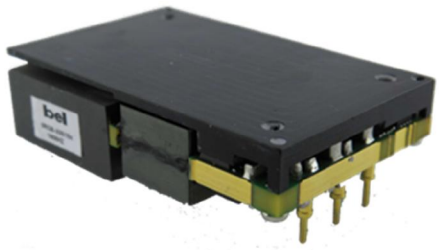
0RQB-X3S11B(F)

Isolated DC-DC Converter

The 0RQB-X3S11B(F) is an isolated DC/DC converter that operates from a nominal 50/54 Vdc source. This converter is intended to provide isolation and step down to generate a regulated intermediate bus for the purpose of powering non-isolated Point-of-Load (POL) converters.

This unit will provide up to 1300 W of output power from a nominal 50/54 Vdc input.

The output of the converter has the droop function which allow the modules operating in parallel with high output current sharing precision. This converter is provided in a 1/4 brick package.



RoHS Compliant

Key Features & Benefits

- 45–58.5 VDC Input / 10.4 VDC @ 125 A Output /1/4th Brick Converter
- Isolated
- Fixed Frequency
- High Efficiency
- High Power Density
- Input Under Voltage Lockout
- OCP/SCP
- Output Over-voltage Protection
- Over Temperature Protection
- Remote On/Off
- Parallel Indication
- Approved to UL/CSA/IEC60950-1, 2nd +A2 version (TBD)
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

Applications

- Networking
- Computers and peripherals
- Telecommunications

1. MODEL SELECTION

MODEL NUMBER	MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RQB-X3S11B	0RQB-X3S11F	10.4 VDC	45 VDC – 58.5 VDC	125 A	1300 W	96.9%

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

PART NUMBER EXPLANATION

0	R	QB	-	X3	S	11	x	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
Through hole mount	RoHS	1/4th Brick		1300 W	45 – 58.5V	10.4 V	B – active low, with HSK plate, Pin Length 0.18" F – active low, with HSK plate, Pin length 0.125"	G – Tray package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	58.5	V
Remote On/Off		-0.3	-	16	V
Ambient Temperature	Long-Term Operating. All components on the Unit meet IPC-9592 (latest revision) derating guidelines.	-5	-	85	°C
	Short-Term Operating (96 hours/year). Unit's component temperatures exceed IPC-9592 (latest revision) derating guidelines but not exceed component temperature ratings.	-20	-	90	°C
Altitude	Maximum operating temperature will be decreased 1°C per 1000 Feet of altitude above sea-level	-500	-	13120	feet
Storage Temperature		-40	-	100	°C

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		45	50/54	58.5	V
Input Current (full load)		-	-	31	A
Input Current (no load)		-	130	-	mA
Remote Off Input Current		-	10	-	mA
Input Reflected Ripple Current (rms)	10uH source impedance, Vin=45-56V, Io=Iomax. Refer to section 12 for detail input capacitance and waveforms.	-	5	10	mA
Input Reflected Ripple Current (pk-pk)		-	20	50	mA
Input Terminal Ripple Current(RMS)		-	-	1300	mA
Input Turn on Voltage Threshold		42.5	44	45.0	V
Input Turn off Voltage Threshold		39	41	42.5	V
Over-voltage Shutdown Threshold		61	-	64	V
Input C-L-C filter					
Recommended input fast-acting fuse on system board		40	–	-	A

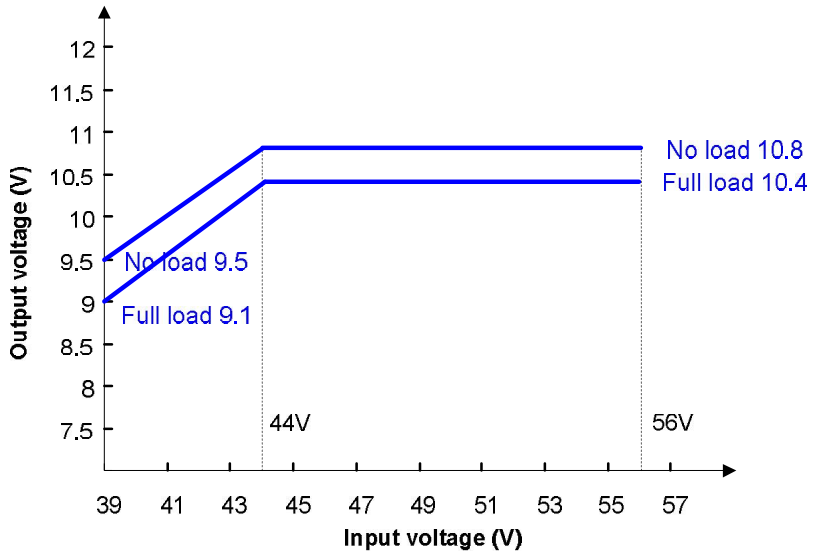
CAUTION: This converter is not internally fused. An input line fuse must be used in application.

