

0RCY-D4T12x

Isolated DC-DC Converter

The 0RCY-D4T12x is an isolated DC/DC converter that operates from a nominal 48 VDC source. This unit provides up to 240 W 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, under voltage lockout and over-temperature protection. The converter is provided in an industry standard 8th brick package.



Key Features & Benefits

- 48 VDC Input / 12 VDC @ 20 A Output
- 1/8th Brick Converter
- Fixed Frequency (350kHz)
- 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 60950-1, 2nd +A2 version
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

Applications

- Networking
- Computers and Peripherals
- Telecommunications



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1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
ORCY-D4T12F	12 VDC	48 VDC	20A	240 W	95.5%
ORCY-D4T12E	12 VDC	48 VDC	20A	240 W	95.5%

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

PART NUMBER EXPLANATION

0	R	CY	-	D4	T	12	x	y
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	48 V	12 V	F – active low with base plate E – active High with base plate	G – Tray package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous Non-operating Input Voltage		-0.3	-	80	V
Input Transient Voltage	100ms maximum	-	-	100	V
Remote On/Off		-0.3	-	18	V
I/O Isolation Voltage		-	-	2250	V
Ambient Temperature		-40	-	85	°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		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 μ H, 5Hz to 20MHz. Use a 100 μ F/100V electrolytic capacitor with ESR=1 ohm max, at 200KHz@25°C.	-	2	-	mA
Input Reflected Ripple Current (pk-pk)		-	10	-	mA
I ² t Inrush Current Transient		-	-	2	A ² s
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.

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

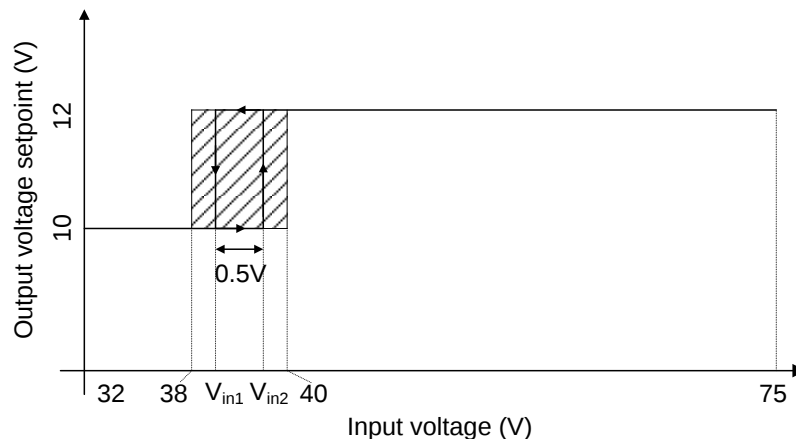
4. OUTPUT SPECIFICATIONS

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=40-75V	11.76	12.00	12.24	V
Load Regulation	Vin=40-75V, Io=0~100% load	-	20	100	mV
Line Regulation	Vin=36-75V, Io=100% load	1.8	2.0	2.2	V
	Vin=40-75V, Io=100% load	-	20	100	mV
Regulation Over Temperature (-40deg.C-85deg.C)	Vin=40-75V	-	20	100	mV
Output Ripple and Noise(pk-pk)	Vin=48V, Io=100%load, 0-20MHz BW, with a 1μF ceramic capacitor, a 10uF Tantalum cap and a 270uF 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 all operating input voltage, 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	A²s
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					
ΔV 50%~75% of Max Load		-	300	-	mV
Settling Time	di/dt=0.1A/μs, Vin=48VDC, with a 1μF ceramic capacitor, a 10μF Tantalum cap and a 270μF AL cap at output.	-	500	-	μs
ΔV 75%~50% of Max Load		-	300	-	mV
Settling Time		-	500	-	μs

