NON-ISOLATED DC/DC CONVERTERS

4.5V-13.2V Input 0.9V-5.0V/3A Output

x7AH-03Exx0 Series

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Remote On/Off
- Under-voltage Lockout (UVLO) *
- OCP/SCP

* Not applicable for 5.0V output module.

Description

The Bel x7AH-03Exx0 Series are part of the low cost non-isolated DC/DC power converters. The modules use a surface mount package or vertical package for ease of layout and space savings, with a low profile of only 7.82mm. The output is closely regulated and the efficiency of 5V output module is typically 95% at full load. Typical features include Remote On/Off, under-voltage lockout, over-current protection and short circuit protection.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Surface Mount	Part Number Vertical Mount
5.0V	8.0 – 13.2V	3A	15W	95%	S7AH-03E500	V7AH-03E500
3.3V	4.5 – 13.2V	3A	9.9W	93%	S7AH-03E330	V7AH-03E330
2.5V	4.5 – 13.2V	3A	7.5W	91%	S7AH-03E250	V7AH-03E250
1.8V	4.5 – 13.2V	3A	5.4W	88%	S7AH-03E180	V7AH-03E180
1.5V	4.5 – 13.2V	3A	4.5W	87%	S7AH-03E150	V7AH-03E150
1.2V	4.5 – 13.2V	3A	3.6W	85%	S7AH-03E120	V7AH-03E120
1.0V	4.5 – 13.2V	3A	3W	84%	S7AH-03E100	V7AH-03E100
0.9V	4.5 – 13.2V	3A	2.7W	82%	S7AH-03E090	V7AH-03E090

Note: Add “0” suffix at the end of the model number to indicate “Tube Packaging”, and “R” for “Reel Packaging”, and “G” for “Tray Packaging”.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3V	-	14V	
Output Enable Terminal Voltage	-0.3V	-	13.2V	
Ambient Temperature	0°C	-	70°C	
Storage Temperature	-40°C	-	100°C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	4.5V	-	13.2V	Min. input voltage for 5.0V output module should be 8.0V
Input Current (no load)	-	30mA	-	
Input Current (full load)	-	-	3A	
Remote Off Input Current	-	4mA	-	
Input Reflected Ripple Current (pk-pk)	-	75mA	150mA	With simulated source impedance of 500nH, 5Hz to 20MHz; Use one 270uF/16V Oscon capacitor with ESR = 0.018 ohm max. at 100KHz at 25°C
Input Reflected Ripple Current (RMS)	-	30mA	60mA	
I^2t Inrush Current Transient	-	$0.02A^2s$	$0.08A^2s$	
Turn-on Voltage Threshold	-	4.1V	4.5V	Not applicable for 5.0V output.
Turn-off Voltage Threshold	-	3.3V	4.0V	

Output Specifications

Parameter			Min	Typ	Max	Notes
Output Voltage Set Point						
	Vo=5.0V		4.900V	5.0V	5.100V	Test condition: Vin=8V, 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=1.0V		0.980V	1.0V	1.020V	
	Vo=0.9V		0.882V	0.9V	0.918V	
Line Regulation						
	Vo=5.0V		-	10mV	15mV	
	Vo=3.3V		-	8mV	10mV	
	Vo=2.5V		-	6mV	10mV	
	Vo=1.8V		-	6mV	10mV	
	Vo=1.5V		-	5mV	8mV	
	Vo=1.2V		-	5mV	8mV	
	Vo=1.0V		-	5mV	8mV	
	Vo=0.9V		-	5mV	8mV	
Load Regulation						
	Vo=5.0V		-	15mV	25mV	
	Vo=3.3V		-	10mV	20mV	
	Vo=2.5V		-	8mV	15mV	
	Vo=1.8V		-	8mV	15mV	
	Vo=1.5V		-	5mV	10mV	
	Vo=1.2V		-	5mV	10mV	
	Vo=1.0V		-	5mV	10mV	
	Vo=0.9V		-	5mV	10mV	
Regulation Over Temperature (0°C to 70 °C)			-	20mV	40mV	
Output Current			0A	-	3A	
Current Limit Threshold			3.3A	-	8A	
Short Circuit Surge Transient			-	$0.02A^2s$	$0.08A^2s$	
Ripple and Noise (RMS)			-	15mV	40mV	BW = 0-20MHz.
Ripple and Noise (pk-pk)				50mV	100mV	BW = 0-20MHz.
Turn on Time			-	-	60mS	
Overshoot at Turn on			-	0%	3%	
Output Capacitance			0uF	-	1200uF	
Transient Response						
50% ~ 100% Max Load	Overshoot	Vo=5V	-	150mV	200mV	di/dt = 0.5A/uS; Vin = 8V; Ta = 25°C and with a 220uF Tan. capacitor on output
	Settling Time		-	60uS	120uS	
100% ~ 50% Max Load	Overshoot		-	150mV	200mV	
	Settling Time		-	60uS	120uS	
50% ~ 100% Max Load	Overshoot	Vo=3.3V	-	110mV	150mV	
	Settling Time		-	60uS	120uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	60uS	120uS	
50% ~ 100% Max Load	Overshoot	Vo=2.5V	-	110mV	150mV	
	Settling Time		-	60uS	100uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	60uS	100uS	

