DUAL 300mA LDO REGULATORS AP2402

General Description

The AP2402 series are dual positive voltage regulator ICs fabricated by CMOS process. Each of these ICs consists of a voltage reference, two error amplifiers, two resistor networks for setting output voltages. Each channel has a current limit circuit for current protection and a chip enable circuit with quick discharge function.

The AP2402 series feature high supply voltage ripple rejection, low dropout voltage, low noise, high output voltage accuracy, and low current consumption which make them ideal for use in various battery-powered devices. The chip-enable function allows the output of each channel to be turned on/off independently, greatly reducing the power consumption.

The AP2402 series have 2.5V/1.8V, 2.8V/1.8V, 2.8V/2.8V, 2.8V/3.3V and 3.3V/3.3V versions.

The 2.5V/1.8V, 2.8V/1.8V and 2.8V/2.8V versions are available in SOT-23-6, TSOT-23-6 and DFN-2×2-8 packages. The 2.8V/3.3V and 3.3V/3.3V versions are available in TSOT-23-6 package only.

Features

- Minimum Output Current Capability per Channel: 300mA
- High Output Voltage Accuracy: ±2%
- Low Quiescent Current per Channel: 50μA Typical
- Low Standby Current: 0.1μA Typical
- High PSRR: 70dB Typical （f=1kHz)
- Extremely Low Noise: 30μVrms (10Hz to 100kHz)
- Operating Temperature: -20 to 60°C
- Compatible with 2.2μF Low ESR Ceramic Capacitor

Applications

- Mobile Phones, Cordless Phones
- Wireless Communication Equipment
- Portable Games
- Cameras, Video Recorders
- Sub-board Power Supplies for Telecom Equipment
- Battery Powered Equipment

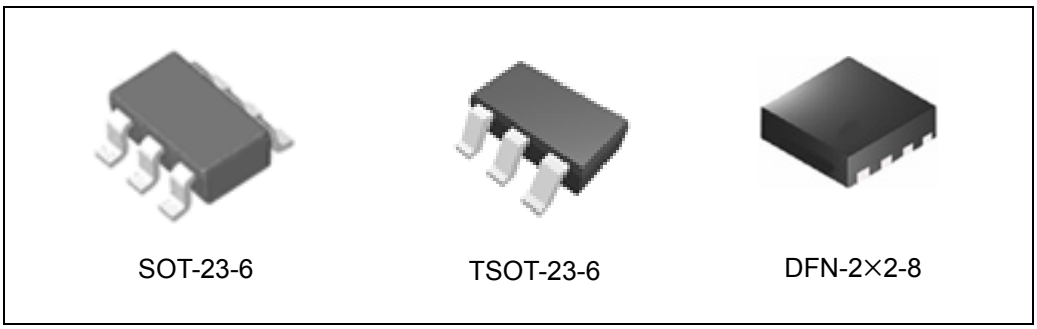


Figure 1. Package Types of AP2402

Pin Configuration

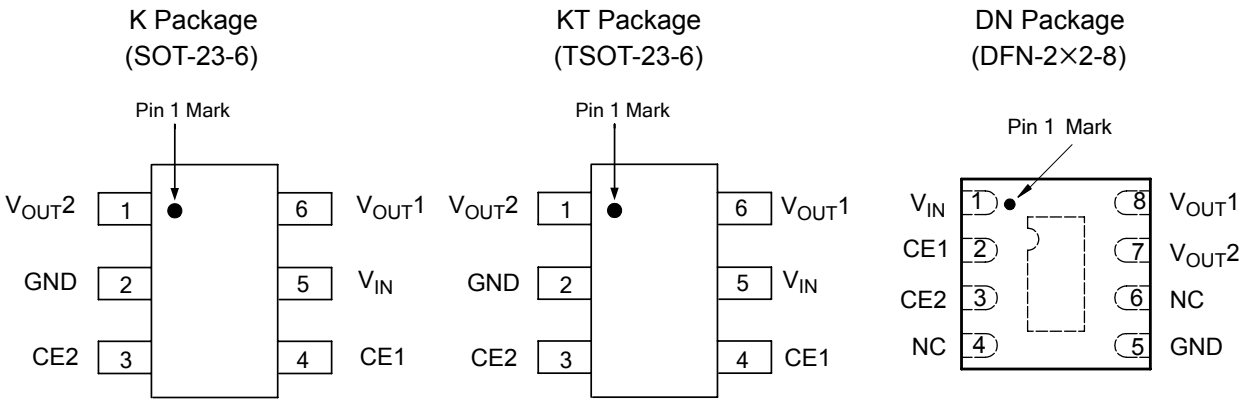


Figure 2. Pin Configuration of AP2402 (Top View)

Pin Description

Pin Number		Pin Name	Function
6-pin	8-pin		
1	7	$V_{OUT}2$	Output voltage 2
2	5	GND	Ground
3	3	CE2	On/Off control 2, logic high=enable; logic low=shutdown
4	2	CE1	On/Off control 1, logic high=enable; logic low=shutdown
5	1	V_{IN}	Input voltage
6	8	$V_{OUT}1$	Output voltage 1
	4, 6	NC	No connection

