

# PT78ST100 Series



1.5 Amp Positive Step-Down  
Integrated Switching Regulator

SLTS059A

(Revised 6/30/2000)

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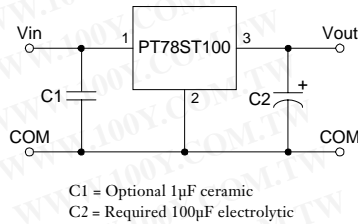
- Very Small Footprint
- High Efficiency > 85%
- Self-Contained Inductor
- Internal Short-Circuit Protection
- Over-Temperature Protection
- Fast Transient Response
- Wide Input Range

The PT78ST100 is a series of wide-input range, 3-terminal regulators.

These ISRs have a maximum output current of 1.5 Amps and an output voltage that is laser trimmed to a variety of industry standard voltages.

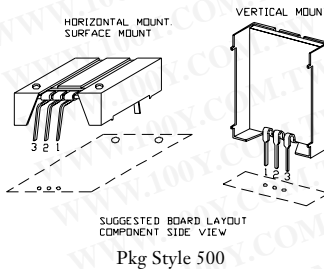
These 78 series regulators have excellent line and load regulation with internal short-circuit and over-temperature protection, and are offered in a variety of standard output voltages. These ISRs are very flexible and may be used in a wide variety of applications.

### Standard Application



### Pin-Out Information

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



### Ordering Information

PT78ST1 XX Y

Output Voltage

Package Suffix

- 33 = 3.3 Volts
- 36 = 3.6 Volts
- 05 = 5.0 Volts
- 51 = 5.1 Volts
- 53 = 5.25 Volts
- 06 = 6.0 Volts
- 65 = 6.5 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

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

### Specifications

Characteristics (T <sub>a</sub> = 25°C unless noted)	Symbols	Conditions	PT78ST100 SERIES			Units
			Min	Typ	Max	
Output Current	I <sub>o</sub>	Over V <sub>in</sub> range	0.1*	—	1.5	A
Short Circuit Current	I <sub>sc</sub>	V <sub>in</sub> = V <sub>in</sub> min	—	3.5	—	Apk
Input Voltage Range	V <sub>in</sub>	0.1 ≤ I <sub>o</sub> ≤ 1.5A V <sub>o</sub> = 3.3V V <sub>o</sub> = 5V V <sub>o</sub> = 12V	9 9 16	— — —	26 38 38	V V V
Output Voltage Tolerance	ΔV <sub>o</sub>	Over V <sub>in</sub> range, I <sub>o</sub> = 1.5A T <sub>a</sub> = 0°C to +60°C	—	±1.0	±2.0	%V <sub>o</sub>
Line Regulation	Reg <sub>line</sub>	Over V <sub>in</sub> range	—	±0.2	±0.4	%V <sub>o</sub>
Load Regulation	Reg <sub>load</sub>	0.1 ≤ I <sub>o</sub> ≤ 1.5A	—	±0.1	±0.2	%V <sub>o</sub>
V <sub>o</sub> Ripple/Noise	V <sub>n</sub>	V <sub>in</sub> = 9V, I <sub>o</sub> = 1.5A V <sub>in</sub> = 16V, I <sub>o</sub> = 1.5A V <sub>o</sub> = 5V V <sub>o</sub> = 12V	— — —	65 90	—	mV <sub>pp</sub> mV <sub>pp</sub>
Transient Response (with 100µF output cap)	t <sub>tr</sub>	50% load change V <sub>o</sub> over/undershoot	— —	100 5	—	µSec %V <sub>o</sub>
Efficiency	η	V <sub>in</sub> = 10V, I <sub>o</sub> = 1A V <sub>in</sub> = 10V, I <sub>o</sub> = 1A V <sub>in</sub> = 17V, I <sub>o</sub> = 1A V <sub>o</sub> = 3.3V V <sub>o</sub> = 5V V <sub>o</sub> = 12V	— — —	80 85 90	—	% % %
Switching Frequency	f <sub>o</sub>	Over V <sub>in</sub> range, I <sub>o</sub> = 1.5A	600	650	700	kHz
Absolute Maximum Operating Temperature Range	T <sub>a</sub>	—	-40	—	+85	°C
Recommended Operating Temperature Range	T <sub>a</sub>	Free Air Convection, (40-60LFM) At V <sub>in</sub> = 24V, I <sub>o</sub> = 1.0A	-40	—	+80**	°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

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

\*\*See Thermal Derating chart.

Note: The PT78ST100 Series requires a 100µF electrolytic or tantalum output capacitor for proper operation in all applications.

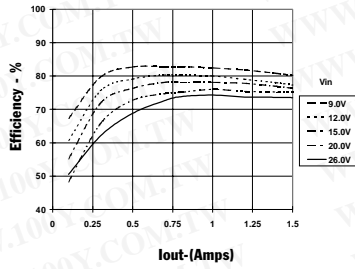
**PT78ST100 Series**

**Typical Characteristics**

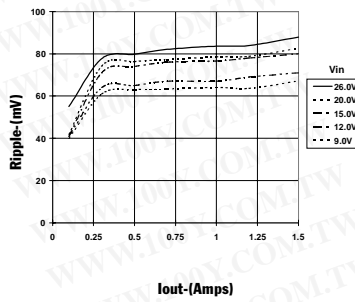
**1.5 Amp Positive Step-Down Integrated Switching Regulator**

**PT78ST133, 3.3 VDC** (See Note 1)

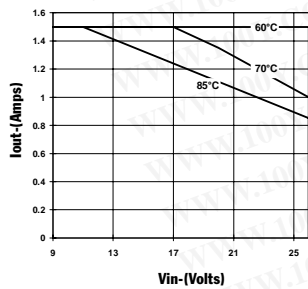
**Efficiency vs Output Current**



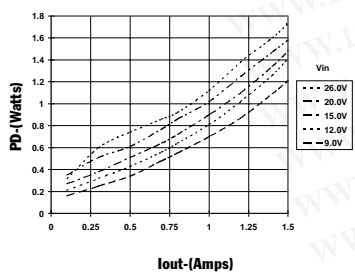
**Ripple vs Output Current**



**Thermal Derating (Ta)** (See Note 2)

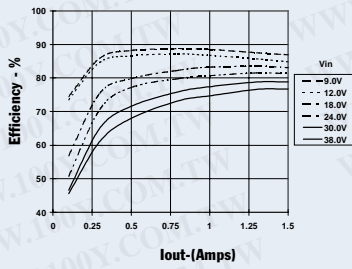


**Power Dissipation vs Output Current**

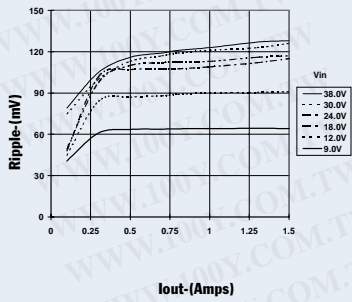


**PT78ST105, 5.0 VDC** (See Note 1)

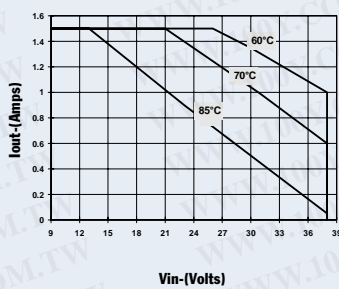
**Efficiency vs Output Current**



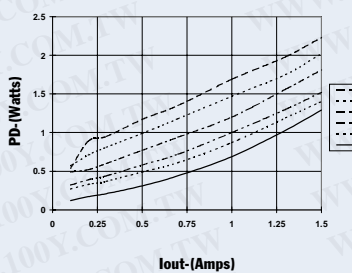
**Ripple vs Output Current**



**Thermal Derating (Ta)** (See Note 2)

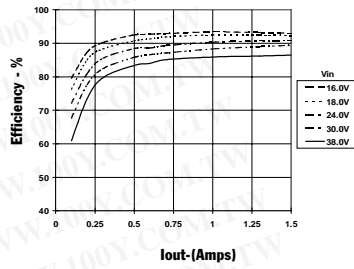


**Power Dissipation vs Output Current**

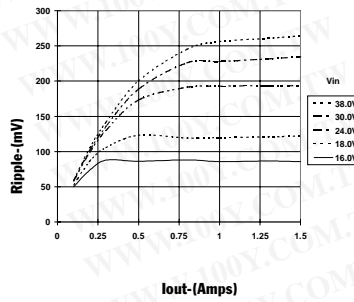


**PT78ST112, 12.0 VDC** (See Note 1)

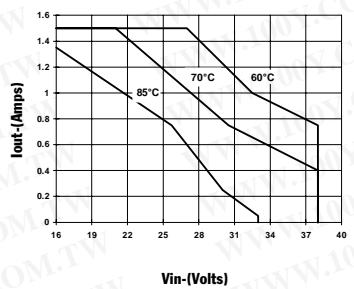
**Efficiency vs Output Current**



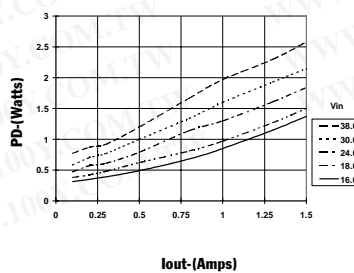
**Ripple vs Output Current**



**Thermal Derating (Ta)** (See Note 2)



**Power Dissipation vs Output Current**



**Note 1:** 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 2:** Thermal derating graphs are developed in free air convection cooling of 40-60 LFM. (See Thermal Application Notes.)

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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>
PT78ST105H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST105S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST105ST	ACTIVE	SIP MOD ULE	EFC	3	200	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST105U	NRND	SIP MOD ULE	EFU	3		TBD	Call TI	Call TI
PT78ST105V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST106H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST106S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST106ST	ACTIVE	SIP MOD ULE	EFC	3	200	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST106V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST107H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST107S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST107ST	ACTIVE	SIP MOD ULE	EFC	3	200	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST108H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST108S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST108V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST109H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST109S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST109V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST110H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST110S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST110V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST112H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST112S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST112V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST114H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type

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>
PT78ST114S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST114V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST115H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST115S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST115ST	ACTIVE	SIP MOD ULE	EFC	3	200	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST115V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST133H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST133S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST133V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST136H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST151H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST151S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST153H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST153S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST153V	ACTIVE	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST165H	ACTIVE	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT78ST165S	ACTIVE	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT78ST165V	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 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.

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