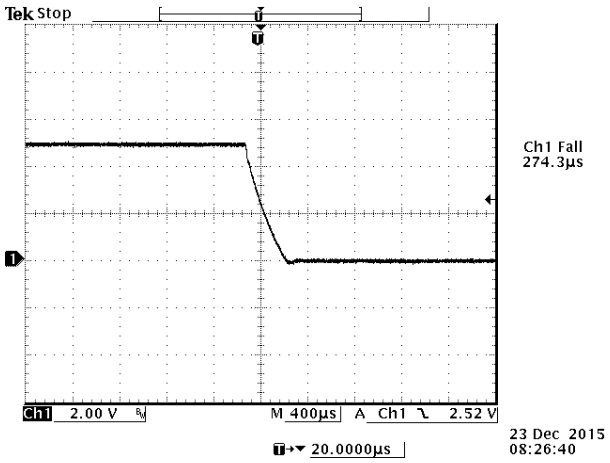

Figure 23. Vin = 48 V, Io = 6 A, Vo = 5 V

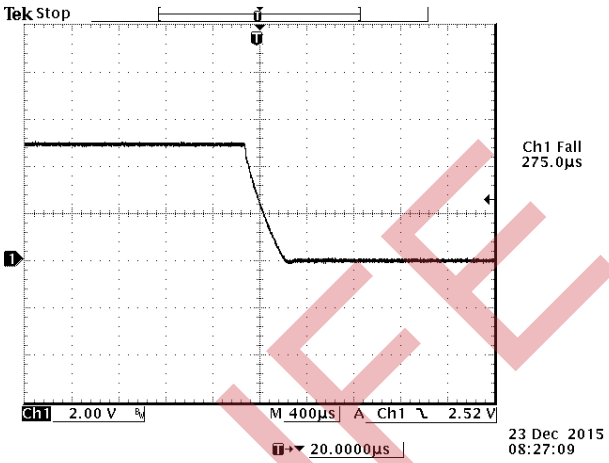

Figure 24. Vin = 48 V, Io = 6 A, Vo = 5 V

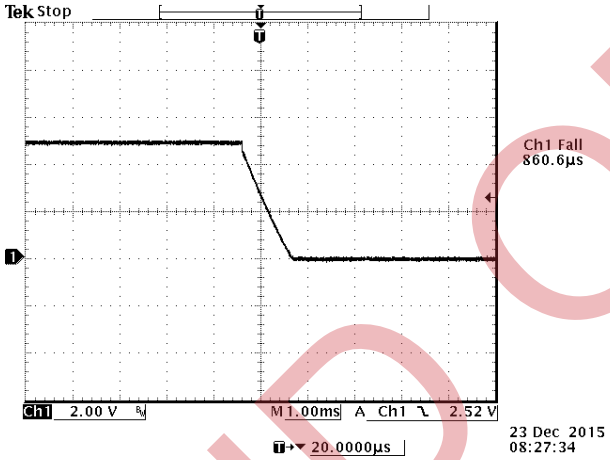

Figure 25. Vin = 48 V, Io = 6 A, Vo = 5 V, with Cext = 1000 µF

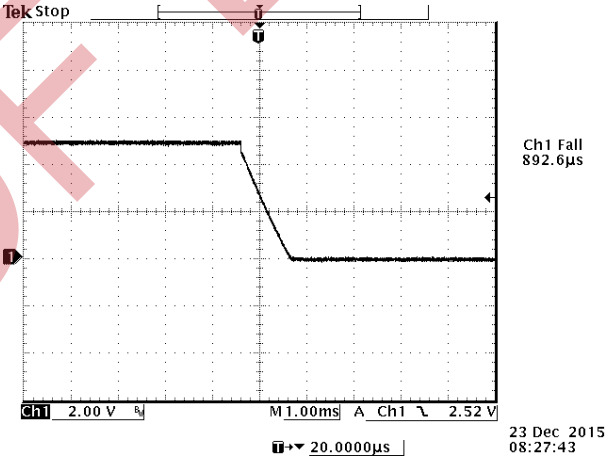

Figure 26. Vin = 48 V, Io = 6 A, Vo = 5 V, with Cext = 1000 µF

12. HOLD UP CIRCUIT

PARAMETER	DESCRIPTION	SYMBOL	MIN	TYP	MAX	UNITS
Hold up Capacitor	Working voltage rating should be 200 V. Caution: This capacitor is necessary for both normal and hold up operation.	C_HOLD	220	-	330	µF
Hold up Voltage	Normal operation.	V_HOLD	45	85	154	V
Hold up Time	16.8 - 137.5 V input and all Iout range.	T_HOLD	12	-	-	ms

