

NON-ISOLATED DC/DC CONVERTERS

5.4 V - 13.2 V Input / 1.0 V - 5.0 V Output / 20 A

bel
POWER PRODUCTS

SRDB-20ExxH Series

RoHS Compliant

- Non-Isolated
- OCP/SCP/OVP
- Low Profile Package
- Remote On/Off (Active High)
- Wide Input
- Remote Sense
- Under-Voltage Lockout (UVLO)



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Description

The Bel SRDB-20ExxH is part of the non-isolated dc/dc converter Power Module series. The modules use a DIP package for ease of layout and space savings. The output is closely regulated and the efficiency of 5 V output module is typically 94% at full load.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number
5.0 V	8.0 V - 13.2 V	20 A	100 W	94%	SRDB-20E50H
3.3 V	5.8 V - 13.2 V	20 A	66 W	92%	SRDB-20E33H
2.5 V	5.4 V - 13.2 V	20 A	50 W	91%	SRDB-20E25H
1.8 V	5.4 V - 13.2 V	20 A	36 W	88%	SRDB-20E18H
1.5 V	5.4 V - 13.2 V	20 A	30 W	87%	SRDB-20E15H
1.2 V	5.4 V - 13.2 V	20 A	24 W	85%	SRDB-20E12H
1.0 V	5.4 V - 13.2 V	20 A	20 W	84%	SRDB-20E10H

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

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	16 V	
Output Enable Terminal Voltage	-0.3 V	-	16 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-40 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	Vo=5.0 V	8 V	-	13.2 V
	Vo=3.3 V	5.8 V	-	13.2 V
	Vo=1.0-2.5 V	5.4 V	-	13.2 V
Input Current (full load)	Vo=5.0 V	-	-	15.1 A
	Vo=3.3 V	-	-	14.1 A
	Vo=2.5 V	-	-	13.3 A
	Vo=1.8 V	-	-	10.4 A
	Vo=1.5 V	-	-	8.4 A
	Vo=1.2 V	-	-	6.9 A
	Vo=1.0 V	-	-	5.9 A

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Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
Input Current (no load)				
Vo=5.0 V	-	200 mA	-	
Vo=3.3 V	-	150 mA	-	
Vo=2.5 V	-	135 mA	-	
Vo=1.8 V	-	120 mA	-	
Vo=1.5 V	-	100 mA	-	
Vo=1.2 V	-	85 mA	-	
Vo=1.0 V	-	80 mA	-	
Input Reflected Ripple Current (pk-pk)	-	130 mA	200 mA	With simulated impedance of 500 nH, 5 Hz to 20 MHz; use two 270 uF/16 V capacitors with ESR=0.018ohm max, at 100 kHz
Input Reflected Ripple Current (rms)	-	40 mA	70 mA	
I ² t Inrush Current Transient	-	0.1 A ² s	0.2 A ² s	
Turn-on Voltage Threshold	4.35 V	4.48 V	4.60 V	
Turn-off Voltage Threshold	3.65 V	3.98 V	4.30 V	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				
Vo=5.0 V	4.900 V	5.0 V	5.100 V	Test conditions: Vin=8 V; Iout=half load
Vo=3.3 V	3.234 V	3.3 V	3.366 V	
Vo=2.5 V	2.450 V	2.5 V	2.550 V	
Vo=1.8 V	1.764 V	1.8 V	1.836 V	
Vo=1.5 V	1.470 V	1.5 V	1.530 V	
Vo=1.2 V	1.176 V	1.2 V	1.224 V	
Vo=1.0 V	0.980 V	1.0 V	1.020 V	
Line Regulation				
Vo=5.0 V	-	±2 mV	±4 mV	
Vo=3.3 V	-	±1 mV	±3 mV	
Vo=2.5 V	-	±1 mV	±3 mV	
Vo=1.8 V	-	±1 mV	±3 mV	
Vo=1.5 V	-	±1 mV	±3 mV	
Vo=1.2 V	-	±1 mV	±3 mV	
Vo=1.0 V	-	±1 mV	±3 mV	
Load Regulation				
Vo=5.0 V	-	±3 mV	±7 mV	
Vo=3.3 V	-	±2 mV	±4 mV	
Vo=2.5 V	-	±2 mV	±4 mV	
Vo=1.8 V	-	±2 mV	±4 mV	
Vo=1.5 V	-	±1 mV	±3 mV	
Vo=1.2 V	-	±1 mV	±3 mV	
Vo=1.0 V	-	±1 mV	±3 mV	
Regulation Over Temperature (-40 °C to +85 °C)				
Vo=5.0 V	-	±15 mV	±30 mV	
Vo=3.3 V	-	±10 mV	±20 mV	
Vo=2.5 V	-	±9 mV	±18 mV	
Vo=1.8 V	-	±8 mV	±16 mV	
Vo=1.5 V	-	±7 mV	±14 mV	
Vo=1.2 V	-	±5 mV	±10 mV	
Vo=1.0 V	-	±5 mV	±10 mV	