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

5. OUTPUT SETPOINT VS. INPUT PLOT



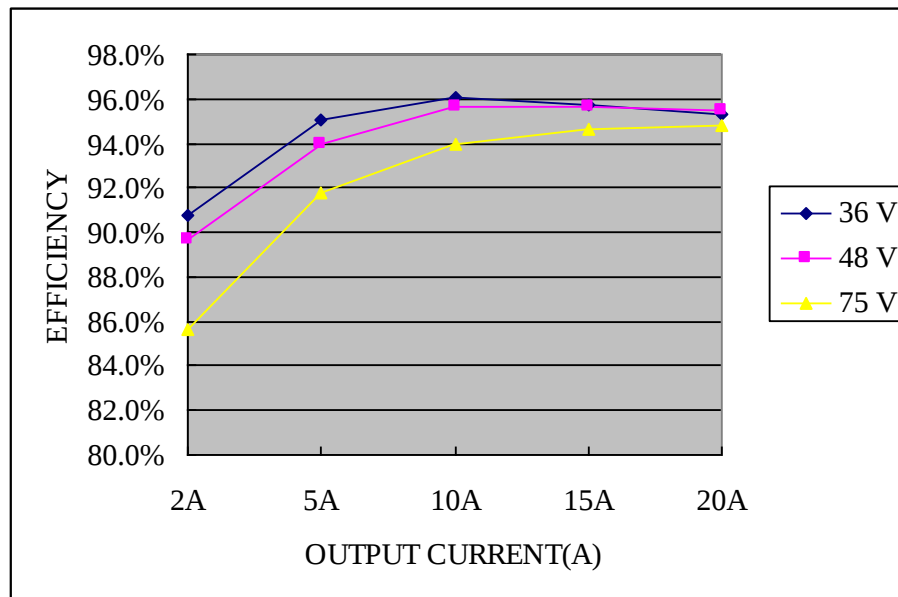
- NOTE:** 1. Output voltage set point is set to 2 different values according to the input voltage range, and the boundary of the input voltage ranges is within 38 - 40V.
 2. There is a ~0.5V hysteresis between Vo setpoint-changing thresholds (shown as Vin1 and Vin2 above).

6. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency (Vin =48V; Io=Io, max)	The efficiency is measured at Vin=48V, full load	-	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=16A, Ta =25°C, FIT=10 ⁹ /MTBF)	-	142	-	
Over Voltage Protection (Static)	Hiccup mode	13.5	13.65	13.8	V
Weight		-	39.7	-	g
Dimensions (L × W × H)		2.30 x 0.90 x 0.48 58.42 x 22.86 x 12.20			inch mm
ISOLATION CHARACTERISTICS					
Input to Output		-	-	2250	V
Input to Case		-	-	2250	V
Output to Case		-	-	500	V
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

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

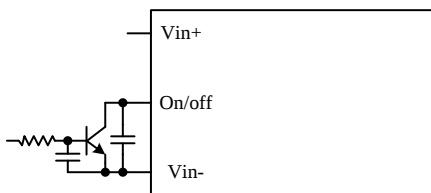
7. EFFICIENCY DATA



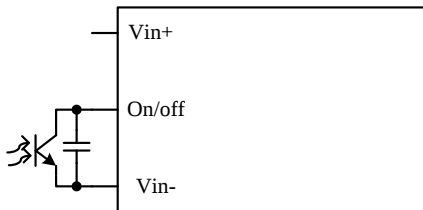
8. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Signal Low (Unit On)	Active Low	0RCY-D4T12F. 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-D4T12E. Remote On/Off pin is open, the module is off.	-0.3	-	0.8	V
Signal High (Unit On)			2.4	-	18	V
Current Sink			0	-	1	mA

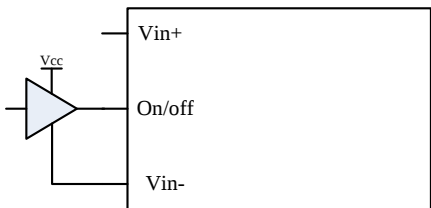
Recommended remote on/off circuit for active low



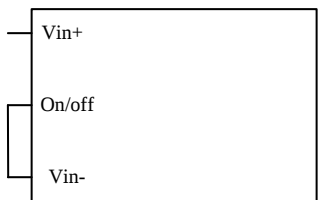
Control with open collector/drain circuit



Control with photocoupler circuit

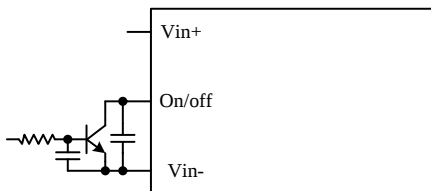


Control with logic circuit

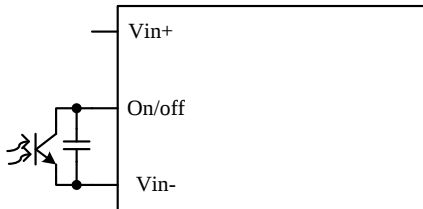


Permanently on

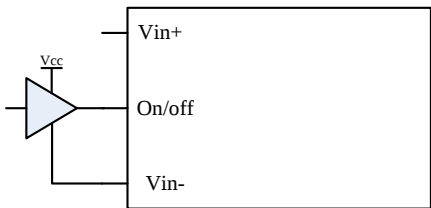
Recommended remote on/off circuit for active high



