

ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

General 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, 2.5V, 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, 2.5V, 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 $I_{OUT}=10mA$ and $V_{OUT}=3V$
200mV Typical at $I_{OUT}=100mA$ and $V_{OUT}=3V$
- Line Regulation: 6mV Typical
- Load Regulation: 25mV Typical
- Low Output Voltage Temperature Coefficient: $\pm 100ppm/^{\circ}C$
- Low Standby Current: 0.1 μ A Typical (AP2139)
- Active Quick Output Discharge (AP2139)
- Logic-controlled Enable (AP2139)

Applications

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

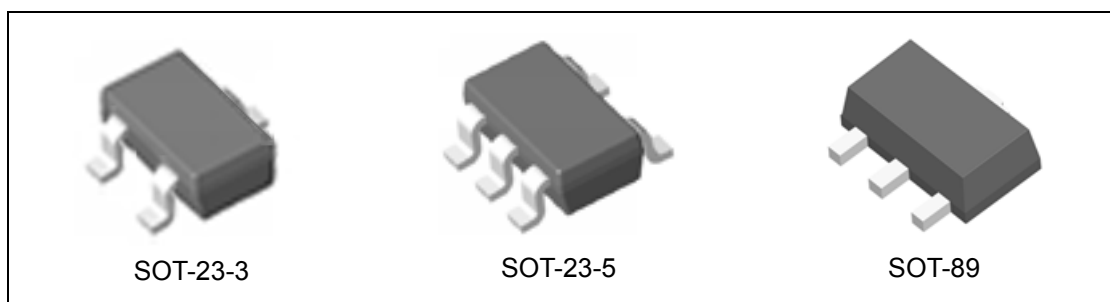


Figure 1. Package Types of AP2138/2139

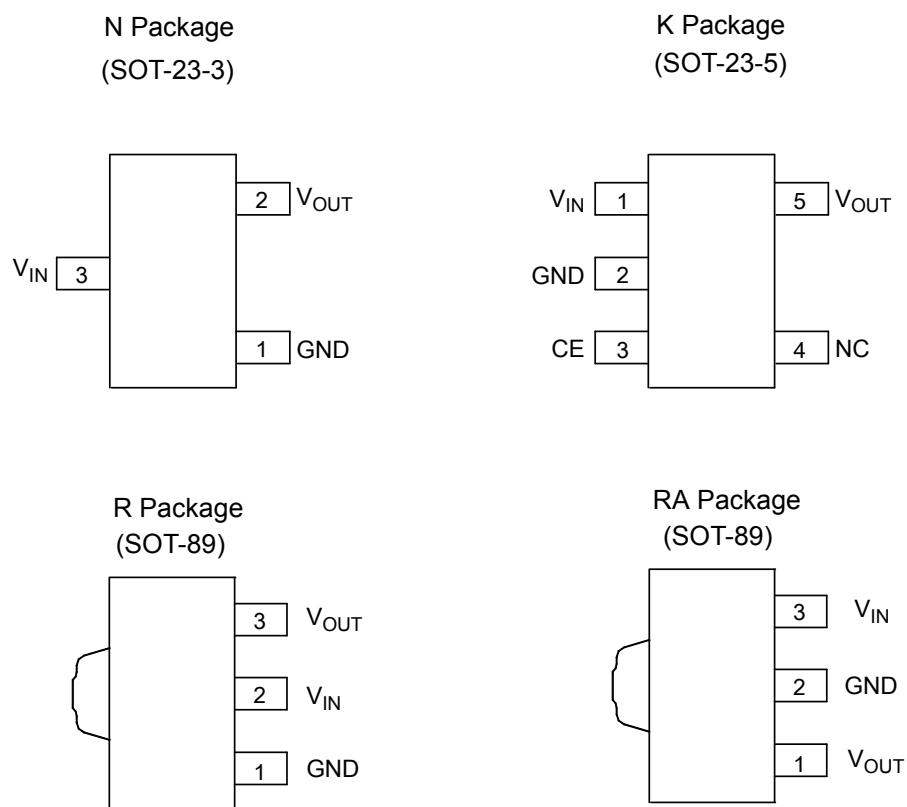
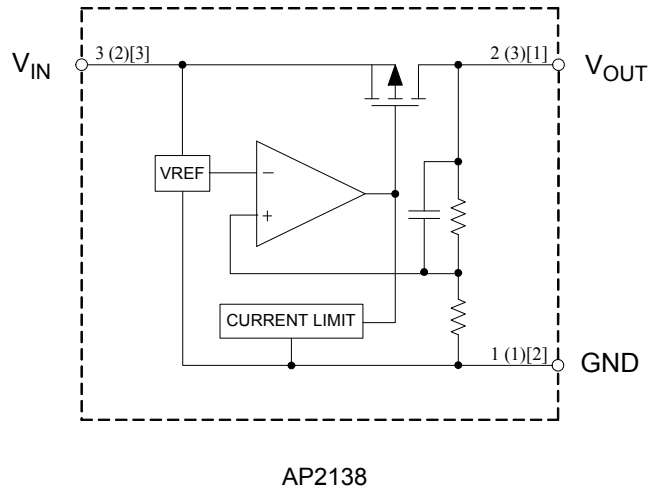
Pin Configuration