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 = 52V, Pout = 650W	10.55	10.6	10.65	V
	Vin = 45-56V	10.3	-	11	V
Load Regulation	Vin=52V,Io=0~100% load	-	0.4	0.53	V
Line Regulation	Vin=45-56V, Io=100% load	-	30	40	mV
Regulation Over Temperature	Vin=50V, Io=100% load, Ta=-20~85C	-	100	200	mV
Ripple and Noise (pk-pk)	Cout = 750uF minimum, approximately 50% ceramic, 50% Oscon or POSCAP.	-	-	150	mV
Ripple and Noise (rms)		-	-	30	mV
Output Ripple and Noise(Pk-Pk) under worst case	Over all operating input voltage, load and ambient temperature condition.	-	-	200	mV
Output Current Range		0	-	125	A
Output DC Current Limit	hiccup mode, non-latching.	130	-	-	A
Rise time	Defined as time between Vout at 10% of final value and Vout at 90% of final value.	-	-	15	ms
Turn on Time	Defined as time between Vin reaching Turn-On voltage and Vout reaching 10% of final value.	20	-	30	ms
	Defined as time between Enable and Vout reaching 10% of final value.	-	-	5	ms
Overshoot at Turn on		-	-	3	%
Output Capacitance	Typically 50% ceramic, 50% Oscon or POSCAP.	0	-	6250	uF
Transient Response					
ΔV 50%~75% of Max Load	1A/us, 4000uF capacitors are near the brick output.	-	-	350	mV
Settling Time		-	-	-	us
ΔV 75%~50% of Max Load		-	-	350	mV
Settling Time		-	-	-	us

5. OUTPUT PLOT VS INPUT



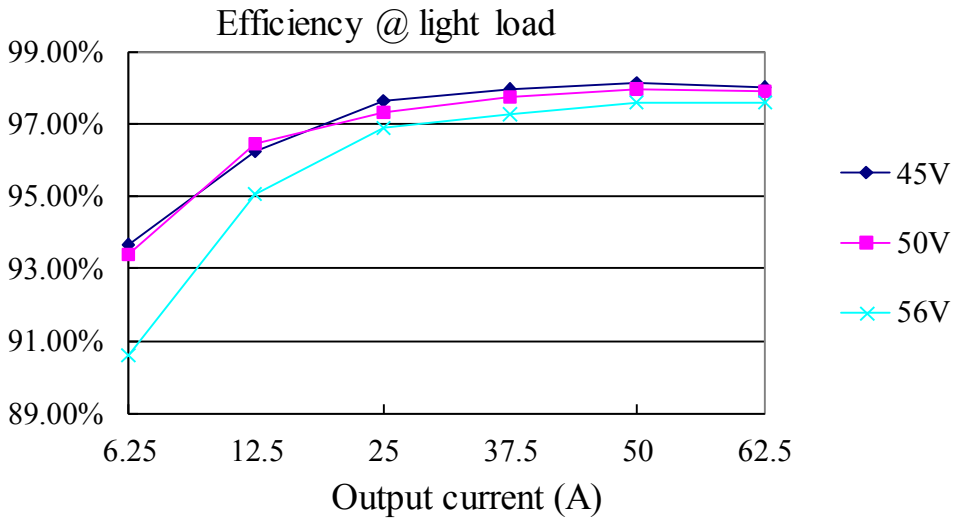
NOTE

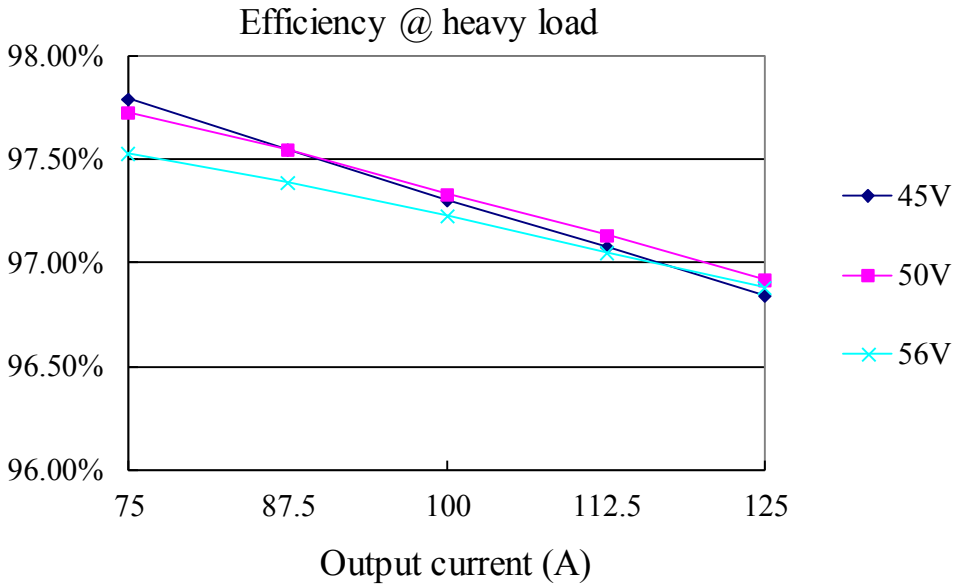
Parameter	*Min*	*Typical*	*Max*	*Units*
Turn on Voltage Threshold	*42.5*	*44*	*45*	*V*
Turn off Voltage Threshold	*39*	*41*	*42.5*	*V*

6. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Vin=50V, Io=125A, Ta=25℃	96.2	96.9	-	%
Switching Frequency	Primary FETs	-	150	-	kHz
MTBF		-	TBD	-	Mhrs
Over Temperature Protection	Reset will occur when over-temperature condition is removed.	-	130	-	℃
Output Over Voltage Protection		-	-	15	V
Weight		-	87.4	-	g
Dimensions Inches (L × W × H) Millimeters (L × W × H)			2.30 x 1.45 x 0.57 58.42 x 36.83 x 14.50		
Isolation Characteristics					
Input to Output		-	-	500	V
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

