

## 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

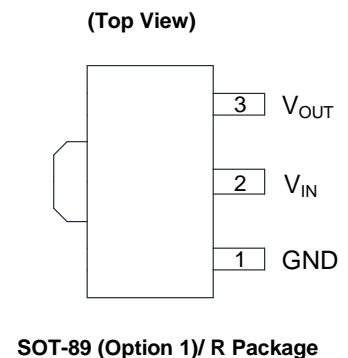
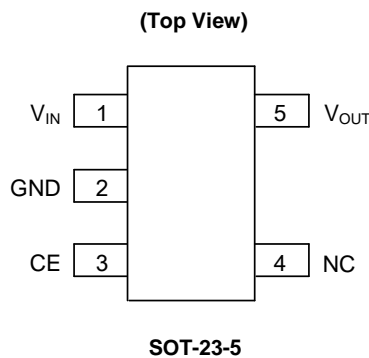
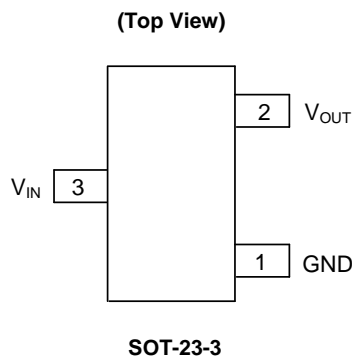
- Ultra-low Quiescent Current: 1.0 $\mu$ A Typical
- Output Voltages: 1.2V, 1.4V, 1.5V, 1.8V, 2.1V, 2.2V, 2.5V, 2.8V, 3.0V, 3.3V, 3.6V and 4.0V
- High Output Voltage Accuracy:  $\pm 2\%$
- Output Current: 250mA
- Low Dropout Voltage:
  - 25mV Typical at  $I_{OUT} = 10\text{mA}$  and  $V_{OUT} = 3\text{V}$
  - 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 $\mu$ 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

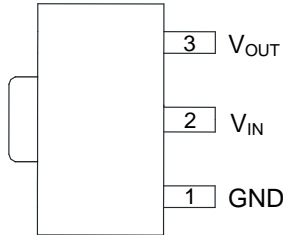
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "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



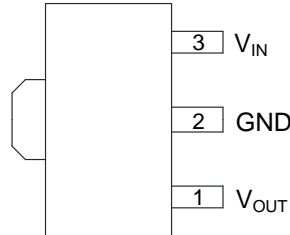
**Pin Assignments** (Cont.)

(Top View)



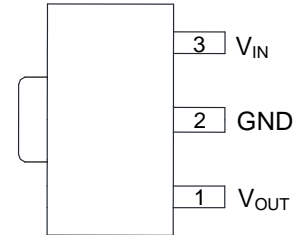
SOT-89 (Option 2)/ R Package

(Top View)



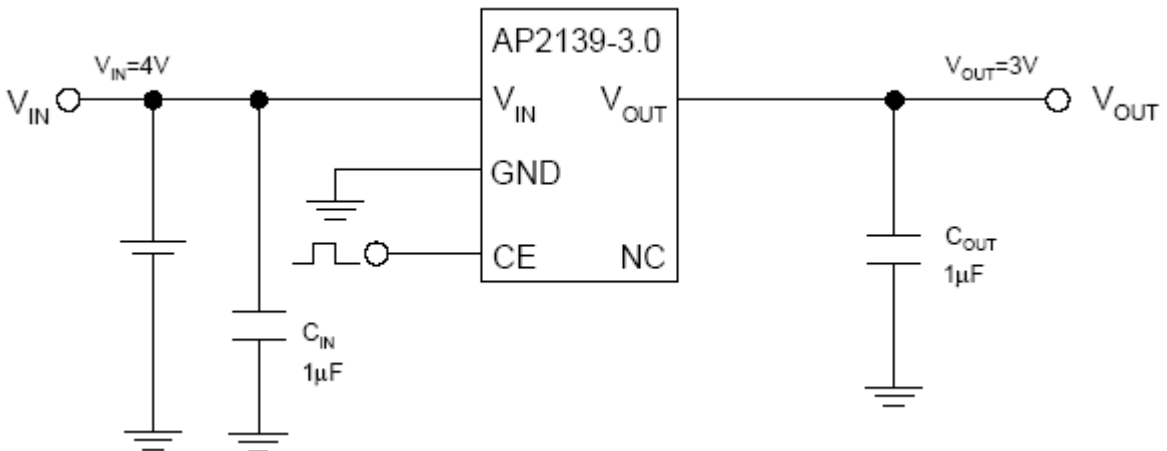
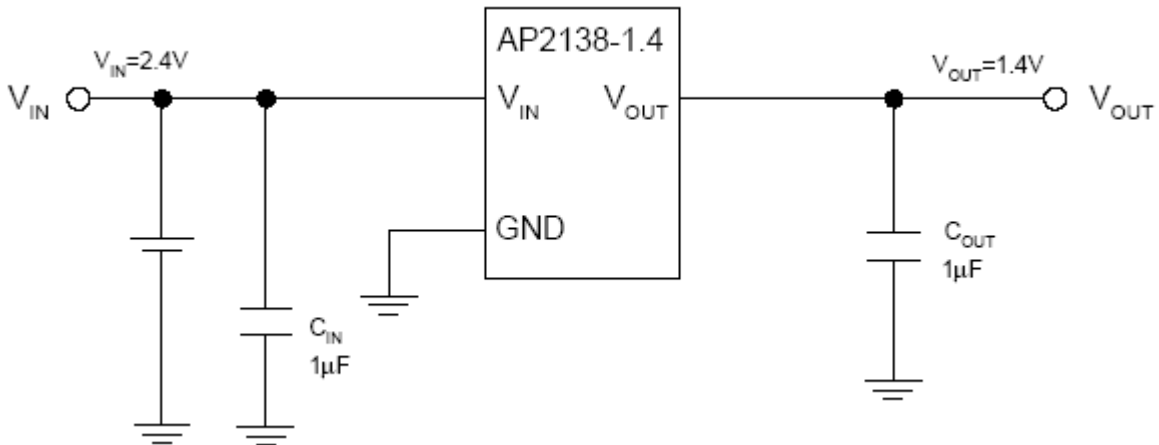
SOT-89 (Option 1)/ RA Package

