

ORCY-D4T03x

Isolated DC-DC Converter

The ORCY-D4T03x is an isolated DC/DC converter that operate from a nominal 48 Vdc source. This unit provides up to 198W of output power from a nominal 48 Vdc input. This unit is designed to be highly efficient and low cost.

Features include remote on/off, short circuit protection, over current protection, undervoltage lockout and over-temperature protection.

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

Key Features & Benefits

- 40-60 VDC Input / 3.3 VDC @ 60 A Output
- 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
- Low Cost
- Basic Isolation
- Input Over Voltage Lockout
- Approved to UL/CSA 62368-1 (pending)
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)



Applications

- Networking
- Computers and peripherals
- Telecommunications

Option

- Remote ON/OFF Logic
- Baseplate

1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
ORCY-D4T03L	3.3 VDC	40-60 VDC	60 A	198 W	94.5%
ORCY-D4T033	3.3 VDC	40-60 VDC	60 A	198 W	94.5%

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

PART NUMBER EXPLANATION

0	R	CY	-	D4	T	03	x	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
Through hole mount	RoHS	1/8 th Brick		198 W	40-60 V	3.3 V	L – Active low, Open frame 3 – Active high, Open frame	G – Tray package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous Non-operating Input Voltage		-0.3	-	60	V
Input Transient Voltage	100ms maximum	-	-	80	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		-	-	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 40V 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)	$V_{in}=48V$, $V_o=3.3V$, $I_o=60A$, With 1*12uH inductor +47uF aluminum electrolytic capacitor at the input	-	7	20	mA
Input Reflected Ripple Current (rms)		-	260	360	mA
I^2t Inrush Current Transient		-	2	4	mA
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

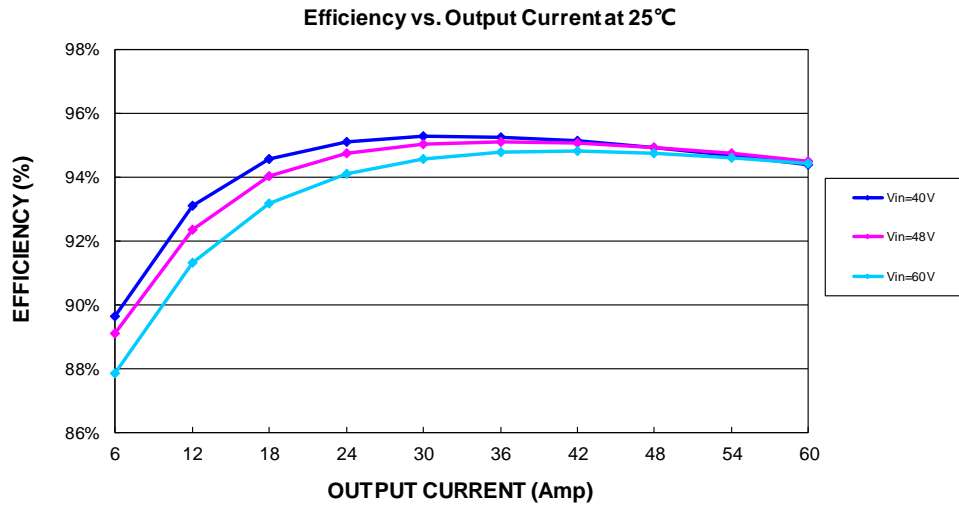
All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	Vin=48V, Io=50% load at 25C ambient.	3.267	3.300	3.333	V
Load Regulation	Vin=48V, Io=0~100% load at 25C ambient.	-	2	10	mV
Line Regulation	Vin=40-60V, Io=50% load at 25C ambient.	-	2	10	mV
Regulation Over Temperature (-40deg.C-85deg.C)		-	10	40	mV
Total output voltage range	Over sample load,line and temperature	3.230	-	3.37	V
Output over voltage	Vin=48V, Io=50% load at 25C ambient.	-	4.3	-	V
Output Ripple and Noise(Pk-Pk) ²	Vin=48V, Io=54A, 5Hz to 20MHz bandwidth, with 47uF*2pcs ceramic, 270uF+680uF oscon, 10uF Tantalum at the output	-	20	40	mV
Output Ripple and Noise(RMS) ²		-	5	10	mV
Output Ripple and Noise(Pk-Pk) ²	Vin=48V, full Load, 5Hz to 20MHz bandwidth, with 47uF*2pcs ceramic, 270uF+680uF oscon, 10uF Tantalum at the output	-	35	50	mV
Output Ripple and Noise(RMS) ²		-	5	10	mV
Output Ripple and Noise(Pk-Pk) under worst case	over all operating input voltage, 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 ² s
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	Minmum cap means 47uF*2pcs ceramic, 270uF+680uF oscon, 10uF Tantalum	1054	-	10000	uF
Transient Response					
ΔV 50% - 75% of 54A		-	65	80	mV
ΔV 50%~75% of Max Load		-	70	90	mV
Settling Time	di/dt=1A/μ s, Vin=48Vdc, Ta=25°C, with 47uF*2pcs ceramic, 270uF+680uF oscon, 10uF Tantalum at the output	-	40	80	us
ΔV 75% - 50% of 54A		-	65	80	mV
ΔV 75%~50% of Max Load		-	70	90	mV
Settling Time		-	40	80	us

