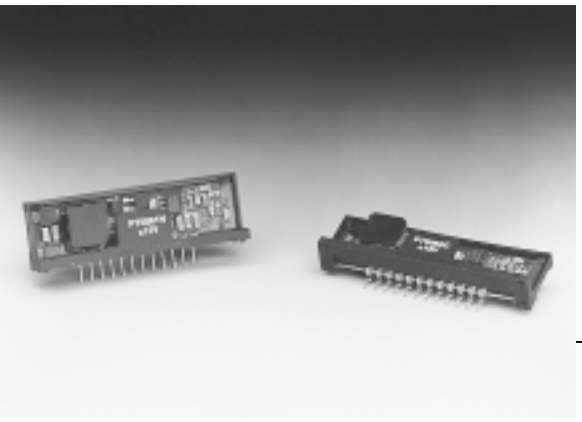
# +5V to ±12V/15V 9W Dual Output Integrated Switching Regulator

SLTS027A

*(Revised 6/30/2000)*



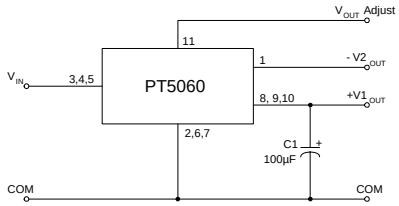
- Dual Outputs: ±12V, ±15V
- Wide Input Voltage Range:
- 85% Efficiency
- Adjustable Output Voltage
- Laser-trimmed Output Voltage

The Power Trends' PT5060 Series is a dual output Integrated Switching Regulator (ISR) designed for use in +5 volt systems that require low power ±12 or ±15 volt rails.

They can be used to power such application circuits as D/A and A/D converters, Op Amps, and interface logic. Both output voltages can be easily adjusted with one external resistor. These ISRs are offered in a low profile 12-pin SIP package in either vertical or horizontal through-hole or SMD-configurations.

Please note that this product does not include short-circuit protection.

## Standard Application




$C_1$ = Required 100µF electrolytic

## Pin-Out Information

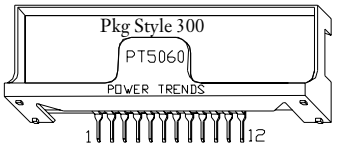
| Pin | Function |
|---|---|
| 1 | $-V2_{out}$ |
| 2 | GND |
| 3 | $V_{in}$ |
| 4 | $V_{in}$ |
| 5 | $V_{in}$ |
| 6 | GND |
| 7 | GND |
| 8 | $+V1_{out}$ |
| 9 | $+V1_{out}$ |
| 10 | $+V1_{out}$ |
| 11 | $V_{out}$ Adjust |
| 12 | Do Not Connect |

## Ordering Information

**PT5061☐** = ±12 Volts
**PT5062☐** = ±15 Volts

## PT Series Suffix (PT1234X)

| Case/Pin Configuration | |
|---|---|
| Vertical Through-Hole | N |
| Horizontal Through-Hole | A |
| Horizontal Surface Mount | C |