7. EFFICIENCY DATA

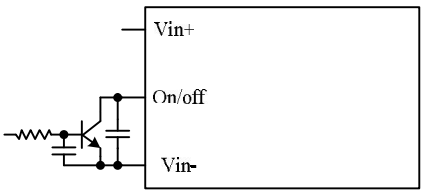




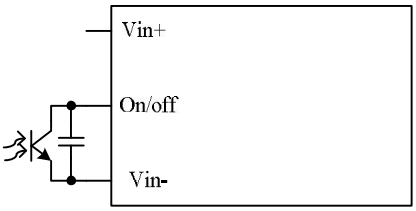
8. REMOTE ON/OFF

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	-	16	V
Current (Out of pin)		Module is on, Venab= -0.3-0.8V	-	-	200	μA
		Module is off, Venab=2.4V	10	-	-	μA
Current (into pin)		Remote on/off pin is pulled up to 10V.	-	-	300	μA
		Remote on/off pin is pulled up to 15V.	-	-	500	μA
Open circuit voltage			-	-	15	V

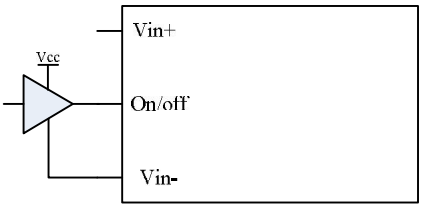
Recommended remote on/off circuit for active low



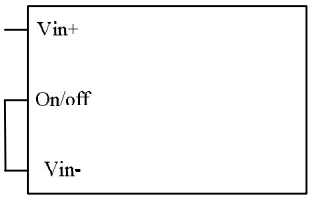
Control with open collector/drain circuit



Control with photocoupler circuit



Control with logic circuit



Permanently on

9. THERMAL DERATING CURVE

Thermal Considerations

New high power architectures require an accurate thermal design. Design engineers have to optimize the module working conditions and ensure reliable operation. Convection cooling is the common mode to cool down the module. Heat transfer is dependent on a test setup and it is important to characterize the module in an environment similar to existent electronic applications. Reported thermal data reflects real operating conditions because the values are physically measured in a wind tunnel.

Thermal Test Setup

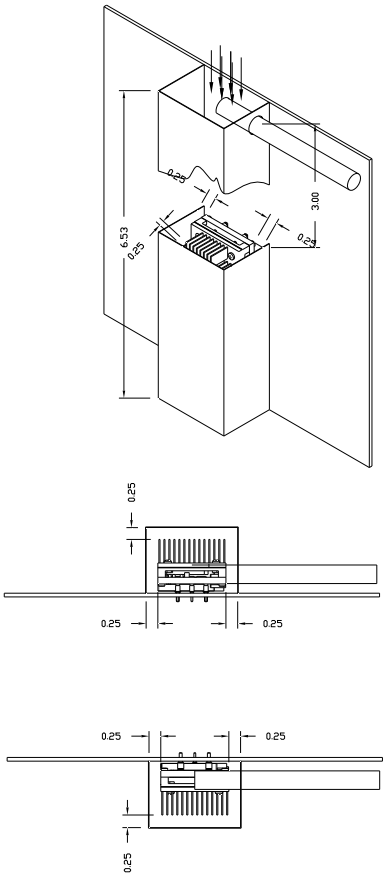
A module in electronic cards is typically located in a busy area without relevant space around it.

To simulate a real condition and avoid turbulence we add a cover with defined dimensions.

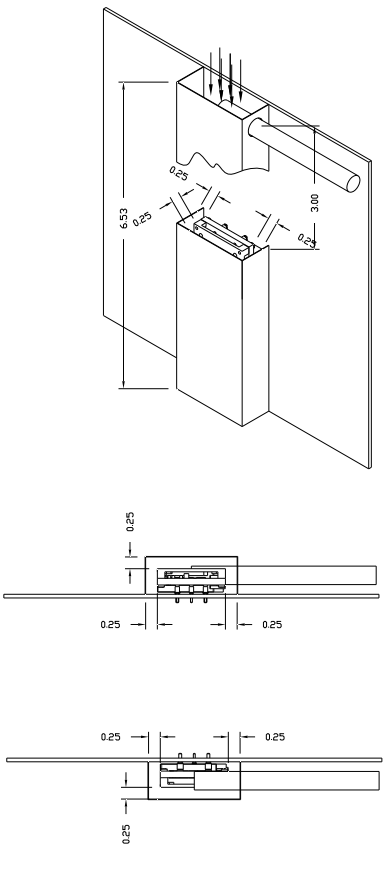
The distance has to be 6.35mm (0.25”inch) from the top of the module and 6.35mm (0.25”inch) on the left and right side of the module.

The values reflect most of the real applications and it is a common procedure in the power module market.

Ambient temperature and airflow are measured in front of the module at the distance of 76.2mm (3”inch).



