AME

AME8855

High PSRR, Low Noise, 600mA CMOS Regulator

■ General Description

The AME8855 family of positive, CMOS linear regulators provide low dropout voltage(420mV@600mA), low quiescent current, and low noise CMOS LDO. These rugged devices have both Thermal Shutdown, and Current limit to prevent device failure under the "Worst" of operating conditions.

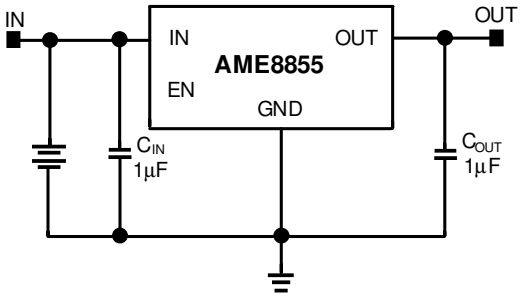
■ Features

- Low Dropout Voltage: 420mV@600mA
- Guaranteed Current: 600mA
- Quiescent Current: 60µA (typ.)
- Over-Temperature Shutdown
- Current Limiting protection
- PSRR:60dB@10KHz
- Ultra-Low-Noise: 100μV_{RMS} at 1Hz to 100KHz
- Low Temperature Coefficient
- Input Voltage Range 2.8V~5.5V
- Output Voltage Range: 0.8V ~ 4.3V
- Green Products Meet RoHS Standards

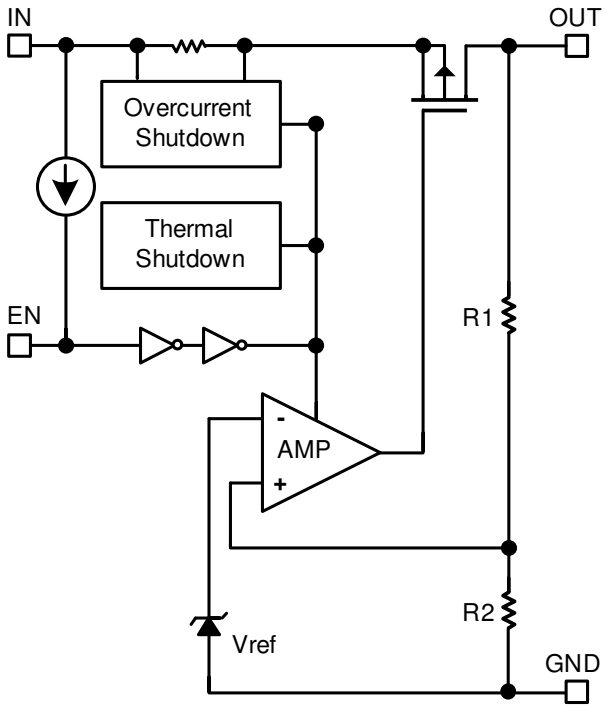
■ Applications

- Instrumentation
- Portable Electronics
- Wireless Devices
- Cordless Phones
- PC Peripherals
- Battery Powered Widgets

■ Typical Application



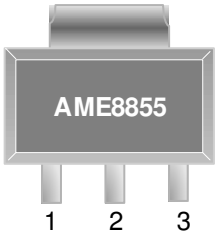
■ Functional Block Diagram



■ Pin Configuration

3 Pin

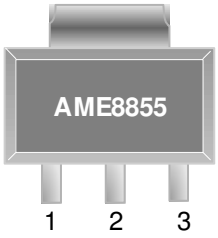
SOT-223
Top View



AME8855-AGTxxx
1. IN
2. GND (TAB)
3. OUT

*** Die Attach:**
Conductive Epoxy

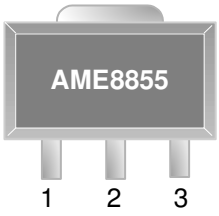
SOT-223
Top View



AME8855-BGTxxx
1. GND
2. OUT (TAB)
3. IN

*** Die Attach:**
Non-Conductive Epoxy

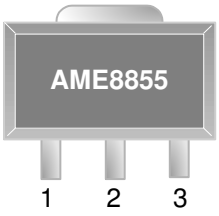
SOT-89
Top View



AME8855-AFTxxx
1. IN
2. GND (TAB)
3. OUT

*** Die Attach:**
Conductive Epoxy

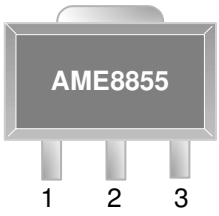
SOT-89
Top View



AME8855-BFTxxx
1. GND
2. OUT (TAB)
3. IN

*** Die Attach:**
Non-Conductive Epoxy

SOT-89
Top View



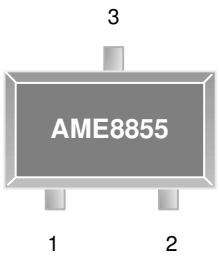
AME8855-CFTxxx
1. GND
2. IN (TAB)
3. OUT

*** Die Attach:**
Non-Conductive Epoxy

■ Pin Configuration (Contd.)

3 Pin

SOT-23
Top View

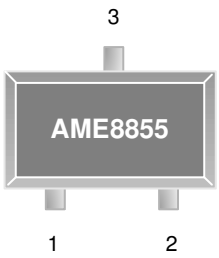


AME8855-AETxxx

1. IN
2. GND
3. OUT

*** Die Attach:**
Non-Conductive Epoxy

SOT-23
Top View



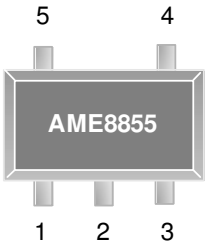
AME8855-BETxxx

1. GND
2. OUT
3. IN

*** Die Attach:**
Non-Conductive Epoxy

5 Pin

SOT-25
Top View



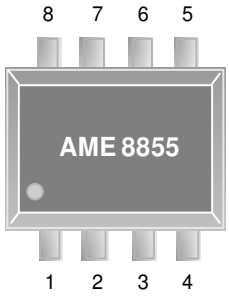
AME8855-AEVxxx

1. IN
2. GND
3. EN
4. NC
5. OUT

*** Die Attach:**
Conductive Epoxy

8 Pin

SOP-8
Top View



AME8855-AHAxxx

1. IN
2. GND
3. GND
4. OUT
5. NC
6. GND
7. GND
8. EN

*** Die Attach:**
Conductive Epoxy

■ Pin Description

SOT-223

Pin Number		Pin Name	Pin Description
A	B		
1	3	IN	Input voltage pin; should be decoupled with 1µF or greater capacitor.
2	1	GND	Ground connection pin.
3	2	OUT	LDO voltage regulator output pin; should be decoupled with a 1.0µF or greater value low ESR ceramic capacitor.

SOT-89

Pin Number			Pin Name	Pin Description
A	B	C		
1	3	2	IN	Input voltage pin; should be decoupled with 1µF or greater capacitor.
2	1	1	GND	Ground connection pin.
3	2	3	OUT	LDO voltage regulator output pin; should be decoupled with a 1.0µF or greater value low ESR ceramic capacitor.

SOT-23

Pin Number		Pin Name	Pin Description
A	B		
1	3	IN	Input voltage pin; should be decoupled with 1µF or greater capacitor.
2	1	GND	Ground connection pin.
3	2	OUT	LDO voltage regulator output pin; should be decoupled with a 1.0µF or greater value low ESR ceramic capacitor.

■ Pin Configuration

SOP-25

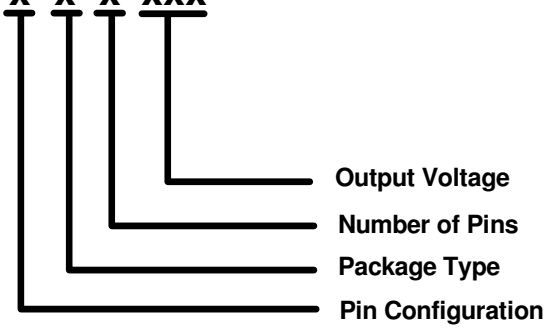
Pin Number	Pin Name	Pin Description
1	IN	Input voltage pin; should be decoupled with 1µF or greater capacitor.
2	GND	Ground connection pin.
3	EN	Enable pin, Active “high". When pulled “low”, the PMOS pass transistor turns off, current consuming less than 1µA. When EN pin floating outside, it’s weakly pulled high from internal MOS .
4	NC	No connection.
5	OUT	LDO voltage regulator output pin; should be decoupled with a 1.0µF or greater value low ESR ceramic capacitor.

SOP-8

Pin Number	Pin Name	Pin Description
1	IN	Input voltage pin; should be decoupled with 1µF or greater capacitor.
2	GND	Ground connection pin.
3	GND	Ground connection pin.
4	OUT	LDO voltage regulator output pin; should be decoupled with a 1.0µF or greater value low ESR ceramic capacitor.
5	NC	No connection.
6	GND	Ground connection pin.
7	GND	Ground connection pin.
8	EN	Enable pin, Active “high". When pulled “low”, the PMOS pass transistor turns off, current consuming less than 1µA. When EN pin floating outside, it’s weakly pulled high from internal MOS .

