

# PT7708—3.3V

20 Amp Programmable  
Next Generation "Big Hammer"



SLTS083

(Revised 6/30/2000)

## Description

The PT7708 is a next generation "Big Hammer", a high-performance Integrated Switching Regulator (ISR), which is made available in Power Trends' aluminum 27-pin SIP package. The PT7708 improves on the popular PT7706 with 20A of output current and short circuit protection.

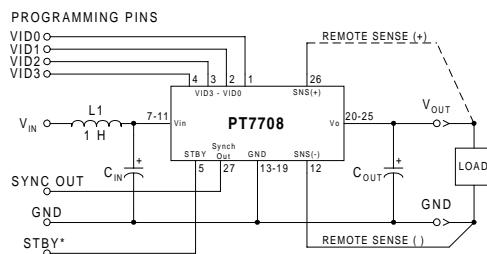
The PT7708 is suitable for existing 5V system designs that require power for the latest high-speed, low-

voltage  $\mu$ Ps, and bus drivers.

The PT7708 output is programmable from 1.3V to 2.05V with a 4-bit input, which is compatible with the Intel Pentium® Processor. A differential remote sense is also provided to compensate for voltage drop between the ISR and load.

Only 330 $\mu$ F of output capacitance are required for proper operation.

## Standard Application



$C_{in}$  = Required 1500 $\mu$ F electrolytic  
 $C_{out}$  = Required 330 $\mu$ F electrolytic  
 $L_1$  = Optional 1 $\mu$ H input choke

## Pin-Out Information

Pin Function
1 VID0
2 VID1
3 VID2
4 VID3
5 STBY* - Stand-by
6 Do Not Connect
7 V <sub>in</sub>
8 V <sub>in</sub>
9 V <sub>in</sub>

For STBY\* pin:  
 open = output enabled  
 ground = output disabled.

Pin Function
10 V <sub>in</sub>
11 V <sub>in</sub>
12 Remote Sense Gnd (+)
13 GND
14 GND
15 GND
16 GND
17 GND
18 GND

Pin Function
19 GND
20 V <sub>out</sub>
21 V <sub>out</sub>
22 V <sub>out</sub>
23 V <sub>out</sub>
24 V <sub>out</sub>
25 V <sub>out</sub>
26 Remote Sense V <sub>out</sub>
27 Sync Out

## Specifications

PT7708 SERIES				
Characteristics	Symbols	Conditions	Min	Typ
Output Current	I <sub>o</sub>	T <sub>a</sub> = +60°C, 200 LFM, pkg N T <sub>a</sub> = +25°C, natural convection	0.1 <sup>(1)</sup> 0.1 <sup>(1)</sup>	— 20
Input Voltage Range	V <sub>in</sub>	0.1A $\leq$ I <sub>o</sub> $\leq$ 20A	3.1	—
Output Voltage Tolerance	$\Delta V_o$	V <sub>in</sub> = +3.3V, I <sub>o</sub> = 20A 0°C $\leq$ T <sub>a</sub> $\leq$ +65°C	V <sub>o</sub> -0.03	— V <sub>o</sub> +0.03
Line Regulation	Reg <sub>line</sub>	3.1V $\leq$ V <sub>in</sub> $\leq$ 3.6V, I <sub>o</sub> = 20A	—	$\pm$ 10
Load Regulation	Reg <sub>load</sub>	V <sub>in</sub> = +3.3V, 0.1 $\leq$ I <sub>o</sub> $\leq$ 20A	—	$\pm$ 10
V <sub>o</sub> Ripple/Noise	V <sub>n</sub>	V <sub>in</sub> = +3.3V, I <sub>o</sub> = 20A	—	50
Transient Response with C <sub>out</sub> = 330 $\mu$ F	$t_{tr}$ V <sub>os</sub>	I <sub>o</sub> step between 10A and 20A V <sub>o</sub> over/undershoot	— —	50 100
Efficiency	$\eta$	V <sub>in</sub> = +3.3V, I <sub>o</sub> = 10A V <sub>in</sub> = +3.3V, I <sub>o</sub> = 20A	V <sub>o</sub> = 1.8V V <sub>o</sub> = 1.5V V <sub>in</sub> = +3.3V, I <sub>o</sub> = 20A V <sub>o</sub> = 1.8V V <sub>o</sub> = 1.5V	85 82 78 74
Switching Frequency	f <sub>o</sub>	3.1V $\leq$ V <sub>in</sub> $\leq$ 3.6V 0.1A $\leq$ I <sub>o</sub> $\leq$ 20A	300	350
Absolute Maximum Operating Temperature Range	T <sub>a</sub>	Over V <sub>in</sub> and I <sub>o</sub> Ranges	-40 <sup>(2)</sup>	— +85 <sup>(3)</sup>
Storage Temperature	T <sub>s</sub>	—	-40	— +125
Mechanical Shock	—	Per Mil-STD-883D, Method 2002.3 1 msec, Half Sine, mounted to a fixture	—	500
Mechanical Vibration	—	Per Mil-STD-883D, Method 2007.2, 20-2000 Hz, Soldered in a PC board	—	10
Weight	—	Vertical/Horizontal	—	31/41
grams				

**Notes:** (1) ISR will operate down to no load with reduced specifications.

(2) For operation below 0°C, C<sub>in</sub> and C<sub>out</sub> must have stable characteristics. Use either low ESR tantalum or Oscon® capacitors.

