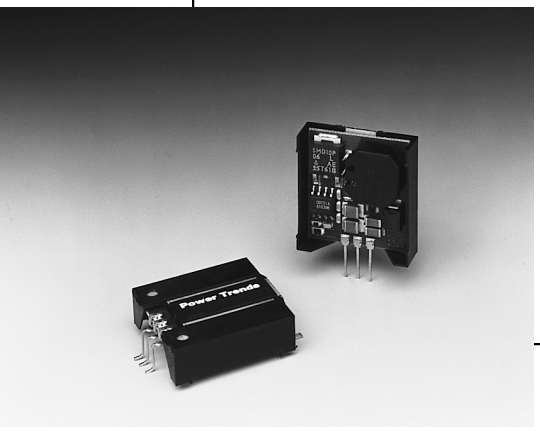
78HT200 Series

2 AMP POSITIVE STEP-DOWN INTEGRATED SWITCHING REGULATOR

Revised 9/22/99

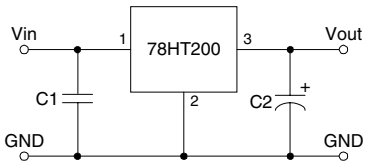


- High Efficiency > 82%
- Wide Input Range
- Self-Contained Inductor
- Short-Circuit Protection
- Over-Temperature Protection
- Fast Transient Response

The 78HT200 is a series of wide input voltage, 3 terminal Integrated Switching Regulators (ISRs). Employing a ceramic substrate, these ISRs have a maximum output current of 2A. The output voltage is laser trimmed for high accuracy.

The 78HT200 series regulators have internal short-circuit and over-temperature protection and may be used in a wide variety of applications.

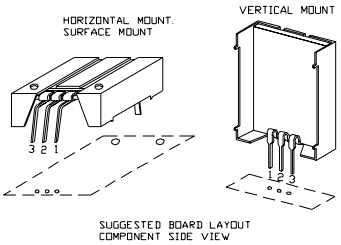
Standard Application



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

Pin-Out Information

Pin No.	Function
1	V_{in}
2	GND
3	V_{out}



Ordering Information

78HT2 XX Y C

Output Voltage	Package Suffix
33 = 3.3 Volts	**V** = Vertical Mount
46 = 4.6 Volts	**S** = Surface Mount
05 = 5.0 Volts	**H** = Horizontal Mount
53 = 5.25 Volts	
65 = 6.5 Volts	
75 = 7.5 Volts	
10 = 10.0 Volts	

(For dimensions and PC board layout see Package Style 500.)

Specifications

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	78HT200 SERIES Min	Typ	Max	Units
Output Current	I_o	Over V_{in} range	0.1*	—	2.0	A
Input Voltage Range	V_{in}	I_o = 0.1 to 2.0A V_o < 4.6V $V_o \geq$ 4.6V	7 V_o +2V	— —	15 28	V V
Output Voltage Tolerance	ΔV_o	Over V_{in} range, I_o = 2.0A T_a = 0°C to +60°C	—	±1.0	±2.0	%Vo
Line Regulation	Reg_{line}	Over V_{in} range	—	±0.4	±0.8	$\%V_o$
Load Regulation	Reg_{load}	0.1 ≤ I_o ≤ 2.0A	—	±0.2	±0.4	$\%V_o$
Ripple/Noise	V_n	V_{in} = V_{in} min, I_o = 2.0A	—	1	—	%Vo
Transient Response (with 100µF output cap)	t_{tr}	50% load change V_o over/undershoot	—	100 5.0	—	µSec $\%V_o$
Efficiency	η	V_{in} = 9V, I_o = 2.0A, V_o = 5V	—	82	—	%
Switching Frequency	f_o	Over V_{in} and I_o ranges $V_o \geq$ 4.6V V_o = 3.3V	700 0.95	750 1.0	800 1.05	kHz MHz
Absolute Maximum Operating Temperature Range	T_a	—	-40	—	+85	°C
Recommended Operating Temperature Range	T_a	Free Air Convection, (40-60LFM) Over V_{in} and I_o ranges	-40	—	+85**	°C
Thermal Resistance	θ_{ja}	Free Air Convection, (40-60LFM)	—	38	—	°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	—	—	—	7	—	Grams

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

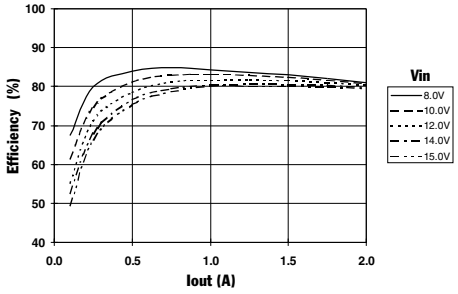
** See Thermal Derating chart.

