

# NON-ISOLATED DC/DC CONVERTERS

## 3 – 15V Input / 1.8V Output / 16A



BP06SRDC-16D180

### SRDC-16D180 Module

### RoHS Compliant

- Nonisolated
- Industry standard pinout
- Fixed frequency
- High efficiency means less power dissipation
- High power density
- Optimized for cost
- Remote on/off
- Programmable undervoltage lockout (UVLO)
- Over current and short circuit protection
- Two phase operation
- Non-latching over temperature shutdown protection



### Description

The Bel SRDC-16D180 module is one in a series of non-isolated, DC/DC power converters that operate from a wide input range of 3V minimum to 15V maximum. This converter is available with 1.8V output. It uses a low profile, surface mount DIP package for ease of layout and space savings. 16A maximum output is also provided. Standard features include remote on/off, over current and short circuit protection, programmable UVLO and output voltage adjust. Optional features include two-wire remote sense or single-ended remote sense with a good power signal. This module also makes use of adaptive positioning to improve transient response performance. It may be used almost anywhere low voltage silicon is employed and a 3 to 15V source is available. Typical applications include file servers, routers, line cards and other computing and communications equipment.

### Applications

- Telecommunications
- Networking
- Computers and peripherals

### Options

- Double-ended remote sense
- Power good signal and single-ended sense

### Part Number Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number	Part Number Power Good Signal & Remote Sense	Part Number Double-ended Remote Sense
1.8V	3 - 15V	16A	29W	86%	SRDC-16D180	SRDC-16D18S	SRDC-16D18D

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### Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	V <sub>in</sub>	-0.3		15	V
Output Enable Terminal Voltage <sup>1</sup>	V <sub>outen</sub>	-0.3		6	V
Ambient Temperature	T <sub>amb</sub>	0		70	°C
Storage Temperature	T <sub>stor</sub>	-40		105	°C

Note: Use beyond the maximum ratings may cause a reliability degradation of the DC/DC converter or may permanently damage the device.

1. The enable pin performs two functions, remote on/off and programmable under voltage lockout. The factory set UVLO point is 3.0V typical, but can be adjusted upward with the addition of a single external resistor located from the enable pin to ground. Turning the converter on and off is accomplished using an open collector/drain device as a switch. The enable pin is internally pulled up to V<sub>in</sub> through a 12.1K resistor and the pin's logic is active high.

### Input Specifications

Parameter	Symbol	Min	Typical	Max	Units
Operating Input Voltage	V <sub>in</sub>	3.1		15	V
Input Current (V <sub>in</sub> =3.3V)	I <sub>in</sub>			10.8	A
Input Current (V <sub>in</sub> =5.0V)	I <sub>in</sub>			7	A
Input Current (V <sub>in</sub> =12.0V)	I <sub>in</sub>			3.2	A
No Load Input Current (V <sub>in</sub> =3.3V)	I <sub>in</sub>			200	mA
No Load Input Current (V <sub>in</sub> =5.0V)	I <sub>in</sub>			150	mA
No Load Input Current (V <sub>in</sub> =12.0V)	I <sub>in</sub>			110	mA
Input Reflected Ripple Current <sup>1</sup>				50	mA <sub>rms</sub>
Input Reflected Ripple Current (P-P) <sup>1</sup>				100	mApk
I <sup>2</sup> t Inrush Current Transient				0.1	A <sup>2</sup> s
Turn On Voltage Threshold <sup>2</sup>			2.92		V
Turn Off Voltage Threshold		2.8	2.85	2.90	V

Note: Input capacitance 100µF/16V, ESR = 0.03 Ω max at 100kHz @ 25° C.

1. With simulated source impedance of 500nH, 5Hz to 20MHz.

2. UVLO is adjustable by terminating on/off pin to ground per the termination resistance table on page 7.

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### Output Specifications

Parameter	Symbol	Min	Typical	Max	Units
Output Voltage Set Point	Vout	1.80	1.82	1.85	V
Load Regulation (Droop Impedance)	Rout	2	2.5	3	mΩ
Line Regulation Input Voltage 3.1V to 15V			15	25	mV
Line Regulation Input Voltage 5V ±20%			3	10	mV
Regulation Over Temperature 0° - 70° C			10	25	mV
Output Ripple and Noise <sup>1</sup>			25	40	mVp-p
Output Ripple and Noise <sup>1</sup>			10	20	mVrms
Output Current Range	Iout	0		16	A
Output DC Current Limit	Ioutlim	18		22	A
Turn on Time Vin to Vout or on/off to Vout	Ton		8	10	ms
Overshoot at Turn On			0	1	%
Output Capacitance	Cout	100		2200	μF

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

1. 0 - 20MHz BW, 0.1μF ceramic cap on output.

