NON-ISOLATED DC/DC CONVERTERS
4.50 – 15V Input / 2.5V Output / 16A

bel POWER PRODUCTS

BP02S7DC-16D250

S7DC-16D250 Module

- 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 S7DC-16D250 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 2.5V 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 4.50 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

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
2.5V	4.50 - 15V	16A	40W	91%	S7DC-16D250	S7DC-16D25S	S7DC-16D25D

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Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	Vin	-0.3		15	V
Output Enable Terminal Voltage[1]	Vouten	-0.3		6	V
Ambient Temperature	Tamb	0		70	°C
Storage Temperature	Tstor	-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 Vin through a 12.1K ohm resistor and the pin's logic is active high.

Input Specifications

Parameter	Symbol	Min	Typical	Max	Units
Operating Input Voltage	Vin	4.50		15	V
Input Current (Vin=5.0V)	Iin			9	A
Input Current (Vin=12.0V)	Iin			4	A
No Load Input Current (Vin=5.0V)	Iin			170	mA
No Load Input Current (Vin=12.0V)	Iin			140	mA
Input Reflected Ripple Current[1]				50	mA_{rms}
Input Reflected Ripple Current (P-P)[1]				100	mApk
I^2t Inrush Current Transient				0.1	A^2s
Turn On Voltage Threshold[2]			3.93		V
Turn Off Voltage Threshold		3.50	3.73	3.80	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 6.

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Output Specifications

Parameter	Symbol	Min	Typical	Max	Units
Output Voltage Set Point	Vout	2.5	2.55	2.6	V
Load Regulation (Droop Impedance)	Rout	2	2.5	3	mΩ
Line Regulation Input Voltage 4.75V to 15V			15	25	mV
Line Regulation Input Voltage 12V ±20%			3	10	mV
Regulation Over Temperature 0° - 70° C			10	25	mV
Output Ripple and Noise[1]			25	40	mVp-p
Output Ripple and Noise[1]			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
Transient Response [2] (Vin=5.0V)					
ΔV 50% to 100% of Max Load			120	150	mV
Settling Time	Ts		100	120	µs
ΔV 100% to 50% of Max Load			120	150	mV
Settling Time	Ts		100	120	µs
Transient Response [2] (Vin=12.0V)					
ΔV 50% to 100% of Max Load			110	140	mV
Settling Time	Ts		100	120	µs
ΔV 100% to 50% of Max Load			110	140	mV
Settling Time	Ts		100	120	µs

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

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BP02S7DC-16D250

General Specifications

Parameter	Symbol	Min	Typical	Max	Units
Efficiency[1] (Vin=5.0V)	η	90	91		%
Efficiency[2] (Vin=12.0V)	η	86.5	87.5		%
Switching Frequency	Fsw	495	550	605	kHz
Output Voltage Trim Range[3]		90		110	%
Remote Sense Compensation (when option specified)				0.5	mV
Weight			16		g