Note: *The 78HT200 Series requires a 100µF electrolytic or tantalum output capacitor for proper operation in all applications.*

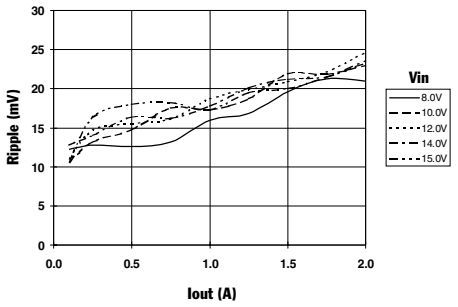
78HT233_ 3.3 VDC

(See Note 1)

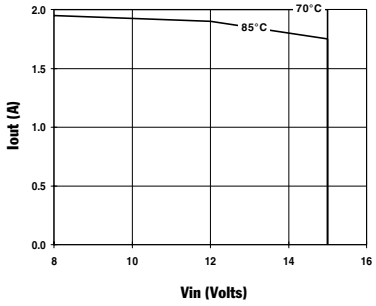
Efficiency vs Output Current



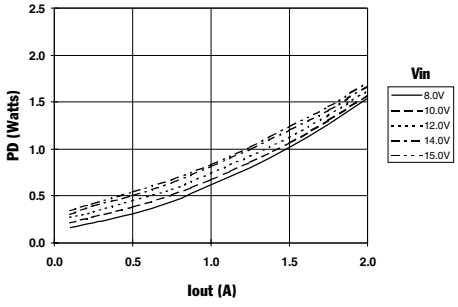
Ripple vs Output Current



Thermal Derating (T_a) (See Note 2)



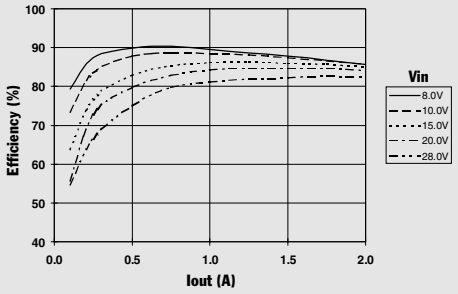
Power Dissipation vs Output Current



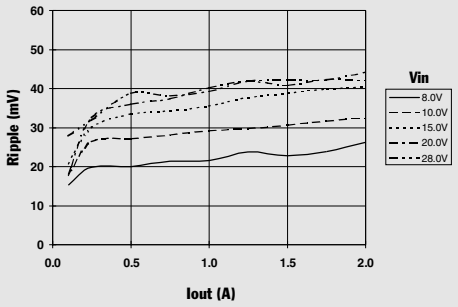
78HT205_ 5.0 VDC

(See Note 1)

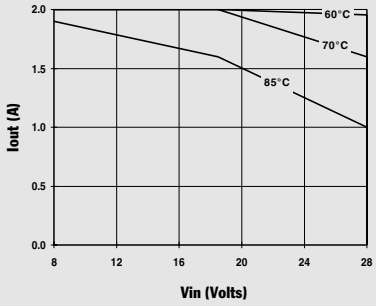
Efficiency vs Output Current



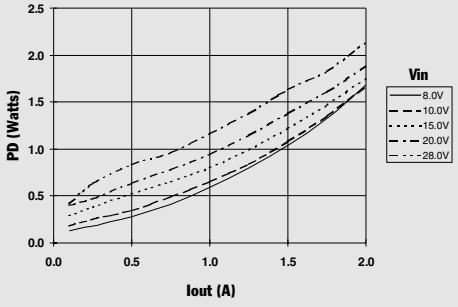
Ripple vs Output Current



Thermal Derating (T_a) (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 Note)*

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
78HT205HC	NRND	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
78HT205SC	NRND	SIP MOD ULE	EFC	3	25	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
78HT205TC	NRND	SIP MOD ULE	EFT	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
78HT205VC	NRND	SIP MOD ULE	EFD	3	25	TBD	Call TI	Level-1-215C-UNLIM
78HT210HC	OBSOLETE	SIP MOD ULE	EFA	3		TBD	Call TI	Call TI
78HT210SC	OBSOLETE	SIP MOD ULE	EFC	3		TBD	Call TI	Call TI
78HT210VC	OBSOLETE	SIP MOD ULE	EFD	3		TBD	Call TI	Call TI
78HT233HC	NRND	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
78HT233SC	NRND	SIP MOD ULE	EFC	3		TBD	Call TI	Call TI
78HT233VC	NRND	SIP MOD ULE	EFD	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
78HT246HC	OBSOLETE	SIP MOD ULE	EFA	3		TBD	Call TI	Call TI
78HT246SC	OBSOLETE	SIP MOD ULE	EFC	3		TBD	Call TI	Call TI
78HT246VC	OBSOLETE	SIP MOD ULE	EFD	3		TBD	Call TI	Call TI
78HT253SC	OBSOLETE	SIP MOD ULE	EFC	3		TBD	Call TI	Call TI
78HT253VC	OBSOLETE	SIP MOD ULE	EFD	3		TBD	Call TI	Call TI
78HT265HC	NRND	SIP MOD ULE	EFA	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
78HT265SC	OBSOLETE	SIP MOD ULE	EFC	3		TBD	Call TI	Call TI
78HT265TC	NRND	SIP MOD ULE	EFT	3	25	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
78HT265VC	OBSOLETE	SIP MOD ULE	EFD	3		TBD	Call TI	Call TI
78HT275HC	OBSOLETE	SIP MOD ULE	EFA	3		TBD	Call TI	Call TI
78HT275SC	OBSOLETE	SIP MOD ULE	EFC	3		TBD	Call TI	Call TI
78HT275VC	OBSOLETE	SIP MOD ULE	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.

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