Data Sheet
June 2000

# Titania™ Power Modules

## Austin Series Non-Isolated SMT DC-DC Power Modules: 3.3 Vdc and 5.0 Vdc Input, 1.5 Vdc to 3.3 Vdc Output, 6A

**The Austin Power Module Series provides precise voltage and fast transient response in the industry's smallest footprint while offering very high reliability and high efficiency.**

## Applications

- Workstations
- Servers
- Desktop computers
- DSP applications
- Distributed power architectures
- Telecommunications equipment
- Adapter cards
- LAN/WAN applications
- Data processing applications

## Description

The Austin Power Module Series is designed to meet the precise voltage and fast transient requirements of today's high performance DSP and microprocessor circuits and system board level applications. Advanced circuit techniques, high-frequency switching, custom passive and active components, and very high-density, surface-mount packaging technology deliver high-quality, ultra compact, DC-DC conversion.

## Features

- 300A/µs load transient response
- Small size and very low profile
- Minimal space on printed circuit board
- Nominal dimensions: 44.6 mm x 12.7 mm x 5.46 mm (1.756 in. x .500 in. x .214 in.)
- High reliability: 200 FITs/5 million hour MTBF
- High efficiency
  - 3.3 $V_{IN}$
    - 86% typical @ 2.5V, 6 A
    - 75% typical @ 1.5V, 6A
  - 5 $V_{IN}$
    - 85% typical @ 3.3V, 6A
    - 73% typical @ 1.8V, 6A
- Single control pin for margining and on/off control
- Overcurrent foldback
- Thermal shutdown
- No external bias required
- Low inductance surface-mount connections
- Parallelable
- *UL** 1950 recognized, *CSA*† C22.2 No. 950-95 Certified, and VDE 0805 Licensed

* *UL* is a registered trademark of Underwriters Laboratories, Inc.
† *CSA* is a registered trademark of Canadian Standards Association.

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability. Input voltage range of $V_{IN}$ = 3.0 V — 3.6V is listed as 3.3 $V_{IN}$ and input voltage range of $V_{IN}$ = 4.5V — 5.5V is listed as 5.0 $V_{IN}$.

**Table 1. Absolute Maximum Ratings**

| Parameter | Device | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| Input Voltage (continuous) | 3.3 $V_{IN}$<br>5.0 $V_{IN}$ | $V_{IN}$<br>$V_{IN}$ | – 0.3<br>– 0.3 | 4.5<br>6.5 | Vdc<br>Vdc |
| Forced Output Voltage | All | $V_{OF}$ | – 0.3 | 6.0 | Vdc |
| OUTEN/ADJ Terminal Voltage | All | $V_{OUTEN/ADJ}$ | – 0.3 | 2.0 | Vdc |
| Storage Temperature | All | $T_{A/STG}$ | – 40 | 150 | °C |

## Electrical Specifications

**Table 2. Input Specifications**

| Parameter | Device | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|---|
| Operating Input Voltage | 3.3 $V_{IN}$<br>5.0 $V_{IN}$ | $V_{IN}$<br>$V_{IN}$ | 3.0<br>4.5 | 3.3<br>5.0 | 3.6<br>5.5 | V<br>V |
| Input Ripple Rejection (120 Hz) | | | | 50 | | dB |
| Operating Input Current<br>• (0A $\leq$ $I_{OUT}$ < 5A)<br>• (3.0V < $V_{IN}$ < 3.6V)<br>• (4.5V < $V_{IN}$ < 5.5V) | <br><br>3.3 $V_{IN}$<br>5.0 $V_{IN}$ | <br><br>$I_{IN}$<br>$I_{IN}$ | <br><br>—<br>— | <br><br>—<br>— | <br><br>5.5<br>5.0 | <br><br>A<br>A |
| Quiescent Input Current ($I_{OUT}$ = 0)<br>(3.0V < $V_{IN}$ < 5.5V) | All | $I_Q$ | — | 15 | — | mA |

## Fusing Considerations

**CAUTION: This power module is not internally fused. An input line fuse must always be used.** This power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of a sophisticated power architecture. To preserve maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a normal-blow fuse with a maximum rating of 10A (see Safety and Reliability Specifications).

## Output Control

The control pin is a dual-function port that serves to enable/disable the converter or provide a means of adjusting the output voltage over a prescribed range. When the control pin is grounded, the converter is disabled. With the pin left open, the converter regulates to its specified output voltage. For any other voltage applied to the pin, the output voltage follows this relationship:

$$V_{OUT} = \frac{V_{CONTROL}}{1.5V} * V_{OUT\ nom}$$

The Thevenin equivalent input resistance of the control pin is approximately 7.68K ohms and the open circuit voltage is 1.5V.

The equation to margin low by connecting a resistor from the control pin to ground is:

$$R_{LOW} = 7.68K \left[ \frac{V_{OUT}/ V_{OUT\ nom}}{1 - V_{OUT}/ V_{OUT\ nom}} \right]$$

To margin low by 5%, $R_{LOW}$ = 146K.

The equation to margin high by connecting a resistor, $R_{HIGH}$, from the control pin to the input voltage, $V_{IN}$ is:

$$R_{HIGH} = \left[ \frac{7.68K}{V_{OUT}/ V_{OUT\ nom} - 1} \right] \left[ \frac{V_{IN}}{1.5} - 1 \right] - 7.68K$$

To maintain high of 5%, $R_{HIGH}$ = 351K for $V_{IN}$ = 5 volts and $R_{HIGH}$ = 177K for $V_{IN}$ = 3.3 volts. Trim resistor tolerance will obviously affect output voltage. To determine the magnitude of this effect, simply use the extreme values in the above equations.

Because trimming affects the system reference, trimming beyond +/- 10% is unacceptable and +/- approximately 5% is desirable. One affect trimming has, aside from output voltage adjustment, is changing the current limit inception point. Trimming the unit down beyond 5% requires derating available current by 1% for every percent beyond 5 that the module is trimmed down. For example, if a module is trimmed down 7%, then output current would have to be derated 2%. If paralleled modules are to be trimmed using the control pin, divide the calculated trim resistance for a single unit by the number of modules paralleled. For example, if two paralleled units are to be trimmed 5% low, then a resistance of 146K divided by 2 should be used.

## Output Regulation

These modules have intentional output resistance to facilitate transient response and paralleling. This means that output voltage will decrease with increasing output current. For this reason, the total DC regulation window at a given operating and ambient temperature is comprised of a no load setpoint and a voltage drop due to module output resistance. Regulation data provided in Table 3 includes both initial setpoint and voltage drop. Because Table 3 includes output resistance drop, the maximum column is always a no load condition and the minimum column is always a full load condition. No module could pass production test with a full load regulation point equal to the maximum column. This means that at any operating current, the regulation will always be better than the total window specified in Table 3.

**Table 3. Output Specifications**

| Parameter | Device | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|---|
| Output voltage<br>These specifications are under all specified input voltage, load current, and temperature conditions. They do not include ripple or transient. | 3.3V<br>2.5V<br>2.0V<br>1.8V<br>1.5V | $V_{OUT}$<br>$V_{OUT}$<br>$V_{OUT}$<br>$V_{OUT}$<br>$V_{OUT}$ | 3.200<br>2.425<br>1.940<br>1.746<br>1.455 | 3.3<br>2.5<br>2.0<br>1.8<br>1.5 | 3.400<br>2.575<br>2.060<br>1.854<br>1.545 | V<br>V<br>V<br>V<br>V |
| Output current | — | $I_{OUT}$ | 0 | — | 6.0 | A |
| Output ripple<br>(See Figure 10) | 3.3 $V_{IN}$<br>5.0 $V_{IN}$ | $V_{RIPPLE}$<br>$V_{RIPPLE}$ | —<br>— | —<br>— | 80<br>100 | $mV_{p-p}$<br>$mV_{p-p}$ |

## Static Voltage Regulation

The output voltage measured at the converter output pins on the system board will be within the range shown in Table 3, except for input voltage turn-on and turn-off. Static voltage regulation includes:

- DC output initial voltage
- Input voltage range
  - 3.0V — 3.6V
  - 4.5V — 5.5V
- Load regulation from 0A — 6A

## Output Ripple and Noise

Ripple and noise are defined as periodic or random signals at the output pins under constant load. Typical full load output ripple and noise waveforms are shown in Figures 12 — 20.

## Output Overcurrent Protection/Overtemperature Protection

Current limiting is provided for momentary overloads and short circuits. A sustained overload may cause the thermal shutdown circuit to activate. The current limit inception is nominally 7 amperes with the power semiconductors at rated temperature in a 25 °C ambient environment. The thermal circuitry will shut down the module at 115 °C minimum on the power semiconductors' top surfaces.

## Input/Output Decoupling

An input capacitance of 100 µF, with an ESR of less than 100 milliohms, and at least 1 µF ceramic or equivalent is recommended for the input to the modules. The 100 µF should always be used unless main bulk buss capacitors are located close to the module. This capacitor provides decoupling in the event of a fault to the module output. Input voltage should never go below 2.5 volts or internal protection circuitry may fail to act. To achieve noise levels shown in Figures 11 – 20, one 100 µF tantalum capacitor and two 1 µF ceramic capacitors were used. 0.75 inches of 0.14 inch wide track (with no ground beneath) was used as an inductor between the input pin of the module and the decoupling capacitors (see Figure 10). An impedance vs. frequency plot has been provided for the 100 µF capacitor to aid in selecting equivalent parts.

Output decoupling used to achieve noise levels shown in Figures 11 – 20 was 1 µF in series with 0.5Ω and .01 µF. Ringing on the output due to common impedance with the input decoupling circuit was damped using the 1 µF/0.5Ω series combination. An equivalent damping network is recommended. Care should be taken that selected output decoupling capacitors do not form troublesome L-C resonant networks with track inductance. Austin Power Modules may be used with up to 10,000 µF of capacitance. The modules are designed to remain stable with any capacitor/ESR combination.