## Specifications

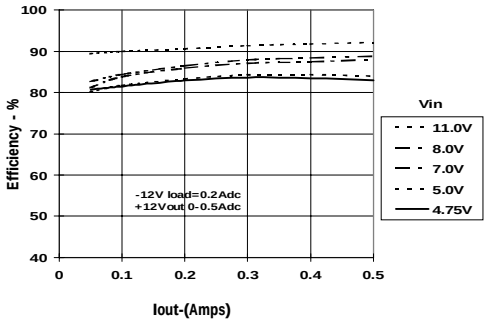
| Characteristics ($T_a$ = 25°C unless noted) | Symbols | Conditions | | PT5060 SERIES Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| Output Current | $I_o$ | Over $V_{in}$ range | $V_o$=+12V<br>$V_o$=-12V | 0.05<br>0.05* | —<br>— | 0.50<br>0.25 | A<br>A |
| | | | $V_o$=+15V<br>$V_o$=-15V | 0.05<br>0.05* | —<br>— | 0.40<br>0.20 | A<br>A |
| Current Limit** | $I_{cl}$ | $V_{in}$ = +5V | | — | 1.5 $I_o$max** | — | A |
| Inrush Current | $I_{ir}$<br>$t_{tr}$ | $V_{in}$ = +5V @ max $I_o$<br>On start up | | —<br>— | 5.5<br>2 | —<br>— | A<br>mSec |
| Input Voltage Range | $V_{in}$ | $I_o$ = 0.1 to $I_o$max | | 4.75 | — | $V_o$-1V | V |
| Output Voltage Tolerance | $\Delta V_o$ | Over $V_{in}$ and $I_o$ ranges<br>$T_A$= 0°C to +70°C | +$V_o$<br>-$V_o$ | —<br>— | ±1.5<br>±5 | ±3.0<br>±10 | %$V_o$<br>%$V_o$ |
| Line Regulation | $Reg_{line}$ | Over $V_{in}$ range, $I_o$=0.5A, $V_o$= +12V | | — | ±0.5 | ±1.0 | %$V_o$ |
| Load Regulation | $Reg_{load}$ | 0.1 < $I_o$ < $I_o$max, $V_{in}$ = +5V, $V_o$= +12V | | — | ±0.5 | ±1.0 | %$V_o$ |
| $V_o$ Ripple/Noise | $V_n$ | $V_{in}$= +5V, $I_o$=$I_o$max | +$V_o$<br>-$V_o$ | —<br>— | ±1.5<br>±2.0 | ±3<br>±3 | %$V_o$<br>%$V_o$ |
| Transient Response | $t_{tr}$<br>$V_{os}$ | 25% load change<br>$V_o$ over/undershoot | | —<br>— | 100<br>3.0 | —<br>5.0 | µSec<br>%$V_o$ |
| Efficiency | η | $V_{in}$= +5V, $I_o$=0.25A each output | | — | 85 | — | % |
| Switching Frequency | $f_o$ | Over $V_{in}$ and $I_o$ ranges | | — | 650 | — | kHz |
| Absolute Maximum Operating Temperature Range | $T_a$ | — | | 0 | — | +85 | °C |
| Recommended Operating Temperature Range | $T_a$ | Free Air Convection (40-60LFM)<br>Over $V_{in}$ and $I_o$ ranges | | 0 | — | +65*** | °C |
| Storage Temperature | $T_s$ | | | -40 | — | +125 | °C |
| Mechanical Shock | | Per Mil-STD-883D, Method 2002.3,<br>1 msec, Half Sine, mounted to a fixture | | — | 500 | — | G's |
| Mechanical Vibration | | Per Mil-STD-883D, Method 2007.2<br>20-2000 Hz, Soldered in a PC board | | — | 15 | — | G's |
| Weight | | | | — | 6.5 | — | grams |

* Do not operate below minimum load.
** Boost topology ISRs are not short circuit protected.
*** See SOA Curves.