■ Ordering Information

AME8855 - x x x xxx



Pin Configuration	Package Type	Number of Pins	Output Voltage
A (SOT-223) (SOT-23) (SOT-89) 1. IN 2. GND 3. OUT	E: SOT-2X F: SOT-89 G: SOT-223 H: SOP	A: 8 T: 3 V: 5	080: 0.8V 090: 0.9V 100: 1.0V 110: 1.1V
B (SOT-223) (SOT-23) (SOT-89) 1. GND 2. OUT 3. IN			120: 1.2V 130: 1.3V 140: 1.4V 150: 1.5V : : : : 420: 4.2V 430: 4.3V
C (SOT-89) 1. GND 2. IN 3. OUT			
A (SOT-25) 1. IN 2. GND 3. EN 4. BYP 5. OUT			
A (SOP-8) 1. IN 2. GND 3. GND 4. OUT 5. NC 6. GND 7. GND 8. EN			

■ Absolute Maximum Ratings

Parameter		Maximum	Unit
Input Voltage		-0.3 to 6	V
EN Voltage		-0.3 to 6	V
Output Current		$P_D/(V_{IN}-V_{OUT})$	mA
Output Voltage		GND-0.3 to V_{IN}+0.3	V
ESD Classification	HBM	2	kV
	MM	200	V

Caution: Stress above the listed in absolute maximum ratings may cause permanent damage to the device.

■ Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Ambient Temperature Range	T_A	- 40 to +85	°C
Junction Temperaturen Range	T_J	- 40 to +125	°C
Storage Temperaturen Range	T_{STG}	- 65 to +150	°C

■ Thermal Information

Parameter	Package	Die Attach	Symbol	Maximum	Unit
Thermal Resistance* (Junction to Case)	SOT-89	Conductive Epoxy	θ_{JC}	40	°C / W
		Non-Conductive Epoxy		46	
	SOT-223	Conductive Epoxy		25	
		Non-Conductive Epoxy		31	
	SOT-23	Non-Conductive Epoxy		140	
	SOT-25	Conductive Epoxy		81	
	SOP-8	Conductive Epoxy		60	
Thermal Resistance (Junction to Ambient)	SOT-89	Conductive Epoxy	θ_{JA}	180	°C / W
		Non-Conductive Epoxy		180	
	SOT-223	Conductive Epoxy		120	
		Non-Conductive Epoxy		135	
	SOT-23	Non-Conductive Epoxy		280	
	SOT-25	Conductive Epoxy		260	
	SOP-8	Conductive Epoxy		150	
Internal Power Dissipation	SOT-89	Conductive Epoxy	P_D	550	mW
		Non-Conductive Epoxy		550	
	SOT-223	Conductive Epoxy		900	
		Non-Conductive Epoxy		800	
	SOT-23	Non-Conductive Epoxy		400	
	SOT-25	Conductive Epoxy		400	
	SOP-8	Conductive Epoxy		810	
Maximum Junction Temperature				150	°C
Lead Temperature (Soldering, 10Sec.)**				260	°C

* Measure θ_{JC} on backside center of molding compound if IC has no tab.
** MIL-STD-202G 210F

■ Electrical Specifications

V_{IN}=$V_{OUT(NOM)}$ +1V, (for V_{OUT}<2V, V_{IN}=2.8V), I_{OUT}=1mA, and C_{OUT}=1µF, C_{IN}=1µF unless otherwise noted. Typical values are at T_A=25°C.

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Input Voltage	V_{IN}		2.8		5.5	V
Output Accuracy	$V_{OUT,ACC}$	I_{OUT}=1mA	-2.0		2.0	%
Output Voltage Range	V_{OUT}		0.8		4.3	V
Dropout Voltage (Note 1)	V_{DROP}	I_{OUT}=600mA, 0.8V≦$V_{OUT(NOM)}$≦2.0V			Note2	mV
		I_{OUT}=600mA, 2.0V<$V_{OUT(NOM)}$≦2.8V			850	
		I_{OUT}=600mA, 2.8V<$V_{OUT(NOM)}$		420	650	
Output Current	I_{OUT}		600			mA
Quiescent Current	I_Q	I_{OUT}=0mA		60	90	µA
Line Regulation $\frac{\frac{\Delta V_{OUT}}{\Delta V_{IN}}\times 100\%}{V_{OUT}}$	REG_{LINE}	I_{OUT}=1mA, 0.8V≦V_{OUT}≦1.2V, 2.8V≦V_{IN}≦3.5V		0.125	0.25	%/V
		I_{OUT}=1mA, 1.2V<V_{OUT}≦2.0V, 2.8V≦V_{IN}≦3.5V		0.1	0.2	
		I_{OUT}=1mA, 2.0V<V_{OUT}≦4.2V, $V_{IN(MIN)}$≦V_{IN}≦$V_{IN(MIN)}$+1V		0.05	0.1	
		I_{OUT}=1mA, 4.2V<V_{OUT}≦4.5V, $V_{IN(MIN)}$≦V_{IN}≦5.5V (Note2)		0.05	0.1	
Load Regulation $\frac{\frac{\Delta V_{OUT}}{V_{OUT}}\times 100\%}{\Delta I_{OUT}}$	REG_{LOAD}	1mA≦I_{OUT}≦600mA 0.8V≦$V_{OUT(NOM)}$≦1.2V		1.5	3	%/A
		1mA≦I_{OUT}≦600mA 1.2V≦$V_{OUT(NOM)}$≦2.0V		1.25	2.5	
		1mA≦I_{OUT}≦600mA 2.0V<$V_{OUT(NOM)}$		1.0	2.0	

■ Electrical Specifications (Contd.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Power Supply Rejection Ration	PSRR	C_{OUT}=1uF, V_{OUT}=0.8V, I_{OUT}=10mA, V_{IN}=2.8V	F=100Hz		60		dB
			F=1KHz		60		
			F=10KHz		60		
Output Voltage Noise	eN	I_{OUT}=10mA, V_{OUT}=0.8V, f=1Hz to 100KHz			100		μV_{RMS}
Enable High (Enabled)	$V_{EN,HI}$	$V_{IN(MIN)} \leqq V_{IN} \leqq 5.5V$		1.4		V_{IN}	V
Enable Low (Shutdown)	$V_{EN,LO}$	$V_{IN(MIN)} \leqq V_{IN} \leqq 5.5V$		0		0.4	
Enable Input Bias Current	$I_{EN,HI}$	$V_{EN=}V_{IN}$				1	μA
	$I_{EN,LO}$	V_{EN}=0V				2	
Shutdown Current	I_{SHDN}	V_{IN}=5.0V, V_{EN}=0V			0.1	1	μA
Shutdown Output Voltage	$V_{OUT,SD}$	I_{OUT}=0.4mA, V_{EN}=0V				0.4	V
Protection							
Output Current Limit	I_{LIM}	V_{OUT}=0.9 x $V_{OUT(NOM)}$		750			mA
Short-Circuit Current	I_{SC}	$V_{OUT} \leqq 0.6V$			300		
Thermal Shutdown Temperature	T_{SHDN}	Shutdown, temperature increasing			150		°C
Thermal Shutdown Hysteresis	$T_{SHDN(HYS)}$				20		

Note1: Dropout Voltage is measured at V_{OUT}=$V_{OUT(NOM)}$x98%
Note2:For V_{OUT} below 2.0V, Dropout Voltage is the Input(MIN) Voltage to Output Voltage differential.

■ Detailed Description

The AME8855 family of CMOS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection thermal shutdown, and Power Good detection circuitry.

The P-channel pass transistor receives data from the error amplifier, over-current shutdown, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 150°C, or the current exceeds 600mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops more 20°C.

Capacitor Selection and Regulator Stability

The AME8855 is stable with an output capacitor to ground of 1μF or greater. Ceramic capacitors have the lowest ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the highest ESR, resulting in the poorest AC response. Unfortunately, large value ceramic capacitors are comparatively expensive. One option is to parallel a 0.1μF ceramic capacitor with a 10μF Aluminum Electrolytic. The benefit is low ESR, high capacitance, and low overall cost.

A second capacitor is recommended between the input and ground to stabilize V_{IN}. The input capacitor should be at least 0.1μF to have a beneficial effect.

Enable Pin

The Enable Pin is Active High. When activated pulled low, the MOS pass transistor shuts off, and all internal circuits are powered down. In this state, the stand by current is than 1μA. When EN pin float outside, It's pulled high.