(Top View)



SOT-89 (Option 2)/ RA Package

**Typical Applications Circuit** (Note 4)

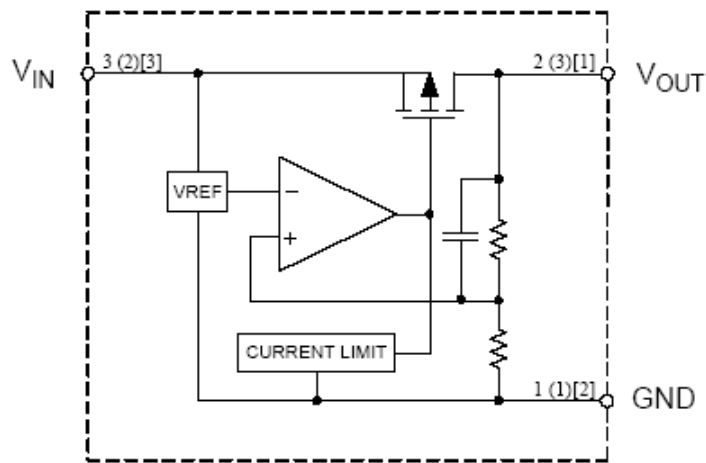


Note 4: Filter capacitors are required at the AP2138/2139's input and output. 1µF capacitor is required at the input. The minimum output capacitance required for stability should be more than 1µF with ESR from 0.01Ω to 100Ω. Ceramic capacitors are recommended.

**Pin Description**

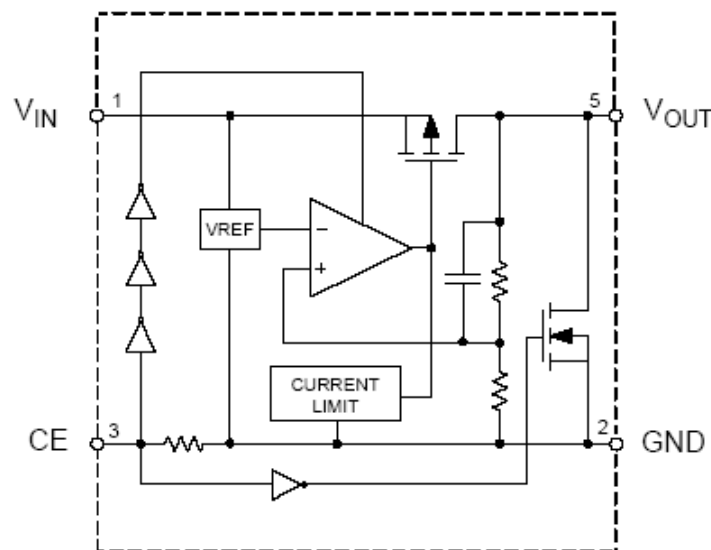
Pin Number				Pin Name	Function
SOT-23-3	SOT-89(R)	SOT-89 (RA)	SOT-23-5		
1	1	2	2	GND	Ground
2	3	1	5	V <sub>OUT</sub>	Regulated output voltage
3	2	3	1	V <sub>IN</sub>	Input voltage
-	-	-	3	CE	Active high enable input. Logic high=enable, logic low=shutdown
-	-	-	4	NC	No connection

**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
$\theta_{JA}$	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,  $\theta_{JA}$ , 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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 140</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 140</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 150</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 180</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 180</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 180</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 250</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 280</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 300</math></b>	–	$\mu V/^{\circ}C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^{\circ}C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{STD}$	Standby Current (AP2139)	$V_{CE} = 0$	–	0.1	1	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 330</math></b>	–	$\mu V/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^\circ C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$I_{PD}$	CE Pull-down Constant Current (AP2139)	–	–	0.2	–	$\mu A$
$V_{IH}$	CE Input Logic-high Voltage (AP2139)	–	1.2	–	–	V
$V_{IL}$	CE Input Logic-low Voltage (AP2139)	–	–	–	0.3	V
$\theta_{JC}$	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	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 330</math></b>	–	$\mu V/^{\circ}C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^{\circ}C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$\theta_{JC}$	Thermal Resistance	SOT-23-3	–	81.9	–	$^{\circ}C/W$
		SOT-89	–	51.1	–	

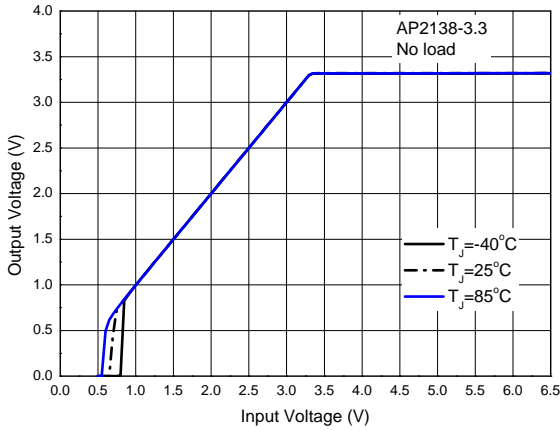
**Electrical Characteristics AP2138/2139-4.0** (@ $V_{IN} = 5.0V$ ,  $T_J = +25^{\circ}C$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = C_{OUT} = 1\mu F$ , **Bold** typeface applies  $-40^{\circ}C \leq T_J \leq +85^{\circ}C$ , unless otherwise specified. Cont.)