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## Output Specifications

Parameter	Symbol	Min	Typical	Max	Units
<b>Transient Response <sup>2</sup> (Vin=3.3V)</b>					
ΔV 50% to 100% of Max Load			60	75	mV
Settling Time	Ts		100	120	μs
ΔV 100% to 50% of Max Load			60	75	mV
Settling Time	Ts		100	120	μs
<b>Transient Response <sup>2</sup> (Vin=5.0V)</b>					
ΔV 50% to 100% of Max Load			100	120	mV
Settling Time	Ts		100	120	μs
ΔV 100% to 50% of Max Load			100	120	mV
Settling Time	Ts		100	120	μs
<b>Transient Response <sup>2</sup> (Vin=12.0V)</b>					
ΔV 50% to 100% of Max Load			135	150	mV
Settling Time	Ts		100	120	μs
ΔV 100% to 50% of Max Load			135	150	mV
Settling Time	Ts		100	120	μs

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

2. di/dt = 1A/1μS, Ta = 25° C with a 560μF oscon cap on output.

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### General Specifications

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Parameter	Symbol	Min	Typical	Max	Units
Efficiency <sup>1</sup> (Vin=3.3V)	$\eta$	85	86		%
Efficiency <sup>2</sup> (Vin=5.0V)	$\eta$	83	84		%
Efficiency <sup>3</sup> (Vin=12.0V)	$\eta$	80	81		%
Switching Frequency	Fsw	495	550	605	kHz
Output Voltage Trim Range <sup>4</sup>		90		110	%
Remote Sense Compensation (when option specified)				300	mV
Weight			16		g

1. Vin=3.3V, full load and Ta=25° C.
2. Vin=5.0V, full load and Ta=25° C.
3. Vin=12.0V, full load and Ta=25° C.
4. See graph on page 7.

### Control Specifications

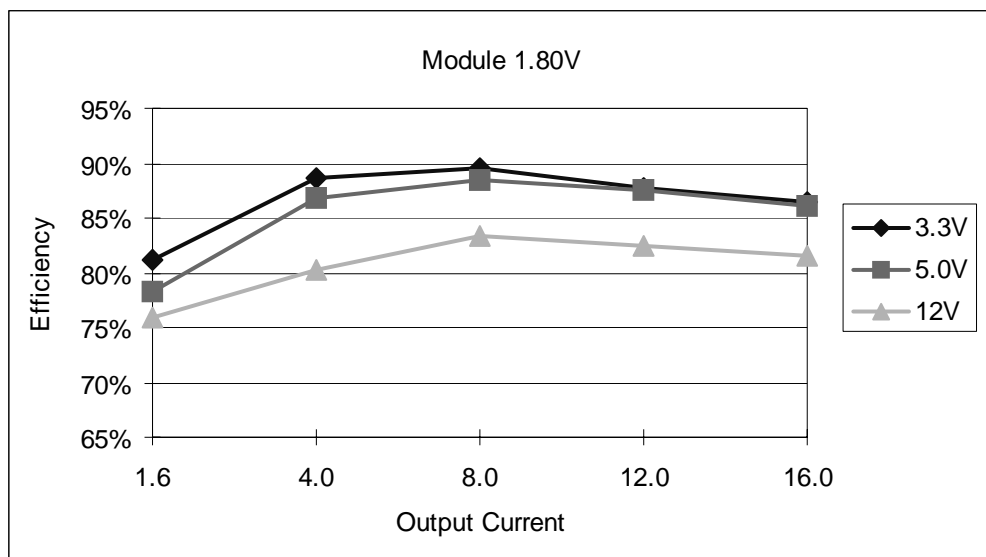
Parameter	Symbol	Min	Typical	Max	Units
Remote On/Off Open Circuit Voltage (Vin=3.3V)	Vouten			1.4	V
Remote On/Off Open Circuit Voltage (Vin=5.0V)	Vouten			2.1	V
Remote On/Off Open Circuit Voltage (Vin=12.0V)	Vouten			5.1	V
Remote On/Off Impedance Limitation (pin pulled up to +Vin)	Renable			11.5	k $\Omega$
Signal Low (Unit Off)		-0.3		0.3	V
Signal High (Unit On)		1.5		5.5	V
Power Good Levels (when option specified)	Vpg				
Signal Low			0.18	0.4	V
Current Sink				4	mA
Signal High (signal is open collector)		4.8		5	V
Under Voltage Threshold Vout rising			1.66		V
Under Voltage Threshold Vout falling			1.62		V

Note: On/off pin designed to work with an open collector/drain switch.

