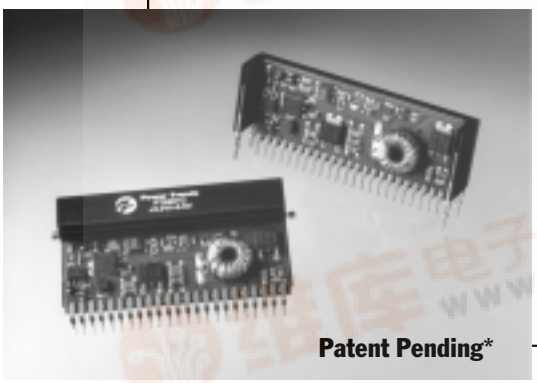
For assistance or to order, call **(800) 531-5782**

Revised 3/9/99

PT6920 Series

5V TO 3.3V/2.5V 25 WATT DUAL OUTPUT INTEGRATED SWITCHING REGULATOR

Application Notes
Mechanical Outline
Product Selector Guide



Patent Pending*

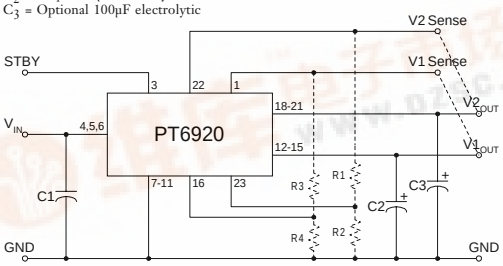
Features

- Dual Outputs:
  +3.3V/6A
  +2.5V/2.2A or +1.8V/1.5A
- Adjustable Output Voltage
- Remote Sense (both outputs)
- Standby Function
- Over-Temperature Protection
- Soft-Start
- Internal Sequencing
- 23-pin SIPPackage

The PT6920 is a new series of 25W dual output ISRs designed to power the latest generation DSP chips. Both output voltages are independently adjustable with external resistors. In addition, the second output voltage of the PT6921 can be selected for 2.5V or 1.8V to accommodate the next generation of DSP chips. The internal power sequencing of both outputs meet the latest requirements of TI's 'C6000 series DSPs.

Standard Application

C_1 = Req'd 560µF electrolytic
C_2 = Req'd 330µF electrolytic
C_3 = Optional 100µF electrolytic



Pin-Out Information

Pin	Function	Pin	Function
1	V_1 Remote Sense	13	V_{1out}
2	Do Not Connect	14	V_{1out}
3	STBY	15	V_{1out}
4	V_{in}	16	V_1 Adjust
5	V_{in}	17	Do Not Connect
6	V_{in}	18	V_{2out}
7	GND	19	V_{2out}
8	GND	20	V_{2out}
9	GND	21	V_{2out}
10	GND	22	V_2 Remote Sense
11	GND	23	V_2 Adjust*
12	V_{1out}		

Note: for PT6921 only:
with pin 23 open, V2out=2.5V
with pin 23 shorted to pin 22, V2out=1.8V

Ordering Information

PT6921❑ = +3.3 Volts
+2.5/+1.8 Volts
PT6922❑ = +3.3 Volts
+1.5 Volts

PT Series Suffix (PT1234X)

Case/Pin Configuration	
Vertical Through-Hole	**N**
Horizontal Through-Hole	**A**
Horizontal Surface Mount	**C**

(For dimensions and PC board layout, see Package Styles 1100 and 1110.)

