Preliminary Datasheet

1A LOW NOISE CMOS LDO REGULATOR WITH ENABLE AP2115

General Description

The AP2115 is CMOS process low dropout linear regulator with enable function, the regulator delivers a guaranteed 1A (min.) continuous load current.

The AP2115 features low power consumption.

The AP2115 is available in 1.2V, 1.8V, 2.5V and 3.3V regulator output, and available in excellent output accuracy ±1.5%, it is also available in an excellent load regulation and line regulation performance.

The AP2115 is available in standard packages of SOIC-8 and SOT-89-5.

Features

- Output Voltage Accuracy: ±1.5%
- Output Current: 1A (Min.)
- Fold-back Short Current Protection: 50mA
- Low Dropout Voltage (3.3V): 450mV (Typ.) @ I_{OUT}=1A
- Stable with 4.7μF Flexible Cap: Ceramic, Tantalum and Aluminum Electrolytic
- Excellent Line Regulation: 0.02%/V (Typ.), 0.1%/V (Max.) @ I_{OUT}=30mA
- Excellent Load Regulation: 0.2%/A @ I_{OUT}=1mA to 1A
- Low Quiescent Current: 60μA (1.2V/1.8V/2.5V)
- Low Output Noise: 30μV_{RMS}
- PSRR: 68dB @ Freq=1kHz (1.2V/1.8V)
- OTSD Protection
- Operation Temperature Range: -40°C to 85°C
- ESD: MM 400V, HBM 4000V

Applications

- LCD Monitor
- LCD TV
- STB

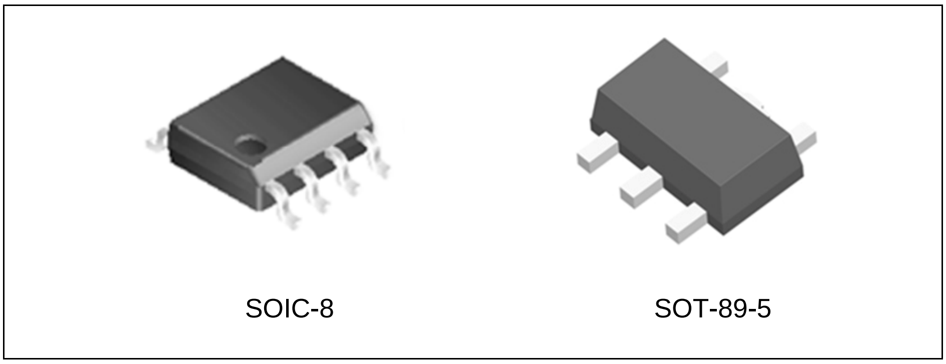


Figure 1. Package Types of AP2115

Pin Configuration

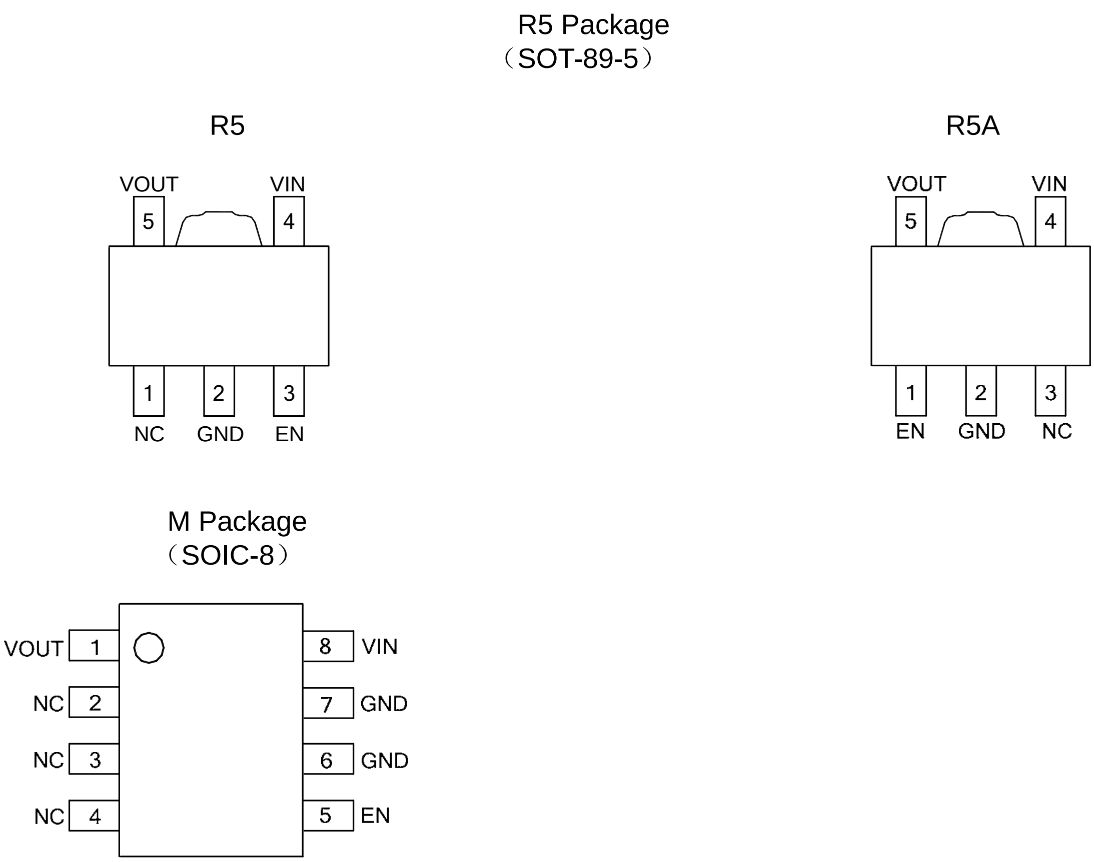


Figure 2. Pin Configuration of AP2115 (Top View)

Pin Descriptions

Pin No.		Name	Function
SOT-89-5	SOIC-8		
1	2, 3, 4	NC/EN	No connection/Chip Enable
2	6, 7	GND	GND
3	5	EN/NC	Chip Enable, H – normal work, L – shutdown output/ No Connection
4	8	VIN	Input Voltage
5	1	VOUT	Output Voltage