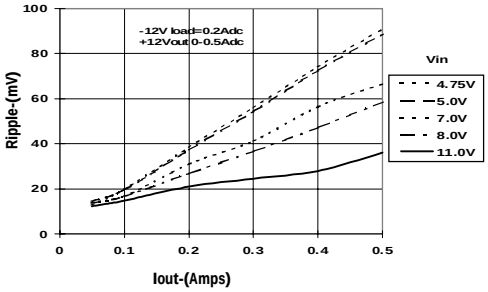
# Typical Characteristics

## PT5061 +/- 12VDC (See Note 1)

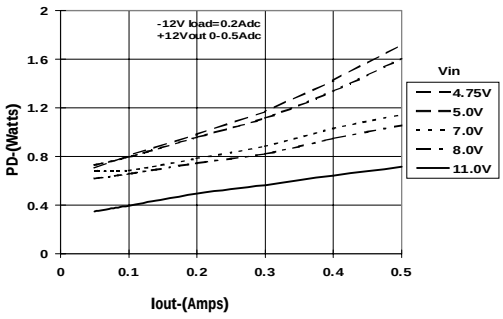
### Efficiency vs Output Current



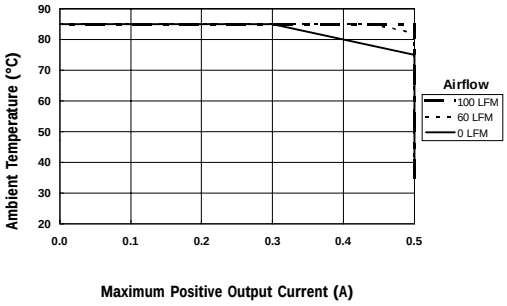

### Ripple Voltage vs Output Current




### Power Dissipation vs Output Current

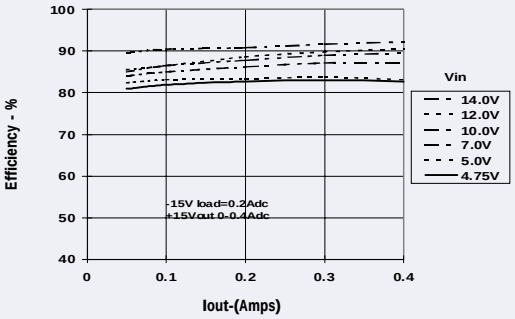



### Safe Operating Area Curve ($V_{in}$ = 5.0V; $I_{out2}$ = 0.25A)

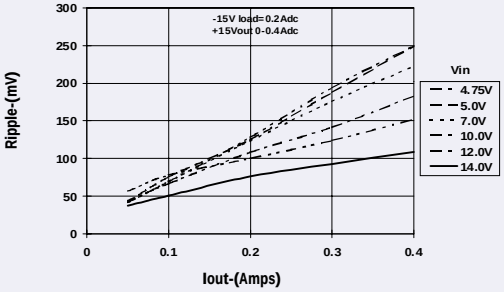



## PT5062 +/- 15V (See Note 1)

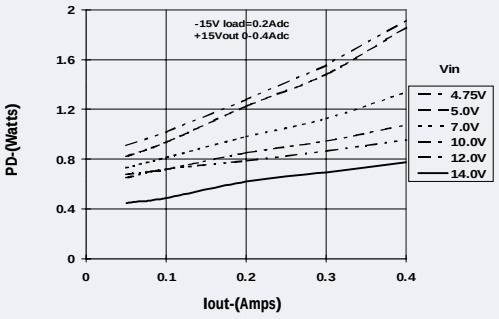
### Efficiency vs Output Current



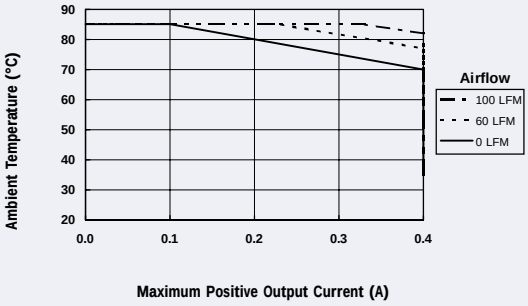

### Ripple Voltage vs Output Current




### Power Dissipation vs Output Current




### Safe Operating Area Curve ($V_{in}$ = 5.0V; $I_{out2}$ = 0.2A)




**Note 1:** *All data listed in the above graphs has been developed from actual products tested at 25°C. This data is considered typical data for the ISR.*

## Adjusting the Output Voltage of the PT5060 Dual Output Boost Converter Series

The dual output voltage of the Power Trends PT5060 Series ISRs can be adjusted higher or lower than the factory trimmed pre-set voltage with the addition of a single external resistor. Table 1 accordingly gives the applicable adjustment range for each model in the series as $V_a$ (min) and $V_a$ (max).

**Adjust Up:** An increase in the output voltage is obtained by adding a resistor R2, between pin 11 ($V_o$ adjust) and pins 2, 6, or 7 (GND).

**Adjust Down:** Add a resistor (R1), between pin 11 ($V_o$ adjust) and pins 8, 9 or 10 ($V1_{out}$).

Refer to Figure 1 and Table 2 for both the placement and value of the required resistor, either (R1) or R2 as appropriate.