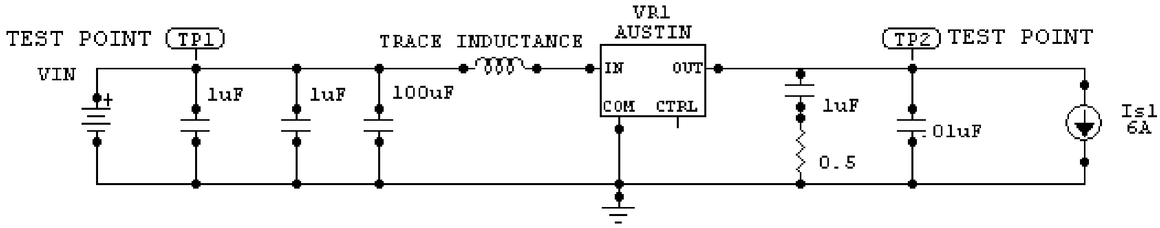



**Figure 10. Input/Output Decoupling Circuit**

# Input/Output Ripple Performance

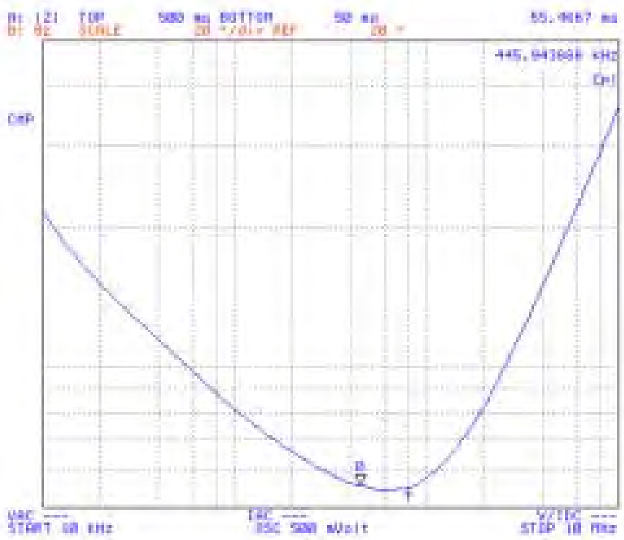



**Figure 11. Impedance vs. Frequency for 100 µF Input Capacitor**

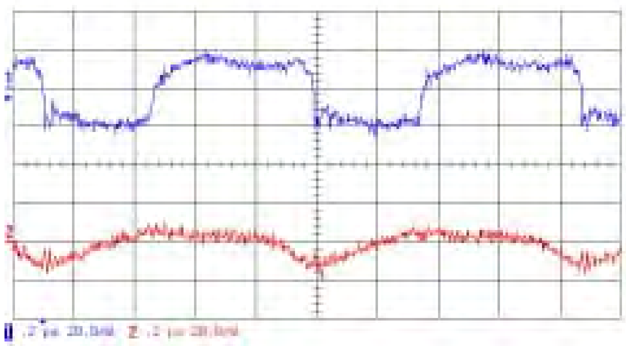


**Figure 12. Typical Ripple Performance**
**3.3 VIN, 1.5 VOUT**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

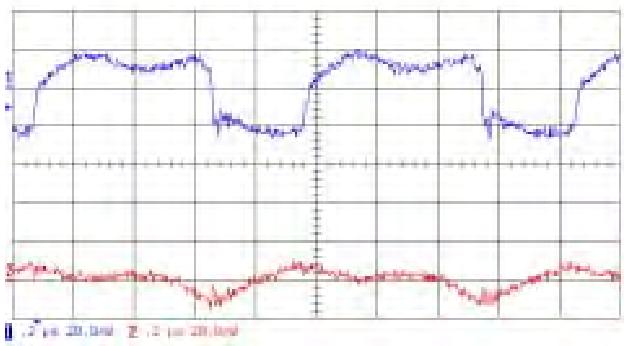


**Figure 13. Typical Ripple Performance**
**3.3 VIN, 1.8 VOUT**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

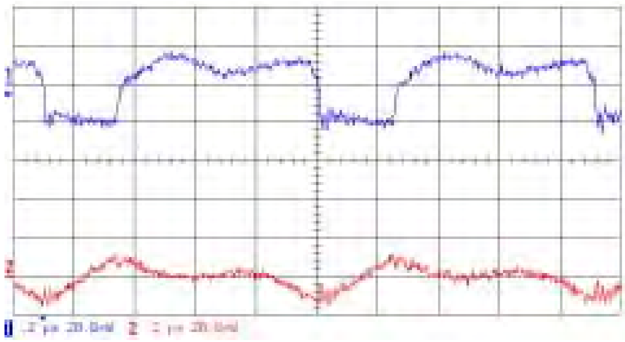


**Figure 14. Typical Ripple Performance**
**3.3 $V_{IN}$, 2.0 $V_{OUT}$**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

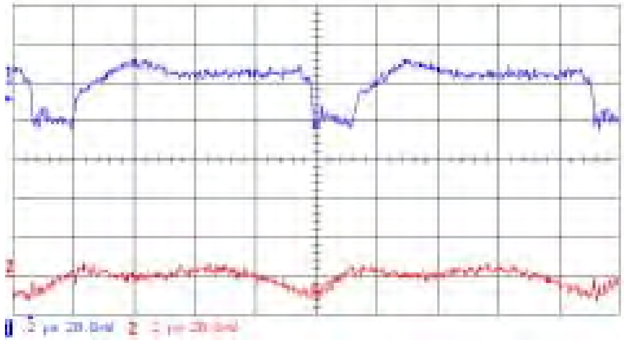


**Figure 15. Typical Ripple Performance**
**3.3 $V_{IN}$, 2.5 $V_{OUT}$**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

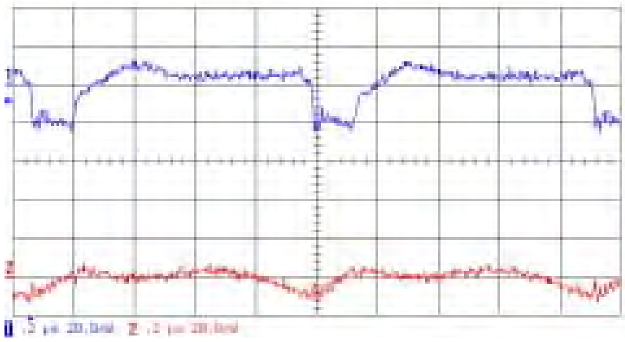


**Figure 16. Typical Ripple Performance**
**5.0 $V_{IN}$, 1.5 $V_{OUT}$**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

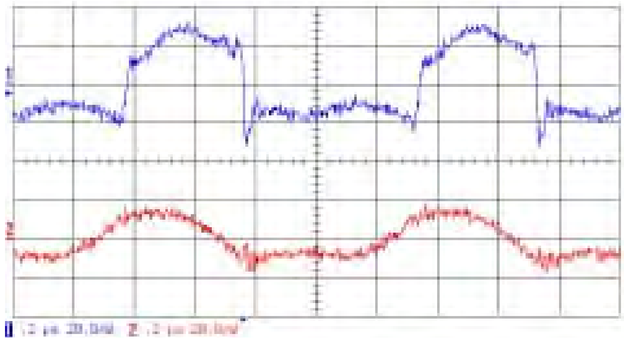


**Figure 17. Typical Ripple Performance**
**5.0 $V_{IN}$, 1.8 $V_{OUT}$**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

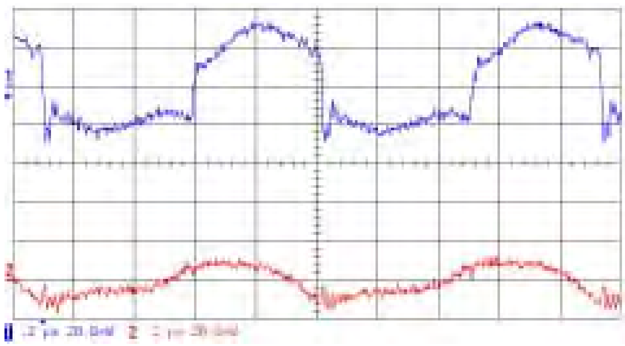


**Figure 18. Typical Ripple Performance**
**5.0 $V_{IN}$, 2.0 $V_{OUT}$**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

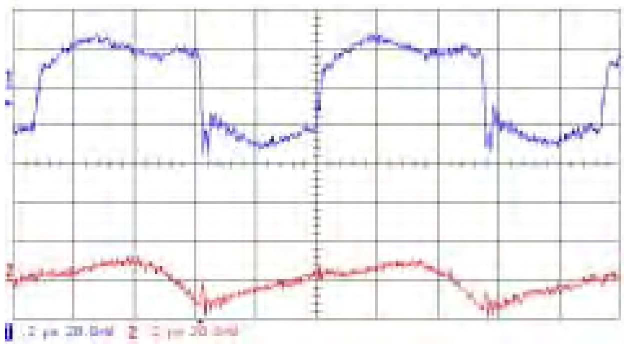


**Figure 19. Typical Ripple Performance**
**5.0 $V_{IN}$, 2.5 $V_{OUT}$**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

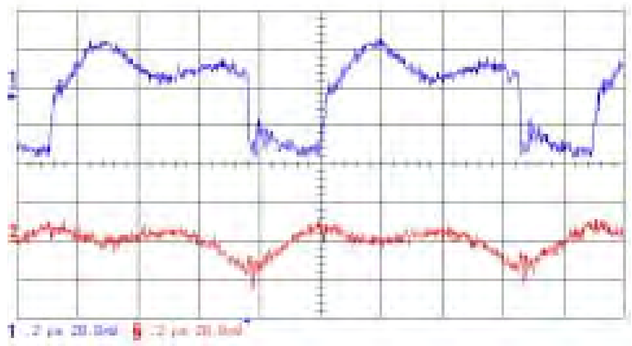


**Figure 20. Typical Ripple Performance**
**5.0 VIN, 3.3 VOUT**
Blue (upper) = Output and Red (lower) = Input
0.2 us/div 20 mv/div

## Input Reflected Ripple Current

Figures 22 and 23 show typical input reflected ripple current measurement waveforms and spectras. Figure 21 depicts the circuit used to produce these results. Current was measured using a LeCroy AP015 current probe.