(3) See Safe Operating Area curves or contact the factory for the appropriate derating.

(4) If the Remote Sense Ground is not used, pin 12 must be connected to pin 13 for optimum output voltage accuracy.

**External Capacitors:** The PT7708 requires a minimum output capacitance of 330 $\mu$ F for proper operation. The PT7708 also requires an input capacitance of 1500 $\mu$ F, which must be rated for a minimum of 1.4Arms of ripple current. For transient or dynamic load applications, additional capacitance may be required. For more information refer to the application note regarding capacitor selection for this product.

**Input Filter:** An input filter inductor is optional for most applications. The inductor must be sized to handle 20ADC with a typical value of 1 $\mu$ H.

# PT7708—3.3V

## 20 Amp Programmable Next Generation "Big Hammer"

### Features

- Single-Device: +3.3V input
- 4-bit Programmable: 1.3V to 2.05V@20A
- High Efficiency
- Differential Remote Sense
- Short-Circuit Protection
- Parallelable with PT7742 20A "Current Booster"

### Programming Information

VID3	VID2	VID1	VID0	V <sub>out</sub>
1	1	1	1	1.30V
1	1	1	0	1.35V
1	1	0	1	1.40V
1	1	0	0	1.45V
1	0	1	1	1.50V
1	0	1	0	1.55V
1	0	0	1	1.60V
1	0	0	0	1.65V
0	1	1	1	1.70V
0	1	1	0	1.75V
0	1	0	1	1.80V
0	1	0	0	1.85V
0	0	1	1	1.90V
0	0	1	0	1.95V
0	0	0	1	2.00V
0	0	0	0	2.05V

Logic 0 = Pin 12 potential (remote sense gnd)

Logic 1 = Open circuit (no pull-up resistors)

VID3 may not be changed while the unit is operating.

### Ordering Information

PT7708□ = 1.3 to 2.05 Volts

(For dimensions and PC board layout, see Package Styles 800 and 810.)

### PT Series Suffix (PT1234X)

#### Case/Pin Configuration

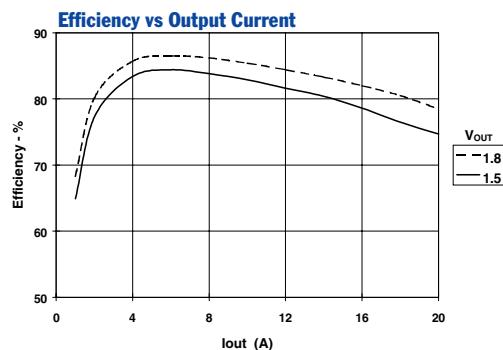
Vertical Through-Hole **N**

Horizontal Through-Hole **A**

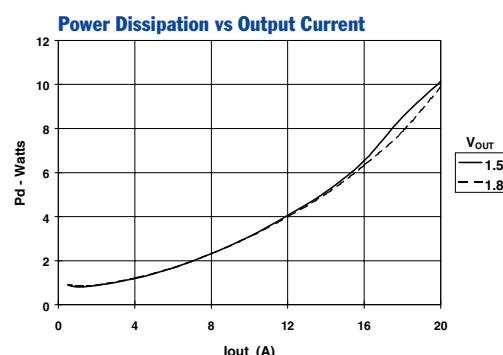
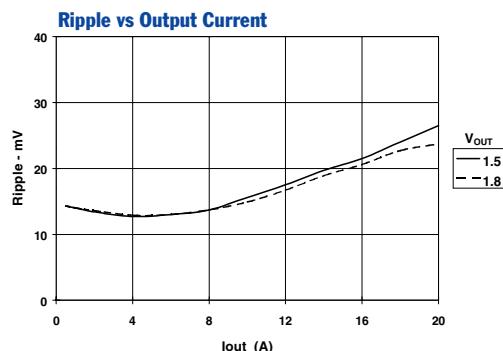
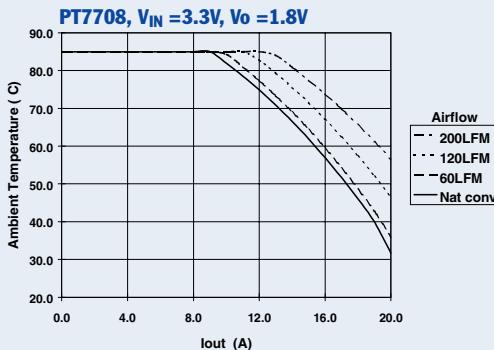
Horizontal Surface Mount **C**

