0RQB-D0W12L

Isolated DC-DC Converter

The 0RQB-D0W12L is an isolated DC/DC converter that provides up to 200 W of output power from a wide input range (72 V, 96 V and 110 V typical).

The unit is designed to be highly efficient. Standard features include remote on/off, input under-voltage lockout, over current protection, short circuit protection and over voltage protection. Conformal coated PCB is used for environmental ruggedness.

Key Features & Benefits

- 72 / 96 / 110 VDC Input
- 12 VDC @ 16.7 A Output
- 1/4th Brick Converter
- Isolated
- Fixed Frequency
- High Efficiency
- Input Under-Voltage Lockout
- Input Over-Voltage Lockout
- OCP / SCP
- Output Over-Voltage Protection
- Over Temperature Protection
- Approved to IEC/EN 62368-1 (TBC)
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

RoHS Compliant

Applications

- Industrial
- Railways
- Telecommunications

1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RQB-D0W12LG	12 VDC	72 / 96 / 110 VDC	16.7 A	200 W	93%

PART NUMBER EXPLANATION

0	R	QB	-	D0	W	12	L	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
Through Hole Mount	RoHS	DOSA Quarter Brick		200 W	72 / 96 / 110 V	12 V	Active Low, with Baseplate	Tray Package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.5	-	164	V
Remote On/Off		-0.3	-	15	V
Current Sink		0	-	10	mA
Isolation Voltage	Input to output	-	-	2250	V
Operating Temperature	Temperature measured at the center of the baseplate, full load	-40	-	95	°C
Thermal Resistance		-	0.3	-	°C/W
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

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage 1	Fully functioning for long term operation.	50	-	137.5	V
Operating Input Voltage 2	Fully functioning for 100 ms operation.	43	-	50	V
Operating Input Voltage 3	Fully functioning for 100 ms operation. Full function is not guaranteed but undamaged for 1 s operation.	137.5	-	156	V
Input Current (full load)		-	-	5.7	A
Input Current (no load)		-	50	-	mA
Remoted Off Input Current		-	2	5	mA
Input Reflected Ripple Current (rms)		-	20	-	mA
Input Reflected Ripple Current (pk-pk)		-	50	-	mA
Under-voltage Turn on Threshold	Turn on Threshold	46	47	49	V
Under-voltage Turn off Threshold	Turn off Threshold, non-latching	40	41	42.5	V
Over-voltage Shutdown Threshold	Auto-recovery and non-latching.	161	163	165	V
Over-voltage Recovery Threshold		154	155	156	V

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	Test condition of the output setpoint: Vin = 110 V, Io = 100% load at 25 °C ambient.	11.76	12	12.24	V
Load Regulation		-	-	±30	mV
Line Regulation		-	-	±30	mV
Regulation Over Temperature		-	±60	±200	mV
Ripple and Noise (pk-pk)	40 kHz – 100 MHz BW, with 1 µF ceramic capacitor and 220 µF bulk electrolytic at output.	-	-	250	mV
Ripple and Noise (rms)		-	-	50	mV
Output Current Range		0	-	16.7	A
Output DC Current Limit	Enter a hiccup mode, non-latching.	18	20	22	A
Rise Time	Vin = 110 V, Io = 16.7 A, with 1 µF ceramic capacitor and 220 µF bulk electrolytic at output.	-	-	200	ms
Start-up Time		-	300	500	ms
Overshoot at Turn on		-	0	3	%
Undershoot at Turn off		-	0	3	%
Output Capacitance		220	-	5000	µF
Transient Response					
△V 50%~75% Load	di/dt = 0.1 A/us, with 1 µF ceramic capacitor and 220 µF bulk electrolytic at output.	-	-	600	mV
Settling Time		-	-	2	ms
△V 75%~50% Load		-	-	600	mV
Settling Time		-	-	2	ms

