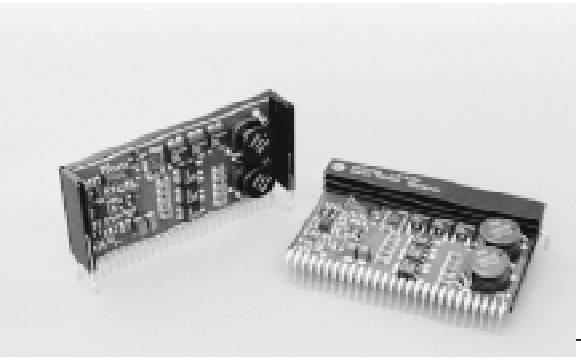


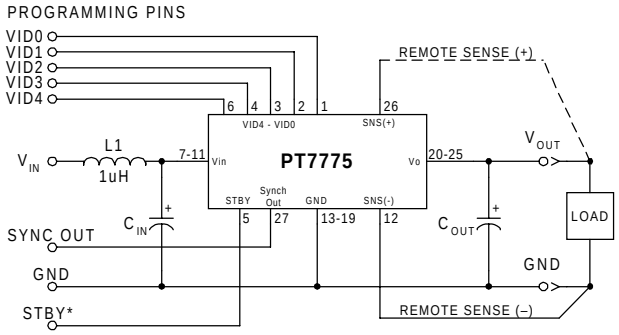
Description

The PT7775 is a high-output, 32A Integrated Switching Regulator (ISR), housed in a 27-pin SIP package. The PT7775 is a low voltage version of the PT7779, a next generation "Sledge Hammer" ISR. These regulators include short circuit protection and require only 330µF of output capacitance.

The low-output voltage and 32A load capability makes the PT7775 an ideal source for powering the industry's latest high-speed, low-voltage µPs, ASICs, and DSPs from an existing 5V source. The output voltage is programmable from 0.8V to 3.1V, via a 5-bit input.

The PT7775 will operate with up to two PT7741 32A current boosters. A differential remote sense provides compensation for voltage drop between the ISR and load.

Standard Application



C_{in} = Required 2400µF electrolytic
C_{out} = Required 330µF electrolytic
L1 = Optional 1µH input choke

Pin-Out Information

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

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

Specifications

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT7775 Min	PT7775 Typ	PT7775 Max	Units
Output Current	I_o	T_a = +60°C, 200 LFM, pkg N T_a = +25°C, natural convection	0.1 (1) 0.1 (1)	— —	32 31	A
Input Voltage Range	V_{in}	0.1A ≤ I_o ≤ 32A	4.5	—	5.5	V
Output Voltage Tolerance	ΔV_o	V_{in} = +5V, I_o = 32A –40°C ≤ T_a ≤ +85°C	V_o-0.03	—	V_o+0.03	V
Line Regulation	Reg_{line}	4.5V ≤ V_{in} ≤ 5.5V, I_o = 32A	—	±10	—	mV
Load Regulation	Reg_{load}	V_{in} = +5V, 0.1 ≤ I_o ≤ 32A	—	±10	—	mV
V_o Ripple/Noise pk-pk	V_n	V_{in} = +5V, I_o = 32A	—	50	—	mV
Transient Response with C_{out} = 330µF	t_{tr} V_{os}	I_o step between 16A and 32A V_o over/undershoot	— —	100 200	— —	µSec mV
Efficiency	η	V_{in} = +5V, I_o = 20A, V_o = 3.3V	—	90	—	%
Switching Frequency	f_o	4.5V ≤ V_{in} ≤ 5.5V 0.1A ≤ I_o ≤ 32A	300	350	400	kHz
Absolute Maximum Operating Temperature Range	T_a	Over V_{in} Range	–40	—	+85 (2)	°C
Storage Temperature	T_s	—	-40	—	+125	°C
Mechanical Vibration		Per Mil-STD-883D, Method 2007.2, 20-20,000Hz, Soldered in a PC board	—	10/15	—	G's
Weight	—	Vertical/Horizontal	—	53/66	—	grams

Notes: *(1) ISR-will operate down to no load with reduced specifications.*
(2) See SOA curves or consult the factory for the appropriate derating.
(3) If the remote sense ground is not used, pin 12 must be connected to pin13 for optimum output voltage accuracy.

