0RQB-C5W24x

Isolated DC-DC Converter

The 0RQB-C5W24x is an isolated DC/DC converter that provide up to 150 W of output power from a wide input range (66 V and 110V typical).

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

Key Features & Benefits

- 50/110/160 VDC Input / 24 VDC @ 6.25 A Output/1/4th Brick Converter
- Reinforced isolation
- Fixed Frequency
- High Efficiency
- Input Under Voltage Lockout
- Input Over Voltage Lockout
- OCP/SCP
- Output Over-Voltage Protection
- Over Temperature Protection
- Approved to UL/CSA60950-1, 2nd +A2 version(TBD)
- 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-C5W24x	24 VDC	50 VDC-160 VDC	6.25 A	150 W	93%

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

PART NUMBER EXPLANATION

0	R	QB	-	C5	W	24	x	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
Through hole mount	RoHS 6	DOSA Quarter Brick		150 W	50 – 160 V	24 V	R - Active low, with baseplate S - Active low, with baseplate	G – Tray package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.5	-	200	V
Remote On/Off		-0.3	-	15	V
Current Sink	Remote on/off pin	0	-	10	mA
Isolation voltage	Input to output	-	-	3000	V
Operating Temperature	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	Fully functioning for 100ms operation	43	-	50	V
	Fully functioning for long term operation	50	-	160	V
Input Current (full load)	Vin=66V, Vo=24V, Io=6.25A	-	-	2.6	A
Input Current (no load)	Vin=110V, Vo=24V	-	50	-	mA
Remoted Off Input Current		-	2	5	mA
Input Reflected Ripple Current (rms)	Detail conditions please refer to input reflected ripple current section	-	20	-	mA
Input Reflected Ripple Current (pk-pk)		-	50	-	mA
Under-voltage Turn on Threshold	Lockout turn on	-	40	-	V
Under-voltage Turn off Threshold	Lockout turn off, non-latching	-	39	-	V
Over-voltage Shutdown Threshold	Auto-recovery and non-latching	165	170	175	V
Over-voltage Recovery Threshold		160	165	170	V

4. OUTPUT SPECIFICATIONS

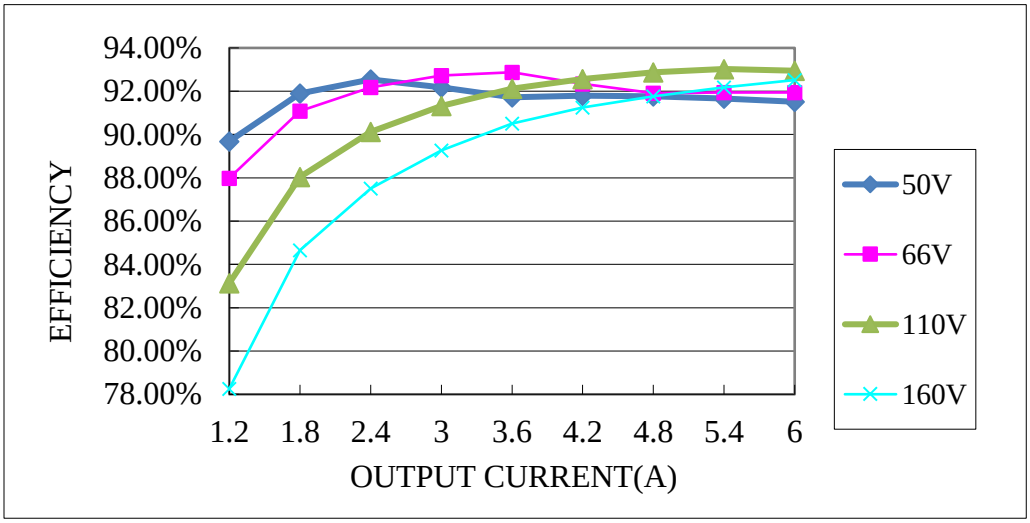
All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	Test condition of the output setpoint: Vin=110V, Io=100% load at 25°C ambient	23.52	24	24.48	V
Load Regulation	Vin=110V, Io=0-6.25A	-	-	±0.50	%
Line Regulation	Vin=50-160V, Io=6.25A	-	-	±0.20	%
Regulation Over Temperature		-	-	±1	%
Ripple and Noise (pk-pk)	40KHz-100MHz BW, with 1µF ceramic capacitor and 220uF bulk electrolytic at output	-	-	250	mV
Ripple and Noise (rms)		-	-	50	mV
Output Current Range		0	-	6.25	A
Output DC Current Limit	Enter a hiccup mode, non-latching	7.0	8.0	10.0	A
Rise time	Vin=110V, Io=6.25A, with 1µF ceramic capacitor and 220uF bulk electrolytic at output	-	-	200	ms
Start-up time		-	300	500	ms
Pre-bias Start up		-	-	5	V
Overshoot at Turn on		-	0	5	%
Undershoot at Turn off		-	0	3	%
Output Capacitance	Typically 100% Oscon or POSCAP.	220	-	2300	uF
Transient Response					
50% load to 75% Load	di/dt=0.1A/us, with 1µF ceramic capacitor and 220uF bulk electrolytic at output	-	-	800	mV
Settling Time		-	-	500	us
75% load to 50% Load		-	-	800	mV
Settling Time		-	-	500	us

