

0RQB-C0U Series

Isolated DC-DC Converter

The 0RQB-C0U Series are isolated DC/DC converters that operate from a nominal 48 VDC source. These units will provide up to 100 W of output power from a nominal 48 VDC input. These units are designed to be highly efficient and low cost. Typical efficiency of 12 VDC output at 48 VDC input and full load is 91%.

Features include remote on/off, over current protection and under-voltage lockout. These converters are provided in an industry standard quarter brick package.



Key Features & Benefits

- 48 VDC Input
- 12 VDC/8.35 A, 5 VDC/20 A, 3.3 VDC/25 A, 1.2-2.5 VDC/30 A Output
- Isolated
- High Efficiency
- High Power Density
- Low Cost
- Input Over / Under Voltage Lockout
- Fixed Frequency (285 kHz)
- Active Low/High (Option)
- Output Over-Voltage Shutdown
- OCP/SCP
- Over Temperature Protection
- Remote On/Off
- Output Voltage Trim
- Positive/Negative Remote Sense
- Basic Isolation
- Approved to UL/CSA 60950-1
- Approved to UL/CSA 62368-1 (pending)

Applications

- Networking
- Computers and Peripherals
- Telecommunications



bel POWER
SOLUTIONS &
PROTECTION

a bel group

belfuse.com/power-solutions

1. MODEL SELECTION

MODEL NUMBER ACTIVE HIGH	MODEL NUMBER ACTIVE LOW	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
0RQB-C0U120	0RQB-C0U12L	12 VDC	18 V - 75 V	8.35 A	100 W	91%
0RQB-C0U050	0RQB-C0U05L	5.0 VDC	18 V - 75 V	20 A	100 W	90%
0RQB-C0U033	0RQB-C0U03L	3.3 VDC	18 V - 75 V	25 A	82.5 W	90%
0RQB-C0U025	0RQB-C0U02L	2.5 VDC	18 V - 75 V	30 A	75 W	89.5%
0RQB-C0UV80	0RQB-C0UV8L	1.8 VDC	18 V - 75 V	30 A	54 W	85%
0RQB-C0UV50	0RQB-C0UV5L	1.5 VDC	18 V - 75 V	30 A	45 W	83%
0RQB-C0UV20	0RQB-C0UV2L	1.2 VDC	18 V - 75 V	30 A	36 W	80%

NOTE: Add "G" suffix at the end of the model numbers listed above to indicate "Tray Package".

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Input Voltage (Continuous)	Non-Operating	-0.3	-	80	V
	Operating	-	-	75	V
Remote On/Off		-0.3	-	18	V
I/O Isolation Voltage		-	-	2000	V
Ambient Temperature		-40	-	85	°C
Storage Temperature		-55	-	125	°C

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

3. INPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Input Voltage		18	48	75	V
Input Current (full load)	V _o = 12 V	-	-	7.0	A
	V _o = 5.0 V	-	-	7.0	
	V _o = 3.3 V	-	-	6.0	
	V _o = 2.5 V	-	-	5.5	
	V _o = 1.8 V	-	-	4.0	
	V _o = 1.5 V	-	-	3.5	
Input Current (no load)	V _o = 1.2 V	-	-	3.0	mA
		-	100	180	
Remote Off Input Current		-	10	15	mA
Input Reflected Ripple Current (pk-pk)	Tested with simulated source impedance of 10 μH, 5 Hz to 20 MHz BW; use a 0.47 μF/100 V ceramic cap and a 100 μF /100 V electrolytic cap with ESR = 1 ohm max. at 200 kHz at 25 °C.	-	20	40	mA
Input Reflected Ripple Current (rms)		-	5	10	mA
I ² t Inrush Current Transient		-	0.05	0.1	A ² s
Turn-on Voltage Threshold		16.5	17.0	17.5	V
Turn-off Voltage Threshold		15.5	16.0	16.5	V
Input Over Voltage Lockout		76	78	80	V

