0RCY-D4T12

Isolated DC-DC Converter

The 0RCY-D4T12 series are isolated DC/DC converters that operate from a nominal 48 VDC source. These units provide up to 240 W of output power from a nominal 48 VDC input.

They are designed to be highly efficient. Features include remote on/off, short circuit protection, over current protection, under voltage lockout and over temperature protection.

These converters are provided in industry standard eighth brick package.

Key Features & Benefits

- 48 VDC Input
- 12 VDC @ 20 A Output
- 1/8th Brick Converter
- 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
- Basic Isolation
- Approved to UL/CSA 62368-1
- 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 ACTIVE HIGH	MODEL NUMBER ACTIVE LOW	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RCY-D4T120G 0RCY-D4T12AG	0RCY-D4T12LG 0RCY-D4T12BG	12 VDC	36 - 75 VDC	20 A	240 W	95.5%

PART NUMBER EXPLANATION

0	R	CY	-	D4	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		240 W	36 - 75 V	12 V	L – Active Low, Open Frame 0 – Active High, Open Frame B – Active Low, with Baseplate A – Active High, 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		-40	-	85	°C
Storage Temperature		-55	-	125	°C
Altitude		-	-	5000	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		36	48	75	V
Input Current (full load)	Test at 40 V input voltage	-	-	8	A
Input Current (no load)		-	60	100	mA
Remote Off Input Current		-	3	6	mA
Input Reflected Ripple Current (RMS)	With simulated source impedance of 10 µH, 5 Hz to 20 MHz. Use a 100 µF/100 V electrolytic capacitor with ESR = 1 ohm max, at 200 kHz @ 25°C	-	2	-	mA
Input Reflected Ripple Current (pk-pk)		-	10	-	mA
I^2t Inrush Current Transient		-	-	2	A^2s
Turn-on Voltage Threshold		-	34	35	V
Turn-off Voltage Threshold		32	33	-	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 15 A 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 = 48 V, Io = 50% load at 25°C ambient	11.94	12.00	12.06	V
Load Regulation	Vin = 36 - 40 V, Io = 0~100% load at 25°C ambient	-	500	650	mV
	Vin = 40 - 5 V, Io = 0~100% load at 25°C ambient	-	20	100	mV
Line Regulation	Vin = 36 - 40 V, Io = 100% load at 25°C ambient	-	700	850	mV
	Vin = 40 - 75 V, Io = 100% load at 25°C ambient	-	20	100	mV
Regulation Over Temperature (-40°C ~ 85°C)	Vin = 36 - 40 V	-	150	300	mV
	Vin = 40 - 75 V	-	20	100	mV
Output Ripple and Noise (pk-pk)	Vin = 48 V, 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
Output 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	-	20	A
Output DC Current Limit		23	28	33	A
Short Circuit Surge Transient	Iout surge	-	-	1	A^2s
Rise Time		-	10	15	ms
Turn on Time	Ton (Enable form Vin)	-	25	30	ms
	Ton (Enable form ON/OFF)	-	25	30	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 270 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, Io = Io max, full load and Ta = 25°C	-	95.5	-	%
Switching Frequency		-	350	-	kHz
Over Temperature Protection		-	125	-	°C
FIT	Calculated Per Bell Core SR-332 (Vin = 48 V, Vo = 12 V, Io = 16 A, Ta = 25°C, FIT = 10^9/MTBF)	-	142	-	-
Weight	0RCY-D4T120G/LG	-	33.7	-	g
	0RCY-D4T12AG/BG	-	39	-	g
Dimensions (L × W × H)	0RCY-D4T120G/LG		2.30 x 0.90 x 0.43		inch
			58.42 x 22.86 x 11.00		mm
	0RCY-D4T12AG/BG		2.30 x 0.90 x 0.48		inch
			58.42 x 22.86 x 12.20		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

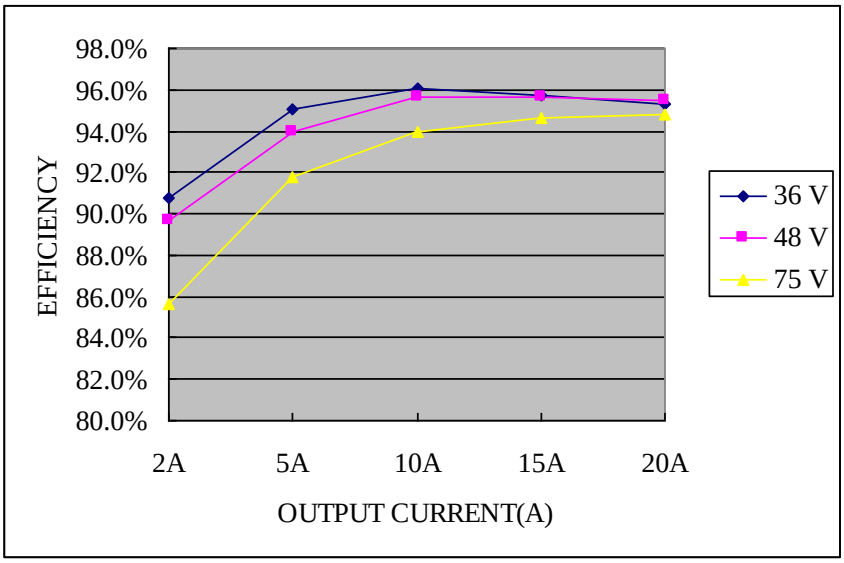

Figure 1. Efficiency data

7. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Signal Low (Unit On)	Active Low	0RCY-D4T12LG/BG	-0.3	-	0.8	V
Signal High (Unit Off)		Remote On/Off pin is open, the module is off	2.4	-	18	V
Signal Low (Unit Off)	Active High	0RCY-D4T120G/AG	-0.3	-	0.8	V
Signal High (Unit On)		Remote On/Off pin is open, the module is on	2.4	-	18	V
Current Sink			0	-	1	mA