Capacitor Selection and Regulator Stability

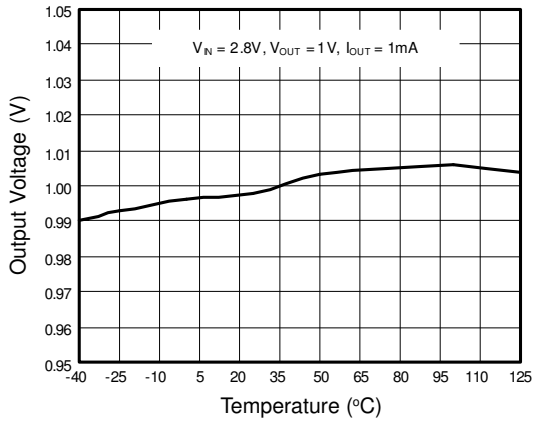
The maximum output power of the AME8855 is limited by the maximum power dissipation of the package. By calculation the power dissipation of the package as a function of the input voltage, output voltage and output current, the maximum input voltage can be obtained. The maximum power dissipation should not exceed the package′s maximum power rating.

$$P_{MAX} = (V_{IN(MAX)}-V_{OUT}) \times I_{OUT}$$

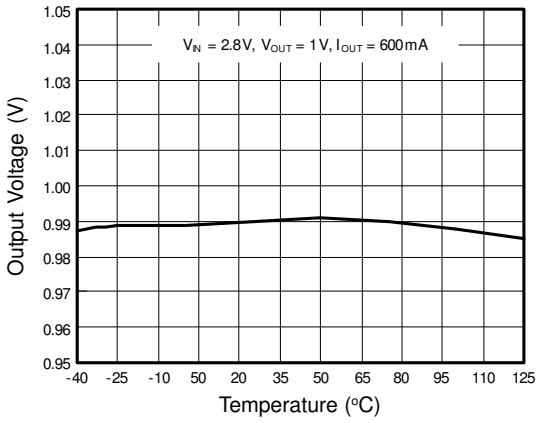
Where:
$V_{IN(MAX)}$ = maximum input voltage
P_{MAX} = maximum power dissipation of the package

■ Characterization Curve

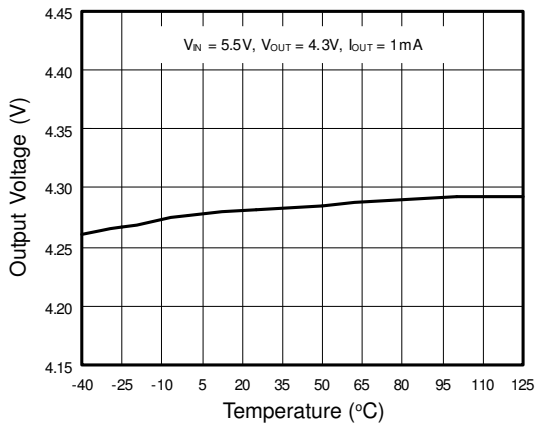
Output Voltage



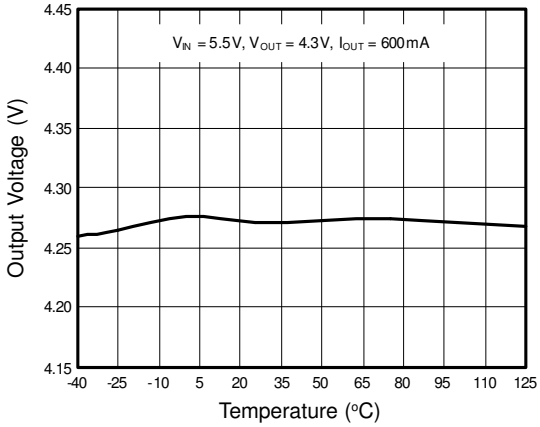
Output Voltage



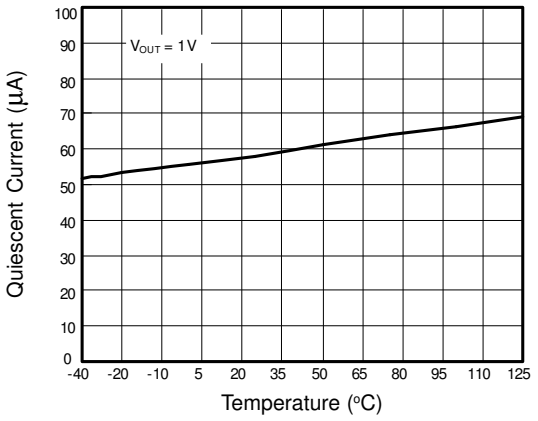
Output Voltage



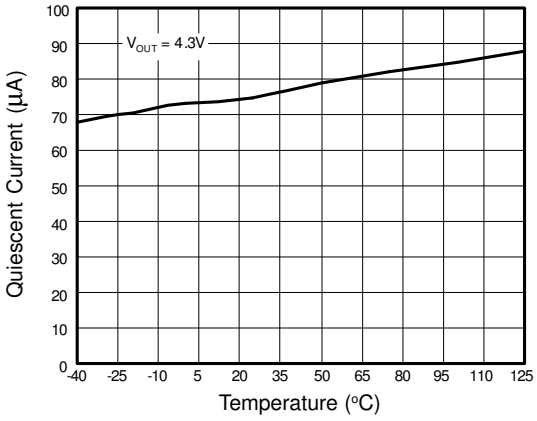
Output Voltage



Quiescent Current

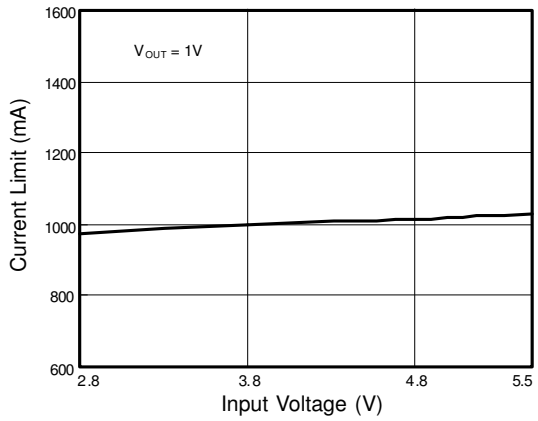


Quiescent Current

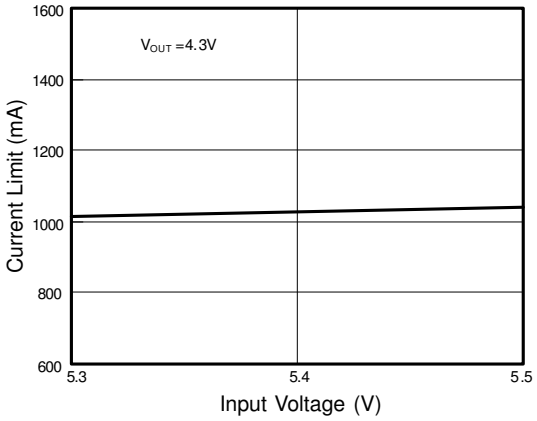


■ Characterization Curve (Contd.)

