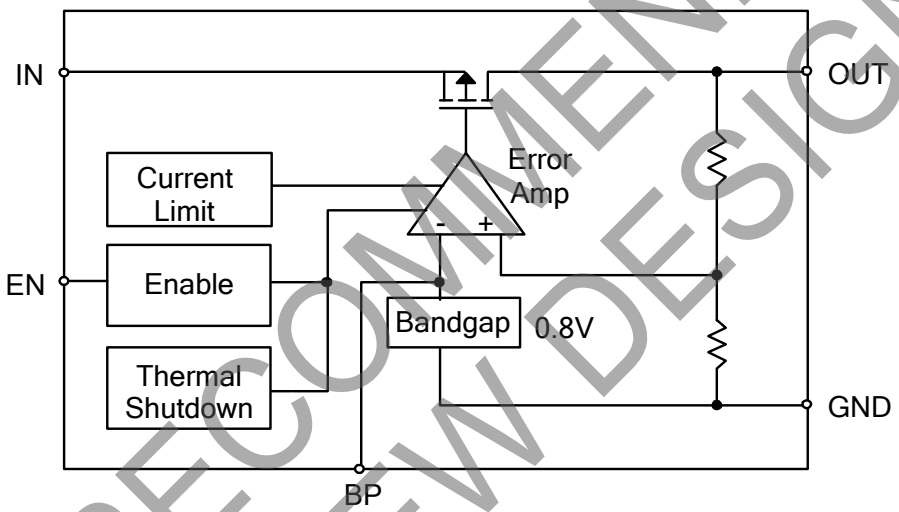
## Pin Descriptions

| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | IN | Voltage Input |
| 2 | GND | Ground |
| 3 | EN | Chip Enable Control |
| 4 | BP | Band-Gap Bypass |
| 5 | OUT | Voltage Output |

## Functional Block Diagram




## Absolute Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| ESD HBM | Human Body Model ESD Protection | 3.5 | kV |
| ESD MM | Machine Model ESD Protection | 400 | V |
| $V_{IN}$ | Input Voltage | -0.3 to 5.5 | V |
| $V_{EN}$ | EN Pin Voltage | -0.3 to 5.5 | V |
| $V_{OUT}$ | Output Voltage | -0.3 to $V_{IN}$+0.3 | V |
| $V_{BP}$ | Band Gap Bypass Pin Voltage | -0.3 to 5.5 | V |
| $P_D$ | Power Dissipation | 500 | mW |
| $T_J$ | Operating Junction Temperature Range | -40 to +125 | °C |
| $T_{ST}$ | Storage Temperature Range | -65 to +150 | °C |

## Recommended Operating Conditions (@$T_A$ = +25°C, unless otherwise specified.)

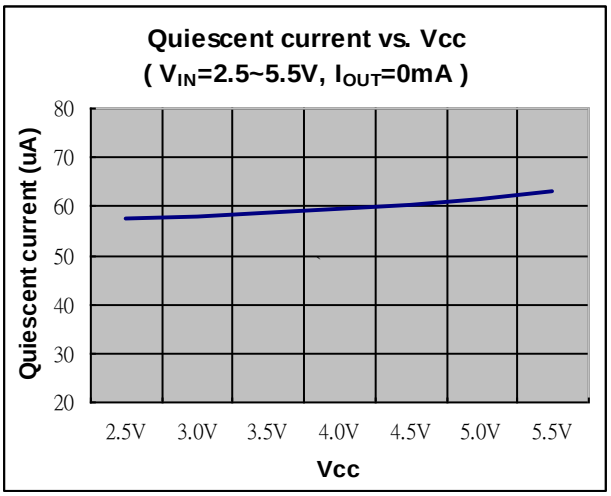
| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | 2.5 | 5.5 | V |
| $I_{OUT}$ | Output Current | — | 150 | mA |
| $T_A$ | Operating Ambient Temperature | -40 | +85 | °C |

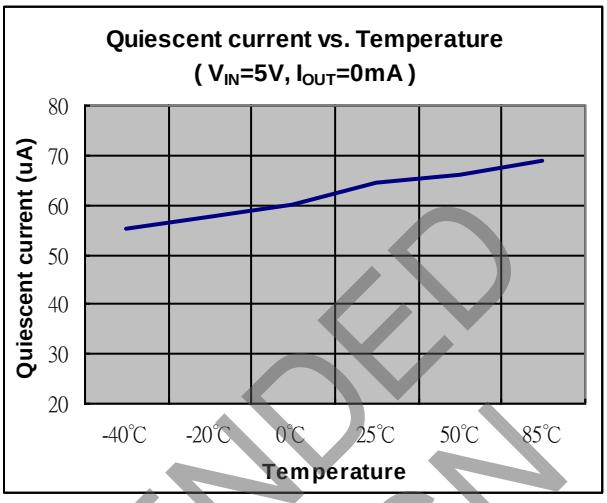
## Electrical Characteristics (@$V_{CC}$ = 3.3V, $I_L$ = 30mA, $C_{IN}$ = 1µF, $C_{OUT}$ = 1µF, $T_A$ = +25°C)

