0RCY-T0T12x

Isolated DC-DC Converter

The 0RCY-T0T12x is an isolated DC-DC converter that operates from a nominal 48 V source. This unit provides up to 300 W of output power from a nominal 48 V 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 and over-temperature protection.

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

Key Features & Benefits

- 48 VDC Input
- 12 VDC @ 25 A Output
- 1/8th Brick Converter
- Basic Isolated
- Fixed Frequency (350 kHz)
- High Efficiency
- High Power Density
- Input Under Voltage Lockout
- OCP/SCP
- Output Over-voltage Protection
- Over Temperature Protection
- Remote On/Off
- Low Cost
- Approved to IEC/EN 62368-1
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

RoHS Compliant

Applications

- Networking
- Computers and peripherals
- Telecommunications

1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RCY-T0T12L	12 VDC	48 VDC	25 A	300 W	95.5%
0RCY-T0T12B	12 VDC	48 VDC	25 A	300 W	95.5%
0RCY-T0T120	12 VDC	48 VDC	25 A	300 W	95.5%
0RCY-T0T12A	12 VDC	48 VDC	25 A	300 W	95.5%

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

PART NUMBER EXPLANATION

0	R	CY	-	T0	T	12	x	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
Through hole mount	RoHS	1/8th Brick		300 W	48V	12 V	L – Active low, open frame 0 – Active high, open frame A – Active high, with baseplate B – Active low, with baseplate	Tray package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	80	V
Input Transient Voltage	100 ms maximum	-	-	100	V
Remote On/Off		-0.3	-	18	V
I/O Isolation Voltage		-	-	1500	V
Ambient temperature	The components on the Unit meet IPC-9592 derating guidelines	-40	-	85	°C
Storage Temperature	The component temperatures might exceed IPC-9592 derating guidelines but not exceed component temperature ratings	-55	-	125	°C
Altitude		-	-	4000	m
Relative Humidity, Operating, Non-Condensing		10	-	90	%

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		36	48	72	V
Input Current (full load)		-	-	9	A
Input Current (no load)		-	60	100	mA
Remote Off Input Current		-	3	6	mA
Input Reflected Ripple Current (pk-pk)	Detail conditions please refer to input reflected ripple current section.	-	-	20	mA
I^2t Inrush Current Transient	Vin = 50 V, with a 100μF/100V input electrolytic capacitor	-	-	2	A^2s
Turn-on Voltage Threshold		34	-	35	V
Turn-off Voltage Threshold		32	-	33	V
Lockout Hysteresis Voltage		2	-	-	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.

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	Vin = 48V, Io = 50% load at 25°C	11.94	12.00	12.06	V
Load Regulation	Vin = 36 – 40 V, Io = 0~100% load at 25°C	-	500	650	mV
	Vin = 40 – 75 V, Io = 0~100% load at 25°C	-	20	100	mV
Line Regulation	Vin = 36 – 40 V, Io = 100% load at 25°C	-	700	850	mV
	Vin = 40 – 75 V, Io = 100% load at 25°C	-	20	100	mV
Regulation Over Temperature (-40°C -85°C)	Vin = 36 – 40 V	-	150	300	mV
	Vin = 40 – 75 V	-	20	120	mV
Ripple and Noise (pk-pk)	Vin = 48V, Io = 100% load at 25°C ambient, 0-20 MHz BW, with a 1 μF ceramic capacitor, a 10 μF Tantalum cap and a 270 μF AL. cap at output.	-	50	100	mV
Ripple and Noise (rms)		-	10	20	mV
Output Ripple and Noise(Pk-Pk) under worst case	Over entire operating input voltage range, load and ambient temperature condition.	-	-	150	mV
Output Current Range		0	-	25	A
Output DC Current Limit		25	30	34	A
Short Circuit Surge Transient		-	-	1	A^2s
Rise Time		-	12	20	ms
Turn on Time	Enable from Vin	-	30	35	ms
	Enable from ON/OFF	-	30	35	ms
Overshoot at Turn on		-	0	3	%
Output Capacitance		270	-	6800	μF
Transient Response					
△V 50%~75% of Max Load	di/dt = 0.1 A/μs, Vin = 48 VDC, Ta = 25°C, with a 1 μF ceramic capacitor, a 10 μF Tantalum cap and a 680 μF AL cap at output.	-	300	-	mV
Settling Time		-	500	-	μs
△V 75%~50% of Max Load		-	300	-	mV
Settling Time		-	500	-	μs

5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	The efficiency is measured at Vin = 48 V, full load and Ta = 25°C.	-	95.8	-	%
Switching Frequency		-	350	-	kHz
Over Temperature Protection		-	125	-	°C
Weight	0RCY-T0T120/L	-	37.3	-	g
	0RCY-T0T12A/B	-	44.5	-	g
FIT		-	TBC	-	
Dimensions (L × W × H)	0RCY-T0T120/L	2.30 x 0.90 x 0.43 58.42 x 22.86 x 11.00			inch mm
	0RCY-T0T12A/B	2.30 x 0.90 x 0.51 58.42 x 22.86 x 13.00			inch 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