Functional Block Diagram

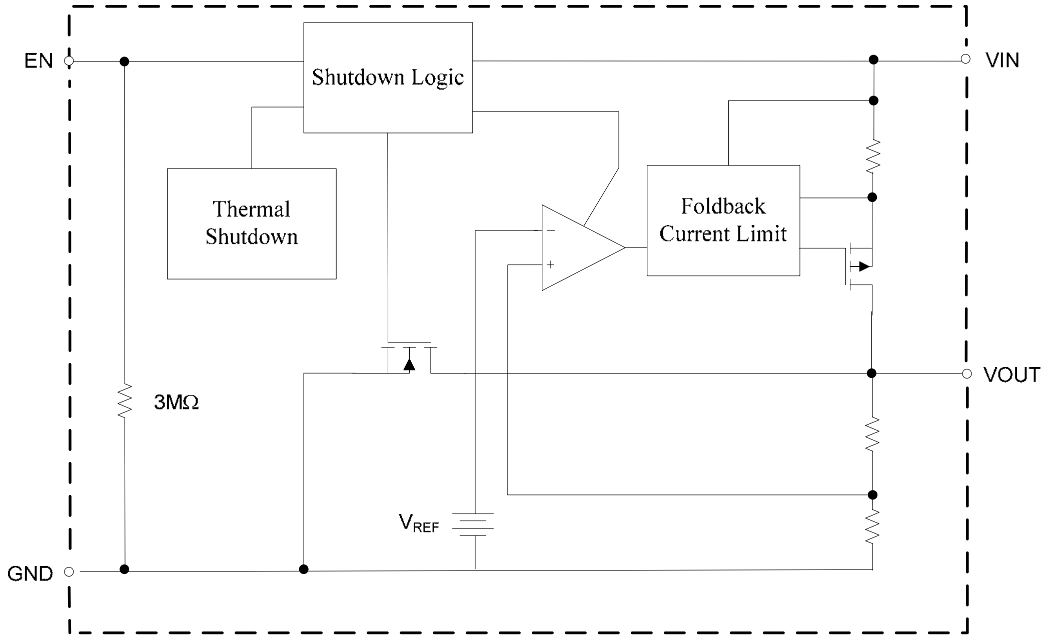
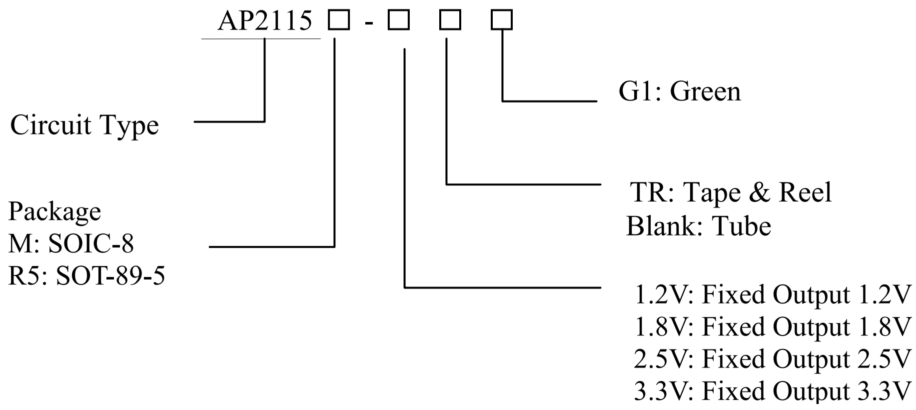


Figure 3. Functional Block Diagram of AP2115

Ordering Information



Package	Temperature Range	Condition	Part Number	Marking ID	Packing Type
SOIC-8	-40 to 85°C	1.2V	AP2115M-1.2G1	2115M-1.2G1	Tube
			AP2115M-1.2TRG1	2115M-1.2G1	Tape & Reel
		1.8V	AP2115M-1.8G1	2115M-1.8G1	Tube
			AP2115M-1.8TRG1	2115M-1.8G1	Tape & Reel
		2.5V	AP2115M-2.5G1	2115M-2.5G1	Tube
			AP2115M-2.5TRG1	2115M-2.5G1	Tape & Reel
		3.3V	AP2115M-3.3G1	2115M-3.3G1	Tube
			AP2115M-3.3TRG1	2115M-3.3G1	Tape & Reel
SOT-89-5	-40 to 85°C	1.2V (R5)	AP2115R5-1.2TRG1	G22G	Tape & Reel
		1.8V (R5)	AP2115R5-1.8TRG1	G22H	Tape & Reel
		2.5V (R5)	AP2115R5-2.5TRG1	G37H	Tape & Reel
		3.3V (R5)	AP2115R5-3.3TRG1	G41H	Tape & Reel
SOT-89-5	-40 to 85°C	1.2V (R5A)	AP2115R5A-1.2TRG1	G27D	Tape & Reel
		1.8V (R5A)	AP2115R5A-1.8TRG1	G27G	Tape & Reel
		2.5V (R5A)	AP2115R5A-2.5TRG1	G41F	Tape & Reel
		3.3V (R5A)	AP2115R5A-3.3TRG1	G41G	Tape & Reel

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

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	6.5	V
Operating Junction Temperature Range	T_J	150	ºC
Storage temperature Range	T_{STG}	-65 to 150	ºC
Lead Temperature (Soldering,10 Seconds)	T_{LEAD}	260	ºC
ESD (Machine Model)		400	V
ESD (Human Body Model)		4000	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.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{IN}	2.5	6.0	V
Ambient Operation Temperature Range	T_A	-40	85	°C

Electrical Characteristics

AP2115-1.2 Electrical Characteristics (Note 2)

V_{IN}=2.5V, C_{IN}=4.7μF (Ceramic), C_{OUT}=4.7μF (Ceramic), Typical T_A=25°C, **Bold** typeface applies over -40°C≤T_J≤85°C ranges, unless otherwise specified (Note 3).