Recommended External Hold up Circuit

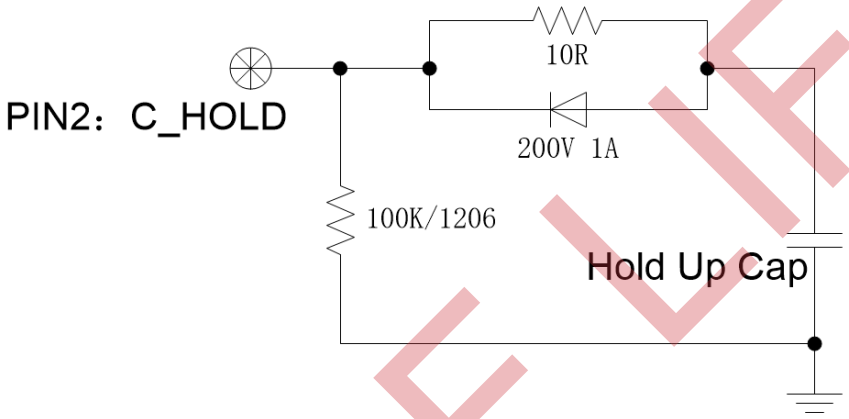

Figure 27.

NOTE: the power of the current-limiting resistance is determined by the rise slope of the input voltage.

13. INPUT UNDER-VOLTAGE LOCKOUT

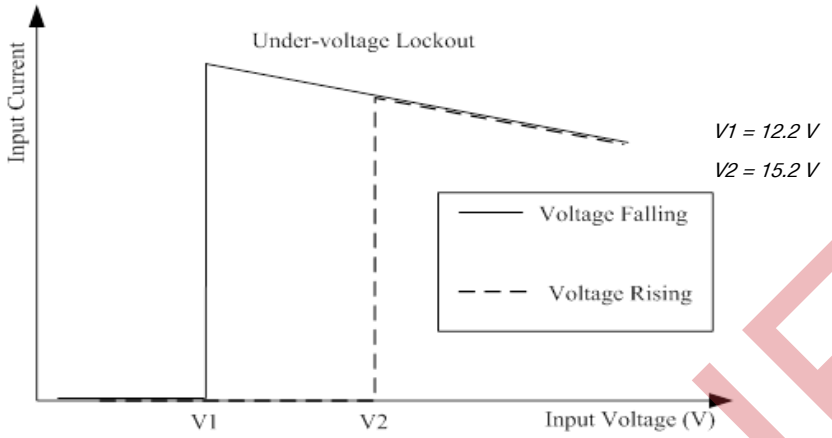

Figure 28. Input under-voltage lockout

14. THERMAL DERATING CURVES

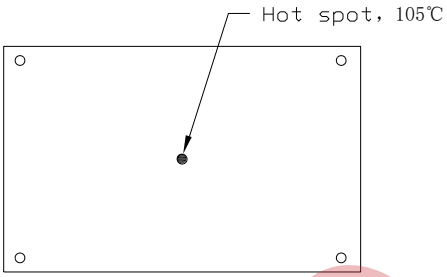

Figure 29. Module top view

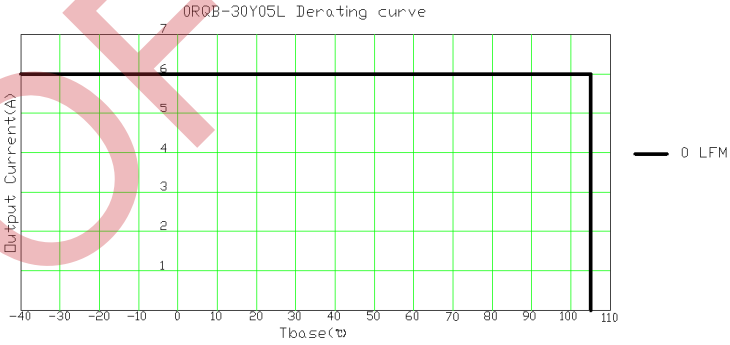

Figure 30. Thermal derating curve

15. SAFETY & EMC

Safety:

safety certificated to EN 62368-1

CE certificated to Low Voltage Directive 2014/35/EU

EMC:

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:

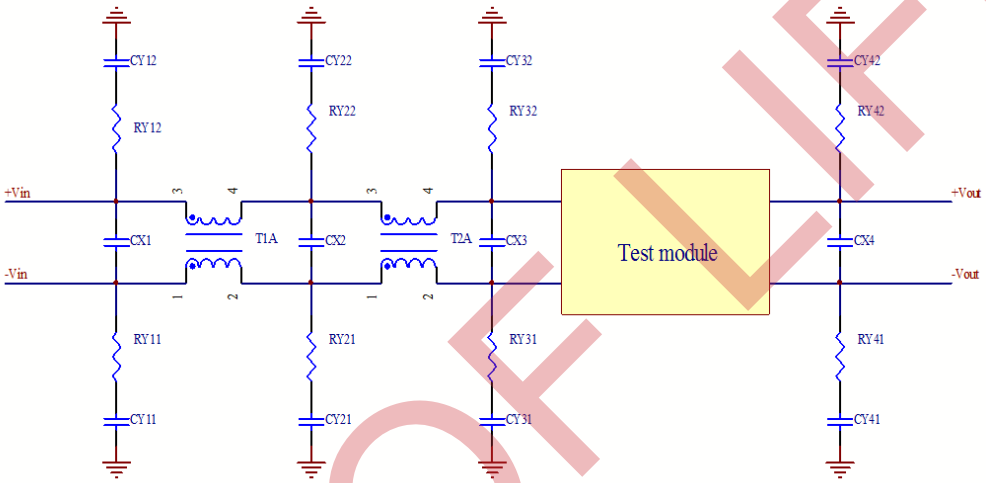

Figure 31.

ITEM	DESIGNATOR	PARAMETER	VENDOR	VENDOR P/N
1	CX1	100μF/200V, AL cap		
2	CX2	220μF/200V, AL cap		
2	CX3	220μF/200V, AL cap		
3	CX4	220μF/200V, AL cap		
3	CY21	0.22μF/1000V, ceramic		
4	CY22	0.22μF/1000V, ceramic		
7	RY21	1206,0 R, Resistor		
8	RY22	1206,0 R ,Resistor		
11	T2A	0.45mH, common mode		
12	T1A	0.9mH, common mode		
12	RY11,RY12,CY11,CY21, RY31,RY32,CY31,CY32 RY41,RY42,CY41,CY42	NIL		

Positive:

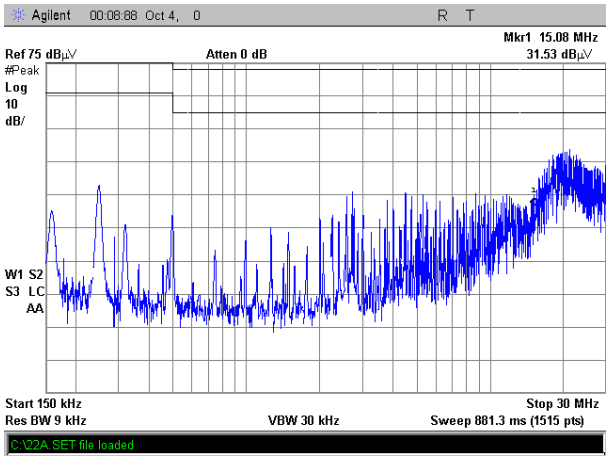

Figure 32.

Negative:

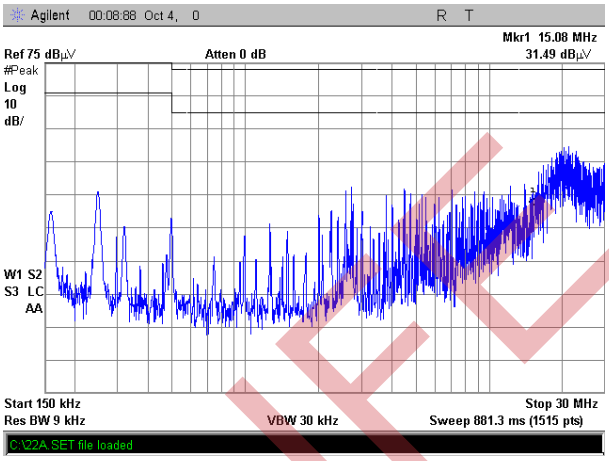

Figure 33.

