ISOLATED DC/DC CONVERTERS

48 Vdc Input 1.2 Vdc - 3.3 Vdc/15 A, 5 Vdc/12 A, 12 Vdc/5 A Output, 1/8 Brick

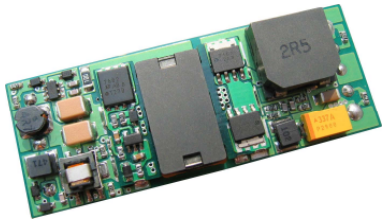
Nov. 22, 2010

Bel Power, Inc. , a subsidiary of Bel Fuse, Inc.

0RCY-60T Series RoHS Compliant Rev.B

Features

- Isolated
- High Efficiency
- High Power Density
- Fixed Frequency (300 KHz)
- Low Cost
- Input Under Voltage Lockout
- Output Voltage Trim
- Output Over Voltage Shutdown
- OCP/SCP
- Over Temperature Protection
- Remote On/Off Logic (Optional)
- Positive/Negative Remote Sence
- Basic Isolation
- Class 1, Category 2, Isolated DC/DC Converter (refer to IPC-9592)
- UL60950-1 Recognized (UL/cUL) (Pending)



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The 0RCY-60T series are isolated dc/dc converters that operate from a nominal 48 Vdc source. These units will provide up to 60 W of output power from a nominal 48 Vdc input. These units are designed to be highly efficient and low cost. Features include remote on/off, short circuit protection, over current protection, over temperature protection, input under voltage lockout, and output over voltage protection. These converters are provided in an industry standard eighth brick package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High	Model Number Active Low
12.0 Vdc	36 Vdc - 75 Vdc	5 A	60.0 W	91%	0RCY-60T120	0RCY-60T12L
5.0 Vdc	36 Vdc - 75 Vdc	12 A	60.0 W	91%	0RCY-60T050	0RCY-60T05L
3.3 Vdc	36 Vdc - 75 Vdc	15 A	50.0 W	89%	0RCY-60T033	0RCY-60T03L
2.5 Vdc	36 Vdc - 75 Vdc	15 A	37.5 W	87%	0RCY-60T025	0RCY-60T02L
1.8 Vdc	36 Vdc - 75 Vdc	15 A	27 W	85%	0RCY-60TV80	0RCY-60TV8L
1.5 Vdc	36 Vdc - 75 Vdc	15 A	22.5 W	84%	0RCY-60TV50	0RCY-60TV5L
1.2 Vdc	36 Vdc - 75 Vdc	15 A	18 W	82%	0RCY-60TV20	0RCY-60TV2L

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

Part Number Explanation

0	R	CY	–	60	T	xx	x
1	2	3		4	5	6	7

1---Through hole mount
2---RoHS 6, change "R" to "7" means RoHS 5
3---Series name
4---Series code
5---Input range (36-75V)
6---Output voltage
7---Enable, "0" means active high, and "L" means active low

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage (continuous)	-0.3	-	80	V	
Input Voltage Transient (100 ms)	-0.3	-	100	V	
Remote On/Off	-2	-	18	V	
I/O isolation voltage	-	-	2000	V	
Ambient Temperature	-40	-	85	°C	
Storage Temperature	-55	-	125	°C	

Note: Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

Input Specifications

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage	36	48	75	V	
Input Current (full load)					
Vo=12.0 V	-	-	3.0	A	
Vo=5.0 V	-	-	2.8	A	
Vo=3.3 V	-	-	2.6	A	
Vo=2.5 V	-	-	2.0	A	
Vo=1.8 V	-	-	1.4	A	
Vo=1.5 V	-	-	1.2	A	
Vo=1.2 V	-	-	0.9	A	
Input Current (no load)					
Vo=12.0 V	-	90	130	mA	
Vo=5.0 V	-	55	75	mA	
Vo=3.3 V	-	45	70	mA	
Vo=2.5 V	-	40	70	mA	
Vo=1.2 V - 1.8 V	-	30	60	mA	
Remote Off Input Current	-	2	5	mA	
Input Reflected Ripple Current (rms)	-	4	10	mA	With simulated source impedance of 10 uH; a 100uF/100V electrolytic capacitor with ESR = 1 ohm max. 5 Hz to 20 MHz
Input Reflected Ripple Current (pk-pk)	-	20	40	mA	
I^2t Inrush Current Transient	-	0.01	0.02	A^2s	
Turn-on Voltage Threshold	32	34	35	V	
Turn-off Voltage Threshold	30	32	34	V	

