

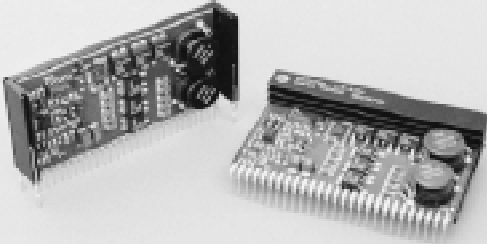
### Description

The PT7778 is a high-output 32A Integrated Switching Regulator (ISR), housed in a 27-pin SIP package. The PT7778 is the 3.3V-input bus version of the PT7779. It includes short circuit protection and requires only 330 $\mu$ F of output capacitance for proper operation.

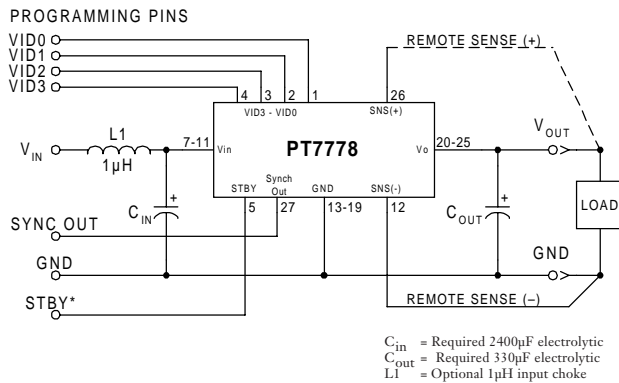
The output voltage of the PT7778 is programmable from 1.3V to 2.05V using a 4-bit input, which is compati-

ble with Intel's Pentium®II Processors. The 32A capability provides the ideal power source for the industry's latest high-speed, low-voltage  $\mu$ Ps, DSPs, and custom VLSI devices. For additional current, the PT7778 may be paralleled with up to two PT7740 32A current boosters.

A differential remote sense is provided to compensate for voltage drop between the ISR and load.



### Standard Application



### 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	N/C	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 (3)	26	Remote Sense $V_{out}$
13	GND	27	Sync Out
14	GND		

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

### Specifications

Characteristics ( $T_a = 25^\circ\text{C}$ unless noted)	Symbols	Conditions	PT7778			
			Min	Typ	Max	Units
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)	—	32 31	A
Input Voltage Range	$V_{in}$	$0.1\text{A} \leq I_o \leq 32\text{A}$	3.1	—	3.6	V
Output Voltage Tolerance	$\Delta V_o$	$V_{in} = +3.3\text{V}$ , $I_o = 32\text{A}$ $-40^\circ\text{C} \leq T_a \leq +85^\circ\text{C}$	$V_o - 0.03$	—	$V_o + 0.03$	V
Line Regulation	$\text{Reg}_{line}$	$3.1\text{V} \leq V_{in} \leq 3.6\text{V}$ , $I_o = 32\text{A}$	—	$\pm 10$	—	mV
Load Regulation	$\text{Reg}_{load}$	$V_{in} = +3.3\text{V}$ , $0.1 \leq I_o \leq 32\text{A}$	—	$\pm 10$	—	mV
$V_o$ Ripple/Noise pk-pk	$V_n$	$V_{in} = +3.3\text{V}$ , $I_o = 32\text{A}$	—	50	—	mV
Transient Response with $C_{out} = 330\mu\text{F}$	$t_{rr}$	$I_o$ step between 16A and 32A	—	100	—	$\mu\text{Sec}$
	$V_{os}$	$V_o$ over/undershoot	—	200	—	mV
Efficiency	$\eta$	$V_{in} = +3.3\text{V}$ , $I_o = 20\text{A}$ , $V_o = 1.8\text{V}$	—	90	—	%
Switching Frequency	$f_o$	$3.1\text{V} \leq V_{in} \leq 3.6\text{V}$ $0.1\text{A} \leq I_o \leq 32\text{A}$	300	350	400	kHz
Absolute Maximum Operating Temperature Range	$T_a$	Over $V_{in}$ Range	-40	—	+85 (2)	$^\circ\text{C}$
Storage Temperature	$T_s$	—	-40	—	+125	$^\circ\text{C}$
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) Consult the Safe Operating Area curves, or contact the factory for the appropriate derating.  
 (3) If the remote sense ground is not used, pin 12 must be connected to pin 13 for optimum output voltage accuracy.