6. EFFICIENCY DATA

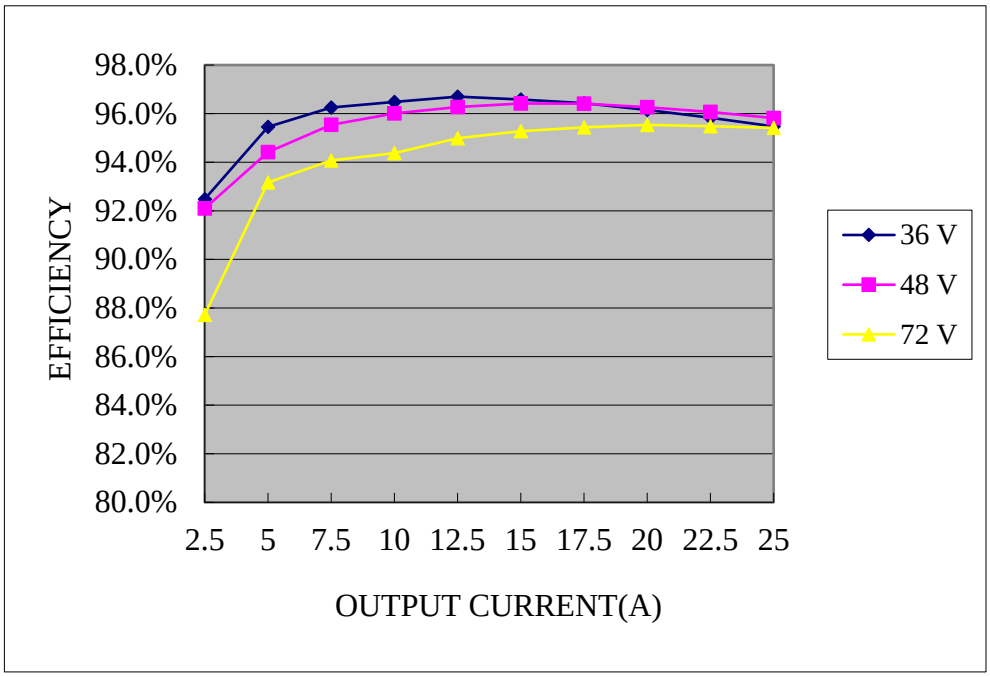

Figure 1. Efficiency data

7. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Signal Low (Unit On)	Active Low	0RCY-T0T12L/B. Remote On/Off pin is open, the module is off.	-0.3	-	0.8	V
Signal High (Unit Off)			2.4	-	18	V
Signal Low (Unit Off)	Active High	0RCY-T0T120/A. Remote On/Off pin is open, the module is on.	-0.3	-	0.8	V
Signal High (Unit On)			2.4	-	18	V
Current Sink			0	-	1	mA

Recommended remote on/off circuit for active low

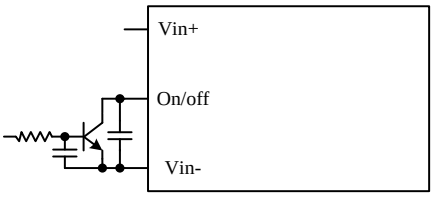

Figure 2. Control with open collector/drain circuit

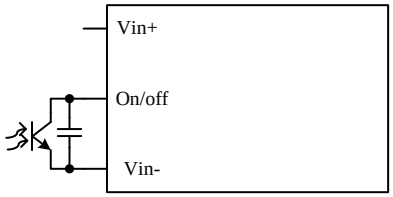

Figure 3. Control with photocoupler circuit

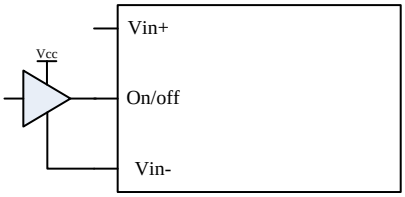

Figure 4. Control with logic circuit

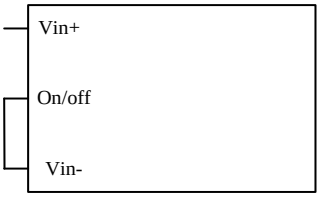

Figure 5. Permanently on

Recommended remote on/off circuit for active high

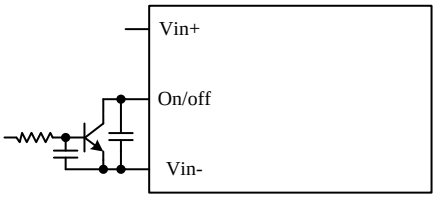

Figure 6. Control with open collector/drain circuit

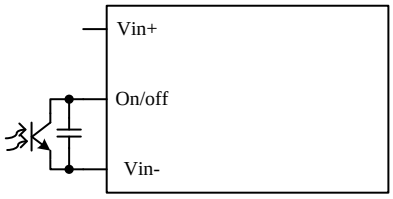

Figure 7. Control with photocoupler circuit

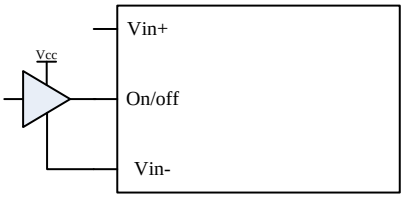

Figure 8. Control with logic circuit

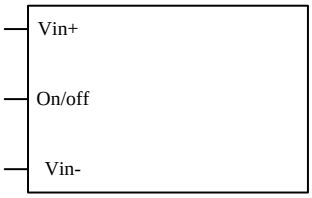

Figure 9. Permanently on

8. INPUT REFLECTED RIPPLE CURRENT

Testing setup

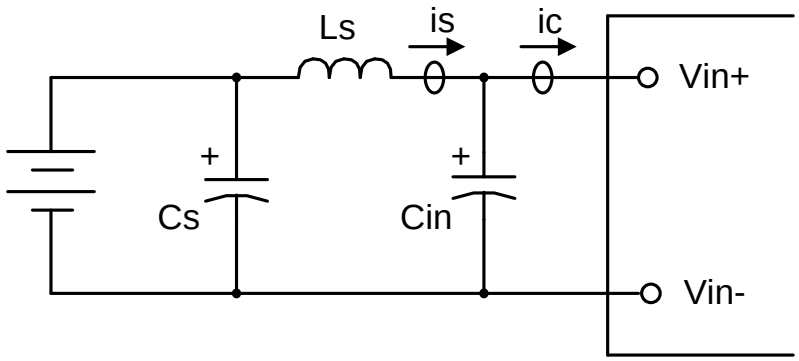

Figure 10.

