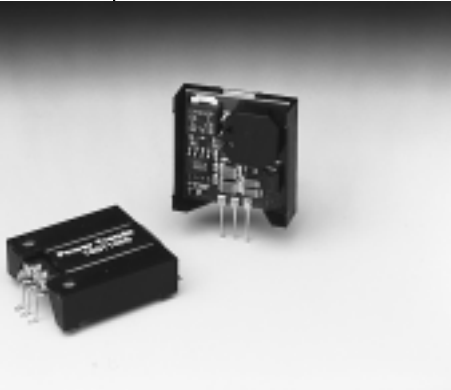


# 78ST100 Series

## 1.5 AMP POSITIVE STEP-DOWN INTEGRATED SWITCHING REGULATOR

Revised 6/30/98

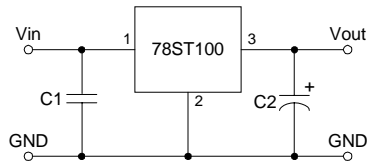


- Very Small Footprint
- High Efficiency > 85%
- Self-Contained Inductor
- Internal Short-Circuit Protection
- Over-Temperature Protection
- Fast Transient Response
- Wide Input Range

The 78ST100 is a series of wide input voltage, 3-terminal Integrated Switching Regulators (ISRs). These ISRs have a maximum output current of 1.5A 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, are very flexible, and may be used in a wide variety of applications.

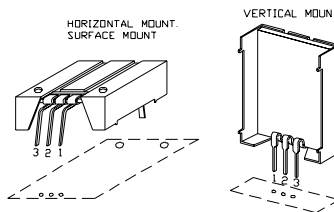
### Standard Application



C1 = Optional 1 $\mu$ F ceramic  
C2 = Required 100 $\mu$ F electrolytic

### Pin-Out Information

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



SUGGESTED BOARD LAYOUT  
COMPONENT SIDE VIEW

Pkg Style 500

### Ordering Information

78ST1 XX Y C

#### Output Voltage

- 33 = 3.3 Volts
- 36 = 3.6 Volts
- 05 = 5.0 Volts
- 51 = 5.1 Volts
- 65 = 6.5 Volts
- 07 = 7.0 Volts
- 08 = 8.0 Volts
- 09 = 9.0 Volts
- 12 = 12.0 Volts

#### Package Suffix

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

### Specifications

Characteristics (T <sub>a</sub> = 25°C unless noted)	Symbols	Conditions	78ST100 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 min</sub>	—	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	7 7 14.5	—	26 30 30	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 100 $\mu$ F output cap)	t <sub>tr</sub>	50% load change V <sub>o</sub> over/undershoot	—	100 5	—	$\mu$ Sec %V <sub>o</sub>
Efficiency	$\eta$	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	$\theta_{ja}$	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.

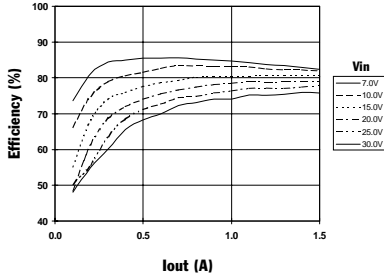
**Note:** The 78ST100 Series requires a 100 $\mu$ F electrolytic or tantalum output capacitor for proper operation in all applications.

