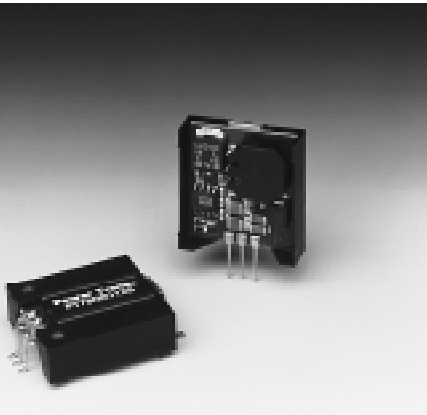
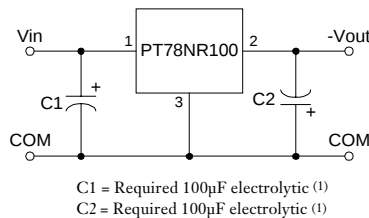




- Negative output from positive input
- Wide Input Range
- Self-Contained Inductor
- Short Circuit Protection
- Over-Temperature Protection
- Fast Transient Response

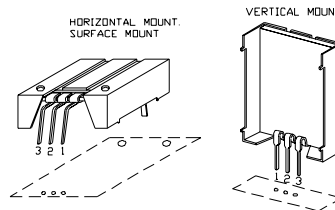
The PT78NR100 Series creates a negative output voltage from a positive input voltage greater than 7V. These easy-to-use, 3-terminal, Integrated Switching Regulators (ISRs) have maximum output power of 5 watts and a negative output voltage that is laser trimmed. They also have excellent line and load regulation.

## Standard Application



## Pin-Out Information

| Pin | Function          |
|-----|-------------------|
| 1   | +V <sub>in</sub>  |
| 2   | -V <sub>out</sub> |
| 3   | GND               |



SUGGESTED BOARD LAYOUT  
COMPONENT SIDE VIEW  
Pkg Style 500

## Ordering Information

**PT78NR1XX Y**

### Output Voltage

**03** = -3.0 Volts  
**05** = -5.0 Volts  
**52** = -5.2 Volts  
**06** = -6.0 Volts  
**07** = -7.0 Volts  
**08** = -8.0 Volts  
**09** = -9.0 Volts  
**10** = -10.0 Volts  
**12** = -12.0 Volts  
**14** = -13.9 Volts  
**15** = -15.0 Volts