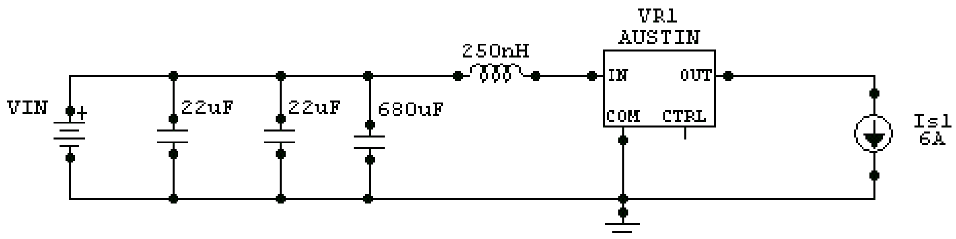



**Figure 21. Input Reflected Ripple Current Circuit**

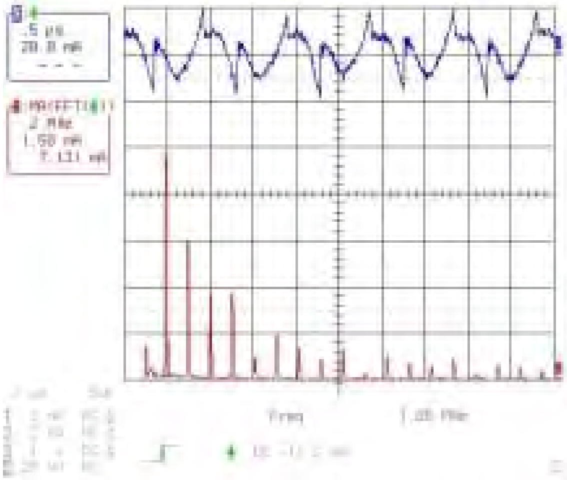


**Figure 22. Typical Input Reflected Ripple Current**
**5.0 $V_{IN}$, 1.5 $V_{OUT}$**
Blue (upper) = $I_{OUT}$ 20 mA/div, .5 us/div
Red (lower) = $I_{OUT}$ spectra 1.5 mA/div, 2 Mhz/div

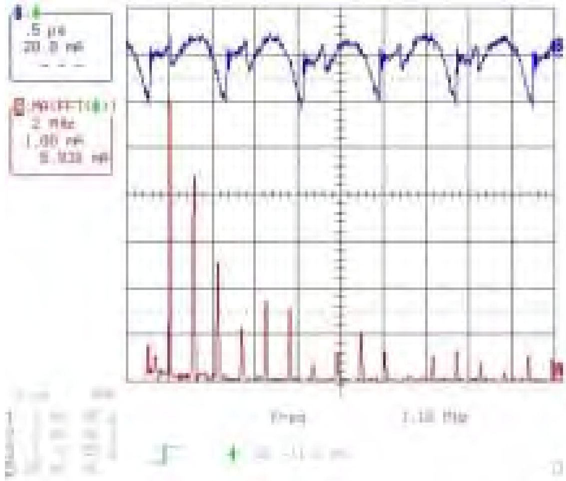


**Figure 23. Typical Input Reflected Ripple Current**
**5.0 $V_{IN}$, 3.3 $V_{OUT}$**
Blue (upper) = $I_{OUT}$ 20 mA/div, .5 us/div
Red (lower) = $I_{OUT}$ spectra 1.0 mA/div, 2 Mhz/div

## Transient Response Performance

Figures 25 – 33 depict typical transient responses obtained using the circuit shown in Figure 24.

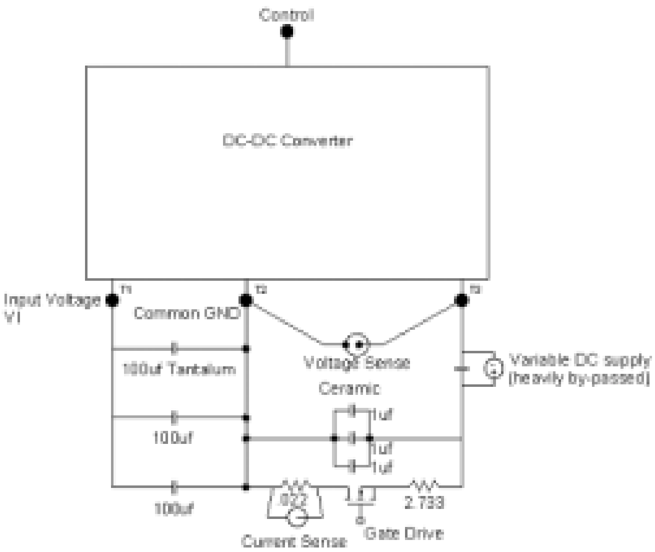



**Figure 24. Load Transient Circuit**
Note: Provides 0.25A to 3.25A load step @ 300 A/µs

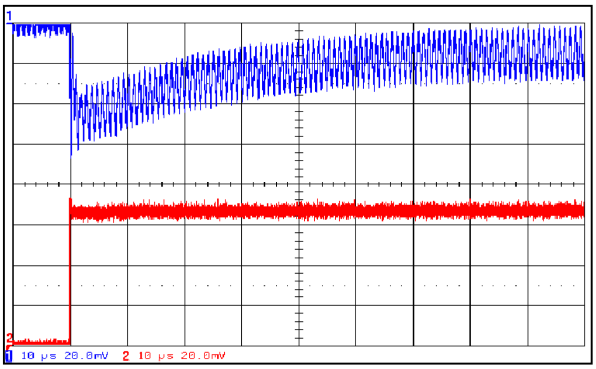


**Figure 25. Typical Transient Response**
**3.3 $V_{IN}$, 1.5 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

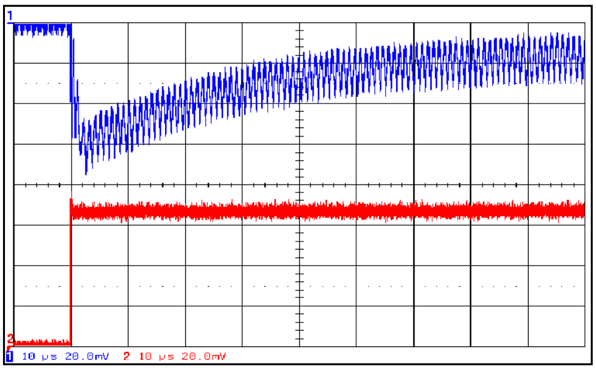


**Figure 26. Typical Transient Response**
**3.3 $V_{IN}$, 1.8 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

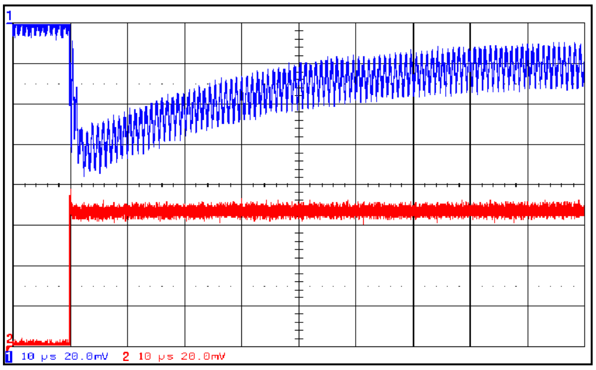


**Figure 27. Typical Transient Response**
**3.3 $V_{IN}$, 2.0 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

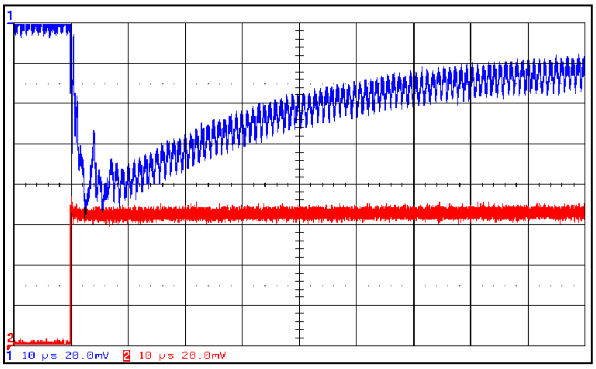


**Figure 28. Typical Transient Response**
**3.3 $V_{IN}$, 2.5 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

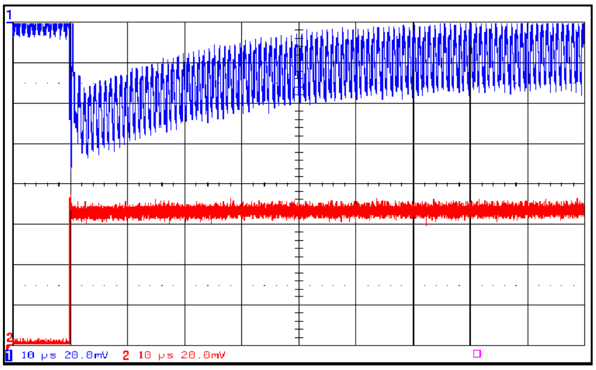


**Figure 29. Typical Transient Response**
**5 $V_{IN}$, 1.5 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

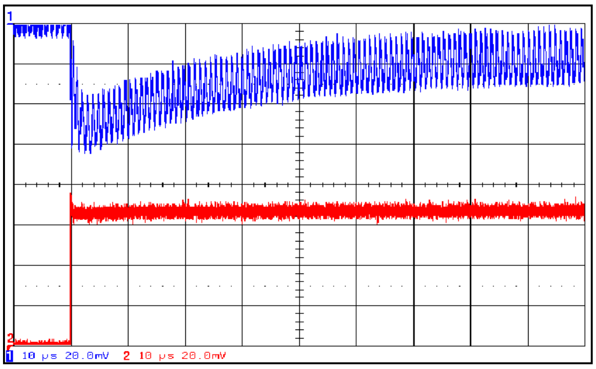


**Figure 30. Typical Transient Response**
**5 $V_{IN}$, 1.8 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

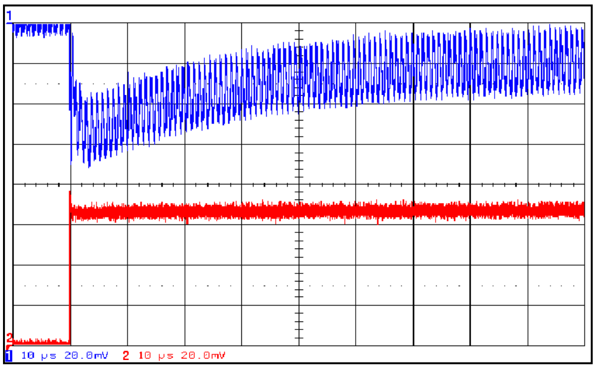



**Figure 31. Typical Transient Response**
**5 $V_{IN}$, 2.0 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

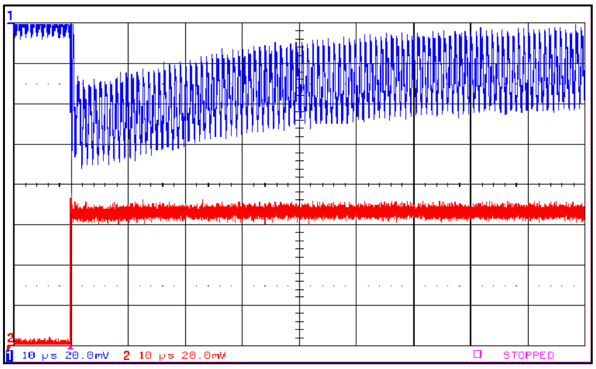



**Figure 32. Typical Transient Response**
**5 $V_{IN}$, 2.5 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

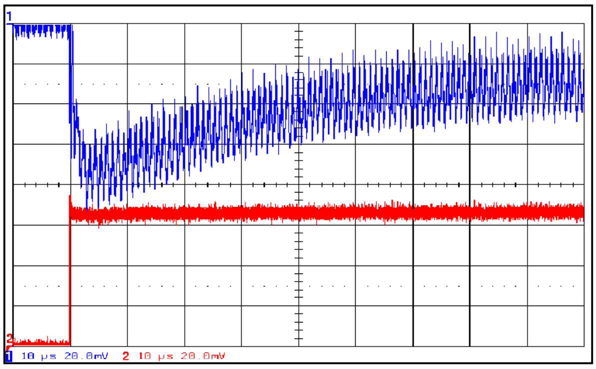



**Figure 33. Typical Transient Response**
**5 $V_{IN}$, 3.3 $V_{OUT}$**

Blue (upper) = $V_{OUT}$ 20 mV/div and Red (lower) = $I_{OUT}$ 1 A/div
10 us/div

# Thermal Ratings

Austin Power Modules are rated to operate in ambient temperatures from 0 °C to 80 °C. The derating curves below are provided as design aids for proper application of the power modules. To insure adequate cooling, the module temperature should be measured in the system configuration. Ideally, temperature will be measured using an infrared temperature probe (such as the FLUKE 80T-IR) or imaging system under the maximum ambient temperature and the minimum air flow conditions. Diode and FET case temperatures measured on the top surface's hottest spot should not exceed 105 °C. An alternative method of measuring temperature is the use of thermocouples. For best results, a small thermocouple should be attached to the leads of each FET and diode using a small amount of cyanoacrylate adhesive.

