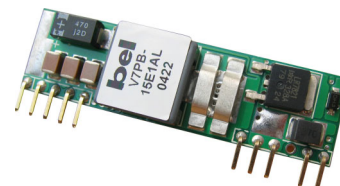


**NON-ISOLATED DC/DC CONVERTERS**

4.5V-13.2V Input    0.9V-5.0V/15A Output

**bel**  
POWER PRODUCTS**V7PB-15E Series**

- Non-Isolated
- High Efficiency
- High Power Density
- Low Cost
- Excellent Thermal Performance
- Remote On/Off
- Active Low/High (option)
- Over Temperature Protection
- Under-voltage Lockout (UVLO)
- OCP/SCP
- Remote Sense
- Industrial Temperature Range
- Wide Input Voltage Range
- Wide Output Trim Range

**Description**

The Bel V7PB-15Exxx series are part of the low cost non-isolated DC/DC power converter series. These modules use a SIP package for ease of layout and space savings. The output is closely regulated and the efficiency at 3.3V output is typically 92% at full load. Typical features include remote on/off, under-voltage lockout, wide input voltage range, wide output trim range, over-current protection and short circuit protection.

**Part Selection**

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active Low	Model Number Active High
5.0V	8.0V – 13.2V	15A	75.0W	92.6%	V7PB-15E50L	V7PB-15E50S
3.3V	4.5V – 13.2V	15A	48.5W	92%	V7PB-15E33L	V7PB-15E33S
2.5V	4.5V – 13.2V	15A	37.5W	90%	V7PB-15E25L	V7PB-15E25S
1.8V	4.5V – 13.2V	15A	27.0W	88%	V7PB-15E18L	V7PB-15E18S
1.5V	4.5V – 13.2V	15A	22.5W	86%	V7PB-15E15L	V7PB-15E15S
1.2V	4.5V – 13.2V	15A	18.0W	84%	V7PB-15E12L	V7PB-15E12S
0.9V	4.5V – 13.2V	15A	13.5W	80%	V7PB-15E09L	V7PB-15E09S
0.9V - 3.63V	4.5V – 13.2V	15A	54.5W	92%	V7PB-15E1AL	V7PB-15E1AS

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

**Absolute Maximum Ratings**

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3V	-	15V	
Output Enable Terminal Voltage	-0.3V	-	15V	
Ambient Temperature	-40°C	-	85°C	
Storage Temperature	-40°C	-	125°C	

**NON-ISOLATED DC/DC CONVERTERS**

4.5V-13.2V Input    0.9V-5.0V/15A Output

**Input Specifications**

Parameter	Min	Typ	Max	Notes
Input Voltage				
0.9V ≤ Vo ≤ 3.63V	4.5V	-	13.2V	
Vo > 3.63V	8.0V	-	13.2V	
Input Current (full load)				
Vo=3.3V	-	-	11.4A	Vin=5V
Vo=2.5V	-	-	9.0A	
Vo=1.8V	-	-	6.7A	
Vo=1.5V	-	-	5.8A	
Vo=1.2V	-	-	4.9A	
Vo=0.9V	-	-	3.9A	
Input Current (full load)				
Vo=5.0V	-	-	11.2A	Vin=12V
Vo=3.3V	-	-	4.9A	
Vo=2.5V	-	-	3.6A	
Vo=1.8V	-	-	2.7A	
Vo=1.5V	-	-	2.3A	
Vo=1.2V	-	-	1.9A	
Vo=0.9V	-	-	1.49A	
Input Current (no load)				
Vo=3.3V	-	-	180mA	Vin=5V
Vo=2.5V	-	-	180mA	
Vo=1.8V	-	-	180mA	
Vo=1.5V	-	-	175mA	
Vo=1.2V	-	-	170mA	
Vo=0.9V	-	-	165mA	
Input Current (no load)				
Vo=5.0V	-	-	210mA	Vin=12V
Vo=3.3V	-	-	160mA	
Vo=2.5V	-	-	140mA	
Vo=1.8V	-	-	120mA	
Vo=1.5V	-	-	120mA	
Vo=1.2V	-	-	110mA	
Vo=0.9V	-	-	105mA	
Input Reflected Ripple Current (pk-pk)	-	-	600mA	Tested with simulated source impedance of 500nH and one 470uF/25V AL. capacitor. with ESR=0.03 ohm max and two 270uF/16V Oscon capacitor. with ESR=0.013 ohm max at 100KHz
Input Reflected Ripple Current (RMS)	-	-	250mA	
I <sup>2</sup> t Inrush Current Transient	-	0.04A <sup>2</sup> s	0.08A <sup>2</sup> s	
Turn-on Voltage Threshold	-	3.9V	-	0.9V ≤ Vo ≤ 3.63V
Turn-off Voltage Threshold	-	2.5V	-	
Turn-on Voltage Threshold	-	5.3V	-	Vo > 3.63V
Turn-off Voltage Threshold	-	4.5V	-	