Output Specifications (continued)

Parameter			Min	Typ	Max	Notes
Transient Response						
50% ~ 100% Max Load	Overshoot	Vo=1.8V	-	110mV	150mV	di/dt = 0.5A/uS; Vin = 8V; Ta = 25°C and with a 220uF electrolytic capacitor on output
	Settling Time		-	60uS	100uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	60uS	100uS	
50% ~ 100% Max Load	Overshoot	Vo=1.5V	-	110mV	150mV	
	Settling Time		-	60uS	120uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	60uS	120uS	
50% ~ 100% Max Load	Overshoot	Vo=1.2V	-	110mV	150mV	
	Settling Time		-	60uS	100uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	60uS	100uS	
50% ~ 100% Max Load	Overshoot	Vo=1.0V	-	110mV	150mV	
	Settling Time		-	60uS	100uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	60uS	100uS	
50% ~ 100% Max Load	Overshoot	Vo=0.9V	-	110mV	150mV	
	Settling Time		-	60uS	100uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	60uS	100uS	

Note: All specifications are typical at 8V input, full load at 25°C unless otherwise stated.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at Vin=8V, full load
Vo=5.0V	91%	95%	-	
Vo=3.3V	89%	93%	-	
Vo=2.5V	87%	91%	-	
Vo=1.8V	84%	88%	-	
Vo=1.5V	83%	87%	-	
Vo=1.2V	81%	85%	-	
Vo=1.0V	80%	84%	-	
Vo=0.9V	78%	82%	-	
Switching Frequency	200KHz	300KHz	400KHz	
Output Trim Range	90% Vo	-	110% Vo	For all outputs [1]
Protection Features				
MTBF	8,278,709 hours			Calculated Per Bell Core TR-332 (Io = Nominal; Ta = 25°C)
Dimensions (surface mount)				
Inches (L × W × H)	0.78 x 0.7 x 0.32			
Millimeters (L × W × H)	19.812 x 17.78 x 8.128			
Dimensions (vertical)				
Inches (L × W × H)	0.7 x 0.308 x 0.65			
Millimeters (L × W × H)	17.78 x 7.82 x 16.51			
Weight	-	5.1g	-	

Notes: All specifications are typical at 25°C unless otherwise stated.
1. Min. of 0.9V output should be 100%Vo.

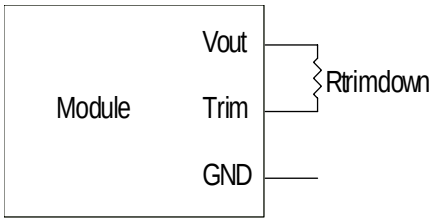
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit On)	-0.3V	-	1V	Remote on/off pin open, unit on.
Signal High (Unit Off)	2.8V	-	13.2V	

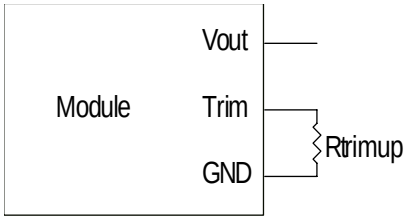
Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) are shown below. The Trim Down resistor should be connected between the Trim pin and Vout. 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.

