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)
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)
- Approved to EN60950-1, 2nd +A2 version

Applications

- Industrial
- Railway

1. MODEL SELECTION

OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY	MODEL NUMBER ACTIVE LOW
5 VDC	24/48/72/96/110 VDC	6 A	30 W	82%	0RQB-30Y05L

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

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	24/48/72/96/110V	5 V	Active low, with baseplate	G – 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	Temperature 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 0.1s operation.	12.9	-	16.8	V
	Full function is not guaranteed but undamaged for 1s operation.	137.5	-	154	
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 10µH, 5Hz 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					
ΔV 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
ΔV 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, Tae=35°C)	-	176.66	-	Mhours
MTBF*		-	5.66	-	
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
Dimensions (L × W ×H)			2.30 x1.45 x 0.59		inch
			58.42 x36.83 x15		mm
Weight		-	62	-	g

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

6. EFFICIENCY DATA

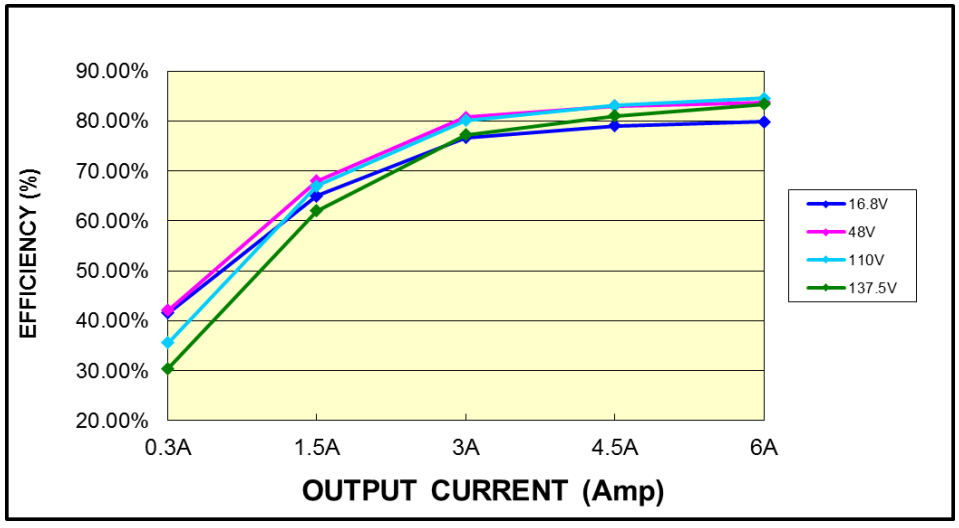

Figure 1. Efficiency

7. THERMAL DERATING CURVES

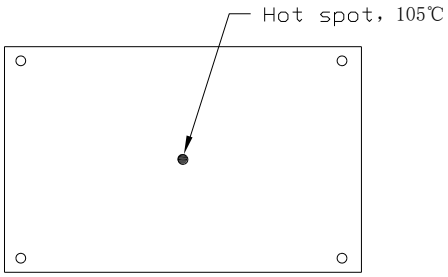

Figure 2. Module top view

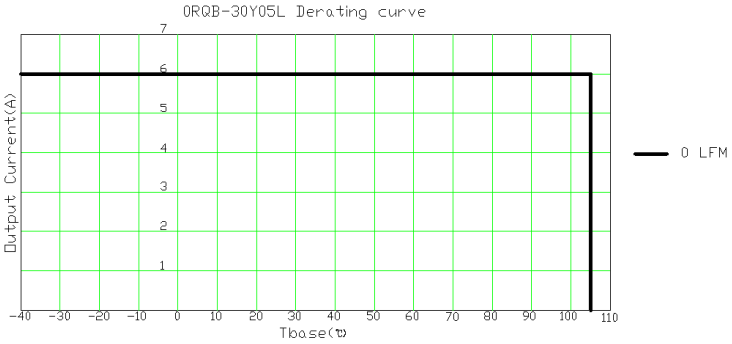

Figure 3. Thermal derating curve

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	-	15	
Current Sink			0	-	1	mA

