



Features

- 40ADC Output Current
- +3.3V or +5V Input
- Low Output Voltages: 0.8V—2.7V
- High Efficiency
- Programmable Output: (VRM Compatible 5-bit Codes)
- Multiphase Topology
- Output Remote Sense
- Short-Circuit Protection
- Thermal Shutdown
- Standby On/Off Control
- Space-Saving Package
- Solderable Copper Case

Description

The PT8100 Excalibur™ power modules are a family of high-output, high-efficiency, fully integrated switching regulators (ISRs), housed in a solderable 31-pin space-saving copper package. Modules are available for operation from either a 3.3V or 5V nominal input bus voltage. Each provides up to 40A of output current at output voltages as low as 0.8V. The output voltage is programmable via a 5-bit input code.

The PT8100 series incorporates a state-of-the-art, 2-phase, multiple power path topology. This extends the output current range while providing superior transient response

and input current ripple performance. The modules are designed for high-end computing and signal processing applications, both of which demand high output currents at low supply voltages.

The modules have a number of standard features to facilitate system integration. These include short-circuit protection, thermal shutdown, standby (On/Off) control, and an output remote sense to compensate for voltage drop between the regulator and the load. In addition, the voltage programming codes are compatible with Intel's® VRM specifications.

Ordering Information

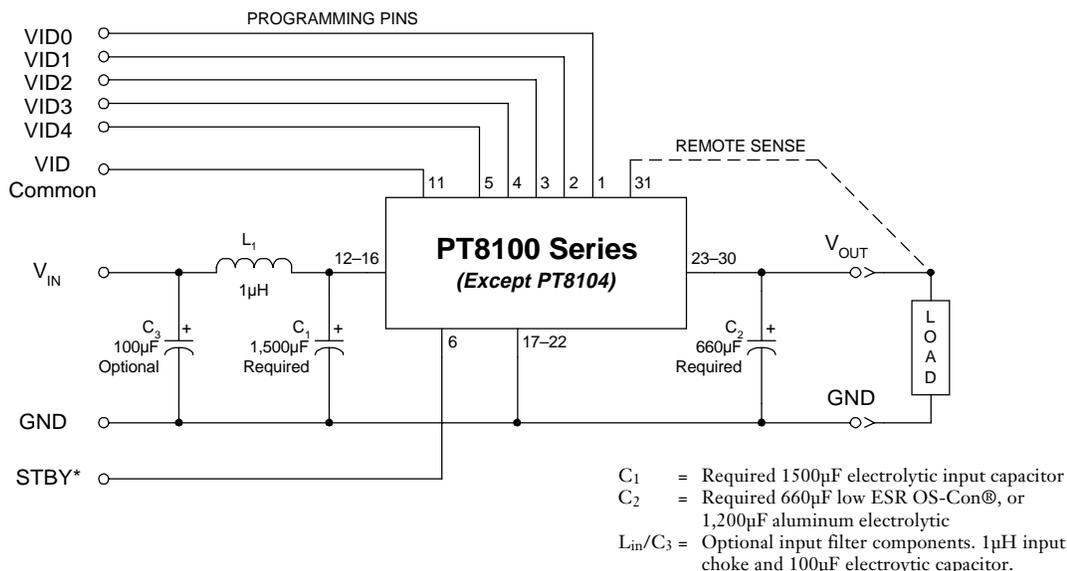
| Part No. | Output Voltage Program Range | Input Bus |
|----------|------------------------------|-----------|
| PT8101□ | =1.300 to 2.70V | 5V |
| PT8102□ | =1.075 to 1.85V | 5V |
| PT8103□ | =1.075 to 1.85V | 3.3V |
| PT8104□ | =1.050 to 1.825V | 5V |
| PT8105□ | =0.800 to 1.575V | 3.3V |

PT Series Suffix (PT1234 x)

| Case/Pin Configuration | Order Suffix | Package Code |
|------------------------|--------------|--------------|
| Vertical | N | (EKH) |
| Horizontal | A | (EKF) |
| SMD | C | (EKG) |

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

Standard Application (See p.3 for PT8104 application schematic)



Pin-Out Information (Except PT8104 –see p.3)

| Pin | Function | Pin | Function | Pin | Function |
|-----|----------------|-----|-----------------|-----|------------------|
| 1 | VID 0 | 12 | V _{in} | 22 | GND |
| 2 | VID 1 | 13 | V _{in} | 23 | V _{out} |
| 3 | VID 2 | 14 | V _{in} | 24 | V _{out} |
| 4 | VID 3 | 15 | V _{in} | 25 | V _{out} |
| 5 | VID 4 | 16 | V _{in} | 26 | V _{out} |
| 6 | STBY* | 17 | GND | 27 | V _{out} |
| 7 | Do Not Connect | 18 | GND | 28 | V _{out} |
| 8 | Do Not Connect | 19 | GND | 29 | V _{out} |
| 9 | Do Not Connect | 20 | GND | 30 | V _{out} |
| 10 | Do Not Connect | 21 | GND | 31 | Remote Sense |
| 11 | VID Common | | | | |