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	$\mu A$
$I_{OUT}$	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	–	–	<b><math>\pm 330</math></b>	–	$\mu V/^{\circ}C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$		–	–	<b><math>\pm 100</math></b>	–	ppm/ $^{\circ}C$
$I_{SHORT}$	Short Circuit Current	$V_{OUT} = 0$	–	50	–	mA
$\theta_{JC}$	Thermal Resistance	SOT-23-3	–	81.9	–	$^{\circ}C/W$

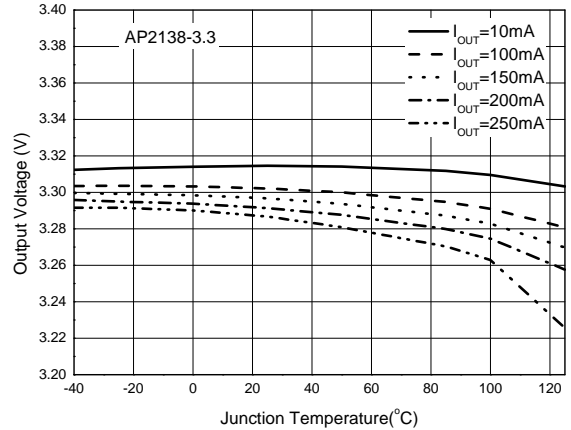


**Performance Characteristics**

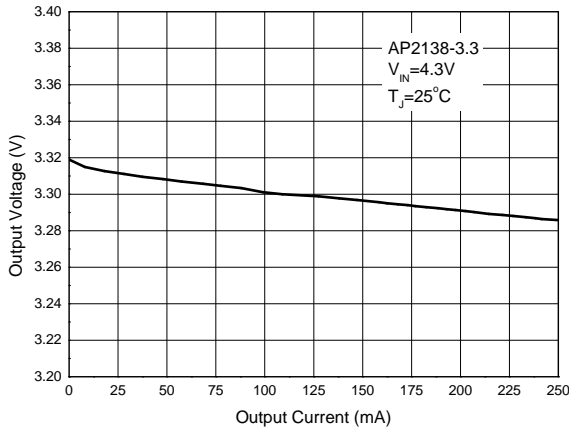
**Output Voltage vs. Input Voltage**



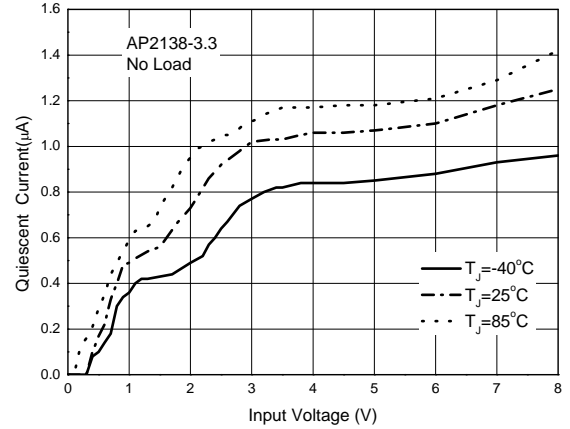
**Output Voltage vs. Junction Temperature**