5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	The efficiency is measured at Vin=48V, 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 300LFM	-	6,957,514	-	hours
Weight	ORCY-D4T033/L	-	34.3	-	g
Dimensions					
Inches (L x W x H)	ORCY-D4T033/L		2.30 x 0.90 x 0.43		Inches
Millimeters (L x W x H)			58.42 x 22.86 x 11.00		Millimeters
<i>Isolation Characteristics</i>					
Input to Output		-	-	1500	V
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

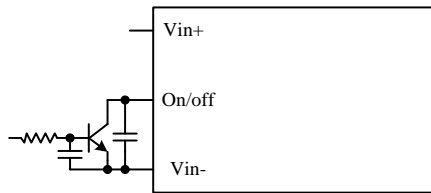
6. EFFICIENCY DATA



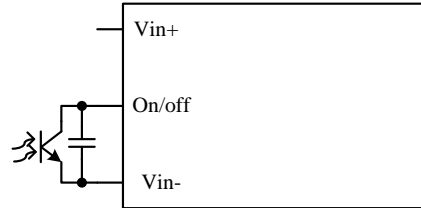
7. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Signal Low (Unit On)	Active Low	0RCY-D4T03L	-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-D4T033	-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

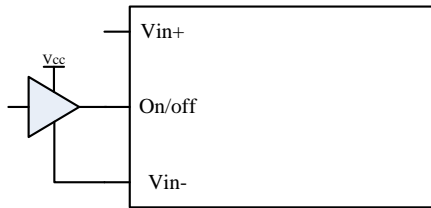
Recommended remote on/off circuit for active low



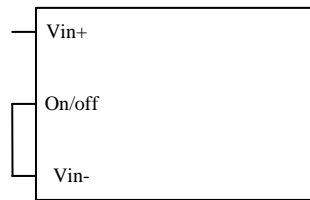
Control with open collector/drain circuit



Control with photocoupler circuit

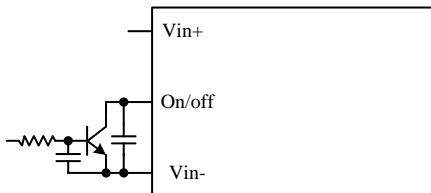


Control with logic circuit

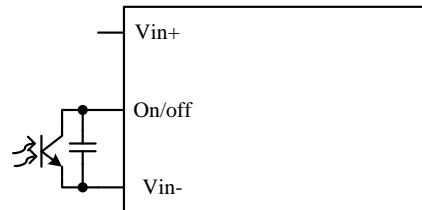


Permanently on

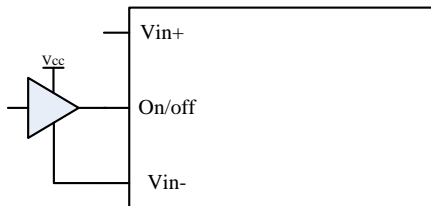
Recommended remote on/off circuit for active high



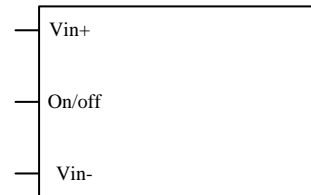
Control with open collector/drain circuit