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Output Specifications (continued)

Parameter	Min	Typ	Max	Notes	
Output Current	0 A	-	20 A		
Current Limit Threshold	24 A	-	40 A		
Short Circuit Surge Transient	-	0.075 A ² s	0.15 A ² s		
Ripple and Noise ¹ (rms)	-	20 mV	40 mV	With 1 uF ceramic capacitor at the output	
Ripple and Noise ¹ (rms)	-	10 mV	20 mV	With 680 uF tantalum capacitor at the output	
Ripple and Noise ¹ (pk-pk)		60 mV	100 mV	With 1 uF ceramic capacitor at the output	
Ripple and Noise ¹ (pk-pk)		30 mV	60 mV	With 680 uF tantalum capacitor at the output	
Turn on Time	-	20 mS	40 mS		
Overshoot at Turn on	-	0%	3%		
Output Capacitance	680 uF	-	8000 uF		
Transient Response					
50% ~ 100% Max Load	Vo=5 V	-	120 mV	200 mV	Test conditions: di/dt = 0.5 A/uS; Vin=8 V; with external 680 uF tantalum capacitor.
Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load	Vo=1.8 V-3.3 V	-	120 mV	200 mV	
Settling Time		-	50 uS	100 uS	
50% ~ 100% Max Load	Vo=1.5 V	-	100 mV	150 mV	
Settling Time		-	40 uS	80 uS	
100% ~ 50% Max Load	Vo=1.2 V	-	100 mV	150 mV	
Settling Time		-	40 uS	80 uS	
50% ~ 100% Max Load	Vo=1.0 V	-	100 mV	150 mV	
Settling Time		-	50 uS	100 uS	
50% ~ 100% Max Load	Vo=1.0 V	-	90 mV	130 mV	
Settling Time		-	40uS	80 uS	
100% ~ 50% Max Load	Vo=1.0 V	-	90 mV	130 mV	
Settling Time		-	40 uS	80 uS	

Notes: All specifications are typical at full load at 25 °C unless otherwise stated.

1. Test conditions of the output ripple and noise: two 270 uF/16 V capacitors with ESR=0.018 ohm max at the input; Vin=8 V, Io=20 A; 0-20 MHz BW.

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General Specifications

Parameter	Min	Typ	Max	Notes	
Efficiency	Vo=5.0 V	91%	94%	-	Measured at Vin=8 V at full load.
	Vo=3.3 V	89%	92%	-	
	Vo=2.5 V	88%	91%	-	
	Vo=1.8 V	85%	88%	-	
	Vo=1.5 V	84%	87%	-	
	Vo=1.2 V	82%	85%	-	
	Vo=1.0 V	81%	84%	-	
Switching Frequency	480 kHz	600 kHz	720 kHz		
Over Voltage Protection (Latch)	108.5%	115%	120%	Can be reset by cycling the input supply voltage or remote on/off.	
Output Trim Range	90%Vo	-	110%Vo		
Remote Sense Compensation		-	10%		
MTBF	3,154,461 hours			Calculated Per Bell Core SR-332 (Io = 16 A, Vin=8 V, Vo=3.3 V; Ta = 25 °C)	
Dimensions	Inches (L x W x H)	1.22 x 0.827 x 0.345			
	Millimeters (L x W x H)	30.99 x 21.0 x 8.76			
Weight	-	11 g	-		