0RQB-X3S11B + External heatsink

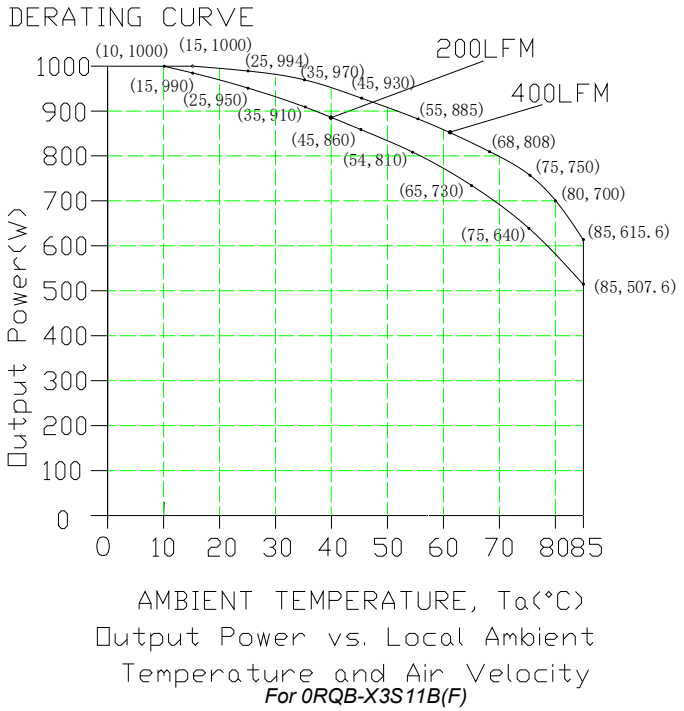


0RQB-X3S11B

Tests setup drawing all measures are in inch

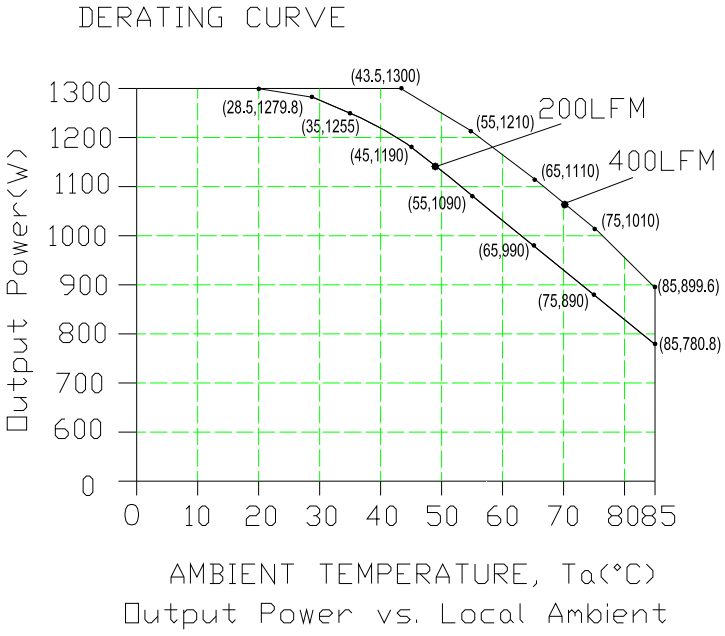
**The size of external heatsink is 2.30” x 1.45” x 0.61”, recommended model number: S08CAA02 from ALPHA*

THERMAL DERATING CURVE



For 0RQB-X3S11B(F)

Note: *Output power vs. ambient temperature and air velocity @Vin=56V (Longitudinal Orientation, airflow from Vout to Vin)*

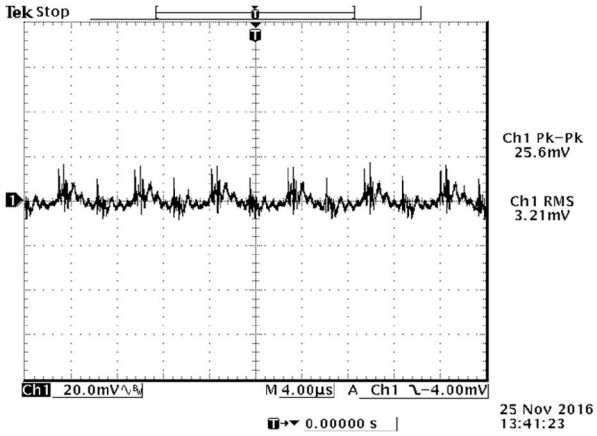


For 0RQB-X3S11B(F) + External heatsink

Note: *Output power vs. ambient temperature and air velocity @Vin=56V (Longitudinal Orientation, airflow from Vout to Vin)*

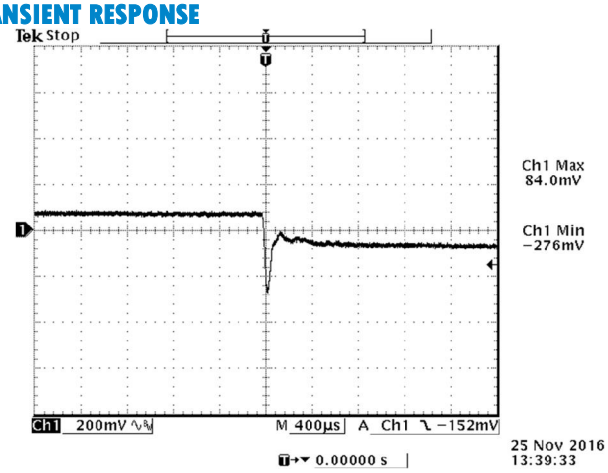
Heatsink information: S08CAA02 from ALPHA