* For STBY pin:
 Open = Output Enabled
 VID Common = Output Disabled

Voltage Programming Information (Except PT8104 –see p.3)

| VID 3 | VID 2 | VID 1 | VID 0 | PT8101 (VRM 8.4) | | PT8102/8103 (VRM 9.1) | | PT8105 (Custom Code) | |
|-------|-------|-------|-------|---------------------------------|-----------------|--------------------------|-----------------|-------------------------|-----------------|
| | | | | VID 4=1 Vout ^(iv) | VID 4=0 Vout | VID 4=1 Vout | VID 4=0 Vout | VID 4=1 Vout | VID 4=0 Vout |
| 1 | 1 | 1 | 1 | 2.00 | 1.30V | 1.075V | 1.475V | 0.800V | 1.200V |
| 1 | 1 | 1 | 0 | 2.10 | 1.35V | 1.100V | 1.500V | 0.825V | 1.225V |
| 1 | 1 | 0 | 1 | 2.30 | 1.40V | 1.125V | 1.525V | 0.850V | 1.250V |
| 1 | 1 | 0 | 0 | 2.40 | 1.45V | 1.150V | 1.550V | 0.875V | 1.275V |
| 1 | 0 | 1 | 1 | 2.50 | 1.50V | 1.175V | 1.575V | 0.900V | 1.300V |
| 1 | 0 | 1 | 0 | 2.60 | 1.55V | 1.200V | 1.600V | 0.925V | 1.325V |
| 1 | 0 | 0 | 1 | 2.70 | 1.60V | 1.225V | 1.625V | 0.950V | 1.350V |
| 1 | 0 | 0 | 0 | N/A | 1.65V | 1.250V | 1.650V | 0.975V | 1.375V |
| 0 | 1 | 1 | 1 | N/A | 1.70V | 1.275V | 1.675V | 1.000V | 1.400V |
| 0 | 1 | 1 | 0 | N/A | 1.75V | 1.300V | 1.700V | 1.025V | 1.425V |
| 0 | 1 | 0 | 1 | N/A | 1.80V | 1.325V | 1.725V | 1.050V | 1.450V |
| 0 | 1 | 0 | 0 | N/A | 1.85V | 1.350V | 1.750V | 1.075V | 1.475V |
| 0 | 0 | 1 | 1 | N/A | 1.90V | 1.375V | 1.775V | 1.100V | 1.500V |
| 0 | 0 | 1 | 0 | N/A | 1.95V | 1.400V | 1.800V | 1.125V | 1.525V |
| 0 | 0 | 0 | 1 | N/A | 2.00V | 1.425V | 1.825V | 1.150V | 1.550V |
| 0 | 0 | 0 | 0 | N/A | 2.05V | 1.450V | 1.850V | 1.175V | 1.575V |

Notes:

- i) Logic 0 = Connect to VID Common
- ii) Logic 1 = Open circuit (no pull-up resistors)
- iii) VID3 and VID4 may not be changed while the unit is operating.
- iv) The output voltage of the PT8101 must not be set higher than 2.7V.

PT8101 /2 Specifications (Unless otherwise stated $T_a = 25^\circ\text{C}$, $C_1 = 1,500\mu\text{F}$, $C_2 = 660\mu\text{F}$, $V_{in} = 5\text{V}$, & $I_o = 40\text{A}$)

| Characteristics | Symbols | Conditions | PT8101/2, $V_{in} = 5\text{V}$ | | | Units | |
|---|----------------------------|--|--------------------------------|-----------|----------|------------------|-----|
| | | | Min | Typ | Max | | |
| Output Current | I_o | 25°C, natural convection 60°C with 200LFM airflow | 0.1 (1) 0.1 (1) | — | 38 40 | A | |
| Input Voltage Range | V_{in} | Over I_o Range | 4.5 | — | 5.5 | V | |
| Set-Point Voltage Tolerance | $V_o \text{ tol}$ | Over V_o range | — | ± 1 | ± 2 | %V | |
| Line Regulation | ΔReg_{line} | Over V_{in} range | — | ± 5 | — | mV | |
| Load Regulation | ΔReg_{load} | Over I_o range | — | ± 5 | — | mV | |
| Temperature Variation | ΔReg_{temp} | $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | — | ± 0.5 | — | % V_o | |
| Total Output Voltage Variation | $\Delta V_{o \text{ tot}}$ | Includes set-point, line load, $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | — | — | ± 3 | %V | |
| Efficiency | η | $I_o = 20\text{A}$ | $V_o = 2.5\text{V}$ | — | 93 | — | % |
| | | | $V_o = 1.8\text{V}$ | — | 90 | — | |
| | | | $V_o = 1.5\text{V}$ | — | 88 | — | |
| | | | $V_o = 1.2\text{V}$ | — | 86 | — | |
| | | $I_o = 40\text{A}$ | $V_o = 2.5\text{V}$ | — | 89 | — | % |
| | | | $V_o = 1.8\text{V}$ | — | 85 | — | |
| | | | $V_o = 1.5\text{V}$ | — | 83 | — | |
| | | | $V_o = 1.2\text{V}$ | — | 81 | — | |
| V_o Ripple (pk-pk) | V_r | 20MHz bandwidth | — | 25 | — | mV | |
| Transient Response ($V_o = 1.8\text{V}$) | t_{tr} | 1A/ μs load step, 50% to 100% $I_{o \text{ max}}$ | — | 50 | — | μSec | |
| | ΔV_{tr} | V_o over/undershoot | — | 75 | — | mV | |
| Transient Response ($V_o = 1.2\text{V}$) | t_{tr} | 1A/ μs load step, 50% to 100% $I_{o \text{ max}}$ | — | 25 | — | μSec | |
| | ΔV_{tr} | V_o over/undershoot | — | 30 | — | mV | |
| Short Circuit Threshold | $I_{o \text{ sc}}$ | — | — | 60 | — | A | |
| Switching Frequency | f_o | Over load range | 300 | 350 | 400 | kHz | |
| Standby Control (pin 6) Input High Voltage Input Low Voltage Input Low Current | V_{IH} | Referenced to GND (pins 17–22) | — | — | Open (2) | V | |
| | V_{IL} | | -0.2 | — | 0.8 | | |
| | I_{IL} | Pin 6 to GND | — | 0.5 | — | mA | |
| Standby Input Current | $I_{in \text{ standby}}$ | Pin 6 to GND | — | 35 | — | mA | |
| External Output Capacitance | C_2 | See application schematic | 660 (5) | — | 15,000 | μF | |
| External Input Capacitance | C_1 | See application schematic | 1,500 | — | — | μF | |
| Operating Temperature Range | T_a | Over V_{in} Range | -40 (3) | — | +85 (4) | $^\circ\text{C}$ | |
| Storage Temperature | T_s | — | -40 | — | +125 | $^\circ\text{C}$ | |
| Mechanical Shock | — | Per Mil-STD-883D, Method 2002.3 1 msec, Half Sine, mounted to a fixture | — | 500 | — | G's | |
| Mechanical Vibration | — | Mil-STD-883D, Method 2007.2 20-2000 Hz, soldered in PCB | Vertical | — | 20 (6) | — | G's |
| | | | Horizontal | — | 20 (6) | — | |
| Weight | — | Vertical/Horizontal | — | 55 | — | grams | |
| Flammability | — | Materials meet UL 94V-0 | — | — | — | — | |