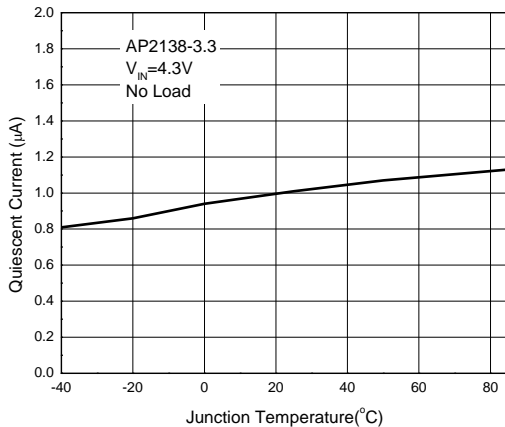
**Output Voltage vs. Output Current**



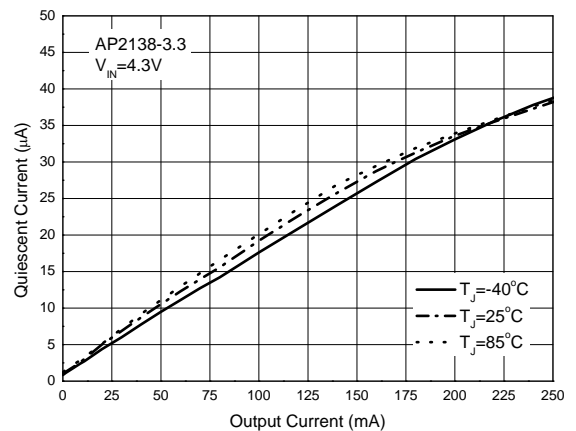
**Quiescent Current vs. Input Voltage**



**Quiescent Current vs. Junction Temperature**

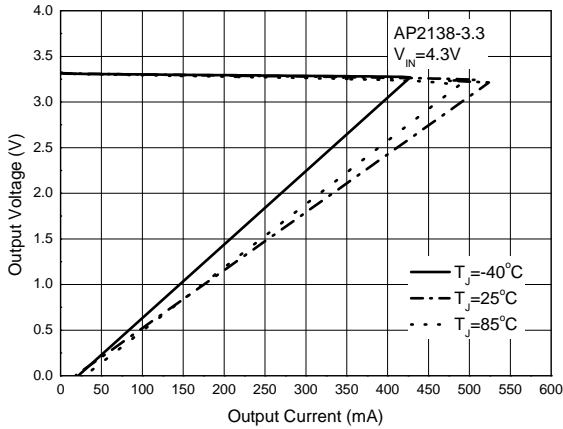


**Quiescent Current vs. Output Current**

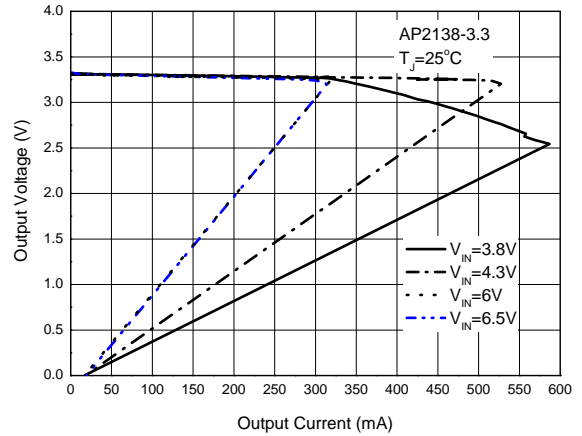


**Performance Characteristics (Cont.)**

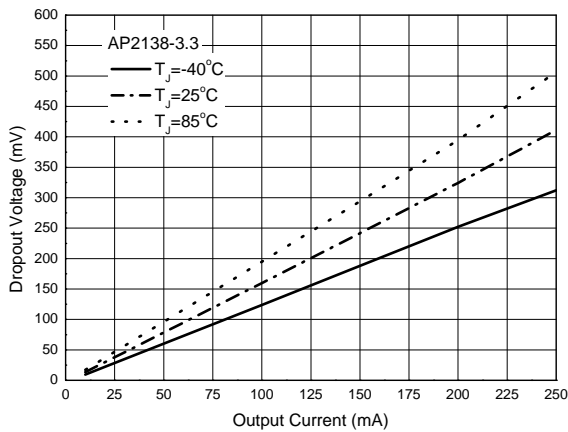
**Output Voltage vs. Output Current**



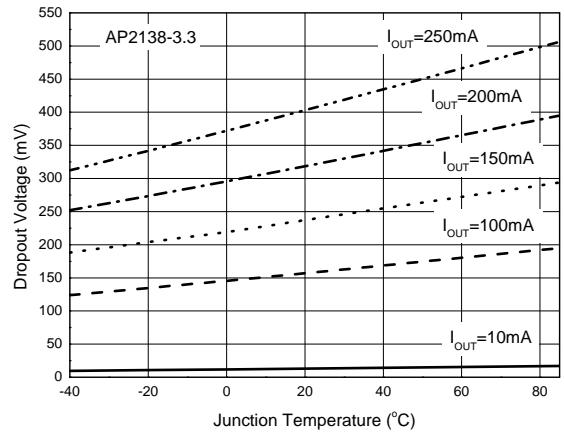
**Output Voltage vs. Output Current**



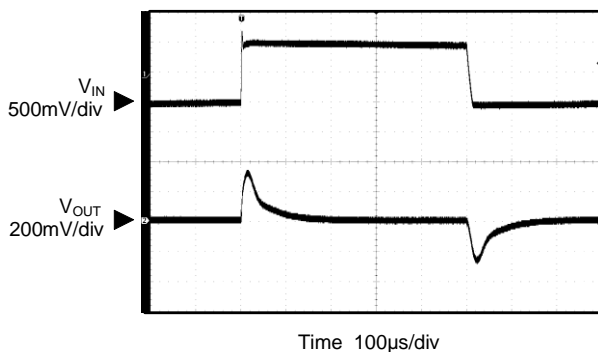
**Dropout Voltage vs. Output Current**



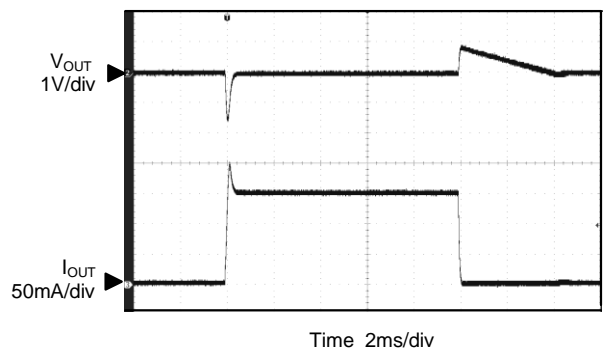
**Dropout Voltage vs. Junction Temperature**