Preliminary Specifications

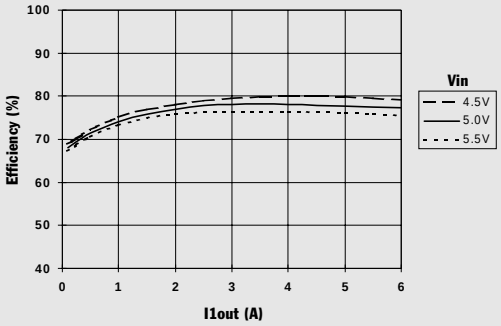
Characteristics (T_a= 25°C unless noted)	Symbols	Conditions		PT6920 SERIES Min	Typ	Max	Units
Output Current	I_o	T_a = +60°C, 200 LFM, pkg N	V_1 = 3.3V	0.1	—	5.5	A
			V_2 = 2.5V	0	—	2.2	A
			V_2 = 1.8V	0	—	1.75	A
			V_2 = 1.2V	0	—	1.2	A
		T_a = +25°C, natural convection	V_1 = 3.3V	0.1	—	6.0	A
			V_2 = 2.5V	0	—	2.2	A
			V_2 = 1.8V	0	—	1.75	A
			V_2 = 1.2V	0	—	1.2	A
Input Voltage Range	V_{in}	0.1A ≤ I_o ≤ I_{max}		4.5	—	5.5	V
Output Voltage Tolerance	ΔV_o	V_{in} = +5V, I_o = I_{max}, both outputs 0°C ≤ T_a ≤ +65°C		V_o-0.1	—	V_o+0.1	V
Line Regulation	Reg_{line}	4.5V ≤ V_{in} ≤ 5.5V, I_o = I_{max}	V_1 = 3.3V	—	±7	±17	mV
			V_2 = 2.5V	—	±7	±13	mV
Load Regulation	Reg_{load}	V_{in} = +5V, 0.1 ≤ I_o ≤ I_{max}	V_1 = 3.3V	—	±17	±33	mV
			V_2 = 2.5V	—	±4	±10	mV
V_o Ripple/Noise	V_n	V_{in} = +5V, I_o = I_{max}	V_1 = 3.3V	—	50	—	mV
			V_2 = 2.5V	—	25	—	mV
Transient Response with C_2 = 330µF	t_{tr}	I_o step between 0.5xI_{max} and I_{max}		—	25	—	µSec
	V_{os}	V_o over/undershoot	V_1 = 3.3V	—	60	—	mV
			V_2 = 2.5V	—	60	—	mV
Efficiency	η	V_{in} = +5V, I_o = 4A total		—	75	—	%
Switching Frequency	f_o	4.5V ≤ V_{in} ≤ 5.5V 0.1A ≤ I_o ≤ I_{max}		475	600	725	kHz
Absolute Maximum Operating Temperature Range	T_a	—		0	—	+85	°C
Recommended Operating Temperature Range	T_a	Forced airflow = 200 LFM Over V_{in} and I_o Ranges		0	—	+65	°C
Storage Temperature	T_s	—		-40	—	+125	°C
Weight	—	Vertical/Horizontal		—	29	—	grams

Note: *The PT6920 series requires a 560µF electrolytic capacitor on the input and a 330µF electrolytic capacitor on the output for proper operation in all applications.*

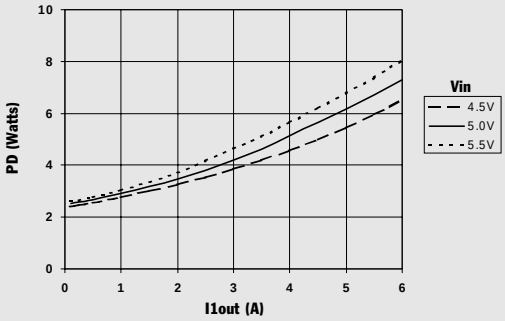
** This product is the subject of one or more patents. Other patents pending.*

PT6921, V2out = 2.5V, I2out = 2.2A (See Note 1)

