

Description

The AP2138/2139 series are CMOS-based positive voltage regulator ICs. Each of these ICs consists of a voltage reference, an error amplifier, a resistor network for setting output voltage and a current limit circuit for current protection.

The difference between AP2138 and AP2139 is the AP2139 has an enable circuit with a quick discharge function.

These ICs feature high output voltage accuracy, extremely low quiescent current and low dropout voltage which make them ideal for use in various power sources for portable applications.

The AP2138/2139 series have 1.2V, 1.4V, 1.5V, 1.8V, 2.1V, 2.2V, 2.5V, 2.8V, 3.0V, 3.3V, 3.6V and 4.0V fixed output voltage versions.

The AP2138 series is available in SOT-23-3 and SOT-89 packages, AP2139 series is available in SOT-23-5 package.

Features

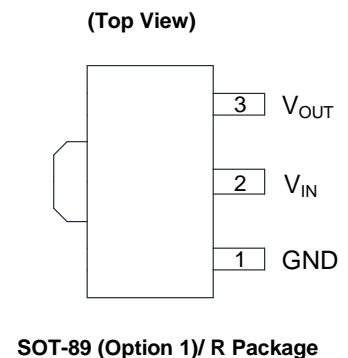
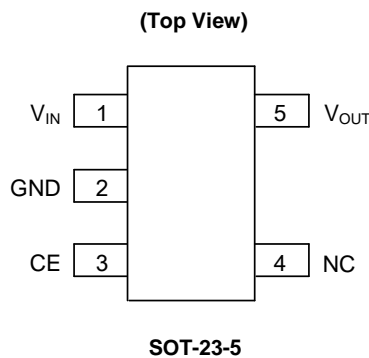
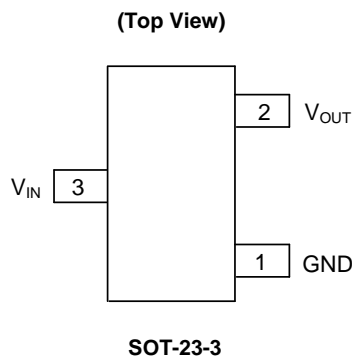
- Ultra-low Quiescent Current: 1.0 μ A Typical
- Output Voltages: 1.2V, 1.4V, 1.5V, 1.8V, 2.1V, 2.2V, 2.5V, 2.8V, 3.0V, 3.3V, 3.6V and 4.0V
- High Output Voltage Accuracy: $\pm 2\%$
- Output Current: 250mA
- Low Dropout Voltage:
 - 25mV Typical at $I_{OUT} = 10\text{mA}$ and $V_{OUT} = 3\text{V}$
 - 200mV Typical at $I_{OUT} = 100\text{mA}$ and $V_{OUT} = 3\text{V}$
- Line Regulation: 6mV Typical
- Load Regulation: 25mV Typical
- Low Output Voltage Temperature Coefficient: $\pm 100\text{ppm}/^\circ\text{C}$
- Low Standby Current: 0.1 μ A Typical (AP2139)
- Active Quick Output Discharge (AP2139)
- Logic-controlled Enable (AP2139)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- Battery Powered Equipment
- Reference Voltage Sources
- Cameras, Video Cameras
- Portable AV Systems
- Mobile Phones
- Communication Tools
- Portable Games

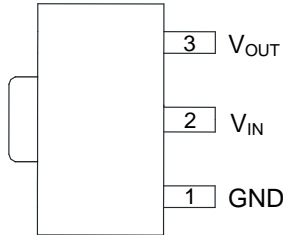
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Assignments



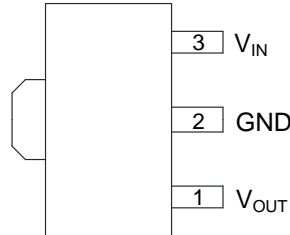
Pin Assignments (Cont.)

(Top View)



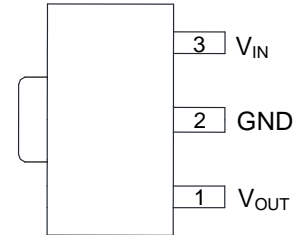
SOT-89 (Option 2)/ R Package

(Top View)



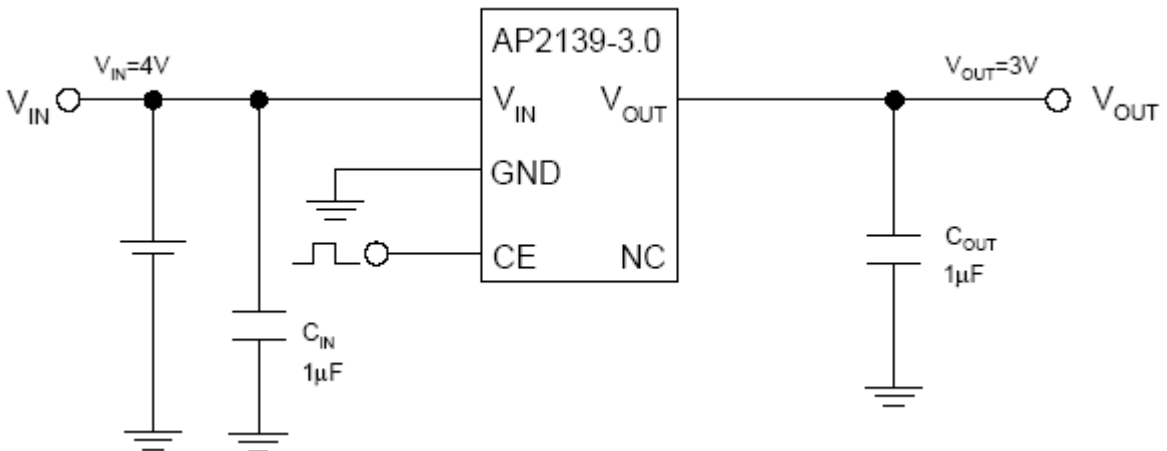
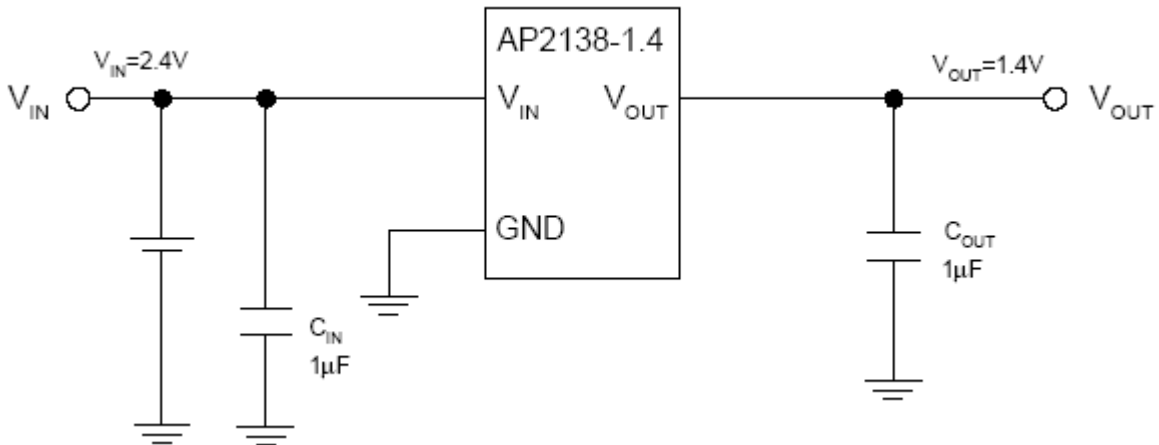
SOT-89 (Option 1)/ RA Package