Notes and values in testing.

is: Input Reflected Ripple Current

ic: Input Terminal Ripple Current

Ls: Simulated Source Impedance (10 µH)

Cs: Offset possible source Impedance (100 µF, ESR < 0.2 Ω @ 100 kHz, 20°C)

Cin: Electrolytic capacitor, should be as closed as possible to the power module to damped ic ripple current and enhance stability. Recommendation: 100 µF, ESR < 0.2 Ω @ 100 kHz, 20°C.

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

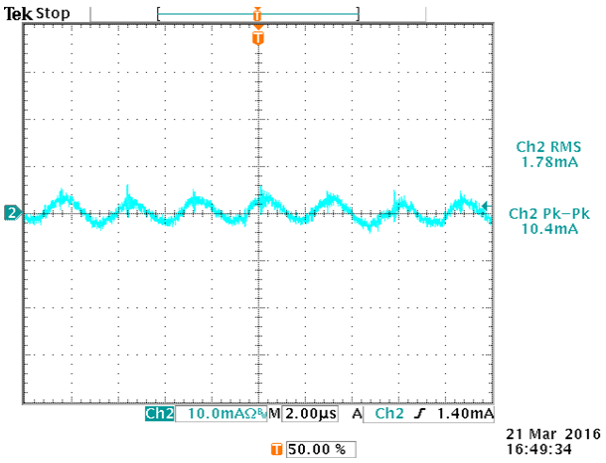

Figure 11. is (input reflected ripple current), AC component

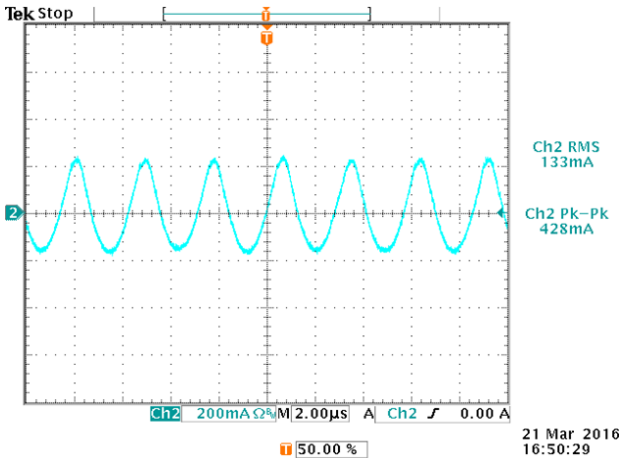

Figure 12. ic (input terminal ripple current), AC component

Test condition: 48 VDC input, 12 VDC/25 A output and Ta = 25 °C, with a 1µF ceramic capacitor and a 270 µF AL. cap at output.

9. RIPPLE AND NOISE WAVEFORM

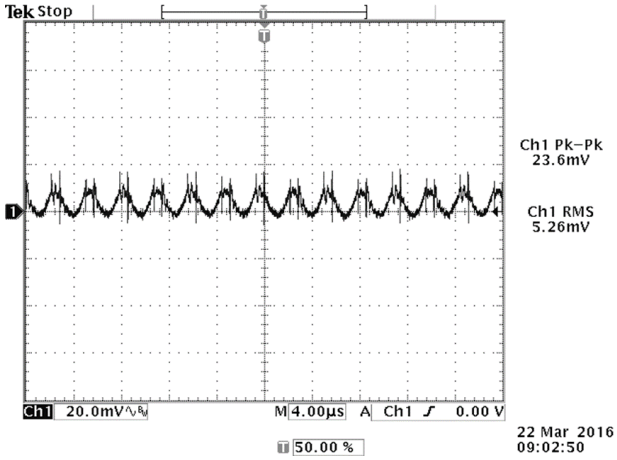

Figure 13. Ripple and noise waveform

Ripple and noise at full load, 48 VDC input, 12VDC/25A output and Ta = 25 °C, and with a 1µF ceramic capacitor, a 10 µF Tantalum cap and a 270 µF AL. cap at output.

10. TRANSIENT RESPONSE WAVEFORMS

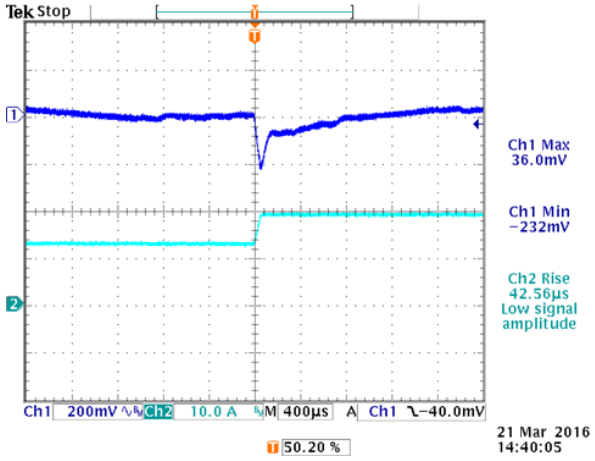

Figure 14. Vout = 12V 50%-75% Load Transients at Vin = 48 V @ Ta = 25°C

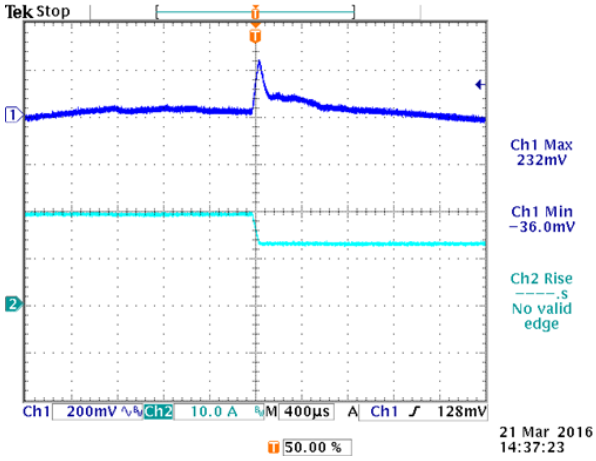

Figure 15. Vout = 12V 75%-50% Load Transients at Vin = 48 V @ Ta = 25°C

Note: Transient Response: di/dt = 0.1 A/µs, with a 1 µF ceramic capacitor, and a 680 µF ALcap at output.