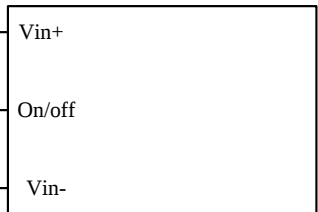
Control with open collector/drain circuit



Control with photocoupler circuit



Control with logic circuit



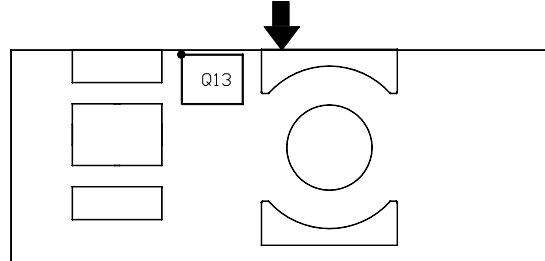
Permanently on

9. THERMAL DERATING CURVE

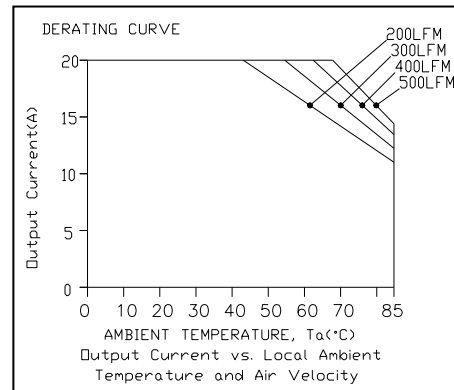
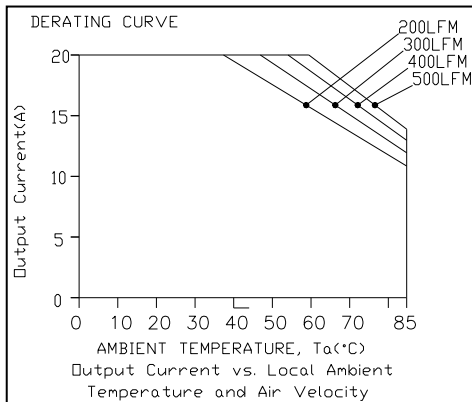
Maximum FET junction temperature derated to 120 °C

The OTP is achieved by temperature sensor U10 and it's in non-latch mode when the hottest component U7 reaches 115°C with 200LFM 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...).