Control with photocoupler circuit



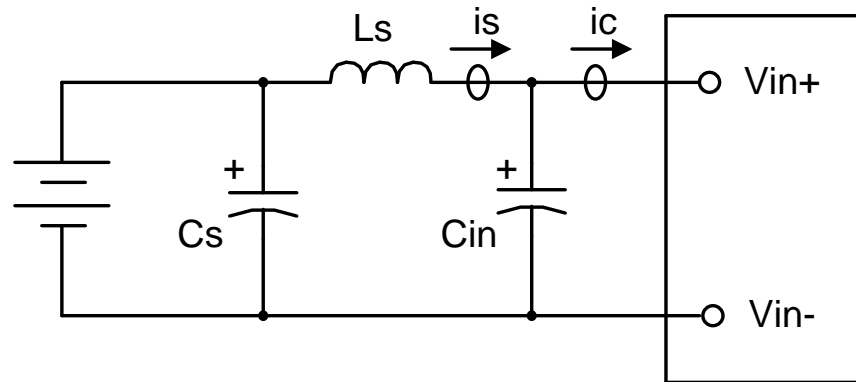
Control with logic circuit



Permanently on

8. INPUT REFLECTED RIPPLE CURRENT

Testing setup



Notes and values in testing.

is: Input Reflected Ripple Current

ic: Input Terminal Ripple Current

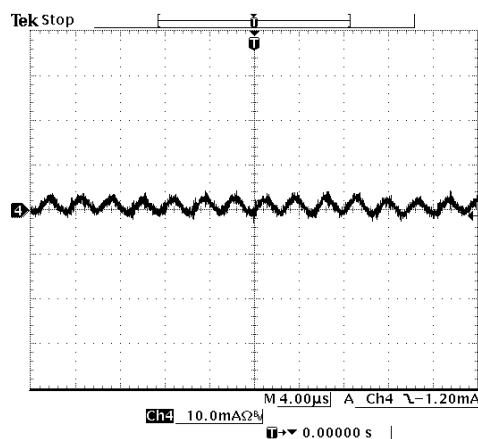
Ls: Simulated Source Impedance (12 μ H)

Cs: Offset possible source Impedance (220 μ F, ESR<0.2 Ω @ 100kHz, 20C)

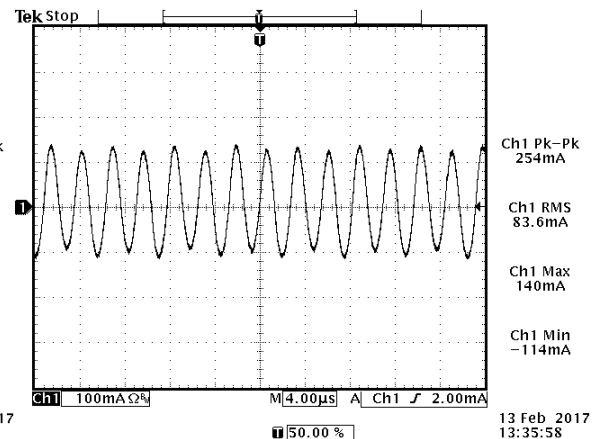
Cin: Capacitor should be as closed as possible to the power module to swallow ic ripple current and help with stability.

Recommendation: 47 μ F/100V, Aluminum electrolytic, 100ZL47M

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



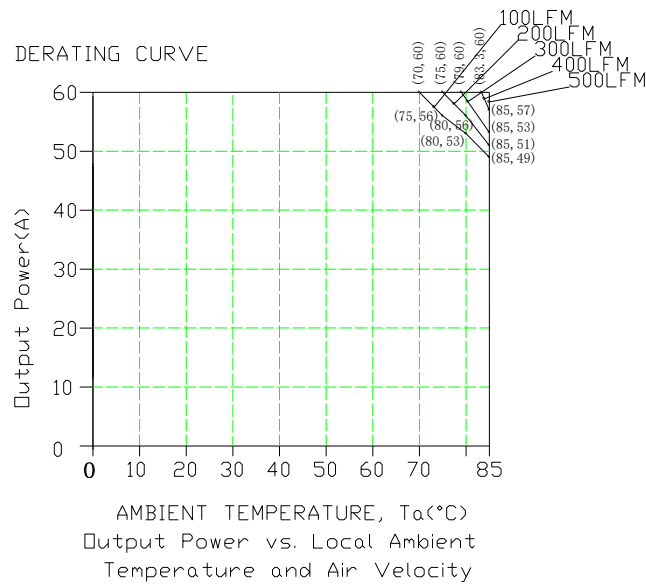
is (input reflected ripple current), AC component