Recommended remote on/off circuit for active low:

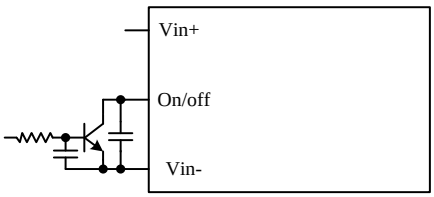

Figure 2. Control with open collector/drain circuit

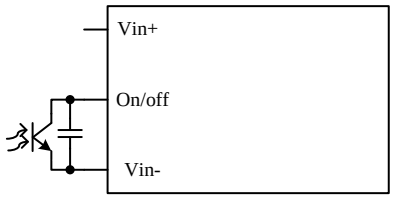

Figure 3. Control with photocoupler circuit

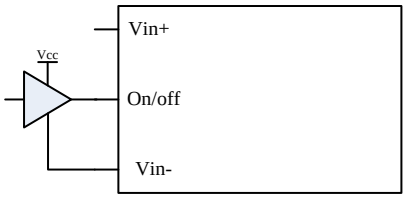

Figure 4. Control with logic circuit

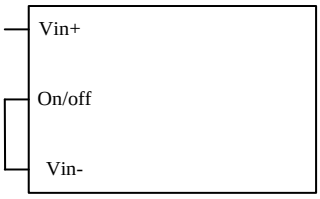

Figure 5. Permanently on

Recommended remote on/off circuit for active high:

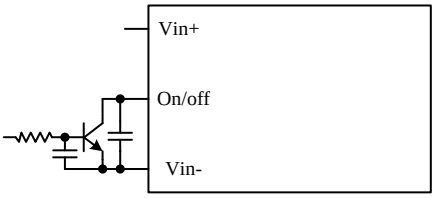

Figure 6. Control with open collector/drain circuit

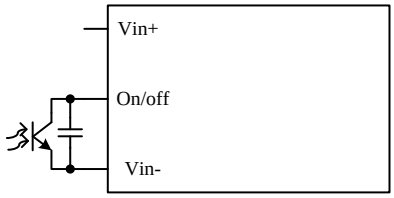

Figure 7. Control with photocoupler circuit

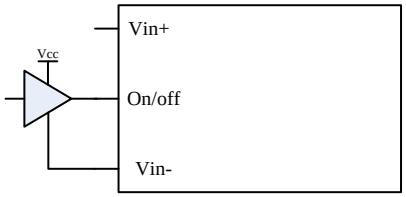

Figure 8. Control with logic circuit

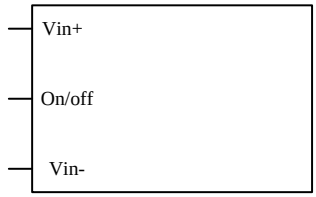

Figure 9. Permanently on

8. RIPPLE AND NOISE WAVEFORM

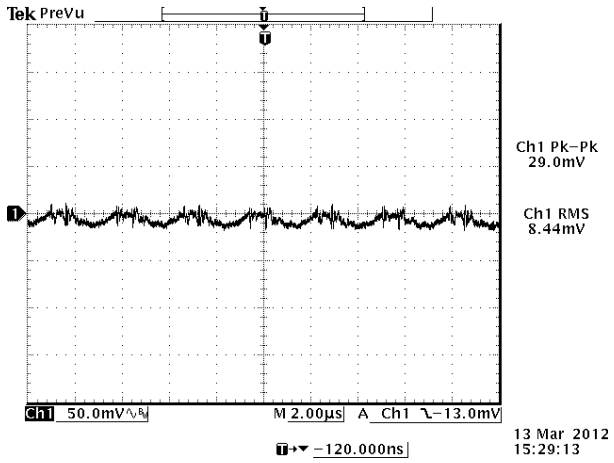

Figure 10. Ripple and noise waveform

Note: Ripple and noise at full load, 48 VDC input, 12 VDC / 20 A output and Ta = 25 °C, and with a 1 µF ceramic capacitor, a 10 µF Tantalum cap and a 270 µF AL cap at output.

