0RQB-D0W12M

Isolated DC-DC Converter

The 0RQB-D0W12M is an isolated DC/DC converter that provide 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.

RoHS Compliant

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)

Applications

- Industrial
- Railways
- Telecommunications

1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RQB-D0W12M	12 VDC	66 -154 VDC	16.7 A	200 W	93%

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

PART NUMBER EXPLANATION

0	R	QB	-	D0	W	12	M	x
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	66 – 154 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	-	160	V
Remote On/Off		-0.3	-	15	V
Current Sink		0	-	10	mA
Isolation Voltage	Input to output	-	-	2250	V
Operating Temperature	Ambient temperature	-40	-	95	°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

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		66	-	154	V
Input Current (full load)		-	-	3.5	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	Lockout turn on	62	63	64	V
Under-Voltage Turn off Threshold	Lockout turn off, non-latching	60	61	62	V
Over-Voltage Shutdown Threshold	Auto-recovery and non-latching	159	162	164	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.	18.5	20	21.5	A
Rise Time	Vin = 110 V, Io = 16.7 A, with 1 µF ceramic capacitor & 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					
50% load to 75% Load	di/dt = 0.1 A/µs, with 1 µF ceramic capacitor and 220 µF bulk electrolytic at output.	-	-	600	mV
Settling Time		-	-	2	ms
75% load to 50% Load		-	-	600	mV
Settling Time		-	-	2	ms

5. GENERAL SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Io=60% Irate – 100% Irate	T_A = 25°C	92	93	-	%
	Io=40% Irate - 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 = 16 A, 500 LFM, Ta = 25°C, FIT = 10^9/MTBF)	-	14.7954	-	FITs
MTBF			-	8,713,829	-	hrs
Dimensions (L × W × H)				2.45 x 1.45x 0.67		inch
				62.23 x 36.83 x17		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

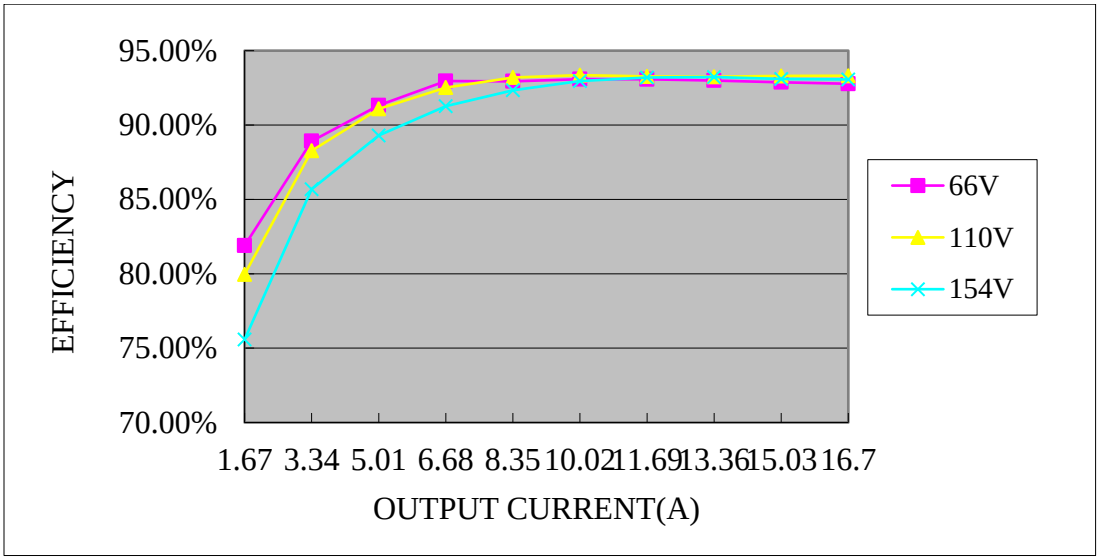

Figure 1. Efficiency data

7. 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	-	15	V
Current Sink			0	-	1	mA