5. GENERAL SPECIFICATIONS

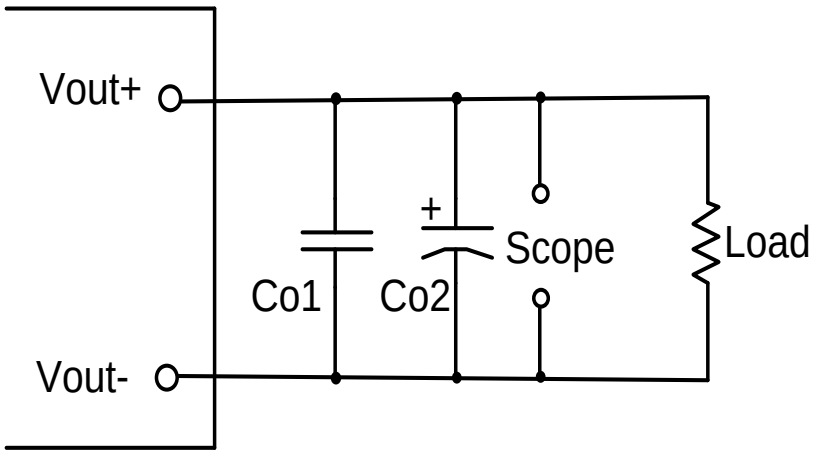
PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Io=60% Irate – 100% Irate	TA = 25°C	92	93	-	%
	Io=40% Irate - 60% Irate		90	92	-	%
Switching Frequency			-	220	-	kHz
Output Voltage Trim Range			21.6	-	26.4	V
Remote Sense Compensation			-	-	1.0	V
Over Temperature Protection		Temperature measured at the center of the baseplate, full load	-	110	-	℃
Output Over Voltage Protection		Enter a latching. non-hiccup mode	-	-	28	V
Weight			-	69	-	g
FIT		Calculated Per Bell Core SR-332 (Vin=110 V, Vo=24V, Io=6.25A, 100LFM, Ta = 25°C, FIT=10^9/MTBF)	-	238.8	-	
MTBF			-	4.2	-	Mhrs
Dimensions Inches (L × W × H) Millimeters (L × W × H)				2.30 x 1.45 x 0.50 58.42 x 36.83 x 12.70		Inches Millimeters
Isolation Characteristics						
Input to Output			-	-	3000	Vdc
Input to Heatsink			-	-	3000	Vdc
Output to Heatsink			-	-	3000	Vdc
Isolation Resistance			10M	-	-	Ohm
Isolation Capacitance			-	2200	-	pF

6. EFFICIENCY DATA



7. RIPPLE AND NOISE

Testing setup



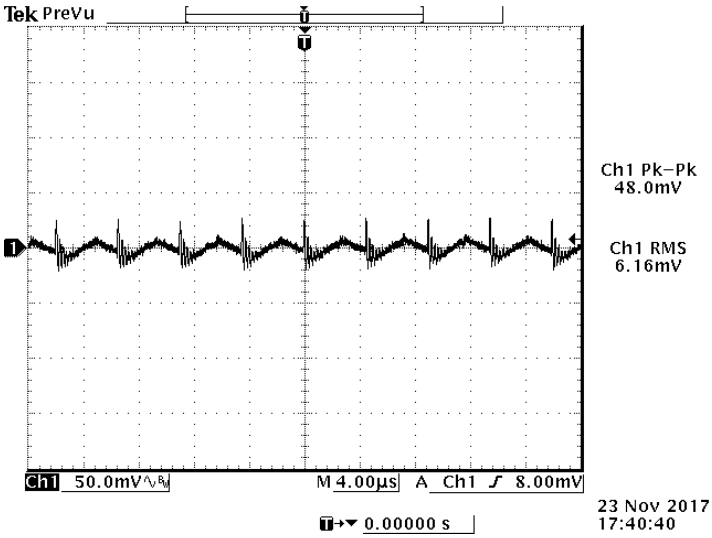
Notes and values in testing.

Co1: 1uF ceramic + 100uF polymer

Co2: 220uF Al

The capacitor should be as closed as possible to the power module to swallow ripple current and help with stability.

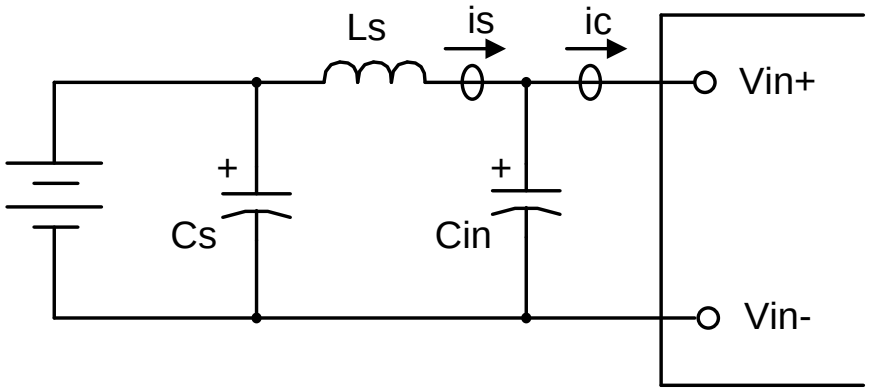
Below measured waveforms are based on above capacitance.