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

4. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT	
Output Voltage Set Point	Vin = 48 V, Io = 50% full load	Vo = 12 V	11.820	12.00	12.180	V
		Vo = 5.0 V	4.925	5.00	5.075	
		Vo = 3.3 V	3.251	3.30	3.360	
		Vo = 2.5 V	2.455	2.50	2.545	
		Vo = 1.8 V	1.773	1.80	1.827	
		Vo = 1.5 V	1.448	1.50	1.523	
Line Regulation		Vo = 12 V	-	±24	±120	mV
		Vo = 5.0 V	-	±5	±25	
		Vo = 3.3 V	-	±4	±15	
		Vo = 2.5 V	-	±4	±10	
		Vo = 1.8 V - 1.2 V	-	±3	±6	
Load Regulation		Vo = 12 V	-	±30	±80	mV
		Vo = 5.0 V	-	±10	±25	
		Vo = 3.3 V - 2.5 V	-	±8	±15	
		Vo = 1.8 V - 1.2 V	-	±5	±10	
Regulation Over Temperature (-40 °C to +85 °C)		Vo = 12 V	-	±60	±100	mV
		Vo = 5.0 V	-	±40	±65	
		Vo = 3.3 V	-	±30	±50	
		Vo = 2.5 V	-	±20	±50	
		Vo = 1.8 V - 1.2 V	-	±15	±30	
Output Current Range		Vo = 12 V	0	-	8.35	A
		Vo = 5.0 V	0	-	20	
		Vo = 3.3 V	0	-	25	
		Vo = 2.5 - 1.2 V	0	-	30	
Current Limit Threshold		Vo = 12 V	9.2	10.5	13	A
		Vo = 5.0 V	24	26	30	
		Vo = 3.3 V	27	32	35	
		Vo = 2.5 V	35	40	45	
		Vo = 1.8 V - 1.2 V	-	36	-	
Short Circuit Surge Transient		-	3	5	A²s	
Ripple and Noise* (rms)	Vin = 48 V	Vo = 12 V	-	30	50	mV
		Vo = 5.0 V	-	25	40	
		Vo = 3.3 V - 2.5 V	-	20	40	
		Vo = 1.8 V - 1.2 V	-	15	30	
		Vo = 1.2 V	-	10	20	
Ripple and Noise* (pk-pk)	Vin = 24 V	Vo = 12 V	-	25	40	mV
		Vo = 5.0 V	-	20	30	
		Vo = 3.3 V	-	15	25	
		Vo = 2.5 V - 1.2 V	-	10	20	
		Vo = 1.2 V	-	10	20	
Ripple and Noise* (pk-pk)	Vin = 48 V	Vo = 12 V	-	100	150	mV
		Vo = 5.0 V	-	75	120	
		Vo = 3.3 V - 2.5 V	-	50	100	
		Vo = 1.8 V - 1.2 V	-	40	80	
		Vo = 1.2 V	-	30	60	
Ripple and Noise* (pk-pk)	Vin = 24 V	Vo = 12 V	-	75	120	mV
		Vo = 5.0 V	-	50	100	
		Vo = 3.3 V	-	35	70	
		Vo = 2.5 V	-	30	60	
		Vo = 1.8 V - 1.2 V	-	25	50	
Turn on Time		10	-	100	ms	
Overshoot at Turn on		-	0	5	%	
Output Capacitance		Vo = 12 V	0	-	1200	µF
		Vo = 5.0 V	0	-	6800	
		Vo = 3.3 V	0	-	15000	
		Vo = 2.5 V - 1.2 V	0	-	20000	

TRANSIENT RESPONSE						
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 12.0\text{ V}$	-	360	480	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	100	250	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 5.0\text{ V}$	-	360	480	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	150	250	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 3.3\text{ V}$	-	200	300	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	100	150	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 2.5\text{ V}$	-	200	300	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	100	150	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 1.8\text{ V} - 1.2\text{ V}$	-	150	200	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	100	100	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 1.8\text{ V} - 1.2\text{ V}$	-	150	200	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	85	100	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 1.8\text{ V} - 1.2\text{ V}$	-	150	200	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	85	100	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 1.8\text{ V} - 1.2\text{ V}$	-	50	80	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	100	150	μs
50% ~ 75% Max Load	Overshoot Settling Time	$V_O = 1.8\text{ V} - 1.2\text{ V}$	-	50	80	mV
75% ~ 50% Max Load	Overshoot Settling Time		-	100	150	μs

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

5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT	
Efficiency	$V_{in} = 48\text{ V}$, full load, $T_a = 25\text{ }^\circ\text{C}$	$V_O = 12\text{ V}$	88	91	-	%
		$V_O = 5.0\text{ V}$	88	90	-	
		$V_O = 3.3\text{ V}$	88	90	-	
		$V_O = 2.5\text{ V}$	88	89.5	-	
		$V_O = 1.8\text{ V}$	-	85	-	
		$V_O = 1.5\text{ V}$	-	83	-	
		$V_O = 1.2\text{ V}$	-	80	-	
Efficiency	$V_{in} = 24\text{ V}$, full load, $T_a = 25\text{ }^\circ\text{C}$	$V_O = 12\text{ V}$	-	92	-	%
		$V_O = 5.0\text{ V}$	-	91	-	
		$V_O = 3.3\text{ V}$	89	91	-	
		$V_O = 2.5\text{ V}$	-	87	-	
		$V_O = 1.8\text{ V}$	-	85	-	
		$V_O = 1.5\text{ V}$	-	83	-	
		$V_O = 1.2\text{ V}$	-	80	-	
Switching Frequency		240	285	320	kHz	
Isolation Capacitance		-	1500	-	pF	
Input to Output Isolation Voltage		-	-	2000	V	
Remote Sense Compensation	The total voltage increased by trim and remote sense should not exceed 10% V_O .	-	-	10	% V_O	
Output Voltage Trim Range		80	-	110	% V_O	
Over Temperature Protection		-	-	125	$^\circ\text{C}$	
Over Voltage Protection	$V_{in} = 48\text{ V}$, full load, Hiccup mode	-	130	-	% V_O	
Weight		-	40	-	g	
Dimensions (L x W x H)		2.30 x 1.45 x 0.395			inch	
		58.42 x 36.83 x 10.04			mm	

