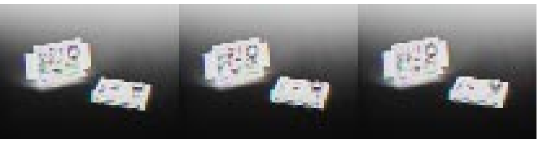
PT6620 Series

6 Amp 12V Input Integrated Switching Regulator

SLTS036B
(Revised 9/20/2000)

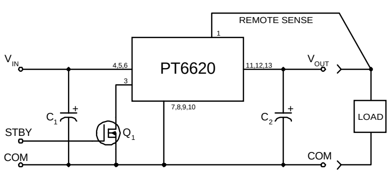


- Single Device: 6A Output
- Input Voltage Range: 9V to 16V
- Adjustable Output Voltage
- 83% Efficiency
- Remote Sense Capability
- Standby Function
- Over-Temperature Protection

The PT6620 series is a line of 12V bus Integrated Switching Regulators (ISRs). These regulators are designed for stand-alone operation in applications requiring as much as 6A of output current. The PT6620 series is packaged in Power Trends' standard 14-Pin SIP (Single In-line Package), which is available in either a vertical or horizontal configuration. Two electrolytic capacitors are required for proper operation.

Please note that this product does not include short circuit protection.

Standard Application



C_1 = Required 330µF electrolytic (1)
C_2 = Required 330µF electrolytic (1)
Q_1 = NFET-or Open Collector Gate

Pin-Out Information

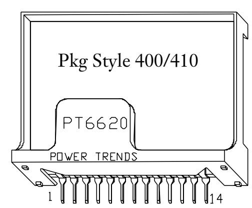
Pin	Function
1	Remote Sense
2	Do Not Connect
3	STBY*- Standby
4	V_{in}
5	V_{in}
6	V_{in}
7	GND
8	GND
9	GND
10	GND
11	V_{out}
12	V_{out}
13	V_{out}
14	V_{out} Adjust

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
PT6627☐ = +1.8 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 T_a = 25°C, natural convection		0.1 (2) 0.1 (2)	— —	6.0 6.0	A
Input Voltage Range	V_{in}	0.1A ≤ I_o ≤ 6.0A	V_o ≤ +5V +6V≤V_o≤+9V	+9 V_o+3	— —	+16 +16	V
Output Voltage Tolerance	ΔV_o	V_{in} = +12V, I_o = 6.0A T_a = 0 to 60°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 V_o = +1.5V V_o = +2.5V V_o = +3.6V V_o = +5.0V V_o = +9.0V	2.3 1.4 1.9 2.5 2.9 5.2	— — — — — —	4.5 2.6 3.7 4.8 6.5 10.0	V
Line Regulation	Reg_{line}	V_{in}(min) ≤V_{in}≤V_{in}(max), 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 V_o > +6V	— —	50 1.0	— —	mVpp %V_o
Transient Response with C_2 = 330µF	t_{tr} V_{os}	I_o step between 3.0A and 6.0A V_o over/undershoot		— —	100 150	— —	µSec mV
Efficiency	η	V_{in} = +12V, I_o = 3.0A	V_o= +3.3/3.6V V_o = +1.5V V_o = +2.5V V_o = +5.0V V_o = +9.0V	— — — — —	84 68 76 86 93	— — — — —	%
		V_{in} = +12V, I_o =6.0A	V_o= +3.3/3.6V V_o = +1.5V V_o = +2.5V V_o = +5.0V V_o = +9.0V	— — — — —	83 66 75 85 92	— — — — —	%
Switching Frequency	f_o	V_{in}(min) ≤V_{in}≤V_{in}(max)	PT6622	500	550	600	kHz
		0.1A ≤ I_o ≤ 6.0	Except PT6622	550	650	750	kHz

Continued

6 Amp 12V Input
Integrated Switching Regulator

Specifications *(continued)*

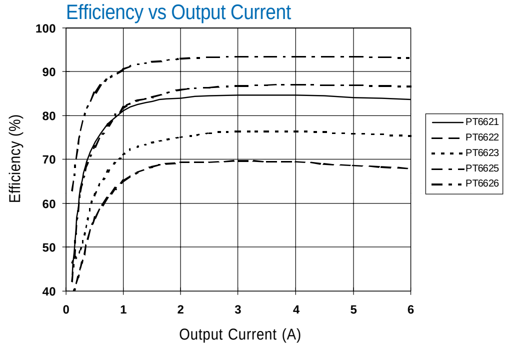
Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT6620 SERIES Min	Typ	Max	Units
Absolute Maximum Operating Temperature Range	T_a	Over V_{in} range	-40	—	+85 (3)	°C
Storage Temperature	T_s	—	-40	—	+125	°C
Mechanical Shock	—	Per Mil-STD-883D, Method 2002.3	—	500	—	G's
Mechanical Vibration	—	Per Mil-STD-883D, Method 2007.2, 20-2000 Hz, soldered in a PC board	—	7.5	—	G's
Weight	—	—	—	14	—	grams

Notes: *(1) The PT6620 Series requires a 330µF(output) and 100µF(input) electrolytic capacitors for proper operation in all applications.*
(2) ISR will operate down to no load with reduced specifications
(3) See safe Operating Area curves or contact the factory for the appropriate derating.