9. TRANSIENT RESPONSE WAVEFORMS

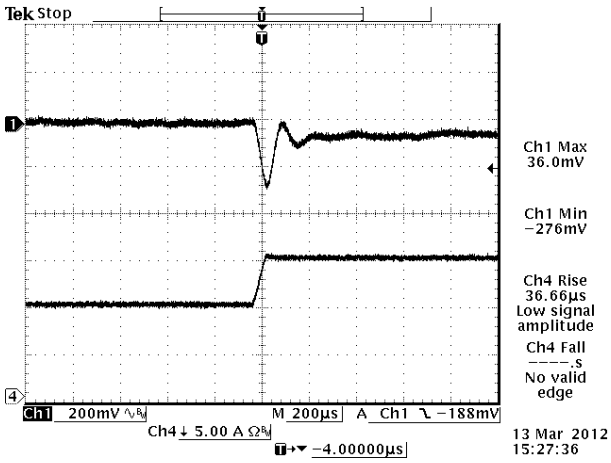

Figure 11. Vout = 12 V 50%-75% Load Transients at Vin = 48 V @ Ta = 25°C

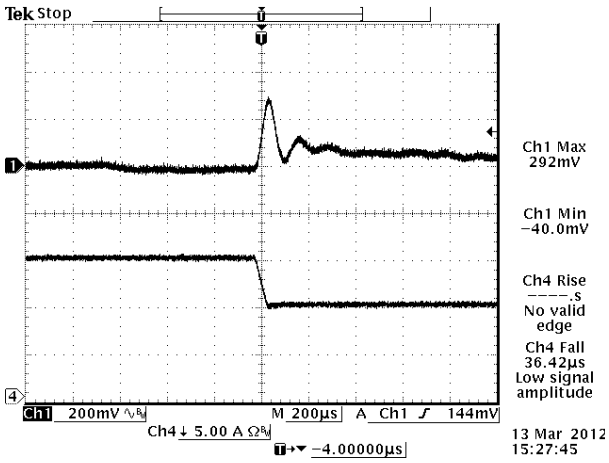

Figure 12. Vout = 12 V 75%-50% Load Transients at Vin = 48 V @ Ta = 25 °C

Note: Transient Response: di/dt = 0.1 A/µs, with a 1 µF ceramic capacitor, a 10 µF Tantalum cap and a 270 µF AL cap at output.

11. STARTUP & SHUTDOWN

Rise time

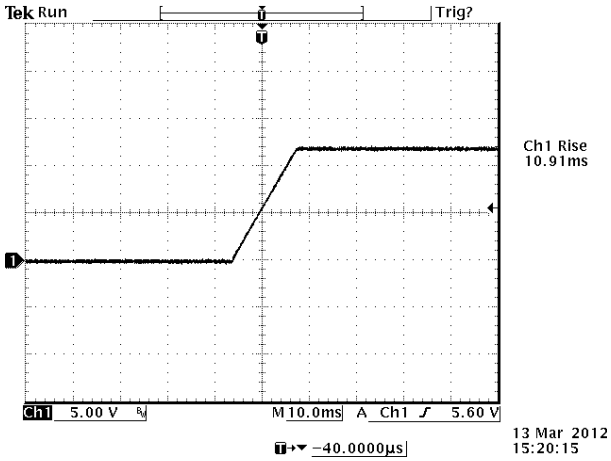

Figure 13. Vout = 12 V / 20 A at Vin = 48 V
@ Ta = 25°C, Cext = 270 µF

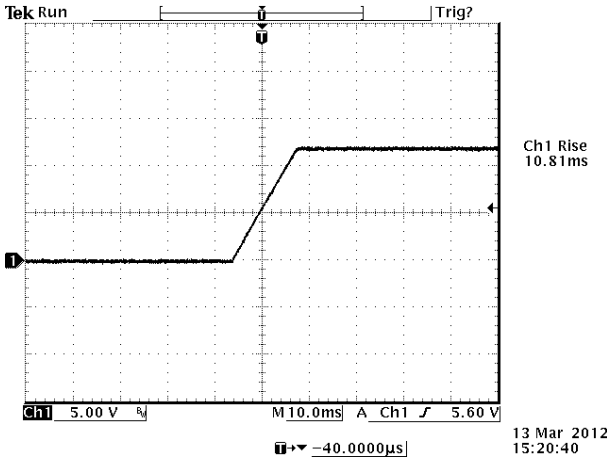

Figure 14. Vout = 12 V / 20 A at Vin = 48 V
@ Ta = 25°C, Cext = 6800 µF

Startup time

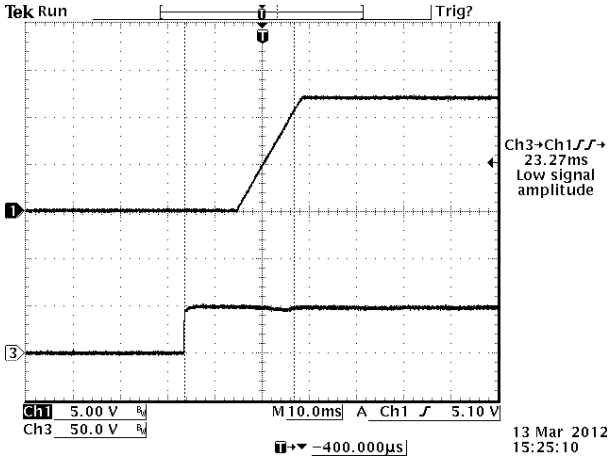

Figure 15. Startup from Vin
Ch1: Vo
Ch3: Vin
Vout = 12 V / 20 A at Vin = 48 V
@ Ta = 25°C, Cext = 6800 µF