1. Vin=5V, full load and Ta=25° C.
2. Vin=12V, full load and Ta=25° C.
3. See graph on page 6.

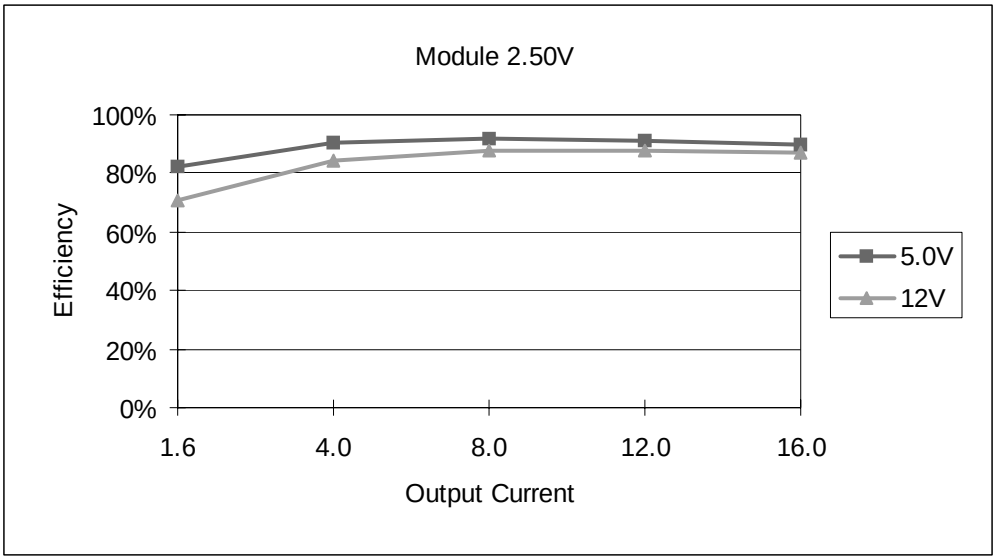
Control Specifications

Parameter	Symbol	Min	Typical	Max	Units
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	kΩ
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)				5	V
Under Voltage Threshold Vout rising			3.04		V
Under Voltage Threshold Vout falling			2.97		V

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

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Efficiency Data

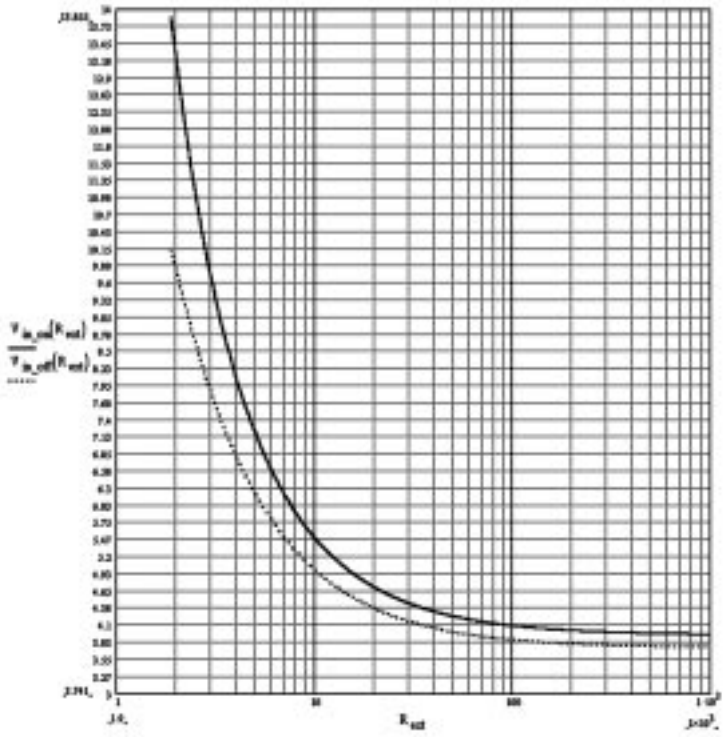


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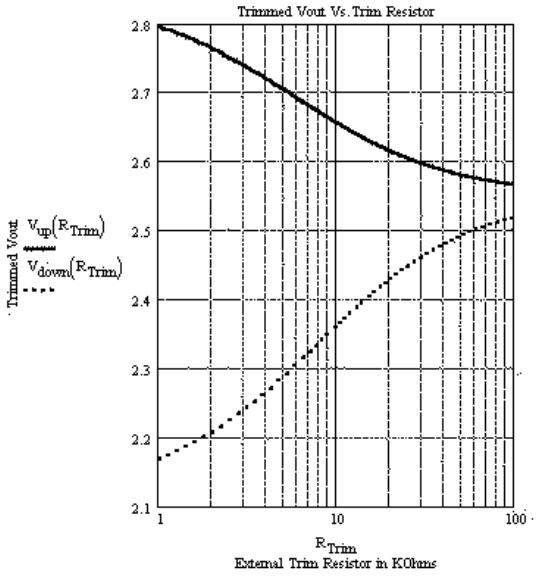
Termination Resistance

Termination Resistance	Rising Vin UVLO	Falling Vin UVLO
Open Circuit	3.93V	3.73V
21K Ω	4.50V	4.33V
5.90K Ω	6.06V	5.86V
4.99K Ω	6.48V	6.24V
3.06K Ω	8.10V	7.65V
2.61K Ω	9.09V	8.56V
2.10K Ω	10.54V	9.55V
2.05K Ω	10.72V	9.69V

