

## PT78NR100 Series

1 Amp Plus to Minus Voltage Integrated Switching Regulator

Power Trends Products  
from Texas Instruments

SLTS058B

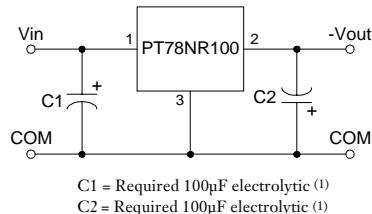
(Revised 8/31/2000)



- 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

HORIZONTAL MOUNT, SURFACE MOUNT

VERTICAL MOUNT

SUGGESTED BOARD LAYOUT  
COMPONENT SIDE VIEW

## Ordering Information

PT78NR1<sub>XX</sub>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 (T <sub>a</sub> = 25°C unless noted)	Symbols	Conditions	PT78NR100 SERIES				
			Min	Typ	Max	Units	
Output Current	I <sub>o</sub>	Over V <sub>in</sub> range	0.05 (2)	—	1.00	A	
		V <sub>o</sub> =-5V	0.05 (2)	—	0.8		
		V <sub>o</sub> =-6V	0.05 (2)	—	0.55		
		V <sub>o</sub> =-7, -8, -9V	0.05 (2)	—	0.5		
		V <sub>o</sub> =-10V	0.05 (2)	—	0.40		
		V <sub>o</sub> =-12V	0.05 (2)	—	0.30		
		V <sub>o</sub> =-13.9, -15V	0.05 (2)	—	0.30		
Short Circuit Current	I <sub>sc</sub>	V <sub>in</sub> =10V	—	4×I <sub>max</sub>	—	Apk	
Inrush Current	I <sub>ir</sub> t <sub>ir</sub>	V <sub>in</sub> =10V On start-up	—	4	—	A	
			—	0.5	—	mSec	
Input Voltage Range	V <sub>in</sub>	0.1 ≤ I <sub>o</sub> ≤ I <sub>max</sub>	V <sub>o</sub> =-5V V <sub>o</sub> =-6, -7, -8, -9V V <sub>o</sub> =-10, -12V V <sub>o</sub> =-13.9, -15V	7 7 7 7	— — — —	25 21 18 15	V
Output Voltage Tolerance	ΔV <sub>o</sub>	Over V <sub>in</sub> range 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 (with 100 $\mu$ F output cap)	t <sub>tr</sub>	50% load change V <sub>o</sub> over/undershoot	—	100 5.0	250	$\mu$ Sec	
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 Operating Temperaturte Range	T <sub>a</sub>	Free Air Convection, (40-60LFM) Over V <sub>in</sub> Range	-40	—	+85 <sup>(3)</sup>	°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, 20-2000 Hz, soldered in a PC board	—	5	—	G's	
Weight	—	—	—	6.5	—	Grams	

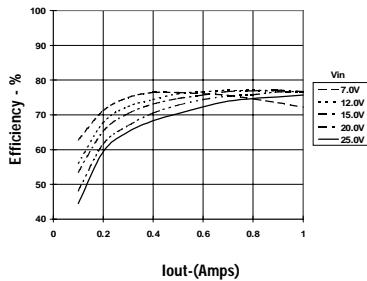
**Notes:**

- (1) The PT78NR100 Series requires a 100 $\mu$ F electrolytic or tantalum capacitor at both the input and output for proper operation in all applications. The input capacitor, C<sub>1</sub> must have a ripple current rating ≥600 mA rms, and an ESR ≤0.2Ω.
- (2) The ISR will operate down to no load with reduced specifications.
- (3) See Thermal Derating chart.

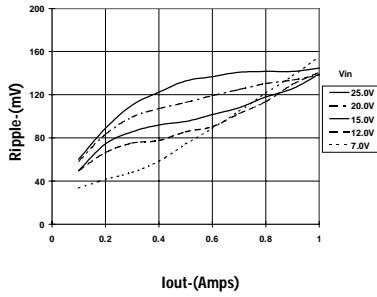
1 Amp Plus to Minus Voltage  
Integrated Switching Regulator