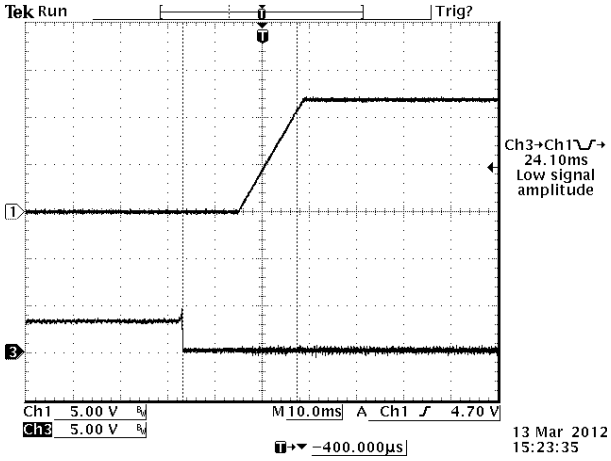

Figure 16. Startup from on/off
Ch1: Vo
Ch3: on/off
Vout = 12 V / 20 A at Vin = 48 V
@ Ta = 25°C, Cext = 6800 µF

Shutdown

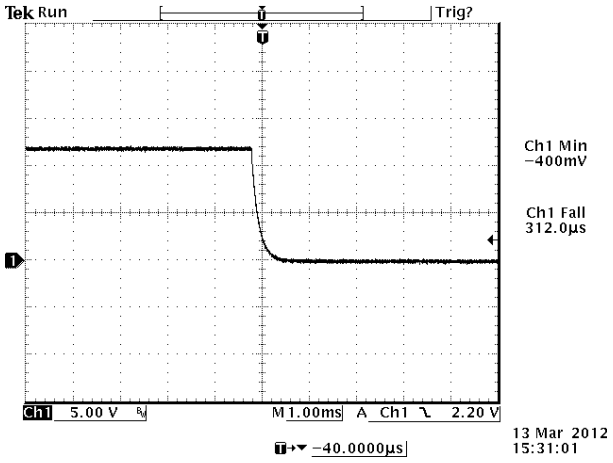

Figure 17. Vout = 12 V / 20 A at Vin = 48 V @ Ta = 25°C, Cext = 270 µF

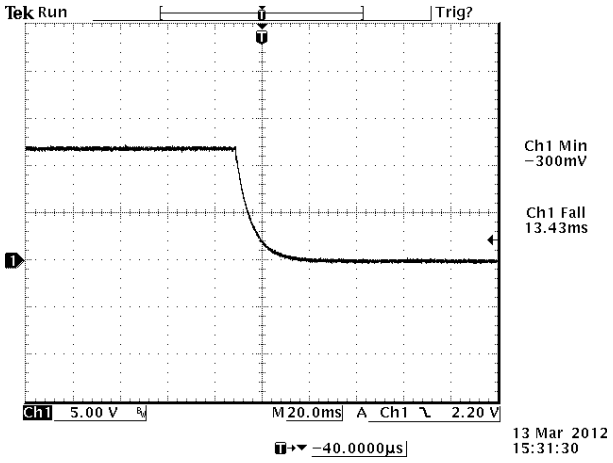

Figure 18. Vout = 12 V / 20 A at Vin = 48 V @ Ta = 25°C, Cext = 6800 µF

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 400 ms. The module operates normally when the output current goes into specified range.

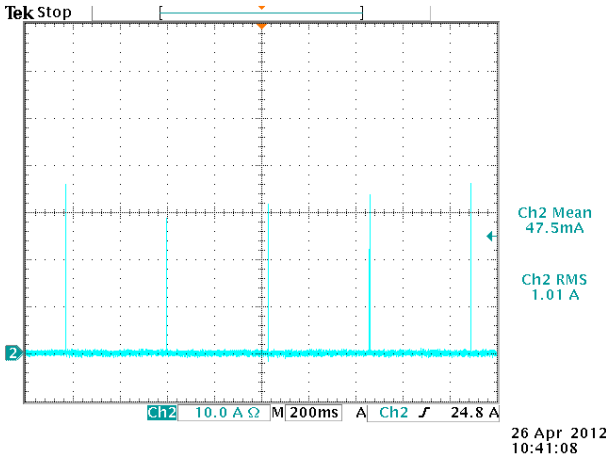

Figure 19. Vin = 48 V @ Ta = 25°C

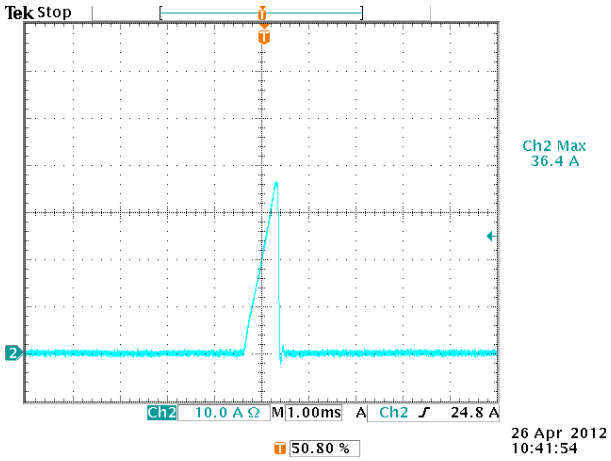

Figure 20. Expansion of on time portion of above figure CH2: Output current waveform

