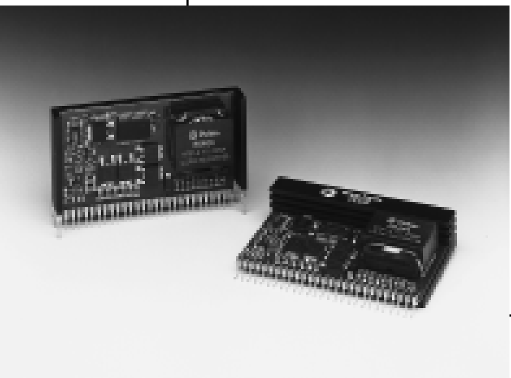
Revised 1/13/99

PT7720 Series

17 AMP 12V INPUT "BIG-HAMMER II" PROGRAMMABLE ISR

Application Notes
Mechanical Outline
Product Selector Guide



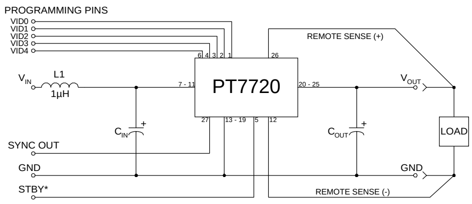
The PT7720 series is a new +12V input, 17A output, high-performance Integrated Switching Regulator (ISR) housed in a 27-pin SIP package. The 17A capability allows easy integration of the latest high-speed, low-voltage µPs and bus drivers into +12V distributed power systems.

The PT7720 series has been designed to work in parallel with one or more of the PT7748 current boosters for increased I_{out} in increments of 17A.

The output voltage of the PT7721 can be easily programmed from 1.3V to 3.5V with a 5 bit input compatible with Intel's Pentium® II Processor. A differential remote sense is also provided which automatically compensates for any voltage drop from the ISR to the load.

1200µF of output capacitance is required for proper operation.

Standard Application



C_{in} = Required 560µF electrolytic (See input filter note)
C_{out} = Required 1200µF electrolytic
L1 = Optional 1µH input choke

Pin-Out Information

Pin	Function	Pin	Function
1	VID0	15	GND
2	VID1	16	GND
3	VID2	17	GND
4	VID3	18	GND
5	STBY* - Stand-by	19	GND
6	VID4	20	V_{out}
7	V_{in}	21	V_{out}
8	V_{in}	22	V_{out}
9	V_{in}	23	V_{out}
10	V_{in}	24	V_{out}
11	V_{in}	25	V_{out}
12	Remote Sense Gnd	26	Remote Sense V_{out}
13	GND	27	Sync Out
14	GND		

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

Features

- +12V bus input
- 5-bit Programmable: 1.3V to 3.5V or 4.5V to 7.6V
- High Efficiency
- Differential Remote Sense
- 27-pin SIP Package
- Parallelable with PT7748 17A current boosters