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

Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	0 V	-	1 V	Remote on/off pin open, unit on.
Signal High (Unit On)	2.5 V	-	13.2 V	

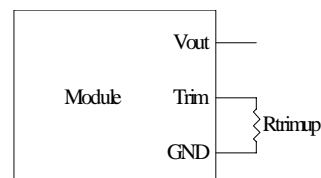
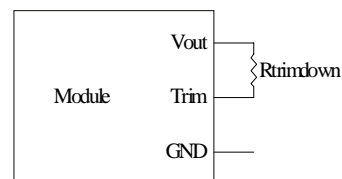
Output Trim Equations

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.

$$R_{trim_down} = \left(\frac{A}{V_{nom} - V_{adj}} - B \right)$$

$$R_{trim_up} = \left(\frac{C}{V_{adj} - V_{nom}} - D \right)$$

Vnom	A	B	C	D
5.0V	30.955	15.805	5.884	8.450
3.3V	3.961	3.407	1.266	1.825
2.5V	1.834	3.397	0.861	2.320
1.8V	1.927	6.916	1.533	5.000
1.5V	1.353	5.851	1.533	3.935
1.2V	0.099	0.446	0.196	0.201
1.0V	0.102	0.684	0.401	0.183

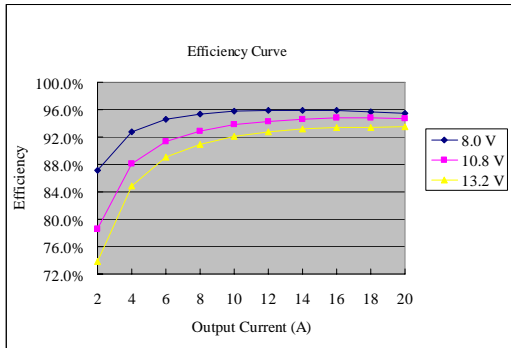


NON-ISOLATED DC/DC CONVERTERS

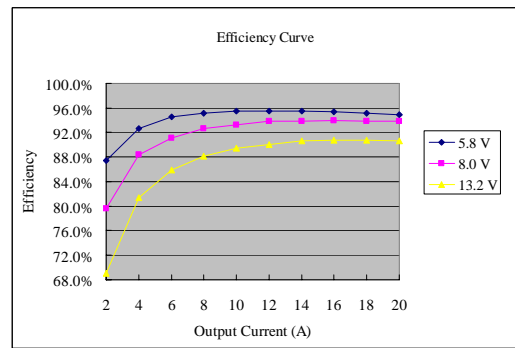
5.4 V - 13.2 V Input / 1.0 V - 5.0 V Output / 20 A



