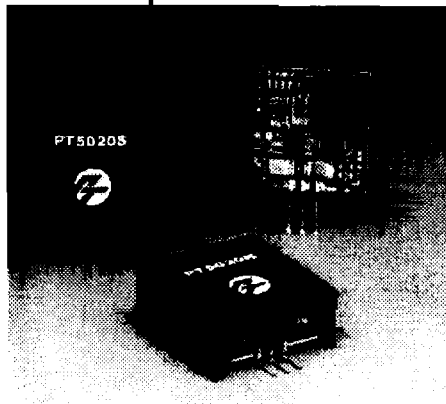


# PT5020 Series

**POSITIVE INPUT/NEGATIVE  
OUTPUT CONVERTER**

**ADVANCED INFORMATION – REVISED 11/95**

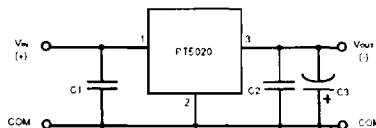


- Input Voltage Range +4.75 to +7 Volts
- Self-Contained Inductor
- Internal Over-Temperature Protection
- Complete solution with only one external capacitor required.

The Power Trends' PT5020 ISRs convert a positive input voltage (typ +5V) to a negative output voltage for a wide range of analog and communication circuit applications.

The plus to minus ISRs use a "Buck-Boost" topology and are packaged in the 3 pin SIP configuration. Available output voltages are -3.3V, -5V, -5.2V, -9V, -12V and -15V

## Standard Application



C<sub>1</sub> = Optional ceramic (1-5μF)  
C<sub>2</sub> = Optional ceramic (1-5μF)  
C<sub>3</sub> = Electrolytic (100μF)

## Pin-Out Information

| Pin No. | Function |
|---------|----------|
| 1       | Input    |
| 2       | Ground   |
| 3       | Output   |



## Ordering Information

PT5021 □ = -3.3 Volts  
PT5022 □ = -5 Volts  
PT5023 □ = -9 Volts  
PT5024 □ = -12 Volts  
PT5025 □ = -15 Volts  
PT5026 □ = -5.2 Volts

(For dimensions, see page 62.)

## PT Series Suffix (PT12345X)

| Case/Pin Configuration   | Heat Tab Configuration |      |     |
|--------------------------|------------------------|------|-----|
|                          | Uncased                | None | Top |
| Vertical Through-Hole    | U                      | N    | S   |
| Horizontal Through-Hole  | —                      | A    | H   |
| Horizontal Surface Mount | —                      | C    | J   |

(See Thermal Application Notes on page 44 for heat tab application data.)