Notes: (1) ISR will operate down to no load with reduced specifications.

(2) The Standby input (pin 6) has an internal pull-up. If it is left open-circuit the module will operate when input power is applied. A low-leakage MOSFET is recommended to control this input. The open-circuit voltage is nominally 5V. See application notes for interface considerations.

(3) For operation below 0°C, C_{out} must have stable characteristics. Use either low ESR tantalum or Oscon® capacitors.

(4) See safe Operating Area curves or consult factory for the appropriate derating.

(5) The PT8100 regulators require a minimum of 660 μF , low ESR output capacitance (1,200 μF for standard aluminum electrolytic) for proper operation.

(6) The case pins on the through-hole package types (suffixes N & A) must be soldered. For more information see the applicable package outline drawing.

Input Filter: The filter components L_1 , and C_3 are optional for most applications. The inductor must be rated to handle the projected input current. A rating of 30ADC is recommended. The capacitance C_1 must be rated for a minimum of 1Arms of ripple current. For transient or dynamic load applications, additional capacitance may be required. For more information refer to the application note on capacitor recommendations for this product.

PT8100 Series

40-A 3.3/5-V Input Programmable Integrated Switching Regulator

PT8103/5 Specifications (Unless otherwise stated $T_a = 25^\circ\text{C}$, $C_1 = 1,500\mu\text{F}$, $C_2 = 660\mu\text{F}$, $V_{in} = 3.3\text{V}$, & $I_o = 40\text{A}$)

| Characteristics | Symbols | Conditions | PT8103/5, $V_{in} = 3.3\text{V}$ | | | Units | | |
|--|---------------------------|---|----------------------------------|-----------|----------|------------------|-----|----|
| | | | Min | Typ | Max | | | |
| Output Current | I_o | 25°C, natural convection 60°C with 200LFM airflow | 0.1 (1) 0.1 (1) | — | 39 40 | A | | |
| Input Voltage Range | V_{in} | Over I_o Range | 3.1 | — | 3.6 | V | | |
| Set-Point Voltage Tolerance | V_o tol | Over V_o range | — | ± 1 | ± 2 | %V | | |
| Line Regulation | ΔReg_{line} | Over V_{in} range | — | ± 5 | — | mV | | |
| Load Regulation | ΔReg_{load} | Over I_o range | — | ± 5 | — | mV | | |
| Temperature Variation | ΔReg_{temp} | $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | — | ± 0.5 | — | % V_o | | |
| Total Output Voltage Variation | $\Delta V_{o,tot}$ | Includes set-point, line, load, $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | — | — | ± 3 | %V | | |
| Efficiency | η | $I_o = 20$ | $V_o = 1.8\text{V}$ | — | 90 | — | % | |
| | | | $V_o = 1.5\text{V}$ | — | 89 | — | | |
| | | | $V_o = 1.2\text{V}$ | — | 87 | — | | |
| | | $I_o = 40$ | $V_o = 1.8\text{V}$ | — | 86 | — | | % |
| | | | $V_o = 1.5\text{V}$ | — | 84 | — | | |
| | | | $V_o = 1.2\text{V}$ | — | 82 | — | | |
| V_o Ripple (pk-pk) | V_r | 20MHz bandwidth | $V_o = 1.8\text{V}$ | — | 25 | — | mV | |
| | | | $V_o = 1.5\text{V}$ | — | 25 | — | | |
| Transient Response ($V_o = 1.2\text{V}$) | t_{tr} | 1A/ μs load step, 50% to 100% $I_{o,max}$ | — | 25 | — | μSec | | |
| | | V_o over/undershoot | — | 30 | — | mV | | |
| Short Circuit Threshold | I_{osc} | — | — | 60 | — | A | | |
| Switching Frequency | f_o | Over load range | 300 | 350 | 400 | kHz | | |
| Standby Control (pin 6) | V_{IH} V_{IL} | Referenced to GND (pins 17–22) | Input High Voltage | — | — | Open (2) | V | |
| | | | Input Low Voltage | -0.2 | — | 0.8 | | |
| | | | Input Low Current | — | 0.5 | — | | mA |
| Standby Input Current | $I_{in, standby}$ | Pin 6 to GND | — | 35 | — | mA | | |
| External Output Capacitance | C_2 | See application schematic | 660 (5) | — | 15,000 | μF | | |
| External Input Capacitance | C_1 | See application schematic | 1,500 | — | — | μF | | |
| Operating Temperature Range | T_a | Over V_{in} Range | -40 (3) | — | +85 (4) | $^\circ\text{C}$ | | |
| Storage Temperature | T_s | — | -40 | — | +125 | $^\circ\text{C}$ | | |
| Mechanical Shock | — | Per Mil-STD-883D, Method 2002.3 1 msec, Half Sine, mounted to a fixture | — | 500 | — | G's | | |
| Mechanical Vibration | — | Mil-STD-883D, Method 2007.2 20–2000 Hz, soldered in PCB | Vertical | — | 20 (6) | — | G's | |
| | | | Horizontal | — | 20 (6) | — | | |
| Weight | — | Vertical/Horizontal | — | 55 | — | grams | | |
| Flammability | — | Materials meet UL 94V-0 | — | — | — | — | | |

