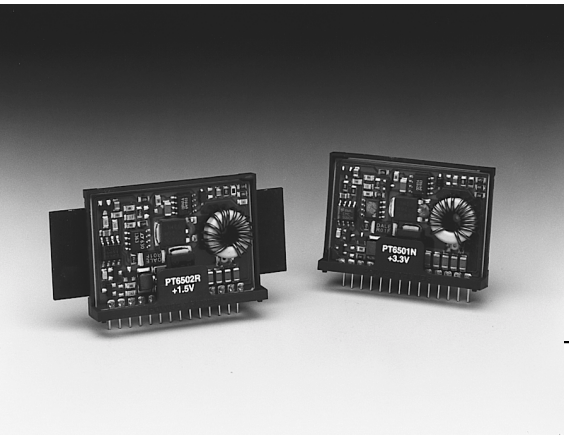
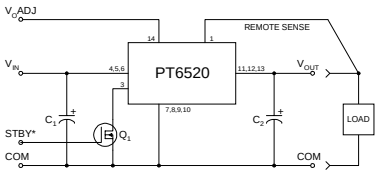


- 8A Single Device Power
- Up to 92% efficiency (PT6521)
- Small SIP Footprint
- Standby Function
- Internal Short-Circuit Protection
- Adjustable Output Voltage
- Soft Start

The PT6520 series is Power Trends' new high performance +3.1 to 6V input, 8 Amp, 14-Pin SIP (Single In-line-Package) Integrated Switching Regulator (ISR). This high-performance ISR allows easy integration of high-speed, low-voltage microprocessors, ASICs, DSPs and their support logic into existing 3.3V or 5V systems without redesigning the central power supply. The high-performance PT6522 solves the problem of providing the low terminating voltages required by BTL/Futurebus+, CTT, HP, and GTL Buses from existing 3.3V or 5V power rails without redesigning the central power supply.

Standard Application



C_1 = Required 330µF electrolytic *
C_2 = Required 330µF electrolytic *

* See notes

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

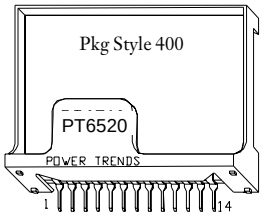
PT6521☐ = 3.3 Volts
† **PT6522☐** = 1.5 Volts
† **PT6523☐** = 2.5 Volts
† **PT6526☐** = 1.8 Volts

†3.3V Input Bus Capable

Note: Back surface of product is conducting metal.

PT Series Suffix (PT1234X)

Case/Pin Configuration	Heat Tab Configuration *None*	*Side*
Vertical Through-Hole	P	R
Horizontal Through-Hole	D	G
Horizontal Surface Mount	E	B



Specifications

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT6520 SERIES Min	Typ	Max	Units
Output Current	I_o	Over V_{in} range	0.1 (1)	—	8.0	A
Short Circuit Current Threshold	I_{sc}	V_{in}=+5V	—	12.0	22.5	Apk
Input Voltage Range	V_{in}	0.1≤ I_o≤ 8.0A V_o=3.3V V_o=2.5V, 1.8V, 1.5V	4.5 3.1	— —	5.5 5.5	V
Output Voltage Tolerance	ΔV_o	V_{in} = +5V, I_o = 8.0A T_a = –40 to +85°C	V_o-0.03	—	V_o+0.03	V
Output Adjust Range	V_o	V_{nom} = 3.3V V_{adj} = (PT6521) V_{nom} = 1.5V V_{adj} = (PT6522) V_{nom} = 2.5V V_{adj} = (PT6523) Pin 14 to Pin1 or GND	2.75 1.47 2.25	— — —	3.75 (2) 1.73 (2) 2.85 (2)	V
Line Regulation	Reg_{line}	4.5V ≤ V_{in} ≤ 5.5V, I_o = 8.0A (PT6521) 3.1V ≤ V_{in} ≤ 5.5V, I_o = 8.0A(PT6522/3/6)	—	±5	±10	mV
Load Regulation	Reg_{load}	0.1 ≤ I_o ≤ 8.0A, V_{in} = +5V, w/remote sense	—	±5	±10	mV
V_o Ripple/Noise	V_n	V_{in} = +5V, I_o = 8.0A	—	35	—	mVpp
Transient Response with C_o = 330µF	t_{tr} V_{os}	I_o step from 4A to 8.0A V_o over/undershoot	— —	50 70	— —	µsec mV
Efficiency	η	V_{in} = +5V, I_o = 3.0A (PT6521) (PT6522) (PT6523) V_{in} = +5V, I_o = 8.0A (PT6521) (PT6522) (PT6523)	— — — — — —	92 80 88 89 75 85	— — — — — —	%
Switching Frequency	f_o	Over V_{in} and I_o ranges	300	350	400	kHz
Absolute Maximum Operating Temperature Range	T_a		-40 (3)	—	+85 (4)	°C
Storage Temperature	T_s	—	-40	—	+125	°C