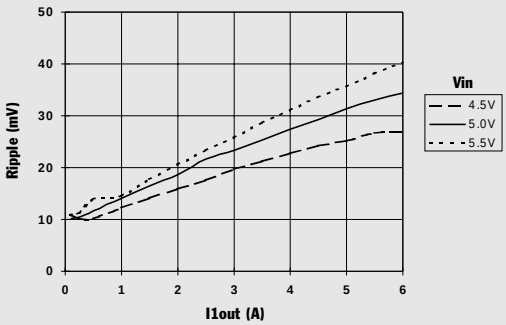
Total Efficiency vs I1out



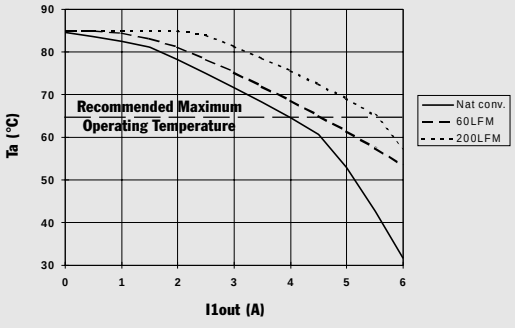
Total Power Dissipation vs I1out



V1out Ripple vs I1out



Safe Operating Area vs I1out



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.*

Adjusting the Output Voltage of the PT6920 Dual Output Voltage ISR

Both output voltages from the Power Trends PT6920 series ISRs can be independantly adjusted higher or lower than their factory trimmed pre-set voltage. In each case only a single external resistor is required to adjust either V_1 (the voltage at V_1out, or V_2 (the voltage at V_2out). Table 1 gives the permissible adjustment range for both V_1 and V_2 for each model in the series as V_a(min) and V_a(max). *Note: V_2 must always be lower than V_1.*

V_1 Adjust Up: To increase the output, add a resistor R4 between pin 16 (V_1 Adjust) and pins 7-11 (GND).

V_1 Adjust Down: Add a resistor (R3), between pin 16 (V_1 Adjust) and pin 1 (V_1 Remote Sense).

V_2 Adjust Up: Add a resistor R2 between pin 23 (V_2 Adjust) and pins 7-11 (GND).

V_2 Adjust Down: Add a resistor (R1) between pin 23 (V_2 Adjust) and pin 22 (V_2 Remote Sense).

Refer to Figure 1 and Table 2 for both the placement and value of the required resistor.

Notes:

1. The voltage at V_1out and V_2out may be adjusted independantly.
2. V_2 must always be at least 0.2V lower than V_1.
3. If V_1 is increased above 3.3V, the minimum input voltage to the ISR must also be increased. The minimum required input voltage must be (V_1 + 1.2)V or 4.5V, whichever is greater. Do not exceed 6.0V
4. Use only a single 1% resistor in either the (R3) or R4 location to adjust V_1, and in the (R1) or R2 location to adjust V_2. Place the resistor as close to the ISR as possible.
5. Never connect capacitors to either the V_1 Adjust or V_2 Adjust pins. Any capacitance added to these control pins will affect the stability of the respective regulated output.
6. To comply with the ISRs power dissipation limits, changes made to either output voltage (V_1 or V_2) may affect the maximum current available from both outputs. For more information, consult the related applications note, "Determining the Maximum Output Current for the PT6920 Series Dual Output ISR."

The adjust up and adjust down resistor values can also be calculated using the following formulae. Be sure to select the correct formula parameter from Table 1 for the output and model being adjusted.

$$(R1)/(R3) = \frac{R_o (V_a - 1)}{V_o - V_a} - R_s \quad k\Omega$$

$$R2/R4 = \frac{R_o}{V_a - V_o} - R_s \quad k\Omega$$

Where: V_o = Original output voltage, (V_1 or V_2)
V_a = Adjusted output voltage
R_o = The resistance value from Table 1
R_s = The series resistance from Table 1

Table 1

PT6920 ADJUSTMENT RANGE AND FORMULA PARAMETERS

Output Bus	V_1 out	V_2 out	
Series Pt #	PT6921/22	PT6921	PT6922
Adj. Resistor	(R3)/R4	(R1)/R2	(R1)/R2
V_o(nom)	3.3V	2.5V	1.5
Va(min)	2.3V	1.8V	1.2
Va(max)	4.2V	3.0V	3.0
R_o (kΩ)	12.1	10.0	9.76
R_s (kΩ)	12.1	11.5	6.49