# 78ST100 Series

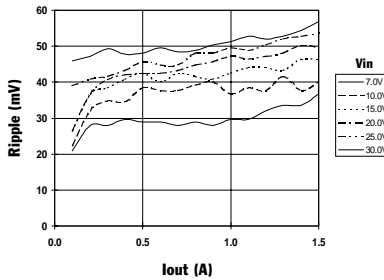
## CHARACTERISTIC DATA

**78ST133\_ 3.3 VDC** (See Note 1)

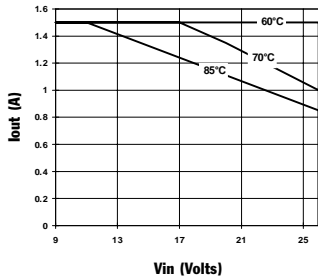
**Efficiency vs Output Current**



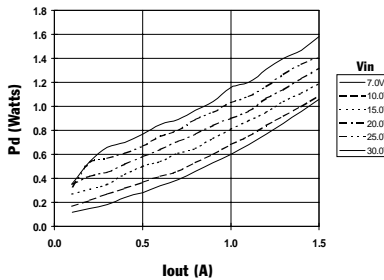
**Ripple vs Output Current**



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

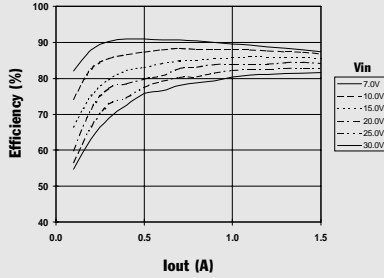


**Power Dissipation vs Output Current**

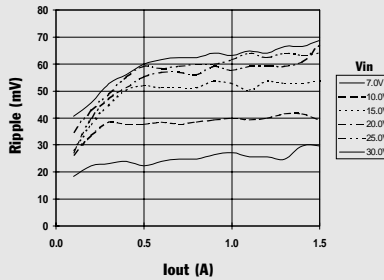


**78ST105\_ 5.0 VDC** (See Note 1)

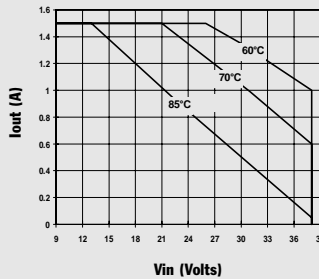
**Efficiency vs Output Current**



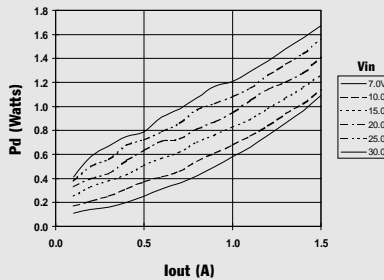
**Ripple vs Output Current**



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

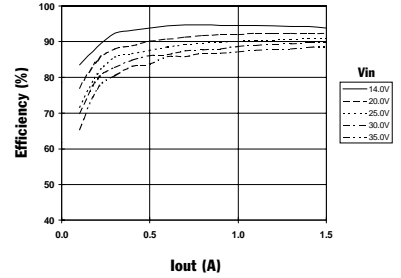


**Power Dissipation vs Output Current**

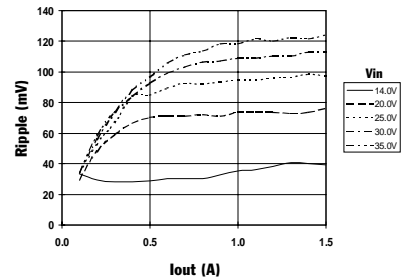


**78ST112\_ 12.0 VDC** (See Note 1)

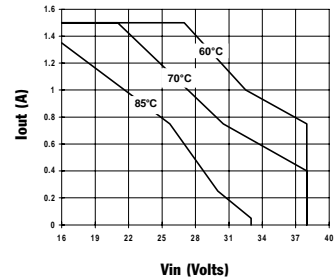
**Efficiency vs Output Current**



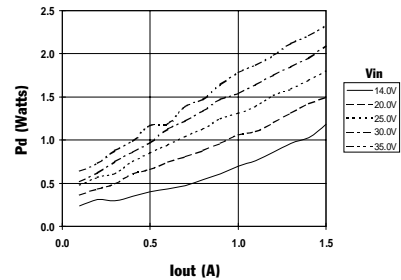
**Ripple vs Output Current**



**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.)

**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>	Samples (Requires Login)
78ST105HC	NRND	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST105SC	NRND	SIP MODULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
78ST105SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST105VC	NRND	SIP MODULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST107HC	OBSOLETE	SIP MODULE	EFA	3		TBD	Call TI	Call TI	
78ST107SC	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST107SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST107VC	OBSOLETE	SIP MODULE	EFD	3		TBD	Call TI	Call TI	
78ST108HC	OBSOLETE	SIP MODULE	EFA	3		TBD	Call TI	Call TI	
78ST108SC	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST108SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST108VC	OBSOLETE	SIP MODULE	EFD	3		TBD	Call TI	Call TI	
78ST109SC	NRND	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST109SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST109TC	OBSOLETE	SIP MODULE	EFT	3		TBD	Call TI	Call TI	
78ST112HC	NRND	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST112SC	NRND	SIP MODULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
78ST112SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST112TC	OBSOLETE	SIP MODULE	EFT	3		TBD	Call TI	Call TI	
78ST112VC	NRND	SIP MODULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST133HC	NRND	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST133SC	NRND	SIP MODULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
78ST133SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST133VC	NRND	SIP MODULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST136SC	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST136SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST136VC	OBSOLETE	SIP MODULE	EFD	3		TBD	Call TI	Call TI	
78ST151HC	OBSOLETE	SIP MODULE	EFA	3		TBD	Call TI	Call TI	
78ST151SC	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST151SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	

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>	Samples (Requires Login)
78ST151VC	OBSOLETE	SIP MODULE	EFD	3		TBD	Call TI	Call TI	
78ST165HC	NRND	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST165SC	NRND	SIP MODULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
78ST165SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI	
78ST165VC	NRND	SIP MODULE	EFD	3		TBD	Call TI	Call TI	

<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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