## Specifications

*Note: Buck Boost topology ISRs are not short circuit protected.*

| Characteristics<br>(T <sub>a</sub> = 25°C unless noted) | Symbols             | Conditions                                                                                                                                                                                           | PT5020 SERIES                                            |                                |                                           | Units                                  |
|---------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------|-------------------------------------------|----------------------------------------|
|                                                         |                     |                                                                                                                                                                                                      | Min                                                      | Typ                            | Max                                       |                                        |
| Output Current                                          | I <sub>o</sub>      | Over V <sub>in</sub> range<br>V <sub>o</sub> = -3.3V<br>V <sub>o</sub> = -5V<br>V <sub>o</sub> = -5.2V<br>V <sub>o</sub> = -9V<br>V <sub>o</sub> = -12V<br>V <sub>o</sub> = -15V                     | 0.25**<br>0.25**<br>0.25**<br>0.10**<br>0.10**<br>0.10** | —<br>—<br>—<br>—<br>—<br>—     | 1.0<br>1.0<br>1.0<br>0.60<br>0.50<br>0.30 | Amps                                   |
| Current Limit                                           | I <sub>d</sub>      | V <sub>in</sub> = 5V                                                                                                                                                                                 | —                                                        | 1.5 I <sub>o max</sub>         | —                                         | Amps                                   |
| Inrush Current                                          | I <sub>ir</sub>     | V <sub>in</sub> = +5V @ max I <sub>o</sub>                                                                                                                                                           | —                                                        | 3.0                            | —                                         | Amps                                   |
|                                                         | t <sub>ir</sub>     | On start up                                                                                                                                                                                          | —                                                        | 1.0                            | —                                         | mSec                                   |
| Input Voltage Range                                     | V <sub>in</sub>     | I <sub>o</sub> = 0.1 to I <sub>o max</sub>                                                                                                                                                           | 4.75                                                     | —                              | 7*                                        | VDC                                    |
| Static Voltage Tolerance                                | V <sub>o</sub>      | Over V <sub>in</sub> Range I <sub>o</sub> = I <sub>max</sub><br>T <sub>A</sub> = -20°C to shutdown                                                                                                   | —                                                        | ±1.5                           | ±3                                        | % V <sub>o</sub>                       |
| Line Regulation                                         | Reg <sub>line</sub> | Over V <sub>in</sub> range                                                                                                                                                                           | —                                                        | ±0.5                           | ±1                                        | % V <sub>o</sub>                       |
| Load Regulation                                         | Reg <sub>load</sub> | I <sub>min</sub> < I <sub>o</sub> < I <sub>max</sub>                                                                                                                                                 | —                                                        | ±0.5                           | ±1                                        | % V <sub>o</sub>                       |
| Ripple/Noise                                            | V <sub>n</sub>      | V <sub>in</sub> = 5V, I <sub>o</sub> = I <sub>max</sub>                                                                                                                                              | —                                                        | ±2                             | ±5                                        | % V <sub>o</sub>                       |
| Transient Response                                      | t <sub>tr</sub>     | 25% load change<br>V <sub>o</sub> over/undershoot                                                                                                                                                    | —                                                        | 500<br>3.0                     | —<br>5.0                                  | μSec<br>% V <sub>o</sub>               |
| Efficiency                                              | η                   | V <sub>in</sub> = 5V, I <sub>o</sub> = 0.5 I <sub>max</sub>                                                                                                                                          | —                                                        | 75                             | —                                         | %                                      |
| Switching Frequency                                     | f <sub>o</sub>      | Over V <sub>in</sub> and I <sub>o</sub> ranges<br>V <sub>o</sub> = -3.3V<br>V <sub>o</sub> = -5V<br>V <sub>o</sub> = -5.2V<br>V <sub>o</sub> = -9V<br>V <sub>o</sub> = -12V<br>V <sub>o</sub> = -15V | 0.8<br>0.8<br>0.8<br>500<br>500<br>0.8                   | 1<br>1<br>1<br>650<br>650<br>1 | 1.2<br>1.2<br>1.2<br>800<br>800<br>1.2    | MHz<br>MHz<br>MHz<br>KHz<br>KHz<br>MHz |
| Operating Temperature                                   | T <sub>A</sub>      | Free Air Convection, (40-60 LFM)<br>Over V <sub>in</sub> and I <sub>o</sub> range                                                                                                                    | -20                                                      | —                              | +65                                       | °C                                     |
| Thermal Resistance                                      | θ <sub>JA</sub>     | Free Air Convection<br>(40-60 LFM)                                                                                                                                                                   | —                                                        | TBD                            | —                                         | °C/W                                   |
| Storage Temperature                                     | T <sub>s</sub>      |                                                                                                                                                                                                      | -40                                                      | —                              | +125                                      | °C                                     |
| Mechanical Shock                                        |                     | Per Mil-STD-883D, Method 2002.3<br>Condition A, 1 msec, Half Sine,<br>mounted to a fixture                                                                                                           | —                                                        | —                              | 500                                       | G's                                    |
| Mechanical Vibration                                    |                     | Per Mil-STD-883D, Method 2007.2<br>Condition A, 20-2000 Hz                                                                                                                                           | —                                                        | —                              | 5                                         | G's                                    |
| Weight (without heat tab)                               |                     |                                                                                                                                                                                                      | —                                                        | 7.5                            | —                                         | grams                                  |
| Relative Humidity                                       |                     | Non-condensing                                                                                                                                                                                       | 0                                                        | —                              | 95                                        | %                                      |

\* For applications with input voltages greater than 7 VDC, use a 78SR Series in the buck boost configuration – see Application Note on page 51.

