# NON-ISOLATED DC/DC CONVERTERS
## 5V Input / 1.2V – 3.3V Output / 8A

bel POWER PRODUCTS

**BP02S7DB-08B**

## S7DB-08B Series

- Nonisolated
- Compact, low profile surface mount package
- Fixed frequency
- High efficiency means less power dissipation
- Excellent thermal performance
- Optimized for cost
- Remote on/off
- Undervoltage lockout (UVLO)
- Over current and short circuit protection
- Remote sense




## Description

The Bel S7DB-08B modules are a series of non-isolated, step down DC/DC power converters that operate from a nominal 5V source. These converters are available in a range of output voltages from 1.2V to 3.3V. They are packaged in a compact, low profile, surface mount DIP package for ease of layout and space savings. 8A maximum output is also provided. Standard features include remote on/off, over current and short circuit protection, UVLO and output voltage adjust. These products may be used almost anywhere low voltage silicon is employed and a 5V source is available. Typical applications include file servers, routers, line cards and other computing and communications equipment.

## Applications

- Distributed power architectures
- Data networking equipment
- Telecommunications
- Computers and peripherals

## Part Number Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Part Number |
|---|---|---|---|---|---|
| 3.3V | 5V | 8A | 26.4W | 93% | S7DB-08B330 |
| 2.5V | 5V | 8A | 20W | 91% | S7DB-08B250 |
| 1.8V | 5V | 8A | 14.4W | 87% | S7DB-08B180 |
| 1.5V | 5V | 8A | 12W | 86% | S7DB-08B150 |
| 1.2V | 5V | 8A | 9.6W | 83% | S7DB-08B120 |

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## Absolute Maximum Ratings

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Continuous Input Voltage | Vin | -0.3 | | 6 | V |
| Output Enable Terminal Voltage | Vouten | -0.3 | | 6 | V |
| Ambient Temperature | Tamb | -40 | | 85 | °C |
| Storage Temperature | Tstor | -55 | | 100 | °C |

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

## Input Specifications

| Parameter | Module | Symbol | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| Operating Input Voltage | All | Vin | 4.5 | 5 | 5.5 | V |
| Input Current | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | Iin | | | 7.2<br>5.6<br>4.6<br>3.9<br>3.0 | A |
| No Load Input Current | All | | | 50 | | mA |
| Remote Off Input Current | | | | 4 | 8 | mA |
| Input Reflected Ripple Current[1] | | | | 30 | 50 | $mA_{rms}$ |
| Input Reflected Ripple Current (P-P)[1] | | | | 60 | 100 | mApk |
| $I^2t$ Inrush Current Transient | | | | 0.05 | 0.07 | $A^2s$ |
| Turn On Voltage Threshold | | | | 4.3 | 4.5 | V |
| Turn Off Voltage Threshold | | | | 3.85 | 4.49 | V |

Note: Input capacitance two 270µF/10V, ESR = 0.018 Ω max at 100kHz @ 25° C.
1. With simulated source impedance of 500nH, 5Hz to 20MHz.

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## Output Specifications

| Parameter | Module | Symbol | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| Output Voltage Set Point [1] | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | Vout | 3.234<br>2.45<br>1.764<br>1.47<br>1.176 | 3.3<br>2.5<br>1.8<br>1.5<br>1.2 | 3.366<br>2.55<br>1.836<br>1.53<br>1.224 | V |
| Load Regulation | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | | | 4.0<br>4.0<br>3.0<br>3.0<br>3.0 | 10<br>10<br>8<br>8<br>8 | mV |
| Line Regulation | All | | | 2.0 | 5 | mV |
| Regulation Over Temperature | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | | | 20<br>15<br>12<br>10<br>10 | 40<br>30<br>25<br>20<br>20 | mV |
| Total Output Voltage Regulation | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | | | | 55<br>45<br>38<br>33<br>33 | mV |
| Output Ripple and Noise [2] | All | | | 30 | 50 | mVp-p |
| Output Ripple and Noise [2] | All | | | 10 | 20 | mVrms |
| Output Current Range | All | Iout | 0 | | 8 | A |
| Output DC Current Limit | All | Ioutlim | 10.4 | | 20 | A |
| Short Circuit Surge | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | Ioutsurge | | 0.1<br>0.3<br>0.4<br>0.5<br>0.6 | 0.3<br>0.6<br>0.8<br>1.0<br>1.2 | $A^2s$ |
| Turn on Time | All | Ton | | 12 | 20 | ms |
| Overshoot at Turn On | All | | | 0 | 3 | % |
| Output Capacitance | All | Cout | 0 | | 3200 | µF |

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
1. Vin = 5V, Iout = full load, Ta = 25° C.
2. 0 - 20MHz, 1µF ceramic cap and 10µF aluminum cap on output.

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## Output Specifications

| Parameter | Module | Symbol | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| **Transient Response [3]** | | | | | | |
| ΔV 50% to 100% of Max Load | 3.3V | | | 90 | 120 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| ΔV 100% to 50% of Max Load | | | | 90 | 120 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| **Transient Response [3]** | | | | | | |
| ΔV 50% to 100% of Max Load | 2.5V | | | 90 | 120 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| ΔV 100% to 50% of Max Load | | | | 90 | 120 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| **Transient Response [3]** | | | | | | |
| ΔV 50% to 100% of Max Load | 1.8V | | | 70 | 100 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| ΔV 100% to 50% of Max Load | | | | 70 | 100 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| **Transient Response [3]** | | | | | | |
| ΔV 50% to 100% of Max Load | 1.5V | | | 70 | 100 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| ΔV 100% to 50% of Max Load | | | | 70 | 100 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| **Transient Response [3]** | | | | | | |
| ΔV 50% to 100% of Max Load | 1.2V | | | 70 | 100 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |
| ΔV 100% to 50% of Max Load | | | | 70 | 100 | mV |
| Settling Time | | Ts | | 25 | 50 | µs |

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
3. di/dt = 0.5A/1µS, Ta = 25° C without external load capacitance.

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## General Specifications

| Parameter | Module | Symbol | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| Efficiency[1] | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | η | 90<br>88<br>84<br>83<br>80 | 93<br>91<br>87<br>86<br>83 | | % |
| Switching Frequency | All | Fsw | 260 | 300 | 340 | kHz |
| Output Voltage Trim Range[2] | All | 3.3V<br>2.5V<br>1.8V<br>1.5V<br>1.2V | 70<br>70<br>90<br>90<br>90 | | 110<br>110<br>120<br>120<br>110 | % |
| Remote Sense Compensation | All | | | | 10 | % |
| Weight | All | | | 10.5 | | g |

1. Vin=5.0V, full load and Ta=25° C.
2. See graphs on pages 12-14.

## Control Specifications

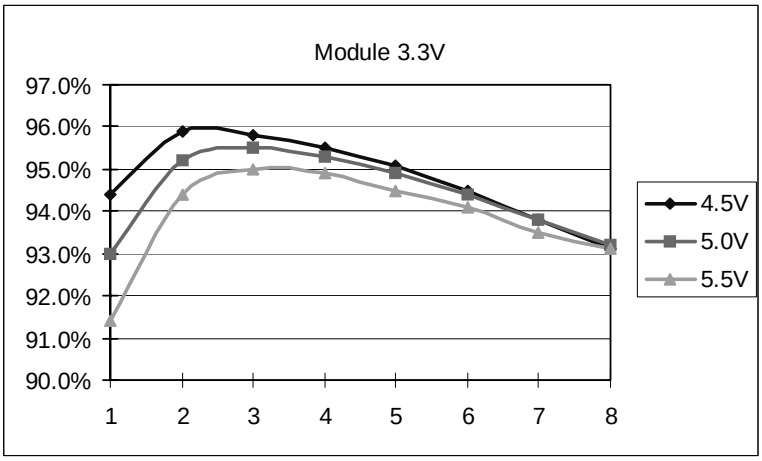
| Parameter | Module | Symbol | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| Remote On/Off [3] | All | Vouten | | | | V |
| Signal Low (Unit On) | All | | 0 | | 1 | V |
| Signal High (Unit Off) | All | | 2.5 | | 5.5 | V |

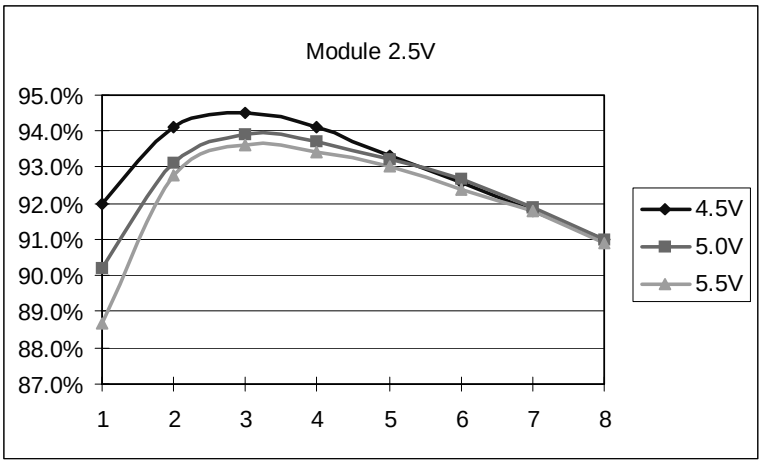
3. With remote on/off pin 8 open, the module is on.

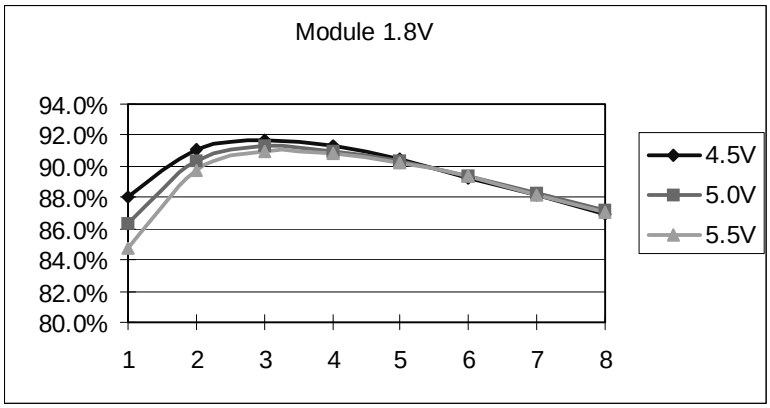
Note: On/off pin designed to work with an open collector/drain switch.