Recommended Remote On/Off Circuit for Active Low

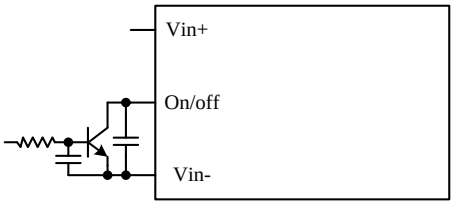

Figure 4. Control with open collector/drain circuit

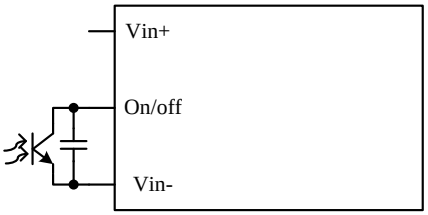

Figure 5. Control with coupler circuit

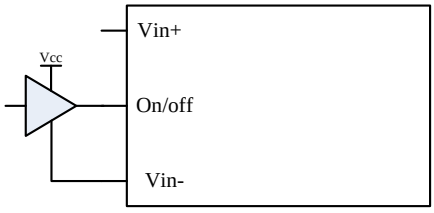

Figure 6. Control with logic circuit

Figure 7. Permanently on

9. INPUT UNDER-VOLTAGE LOCKOUT

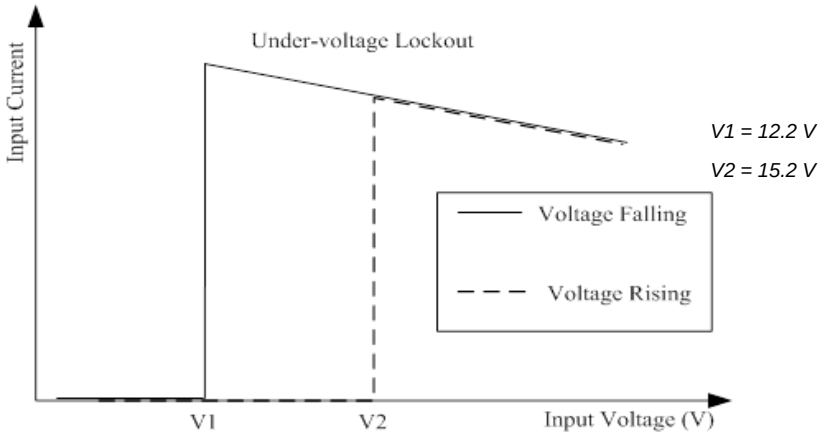

Figure 8. Input under-voltage lockout

10. INPUT NOISE

Input Reflected Ripple Current

Testing set up

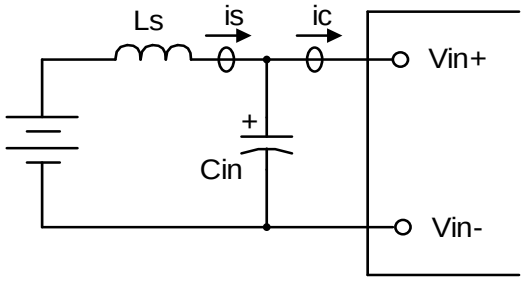

Figure 9.

Notes and values in testing.

is: Input Reflected Ripple Current

ic: Input Terminal Ripple Current

Ls: Simulated Source Impedance (10μH)

Cin: Electrolytic capacitor, should be as closed as possible to the power module to swallow ic ripple current and help with stability. Recommendation: 2* 100μF, ESR<0.5R @ 100 kHz, 20C

