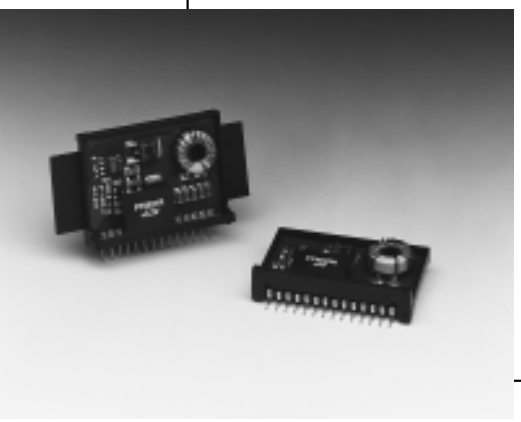
PT6620 Series

6 AMP 12V INPUT INTEGRATED SWITCHING REGULATOR

Application Notes
Mechanical Outline
Product Selector Guide



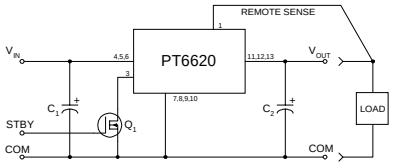
- Single Device: 6A Output
- Input Voltage Range: 9V to 14V
- Adjustable Output Voltage
- 83% Efficiency
- Remote Sense Capability
- Standby Function
- Over-Temperature Protection

The PT6620 series is a new addition to Power Trends' line of 12V bus Integrated Switching Regulators (ISRs).

Designed for stand-alone operation in applications requiring as much as 6A of output current, the PT6620 is packaged in a 14-Pin SIP (Single In-line Package) and is available in a surface-mount configuration.

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

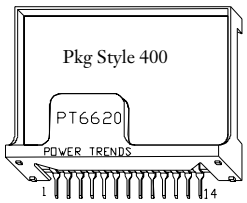
Pin	Function
1	Remote Sense
2	Do Not Connect
3	STBY*- Standby
4	V_{in}
5	V_{in}
6	V_{in}
7	GND
8	GND
9	GND
10	GND
11	V_{out}
12	V_{out}
13	V_{out}
14	V_{out} Adjust

Ordering Information

PT6621☐ = +3.3 Volts
PT6622☐ = +1.5 Volts
PT6623☐ = +2.5 Volts
PT6624☐ = +3.6 Volts
PT6625☐ = +5.0 Volts
PT6626☐ = +9.0 Volts

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		PT6620 SERIES Min	Typ	Max	Units
Output Current	I_o	T_a = 60°C, 200 LFM, pkg P		0.1*	—	6.0**	A
		T_a = 25°C, natural convection		0.1*	—	6.5**	A
Input Voltage Range	V_{in}	0.1A ≤ I_o ≤ 6.0A	V_o ≤ +5V	+9	—	+14	V
			+6V≤V_o≤+9V	V_o+3	—	+14	V
Output Voltage Tolerance T_a = 0 to 60°C	ΔV_o	V_{in} = +12V, I_o = 6.0A		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	2.3	—	4.5	V
			V_o = +1.5V	1.4	—	2.7	
			V_o = +2.5V	1.9	—	3.7	
			V_o = +3.6V	2.5	—	4.8	
			V_o = +5.0V	2.9	—	6.5	
			V_o = +9.0V	5.2	—	10.0	
Line Regulation	Reg_{line}	+9V≤V_{in}≤+14V, I_o = 6.0A		—	±0.5	±1.0	%V_o
Load Regulation	Reg_{load}	V_{in} = +12V, 0.1≤ I_o≤6.0A		—	±0.5	±1.0	%V_o
V_o Ripple/Noise	V_n	V_{in} = +12V, I_o = 6.0A	V_o ≤ +6V	—	50	—	mVpp
			V_o > +6V	—	1.0	—	%V_o
Transient Response with C_2 = 330µF	t_{tr}	I_o step between 3.0A and 6.0A		—	100	—	µSec
	V_{os}	V_o over/undershoot		—	150	—	mV
Efficiency	η	V_{in} = +12V, I_o = 3.0A	V_o= +3.3/3.6V	—	84	—	%
			V_o = +1.5V	—	68	—	%
			V_o = +2.5V	—	76	—	%
			V_o = +5.0V	—	86	—	%
			V_o = +9.0V	—	93	—	%
		V_{in} = +12V, I_o =6.0A	V_o= +3.3/3.6V	—	83	—	%
			V_o = +1.5V	—	66	—	%
			V_o = +2.5V	—	75	—	%
			V_o = +5.0V	—	85	—	%
			V_o = +9.0V	—	92	—	%

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

** See SOA curves - Output power is limited to 30W maximum.

Note: *The PT6620 Series requires a 330µF(output) and 330µF(input) electrolytic capacitors for proper operation in all applications.*

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

Specifications (continued)

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT6620 SERIES Min	Typ	Max	Units
Switching Frequency	f_o	9V ≤ V_{in} ≤ 14V 0.1A ≤ I_o ≤ 6.0A PT6622	500 500	650 550	775 600	kHz kHz
Recommended Operating Temperature Range	T_a	Free Air Convection (40-60 LFM) Over V_{in} and I_o ranges with heat tab	-40	—	+65**	°C
Absolute Maximum Operating Temperature Range	T_a		-40	—	+85	°C
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