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

6. CONTROL SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
REMOTE ON/OFF						
Signal Low (Unit On)	Active Low	ORQB-C0UxxL. The remote on/off pin open, Unit off.	-0.3	-	0.8	V
Signal High (Unit Off)						
Signal Low (Unit Off)	Active High	ORQB-C0Uxx0. The remote on/off pin open, Unit on.	-0.3	-	0.8	V
Signal High (Unit On)						
Current Sink			0	-	0.75	mA

7. OUTPUT TRIM EQUATIONS

Equations for calculating the trim resistor are shown below (Unit: kΩ). The Trim Down resistor should be connected between the Trim pin and Ground pin. The Trim Up resistor should be connected between the Trim pin and the Vout. Only one of the resistors should be used for any given application.

For Vo = 1.5 V – 12 V:

$$R_{trimdown} = \frac{511}{|\delta|} - 10.22$$

$$R_{trimup} = \frac{(100 + \delta) \cdot V_o \cdot 5.11 - 626}{1.225 \cdot \delta} - 10.22$$

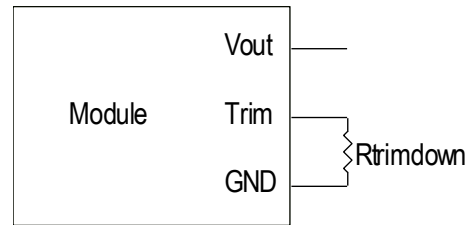


Figure 1. Trim down circuit

For Vo = 1.2 V:

$$R_{trimdown} = \frac{511}{|\delta|} - 10.22$$

$$R_{trimup} = \frac{(100 + \delta) \cdot V_o \cdot 5.11 - 313}{0.6125 \cdot \delta} - 10.22$$

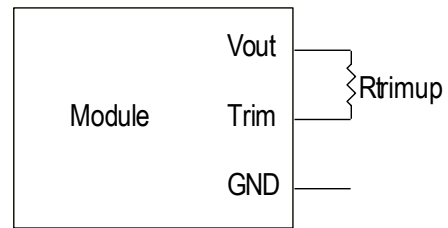


Figure 2. Trim up circuit

NOTES:

$$\delta = \frac{(V_o_{req} - V_o)}{V_o} \times 100[\%]$$

Vo_req = Desired (trimmed) output voltage [V]; Vo = output voltage

8. EFFICIENCY DATA

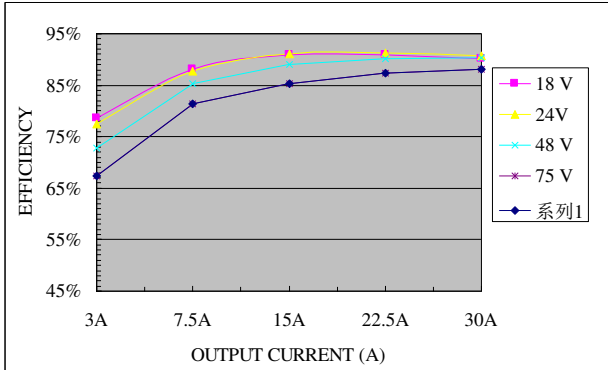


Figure 3. Vo = 2.5 V

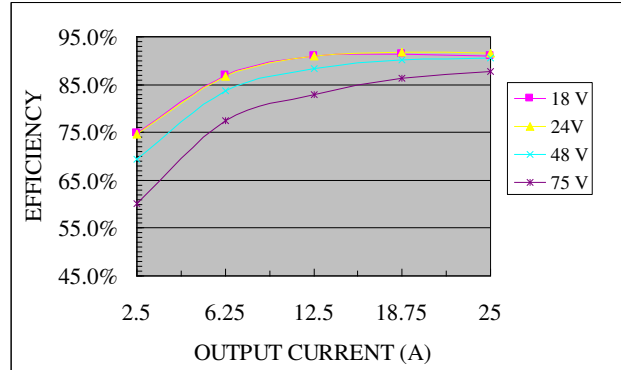


Figure 4. Vo = 3.3 V

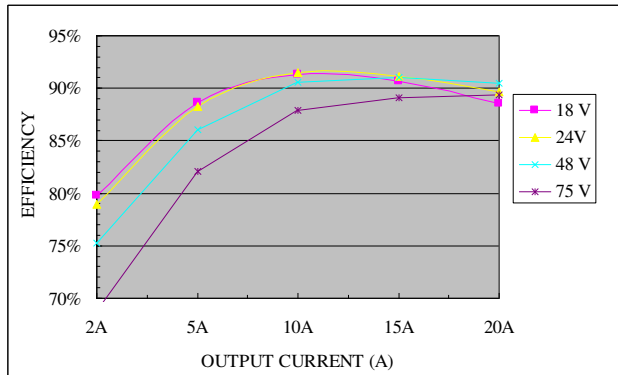


Figure 5. Vo = 5 V

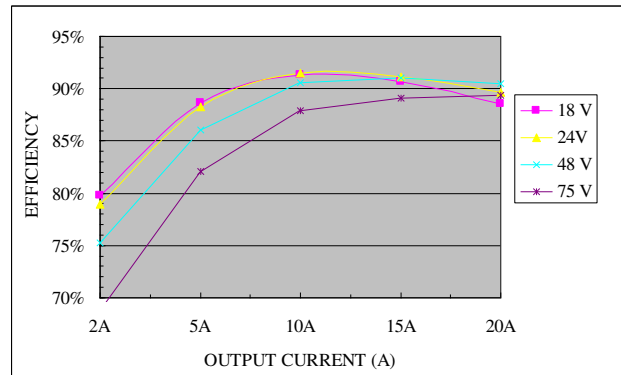


Figure 6. Vo = 12 V

9. THERMAL DERATING CURVES

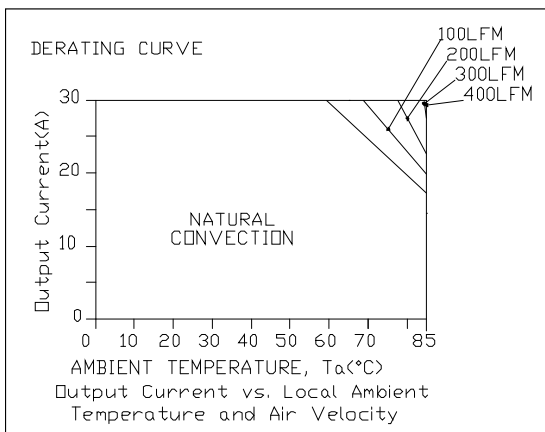


Figure 7. Vo = 2.5 V, Vin = 48 V

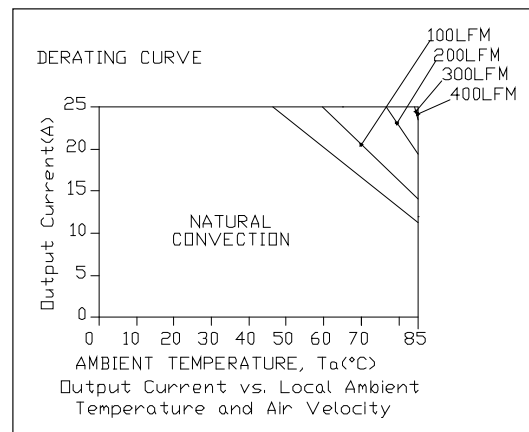


Figure 8. Vo = 3.3 V, Vin = 48 V

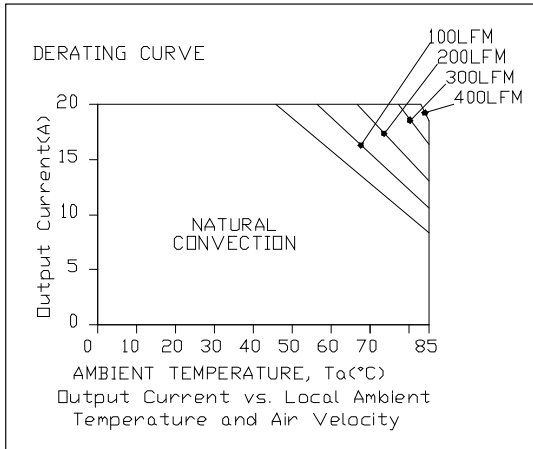