(Top View)



SOT-89 (Option 2)/ RA Package

Typical Applications Circuit (Note 4)

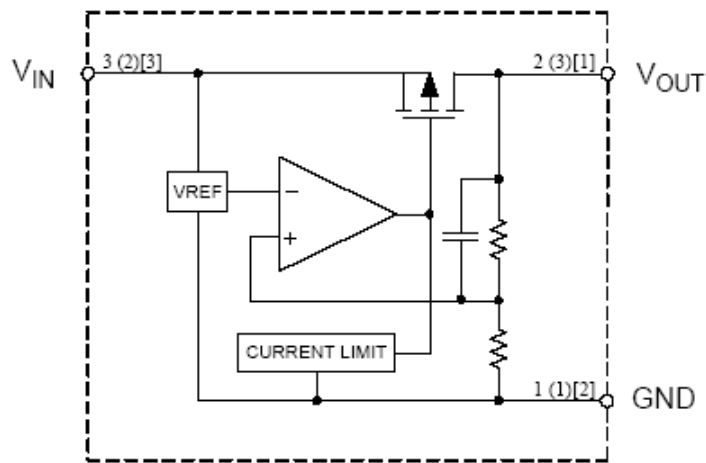


Note 4: Filter capacitors are required at the AP2138/2139's input and output. 1µF capacitor is required at the input. The minimum output capacitance required for stability should be more than 1µF with ESR from 0.01Ω to 100Ω. Ceramic capacitors are recommended.

Pin Description

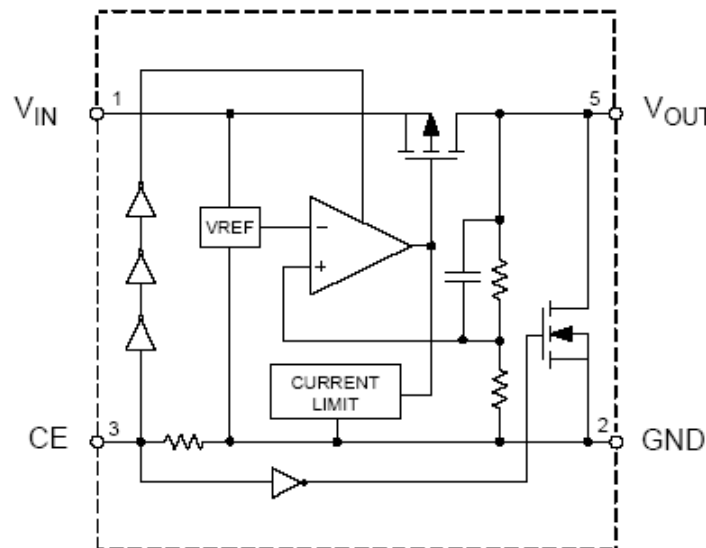
| Pin Number | | | | Pin Name | Function |
|------------|-----------|-------------|----------|------------------|---|
| SOT-23-3 | SOT-89(R) | SOT-89 (RA) | SOT-23-5 | | |
| 1 | 1 | 2 | 2 | GND | Ground |
| 2 | 3 | 1 | 5 | V _{OUT} | Regulated output voltage |
| 3 | 2 | 3 | 1 | V _{IN} | Input voltage |
| - | - | - | 3 | CE | Active high enable input. Logic high=enable, logic low=shutdown |
| - | - | - | 4 | NC | No connection |

Functional Block Diagram



A(B)[C]
A: SOT-23-3
B: SOT-89 (R)
C: SOT-89 (RA)

AP2138



AP2139

Absolute Maximum Ratings (Note 5)

| Symbol | Parameter | Rating | | Unit |
|---------------|-------------------------------|----------------------|-----|------|
| V_{IN} | Input Voltage | 6.6 | | V |
| V_{CE} | Enable Input Voltage (AP2139) | -0.3 to $V_{IN}+0.3$ | | V |
| T_{LEAD} | Lead Temperature | +260 | | °C |
| T_J | Junction Temperature | +150 | | °C |
| T_{STG} | Storage Temperature Range | -65 to +150 | | °C |
| ESD | ESD (Machine Model) | 350 | | V |
| ESD | ESD (Human Body Model) | 2000 | | V |
| θ_{JA} | Thermal Resistance (Note 6) | SOT-23-3 | 250 | °C/W |
| | | SOT-23-5 | 250 | |
| | | SOT-89 | 165 | |

- Notes:
- Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.
 - Absolute maximum ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside of its operating ratings. The maximum allowable power dissipation is a function of the maximum junction temperature, $T_{J(max)}$, the junction-to-ambient thermal resistance, θ_{JA} , and the ambient temperature, T_A . The maximum allowable power dissipation at any ambient temperature is calculated using: $P_{D(max)} = (T_{J(max)} - T_A) / \theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature.

Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|----------|-------------------------------------|-----|-----|------|
| V_{IN} | Input Voltage | 2.5 | 6.0 | V |
| T_A | Operating Ambient Temperature Range | -40 | +85 | °C |

Electrical Characteristics AP2138/2139-1.2 (@ $V_{IN} = 2.5V$, $V_{CE} = 2.5V$ (AP2139), $T_J = +25^{\circ}C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^{\circ}C \leq T_J \leq +85^{\circ}C$, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|-------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 1.176 | 1.200 | 1.224 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $2.2V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 100 | 300 | mV |
| | | $I_{OUT} = 30mA$ | – | 400 | 700 | |
| | | $I_{OUT} = 100mA$ | – | 700 | 1000 | |
| | | $I_{OUT} = 250mA$ | – | 1000 | 1300 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 140 | – | $\mu V/^{\circ}C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^{\circ}C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^{\circ}C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-1.4 (@ $V_{IN} = 2.5V$, $V_{CE} = 2.5V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 1.372 | 1.400 | 1.428 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $2.4V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 100 | 300 | mV |
| | | $I_{OUT} = 30mA$ | – | 400 | 700 | |
| | | $I_{OUT} = 100mA$ | – | 600 | 900 | |
| | | $I_{OUT} = 250mA$ | – | 1000 | 1300 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 140 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-1.5 (@ $V_{IN} = 2.5V$, $V_{CE} = 2.5V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 1.470 | 1.500 | 1.530 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $2.5V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 100 | 300 | mV |
| | | $I_{OUT} = 30mA$ | – | 200 | 400 | |
| | | $I_{OUT} = 100mA$ | – | 600 | 900 | |
| | | $I_{OUT} = 250mA$ | – | 1000 | 1300 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 150 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-1.8 (@ $V_{IN} = 2.8V$, $V_{CE} = 2.8V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 1.764 | 1.800 | 1.836 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $2.8V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 25 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 120 | 250 | |
| | | $I_{OUT} = 100mA$ | – | 400 | 700 | |
| | | $I_{OUT} = 250mA$ | – | 850 | 1100 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 180 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-2.1 (@ $V_{IN} = 3.1V$, $V_{CE} = 3.1V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 2.058 | 2.100 | 2.142 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $3.1V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 25 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 120 | 250 | |
| | | $I_{OUT} = 100mA$ | – | 400 | 700 | |
| | | $I_{OUT} = 250mA$ | – | 750 | 1100 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 180 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |

Electrical Characteristics AP2138/2139-2.2 (@ $V_{IN} = 3.2V$, $V_{CE} = 3.2V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 2.156 | 2.2 | 2.244 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $3.2V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 25 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 120 | 250 | |
| | | $I_{OUT} = 100mA$ | – | 400 | 700 | |
| | | $I_{OUT} = 250mA$ | – | 700 | 1050 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 180 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |

Electrical Characteristics AP2138/2139-2.5 (@ $V_{IN} = 3.5V$, $V_{CE} = 3.5V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 2.450 | 2.500 | 2.550 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $3.5V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 25 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 100 | 250 | |
| | | $I_{OUT} = 100mA$ | – | 250 | 500 | |
| | | $I_{OUT} = 250mA$ | – | 650 | 1000 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 250 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-2.8 (@ $V_{IN} = 3.8V$, $V_{CE} = 3.8V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 2.744 | 2.800 | 2.856 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $3.8V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 25 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 70 | 200 | |
| | | $I_{OUT} = 100mA$ | – | 250 | 500 | |
| | | $I_{OUT} = 250mA$ | – | 500 | 800 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 280 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-3.0 (@ $V_{IN} = 4V$, $V_{CE} = 4V$ (AP2139), $T_J = +25^{\circ}C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^{\circ}C \leq T_J \leq +85^{\circ}C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|-------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 2.940 | 3.000 | 3.060 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $4V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 25 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 70 | 200 | |
| | | $I_{OUT} = 100mA$ | – | 200 | 400 | |
| | | $I_{OUT} = 250mA$ | – | 450 | 700 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 300 | – | $\mu V/^{\circ}C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^{\circ}C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^{\circ}C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-3.3 (@ $V_{IN} = 4.3V$, $V_{CE} = 4.3V$ (AP2139), $T_J = +25^\circ C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^\circ C \leq T_J \leq +85^\circ C$, unless otherwise specified. Cont.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 3.234 | 3.300 | 3.366 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{STD} | Standby Current (AP2139) | $V_{CE} = 0$ | – | 0.1 | 1 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $4.3V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 20 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 50 | 200 | |
| | | $I_{OUT} = 100mA$ | – | 160 | 300 | |
| | | $I_{OUT} = 250mA$ | – | 400 | 600 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 330 | – | $\mu V/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^\circ C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| I_{PD} | CE Pull-down Constant Current (AP2139) | – | – | 0.2 | – | μA |
| V_{IH} | CE Input Logic-high Voltage (AP2139) | – | 1.2 | – | – | V |
| V_{IL} | CE Input Logic-low Voltage (AP2139) | – | – | – | 0.3 | V |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^\circ C/W$ |
| | | SOT-23-5 | – | 81.9 | – | |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-3.6 (@ $V_{IN} = 4.6V$, $T_J = +25^{\circ}C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^{\circ}C \leq T_J \leq +85^{\circ}C$, unless otherwise specified. Cont.)

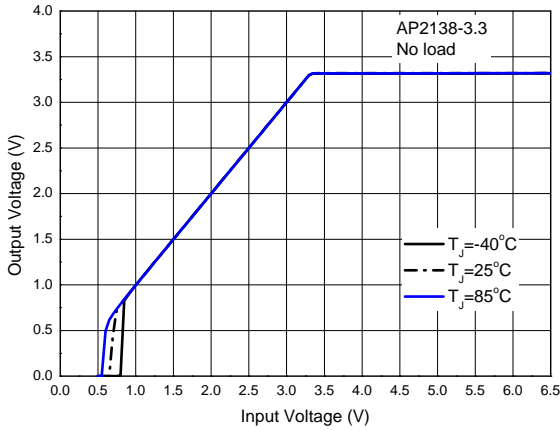
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|-------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 3.528 | 3.600 | 3.672 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $4.6V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 20 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 50 | 200 | |
| | | $I_{OUT} = 100mA$ | – | 160 | 300 | |
| | | $I_{OUT} = 250mA$ | – | 400 | 600 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 330 | – | $\mu V/^{\circ}C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^{\circ}C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^{\circ}C/W$ |
| | | SOT-89 | – | 51.1 | – | |

Electrical Characteristics AP2138/2139-4.0 (@ $V_{IN} = 5.0V$, $T_J = +25^{\circ}C$, $I_{OUT} = 40mA$, $C_{IN} = C_{OUT} = 1\mu F$, **Bold** typeface applies $-40^{\circ}C \leq T_J \leq +85^{\circ}C$, unless otherwise specified. Cont.)

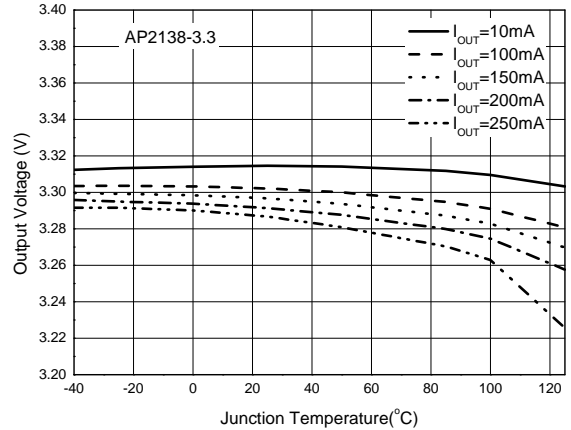
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|-------------------------------|-------|-----------------------------|-------|-------------------|
| V_{IN} | Input Voltage | – | – | – | 6.0 | V |
| V_{OUT} | Output Voltage | – | 3.920 | 4.000 | 4.080 | V |
| I_Q | Quiescent Current | $I_{OUT} = 0$ | – | 1.0 | 1.5 | μA |
| I_{OUT} | Output Current | – | 250 | – | – | mA |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | – | 25 | 40 | mV |
| V_{RLINE} | Line Regulation | $5V \leq V_{IN} \leq 6V$ | – | 6 | 18 | mV |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 10mA$ | – | 20 | 100 | mV |
| | | $I_{OUT} = 30mA$ | – | 50 | 200 | |
| | | $I_{OUT} = 100mA$ | – | 160 | 300 | |
| | | $I_{OUT} = 250mA$ | – | 400 | 600 | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | – | – | ± 330 | – | $\mu V/^{\circ}C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | – | – | ± 100 | – | ppm/ $^{\circ}C$ |
| I_{SHORT} | Short Circuit Current | $V_{OUT} = 0$ | – | 50 | – | mA |
| θ_{JC} | Thermal Resistance | SOT-23-3 | – | 81.9 | – | $^{\circ}C/W$ |