UVLO



Output Voltage Trim Range



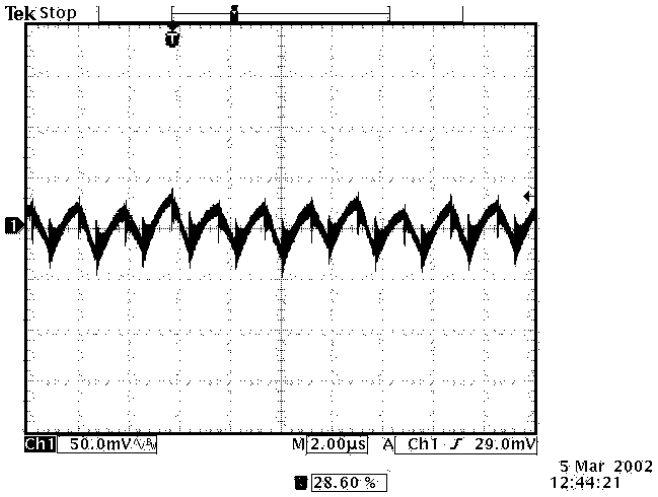
$V_{up}(10^9) = 2.55$ $V_{down}(10^9) = 2.55$

Trimmed Vout for Various K-Ohm E96 Resistor Values

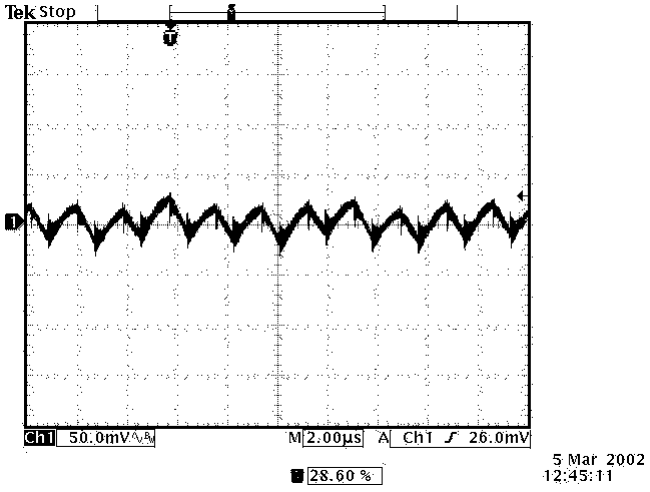
$V_{up}(30.1) = 2.597$	$V_{down}(30.1) = 2.461$
$V_{up}(12.1) = 2.644$	$V_{down}(12.1) = 2.38$
$V_{up}(10) = 2.657$	$V_{down}(10) = 2.36$
$V_{up}(5.11) = 2.704$	$V_{down}(5.11) = 2.289$
$V_{up}(4.32) = 2.716$	$V_{down}(4.32) = 2.272$
$V_{up}(3.83) = 2.725$	$V_{down}(3.83) = 2.26$
$V_{up}(3.01) = 2.741$	$V_{down}(3.01) = 2.238$
$V_{up}(2.87) = 2.744$	$V_{down}(2.87) = 2.234$
$V_{up}(2.67) = 2.748$	$V_{down}(2.67) = 2.228$
$V_{up}(2.00) = 2.765$	$V_{down}(2.00) = 2.207$
$V_{up}(1.00) = 2.796$	$V_{down}(1.00) = 2.168$
$V_{up}(0) = 2.838$	$V_{down}(0) = 2.12$

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Ripple and Noise



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

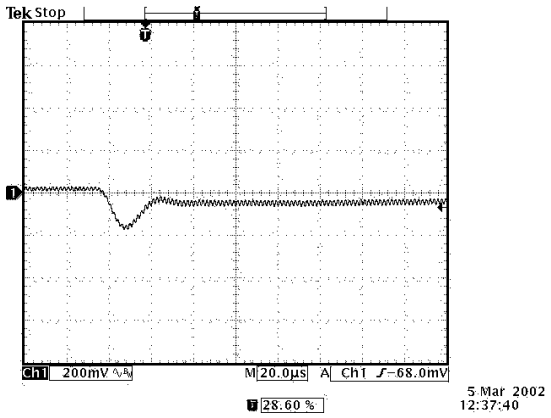


Ripple and noise at full load and 12.0Vdc input, and Ta=25° C with 560 µF external cap

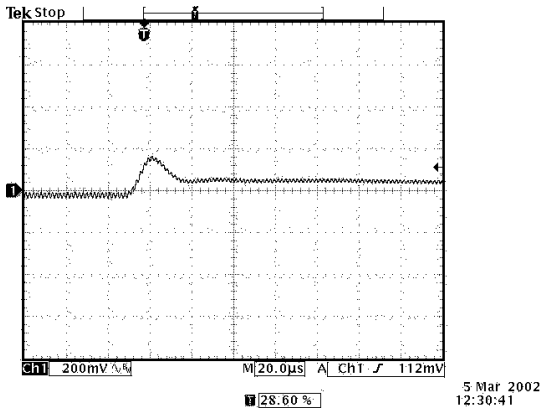
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Transient Response

Transient response: di/dt = 1.0A/µS

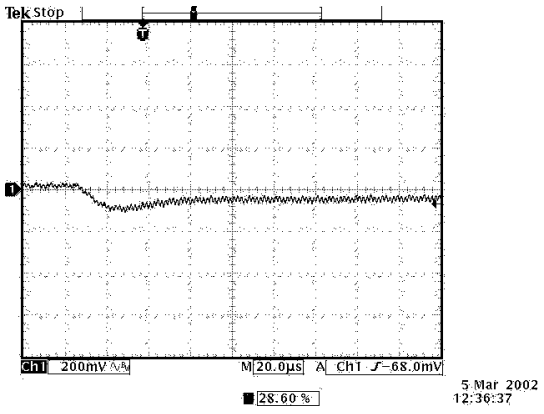


Vout=2.5V
50% to 100% load transients at 12.0V input and Ta=25° C

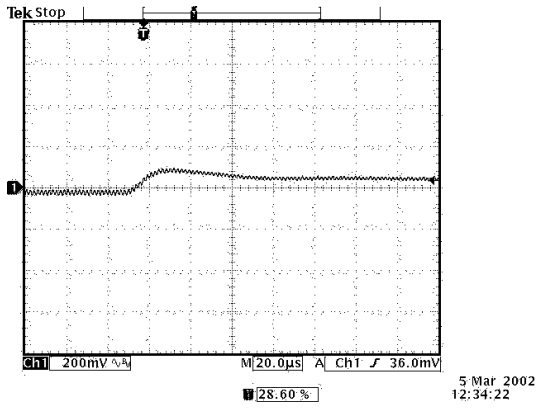


Vout=2.5V
100% to 50% load transients at 12.0V input and Ta=25° C

Transient response: di/dt = 1.0A/µS, external load capacitance 560µF



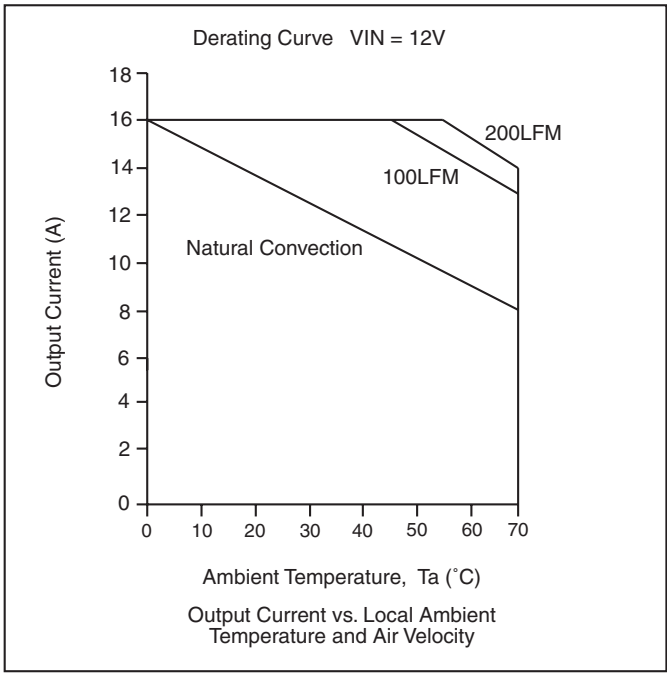
Vout=2.5V
50% to 100% load transients at 12.0V input and Ta=25° C