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_{OUT}	V_{IN}=2.5V, 1mA ≤ I_{OUT} ≤ 30mA		V_{OUT} ×98.5%	1.2	V_{OUT} ×101.5%	V
Input Voltage	V_{IN}					6	V
Maximum Output Current	$I_{OUT(MAX)}$	V_{IN}=2.5V, V_{OUT}=1.182V to 1.218V		1			A
Load Regulation	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle I_{OUT}}$	V_{IN}=2.5V, 1mA ≤ I_{OUT} ≤1A			0.2	1	%/A
Line Regulation	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle V_{IN}}$	2.5V≤V_{IN}≤6V, I_{OUT}=30mA		-0.1	0.02	0.1	%/V
Dropout Voltage	V_{DROP}	I_{OUT}=1.0A			1200	1300	mV
Quiescent Current	I_Q	V_{IN}=2.5V, I_{OUT}=0mA			60	75	μA
Power Supply Rejection Ratio	PSRR	Ripple 1Vp-p V_{IN}=2.5V, I_{OUT}=100mA	f=100Hz		68		dB
			f=1KHz		68		
Output Voltage Temperature Coefficient	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle T}$	I_{OUT}=30mA, T_A =-40°C to 85°C			±30		ppm/°C
Short Current Limit	I_{SHORT}	V_{OUT}=0V			50		mA
RMS Output Noise	V_{NOISE}	10Hz ≤ f ≤100kHz (No Load)			30		μV_{RMS}
V_{EN} High Voltage	V_{IH}	Enable logic high, regulator on		1.5			V
V_{EN} Low Voltage	V_{IL}	Enable logic low, regulator off				0.4	
Standby Current	I_{STD}	V_{IN}=3.5V, V_{EN} in OFF mode			0.01	1.0	μA
Start-up Time	t_S	No Load			20		μs
EN Pull Down Resistor	R_{PD}				3.0		MΩ
V_{OUT} Discharge Resistor	R_{DCHG}	Set EN pin at Low			60		Ω
Thermal Shutdown Temperature	T_{OTSD}				160		°C
Thermal Shutdown Hysteresis	T_{HYOTSD}				25		
Thermal Resistance	θ_{JC}	SOIC-8			74.6		°C/W
		SOT-89-5			47		

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.
Note 3: Production testing at T_A=25°C. Over temperature specifications guaranteed by design only.

Electrical Characteristics (Continued)

AP2115-1.8 Electrical Characteristics (Note 2)

V_{IN}=2.8V, C_{IN}=4.7μF (Ceramic), C_{OUT}=4.7μF (Ceramic), Typical T_A=25°C, **Bold** typeface applies over -40°C≤T_J≤85°C ranges, unless otherwise specified (Note 3).

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	V_{IN}=2.8V, 1mA ≤ I_{OUT} ≤ 30mA	98.5% ×V_{OUT}	1.8	101.5% × V_{OUT}	V
Maximum Output Current	$I_{OUT(MAX)}$	V_{IN}=2.8V, V_{OUT}=1.773V to 1.827V	1			A
Load Regulation	$\frac{\Delta V_{OUT}/V_{OUT}}{\Delta I_{OUT}}$	V_{IN}=2.8V, 1mA ≤ I_{OUT} ≤1A		0.2	1	%/A
Line Regulation	$\frac{\Delta V_{OUT}/V_{OUT}}{\Delta V_{IN}}$	2.8V≤V_{IN}≤6V, I_{OUT}=30mA	-0.1	0.02	0.1	%/V
Dropout Voltage	V_{DROP}	I_{OUT}=1.0A		500	750	mV
Quiescent Current	I_Q	V_{IN}=2.8V, I_{OUT}=0mA		60	75	μA
Power Supply Rejection Ratio	PSRR	Ripple 1Vp-p V_{IN}=2.8V, I_{OUT}=100mA, f=100Hz		68		dB
		Ripple 1Vp-p V_{IN}=2.8V, I_{OUT}=100mA, f=1KHz		68		dB
Output Voltage Temperature Coefficient	$\frac{\Delta V_{OUT}/V_{OUT}}{\Delta T}$	I_{OUT}=30mA, T_A =-40°C to 85°C		±30		ppm/°C
Short Current Limit	I_{SHORT}	V_{OUT}=0V		50		mA
RMS Output Noise	V_{NOISE}	10Hz ≤ f ≤100kHz (No load)		30		μV_{RMS}
V_{EN} High Voltage	V_{IH}	Enable logic high, regulator on	1.5			V
V_{EN} Low Voltage	V_{IL}	Enable logic low, regulator off			0.4	V
Standby Current	I_{STD}	V_{IN}=3.5V, V_{EN} in OFF mode		0.01	1.0	μA
Start-up Time	t_S	No Load		20		μs
EN Pull Down Resistor	R_{PD}			3.0		MΩ
V_{OUT} Discharge Resistor	R_{DCHG}	Set EN pin at Low		60		Ω
Thermal Shutdown Temperature	T_{OTSD}			160		°C
Thermal Shutdown Hysteresis	T_{HYOTSD}			25		°C
Thermal Resistance	θ_{JC}	SOIC-8		74.6		°C/W
		SOT-89-5		47		°C/W

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.
Note 3: Production testing at T_A=25°C. Over temperature specifications guaranteed by design only.

Electrical Characteristics (Continued)

AP2115-2.5 Electrical Characteristics (Note 2)

V_{IN}=3.5V, C_{IN}=4.7μF (Ceramic), C_{OUT}=4.7μF (Ceramic), Typical T_A=25°C, **Bold** typeface applies over -40°C≤T_J≤85°C ranges, unless otherwise specified (Note 3).

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_{OUT}	V_{IN}=3.5V, 1mA ≤ I_{OUT} ≤ 30mA		98.5% ×V_{OUT}	2.5	101.5% ×V_{OUT}	V
Maximum Output Current	$I_{OUT(MAX)}$	V_{IN}=3.5V, V_{OUT}=2.463V to 2.537V		1			A
Load Regulation	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle I_{OUT}}$	V_{OUT}=2.5V, V_{IN}=V_{OUT}+1V 1mA ≤ I_{OUT} ≤1A			0.2	1	%/A
Line Regulation	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle V_{IN}}$	3.5V≤V_{IN}≤6V, I_{OUT}=30mA		-0.1	0.02	0.1	%/V
Dropout Voltage	V_{DROP}	I_{OUT} =1A			450	750	mV
Quiescent Current	I_Q	V_{IN}=3.5V, I_{OUT}=0mA			60	80	μA
Standby Current	I_{STD}	V_{IN}=3.5V, V_{EN} in OFF mode			0.01	1.0	μA
Power Supply Rejection Ratio	PSRR	Ripple 1Vp-p V_{IN}=3.5V, I_{OUT}=100mA	f=100Hz		65		dB
			f=1KHz		65		
Output Voltage Temperature Coefficient	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle T}$	I_{OUT}=30mA			±30		ppm/°C
Short Current Limit	I_{SHORT}	V_{OUT}=0V			50		mA
RMS Output Noise	V_{NOISE}	10Hz ≤ f ≤100kHz			30		μV_{RMS}
V_{EN} High Voltage	V_{IH}	Enable logic high, regulator on		1.5			V
V_{EN} Low Voltage	V_{IL}	Enable logic low, regulator off				0.4	
Start-up Time	t_S	No Load			20		μs
EN Pull Down Resistor	R_{PD}				3.0		MΩ
V_{OUT} Discharge Resistor	R_{DCHG}	Set EN pin at Low			60		Ω
Thermal Shutdown Temperature	T_{OTSD}				160		°C
Thermal Shutdown Hysteresis	T_{HYOTSD}				25		
Thermal Resistance	θ_{JC}	SOIC-8			74.6		°C/W
		SOT-89-5			47		

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.
Note 3: Production testing at T_A=25°C. Over temperature specifications guaranteed by design only.