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

Output Specifications

Parameter	Min	Typ	Max	Unit	Notes
Output Voltage Set Point					
Vo=12.0 V	11.760	12.0	12.240	V	
Vo=5.0 V	4.925	5.0	5.075	V	
Vo=3.3 V	3.250	3.3	3.350	V	Vin=48 V, Io=50% full load, Ta=25 °C.
Vo=2.5 V	2.463	2.5	2.538	V	
Vo=1.8 V	1.773	1.8	1.827	V	
Vo=1.5 V	1.478	1.5	1.523	V	
Vo=1.2 V	1.182	1.2	1.218	V	
Line Regulation					
Vo=12.0 V	-	±24	±48	mV	
Vo=5.0 V	-	±5	±10	mV	
Vo=3.3 V	-	±3	±7	mV	
Vo=2.5 V	-	±3	±7	mV	
Vo=1.8 V	-	±3	±7	mV	
Vo=1.5 V	-	±3	±7	mV	
Vo=1.2 V	-	±3	±7	mV	
Load Regulation					
Vo=12.0 V	-	±30	±60	mV	
Vo=5.0 V	-	±10	±20	mV	
Vo=3.3 V	-	±7	±15	mV	
Vo=2.5 V	-	±6	±12	mV	
Vo=1.8 V	-	±5	±10	mV	
Vo=1.5 V	-	±5	±10	mV	
Vo=1.2 V	-	±5	±10	mV	
Regulation Over Temperature (-40 °C to +85 °C)					
Vo=12.0 V	-	±60	±100	mV	
Vo=5.0 V	-	±45	±75	mV	
Vo=3.3 V	-	±30	±50	mV	
Vo=2.5 V	-	±25	±40	mV	
Vo=1.8 V	-	±20	±30	mV	
Vo=1.5 V	-	±15	±25	mV	
Vo=1.2 V	-	±12	±20	mV	
Output Current					
Vo=12.0 V	0	-	5	A	
Vo=5.0 V	0	-	12	A	
Vo=3.3 V	0	-	15	A	
Vo=2.5 V	0	-	15	A	
Vo=1.8 V	0	-	15	A	
Vo=1.5 V	0	-	15	A	
Vo=1.2 V	0	-	15	A	
Current Limit Threshold					
Vo=12.0 V	5.5	6.5	8	A	
Vo=5.0 V	13.5	16	19	A	
Vo=3.3 V	16	18	20	A	
Vo=2.5 V	16	18	20	A	
Vo=1.8 V	16	18	20	A	
Vo=1.5 V	16	18	20	A	
Vo=1.2 V	16	18	20	A	
Short Circuit Surge Transient	-	3	5	A^2s	

Output Specifications (continued)

Parameter	Min	Typ	Max	Unit	Notes
Ripple and Noise (rms)					
Vo=12.0 V	-	25	50	mV	Test conditions: Vin=48 V, Ta=25 °C, with a 1uF ceramic capacitor and a 10 uF Tantalum capacitor at the output.
Vo=5.0 V	-	25	50	mV	
Vo=3.3 V	-	15	30	mV	
Vo=2.5 V	-	12	25	mV	
Vo=1.8 V	-	10	20	mV	
Vo=1.5 V	-	10	20	mV	
Vo=1.2 V	-	10	20	mV	
Ripple and Noise (pk-pk)					
Vo=12.0 V	-	100	130	mV	
Vo=5.0 V	-	95	120	mV	
Vo=3.3 V	-	55	80	mV	
Vo=2.5 V	-	55	80	mV	
Vo=1.8 V	-	45	70	mV	
Vo=1.5 V	-	45	70	mV	
Vo=1.2 V	-	45	70	mV	
Turn on Time	-	15	30	mS	
Overshoot at Turn on	-	0	5	%	
Output Capacitance					
Vo=12.0 V	0	-	1000	uF	
Vo=5.0 V	0	-	10000		
Vo=3.3 V	0	-	15000		
Vo=2.5 V	0	-	15000		
Vo=1.8 V	0	-	15000		
Vo=1.5 V	0	-	15000		
Vo=1.2 V	0	-	15000		

Transient Response							
25% ~ 50% Max Load	Overshoot	Vo= 12.0 V	-	300	400	mV	Test conditions: di/dt = 0.1 A/uS, Vin=48 V, with a 1 uF ceramic capacitor and a 10 uF Tantalum capacitor at the output.
	Settling Time		-	400	500	uS	
50% ~ 25% Max Load	Overshoot		-	300	400	mV	
	Settling Time		-	400	500	uS	
25% ~ 50% Max Load	Overshoot	Vo= 5.0 V	-	200	230	mV	
	Settling Time		-	300	400	uS	
50% ~ 25% Max Load	Overshoot		-	200	230	mV	
	Settling Time		-	300	400	uS	
25% ~ 50% Max Load	Overshoot	Vo= 1.2 V - 3.3 V	-	150	200	mV	
	Settling Time		-	200	250	uS	
50% ~ 25% Max Load	Overshoot		-	150	200	mV	
	Settling Time		-	200	250	uS	

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

General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Efficiency					
V_O=12.0 V	88	91	-	%	Vin=48V, full load
V_O=5.0 V	88	91	-	%	
V_O=3.3 V	87	89	-	%	
V_O=2.5 V	85	87	-	%	
V_O=1.8 V	83	85	-	%	
V_O=1.5 V	82	84	-	%	
V_O=1.2 V	80	82	-	%	
Switching Frequency	270	300	330	kHz	
Isolation capacitance	-	1500	-	pF	
Output Voltage Trim Range	80	-	110	%Vo	The total voltage increased by trim and remote sense should not exceed 10%Vo
Remote Sense Compesation	-	-	10	%Vo	
Over Temperature Protection	-	125	-	°C	
Over Voltage Protection	-	130	-	%Vo	Vin=48V, full load, in hiccup mode
Weight	-	20	-	g	
MTBF	2,410,000			hours	Calculated Per Bell Core SR-332 (I_O = 12 A, Vin=48 V, Vo=3.3 V, T_a = 25 °C, No forced air)
Dimensions					
Inches (L × W × H)	2.30 x 0.896 x 0.411			-	
Millimeters (L × W × H)	58.42 x 22.86 x 10.45				

