0RCY-D4T03

Isolated DC-DC Converter

The 0RCY-D4T03 series are isolated DC/DC converters that operate from a nominal 48 VDC source. These units provide up to 198 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 an industry standard eighth brick package.

Key Features & Benefits

- 40 - 60 VDC Input
- 3.3 VDC @ 60 A Output
- 1/8th Brick Converter
- Basic Insulation
- Fixed Frequency
- High Efficiency
- High Power Density
- Input Under-Voltage Lockout
- OCP/SCP
- Output Over-Voltage Protection
- Over Temperature Protection
- Remote On/Off
- 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-D4T03 series	3.3 VDC	40 - 60 VDC	60 A	198 W	94.5%

PART NUMBER EXPLANATION

0	R	CY	-	D4	T	03	x
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic
Through Hole Mount	RoHS	1/8th Brick		198 W	40 - 60 V	3.3 V	L - Active Low, Open Frame

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous Non-operating Input Voltage		-0.3	-	60	V
Input Transient Voltage	100 ms maximum	-	-	80	V
Remote On/Off		-0.3	-	18	V
I/O Isolation Voltage		-	-	1500	VDC
Ambient Temperature		-40	-	85	°C
Storage Temperature		-55	-	125	°C
Altitude		-	-	4000	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			40	48 / 54	60	V
Input Current (full load)		Test at 40 V input voltage	-	-	5.3	A
Input Current (no load)			-	50	80	mA
Remote Off Input Current			-	6	10	mA
Input Reflected Ripple Current (pk-pk)	is	Vin = 48 V, Vo = 3.3 V, Io = 60 A, With 1*12 µH inductor + 47 µF aluminum electrolytic capacitor at the input	-	7	20	mA
	ic		-	260	360	mA
Input Reflected Ripple Current (rms)	is		-	2	4	mA
	ic		-	85	120	mA
I^2t Inrush Current Transient			-	-	2	A^2s
Turn-on Voltage Threshold			32.5	34.5	37.6	V
Turn-off Voltage Threshold			30.5	32.5	34	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 8 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.	3.267	3.300	3.333	V
Load Regulation	Vin = 48 V, Io = 0~100% load at 25°C ambient.	-	2	5	mV
Line Regulation	Vin = 40 – 60 V, Io = 50% load at 25°C ambient.	-	2	10	mV
Regulation Over Temperature (-40°C to 85°C)		-	10	20	mV
Total Output Voltage Range	Over sample load, line and temperature	3.26	-	3.34	V
Output Over-Voltage Protection (Latch Mode)	Vin = 48 V, Io = 50% load at 25°C ambient.	-	4.3	-	V
Output Ripple and Noise (pk-pk)	Vin = 48 V, Io = 54 A, 5 Hz to 20 MHz bandwidth, with 47 µF*2 pcs ceramic, 270 µF+680 µF oscon, 10 µF Tantalum at the output	-	20	40	mV
Output Ripple and Noise (RMS)		-	5	10	mV
Output Ripple and Noise (pk-pk)	Vin = 48 V, full Load, 5 Hz to 20 MHz bandwidth, with 47 µF*2 pcs ceramic, 270 µF+680 µF oscon, 10 µF Tantalum at the output	-	35	50	mV
Output Ripple and Noise (RMS)		-	5	10	mV
Output Ripple and Noise (pk-pk) under worst case	Over entire operating input voltage range, load and ambient temperature condition	-	-	80	mV
Output Current Range		0	-	60	A
Output DC Current Limit	Hiccup mode	62	-	80	A
Short Circuit Surge Transient		-	-	5	A^2s
Rise Time		-	3	5	ms
Turn on Time	Ton (Enable form Vin)	-	15	20	ms
	Ton (Enable form ON/OFF)	-	15	20	ms
Overshoot at Turn on		-	0	1.5	%
Output Capacitance	Minimum cap means 47 µF*2 pcs ceramic, 270 µF+680 µF oscon, 10 µF Tantalum	1054	-	10000	µF
Transient Response					
ΔV 50% - 75% of 54 A	di/dt = 1 A/µs, Vin = 48 VDC, Ta = 25 °C, with 47 µF*2 pcs ceramic, 270 µF+ 680 µF oscon, 10 µF Tantalum at the output	-	65	80	mV
ΔV 50%~75% of Max Load		-	70	90	mV
Settling Time		-	40	80	µs
ΔV 75% - 50% of 54 A		-	65	80	mV
ΔV 75%~50% of Max Load		-	70	90	mV
Settling Time		-	40	80	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.	-	94.5	-	%
Switching Frequency		-	182	-	kHz
Output Voltage Trim Range		2.64	-	3.63	V
Over Temperature Protection		-	125	-	°C
MTBF	Io = 80% of Io.max, Ta = 40 °C Airflow 300 LFM	-	6,957,514	-	hours
Weight		-	34.3	-	g
Dimensions (L × W × H)			2.30 x 0.90 x 0.43 58.42 x 22.86 x 11.00		inch mm
Isolation Characteristics					
Input to Output		-	-	1500	VDC
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

6. EFFICIENCY DATA

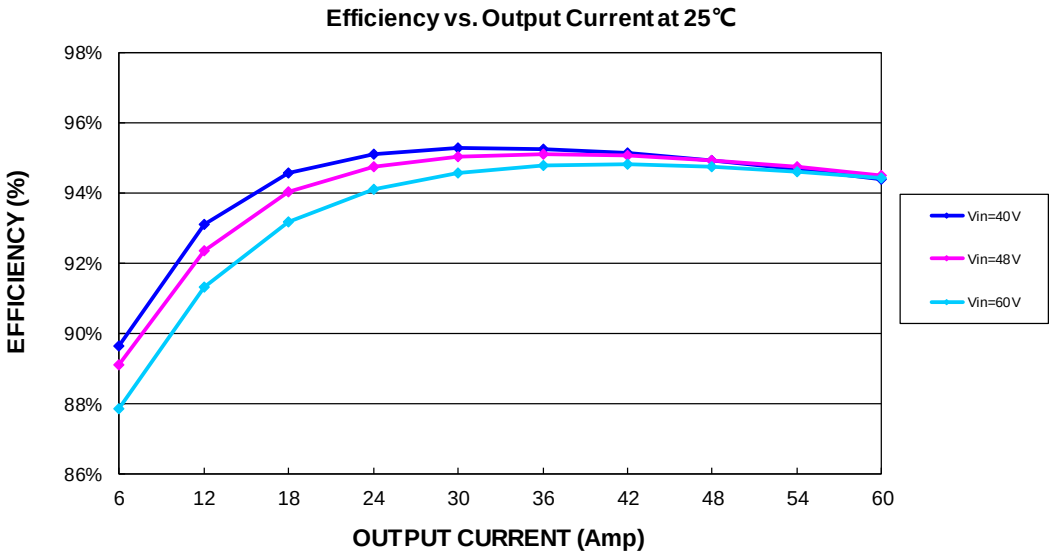

Figure 1. Efficiency data

7. REMOTE ON/OFF

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

Recommended remote on/off circuit for active low

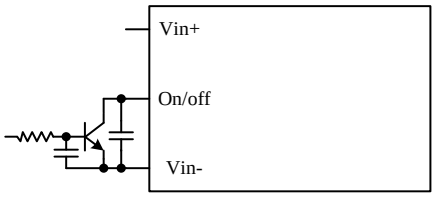

Figure 2. Control with open collector/drain circuit

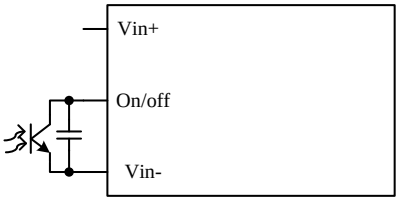

Figure 3. Control with photocoupler circuit

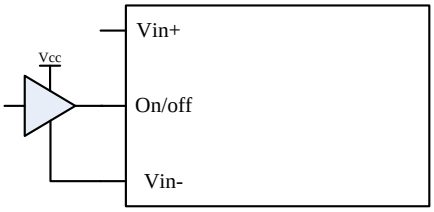

Figure 4. Control with logic circuit

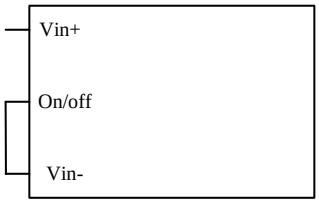

Figure 5. Permanently on

8. INPUT REFLECTED RIPPLE CURRENT

Testing setup

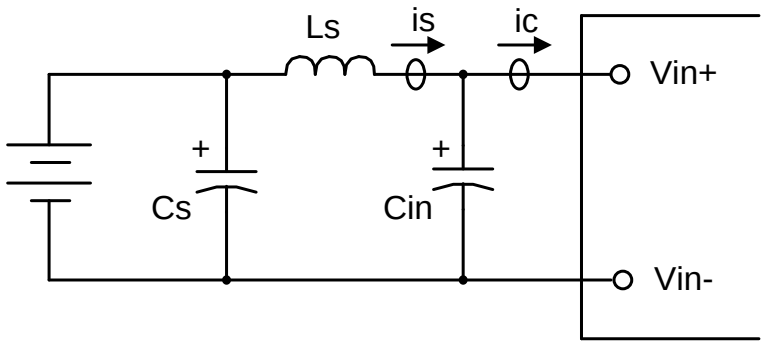

Figure 6.