**Output Specifications**

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				
Vo=5.0V	4.900V	5.0V	5.100V	Test condition: Vin=12V, Iout=full load
Vo=3.3V	3.234V	3.3V	3.366V	
Vo=2.5V	2.450V	2.5V	2.550V	
Vo=1.8V	1.764V	1.8V	1.836V	
Vo=1.5V	1.470V	1.5V	1.530V	
Vo=1.2V	1.176V	1.2V	1.224V	
Vo=0.9V	0.882V	0.9V	0.918V	

**NON-ISOLATED DC/DC CONVERTERS**

4.5V-13.2V Input    0.9V-5.0V/15A Output

**Output Specifications (continued)**

Parameter	Min	Typ	Max	Notes
Load Regulation				
Vo=5.0V	-	15mV	40mV	
Vo=3.3V	-	10mV	20mV	
Vo=2.5V	-	8mV	20mV	
Vo=1.8V	-	6mV	15mV	
Vo=1.5V	-	5mV	15mV	
Vo=1.2V	-	5mV	15mV	
Vo=0.9V	-	5mV	15mV	
Line Regulation				
Vo=5.0V	-	15mV	35mV	
Vo=3.3V	-	10mV	20mV	
Vo=2.5V	-	7mV	15mV	
Vo=1.8V	-	5mV	10mV	
Vo=1.5V	-	3mV	10mV	
Vo=1.2V	-	3mV	10mV	
Vo=0.9V	-	3mV	10mV	
Regulation Over Temperature (-40°C to +85 °C)				
Vo=5.0V	-	40mV	80mV	
Vo=3.3V	-	15mV	30mV	
Vo=2.5V	-	10mV	20mV	
Vo=1.8V	-	5mV	15mV	
Vo=1.5V	-	5mV	15mV	
Vo=1.2V	-	5mV	15mV	
Vo=0.9V	-	2mV	10mV	
Output Current	0A	-	15A	
Current Limit Threshold	18A	-	45A	
Short Circuit Surge Transient				
Vo=5.0V	-	4.5A <sup>2</sup> s	9A <sup>2</sup> s	
Vo=3.3V	-	3.9A <sup>2</sup> s	7.8A <sup>2</sup> s	
Vo=2.5V	-	3A <sup>2</sup> s	6A <sup>2</sup> s	
Vo=1.8V	-	3A <sup>2</sup> s	6A <sup>2</sup> s	
Vo=1.5V	-	3A <sup>2</sup> s	6A <sup>2</sup> s	
Vo=1.2V	-	3A <sup>2</sup> s	6A <sup>2</sup> s	
Vo=0.9V	-	2.5A <sup>2</sup> s	5A <sup>2</sup> s	
Turn on Time				
Vo=5.0V	-	280mS	310mS	
Vo=3.3V	-	280mS	310mS	
Vo=2.5V	-	240mS	270mS	
Vo=1.8V	-	220mS	250mS	
Vo=1.5V	-	200mS	230mS	
Vo=1.2V	-	190mS	220mS	
Vo=0.9V	-	170mS	200mS	
Overshoot at Turn on	-	-	5%Vo,set	
Output Capacitoracitance	-	-	6800uF	
Output Ripple and Noise (pk-pk)				
Vo=5.0V	-	60mV	100mV	Test conditions: 0-20MHz BW; 22uF tantalum capacitor at the output
Vo=3.3V	-	60mV	100mV	
Vo=2.5V	-	50mV	90mV	
Vo=1.8V	-	40mV	80mV	
Vo=1.5V	-	40mV	80mV	
Vo=1.2V	-	30mV	70mV	
Vo=0.9V	-	20mV	60mV	