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

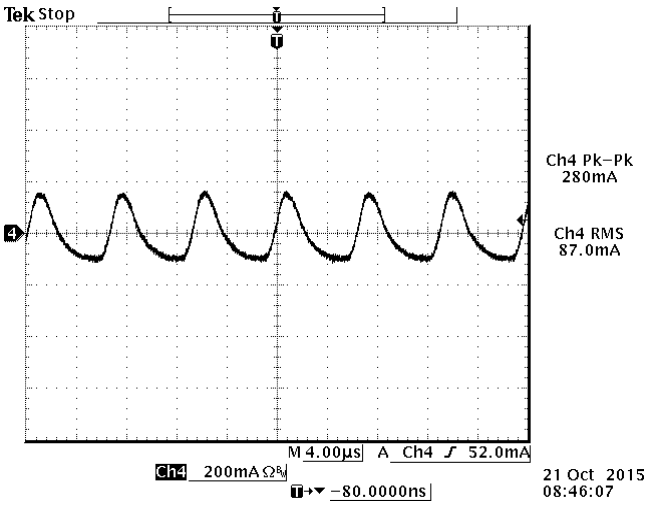

Figure 10. is (input reflected ripple current), AC component

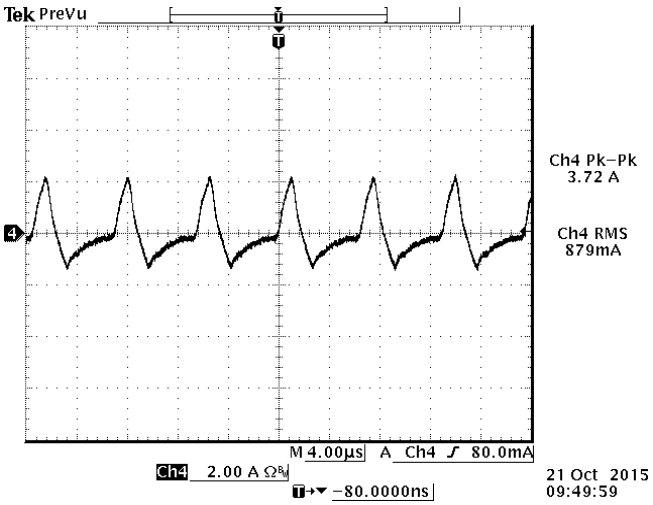

Figure 11. ic (input reflected ripple current), AC component

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

11. RIPPLE AND NOISE WAVEFORM

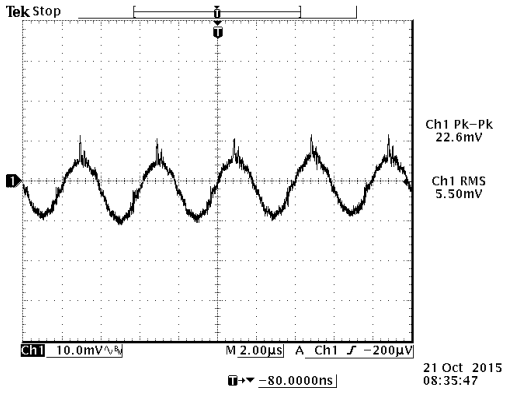

Figure 12.

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

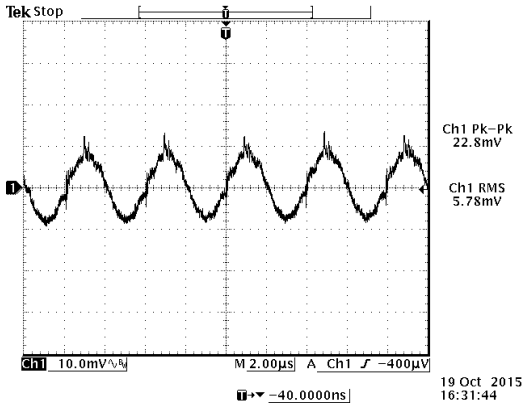

Figure 13.