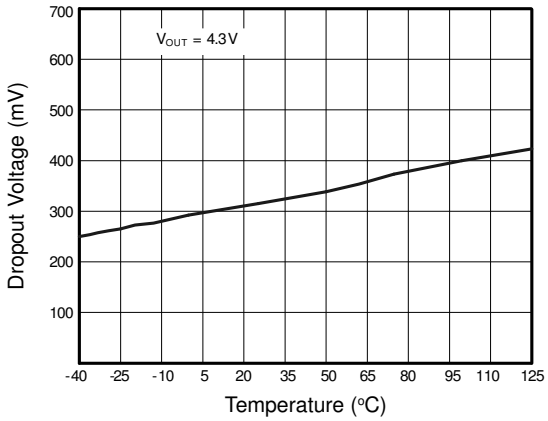
Current Limit vs Input Voltage



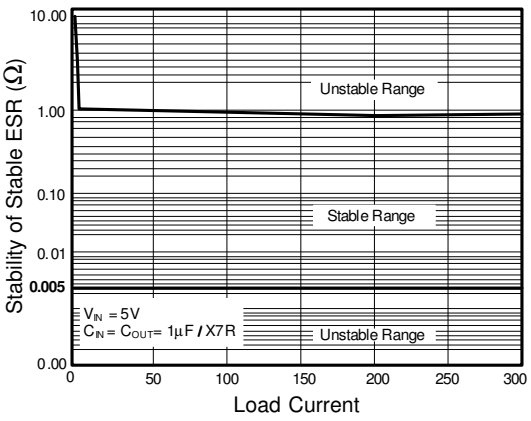
Current Limit vs Input Voltage



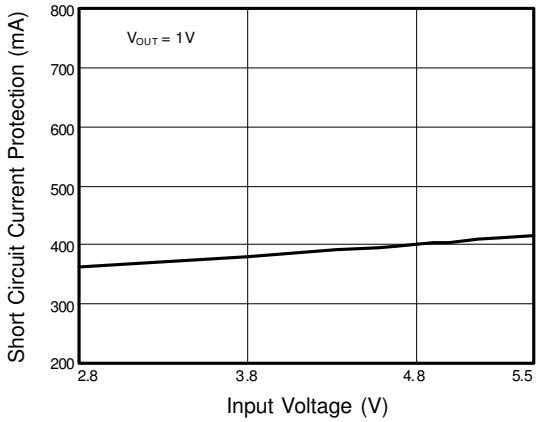
Dropout Voltage



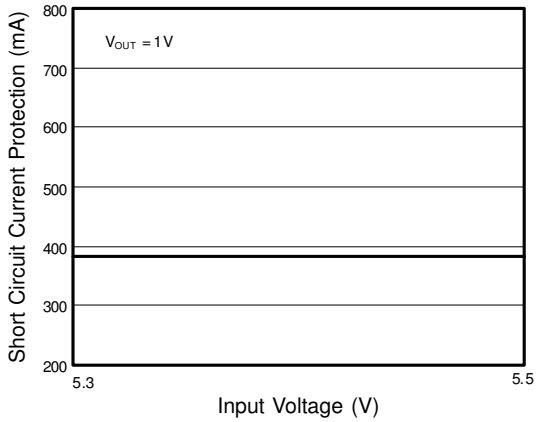
Stability vs. ESR vs. Load Current



Short Circuit Current Protection

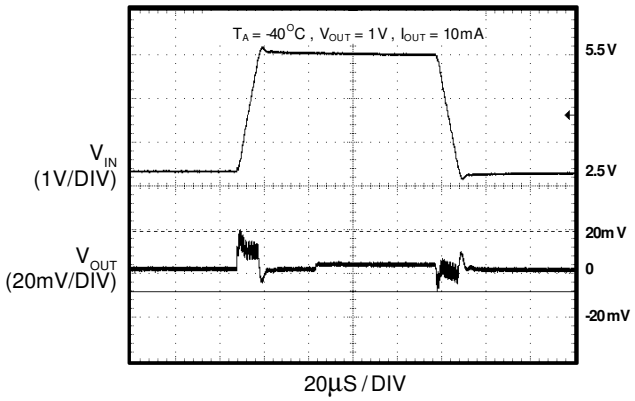


Short Circuit Current Protection

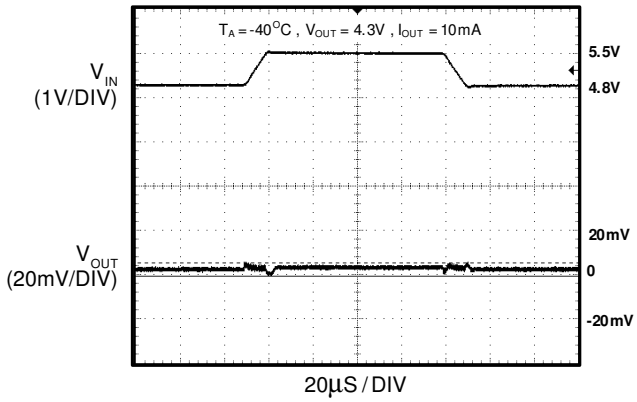


■ Characterization Curve (Contd.)

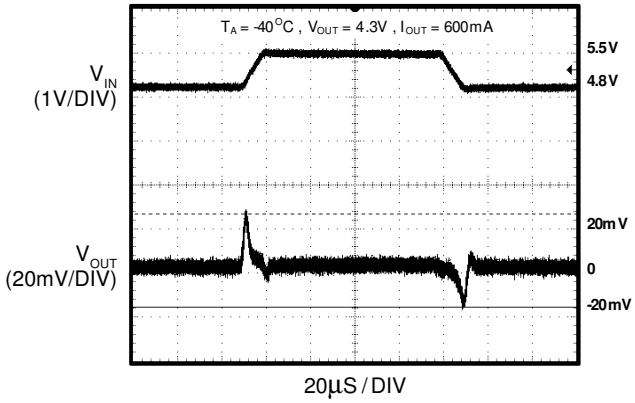
Line Transient Response



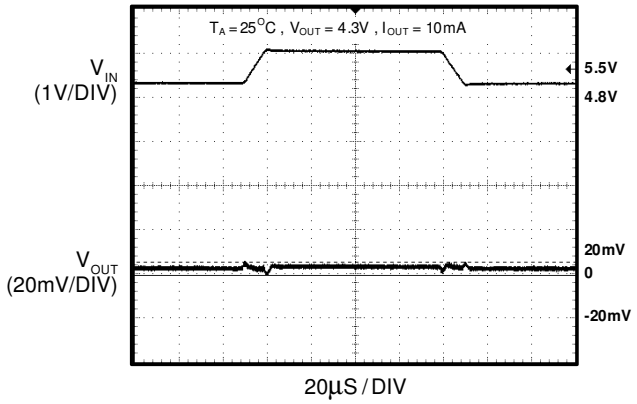
Line Transient Response



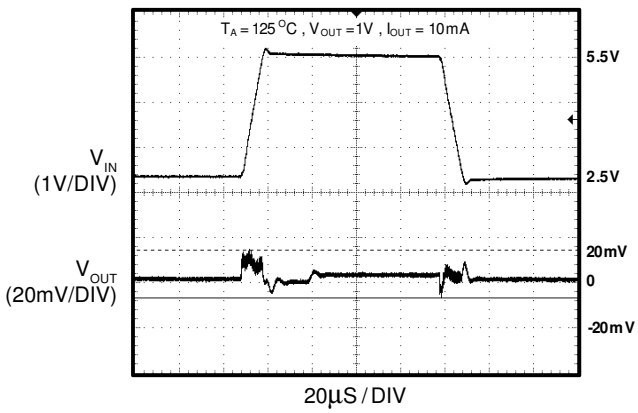
Line Transient Response



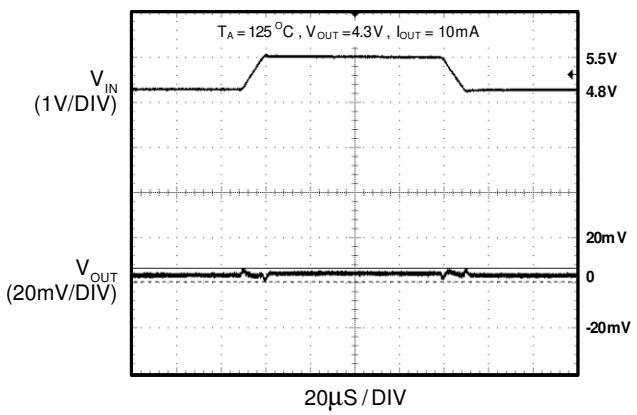
Line Transient Response



Line Transient Response

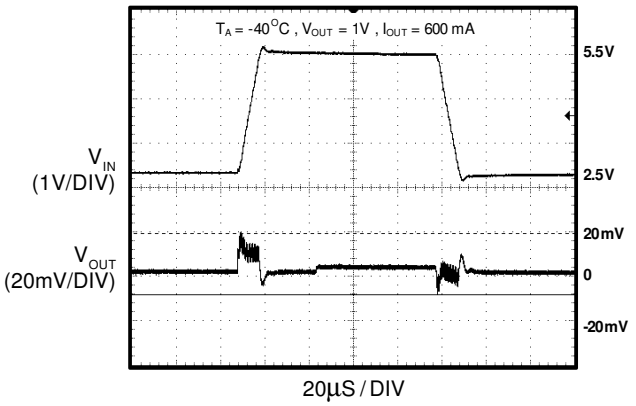


Line Transient Response

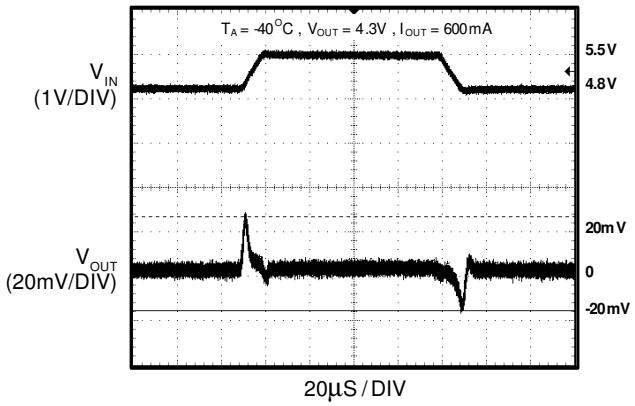


■ Characterization Curve (Contd.)