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

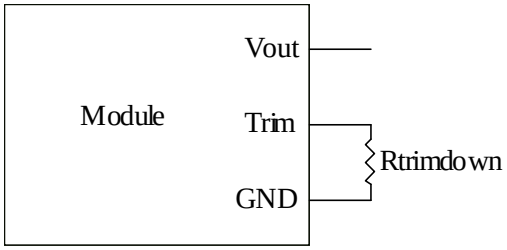
Remote On/Off

Parameter		Min	Typ	Max	Unit	Notes
Signal Low (Unit On)	Active Low	-0.3	-	0.8	V	0RCY-60TxxL. The remote on/off pin open, Unit off
Signal High (Unit Off)		2.4	-	18	V	
Signal Low (Unit Off)	Active High	-0.3	-	0.8	V	0RCY-60Txx0. The remote on/off pin open, Unit on
Signal High (Unit On)		2.4	-	18	V	
Current Sink		0	-	0.75	mA	

Output Trim Equations

Equations for calculating the trim resistor (in kΩ) are shown below. 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.

$$Rtrimdown = \frac{511}{|delta|} - 10.22$$

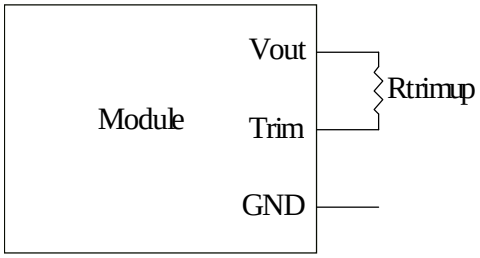


1.Vo =12 V-1.5 V

$$Rtrimup = \frac{(100 + delta) \cdot Vo \cdot 5.11 - 626}{1.225 \cdot delta} - 10.22$$

2. Vo =1.2 V

$$Rtrimup = \frac{(100 + delta) \cdot Vo \cdot 5.11 - 626}{1.225 \cdot delta} - 10.22$$

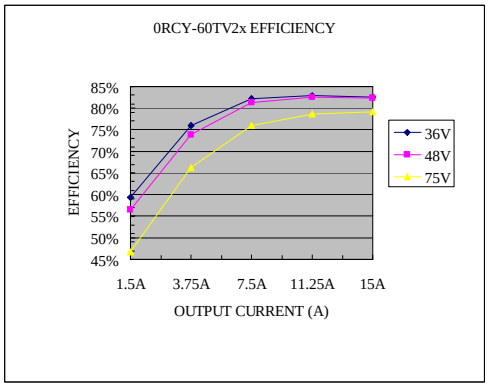


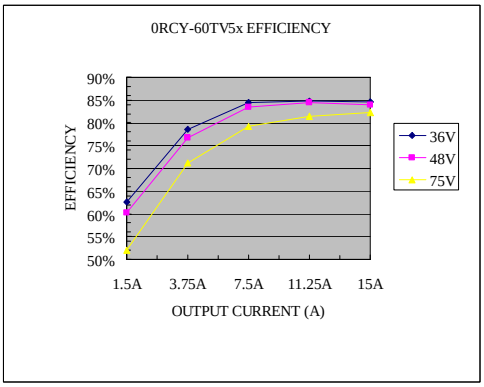
Notes:

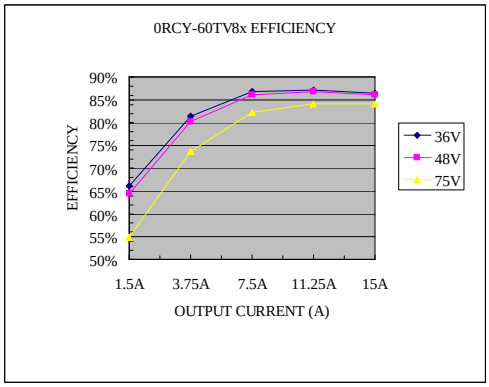
$$delta = \frac{(Vo\_req - Vo)}{Vo} \times 100[\%]$$

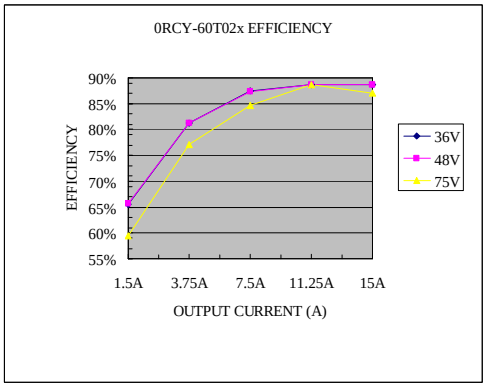
Vo_req=Desired (trimmed) output voltage [V]