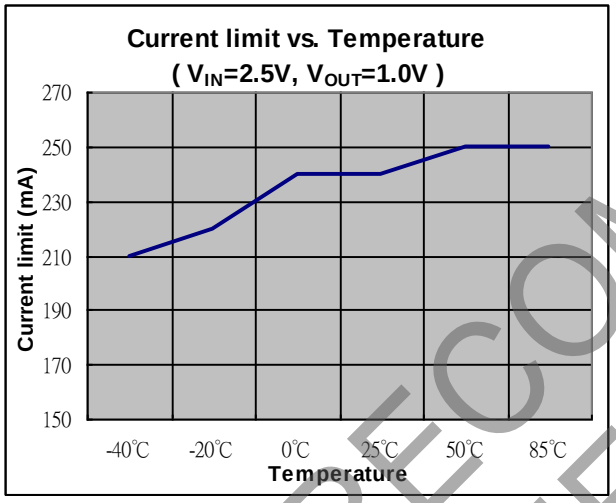
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **System Supply Input** | | | | | | |
| $V_{IN}$ | Operating Input Voltage | $I_L$ = 0 to 150mA | 2.5 | — | 5.5 | V |
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | $V_{IN} = V_{OUT}$ + 1V where 1mA ≤ $I_{OUT}$ ≤ 50mA | -2 | — | 2 | % |
| $V_{DO}$ | Dropout Voltage | $I_L$ = 150mA | — | 200 | 300 | mV |
| $I_{OUT}$ | Output Current | $V_{IN} - V_{OUT}$ = 1V | 150 | — | — | mA |
| $I_Q$ | Quiescent Current | $V_{IN} = V_{OUT}$ + 1V where $I_{OUT}$ = 0 and $V_{EN} = V_{IN}$ | — | 50 | 80 | µA |
| $I_{SHUTDOWN}$ | Shutdown Current | $V_{IN} = V_{OUT}$ + 1V where $I_{OUT}$ = 0 and $V_{EN}$ = 0 | — | 0.1 | 1 | µA |
| PSRR | Power Supply Rejection Ratio | $I_{OUT}$ = 30mA, f = 1kHz | — | 70 | — | dB |
| $I_{LIMIT}$ | Current Limit | — | 200 | 250 | — | mA |
| **Thermal Management** | | | | | | |
| $T_{SHUTDOWN}$ | Thermal Shutdown | — | — | +150 | — | °C |
| **Reference Voltage** | | | | | | |
| $\Delta V_{REF}/\Delta T$ | Tempco of Bandgap Reference | — | — | 30 | 50 | ppm/°C |
| $\Delta V_{OUT}/\Delta T$ | Tempco of Output Voltage | $I_{OUT}$ = 30mA, -40°C ≤ $T_A$ ≤ +85°C | — | 50 | 100 | ppm/°C |
| **Control and Protection** | | | | | | |
| $V_{IH,EN}$ | — | — | 2.0 | — | — | V |
| $V_{IL,EN}$ | — | — | — | — | 0.7 | V |
| $I_{EN}$ | EN Pin Leakage Current | $V_{EN} = V_{IN}$ @$V_{IN}$ = 5.0V and $V_{SS}$ = 0V | — | 0.01 | 0.1 | µA |
| | | $V_{EN} = V_{SS}$ @$V_{IN}$ = 5.0V and $V_{SS}$ = 0V | — | 0.01 | 0.1 | µA |
| **Regulation** | | | | | | |
| $\Delta V_O/\Delta V_{IN}$ | Line Regulation | $V_{OUT}$ + 0.5V ≤ $V_{IN}$ ≤ 5.5V where $V_{OUT}$ > 2.0V, $I_{OUT}$ = 30mA | — | 0.02 | 0.1 | %/V |
| $\Delta V_{LOAD}$ | Load Regulation | 1mA ≤ $I_L$ ≤ 150mA where $V_{IN} = V_{OUT}$ + 1V | — | 0.003 | 0.006 | %/mA |
| **Noise** | | | | | | |
| $e_n$ | Output Noise | BW = 10Hz to 100kHz | — | 50 | — | $\mu V_{rms}$ |
| **Thermal Resistance** | | | | | | |
| $\theta_{JA}$ | Thermal Resistance Junction-to-Ambient | SOT25 (Note 4) | — | 200 | — | °C/W |
| | | SOT353 (Note 4) | — | 337 | — | °C/W |
| $\theta_{JC}$ | Thermal Resistance Junction-to-Case | SOT25 (Note 4) | — | 52 | — | °C/W |
| | | SOT353 (Note 4) | — | 121 | — | °C/W |