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

12. TRANSIENT RESPONSE

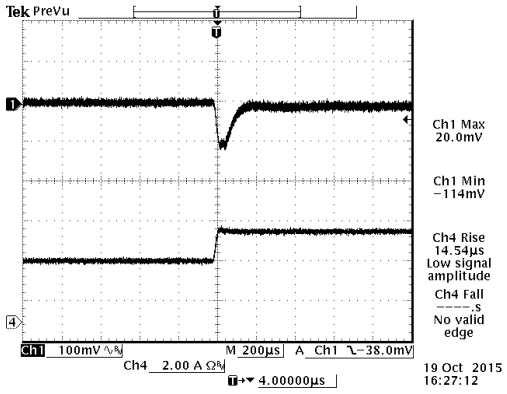

Figure 14. 50%-75% Load Transients at Vin=48V@Ta=25℃

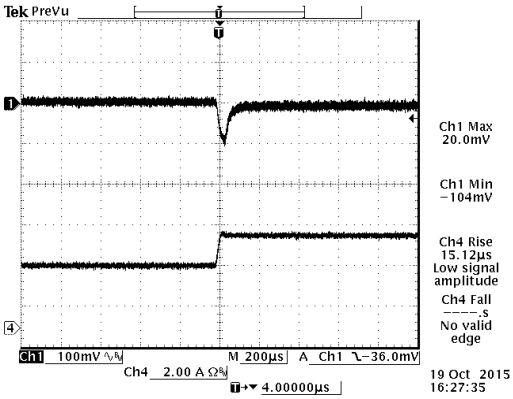

Figure 15. 50%-75% Load Transients at Vin=110V@Ta=25 ℃

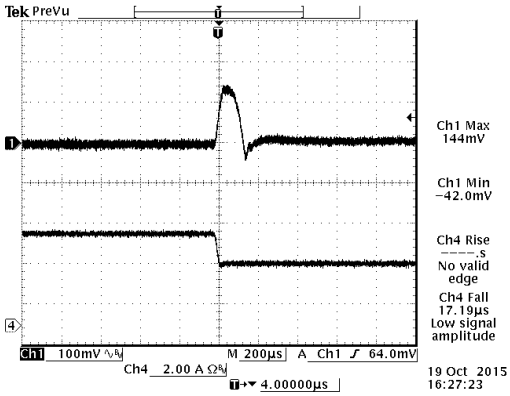

Figure 16. 75%-50% Load Transients at Vin=48V@Ta=25℃

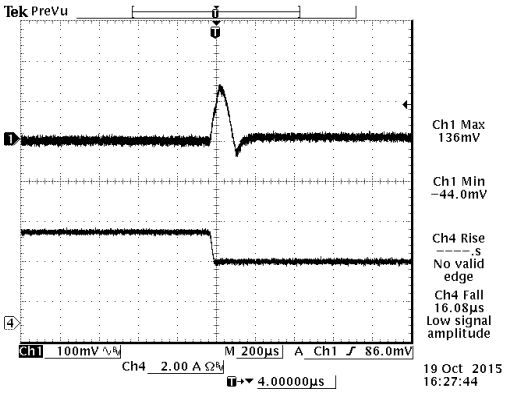

Figure 17. 75%-50% Load Transients at Vin=110V@Ta=25℃

13. STARTUP & SHUTDOWN

Turn on rise time

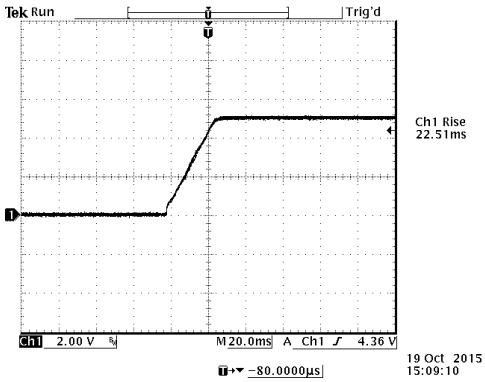