**Line Transient (VIN=4.3V to 5.3V, IOUT=10mA)**

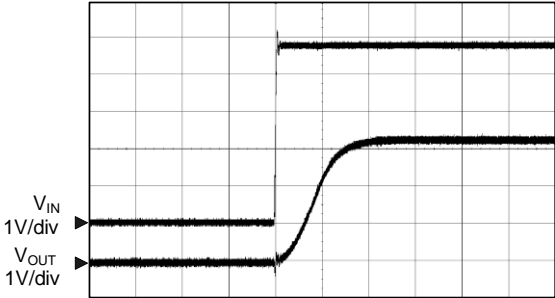


**Load Transient (VIN=4.3V, IOUT=1mA to 150mA)**



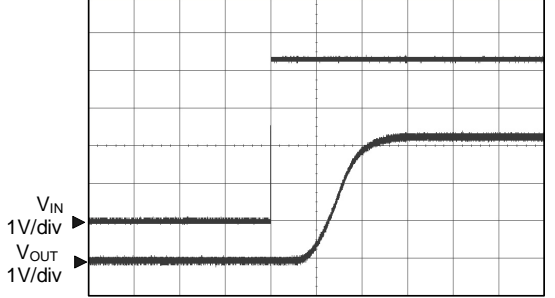
**Performance Characteristics (Cont.)**

**Start-up Response**



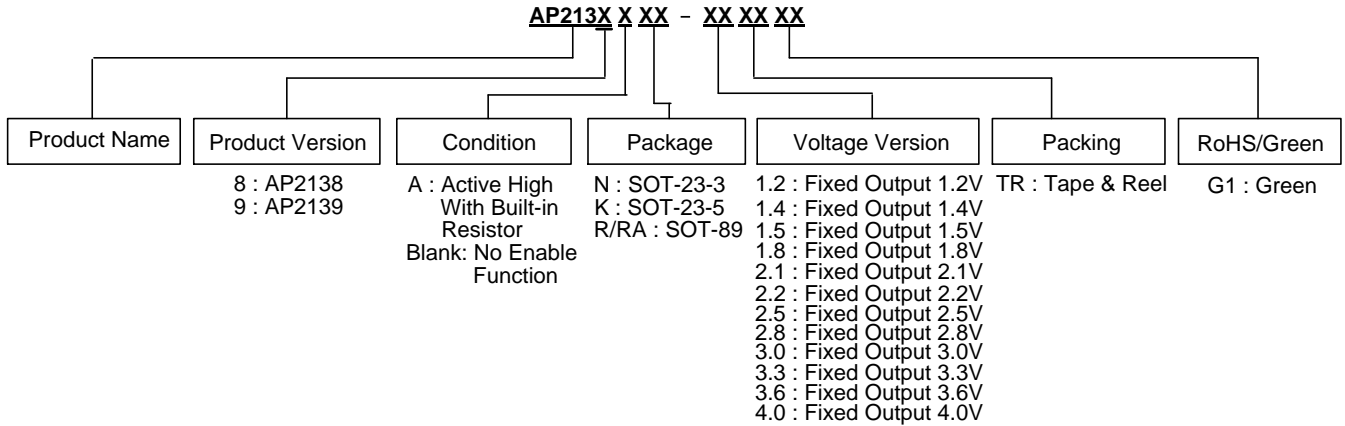
Time 200 $\mu$ s/div

**Enable Input Response**



Time 200 $\mu$ 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
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.)

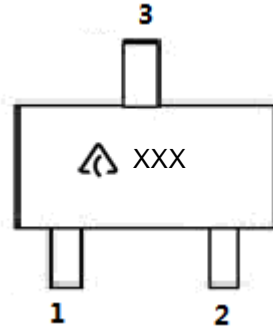
Package	Temperature Range	Condition	Part Number	Marking ID	Packing
SOT-89	-40 to +85°C	1.2V (RA) (NRND)(Note 7)	AP2138RA-1.2TRG1	G13L	1000/Tape & Reel
		1.4V (RA) (NRND)(Note 7)	AP2138RA-1.4TRG1	G13M	1000/Tape & Reel
		1.5V (RA) (NRND)(Note 7)	AP2138RA-1.5TRG1	G13N	1000/Tape & Reel
		1.8V (RA) (NRND)(Note 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

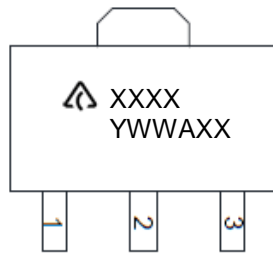
(Top View)



 : Logo  
XXX: Marking ID (See Ordering Information)

(2) SOT-89

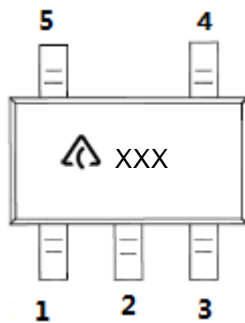
(Top View)




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: 7<sup>th</sup> and 8<sup>th</sup> Digits of Batch Number