Forced Airflow Direction

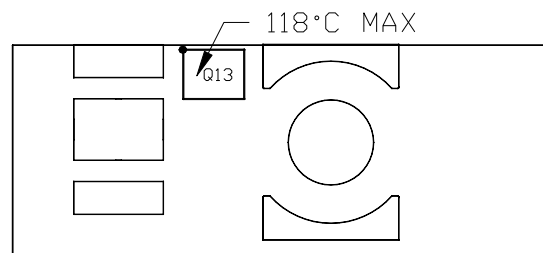


BOTTOM VIEW



$V_{in}=48\text{ V}$
without heat spreader

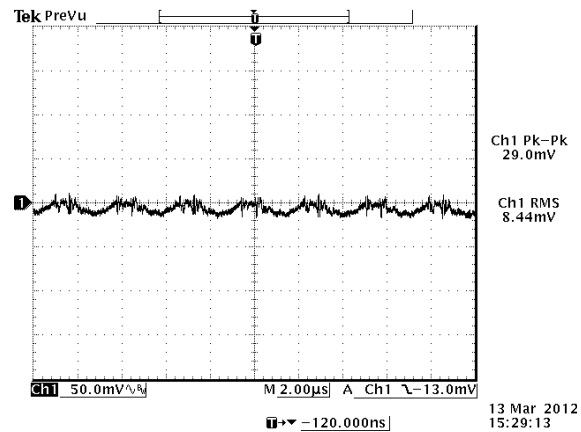
$V_{in}=48\text{ V}$
with heat spreader



BOTTOM VIEW

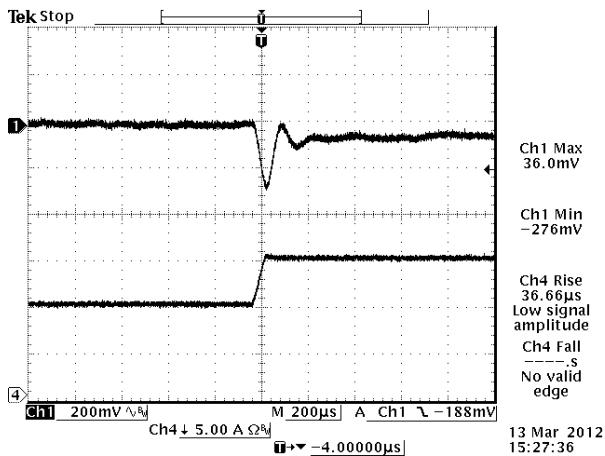
Temperature reference points on bottom side

10. RIPPLE AND NOISE WAVEFORM



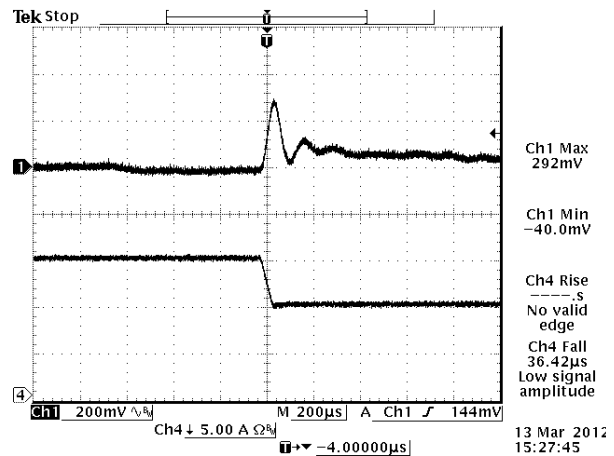
NOTE: Ripple and noise at full load, 48 VDC input, 12 VDC / 20 A output and $T_a=25^\circ\text{C}$, and with a $1\mu\text{F}$ ceramic capacitor, a $10\mu\text{F}$ Tantalum cap and a $270\mu\text{F}$ AL.cap at output.

11. TRANSIENT RESPONSE WAVEFORMS



$V_{out}=12\text{V}$ 50%-75% Load Transients at

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



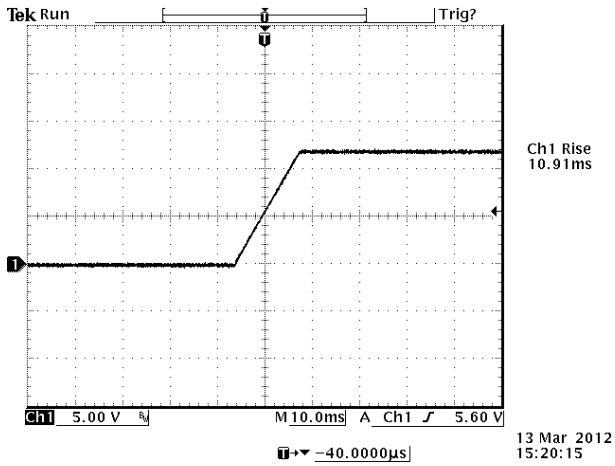
$V_{out}=12\text{V}$ 75%-50% Load Transients at $V_{in}=48\text{V}$

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

NOTE: Transient Response: $di/dt=0.1\text{A}/\mu\text{s}$, with a $1\mu\text{F}$ ceramic capacitor, a $10\mu\text{F}$ Tantalum cap and a $270\mu\text{F}$ AL cap at output.