Specifications

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT7720 SERIES Min	Typ	Max	Units
Output Current	I_o	T_a = +60°C, 200 LFM, pkg N, $V_o \le 5V$ T_a = +25°C, natural convection, $V_o \le 5V$	0.1* 0.1*	— —	17** 17**	A A
Output Power	P_o	T_a = +60°C, 200 LFM, pkg N, $V_o \ge 5V$ T_a = +25°C, natural convection, $V_o \ge 5V$	— —	— —	85 85	Watts Watts
Input Voltage Range	V_{in}	$0.1A \le I_o \le 17A$	11.0	—	14.0	V
Output Voltage Tolerance	ΔV_o	V_{in} = +12V, I_o = 17A (PT7721) $0°C \le T_a \le +60°C$ (PT7722)	Vo-0.03 —	— ±1.0%	Vo+0.03 ±2.0%	V % Vo
Line Regulation	Reg_{line}	$11V \le V_{in} \le 14V$, I_o = 17A (Using remote sense)	—	±5	±10	mV
Load Regulation	Reg_{load}	V_{in} = +12V, $0.1 \le I_o \le 17A$ (Using remote sense)	—	±5	±10	mV
V_o Ripple/Noise	V_n	V_{in} = +12V, I_o = 17A (PT7721) (PT7722)	— —	50 100	— —	mVpp mVpp
Transient Response with C_{out} = 1200µF	t_{tr} V_{os}	I_o step between 7.5A and 15A V_o over/undershoot	— —	100 200	— —	µSec mV
Efficiency	η	V_{in} = +12V, I_o = 10A V_o = 5.0V V_o = 3.3V V_o = 2.5V V_o = 1.5V	— — — —	90 88 85 78	— — — —	% % % %
Switching Frequency	f_o	$11V \le V_{in} \le 14V$ $0.1A \le I_o \le 17A$	300	350	400	kHz
Absolute Maximum Operating Temperature Range	T_a	—	0	—	+85	°C
Recommended Operating Temperature Range	T_a	Forced Air Flow = 200 LFM At V_{in} = 12V, I_o = 12A	0	—	+65***	°C
Storage Temperature	T_s	—	-40	—	+125	°C
Mechanical Shock		Per Mil-STD-883D, Method 2002.3 , 1 msec, Half Sine, mounted to a fixture	—	TBD	—	G's
Mechanical Vibration		Per Mil-STD-883D, Method 2007.2, 20-2000 Hz, Soldered in a PC board	—	TBD	—	G's
Weight	—	Vertical/Horizontal	—	51/64	—	grams

* ISR-will operate down to no load with reduced specifications. Please note that this product is not short-circuit protected.
** The PT7720 series can be easily paralleled with one or more of the PT7748 Current Boosters to provide increased output current in increments of 17A.
*** See Safe Operating Area chart.

Output Capacitors: *The PT7720 series requires a minimum output capacitance of 1200µF for proper operation. Do not use Oscon type capacitors. The maximum allowable output capacitance Is (57,000 ÷ Vout)µF, or 15,000µF, whichever is less.*

Input Filter: *An input inductor is optional for most applications. The input inductor must be sized to handle 7ADC with a typical value of 1µH. The input capacitance must be rated for a minimum of 4.0 Arms of ripple current when operated at maximum output current and maximum output voltage. Contact an applications engineer for input capacitor selection for applications at other output voltages and output currents.*

Power Trends, Inc. 27715 Diehl Road, Warrenville, IL 60555 **(800) 531-5782** Fax: (630) 393-6902 **http://www.powertrends.com**

Programming Information

				PT7721		PT7722	
				VID4=1	VID4=0	VID4=1	VID4=0
VID3	VID2	VID1	VID0	Vout	Vout	Vout	Vout
1	1	1	1	2.0V	1.30V	4.5V	6.1V
1	1	1	0	2.1V	1.35V	4.6V	6.2V
1	1	0	1	2.2V	1.40V	4.7V	6.3V
1	1	0	0	2.3V	1.45V	4.8V	6.4V
1	0	1	1	2.4V	1.50V	4.9V	6.5V
1	0	1	0	2.5V	1.55V	5.0V	6.6V
1	0	0	1	2.6V	1.60V	5.1V	6.7V
1	0	0	0	2.7V	1.65V	5.2V	6.8V
0	1	1	1	2.8V	1.70V	5.3V	6.9V
0	1	1	0	2.9V	1.75V	5.4V	7.0V
0	1	0	1	3.0V	1.80V	5.5V	7.1V
0	1	0	0	3.1V	1.85V	5.6V	7.2V
0	0	1	1	3.2V	1.90V	5.7V	7.3V
0	0	1	0	3.3V	1.95V	5.8V	7.4V
0	0	0	1	3.4V	2.00V	5.9V	7.5V
0	0	0	0	3.5V	2.05V	6.0V	7.6V

Logic 0 = Pin 12 potential (remote sense gnd)
Logic 1 = Open circuit (no pull-up resistors)
VID3 and VID4 may not be changed while the unit is operating.