ic (input terminal ripple current), AC component

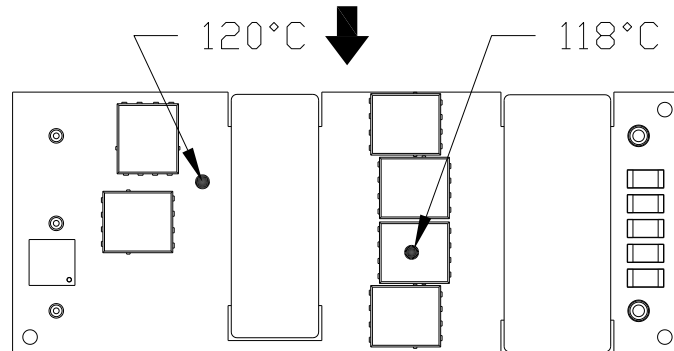
Note: Vin=48V, Vo=3.3V, Io=54A, with 2*47 μ F ceramic, 1*270 μ F+1*680 μ F OSCON and 1*10 μ F Tantalum at the output, Ta=25 deg C.

9. THERMAL DERATING CURVES



$V_{in}=48V, V_o=3.3V$

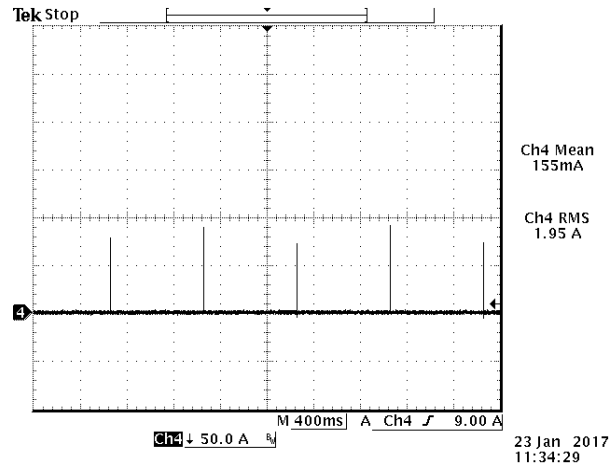
Forced Airflow Direction



TOP VIEW

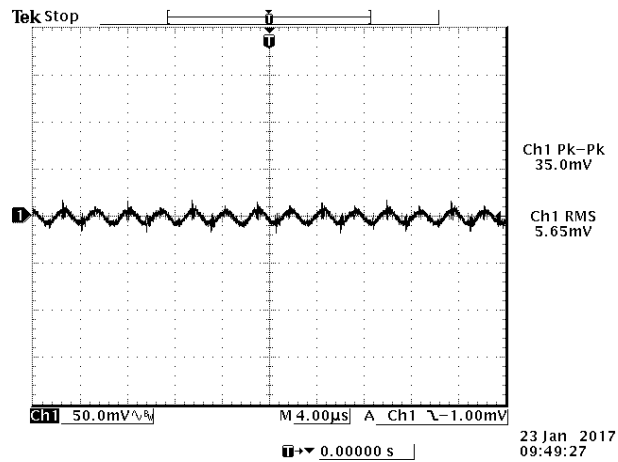
Temperature reference points on top side