Recommended remote on/off circuit for active low

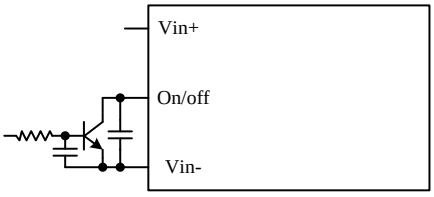

Figure 2. Control with open collector/drain circuit

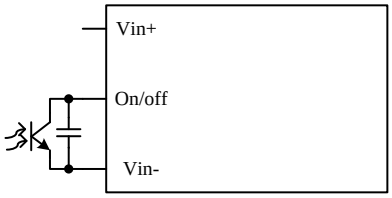

Figure 3. Control with photocoupler circuit

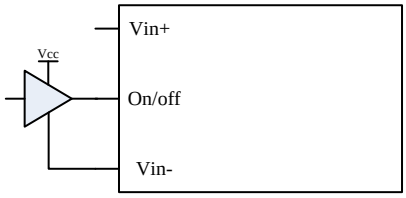

Figure 4. Control with logic circuit

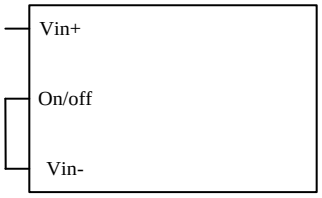

Figure 5. Permanently on

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 carries 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 0.1uF 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.

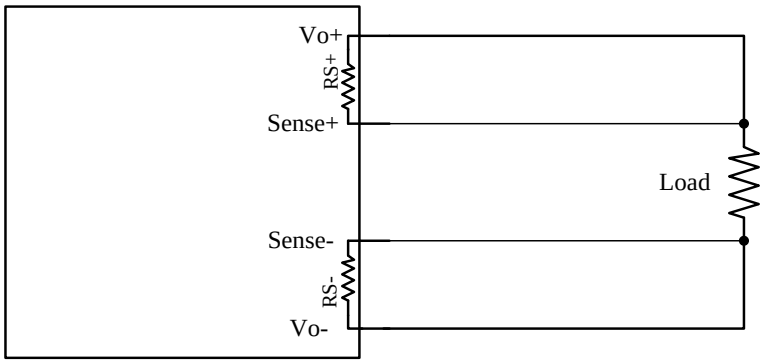

Figure 6.

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.

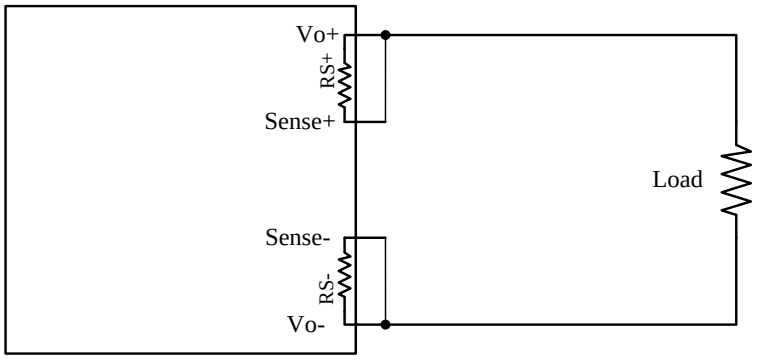

Figure 7.