13. INPUT UNDER-VOLTAGE LOCKOUT

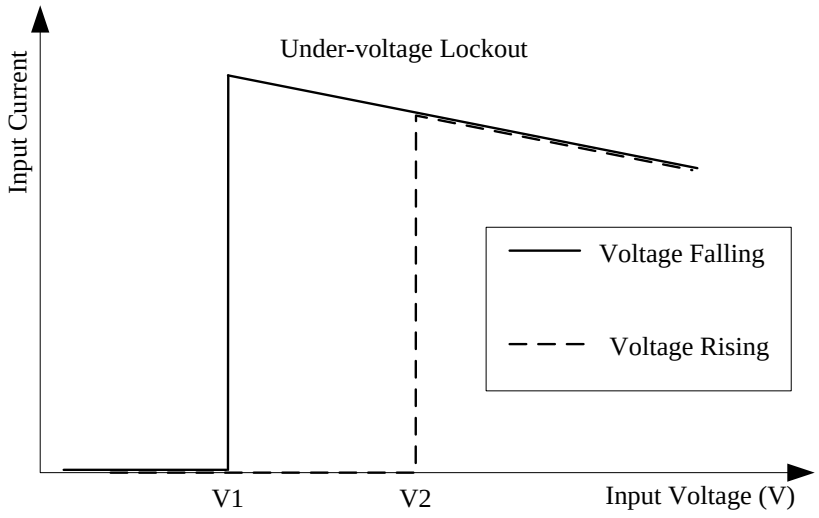

Figure 21. Input under-voltage lockout

V1 = 33 V

V2 = 34 V

14. THERMAL DERATING CURVES

Maximum FET junction temperature derated to 120 °C.
The OTP is achieved by temperature sensor U10 and it's in non-latch mode when the hottest component U7 reaches 115 °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...).

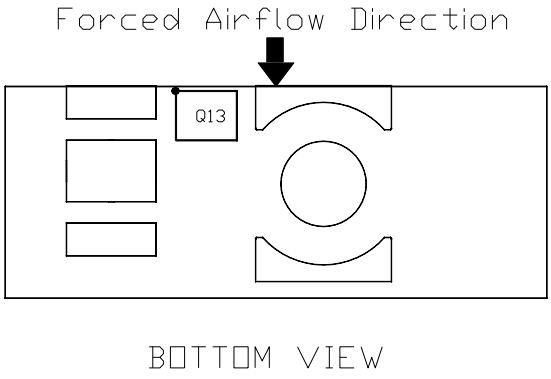

Figure 22. Airflow direction

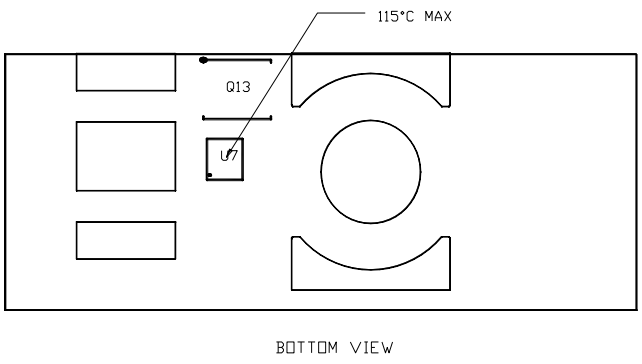

Figure 23. Hot spot

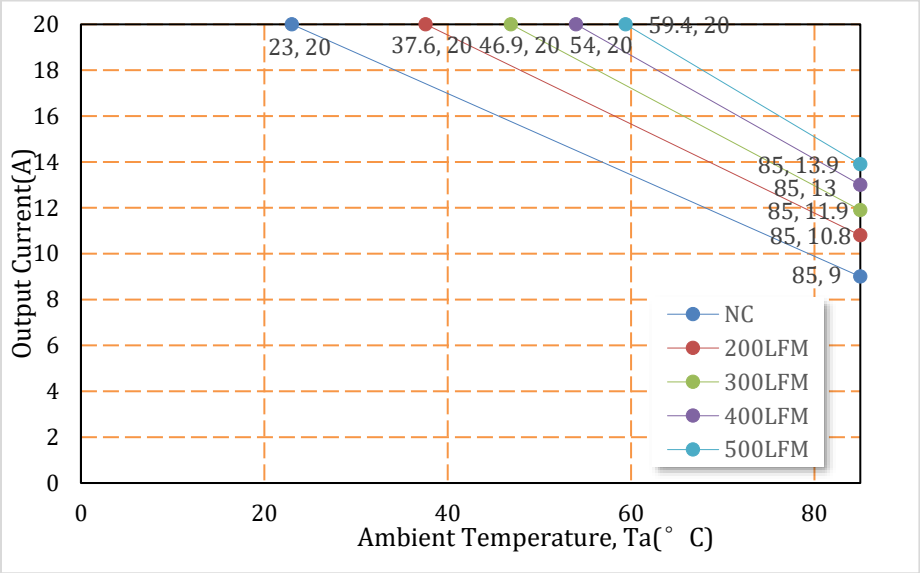

Figure 24. Vin = 48 V Open frame version (0RCY-D4T12LG/0G)