(3) SOT-23-5

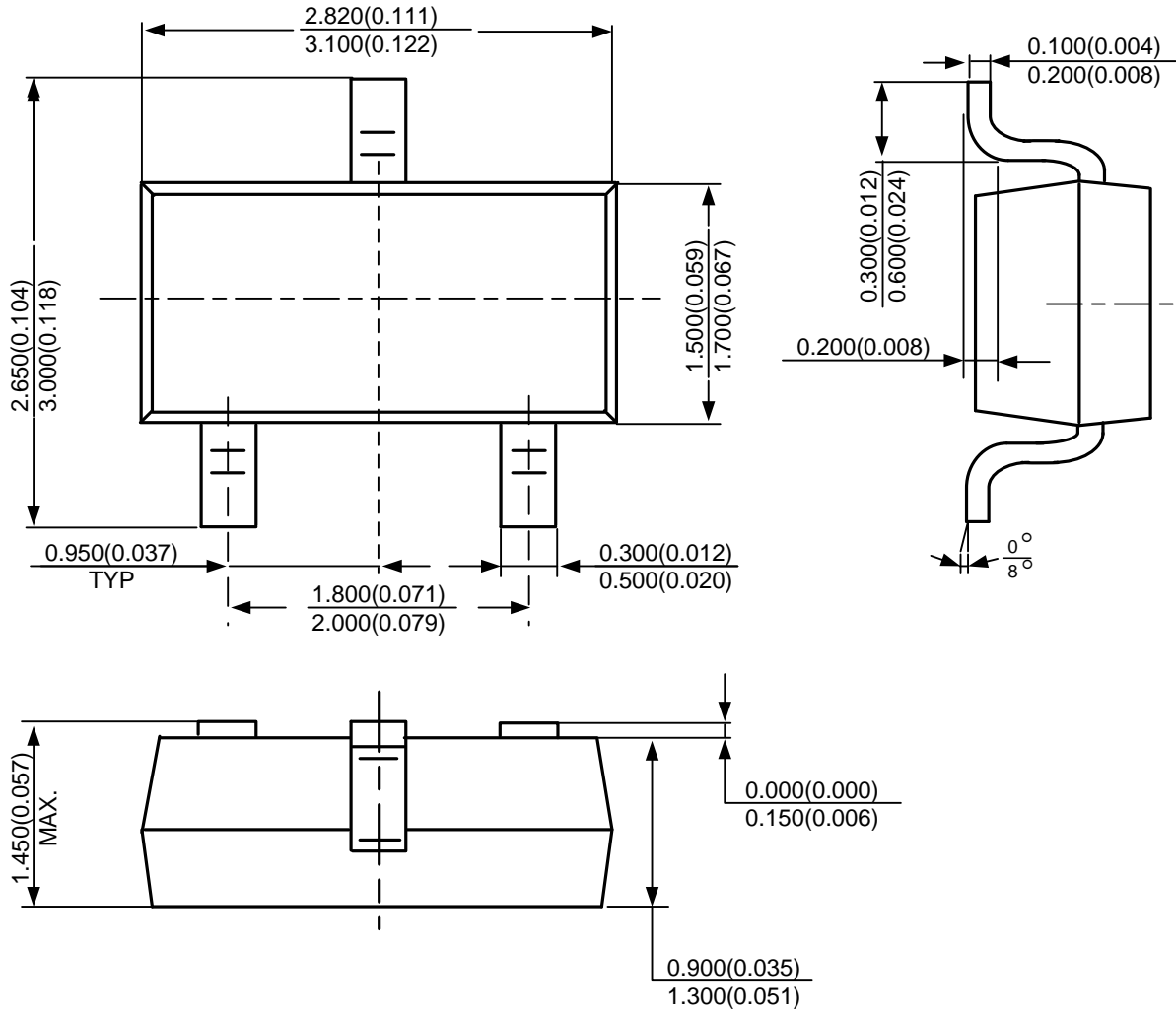
(Top View)



 : Logo  
XXX: Marking ID (See Ordering Information)

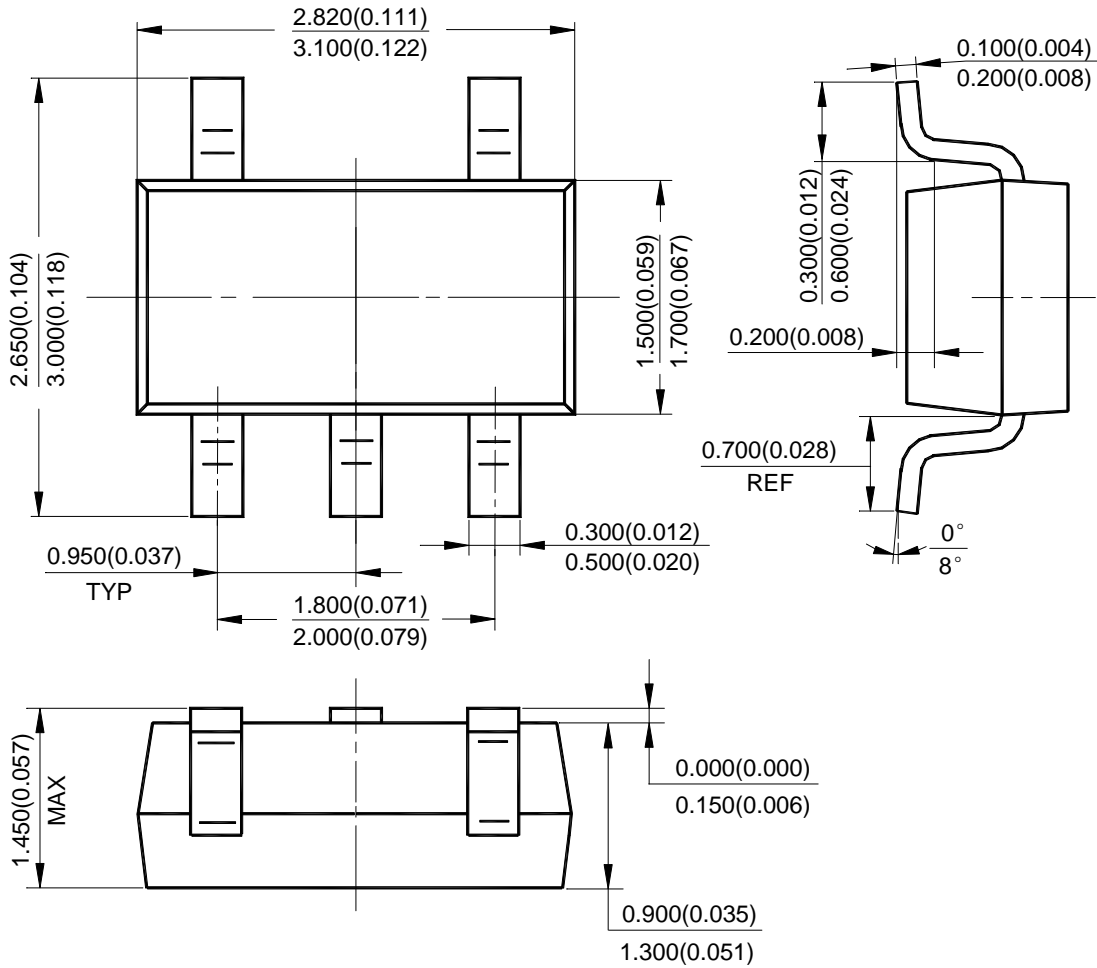
**Package Outline Dimensions** (All dimensions in mm(inch).)