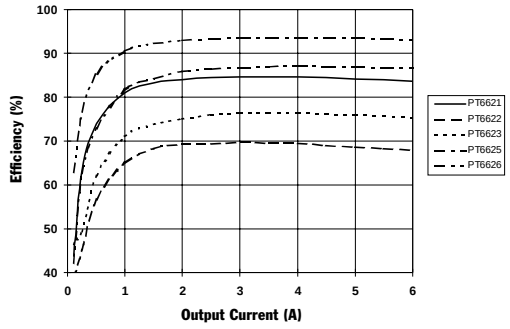
** See SOA curves - Output power is limited to 30W maximum.

Note: *The PT6620 Series requires a 330µF(output) and 100µF(input) electrolytic capacitors for proper operation in all applications.*

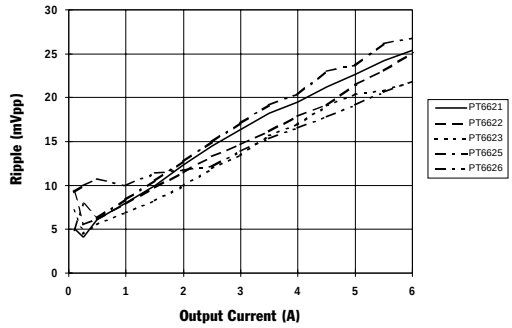
CHARACTERISTIC DATA

PT6620 Series @Vin=+12V

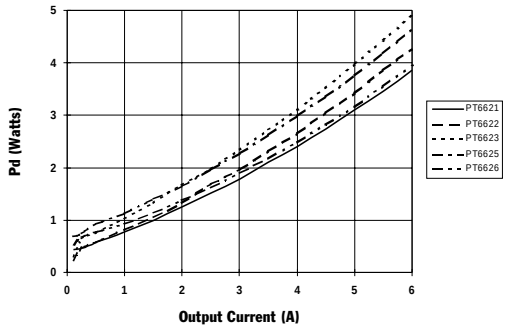
Efficiency vs Output Current



Output Ripple vs Output Current

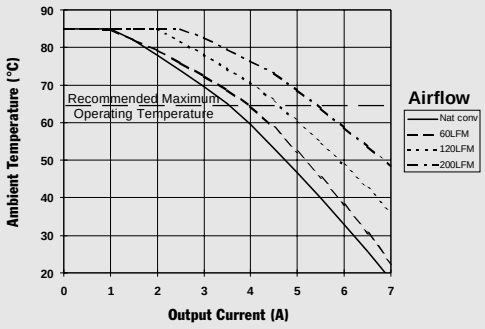


Power Dissipation vs Output Current

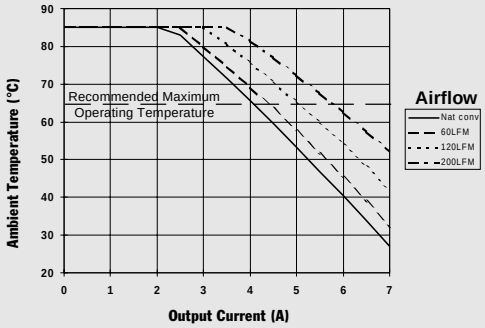


Safe Operating Area Curves @Vin=+12V

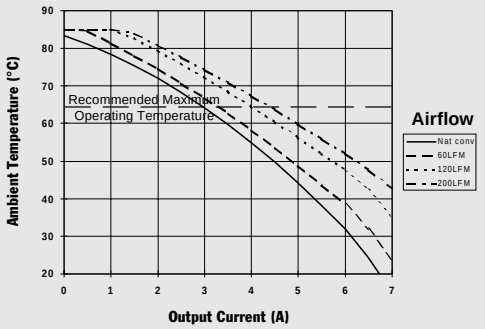
PT6621P, 3.3V



PT6622P, 1.5V



PT6625P, 5.0V



Note: *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 PT6620 7Amp12V Bus Converter Series

The output voltage of the Power Trends PT6650 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.

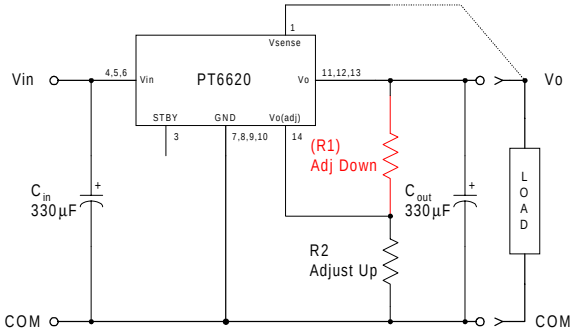
Notes:

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} + 3, or 9V, whichever is higher.
5. The maximum output current must be limited to the equivalent of 30Watts.

   i.e. $I_{out}(max) = \frac{12}{V_a}$ Adc,

   where V_a is the adjusted output voltage.