### T Y P I C A L C H A R A C T E R I S T I C S

#### Characteristic Data, V<sub>in</sub> =3.3V (See Note A)



#### Safe Operating Area (See Note B)



**Note A:** All data in the above graphs has been developed from actual products tested at 25°C. The data is considered typical for the ISR

**Note B:** SOA curves represent operating conditions at which internal components are at or below manufacturer's maximum rated operating temperatures.

## Capacitor Recommendations for the PT7708/09 Regulators and PT7742/43 Current Boosters

### Input Capacitors

The recommended input capacitance is determined by 1.4 ampere minimum ripple current rating and 1500 $\mu$ F minimum capacitance. Capacitors listed below must be rated for a minimum of 2x the input voltage with +5V operation. Ripple current and  $\leq$ 100m $\Omega$  Equivalent Series Resistance (ESR) values are the major considerations along with temperature when selecting the proper capacitor.

### Output Capacitors

The minimum required output capacitance is 330 $\mu$ F with a maximum ESR less than or equal to 100m $\Omega$ . Failure to observe this requirement may lead to regulator instability or oscillation. Electrolytic capacitors have poor ripple performance at frequencies greater than 400kHz, but excellent low frequency transient response. Above the ripple frequency ceramic decoupling capacitors are necessary to improve the transient response and reduce any microprocessor high frequency noise components apparent during higher current excursions. Preferred low ESR type capacitor part numbers are identified in the Table 1 below.

**Table 1 Capacitors Characteristic Data**

Capacitor Vendor/ Series	Capacitor Characteristics					Quantity		Vendor Number
	Working Voltage	Value(pF)	(ESR) Equivalent Series Resistance	105°C Maximum Ripple Current(mA)	Physical Size(mm)	Input Bus	Output Bus	
Panasonic FC Surface Mtg FA	16V 35V	2200 330	0.038 $\Omega$ 0.065 $\Omega$	2000mA 1205mA	18x16.5 12.5x16.5	1	1	EEVFC1C222N EEVFC1V331LQ
	10V 16V	680 1800	0.090 $\Omega$ 0.032 $\Omega$	755mA 2000mA	10x12.5 18x15	1	1	EEUFA1A681 EEUFA1C182A
United Chemi-Con LTV Series	25V 16V 16V	330 2200 470	0.084 $\Omega$ 0.038 $\Omega$ 0.084 $\Omega/2=0.042\Omega$	825mA 1630mA 825mA x2	10x16 16x20 10x16	1	1 1 1	LXV25VB331M10X16LL LXV16VB222M16X20LL LXV16VB471M10X16LL
Nichicon PL Series PM Series	10V 10V 25V	680 1800 330	0.090 $\Omega$ 0.044 $\Omega$ 0.095 $\Omega$	770mA 1420mA 750mA	10x15 16x15 10x15	1	1 1 1	UPL1A681MHH6 UPL1A182MHH6 UPL1E331MPH6
Oscon SS SV	10V 10V	330 330	0.025W/4=0.006 $\Omega$ 0.020/4=0.005 $\Omega$	>9800mA >9800mA	10x10.5 10.3x12.6	4 4	N/R (Note)	10SS330M 10SV330M(Sufvace Mtg)
AVX Tantalum TPS- Series	10V 10V	330 330	0.100/5=20 $\Omega$ 0.060 $\Omega$	3500mA 1826mA	7.3Lx 4.3Wx 4.1H	5 5	1 1	TPSV337M010R0100 TPSV337M010R0060
Sprague Tantalum 595D/594D	10V 10V	330 680	0.045W/4=0.011 $\Omega$ 0.090 $\Omega$	>4500mA >1660mA	7.3L x 5.7W x 4.0H	5 2	1 1	594D337X0010R2T Surface Mount 595D687X0010R2T
Kemet Tantalum T510/T495 Series	10V 10V	330 220	0.035 $\Omega$ 0.070 $\Omega/2=0.035\Omega$	2000mA >2000mA	4.3Wx7.3L x4.0H	5 6	1 2	510X337M010AS T495X227M010AS Surface Mount
Sanyo Poscap TPB	10V	220	0.040 $\Omega$	3000mA	7.2L x 4.3W x 3.1H	6	2	10TPB220M Surface Mount

**Note:** (N/R) is not recommended for this application, due to extremely low Equivalent Series Resistance (ESR)

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