Notes: (1) ISR will operate down to no load with reduced specifications.

(2) The Standby input (pin 6) has an internal pull-up. If it is left open-circuit the module will operate when input power is applied. A low-leakage MOSFET is recommended to control this input. The open-circuit voltage is nominally 5V. See application notes for interface considerations.

(3) For operation below 0°C, C_{out} must have stable characteristics. Use either low ESR tantalum or Oscon® capacitors.

(4) See safe Operating Area curves or consult factory for the appropriate derating.

(5) The PT8100 regulators require a minimum of 660 μF , low ESR output capacitance (1,200 μF for standard aluminum electrolytic) for proper operation.

(6) The case pins on the through-hole package types (suffixes N & A) must be soldered. For more information see the applicable package outline drawing.

Input Filter: The filter components L_1 and C_3 are optional for most applications. The inductor must be rated to handle the projected input current. A rating of 30ADC is recommended. The input capacitance, C_1 must be rated for a minimum of 1Arms of ripple current. For transient or dynamic load applications, additional capacitance may be required. For more information refer to the application note on capacitor recommendations for this product.

PT8104 Specifications (Unless otherwise stated $T_a = 25^\circ\text{C}$, $C_1 = 1,500\mu\text{F}$, $C_2 = 660\mu\text{F}$, $V_{in} = 5\text{V}$, $V_o = 1.8\text{V}$, & $I_o = 40\text{A}$)

| Characteristics | Symbols | Conditions | PT8104, $V_{in} = 5\text{V}$ | | | Units | |
|---|----------------------------------|---|------------------------------|-----------|----------|------------------|-----|
| | | | Min | Typ | Max | | |
| Output Current | I_o | 25°C , natural convection 60°C with 200LFM airflow | 0.1 (1) 0.1 (1) | — | 38 40 | A | |
| Input Voltage Range | V_{in} | Over I_o Range | 4.5 | — | 5.5 | V | |
| Set-Point Voltage Tolerance | V_o tol | Over V_o range | — | ± 1 | ± 2 | %V | |
| Line Regulation | ΔReg_{line} | Over V_{in} range | — | ± 10 | — | mV | |
| Load Regulation (Droop) | ΔReg_{load} | Over I_o range | — | 1.5 | — | mV/A | |
| Temperature Variation | ΔReg_{temp} | $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | — | ± 0.5 | — | % V_o | |
| Total Output Voltage Variation | $\Delta V_{o,tot}$ | Includes set-point, line, load, $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$, pin 31 to GND | — | — | 75 (2) | mV | |
| Efficiency | η | $I_o = 15\text{A}$ | $V_o = 1.8\text{V}$ | — | 90 | — | % |
| | | | $V_o = 1.5\text{V}$ | — | 88 | — | |
| | | | $V_o = 1.2\text{V}$ | — | 87 | — | |
| | | $I_o = 40\text{A}$ | $V_o = 1.8\text{V}$ | — | 85 | — | |
| | | | $V_o = 1.5\text{V}$ | — | 82 | — | |
| | | | $V_o = 1.2\text{V}$ | — | 80 | — | |
| V_o Ripple (pk-pk) | V_r | 20MHz bandwidth | — | 25 | — | mV | |
| Transient Response ($V_o = 1.2\text{V}$) | t_{tr} | 1A/ μs load step, 50% to 100% I_{omax} | — | 50 | — | μSec | |
| | ΔV_{tr} | V_o over/undershoot | — | 50 | — | mV | |
| Short Circuit Threshold | I_{osc} | — | — | 58 | — | A | |
| Switching Frequency | f_o | Over load range | 300 | 350 | 400 | kHz | |
| Standby Control (pin 6) Input High Voltage Input Low Voltage Input Low Current | V_{IH} V_{IL} I_{IL} | Referenced to GND (pins 17–22) Pin 6 to GND | — | — | Open (3) | V | |
| | | | -0.2 | — | 0.8 | | |
| | | | — | 0.5 | — | | mA |
| Standby Input Current | $I_{in, standby}$ | Pin 6 to GND | — | 35 | — | mA | |
| External Output Capacitance | C_2 | See PT8104 application schematic | 660 (6) | — | 15,000 | μF | |
| External Input Capacitance | C_1 | See PT8104 application schematic | 1,500 | — | — | μF | |
| Operating Temperature Range | T_a | Over V_{in} Range | -40 (4) | — | +85 (5) | $^\circ\text{C}$ | |
| Storage Temperature | T_s | — | -40 | — | +125 | $^\circ\text{C}$ | |
| Mechanical Shock | — | Per Mil-STD-883D, Method 2002.3 1 msec, Half Sine, mounted to a fixture | — | 500 | — | G's | |
| Mechanical Vibration | — | Mil-STD-883D, Method 2007.2 20-2000 Hz, soldered in PCB | Vertical | — | 20 (7) | — | G's |
| | | | Horizontal | — | 20 (7) | — | |
| Weight | — | Vertical/Horizontal | — | 55 | — | grams | |
| Flammability | — | Materials meet UL 94V-0 | — | — | — | — | |

Notes: (1) ISR-will operate down to no load with reduced specifications.

