

Features

- 90%+ Efficiency
- Internal Short-Circuit Protection
- Pin-Compatible with 3-Terminal Linear Regulators
- Laser-Trimmed Output Voltage
- Over-Temperature Protection
- Small Footprint
- Wide Input Range
- 5-Pin Mount Option (Suffixes L & M)

Description

The PT5100 modules are a series of economical, easy-to-use 1-A positive step-down, Integrated Switching Regulators (ISRs). These ISRs are compatible with most TO-220 style linear regulators, and when employed as a linear replacement, provide significant benefits in both efficiency and power dissipation. They are recommended for use in a wide variety of on-board power regulation applications. These include computer, data storage, industrial controls, and battery powered equipment. Modules are laser-trimmed for optimal output voltage accuracy, and exhibit excellent line and load regulation. The PT5100 also features output current limiting and thermal shutdown protection.

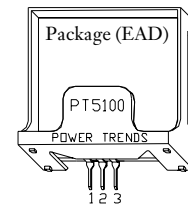
Ordering Information

| | |
|-----------------|---------------|
| PT5101 □ | = +5.0 Volts |
| PT5102 □ | = +12.0 Volts |
| PT5103 □ | = +3.3 Volts |
| PT5105 □ | = +6.5 Volts |
| PT5107 □ | = +15.0 Volts |
| PT5109 □ | = +5.6 Volts |
| PT5110 □ | = +9.0 Volts |
| PT5111 □ | = +10.0 Volts |
| PT5112 □ | = +8.0 Volts |

PT Series Suffix (PT1234x)

| Case/Pin Configuration | Order Suffix | Package Code |
|------------------------|--------------|--------------|
| Vertical | N | (EAD) |
| Horizontal | A | (EAA) |
| SMD | C | (EAC) |
| Horizontal, 2-pin Tab | M | (EAM) |
| SMD, 2-Pin Tab | L | (EAL) |

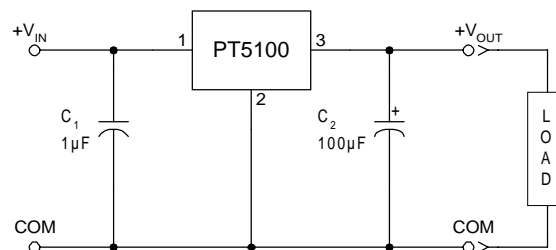
(Reference the applicable package code drawing for the dimensions and PC board layout)



Pin-Out Information

| Pin | Function |
|-----|------------------|
| 1 | V _{in} |
| 2 | GND |
| 3 | V _{out} |

Standard Application



C₁ = Optional 1µF ceramic capacitor
C₂ = Required 100µF electrolytic

PT5100 Series

1-A Positive Step-down Integrated Switching Regulator

Specifications (Unless otherwise stated, $T_a = 25^\circ\text{C}$, $V_{in} = V_{in\text{min}}$, $C_{out} = 100\mu\text{F}$, and $I_o = I_{o\text{max}}$)

| Characteristic | Symbol | Conditions | PT5100 SERIES | | | Units | |
|--------------------------------|----------------------------|--|------------------------|------------------|----------------------|------------------|---------------------------|
| | | | Min | Typ | Max | | |
| Output Current | I_o | Over V_{in} range | 0.1 ⁽¹⁾ | — | 1.0 | A | |
| Input Voltage Range | V_{in} | Over I_o Range | $V_o = 3.3\text{V}$ | 9 | — | 26 | VDC |
| | | | $V_o = 5.0\text{V}$ | 9 | — | 38 | |
| | | | $V_o > 5.0\text{V}$ | $V_o + 4$ | — | 38 | |
| Set Point Voltage Tolerance | $V_o\text{tol}$ | | — | ± 1 | ± 2 | $\%V_o$ | |
| Temperature Variation | Reg_{temp} | $0^\circ \leq T_a \leq +60^\circ\text{C}$, $I_o = I_{o\text{min}}$ | — | ± 0.5 | — | $\%V_o$ | |
| Line Regulation | Reg_{line} | Over V_{in} range | — | ± 5 | ± 10 | mV | |
| Load Regulation | Reg_{load} | Over I_o range | — | ± 5 | ± 10 | mV | |
| Total Output Voltage Variation | $\Delta V_{o\text{tot}}$ | Includes set-point, line, load, $0^\circ \leq T_a \leq +60^\circ\text{C}$ | — | ± 1.5 | ± 3 | $\%V_o$ | |
| Efficiency | η | | $V_o = 15\text{V}$ | — | 95 | — | % |
| | | | $V_o = 12\text{V}$ | — | 94 | — | |
| | | | $V_o = 10\text{V}$ | — | 92 | — | |
| | | | $V_o = 5.0\text{V}$ | — | 90 | — | |
| | | | $V_o = 3.3\text{V}$ | — | 82 | — | |
| V_o Ripple (pk-pk) | V_r | 20MHz bandwidth | — | 2 | — | $\%V_o$ | |
| Transient Response | t_{tr} | 1A/ μs load step, 50% to 100% $I_{o\text{max}}$ | — | 100 | 200 | μs | |
| | ΔV_{tr} | V_o over/undershoot | — | ± 5.0 | — | $\%V_o$ | |
| Current Limit | I_{lim} | $\Delta V_o = -1\%$ | 1.2 | 2.6 | — | A | |
| Switching Frequency | f_s | Over V_{in} range | $V_o \geq 5.0\text{V}$ | 500 | 650 | 800 | kHz |
| | | | $V_o \leq 3.3\text{V}$ | 575 | 725 | 875 | |
| External Output Capacitance | C_{out} | | 100 | — | — | μF | |
| Operating Temperature Range | T_a | Over V_{in} range | -40 ⁽²⁾ | — | $+85$ ⁽³⁾ | $^\circ\text{C}$ | |
| Thermal Resistance | θ_{ja} | Free-air convection (40-60LFM) | $V_o = 3.3\text{V}$ | — | 45 | — | $^\circ\text{C}/\text{W}$ |
| | | | $V_o = 5.0\text{V}$ | — | 50 | — | |
| | | | $V_o \geq 12\text{V}$ | — | 60 | — | |
| Storage Temperature | T_s | — | -40 | — | $+125$ | $^\circ\text{C}$ | |
| Reliability | MTBF | Per Bellcore TR-332 50% stress, $T_a = 40^\circ\text{C}$, ground benign | 11.3 | — | — | 10^6 Hrs | |
| Mechanical Shock | — | Per Mil-Std-883D, method 2002.3, 1mS, half-sine, mounted to a fixture | — | 500 | — | G's | |
| Mechanical Vibration | — | Per Mil-Std-883D, Method 2007.2 20-2000Hz, soldered in PC board | — | 5 ⁽⁴⁾ | — | G's | |
| Weight | — | Suffixes N, A, & C | — | 4.5 | — | grams | |
| | | Suffixes L & M | — | 6.5 | — | | |
| Flammability | — | Materials meet UL 94V-0 | — | — | — | — | |

Notes: (1) The ISR will operate at no load with reduced specifications.

(2) For operation below 0°C , use a tantalum type capacitor for C_2 .

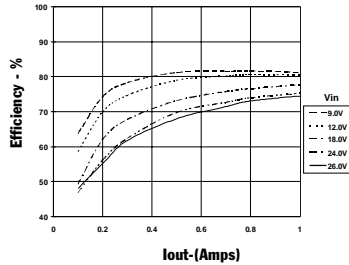
(3) See Thermal Derating curves.

(4) The tab pins on the 5-pin mount package types (suffixes L & M) must be soldered. For more information see the applicable package outline drawing.

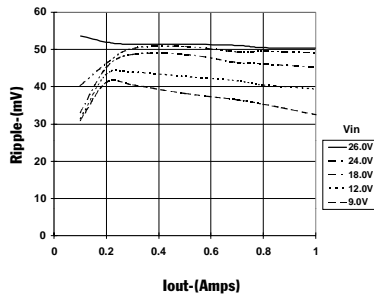
1-A Positive Step-down
Integrated Switching Regulator

PT5103, 3.3 VDC (See Note A)

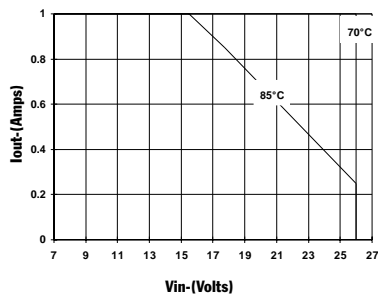
Efficiency vs Output Current



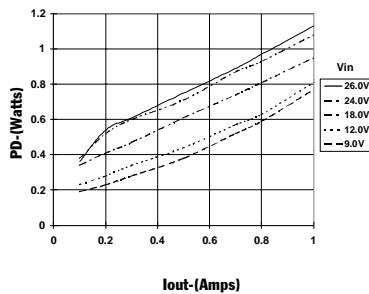
Ripple vs Output Current



Thermal Derating (T_A) (See Note B)

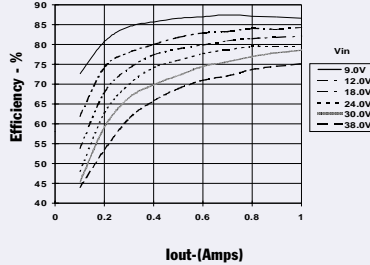


Power Dissipation vs Output Current

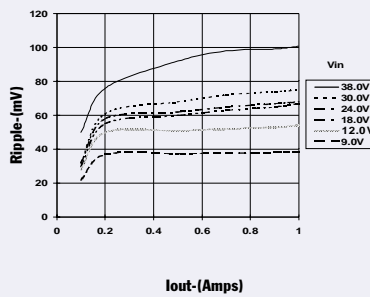


PT5101, 5.0 VDC (See Note A)

