78ST100 Series

1.5 AMP POSITIVE STEP-DOWN INTEGRATED SWITCHING REGULATOR
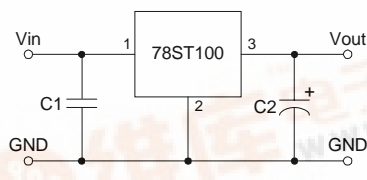
Revised 6/30/98

- 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.
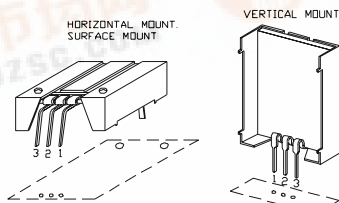
Pin-Out Information

Pin	Function
1	V_{in}
2	GND
3	V_{out}

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

Standard Application

C1 = Optional 1µF ceramic
C2 = Required 100µF electrolytic

HORIZONTAL MOUNT. SURFACE MOUNT
VERTICAL MOUNT
SUGGESTED BOARD LAYOUT COMPONENT SIDE VIEW
Pkg Style 500

Specifications

Characteristics (Ta = 25°C unless noted)	Symbols	Conditions		Min	Typ	Max	Units
Output Current	I_o	Over V_{in} range		0.1*	—	1.5	A
Short Circuit Current	I_{sc}	V_{in} = V_{in} min		—	3.5	—	Apk
Input Voltage Range	V_{in}	$0.1 \le I_o \le 1.5A$	V_o= 3.3V	7	—	26	V
			V_o= 5V	7	—	30	V
			V_o= 12V	14.5	—	30	V
Output Voltage Tolerance	ΔV_o	Over V_{in} range, I_o=1.5A T_a = 0°C to +60°C		—	±1.0	±2.0	%V_O
Line Regulation	Reg_{line}	Over V_{in} range		—	±0.2	±0.4	%V_O
Load Regulation	Reg_{load}	$0.1 \le I_o \le 1.5A$		—	±0.1	±0.2	%V_O
V_o Ripple/Noise	V_n	V_{in}= 9V, I_o= 1.5A V_o= 5V		—	65	—	mV_{pp}
		V_{in}= 16V, I_o= 1.5A V_o= 12V		—	90	—	mV_{pp}
Transient Response (with 100µF output cap)	t_{tr}	50% load change V_o over/undershoot		—	100	—	µSec
				—	5	—	%V_O
Efficiency	η	V_{in}= 10V, I_o= 1A V_o= 3.3V		—	80	—	%
		V_{in}= 10V, I_o= 1A V_o= 5V		—	85	—	%
		V_{in}= 17V, I_o= 1A V_o= 12V		—	90	—	%
Switching Frequency	f_o	Over V_{in} range, I_o=1.5A		600	650	700	kHz
Absolute Maximum Operating Temperature Range	T_a	—		-40	—	+85	°C
Recommended Operating Temperature Range	T_a	Free Air Convection, (40-60LFM) At V_{in}= 24V, I_o=1.0A		-40	—	+80**	°C
Thermal Resistance	θ_{ja}	Free Air Convection, (40-60LFM)		—	45	—	°C/W
Storage Temperature	T_s	—		-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 100µF electrolytic or tantalum output capacitor for proper operation in all applications.*
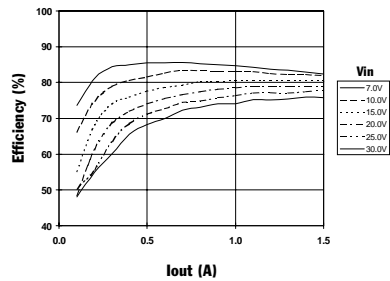
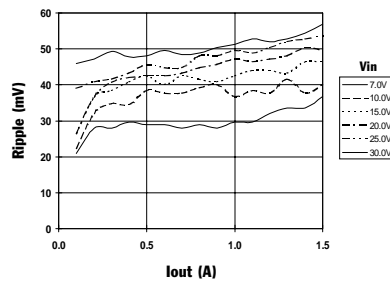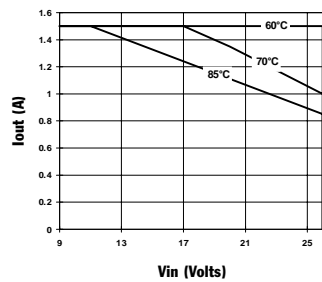**CHARACTERISTIC DATA**

78ST133_ 3.3 VDC (See Note 1)

Efficiency vs Output Current

Efficiency (%) vs Iout (A)

Vin
7.0V
10.0V
15.0V
20.0V
25.0V
30.0V

Ripple vs Output Current

Ripple (mV) vs Iout (A)

Vin
7.0V
10.0V
15.0V
20.0V
25.0V
30.0V

Thermal Derating (T$_a$) (See Note 2)

Iout (A) vs Vin (Volts)

60°C
70°C
85°C

Power Dissipation vs Output Current

Pd (Watts) vs Iout (A)

Vin
7.0V
10.0V
15.0V
20.0V
25.0V
30.0V
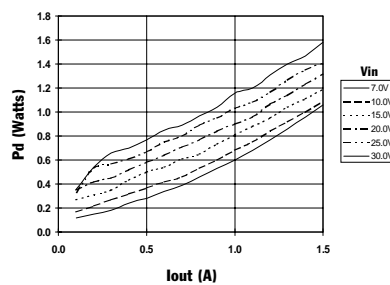
78ST105_ 5.0 VDC (See Note 1)