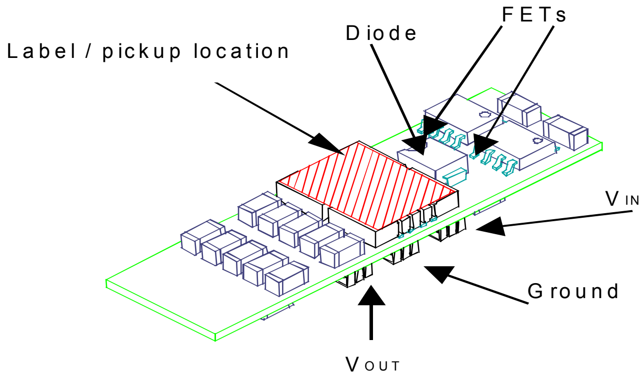



**Figure 34. Thermocouple Location**

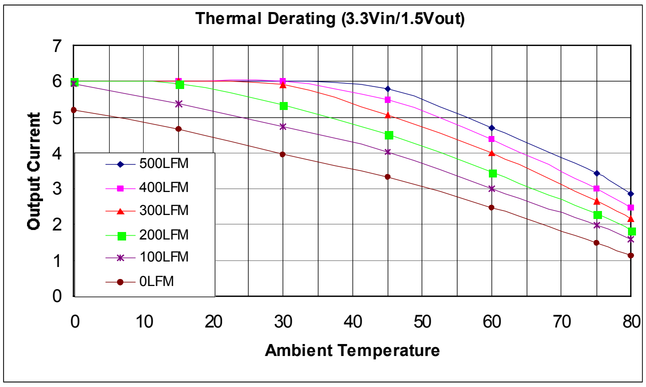



**Figure 35. Thermal Derating for 3.3 VIN, 1.5 VOUT**

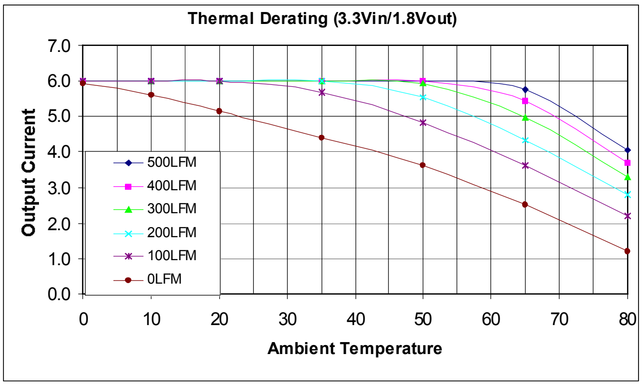



**Figure 36. Thermal Derating for 3.3 VIN, 1.8 VOUT**

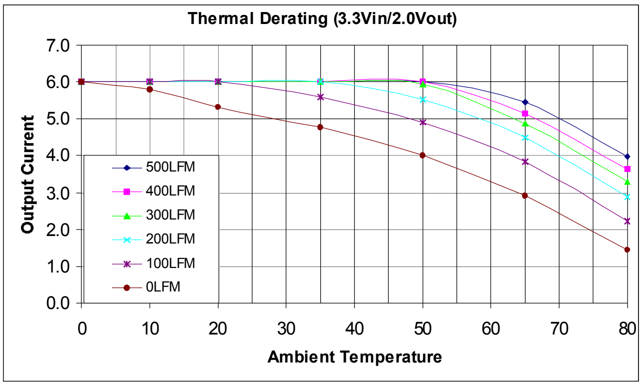



Figure 37. Thermal Derating for 3.3 VIN, 2.0 VOUT

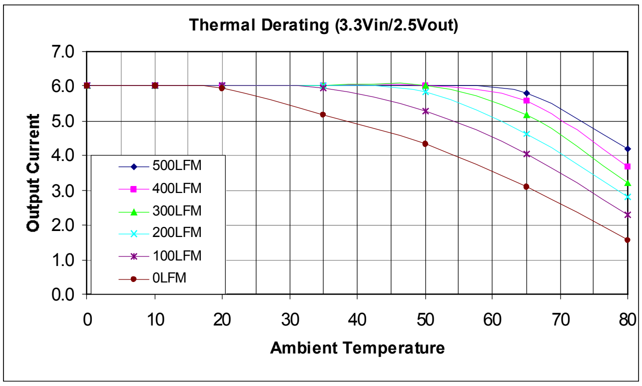



Figure 38. Thermal Derating for 3.3 VIN, 2.5 VOUT

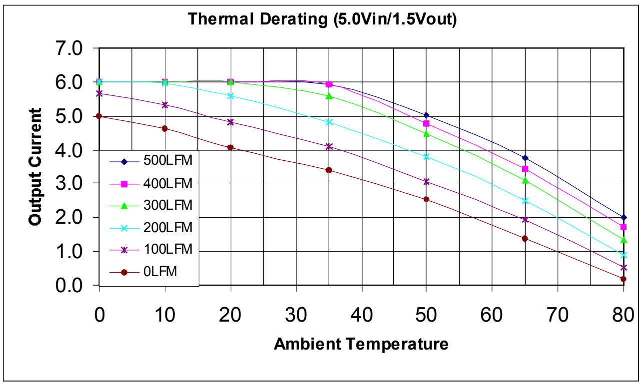



Figure 39. Thermal Derating for 5 VIN, 1.5VOUT

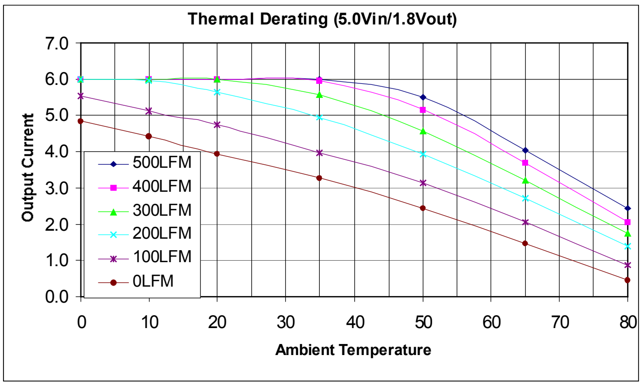



Figure 40. Thermal Derating for 5 VIN, 1.8 VOUT

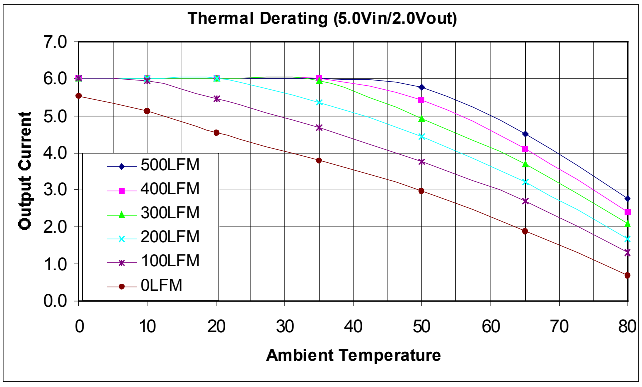



Figure 41. Thermal Derating for 5 VIN, 2.0 VOUT

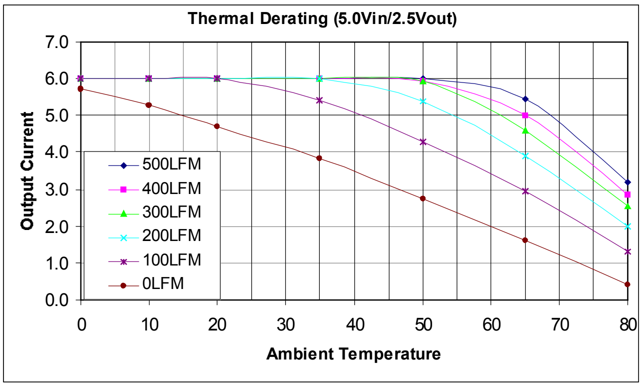



Figure 42. Thermal Derating for 5 VIN, 2.5 VOUT

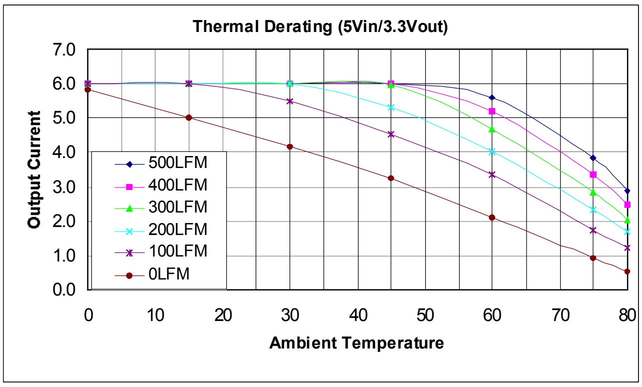



**Figure 43. Thermal Derating for 5 $V_{IN}$, 3.3 $V_{OUT}$**

## Full Load Input/Output Start-Up Characteristic

The following figures demonstrate the start-up characteristic of each module into the maximum load. Each converter is shown with an input ramp of 1 ms and 20 ms.