11. STARTUP & SHUTDOWN

Rise time

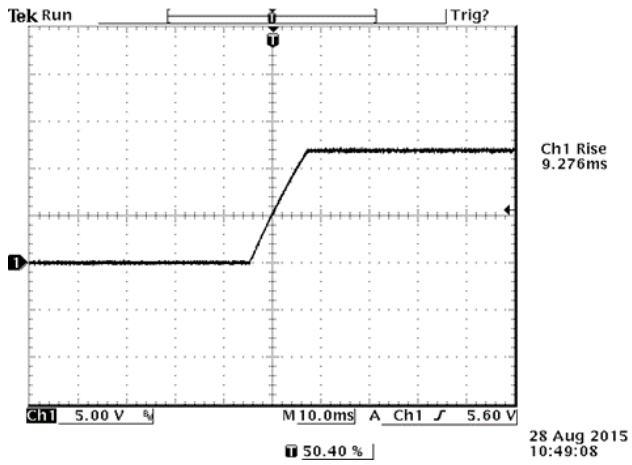

Figure 16. Vout = 12 V / 25 A at Vin = 48 V
@Ta = 25°C, Cext = 270 µF

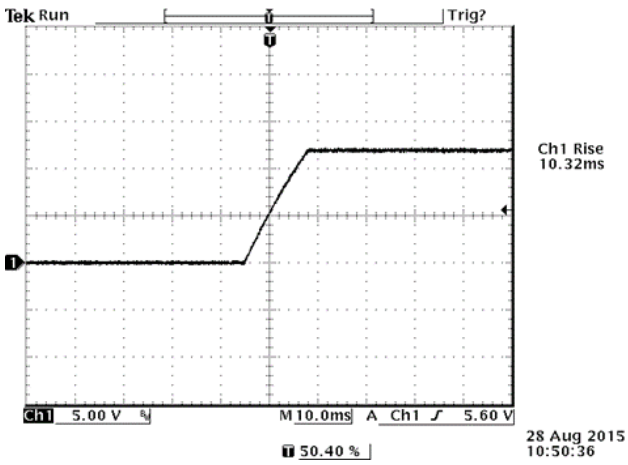

Figure 17. Vout = 12 V / 25 A at Vin = 48 V
@Ta = 25°C, Cext = 6800 µF

Startup time

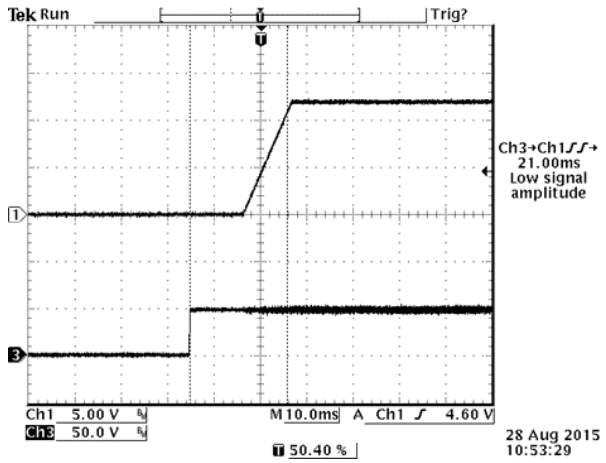

Figure 18. Startup from Vin
Ch1: Vo
Ch3: Vin
Vout = 12V/25A at Vin = 48 V @ Ta = 25°C
Cext = 270 µF

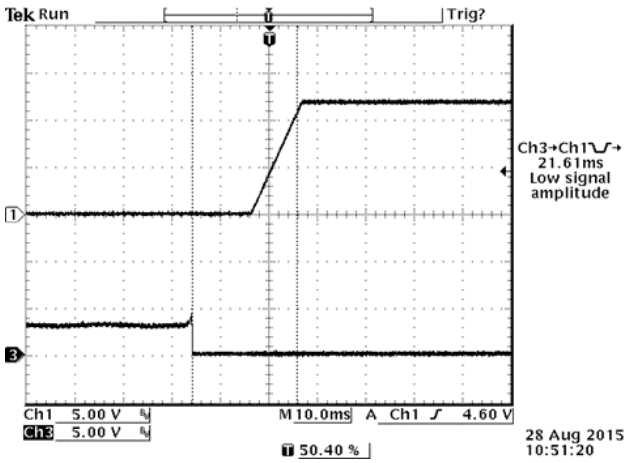

Figure 19. Startup from on/off
Ch1: Vo
Ch3: on/off
Vout = 12V/25A at Vin = 48 V @ Ta = 25°C
Cext = 6800 µF