Figure 9. $V_o = 5.0\text{ V}$, $V_{in} = 48\text{ V}$

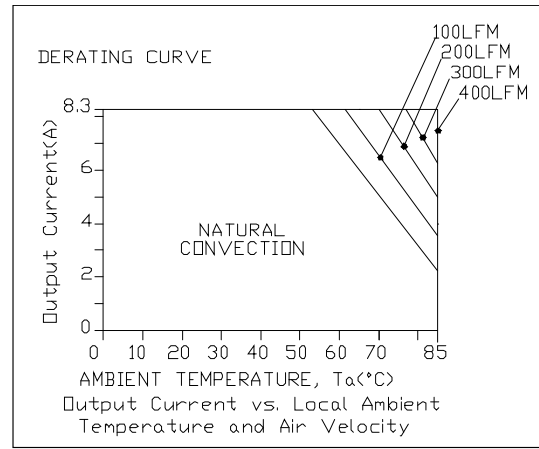


Figure 10. $V_o = 12\text{ V}$, $V_{in} = 48\text{ V}$

10. RIPPLE AND NOISE WAVEFORMS

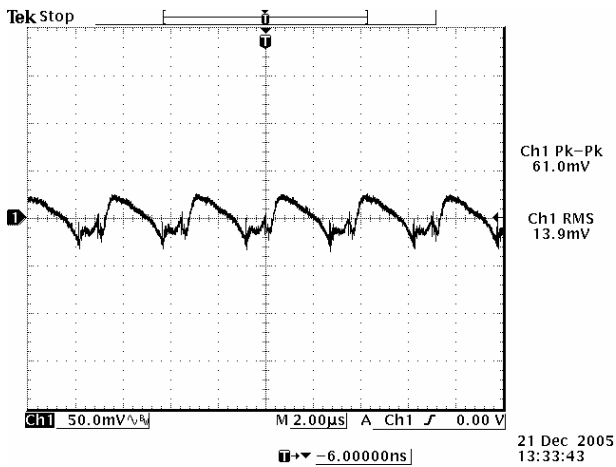


Figure 11. 2.5 V / 30 A output

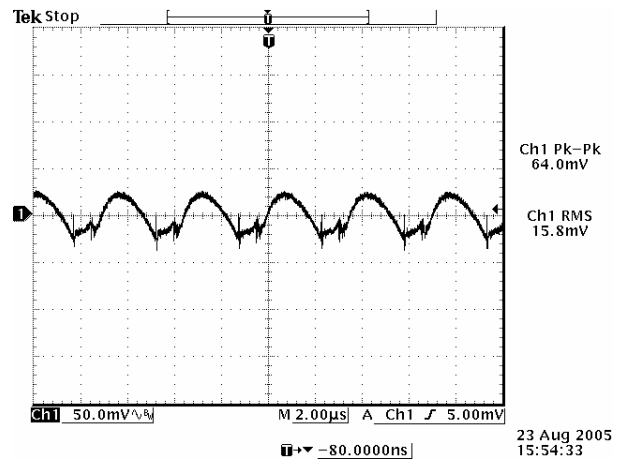


Figure 12. 3.3 V / 25 A output

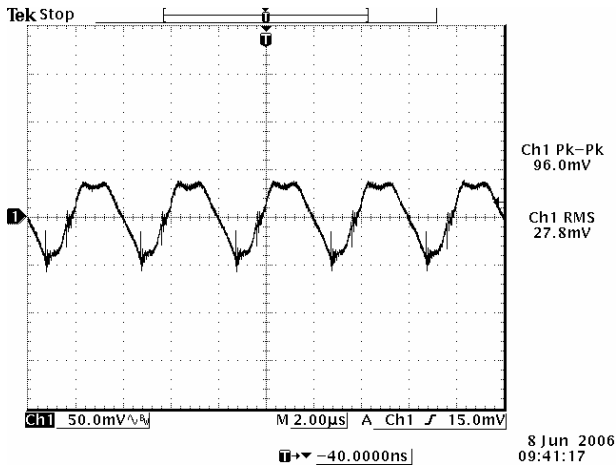


Figure 13. 5.0 V / 20 A output

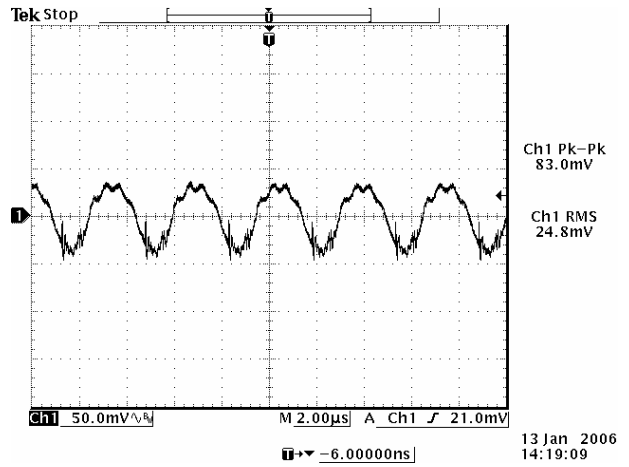


Figure 14. 12 V / 8.35 A output

NOTE: Ripple & noise at full load, 48 V input, with a 1 µF ceramic capacitor and a 10 µF tantalum capacitor at the output, Ta = 25°C.

11. TRANSIENT RESPONSE WAVEFORMS

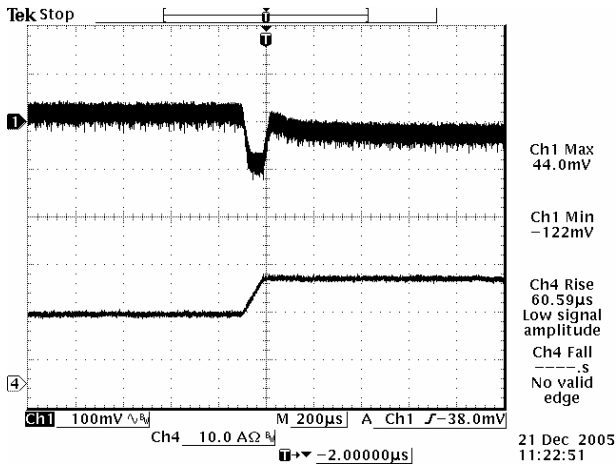


Figure 15. Vout = 2.5 V, 50%-75% Load Transients at Vin = 48 V

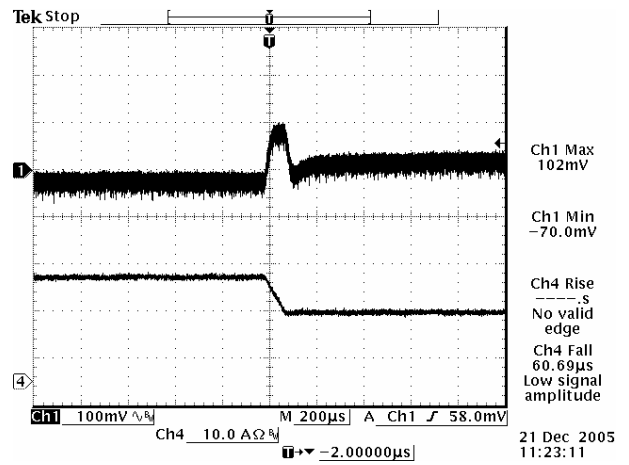


Figure 16. Vout = 2.5 V, 75%-50% Load Transients at Vin = 48 V

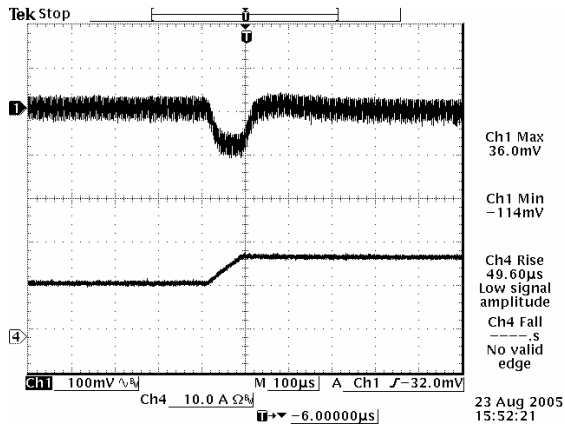


Figure 17. $V_{out} = 3.3\text{ V}$, 50%-75% Load Transients at $V_{in} = 48\text{ V}$

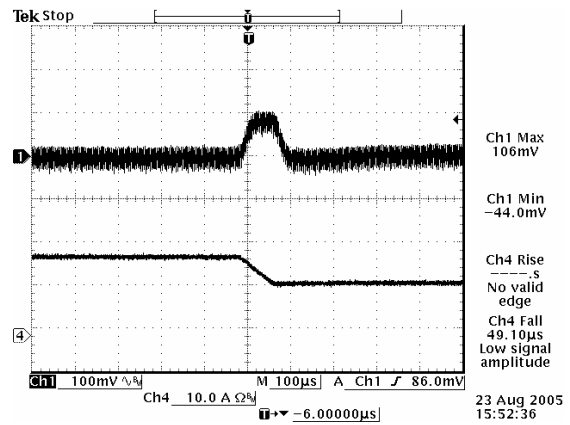


Figure 18. $V_{out} = 3.3\text{ V}$, 75%-50% Load Transients at $V_{in} = 48\text{ V}$

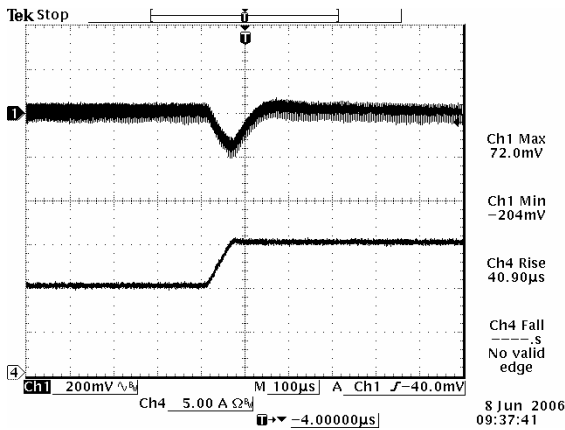


Figure 19. $V_{out} = 5.0\text{ V}$, 50%-75% Load Transients at $V_{in} = 48\text{ V}$