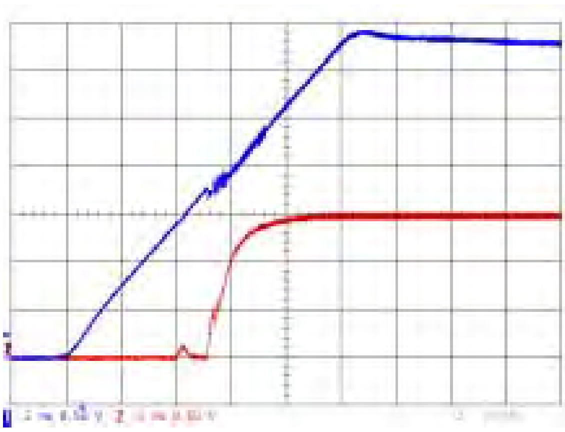


**Figure 44. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 1.5 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
0.2 ms/div

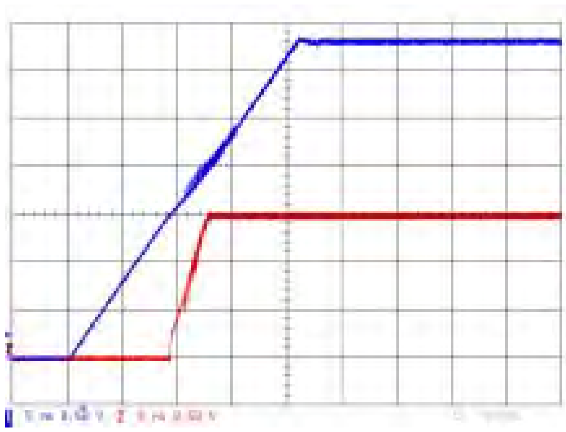


**Figure 45. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 1.5 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
5.0 ms/div

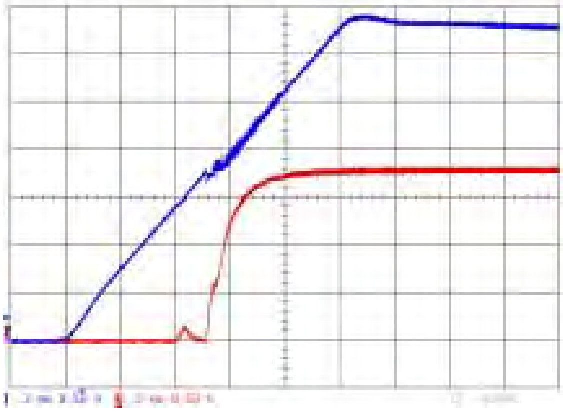


**Figure 46. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 1.8 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
0.2 ms/div

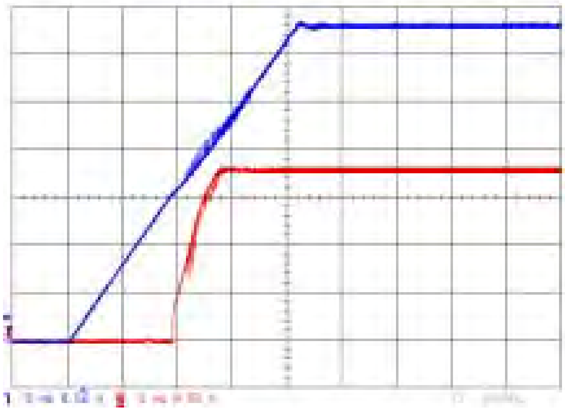


**Figure 47. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 1.8 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
5.0 ms/div

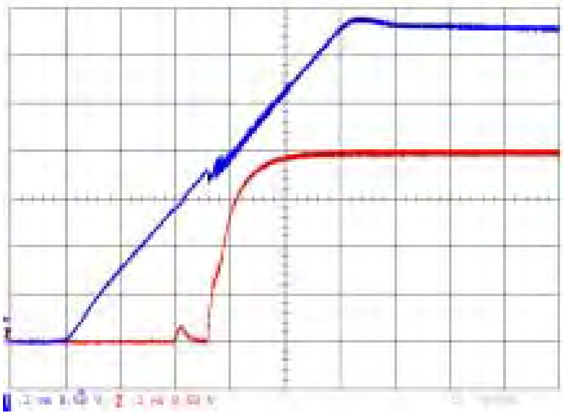


**Figure 48. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 2.0 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
0.2 ms/div

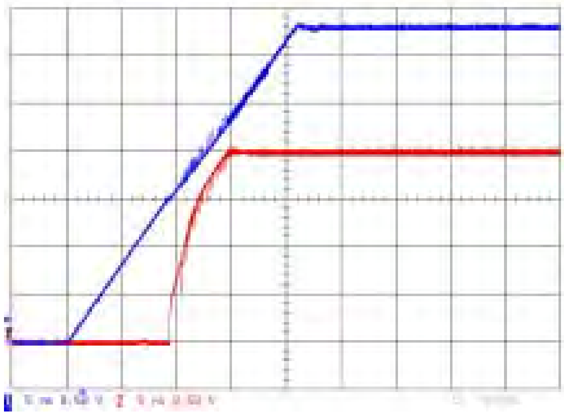


**Figure 49. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 2.0 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
5.0 ms/div

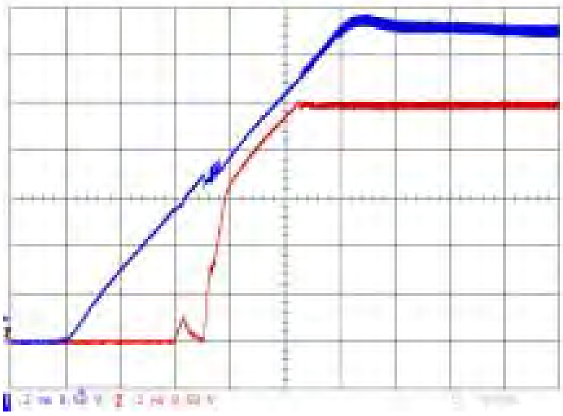


**Figure 50. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 2.5 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
0.2 ms/div

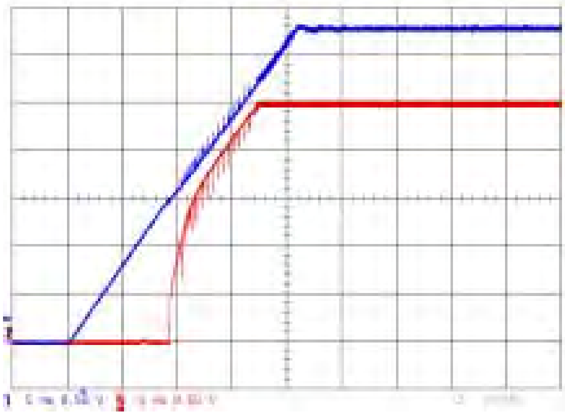


**Figure 51. Input/Output Start-Up Characteristic: 3.3 $V_{IN}$, 2.5 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 0.5 V/div and Lower = $V_{OUT}$ 0.5 V/div
5.0 ms/div

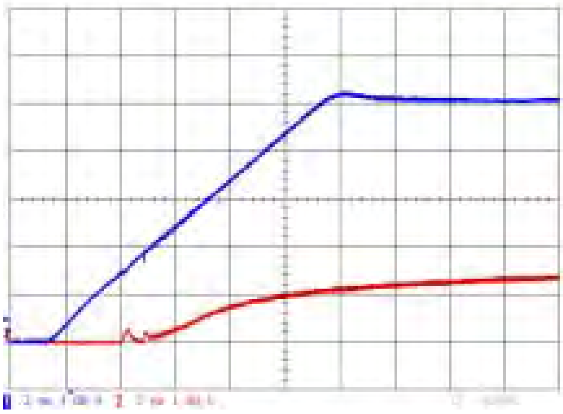


**Figure 52. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 1.5 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
0.2 ms/div

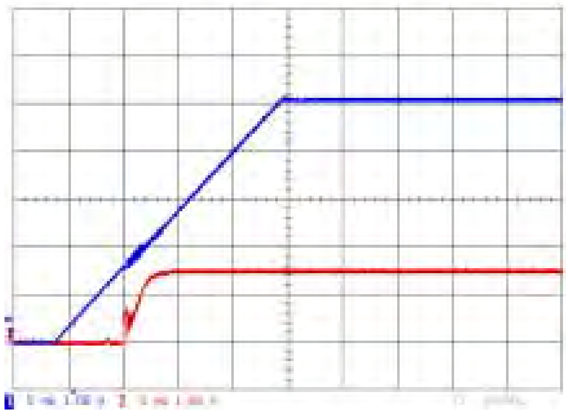


**Figure 53. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 1.5 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
5.0 ms/div

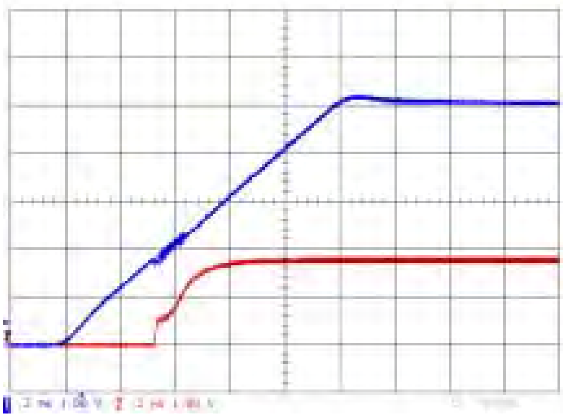


**Figure 54. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 1.8 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
0.2 ms/div

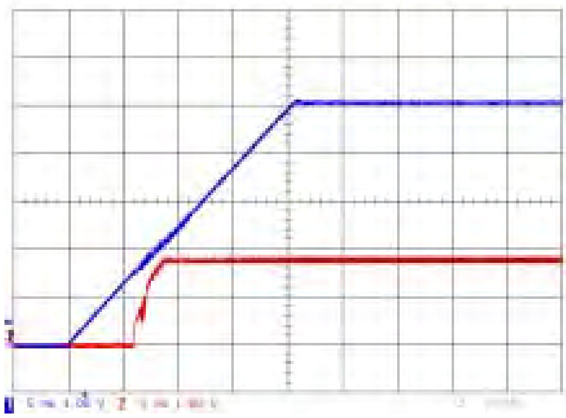


**Figure 55. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 1.8 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
5.0 ms/div

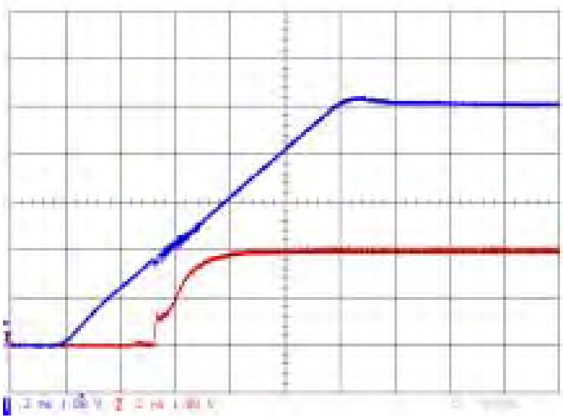


**Figure 56. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 2.0 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
0.2 ms/div