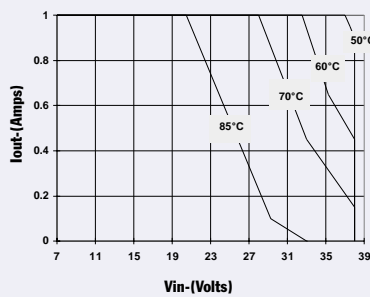
Efficiency vs Output Current



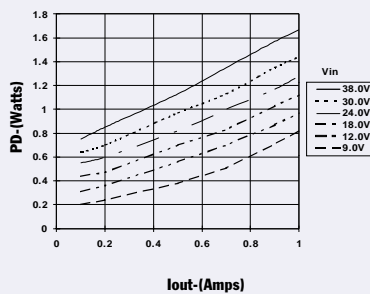
Ripple vs Output Current



Thermal Derating (T_A) (See Note B)

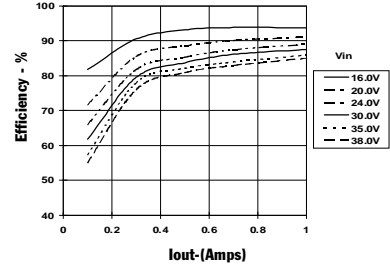


Power Dissipation vs Output Current

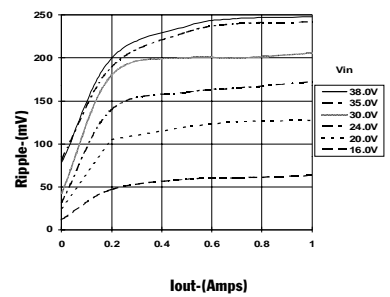


PT5102, 12.0 VDC (See Note A)

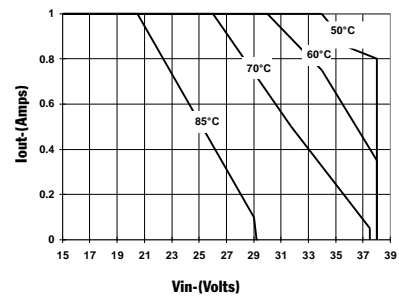
Efficiency vs Output Current



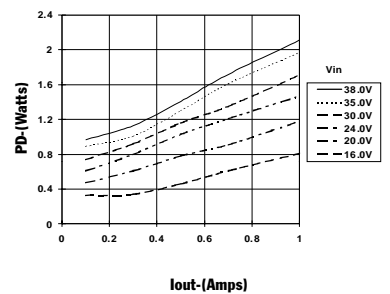
Ripple vs Output Current



Thermal Derating (T_A) (See Note B)



Power Dissipation vs Output Current



Note A: Characteristic data has been developed from actual products tested at 25°C. This data is considered typical data for the Converter.
Note B: Thermal derating graphs are developed in free-air convection cooling, which corresponds to approximately 40-60LFM of airflow.

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| PT5101A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101CT | ACTIVE | SIP MOD ULE | EAC | 3 | 200 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101G | ACTIVE | SIP MOD ULE | EAG | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101H | ACTIVE | SIP MOD ULE | EAH | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101J | ACTIVE | SIP MOD ULE | EAJ | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101L | ACTIVE | SIP MOD ULE | EAL | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101M | ACTIVE | SIP MOD ULE | EAM | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101S | ACTIVE | SIP MOD ULE | EAF | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5101U | ACTIVE | SIP MOD ULE | EAU | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102CT | ACTIVE | SIP MOD ULE | EAC | 3 | 200 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102H | ACTIVE | SIP MOD ULE | EAH | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102J | ACTIVE | SIP MOD ULE | EAJ | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102M | ACTIVE | SIP MOD ULE | EAM | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5102S | ACTIVE | SIP MOD ULE | EAF | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5103A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5103C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5103H | ACTIVE | SIP MOD ULE | EAH | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5103J | ACTIVE | SIP MOD ULE | EAJ | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5103L | ACTIVE | SIP MOD ULE | EAL | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5103M | ACTIVE | SIP MOD ULE | EAM | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| PT5103N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5105A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5105C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5105L | ACTIVE | SIP MOD ULE | EAL | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5105N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5107A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5107C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5107J | ACTIVE | SIP MOD ULE | EAJ | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5107M | ACTIVE | SIP MOD ULE | EAM | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5107N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5109A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5109C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5109M | ACTIVE | SIP MOD ULE | EAM | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5109N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5110A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5110C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5110N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5110S | ACTIVE | SIP MOD ULE | EAF | 3 | 16 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5111A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5111C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5111M | ACTIVE | SIP MOD ULE | EAM | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5111N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5112A | ACTIVE | SIP MOD ULE | EAA | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5112C | ACTIVE | SIP MOD ULE | EAC | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5112L | ACTIVE | SIP MOD ULE | EAL | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |
| PT5112N | ACTIVE | SIP MOD ULE | EAD | 3 | 35 | TBD | Call TI | Level-1-215C-UNLIM |

(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) 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.

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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