Test condition: *Vin=110V, Vo=24V, Io=6A, Cout=1uF ceramic + 100uF polymer + 220uF Al*

8. INPUT NOISE

Input reflected ripple current



Notes and values in testing.

is: Input Reflected Ripple Current

ic: Input Terminal Ripple Current

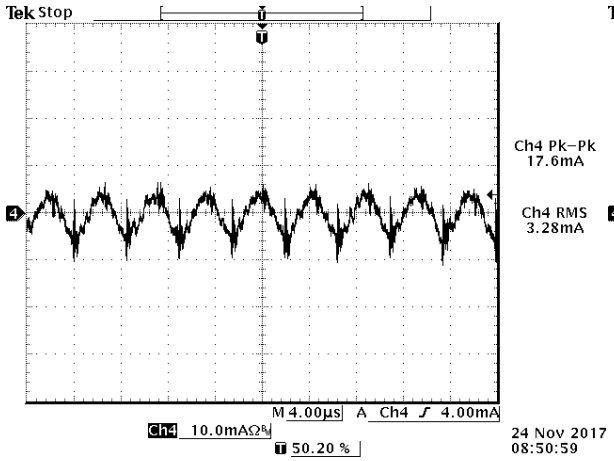
Ls: Simulated Source Impedence (12µH)

Cs: Offset possilbe source Impedence (220µF, ESR<0.1Ω @ 100kHz, 20C)

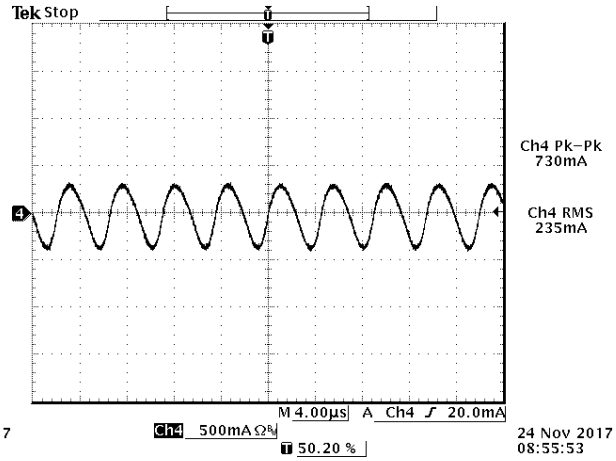
Cin: Electrolytic capacitor, should be as closed as possible to the power module to swallow ic ripple current and help with stability.

Recommendation: 100µF/200V, ESR<0.2Ω @ 100kHz, 20C.

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



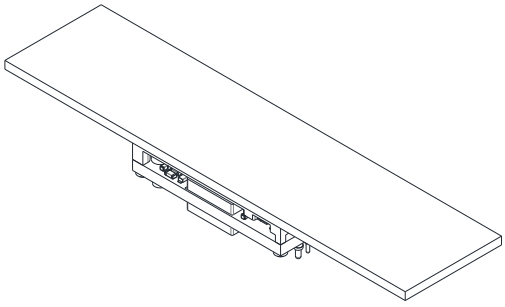
is (input reflected ripple current), AC component



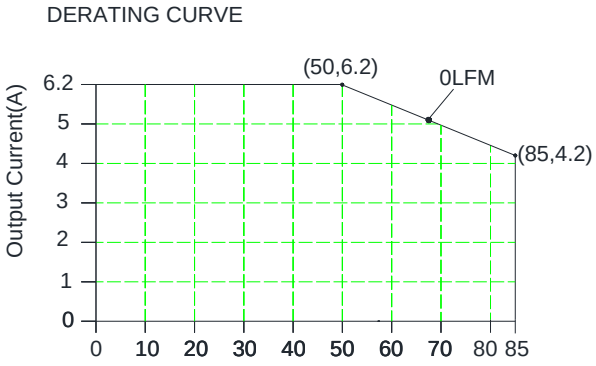
ic (input terminal ripple current), AC component

Test condition: Vin=110V, Vo=24V, Io=6A, Cout=1uF ceramic + 100uF polymer + 220uF Al

9. THERMAL DERATING CURVES



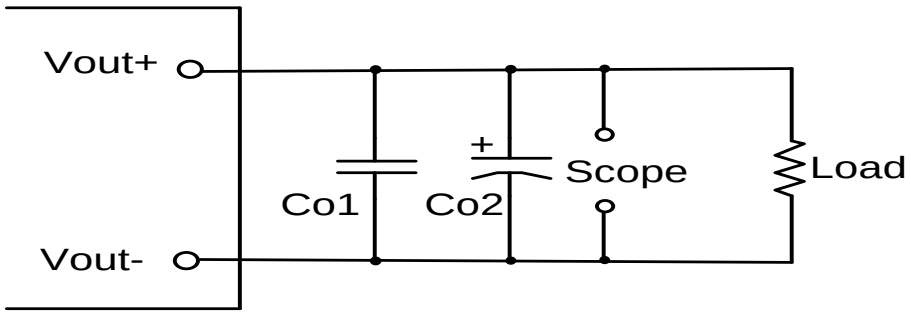
Test setup: Vin=110V, 0LFM, external HSK Dimension: 158mm X 38mm X 6mm.



Output Current vs. Local Ambient Temperature and Air Velocity

10. TRANSIENT RESPONSE

Testing setup



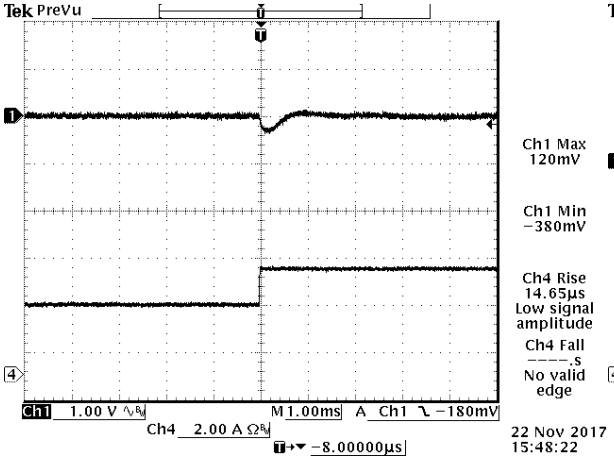
Notes and values in testing.