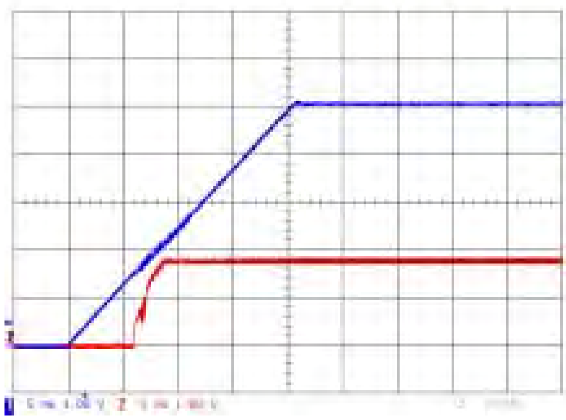


**Figure 57. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 2.0 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
5.0 ms/div

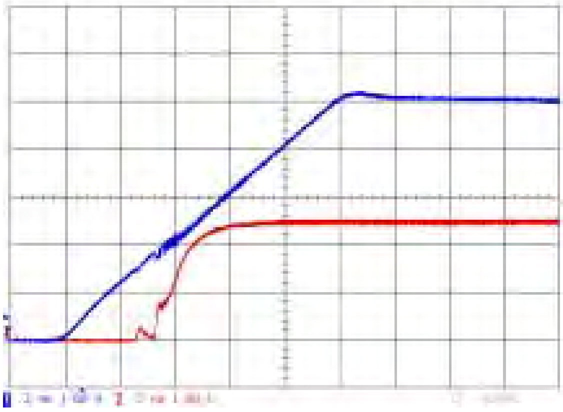


**Figure 58. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 2.5 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
0.2 ms/div

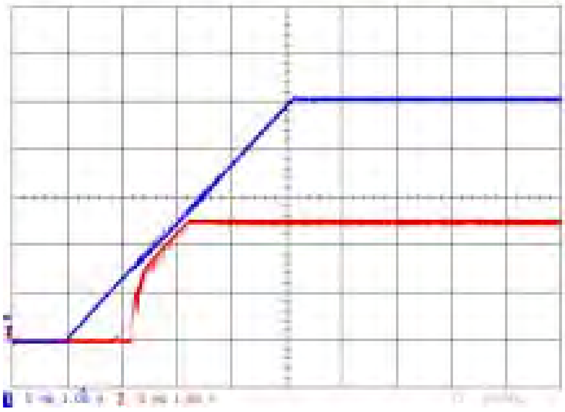


**Figure 59. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 2.5 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
5.0 ms/div

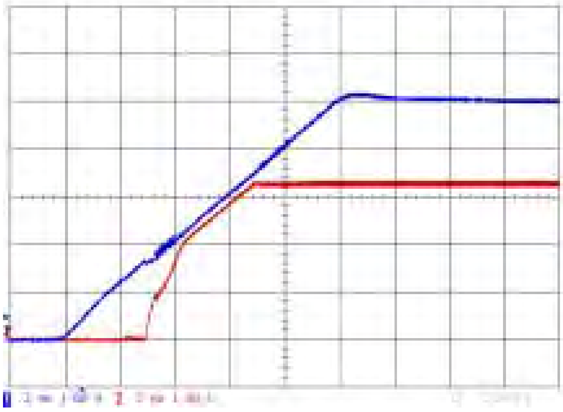


**Figure 60. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 3.3 $V_{OUT}$, 1 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
0.2 ms/div

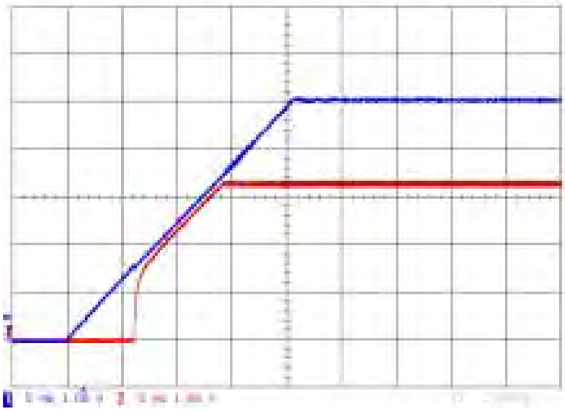


**Figure 61. Input/Output Start-Up Characteristic: 5.0 $V_{IN}$, 3.3 $V_{OUT}$, 20 ms input ramp**
Upper = $V_{IN}$ 1.0 V/div and Lower = $V_{OUT}$ 1.0 V/div
5.0 ms/div

## Efficiency

Figures 62 – 70 show typical efficiency charts for Austin Power Modules at different input voltages. The data reflects a 25 °C ambient temperature. Efficiencies will decrease approximately 2% at maximum temperatures. Efficiency is measured in production at 25 °C and full load.

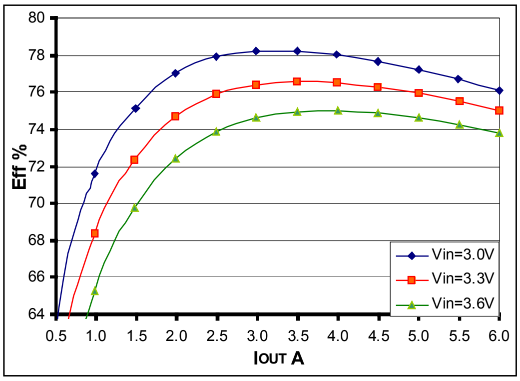



**Figure 62. Efficiency: 3.3 VIN, 1.5 VOUT**

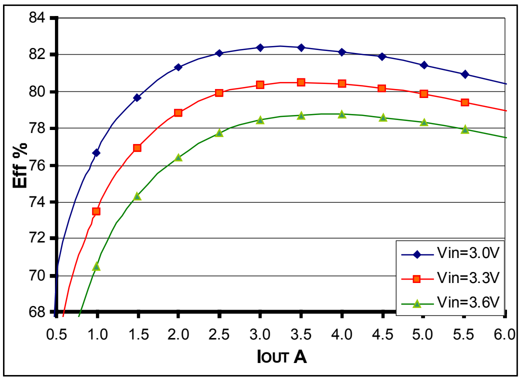



**Figure 63. Efficiency: 3.3 VIN, 1.8 VOUT**

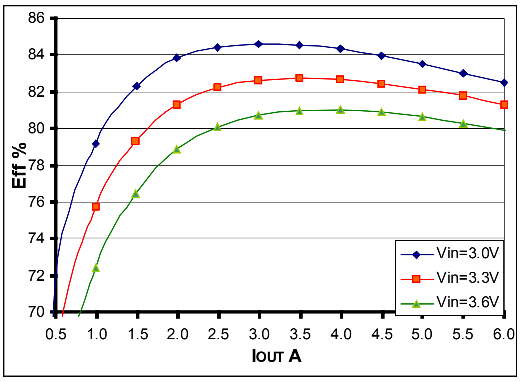



**Figure 64. Efficiency: 3.3 VIN, 2.0 VOUT**

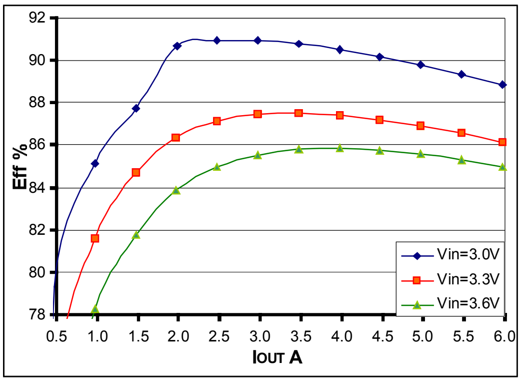



**Figure 65. Efficiency: 3.3 VIN, 2.5 VOUT**

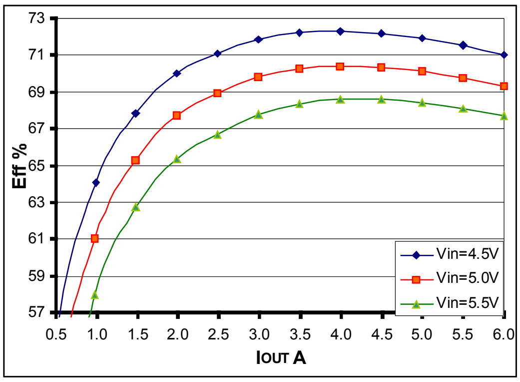



**Figure 66. Efficiency: 5.0 VIN, 1.5 VOUT**

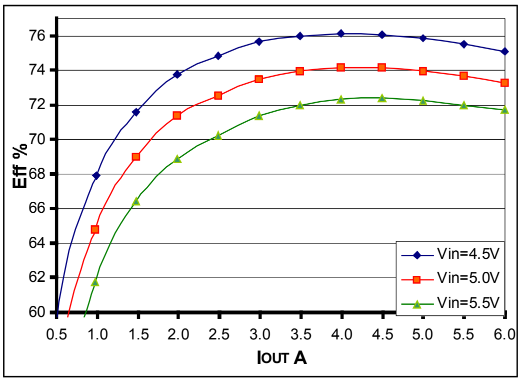



**Figure 67. Efficiency: 5.0 VIN, 1.8 VOUT**

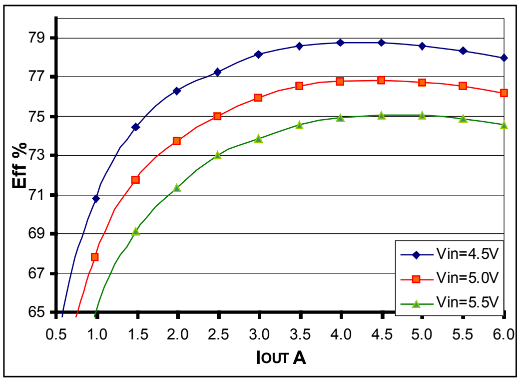



Figure 68. Efficiency: 5.0 VIN, 2.0 VOUT

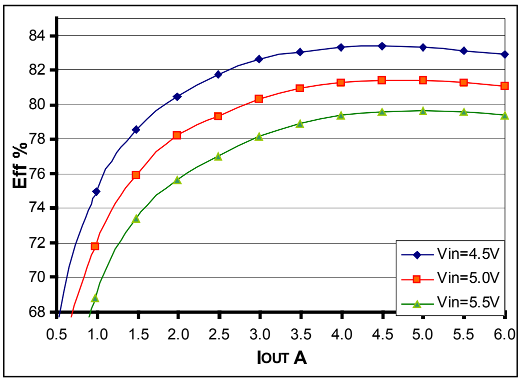



Figure 69. Efficiency: 5.0 VIN, 2.5 VOUT

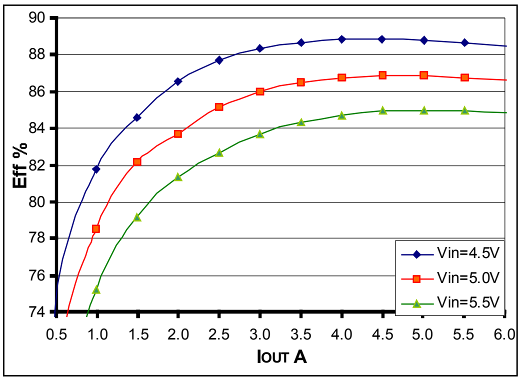



Figure 70. Efficiency: 5.0 VIN, 3.3 VOUT

## Parallel Operation

Up to five Austin Power Modules may be paralleled for extra output current needs. For N units operating in parallel, the output current rating will be equal to 6+(N-1)*4. For example, three modules can deliver 14 amps. For parallel operation, connect each control pin together. Care should be taken to make each module see the same approximate trace resistance to the load. In most cases, this requires that all converters be close together. Thermal derating can be approximated for parallel units by using the average current plus 1 amp for an individual module. For example, if three modules are carrying 12 amps, there is an average current of 3 amps so the derating curve at 4 amps would be used. Input and output decoupling should be scaled with the number of modules paralleled. If paralleled modules are to be trimmed using the control pin, divide the calculated trim resistance for a single unit by the number of modules paralleled. For example, if two paralleled units are to be trimmed 5% low, then a resistance of 146K divided by 2 should be used.