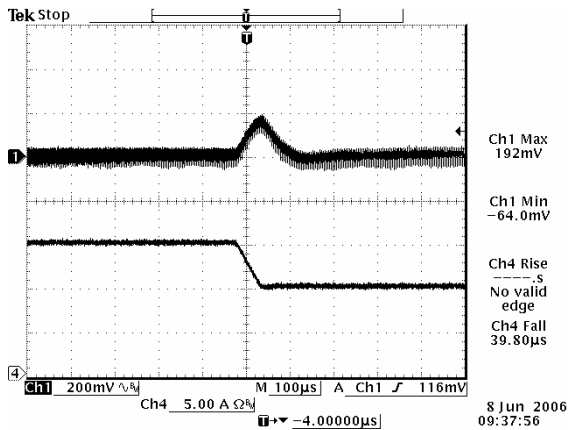


Figure 20. $V_{out} = 5.0\text{ V}$, 75%-50% Load Transients at $V_{in} = 48\text{ V}$

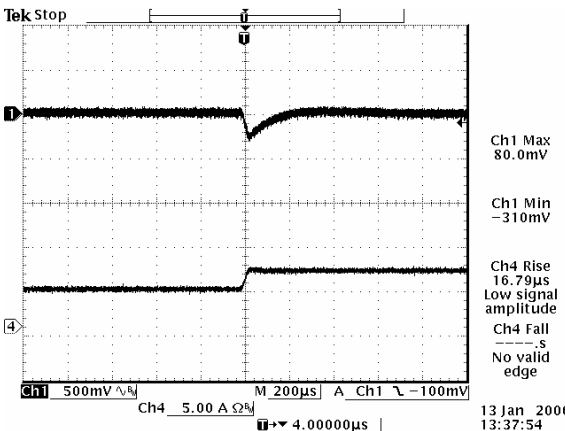


Figure 21. $V_{out} = 12\text{ V}$, 50%-75% Load Transients at $V_{in} = 48\text{ V}$

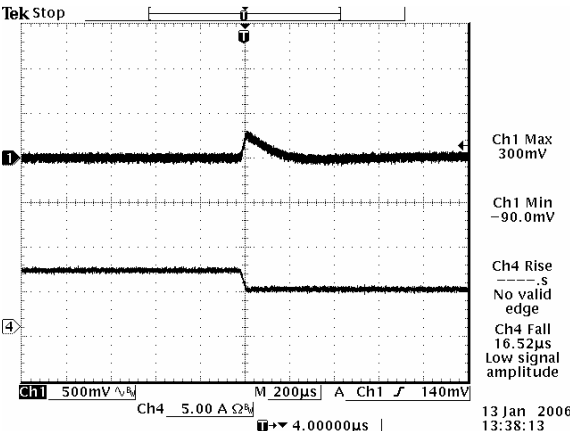


Figure 22. $V_{out} = 12\text{ V}$, 75%-50% Load Transients at $V_{in} = 48\text{ V}$

NOTE: Transients at $di/dt = 0.1\text{ A}/\mu\text{s}$, $V_{in} = 48\text{ V}$, with a $1\text{ }\mu\text{F}$ ceramic capacitor & a $10\text{ }\mu\text{F}$ Tantalum capacitor at the output, $T_a = 25^\circ\text{C}$