(Continued)

Specifications *(From previous page)*

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT6520 SERIES Min	Typ	Max	Units
Mechanical Shock		Per Mil-STD-883D, Method 2002.3, 1msec, half sine, fixture mounted	—	500	—	G's
Mechanical Vibration			—	7.5	—	G's
Weight			—	14	—	grams

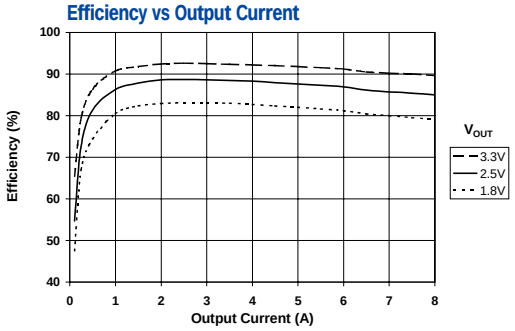
Notes: *(1) The ISR will operate down to no load with reduced specifications.*
(2) V_{in}min =3.1V, or V_o +0.5V, whichever is greater. (See related application notes on adjusting the output voltage).
(3) For operation below 0°C, Cin and Cout must have stable characteristics. Use either low ESR tantalum or Oscon® capacitors
(4) See Safe Operating Area curves for appropriate derating.

Input/Output Capacitors : *The PT6520 Series requires a 330µF electrolytic or tantalum input and output capacitor for proper operation in all applications. In addition the input capacitance, C_1, must be rated for a minimum of 1.2Arms ripple current. For transient or dynamic load applications, additional capacitance may be required.*