(1) Package Type: SOT-23-3



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

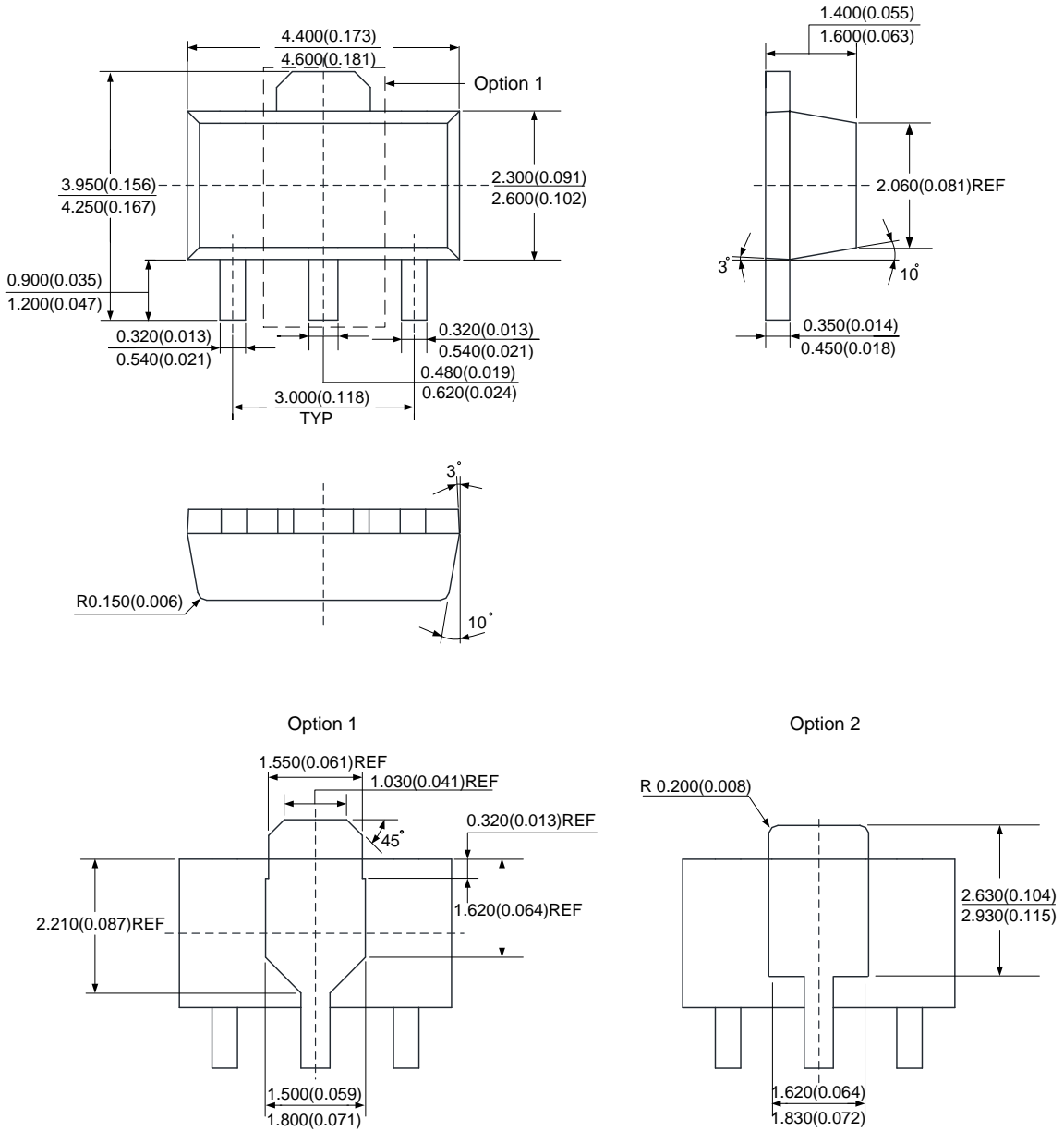
(2) Package Type: SOT-23-5





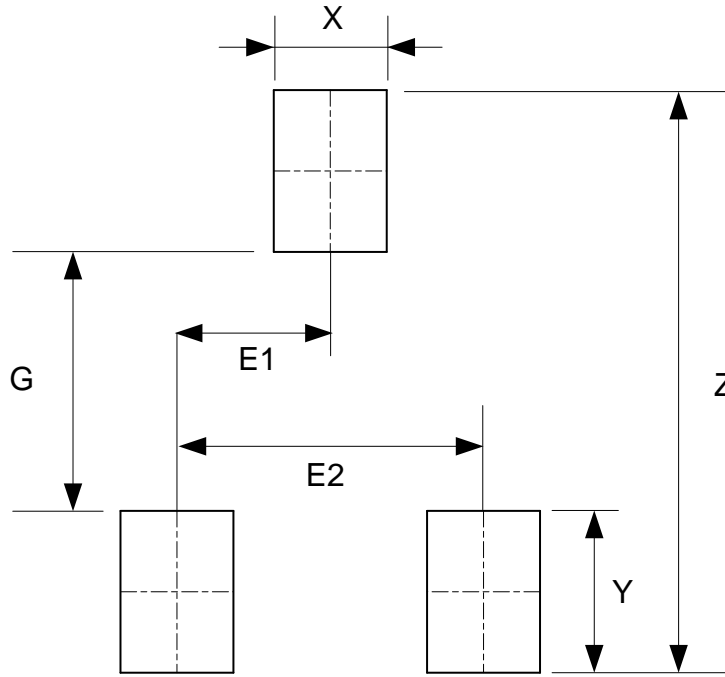
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(3) Package Type: SOT-89