Ordering Information

PT7721❑ = 1.3 to 3.5 Volts
PT7722❑ = 4.5 to 7.6 Volts

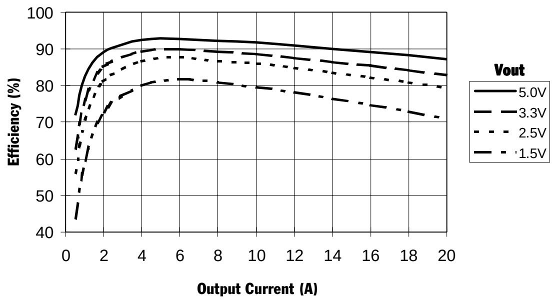
(For dimensions and PC board layout, see Package Styles 1000 and 1010.)

PT Series Suffix (PT1234X)

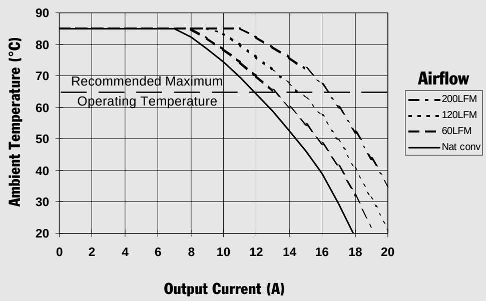
Case/Pin Configuration	
Vertical Through-Hole	N
Horizontal Through-Hole	A
Horizontal Surface Mount	C

CHARACTERISTIC DATA

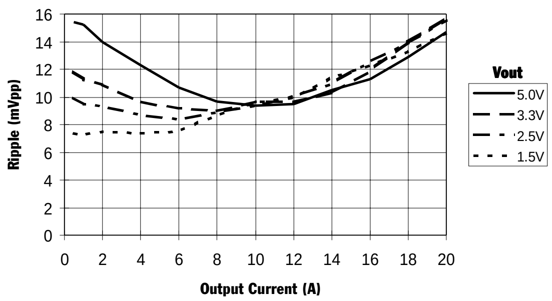
Efficiency vs Output Current (@V_{in}=+12V)



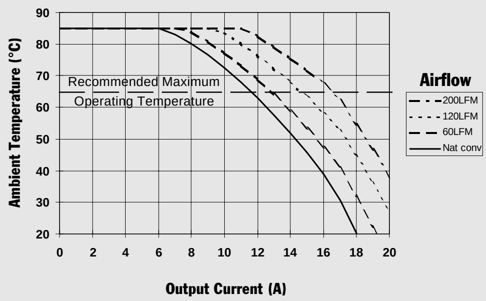
Safe Operating Area (@V_{in}=+12V, V_{out}=+3.3V, Pkg N)



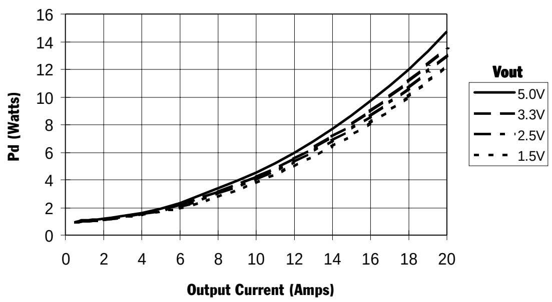
Output Ripple vs Output Current (@V_{in}=+12V)



Safe Operating Area (@V_{in}=+12V, V_{out}=+5.0V, Pkg N)



Power Dissipation vs Output Current (@V_{in}=+12V)



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

Pin-Coded Output Voltage Adjustment on the "Big Hammer II" Series ISRs

Power Trends PT7720 series ISRs incorporate pin-coded voltage control to adjust the ouput voltage. The control pins are identified VID0 - VID4 (pins 1, 2, 3, 4, & 6) respectively. When the control pins are left open-circuit, the ISR output will regulate at its factory trimmed output voltage. Each pin is internally connected to a precision resistor, which when grounded changes the output voltage by a set amount. By selectively grounding VID0 -VID4, the output voltage of each ISR in the PT7720 series ISRs can be programmed in incremental steps over its specified output voltage range. The output voltage ranges offered by these regulators provide a convenient method of output voltage selection for many applications. In addition, the program code and output voltage range of the PT7721 model ISR is compatible with the voltage ID specification defined by Intel Corporation for voltage regulator modules (VRMs) used to power Pentium® microprocessors. Refer to Figure 1 below for the connection schematic, and the PT7720 Data Sheet for the appropriate programming code information.

