300mA FIXED OUTPUT VOLTAGE LDO REGULATOR AP2115

General Description

The AP2115 is positive voltage regulator IC designed by CMOS process. The AP2115 has features of low dropout voltage, high output voltage accuracy and low current consumption. It consists of a voltage reference, an error amplifier, a resistor network for setting output voltage, a current limit circuit for current protection, a circuit for over temperature protection and a chip enable circuit. Thus, the AP2115 is suitable for various power sources for portable application.

The AP2115 is available in standard SOT-23-5 package.

Features

- High Ripple Rejection: 70dB at f=1KHz
- Ultra Low Dropout Voltage: 0.3V Typical at I_{OUT}=300mA
- Low Operation Current: 80μA Typical
- High Line Regulation: 4mV Typical
- High Load Regulation: 12mV Typical at I_{OUT}=300mA
- Low Temperature-drift Coefficient of Output Voltage
- High Output Voltage Accuracy: ± 2%
- Excellent Line Transient Response and Load Transient Response
- Output Voltage: 1.8V, 2.5V, 2.8V, 3.0V, 3.3V
- Low ESR Capacitor Compatible
- Wide Temperature Range: -40°C to 125°C
- Current and Thermal Protection

Application

- Mobile Phones, Cordless Phones
- Portable Games
- Cameras
- Portable AV Equipment
- Battery Powered Equipment

SOT-23-5

Figure 1. Package Type of AP2115

Pin Configuration

K Package
(SOT-23-5)

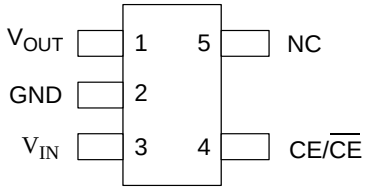
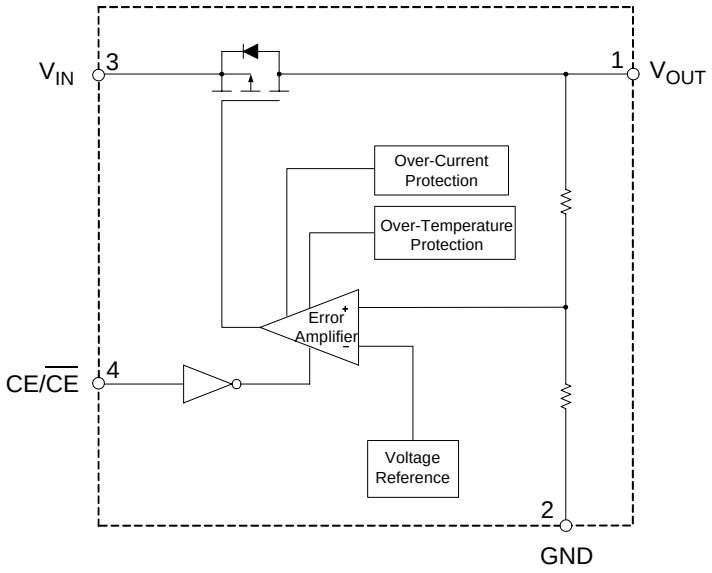


Figure 2. Pin Configuration of AP2115 (Top View)

Pin Description

Pin Number	Pin Name	Function
1	V_{OUT}	Voltage regulator output pin
2	GND	Ground pin
3	V_{IN}	Input voltage pin
4	CE/$\overline{CE}$	Active high/low enable input pin (active high for AP2115B)
5	NC	No connection

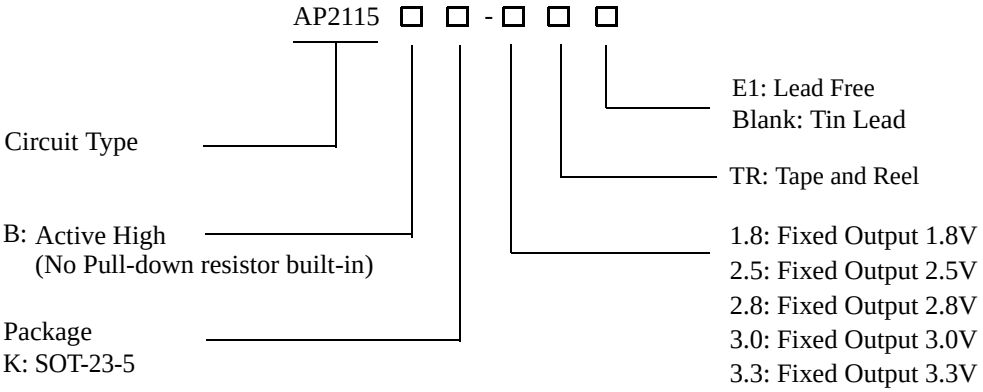
Functional Block Diagram



Active High Version

Figure 3. Functional Block Diagram of AP2115

Ordering Information



Ordering Information (Continued)

Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
SOT-23-5	-40 to 125°C	AP2115BK-1.8TR	AP2115BK-1.8TRE1	K7B	E7B	Tape & Reel
		AP2115BK-2.5TR	AP2115BK-2.5TRE1	K7D	E7D	Tape & Reel
		AP2115BK-2.8TR	AP2115BK-2.8TRE1	K7F	E7F	Tape & Reel
		AP2115BK-3.0TR	AP2115BK-3.0TRE1	K7H	E7H	Tape & Reel
		AP2115BK-3.3TR	AP2115BK-3.3TRE1	K7J	E7J	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Input Voltage (Note 2)	V_{IN}	-0.3 to 8	V
Input Voltage (CE/$\overline{CE}$ Pin)	V_{SHDN}	-0.3 to V_{IN}+0.3	V
Output Voltage	V_{OUT}	-0.3 to V_{IN}+0.3	V
Output Current	I_{OUT}	500	mA
Power Dissipation	P_D	250	mW
Storage Temperature Range	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10sec)	T_{LEAD}	300	°C
ESD (Machine Model)	ESD	200	V

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: All voltage values are with respect to network ground terminal.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Input Voltage (Note 3)	V_{IN}	2.2	6.5	V
Operating Junction Temperature Range	T_J	-40	125	°C

Note 3: To calculate the minimum input voltage for maximum output current, the following formula is recommended:
$V_{IN(Min)}=V_{OUT(Max)}+V_{DROP(Max\ load)}$

Electrical Characteristics

AP2115-1.8V Electrical Characteristics

$V_{IN}=V_{OUT}+1V$, $T_A=25^oC$, $C_{IN}=1\mu F$, $C_L=1\mu F$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$1mA\leq I_{OUT}\leq 30mA$	1.764	1.8	1.836	V
Output Current	I_{OUT}		300			mA
Current Limit				500		mA
Quiescent Current				80	150	μA
Ground Pin Current	I_{GND}	I_{OUT}=300mA		90	150	μA
Dropout Voltage (Note 4)	V_{DROP}	I_{OUT}=1mA		400	600	mV
		I_{OUT}=50mA		400	600	
		I_{OUT}=200mA		400	600	
		I_{OUT}=300mA		600	900	
Load Regulation	V_{RLOAD}	$1mA\leq I_{OUT}\leq 300mA$		7.2	18	mV
Line Regulation	V_{RLINE}	$V_{OUT}+0.5V\leq V_{IN}\leq 6V$ I_{OUT}=30mA		4	15	mV
CE/$\overline{CE}$ Input High Threshold	V_{IH}		1.5			V
CE/$\overline{CE}$ Input Low Threshold	V_{IL}				0.4	V
CE/$\overline{CE}$ Bias Current	I_{SD}				100	nA
Shutdown Supply Current	I_{GSD}	V_{OUT}=0V		0.1	1	μA
Thermal Shutdown Temperature	T_{SD}			165		^oC
Power Supply Ripple Rejection	PSRR	Ripple $0.5V_{P-P}$ f=1kHz, I_{OUT}=30mA		70		dB
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	I_{OUT}=30mA $-40^oC\leq T_J\leq 125^oC$		180		$\mu V/^oC$
Short Current Limit	I_{LIMIT}	V_{OUT}=0V		450		mA
Turn-on Time (Note 5)	T_{ON}			60		μs
RMS Output Noise	V_{NOISE}	$T_A=25^oC$ 10Hz≤f≤100kHz		200		μVrms

Note 4: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 98% of its nominal value which is measured at V_{OUT}+1V applied to V_{IN}. The 1.8V version dropout voltage is limited by the input voltage range.

Note 5: Turn-on time is time measured between the enable input just exceeding V_{IH} and the output voltage just reaching 95% of its nominal value.