Figure 18. Vin=48V, Io=6A, Vo=5V

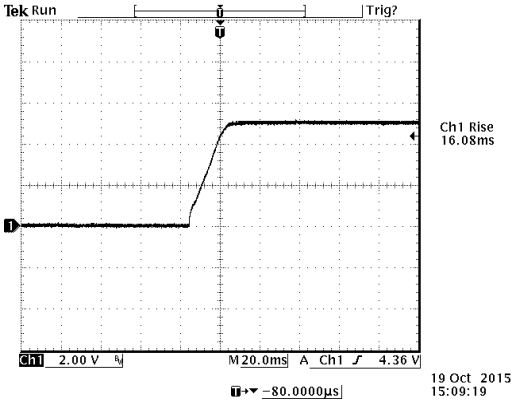

Figure 19. Vin=110V, Io=6A, Vo=5V

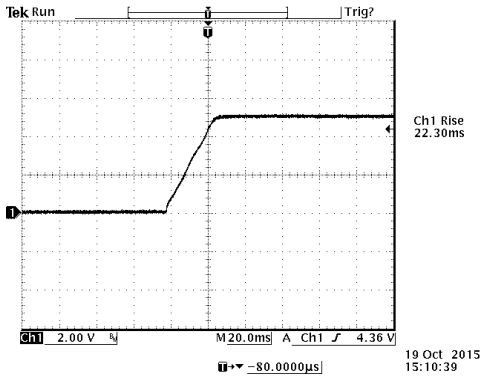

Figure 20. Vin=48V, Io=6A, Vo=5V, with Cext=1000µF

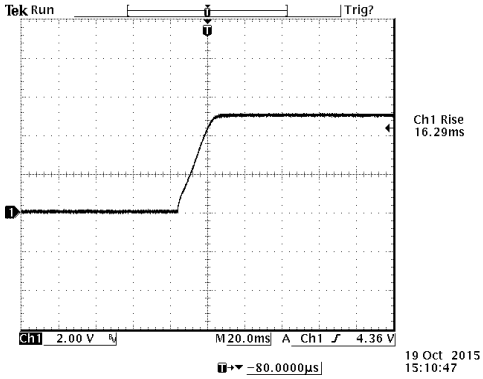

Figure 21. Vin=48V, Io=6A, Vo=5V, with Cext=1000µF

Turn on delay time

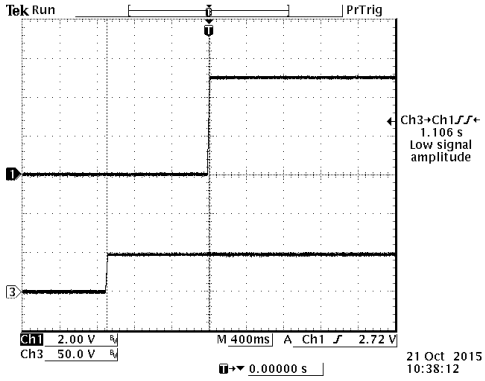

Figure 22. Startup from Vin
Ch1: Vo
Ch3: Vin
Vin=48V, Io=6A, Vo=5V

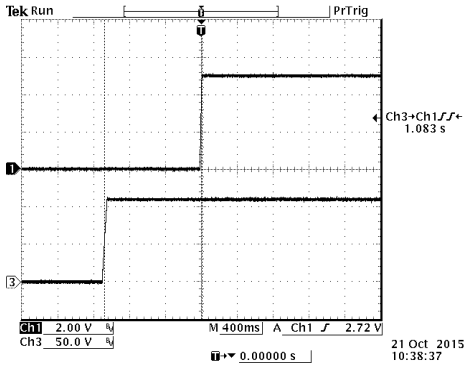

Figure 23. Startup from Vin
Ch1: Vo
Ch3: Vin
Vin=110V, Io=6A, Vo=5V

STARTUP & SHUTDOWN(CONTINUED)