Co1: 1uF ceramic + 100uF polymer

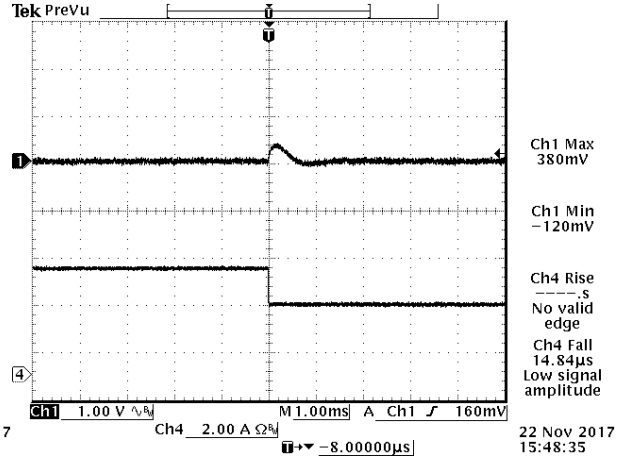
Co2: 220uF Al

The capacitor should be as closed as possible to the power module to swallow ripple current and help with stability.

Below measured waveforms are based on above capacitance.



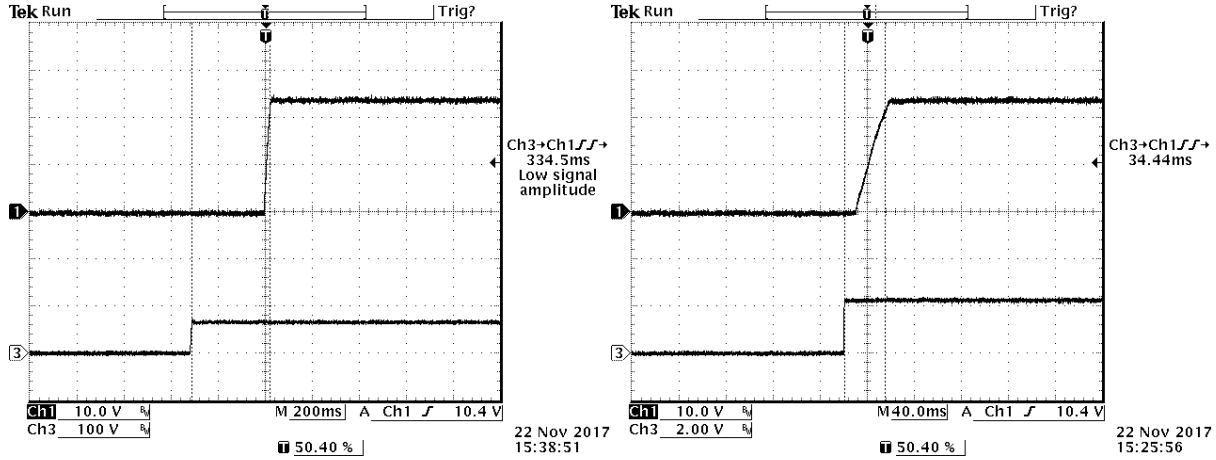
50% -75%



75%-50%

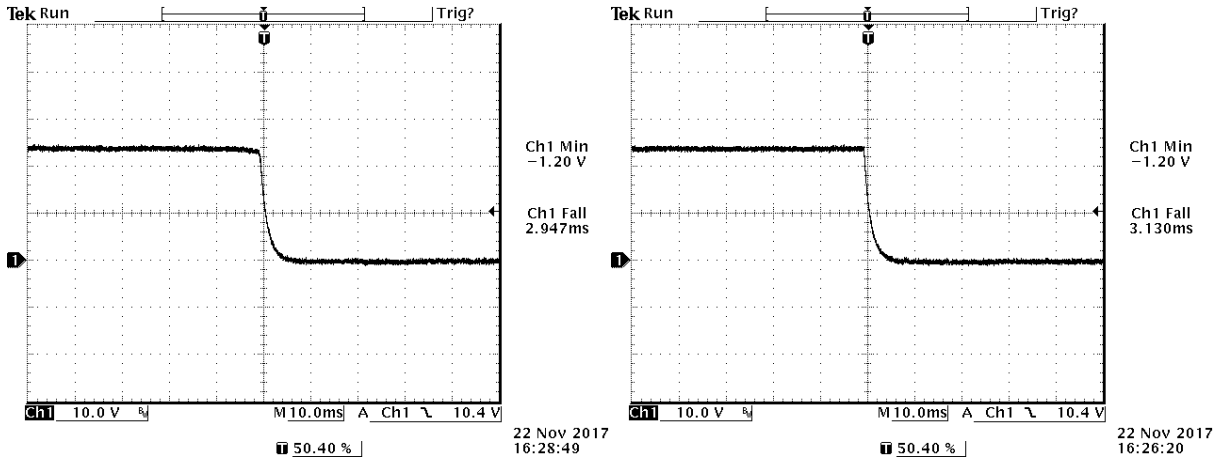
Test condition: *Vin=110V, Vo=24V, Io=6A, di/dt=2.5A/us,Cout=1uF ceramic + 100uF polymer + 220uF Al*

11. STARTUP & SHUTDOWN



Start up from Vin *Start up from on/off*

Test conditon: *Vin=66V, Vo=24V, Io=6A, Cout=1uF ceramic + 100uF polymer + 220uF Al*