### Package Suffix

**V** = Vertical Mount  
**S** = Surface Mount  
**H** = Horizontal Mount

## Specifications

| Characteristics<br>(T <sub>a</sub> = 25°C unless noted) | Symbols                            | Conditions                                                                                                                                                                                   | PT78NR100 SERIES                                                     |                            |                                            | Units                   |
|---------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------|--------------------------------------------|-------------------------|
|                                                         |                                    |                                                                                                                                                                                              | Min                                                                  | Typ                        | Max                                        |                         |
| Output Current                                          | I <sub>o</sub>                     | Over V <sub>in</sub> range<br>V <sub>o</sub> = -5V<br>V <sub>o</sub> = -6V<br>V <sub>o</sub> = -7, -8, -9V<br>V <sub>o</sub> = -10V<br>V <sub>o</sub> = -12V<br>V <sub>o</sub> = -13.9, -15V | 0.05 (2)<br>0.05 (2)<br>0.05 (2)<br>0.05 (2)<br>0.05 (2)<br>0.05 (2) | —<br>—<br>—<br>—<br>—<br>— | 1.00<br>0.8<br>0.55<br>0.5<br>0.40<br>0.30 | A                       |
| Short Circuit Current                                   | I <sub>sc</sub>                    | V <sub>in</sub> = 10V                                                                                                                                                                        | —                                                                    | 4 × I <sub>max</sub>       | —                                          | A <sub>pk</sub>         |
| Inrush Current                                          | I <sub>ir</sub><br>t <sub>ir</sub> | V <sub>in</sub> = 10V<br>On start-up                                                                                                                                                         | —<br>—                                                               | 4<br>0.5                   | —                                          | A<br>mSec               |
| Input Voltage Range                                     | V <sub>in</sub>                    | 0.1 ≤ I <sub>o</sub> ≤ I <sub>max</sub><br>V <sub>o</sub> = -5V<br>V <sub>o</sub> = -6, -7, -8, -9V<br>V <sub>o</sub> = -10, -12V<br>V <sub>o</sub> = -13.9, -15V                            | 7<br>7<br>7<br>7                                                     | —<br>—<br>—<br>—           | 25<br>21<br>18<br>15                       | V<br>V<br>V<br>V        |
| Output Voltage Tolerance                                | ΔV <sub>o</sub>                    | Over V <sub>in</sub> range<br>T <sub>a</sub> = -20°C to +70°C                                                                                                                                | —                                                                    | ±1.0                       | ±3.0                                       | %V <sub>o</sub>         |
| Line Regulation                                         | Reg <sub>line</sub>                | Over V <sub>in</sub> range                                                                                                                                                                   | —                                                                    | ±0.5                       | ±1.0                                       | %V <sub>o</sub>         |
| Load Regulation                                         | Reg <sub>load</sub>                | 0.1 ≤ I <sub>o</sub> ≤ I <sub>max</sub>                                                                                                                                                      | —                                                                    | ±0.5                       | ±1.0                                       | %V <sub>o</sub>         |
| V <sub>o</sub> Ripple/Noise                             | V <sub>n</sub>                     | V <sub>in</sub> = 10V, I <sub>o</sub> = I <sub>max</sub>                                                                                                                                     | —                                                                    | ±2                         | —                                          | %V <sub>o</sub>         |
| Transient Response<br>(with 100µF output cap)           | t <sub>tr</sub>                    | 50% load change<br>V <sub>o</sub> over/undershoot                                                                                                                                            | —<br>—                                                               | 100<br>5.0                 | 250<br>—                                   | µSec<br>%V <sub>o</sub> |
| Efficiency                                              | η                                  | V <sub>in</sub> = 10V, I <sub>o</sub> = 0.5 × I <sub>max</sub> , V <sub>o</sub> = -5V                                                                                                        | —                                                                    | 75                         | —                                          | %                       |
| Switching Frequency                                     | f <sub>o</sub>                     | Over V <sub>in</sub> and I <sub>o</sub> ranges                                                                                                                                               | 600                                                                  | 650                        | 700                                        | kHz                     |
| Absolute Maximum<br>Operating Temperature Range         | T <sub>a</sub>                     | Free Air Convection, (40-60LFM)<br>Over V <sub>in</sub> Range                                                                                                                                | -40                                                                  | —                          | +85 (3)                                    | °C                      |
| Thermal Resistance                                      | θ <sub>ja</sub>                    | Free Air Convection, (40-60LFM)                                                                                                                                                              | —                                                                    | 45                         | —                                          | °C/W                    |
| Storage Temperature                                     | T <sub>s</sub>                     | —                                                                                                                                                                                            | -40                                                                  | —                          | +125                                       | °C                      |
| Mechanical Shock                                        | —                                  | Per Mil-STD-883D, Method 2002.3                                                                                                                                                              | —                                                                    | 500                        | —                                          | G's                     |
| Mechanical Vibration                                    | —                                  | Per Mil-STD-883D, Method 2007.2,<br>20-2000 Hz, soldered in a PC board                                                                                                                       | —                                                                    | 5                          | —                                          | G's                     |
| Weight                                                  | —                                  | —                                                                                                                                                                                            | —                                                                    | 6.5                        | —                                          | Grams                   |

**Notes:** (1) The PT78NR100 Series requires a 100µF electrolytic or tantalum capacitor at both the input and output for proper operation in all applications. The input capacitor, C1, must have a ripple current rating ≥600 mA<sub>rms</sub>, and an ESR ≤0.2Ω.

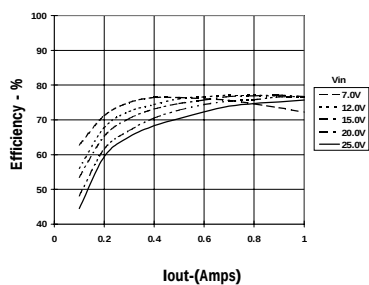
(2) The ISR will operate down to no load with reduced specifications.

(3) See Thermal Derating chart.

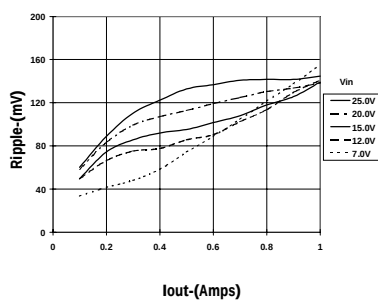
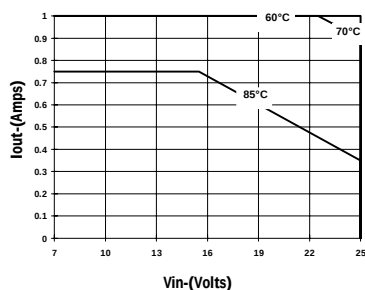
1 Amp Plus to Minus Voltage  
Integrated Switching Regulator

PT78NR105 -5.0 VDC (See Note A)

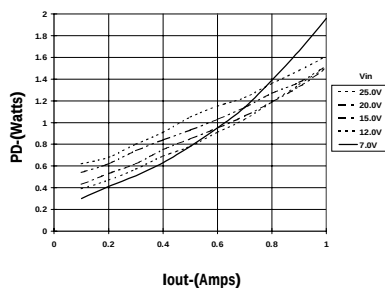
Efficiency vs Output Current



Ripple vs Output Current

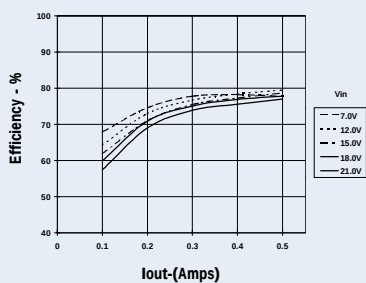
Thermal Derating ( $T_a$ ) (See Note B)