10. RIPPLE AND NOISE

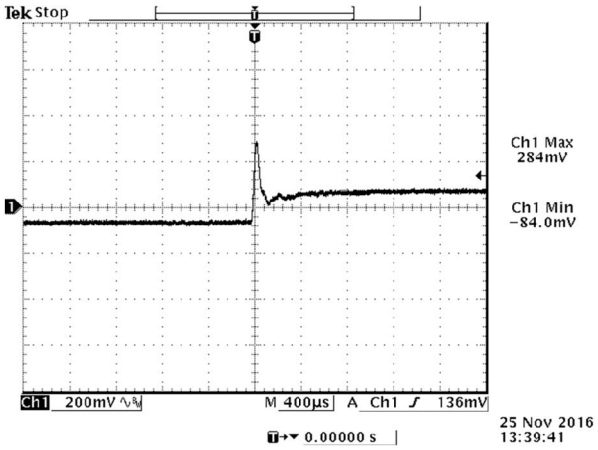


Notes: *Ripple and noise, 50Vdc input, 1300W output, Ta=25 deg C, with Cout = 3100uF*

11. TRANSIENT RESPONSE



50%-75% Load Transients at Vin=50V@Ta=25℃

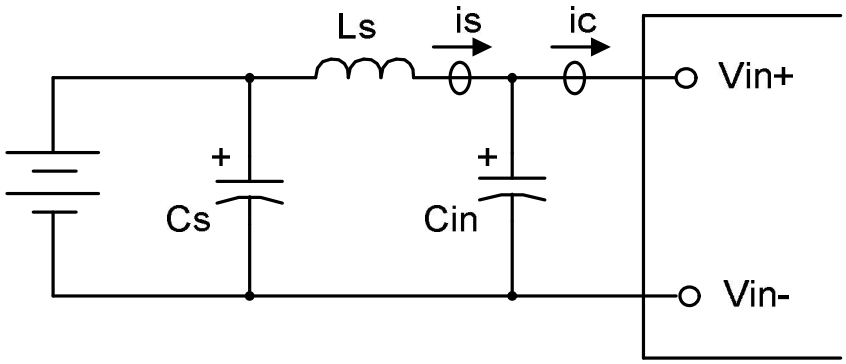


75%-50% Load Transients at Vin=50V@Ta=25℃

12. INPUT NOISE

Input reflected ripple current

Testing set up



Notes and values in testing.

is: Input Reflected Ripple Current

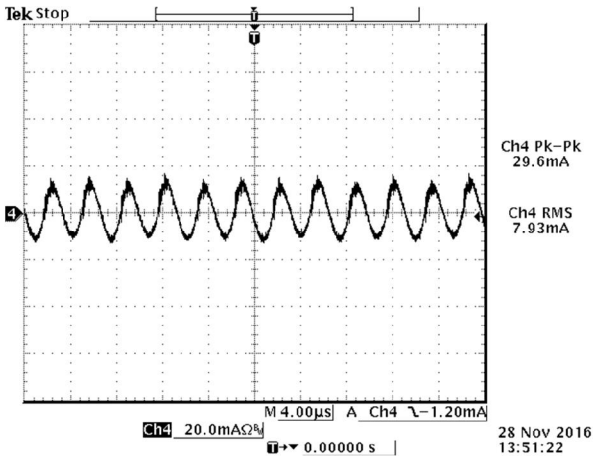
ic: Input Terminal Ripple Current

Ls: Simulated Source Impedance (12μH)

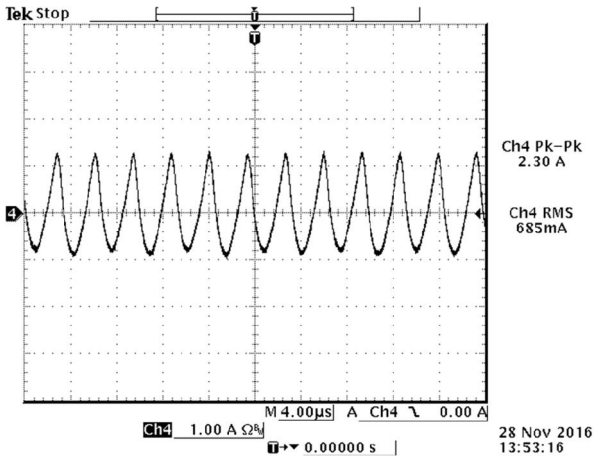
Cs: Offset possible source Impendence (100μF, ESR<0.2Ω @ 100kHz, 20C)

Cin: Electrolytic capacitor, should be as closed as possible to the power module to swallow ic ripple current and help with stability. Recommendation: 100μF, 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

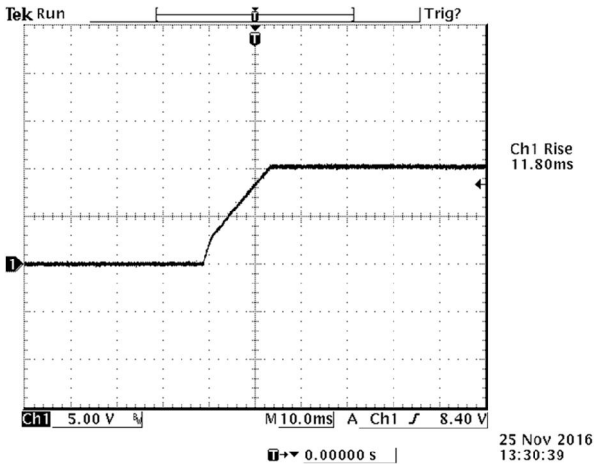


ic (input terminal ripple current), AC component

Test condition: *50Vdc input, 1300W output and Ta=25 deg C, with 31 * 100 μF ceramic capacitor at output.*