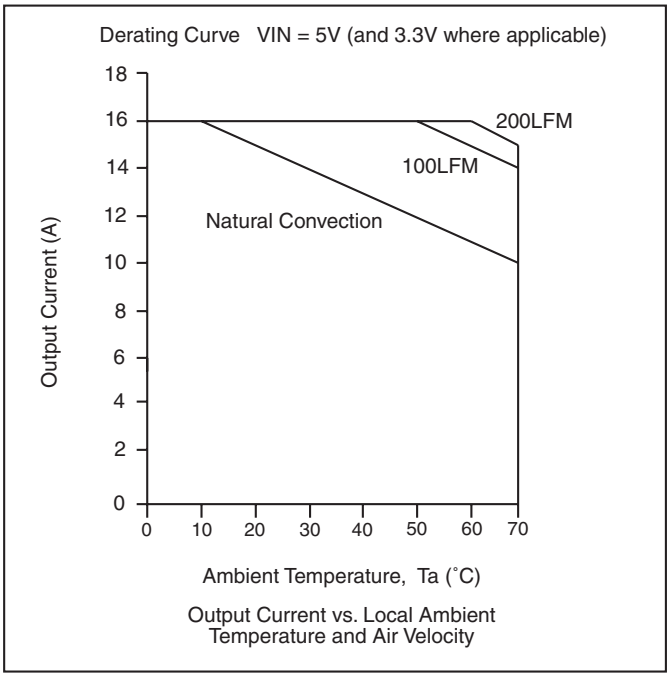
Vout=2.5V
100% to 50% load transients at 12.0V input and Ta=25° C

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Thermal Considerations



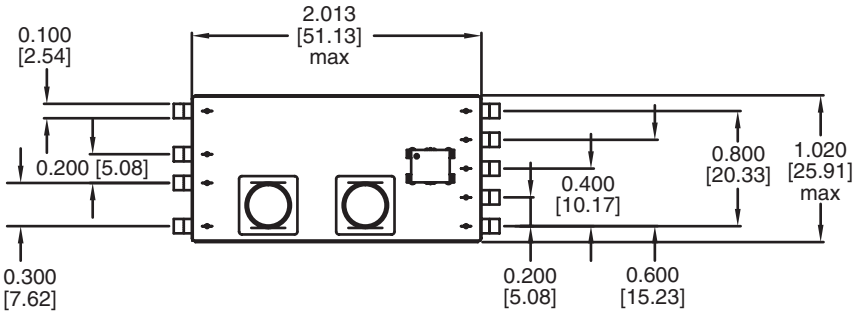
Output Current vs. Local Ambient Temperature and Air Velocity

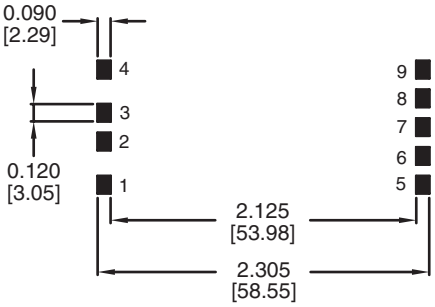


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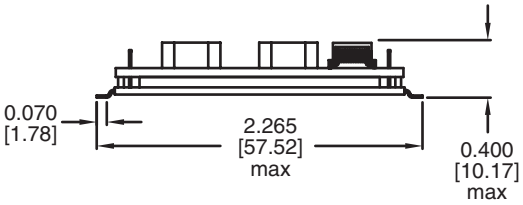
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Mechanical





Recommended PCB Pad Layout



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

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

1. Pin 3 not used on module S7DC-16D250, used for - sense on S7DC-16D25D and used for power good signal on the S7DC-16D33S module.

2. Pin 4 not used on module S7DC-16D250, used for + sense on both the S7DC-16D25S and S7DC-16D25D modules.

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