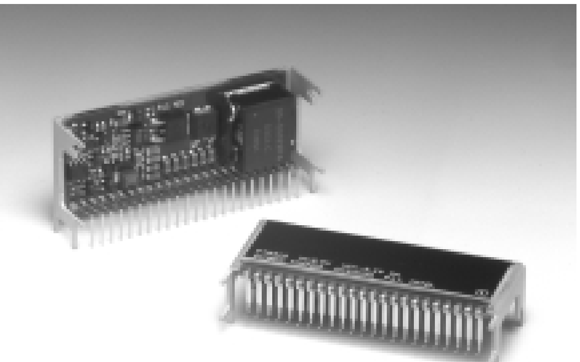
12 Watt 5V/3.3V Input Plus to Minus Voltage Converter

SLTS113

(Revised 11/30/2000)



Patent pending on package assembly

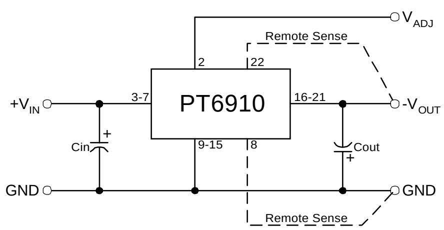
- Single-Device: +5V/3.3V input
- Remote Sense
- +5V & +3.3V Input Voltage
- Adjustable Output Voltage
- 23-pin Space-Saving Package
- Solderable Copper Case

The PT6910 series is a series of high performance 12 watt, plus to minus voltage convertors that are designed to power the latest ECL (–5.2V) and GaAs (-2.0V) ICs from an existing +5.0V or +3.3V source.

These regulators are similar to the popular PT6900 series with the added feature of Power Trends' unique solderable copper case.

A 330µF electrolytic capacitor is required on both the input and output for proper operation. Also note that this product does not include short-circuit protection.

Standard Application



C_{in} = Required 330µF electrolytic
C_{out} = Required 330µF electrolytic

Pin-Out Information

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

Ordering Information

+5V Input	+3.3V Input	V_{out}
PT6911❑	**PT6914❑**	= –2.0V
PT6912❑	**PT6915❑**	= –5.2V
PT6913❑		= –1.5V

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 1300 and 1310.)

Specifications

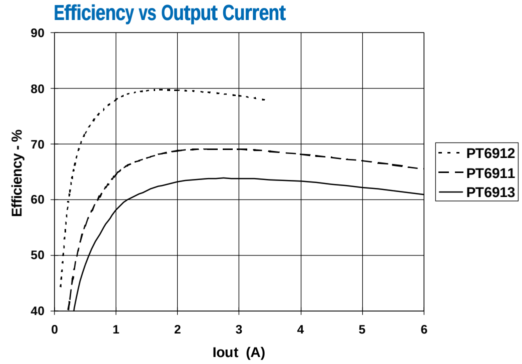
Characteristics (T_a= 25°C unless noted)	Symbols	Conditions	PT6910 SERIES Min	Typ	Max	Units
Output Current	I_o	T_a = +25°C, natural convection V_{in} =5.0V, V_o =–2.0V / –1.5V V_o =–5.2V	 0.1 (1) 0.1 (1)	 — —	 6.0 (2) 3.5 (2)	A
		V_{in} =3.3V, V_o =–2.0V V_o =–5.2V	0.1 (1) 0.1 (1)	— —	5.0 (2) 2.5 (2)	A A
Input Voltage Range		$0.1A \le I_o \le I_{max}$ PT6911 PT6912/PT6913 PT6914/PT6915	4.5 3.1	— —	5.5 3.6	V
Output Voltage Tolerance	ΔV_o	Nominal V_{in}, I_o = I_{max} $0°C \le T_a \le +60°C$	Vo – 0.05	—	Vo + 0.05	V
Output Adjust Range	V_o	Pin 14 to V_o or GND, V_o =–2.0V V_o =–5.2V V_o =–1.5V	–1.4 –2.7 –1.2	— — —	–4.4 –6.5 –3.4	V
Line Regulation	Reg_{line}	Over V_{in} range, I_o =I_{max}	—	±0.5	±1.0	%
Load Regulation	Reg_{load}	V_{in} =V_{nom}, $0.1 \le I_o \le I_{max}$	—	±0.5	±1.0	%
V_o Ripple/Noise	V_n	V_{in} = V_{nom}, I_o =I_{max}, V_o =–1.5V / –2.0V V_o =–5.2V	— —	40 50	— —	mV
Transient Response with C_{out} = 330µF	t_{tr} V_{os}	I_o step between 0.5xI_{max} and I_{max} V_o over/undershoot	— —	200 200	— —	µSec mV
Efficiency	η	V_{in} =+5V, I_o =0.5xI_{max}, V_o = –1.5V V_o = –2.0V V_o = –5.2V	— — —	65 70 77	— — —	%
		V_{in} = +3.3V, I_o =0.5xI_{max}, Vo = –2.0V Vo = –5.2V	— —	67 75	— —	%
Switching Frequency	f_o	Over V_{in} and I_o ranges	500	—	600	kHz
Absolute Maximum Operating Temperature Range	T_a		0	—	+85 (2)	°C
Recommended Operating Temperature Range	T_a	Over V_{in} Range	0	—	+60	°C
Storage Temperature	T_s		-40	—	+125	°C
Weight	—	Vertical/Horizontal	—	26	—	grams