**NON-ISOLATED DC/DC CONVERTERS**

4.5V-13.2V Input    0.9V-5.0V/15A Output

**Output Specifications (continued)**

Parameter	Min	Typ	Max	Notes
Output Ripple and Noise (RMS)				Test conditions: 0-20MHz BW; 22uF tantalum capacitor at the output
Vo=5.0V	-	25mV	50mV	
Vo=3.3V	-	20mV	40mV	
Vo=2.5V	-	15mV	30mV	
Vo=1.8V	-	10mV	20mV	
Vo=1.5V	-	10mV	20mV	
Vo=1.2V	-	10mV	20mV	
Vo=0.9V	-	5mV	15mV	
<b>Transient Response (Vin=12V)</b>				
50% ~ 100% Max Load	-	150mV	220mV	Test conditions: di/dt=0.5A/us, Vin=12.0Vdc, and with a 470uF tantalum capacitor at the output except Vo=5.0V
Settling Time	-	60uS	100uS	
100% ~ 50% Max Load	-	150mV	220mV	
Settling Time	-	60uS	100uS	
50% ~ 100% Max Load	-	80mV	120mV	
Settling Time	-	60uS	100uS	
100% ~ 50% Max Load	-	80mV	120mV	
Settling Time	-	60uS	100uS	
50% ~ 100% Max Load	-	70mV	120mV	
Settling Time	-	60uS	90uS	
100% ~ 50% Max Load	-	70mV	120mV	
Settling Time	-	60uS	90uS	
<b>Transient Response (Vin=5V)</b>				
50% ~ 100% Max Load	-	120mV	160mV	Test conditions: di/dt = 0.5A/uS; Vin =5V; with one 470uF tantalum capacitor at the output
Settling Time	-	70uS	120uS	
100% ~ 50% Max Load	-	120mV	160mV	
Settling Time	-	70uS	120uS	

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

**NON-ISOLATED DC/DC CONVERTERS****4.5V-13.2V Input    0.9V-5.0V/15A Output****General Specifications**

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at $V_{in}=12V$ , full load.
$V_o=5.0V$	88%	92.6%	-	
$V_o=3.3V$	87%	92%	-	
$V_o=2.5V$	85%	90%	-	
$V_o=1.8V$	83%	88%	-	
$V_o=1.5V$	81%	86%	-	
$V_o=1.2V$	79%	84%	-	
$V_o=0.9V$	75%	80%	-	
Efficiency				Measured at $V_{in}=5V$ , full load.
$V_o=3.3V$	88%	93%	-	
$V_o=2.5V$	86%	91%	-	
$V_o=1.8V$	83%	88%	-	
$V_o=1.5V$	81%	86%	-	
$V_o=1.2V$	79%	83%	-	
$V_o=0.9V$	75%	81%	-	
Switching Frequency	180KHz	200KHz	220KHz	
Output Voltage Trim Range (Wide Trim)	-	-	403% $V_o$	$V_o=0.9V$
Output Voltage Trim Range (Narrow Trim)				
$V_o=1.2V-5.0V$	90% $V_o$	-	110% $V_o$	
$V_o=0.9V$	-	-	110% $V_o$	
Remote Sense Compensation	-	-	10% $V_o$	
MTBF	3,714,560 hours			Calculated Per Bell Core TR-332 ( $I_o = 80\%I_{o,max}$ ; $V_o=1.8V$ ; $V_{in}=12V$ ; $T_a = 25^\circ C$ )
Dimensions				
Inches (L x W x H)	2.0 x 0.55 x 0.36			
Millimeters (L x W x H)	50.8 x 13.97 x 9.14			
Weight	-	10g	-	