Figure 2. Pin Configuration of AP2138/2139 (Top View)

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)

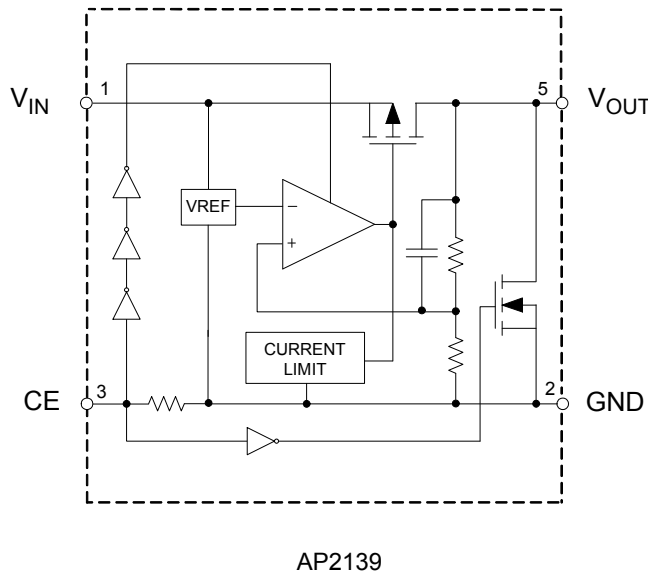


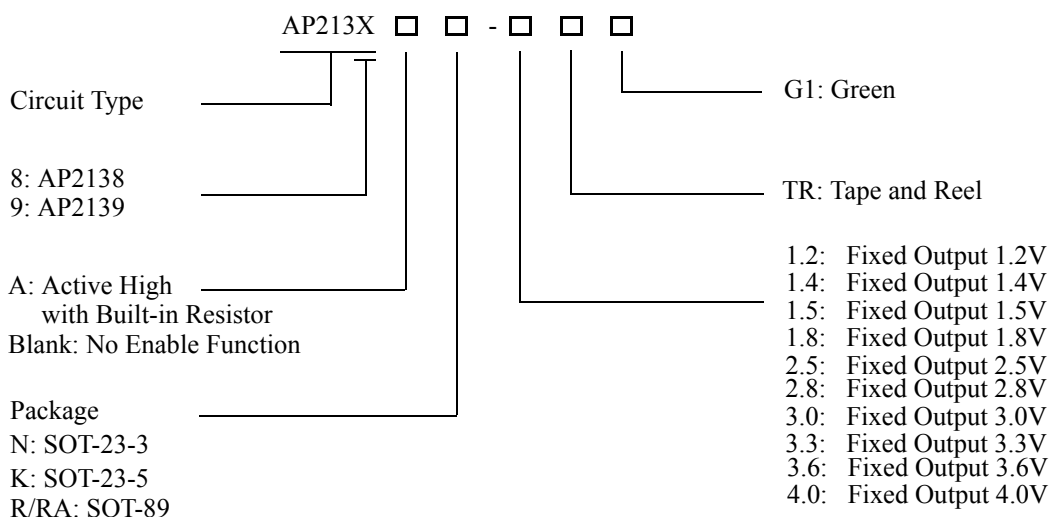
Figure 3. Functional Block Diagram of AP2138/2139



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Ordering Information



Package	Temperature Range	Condition	Part Number	Marking ID	Packing Type
SOT-23-3	-40 to 85°C	1.2V	AP2138N-1.2TRG1	GA3	Tape & Reel
		1.4V	AP2138N-1.4TRG1	GG1	Tape & Reel
		1.5V	AP2138N-1.5TRG1	GG2	Tape & Reel
		1.8V	AP2138N-1.8TRG1	GG4	Tape & Reel
		2.5V	AP2138N-2.5TRG1	GG5	Tape & Reel
		2.8V	AP2138N-2.8TRG1	GG6	Tape & Reel
		3.0V	AP2138N-3.0TRG1	GG3	Tape & Reel
		3.3V	AP2138N-3.3TRG1	GG7	Tape & Reel
		3.6V	AP2138N-3.6TRG1	GG8	Tape & Reel
SOT-89	-40 to 85°C	1.2V(R)	AP2138R-1.2TRG1	G42C	Tape & Reel
		1.4V (R)	AP2138R-1.4TRG1	G42D	Tape & Reel
		1.5V (R)	AP2138R-1.5TRG1	G42E	Tape & Reel
		1.8V (R)	AP2138R-1.8TRG1	G42F	Tape & Reel
		2.5V (R)	AP2138R-2.5TRG1	G42G	Tape & Reel
		2.8V (R)	AP2138R-2.8TRG1	G42H	Tape & Reel
		3.0V (R)	AP2138R-3.0TRG1	G42J	Tape & Reel
		3.3V (R)	AP2138R-3.3TRG1	G42K	Tape & Reel

**ULTRA LOW QUIESCENT CURRENT CMOS LDO****AP2138/2139****Ordering Information (Continued)**

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

BCD Semiconductor's products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.

