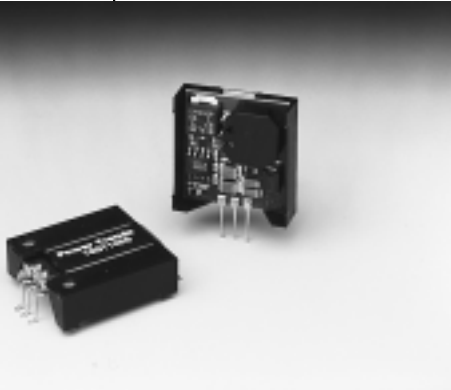


# 78ST100 Series

## 1.5 AMP POSITIVE STEP-DOWN INTEGRATED SWITCHING REGULATOR

Revised 6/30/98

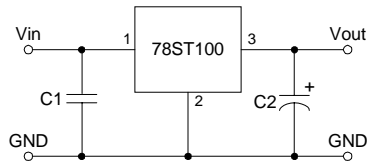


- Very Small Footprint
- High Efficiency > 85%
- Self-Contained Inductor
- Internal Short-Circuit Protection
- Over-Temperature Protection
- Fast Transient Response
- Wide Input Range

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.

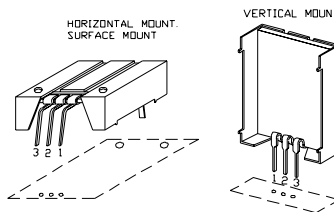
### Standard Application



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.

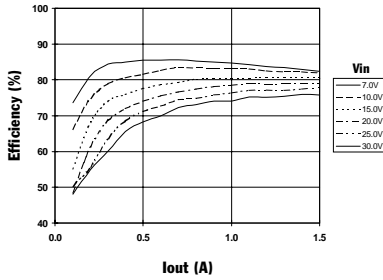
**Note:** The 78ST100 Series requires a 100 $\mu$ F electrolytic or tantalum output capacitor for proper operation in all applications.

# 78ST100 Series

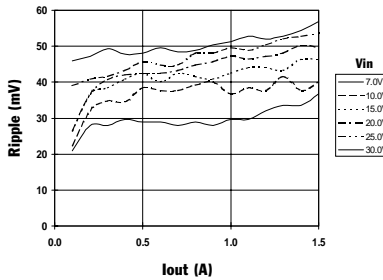
## CHARACTERISTIC DATA

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

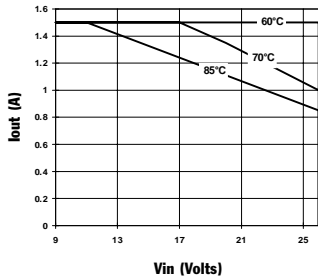
**Efficiency vs Output Current**



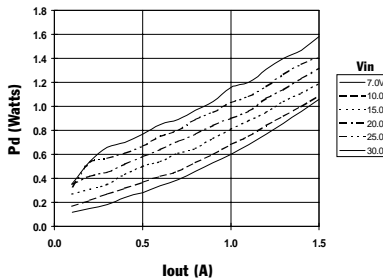
**Ripple vs Output Current**



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

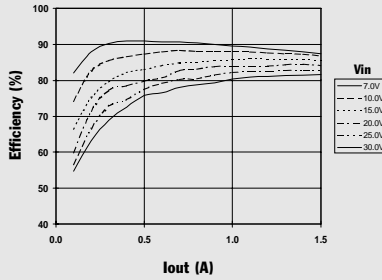


**Power Dissipation vs Output Current**

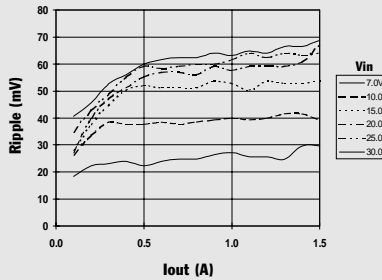


**78ST105\_ 5.0 VDC** (See Note 1)

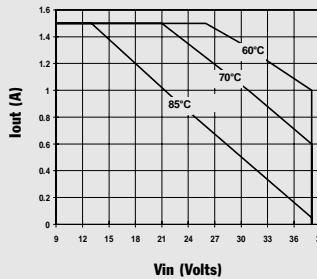
**Efficiency vs Output Current**



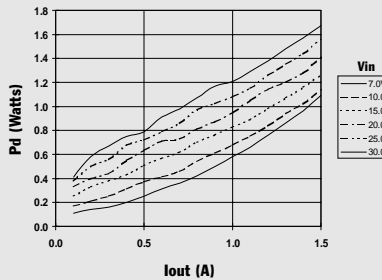
**Ripple vs Output Current**



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

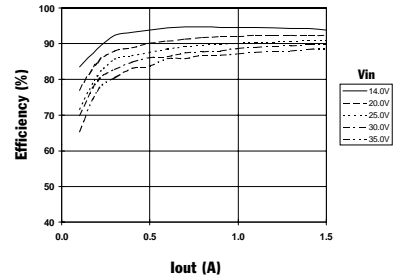


**Power Dissipation vs Output Current**

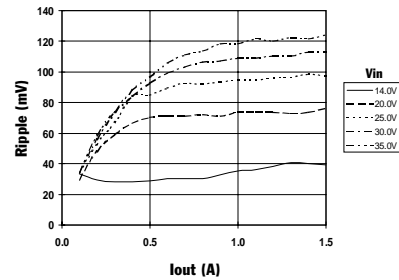


**78ST112\_ 12.0 VDC** (See Note 1)

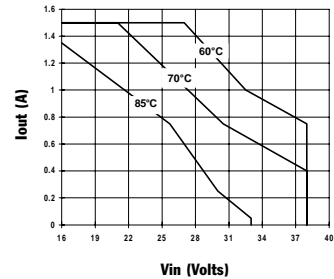
**Efficiency vs Output Current**



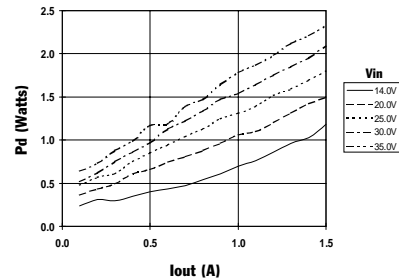
**Ripple vs Output Current**



**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 (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
78ST105HC	LIFEBUY	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST105SC	LIFEBUY	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	LIFEBUY	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	LIFEBUY	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST112SC	LIFEBUY	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	LIFEBUY	SIP MODULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST133HC	LIFEBUY	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST133SC	LIFEBUY	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	

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
78ST133VC	LIFEBUY	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	
78ST151VC	OBSOLETE	SIP MODULE	EFD	3		TBD	Call TI	Call TI	
78ST165HC	LIFEBUY	SIP MODULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
78ST165SC	LIFEBUY	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	

(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.

**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

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

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>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)