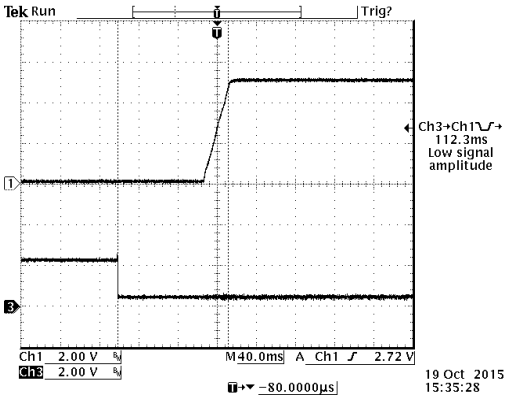

Figure 24. Startup from on/off
Ch1: Vo
Ch3: on/off
Vin=48V, Io=6A, Vo=5V

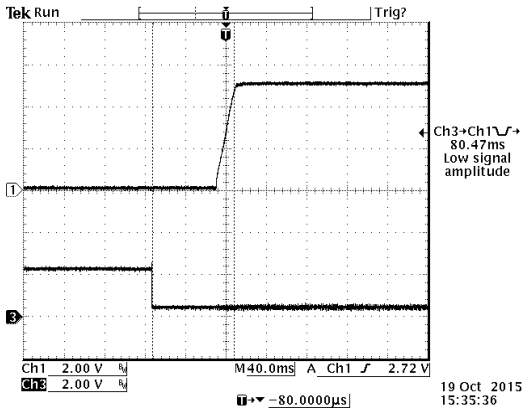

Figure 25. Startup from on/off
Ch1: Vo
Ch3: on/off
Vin=110V, Io=6A, Vo=5V

Shutdown

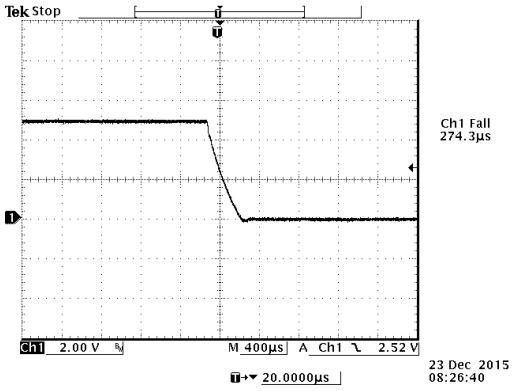

Figure 26. Vin=48V, Io=6A, Vo=5V

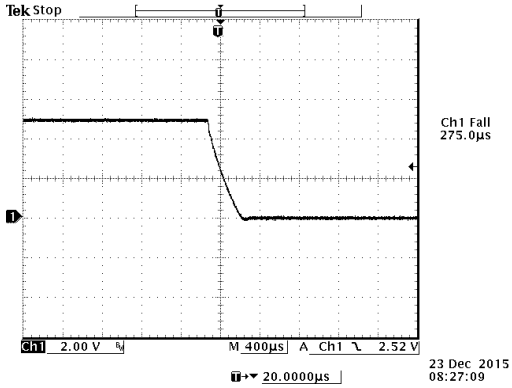

Figure 27. Vin=48V, Io=6A, Vo=5V

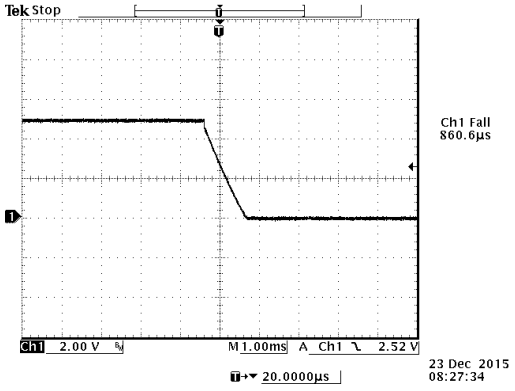

Figure 28. Vin=48V, Io=6A, Vo=5V, with Cext=1000µF

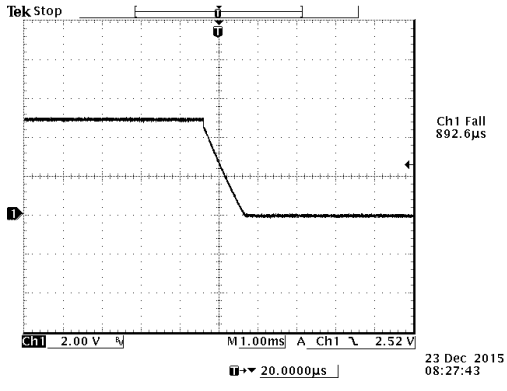

Figure 29. Vin=48V, Io=6A, Vo=5V, with Cext=1000µF

14. HOLD UP CIRCUIT

PARAMETER	DESCRIPTION	SYMBOL	MIN	TYP	MAX	UNITS
Hold up Capacitor	Working voltage rating should be 200V. 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	16.8-137.5V input and all Iout range.	T_HOLD	12	-	-	ms

Recommended External Hold up Circuit

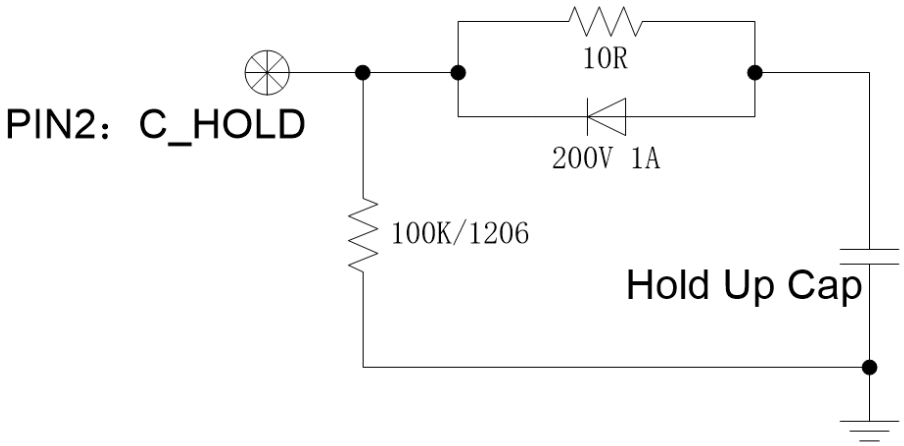

Figure 30.