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## Efficiency Data

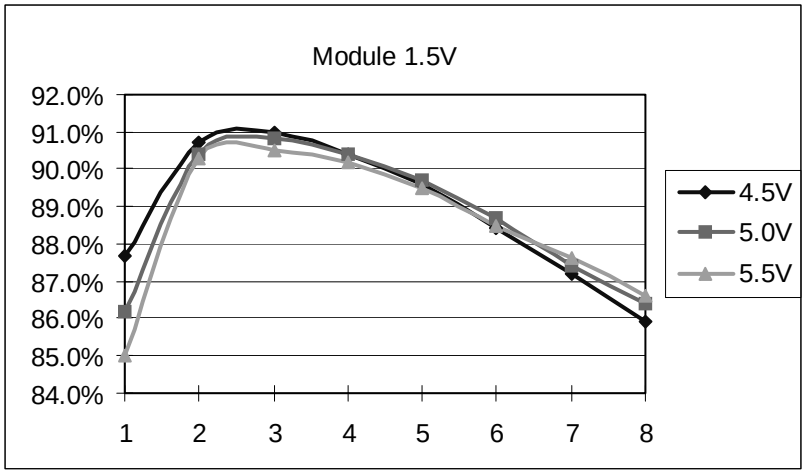


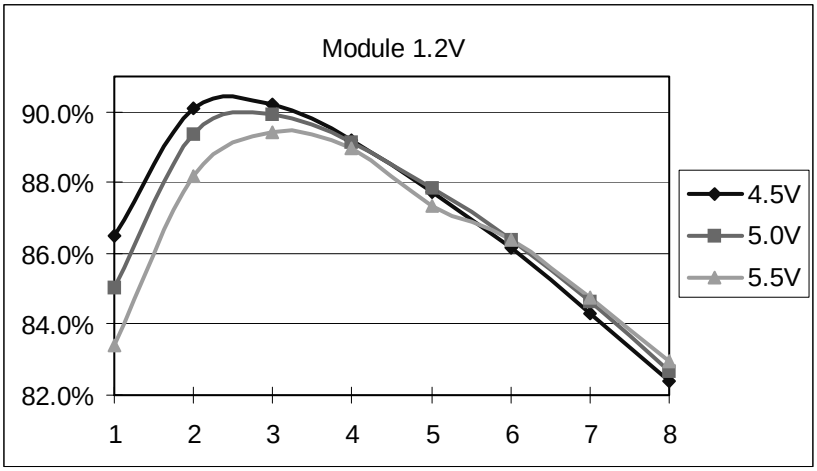




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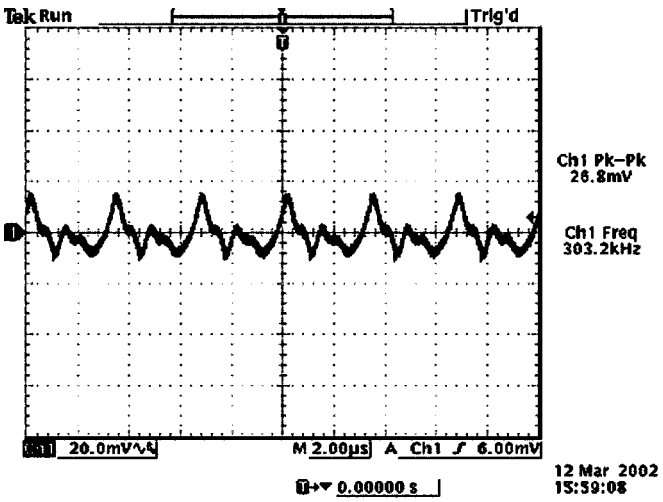
## Efficiency Data



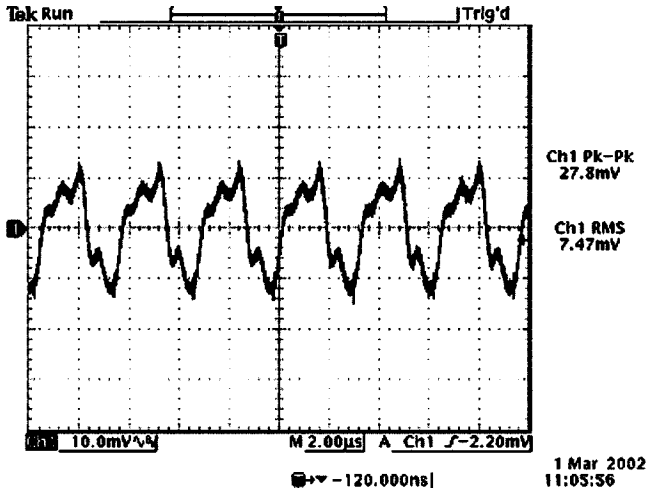




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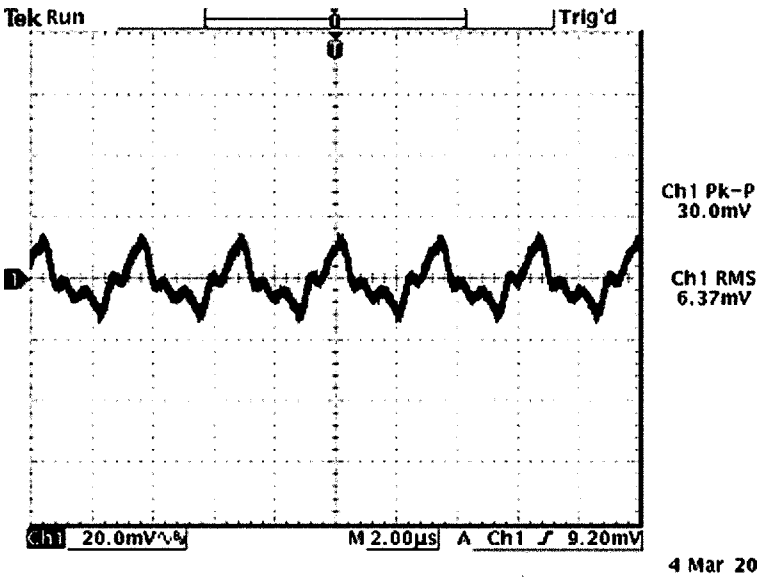
## Ripple and Noise