9. RIPPLE AND NOISE WAVEFORM

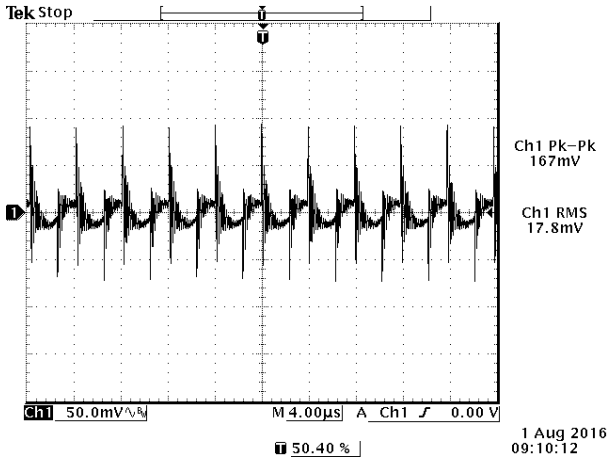

Figure 8. Ripple and noise waveform

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

10. TRANSIENT RESPONSE WAVEFORM

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

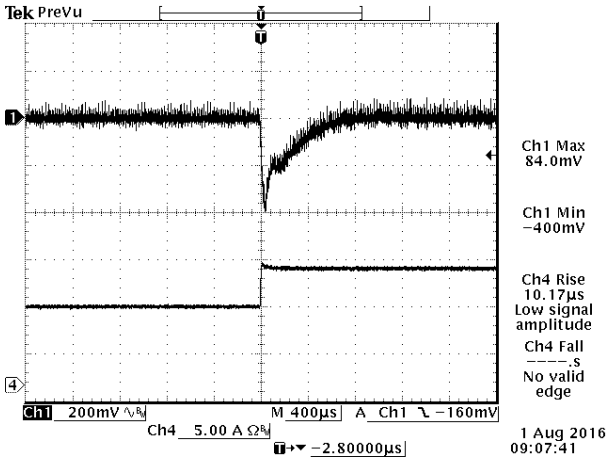

Figure 9. Vout = 12 V 50%-75% Load Transients at Vin = 110 V, Ta = 25 °C

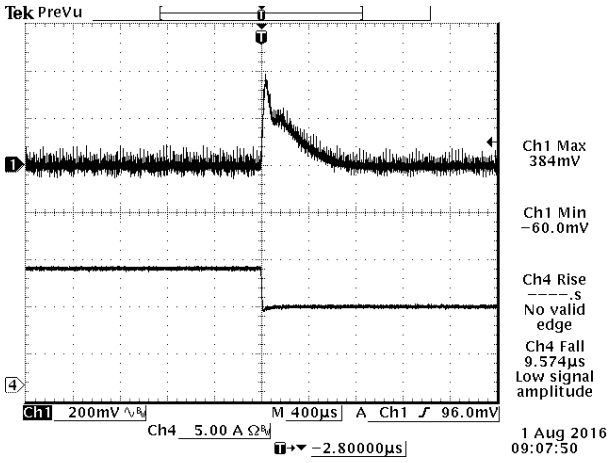

Figure 10. Vout = 12 V 75%-50% Load Transients at Vin = 110 V, Ta = 25 °C

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 milli-seconds. 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.