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

15. SAFETY & EMC

Safety:

TUV certificated to EN60950-1, 2nd edition+ A2 version

CE certificated to Low Voltage Directive 2014/35/EU

EMC:

Conductive EMI: EN55022 class A

Compliance to EN55022 class A (both peak and average) with the following inductive and capacitive filter

Setup:

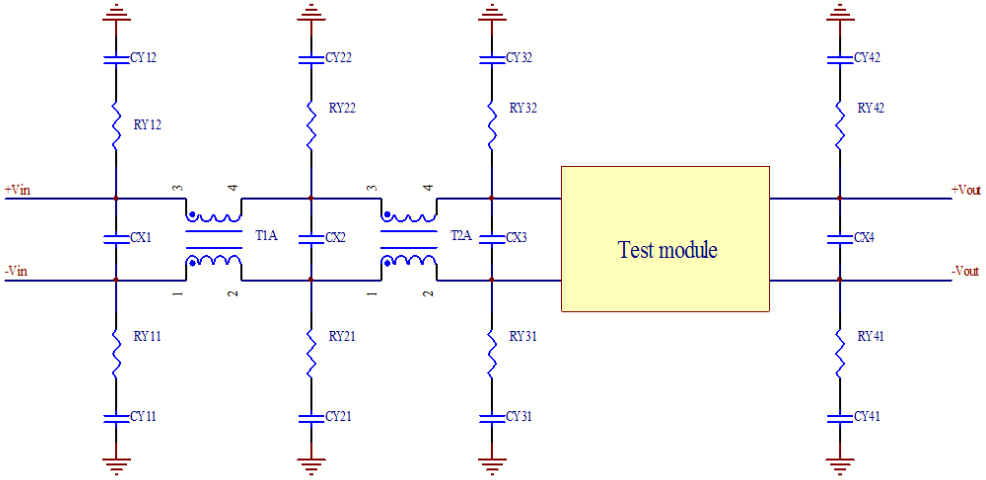

Figure 31.

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		

SAFETY & EMC (CONTINUED)

Positive:

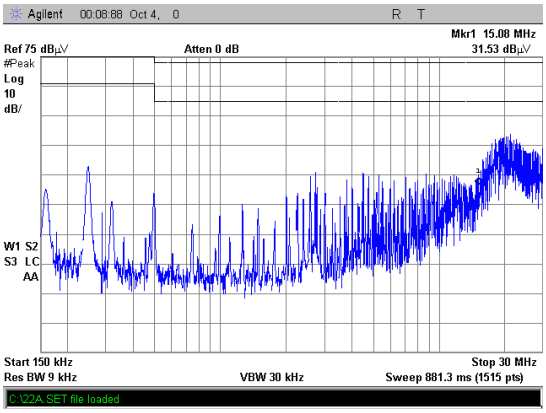

Figure 32.

Negative:

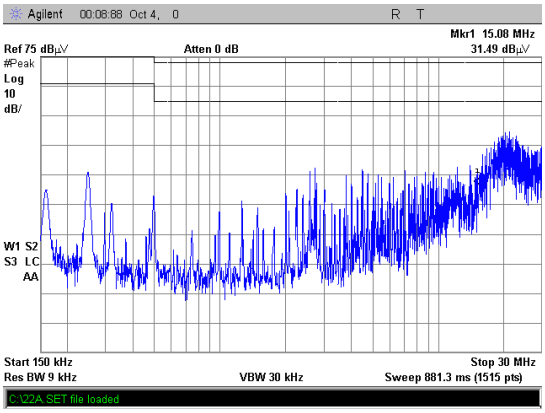

Figure 33.