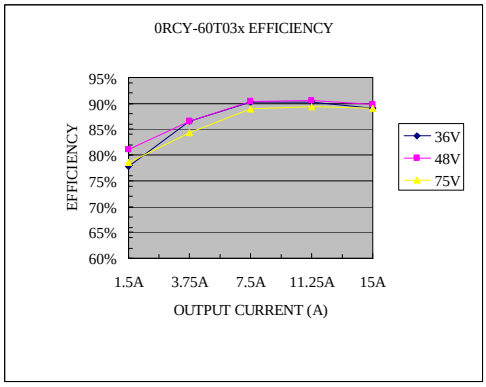
Efficiency Data

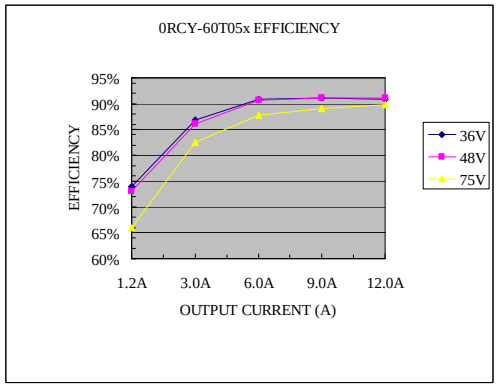


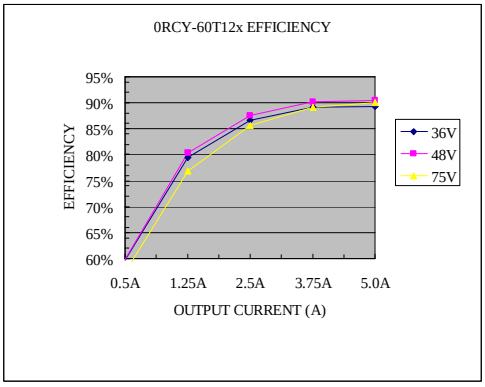






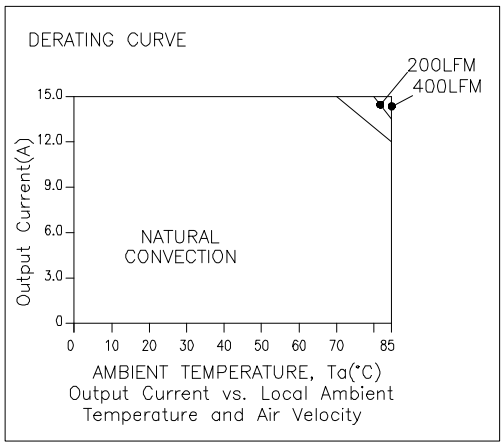




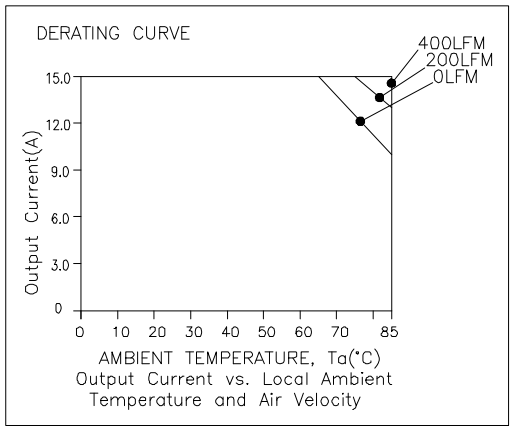


Thermal Derating Curves

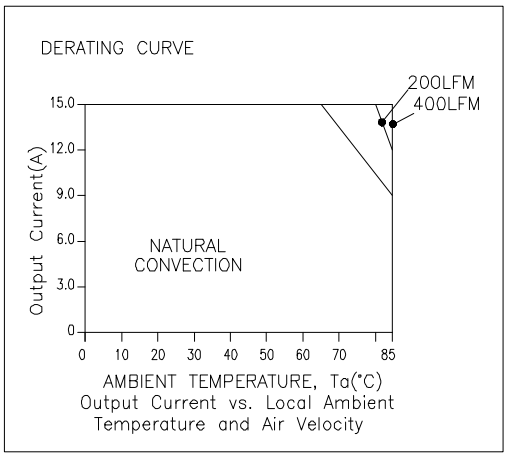
Vin=48V, with maximum junction temperature of semiconductors derated to 120 degree C.