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### Efficiency Data



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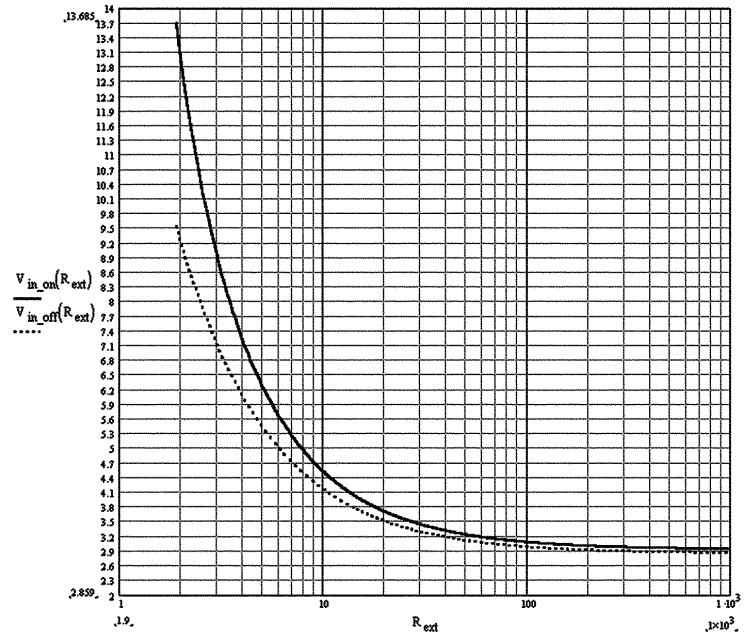


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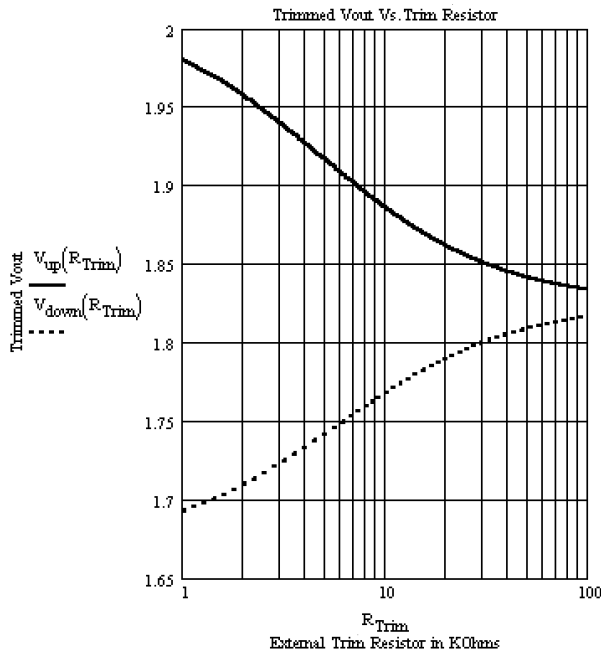
### Termination Resistance

Termination Resistance	Rising Vin UVLO	Falling Vin UVLO
Open Circuit	2.92V	2.85V
10.2K $\Omega$	4.50V	4.14V
5.36K $\Omega$	6.06V	5.28V
4.75K $\Omega$	6.50V	5.60V
3.48K $\Omega$	8.00V	6.58V
3.01K $\Omega$	9.00V	7.14V
2.49K $\Omega$	10.5V	8.00V
2.37K $\Omega$	11.0V	8.26V