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

**Control Specifications**

Parameter	Min	Typ	Max	Notes
<b>Remote On/Off</b>				
Signal Low (Unit Off)	-0.3V	-	0.4V	V7PB-15ExxS
Signal High (Unit On)	2.8V	-	13.2V	
Signal Low (Unit On)	-0.3V	-	0.4V	V7PB-15ExxL
Signal High (Unit Off)	2.8V	-	13.2V	

**NON-ISOLATED DC/DC CONVERTERS**

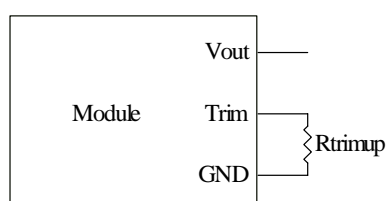
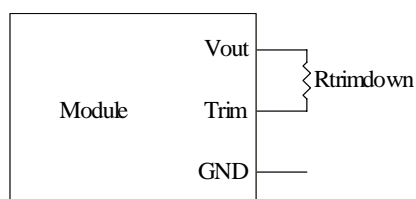
4.5V-13.2V Input    0.9V-5.0V/15A Output

**bel**  
POWER PRODUCTS**Output Trim Equations**

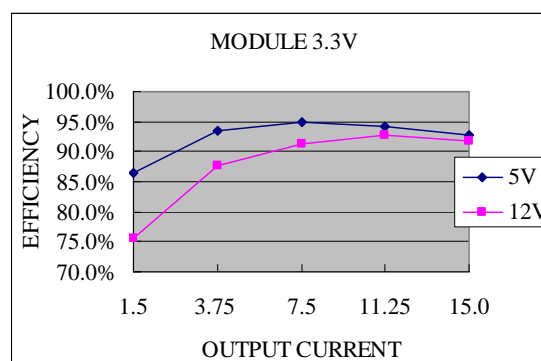
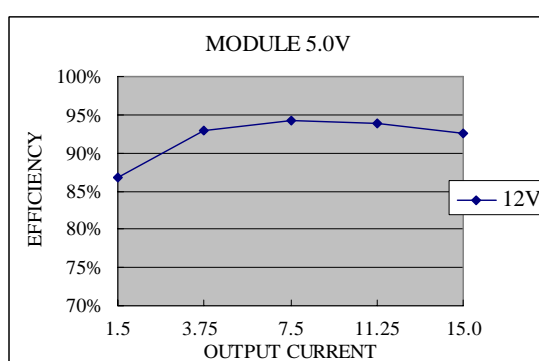
Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage ( $V_{adj}$ ) and the nominal output voltage of the converter ( $V_{nom}$ ) are shown below. The Trim Down resistor should be connected between the Trim pin and  $V_{out}$ . The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

$$R_{TrimDown} = \frac{A}{V_{nom} - V_{adj}} - B$$

$$R_{TrimUp} = \frac{C}{V_{adj} - V_{nom}} - D$$



Vnom	A	B	C	D
0.9 - 3.63	N/A	N/A	6.008	2.150
5.0	31.574	19.010	6.008	11.50
3.3	18.8157	25.310	6.008	17.800
2.5	12.7927	30.110	6.008	22.600
1.8	7.5426	39.110	6.008	31.600
1.5	5.2865	33.610	6.008	26.100
1.2	3.027	24.410	6.008	16.900
0.9	N/A	N/A	6.008	64.900

