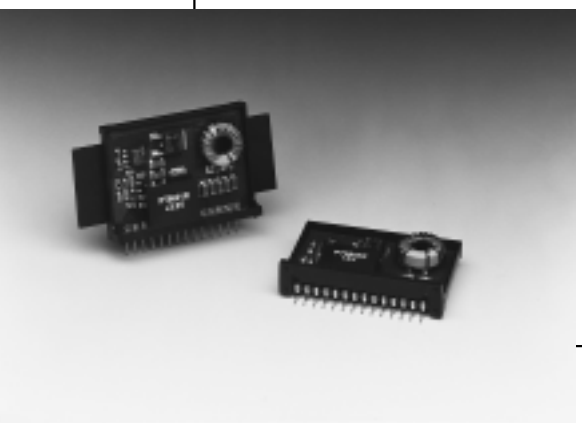
PT6600 Series

9 AMP ADJUSTABLE INTEGRATED SWITCHING REGULATOR

Application Notes
Mechanical Outline
Product Selector Guide

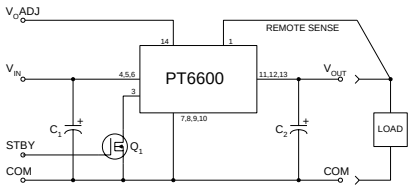


- Single Device 9A Output
- Input Voltage Range: 3.1V to 6.0V
- Adjustable Output Voltage
- 90% Efficiency
- Remote Sense Capability
- Standby Function
- Over-Temperature Protection

The PT6600 series is a new addition to the Power Trends' high performance family of 14-Pin SIP (Single In-line Package) Integrated Switching Regulators (ISRs), designed for stand alone operation in applications requiring as much as 9A of output current (10A with a side heat tab).

Only two external capacitors are required for proper operation. Please note that this product does not include short circuit protection.

Standard Application



C_1 = Required 330µF electrolytic
C_2 = Required 330µF electrolytic
Q_1 = NFET-or Open Collector Gate

Pin-Out Information

Pin	Function
1	Remote Sense
2	Do not connect
3	STBY*-Standby
4	V_{in}
5	V_{in}
6	V_{in}
7	GND
8	GND
9	GND
10	GND
11	V_{out}
12	V_{out}
13	V_{out}
14	V_{out} Adjust

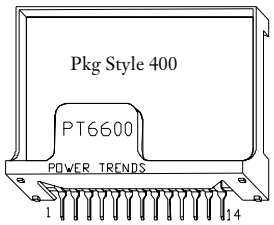
Ordering Information

PT6601☐ = +3.3 Volts
†**PT6602☐** = +1.5 Volts
PT6603☐ = +2.5 Volts
PT6604☐ = +3.6 Volts
†**PT6605☐** = +1.2 Volts
†**PT6606☐** = +1.8 Volts

†3.3V Input Bus Capable

PT Series Suffix (PT1234X)

Case/Pin Configuration	*Heat Spreader*	*Heat Spreader with Side Tabs*
Vertical Through-Hole	**P**	**R**
Horizontal Through-Hole	**D**	**G**
Horizontal Surface Mount	**E**	**B**



Note: Back surface of product is conducting metal.

Specifications

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions		PT6600 SERIES Min	Typ	Max	Units
Output Current	I_o	T_a = 60°C, 200 LFM, pkg P		0.1*	—	9.0**	A
		T_a = 25°C, natural convection		0.1*	—	7.0**	A
Input Voltage Range	V_{in}	0.1A ≤ I_o ≤ 8.0A	V_o= +2.5/3.3V	4.5	—	6.0	V
			V_o= +1.5V	3.1	—	6.0	
			V_o= +3.6V	4.8	—	6.0	
Output Voltage Tolerance	ΔV_o	V_{in} = +5V, I_o = 8.0A T_a = 0°C to 65°C		V_o-0.1	—	V_o+0.1	V
Output Voltage Adjust Range	V_{oadj}	Pin 14 to V_o or ground	V_o= +3.3V	2.25	—	4.20	V
		V_{in}min=+3.1V or V_o+1.2V	V_o= +1.5V	1.27	—	2.65	
		(whichever is greater)	V_o= +2.5V	1.80	—	3.50	
			V_o= +3.6V	2.50	—	4.30	
Line Regulation	Reg_{line}	4.5V ≤ V_{in} ≤ 6.0V, I_o = 8.0A	V_o= +3.3V	—	±7	±17	mV
		3.1V ≤ V_{in} ≤ 6.0V, I_o = 8.0A	V_o= +1.5V	—	±3	±8	
		4.5V ≤ V_{in} ≤ 6.0V, I_o = 8.0A	V_o= +2.5V	—	±7	±13	
Load Regulation	Reg_{load}	V_{in} = +5V, 0.1 ≤ I_o ≤ 8.0A	V_o= +3.3V	—	±17	±33	mV
			V_o= +1.5V	—	±12	±23	
			V_o= +2.5V	—	±13	±25	
V_o Ripple/Noise	V_n	V_{in} = 5V, I_o = 8.0A		—	50	—	mVpp
Transient Response	t_{tr}	I_o step between 4.0A and 8.0A		—	100	—	µSec
with C_2 = 330µF	V_{os}	V_o over/undershoot		—	150	—	mV
Efficiency	η	V_{in} = +5V, I_o = 3.0A	V_o = +3.3/3.6V	—	90	—	%
			V_o = +1.5V	—	76	—	%
			V_o = +2.5V	—	85	—	%
		V_{in} = +5V, I_o = 8.0A	V_o = +3.3/3.6V	—	83	—	%
			V_o = +1.5V	—	68	—	%
			V_o = +2.5V	—	76	—	%