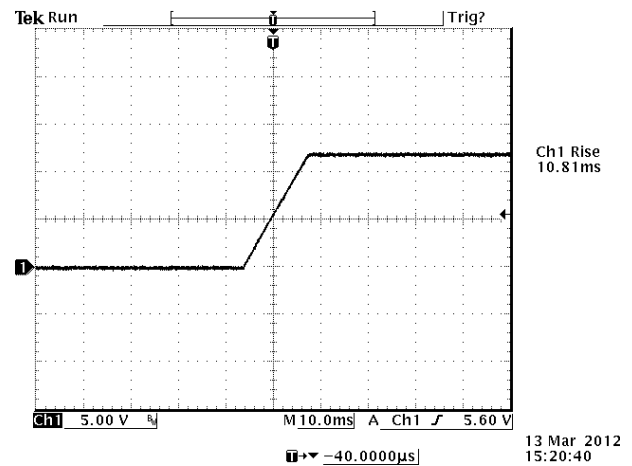
12. STARTUP & SHUTDOWN

RISE TIME



$V_{out} = 12V/20A$ at $V_{in} = 48V @ T_a = 25^\circ C$

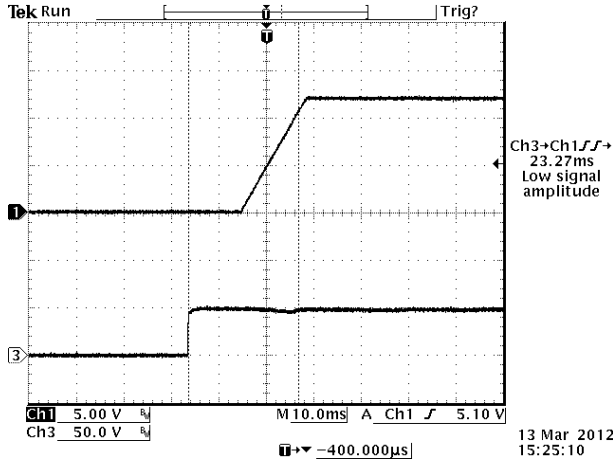
$C_{ext} = 270\mu F$



$V_{out} = 12V/20A$ at $V_{in} = 48V @ T_a = 25^\circ C$

$C_{ext} = 6800\mu F$

STARTUP TIME



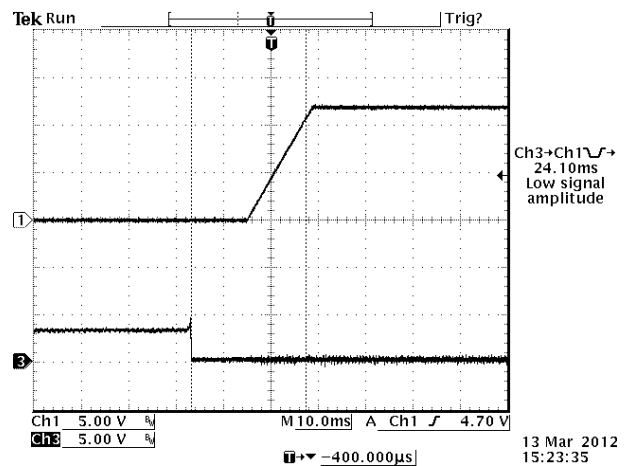
Startup from V_{in}

Ch1: V_o

Ch3: V_{in}

$V_{out} = 12V/20A$ at $V_{in} = 48V @ T_a = 25^\circ C$

$C_{ext} = 6800\mu F$



Startup from on/off

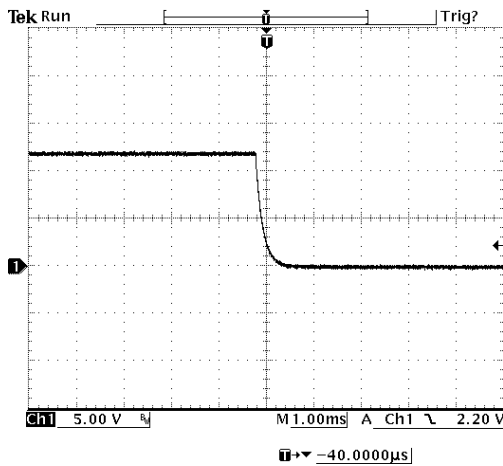
Ch1: V_o

Ch3: on/off

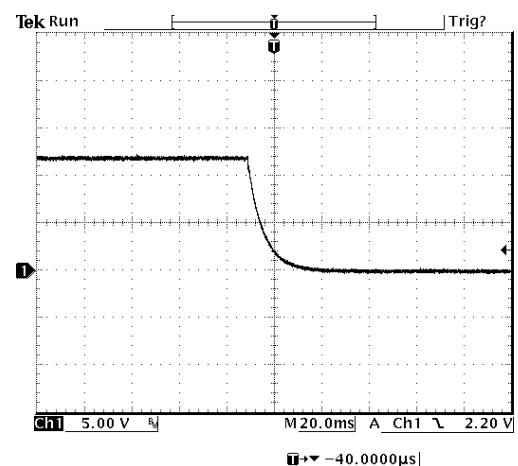
$V_{out} = 12V/20A$ at $V_{in} = 48V @ T_a = 25^\circ C$