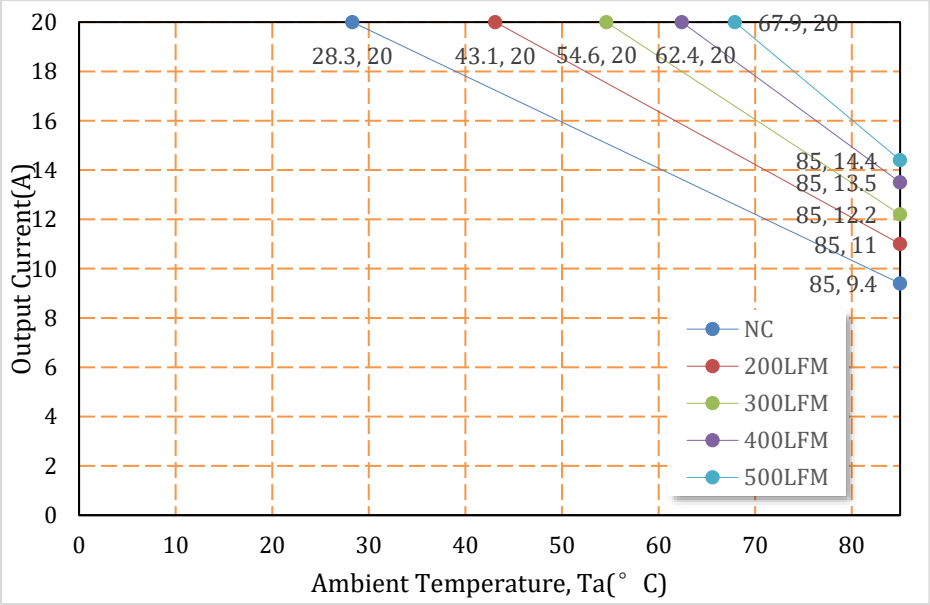

Figure 25. Vin = 48 V with baseplate version (0RCY-D4T12AG/BG)

15. SAFETY & EMC

Safety:

Material flammability: UL 94V-0

Approved to IEC/EN 62368-1

Approved to UL/CSA 62368-1

EMC:

Compliance to EN 55032 class A (both peak and average) with the following inductive and capacitive filter.

Test Setup:

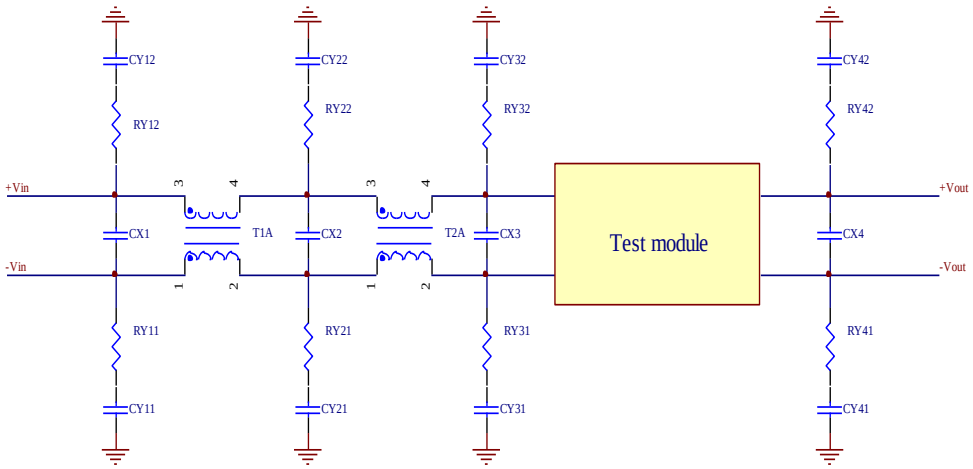

Figure 26. Test setup

ITEM	DESIGNATOR	PARAMETER	VENDOR	VENDOR P/N
1	CX2	100uF/100V, AL cap		
2	CX3	220uF/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	0.81mH, common mode		
12	T1A, CX1, CX2 RY11, RY21, RY12 RY22, CY11, CY21 CY12, CY22	NIL		

Positive:

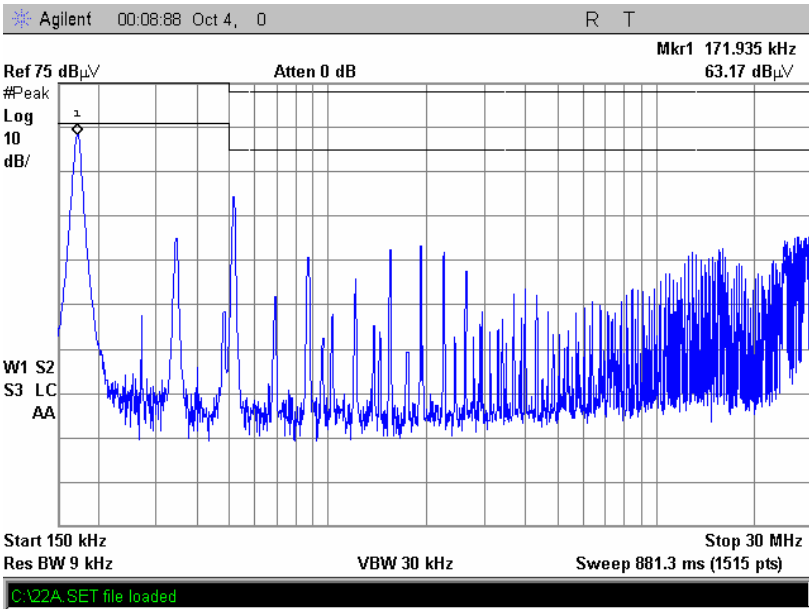

Figure 27.