5. GENERAL SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Io = 60% – 100% Irate	TA = 25 °C	92	93	-	%
	Io = 40% - 60% Irate		90	92	-	
Switching Frequency			-	250	-	kHz
Output Voltage Trim Range			10.8	-	13.2	V
Over Temperature Protection		Temperature measured at the center of the baseplate, full load	-	110	-	°C
Output Over Voltage Protection		Enter a latching. non-hiccup mode	-	-	15	V
Weight			-	69	-	g
FIT		Calculated Per Bell Core SR-332 (Vin = 110 V, Vo = 12 V, Io = 13 A, Ta = 25°C, FIT = 10^9/MTBF)	-	190.48	-	-
MTBF			-	5.25	-	Mhrs
Dimensions (L × W × H)				2.45 x 1.45 x 0.59		inch
				62.23 x 36.83 x15.0		mm
Isolation Characteristics						
Input to Output			-	-	2250	VDC
Input to Heatsink			-	-	2250	VDC
Output to Heatsink			-	-	2250	VDC
Isolation Resistance			10M	-	-	Ohm
Isolation Capacitance			-	2200	-	pF

6. EFFICIENCY DATA

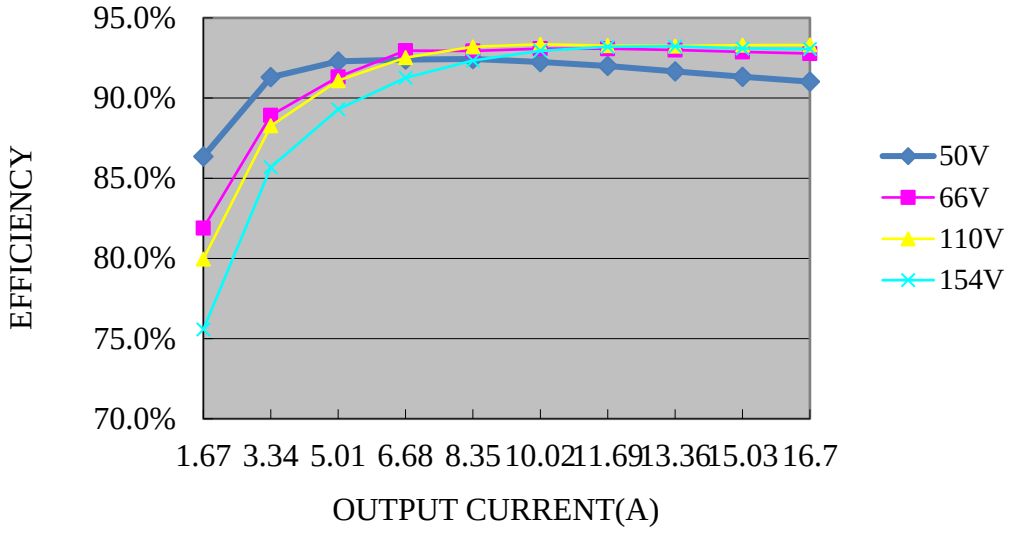


Figure 1. Efficiency data

7. REMOVE 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

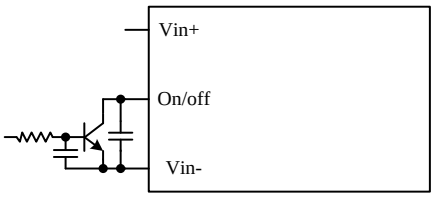


Figure 2. Control with open collector/drain circuit

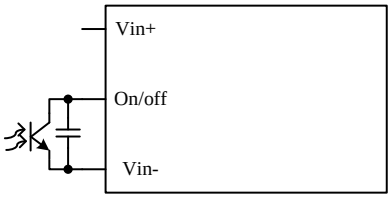


Figure 3. Control with photocoupler circuit

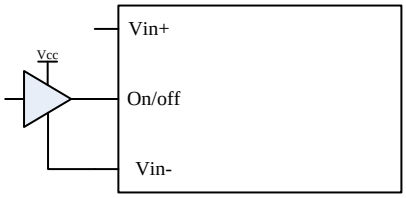


Figure 4. Control with logic circuit

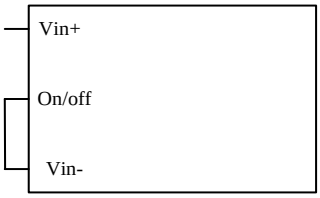


Figure 5. Permanently on

8. REMOTE SENSE

This module has remote sense compensation feature. It can minimize the effects of resistance between output and load in system layout and facilitate accurate voltage regulation at load terminals or other selected point.

1. The remote sense lines carry very little current and hence do not require a large cross-sectional area.

2. This module compensates for a maximum drop of 4% of the nominal output voltage.

3. If the unit is already trimmed up, the available remote sense compensation range should be correspondingly reduced. The total voltage increased by trim and remote sense should not exceed 4% of the nominal output voltage.