### UVLO



### Output Voltage Trim Range

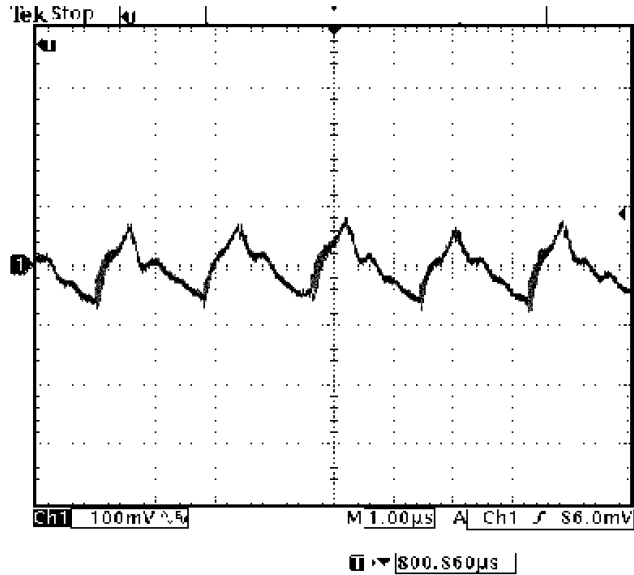


$V_{up}(10^9) = 1.825$	$V_{down}(10^9) = 1.825$
Trimmed Vout for Various K-Ohm E96 Resistor Values	
$V_{up}(30.1) = 1.851$	$V_{down}(30.1) = 1.8$
$V_{up}(12.1) = 1.879$	$V_{down}(12.1) = 1.774$
$V_{up}(10) = 1.886$	$V_{down}(10) = 1.768$
$V_{up}(5.11) = 1.916$	$V_{down}(5.11) = 1.742$
$V_{up}(4.32) = 1.924$	$V_{down}(4.32) = 1.735$
$V_{up}(3.83) = 1.93$	$V_{down}(3.83) = 1.731$
$V_{up}(3.01) = 1.941$	$V_{down}(3.01) = 1.722$
$V_{up}(2.87) = 1.943$	$V_{down}(2.87) = 1.721$
$V_{up}(2.67) = 1.946$	$V_{down}(2.67) = 1.718$
$V_{up}(2.00) = 1.958$	$V_{down}(2.00) = 1.709$
$V_{up}(1.00) = 1.98$	$V_{down}(1.00) = 1.692$
$V_{up}(0) = 2.012$	$V_{down}(0) = 1.67$

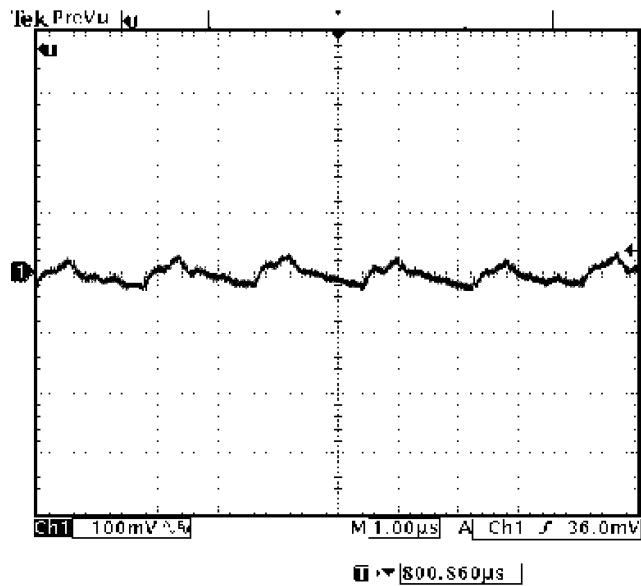
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**Ripple and Noise**



Ripple and noise at full load and 12.0Vdc input,  
and Ta=25° C



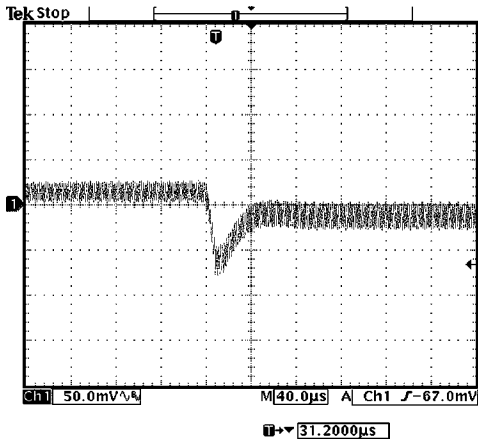
Ripple and noise at full load and 12.0Vdc input,  
and Ta=25° C with 560 µF external cap