Power Dissipation vs Output Current

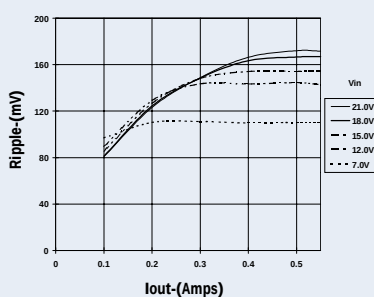
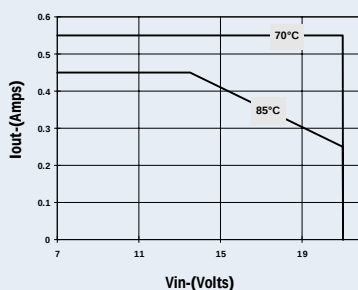


PT78NR109 -9.0 VDC (See Note A)

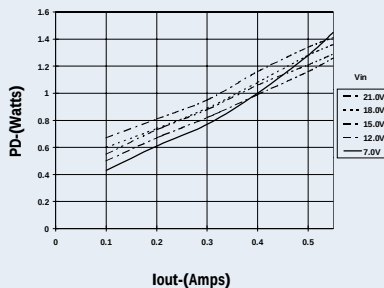
Efficiency vs Output Current



Ripple vs Output Current

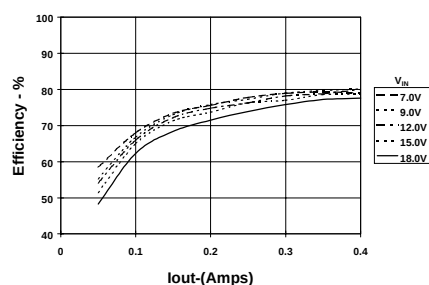
Thermal Derating ( $T_a$ ) (See Note B)

Power Dissipation vs Output Current

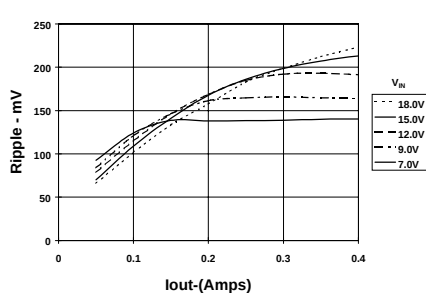
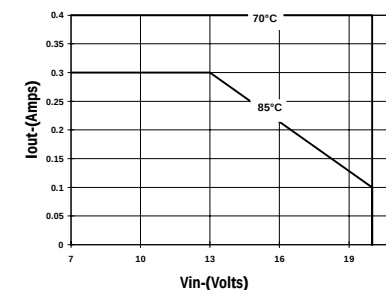


PT78NR112 -12.0 VDC (See Note A)

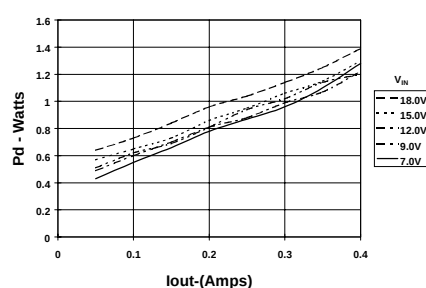
Efficiency vs Output Current



Ripple vs Output Current

Thermal Derating ( $T_a$ ) (See Note B)

Power Dissipation vs Output Current



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

Note B: Thermal derating graphs are developed in free air convection cooling of 40-60 LFM. (See Thermal Application Notes.)

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| PT78NR103H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR103S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR103V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR105H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR105S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR105V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR106H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR106S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR106V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR107H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR107S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR107V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR108S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR109H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR109S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR109V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR112H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR112S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR112ST      | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 200         | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR112V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR115H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR115S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |
| PT78NR115V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR152H       | ACTIVE                | SIP MOD ULE  | EFA             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |
| PT78NR152S       | ACTIVE                | SIP MOD ULE  | EFC             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | Level-1-215C-UNLIM           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| PT78NR152V       | ACTIVE                | SIP MOD ULE  | EFD             | 3    | 25          | Pb-Free (RoHS)          | Call TI          | N / A for Pkg Type           |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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| DSP                         | <a href="http://dsp.ti.com">dsp.ti.com</a>                         |
| Clocks and Timers           | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>           |
| Interface                   | <a href="http://interface.ti.com">interface.ti.com</a>             |
| Logic                       | <a href="http://logic.ti.com">logic.ti.com</a>                     |
| Power Mgmt                  | <a href="http://power.ti.com">power.ti.com</a>                     |
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| RFID                        | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>               |
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|                    |                                                                          |
|--------------------|--------------------------------------------------------------------------|
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| Broadband          | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Medical            | <a href="http://www.ti.com/medical">www.ti.com/medical</a>               |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
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| Security           | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
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