4. When using remote sense compensation, all the resistance, parasitic inductance and capacitance of the system are incorporated within the feedback loop of this module which can make an effect on the module's compensation, affecting the stability and dynamic response. A 0.1 μF ceramic capacitor can be connected at the point of load to de-couple noise on the sense wires.

5. Recommend the connection of remote sense compensation as below figure. There are a resistor RS+ (100 ohm) from Vo+ to Sense+ and a resistor RS- (100 ohm)) from Vo- to Sense- inside of this module.

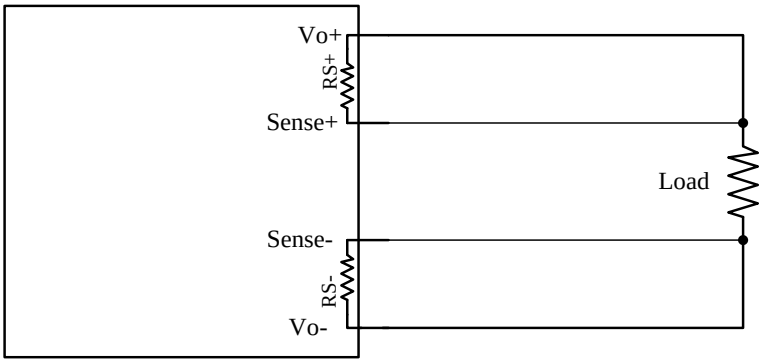


Figure 6.

6. If not using remote sense compensation, please connect sense directly to output at module's pin, that is, connect sense+ to Vo+ and sense- to Vo- at module's pin, the shorter the better. see below figure.

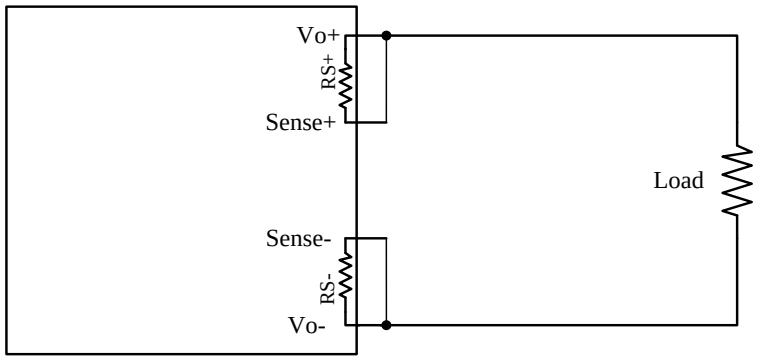


Figure 7.

9. RIPPLE AND NOISE WAVEFORM

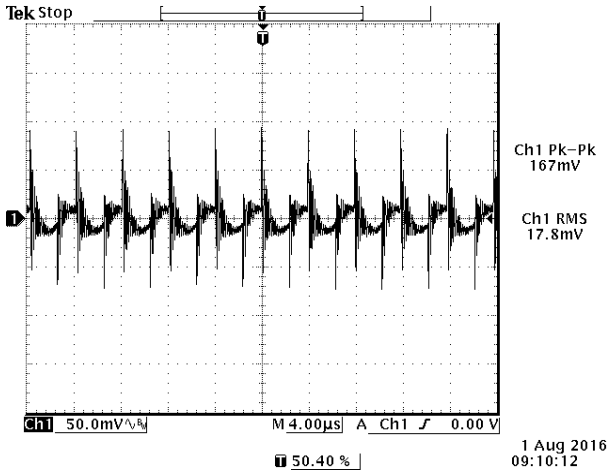


Figure 8.

Note: Ripple and noise 110 VDC input, 12 VDC / 16.7 A output and Ta = 25 °C, and with a 1 µF ceramic cap and 220 µF electrolytic cap at output.

10. TRANSIENT RESPONSE WAVEFORMS

Transient Response: di/dt=0.1 A/us, 1 µF ceramic cap and 220 µF electrolytic cap at output.