Shutdown

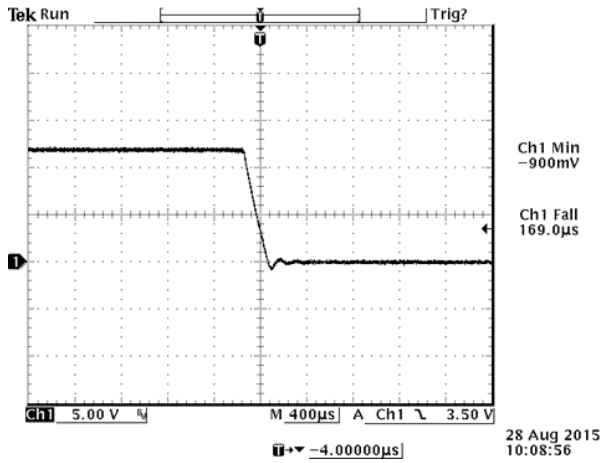

Figure 20. Vout = 12 V/25 A at Vin = 48 V
@Ta = 25°C, Cext = 270 µF

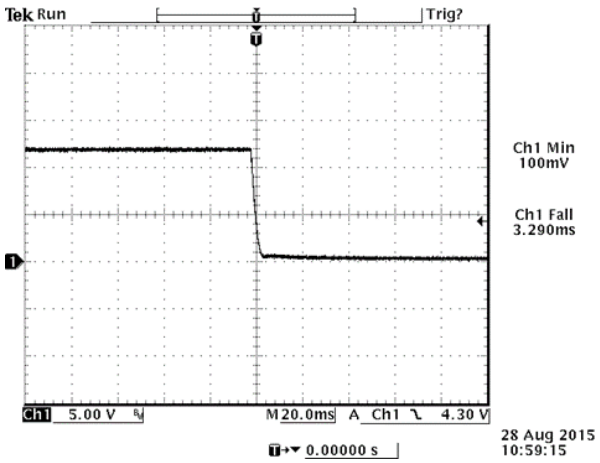

Figure 21. Vout = 12 V/25 A at Vin = 48 V
@Ta = 25°C, Cext = 6800 µF

12. OVER CURRENT PROTECTION

To provide protection in a fault output overload condition, the module is equipped with internal over current protection circuitry. If the over current condition occurs, the module will shut down into hiccup mode and restart once every 400ms. The module operates normally when the output current goes into specified range.

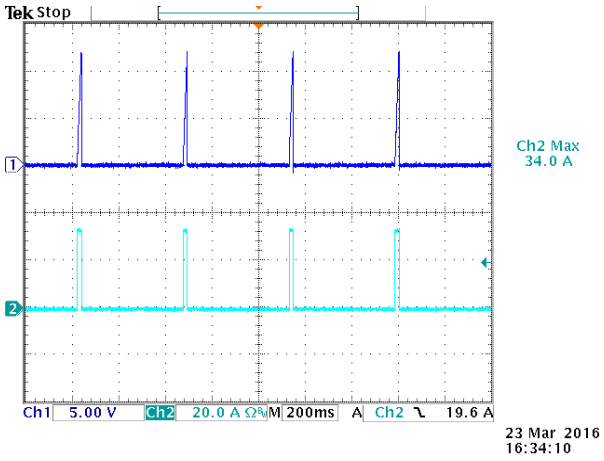

Figure 22. Vin = 48 V @ Ta = 25°C
CH1: Output Voltage
CH2: Output Current

13. INPUT UNDER-VOLTAGE LOCKOUT

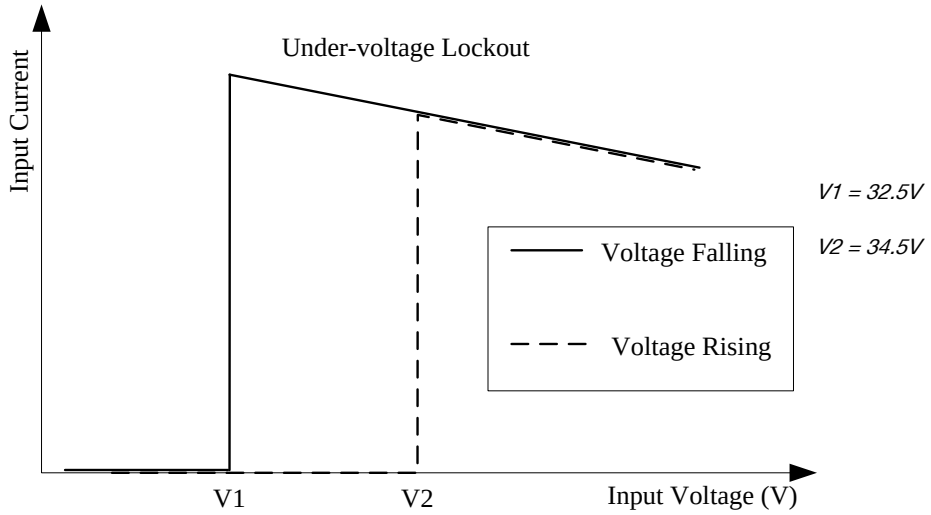

Figure 23. Input under-voltage lockout

14. THERMAL DERATING CURVES

Maximum junction temperature of semiconductors derated to 120 °C.

The OTP is achieved by temperature sensor U10 and it's in non-latch mode when the hottest component Q13 reaches 120°C with 200 LFM air flow correspondingly. It will restart automatically when the temperature falls down to 105°C. The protecting point will be varied a little under different conditions (air flow, ambient temperature, input voltage, load...).