(2) Total output voltage variation includes load regulation droop, which is required for compliance with specification V_{RM} 8.4-5

(3) The Standby input (pin 6) has an internal pull-up. If it is left open-circuit the module will operate when input power is applied. A low-leakage MOSFET is recommended to control this input. The open-circuit voltage is nominally 5V. See application notes for interface considerations.

(4) For operation below 0°C, C_{out} must have stable characteristics. Use either low ESR tantalum or Oscon® capacitors.

(5) See safe Operating Area curves or consult factory for the appropriate derating.

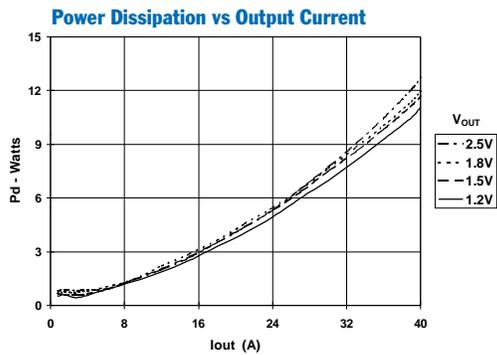
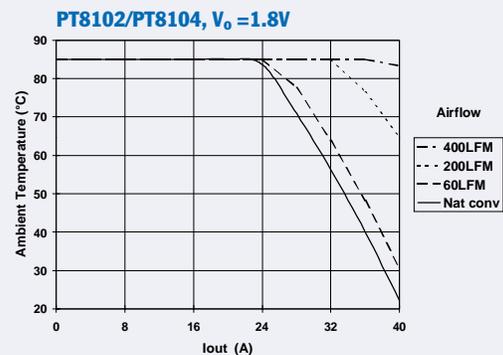
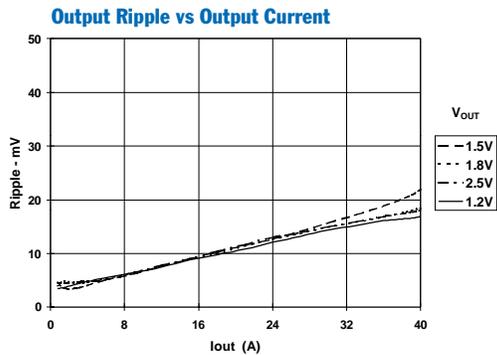
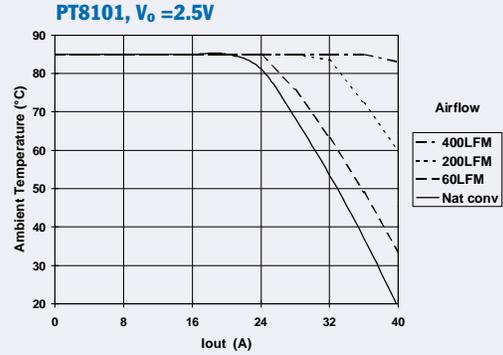
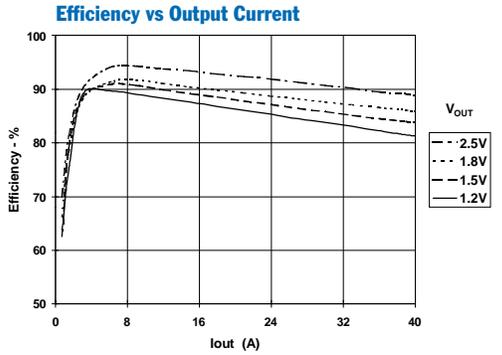
(6) The PT8100 regulators require a minimum of 660 μF , low ESR output capacitance (1,200 μF for standard aluminum electrolytic) for proper operation.

(7) The case pins on the through-hole package types (suffixes N & A) must be soldered. For more information see the applicable package outline drawing.

Input Filter: The filter components L_1 and C_3 are optional for most applications. The inductor must be rated to handle the projected input current. A rating of 20ADC is recommended. The input capacitance, C_1 must be rated for a minimum of 1Arms of ripple current. For transient or dynamic load applications, additional capacitance may be required. For more information refer to the application note on capacitor recommendations for this product.

Characteristic Data; $V_{in} = 5V$, PT8101/2/4 (See Note A)

Safe Operating Area; $V_{in} = 5V$ (See Note B)

