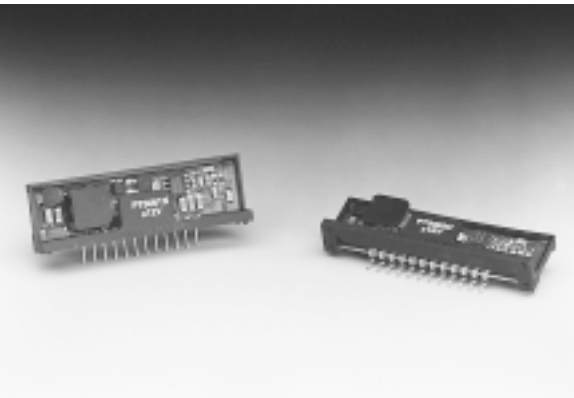


# PT5060 Series

9-W +5V-Input Dual-Output  
Integrated Switching Regulator

SLTS027B

(Revised 12/19/2001)



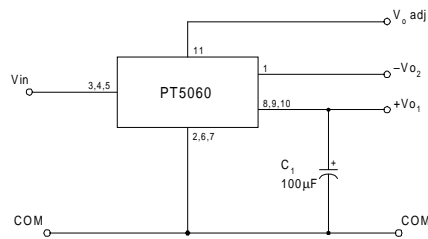
## Features

- Single Device: +5V Input
- Complimentary Dual Output:  $\pm 12V$ ,  $\pm 15V$
- Wide Input Voltage Range
- 85% Efficiency
- Adjustable Output Voltage
- Laser-trimmed

## Description

The PT5060 series of dual-output Integrated Switching Regulators (ISRs) provide a complimentary  $\pm 12V$  or  $\pm 15V$  from a single +5V input. Applications include systems that require power for analog interface circuitry, such as D/A and A/D converters, and Op Amps. The output voltage can be adjusted with an external resistor. These ISRs are made available in a 12-pin single in-line pin (SIP) package. Note that these modules are not short-circuit protected.

## Standard Application



$C_1$  = Required 100µF electrolytic

## Pin-Out Information

| Pin | Function       |
|-----|----------------|
| 1   | $-V_{O2}$      |
| 2   | GND            |
| 3   | $V_{in}$       |
| 4   | $V_{in}$       |
| 5   | $V_{in}$       |
| 6   | GND            |
| 7   | GND            |
| 8   | $+V_{O1}$      |
| 9   | $+V_{O1}$      |
| 10  | $+V_{O1}$      |
| 11  | $V_o$ Adj      |
| 12  | Do Not Connect |

## Ordering Information

PT5061□ =  $\pm 12$  Volts

PT5062□ =  $\pm 15$  Volts

## PT Series Suffix (PT1234 x)

| Case/Pin Configuration | Order Suffix | Package Code * |
|------------------------|--------------|----------------|
| Vertical               | <b>N</b>     | (ECD)          |
| Horizontal             | <b>A</b>     | (ECA)          |
| SMD                    | <b>C</b>     | (ECC)          |
| Vertical, Side Tabs    | <b>R</b>     | (ECE)          |
| Horizontal, Side Tabs  | <b>G</b>     | (ECG)          |
| SMD, Side Tabs         | <b>B</b>     | (ECK)          |

\* Previously known as package style 300.

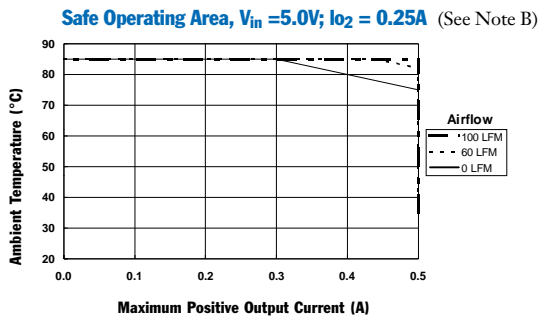
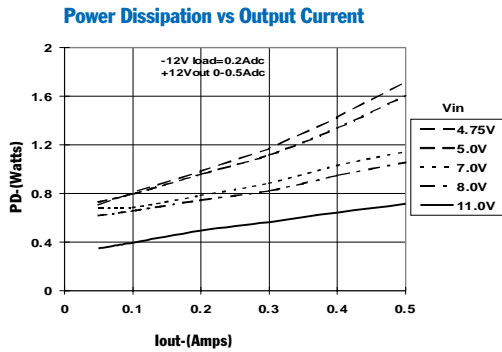
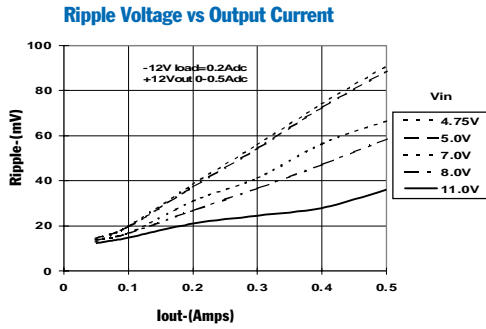
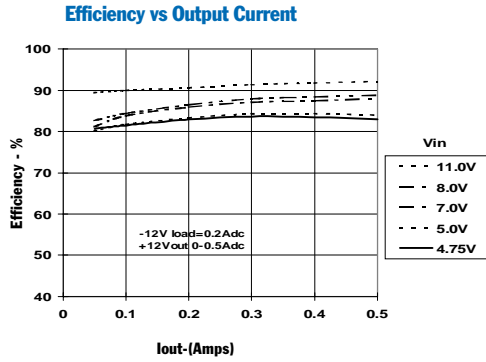
(Reference the applicable package code drawing for the dimensions and PC board layout)