Performance Characteristics

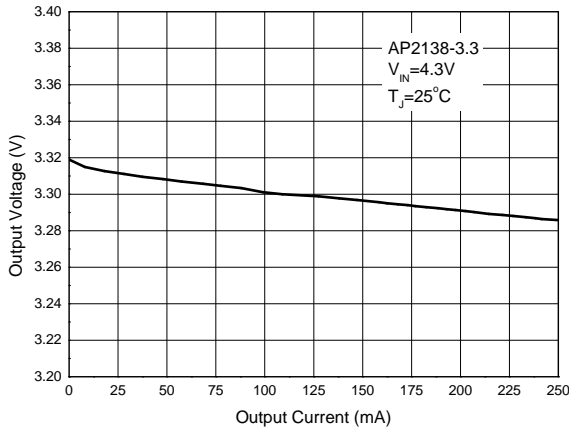
Output Voltage vs. Input Voltage



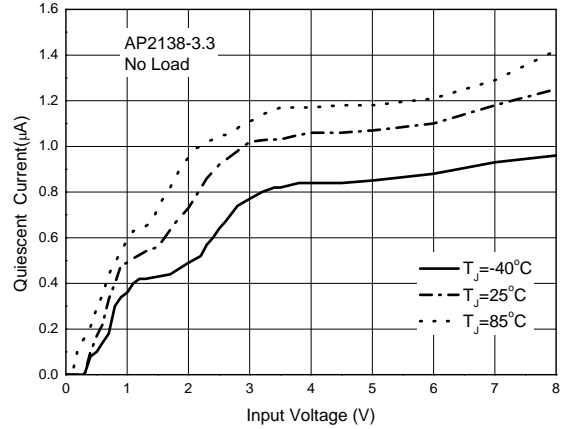
Output Voltage vs. Junction Temperature



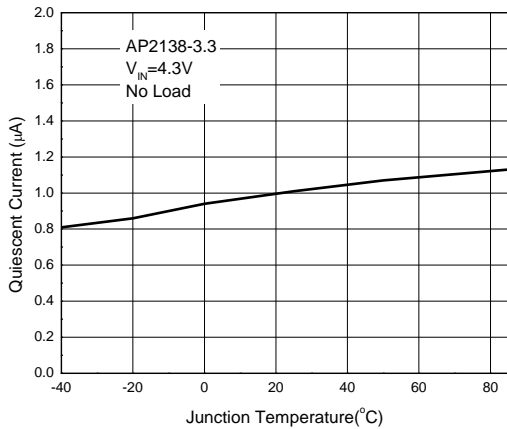
Output Voltage vs. Output Current



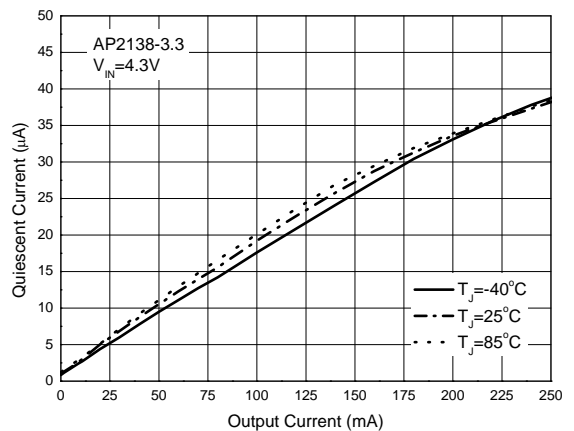
Quiescent Current vs. Input Voltage



Quiescent Current vs. Junction Temperature

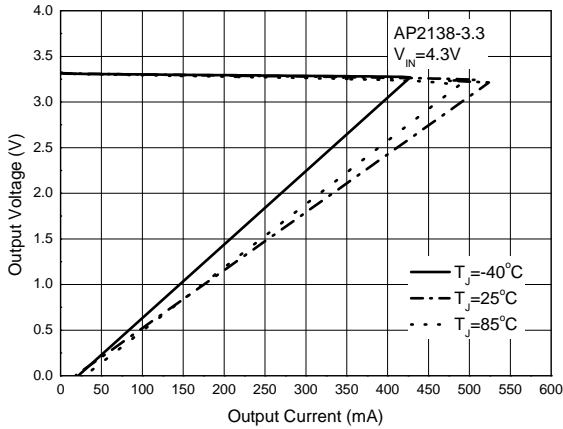


Quiescent Current vs. Output Current

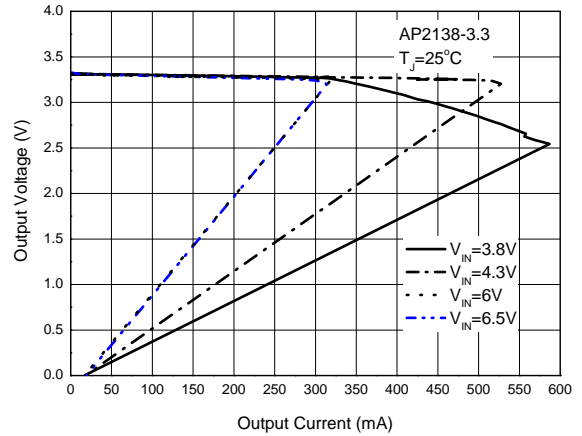


Performance Characteristics (Cont.)