10. OVER CURRENT PROTECTION



$V_{in}=48V@T_a=25^{\circ}C$

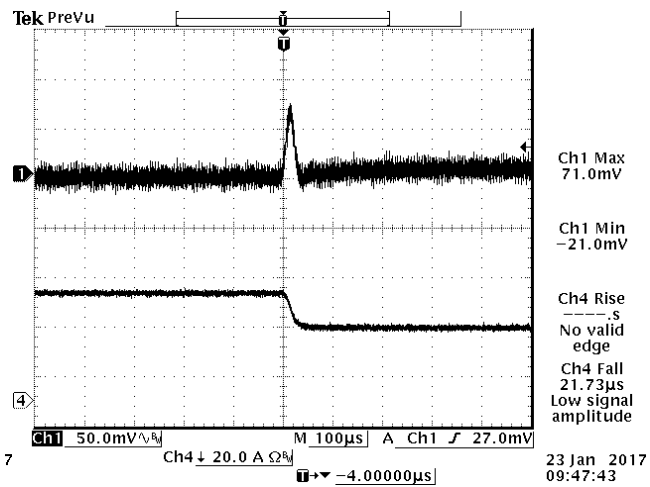
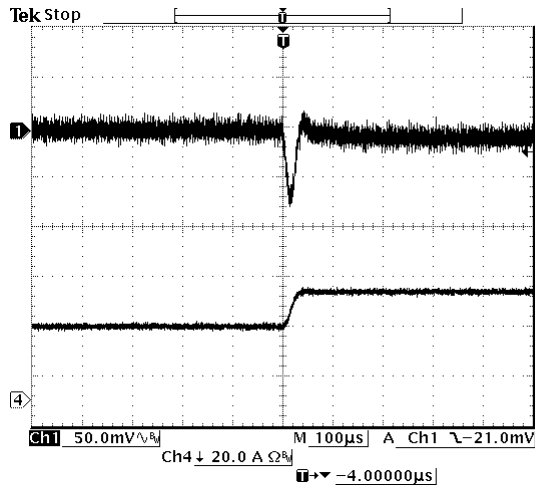
11. RIPPLE AND NOISE WAVEFORM



$V_{in}=48V, V_o=3.3V, I_o=60A$

Note: Ripple and noise at full load, 0-20MHz BW, with 2*47uF ceramic, 1*270uF+1*680uF OSCON and 1*10uF Tantalum at the output, $T_a=25$ deg C.

12. TRANSIENT RESPONSE WAVEFORMS



$V_{in}=48V, V_o=3.3V, I_o=30A-45A, di/dt=1A/\mu s$

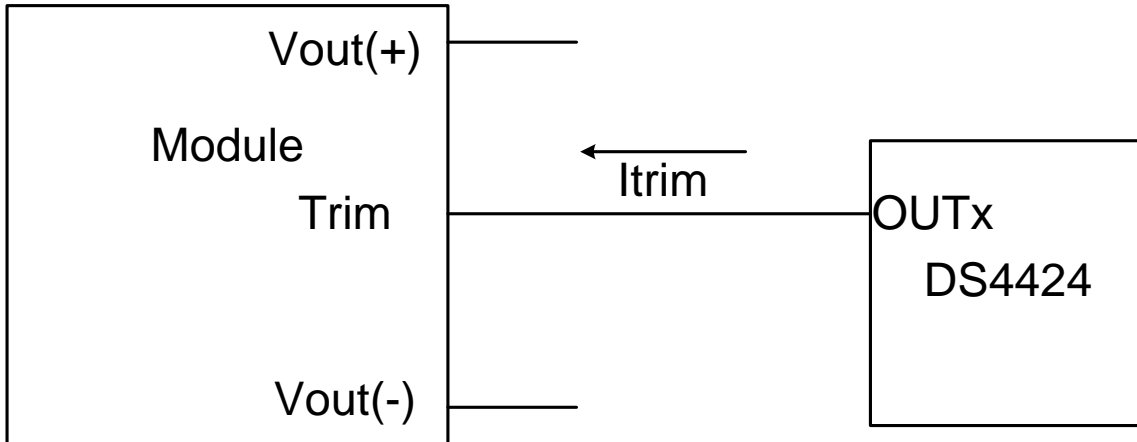
$V_{in}=48V, V_o=3.3V, I_o=45A-30A, di/dt=1A/\mu s$

Note: Transient response at $di/dt=1A/\mu s$, 0-20MHz BW, with 2*47µF ceramic, 1*270µF+1*680µF OSCON and 1*10µF Tantalum at the output, $T_a=25$ deg C.