16. MECHANICAL OUTLINE

OUTLINE

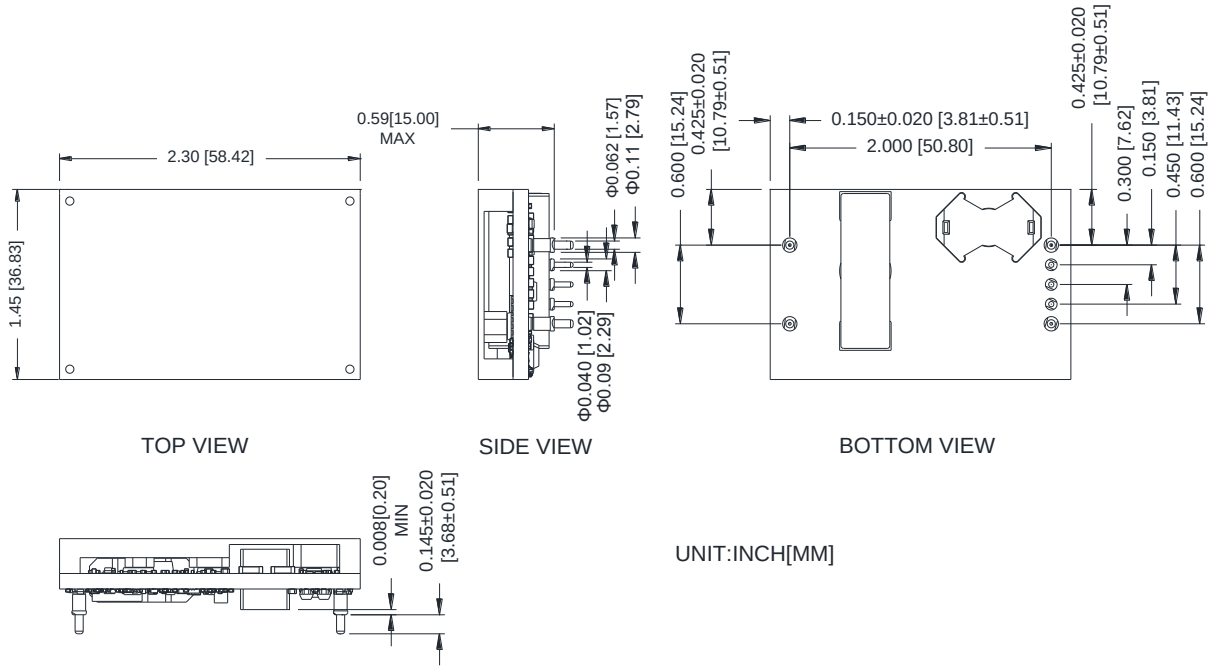

Figure 34. Outline

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 ºC for less than 5 seconds.

NOTE: 1) All Pins: Material - Copper Alloy;

Finish – Tin plated

2) Undimensioned components are shown for visual reference only.

3) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm).

MECHANICAL OUTLINE(CONTINUED)

PIN DEFINITIONS

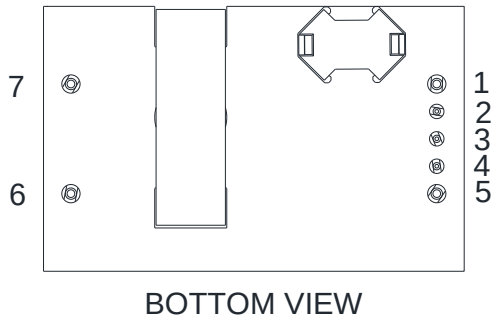

Figure 35. Pins

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

RECOMMENDED PAD LAYOUT

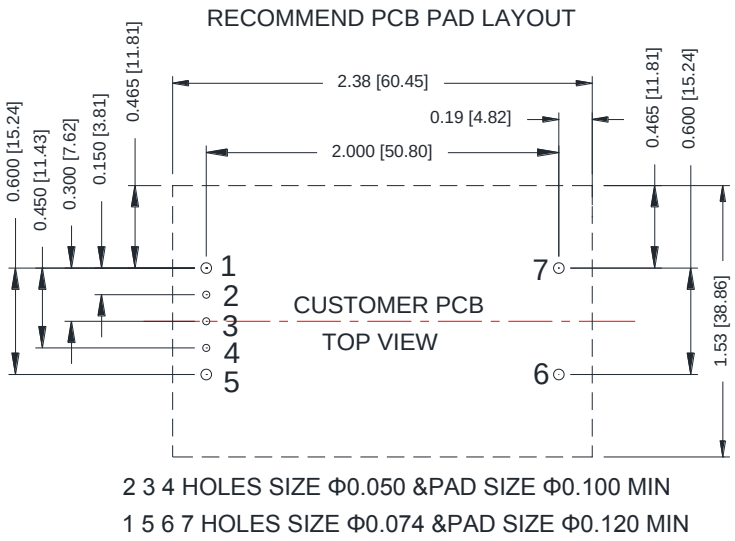

Figure 36. Recommended pad layout

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

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.