Notes: *(1) ISR-will operate down to no load with reduced specifications.*
(2) See Safe Operating Area curves, or consult the factory for the appropriate derating.

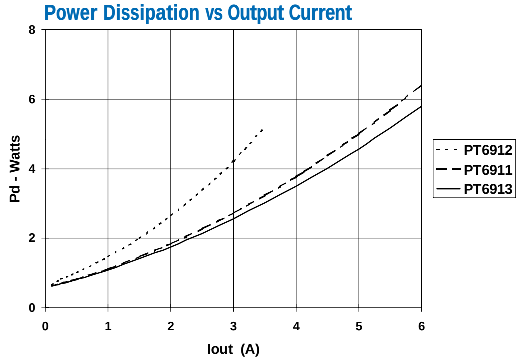
Typical Characteristics

5.0V Input Voltage (See Note A)

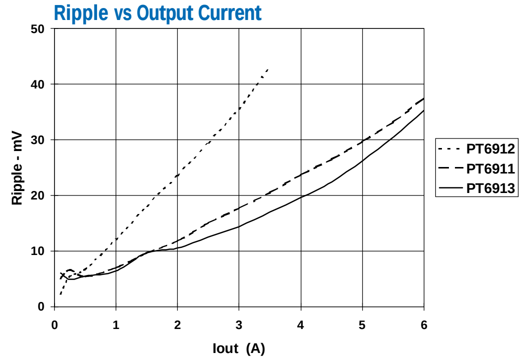
Efficiency vs Output Current



Power Dissipation vs Output Current

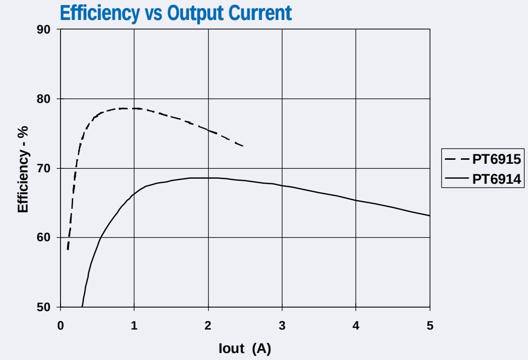


Ripple vs Output Current

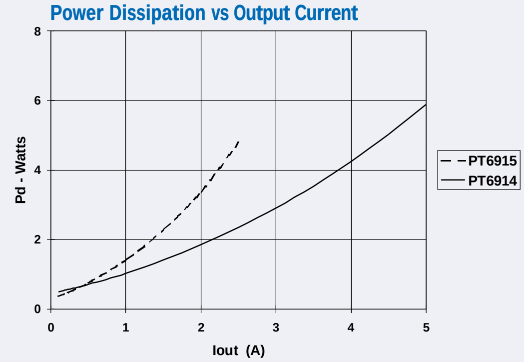


3.3V Input Voltage (See Note A)