$C_{ext} = 6800\mu F$

SHUTDOWN:



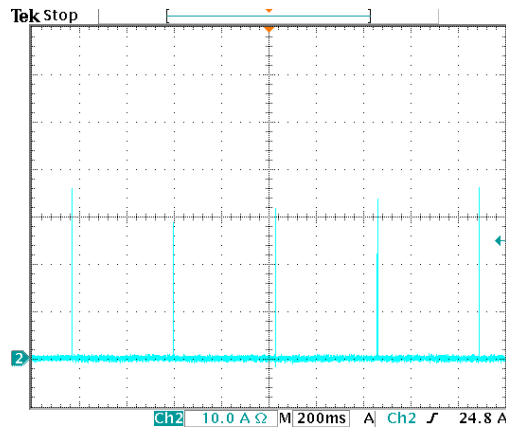
$V_{out} = 12V/20A$ at $V_{in} = 48V @ T_a = 25^\circ C$
 $C_{ext} = 270\mu F$



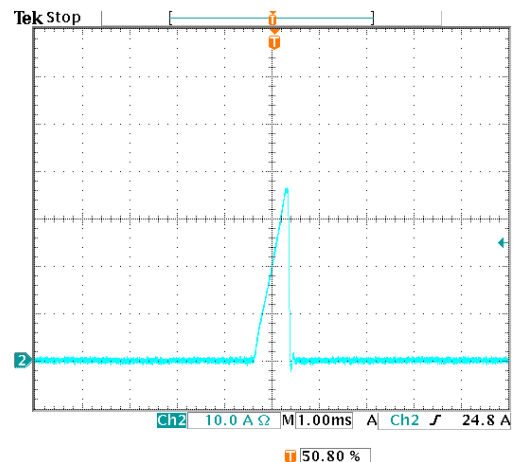
$V_{out} = 12V/20A$ at $V_{in} = 48V @ T_a = 25^\circ C$
 $C_{ext} = 6800\mu F$

13. OCP

To provide protection in a fault output overload condition, the module is equipped with internal over current protection circuitry. If the overcurrent 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.