Figure 1

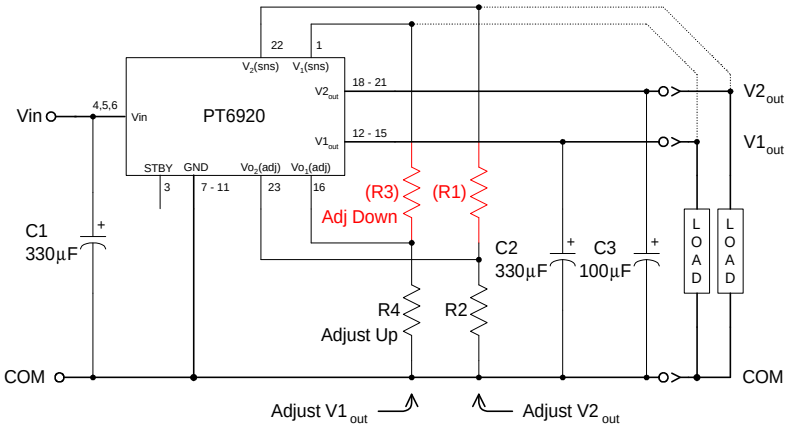


Table 2

PT6920 ADJUSTMENT RESISTOR VALUES

Output Bus	V_1 out	V_2 out	
Series Pt #	PT6921/22	PT6921	PT6922
Adj Resistor	(R3)/R4	(R1)/R2	(R1)/R2
V_o(nom)	3.3Vdc	2.5Vdc	1.5Vdc
V_a(req'd)			
1.2			(0.0)kΩ
1.25			(3.3)kΩ
1.3			(8.2)kΩ
1.35			(16.3)kΩ
1.4			(32.6)kΩ
1.45			(81.4)kΩ
1.5			
1.55			189.0kΩ
1.6			91.1kΩ
1.65			58.6kΩ
1.7			42.3kΩ
1.75			32.6kΩ
1.8		(0.0)kΩ	26.0kΩ
1.85		(1.6)kΩ	21.4kΩ
1.9		(3.5)kΩ	17.9kΩ
1.95		(5.8)kΩ	15.2kΩ
2.0		(8.5)kΩ	13.0kΩ
2.05		(11.8)kΩ	11.3kΩ
2.1		(16.0)kΩ	9.8kΩ
2.15		(21.4)kΩ	8.5kΩ
2.2		(28.5)kΩ	7.5kΩ
2.25		(38.5)kΩ	6.5kΩ
2.3	(3.6)kΩ	(53.5)kΩ	5.7kΩ
2.35	(5.1)kΩ	(78.5)kΩ	5.0kΩ
2.4	(6.7)kΩ	(129.0)kΩ	4.4kΩ
2.45	(8.5)kΩ	(279.0)kΩ	3.8kΩ
2.5	(10.6)kΩ		3.3kΩ
2.55	(12.9)kΩ	189.0kΩ	2.8kΩ
2.6	(15.6)kΩ	88.5kΩ	2.4kΩ
2.65	(18.6)kΩ	55.2kΩ	2.0kΩ
2.7	(22.2)kΩ	38.5kΩ	1.6kΩ
2.75	(26.4)kΩ	28.5kΩ	1.3kΩ
2.8	(31.5)kΩ	21.8kΩ	1.0kΩ
2.85	(37.6)kΩ	17.1kΩ	0.7kΩ
2.9	(45.4)kΩ	13.5kΩ	0.5kΩ
2.95	(55.3)kΩ	10.7kΩ	0.2kΩ
3.0	(68.6)kΩ	8.5kΩ	0.0kΩ
3.05	(87.1)kΩ		
3.1	(115.0)kΩ		
3.15	(161.0)kΩ		
3.2	(254.0)kΩ		
3.25	(532.0)kΩ		
3.3			
3.4	109.0kΩ		
3.5	48.4kΩ		
3.6	28.2kΩ		
3.7	18.2kΩ		
3.8	12.1kΩ		
3.9	8.1kΩ		
4.0	5.2kΩ		
4.1	3.0kΩ		
4.2	1.3kΩ		

R1/R3 = (Red) R2/R4 = Black

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