Electrical Characteristics (Continued)

AP2115-3.3 Electrical Characteristics (Note 2)

V_{IN}=4.3V, C_{IN}=4.7μF (Ceramic), C_{OUT}=4.7μF (Ceramic), Typical T_A=25°C, **Bold** typeface applies over -40°C≤T_J≤85°C ranges, unless otherwise specified (Note 3).

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_{OUT}	V_{IN}=4.3V, 1mA ≤ I_{OUT} ≤ 30mA		98.5% ×V_{OUT}	3.3	101.5% ×V_{OUT}	V
Maximum Output Current	$I_{OUT(MAX)}$	V_{IN}=4.3V, V_{OUT}=3.25V to 3.35V		1			A
Load Regulation	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle I_{OUT}}$	V_{IN}=4.3V, 1mA ≤ I_{OUT} ≤1A			0.2	1	%/A
Line Regulation	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle V_{IN}}$	4.3V≤V_{IN}≤6V, I_{OUT}=30mA		-0.1	0.02	0.1	%/V
Dropout Voltage	V_{DROP}	I_{OUT}=1A			450	750	mV
Quiescent Current	I_Q	V_{IN}=4.3V, I_{OUT}=0mA			65	90	μA
Power Supply Rejection Ratio	PSRR	Ripple 1Vp-p V_{IN}=4.3V, I_{OUT}=100mA	f=100Hz		65		dB
			f=1KHz		65		
Output Voltage Temperature Coefficient	$\frac{\triangle V_{OUT}/V_{OUT}}{\triangle T}$	I_{OUT}=30mA			±30		ppm/°C
Short Current Limit	I_{SHORT}	V_{OUT}=0V			50		mA
RMS Output Noise	V_{NOISE}	10Hz ≤ f ≤100kHz (No load)			30		μV_{RMS}
V_{EN} High Voltage	V_{IH}	Enable logic high, regulator on		1.5			V
V_{EN} Low Voltage	V_{IL}	Enable logic low, regulator off				0.4	
Standby Current	I_{STD}	V_{IN}=3.5V, V_{EN} in OFF mode			0.01	1.0	μA
Start-up Time	t_S	No Load			20		μs
EN Pull Down Resistor	R_{PD}				3.0		MΩ
V_{OUT} Discharge Resistor	R_{DCHG}	Set EN pin at Low			60		Ω
Thermal Shutdown Temperature	T_{OTSD}				160		°C
Thermal Shutdown Hysteresis	T_{HYOTSD}				25		
Thermal Resistance	θ_{JC}	SOIC-8			74.6		°C/W
		SOT-89-5			47		

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.
Note 3: Production testing at T_A=25°C. Over temperature specifications guaranteed by design only.

Typical Performance Characteristics

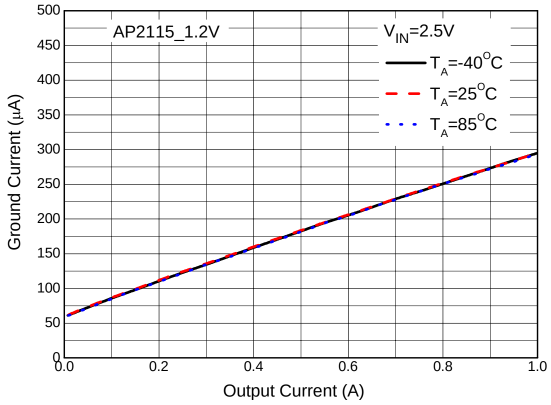


Figure 4. Ground Current vs. Output Current

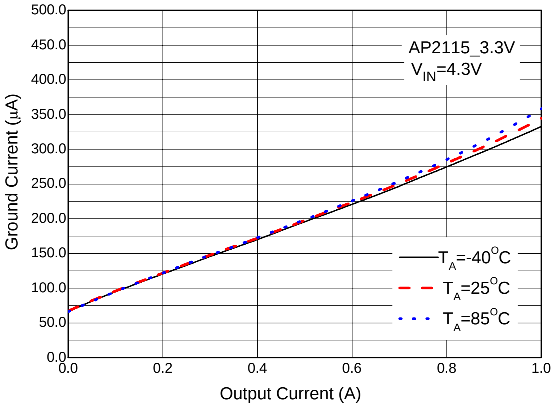


Figure 5. Ground Current vs. Output Current

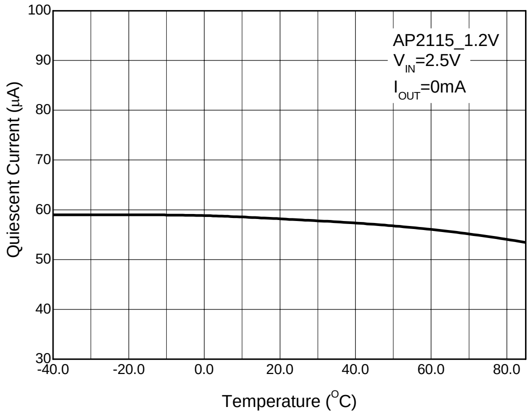


Figure 6. Quiescent Current vs. Temperature

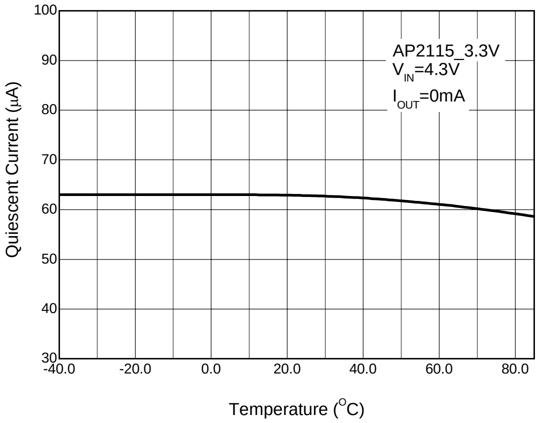


Figure 7. Quiescent Current vs. Temperature

Typical Performance Characteristics (Continued)