**ULTRA LOW QUIESCENT CURRENT CMOS LDO****AP2138/2139****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit	
Input Voltage	V_{IN}	7.0	V	
Enable Input Voltage (AP2139)	V_{CE}	-0.3 to $V_{IN}+0.3$	V	
Lead Temperature	T_{LEAD}	260	°C	
Junction Temperature	T_J	150	°C	
Storage Temperature Range	T_{STG}	-65 to 150	°C	
ESD (Machine Model)	ESD	350	V	
ESD (Human Body Model)	ESD	2000	V	
Thermal Resistance (Note 2)	θ_{JA}	SOT-23-3	250	°C/W
		SOT-23-5	250	
		SOT-89	165	

Note 1: 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.

Note 2: 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

Parameter	Symbol	Min	Max	Unit
Input Voltage	V_{IN}	2.5	6.6	V
Operating Ambient Temperature Range	T_A	-40	85	°C



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics

AP2138/2139-1.2 Electrical Characteristics

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		1.176	1.200	1.224	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$2.2V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		100	300	mV
		$I_{OUT}=30mA$		400	700	
		$I_{OUT}=100mA$		700	1000	
		$I_{OUT}=250mA$		1000	1300	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 140		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics(Continued)

AP2138/2139-1.4 Electrical Characteristics

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		1.372	1.400	1.428	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$2.4V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		100	300	mV
		$I_{OUT}=30mA$		400	700	
		$I_{OUT}=100mA$		600	900	
		$I_{OUT}=250mA$		1000	1300	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 140		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138/2139-1.5 Electrical Characteristics

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		1.470	1.500	1.530	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$2.5V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		100	300	mV
		$I_{OUT}=30mA$		200	400	
		$I_{OUT}=100mA$		600	900	
		$I_{OUT}=250mA$		1000	1300	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 150		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138/2139-1.8 Electrical Characteristics

($V_{IN}=2.8V$, $V_{CE}=2.8V$ (AP2139), $T_J=25^{\circ}C$, $I_{OUT}=40mA$, $C_{IN}=C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		1.764	1.800	1.836	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$2.8V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		25	100	mV
		$I_{OUT}=30mA$		120	250	
		$I_{OUT}=100mA$		400	700	
		$I_{OUT}=250mA$		850	1100	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 180		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138/2139-2.5 Electrical Characteristics

($V_{IN}=3.5V$, $V_{CE}=3.5V$ (AP2139), $T_J=25^{\circ}C$, $I_{OUT}=40mA$, $C_{IN}=C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		2.450	2.500	2.550	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$3.5V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		25	100	mV
		$I_{OUT}=30mA$		100	250	
		$I_{OUT}=100mA$		250	500	
		$I_{OUT}=250mA$		650	1000	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 250		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138/2139-2.8 Electrical Characteristics

($V_{IN}=3.8V$, $V_{CE}=3.8V$ (AP2139), $T_J=25^{\circ}C$, $I_{OUT}=40mA$, $C_{IN}=C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		2.744	2.800	2.856	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$3.8V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		25	100	mV
		$I_{OUT}=30mA$		70	200	
		$I_{OUT}=100mA$		250	500	
		$I_{OUT}=250mA$		500	800	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 280		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138/2139-3.0 Electrical Characteristics

($V_{IN}=4V$, $V_{CE}=4V$ (AP2139), $T_J=25^\circ C$, $I_{OUT}=40mA$, $C_{IN}=C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^\circ C \leq T_J \leq 85^\circ C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		2.940	3.000	3.060	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$4V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		25	100	mV
		$I_{OUT}=30mA$		70	200	
		$I_{OUT}=100mA$		200	400	
		$I_{OUT}=250mA$		450	700	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 300		$\mu V/^\circ C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^\circ C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^\circ C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138/2139-3.3 Electrical Characteristics

($V_{IN}=4.3V$, $V_{CE}=4.3V$ (AP2139), $T_J=25^{\circ}C$, $I_{OUT}=40mA$, $C_{IN}=C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		3.234	3.300	3.366	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Standby Current (AP2139)	I_{STD}	$V_{CE}=0$		0.1	1	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$4.3V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		20	100	mV
		$I_{OUT}=30mA$		50	200	
		$I_{OUT}=100mA$		160	300	
		$I_{OUT}=250mA$		400	600	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 330		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
CE Pull-down Constant Current (AP2139)	I_{PD}			0.2		μA
CE Input Logic-high Voltage (AP2139)	V_{IH}		1.2			V
CE Input Logic-low Voltage (AP2139)	V_{IL}				0.3	V
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138-3.6 Electrical Characteristics