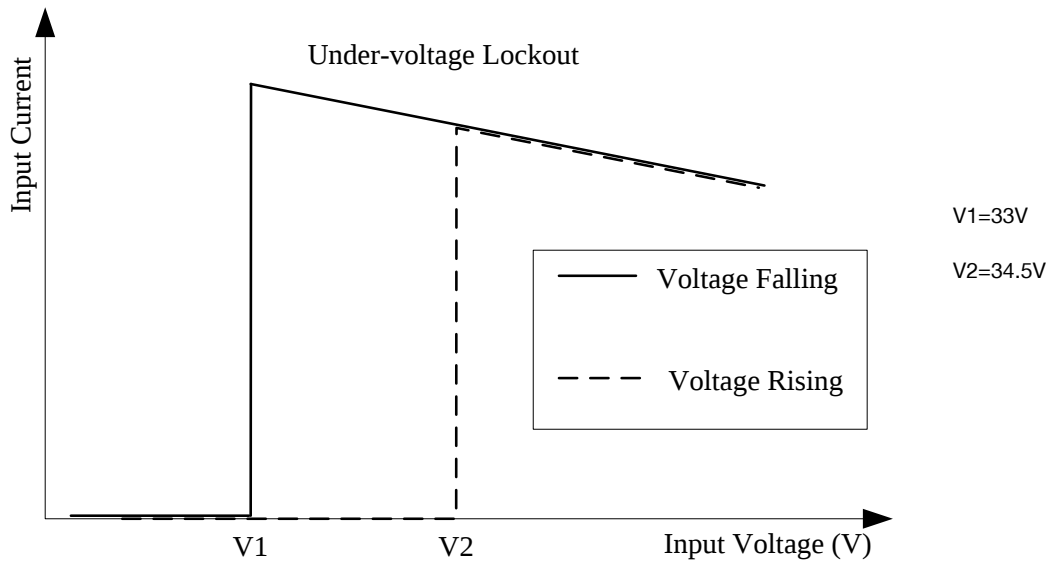
$V_{in} = 48V @ T_a = 25^\circ C$



Expansion of on time portion of above figure

CH2: Output current waveform

14. INPUT UNDER-VOLTAGE LOCKOUT

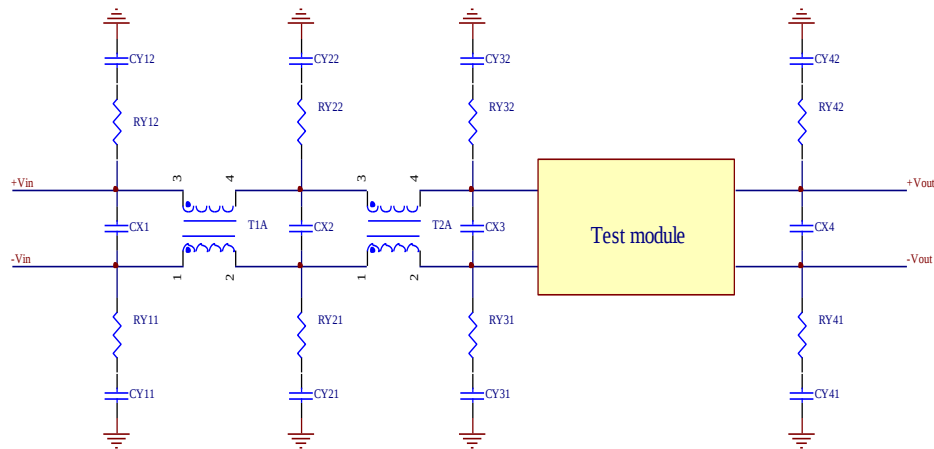


15. SAFETY & EMC

SAFETY :

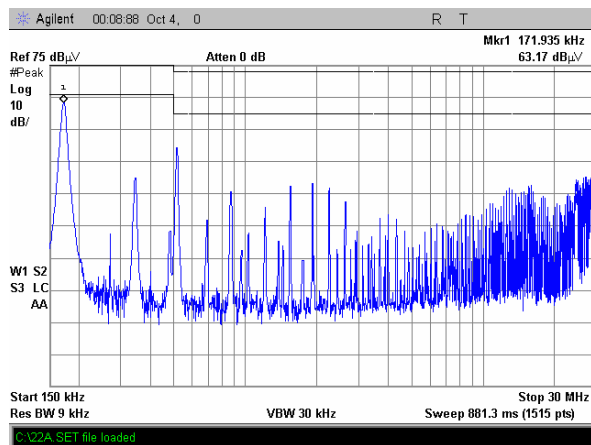
Material flammability: UL94V-0
Compliance to IEC60950-1
Compliance to UL60950-1

SETUP:

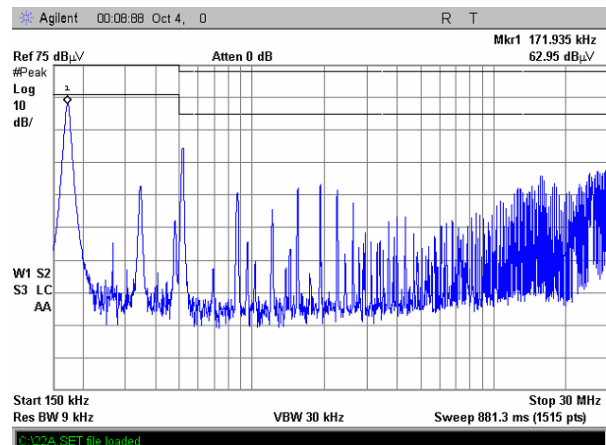


ITEM	DESIGNATOR	PARAMETER	VENDOR	VENDOR P/N
1	CX2	100uF/100V, AL cap		
2	CX3	220uF/100V, AL cap		
3	CY31	2*6.8nF/1000V,ceramic		
4	CY32	2*6.8nF/1000V,ceramic		
5	CY41	6.8nF/1000V,ceramic		
6	CY42	6.8nF/1000V,ceramic		
7	RY31	1206,0R,Resistor		
8	RY32	1206,0R,Resistor		
9	RY41	1206,0R,Resistor		
10	RY42	1206,0R,Resistor		
11	T2A	0.81mH, common mode		
12	T1A,CX1,CX2 RY11,RY21,RY12 RY22,CY11,CY21 CY12,CY22	NIL		