**Suggested Pad Layout**

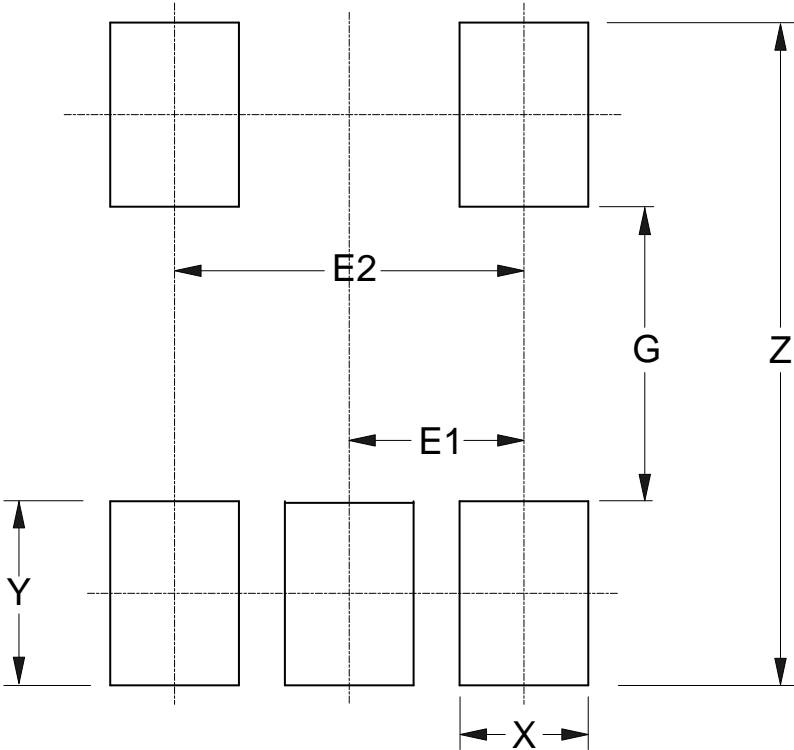
(1) Package Type: SOT-23-3



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.)

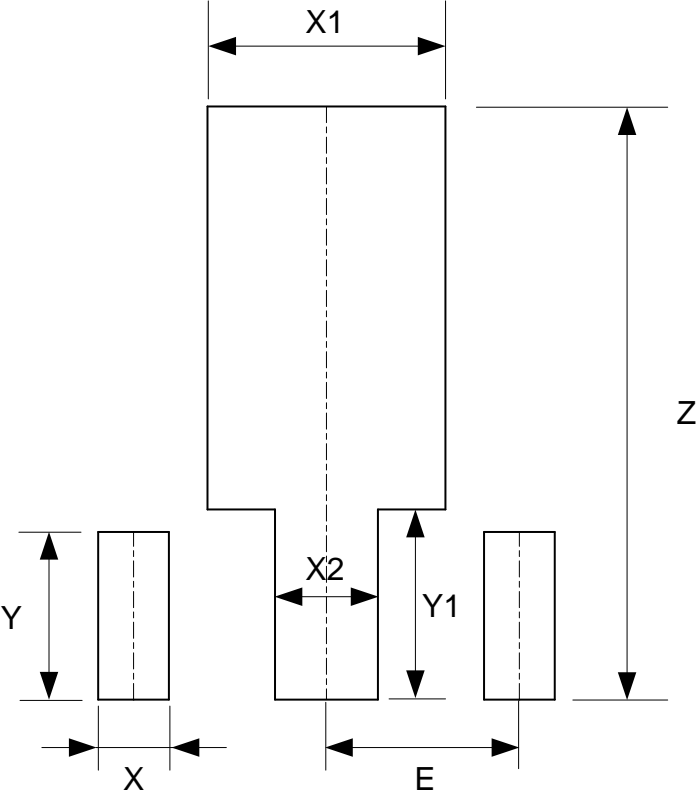
(2) Package Type: SOT-23-5



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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