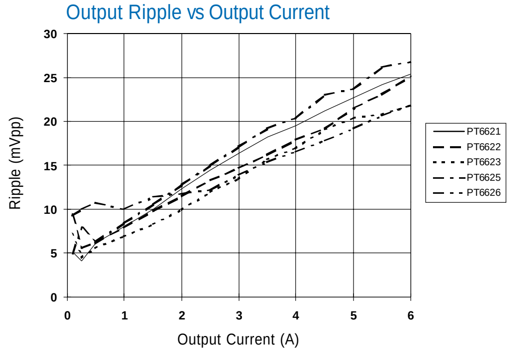
TYPICAL CHARACTERISTICS

PT6620 Series @Vin=+12V (See Note A)

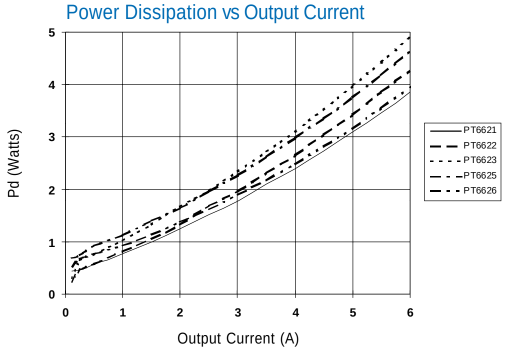
Efficiency vs Output Current



Output Ripple vs Output Current

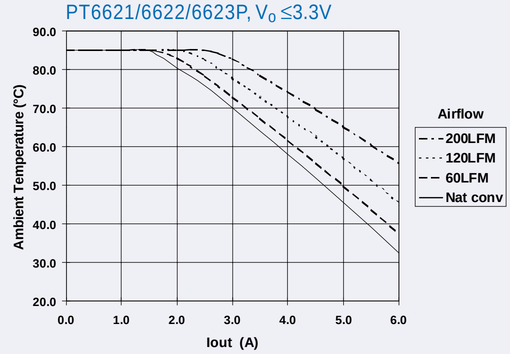


Power Dissipation vs Output Current

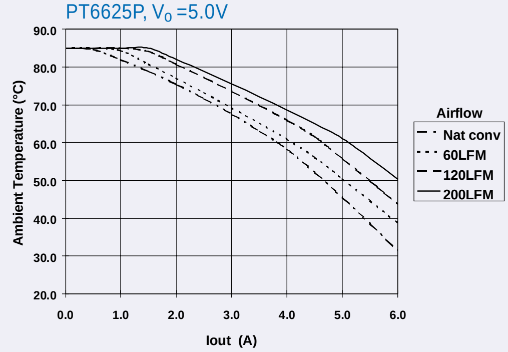


Safe Operating Area, Vin=+12V (See Note B)

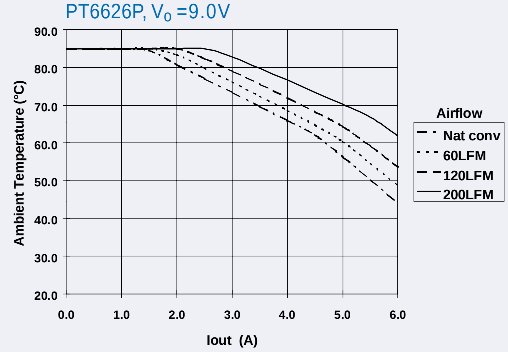
PT6621/6622/6623P, $V_O \leq 3.3V$



PT6625P, V_O =5.0V



PT6626P, V_O =9.0V



Note A: *All characteristic data in the above graphs has been develped from actual products tested at 25°C. This data is considered typical for the ISR.*
Note B: *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 PT6620 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).

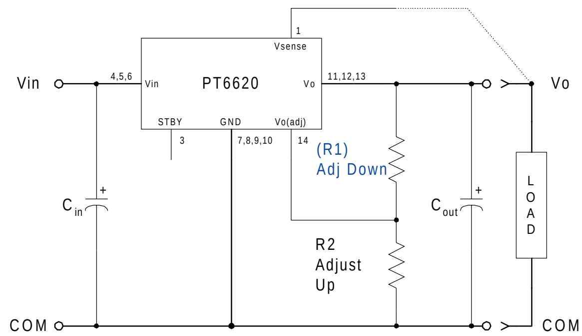
Adjust Down: Add a resistor (R1), between pin 14 (V_o adjust) and pins 11-13 (V_{out}).