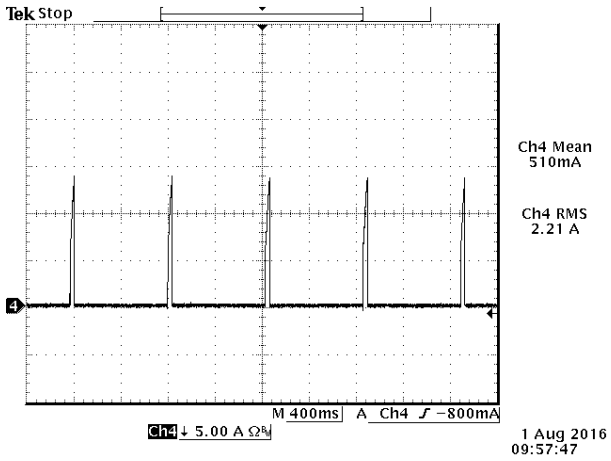

Figure 11. Over current protection

12. OVER TEMPERATURE PROTECTION

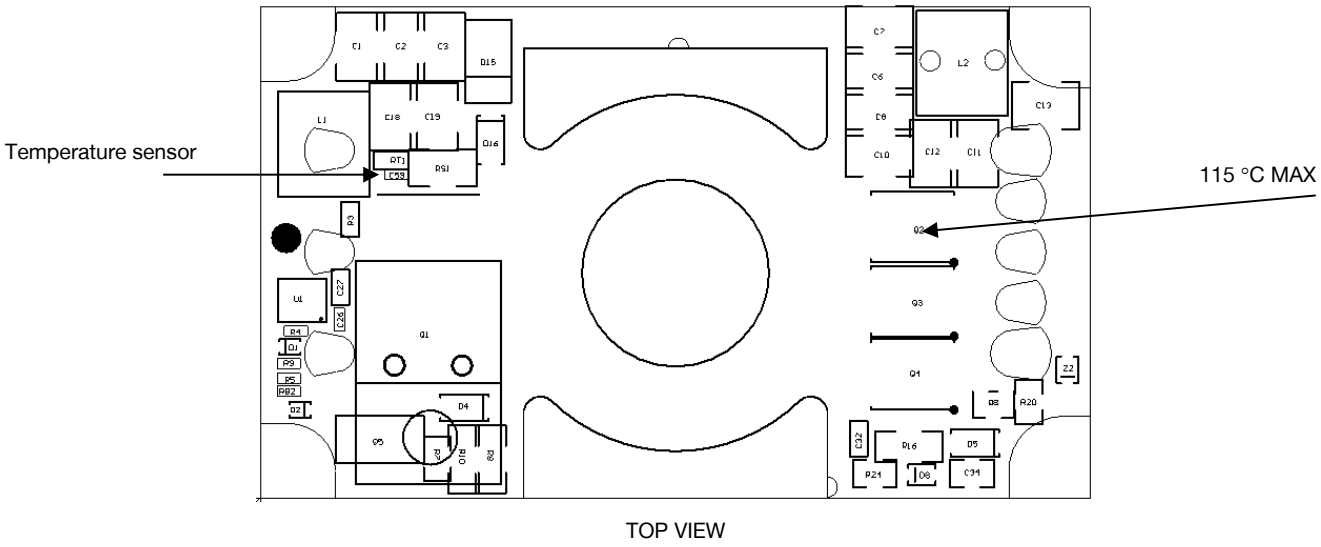

Figure 12. Over temperature protection

13. INPUT UNDER-VOLTAGE LOCKOUT

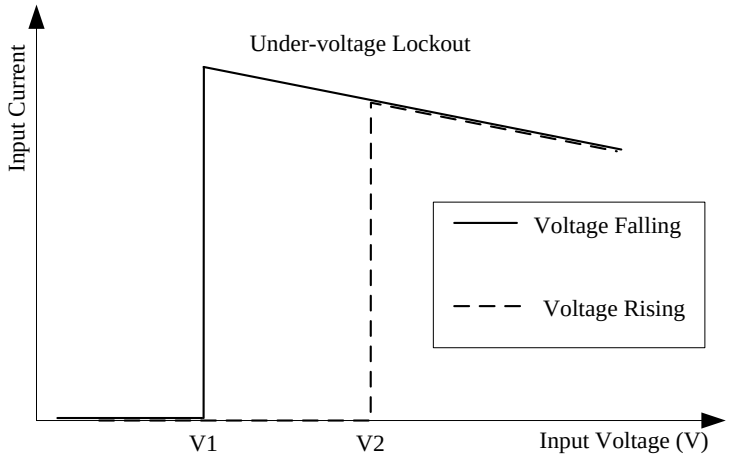

Figure 13. Input under-voltage lockout
V1 = 61 V
V2 = 63 V

14. THERMAL DERATING CURVE

1. In order to make it convenient for safety and test engineer, each curve has 3 air velocity at most.
2. If the minimum air velocity is 0 LFM or 50 LFM, do not mark on the curve, just record as "Natural Convection".

Maximum junction temperature of semiconductors derated to 115°C.

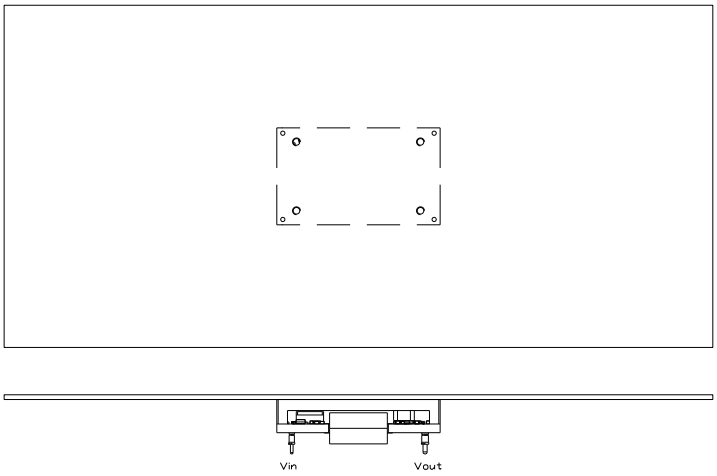

Figure 14. Thermal test setup

HSK Dimension: 270 x 130 x 1.6 mm.

TA is the temperature on the large heatsink rib.