($V_{IN}=4.6V$, $T_J=25^{\circ}C$, $I_{OUT}=40mA$, $C_{IN}=C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		3.528	3.600	3.672	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$4.6V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		20	100	mV
		$I_{OUT}=30mA$		50	200	
		$I_{OUT}=100mA$		160	300	
		$I_{OUT}=250mA$		400	600	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 330		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



ULTRA LOW QUIESCENT CURRENT CMOS LDO

AP2138/2139

Electrical Characteristics (Continued)

AP2138-4.0 Electrical Characteristics

($V_{IN}=5.0V$, $T_J=25^{\circ}C$, $I_{OUT}=40mA$, $C_{IN}=C_{OUT}=1\mu F$, **Bold** typeface applies over $-40^{\circ}C \leq T_J \leq 85^{\circ}C$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}				6.6	V
Output Voltage	V_{OUT}		3.920	4.000	4.080	V
Quiescent Current	I_Q	$I_{OUT}=0$		1.0	1.5	μA
Output Current	I_{OUT}		250			mA
Load Regulation	V_{RLOAD}	$1mA \leq I_{OUT} \leq 100mA$		25	40	mV
Line Regulation	V_{RLINE}	$5V \leq V_{IN} \leq 6V$		6	18	mV
Dropout Voltage	V_{DROP}	$I_{OUT}=10mA$		20	100	mV
		$I_{OUT}=30mA$		50	200	
		$I_{OUT}=100mA$		160	300	
		$I_{OUT}=250mA$		400	600	
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$			± 330		$\mu V/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			± 100		ppm/ $^{\circ}C$
Short Circuit Current	I_{SHORT}	$V_{OUT}=0$		50		mA
Thermal Resistance	θ_{JC}	SOT-23-3		81.9		$^{\circ}C/W$
		SOT-23-5		81.9		
		SOT-89		51.1		