* ISR will operate down to no load with reduced specifications.

** See SOA curves

Note: *The PT6600 Series requires two 330µF electrolytic capacitors (input and output) for proper operation in all applications. See PT6000/7000 Series Capacitor application note.*

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Specifications (continued)

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT6600 SERIES Min	Typ	Max	Units
Switching Frequency	f_o	3.1V ≤ V_{in} ≤ 6.0V 0.1A ≤ I_o ≤ 8.0A	475	600	725	kHz
Absolute Maximum Operating Temperature Range	T_a		0	—	+85	°C
Recommended Operating Temperature Range	T_a	Free Air Convection (40-60 LFM) Over V_{in} and I_o ranges with heat tab	0	—	65**	°C
Thermal Resistance	θ_{ja}	Free Air Convection (40-60 LFM)	—	25	—	°C/W
Storage Temperature	T_s	—	-40	—	+125	°C
Mechanical Shock	—	Per Mil-STD-883D, Method 2002.3	—	500	—	G's
Mechanical Vibration	—	Per Mil-STD-883D, Method 2007.2, 20-2000 Hz, soldered in a PC board	—	7.5	—	G's
Weight	—	—	—	14	—	grams

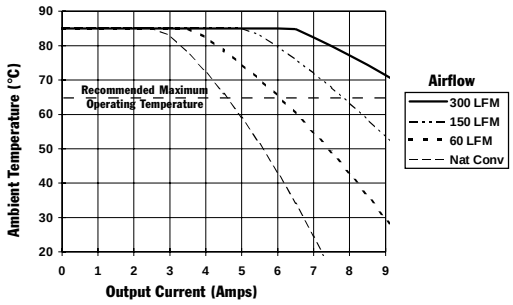
** See SOA curves

Note: *The PT6600 Series requires two 330µF electrolytic capacitors (input and output) for proper operation in all applications.*

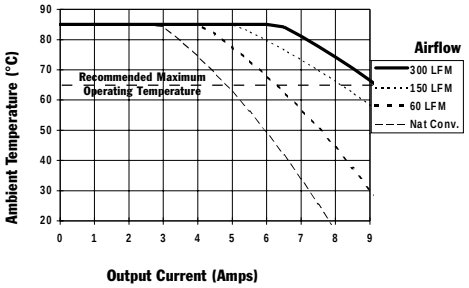
CHARACTERISTIC DATA

Safe Operating Area Curves (@ V_{in}=+5.0V) (See Note 2)

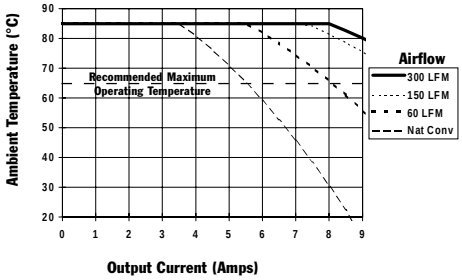
PT6601P (Vertical)



PT6601D (Horizontal)



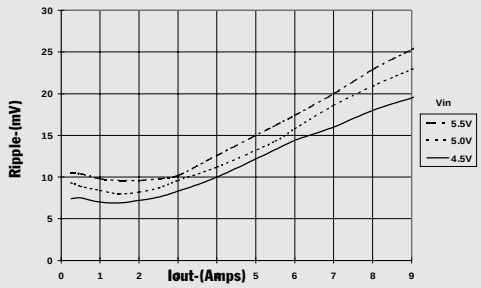
PT6601R (Vertical with Side Tab)



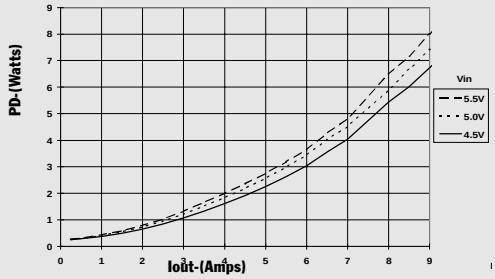
PT6601, 3.3 VDC (See Note 1)