**External Capacitors:** The PT7778 requires a minimum output capacitance of 330 $\mu$ F for proper operation. The PT7778 also requires an input capacitance of 2400 $\mu$ F, which must be rated for a minimum of 2.0Arms of ripple current. For transient or dynamic load applications, additional capacitance may be required. For further information, see the accompanying application note on capacitor selection for this product.

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

# PT7778—3.3V

## 32 Amp Programmable Integrated Switching Regulator

### Features

- +3.3V Input
- 32A Output (64A with PT7740 Booster)
- 4-bit Programmable: 1.3V to 2.05V
- High Efficiency
- Short Circuit Protection
- Differential Remote Sense
- 27-pin SIP Package

### 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

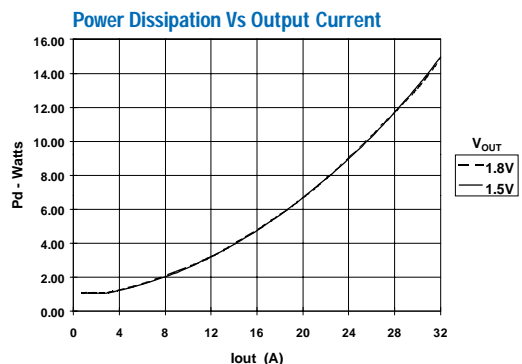
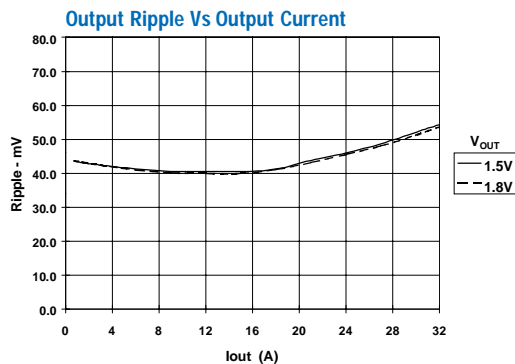
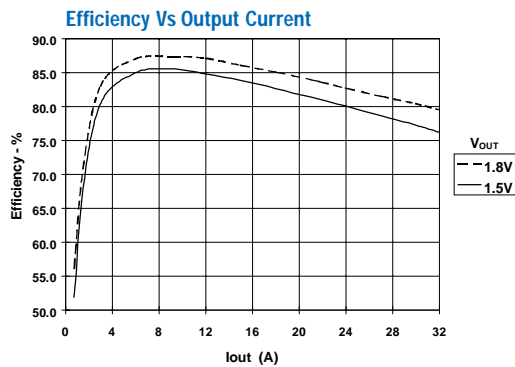
**PT7778□** = 1.3 to 3.5 Volts  
 For dimensions and PC board layout, see Package Style 1020 and 1030

### PT Series Suffix (PT1234X)

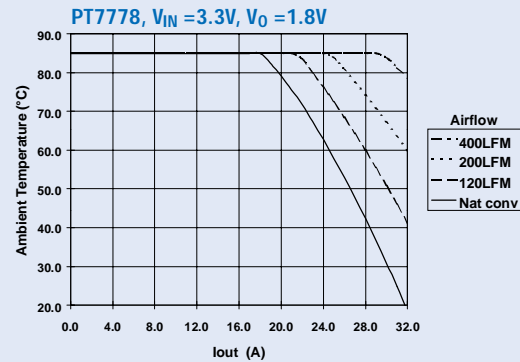
Case/Pin Configuration	
Vertical Through-Hole	<b>N</b>
Horizontal Through-Hole	<b>A</b>
Horizontal Surface Mount	<b>C</b>

## TYPICAL CHARACTERISTICS

### Performance Characteristics, V<sub>in</sub> = 3.3V (See Note A)



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



**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 rated operating temperatures.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
PT7778C	NRND	SIP MOD ULE	EJC	27		TBD	Call TI	Call TI

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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