Ripple and noise at full load and 5Vdc input,
3.3Vdc output and Ta=25° C



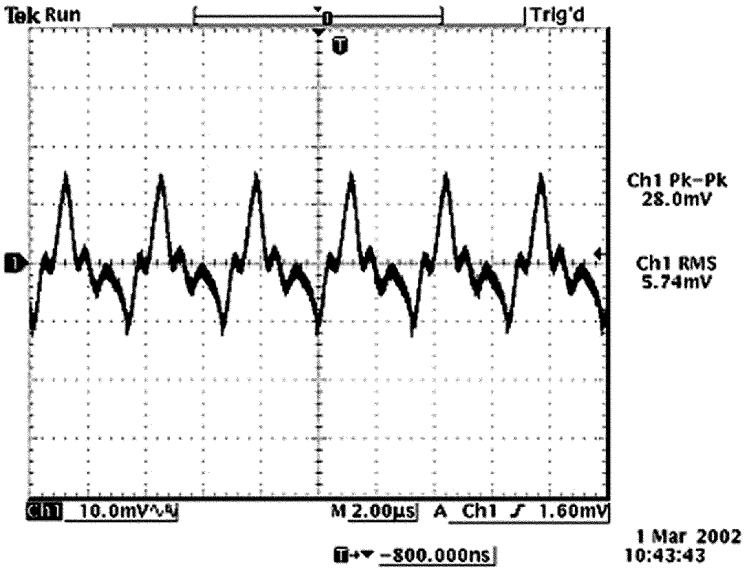

Ripple and noise at full load and 5Vdc input,
2.5Vdc output and Ta=25° C



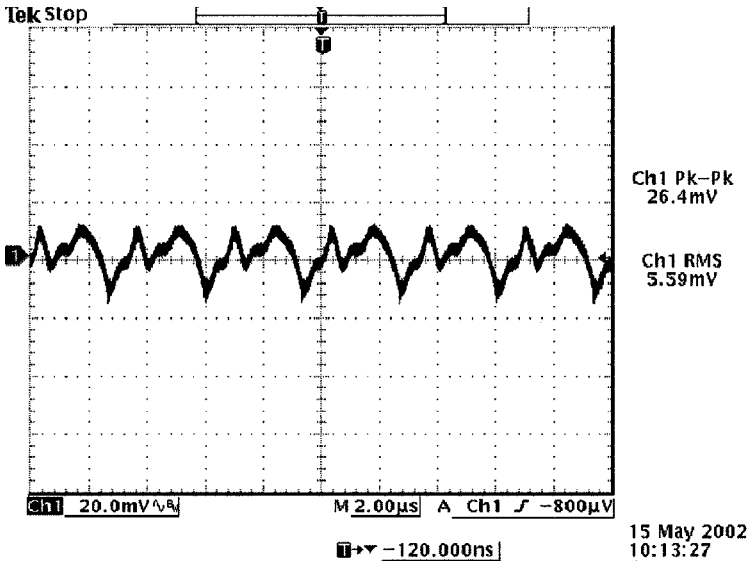

Ripple and noise at full load and 5Vdc input,
1.8Vdc output and Ta=25° C

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## Ripple and Noise




Ripple and noise at full load and 5Vdc input,
1.5Vdc output and Ta=25° C

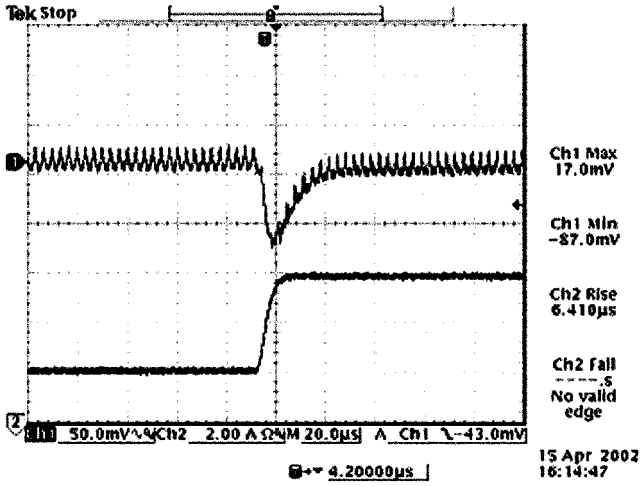



Ripple and noise at full load and 5Vdc input,
1.2Vdc output and Ta=25° C

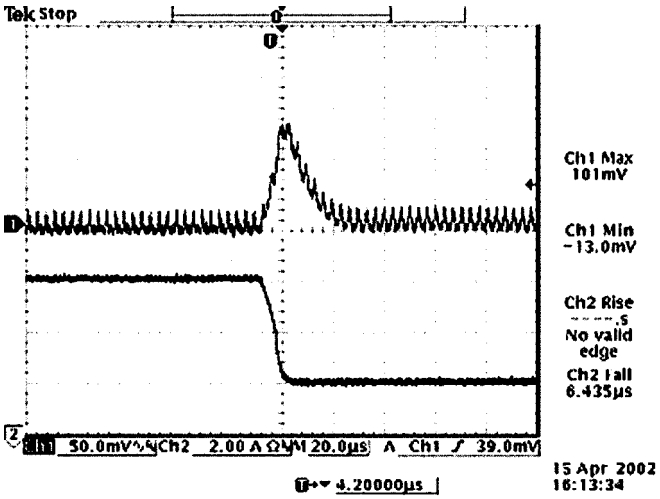
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## Transient Response