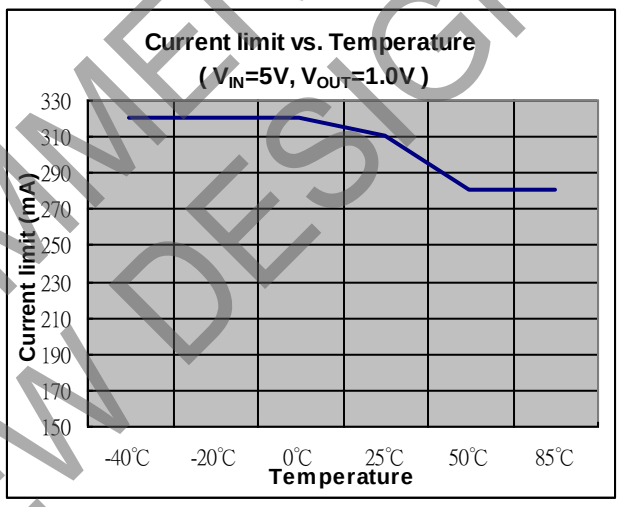
Note: 4. Test condition for SOT25 and SOT353: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

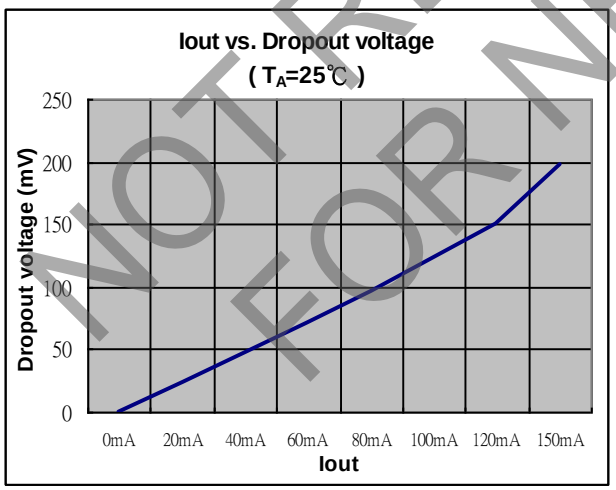
## Typical Operating Characteristics

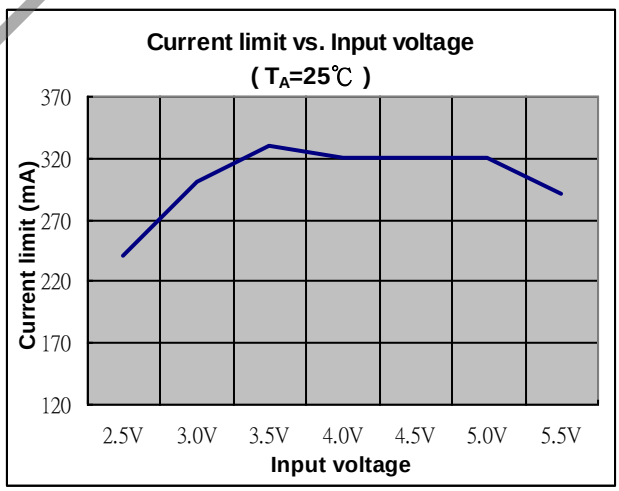