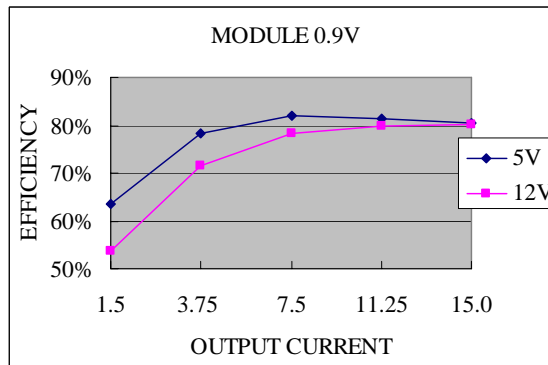
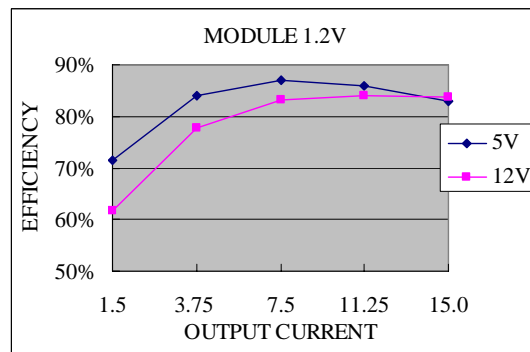
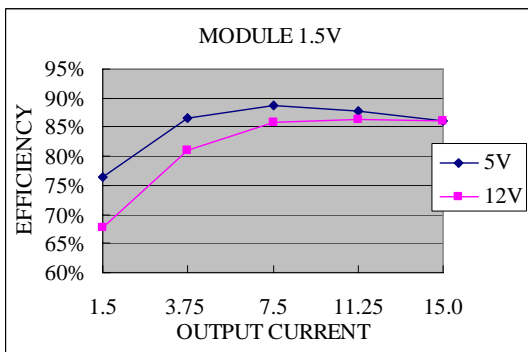
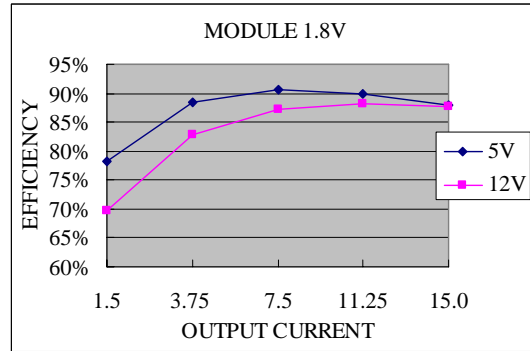
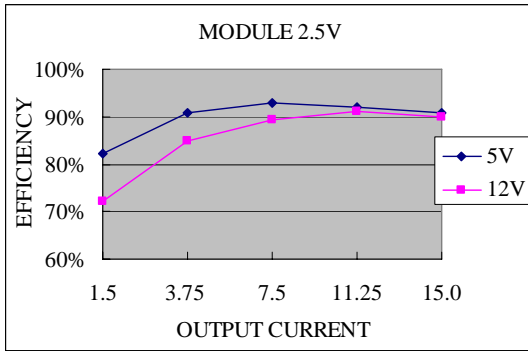
**Efficiency Data**

# NON-ISOLATED DC/DC CONVERTERS

4.5V-13.2V Input 0.9V-5.0V/15A Output



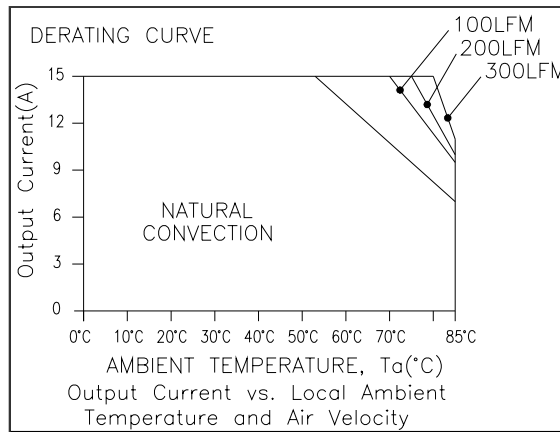
## Efficiency Data (continued)