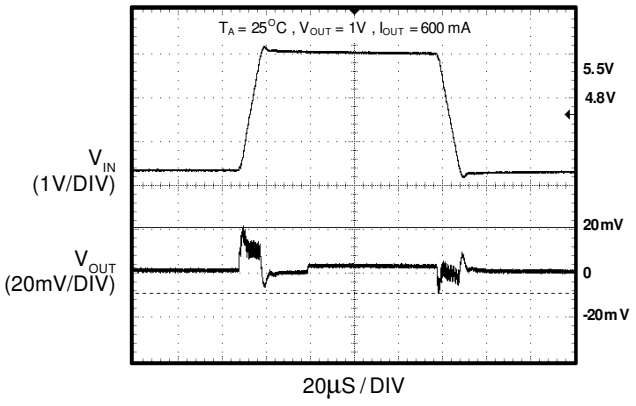
Line Transient Response



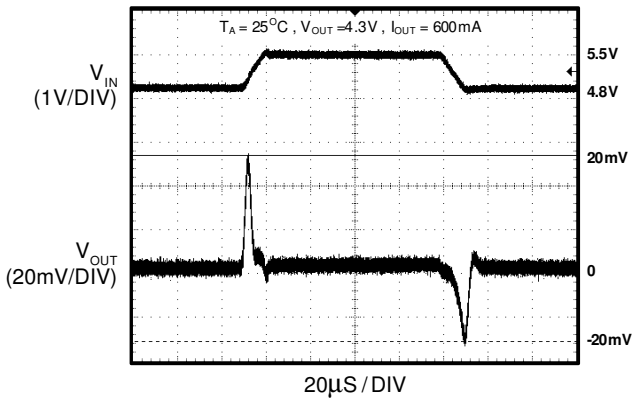
Line Transient Response



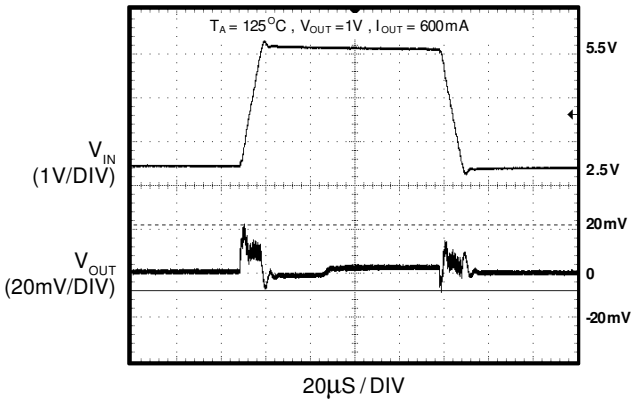
Line Transient Response



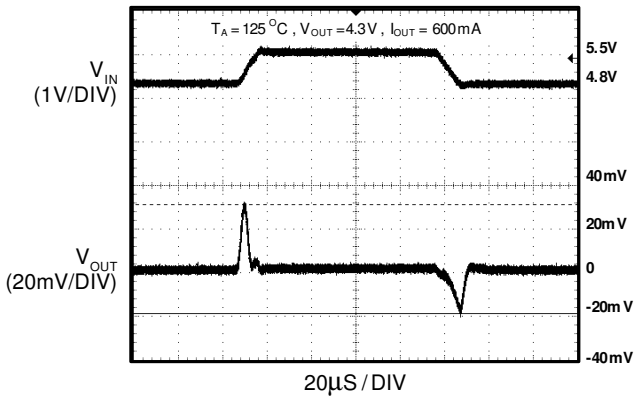
Line Transient Response



Line Transient Response

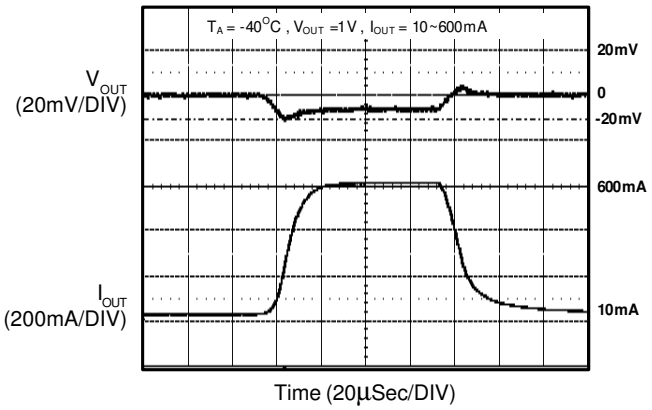


Line Transient Response

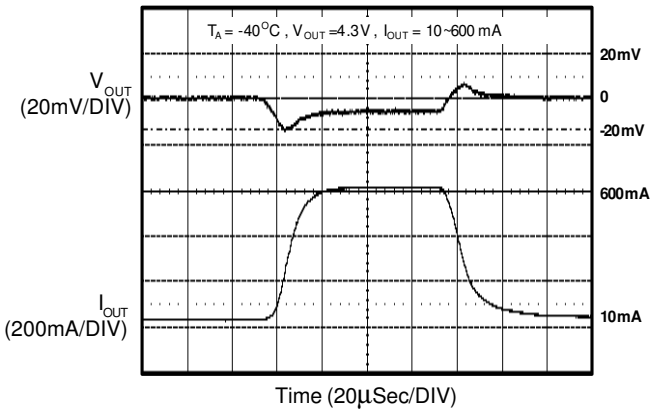


■ Characterization Curve (Contd.)

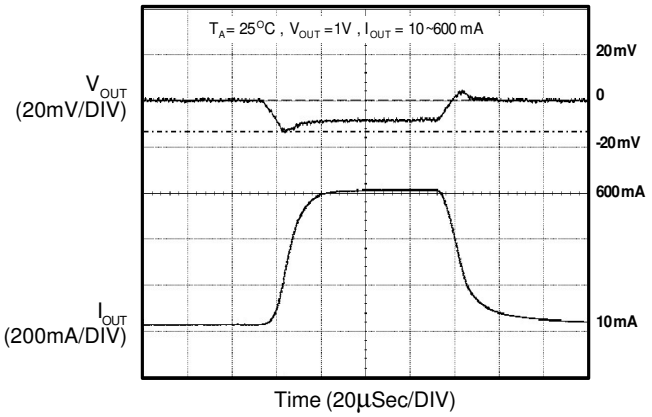
Load Transient Response



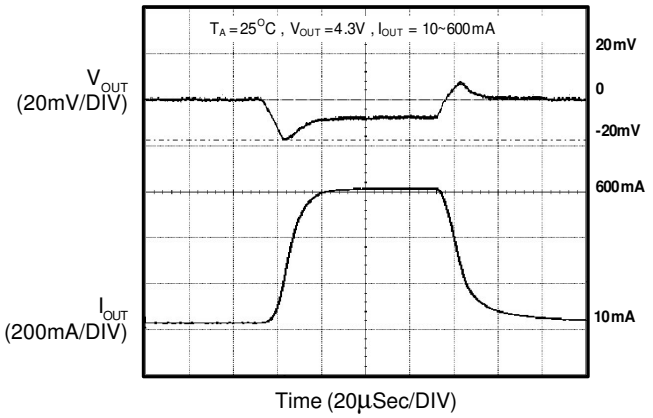
Load Transient Response



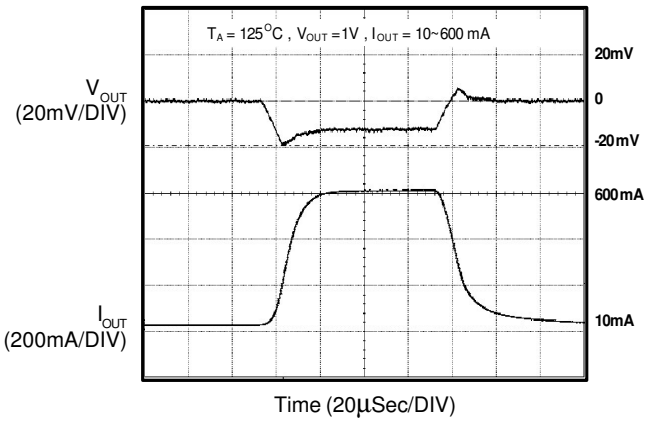
Load Transient Response



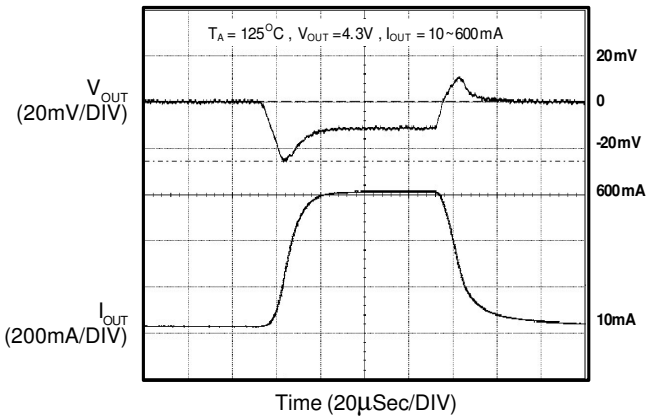
Load Transient Response



Load Transient Response

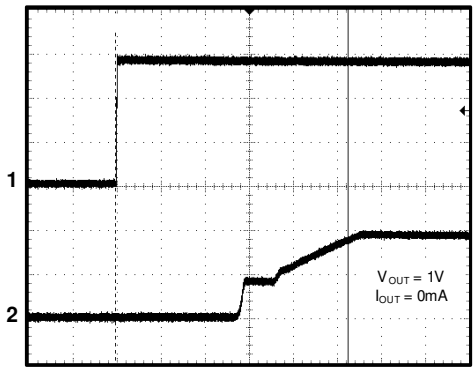


Load Transient Response



■ Characterization Curve (Contd.)

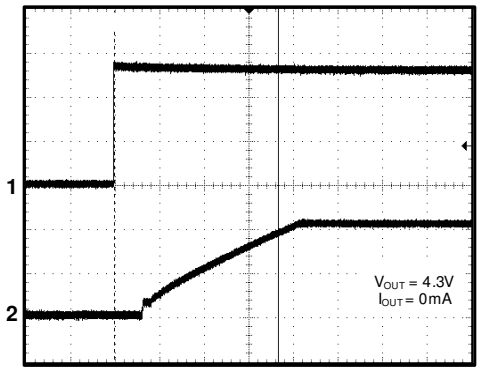
Chip Enable Transient Response



10µS/DIV

1) EN= 2V/Div
2) V_{OUT}= 500mV/Div

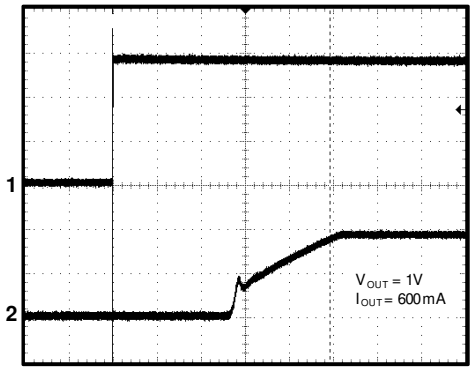
Chip Enable Transient Response



40µS/DIV

1) EN= 2V/Div
2) V_{OUT}= 2V/Div

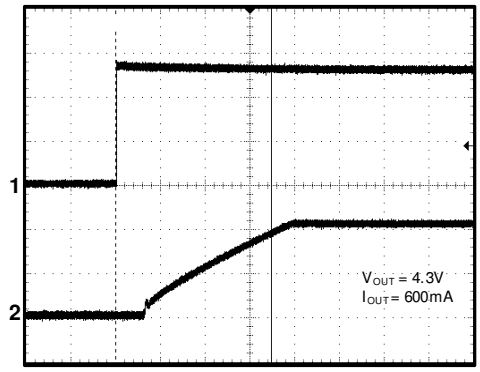
Chip Enable Transient Response



10µS/DIV

1) EN= 1V/Div
2) V_{OUT}= 500mV/Div

Chip Enable Transient Response

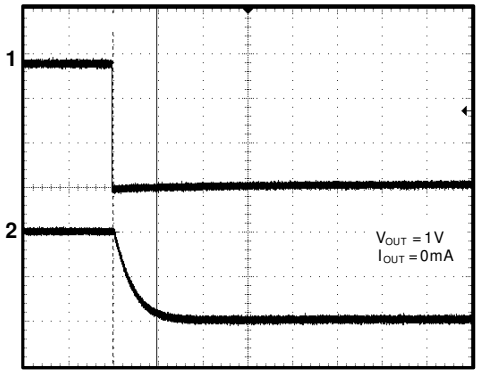


40µS/DIV

1) EN= 2V/Div
2) V_{OUT}= 2V/Div

■ Characterization Curve (Contd.)

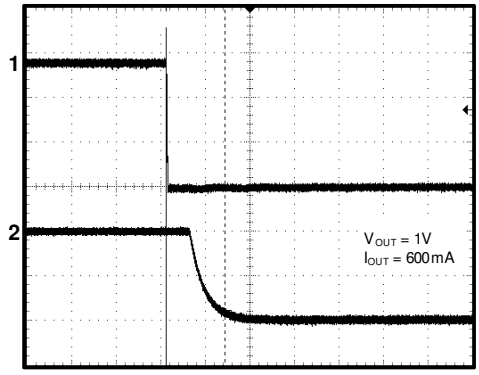
Shut Down Curve Output Voltage



40µS/DIV

1) EN= 1V/Div
2) V_{OUT}= 500mV/Div

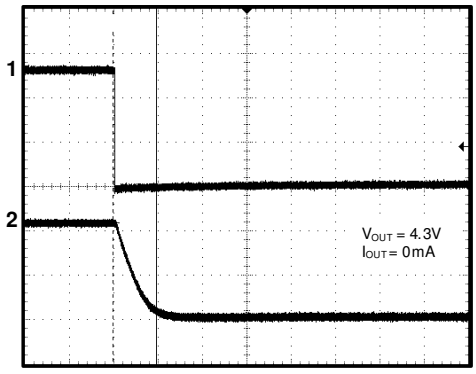
Shut Down Curve Output Voltage



4µS/DIV

1) EN= 1V/Div
2) V_{OUT}= 500mV/Div

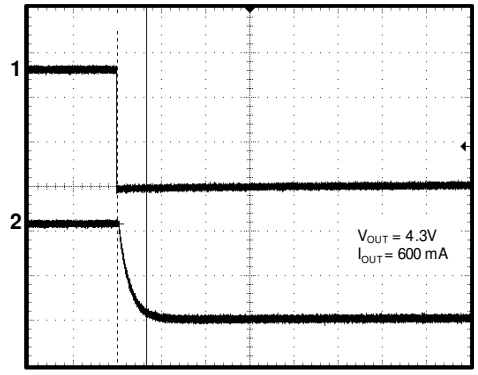
Shut Down Curve Output Voltage



40µS/DIV

1) EN= 2V/Div
2) V_{OUT}= 2V/Div

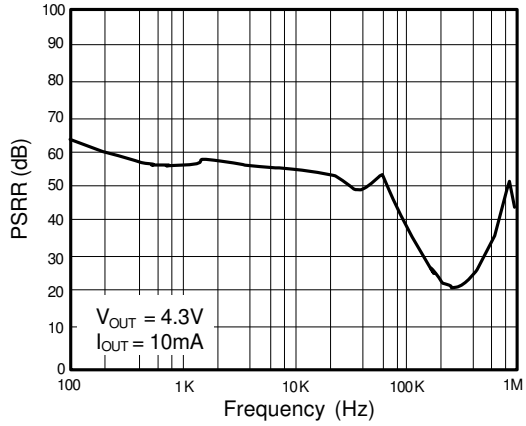
Shut Down Curve Output Voltage



20µS/DIV

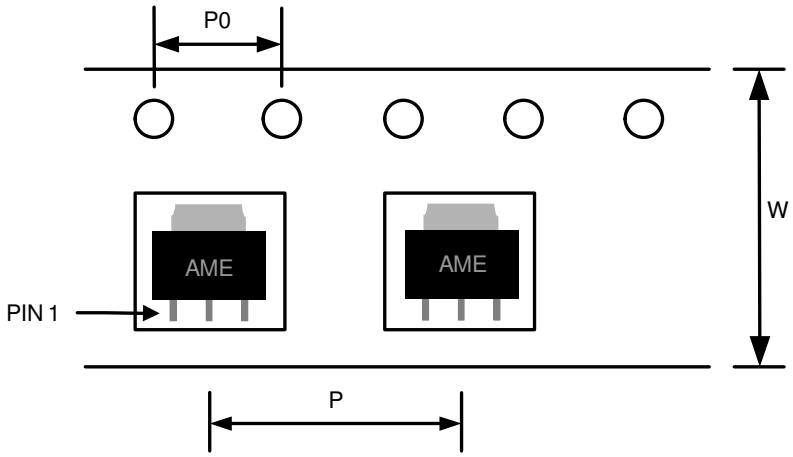
1) EN= 2V/Div
2) V_{OUT}= 2V/Div

PSRR vs Frequency



■ Tape and Reel Dimension

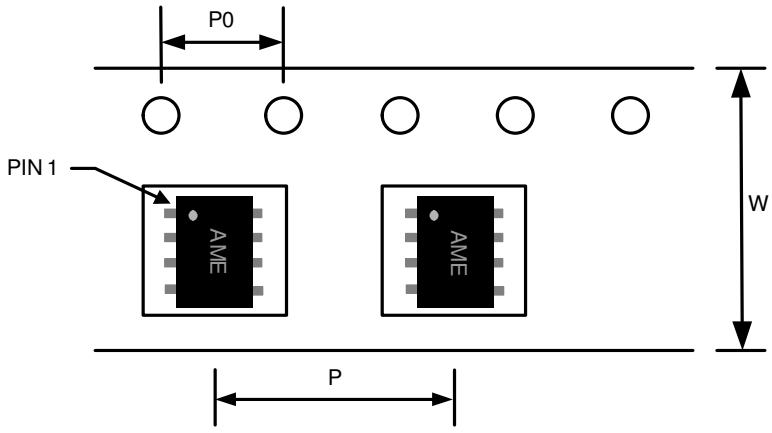
SOT-223



Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Pitch (P0)	Part Per Full Reel	Reel Size
SOT-223	12.0±0.1 mm	8.0±0.1 mm	4.0±0.1 mm	2500pcs	330±1 mm

SOP-8

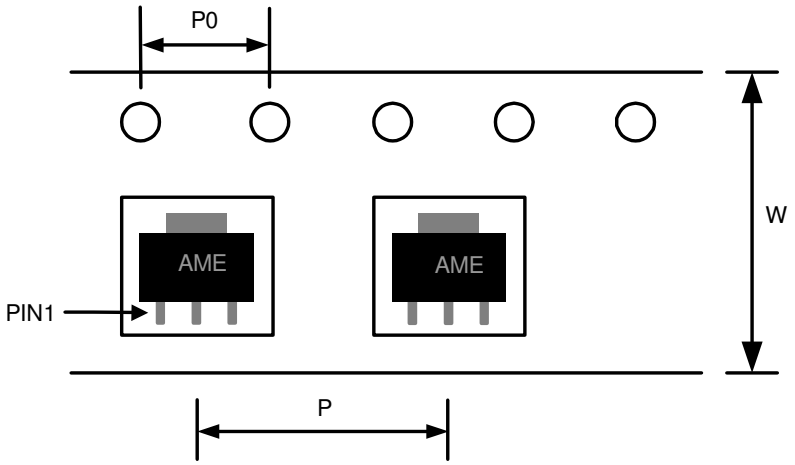


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Pitch (P0)	Part Per Full Reel	Reel Size
SOP-8	12.0±0.1 mm	8.0±0.1 mm	4.0±0.1 mm	2500pcs	330±1 mm

■ Tape and Reel Dimension (Contd.)

SOT-89

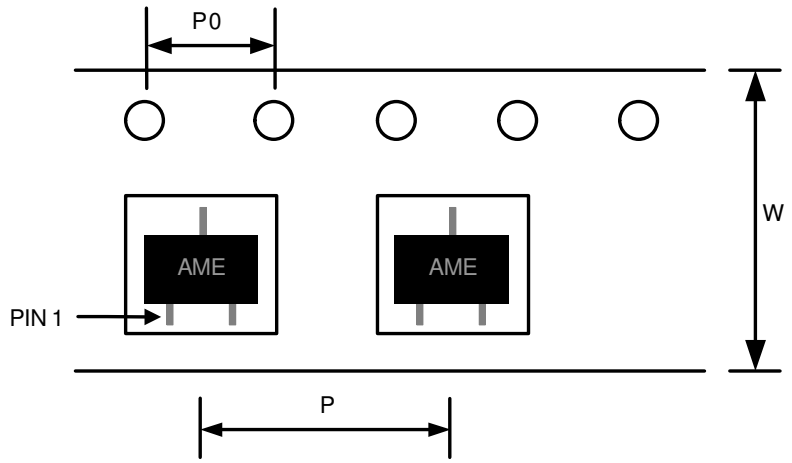


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Pitch (P0)	Part Per Full Reel	Reel Size
SOT-89	12.0±0.1 mm	8.0±0.1 mm	4.0±0.1 mm	1000pcs	180±1 mm

■ Tape and Reel Dimension (Contd.)

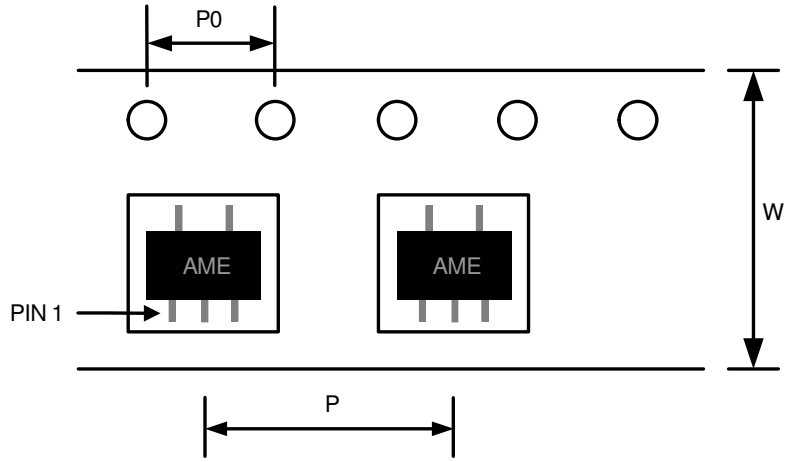
SOT-23



Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Pitch (P0)	Part Per Full Reel	Reel Size
SOT-23	8.0±0.1 mm	4.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

SOT-25

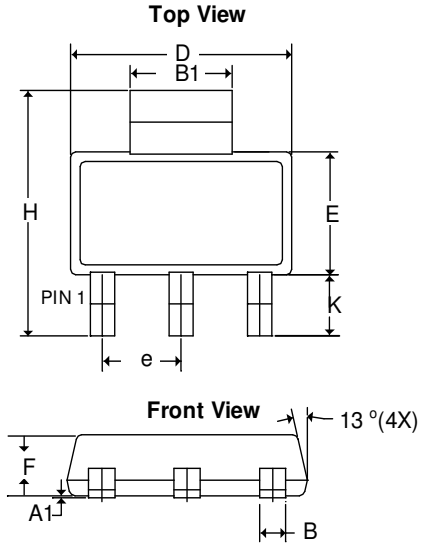


Carrier Tape, Number of Components Per Reel and Reel Size

Package	**Carrier Width (W)**	**Pitch (P)**	**Pitch (P0)**	**Part Per Full Reel**	**Reel Size**
SOT-25	8.0±0.1 mm	4.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

■ Package Dimension

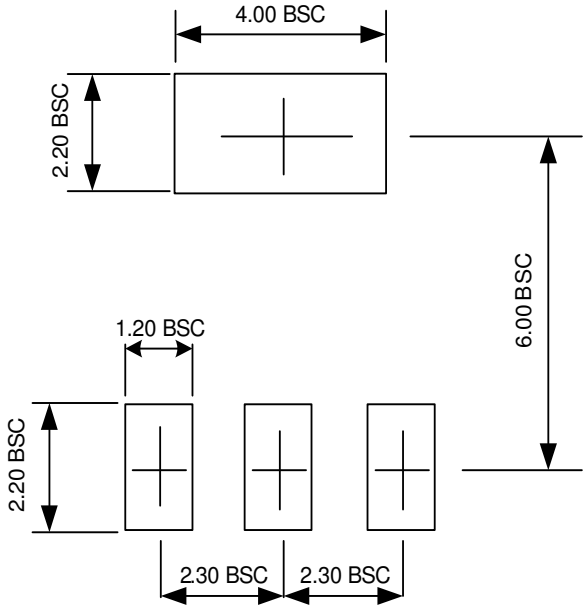
SOT-223



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A_1	0.01	0.10	0.0004	0.0039
B	0.60	0.84	0.0236	0.0330
B_1	2.90	3.15	0.1140	0.1240
C	0.23	0.38	0.0091	0.0150
D	6.20	6.71	0.2441	0.2640
E	3.30	3.71	0.1299	0.1460
e	2.30 BSC		0.0906 BSC	
F	1.40	1.80	0.0551	0.0709
H	6.70	7.30	0.2638	0.2874
K	1.665	1.669	0.0656	0.0657
θ	0°	10°	0°	10°

■ Lead Pattern

■ Lead Pattern



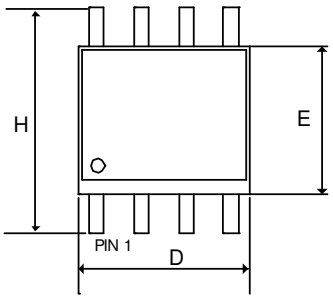
Note:

1. Lead pattern unit description:
   BSC: Basic. Represents theoretical exact dimension or dimension target.
2. Dimensions in Millimeters.
3. General tolerance ±0.05mm unless otherwise specified.

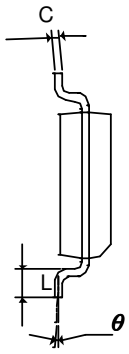
■ Package Dimension (Contd.)

SOP-8

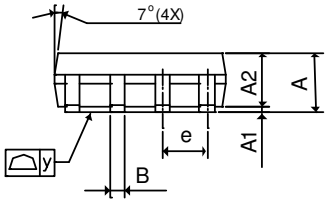
Top View



Side View



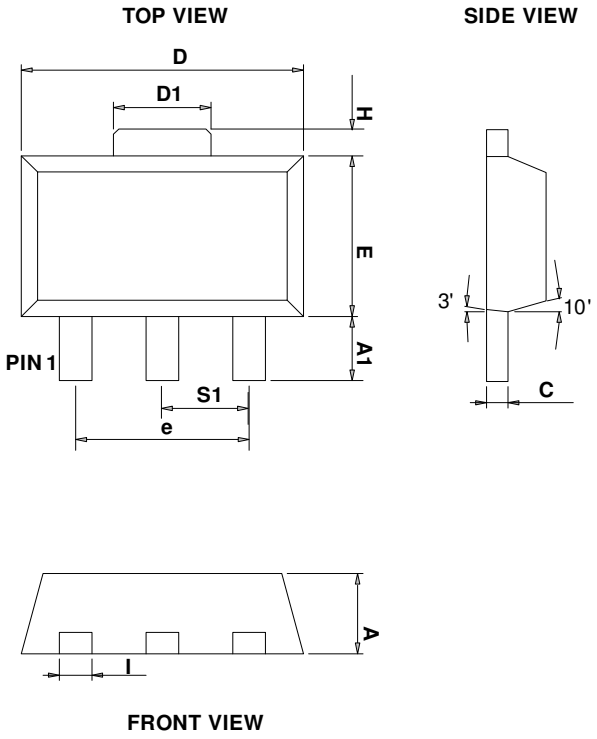
Front View



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.0531	0.0689
A_1	0.10	0.30	0.0039	0.0118
A2	1.473 REF		0.0580 REF	
B	0.33	0.51	0.0130	0.0201
C	0.17	0.25	0.0067	0.0098
D	4.70	5.33	0.1850	0.2098
E	3.80	4.00	0.1496	0.1575
e	1.27 BSC		0.0500 BSC	
L	0.40	1.27	0.0157	0.0500
H	5.80	6.30	0.2283	0.2480
y	-	0.10	-	0.0039
θ	0°	8°	0°	8°

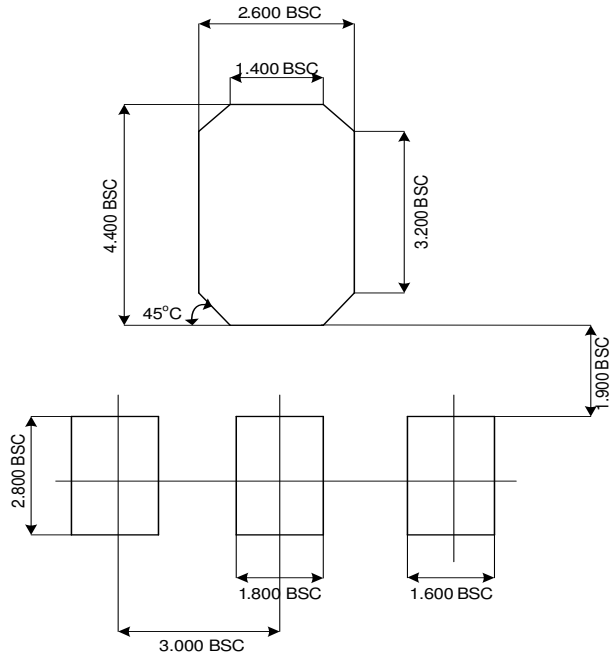
■ Package Dimension (Contd.)

SOT-89



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.39	1.60	0.0547	0.0630
A_1	0.8 REF		0.0315 REF	
C	0.35	0.44	0.0138	0.0173
D	4.39	4.60	0.1728	0.1811
D_1	1.35	1.85	0.0531	0.0728
E	2.28	2.60	0.0898	0.1024
I	0.32	0.56	0.0126	0.0220
e	3.00 REF		0.1181 REF	
H	0.70 REF		0.0276 REF	
S1	1.50 REF		0.0591 REF	

■ Lead Pattern

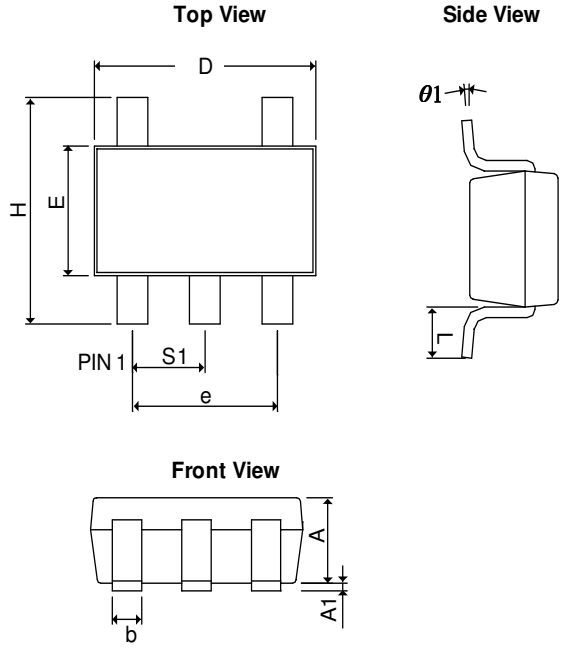


Note:

1. Lead pattern unit description:
   BSC: Basic. Represents theoretical exact dimension or dimension target.
2. Dimensions in Millimeters.
3. General tolerance ±0.05mm unless otherwise specified.

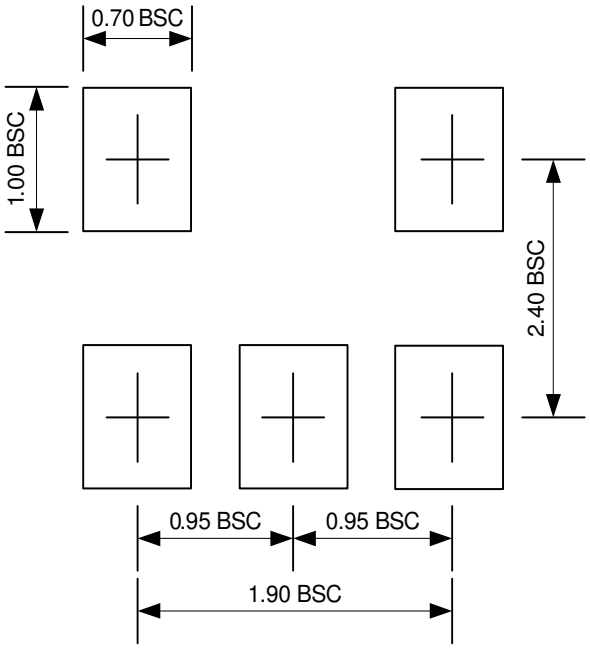
■ Package Dimension (Contd.)

SOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.30	0.0354	0.0512
A_1	0.00	0.15	0.0000	0.0059
b	0.30	0.55	0.0118	0.0217
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.0748 BSC	
H	2.60	3.00	0.1024	0.1181
L	0.37 BSC		0.0146 BSC	
θ1	0°	10°	0°	10°
S_1	0.95 BSC		0.0374 BSC	

■ Lead Pattern



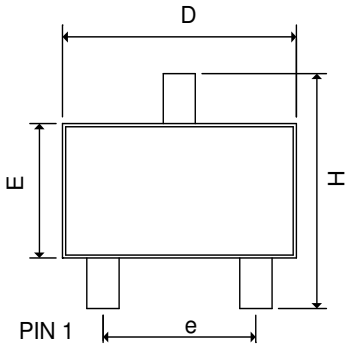
Note:

1. Lead pattern unit description:
   BSC: Basic. Represents theoretical exact dimension or dimension target.
2. Dimensions in Millimeters.
3. General tolerance ±0.05mm unless otherwise specified.

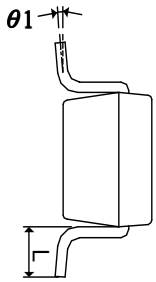
■ Package Dimension (Contd.)

SOT-23

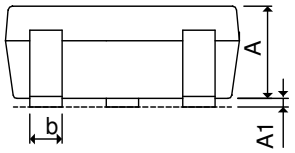
Top View



Side View

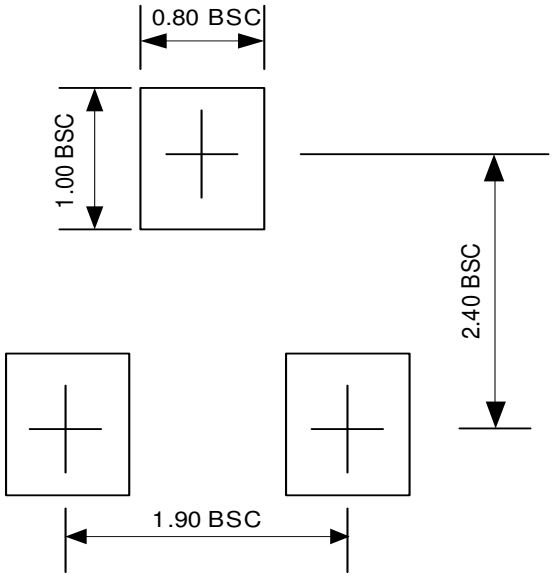


Front View



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.40	0.0354	0.0551
A_1	0.00	0.15	0.0000	0.0059
b	0.30	0.50	0.0118	0.0197
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.0748 BSC	
H	2.40	3.00	0.0945	0.1181
L	0.35BSC		0.0138 BSC	
θ1	0°	10°	0°	10°

■ Lead Pattern



Note:

1. Lead pattern unit description:
   BSC: Basic. Represents theoretical exact dimension or dimension target.
2. Dimensions in Millimeters.
3. General tolerance ±0.05mm unless otherwise specified.

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