## Specifications (Unless otherwise stated, $T_a = 25^\circ C$ , $V_{in} = +5V$ , $I_o = I_{o,max}$ , $C_1 = 100\mu F$ )

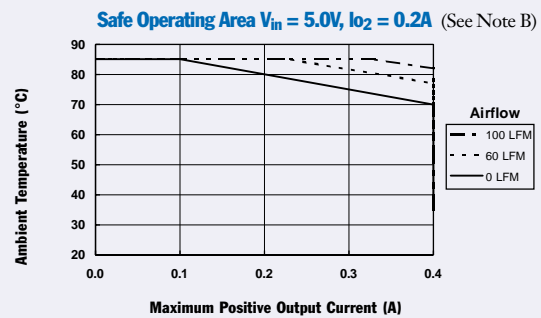
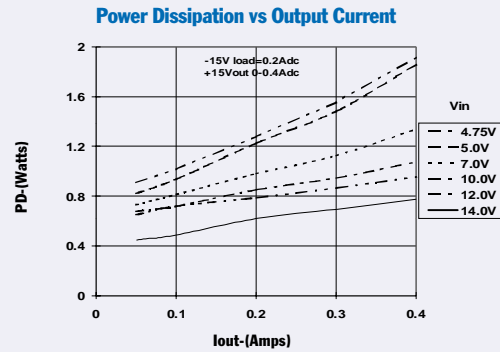
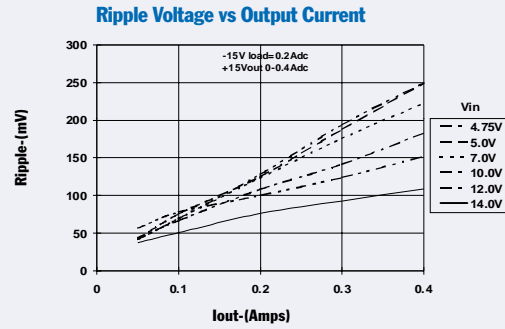
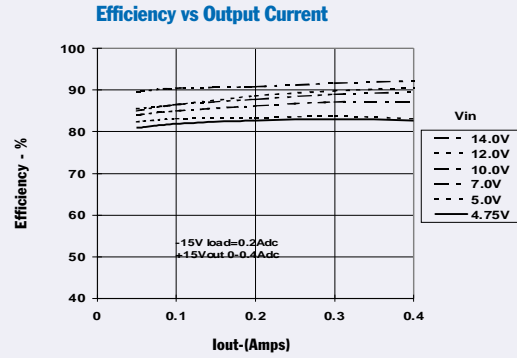
| Characteristics             | Symbol               | Conditions                                                               | PT5060 SERIES                      |                  |                      | Units                            |
|-----------------------------|----------------------|--------------------------------------------------------------------------|------------------------------------|------------------|----------------------|----------------------------------|
|                             |                      |                                                                          | Min                                | Typ              | Max                  |                                  |
| Output Current              | $I_o$                | Over $V_{in}$ range                                                      | $V_{O1} = +12V$<br>$V_{O2} = -12V$ | 0.05<br>—        | —<br>0.50            | A                                |
|                             |                      |                                                                          | $V_{O1} = +15V$<br>$V_{O2} = -15V$ | 0.05<br>0.05 (1) | —<br>0.40<br>0.20    | A                                |
| Current Limit               | $I_{lim}$            |                                                                          |                                    | —                | 150 (2)              | % $I_{o,max}$                    |
| Inrush Current              | $I_{ir}$             | On start up                                                              |                                    | —                | 5.5 (3)              | A                                |
|                             | $t_{tr}$             |                                                                          |                                    | —                | 2                    | mSec                             |
| Input Voltage Range         | $V_{in}$             | Over $I_o$ range                                                         |                                    | 4.75             | —                    | $+V_o - 1$<br>V                  |
| Output Voltage Tolerance    | $\Delta V_o$         | Over $V_{in}$ and $I_o$ ranges<br>$T_a = 0^\circ C$ to SOA limit (3)     | $+V_{O1}$<br>$-V_{O2}$             | —<br>—           | $\pm 1.5$<br>$\pm 5$ | $\pm 3.0$<br>$\pm 10$<br>% $V_o$ |
| Line Regulation             | $Reg_{line}$         | Over $V_{in}$ range                                                      |                                    | —                | $\pm 0.5$            | $\pm 1.0$<br>% $V_o$             |
| Load Regulation             | $Reg_{load}$         | $0.1 \leq I_o \leq I_{o,max}$                                            |                                    | —                | $\pm 0.5$            | $\pm 1.0$<br>% $V_o$             |
| $V_o$ Ripple (pk-pk)        | $V_n$                | 20MHz bandwidth                                                          | $+V_{O1}$<br>$-V_{O2}$             | —<br>—           | $\pm 1.5$<br>$\pm 2$ | $\pm 3$<br>$\pm 3$<br>% $V_o$    |
| Transient Response          | $t_{tr}$<br>$V_{os}$ | 25% load change<br>$V_o$ over/undershoot                                 |                                    | —<br>—           | 100<br>3             | —<br>5<br>$\mu Sec$<br>% $V_o$   |
| Efficiency                  | $\eta$               | $I_o = 0.2A$ each output                                                 |                                    | —                | 85                   | —<br>%                           |
| Switching Frequency         | $f_s$                | Over $V_{in}$ and $I_o$ ranges                                           |                                    | —                | 650                  | —<br>kHz                         |
| Operating Temperature Range | $T_a$                | —                                                                        |                                    | 0                | —                    | $+85$ (4)<br>$^\circ C$          |
| Storage Temperature         | $T_s$                |                                                                          |                                    | -40              | —                    | $+125$<br>$^\circ C$             |
| Mechanical Shock            |                      | Per Mil-STD-883D, Method 2002.3, 1 msec, Half Sine, mounted to a fixture | —                                  | 500              | —                    | G's                              |
| Mechanical Vibration        |                      | Per Mil-STD-883D, Method 2007.2 20-2000 Hz, Soldered in a PC board       | —                                  | 15               | —                    | G's                              |
| Weight                      |                      |                                                                          |                                    | —                | 6.5                  | —<br>grams                       |