Typical Performance Characteristics

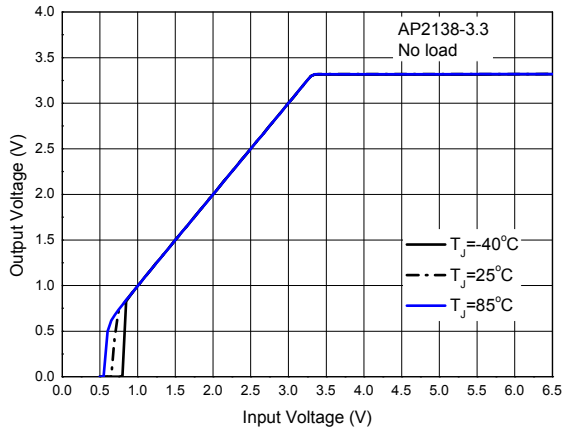


Figure 4. Output Voltage vs. Input Voltage

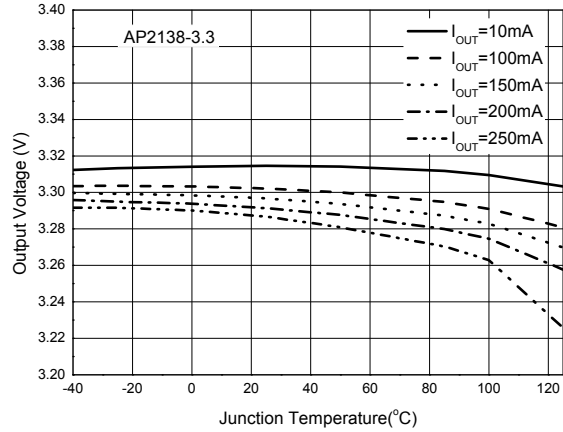


Figure 5. Output Voltage vs. Junction Temperature

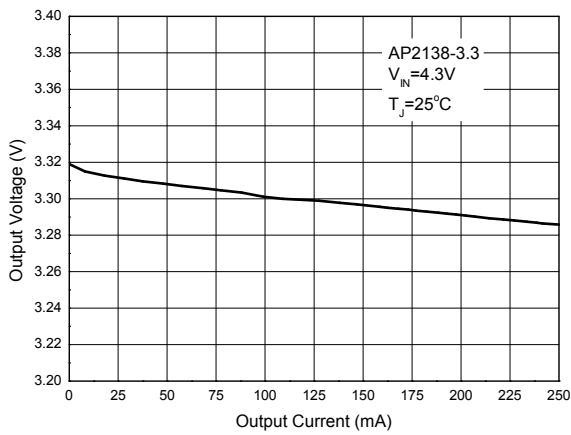


Figure 6. Output Voltage vs. Output Current

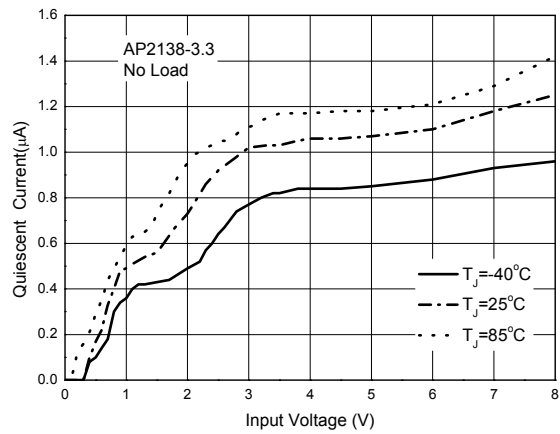


Figure 7. Quiescent Current vs. Input Voltage



Typical Performance Characteristics (Continued)

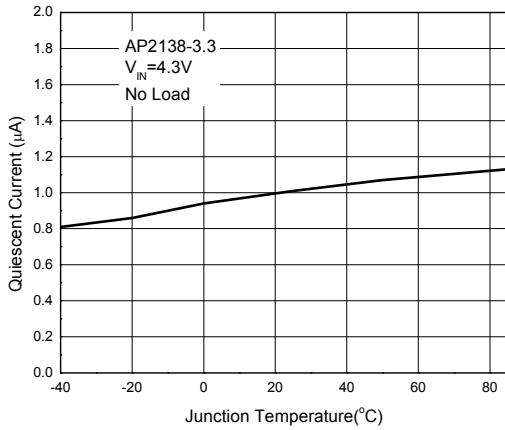


Figure 8. Quiescent Current vs. Junction Temperature

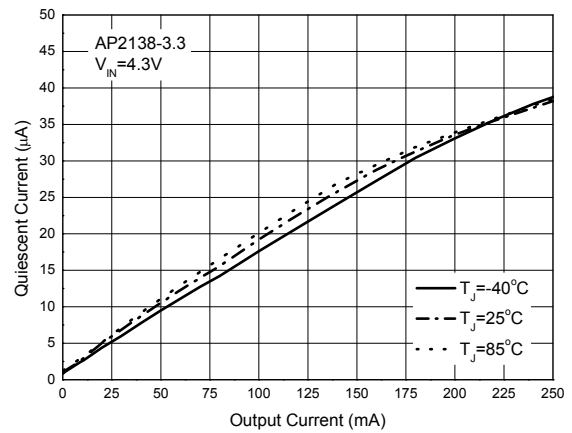


Figure 9. Quiescent Current vs. Output Current

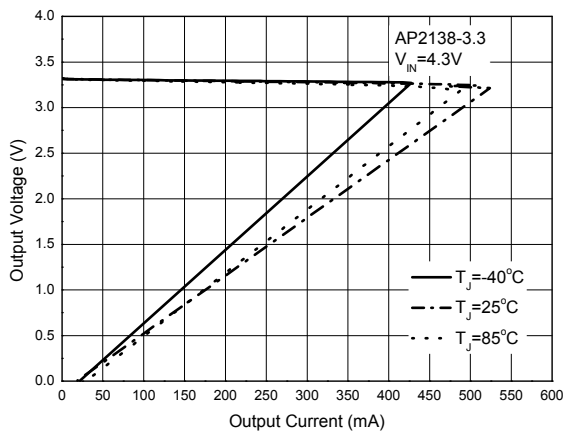


Figure 10. Output Voltage vs. Output Current

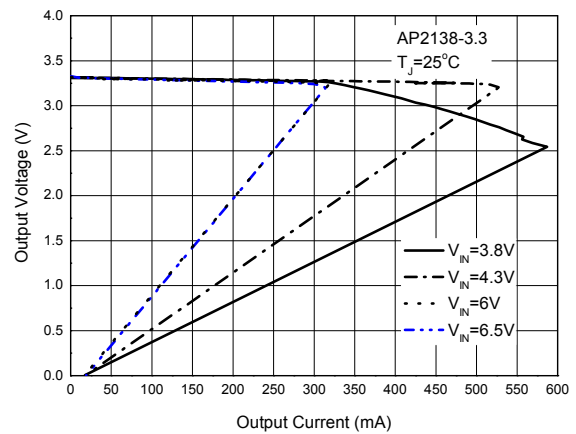


Figure 11. Output Voltage vs. Output Current



Typical Performance Characteristics (Continued)