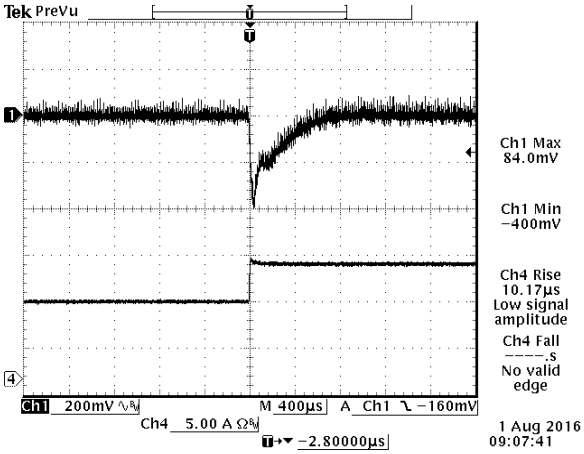


Figure 9. Vout = 12 V, 50%-75% Load Transients at Vin = 110 V, Ta = 25°C

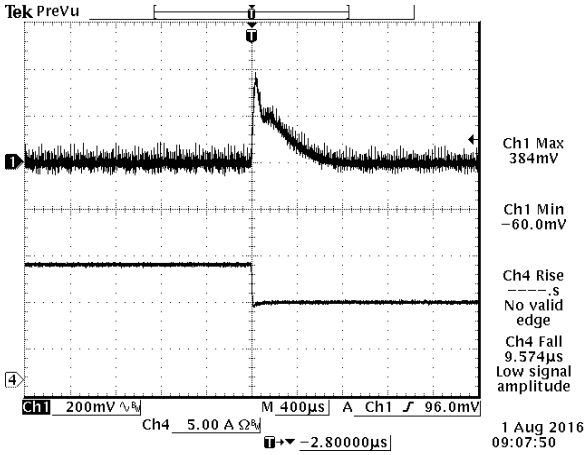


Figure 10. Vout = 12 V, 75%-50% Load Transients at Vin = 110 V, Ta = 25°C

11. OVER CURRENT PROTECTION

To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry which can endure current limiting for a few milliseconds. If the over current condition persists beyond a few milliseconds, the module will shut down into hiccup mode and restart once every 800 ms. The module operates normally when the output current goes into specified range. The typical average output current is 0.51 A during hiccup.