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

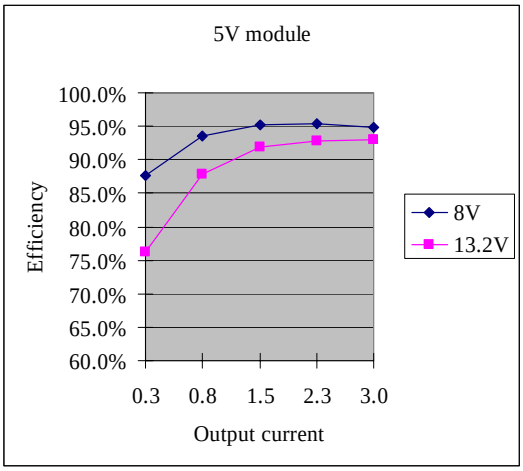


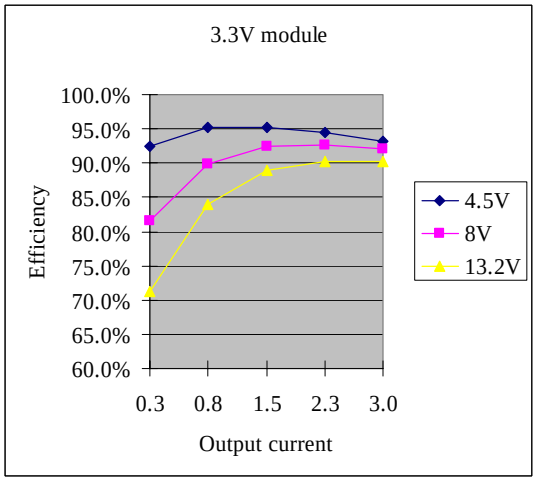
$$R_{TrimUp} = \frac{C}{V_{adj} - V_{nom}} - D$$

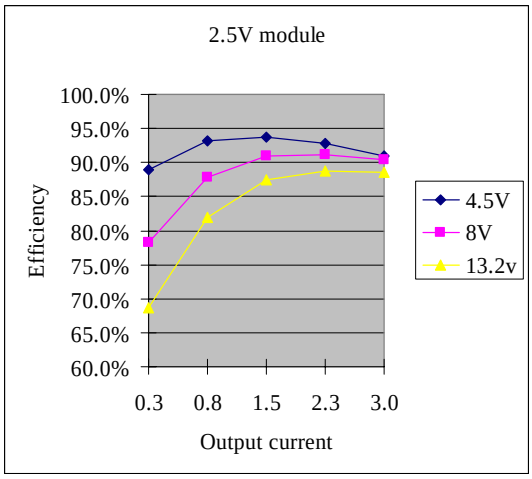


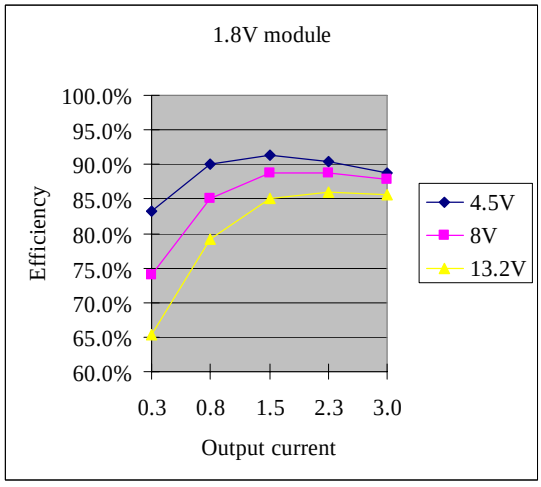
Vnom	A	B	C	D
5.0	61.940	29.400	11.760	14.700
3.3	53.840	61.700	17.200	40.200
2.5	9.596	15.620	4.496	10.000
1.8	3.850	13.830	3.064	10.000
1.5	3.120	14.420	3.536	10.000
1.2	1.790	10.910	3.536	6.490
1.0	0.511	3.490	1.992	1.000
0.9	X	X	0.960	0.100

