

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 μ 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.

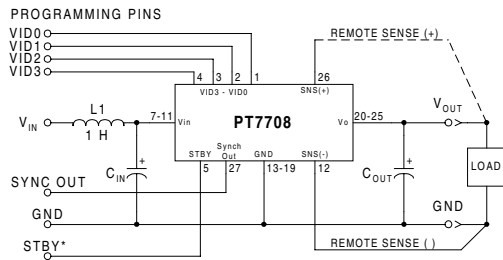
Only 330 μ F of output capacitance are required for proper operation.

Pin-Out Information

Pin Function	Pin Function	Pin Function
1 VID0	10 V_{in}	19 GND
2 VID1	11 V_{in}	20 V_{out}
3 VID2	12 Remote Sense Gnd (4)	21 V_{out}
4 VID3	13 GND	22 V_{out}
5 STBY* - Stand-by	14 GND	23 V_{out}
6 Do Not Connect	15 GND	24 V_{out}
7 V_{in}	16 GND	25 V_{out}
8 V_{in}	17 GND	26 Remote Sense V_{out}
9 V_{in}	18 GND	27 Sync Out

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

Standard Application



C_{in} = Required 1500 μ F electrolytic
 C_{out} = Required 330 μ F electrolytic
 $L1$ = Optional 1 μ H input choke

Specifications

Characteristics ($T_a = 25^\circ\text{C}$ unless noted)	Symbols	Conditions	PT7708 SERIES			Units
			Min	Typ	Max	
Output Current	I_o	$T_a = +60^\circ\text{C}$, 200 LFM, pkg N $T_a = +25^\circ\text{C}$, natural convection	0.1(1) 0.1(1)	—	19 20	A
Input Voltage Range	V_{in}	$0.1\text{A} \leq I_o \leq 20\text{A}$	3.1	—	3.6	V
Output Voltage Tolerance	ΔV_o	$V_{in} = +3.3\text{V}$, $I_o = 20\text{A}$ $0^\circ\text{C} \leq T_a \leq +65^\circ\text{C}$	$V_o - 0.03$	—	$V_o + 0.03$	V
Line Regulation	Reg_{line}	$3.1\text{V} \leq V_{in} \leq 3.6\text{V}$, $I_o = 20\text{A}$	—	± 10	—	mV
Load Regulation	Reg_{load}	$V_{in} = +3.3\text{V}$, $0.1 \leq I_o \leq 20\text{A}$	—	± 10	—	mV
V_o Ripple/Noise	V_n	$V_{in} = +3.3\text{V}$, $I_o = 20\text{A}$	—	50	—	mV
Transient Response with $C_{out} = 330\mu\text{F}$	t_{tr} V_{os}	I_o step between 10A and 20A V_o over/undershoot	—	50	—	μSec
			—	100	—	mV
Efficiency	η	$V_{in} = +3.3\text{V}$, $I_o = 10\text{A}$	$V_o = 1.8\text{V}$	—	85	%
			$V_o = 1.5\text{V}$	—	82	
		$V_{in} = +3.3\text{V}$, $I_o = 20\text{A}$	$V_o = 1.8\text{V}$	—	78	%
			$V_o = 1.5\text{V}$	—	74	
Switching Frequency	f_o	$3.1\text{V} \leq V_{in} \leq 3.6\text{V}$ $0.1\text{A} \leq I_o \leq 20\text{A}$	300	350	400	kHz
Absolute Maximum Operating Temperature Range	T_a	Over V_{in} and I_o Ranges	-40 (2)	—	+85 (3)	$^\circ\text{C}$
Storage Temperature	T_s	—	-40	—	+125	$^\circ\text{C}$
Mechanical Shock		Per Mil-STD-883D, Method 2002.3 1 msec, Half Sine, mounted to a fixture	—	500	—	G's
Mechanical Vibration		Per Mil-STD-883D, Method 2007.2, 20-2000 Hz, Soldered in a PC board	—	10	—	G's
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_{in} and C_{out} 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 μ F for proper operation. The PT7708 also requires an input capacitance of 1500 μ 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 μ 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	Vout
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)

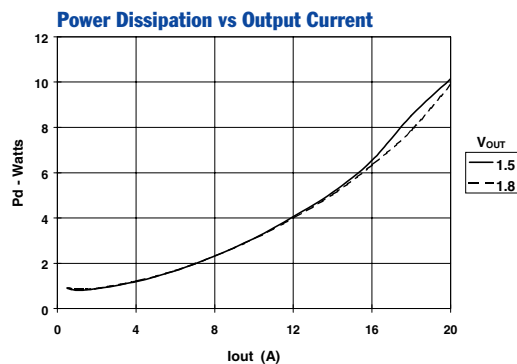
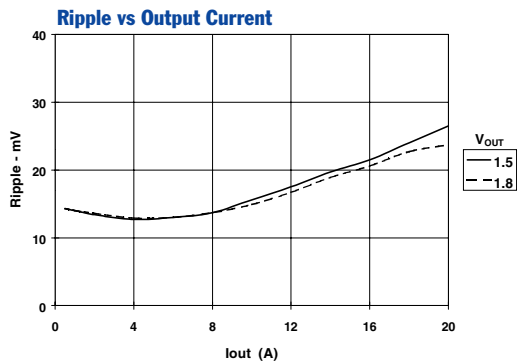
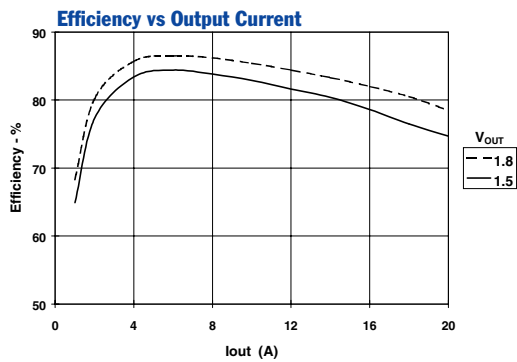
Case/Pin