Notes and values in testing:

is: Input Reflected Ripple Current
ic: Input Terminal Ripple Current
Ls: Simulated Source Impedance (12 µH)
Cs: Offset possible source Impedance (220 µF, ESR < 0.2 Ω @ 100 kHz, 20°C)
Cin: Capacitor should be as close as possible to the power module to damp ic ripple current and enhance stability.
Recommendation: 47 µF / 100 V, Aluminum electrolytic, 100ZL47M.

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

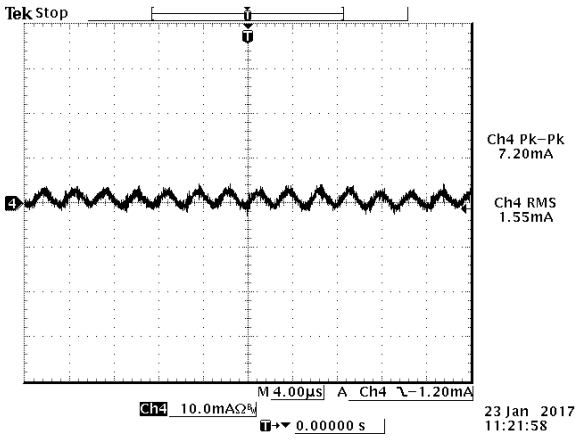

Figure 7. is (input reflected ripple current), AC component

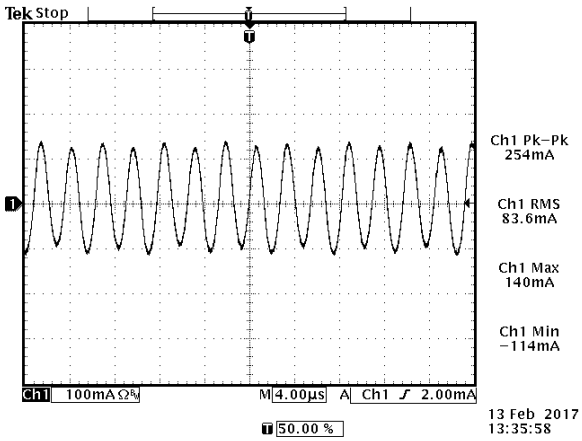

Figure 8. ic (input terminal ripple current), AC component

Note: Vin = 48 V, Vo = 3.3 V, Io = 54 A, with 2*47 µF ceramic, 1*270 µF+1*680 µF OSCON and 1*10 µF Tantalum at the output, Ta = 25 °C.