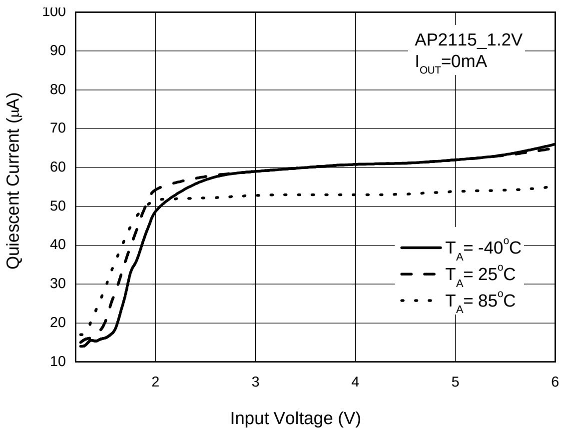


Figure 8. Quiescent Current vs. Input Voltage

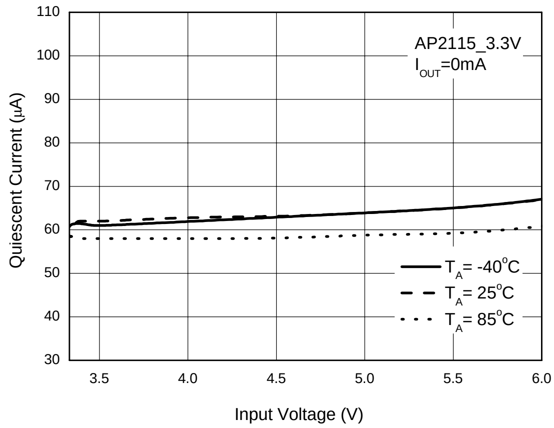


Figure 9. Quiescent Current vs. Input Voltage

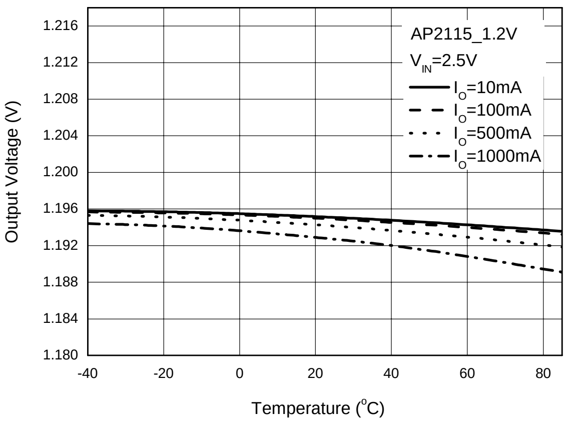


Figure 10. Output Voltage vs. Temperature

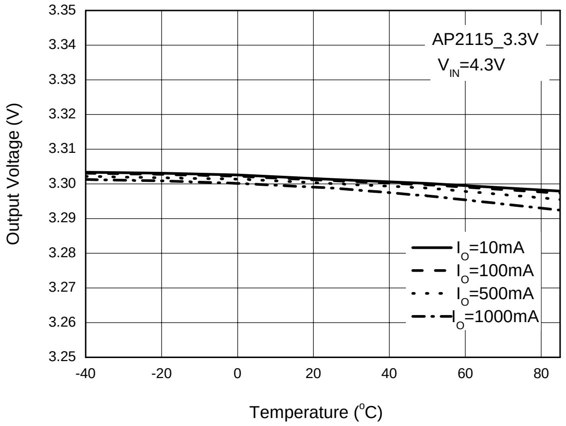


Figure 11. Output Voltage vs. Temperature

Typical Performance Characteristics (Continued)

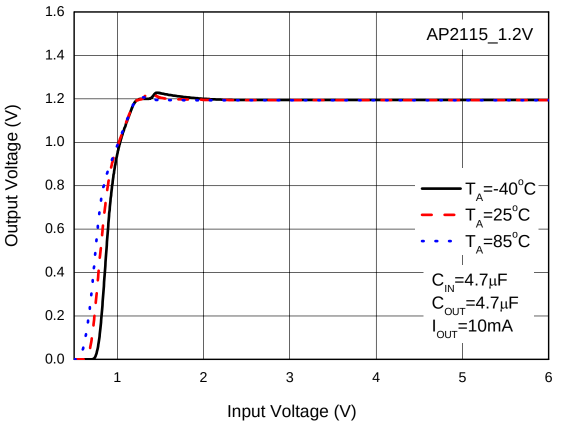


Figure 12. Output Voltage vs. Input Voltage

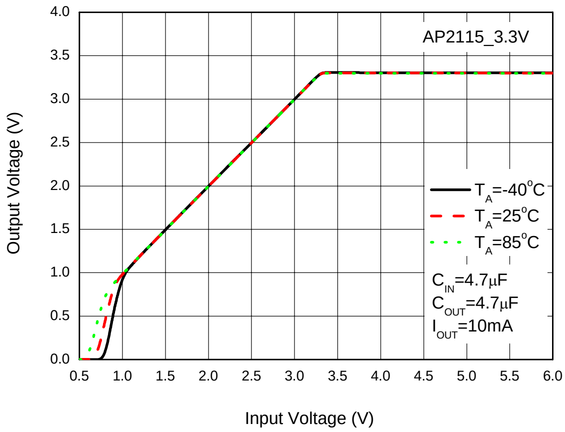


Figure 13. Output Voltage vs. Input Voltage

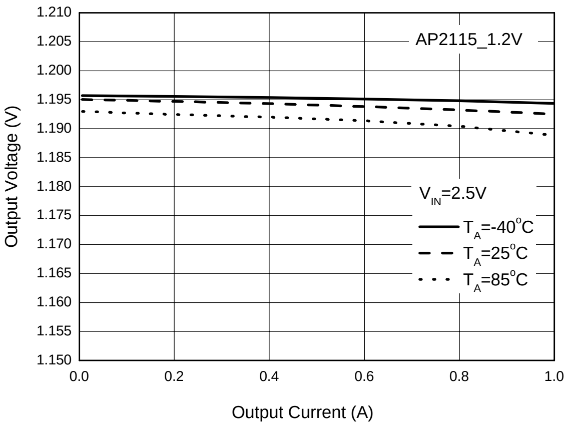


Figure 14. Output Voltage vs. Output Current

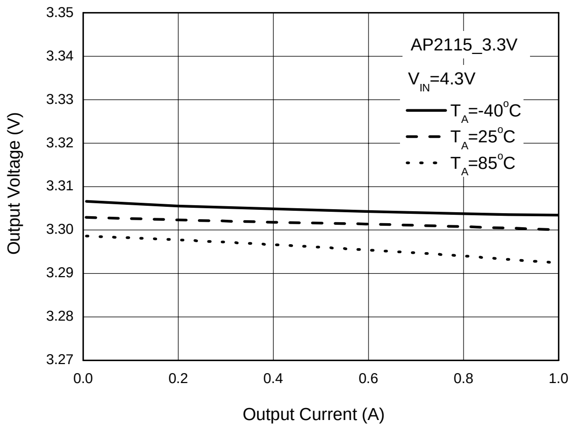


Figure 15. Output Voltage vs. Output Current

Typical Performance Characteristics (Continued)