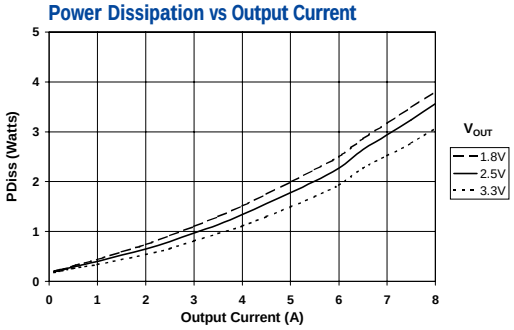
TYPICAL CHARACTERISTICS

PT6521, PT6523, PT6526; V_{IN} =5.0V *(See Note A)*

Efficiency vs Output Current

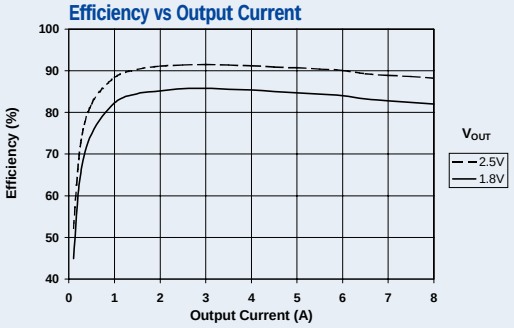


Power Dissipation vs Output Current

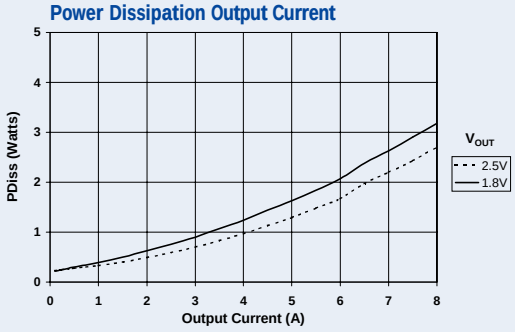


PT6523, PT6526; V_{IN} =3.3V *(See Note A)*

Efficiency vs Output Current

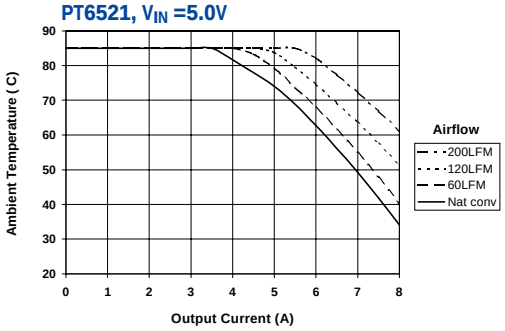


Power Dissipation Output Current



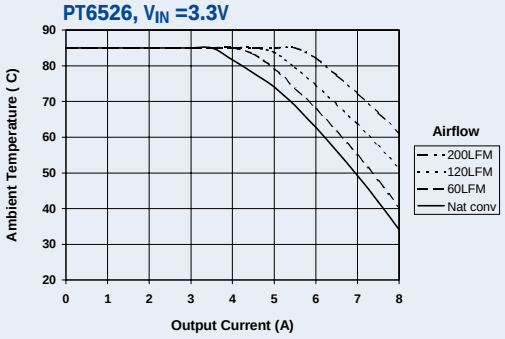
Safe Operating Area Curves *(See Note B)*

PT6521, V_{IN} =5.0V



Safe Operating Area Curves *(See Note B)*

PT6526, V_{IN} =3.3V



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

Adjusting the Output Voltage of the PT6520 Low Input Voltage Bus ISRs

The output voltage of the Power Trends PT6520 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 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 pin 1 V_o(sense) [3].

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 not being used, the resistor (R1) may be connected between pin 14 (V_o adjust) and pins 11-13 (V_{out}).
4. Adjusting the output voltage of the PT6523 (2.5V model) higher than the factory pre-trimmed output voltage may increase the minimum input voltage specified for the part. This model must comply with the following requirements.

   PT6523:

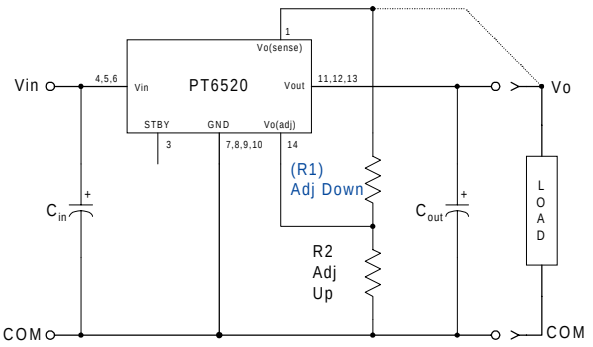
   V_{in}(min) = (V_a + 0.5)V or 3.1V, whichever is greater.

Table 1

PT6520 ADJUSTMENT AND FORMULA PARAMETERS

Series Pt #	PT6522	PT6526	PT6523	PT6521
V_o (nom)	1.5	1.8	2.5	3.3
V_a (min)	1.47	1.75	2.25	2.75
V_a (max)	1.73	2.0	2.85	3.75
R_S (kΩ)	49.9	49.9	33.2	24.9

Figure 1



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

$$(R1) = \frac{10 \cdot (V_a - 1.27)}{(V_o - V_a)} - R_s \quad k\Omega$$

$$R2 = \frac{12.7}{V_a - V_o} - R_s \quad k\Omega$$

Where: V_o = Original output voltage
V_a = Adjusted output voltage
R_s = Series resistance value from Table 1