Configuration

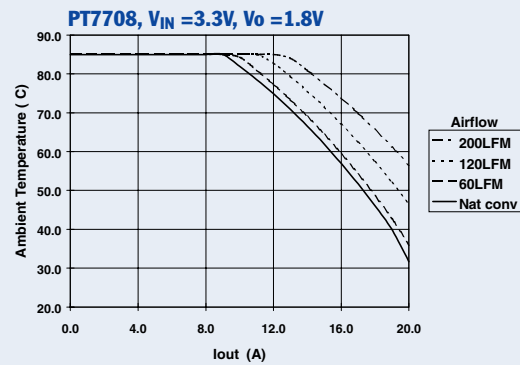
Vertical Through-Hole	N
Horizontal Through-Hole	A
Horizontal Surface Mount	C

TYPICAL CHARACTERISTICS

Characteristic Data, $V_{in} = 3.3V$ (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 1500µF minimum capacitance. Capacitors listed below must be rated for a minimum of 2x the input voltage with +5V operation. Ripple current and $\leq 100\text{m}\Omega$ 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 330µF with a maximum ESR less than or equal to 100mΩ. 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.

Tantalum Characteristics

Tantalum capacitors with a minimum 10V rating are recommended on the output bus, but only the AVX TPS Series, Sprague 594/595 Series, or Kemet T495/T510 Series. The AVX TPS Series, Sprague Series or Kemet Series capacitors are specified over other types due to their higher surge current, excellent power dissipation and ripple current ratings. As an example, the TAJ Series by AVX is not recommended. This series exhibits considerably higher ESR, reduced power dissipation and lower ripple current capability. The TAJ Series is a less reliable compared to the TPS series when determining power dissipation capability.

Capacitor Table

Table 1 identifies the characteristics of capacitors from a number of vendors with acceptable ESR and ripple current (rms) ratings. The suggested minimum quantities per regulator for both the input and output buses are identified.

This is not an extensive capacitor list. The table below is a selection guide for input and output capacitors. Other capacitor vendors are available with comparable RMS ripple current rating and ESR (Equivalent Series Resistance at 100kHz). These critical parameters are necessary to insure both optimum regulator performance and long capacitor life.

Table 1 Capacitors Characteristic Data

Capacitor Vendor/ Series	Capacitor Characteristics					Quantity		Vendor Number
	Working Voltage	Value(µF)	(ESR) Equivalent Series Resistance	105°C Maximum Ripple Current(Irms)	Physical Size(mm)	Input Bus	Output Bus	
Panasonic FC Surface Mtg FA	16V	2200	0.038Ω	2000mA	18x16.5	1	1	EEVFC1C222N EEVFC1V331LQ
	35V	330	0.065Ω	1205mA	12.5x16.5		1	
	10V	680	0.090Ω	755mA	10x12.5		1	EEUFA1A681 EEUFA1C182A
	16V	1800	0.032Ω	2000mA	18x15	1	1	
United Chemi -Con LFBV Series	25V	330	0.084Ω	825mA	10x16	1	1	LXV25VB331M10X16LL LXV16VB222M16X20LL LXV16VB471M10X16LL
	16V	2200	0.038Ω	1630mA	16x20		1	
	16V	470	0.084Ω/2=0.42Ω	825mA x2	10x16		1	
Nichicon PL Series PM Series	10V	680	0.090Ω	770mA	10x15	1	1	UPL1A681MHH6 UPL1A182MHH6 UPL1E331MPH6
	10V	1800	0.044Ω	1420mA	16x15		1	
	25V	330	0.095Ω	750mA	10x15		1	
Oscon SS SV	10V	330	0.025W/4=0.006Ω	>9800mA	10x10.5	4	N/R (Note)	10SS330M 10SV330M(Sufvace Mtg)
	10V	330	0.020/4=0.005Ω	>9800mA	10.3x12.6	4		
AVX Tanatalum TPS- Series	10V	330	0.100/5=20Ω	3500mA	7.3Lx	5	1	TPSV337M010R0100 TPSV337M010R0060
	10V	330	0.060Ω	1826mA	4.3Wx 4.1H	5	1	
Sprague Tantalum 595D/594D	10V	330	0.045W/4=0.011Ω	>4500mA	7.3L x	5	1	594D337X0010R2T Surface Mount 595D687X0010R2T
	10V	680	0.090Ω	>1660mA	5.7W x 4.0H	2	1	
Kemet Tantalum T510/T495 Series	10V	330	0.035Ω	2000mA	4.3Wx7.3L x4.0H	5	1	510X337M010AS
	10V	220	0.070Ω/2=0.035Ω	>2000mA		6	2	T495X227M010AS Surface Mount
Sanyo Poscap TPB	10V	220	0.040Ω	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)

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated