

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

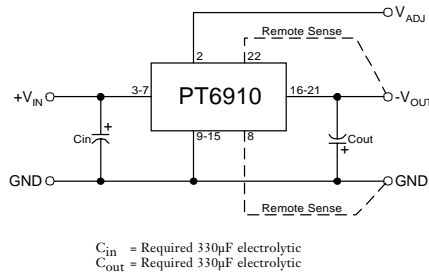
The PT6910 series is a series of high performance 12 watt, plus to minus voltage converters that are designed to power the latest ECL (-5.2V) and

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



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 |

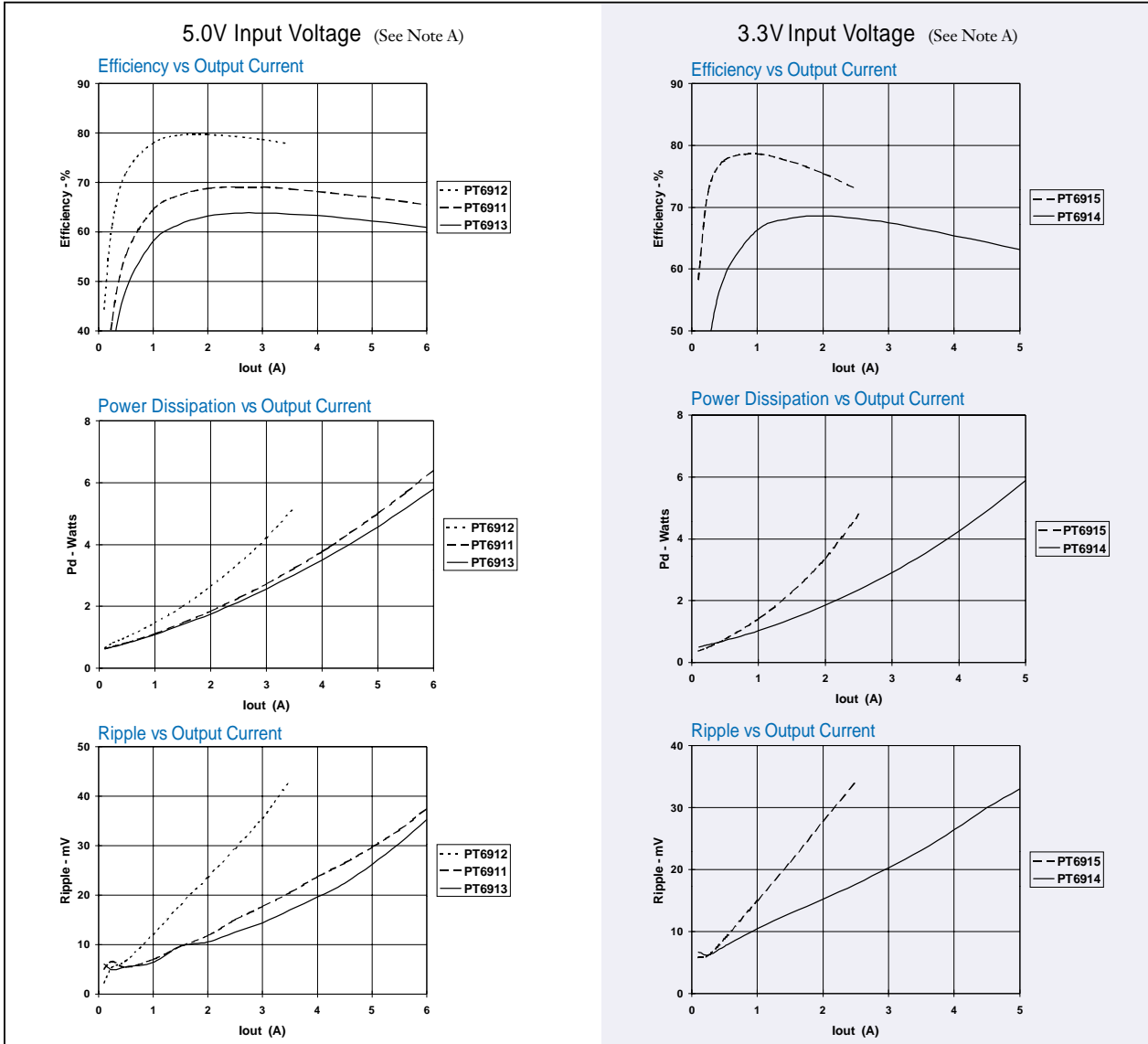
(For dimensions and PC board layout, see Package Styles 1300 and 1310.)

Specifications

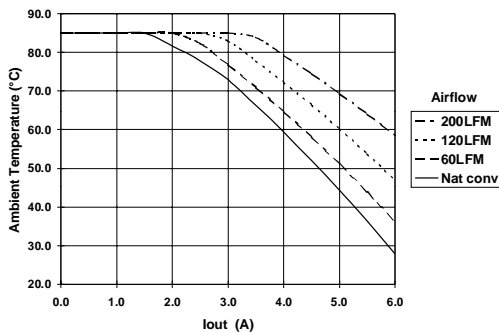
| Characteristics ($T_a = 25^\circ\text{C}$ unless noted) | Symbols | Conditions | PT6910 SERIES | | | Units | |
|---|--------------|---|---|-----------|----------------------|--------------------|---|
| | | | Min | Typ | Max | | |
| Output Current | I_o | $T_a = +25^\circ\text{C}$, natural convection | | | | | |
| | | $V_{in} = 5.0\text{V}$ | $V_o = -2.0\text{V} / -1.5\text{V}$ $V_o = -5.2\text{V}$ | 0.1 (1) | — | 6.0 (2) 3.5 (2) | A |
| | | $V_{in} = 3.3\text{V}$ | $V_o = -2.0\text{V}$ $V_o = -5.2\text{V}$ | 0.1 (1) | — | 5.0 (2) 2.5 (2) | A |
| Input Voltage Range | | $0.1\text{A} \leq I_o \leq I_{max}$ PT6911 PT6912/PT6913 PT6914/PT6915 | 4.5 3.1 | — | 5.5 3.6 | V | |
| Output Voltage Tolerance | ΔV_o | Nominal V_{in} , $I_o = I_{max}$ $0^\circ\text{C} \leq T_a \leq +60^\circ\text{C}$ | $V_o - 0.05$ | — | $V_o + 0.05$ | V | |
| Output Adjust Range | V_o | Pin 14 to V_o or GND $V_o = -2.0\text{V}$ $V_o = -5.2\text{V}$ $V_o = -1.5\text{V}$ | -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} | $V_{in} = V_{nom}$, $0.1 \leq I_o \leq I_{max}$ | — | ± 0.5 | ± 1.0 | % | |
| V_o Ripple/Noise | V_n | $V_{in} = V_{nom}$, $I_o = I_{max}$ $V_o = -1.5\text{V} / -2.0\text{V}$ $V_o = -5.2\text{V}$ | — | 40 50 | — | mV | |
| Transient Response with $C_{out} = 330\mu\text{F}$ | t_{tr} | I_o step between $0.5I_{max}$ and I_{max} | — | 200 | — | µSec | |
| | V_{os} | V_o over/undershoot | — | 200 | — | mV | |
| Efficiency | η | $V_{in} = +5\text{V}$, $I_o = 0.5I_{max}$ | $V_o = -1.5\text{V}$ | — | 65 | — | % |
| | | | $V_o = -2.0\text{V}$ | — | 70 | — | |
| | | | $V_o = -5.2\text{V}$ | — | 77 | — | |
| | | $V_{in} = +3.3\text{V}$, $I_o = 0.5I_{max}$ | $V_o = -2.0\text{V}$ | — | 67 | — | % |
| $V_o = -5.2\text{V}$ | — | 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) | $^\circ\text{C}$ | |
| Recommended Operating Temperature Range | T_a | Over V_{in} Range | 0 | — | +60 | $^\circ\text{C}$ | |
| Storage Temperature | T_s | | -40 | — | +125 | $^\circ\text{C}$ | |
| 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.

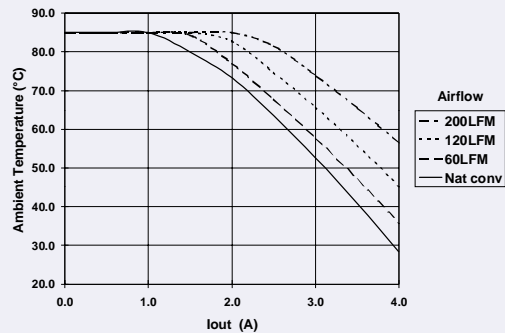
12 Watt 5V/3.3V Input
Plus to Minus Voltage Converter



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 components are at or below manufacturer's maximum operating temperature.

PT6900/6910 Series

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.

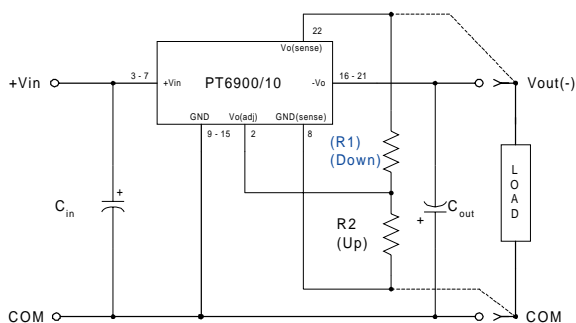
Notes:

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.

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

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.

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

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

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

Table 1

| 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 (k Ω) | 12.7 | 10.0 | 17.4 |

PT6900/6910 Series

Table 2

PT6900/PT6910 ADJUSTMENT RESISTOR VALUES

| Series Pt # | PT6903/13 | PT6901/11 | PT6902/12 |
|------------------------|-----------|-----------|-----------|
| 5.0V Bus | | | |
| 3.3V Bus | | PT6904/14 | PT6905/15 |
| V ₀ (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 |

R1 = (Blue)

R2 = Black

| Series Pt # | PT6901/11 | PT6902/12 |
|------------------------|-----------|------------|
| 5.0V Bus | | |
| 3.3V Bus | PT6904/14 | PT6905/15 |
| V ₀ (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 |

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| PT6911A | ACTIVE | SIP MOD ULE | ELA | 23 | 10 | TBD | Call TI | Level-1-215C-UNLIM |
| PT6911C | ACTIVE | SIP MOD ULE | ELC | 23 | 10 | TBD | Call TI | Level-3-215C-168HRS |
| PT6911N | ACTIVE | SIP MOD ULE | ELD | 23 | 10 | TBD | Call TI | Level-1-215C-UNLIM |
| PT6912A | ACTIVE | SIP MOD ULE | ELA | 23 | 10 | TBD | Call TI | Level-1-215C-UNLIM |
| PT6912C | ACTIVE | SIP MOD ULE | ELC | 23 | 10 | TBD | Call TI | Level-3-215C-168HRS |
| PT6912N | ACTIVE | SIP MOD ULE | ELD | 23 | 10 | TBD | Call TI | Level-1-215C-UNLIM |
| PT6913C | ACTIVE | SIP MOD ULE | ELC | 23 | 10 | TBD | Call TI | Level-3-215C-168HRS |
| PT6914A | ACTIVE | SIP MOD ULE | ELA | 23 | 10 | TBD | Call TI | Level-1-215C-UNLIM |
| PT6914C | ACTIVE | SIP MOD ULE | ELC | 23 | 10 | TBD | Call TI | Level-3-215C-168HRS |
| PT6914N | ACTIVE | SIP MOD ULE | ELD | 23 | 10 | TBD | Call TI | Level-1-215C-UNLIM |
| PT6915A | ACTIVE | SIP MOD ULE | ELA | 23 | 10 | TBD | Call TI | Level-1-215C-UNLIM |
| PT6915C | ACTIVE | SIP MOD ULE | ELC | 23 | 10 | TBD | Call TI | Level-3-215C-168HRS |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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