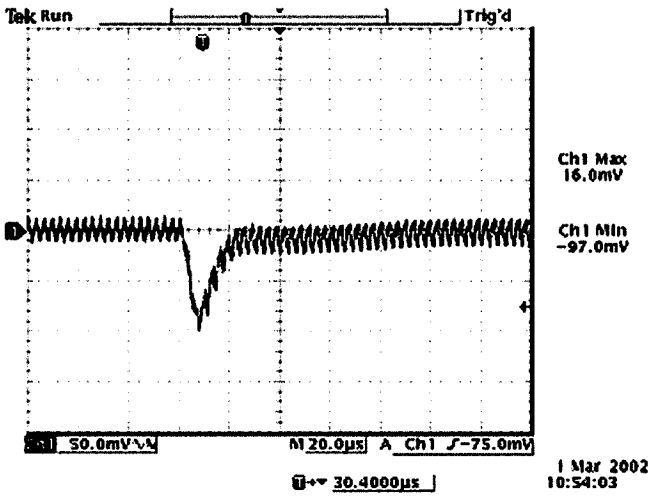
Transient response: di/dt = 0.5A/µS



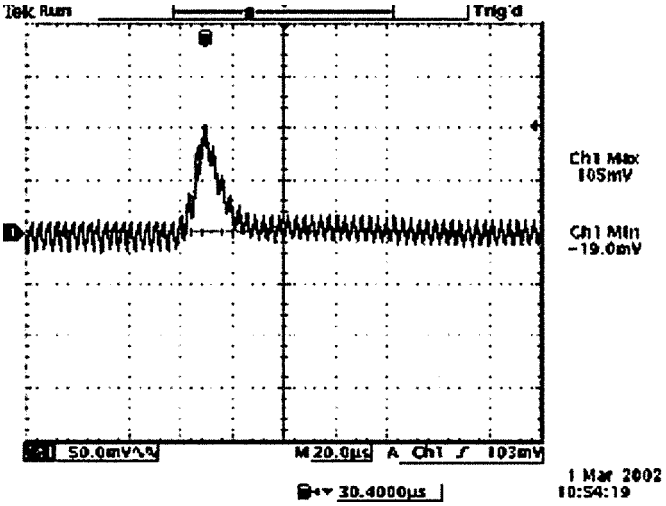

Vout=3. 3V
50% to 100% load transients at 5V input and Ta=25° C




Vout=3.3V
100% to 50% load transients at 5V input and Ta=25° C




Vout=2.5V
50% to 100% load transients at 5V input and Ta=25° C

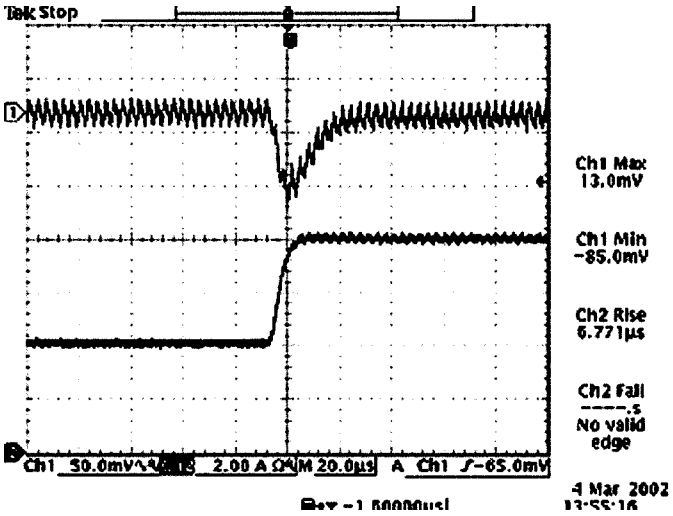



Vout=2.5V
100% to 50% load transients at 5V input and Ta=25° C

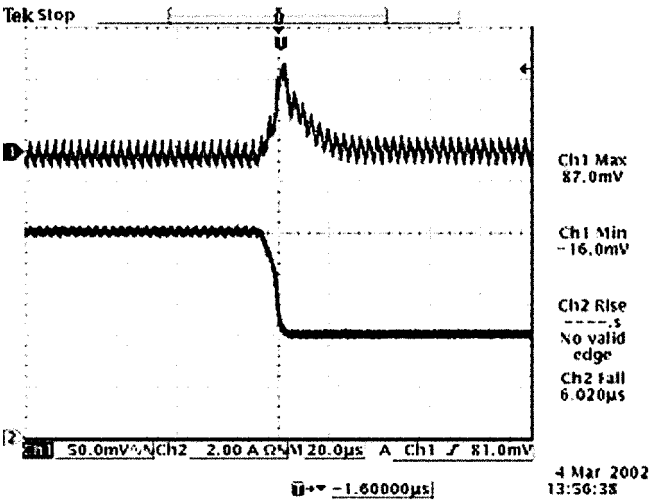
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## Transient Response