Efficiency vs Output Current

Ripple vs Output Current



Power Dissipation vs Output Current



Note 1: *All data listed in the above graphs has been developed from actual products tested at 25°C. This data is considered typical data for the ISR.*
Note 2: *SOA curves represent operating conditions at which internal components are at or below manufacturer's maximum rated operating temperatures.*

Adjusting the Output Voltage of the PT6500 and PT6600 5V Bus Converters

The output voltage of the Power Trends PT6500/PT6600 Series ISRs may be adjusted higher or lower than the factory trimmed pre-set voltage with the addition of a single external resistor. Table 1 accordingly gives the allowable adjustment range for each model in the series as V_a (min) and V_a (max).

Adjust Up: An increase in the output voltage is obtained by adding a resistor R2, between pin 14 (V_o adjust) and pins 7-10 (GND).

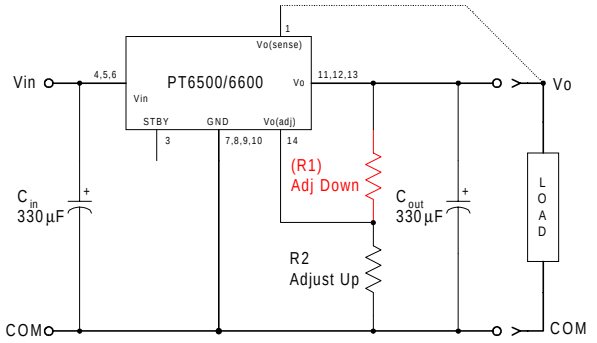
Adjust Down: Add a resistor (R1), between pin 14 (V_o adjust) and pins 11-13 (V_{out}).

Refer to Figure 1 and Table 2 for both the placement and value of the required resistor, either (R1) or R2 as appropriate.

Notes:

1. Use only a single 1% resistor in either the (R1) or R2 location. Place the resistor as close to the ISR as possible.
2. Never connect capacitors from V_o adjust to either GND, V_{out}, or the Remote Sense pin. Any capacitance added to the V_o adjust pin will affect the stability of the ISR.
3. If the Remote Sense feature is being used, connecting the resistor (R1) between pin 14 (V_o adjust) and pin 1 (Remote Sense) can benefit load regulation.
4. The minimum input voltage required by the part is V_{out} + 1.2 or 3.1V, whichever is higher.

Figure 1



The values of (R1) [adjust down], and R2 [adjust up], can also be calculated using the following formulae.

$$(R1) = \frac{R_o (V_a - 1.0)}{(V_o - V_a)} - R_s \quad k\Omega$$

$$R2 = \frac{R_o}{V_a - V_o} - R_s \quad k\Omega$$

Where: V_o = Original output voltage
V_a = Adjusted output voltage
R_o = The resistance value in Table 1
R_s = The series resistance from Table 1

Table 1

PT6500/6600 ADJUSTMENT AND FORMULA PARAMETERS

Series Pt #	PT6505	PT6507	PT6502	PT6508	PT6506	PT6503	PT6501	PT6504
	PT6605	PT6607	PT6602	PT6608	PT6606	PT6603	PT6601	PT6604
V_o (nom)	1.2	1.3	1.5	1.7	1.8	2.5	3.3	3.6
V_a (min)	1.14	1.19	1.27	1.36	1.4	1.8	2.25	2.5
V_a (max)	2.35	2.45	2.65	2.85	2.95	3.5	4.2	4.3
R_o (kΩ)	2.49	2.49	2.49	2.49	2.49	4.99	12.1	10.0
R_S (kΩ)	2.0	2.0	2.0	2.0	2.0	4.22	12.1	12.1