Asia-Pacific
+86 755 298 85888

Europe, Middle East
+353 61 49 8941

North America
+1 866 513 2839

12. MECHANICAL DIMENSIONS

OUTLINE

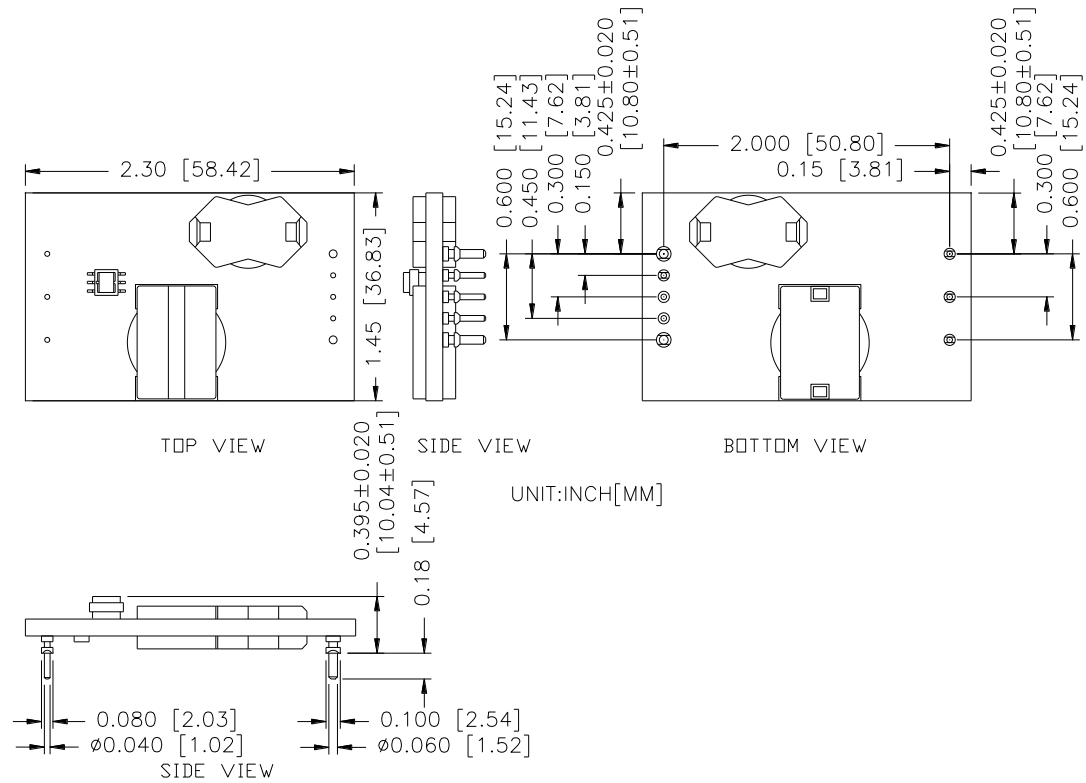


Figure 23. Outline

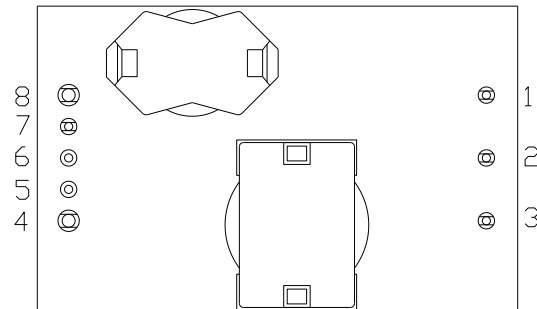
NOTE: This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.

NOTES: 1) All Pins: Material - Copper Alloy;
Finish - Gold plated

2) Un-dimensioned components are shown for visual reference only.

3) All dimensions in inch [mm]; Tolerances: x.xxx +/-0.020 inch [0.51 mm]; x.xxx +/-0.010 inch [0.25 mm].

PIN DEFINITIONS

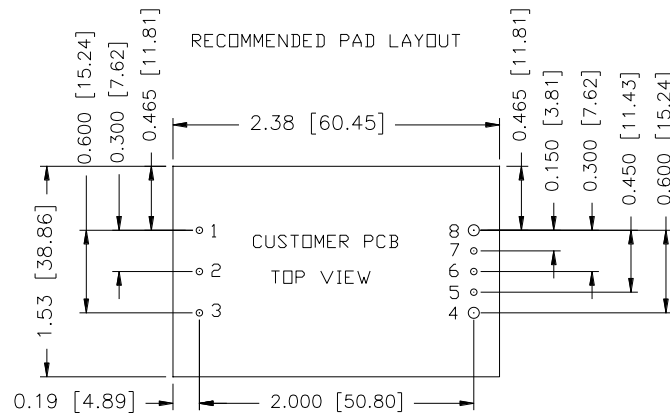


BOTTOM VIEW

Figure 24. Pins

PIN	FUNCTION	PIN SIZE
1	Vin (+)	0.040"
2	Remote On/Off	0.040"
3	Vin (-)	0.040"
4	Vout (-)	0.062"
5	Remote Sense (-)	0.040"
6	Trim	0.040"
7	Remote Sense (+)	0.040"
8	Vout (+)	0.062"

RECOMMENDED PAD LAYOUT



1,2,3,5,6,7 \varnothing 0.050 HOLE SIZE, \varnothing 0.100 min PAD SIZE
 4,8 \varnothing 0.074 HOLE SIZE, \varnothing 0.120 min PAD SIZE

Figure 25. Recommended pad layout

13. REVERSION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2013-06-17	PA	First release.	XF.Jiang
2021-05-20	AA	Add object ID and safety certificate. Update mechanical outline and recommended pad layout.	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.



tech.support@psbel.com
belfuse.com/power-solutions