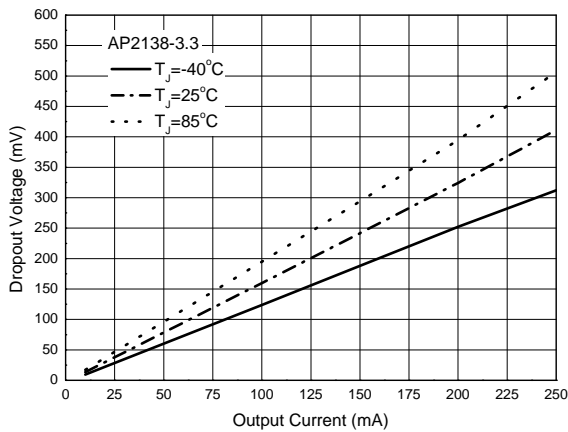
Output Voltage vs. Output Current



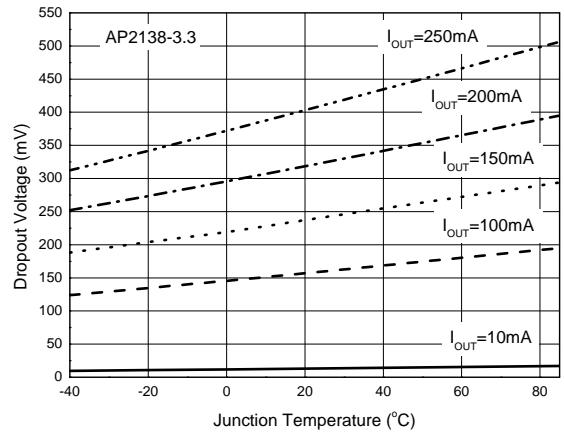
Output Voltage vs. Output Current



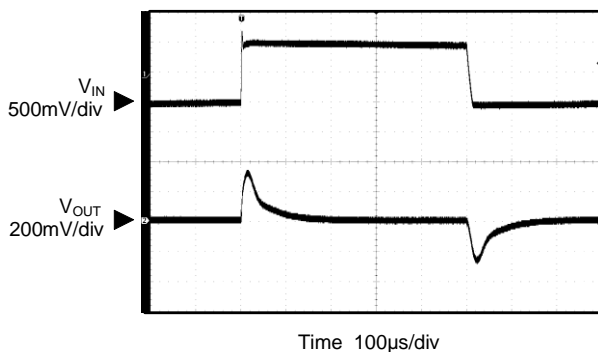
Dropout Voltage vs. Output Current



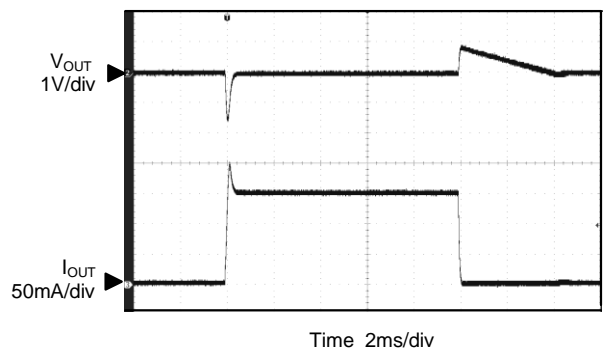
Dropout Voltage vs. Junction Temperature



Line Transient ($V_{IN}=4.3V$ to $5.3V$, $I_{OUT}=10mA$)

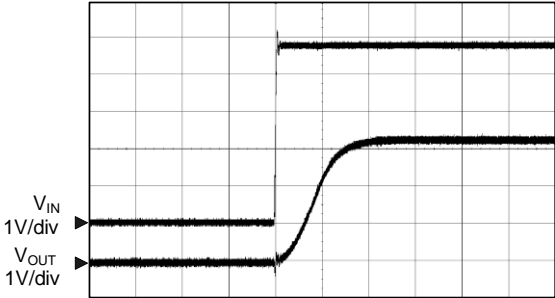


Load Transient ($V_{IN}=4.3V$, $I_{OUT}=1mA$ to $150mA$)



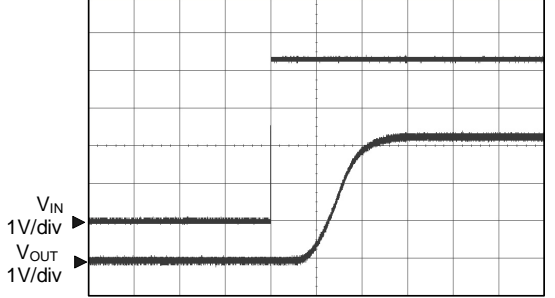
Performance Characteristics (Cont.)

Start-up Response



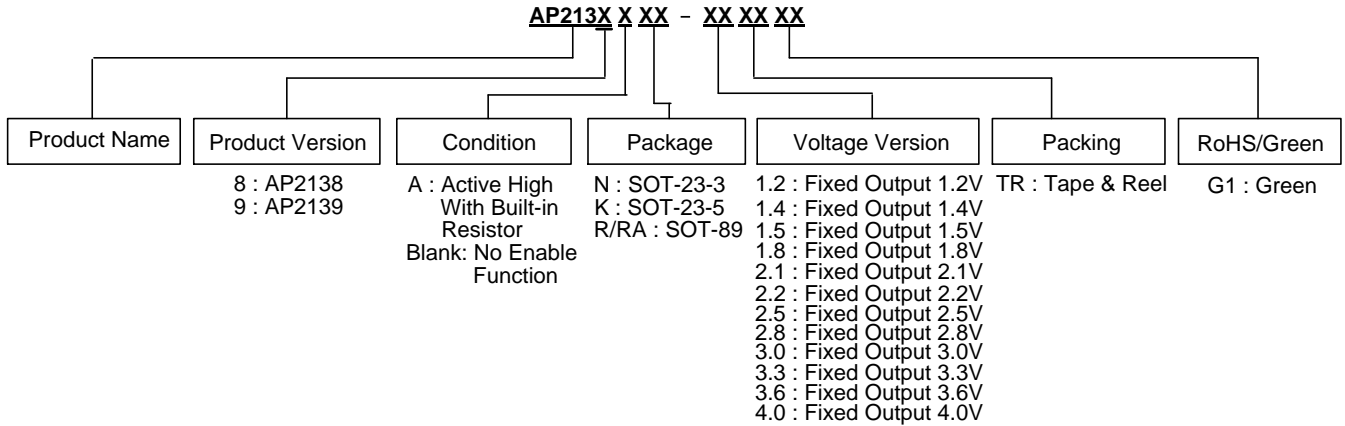
Time 200 μ s/div

Enable Input Response



Time 200 μ s/div

Ordering Information



| Package | Temperature Range | Condition | Part Number | Marking ID | Packing |
|----------|-------------------|-------------------------|-----------------|------------|------------------|
| SOT-23-3 | -40 to +85°C | 1.2V | AP2138N-1.2TRG1 | GA3 | 3000/Tape & Reel |
| | | 1.4V | AP2138N-1.4TRG1 | GG1 | 3000/Tape & Reel |
| | | 1.5V | AP2138N-1.5TRG1 | GG2 | 3000/Tape & Reel |
| | | 1.8V | AP2138N-1.8TRG1 | GG4 | 3000/Tape & Reel |
| | | 2.1V | AP2138N-2.1TRG1 | GGB | 3000/Tape & Reel |
| | | 2.2V | AP2138N-2.2TRG1 | GGC | 3000/Tape & Reel |
| | | 2.5V | AP2138N-2.5TRG1 | GG5 | 3000/Tape & Reel |
| | | 2.8V | AP2138N-2.8TRG1 | GG6 | 3000/Tape & Reel |
| | | 3.0V | AP2138N-3.0TRG1 | GG3 | 3000/Tape & Reel |
| | | 3.3V | AP2138N-3.3TRG1 | GG7 | 3000/Tape & Reel |
| | | 3.6V | AP2138N-3.6TRG1 | GG8 | 3000/Tape & Reel |
| | | 4.0V (NRND)(Note 7) | AP2138N-4.0TRG1 | GE9 | 3000/Tape & Reel |
| SOT-89 | -40 to +85°C | 1.2V (R) (NRND)(Note 7) | AP2138R-1.2TRG1 | G42C | 1000/Tape & Reel |
| | | 1.4V (R) (NRND)(Note 7) | AP2138R-1.4TRG1 | G42D | 1000/Tape & Reel |
| | | 1.5V (R) (NRND)(Note 7) | AP2138R-1.5TRG1 | G42E | 1000/Tape & Reel |
| | | 1.8V (R) (NRND)(Note 7) | AP2138R-1.8TRG1 | G42F | 1000/Tape & Reel |
| | | 2.5V (R) (NRND)(Note 7) | AP2138R-2.5TRG1 | G42G | 1000/Tape & Reel |
| | | 2.8V (R) (NRND)(Note 7) | AP2138R-2.8TRG1 | G42H | 1000/Tape & Reel |
| | | 3.0V (R) (NRND)(Note 7) | AP2138R-3.0TRG1 | G42J | 1000/Tape & Reel |
| | | 3.3V (R) (NRND)(Note 7) | AP2138R-3.3TRG1 | G42K | 1000/Tape & Reel |
| | | 3.6V (R) (NRND)(Note 7) | AP2138R-3.6TRG1 | G42M | 1000/Tape & Reel |

Ordering Information (Cont.)