16. MECHANICAL OUTLINE

OUTLINE

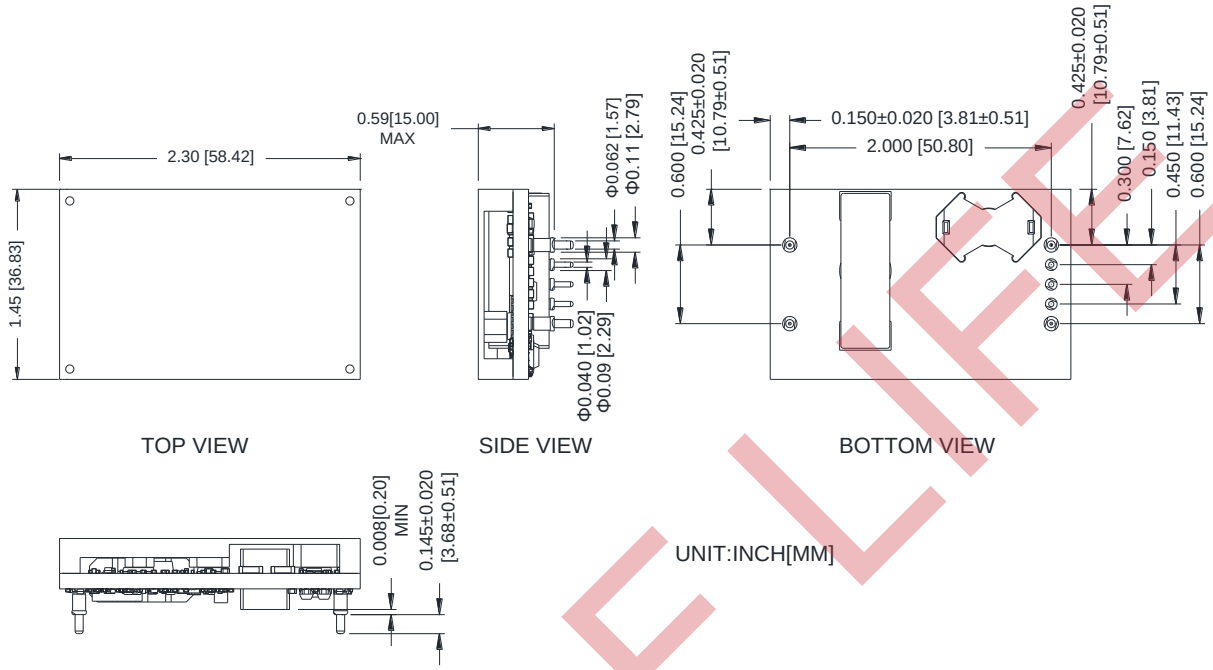

Figure 34. Outline

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 – Tin plated

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

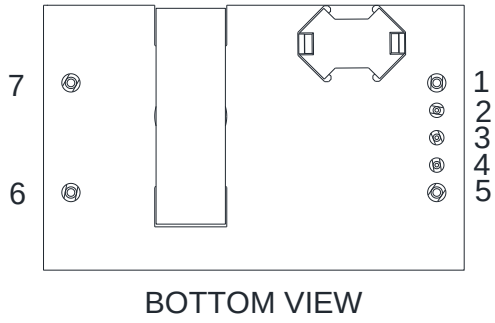

Figure 35. Pins

PIN	FUNCTION
1	Vin(+)
2	C_HOLD
3	ON/OFF
4	V_AUX(5V)
5	Vin(-)
6	Vout(-)
7	Vout(+)

RECOMMENDED PAD LAYOUT

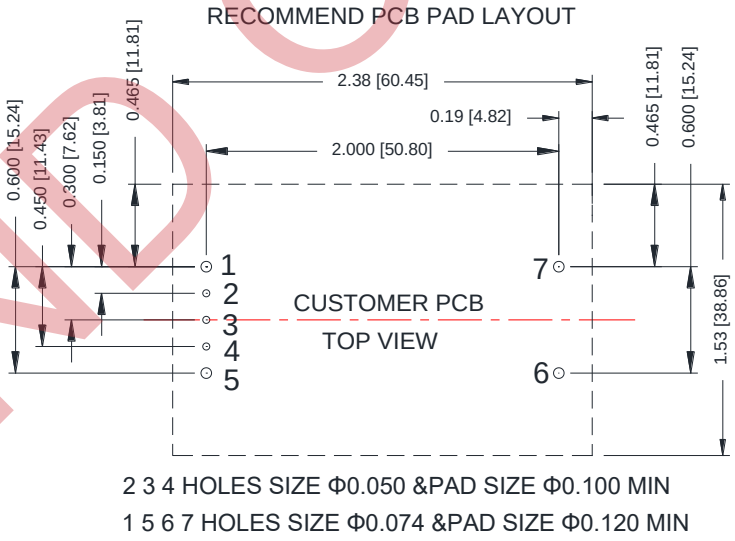

Figure 36. Recommended pad layout

17. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2014-11-12	A	First release	S.Wang
2015-12-23	B	1. Update rise time and turn on time 2. Update Efficiency value 3. Update waveform of electrical performance	S.Wang
2016-02-26	C	1. Change the operation temperature in Absolute Maximum Ratings 2. Add thermal resistance in Absolute Maximum Ratings	S.Wang
2016-04-21	D	Update Safety Certification, MTBF, Thermal Derating Curve, MD.	S.Wang
2018-04-28	AE	Update Operating Input Voltage Range 2, Under-voltage, MD, Turn off Threshold and Transient Response	S.Wang
2018-10-10	AF	Update hold-up circuit	S.Wang
2019-10-24	AG	Add feature reinforced isolation	S.Wang
2021-05-12	AH	Add object ID. Update safety certificate.	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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