9. OVER CURRENT PROTECTION

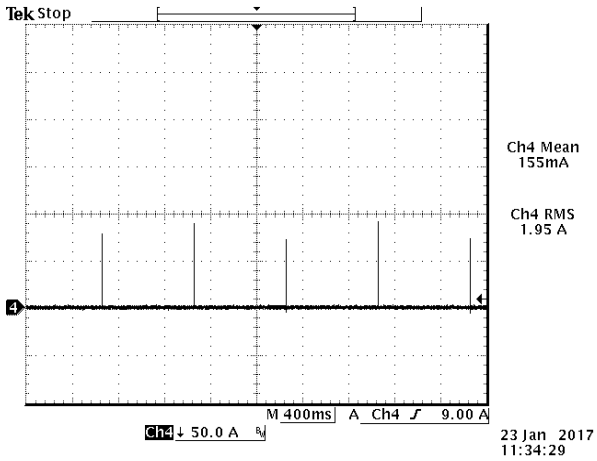

Figure 9. Vin = 48 V @ Ta = 25°C

10. RIPPLE AND NOISE WAVEFORM

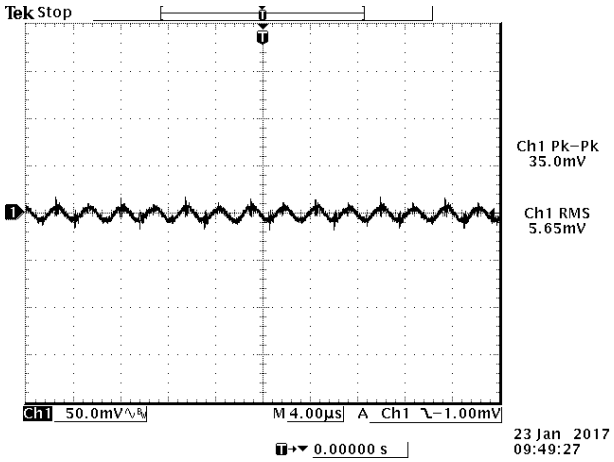

Figure 10. Vin = 48 V, Vo = 3.3 V, Io = 60 A

Note: Ripple and noise at full load, 0 – 20 MHz BW, with 2*47 µF ceramic, 1*270 µF+1*680 µF OSCON and 1*10 µF Tantalum at the output, Ta = 25 °C.

11. TRANSIENT RESPONSE WAVEFORMS

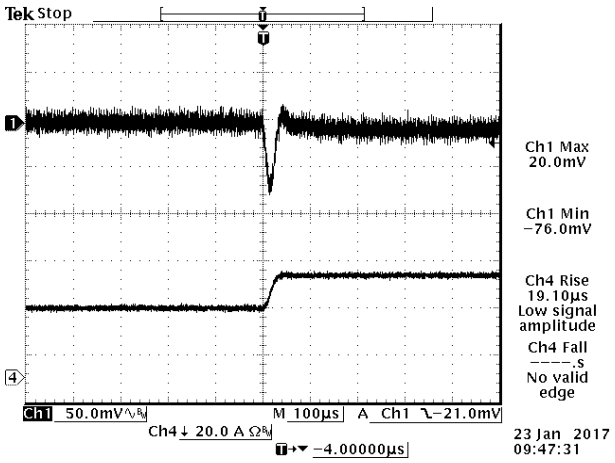

Figure 11. Vin = 48 V, Vo = 3.3 V, Io = 30 A – 45 A, di/dt = 1 A/µs

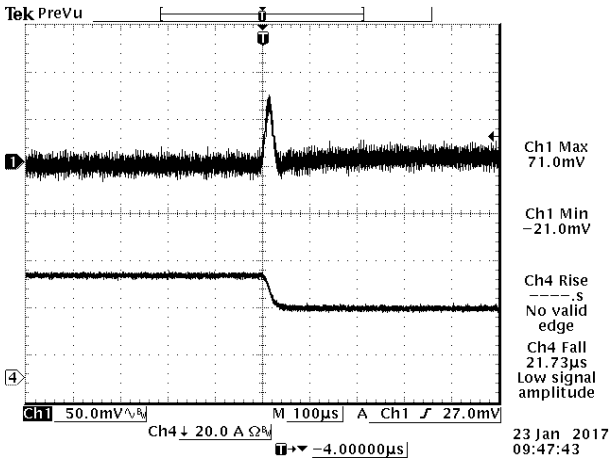

Figure 12. Vin = 48 V, Vo = 3.3 V, Io = 45 A – 30 A, di/dt = 1 A/µs

Note: Transient response at di/dt = 1 A/µs, 0 – 20 MHz BW, with 2*47 µF ceramic, 1*270 µF+1*680 µF OSCON and 1*10 µF Tantalum at the output, Ta = 25 °C.