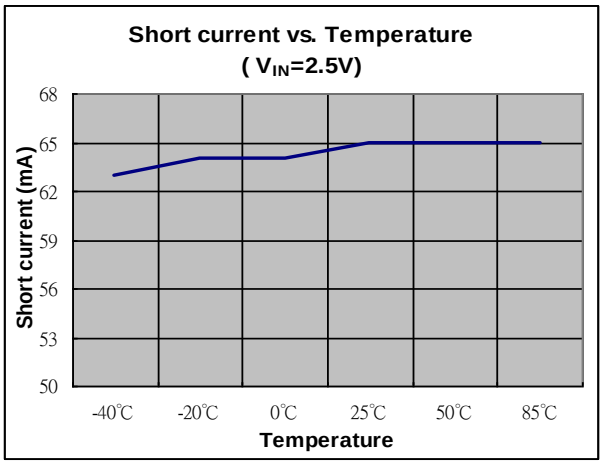



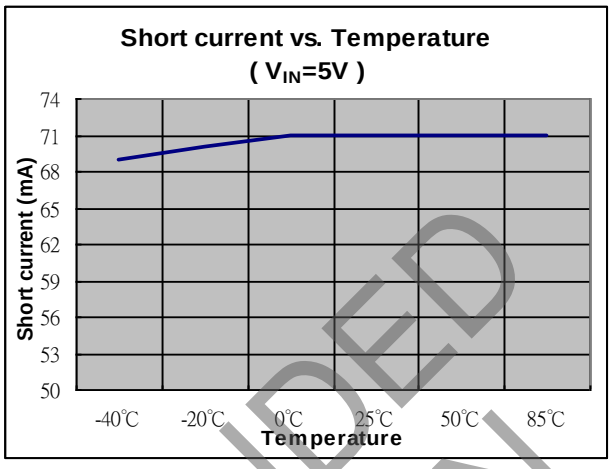



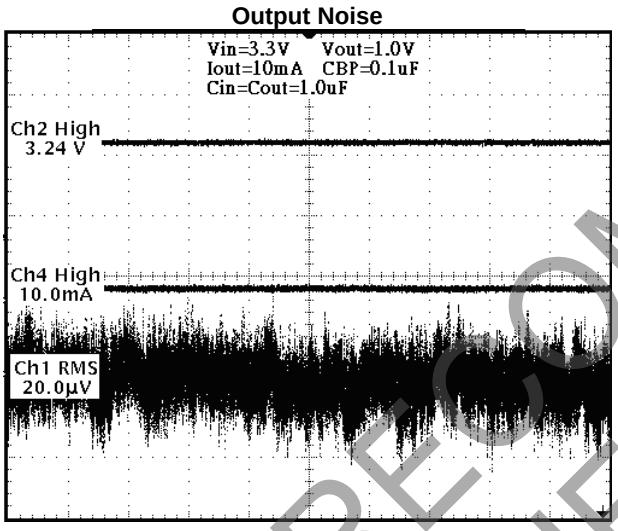



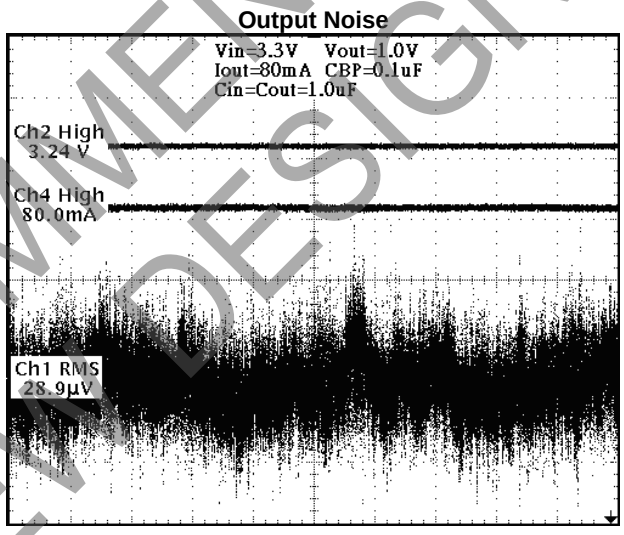



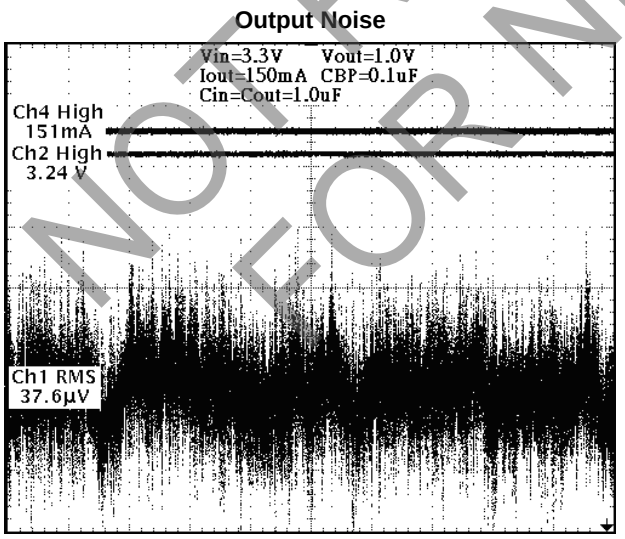
## Typical Operating Characteristics (Cont.)



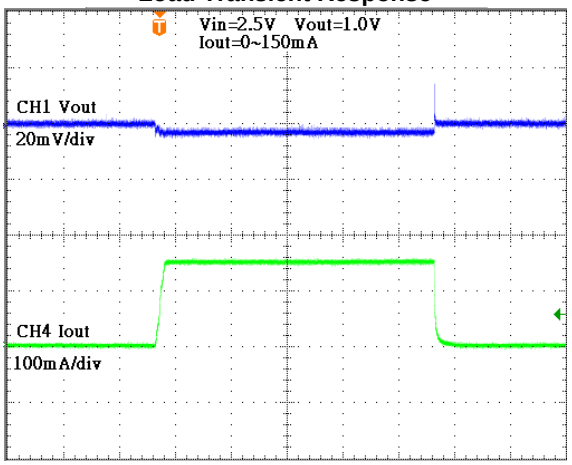



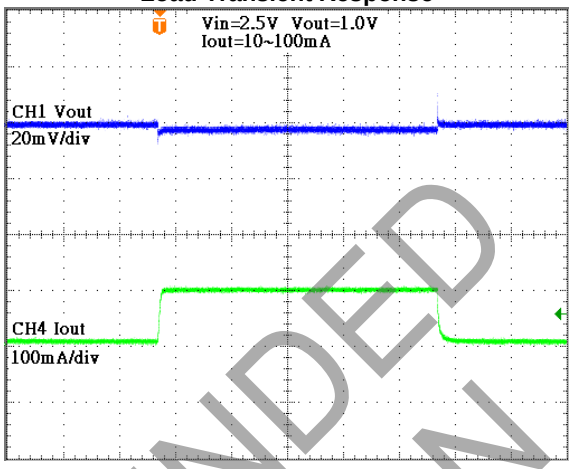



## Typical Operating Characteristics (Cont.)

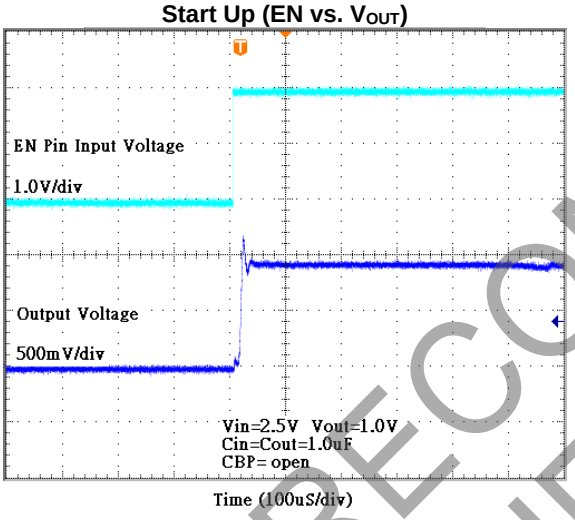
**Load Transient Response**



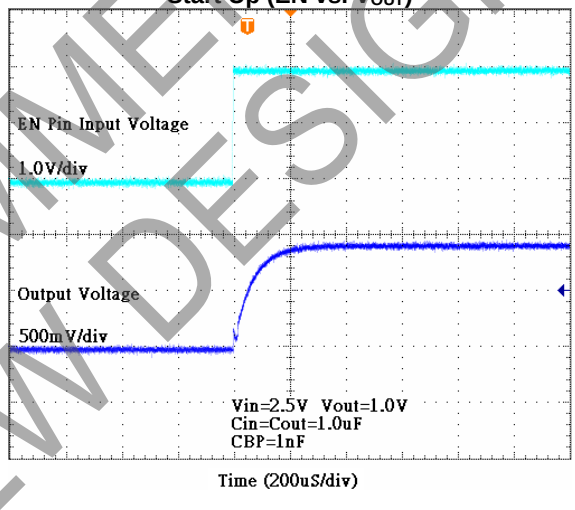

**Load Transient Response**



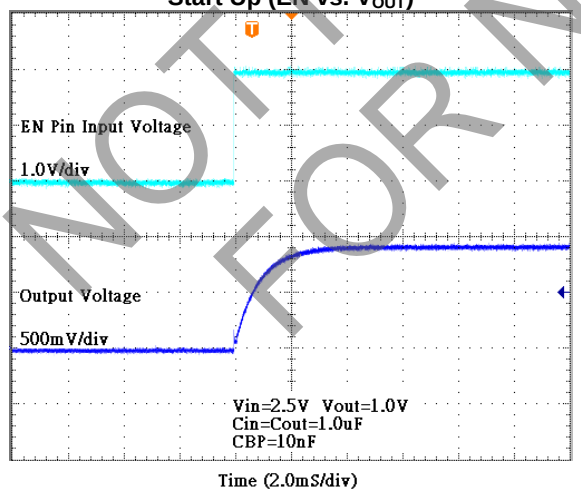

**Start Up (EN vs. $V_{OUT}$)**



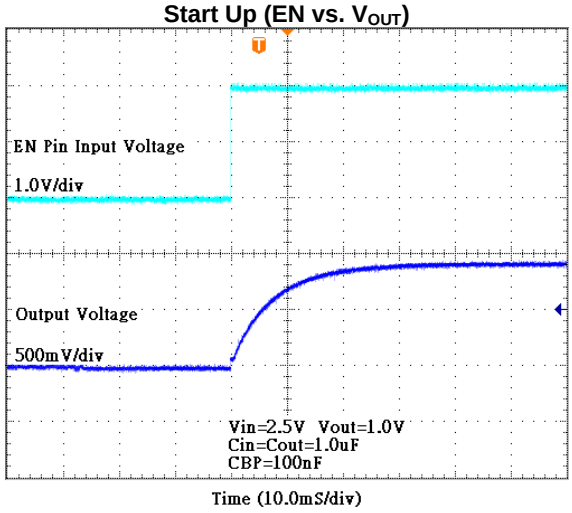

**Start Up (EN vs. $V_{OUT}$)**




**Start Up (EN vs. $V_{OUT}$)**




**Start Up (EN vs. $V_{OUT}$)**



## Application Note

**Input Capacitor**

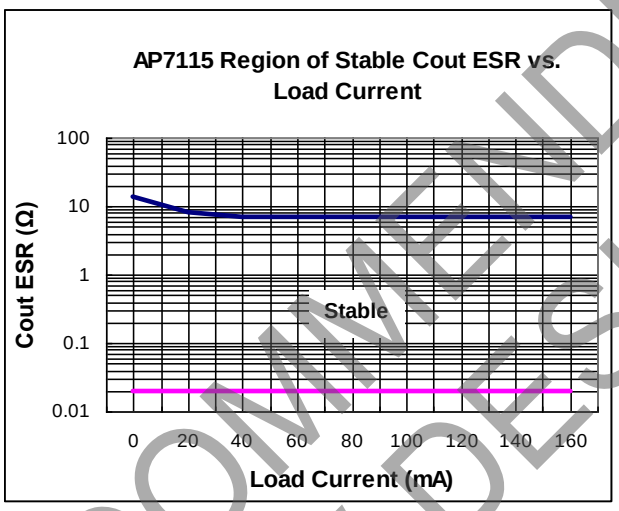
A 1µF input capacitor is required between the AP7115 input pin and GND.

There are no requirements for the ESR on input capacitor, but tolerance and temperature coefficient must be considered.

**Output Capacitor**

The AP7115 can work with very small ceramic output capacitors (1µF or greater). Higher capacitance values help to improve transient. The output capacitor's ESR is critical because it from a zero to provide phase lead which is required for loop stability.

Figure below is Cout ESR vs. Load Current.




**Band-Gap Bypass Capacitor**

0.1µF bypass capacitor Between BP pin and GND can reduce output voltage noise.

**Shutdown Input Operation**

The AP7115 is shutdown by pulling the EN pin low, and turned on by driving the input high. If the shutdown feature is not required, the EN pin should be tied to VIN to keep the regulator on at all time.

**Dropout Voltage**

$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS(ON)} \times I_{OUT}$

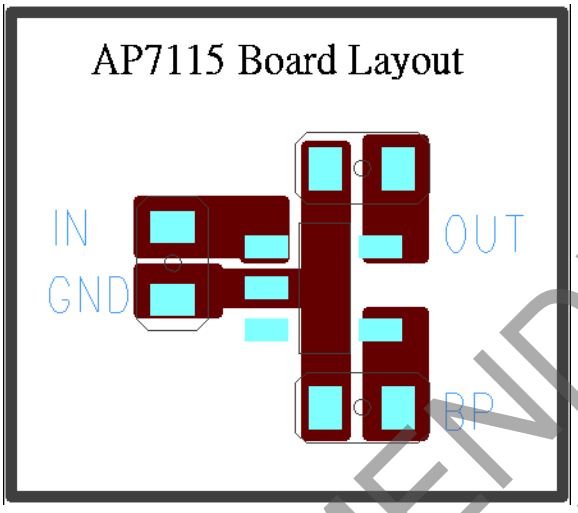
**Current Limit**

The AP7115 monitors and controls the PMOS' gate voltage, limiting the output current to 250mA (typ.). The output can be shorted to ground for an indefinite period of time without damaging the part.

## Application Note (Cont.)

**PCB Layout**

Optimum performance can only be achieved when the device is mounted on a PC board according to the diagram below:




**Thermal Considerations**

Thermal Shutdown Protection limits power dissipation in AP7115. When the operation junction temperature exceeds +155°C, the Over Temperature Protection circuit starts the thermal shutdown function and turns the pass element off. The pass element turns on again after the junction temperature cools by +30°C. For continuous operation, do not exceed absolute maximum operation junction temperature +125°C. The power dissipation definition in device is:

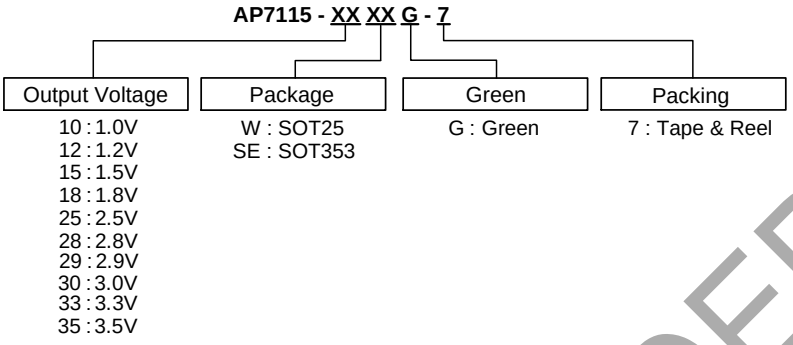
$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by the following formula:

$P_{D(MAX)} = ( T_{J(MAX)} - T_A ) / \theta_{JA}$

Where $T_{J(MAX)}$ is the maximum operation junction temperature +125°C, $T_A$ is the ambient temperature and the $\theta_{JA}$ is the junction to ambient thermal resistance.

## Ordering Information

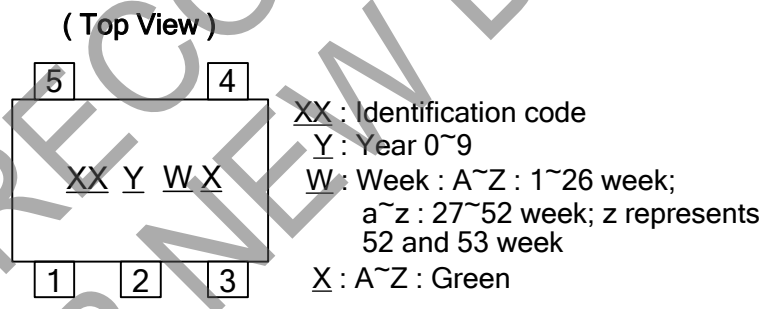



| Part Number | Package Code | Packaging (Note 5) | 7" Tape and Reel | |
|---|---|---|---|---|
| | | | Quantity | Part Number Suffix |
| AP7115-XXWG-7 | W | SOT25 | 3000/Tape & Reel | -7 |
| AP7115-XXSEG-7 | SE | SOT353 | 3000/Tape & Reel | -7 |

Notes: 5. Pad layout as shown in Diodes Incorporated's package outline PDFs, which can be found on our website at http://www.diodes.com/package-outlines.html.

## Marking Information

**SOT25/SOT353**

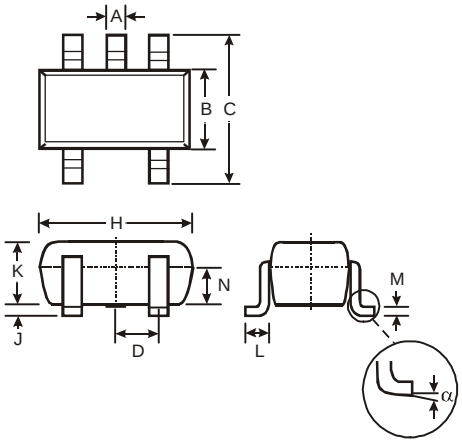



| Part Number SOT25 | Identification Code | Part Number SOT353 | Identification Code |
|---|---|---|---|
| AP7115-10WG-7 | FO | AP7115-10SEG-7 | GO |
| AP7115-12WG-7 | FP | AP7115-12SEG-7 | GP |
| AP7115-15WG-7 | FQ | AP7115-15SEG-7 | GQ |
| AP7115-18WG-7 | FR | AP7115-18SEG-7 | GR |
| AP7115-25WG-7 | FS | AP7115-25SEG-7 | GS |
| AP7115-28WG-7 | FT | AP7115-28SEG-7 | GT |
| AP7115-29WG-7 | FU | AP7115-29SEG-7 | GU |
| AP7115-30WG-7 | FV | AP7115-30SEG-7 | GV |
| AP7115-33WG-7 | FW | AP7115-33SEG-7 | GW |
| AP7115-35WG-7 | FX | AP7115-35SEG-7 | GX |

## Package Outline Dimensions

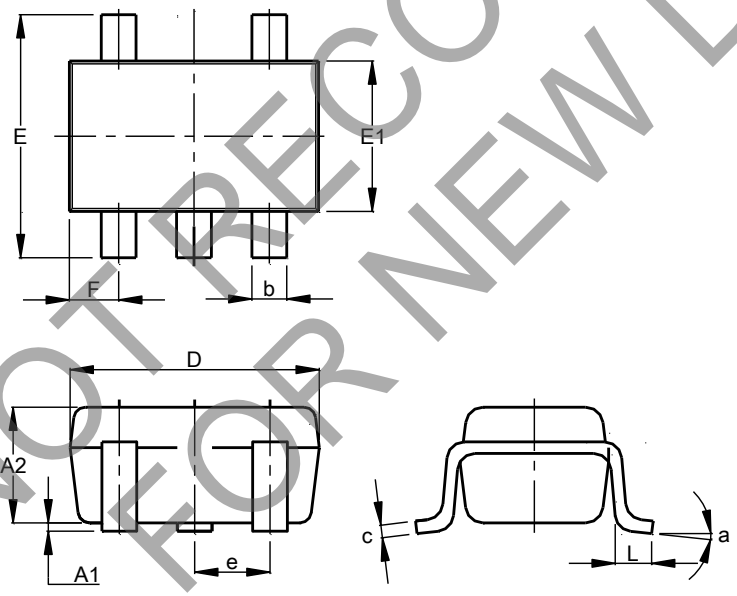
Please see http://www.diodes.com/package-outlines.html for the latest version.

**(1) Package Type: SOT25**




| SOT25 | | | |
|---|---|---|---|
| Dim | Min | Max | Typ |
| A | 0.35 | 0.50 | 0.38 |
| B | 1.50 | 1.70 | 1.60 |
| C | 2.70 | 3.00 | 2.80 |
| D | - | - | 0.95 |
| H | 2.90 | 3.10 | 3.00 |
| J | 0.013 | 0.10 | 0.05 |
| K | 1.00 | 1.30 | 1.10 |
| L | 0.35 | 0.55 | 0.40 |
| M | 0.10 | 0.20 | 0.15 |
| N | 0.70 | 0.80 | 0.75 |
| α | 0° | 8° | - |
| All Dimensions in mm | | | |

**(2) Package Type: SOT353**

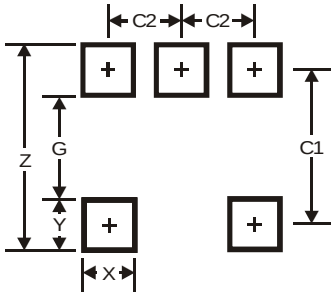



| SOT353 | | | |
|---|---|---|---|
| Dim | Min | Max | Typ |
| A1 | 0.00 | 0.10 | 0.05 |
| A2 | 0.90 | 1.00 | 1.00 |
| b | 0.10 | 0.30 | 0.25 |
| c | 0.10 | 0.22 | 0.11 |
| D | 1.80 | 2.20 | 2.15 |
| E | 2.00 | 2.20 | 2.10 |
| E1 | 1.15 | 1.35 | 1.30 |
| e | 0.650 BSC | | |
| F | 0.40 | 0.45 | 0.425 |
| L | 0.25 | 0.40 | 0.30 |
| a | 0° | 8° | -- |
| All Dimensions in mm | | | |

## Suggested Pad Layout

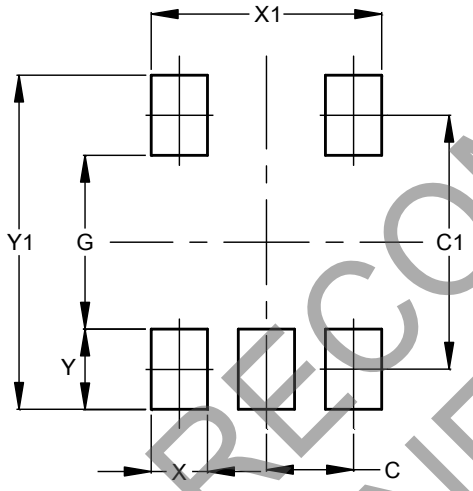
Please see http://www.diodes.com/package-outlines.html for the latest version.

**(1) Package Type: SOT25**




| Dimensions | Value |
|---|---|
| Z | 3.20 |
| G | 1.60 |
| X | 0.55 |
| Y | 0.80 |
| C1 | 2.40 |
| C2 | 0.95 |

**(2) Package Type: SOT353**




| Dimensions | Value (in mm) |
|---|---|
| C | 0.650 |
| C1 | 1.900 |
| G | 1.300 |
| X | 0.420 |
| X1 | 1.720 |
| Y | 0.600 |
| Y1 | 2.500 |

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