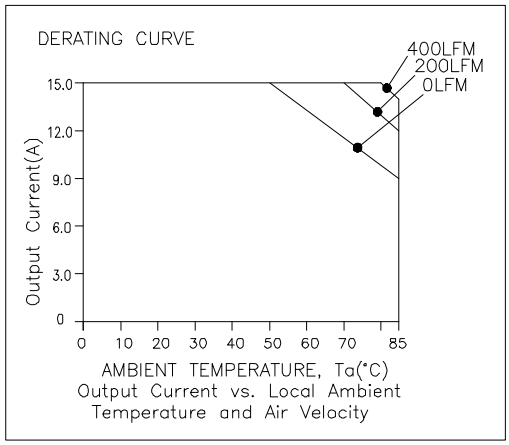
Vo=1.2 V



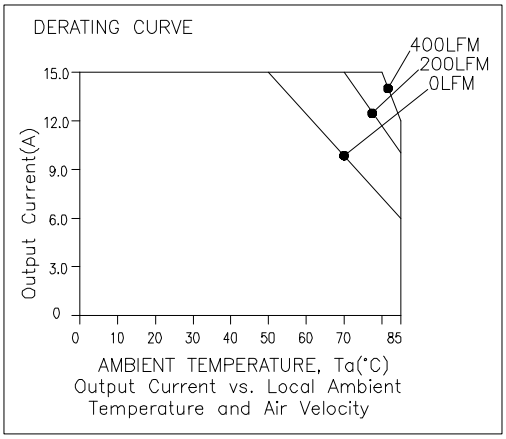
Vo=1.5 V



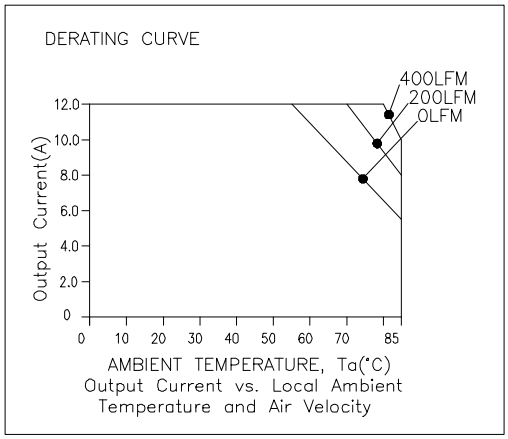
Vo=1.8 V



Vo=2.5 V

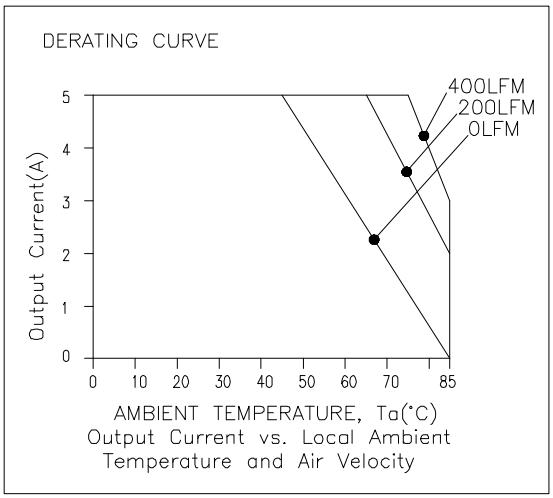


Vo=3.3 V



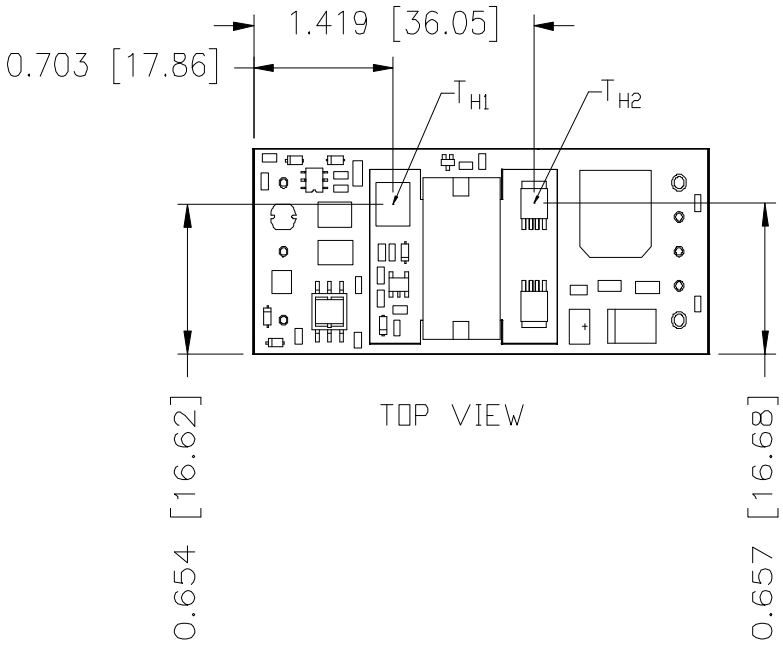
Vo=5 V

Thermal Derating Curves (continued)



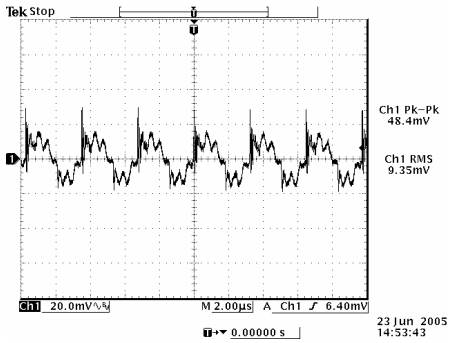
Vo=12 V

Thermal Reference

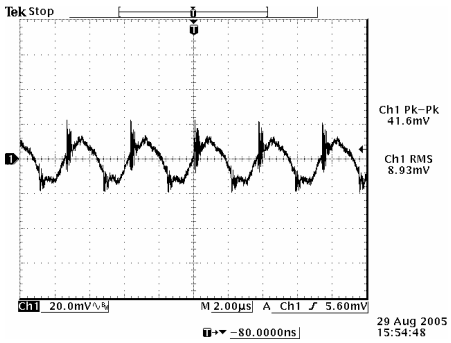


Note： T_{H1} and T_{H2} are hot spots which should not exceed 118 degree C.

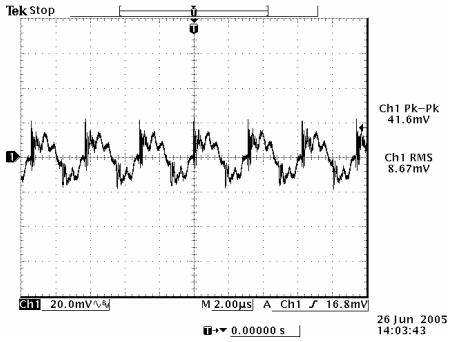
Ripple and Noise Waveforms



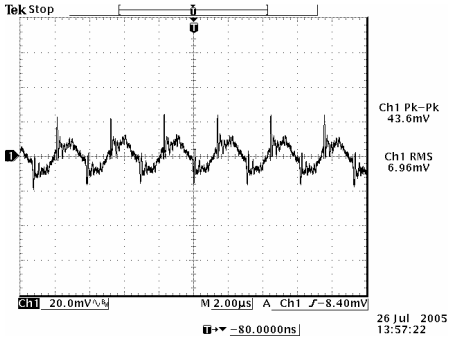
1.2 V/15 A output.



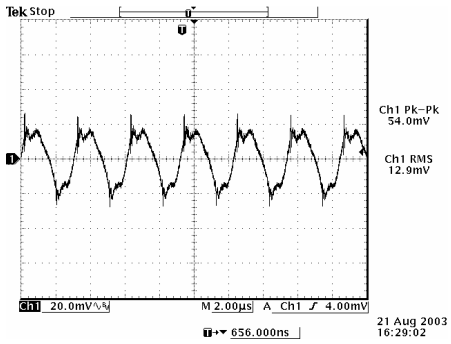
1.5 V/15 A output



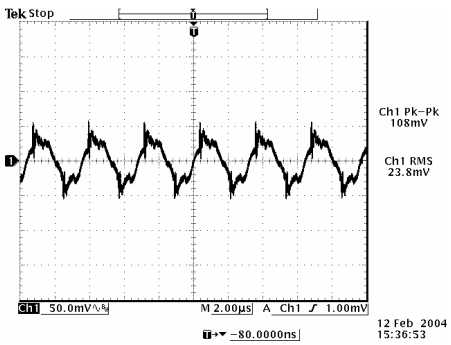
1.8 V/15 A output.



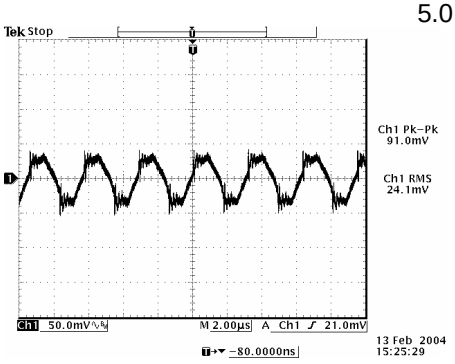
2.5 V/15 A output



3.3 V/15 A output.



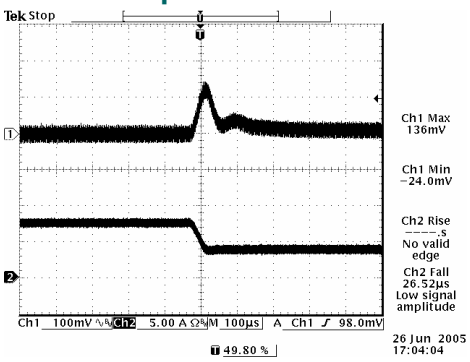
5.0 V/12 A output



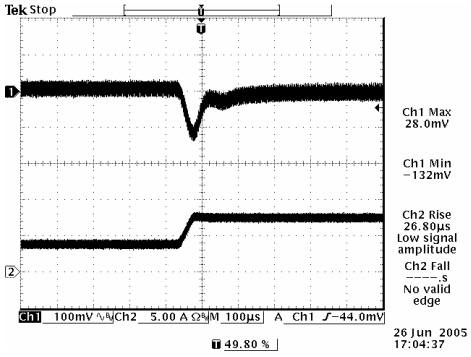
12 V/5 A output

Note: Ripple and noise at full load, 48 V input, and with a 1 uF ceramic cap and a 10 uF tantalum cap at the output, Ta=25 deg C.

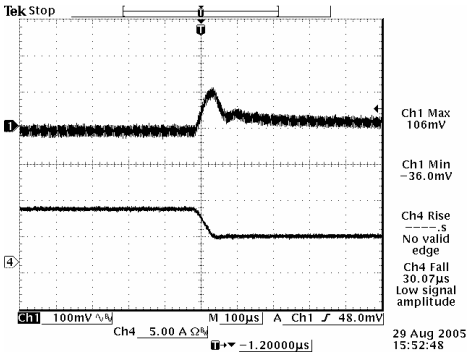
Transient Response Waveforms



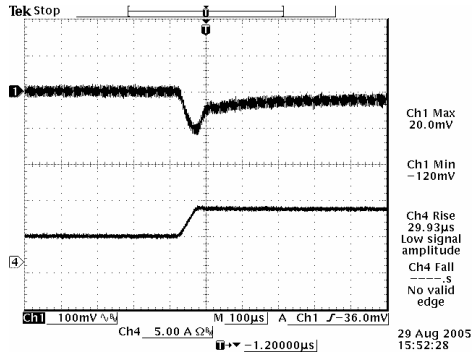
Vout=1.2 V 50% to 25% Load Transients



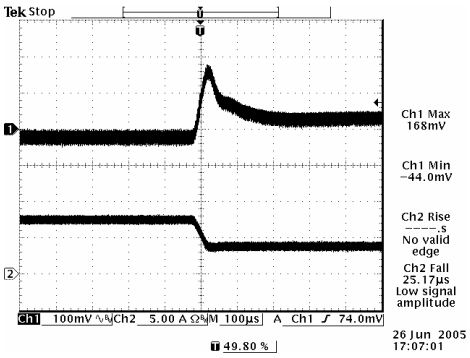
Vout=1.2 V 25% to 50% Load Transients



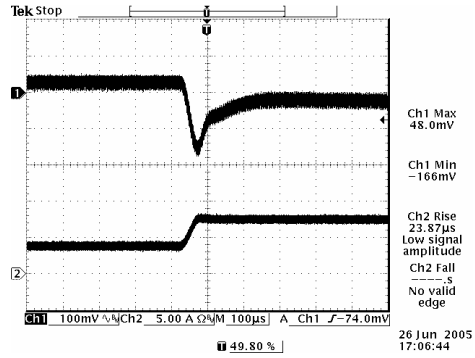
Vout=1.5 V 50% to 25% Load Transients



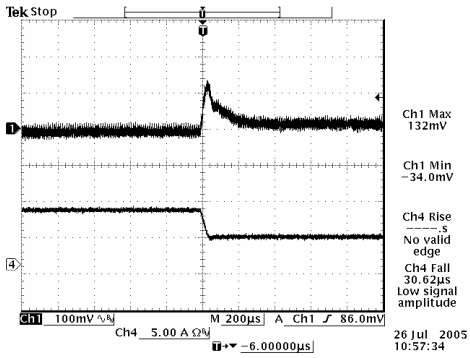
Vout=1.5 V 25% to 50% Load Transients



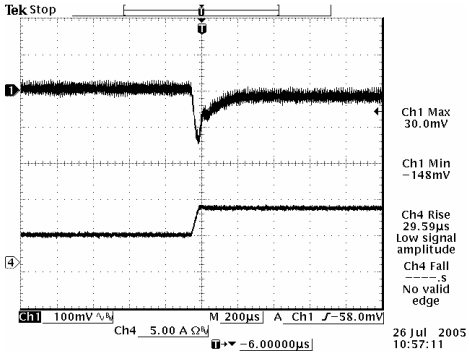
Vout=1.8 V 50% to 25% Load Transients



Vout=1.8 V 25% to 50% Load Transients

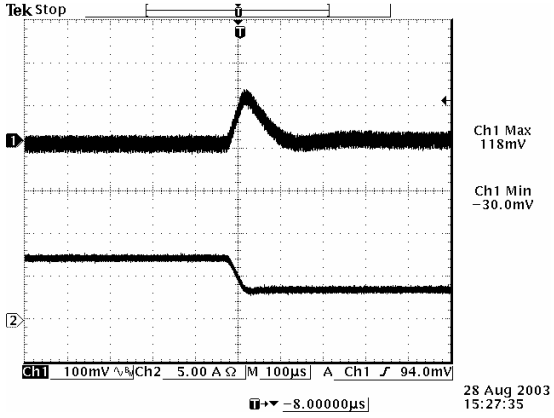


Vout=2.5 V 50% to 25% Load Transients

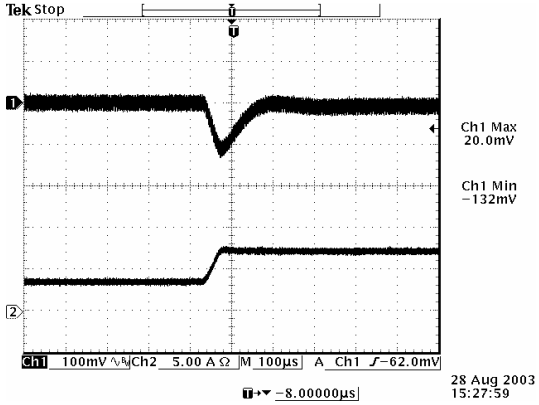


Vout=2.5 V 25% to 50% Load Transients

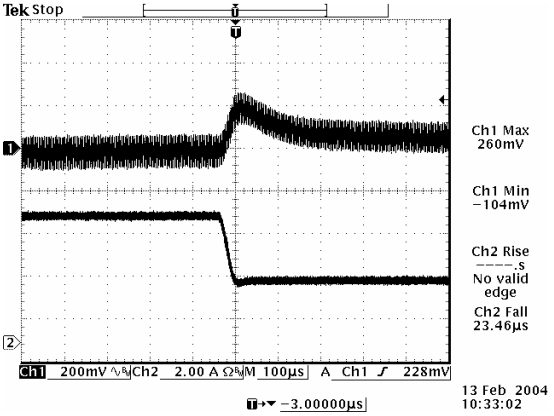
Transient Response Waveforms (continued)