Electrical Characteristics (Continued)

AP2115-2.5V Electrical Characteristics

$V_{IN}=V_{OUT}+1V$, $T_A=25^oC$, $C_{IN}=1\mu F$, $C_L=1\mu F$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$1mA\leq I_{OUT}\leq 30mA$	2.45	2.5	2.55	V
Output Current	I_{OUT}		300			mA
Current Limit				500		mA
Quiescent Current				80	150	μA
Ground Pin Current	I_{GND}	I_{OUT}=300mA		90	150	μA
Dropout Voltage (Note 4)	V_{DROP}	I_{OUT}=1mA		1	5	mV
		I_{OUT}=50mA		50	75	
		I_{OUT}=200mA		200	300	
		I_{OUT}=300mA		300	450	
Load Regulation	V_{RLOAD}	$1mA\leq I_{OUT}\leq 300mA$		10	25	mV
Line Regulation	V_{RLINE}	$V_{OUT}+0.5V\leq V_{IN}\leq 6V$ I_{OUT}=30mA		4	15	mV
CE/$\overline{CE}$ Input High Threshold	V_{IH}		1.5			V
CE/$\overline{CE}$ Input Low Threshold	V_{IL}				0.4	V
CE/$\overline{CE}$ Bias Current	I_{SD}				100	nA
Shutdown Supply Current	I_{GSD}	V_{OUT}=0V		0.1	1	μA
Thermal Shutdown Temperature	T_{SD}			165		^oC
Power Supply Ripple Rejection	PSRR	Ripple $0.5V_{P-P}$ f=1kHz, I_{OUT}=30mA		70		dB
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	I_{OUT}=30mA $-40^oC\leq T_J\leq 125^oC$		250		μV/^oC
Short Current Limit	I_{LIMIT}	V_{OUT}=0V		450		mA
Turn-on Time (Note 5)	T_{ON}			60		μs
RMS Output Noise	V_{NOISE}	$T_A=25^oC$ 10Hz≤f≤100kHz		200		μVrms

Note 4: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 98% of its nominal value which is measured at V_{OUT}+1V applied to V_{IN}.

Note 5: Turn-on time is time measured between the enable input just exceeding V_{IH} and the output voltage just reaching 95% of its nominal value.

Electrical Characteristics (Continued)

AP2115-2.8V Electrical Characteristics

$V_{IN}=V_{OUT}+1V$, $T_A=25^oC$, $C_{IN}=1\mu F$, $C_L=1\mu F$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$1mA \le I_{OUT} \le 30mA$	2.744	2.8	2.856	V
Output Current	I_{OUT}		300			mA
Current Limit				500		mA
Quiescent Current				80	150	μA
Ground Pin Current	I_{GND}	I_{OUT}=300mA		90	150	μA
Dropout Voltage (Note 4)	V_{DROP}	I_{OUT}=1mA		1	5	mV
		I_{OUT}=50mA		50	75	
		I_{OUT}=200mA		200	300	
		I_{OUT}=300mA		300	450	
Load Regulation	V_{RLOAD}	$1mA \le I_{OUT} \le 300mA$		11.2	28	mV
Line Regulation	V_{RLINE}	$V_{OUT}+0.5V \le V_{IN} \le 6V$ I_{OUT}=30mA		4	15	mV
CE/$\overline{CE}$ Input High Threshold	V_{IH}		1.5			V
CE/$\overline{CE}$ Input Low Threshold	V_{IL}				0.4	V
CE/$\overline{CE}$ Bias Current	I_{SD}				100	nA
Shutdown Supply Current	I_{GSD}	V_{OUT}=0V		0.1	1	μA
Thermal Shutdown Temperature	T_{SD}			165		^oC
Power Supply Ripple Rejection	PSRR	Ripple $0.5V_{P-P}$ f=1kHz, I_{OUT}=30mA		70		dB
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	I_{OUT}=30mA $-40^oC \le T_J \le 125^oC$		280		μV/^oC
Short Current Limit	I_{LIMIT}	V_{OUT}=0V		450		mA
Turn-on Time (Note 5)	T_{ON}			60		μs
RMS Output Noise	V_{NOISE}	$T_A=25^oC$ 10Hz≤f ≤100kHz		200		μVrms

Note 4: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 98% of its nominal value which is measured at V_{OUT}+1V applied to V_{IN}.

Note 5: Turn-on time is time measured between the enable input just exceeding V_{IH} and the output voltage just reaching 95% of its nominal value.

Electrical Characteristics (Continued)

AP2115-3.0V Electrical Characteristics

$V_{IN}=V_{OUT}+1V$, $T_A=25^oC$, $C_{IN}=1\mu F$, $C_L=1\mu F$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$1mA \le I_{OUT} \le 30mA$	2.94	3.0	3.06	V
Output Current	I_{OUT}		300			mA
Current Limit				500		mA
Quiescent Current				80	150	μA
Ground Pin Current	I_{GND}	I_{OUT}=300mA		90	150	μA
Dropout Voltage (Note 4)	V_{DROP}	I_{OUT}=1mA		1	5	mV
		I_{OUT}=50mA		50	75	
		I_{OUT}=200mA		200	300	
		I_{OUT}=300mA		300	450	
Load Regulation	V_{RLOAD}	$1mA \le I_{OUT} \le 300mA$		12	30	mV
Line Regulation	V_{RLINE}	$V_{OUT}+0.5V \le V_{IN} \le 6V$ I_{OUT}=30mA		4	15	mV
CE/$\overline{CE}$ Input High Threshold	V_{IH}		1.5			V
CE/$\overline{CE}$ Input Low Threshold	V_{IL}				0.4	V
CE/$\overline{CE}$ Bias Current	I_{SD}				100	nA
Shutdown Supply Current	I_{GSD}	V_{OUT}=0V		0.1	1	μA
Thermal Shutdown Temperature	T_{SD}			165		^oC
Power Supply Ripple Rejection	PSRR	Ripple $0.5V_{P-P}$ f=1kHz, I_{OUT}=30mA		70		dB
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	I_{OUT}=30mA $-40^oC \le T_J \le 125^oC$		300		μV/^oC
Short Current Limit	I_{LIMIT}	V_{OUT}=0V		450		mA
Turn-on Time (Note 5)	T_{ON}			60		μs
RMS Output Noise	V_{NOISE}	$T_A=25^oC$ 10Hz≤f≤100kHz		200		μVrms

Note 4: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 98% of its nominal value which is measured at V_{OUT}+1V applied to V_{IN}.

Note 5: Turn-on time is time measured between the enable input just exceeding V_{IH} and the output voltage just reaching 95% of its nominal value.

Electrical Characteristics (Continued)

AP2115-3.3V Electrical Characteristics

$V_{IN}=V_{OUT}+1V$, $T_A=25^oC$, $C_{IN}=1\mu F$, $C_L=1\mu F$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	$1mA \le I_{OUT} \le 30mA$	3.234	3.3	3.366	V
Output Current	I_{OUT}		300			mA
Current Limit				500		mA
Quiescent Current				80	150	μA
Ground Pin Current	I_{GND}	I_{OUT}=300mA		90	150	μA
Dropout Voltage (Note 4)	V_{DROP}	I_{OUT}=1mA		1	5	mV
		I_{OUT}=50mA		50	75	
		I_{OUT}=200mA		200	300	
		I_{OUT}=300mA		300	450	
Load Regulation	V_{RLOAD}	$1mA \le I_{OUT} \le 300mA$		13.2	33	mV
Line Regulation	V_{RLINE}	$V_{OUT}+0.5V \le V_{IN} \le 6V$ I_{OUT}=30mA		4	15	mV
CE/$\overline{CE}$ Input High Threshold	V_{IH}		1.5			V
CE/$\overline{CE}$ Input Low Threshold	V_{IL}				0.4	V
CE/$\overline{CE}$ Bias Current	I_{SD}				100	nA
Shutdown Supply Current	I_{GSD}	V_{OUT}=0V		0.1	1	μA
Thermal Shutdown Temperature	T_{SD}			165		^oC
Power Supply Ripple Rejection	PSRR	Ripple $0.5V_{P-P}$ f=1kHz, I_{OUT}=30mA		70		dB
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	I_{OUT}=30mA $-40^oC \le T_J \le 125^oC$		330		μV/^oC
Short Current Limit	I_{LIMIT}	V_{OUT}=0V		450		mA
Turn-on Time (Note 5)	T_{ON}			60		μs
RMS Output Noise	V_{NOISE}	$T_A=25^oC$ 10Hz≤f≤100kHz		200		μVrms

Note 4: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 98% of its nominal value which is measured at V_{OUT}+1V applied to V_{IN}.

Note 5: Turn-on time is time measured between the enable input just exceeding V_{IH} and the output voltage just reaching 95% of its nominal value.

Typical Performance Characteristics

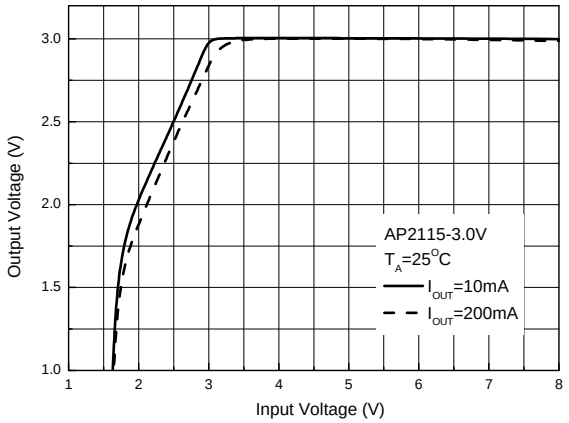


Figure 4. Output Voltage vs. Input Voltage

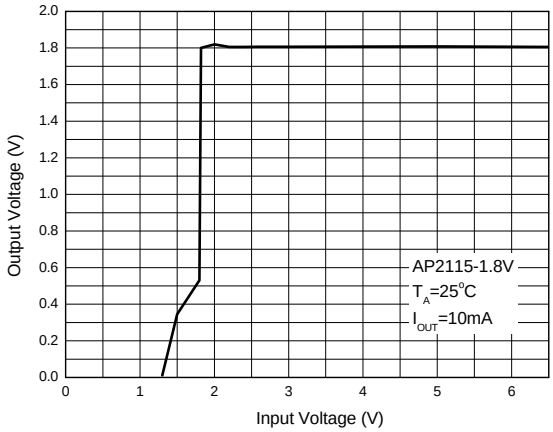


Figure 5. Output Voltage vs. Input Voltage

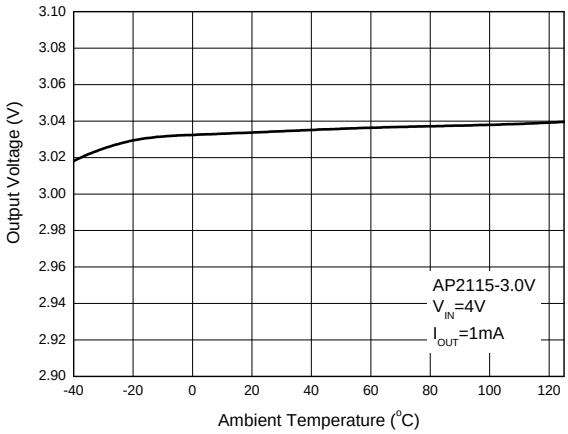


Figure 6. Output Voltage vs. Temperature

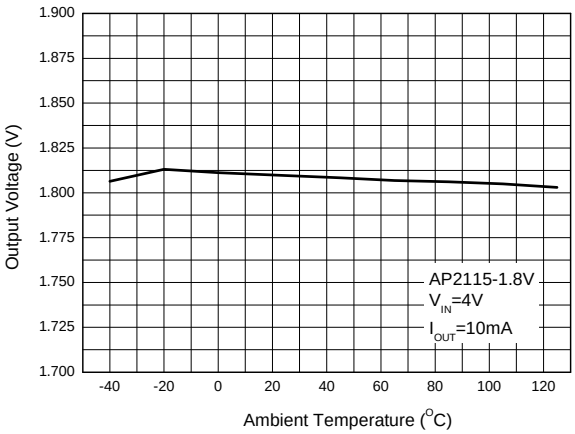


Figure 7. Output Voltage vs. Temperature

Typical Performance Characteristics

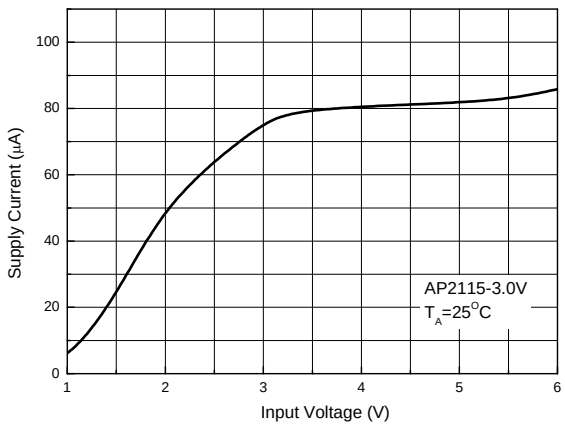


Figure 8. Input Voltage vs. Supply Current (No Load)

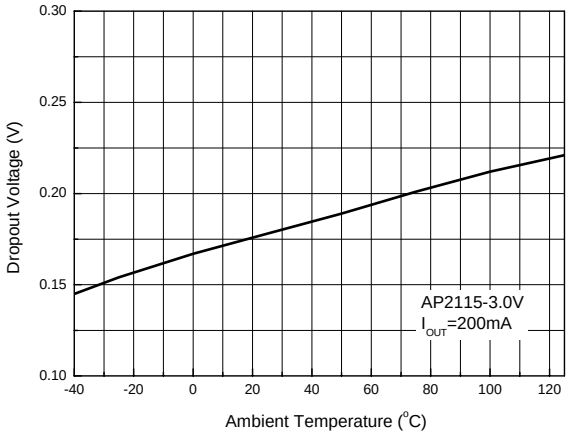


Figure 9. Dropout Voltage vs. Ambient Temperature

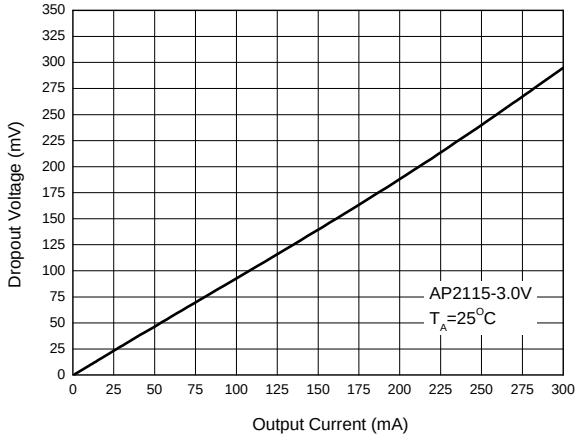


Figure 10. Dropout Voltage vs. Output Current

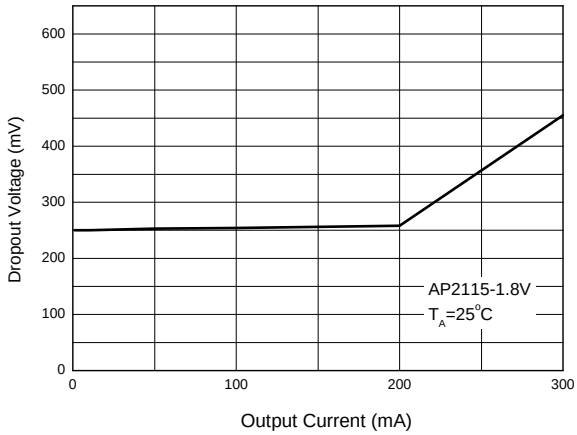


Figure 11. Dropout Voltage vs. Output Current

Typical Performance Characteristics (Continued)

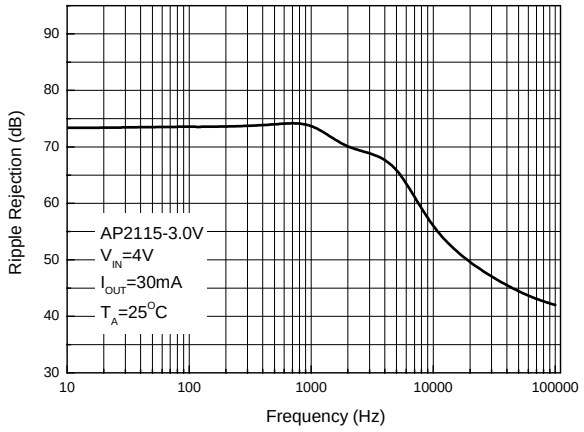


Figure 12. Ripple Rejection vs. Frequency

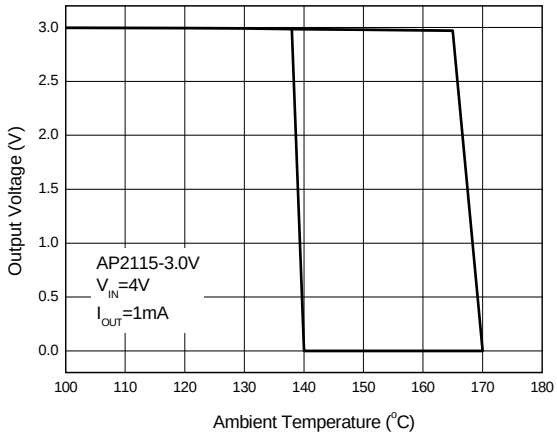


Figure 13. Output Voltage vs. Ambient Temperature

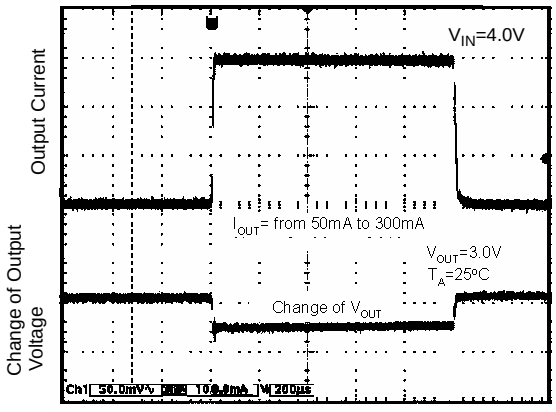


Figure 14. Load Transient

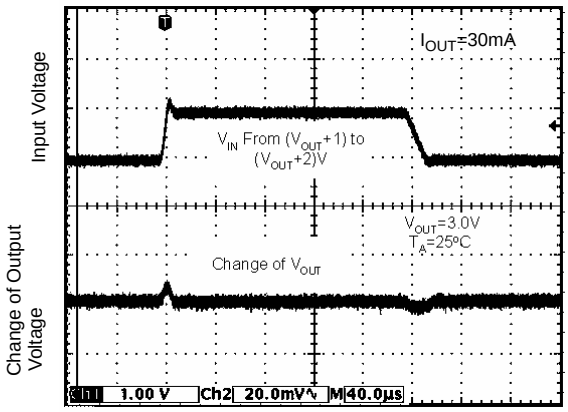


Figure 15. Line Transient

Typical Performance Characteristics (Continued)

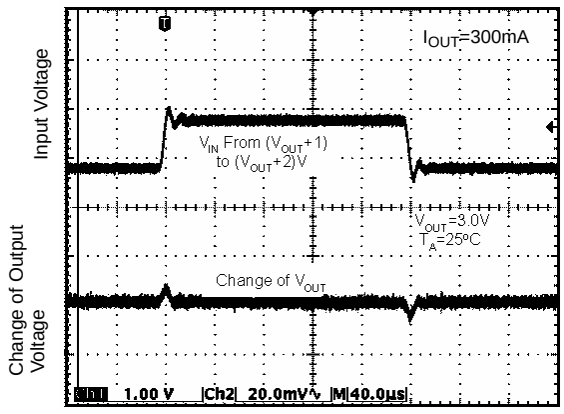


Figure 16. Line Transient

Typical Application

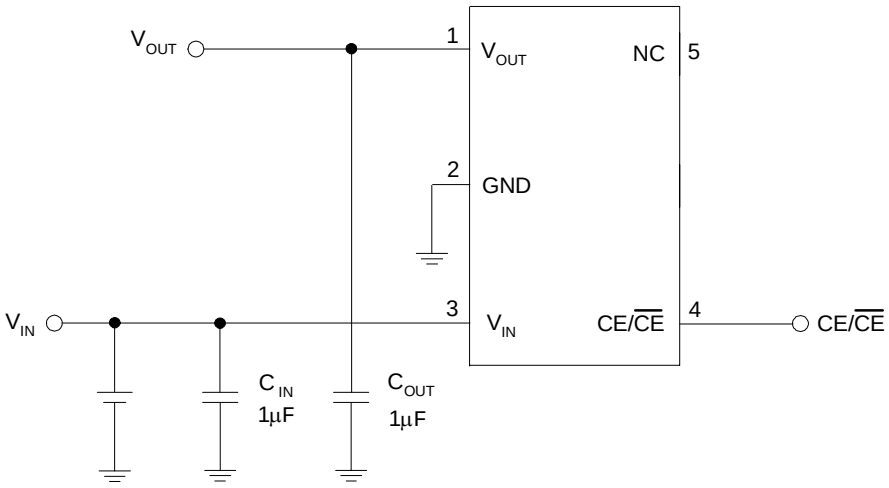
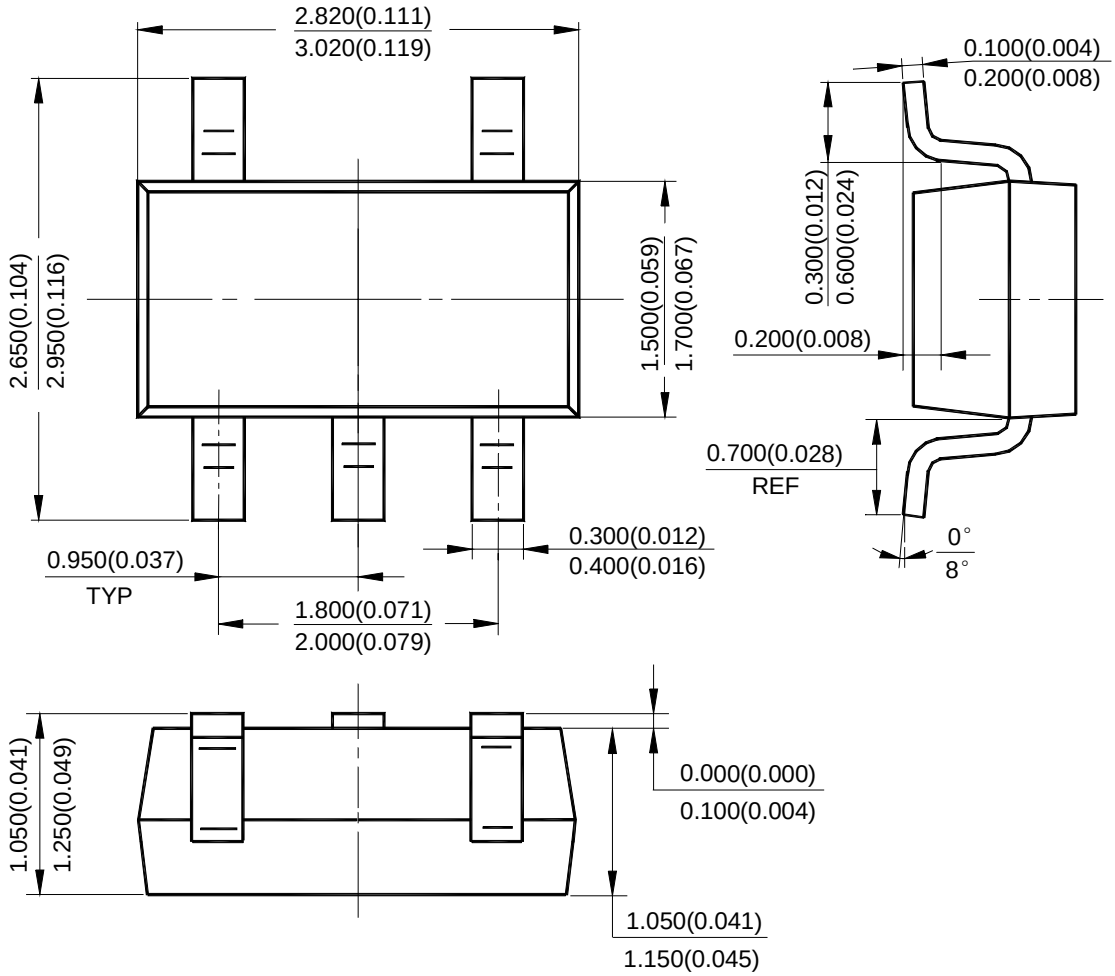


Figure 17. Typical Application of AP2115

Note: Filter capacitors are required at the AP2115's input and output. 1μF capacitors are required at the input. The minimum output capacitance required for stability should be≥1μF with ESR from 0.1Ω to 10Ω.

Mechanical Dimensions

SOT-23-5 **Unit: mm(inch)**



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