Negative:

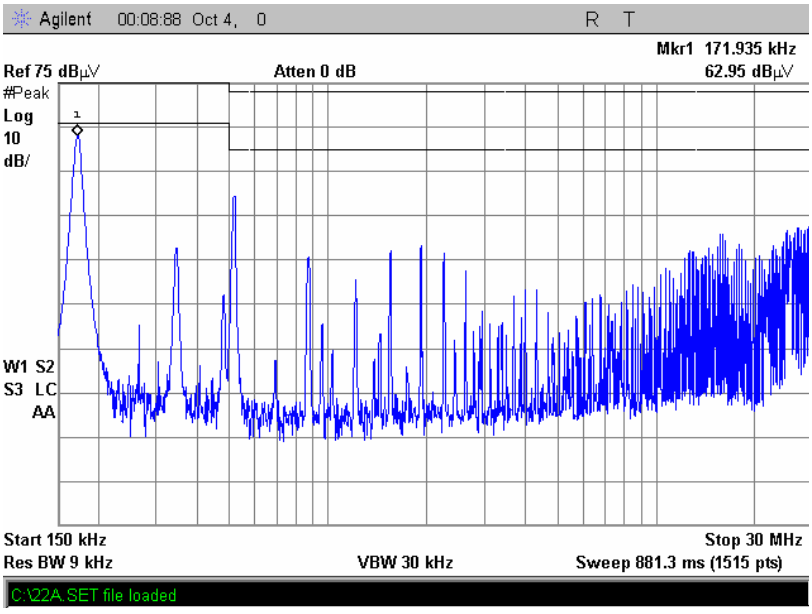

Figure 28.

16. MECHANICAL DIMENSIONS

0RCY-D4T120G/LG OUTLINE

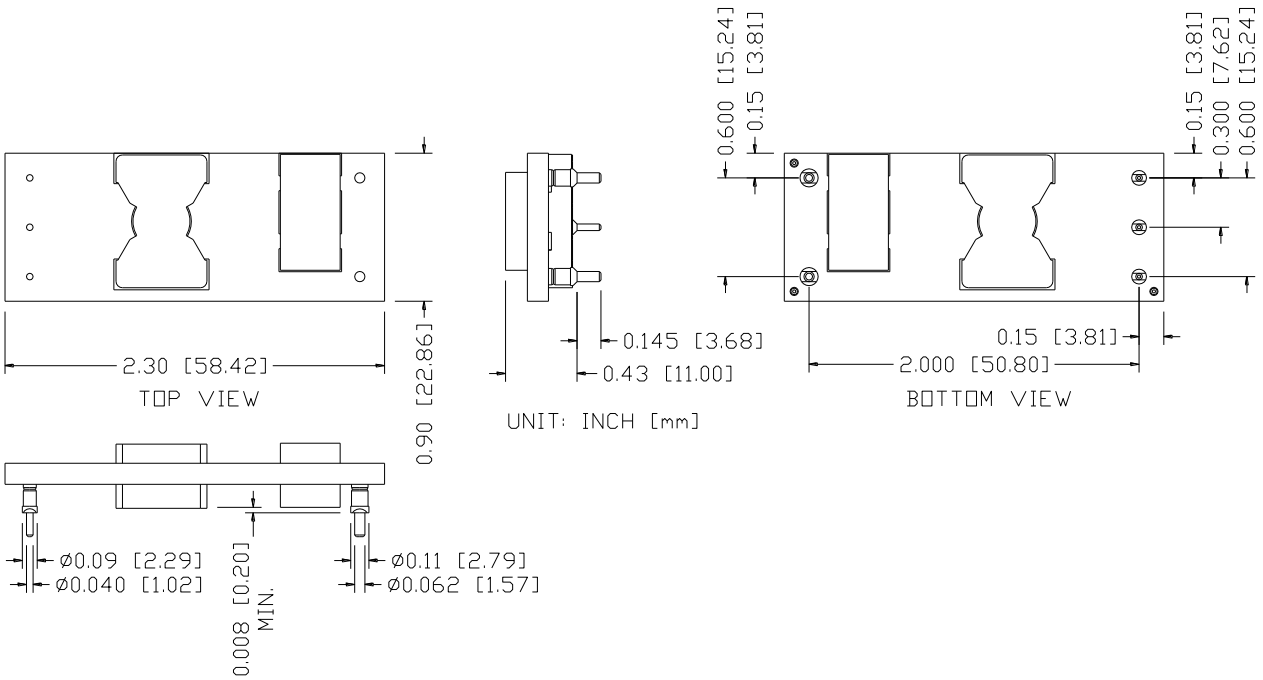

Figure 29. 0RCY-D4T120G/LG Outline

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 [0.51 mm]. x.xxx +/-0.010 inch [0.25 mm].