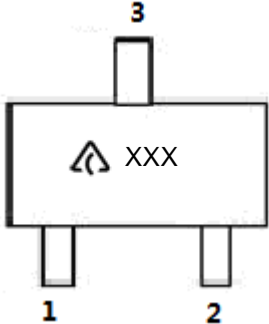
| Package | Temperature Range | Condition | Part Number | Marking ID | Packing |
|----------|-------------------|------------------------------------|------------------|------------|------------------|
| SOT-89 | -40 to +85°C | 1.2V (RA) (NRND)(Note 7) | AP2138RA-1.2TRG1 | G13L | 1000/Tape & Reel |
| | | 1.4V (RA) (NRND)(Note 7) | AP2138RA-1.4TRG1 | G13M | 1000/Tape & Reel |
| | | 1.5V (RA) (NRND)(Note 7) | AP2138RA-1.5TRG1 | G13N | 1000/Tape & Reel |
| | | 1.8V (RA) (NRND)(Note 7) | AP2138RA-1.8TRG1 | G13O | 1000/Tape & Reel |
| | | 2.5V (RA) (NRND)(Note 7) | AP2138RA-2.5TRG1 | G13P | 1000/Tape & Reel |
| | | 2.8V (RA) (NRND)(Note 7) | AP2138RA-2.8TRG1 | G33J | 1000/Tape & Reel |
| | | 3.0V (RA) (NRND)(Note 7) | AP2138RA-3.0TRG1 | G37J | 1000/Tape & Reel |
| | | 3.3V (RA) | AP2138RA-3.3TRG1 | G41J | 1000/Tape & Reel |
| SOT-23-5 | -40 to +85°C | Active High with Built-in Resistor | AP2139AK-1.2TRG1 | G7R | 3000/Tape & Reel |
| | | Active High with Built-in Resistor | AP2139AK-1.4TRG1 | G6L | 3000/Tape & Reel |
| | | Active High with Built-in Resistor | AP2139AK-1.5TRG1 | G6M | 3000/Tape & Reel |
| | | Active High with Built-in Resistor | AP2139AK-1.8TRG1 | G6N | 3000/Tape & Reel |
| | | Active High with Built-in Resistor | AP2139AK-2.5TRG1 | G6P | 3000/Tape & Reel |
| | | Active High with Built-in Resistor | AP2139AK-2.8TRG1 | G6Q | 3000/Tape & Reel |
| | | Active High with Built-in Resistor | AP2139AK-3.0TRG1 | G6J | 3000/Tape & Reel |
| | | Active High with Built-in Resistor | AP2139AK-3.3TRG1 | G6R | 3000/Tape & Reel |

Note 7: NRND: Not Recommended for New Design.

Marking Information

(1) SOT-23-3

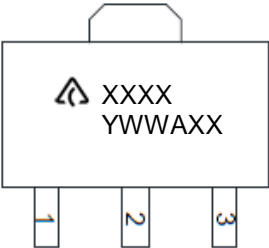
(Top View)



△ : Logo
XXX: Marking ID (See Ordering Information)

(2) SOT-89

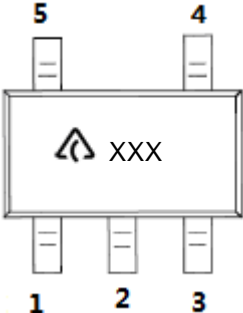
(Top View)



First Line: Logo and Marking ID
(See Ordering Information)
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: 7th and 8th Digits of Batch Number

(3) SOT-23-5

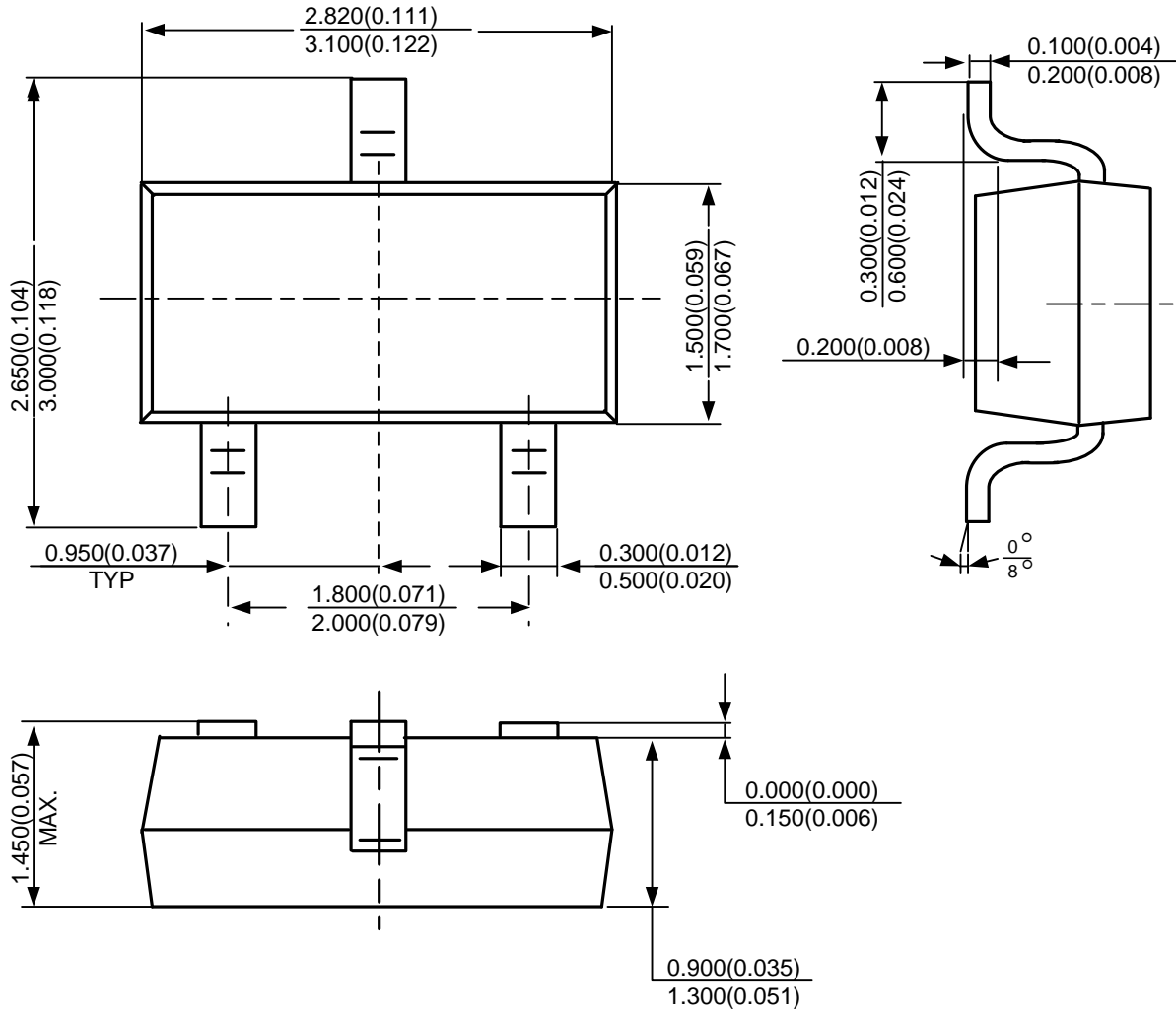
(Top View)