**PT78NR105 -5.0 VDC** (See Note A)

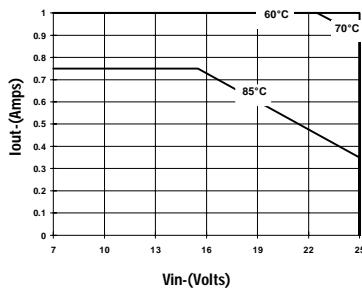
**Efficiency vs Output Current**



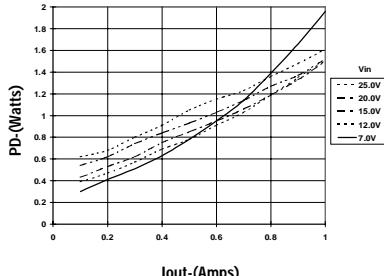
**Ripple vs Output Current**



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

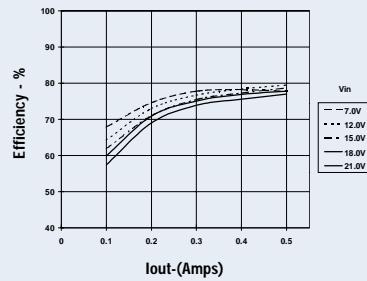


**Power Dissipation vs Output Current**

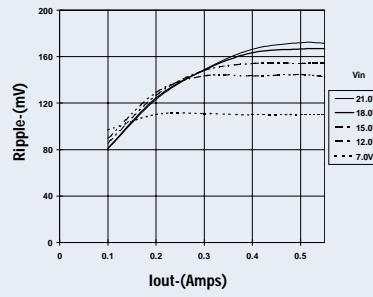


**PT78NR109 -9.0 VDC** (See Note A)

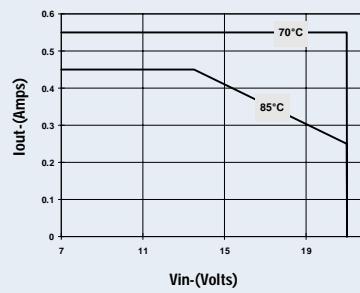
**Efficiency vs Output Current**



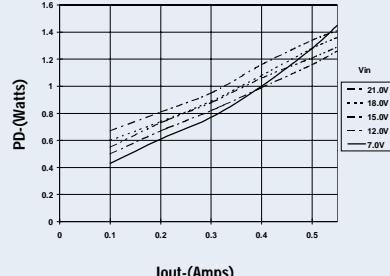
**Ripple vs Output Current**



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

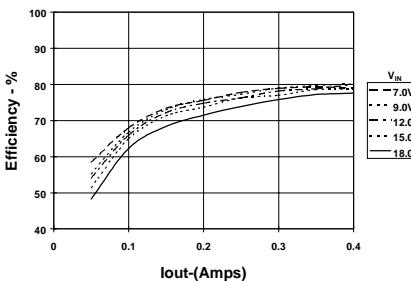


**Power Dissipation vs Output Current**

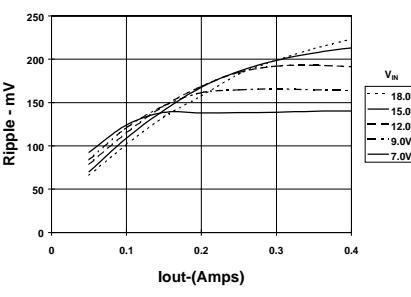


**PT78NR112 -12.0 VDC** (See Note A)

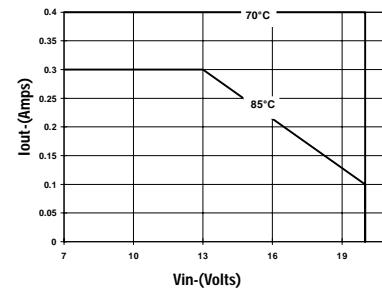
**Efficiency vs Output Current**



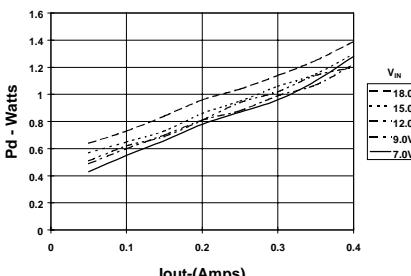
**Ripple vs Output Current**



**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 (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
PT78NR103H	OBsolete SIP MODULE	EFA	3			TBD	Call TI	Call TI	-40 to 85		
PT78NR103V	OBsolete SIP MODULE	EFD	3			TBD	Call TI	Call TI	-40 to 85		
PT78NR106V	OBsolete SIP MODULE	EFD	3			TBD	Call TI	Call TI			
PT78NR108ST	OBsolete SIP MODULE	EFC	3			TBD	Call TI	Call TI			
PT78NR108V	OBsolete SIP MODULE	EFD	3			TBD	Call TI	Call TI			

(1) 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.

(2) 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)

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and



www.ti.com

## PACKAGE OPTION ADDENDUM

5-Mar-2015

---

continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products	Applications
Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
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>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>
	<b>TI E2E Community</b>
	<a href="http://e2e.ti.com">e2e.ti.com</a>