12. STARTUP

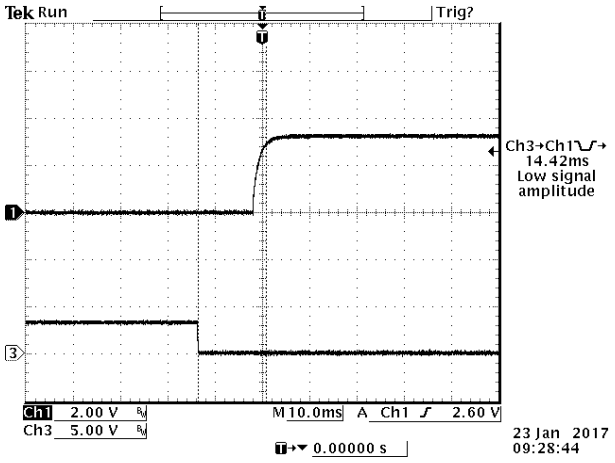

Figure 13. CH1: Vout, CH3: ENABLE
Vin = 48 V, Vo = 3.3 V, Io = 60 A

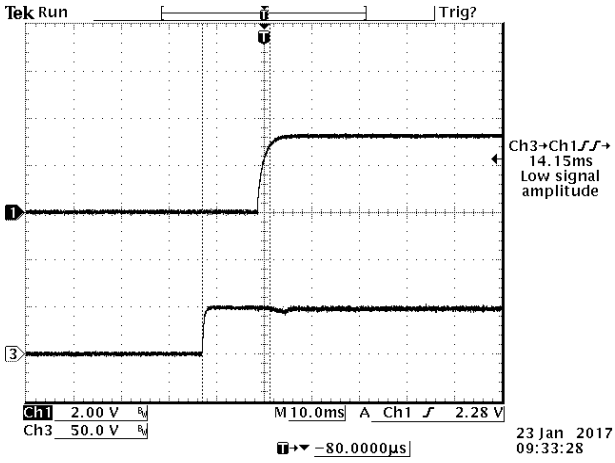

Figure 14. CH1: Vout, CH3: Vin
Vin = 48 V, Vo = 3.3 V, Io = 60 A

Note: With 2*47 µF ceramic, 1*270 µF+1*680 µF OSCON and 1*10 µF Tantalum at the output, Ta = 25 °C.

13. INPUT UNDER-VOLTAGE LOCKOUT

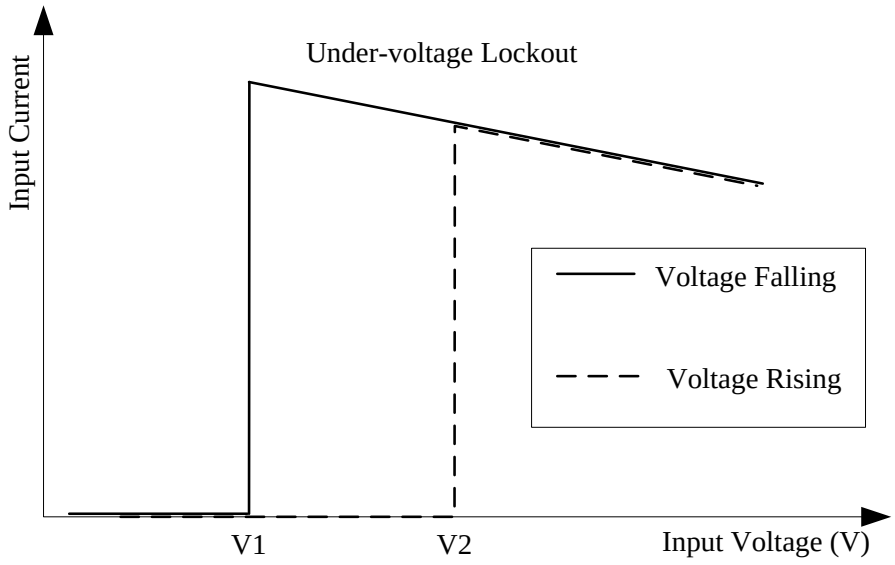

Figure 15. Input under-voltage lockout

V1 = 32.5 V

V2 = 34.5 V

14. TRIM

Output voltage adjustment by applying external current (Itrim), the Itrim is the output of source/sink current DAC IC, such as DS4424.

Trim test circuit:

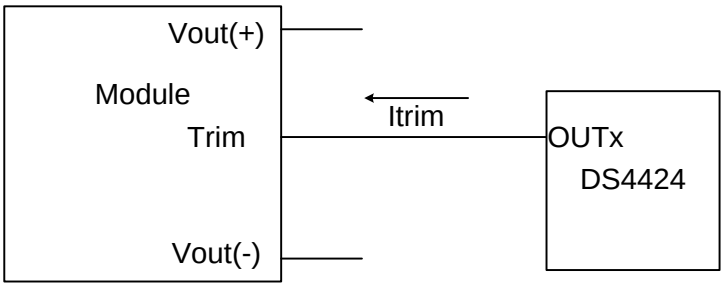

Figure 16. Trim test circuit

The characteristic of output voltage vs Itrim:

Itrim(uA)	Vout(V)
+50	3.63
+25	3.465
0	3.3
-25	3.135
-50	2.97

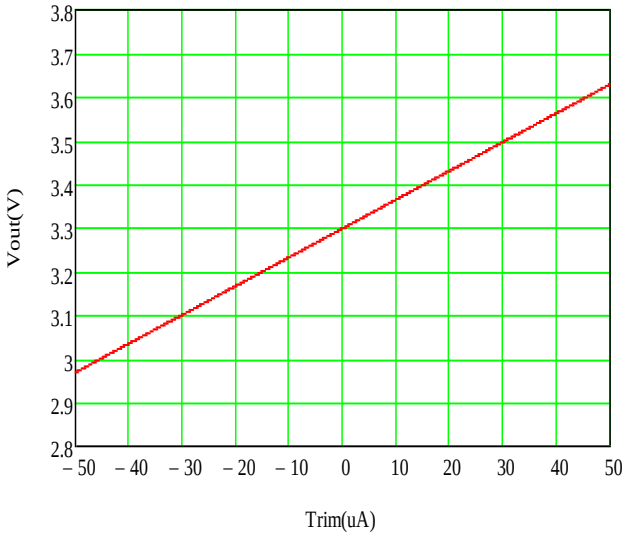

Figure 17. Trim derating curve

15. THERMAL DERATING CURVES

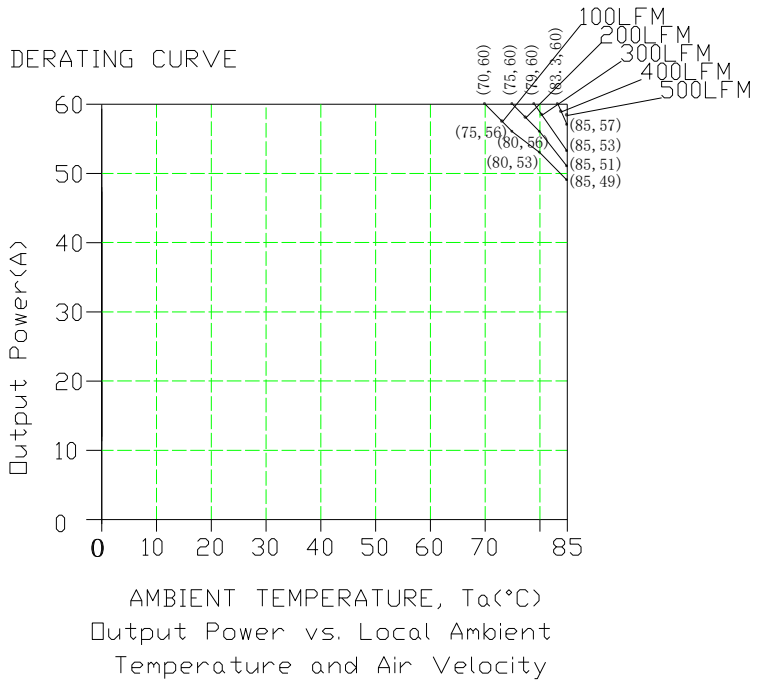

Figure 18. Thermal derating curve @ Vin = 48 V, Vo = 3.3 V

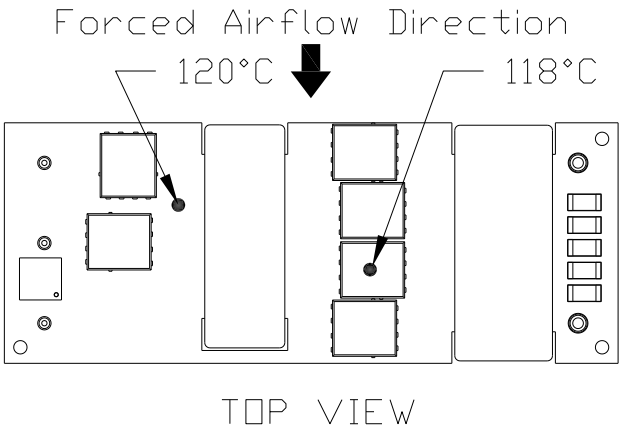

Figure 19. Temperature reference points on top side and airflow direction

16. SOLDERING INFORMATION

The modules are designed to be compatible with a Paste-In-Hole assembly process. The suggested Pb-free solder paste is Sn/Ag/Cu(SAC). The recommended reflow profile using Sn/Ag/Cu solder is shown in the following. Recommended reflow peak temperature is 245 °C while the part can withstand peak temperature of 260 °C maximum for 10seconds. This profile should be used only as a guideline. Many other factors influence the success of SMT reflow soldering. Since your production environment may differ, please thoroughly review these guidelines with your process engineers.