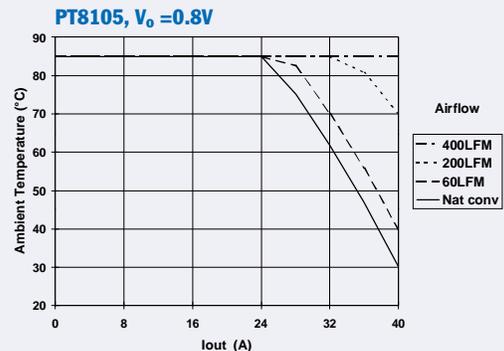
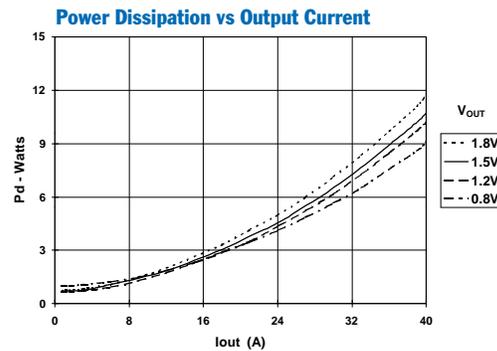
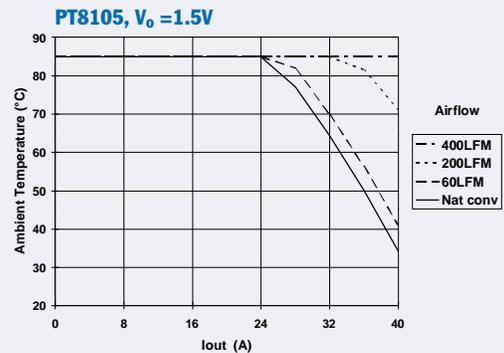
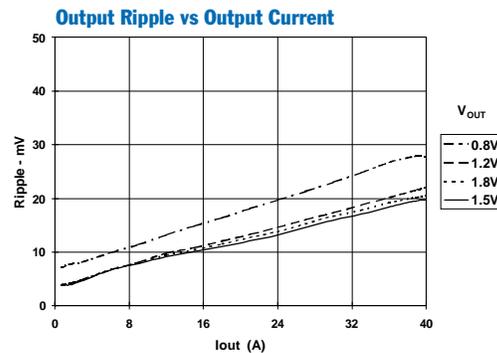
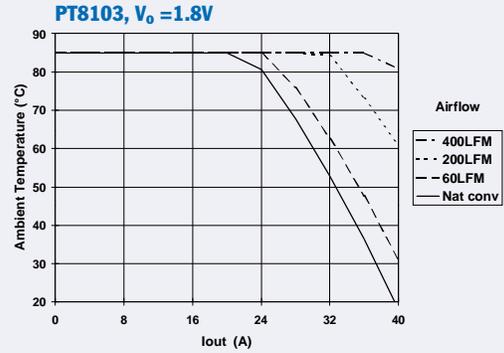
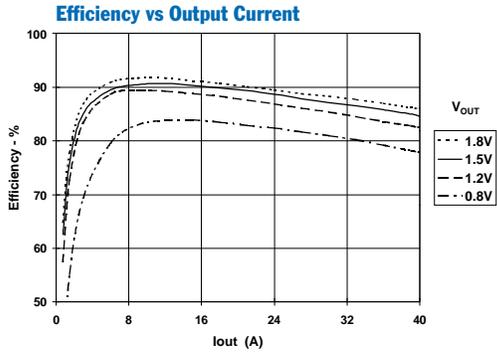


Note A: Characteristic data has been developed from actual products tested at 25°C. This data is considered typical data for the Converter.

Note B: SOA curves represent the conditions at which internal components are at or below the manufacturer's maximum operating temperatures

Characteristic Data; $V_{in} = 3.3V$, PT8103/5 (See Note A)

Safe Operating Area; $V_{in} = 3.3V$ (See Note B)



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: SOA curves represent the conditions at which internal components are at or below the manufacturer's maximum operating temperatures

Capacitor Recommendations for the Non-Isolated 40-A Excalibur™ Series of Regulators

Input Capacitors

The recommended input capacitance is determined by the 1.0 ampere minimum ripple current rating and 1500µF minimum capacitance. Capacitors listed below must be rated for a minimum of 2× the input voltage with +5V operation. Ripple current and ≤100mΩ equivalent series resistance (ESR) values are the major considerations along with temperature when selecting the proper capacitor.

Output Capacitors

The minimum required output capacitance is either 660µF Oscon/Tantalum or 1200µF Aluminum Electrolytic with a maximum ESR less than or equal to 100mΩ. Failure to observe this requirement may lead to regulator instability or oscillation. Electrolytic capacitors have poor ripple performance at frequencies greater than 400kHz, but excellent low frequency transient response. Above the ripple frequency ceramic decoupling capacitors are necessary to improve the transient response and reduce any high frequency noise components apparent during higher current excursions. Preferred low ESR type capacitor part numbers are identified in Table 1 below.

Tantalum Characteristics

Tantalum capacitors with a minimum 10V rating are recommended on the output bus, but only the AVX TPS, Sprague 594/595, or Kemet T495/T510 product series. The AVX TPS, Sprague, or Kemet series capacitors are specified over other types due to their higher surge current, excellent power dissipation, and ripple current ratings. As a caution, the TAJ Series by AVX is not recommended. This series exhibits considerably higher ESR, reduced power dissipation and lower ripple current capability. The TAJ series is also less reliable compared to the TPS series when determining power dissipation capability.

Capacitor Table

Table 1 identifies the characteristics of capacitors from a number of vendors with acceptable ESR and ripple current (rms) ratings. The suggested minimum quantities per regulator for both the input and output buses are identified.

This is not an extensive capacitor list. The table below is a suggested selection guide for input and output capacitors. Other capacitor vendors are available with comparable RMS ripple current rating and ESR (Equivalent Series Resistance at 100kHz). These critical parameters are necessary to insure both optimum regulator performance and long capacitor life.