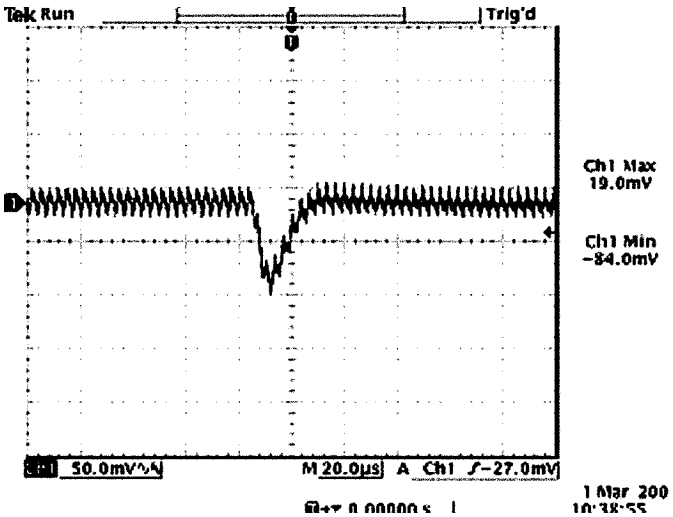
Transient response: di/dt = 0.5A/µS



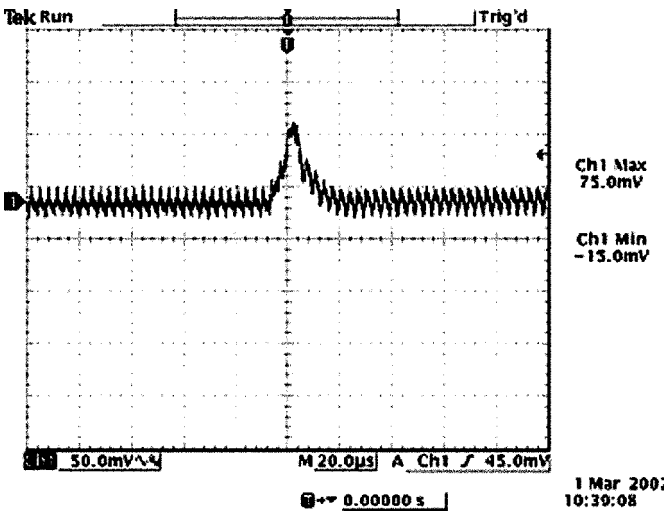

Vout=1.8V
50% to 100% load transients at 5V input and Ta=25° C




Vout=1.8V
100% to 50% load transients at 5V input and Ta=25° C




Vout=1.5V
50% to 100% load transients at 5V input and Ta=25° C

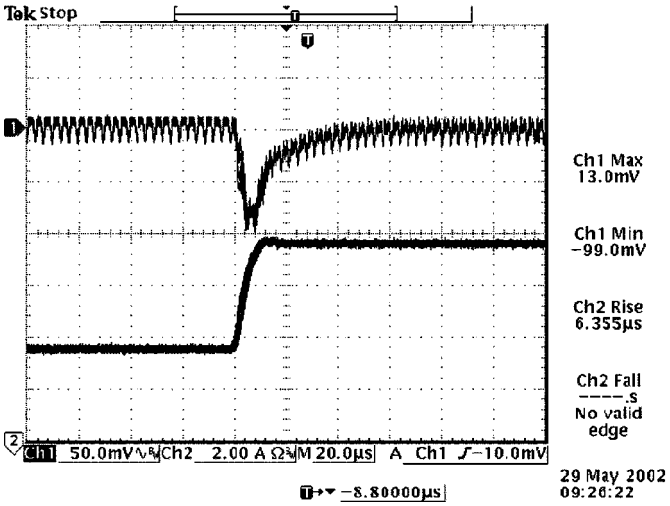



Vout=1.5V
100% to 50% load transients at 5V input and Ta=25° C

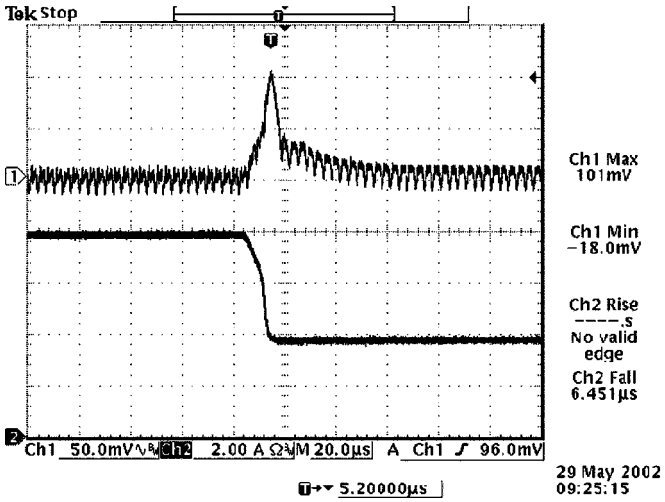
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## Transient Response

Transient response: di/dt = 0.5A/µS

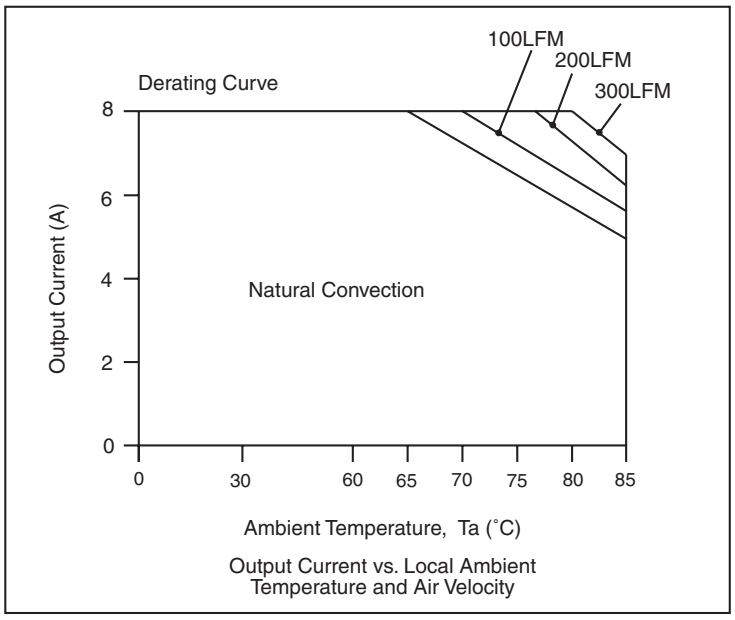



Vout=1.2V
50% to 100% load transients at 5V input and Ta=25° C




Vout=1.2V
100% to 50% load transients at 5V input and Ta=25° C

## Thermal Considerations

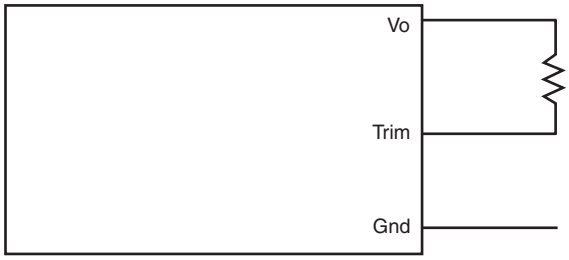



Output Current vs. Local Ambient Temperature and Air Velocity

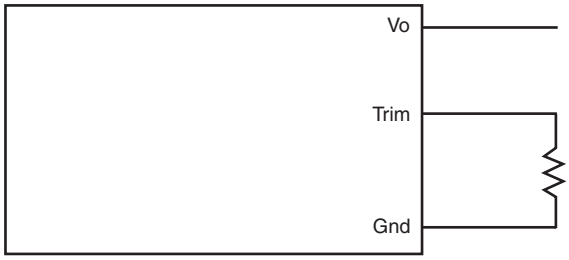
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## Output Voltage Set-Point Adjustment