14. TRIM

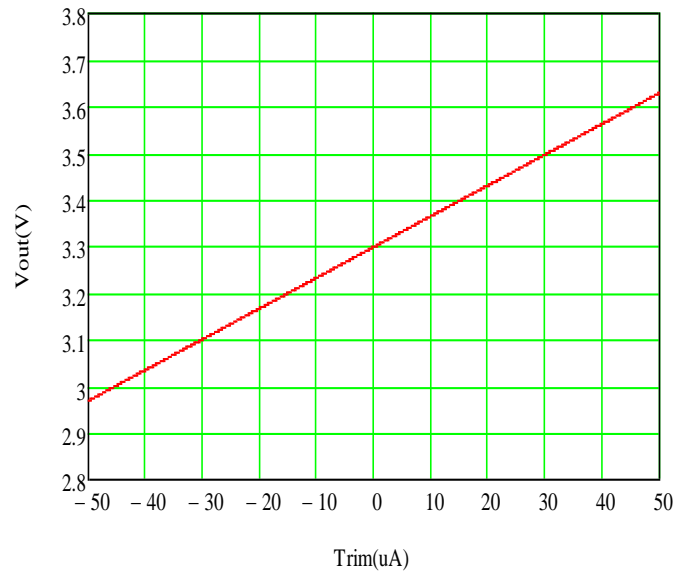
Output voltage adjustment by applying external current (I_{trim}), the I_{trim} is the output of source/sink current DAC IC, such as DS4424.

Trim test circuit

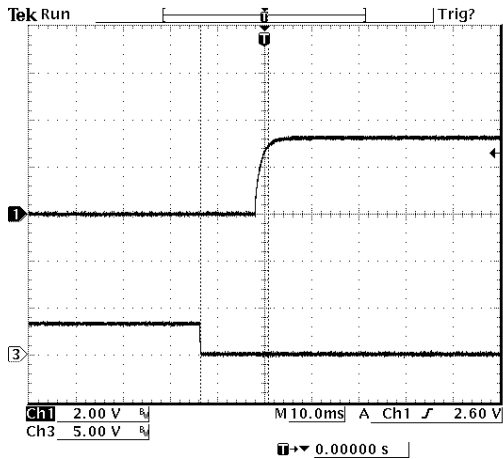


The characteristic of output voltage vs I_{trim}

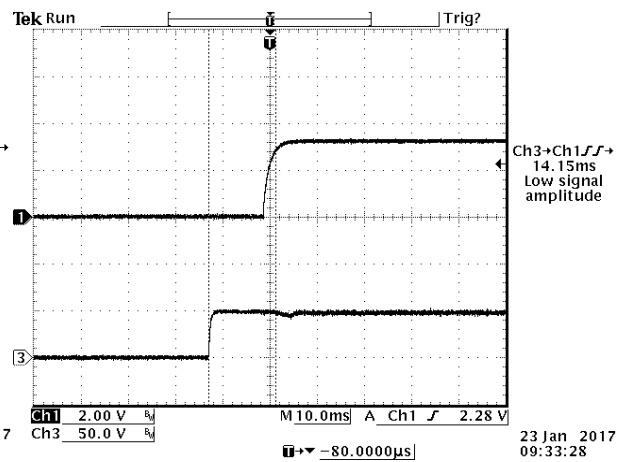
$I_{trim}(\mu A)$	$V_{out}(V)$
+50	3.63
+25	3.465
0	3.3
-25	3.135
-50	2.97



15. STARTUP



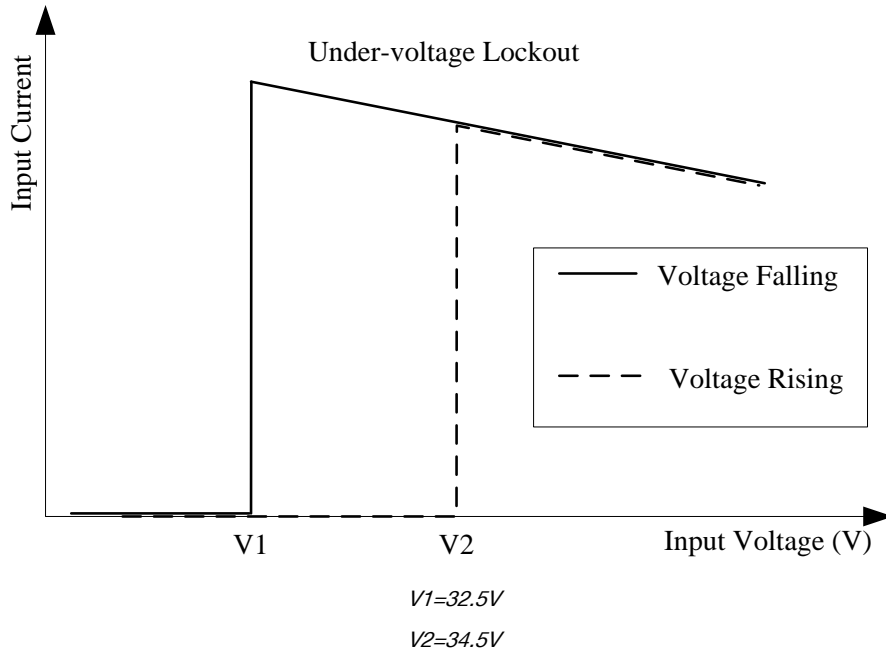
CH1=Vout, CH3=ENABLE
Vin=48V, Vo=3.3V, Io=60A