Table 2

PT6520 ADJUSTMENT RESISTOR VALUES

Series Pt #	PT6522	PT6526	PT6523	PT6521
V_o (nom)	1.5	1.8	2.5	3.3
V_a (req'd)				
1.47	(16.8)kΩ			
1.5				
1.55	204.0kΩ			
1.6	77.1kΩ			
1.65	34.8kΩ			
1.7	13.6kΩ			
1.75		(46.1)kΩ		
1.8				
1.85		204.0kΩ		
1.9		77.1kΩ		
1.95		34.8kΩ		
2.0		13.6kΩ		
2.05				
2.1				
2.15				
2.2				
2.25			(6.0)kΩ	
2.3			(18.3)kΩ	
2.35			(38.8)kΩ	
2.4			(79.8)kΩ	
2.45			(203.0)kΩ	
2.5				
2.55			221.0kΩ	
2.6			93.8kΩ	
2.65		Requires V_{in} >3.1Vdc	51.5kΩ	
2.7			30.3kΩ	
2.75			17.6kΩ	(2.0)kΩ
2.8			9.1kΩ	(5.7)kΩ
2.85			3.1kΩ	(10.2)kΩ
2.9				(15.9)kΩ
2.95				(23.1)kΩ
3.0				(32.8)kΩ
3.05				(46.3)kΩ
3.1				(66.6)kΩ
3.15				(100.0)kΩ
3.2				(168.0)kΩ
3.25				(371.0)kΩ
3.3				
3.35				229.0kΩ
3.4				102.0kΩ
3.45				59.8kΩ
3.5				38.6kΩ
3.55				25.9kΩ
3.6				17.4kΩ
3.65				11.4kΩ
3.7				6.9kΩ
3.75				3.3kΩ

R1 = (Blue) R2 = Black

Using the Standby Function on the PT6520 3.3/5V Bus Converters

The PT6520 series are high efficiency regulators that are designed to operate off low input bus voltages. The regulators are also pin-compatible with Power Trends' PT6500/6600 series. These devices feature a standby function, which may be used in applications that require 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, and provides a regulated output when a valid supply voltage is applied to V_{in} (pins 4, 5, & 6) with respect to GND (pins 7-10). If a low voltage[3] is then applied to pin 3 the regulator output will be disabled and the input current drawn by the ISR will typically drop to 5mA[4]. The standby control may also be used to hold-off the regulator output during the period that input power is applied.

Pin 3 is ideally controlled with an open-collector (or open-drain) discrete transistor (See Figure 1). The open-ciruit voltage is typcially 12.6V. Table 1 gives the circuit parameters for this control input.

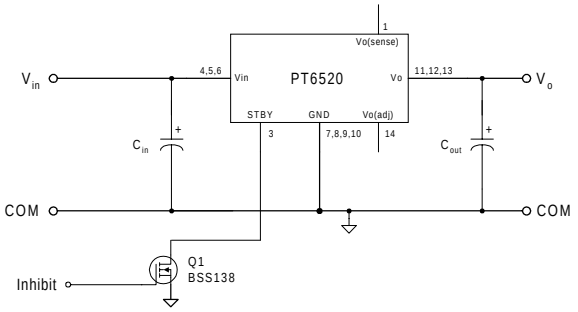
Table 1 Standby Control Circuit Parameters [2, 3]

Parameter	Min	Typ	Max
On/Off Threshold	0.4V		
I_{stby}		0.5mA	
V_{stby}		12.6V	15V

Notes:

1. The operation of the Standby/Inhibit 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 control input requires no external pull-up resistor. The open-circuit voltage of the STBY* pin is typically 12.6V.
3. The standby control input is *Not* compatible with TTL or other devices that incorporate a totem-pole output drive. Use only a true open-collector device, preferably a discrete bipolar transistor (or MOSFET). To ensure the regulator output is disabled, the control pin must be pulled to less than 0.4Vdc with a low-level 0.5mA sink to ground.
4. When the regulator output is disabled the current drawn from the input source is typically reduced to 5mA.

Figure 1



Turn-On Time: In the circuit of Figure 1, turning Q_1 on applies a low voltage to the Standby control (pin 3) and disables the regulator ouput. Correspondingly, turning Q_1 off removes the low-voltage signal and enables the output. Once enabled, the output will typically experience a 10–15ms delay followed by a predictable ramp-up of voltage. The regulator should provide a fully regulated output voltage within 40ms. The waveform of Figure 2 shows the output voltage response of a PT6521 (3.3V) following the turn-off of Q_1 at time t = 0.0 secs. The waveform was measured with a 5Vdc input voltage, and 0.6Ω load.

Figure 2