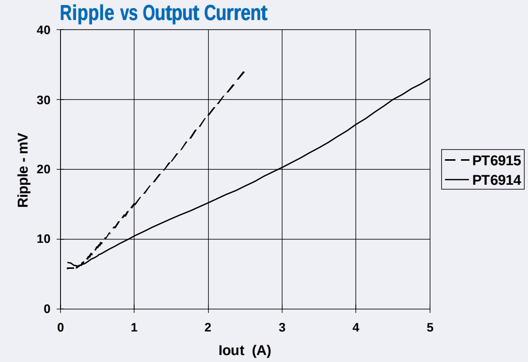
Efficiency vs Output Current



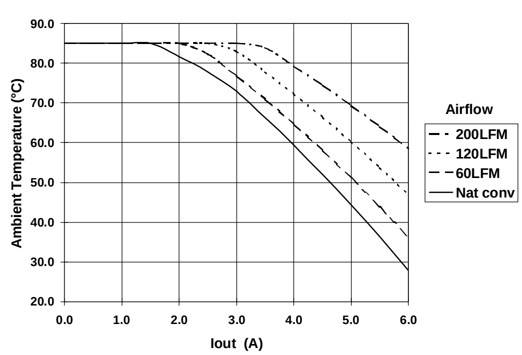
Power Dissipation vs Output Current



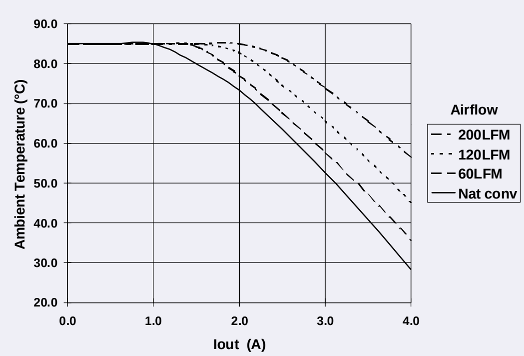
Ripple vs Output Current



PT6911 Safe Operating Area, Vin =5.0V (See Note B)



PT6912 Safe Operating Area, Vin =5.0V (See Note B)



Note A: *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 DC-DC Converter.*
Note B: *SOA curves represent the condition at which internal com-ponents are at or below manufacturere's maximum operating temperature.*

Adjusting the Output Voltage of the PT6900/PT6910 Positive to Negative Converter Series

The negative output voltage of the Power Trends PT6900 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 2 (V_o adjust) and pin 8 (Remote Sense GND).

Adjust Down: Add a resistor (R1), between pin 2 (V_o adjust) and pin 22 (Remote Sense V_o).

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

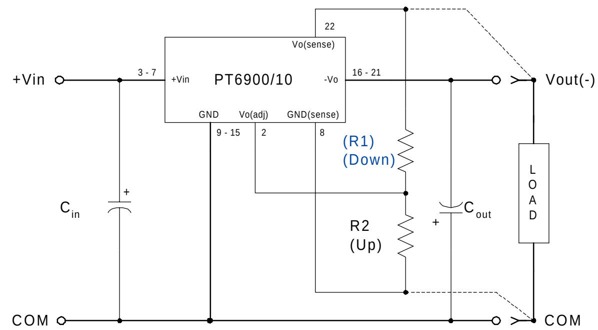
Notes:

1. Only a single 1% resistor is required in either the (R1) or R2 location. Do not use (R1) and R2 simultaneously. 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 Sense pins. Any capacitance added to the V_o adjust pin will affect the stability of the ISR.
3. If the sense pins are not being used, the resistors (R1) and R2 can be connected to V_{out} and GND respectively.
4. An increase in the output voltage must be accompanied by a corresponding reduction in the maximum output current. The revised maximum output current must be reduced to the equivalent of 12Watts.

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

where V_a is the adjusted output voltage.