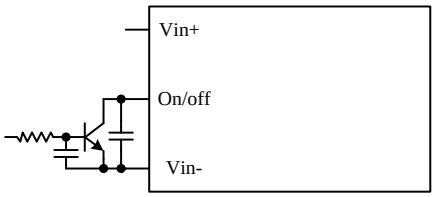
Shutdown from Vin *Shutdown from on/off*

Test condition: *Vin=66V, Vo=24V, Io=6A, Cout=1uF ceramic + 100uF polymer + 220uF Al*

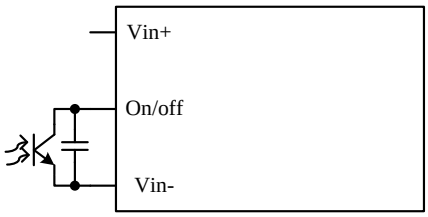
12. REMOTE ON/OFF

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	-	10	mA

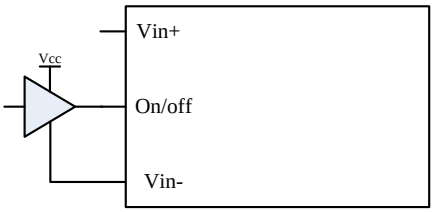
Recommended remote on/off circuit for active low



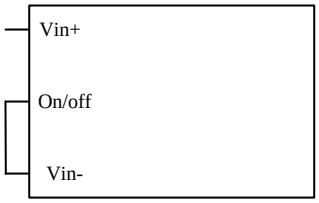
Control with open collector/drain circuit



Control with photocoupler circuit



Control with logic circuit

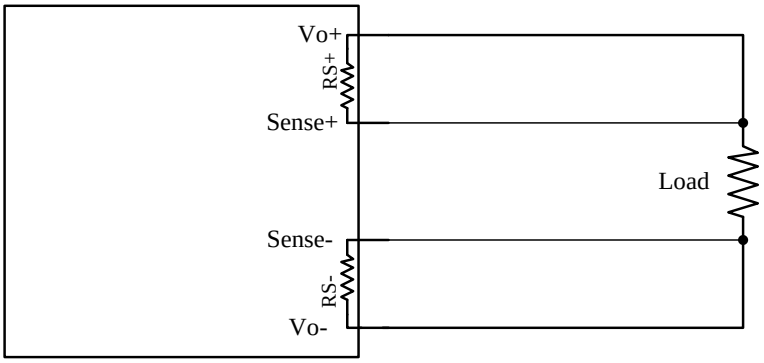


Permanently on

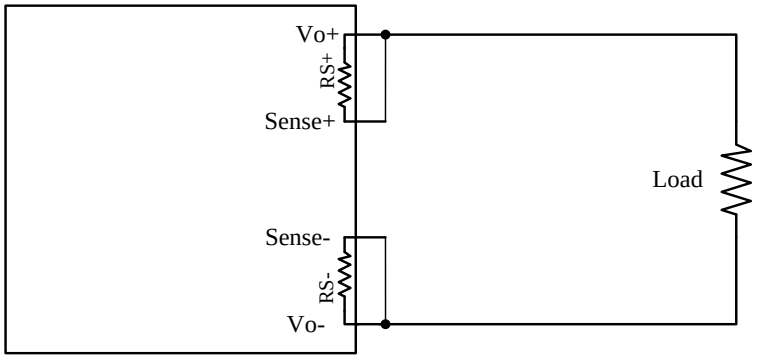
13. REMOTE SENSE

This module has remote sense compensation feature. It can minimizes the effects of resistance between module's output and load in system layout and facilitates 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 1.0V at 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 1.0V at 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. The can make an effect on the module's compensation, affecting the stability and dyn.
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.



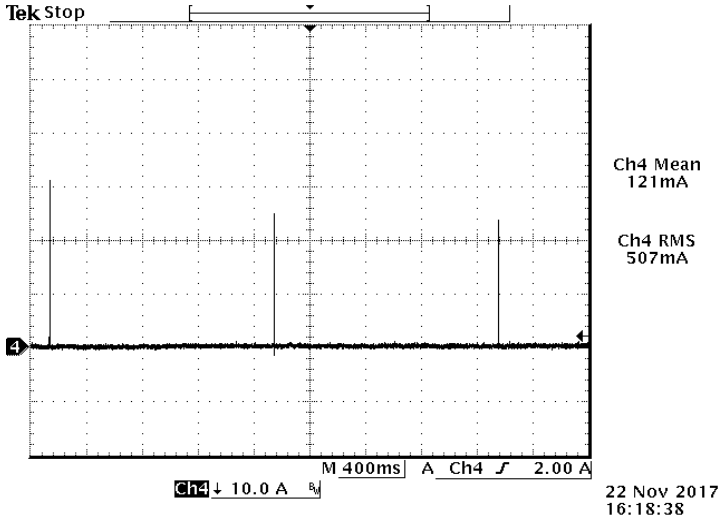
6. If not using remote sense compensation, please connect sense directly to output at module's pin, that is, connect sense+ to Vo+ and sense- to Vo- at module's pin, the shorter the better. See below figure.