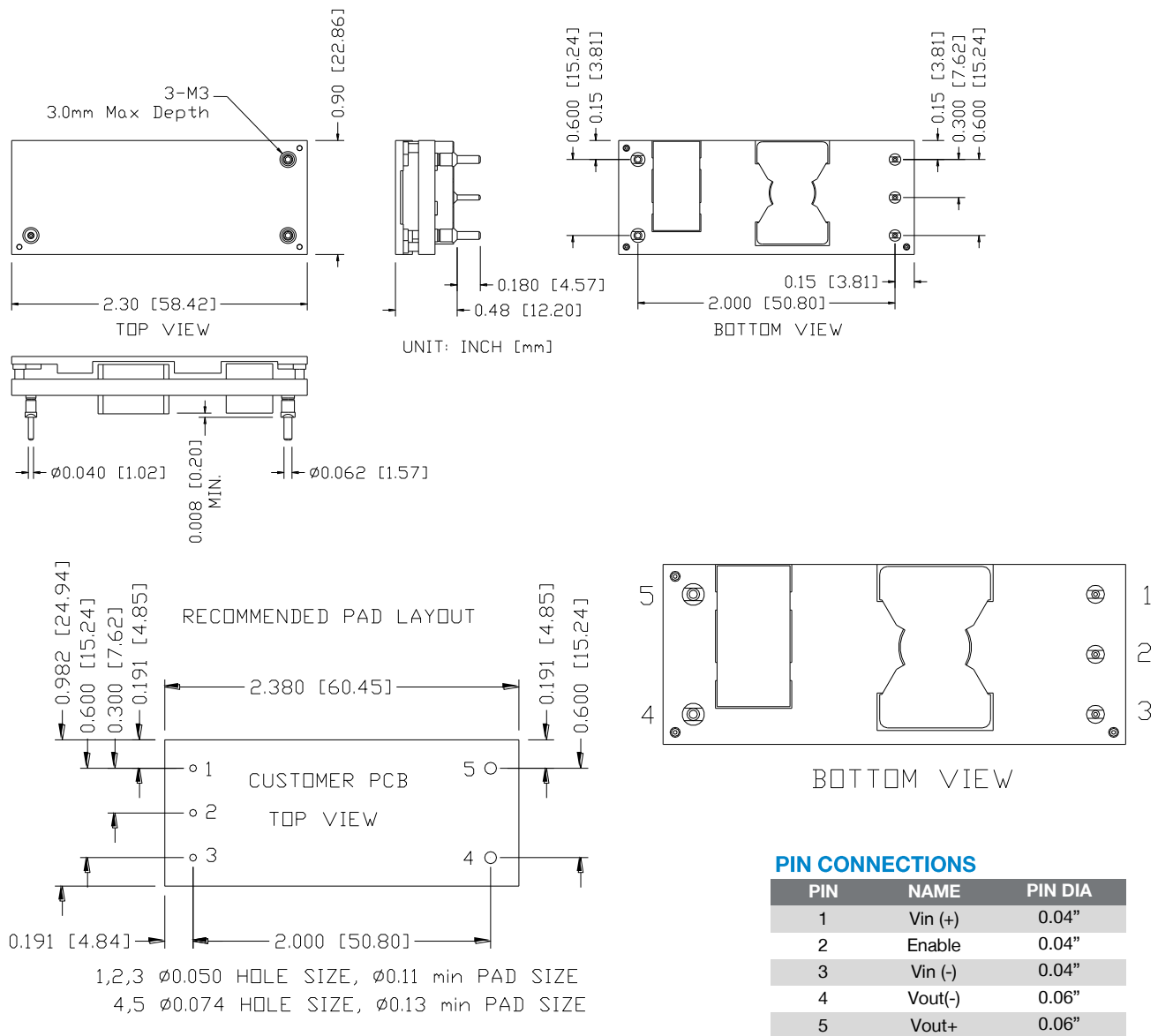
POSITIVE:



NEGATIVE:



16. MECHANICAL DIMENSIONS



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) 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].

17. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2013-11-14	PA	First release	Zhao Tang
2014-10-8	PB	Change Isolation characteristics, I/O Isolation Voltage	Zhao Tang
2016-12-20	AC	First release	XF Jiang
2017-05-09	AD	Add Over Voltage Protection (Static)	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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Rev. AD1