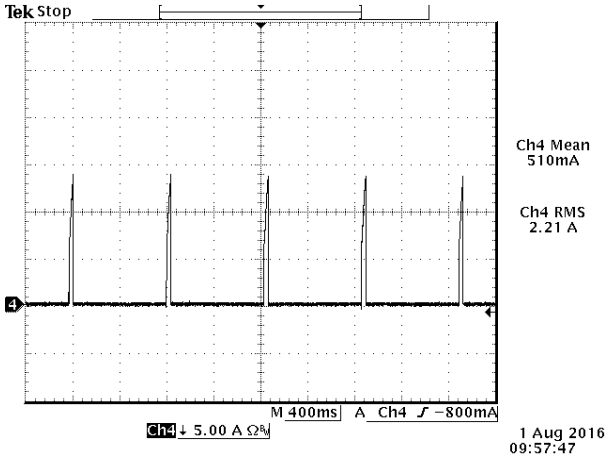


Figure 11. Over current protection

12. OVER TEMPERATURE PROTECTION

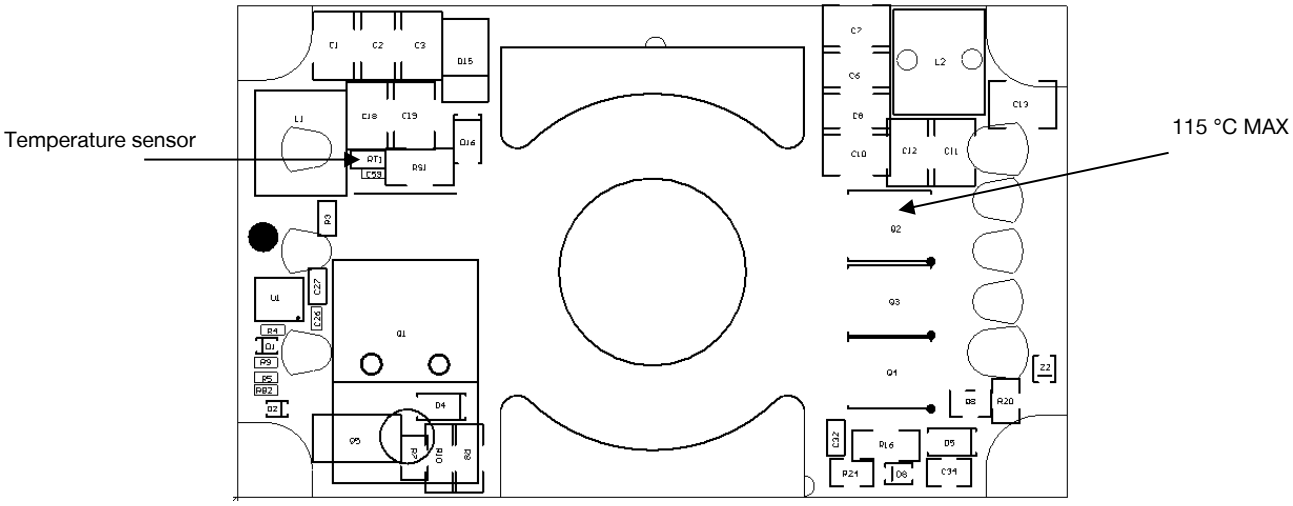


Figure 12. Over temperature protection

13. INPUT UNDER-VOLTAGE LOCKOUT

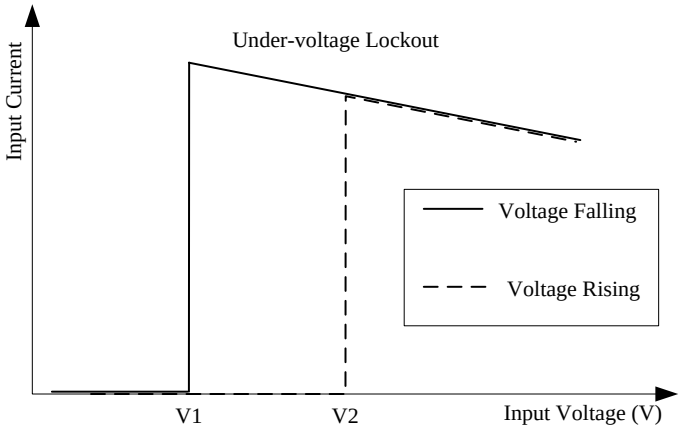
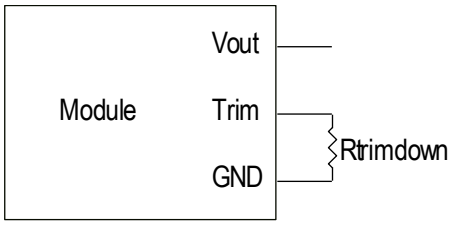


Figure 13. Input under-voltage lockout
V1 = 38 V
V2 = 40 V

14. TRIM

0RQB-D0W12L Trim Resistor Calculate

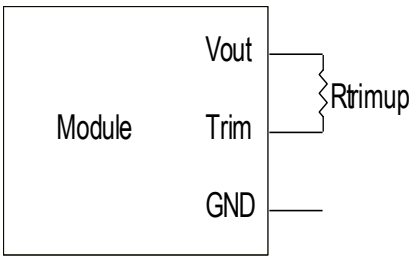
Trim down test circuit



$$R_{trimdown} = \frac{Vo\_req}{12 - Vo\_req} - 1[k\Omega]$$

Figure 14. Trim down test circuit

Trim up test circuit



$$R_{trimup} = \frac{1 - 0.10332}{0.10332 - 1.24/Vo\_req} - 1[k\Omega]$$

Figure 15. Trim up test circuit

Note: Vo_req=Desired(trimmed) output voltage[V]

15. THERMAL DERATING CURVES

Maximum junction temperature of semiconductors derated to 115 °C.