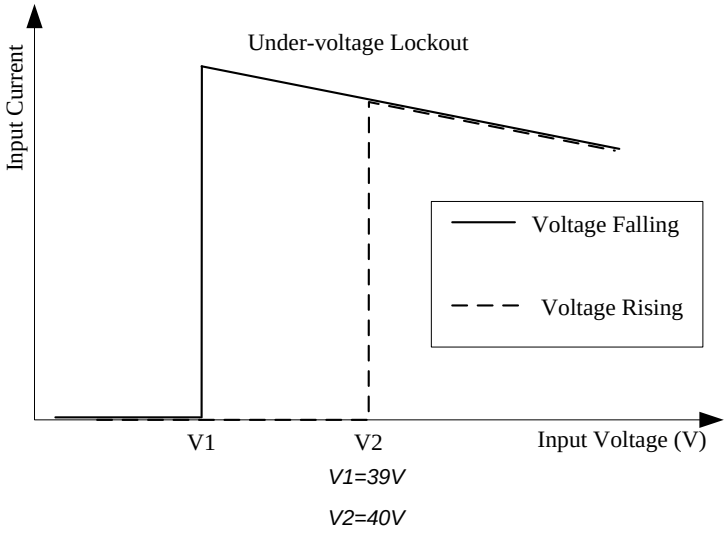
14. OCP

Hiccup:

To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for a few mili-seconds. If the overcurrent condition persists beyond a few milliseconds, the module will shut down into hiccup mode. The module operates normally when the output current goes into specified range. The typical average output current is 0.12A during hiccup.



15. INPUT UNDER-VOLTAGE LOCKOUT



V1=39V

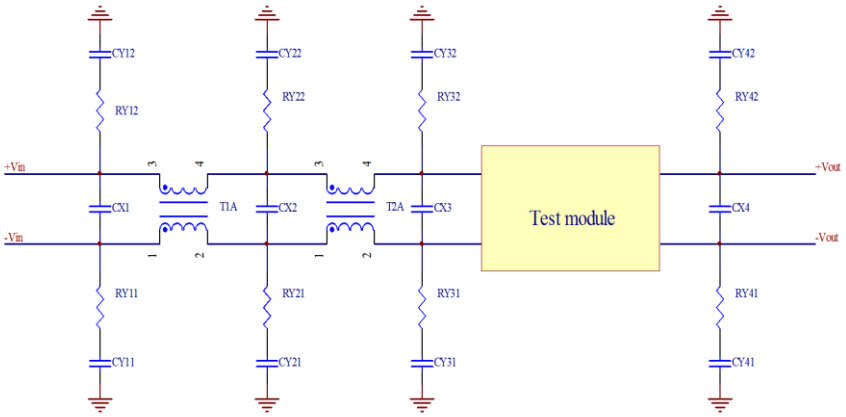
V2=40V

16. SAFETY&EMC

Safety:

1. Compliance to UL/CSA60950-1
2. Compliance to EN/IEC60950-1

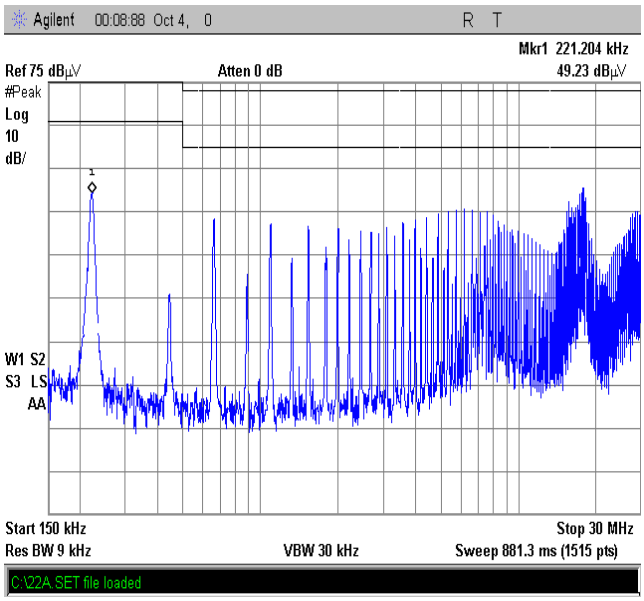
Setup:



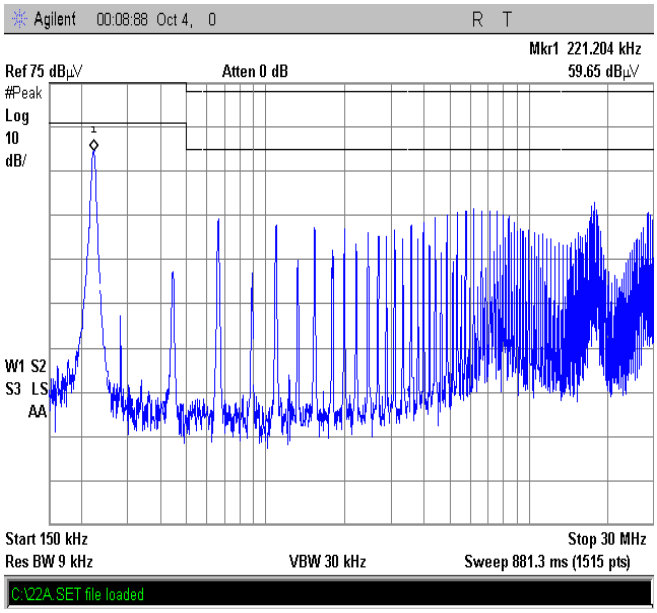
T1A	CX1	RY11	RY12	CY11
T2A	CX2	RY21	RY22	CY21
2.5mH	1uF			
	CX3	RY31	RY32	CY31
	1uF+330uF AL	0R	0R	4.7nF
	CX4	RY41	RY42	CY41

SAFETY&EMC(CONTINUED)

Positive:



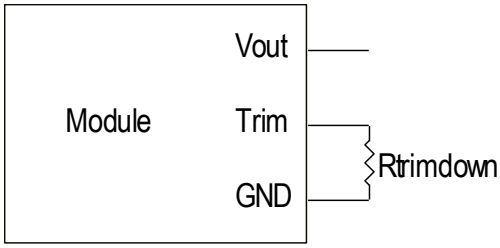
Negative:



17. TRIM

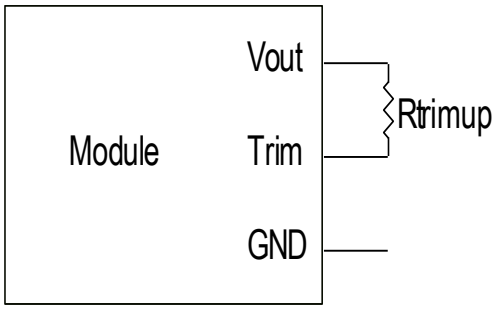
0RQB-C5W24x Trim Resistor Calculate

Trim down test circuit



$$R_{trimdown} = \frac{Vo\_req}{24 - Vo\_req} - 1\,[k\,\Omega]$$

Trim up test circuit



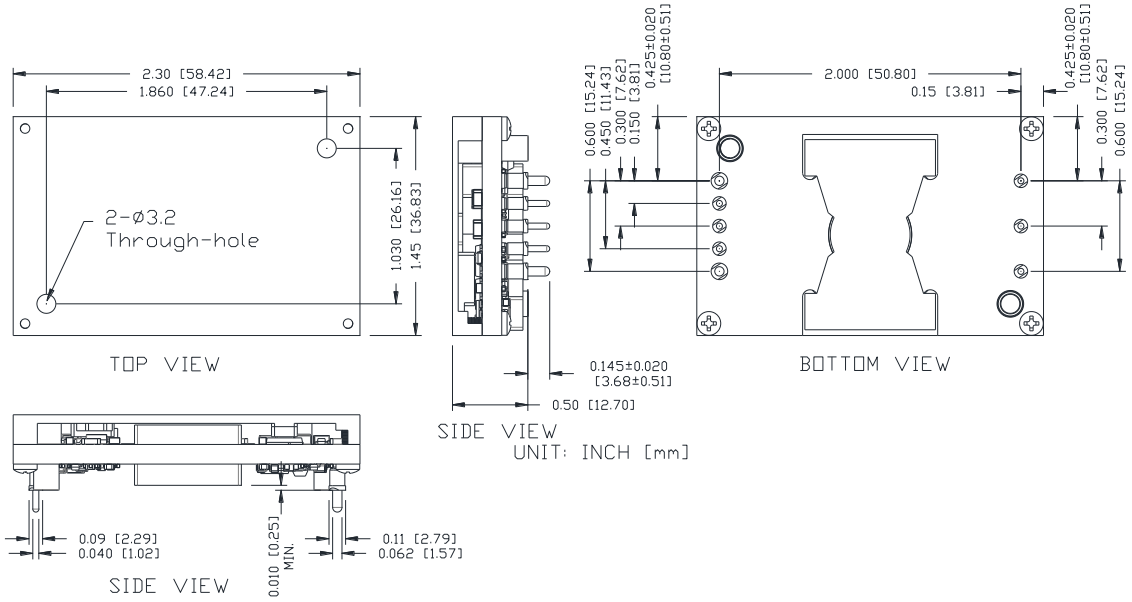
$$R_{trimup} = \frac{1 - 0.051875}{0.051876 - 1.24 / Vo\_req} - 1\,[k\,\Omega]$$

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

18. MECHANICAL DIMENSIONS

0RQB-C5W24R

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:

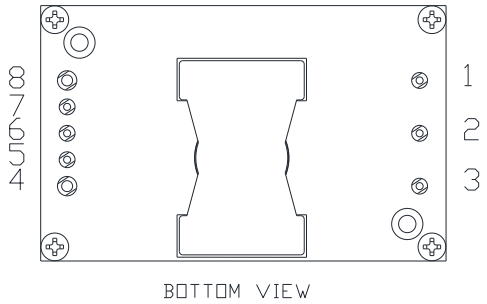
All Pins: Material - Copper Alloy;
Finish – Tin plated.

1） Undimensioned components are shown for visual reference only.

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

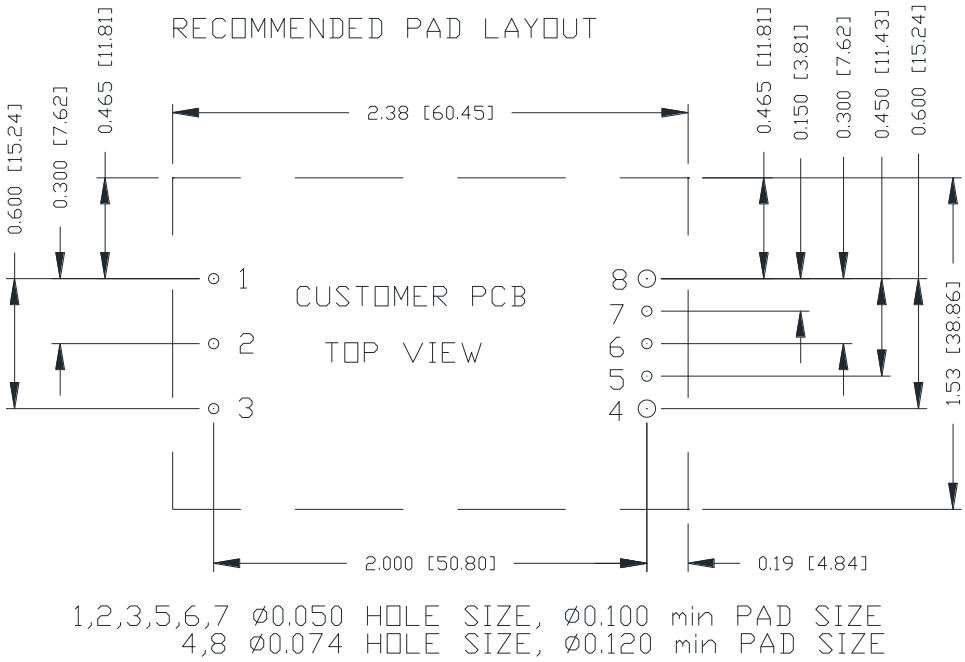
MECHANICAL DIMENSIONS(CONTINUED)