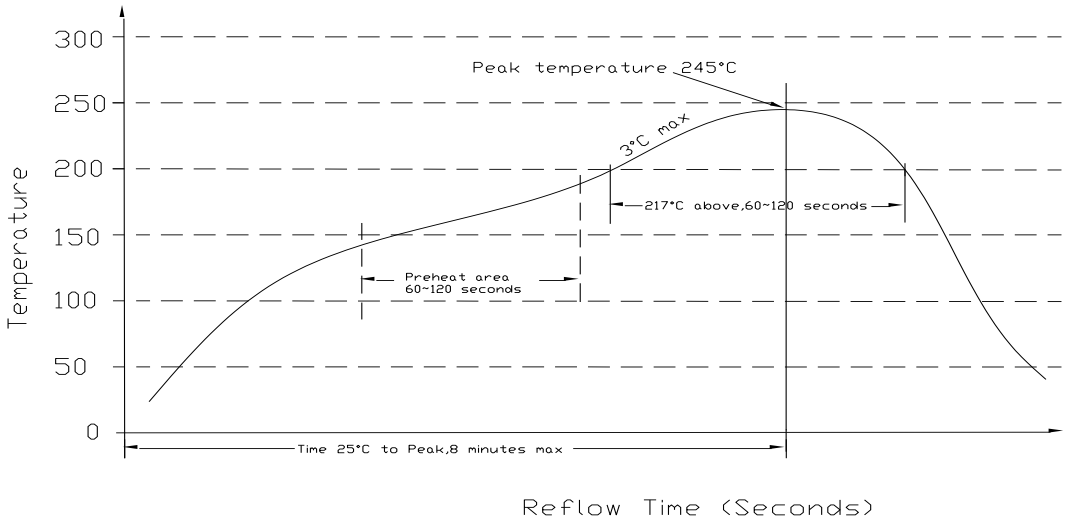

Figure 20. Soldering information

17. MSL RATING

The modules have a MSL rating of 3.

18. STORAGE AND HANDLING

They are designed to be compatible with J-STD-033 Rev:A (Handling, Packing, Shipping and Use of Moisture /Reflow Sensitive surface Mount devices). Moisture barrier bags (MBB) with desiccant are applied. The recommended storage environment and handling procedure is detailed in J-STD-033.

19. PRE-BAKING

These components have been designed, handled, and packaged ready for pb-free reflow soldering. If the assembly shop follows J-STD-033 guidelines, no pre-bake of this component is required before being reflowed to a PCB. Our packaging tray can only withstand temperature of 70°C max.