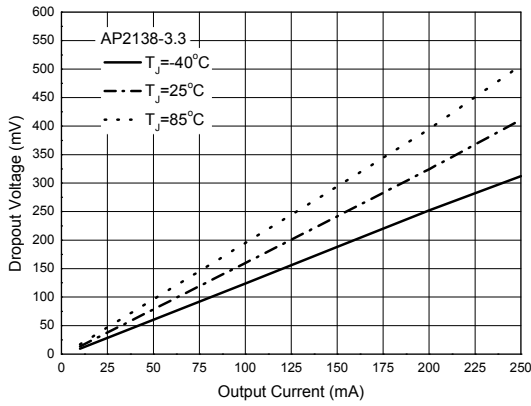


Figure 12. Dropout Voltage vs. Output Current

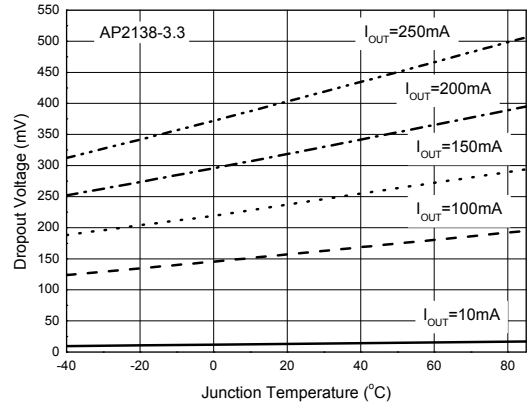


Figure 13. Dropout Voltage vs. Junction Temperature

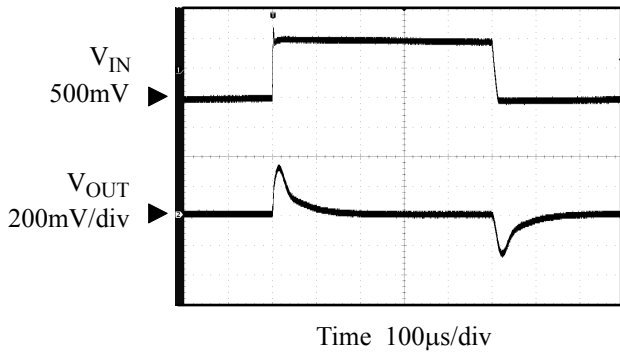


Figure 14. Line transient ($V_{IN} = 4.3$ to 5.3V , $I_{OUT} = 10\text{mA}$)

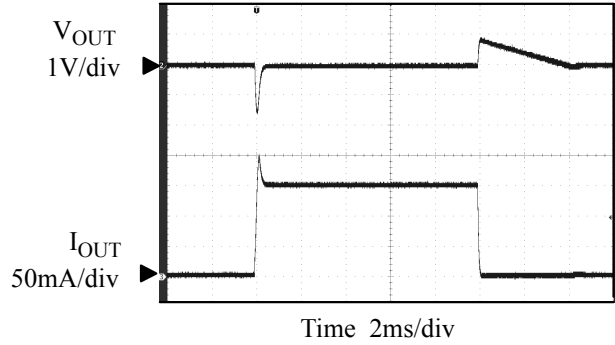


Figure 15. Load transient ($V_{IN} = 4.3\text{V}$, $I_{OUT} = 1\text{mA}$ to 150mA)

Typical Performance Characteristics (Continued)