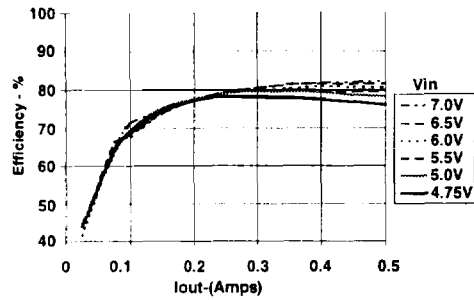
\*\* ISR will operate down to no load with reduced specifications.

## CHARACTERISTIC DATA

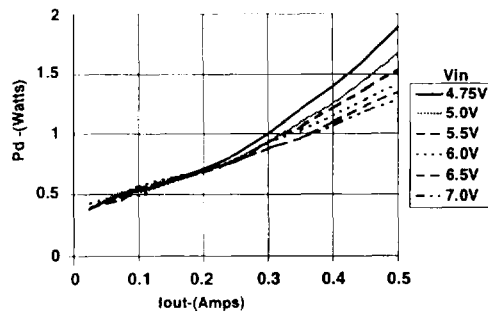
## PT5022 (-5VDC)

(See Note 1)

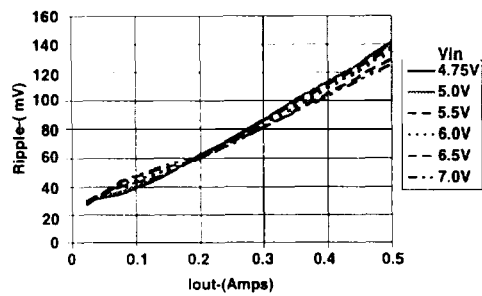
Efficiency vs Output Current



Power Dissipation vs Output Current



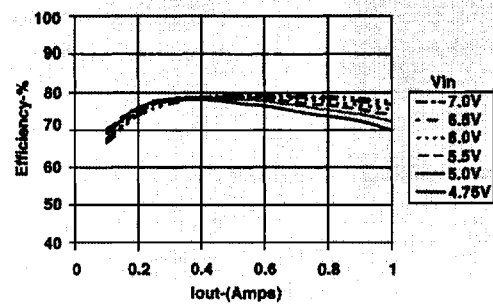
Ripple Voltage vs Output Current



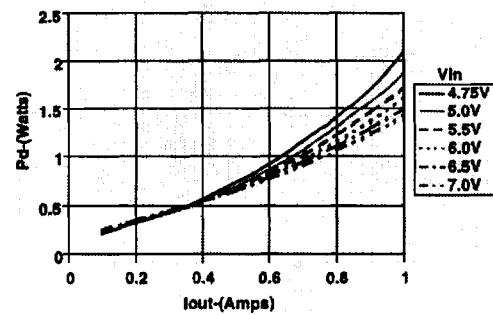
## PT5024 (-12VDC)

(See Note 1)

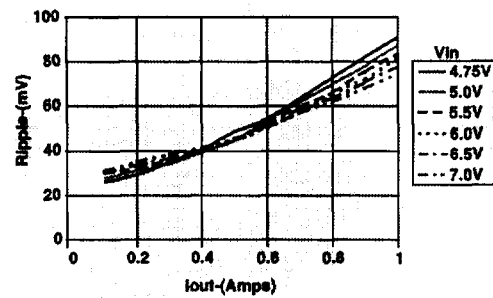
Efficiency vs Output Current



Power Dissipation vs Output Current



Ripple Voltage vs Output Current



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.