CH1=Vout, CH3=Vin
Vin=48V, Vo=3.3V, Io=60A

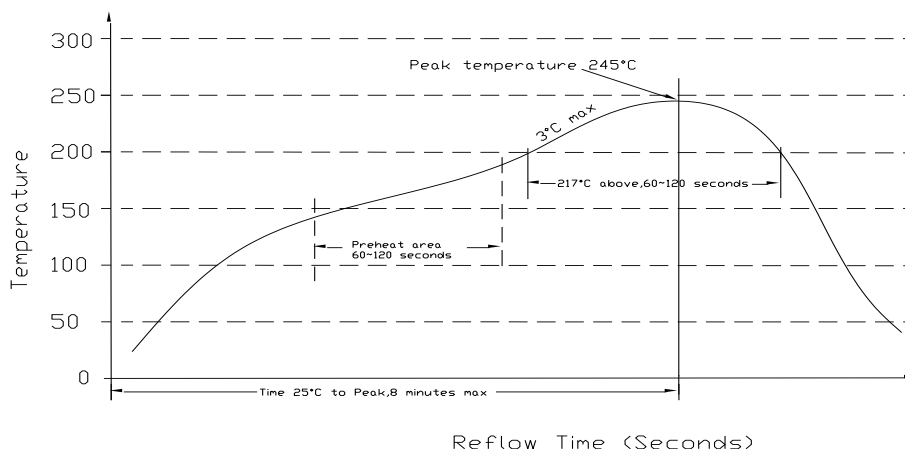
Note: With 2*47uF ceramic, 1*270uF+1*680uF OSCON and 1*10uF Tantalum at the output, Ta=25 deg C.

16. INPUT UNDER-VOLTAGE LOCKOUT



17. SOLDERING INFORMATION

The ORCY-D4T03x 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.



18. MSL RATING

The ORCY-D4T03x modules have a MSL rating of 3.

19. STORAGE AND HANDLING

The ORCY-D4T03x modules 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.

20. PRE-BAKING

This component has 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.