Trim Down Test Circuit



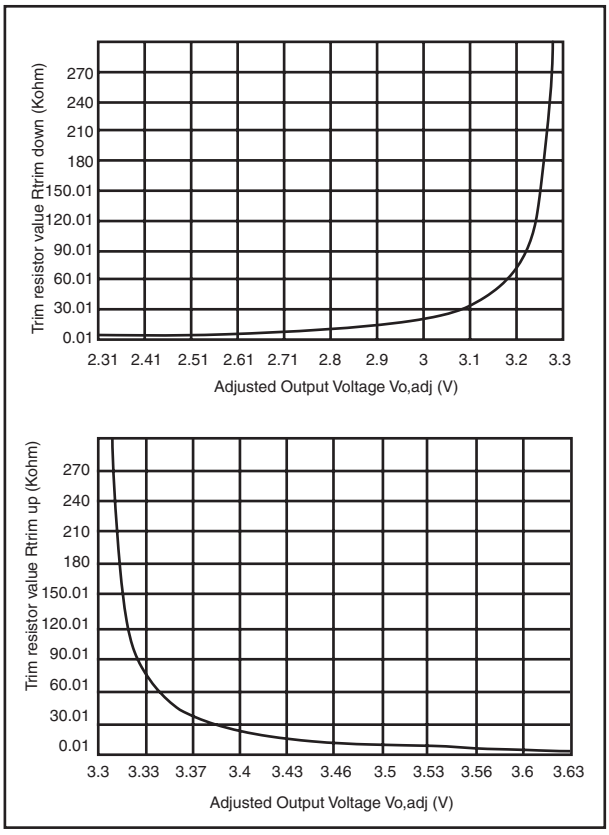

Trim Up Test Circuit




**S7DB-08B330 Trim Resistor Calculation**

$$\text{Rtrim down} = \left(\frac{7.964}{\text{Vo} - \text{Vo, adj}} - 6.82\right) \text{ Kohm}$$

$$\text{Rtrim up} = \left(\frac{2.536}{\text{Vo, adj} - \text{Vo}} - 3.65\right) \text{ Kohm}$$




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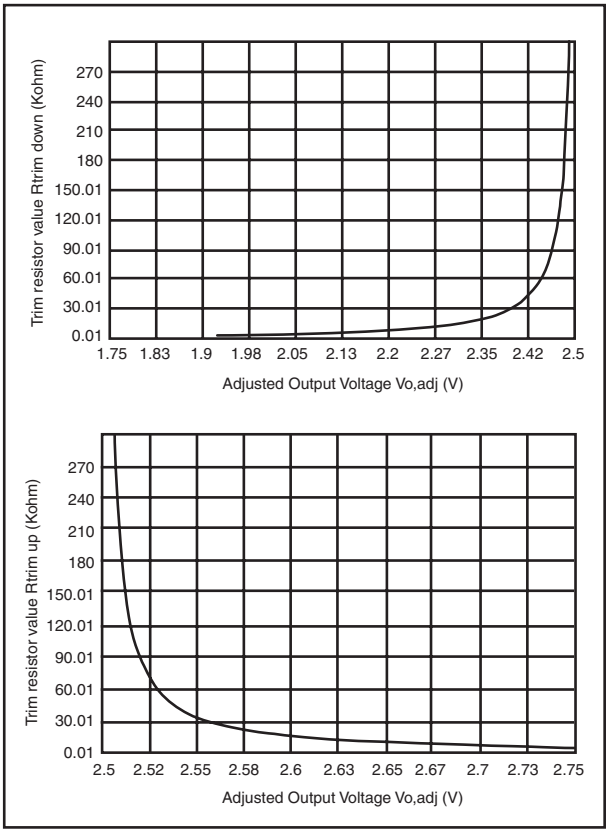
**BP02S7DB-08B**

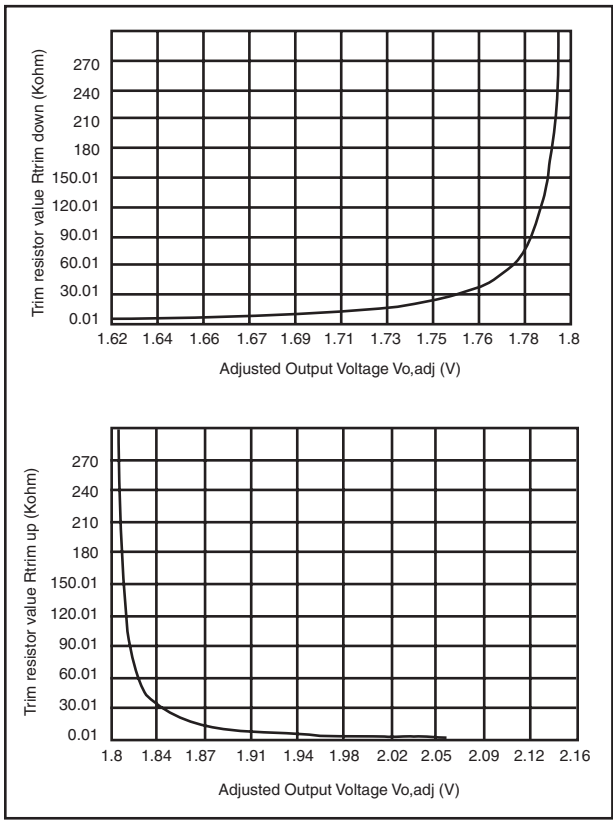
## Output Voltage Set-Point Adjustment

### S7DB-08B250 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{3.691}{\text{Vo} - \text{Vo, adj}} - 4.12\right) \text{ Kohm}$$

$$\text{Rtrim up} = \left(\frac{1.728}{\text{Vo, adj} - \text{Vo}} - 1.96\right) \text{ Kohm}$$