- Notes:**
- (1) Do not operate the negative output rail of these ISRs below the minimum load.
  - (2) ISRs based on a boost topology are not short-circuit protected.
  - (3) The inrush current stated is above the normal input current for the associated output load.
  - (4) See Safe Operating Area curves or consult the factory for the appropriate derating.

**PT5061 +/- 12VDC** (See Note A)



**PT5062 +/- 15V** (See Note A)



**Note A:** Characteristic data has been developed from actual products tested at 25°C. This data is considered typical data for the Converter.  
**Note B:** Thermal derating graphs are developed in free-air convection cooling, which corresponds to approximately 40-60LFM of airflow.

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

The dual output voltage of the PT5060 series modules can be adjusted higher or lower than the factory pre-set voltage with the addition of a single external resistor. Table 1 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  $R_2$ , between pin 11 ( $V_o$  adj) and pins 2, 6, or 7 (GND).

**Adjust Down:** Add a resistor ( $R_1$ ), between pin 11 ( $V_o$  adj) and pins 8, 9 or 10 ( $V_{o1}$ ).

Refer to Figure 1 and Table 2 for both the placement and value of the required resistor, either ( $R_1$ ) or  $R_2$  as appropriate.

### Notes:

- Both the positive and negative voltage outputs from the ISR are adjusted simultaneously.
- Use only a single 1% resistor in either the ( $R_1$ ) or  $R_2$  location. Place the resistor as close to the ISR as possible.
- Never connect capacitors from  $V_o$  adj to either GND or  $V_{o1}$ . Any capacitance added to the  $V_o$  adjust pin will affect the stability of the ISR.
- An increase in the output voltage must be accompanied by a corresponding reduction in the specified maximum current at each output. For  $V_{o1}$  and  $-V_{o2}$ , the revised maximum output current must be reduced to the equivalent of 6 watts and 3 watts respectively. i.e.

$$I_{o1}(\text{max}) = \frac{6}{V_a} \text{ A dc}$$

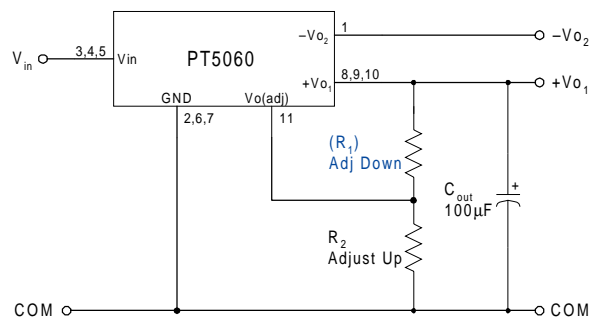
and

$$I_{o2}(\text{max}) = \frac{3}{V_a} \text{ A dc,}$$

where  $V_a$  is the adjusted output voltage.

- 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  $(V_o - 1)\text{Vdc}$  or 14Vdc, whichever is less.

Figure 1



The values of ( $R_1$ ) [adjust down], and  $R_2$  [adjust up], can also be calculated using the following formulas.

$$(R_1) = \frac{3.65 (V_a - 2.5)}{(V_o - V_a)} - 0.1 \quad \text{k}\Omega$$

$$R_2 = \frac{9.125}{V_a - V_o} - 0.1 \quad \text{k}\Omega$$

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                           | 0.5/0.25A dc | 0.4/0.2A dc |
| $V_o$ (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       |

$R_1$  = (Blue)       $R_2$  = Black

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