Figure 1



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

$$(R1) = \frac{24.9\,(V_a - V_r)}{(V_o - V_a)} - R_s \quad k\Omega$$

$$R2 = \frac{24.9\,V_r}{(V_a - V_o)} - R_s \quad k\Omega$$

Where:

V_o = Original output voltage
V_a = Adjusted output voltage
V_r = Reference voltage in Table 1
R_s = The resistance given in Table 1

Table1

PT6900/PT6910 ADJUSTMENT RANGE AND FORMULA PARAMETERS

Series Pt #			
5.0V Bus	**PT6903/13**	**PT6901/11**	**PT6902/12**
3.3V Bus		**PT6904/14**	**PT6905/15**
V_o (nom)	-1.5V	-2.0V	-5.2V
V_a (min)	-1.2V	-1.4V	-2.7V
V_a (max)	-3.4V	-4.5V	-6.5V
V_r	-1.0V	-1.0V	-0.92V
R_s (kΩ)	12.7	10.0	17.4

Table 2

PT6900/PT6910 ADJUSTMENT RESISTOR VALUES

Series Pt #			
5.0V Bus	**PT6903/13**	**PT6901/11**	**PT6902/12**
3.3V Bus		**PT6904/14**	**PT6905/15**
V_o (nom)	**–1.5Vdc**	**–2.0Vdc**	**–5.2Vdc**
V_a (req'd)			
–1.2	(3.9)kΩ		
–1.3	(24.7)kΩ		
–1.4	(86.9)kΩ	(6.6)kΩ	
–1.5		(14.9)kΩ	
–1.6	236.0kΩ	(27.4)kΩ	
–1.7	112.0kΩ	(48.1)kΩ	
–1.8	70.3kΩ	(89.6)kΩ	
–1.9	49.6kΩ	(214.0)kΩ	
–2.0	37.1kΩ		
–2.1	28.8kΩ	239.0kΩ	
–2.2	22.9kΩ	115.0kΩ	
–2.3	18.4kΩ	73.0kΩ	
–2.4	15.0kΩ	52.3kΩ	
–2.5	12.2kΩ	39.8kΩ	
–2.6	9.9kΩ	31.5kΩ	
–2.7	8.1kΩ	25.6kΩ	(0.3)kΩ
–2.8	6.5kΩ	21.1kΩ	(2.1)kΩ
–2.9	5.1kΩ	17.7kΩ	(4.0)kΩ
–3.0	3.9kΩ	14.9kΩ	(6.1)kΩ
–3.1	2.9kΩ	12.6kΩ	(8.5)kΩ
–3.2	2.0kΩ	10.8kΩ	(11.0)kΩ
–3.3	1.1kΩ	9.2kΩ	(13.8)kΩ
–3.4	0.4kΩ	7.8kΩ	(16.9)kΩ
–3.5		6.6kΩ	(20.4)kΩ
–3.6		5.6kΩ	(24.3)kΩ
–3.7		4.7kΩ	(28.7)kΩ
–3.8		3.8kΩ	(33.8)kΩ

Series Pt #		
5.0V Bus	**PT6901/11**	**PT6902/12**
3.3V Bus	**PT6904/14**	**PT6905/15**
V_o (nom)	**–2.0Vdc**	**–5.2Vdc**
V_a (req'd)		
–3.9	3.1kΩ	(39.7)kΩ
–4.0	2.5kΩ	(46.5)kΩ
–4.1	1.9kΩ	(54.6)kΩ
–4.2	1.3kΩ	(64.3)kΩ
–4.3	0.8kΩ	(76.1)kΩ
–4.4	0.4kΩ	(90.9)kΩ
–4.5	0.0kΩ	(106.0)kΩ
–4.6		(135.0)kΩ
–4.7		(171.0)kΩ
–4.8		(224.0)kΩ
–4.9		(313.0)kΩ
–5.0		(491.0)kΩ
–5.1		(1020.0)kΩ
–5.2		
–5.3		212.0kΩ
–5.4		97.1kΩ
–5.5		59.0kΩ
–5.6		39.9kΩ
–5.7		28.4kΩ
–5.8		20.8kΩ
–5.9		15.3kΩ
–6.0		11.2kΩ
–6.1		8.1kΩ
–6.2		5.5kΩ
–6.3		3.4kΩ
–6.4		1.7kΩ
–6.5		0.2kΩ

R1 = (Blue)   R2 = Black