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.

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 = (Blue) R2 = Black

Using the Standby Function on the PT6620 Series of 12V Bus Converters

For applications requiring output voltage On/Off control, the 14-pin PT6620 ISR series incorporates a standby function. This feature may be used for power-up/shutdown sequencing, and wherever there is a requirement for the output status of the module to be controlled by external circuitry.

The standby function is provided by the *STBY** control, pin 3. If pin 3 is left open-circuit the regulator operates normally, providing a regulated output whenever a valid supply voltage is applied to V_{in} (pins 4, 5, & 6) with respect to GND (pins 7-10). Connecting pin 3 to ground [2] will disable the regulator output and reduce the input current to less than 30mA [4]. Grounding the standby control will also hold-off the regulator output during the period that input power is applied.

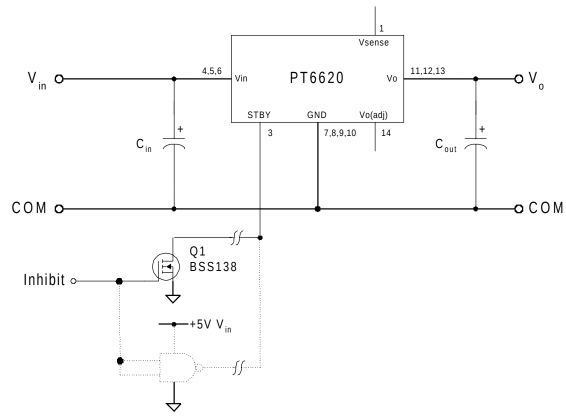
The standby input is ideally controlled with an open-collector (or open-drain) discrete transistor (See Figure 1). It can also be driven directly from a dedicated TTL[3] compatible gate. Table 1 provides details of the threshold requirements.

Table 1 Inhibit Control Thresholds (2,3)

Parameter	Min	Max
Enable (V_{IH})	1V	5V
Disable (V_{IL})	–0.1V	0.3V

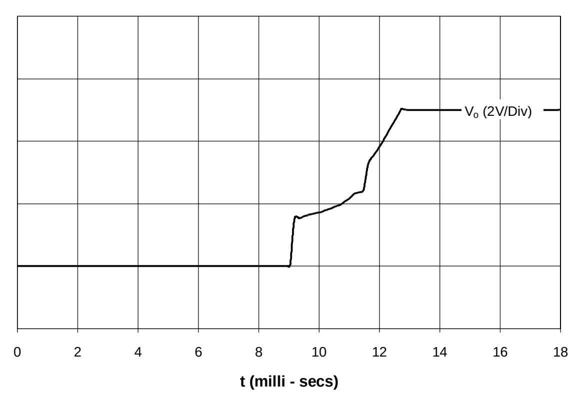
Notes:
1. The Standby/Inhibit control logic is similar for all Power Trends' modules, but the flexibility and threshold tolerances will be different. For specific information on this function for other regulator models, consult the applicable application note.
2. The Standby input on the PT6620 regulator series may be controlled using either an open-collector (or open-drain) discrete transistor, or a device with a totem-pole output. A pull-up resistor is not necessary. The control input has an open-circuit voltage of about 1.5Vdc. To disable the regulator output, the control pin must be "pulled" to less than 0.3Vdc with a low-level 0.25mA max. sink to ground.
3. The Standby input on the PT6620 series is also compatible with TTL logic. A standard TTL logic gate will meet the 0.3V V_{IL}(max) requirement (Table 1) at 0.25mA sink current. *Do not* drive the Standby control input above 5Vdc.
4. When the regulator output is disabled the current drawn from the input source is reduced to approximately 15mA (30mA maximum).
5. The turn-off time of Q_1, or rise time of the standby input is not critical on the PT6620 series. Turning Q_1 off slowly, over periods up to 100ms, will not damage the regulator. However, a slow turn-off time will increase both the initial delay and rate-of-rise of the output voltage.

Figure 1



Turn-On Time: Turning Q_1 in Figure 1 off, removes the low-voltage signal at pin 3 and enables the output. The PT6620 series of regulators will provide a fully regulated output voltage within 20ms. The actual turn-on time may vary with load and the total amount of output capacitance. Figure 2 shows the typical output voltage waveform of a PT6625 (5.0V) following the prompt turn-off of Q_1 at time t =0 secs. The waveform was measured with a 12V input voltage, and 5A resistive load.

Figure 2



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