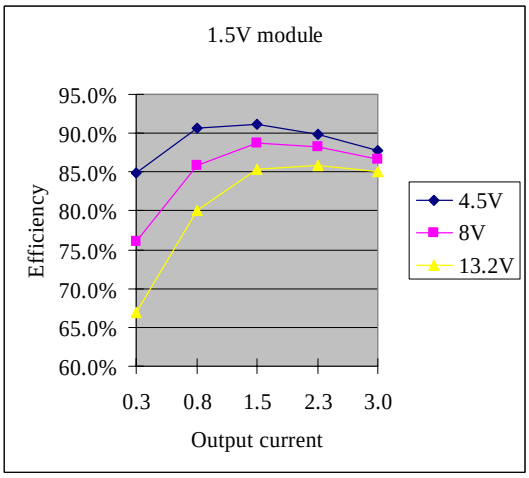
Efficiency Data

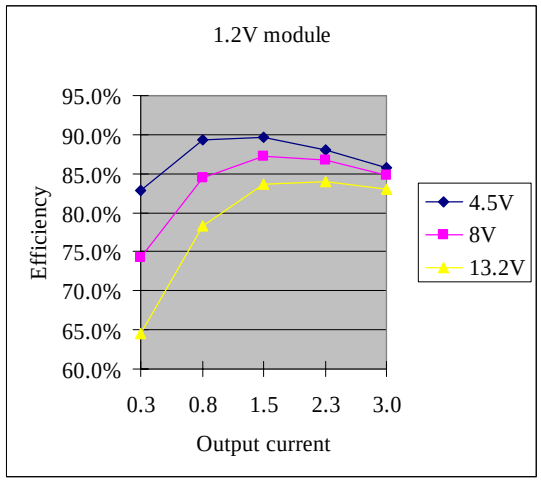




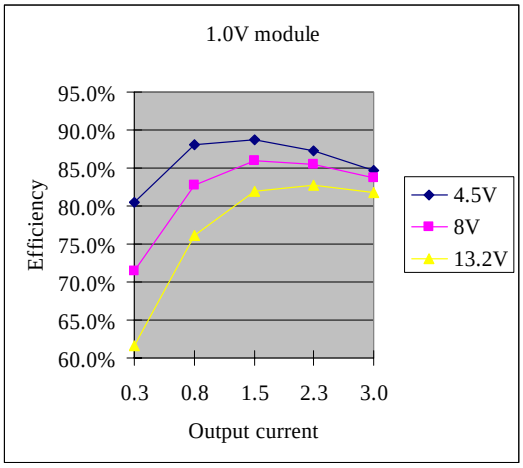


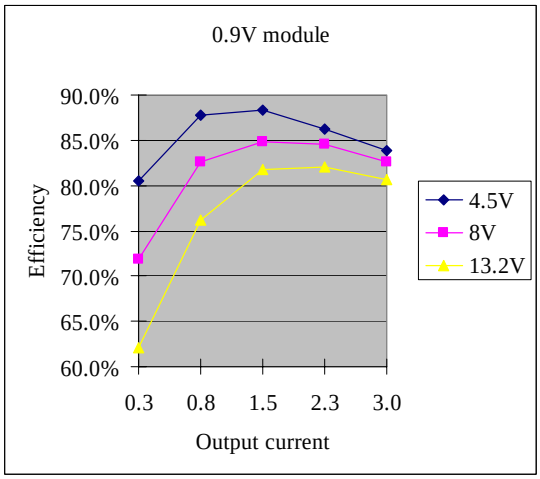




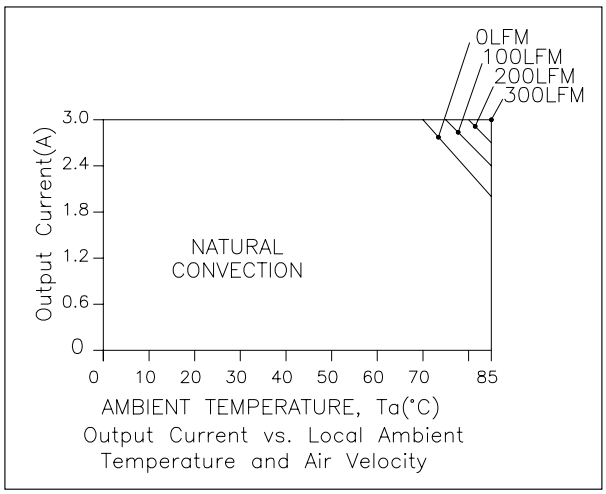


Efficiency Data (continued)



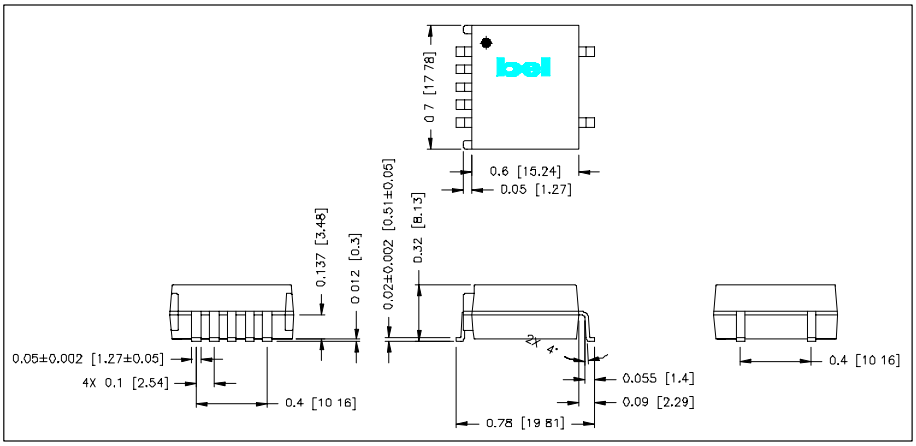


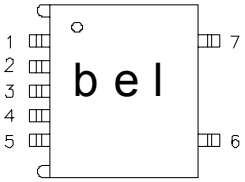
Thermal Derating Curve



For all outputs.