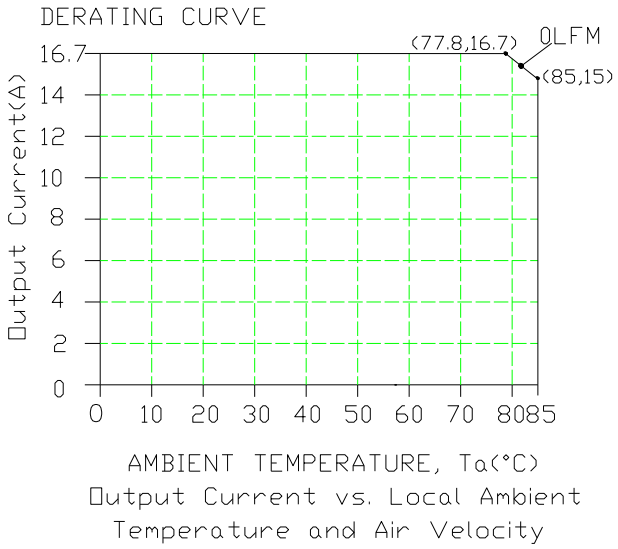

Figure 15. Thermal derating curve

15. SAFETY & EMC

Safety:

Approved to IEC/EN 62368-1 (TBC)

EMC:

Compliance to EN55032 class A (both peak and average) with the following inductive and capacitive filter

Test Setup:

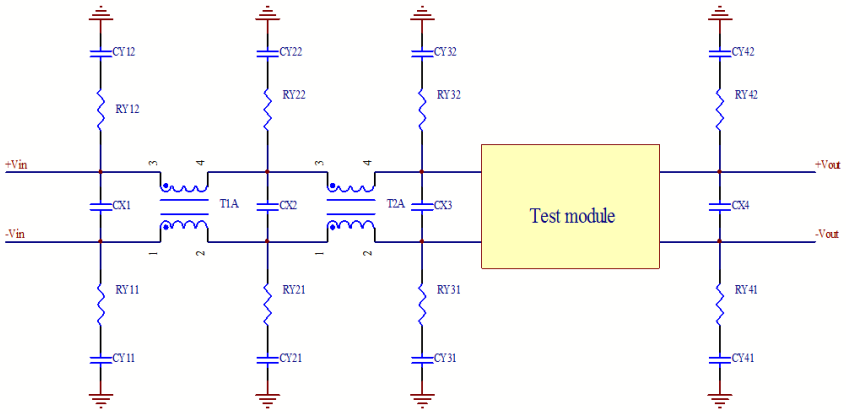

Figure 16. Test setup

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

Positive:

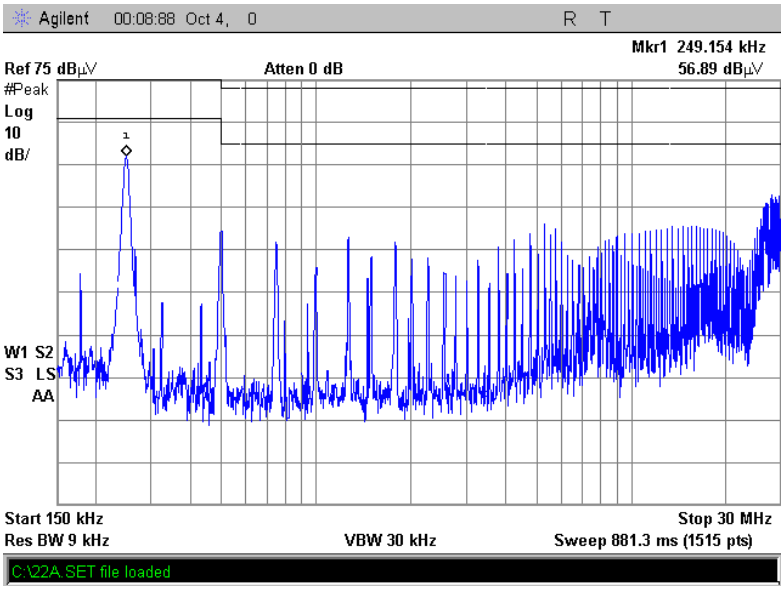

Figure 17.