External Capacitors: *The PT7775 requires a minimum output capacitance of 330µF (ESR ≤0.1Ω) for proper operation. The PT7775 also requires an input capacitance of 2400µF, which must be rated for a minimum of 2.0Arms ripple current. For transient or dynamic load applications, additional capacitance may be required. For further information, see the accompanying capacitor application note for this product.*

Input Filter: *An input filter choke is optional for most applications. The input inductor must be sized to handle 32ADC with a typical value of 1µH.*

PT7775—5V

32 Amp 0.8V to 3.1V Programmable Integrated Switching Regulator

Features

- +5V input
- 32A Output (64A with PT7741)
- 5-bit Programmable: 0.8V to 3.1V
- 90% Efficiency
- Short Circuit Protection
- Differential Remote Sense
- 27-pin SIP Package
- Compatible with PT7741 "Current Booster"

Programming Information

VID3	VID2	VID1	VID0	VID4=1 Vout	VID4=0 Vout
1	1	1	1	1.6V	0.80V
1	1	1	0	1.7V	0.85V
1	1	0	1	1.8V	0.90V
1	1	0	0	1.9V	0.95V
1	0	1	1	2.0V	1.00V
1	0	1	0	2.1V	1.05V
1	0	0	1	2.2V	1.10V
1	0	0	0	2.3V	1.15V
0	1	1	1	2.4V	1.20V
0	1	1	0	2.5V	1.25V
0	1	0	1	2.6V	1.30V
0	1	0	0	2.7V	1.35V
0	0	1	1	2.8V	1.40V
0	0	1	0	2.9V	1.45V
0	0	0	1	3.0V	1.50V
0	0	0	0	3.1V	1.55V

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

PT7775❑ = 0.8 to 3.1 Volts

For dimensions and PC board layout, see Package Style 1020 and 1030

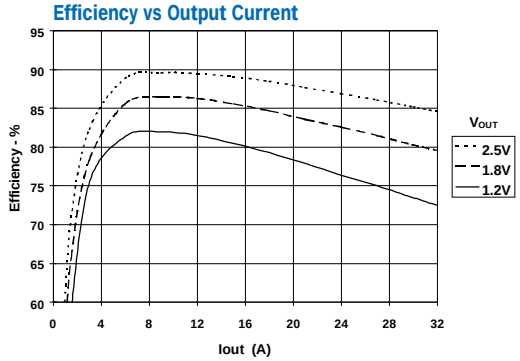
PT Series Suffix (PT1234X)

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

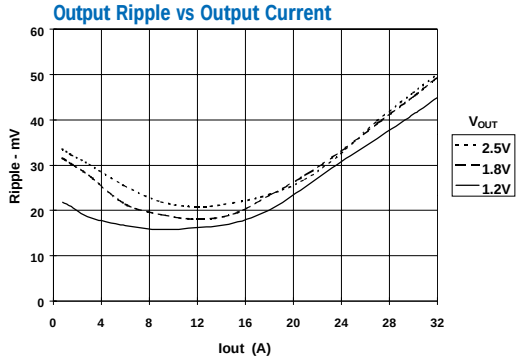
TYPICAL CHARACTERISTICS

Performance Characteristics, V_{IN} =5.0V (See Note A)