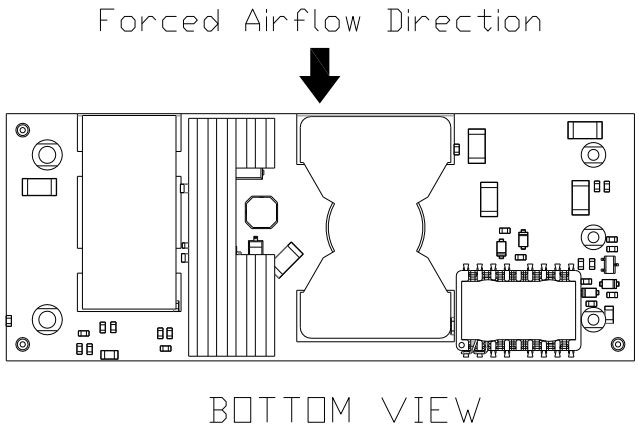

Figure 24. Airflow direction

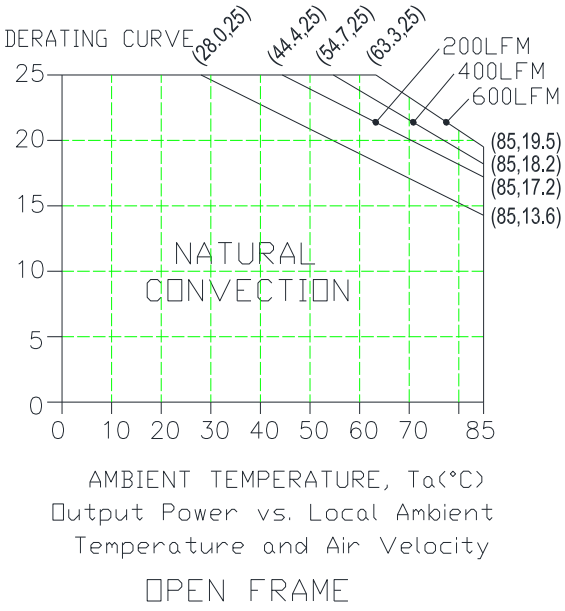

Figure 25. Derating curve-open frame

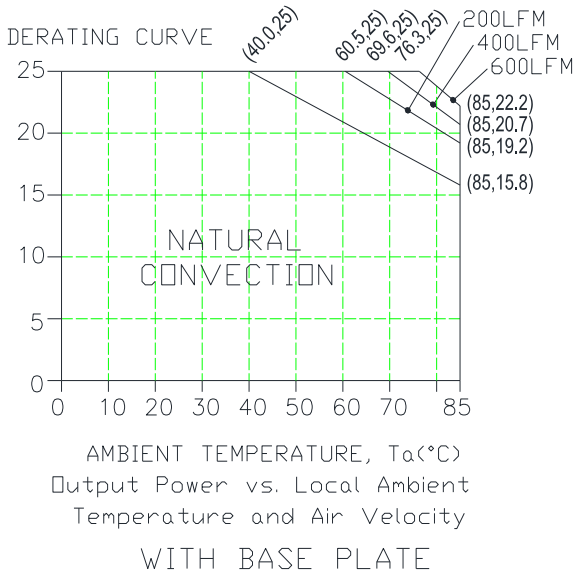

Figure 26. Derating curve-with base plate

Note: Output power vs. ambient temperature and air velocity @ Vin = 48 V

15. SAFETY & EMC

Safety :
Approved to IEC/EN 62368-1

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

Setup:

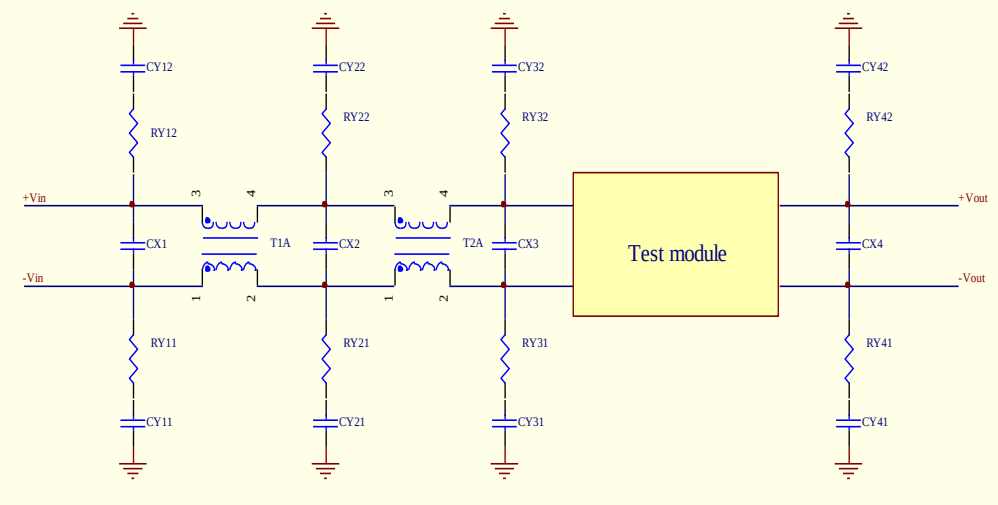

Figure 27.

ITEM	DESIGNATOR	PARAMETER	VENDOR	VENDOR P/N
1	CX2	100μF/100V, AL cap		
2	CX3	220μF/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	0.125mH, common mode		
12	T1A,CX1,CX2 RY11,RY21,RY12 RY22,CY11,CY21 CY12,CY22,CX4	NIL		

Positive:

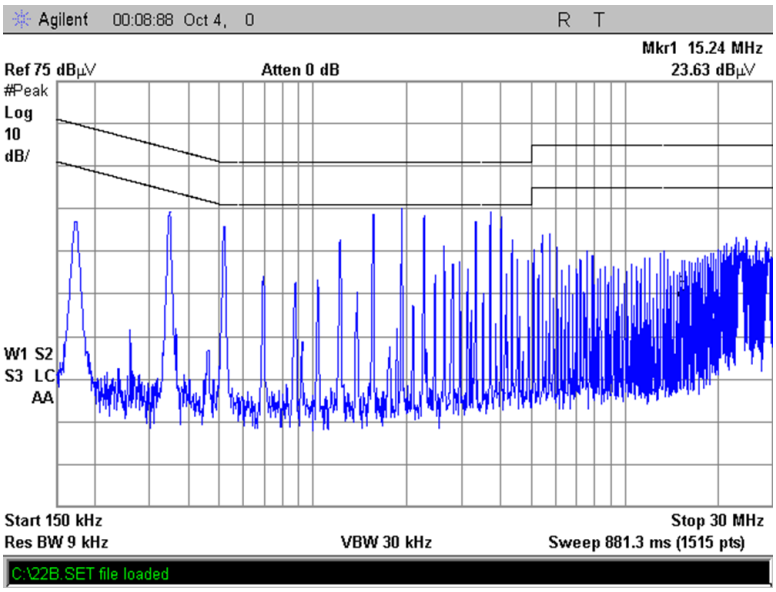

Figure 28.

Negative:

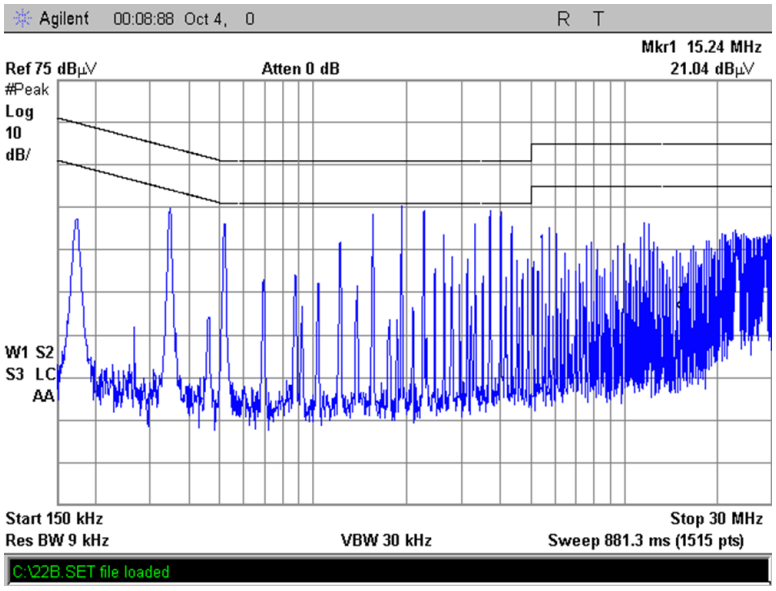

Figure 29.

16. MECHANICAL DIMENSIONS

0RCY-T0T120/L OUTLINE

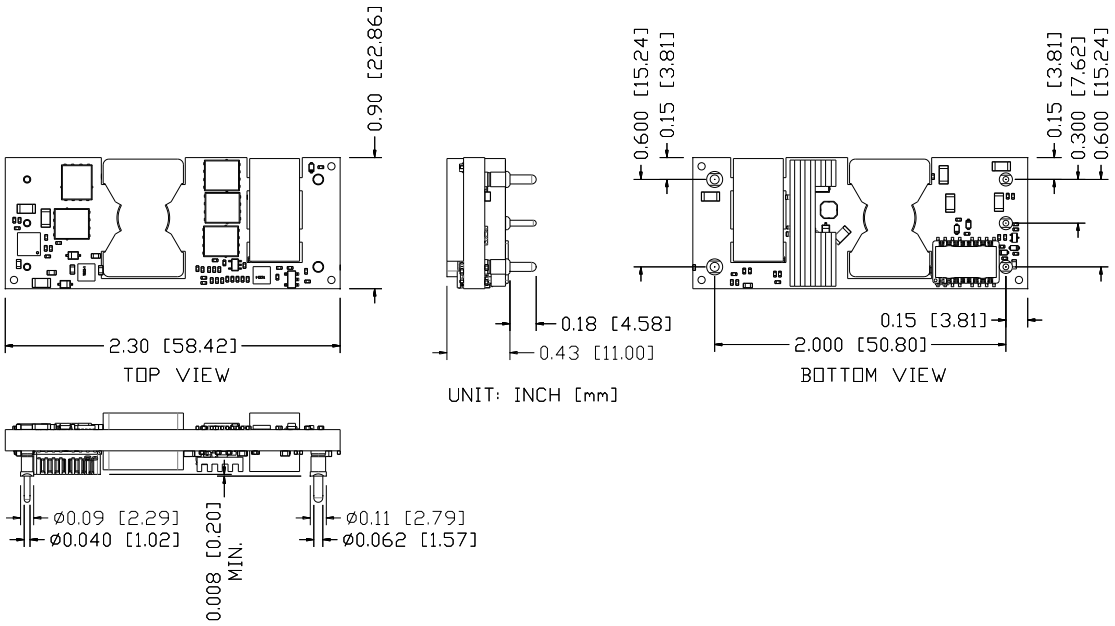

Figure 30. 0RCY-T0T120/L Outline

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 inches; Tolerances: x.xx +/-0.02 in [0.51 mm]. x.xxx +/-0.010 in [0.25 mm].