Notes:

1. The programming convention is as follows:-

   Logic 0: Connect to pin12 (Remote Sense Ground).
   Logic 1: Open circuit/open drain (See notes 2, & 4)

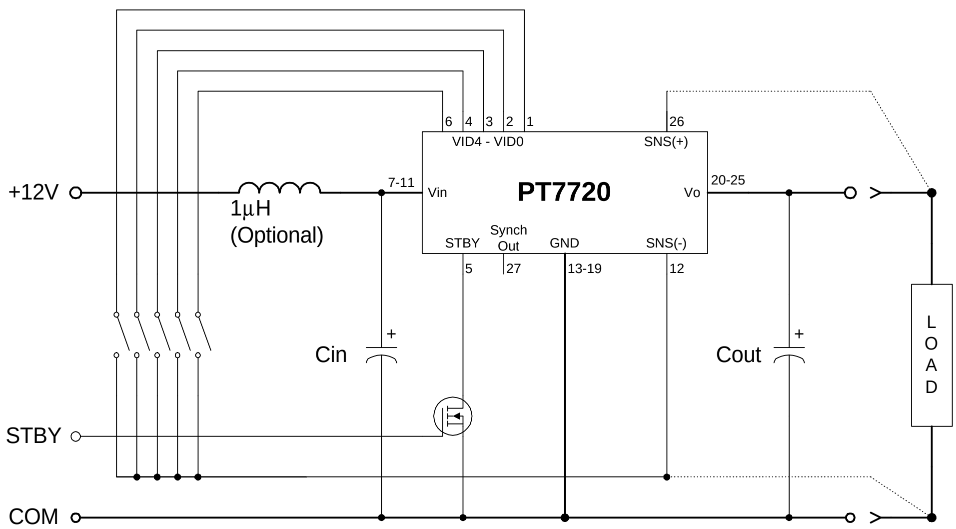
2. Do not connect pull-up resistors to the voltage programming pins.

3. To minimize output voltage error, always use pin 12 (Remote Sense Ground) as the logic "0" reference. While the regular ground (pins 13-19) can also be used for programming, doing so will degrade the load reglation of the product.

4. If active devices are used to ground the voltage control pins, low-level open drain MOSFET devices should be used over bipolar transistors. The inherent V_{ce}(sat) in bipolar devices introduces errors in the device's internal divider network. Discrete transistors such as the BSS138, 2N7002, IRLML2402, or the 74C906 hex open-drain buffer are examples of appropriate devices.

Active Voltage Programming:
Special precautions should be taken when making changes to the voltage control progam code while the unit is powered. It is highly recommended that the ISR be either powered down or held in standby. Changes made to the program code while V_{out} is enabled induces high current transients through the device. This is the result of the electrolytic output capacitors being either charged or discharged to the new output voltage set-point. The transient current can be minimized by making only incremental changes to the binary code, i.e. one LSB at a time. A minimum of 100µs settling time between each program state is also recommended. Making non-incremental changes to VID3 and VID4 with the output enabled is discouraged. If they are changed, the transients induced can overstress the device resulting in a permanent drop in efficiency. If the use of active devices prevents the program code being asserted prior to power-up, pull pin 5 (STBY) to the device GND during the period that the input voltage is applied to V_{in}. Releasing pin 5 will then allow the device output to execute a soft-start power-up to the programmed voltage.

Figure 1



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