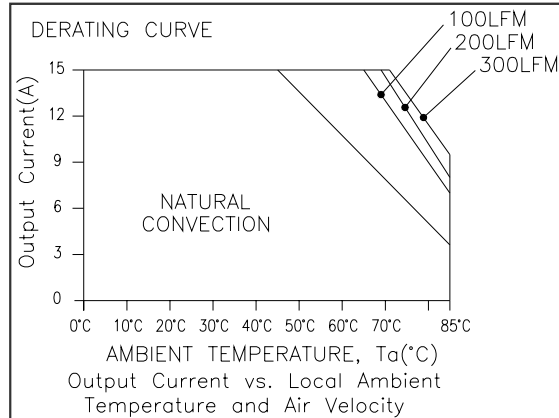
**NON-ISOLATED DC/DC CONVERTERS**  
**4.5V-13.2V Input    0.9V-5.0V/15A Output**



**Thermal Derating Curves**

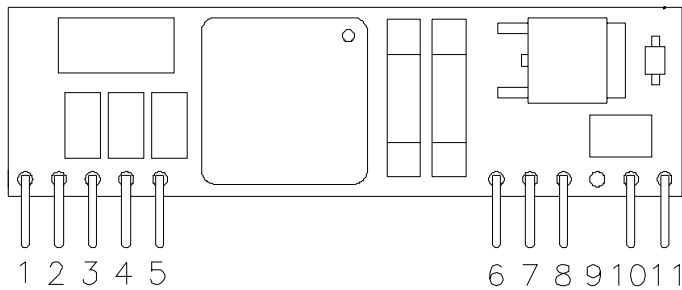
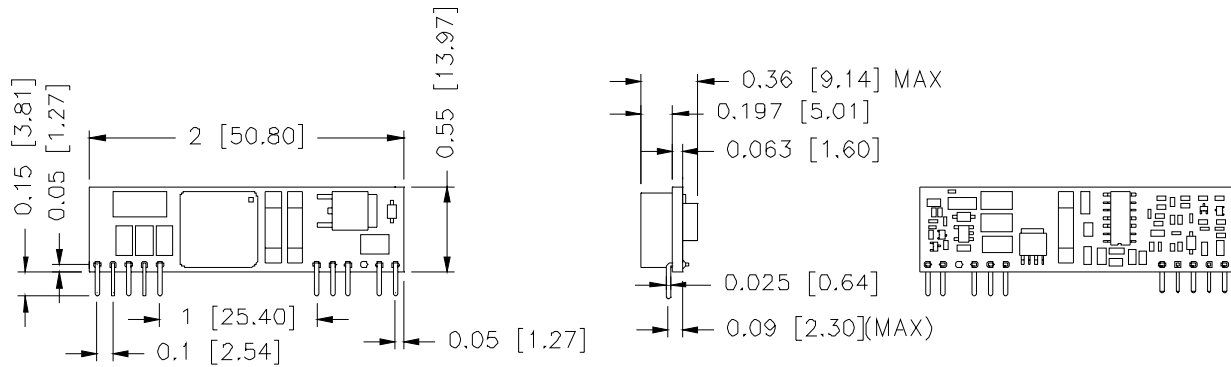


**( $V_{in}=5.5V$ ,  $V_o=3.3V$ )**



**( $V_{in}=13.2V$ ,  $V_o=3.3V$ )**



**NON-ISOLATED DC/DC CONVERTERS****4.5V-13.2V Input    0.9V-5.0V/15A Output****bel**  
POWER PRODUCTS**Pin Connections**

Pin	Function
1	Vo+
2	Vo+
3	Opt. Remote Sense (+)
4	Vo+
5	Ground
6	Ground
7	Vin+
8	Vin+
9	Not used
10	Trim
11	Remote On/Off

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