△ : Logo
XXX: Marking ID (See Ordering Information)

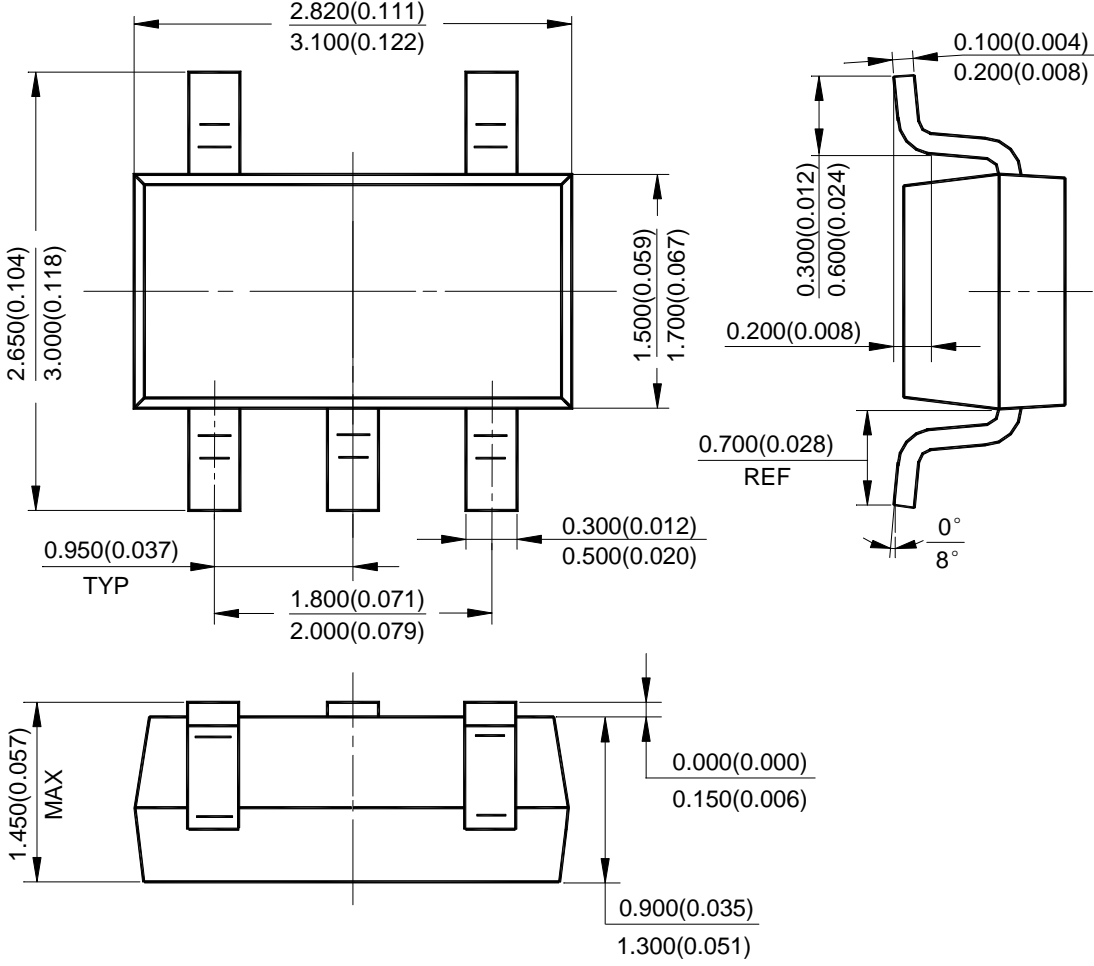
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT-23-3



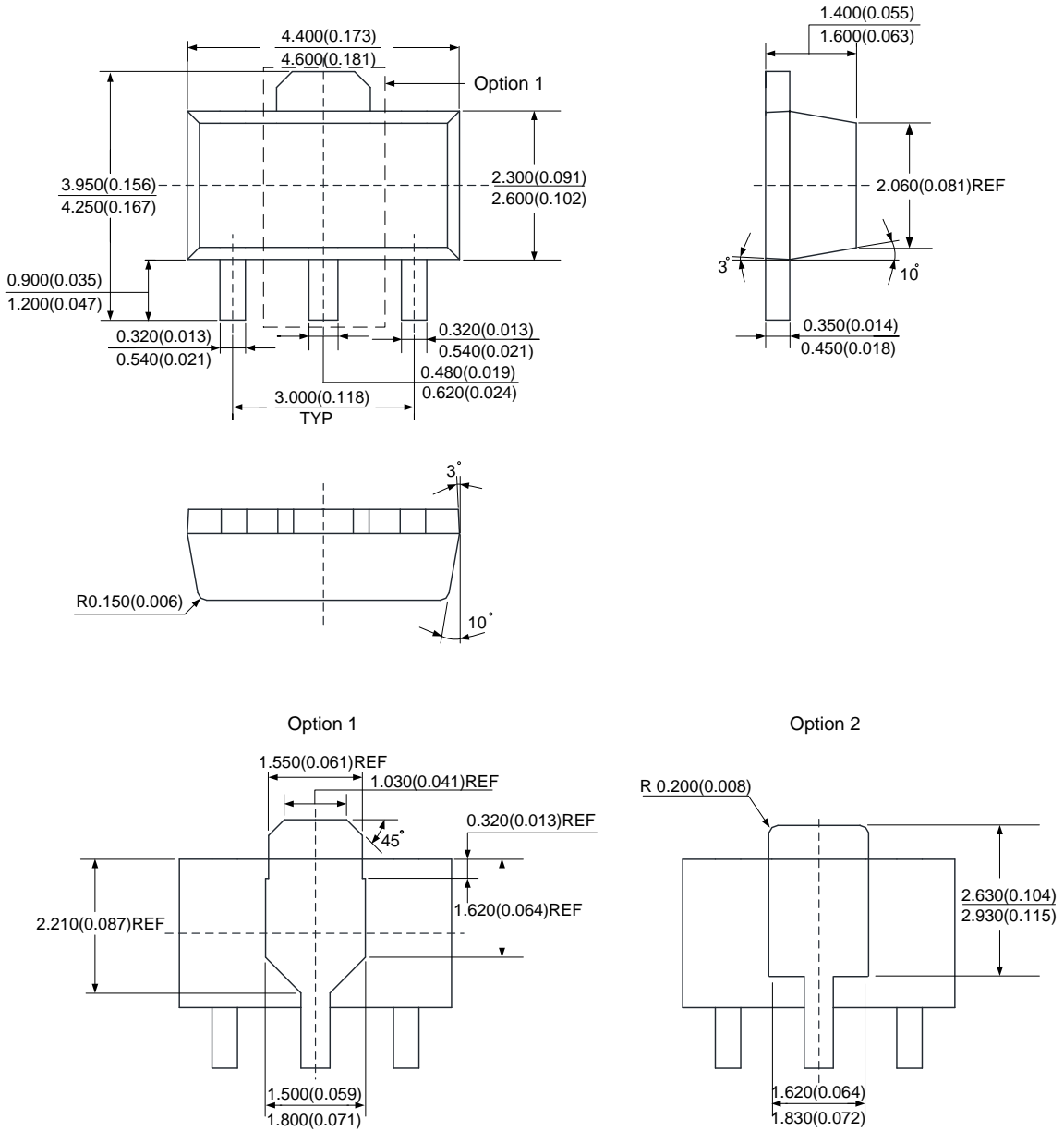
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