0RCY-T0T12A/B OUTLINE

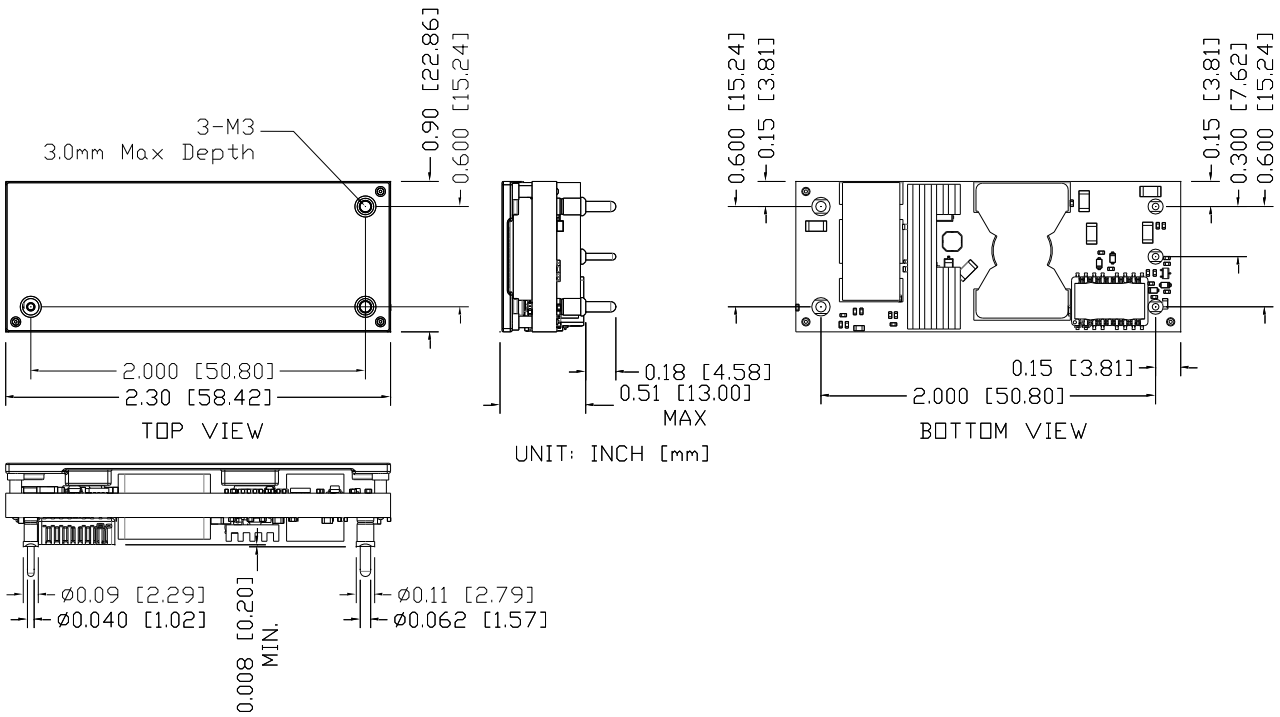

Figure 31. 0RCY-T0T12A/B Outline

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 inches; Tolerances: x.xx +/-0.02 in [0.51 mm]. x.xxx +/-0.010 in [0.25 mm].

PIN DEFINITIONS

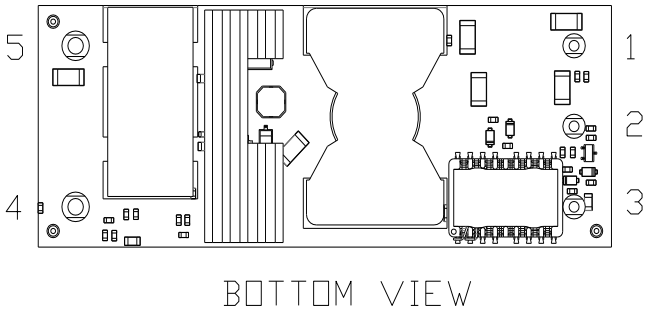

Figure 32. Pins

PIN	FUNCTION	PIN SIZE
1	Vin (+)	0.04”
2	ON/OFF	0.04”
3	Vin (-)	0.04”
4	Vout(-)	0.06”
5	Vout(+)	0.06”

RECOMMENDED PAD LAYOUT

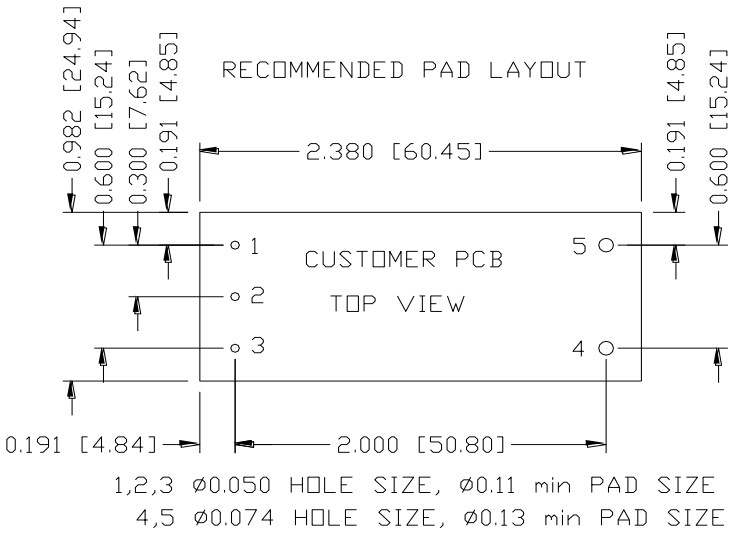

Figure 33. Recommended pad layout

17. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2016-03-24	PA	First release.	Z.Tang
2017-04-20	AB	Update Model.	HL.Lu
2017-12-18	AC	Add 0RCY-T0T12C.	XF.Jiang
2019-05-24	AD	Update TD curves.	XF.Jiang
2019-08-12	AE	Add a note of 0RCY-T0T12C in part number explanation.	XF.Jiang
2020-07-27	AF	Add module photo. Delete 0RCY-T0T12C.	F.Tao
2021-04-28	AG	Add object ID and safety certificate. Update 0RCY-T0T120/L outline.	XF.Jiang

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

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