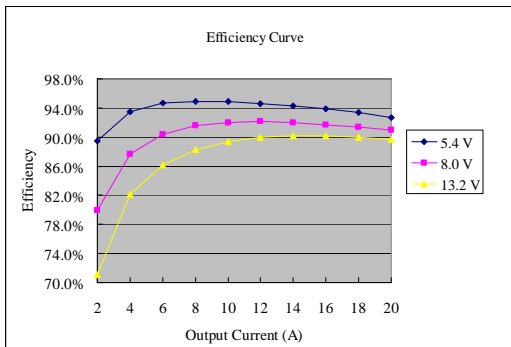
Efficiency Data



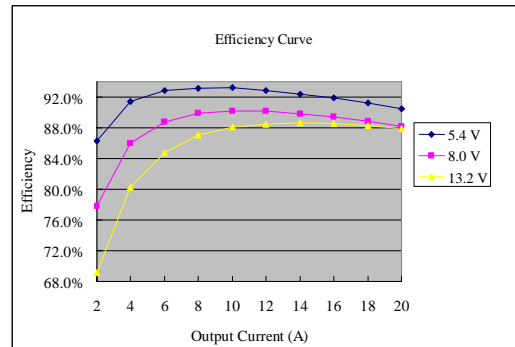
Vo=5.5 V



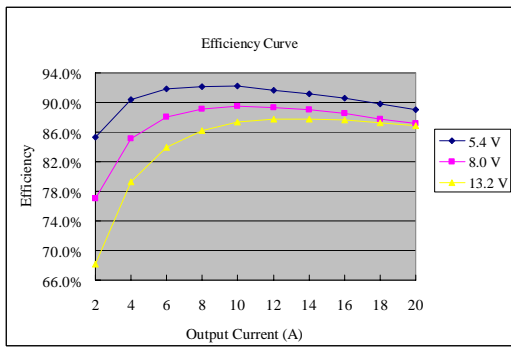
Vo=3.3 V



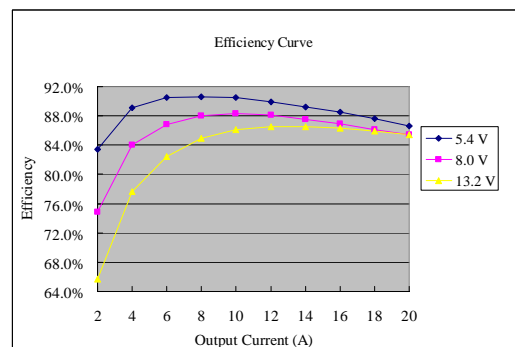
Vo=2.5 V



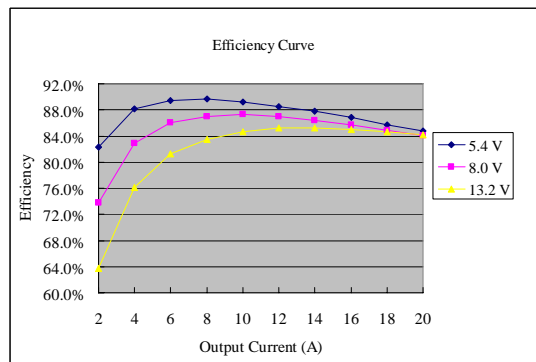
Vo=1.8 V



Vo=1.5 V



Vo=1.2 V



Vo=1.0 V

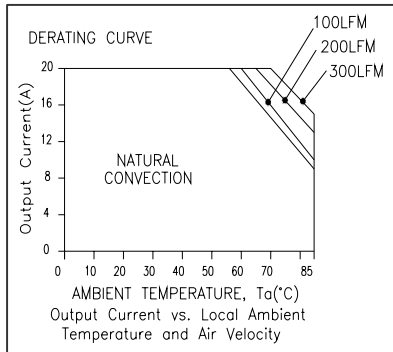
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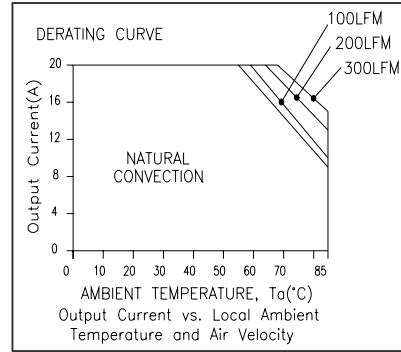


Thermal Derating Curves

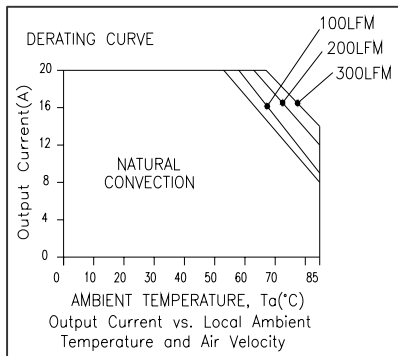
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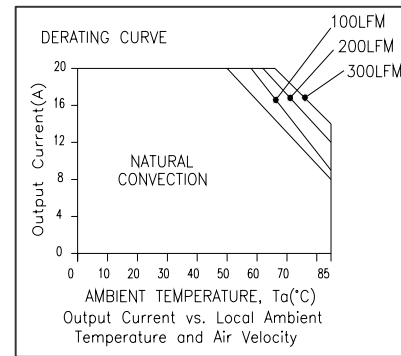
SRDB-20E10H (Vin=8 V)



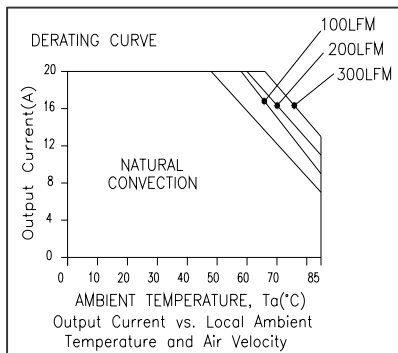
SRDB-20E12H (Vin=8 V)