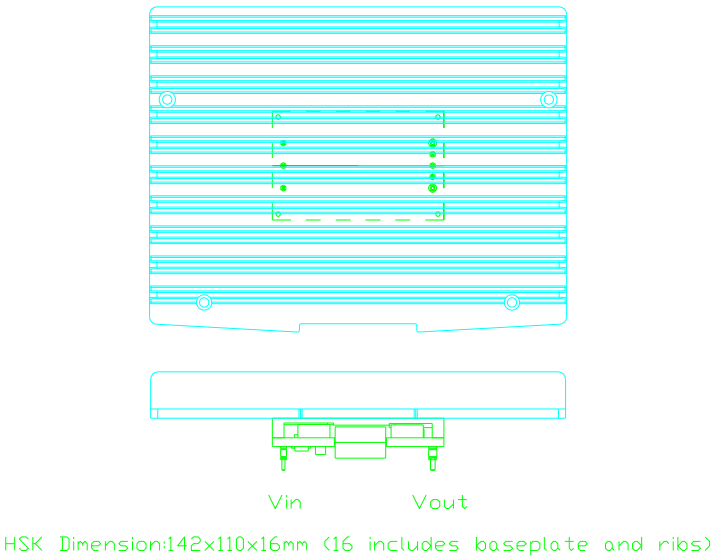


Figure 16. Thermal test setup

TA is the temperature on the large heatsink rib.

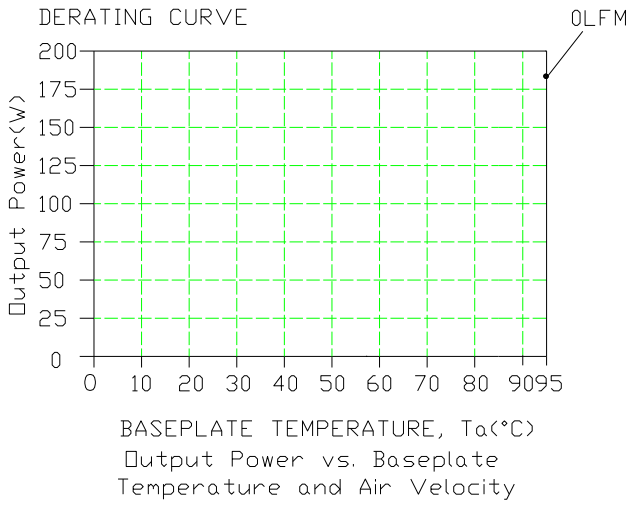


Figure 17. Thermal derating curve

16. SAFETY & EMC

Safety:

TBC

EMC:

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

Test Setup:

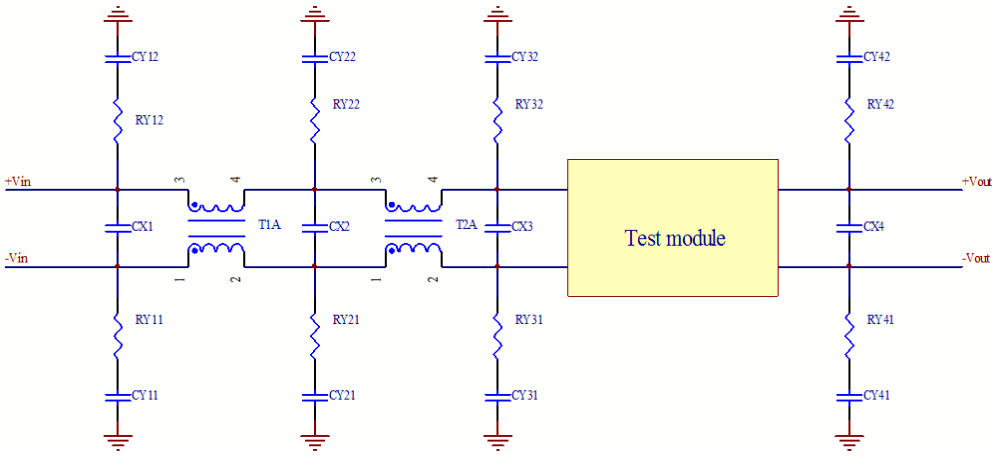


Figure 18.

T1A	CX1	RY11	RY12	CY11	CY12
-	330µF AL	-	-	-	-
T2A	CX2	RY21	RY22	CY21	CY22
1mH	1µF	0R	0R	2.2µF	2.2µF
	CX3	RY31	RY32	CY31	CY32
	1µF	-	-	-	--
	CX4	RY41	RY42	CY41	CY42
	220µF AL	-	-	-	-