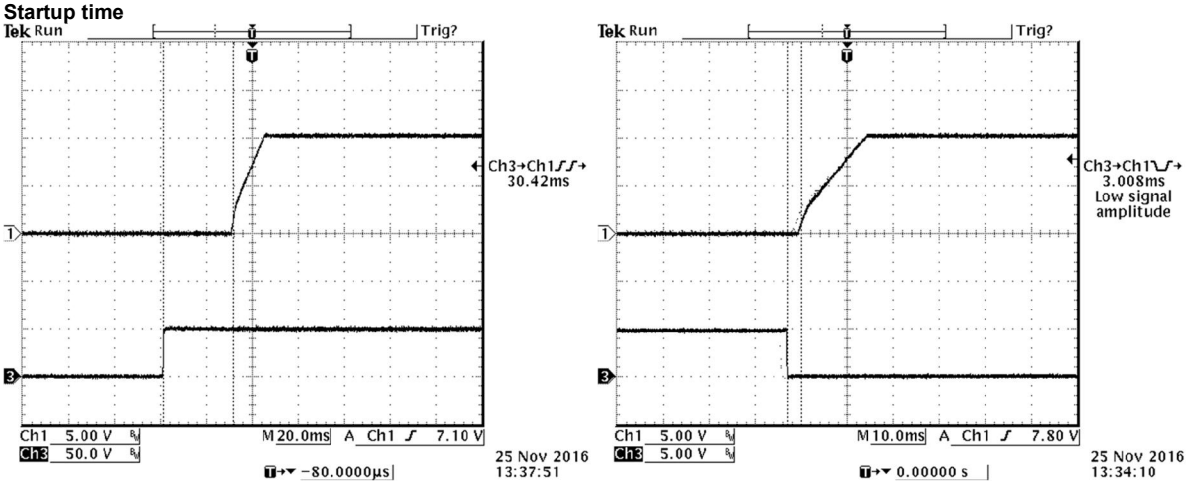
13. STARTUP&SHUTDOWN

Rise time



Test Condition: *Vin=50V, Po=1300W, with 31 * 100 µF ceramic capacitor and 3200uF AL. cap at output.*

Startup time



Startup from Vin

Ch1: Vo

Ch3: Vin

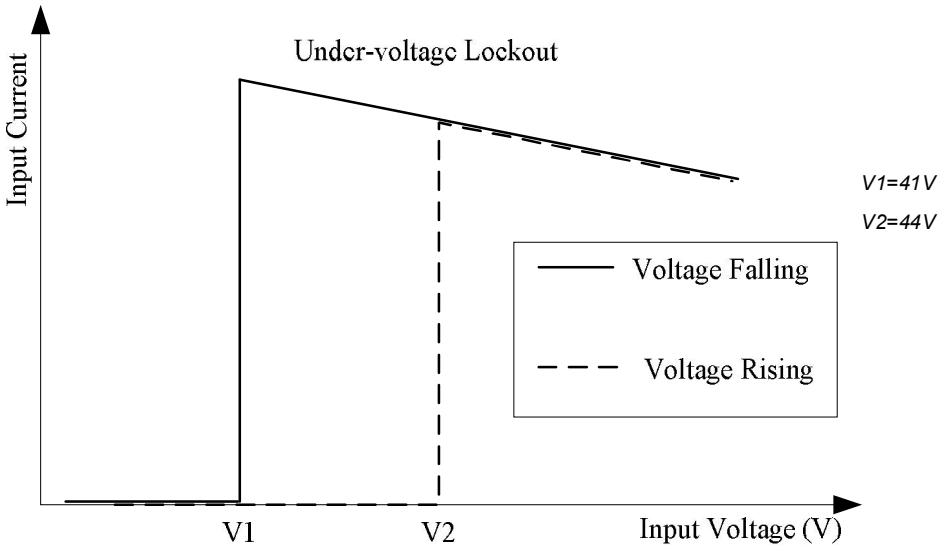
Startup from on/off

Ch1: Vo

Ch3: on/off

Test Condition: *Vin=50V, Po=1300W, with 31 * 100 µF ceramic capacitor and 3200uF AL. cap at output*