Table 2

PT6500/PT6600 ADJUSTMENT RESISTOR VALUES

Series Pt #	PT6505	PT6507	PT6502	PT6508	PT6506	PT6503	PT6501	PT6504
	PT6605	PT6607	PT6602	PT6608	PT6606	PT6603	PT6601	PT6604
V_o (nom)	1.2	1.3	1.5	1.7	1.8	2.5	3.3	3.6
V_a (req'd)								
1.15	(5.5)kΩ							
1.2		(3.0)kΩ						
1.25	47.8kΩ	(10.5)kΩ						
1.3	22.9kΩ		(1.7)kΩ					
1.35	14.6kΩ	47.8kΩ	(3.8)kΩ					
1.4	10.5kΩ	22.9kΩ	(8.0)kΩ	(1.3)kΩ	(0.5)kΩ			
1.45	8.0kΩ	14.6kΩ	(20.4)kΩ	(2.5)kΩ	(1.2)kΩ			
1.5	6.3kΩ	10.5kΩ		(4.2)kΩ	(2.2)kΩ			
1.55	5.1kΩ	8.0kΩ	47.8kΩ	(7.1)kΩ	(3.5)kΩ			
1.6	4.2kΩ	6.3kΩ	22.9kΩ	(12.9)kΩ	(5.5)kΩ			
1.65	3.5kΩ	4.1kΩ	14.6kΩ	(30.4)kΩ	(8.8)kΩ			
1.7	3.0kΩ	4.2kΩ	10.5kΩ		(15.4)kΩ			
1.75	2.5kΩ	3.5kΩ	8.0kΩ	47.8kΩ	(35.4)kΩ			
1.8	2.2kΩ	3.0kΩ	6.3kΩ	22.9kΩ		(1.5)kΩ		
1.85	1.8kΩ	2.5kΩ	5.1kΩ	14.6kΩ	47.8kΩ	(2.3)kΩ		
1.9	1.6kΩ	2.2kΩ	4.2kΩ	10.5kΩ	22.9kΩ	(3.3)kΩ		
1.95	1.3kΩ	1.8kΩ	3.5kΩ	8.0kΩ	14.6kΩ	(4.4)kΩ		
2.0	1.1kΩ	1.6kΩ	3.0kΩ	6.3kΩ	10.5kΩ	(5.8)kΩ		
2.05	0.9kΩ	1.3kΩ	2.5kΩ	5.1kΩ	8.0kΩ	(7.4)kΩ		
2.1	0.8kΩ	1.1kΩ	2.2kΩ	4.2kΩ	6.3kΩ	(9.5)kΩ		
2.15	0.6kΩ	0.9kΩ	1.8kΩ	3.5kΩ	5.1kΩ	(12.2)kΩ		
2.2	0.5kΩ	0.8kΩ	1.6kΩ	3.0kΩ	4.2kΩ	(15.7)kΩ		
2.25	0.4kΩ	0.6kΩ	1.3kΩ	2.5kΩ	3.5kΩ	(20.7)kΩ	(2.3)kΩ	
2.3	0.3kΩ	0.5kΩ	1.1kΩ	2.2kΩ	3.0kΩ	(28.2)kΩ	(3.6)kΩ	
2.35	0.2kΩ	0.4kΩ	0.9kΩ	1.8kΩ	2.5kΩ	(40.7)kΩ	(5.1)kΩ	
2.4		0.3kΩ	0.8kΩ	1.6kΩ	2.2kΩ	(65.6)kΩ	(6.7)kΩ	
2.45		0.2kΩ	0.6kΩ	1.3kΩ	1.8kΩ	(140.0)kΩ	(8.5)kΩ	
2.5			0.5kΩ	1.1kΩ	1.6kΩ		(10.6)kΩ	(1.5)kΩ
2.55			0.4kΩ	0.9kΩ	1.3kΩ	95.6kΩ	(12.9)kΩ	(2.7)kΩ
2.6			0.3kΩ	0.8kΩ	1.1kΩ	45.7kΩ	(15.6)kΩ	(3.9)kΩ
2.65			0.2kΩ	0.6kΩ	0.9kΩ	29.0kΩ	(18.6)kΩ	(5.3)kΩ
2.7				0.5kΩ	0.8kΩ	20.7kΩ	(22.2)kΩ	(6.8)kΩ
2.75				0.4kΩ	0.6kΩ	15.7kΩ	(26.4)kΩ	(8.5)kΩ
2.8				0.3kΩ	0.5kΩ	12.4kΩ	(31.5)kΩ	(10.4)kΩ
2.85				0.2kΩ	0.4kΩ	10.0kΩ	(37.6)kΩ	(12.6)kΩ
2.9					0.3kΩ	8.3kΩ	(45.4)kΩ	(15.0)kΩ
2.95					0.2kΩ	0.9kΩ	(55.3)kΩ	(17.9)kΩ
3.0						5.8kΩ	(68.6)kΩ	(21.2)kΩ
3.1						4.1kΩ	(115.0)kΩ	(29.9)kΩ
3.2						2.9kΩ	(254.0)kΩ	(42.9)kΩ
3.3						2.0kΩ		(64.6)kΩ
3.4						1.3kΩ	109.0kΩ	(108.0)kΩ
3.5						0.8kΩ	48.4kΩ	(238.0)kΩ
3.6							28.2kΩ	
3.7							18.2kΩ	87.9kΩ
3.8							12.1kΩ	37.9kΩ
3.9	4/. V_{out} >3.8Vdc requires V_{in} >5.0Vdc !						8.1kΩ	21.2kΩ
4.0							5.2kΩ	12.9kΩ
4.1							3.0kΩ	7.9kΩ
4.2							1.3kΩ	4.6kΩ
4.3								2.2kΩ

R1 = (Red) R2 = Black

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