**Notes:**

1. Both the positive and negative voltage outputs from the ISR are adjusted simultaneously.
2. Use only a single 1% resistor in either the (R1) or R2 location. Place the resistor as close to the ISR as possible.
3. Never connect capacitors from $V_o$ adjust to either GND or $V_o$ . Any capacitance added to the $V_o$ adjust pin will affect the stability of the ISR.
4. An increase in the output voltage must be accompanied by a corresponding reduction in the specified maximum current at each output. For $V1_{out}$ and $-V2_{out}$, the revised maximum output current must be reduced to the equivalent of 6Watts and 3Watts respectively. i.e.

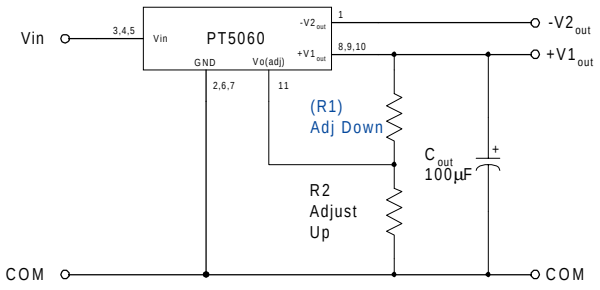
$$I1_{out}(max) = \frac{6}{V_a} \quad Adc$$

and $$I2_{out}(max) = \frac{3}{V_a} \quad Adc,$$

where $V_a$ is the adjusted output voltage.

5. Adjustments to the output voltage will also limit the maximum input voltage that can be applied to the ISR. The maximum input voltage that may be applied is limited to ($V_{out}$ – 1)Vdc or 14Vdc, whichever is less.

*Figure 1*




The values of (R1) [adjust down], and R2 [adjust up], can also be calculated using the following formulae.

$$(R1) = \frac{3.65\,(V_a - 2.5)}{(V_o - V_a)} - 0.1 \quad k\Omega$$

$$R2 = \frac{9.125}{V_a - V_o} - 0.1 \quad k\Omega$$

Where: $V_o$ = Original output voltage
$V_a$ = Adjusted output voltage

*Table 1*

**PT5060 ADJUSTMENT AND FORMULA PARAMETERS**

| Series Pt # | PT5061 | PT5062 |
|---|---|---|
| $V_o$ (nom) | ±12.0V | ±15.0V |
| $V_a$ (min) | ± 7.5V | ± 7.5V |
| $V_a$ (max) | ±14.0V | ±20.0V |

*Table 2*

**PT5060 ADJUSTMENT RESISTOR VALUES**

| Series Pt # | PT5061 | PT5062 |
|---|---|---|
| Current | 0.5/0.25Adc | 0.4/0.2Adc |
| $V_o$(nom) | ±12.0Vdc | ±15.0Vdc |
| $V_a$(req'd) | | |
| 7.0 | | |
| 7.5 | (4.0)kΩ | (2.3)kΩ |
| 8.0 | (4.9)kΩ | (2.8)kΩ |
| 8.5 | (6.2)kΩ | (3.3)kΩ |
| 9.0 | (7.8)kΩ | (3.9)kΩ |
| 9.5 | (10.1)kΩ | (4.6)kΩ |
| 10.0 | (13.6)kΩ | (5.4)kΩ |
| 10.5 | (19.4)kΩ | (6.4)kΩ |
| 11.0 | (30.9)kΩ | (7.7)kΩ |
| 11.5 | (65.6)kΩ | (9.3)kΩ |
| 12.0 | | (11.5)kΩ |
| 12.5 | 18.2kΩ | (14.5)kΩ |
| 13.0 | 9.0kΩ | (19.1)kΩ |
| 13.5 | 6.0kΩ | (26.7)kΩ |
| 14.0 | 4.5kΩ | (41.9)kΩ |
| 14.5 | | (87.5)kΩ |
| 15.0 | | |
| 15.5 | | 18.2kΩ |
| 16.0 | | 9.0kΩ |
| 16.5 | | 6.0kΩ |
| 17.0 | | 4.5kΩ |
| 17.5 | | 3.6kΩ |
| 18.0 | | 2.9kΩ |
| 18.5 | | 2.5kΩ |
| 19.0 | | 2.2kΩ |
| 19.5 | | 1.9kΩ |
| 20.0 | | 1.7kΩ |

R1 = (Blue) R2 = Black