Figure 1



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

$$(R1) = \frac{R_o (V_a - 1.25)}{(V_o - V_a)} - R_s \quad k\Omega$$

$$R2 = \frac{1.25\, R_o}{V_a - V_o} - R_s \quad k\Omega$$

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

PT6620 ADJUSTMENT AND FORMULA PARAMETERS

Series Pt #	PT6622	PT6623	PT6621	PT6624	PT6625	PT6626
V_o (nom)	1.5V	2.5V	3.3V	3.6V	5.0V	9.0V
V_a (min)	1.4V	1.9V	2.3V	2.5V	2.9V	5.2V
V_a (max)	2.7V	3.7V	4.5V	4.8V	6.5V	10.0V
R_O (kΩ)	4.99	10.0	12.1	12.1	16.2	12.1
R_S (kΩ)	2.49	4.99	12.1	12.1	12.1	12.1

Table 2

PT6620 ADJUSTMENT RESISTOR VALUES

Series Pt #	PT6622	PT6623	PT6621	PT6624	PT6625
Current	7.5Adc	7.5Adc	7.5Adc	7.5Adc	6.0Adc
V_o (nom)	1.5Vdc	2.5Vdc	3.3Vdc	3.6Vdc	5.0Vdc
V_a (req'd)					
1.4	(5.0)kΩ				
1.5					
1.6	59.9k				
1.7	28.7k				
1.8	18.3k				
1.9	13.1k	(5.8)kΩ			
2.0	10.0k	(10.0)kΩ			
2.1	7.9k	(16.3)kΩ			
2.2	6.4k	(26.7)kΩ			
2.3	5.3k	(47.5)kΩ	(0.6)kΩ		
2.4	4.4k	(110.0)kΩ	(3.4)kΩ		
2.5	3.8k		(6.8)kΩ	(1.7)kΩ	
2.6	3.2k	120.0k	(11.2)kΩ	(4.2)kΩ	
2.7		57.5k	(17.1)kΩ	(7.4)kΩ	
2.8		36.7k	(25.4)kΩ	(11.3)Ω	
2.9		26.3k	(37.8)kΩ	(16.4)kΩ	(0.6)kΩ
3.0		20.0k	(58.5)kΩ	(23.2)kΩ	(2.1)kΩ
3.1		15.8k	(99.8)kΩ	(32.7)kΩ	(3.7)Ω
3.2		12.9k	(224.0)kΩ	(46.9)kΩ	(5.5)kΩ
3.3		10.6k		(70.6)kΩ	(7.4)kΩ
3.4		8.9k	139.0k	(118.0)kΩ	(9.7)kΩ
3.5		7.5k	63.5k	(260.0)kΩ	(12.2)kΩ
3.6		6.4k	38.3k		(15.1)kΩ
3.7		5.4k	25.7k	139.0k	(18.4)kΩ
3.8			18.2k	63.5k	(22.3)kΩ
3.9			13.1k	38.3k	(26.9)kΩ
4.0			9.5k	25.7k	(32.5)kΩ
4.1			6.8k	18.2k	(39.2)kΩ
4.2			4.7k	13.1k	(47.6)kΩ
4.3			3.0k	9.5k	(58.5)kΩ
4.4			1.7k	6.8k	(73.0)kΩ
4.5			0.5k	4.7k	(93.2)kΩ
4.6				3.0k	(124.0)kΩ
4.7				1.7k	(174.0)kΩ
4.8				0.5k	(275.0)kΩ
4.9					(579.0)kΩ
5.0					
5.1					190.0k

Series Pt #	PT6625	PT6626
Current	6Adc	3.3Adc
V_o (nom)	5.0Vdc	9.0Vdc
V_a (req'd)		
5.2	89.1k	(0.5)kΩ
5.3	55.4k	(1.1)kΩ
5.4	38.5k	(1.9)kΩ
5.5	28.4k	(2.6)kΩ
5.6	21.7k	(3.4)kΩ
5.7	16.8k	(4.2)kΩ
5.8	13.2k	(5.1)kΩ
5.9	10.4k	(6.1)kΩ
6.0	8.2k	(7.1)kΩ
6.1	6.3k	(8.1)kΩ
6.2	4.8k	(9.3)kΩ
6.3	3.5k	(10.5)kΩ
6.4	2.4k	(11.9)kΩ
6.5	1.4k	(13.3)kΩ
6.6		(14.9)kΩ
6.7		(16.6)kΩ
6.8		(18.4)kΩ
6.9		(20.5)kΩ
7.0		(22.7)kΩ
7.1		(25.2)kΩ
7.2		(27.9)kΩ
7.3		(31.0)kΩ
7.4		(34.4)kΩ
7.5		(38.3)kΩ
7.6		(42.8)kΩ
7.8		(53.9)kΩ
8.0		(69.6)kΩ
8.2		(93.0)kΩ
8.4		(132.0)kΩ
8.6		(210.0)kΩ
8.8		(445.0)kΩ
9.0		
9.2		63.5k
9.4		25.7k
9.6		13.1k
9.8		6.8k
10.0		3.0k

R1 = (Red) R2 = Black

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