### S7DB-08B180 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{1.52}{\text{Vo} - \text{Vo, adj}} - 4.12\right) \text{ Kohm}$$

$$\text{Rtrim up} = \left(\frac{1.208}{\text{Vo, adj} - \text{Vo}} - 2.61\right) \text{ Kohm}$$

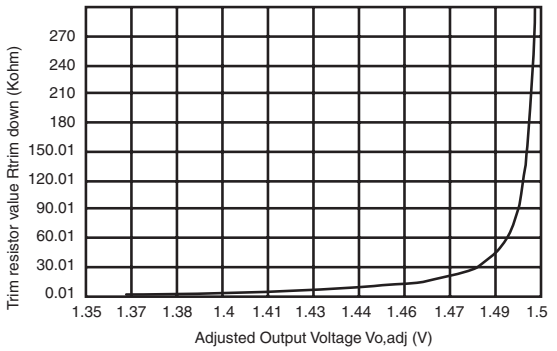
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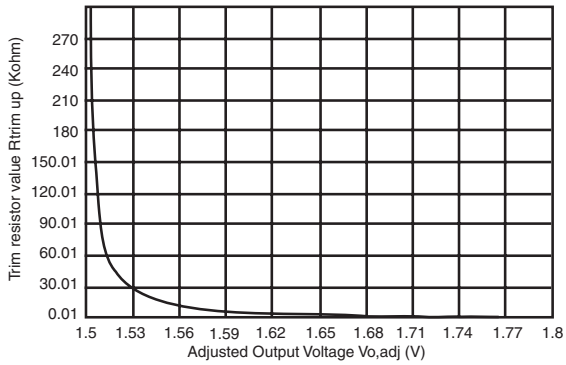
## Output Voltage Set-Point Adjustment

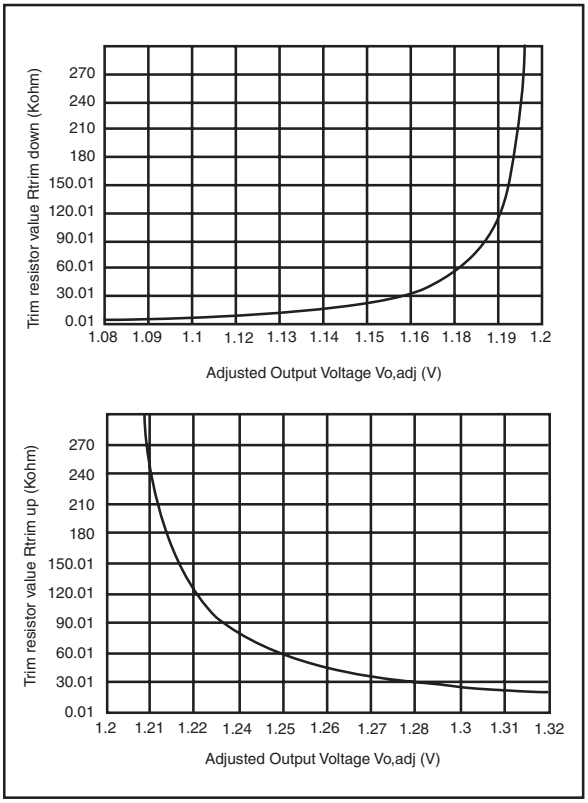
### S7DB-08B150 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{0.749}{Vo - Vo,\ adj} - 3.21\right) \text{ Kohm}$$

$$\text{Rtrim up} = \left(\frac{0.848}{Vo,\ adj - Vo} - 2.15\right) \text{ Kohm}$$



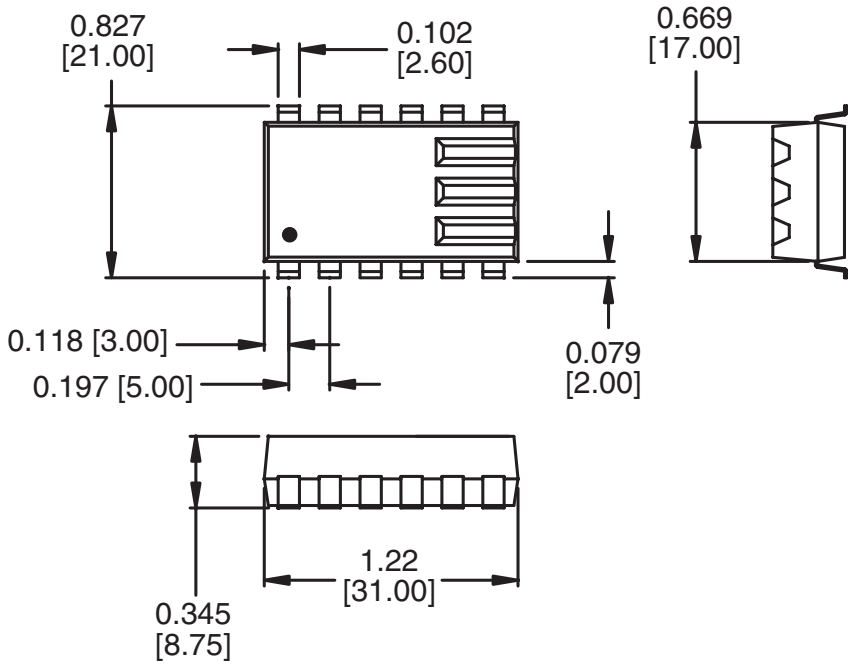

### S7DB-08B120 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{1.562}{Vo - Vo,\ adj} - 8.48\right) \text{ Kohm}$$

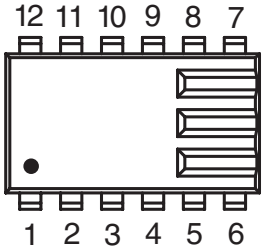
$$\text{Rtrim up} = \left(\frac{3.064}{Vo,\ adj - Vo} - 4.64\right) \text{ Kohm}$$

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## Mechanical




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




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