Positive

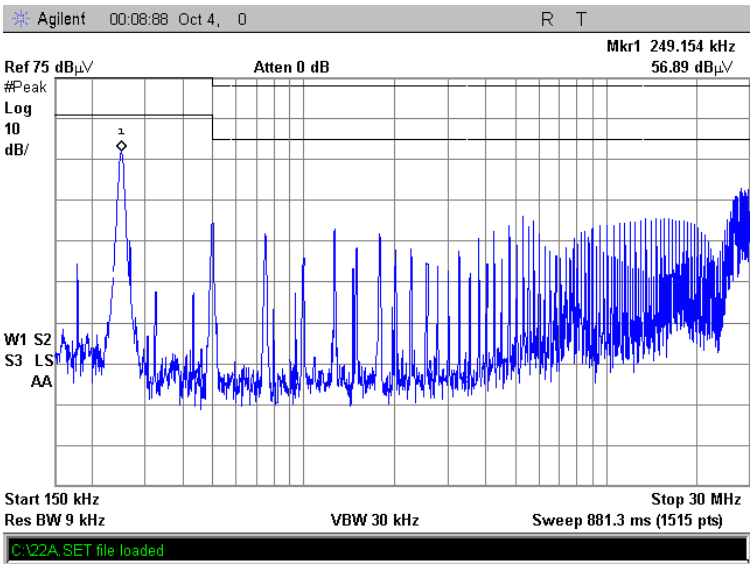


Figure 19.

Negative

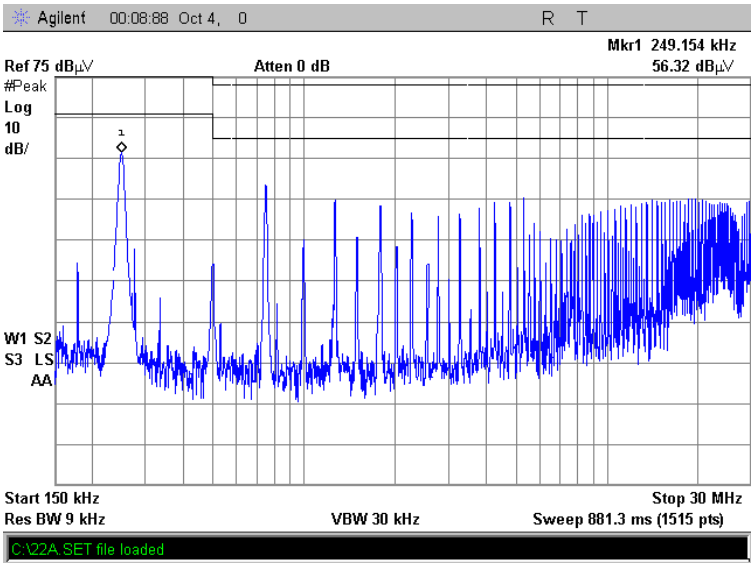


Figure 20.