PIN DEFINITIONS



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

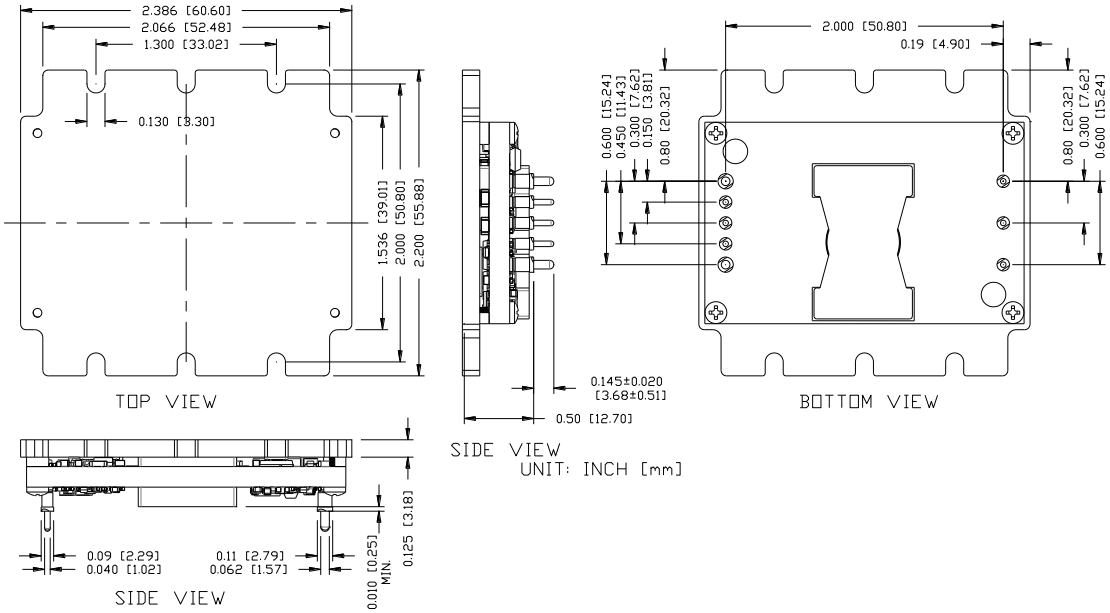
RECOMMENDED PAD LAYOUT



MECHANICAL DIMENSIONS(CONTINUED)

0RQB-C5W24S

OUTLINE



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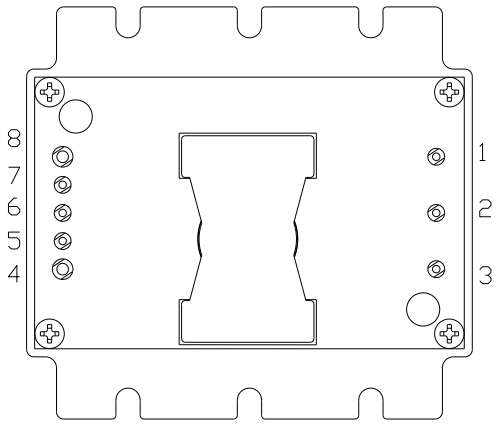
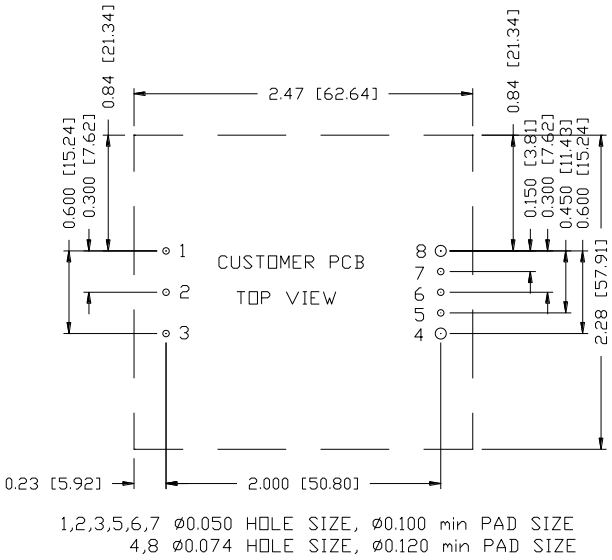
MECHANICAL DIMENSIONS(CONTINUED)

PIN DEFINITIONS



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

RECOMMENDED PAD LAYOUT



19. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2018-09-10	AA	First release	J.Yao
2018-10-23	AB	Add 0RQB-C5W24S	J.Yao
2019-10-24	AC	Add feature reinforced isolation	J.Yao

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

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