## Mechanical Specifications

**Table 4. Mechanical Specifications**

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Physical Size<br>*Dimensions listed are typical, with a tolerance of +/-0.01 inches | L<br>W<br>H | —<br>—<br>— | *44.6 (1.756)<br>12.7 (0.5)<br>5.46 (0.215) | —<br>—<br>— | mm (in.)<br>mm (in.)<br>mm (in.) |
| Weight | — | — | 4.0 | — | grams (oz.) |
| Connector Coplanarity | — | — | — | 0.127 (0.005) | mm (in.) |
| Interconnecting | Low-inductance surface-mount connector | | | | |
| Labeling | The label spans the magnetic component and contains the following:<br>• Line A: Device code<br>• Line B: Lucent product code<br>• Line C: Six-digit lot number<br>• Line D: The circuit serial number within the lot, which can be either a four-digit number or a barcode. | | | | |
| Shock | Method: MIL-STD-202F, method 213B, individual mounted units, 50 G, V2 sine, 6 ms; twice for each orthogonal axis | | | | |
| Vibration | Method: TR-EOP-000063, Sec. 5.4.4, individual mounted units, 5 to 50 Hz sweep @ 0.5 G, 50 to 500 Hz sweep @ 1.5 G; vibration introduced in all 3 orthogonal axes | | | | |

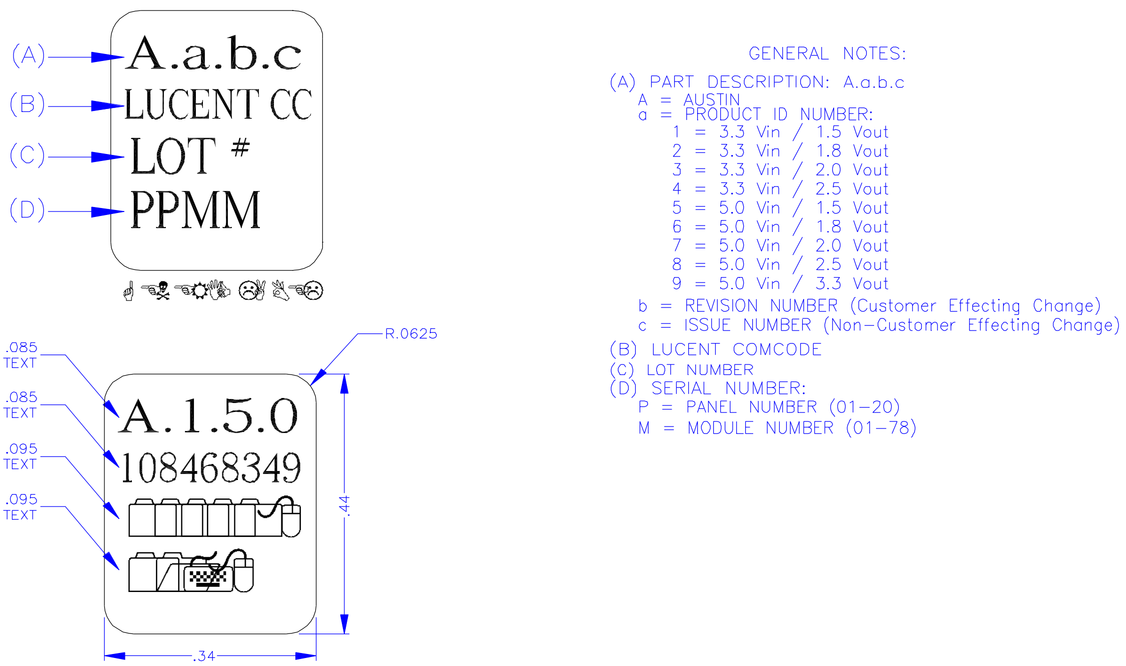



**Figure 71. Detailed Drawing of Product ID Label**

## Safety and Reliability Specifications

**Table 5. Reliability and Safety Specifications**

| Parameter | Symbol | Value | Ucl | Unit |
|---|---|---|---|---|
| Reliability<br>($V_{IN}$ = 3.3V, $I_{OUT}$= 4.4A, $T_A$ = 55 °C), 200 LFM airflow along PCB long axis | FIT | 200 | 60% | Per $10^9$ device hours |
| ESD Summary | Per MIL-STD-883C, Method 3015.7, Notice 8, ± 2000V | | | |
| EMI | FCC Class B and EN55022 Class B Radiated Emissions | | | |
| Safety | Designed to meet *UL* 1950, *CSA* C22.2 No. 950-95, and VDE 0805 (EN60950, IEC950) | | | |

For safety agency approval of the system in which the Austin Power Module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard.

For the converter output to meet the requirements of safety extra-low voltage (SELV), the input must meet SELV requirements.

The Austin Power Module has extra-low voltage (ELV) outputs when all inputs are ELV.

The input to these units is to be provided with a maximum 10A normal blow fuse in the ungrounded lead.

## Reflow Profile

An example reflow profile (using the 63/37 solder) for the Austin Power Module is:

- Pre-heating zone: room temperature to 183 °C (2.0 to 4.0 minutes maximum)
- Initial ramp rate: < 2.5 °C per second
- Soaking zone: 155 °C to 183 °C — 60 to 90 seconds typical (2.0 minutes maximum)
- Reflow zone ramp rate: 1.3 °C to 1.6 °C per second
- Reflow zone: 210 °C to 235 °C peak temperature — 30 to 60 seconds typical (90 seconds maximum)

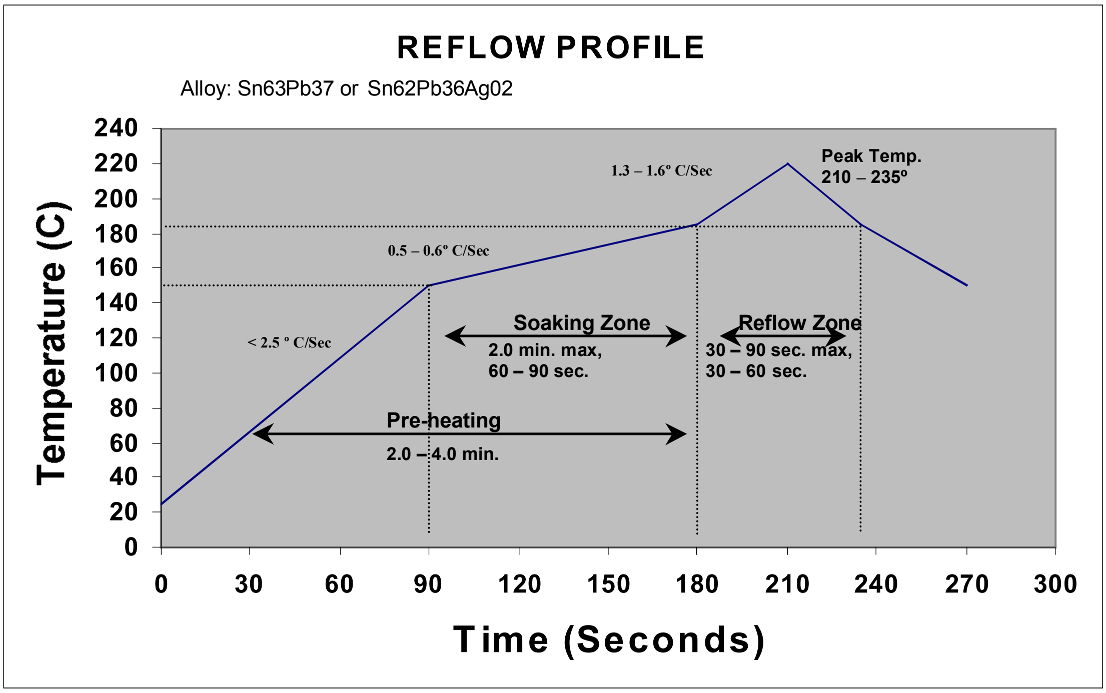



**Figure 72. Reflow Profile — Source: Kester**

## Pad Size

Recommended surface mount pad size is a minimum of 0.120 in. x 0.075 in. and a maximum of 0.140 in. x 0.095 in.

## Solder Paste Height

The recommended solder paste height as applied via standard SMT processes is 0.009” ± – 0.002”.

## Solder Paste Coverage

The recommended solder paste coverage over surface mount pads is 90%.

## Pick and Place Location

The product ID label is to be utilized for vacuum pick up of the Austin Power Module. The center location of this label is identified below.