20. MECHANICAL DIMENSIONS

OUTLINE

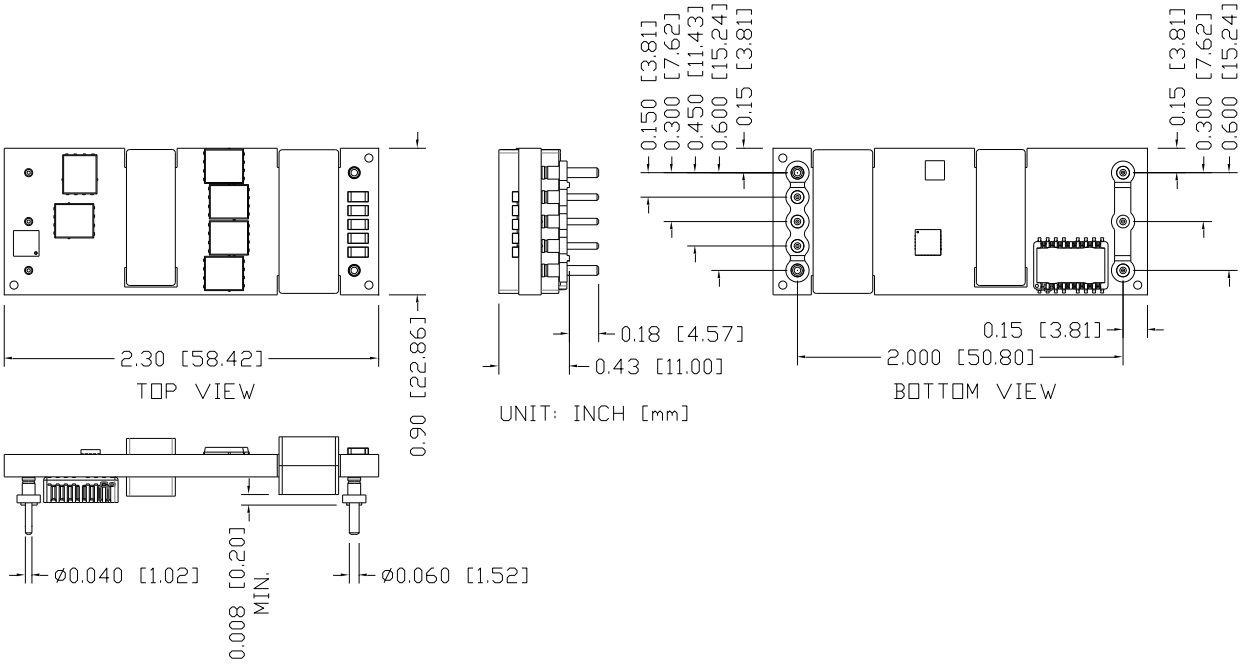

Figure 21. Outline

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

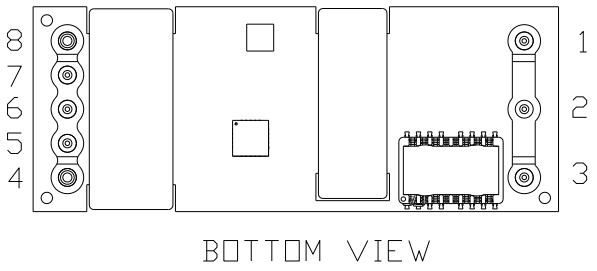

Figure 22. Pins

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

RECOMMENDED PAD LAYOUT

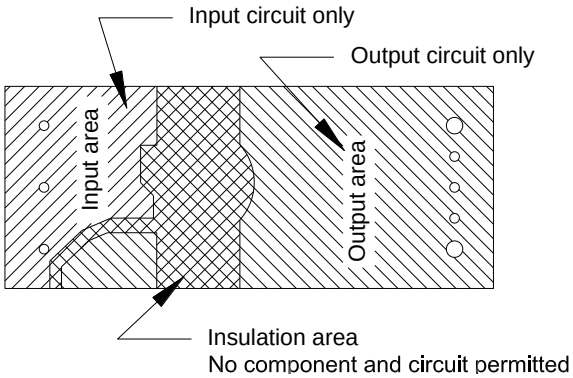

Figure 23. Recommend pad layout-1

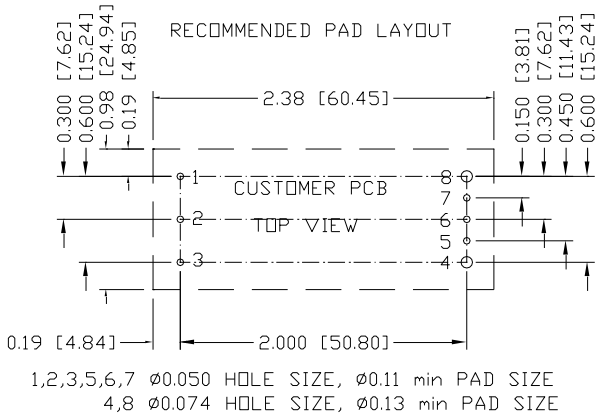

Figure 24. Recommend pad layout-2

21. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2016-09-29	AA	First release.	XF.Jiang
2017-01-25	AB	Update input current, Input Reflected Ripple Current, turn on/off voltage Threshold, line regulation, load regulation, regulation over temperature, output ripple and noise, rise time, turn on time, output capacitance, transient response, efficiency, switching frequency, add efficiency data, transient response, ripple and noise, input ripple and noise, start up, OCP, update mechanical outline, UVLO.	XF.Jiang
2017-02-20	AC	Update input reflected ripple current, output ripple and noise, transient response, add thermal derating curve, update input noise.	XF.Jiang
2017-05-19	AD	Update Overshoot, Change FIT to MTBF, Delete Case.	XF.Jiang
2017-11-27	AE	Correct pin length and pin notes.	J.Yao
2018-08-16	AF	Update the form and add soldering information.	J.Yao
2020-10-14	AG	Delete 0RCY-D4T033.	XF.Jiang
2021-05-04	AH	Add object ID.	XF.Jiang
2022-09-21	AJ	Update load regulation max value, regulation over temperature max value and total output voltage range. Add recommend pad layout for customer. Delete input over voltage lockout description. Add output over-voltage protection note: latch. Change isolation voltage unit to VDC.	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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