Table 1 Capacitors Characteristic Data

| Capacitor Vendor Series | Capacitor Characteristics | | | | | Quantity | | Vendor Number |
|--|---------------------------|-------------|------------------------------------|-----------------------------------|---------------------------|-----------|------------|---|
| | Working Voltage | Value(µF) | (ESR) Equivalent Series Resistance | 85°C Maximum Ripple Current(Irms) | Physical Size(mm) | Input Bus | Output Bus | |
| Panasonic FC/FK (Surface Mount) FC (Radial) | 16V | 1500 | 0.060Ω | 1100mA | 12.5×13.5 | 1 | 1 | EEVFK1C152Q EEVFC1C222N |
| | 16V | 2200 | 0.038Ω | 2000mA | 18×16.5 | 1 | 1 | |
| | 16V | 1500 | 0.043Ω | 1690mA | 16×15 | 1 | 1 | EEUFC1C152S |
| United Chemi-Con LXZ (Radial) FX | 16V | 1500 | 0.038Ω | 1660mA | 12.5×20 | 1 | 1 | LXZ16VB155M12X20LL LXZ25VB182M16X20LL |
| | 25V | 1800 | 0.029Ω | 2200mA | 16×20 | 1 | 1 | |
| | 6.3V 10V | 1000 680 | 0.013Ω 0.015Ω±2 =0.007Ω | 4935mA >7000mA | 10×10.5 10×10.5 | 1 2 | 1 1 | 6FX1000M (Vin =3.3V) 10FX680M (Os-con) |
| Nichicon PL Series UD Series | 10V | 1500 | 0.050Ω | 1190mA | 16×15 | 1 | 1 | UPM1A152MHH6 UPM1A182MHH6 |
| | 10V | 1800 | 0.044Ω | 1420mA | 16×15 | 1 | 1 | |
| | 10V | 1000 | 0.09Ω | 670mA×2 | 10×10 | 2 | 2 | UUD1A102MCR1GS |
| Os-con: SS SVP (Surface Mount) SVP (Surface Mount) | 10V | 330 | 0.025Ω±3 =0.008Ω | >7000mA | 10×10.5 | 3 | 2 | 10SS330M 10SVP330M 10SVP560M |
| | 10V | 330 | 0.017Ω±3 =0.006Ω | >7000mA | 10.3×12.6 | 3 | 2 | |
| | 10V | 560 | 0.013Ω±2 =0.065Ω | >7000mA | 10×12.7 | 2 | 2 | |
| AVX Tantalum TPS Series (Surface Mount) | 10V | 330 | 0.100Ω±3 =0.034Ω | >3500mA | 7.0 L ×5.97 W | 3 | 2 | TPSV337M010R0100 TPSV337M010R0060 |
| | 10V | 330 | 0.060Ω±3 =0.020Ω | >3500mA | ×3.45 H | 3 | 2 | |
| Vishay/Sprague Tantalum 595D/594D Series (Surface Mount) | 10V | 330 | 0.045Ω±3 =0.015Ω | >4600mA | 7.2 L ×6.0 W | 3 | 2 | 594D337X0010R2T 595D687X0010R2T |
| | 10V | 680 | 0.090Ω±4 =0.023Ω | >2500mA | ×3.5 H | 2 | 1 | |
| Kemet Tantalum T510/T495 /T520 (Surface Mount) | 10V | 330 | 0.035Ω±3 =0.012Ω | >5000mA | 7.3 L ×4.3 W | 3 | 1 | T510X337M010AS T495X227M010AS |
| | 10V | 220 | 0.070Ω±5 =0.035Ω | >3000mA | ×4.0 H | 5 | 2 | |
| Sanyo Poscap TPB (Surface Mount) | 10V | 220 | 0.040Ω±5 =0.008Ω | >3000mA | 7.2 L ×4.3 W ×3.1 H | 5 | 2 | 10TPB220M |

Pin-Coded Output Voltage Programming of the 40-A Rated PT8100 Series Regulators

The PT8100 series of Excalibur® ISRs incorporate a pin-coded programmable output voltage. In each case the desired output voltage must be selected from a preset range defined by the regulator model. Programming is achieved by selectively connecting the control inputs, “VID0-VID4” (“VID 25mV-VID3” for PT8104), pins 1-5, to the “VID Common,” pin 11. ¹ The programming code and pinout information for each model is provided in the PT8100 specifications. Some of the program codes are compatible with the “Voltage ID” codes defined by the Intel® VRM specifications. Figure 1 shows the pin-strap connections for selecting 1.5V output voltage from a PT8101.

Notes:

1. The programming convention is as follows:-
 Logic 0: Connect to pin 11 (VID Common).
 Logic 1: Open circuit/open drain (See notes 2, & 4)
2. The output voltage range of the PT8101 is limited to 2.7V maximum. Above this voltage, the performance of the module is not guaranteed. Although the module will appear to function above this voltage, VID 4 (pin 5) should not be used to set the output voltage higher than 2.7V.
3. Do not connect pull-up resistors to the voltage programming pins.
4. To minimize output voltage error, use pin 11 (VID Common) as the logic “0” reference. However if the regulator is used to power a VRM compatible

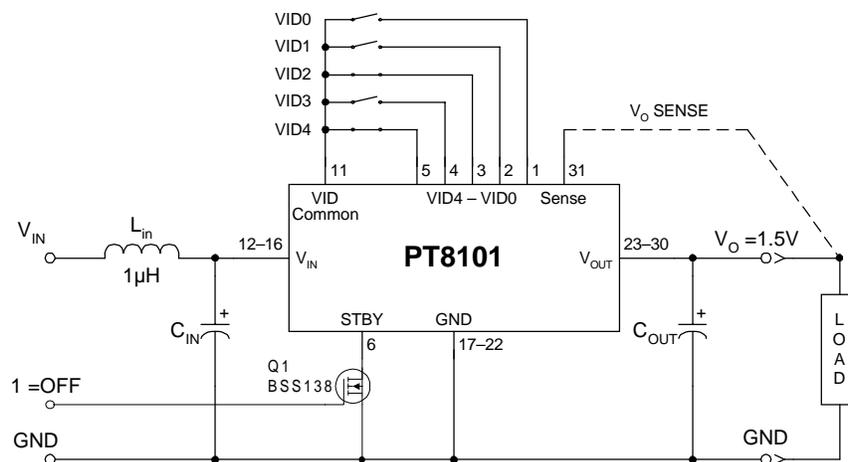
microprocessor this may not be possible. In this case either connect pin 11 to pins 17-22, or the ground plane close to the regulator. This will allow the microprocessor to use the common ground as a VID control reference.