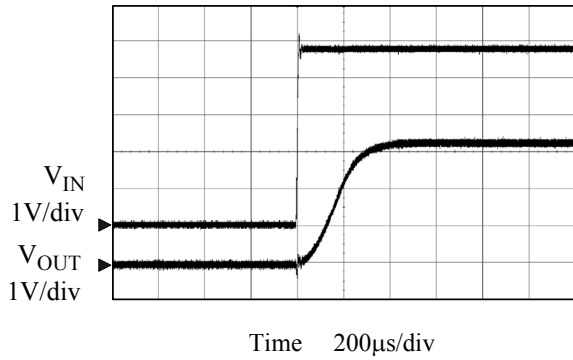


Figure 16. Start-up Response

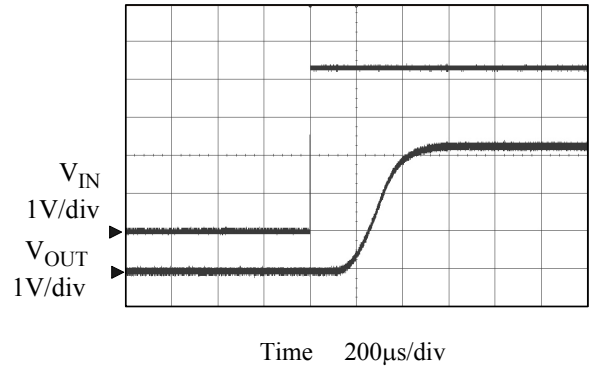
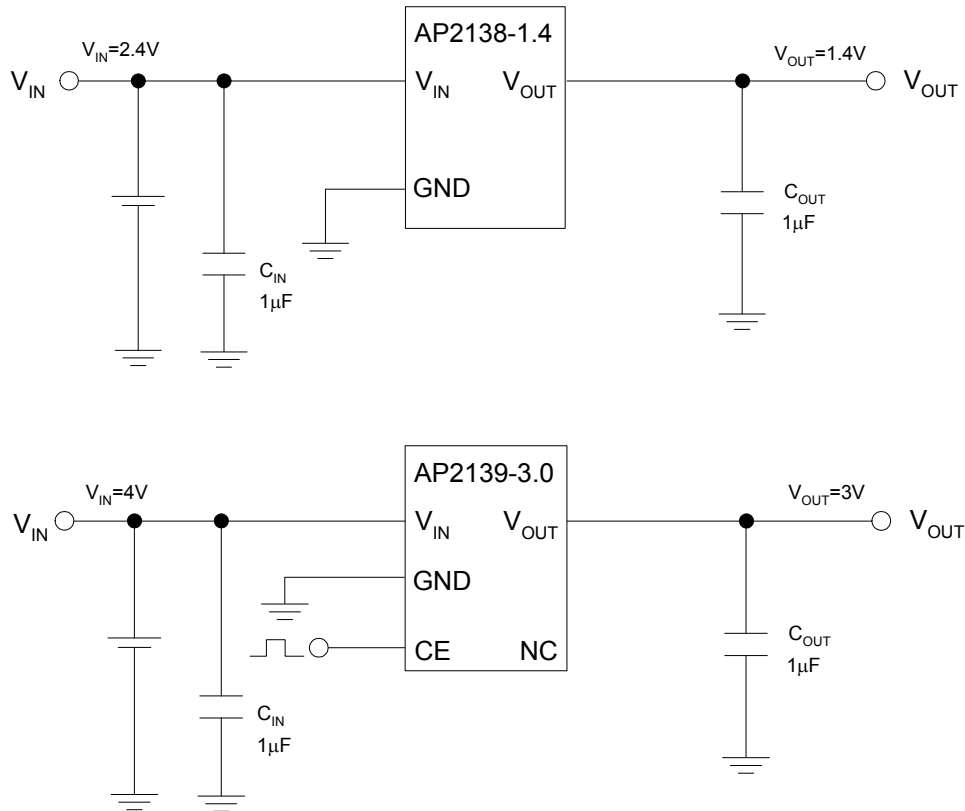


Figure 17. Enable Input Response

Typical Application


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

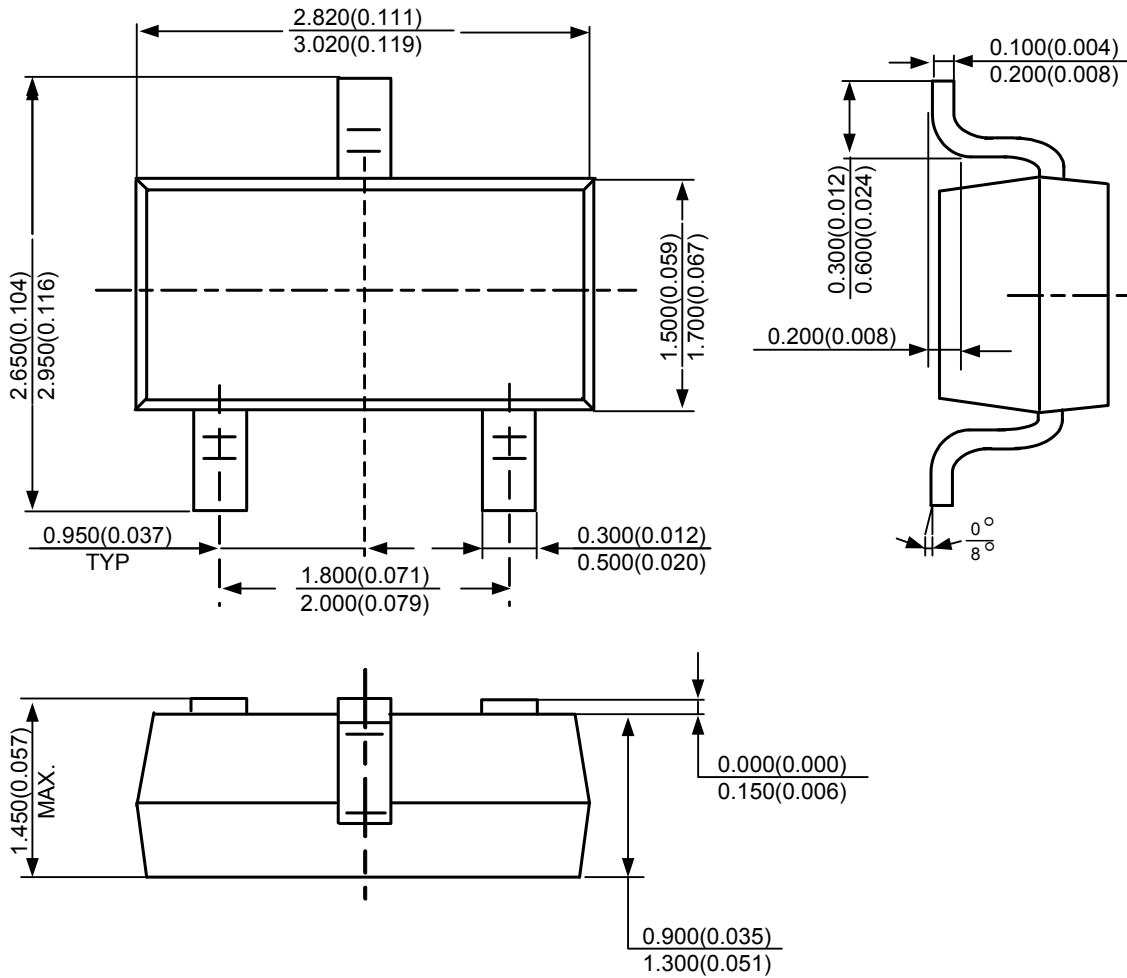
Figure 18. Typical Application of AP2138/2139