17. MECHANICAL DIMENSIONS

OUTLINE

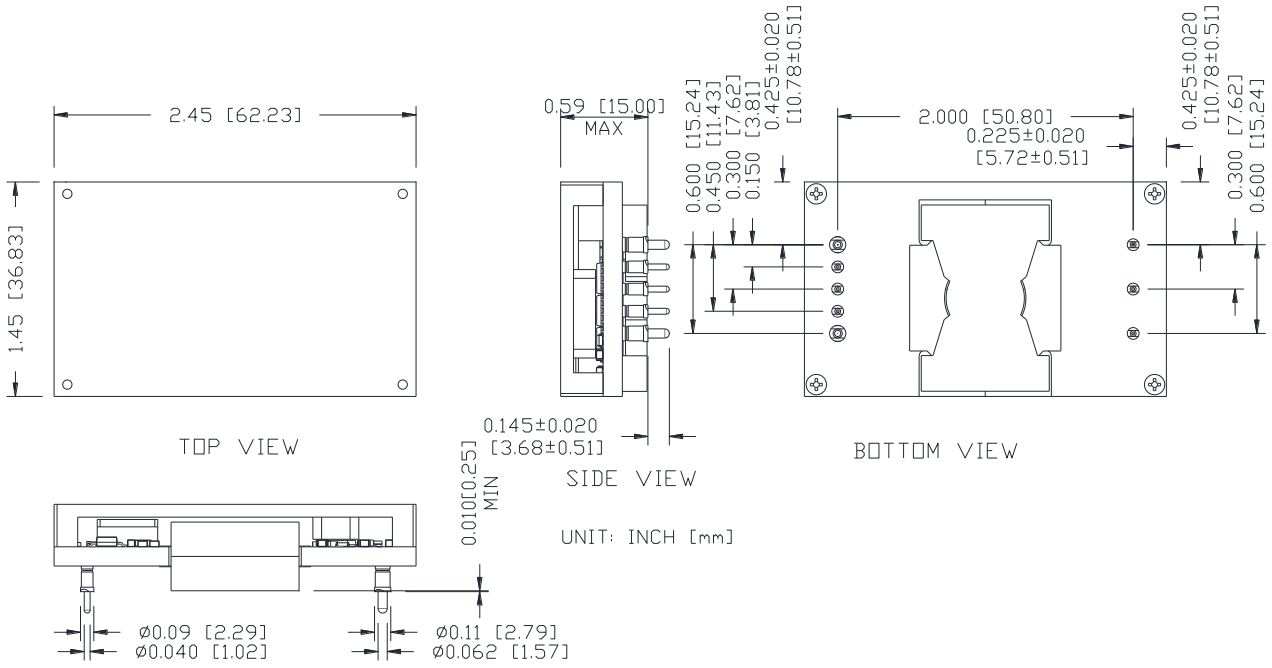


Figure 21. Outline

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

PIN DEFINITIONS

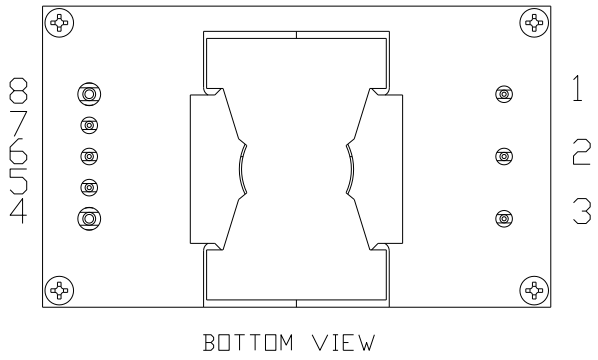


Figure 22. Pins

PIN	FUNCTION	PIN SIZE	PIN LENGTH
1	Vin(+)	0.040''	0.145''
2	On/off	0.040''	0.145''
3	Vin(-)	0.040''	0.145''
4	Vout(-)	0.062''	0.145''
5	Sense(-)	0.040''	0.145''
6	Trim	0.040''	0.145''
7	Sense(+)	0.040''	0.145''
8	Vout(+)	0.062''	0.145''

RECOMMENDED PAD LAYOUT

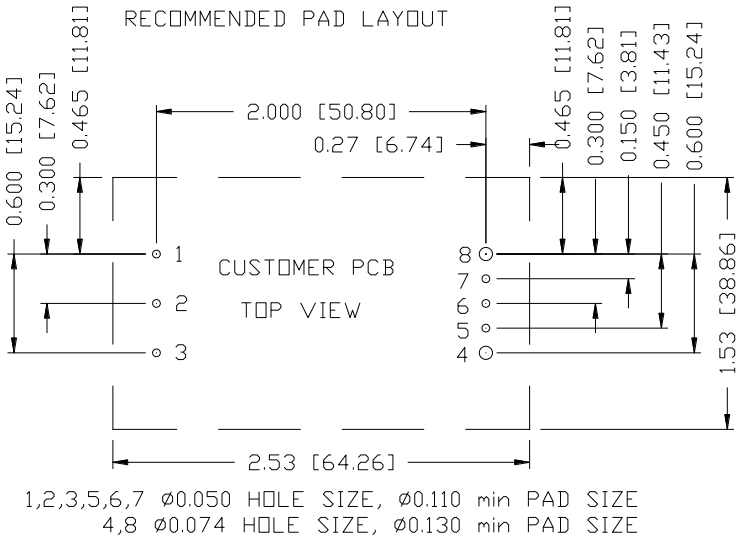


Figure 23. Recommended pad layout

18. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2016-09-09	AA	First release	Z.Tang
2017-04-13	AB	Update Input Voltage	J.Yan
2017-06-07	AC	Update Input Specs	J.Yan
2017-08-04	AD	Update Efficiency Data	S.Wang
2017-08-22	AE	Update Operating Input Voltage	S.Wang
2018-03-07	AF	Update MTBF	S.Wang
2019-04-25	AG	Update Input Specifications and Mechanical Dimensions	S.Wang
2021-05-18	AH	Add object ID. Update recommended pad layout.	XF.Jiang

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

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