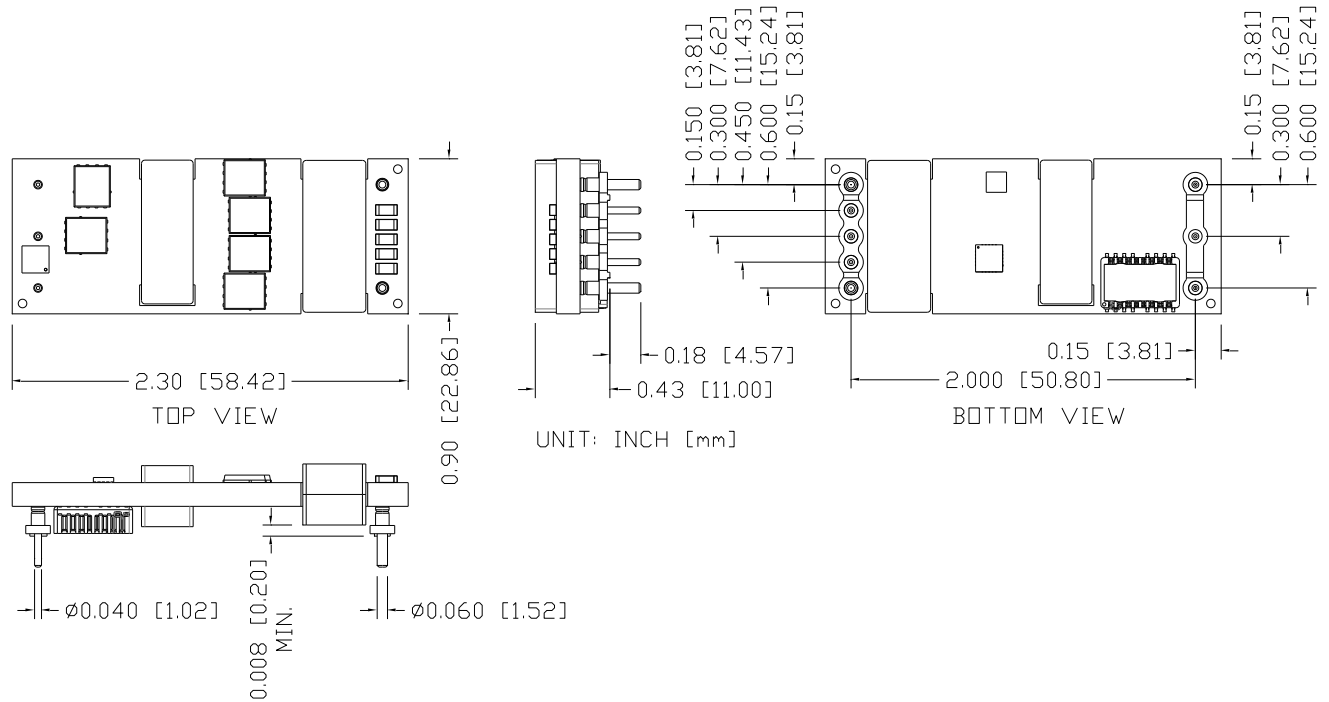
Asia-Pacific
+86 755 298 85888

Europe, Middle East
+353 61 225 977

North America
+1 408 785 5200

21. MECHANICAL DIMENSIONS

OUTLINE

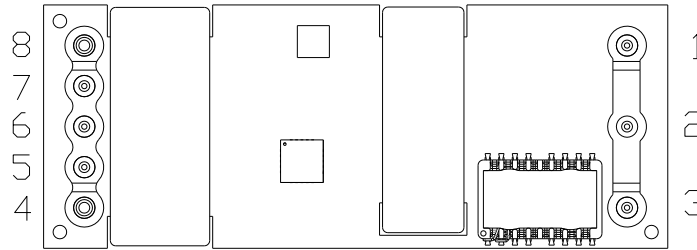


NOTES:

- 1) All Pins: Material - Copper Alloy;
Finish - 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.
- 2) Undimensioned 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].

MECHANICAL DIMENSIONS(CONTINUED)

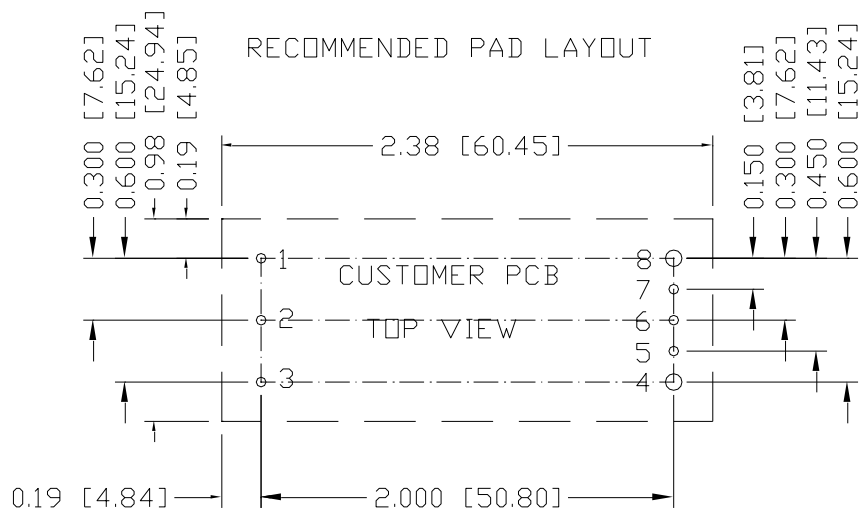
PIN DEFINITIONS



BOTTOM VIEW

PIN	NAME	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



1,2,3,5,6,7 \varnothing 0.050 HOLE SIZE, \varnothing 0.11 min PAD SIZE
 4,8 \varnothing 0.074 HOLE SIZE, \varnothing 0.13 min PAD SIZE

22. 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

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.