S7AH-03E

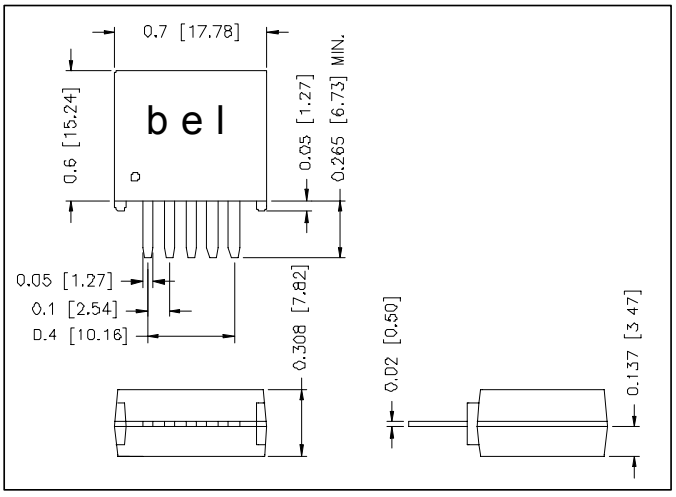


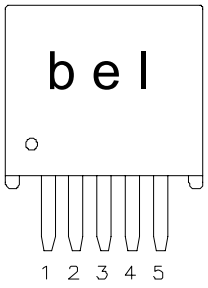


Pin Connections

Pin	Function
1	Remote On/Off (option)
2	Vin (+)
3	Ground
4	Vout (+)
5	Trim (option)
6	N/A
7	N/A

V7AH-03E





Pin Connections

Pin	Function
1	Remote On/Off (option)
2	Vin (+)
3	Ground
4	Vout (+)
5	Trim (option)

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