Mechanical Dimensions

SOT-23-3

Unit: mm(inch)

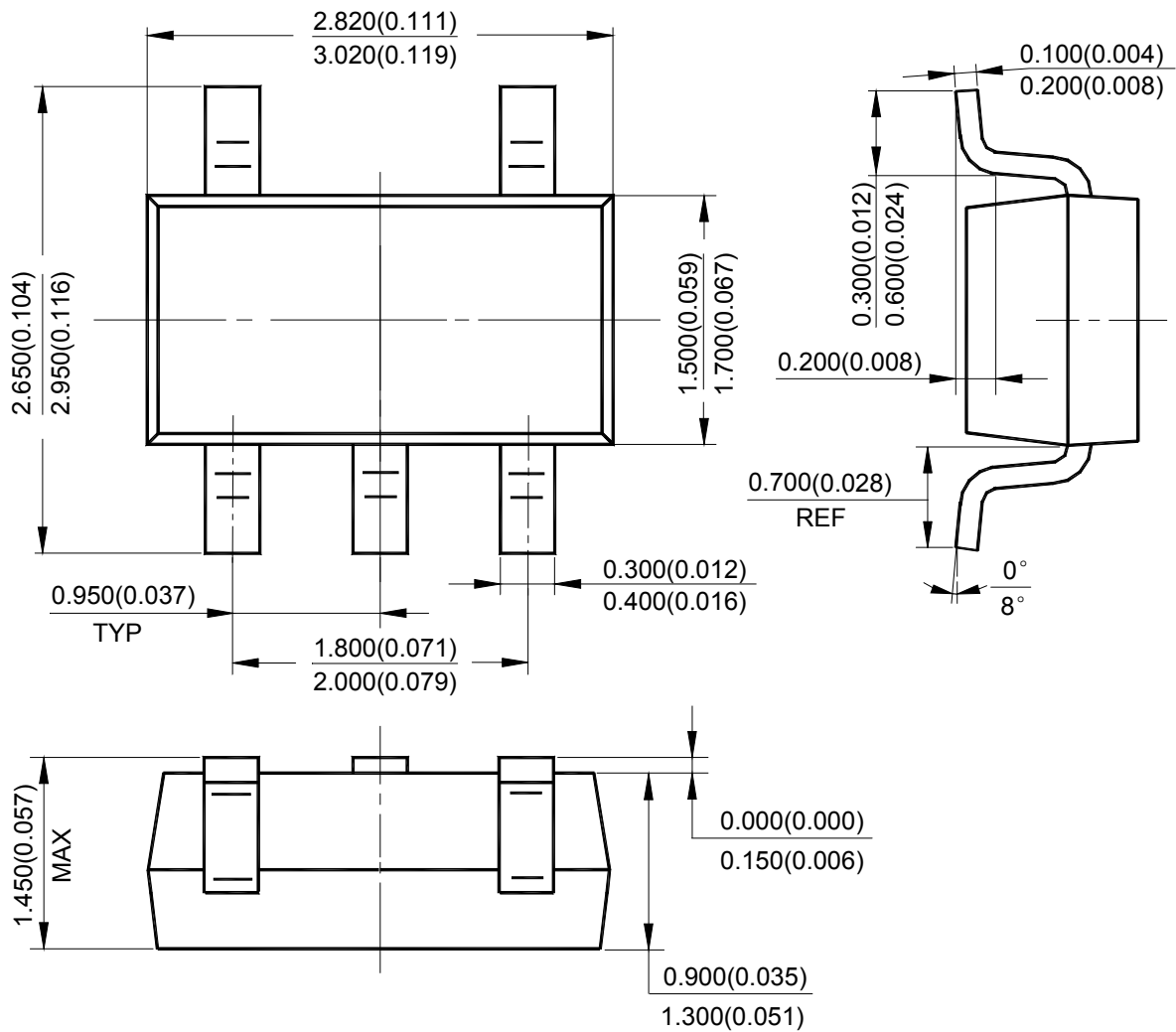




Mechanical Dimensions (Continued)

SOT-23-5

Unit: mm(inch)





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