0RCY-D4T12AG/BG OUTLINE

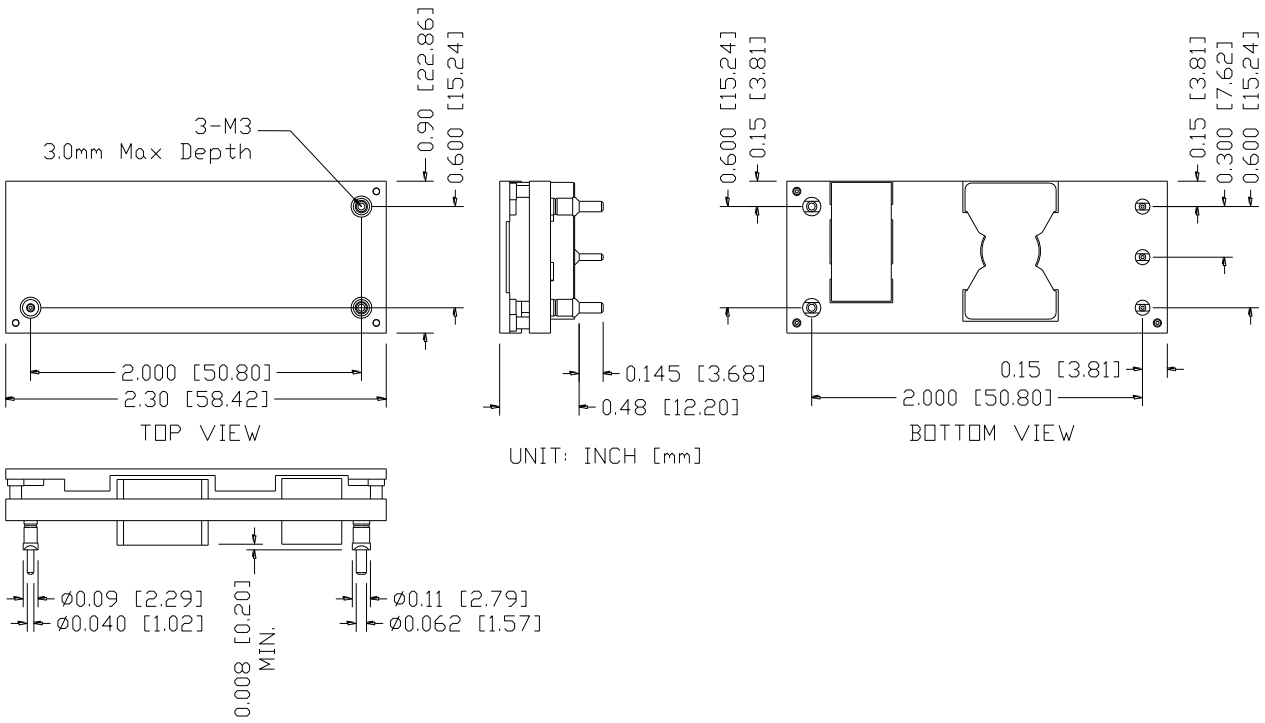

Figure 30. 0RCY-D4T12AG/BG Outline

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 [0.51 mm]. x.xxx +/-0.010 inch [0.25 mm].

PIN DEFINITIONS

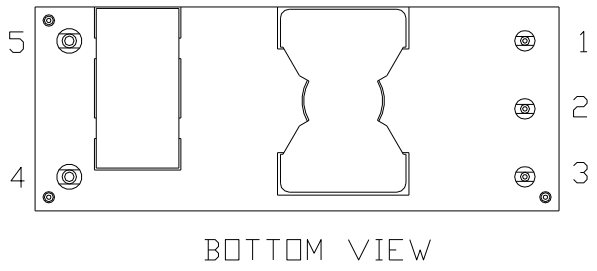

Figure 31. Pins

PIN	NAME	PIN DIA
1	Vin (+)	0.04”
2	Enable	0.04”
3	Vin (-)	0.04”
4	Vout(-)	0.06”
5	Vout+	0.06”

RECOMMENDED PAD LAYOUT

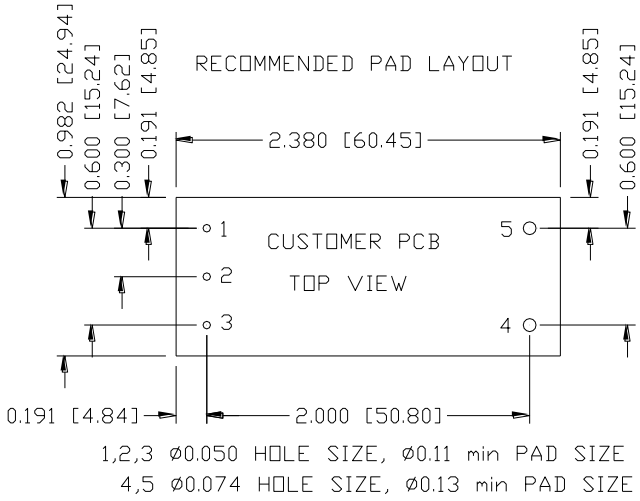

Figure 32. Recommended pad layout

17. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2012-7-5	PA	First release	Z.Tang
2012-12-7	PB	Updated Load Regulation, Line Regulation, and Regulation Over Temperature, Output Capacitance in, Safety & EMC and weight. Add I2t Inrush Current Transient, Short Circuit Surge Transient and FIT in general spec, Add part 0RCY-D4T123.	Z.Tang
2012-12-29	PC	Update the MD. Marked the depth of the screw holes.	Z.Tang
2013-06-17	PD	Update the description.	Z.Tang
2016-11-03	AE	Update the MD.	XF.Jiang
2017-12-27	AF	Delete 0RCY-D4T123.	XF.Jiang
2018-06-12	AG	Update Isolation Voltage.	XF.Jiang
2019-05-24	AH	Update TD curves.	XF.Jiang
2020-07-27	AI	Update safety certification, change title by adding 0,L,A,B suffix.	F.Tao
2021-05-04	AJ	Add object ID. Update isolated voltage and recommended pad layout.	XF.Jiang
2022-05-05	AK	Update altitude to 5000m. Correct figure 23 hot spot and thermal derating curves.	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.