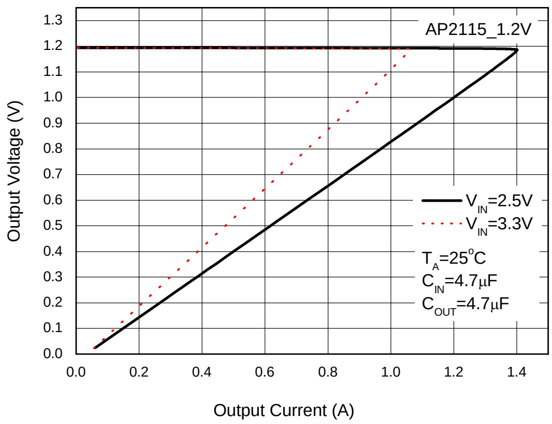


Figure 16. Output Voltage vs. Output Current

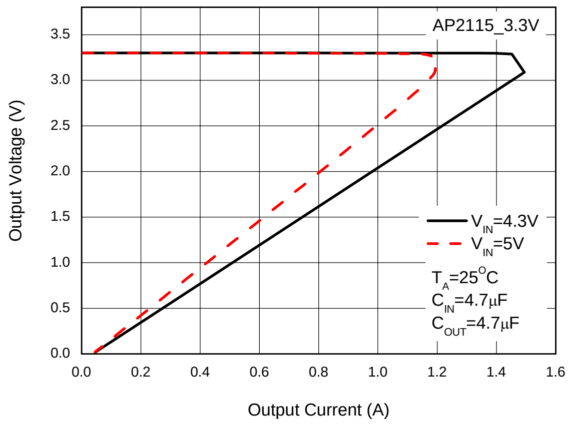


Figure 17. Output Voltage vs. Output Current

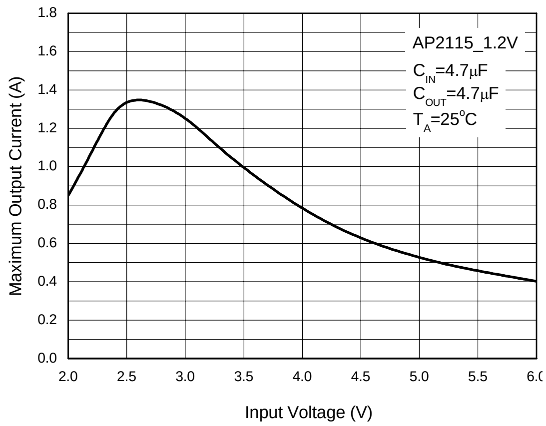


Figure 18. Maximum Output Current vs. Input Voltage

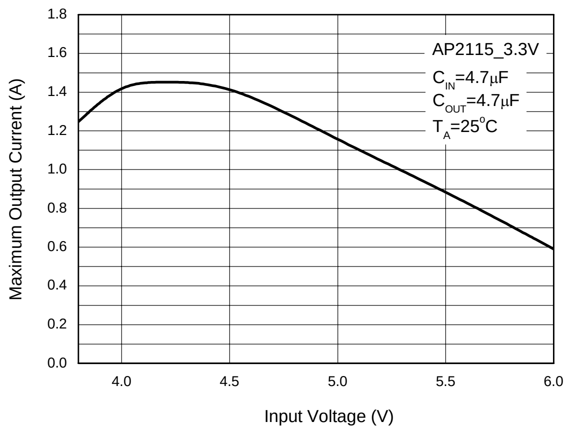


Figure 19. Maximum Output Current vs. Input Voltage

Typical Performance Characteristics (Continued)