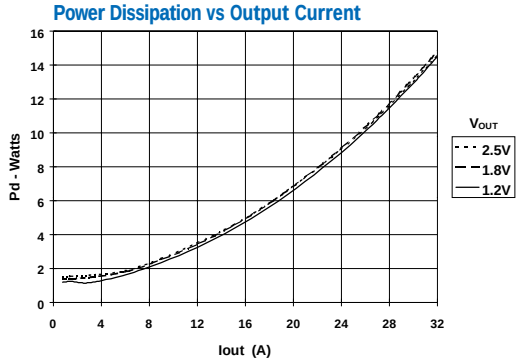
Efficiency vs Output Current



Output Ripple vs Output Current

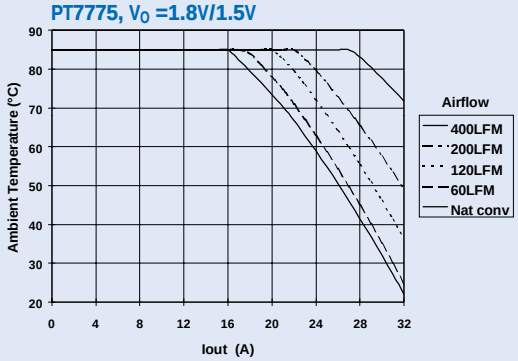


Power Dissipation vs Output Current

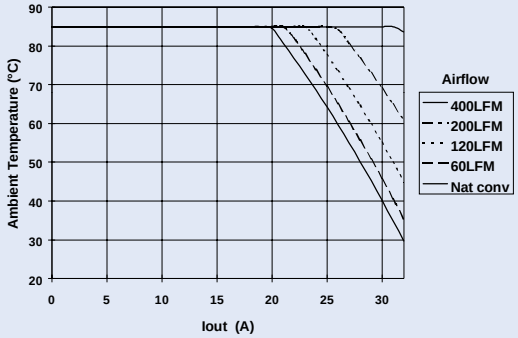


Safe Operating Area, V_{IN} =5.0V (See Note B)

PT7775, V_O =1.8V/1.5V



PT7775, V_O =1.2V



Note A: *Characteristic data has been developed from actual products tested at 25°C. This data is considered typical for the regulator.*
Note B: *Safe Operating Area curves represent conditions at which internal components are at or below manufacturer's maximum operating temperatures.*

Capacitor Recommendations for the PT7775/8/9 Regulators and PT7740/1 Current Boosters

Input Capacitors

The recommended input capacitance is determined by 2.0 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 ≤100mΩ 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		
	Working Voltage	Value(µF)	(ESR) Equivalent Series Resistance	105°C Maximum Ripple Current(Irms)	Physical Size(mm)	Input Bus	Output Bus	Vendor Number
Panasonic FC Surface Mtg FA Radial	16V 35V 10V 16V	3300 330 680 1200	0.028Ω 0.065Ω 0.090Ω 0.038Ω	2490mA 1205mA 755mA 1690mA	18x21.5 12.5x16.5 10x12.5 16x15	1 2	1 1 1 1	EEVFC1C333N EEVFC1V331LQ EEUFA1A681 EEUFA1C122S
United Chemi -Con LFVSeries	25V 16V 16V	330 2200 470	0.084Ω 0.038Ω 0.084Ω	825mA 1630mA 825mA	10x16 16x20 10x16	 2 	1 1 1	LXV25VB331M10X16LL LXV16VB222M16X20LL LXV16VB471M10X16LL
Nichicon PL Series PM Series	10V 10V 25V	680 2700 330	0.085Ω 0.035Ω 0.095Ω	795mA 1740mA 750mA	10x15 16x20 10x15	 2 	1 1 1	UPL1A681MPH6 UPL1A272MHH6 UPL1E331MPH6
Oscon SS SV	10V 10V	330 330	0.025Ω/7=0.006Ω 0.020Ω/7=0.005Ω	>9800mA >9800mA	10x10.5 10.3x12.6	7 7	N/R (Note)	10SS330M 10SV330M(Sufvace Mtg
AVX Tanatalum TPS- Series	10V 10V	330 330	0.100/7=15Ω 0.060/7Ω	3500mA 1826mA	7.3Lx 4.3Wx 4.1H	7 7	1 1	TPSV337M010R0100 TPSV337M010R0060
Sprague Tantalum 595D/594D	10V 10V	330 680	0.045W/7=0.011Ω 0.090Ω/4	>4500mA >1660mA	7.3L x 5.7W x 4.0H	7 4	1 1	594D337X0010R2T Surface Mount 595D687X0010R2T
Kemet Tantalum T510/T495 Series	10V 10V	330 220	0.035Ω/5=0.007Ω 0.070Ω/2=0.035Ω	2000mA >2000mA	4.3Wx7.3L x4.0H	7 	1 2	T510X337M010AS T495X227M010AS Surface Mount
Sanyo Poscap TPB	10V	220	0.040Ω	3000mA	7.2L x 4.3W x 3.1H		2	10TPB220M Surface Mount

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

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

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

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.