Efficiency vs Output Current
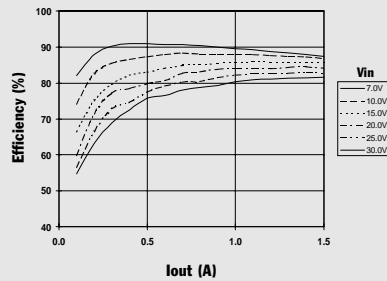
Efficiency (%) vs Iout (A)

Vin
7.0V
10.0V
15.0V
20.0V
25.0V
30.0V

Ripple vs Output Current

Ripple (mV) vs Iout (A)

Vin
7.0V
10.0V
15.0V
20.0V
25.0V
30.0V

Thermal Derating (T$_a$) (See Note 2)

Iout (A) vs Vin (Volts)

60°C
70°C
85°C

Power Dissipation vs Output Current

Pd (Watts) vs Iout (A)

Vin
7.0V
10.0V
15.0V
20.0V
25.0V
30.0V
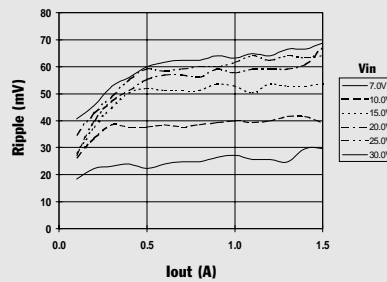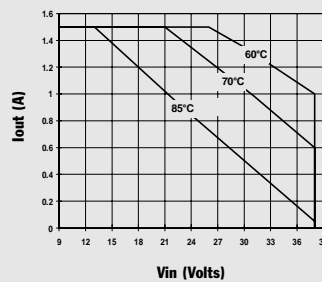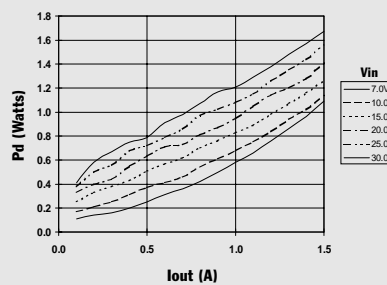
78ST112_ 12.0 VDC (See Note 1)

Efficiency vs Output Current
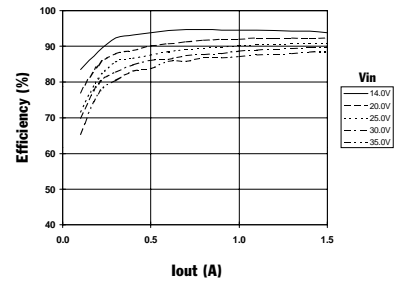
Efficiency (%) vs Iout (A)

Vin
14.0V
20.0V
25.0V
30.0V
35.0V

Ripple vs Output Current

Ripple (mV) vs Iout (A)

Vin
14.0V
20.0V
25.0V
30.0V
35.0V

Thermal Derating (T$_a$) (See Note 2)

Iout (A) vs Vin (Volts)

60°C
70°C
85°C

Power Dissipation vs Output Current

Pd (Watts) vs Iout (A)

Vin
14.0V
20.0V
25.0V
30.0V
35.0V
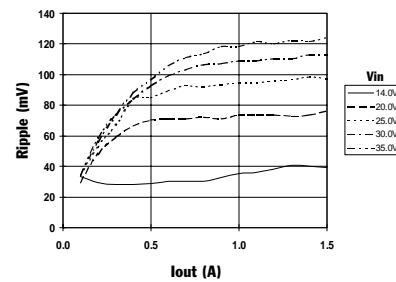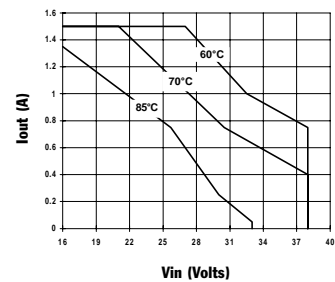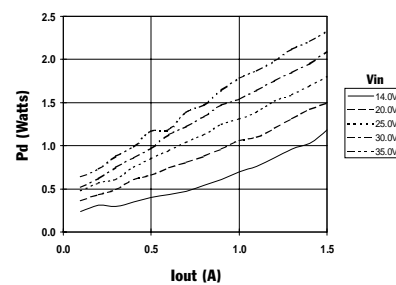
Note 1: *All data listed in the above graphs, except for derating data, has been developed from actual products tested at 25°C. This data is considered typical data for the ISR.*
Note 2: *Thermal derating graphs are developed in free air convection cooling of 40-60 LFM. (See Thermal Application Notes.)*

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PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
78ST105HC	NRND	SIP MODULE	EFA	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST105SC	NRND	SIP MODULE	EFC	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST105SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI
78ST105VC	NRND	SIP MODULE	EFD	3	25	TBD	Call TI	Level-1-215C-UNLIM
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
78ST109HC	NRND	SIP MODULE	EFA	3	25	TBD	Call TI	Level-1-215C-UNLIM
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
78ST109VC	NRND	SIP MODULE	EFD	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST112HC	NRND	SIP MODULE	EFA	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST112SC	NRND	SIP MODULE	EFC	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST112SCT	OBSOLETE	SIP MODULE	EFC	3		TBD	Call TI	Call TI
78ST112TC	NRND	SIP MODULE	EFT	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST112VC	NRND	SIP MODULE	EFD	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST133HC	NRND	SIP MODULE	EFA	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST133SC	NRND	SIP MODULE	EFC	3	25	TBD	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)
78ST133VC	NRND	SIP MODULE	EFD	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST136HC	NRND	SIP MODULE	EFA	3	25	TBD	Call TI	Level-1-215C-UNLIM
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	NRND	SIP MODULE	EFA	3	25	TBD	Call TI	Level-1-215C-UNLIM
78ST165SC	NRND	SIP MODULE	EFC	3	25	TBD	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) 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.
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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