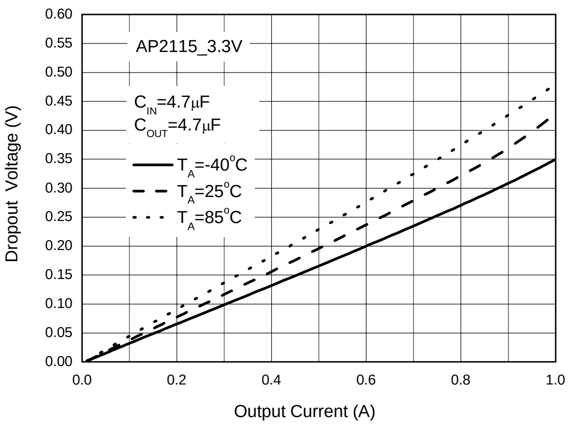


Figure 20. Dropout Voltage vs. Output Current

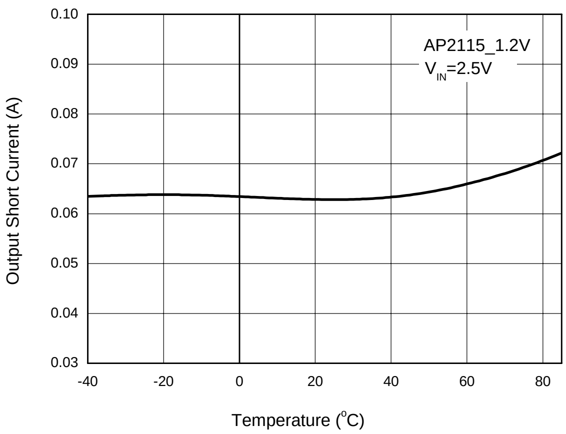


Figure 21. Output Short Current vs. Temperature

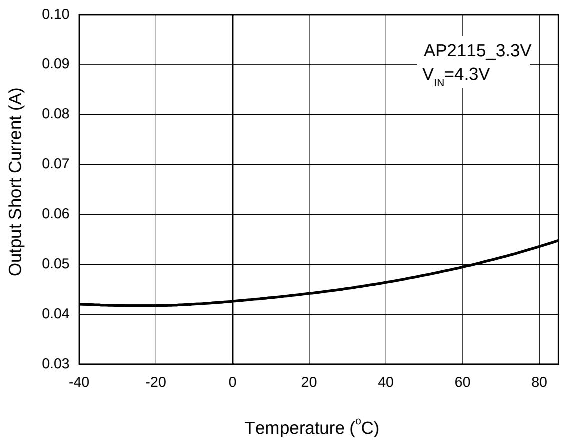


Figure 22. Output Short Current vs. Temperature

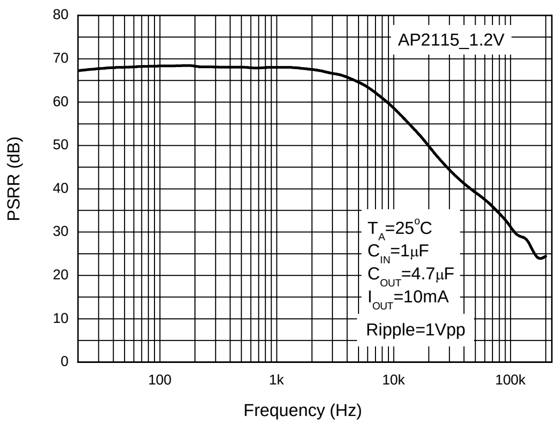


Figure 23. PSRR vs. Frequency

Typical Performance Characteristics (Continued)

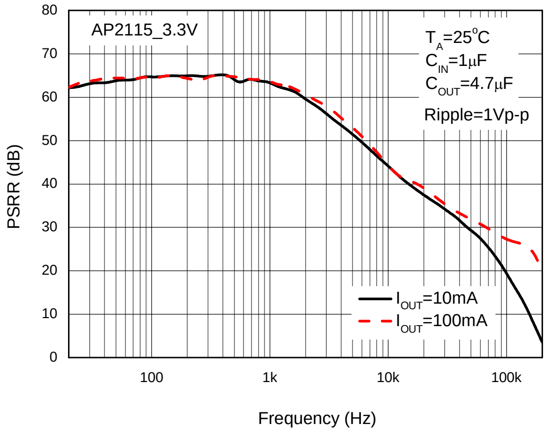


Figure 24. PSRR vs. Frequency

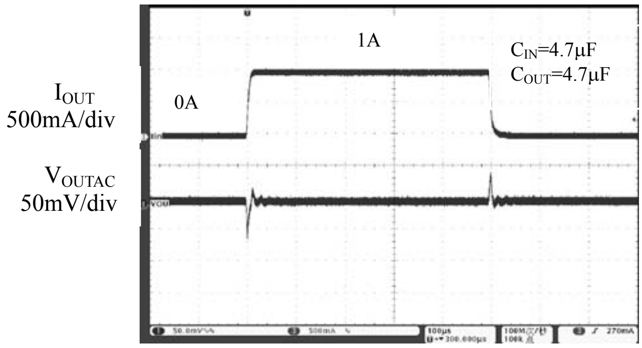


Figure 25. Load Transient

Typical Application

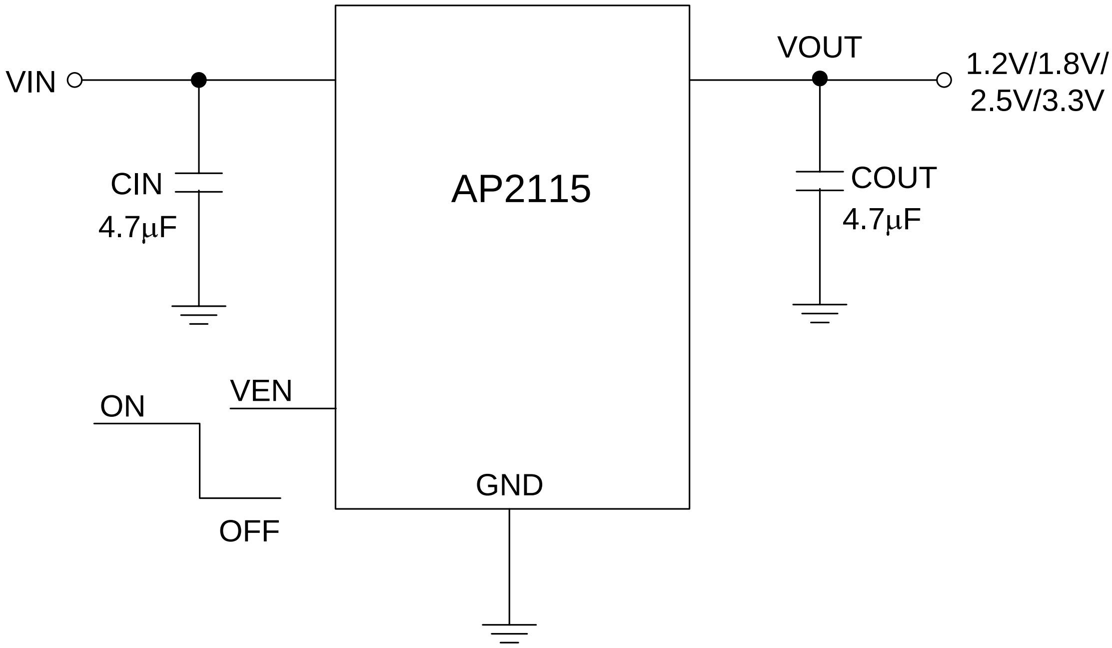
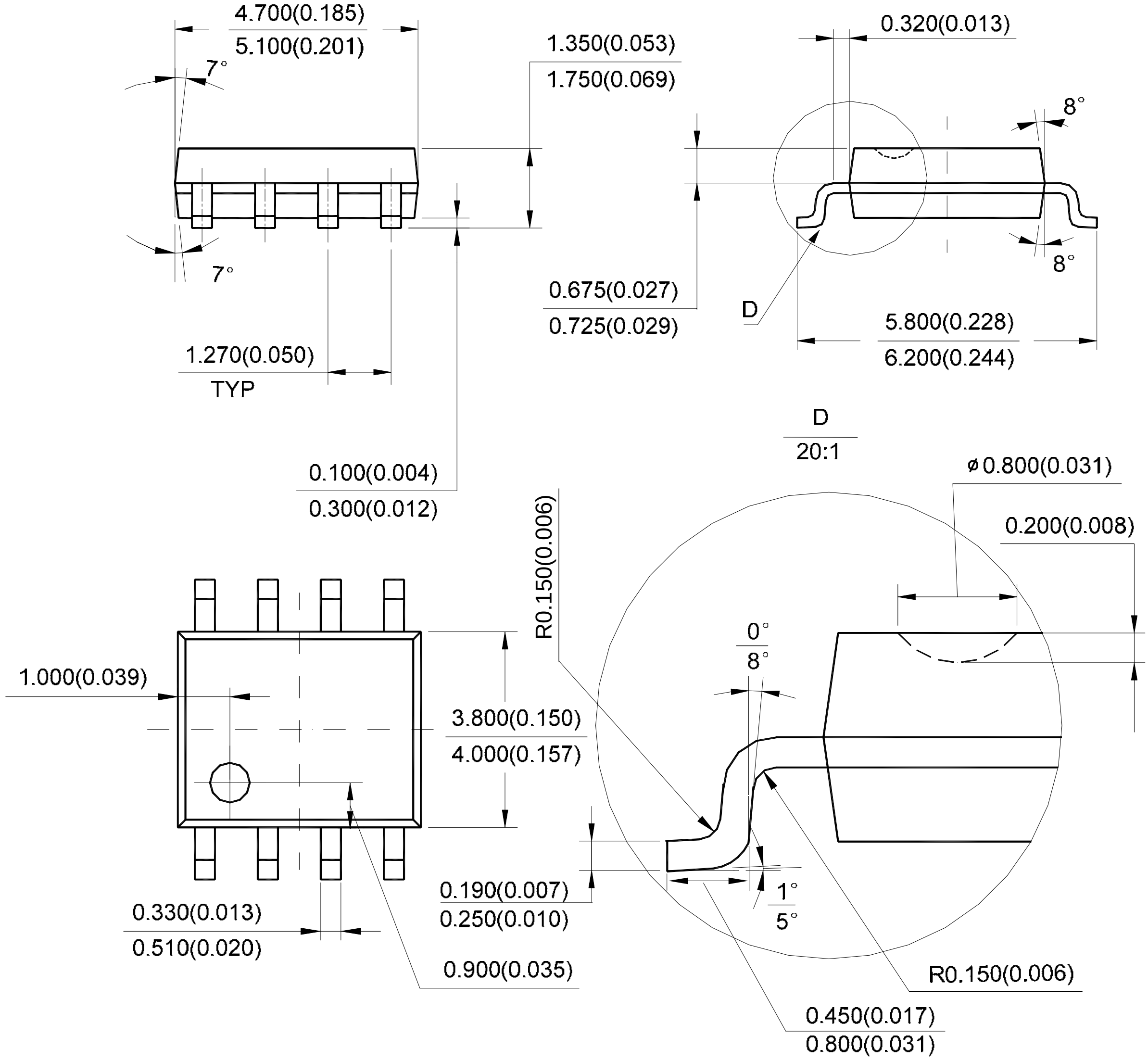