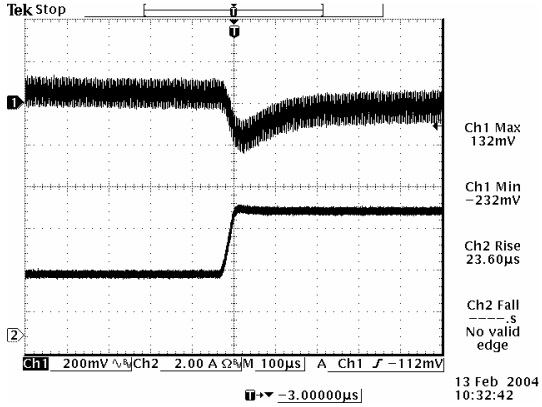
Vout=3.3 V 50% to 25% Load Transients



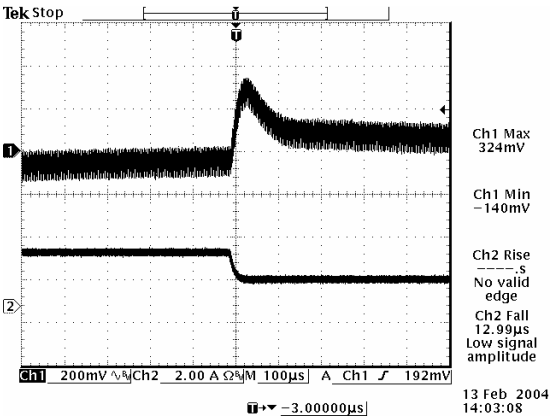
Vout=3.3 V 25% to 50% Load Transients



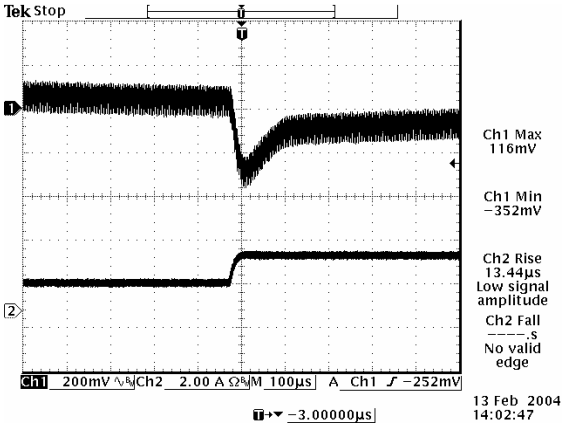
Vout=5.0 V 50% to 25% Load Transients



Vout=5.0 V 25% to 50% Load Transients



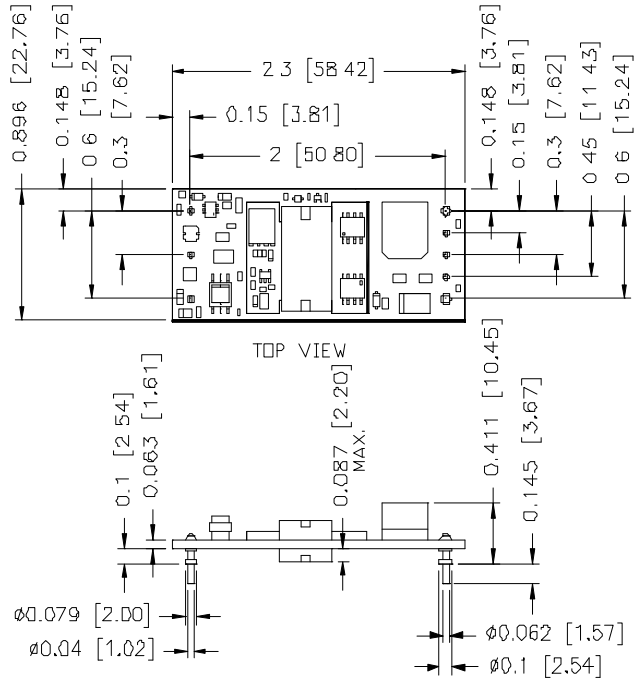
Vout=12 V 50% to 25% Load Transients

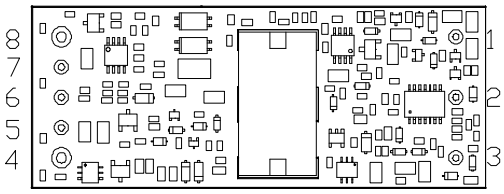


Vout=12 V 25% to 50% Load Transients

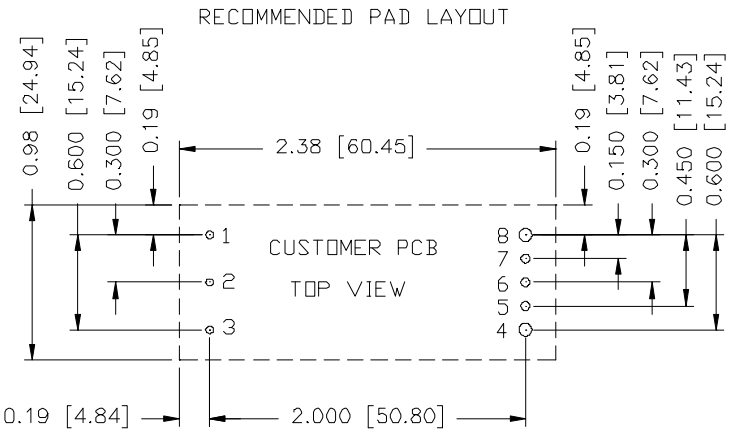
Note: Transient response is tested at di/dt=0.1 A/uS, external 10 uF tantalum capacitor and 1 uF ceramic capacitor, Vin=48 V, Ta=25 deg C.

Mechanical Outline





Pin	Function	Dia.
1	Vin(+)	0.04”
2	Remote On/Off	0.04”
3	Vin(-)	0.04”
4	Vout(-)	0.062”
5	Sense-	0.04”
6	TRIM	0.04”
7	Sense+	0.04”
8	Vout(+)	0.062”



1,2,3,5,6,7 ø0.047 HOLE SIZE, ø0.08 min PAD SIZE
4,8 ø0.07 HOLE SIZE, ø0.10 min PAD SIZE

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.

Note:

1) All Pins: Material - Copper Alloy;
Finish – 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.
2) Undimensioned components are shown for visual reference only.
3) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm).

Revision History

Date	Revision	Changes Detail	Approval
2010-11-22	B	Add diameter of pin and recommended pad layout in MD.	XF Jiang

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products.

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