(2) Package Type: SOT-23-5



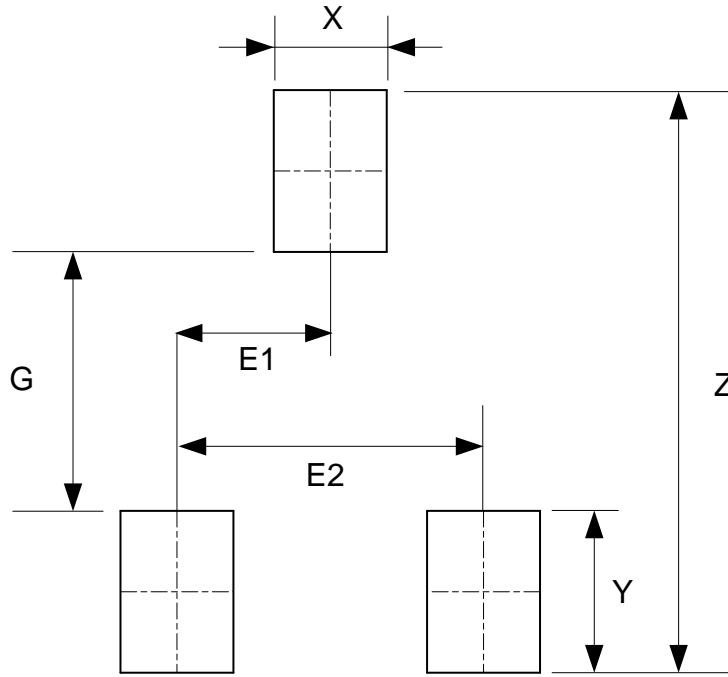
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

(3) Package Type: SOT-89



Suggested Pad Layout

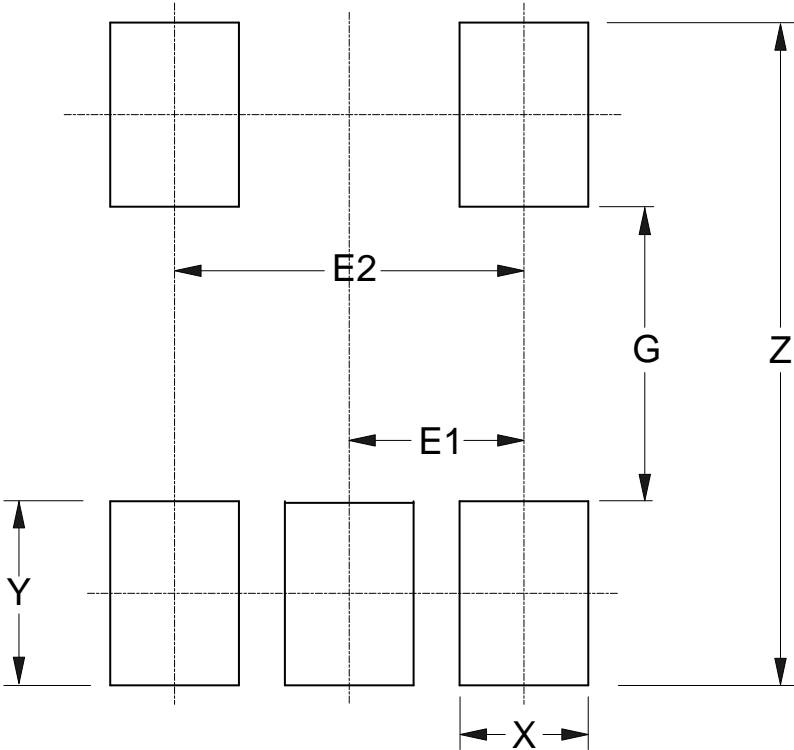
(1) Package Type: SOT-23-3



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E1 (mm)/(inch) | E2 (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Value | 3.600/0.142 | 1.600/0.063 | 0.700/0.028 | 1.000/0.039 | 0.950/0.037 | 1.900/0.075 |

Suggested Pad Layout (Cont.)

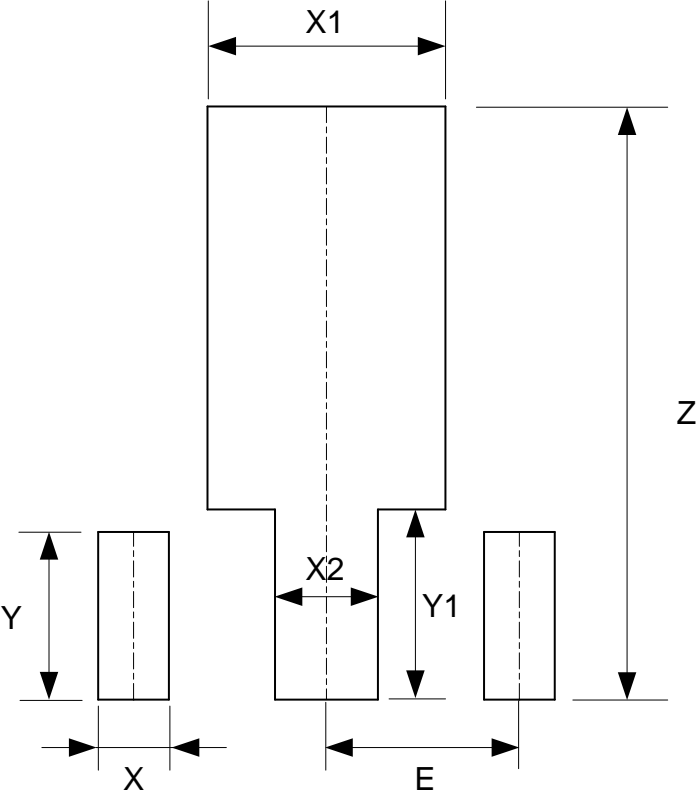
(2) Package Type: SOT-23-5



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E1 (mm)/(inch) | E2 (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Value | 3.600/0.142 | 1.600/0.063 | 0.700/0.028 | 1.000/0.039 | 0.950/0.037 | 1.900/0.075 |

Suggested Pad Layout (Cont.)

(3) Package Type: SOT-89



| Dimensions | Z (mm)/(inch) | X (mm)/(inch) | X1 (mm)/(inch) | X2 (mm)/(inch) | Y (mm)/(inch) | Y1 (mm)/(inch) | E (mm)/(inch) |
|------------|------------------|------------------|-------------------|-------------------|------------------|-------------------|------------------|
| Value | 4.600/0.181 | 0.550/0.022 | 1.850/0.073 | 0.800/0.031 | 1.300/0.051 | 1.475/0.058 | 1.500/0.059 |

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

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