4. If active devices are used to ground the voltage control pins, low-level open-drain MOSFETs should be used over bipolar transistors. The inherent $V_{ce(sat)}$ in bipolar devices introduces errors in the device’s internal voltage control circuit. Discrete transistors such as the BSS138, 2N7002, IRLML2402, are examples of appropriate devices.

Active Voltage Programming:

Special precautions should be taken when making changes to the voltage control program code while the output is active. It is recommended that the ISR be powered down or placed in standby. Changes made to the program code while V_{out} is active can induce high current transients through the device. This is the result of the electrolytic output capacitors being either charged or discharged to the new output voltage set-point. The transient current can be minimized by making only incremental changes to the binary code, i.e. one LSB at a time. A minimum of 100 μ s settling time between each program state is also recommended. Making non-incremental changes to VID3 and VID4 with the output enabled is discouraged. The transients induced may activate the module’s over-current protection. When using active devices to program the output voltage, their state should be asserted prior to input power being applied. If this is not possible, pull *STBY** (pin 6) to GND during the application of power, assert the program code, then release pin 6. The release of pin 6 will then allow the device to initiate a soft-start power-up to the program voltage.

Figure 1



Using the On/Off Standby Function of the PT8100 Series of Programmable ISRs

The PT8100 series of programmable ISRs incorporates an On/Off Standby function. This feature may be used to turn the regulated output of the module off while input voltage is applied. This places the module in “standby” mode. The standby control may be used for power-up sequencing, or wherever there is a requirement to control the module’s output status from another circuit.

The Standby function is provided by the *STBY** control, pin 6. If pin 6 is left open-circuit the regulator operates normally, providing a regulated output when a valid supply voltage is applied to V_{in} (pins 10-16) with respect to GND (pins 17-22). Connecting pin 6 to ground¹ places the regulator in standby mode², and reduces the input current to typically 20mA. Applying a ground signal to pin 6 prior to power-up, will inhibit the output during the period that input power is applied. When the ground signal to pin 6 is removed, the regulator initiates a soft-start to re-establish the set output voltage.³ To ensure that the regulator output is properly enabled, the *STBY** control pin must be open circuit.

Table 1 Standby Control Requirements²

| Parameter | Min | Typ | Max |
|------------|-------|--------|------------------------|
| V_{IH} | — | | Open Cct. ¹ |
| V_{IL} | -0.2V | — | 0.8V |
| I_{STBY} | | -0.5mA | |

Notes:

1. The standby on a PT8100 series regulators must be controlled with an open-collector (or open-drain) transistor (See fig. 1). *Do Not* use a pull-up resistor. Table 1 gives the *STBY** pin parameters. The control pin has an open-circuit voltage equal to V_{in} . To shut the regulator output off, the control pin must be “pulled” to less than 0.8Vdc with a low-impedance sink to ground.

2. In the standby mode the output of the regulator is tri-state, and the output voltage falls at the rate that the load circuit discharges the output filter capacitors.
3. When the ground signal to the *Standby* pin is removed, the regulator output initiates a soft-start cycle by first asserting a low impedance to ground. If an external voltage is applied to the output bus, it will sink current and possibly over-stress the part.

Turn-On Time

Turning Q_1 in Figure 1 off, removes the low-voltage signal at pin 6. After approximately 4ms the regulator output rises and reaches full regulation within 10ms. Fig. 2 shows the typical waveforms of a PT8101 following the prompt turn-off of Q_1 . The turn-off of Q_1 corresponds to the rise in V_{stby} . The output voltage was set to 1.8V, and the waveforms were measured with a 5V input source, and 9.25A resistive load.

Figure 2

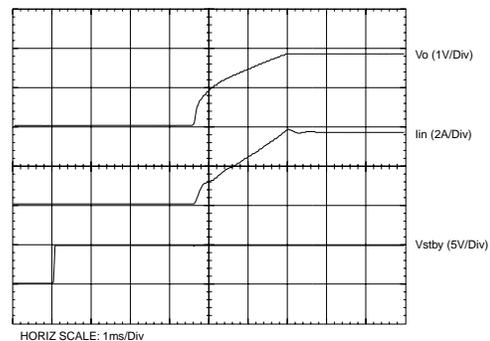
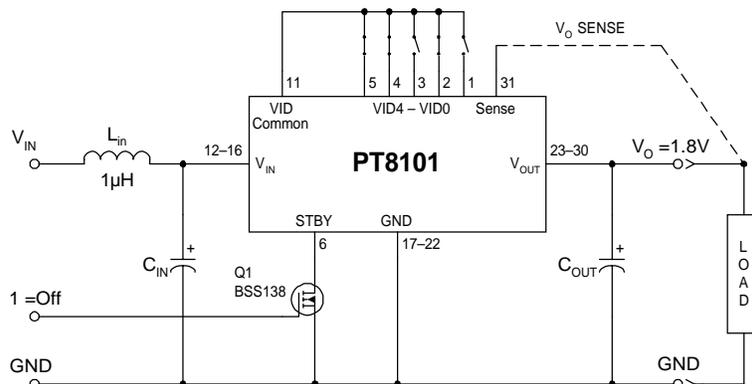


Figure 1



IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265