Negative:

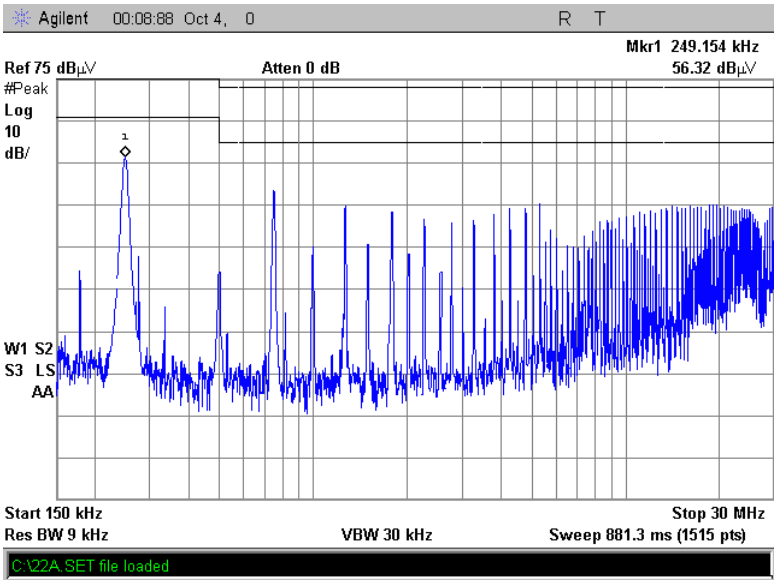

Figure 18.