Figure 26. AP2115 Typical Application

Mechanical Dimensions

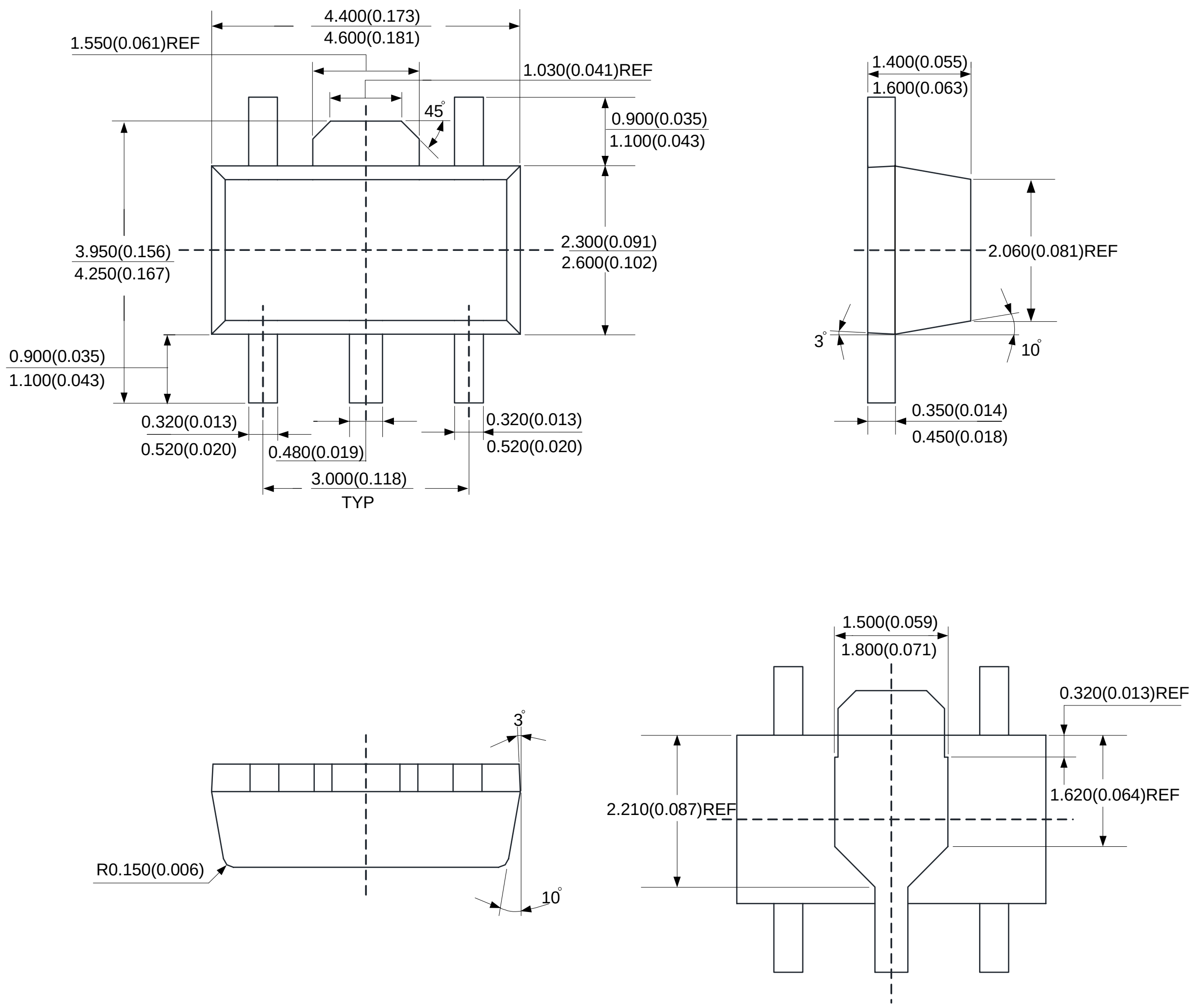
SOIC-8 **Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.

Mechanical Dimensions (Continued)

SOT-89-5 **Unit: mm(inch)**



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