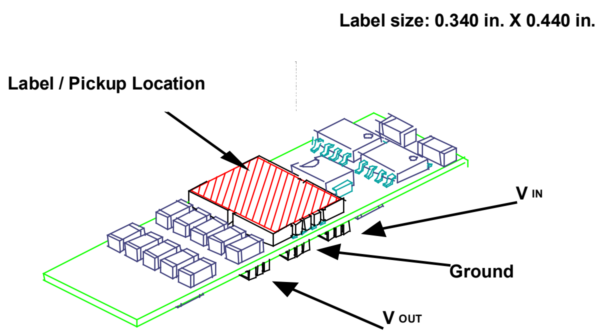



**Figure 73. Pick and Place Location**

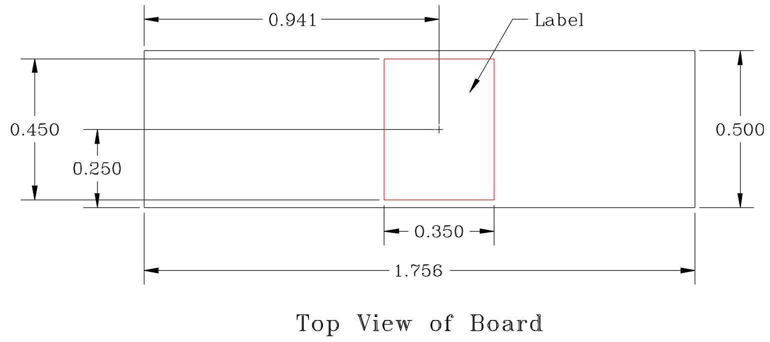



**Figure 74. Top View of Board**

Note: Measurement is in inches

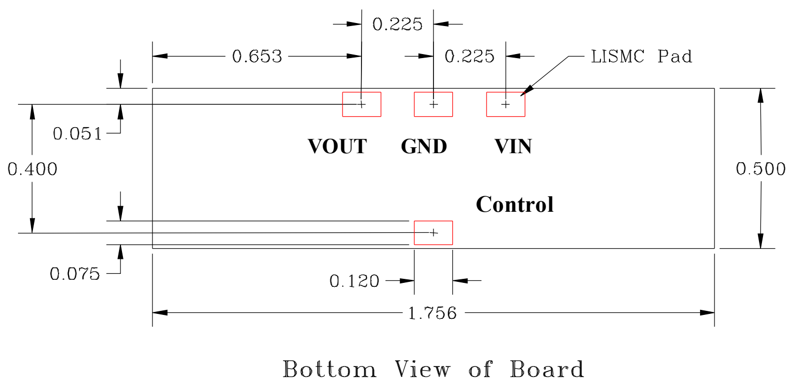



**Figure 75. Pad Locations**

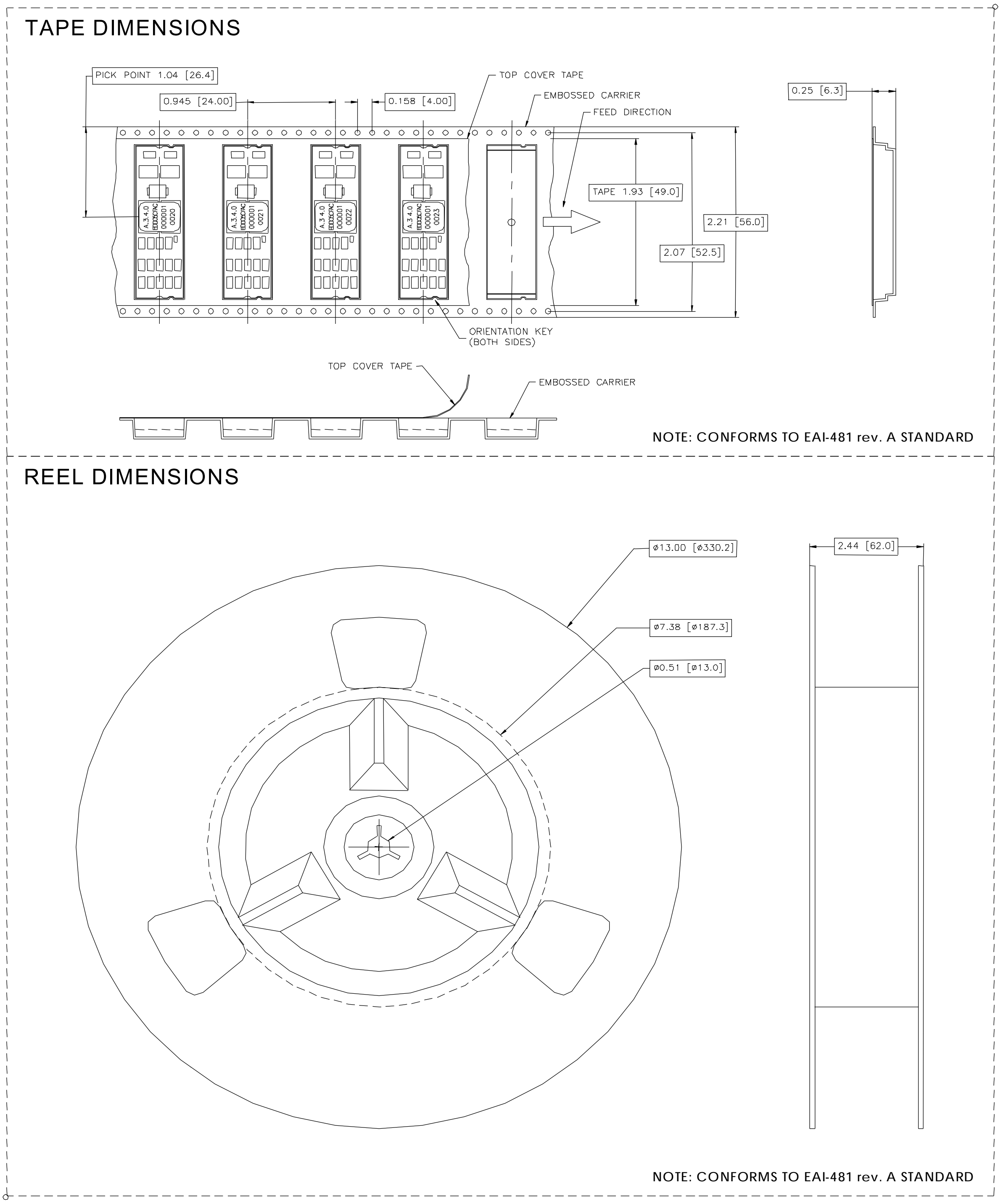
Note: Measurement is in inches

## Ordering Information

Call 1-87-SMALLPWR (1-877-625-5797) to order Austin Power Modules or order online at http://power.lucent.com/titania.

**Table 6. Coding Scheme for Ordering**

| Product Code | Comcode | Expanded Product Description |
|---|---|---|
| AUSTIN 5V 3.3V 5A T | 108612961 | 5 $V_{IN}$; 3.3 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 5V 2.5V 5A T | 108612953 | 5 $V_{IN}$; 2.5 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 5V 2.0V 5A T | 108612946 | 5 $V_{IN}$; 2.0 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 5V 1.8V 5A T | 108612938 | 5 $V_{IN}$; 2.8 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 5V 1.5V 5A T | 108613266 | 5 $V_{IN}$; 1.5 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 3.3V 2.5V 5A T | 108612912 | 3.3 $V_{IN}$; 2.5 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 3.3V 2.0V 5A T | 108613258 | 3.3 $V_{IN}$; 2.0 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 3.3V 1.8V 5A T | 108612920 | 3.3 $V_{IN}$; 1.8 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 3.3V 1.5V 5A T | 108613241 | 3.3 $V_{IN}$; 1.5 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; Tape & Reel package |
| AUSTIN 5V 3.3V 5A J | 108505710 | 5 $V_{IN}$; 3.3 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC Tray package |
| AUSTIN 5V 2.5V 5A J | 108505702 | 5 $V_{IN}$; 2.5 $V_{OUT}$; 4 terminal surface mount; 5A Iout; 300 A/µsec transient response; JEDEC tray package |
| AUSTIN 5V 2.0V 5A J | 108505694 | 5 $V_{IN}$; 2.0 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC tray package |
| AUSTIN 5V 1.8V 5A J | 108505686 | 5 $V_{IN}$; 1.8 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC tray package |
| AUSTIN 5V 1.5V 5A J | 108505678 | 5 $V_{IN}$; 1.5 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC tray package |
| AUSTIN 3.3V 2.5V 5A J | 108468372 | 3.3 $V_{IN}$; 2.5 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC tray package |
| AUSTIN 3.3V 2.0V 5A J | 108468364 | 3.3 $V_{IN}$; 2.0 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC tray package |
| AUSTIN 3.3V 1.8V 5A J | 108468356 | 3.3 $V_{IN}$; 1.8 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC tray package |
| AUSTIN 3.3V 1.5V 5A J | 108468349 | 3.3 $V_{IN}$; 1.5 $V_{OUT}$; 4 terminal surface mount; 5A $I_{OUT}$; 300 A/µsec transient response; JEDEC tray package |




**Figures 76 & 77. Austin Power Modules Packaging**

The above drawings represent Carrier Tape and Reel configuration. Austin Power Modules are shipped in quantities of 250 modules per tape and reel, or four JEDEC trays with 42 modules per tray, for a total of 168 modules.

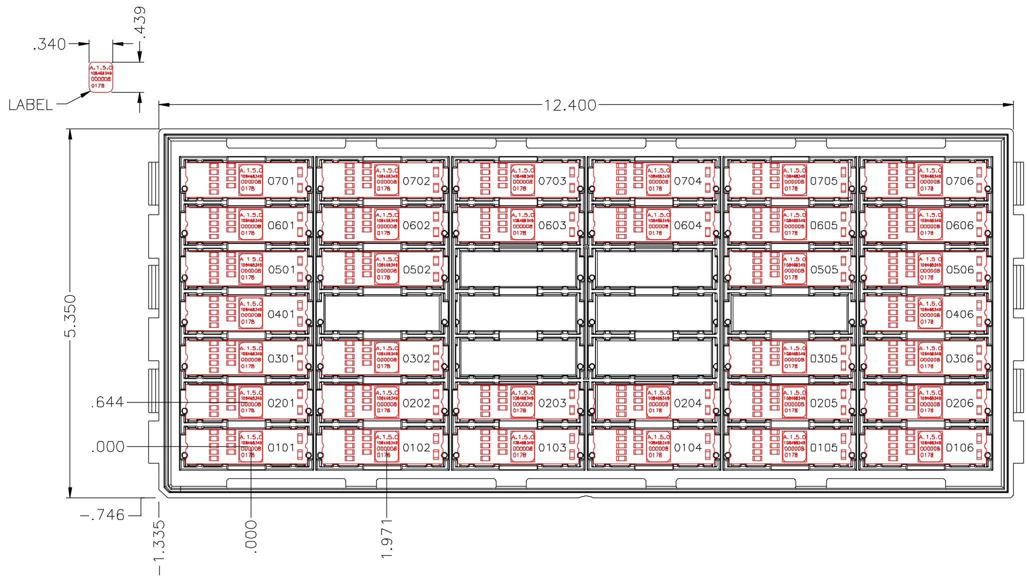



**Figure 78. Austin Modules arranged in JEDEC-style tray**

For additional information, contact your Power Systems Group Account Manager or the following:

MICROPOWER: 12301-II Riata Trace Parkway, Austin, TX 78727, USA
PHONE: **1-87-SMALLPWR (1-877-625-5797),** outside U.S. **972-284-2626** for product-related questions or technical assistance
FAX: **1-888-315-5182**
INTERNET: http://power.lucent.com/titania
E-MAIL: titania@lucent.com for product-related questions or technical assistance
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