14. INPUT UNDER-VOLTAGE LOCKOUT



15. POWER GOOD

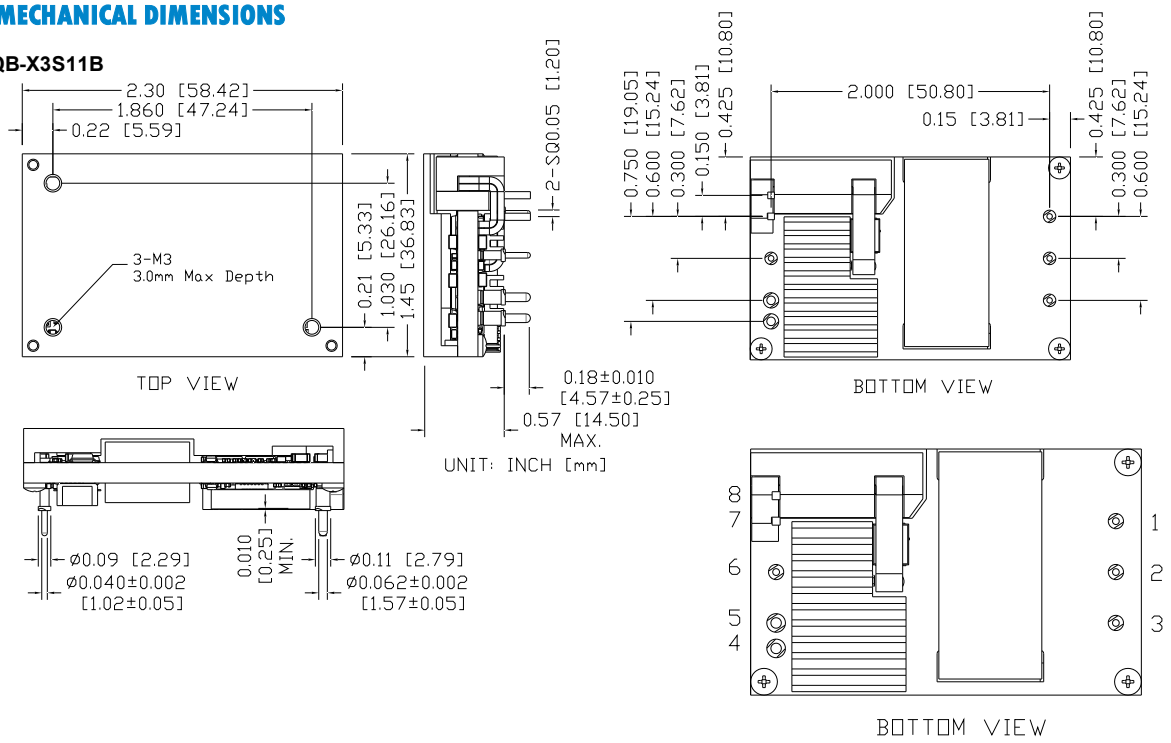
1. The Power Good signal is a non-latching open-collector output that is Low during normal operation and is pulled High when any of the following conditions occur:
   - Over-Temperature
   - Over-Current
   - Vout is outside of the DC Output Band while Vin is within the Vin Operating Range
   - Vin is within the Vin Operating Range but the unit is not operating (to determine if 1 Unit used in a parallel configuration is not operating)
   - Vin is outside of the Vin Operating Range

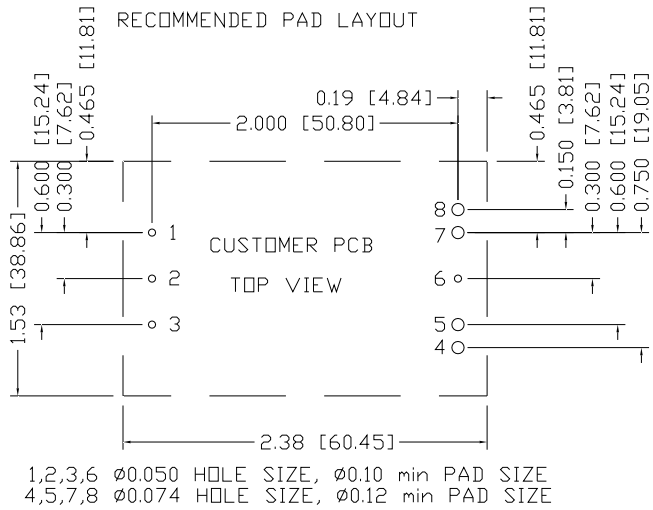
2. The Power Good signal is referenced to Vout(-).

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Low (trigger limits)		8.2	-	8.6	V
Output Voltage High (trigger limits)		12.6	-	13.1	V
Input Voltage Low (trigger limits) Rising	PG signal indicats good when Vin is within operating range and indicats bad ~20ms before unit is shut-down due to UV.	42.5	-	45	V
Hysteresis		-	1	-	V
High State Voltage		0	-	5.5	V
High State Leakage Current (into Pin)		0	-	10	μA
Low State Voltage		0	-	0.8	V
Low State Current (into Pin)		0	-	5	mA
Power Good Signal De-assert Response Time	Duration between the fault occurring and the Power-Good Signal de-asserting	0	-	3	ms
Power Good Signal Assert Response Time	Duration between unit powering up with no faults and the Power Good Signal asserting	0	-	3	ms
Power Good Signal Duration	Duration the Power-Good signal stays de-asserted if a transient fault occurs	200		600	ms
Over Temperature Warning	For OT Warning, the PG signal will toggle as an impulse wave.	-	10degC below OTP threshold	-	-
OT Warning PG signal frequence		90	100	110	kHZ
OT Warning PG signal duty cycle		47.5	50	52.5	%

16. MECHANICAL DIMENSIONS

0RQB-X3S11B





PIN CONNECTIONS

PIN	FUNCTION	FUNCTION	PIN SIZE
1	Vin (+)	Positive input voltage	0.04"
2	ON/OFF	Input to turn converter on and off, referenced to Vin(-)	0.04"
3	Vin (-)	Negative input voltage	0.04"
4	Vout(-)	Negative output voltage	0.062"
5	Vout(-)	Negative output voltage	0.062"
6	PGOOD	Power-Good	0.04"
7	Vout(+)	Positive output voltage	SQ0.05"
8	Vout(+)	Positive output voltage	SQ0.05"

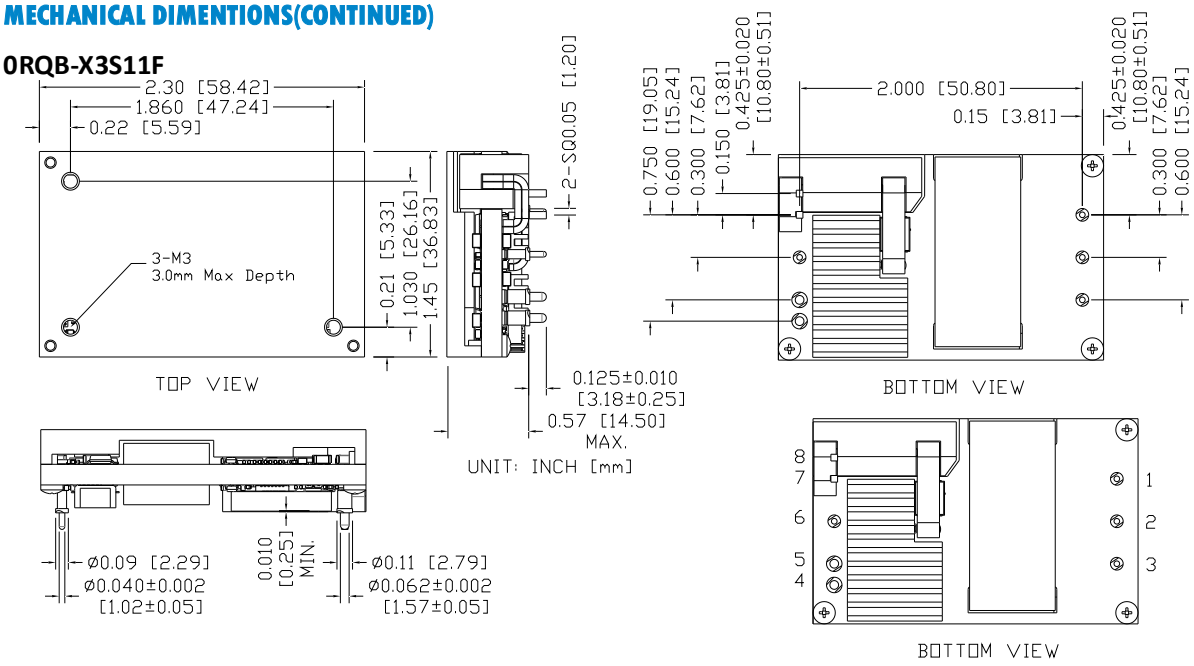
Note: This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 ºC for less than 5 seconds.

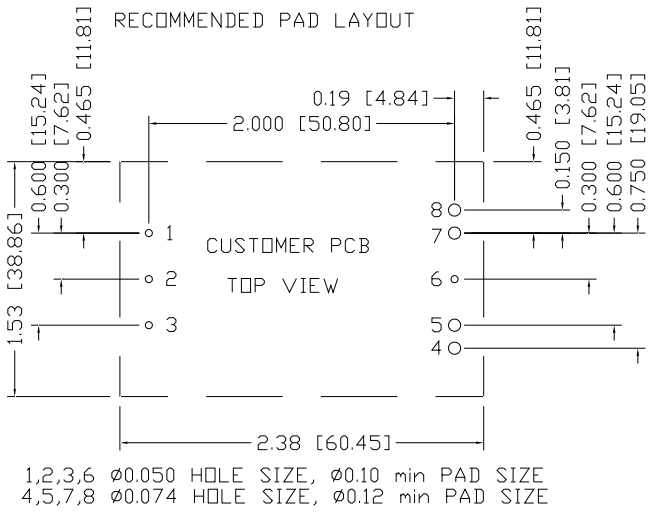
NOTES:

1) All Pins: Material - Copper Alloy;
   Finish – Tin plated
2) 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 DIMENTIONS(CONTINUED)

0RQB-X3S11F





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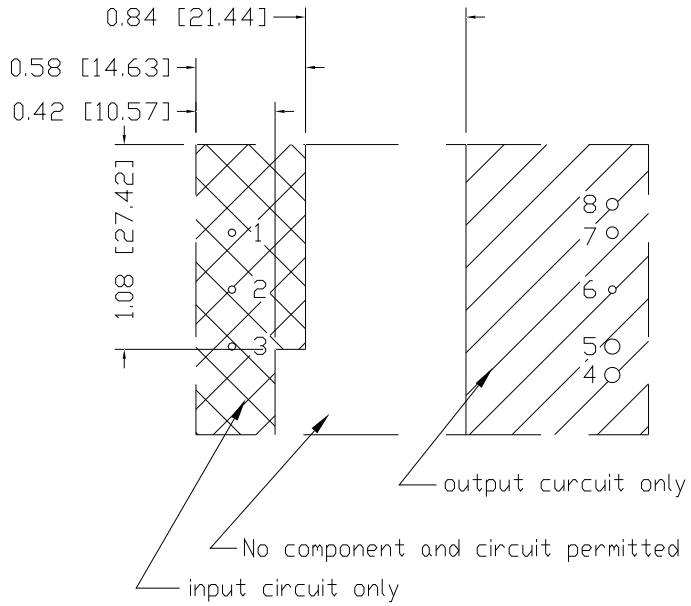
MECHANICAL DIMENSIONS(CONTINUED)

0RQB-X3S11B/0RQB-X3S11F



CUSTOMER PCB

TOP VIEW

NOTES:

1) All Pins: Material - Copper Alloy;
   Finish – Tin plated
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
2016-04-14	AA	First release	J Yan
2016-12-05	AB	Update Cover, input specs, output specs, general, Efficiency data, TD, NR, TR.	J Yan
2017-04-07	AC	Add PN and Mechanical drawing of 0RQB-X3S11F.	J Yan
2017-08-04	AD	Add Output Plot VS Input.	J Yan
2017-09-27	AE	Update General Specifications, Efficiency data, Input voltage max and Power good.	J Yan

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.