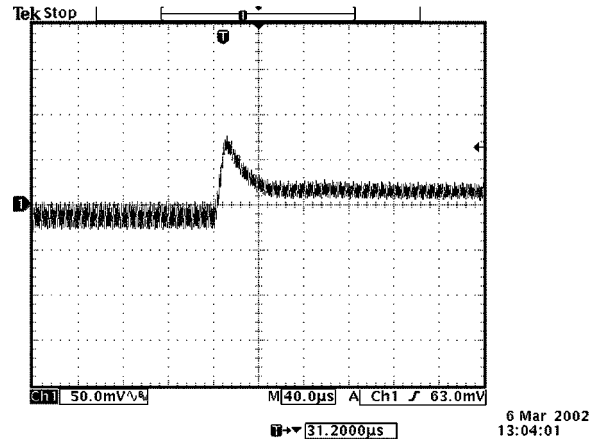
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### Transient Response

Transient response:  $di/dt = 1.0A/\mu S$

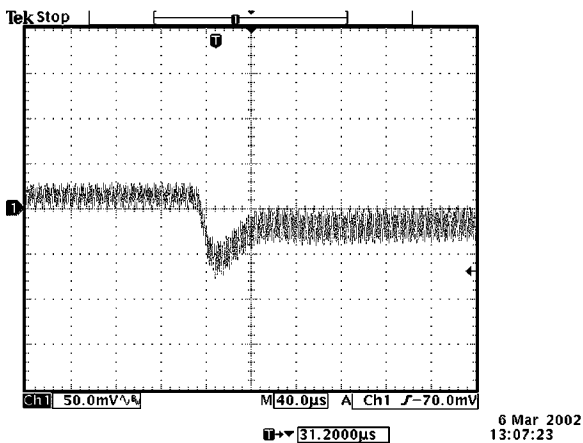


Vout=1.8V  
50% to 100% load transients at 12.0V input and Ta=25° C

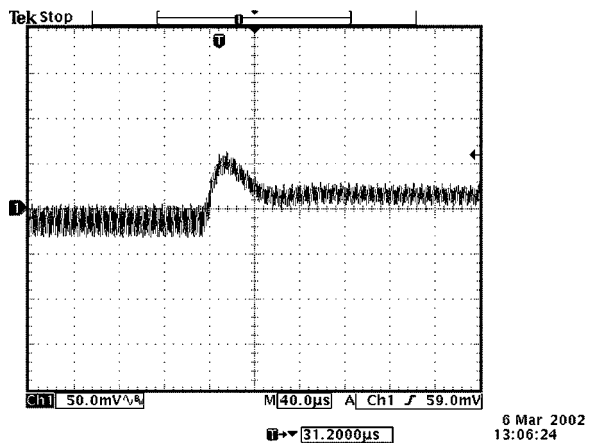


Vout=1.8V  
100% to 50% load transients at 12.0V input and Ta=25° C

Transient response:  $di/dt = 1.0A/\mu S$ , external load capacitance 560µF



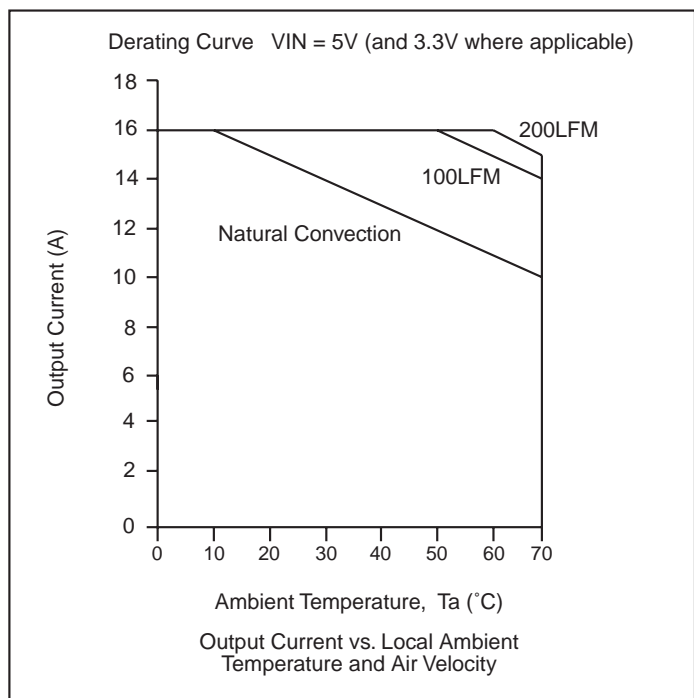
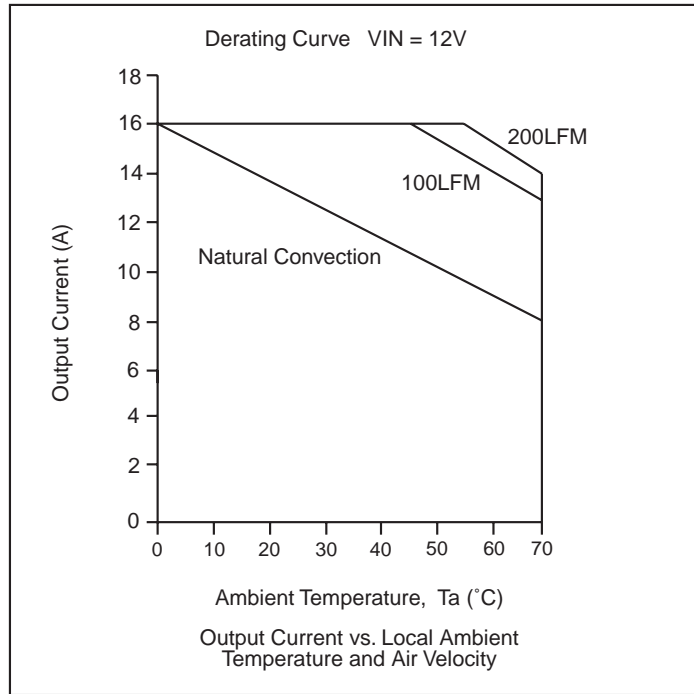
Vout=1.8V  
50% to 100% load transients at 12.0V input and Ta=25° C



Vout=1.8V  
100% to 50% load transients at 12.0V input and Ta=25° C

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**Thermal Considerations**



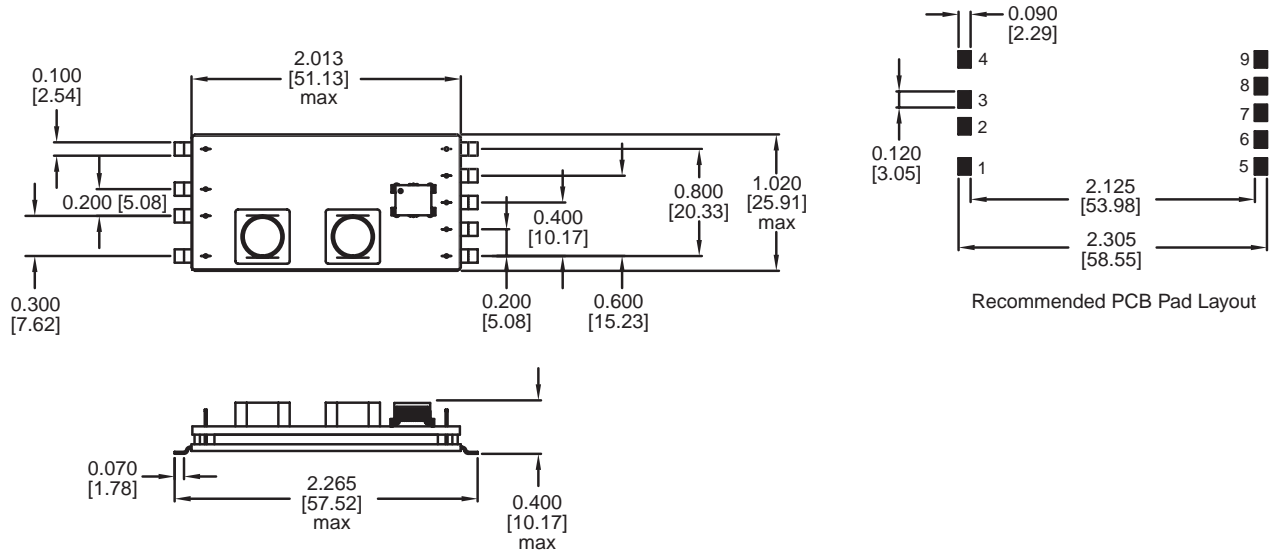
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### Mechanical



Recommended PCB Pad Layout

Dimensions are in inches [millimeters].  
Standard dimension tolerance is  $\pm 0.005$  [0.13] unless otherwise noted.

Pin	Function
1	Control Ground
2	On/Off Control
3 <sup>1</sup>	No Connection
4 <sup>2</sup>	No Connection
5	+Vo
6	Trim
7	Power Ground
8	Power Ground
9	+Vin

1. Pin 3 not used on module S7DC-16D180, used for - sense on S7DC-16D18D and used for power good signal on the S7DC-16D18S module.
2. Pin 4 not used on module S7DC-16D180, used for + sense on both the S7DC-16D18S and S7DC-16D18D modules.

### 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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