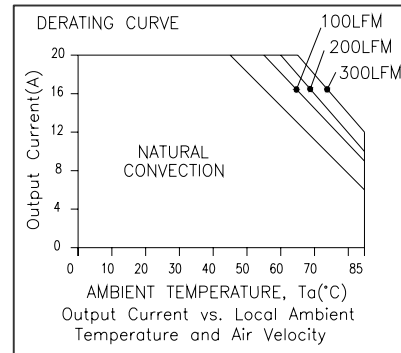
SRDB-20E15H (Vin=8 V)



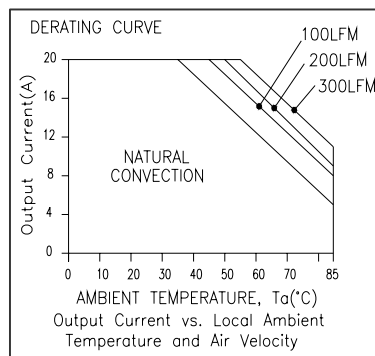
SRDB-20E18H (Vin=8 V)



SRDB-20E25H (Vin=8 V)



SRDB-20E33H (Vin=8 V)



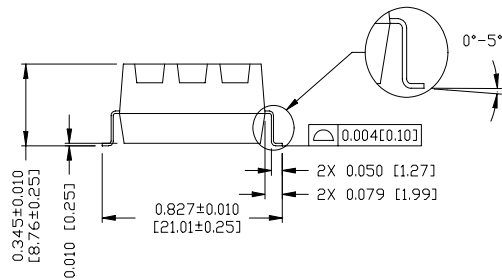
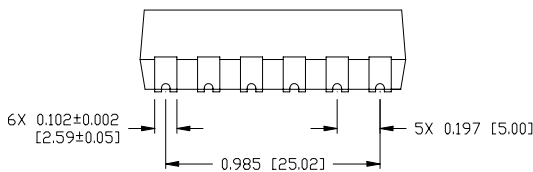
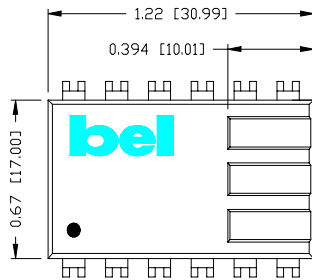
SRDB-20E50H (Vin=8 V)

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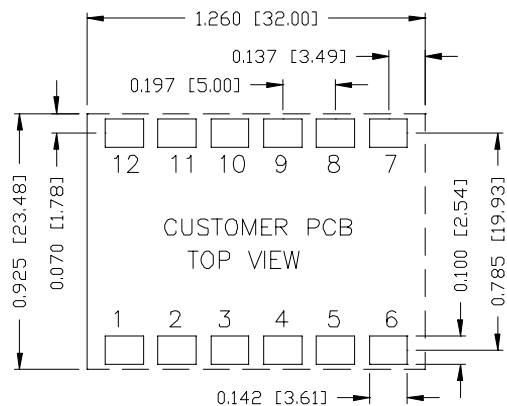
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Mechanical Outline

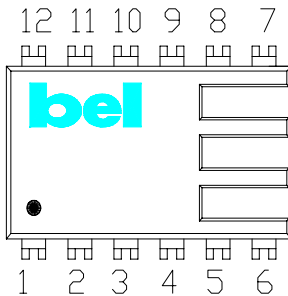


RECOMMENDED PAD LAYOUT



DON'T PLACE OTHER COMPONENTS IN THIS DASHED AREA

Pin Connections



Pin	Function
1	+Vo
2	+Vo
3	Ground
4	Ground
5	Ground
6	+Vin
7	+Vin
8	Ground
9	Ground
10	Remote On/Off
11	Trim
12	Remote Sense (+)

Note: Though there are 5 GND pins (3,4,5,8,9), it is highly recommended that all of them should be used in the system application, because of the current and the thermal conduction.

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 240°C.



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