16. TRIM

0RQB-D0W12M Trim Resistor Calculate

Trim down test circuit

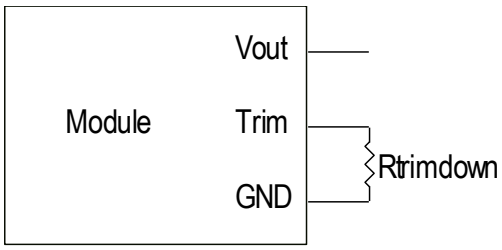

Figure 19. Trim down test circuit

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

Trim up test circuit

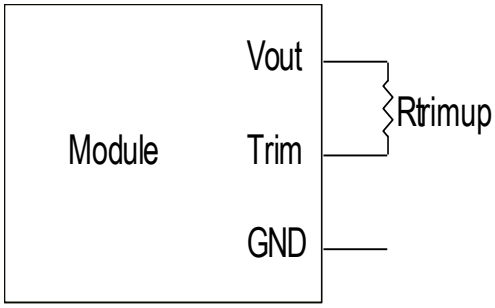

Figure 20. Trim up test circuit

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

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

17. MECHANICAL DIMENSIONS

OUTLINE

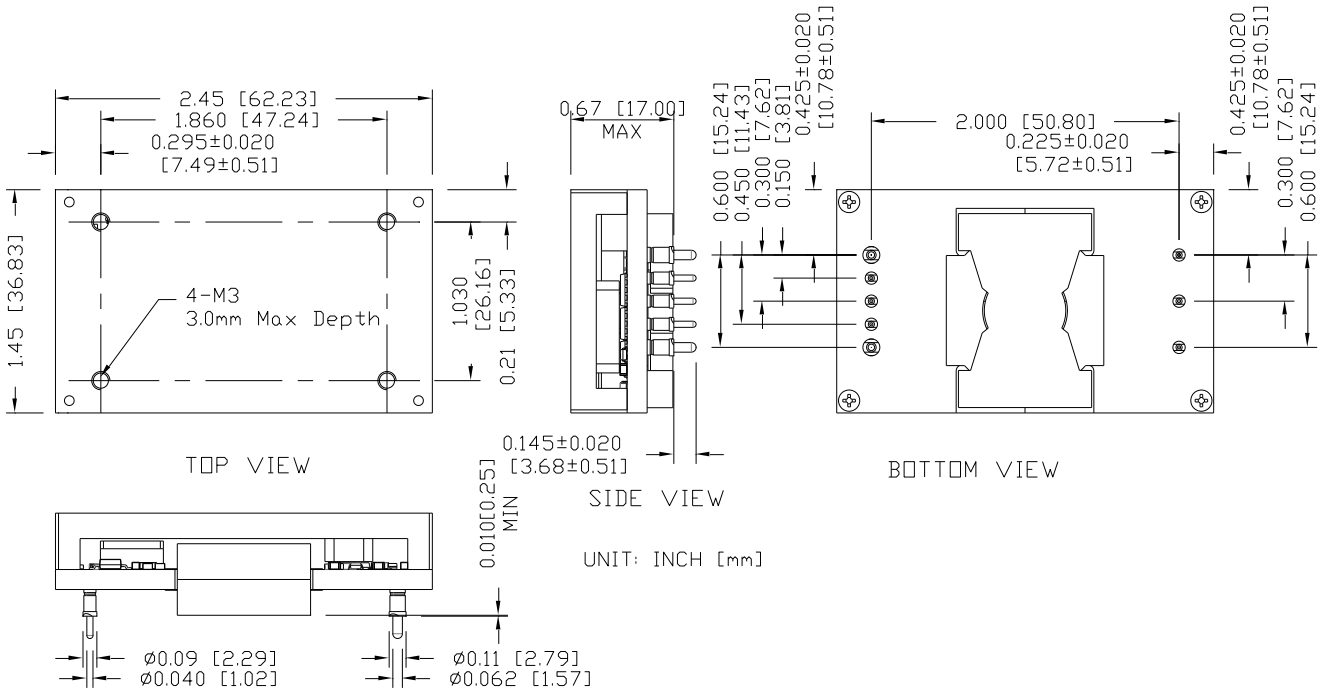

Figure 21.

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

PIN DEFINITIONS

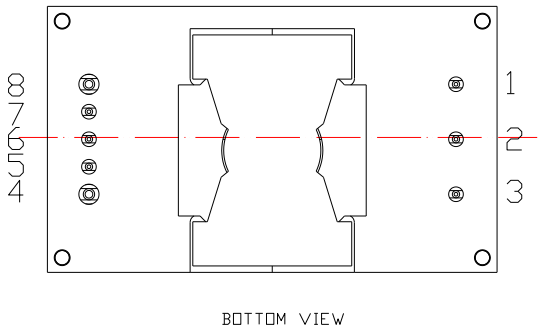

Figure 22. Pins

PIN	FUNCTION	PIN	FUNCTION
1	Vin (+)	5	Sense(-)
2	On/off	6	Trim
3	Vin (-)	7	Sense(+)
4	Vout(-)	8	Vout(+)

RECOMMENDED PAD LAYOUT

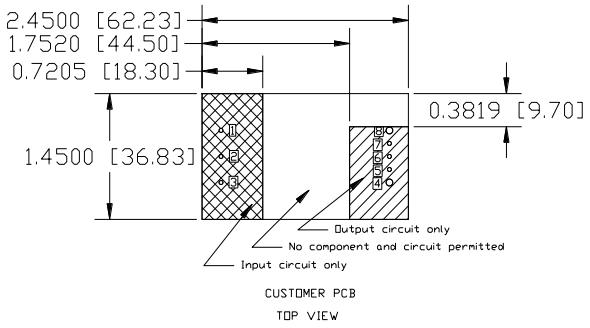

Figure 23. Recommended pad layout-1

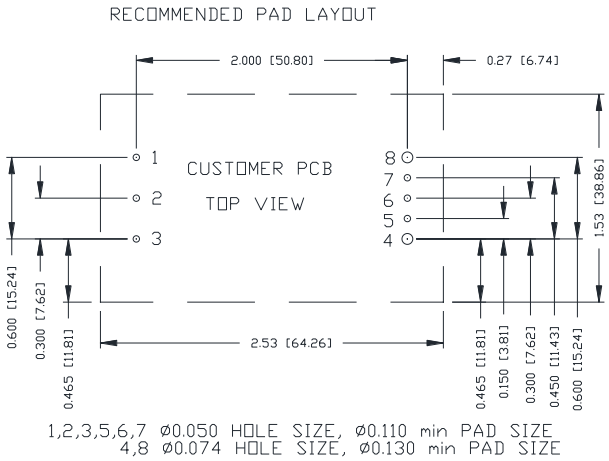

Figure 24. Recommended pad layout-2

18. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2017-01-16	AA	First release.	HL.Lu
2017-09-07	AB	Update the MD.	S.Wang
2018-06-20	AC	Update Part Number Explanation and Remote on/off.	S.Wang
2021-03-15	AD	Add object ID, FIT and MTBF content. Update recommended pad layout.	XF.Jiang