Functional Block Diagram

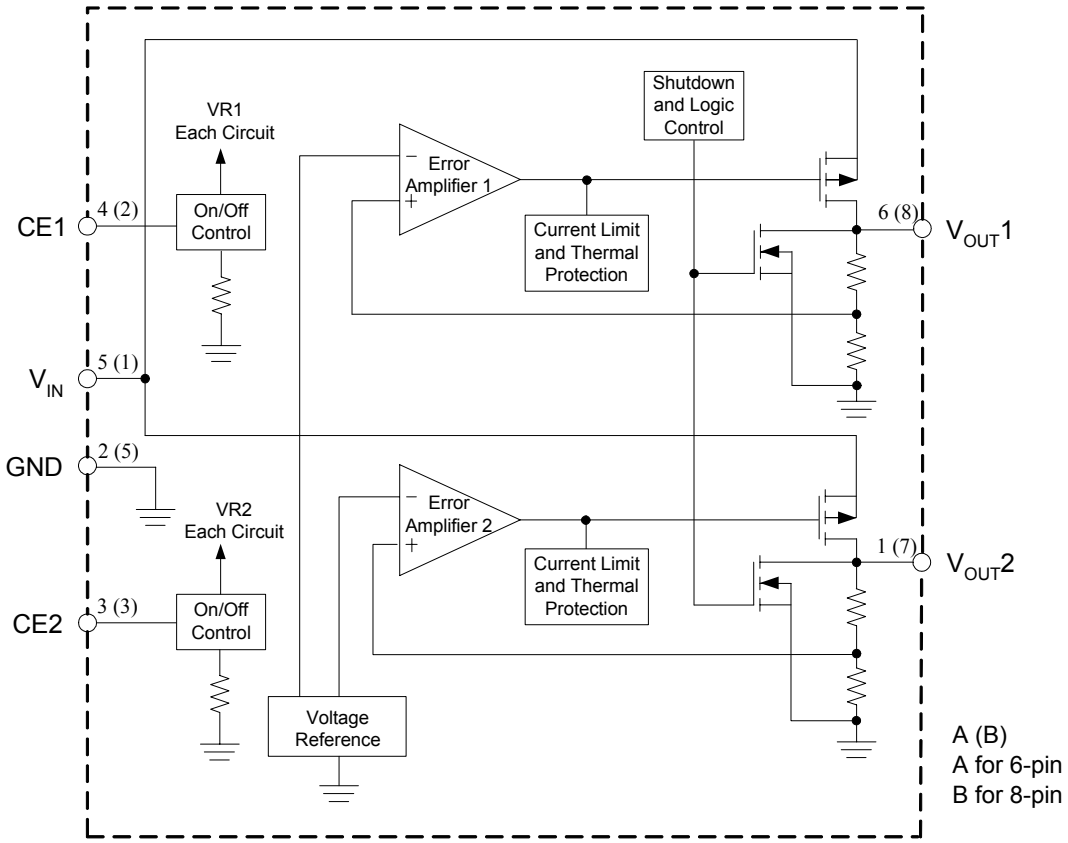
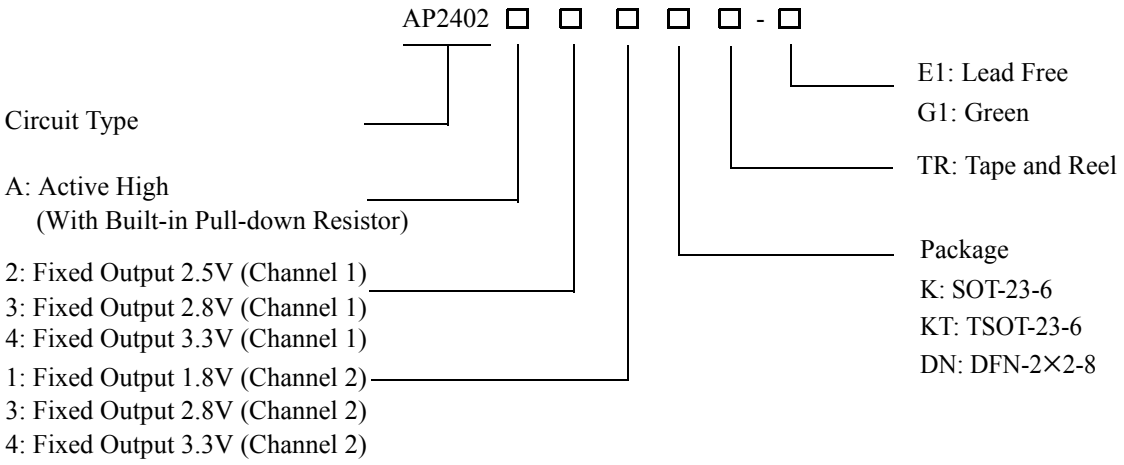


Figure 3. Functional Block Diagram of AP2402

Ordering Information



Package	Temperature Range	Output Voltages	Part Number	Marking ID	Part Number	Marking ID	Packing Type
			Lead-Free	Lead-Free	Green	Green	
SOT-23-6	-20 to 60°C	2.5V/1.8V	AP2402A21KTR-E1	EAA	AP2402A21KTR-G1	GAA	Tape & Reel
		2.8V/1.8V	AP2402A31KTR-E1	EAB	AP2402A31KTR-G1	GAB	Tape & Reel
		2.8V/2.8V	AP2402A33KTR-E1	EAC	AP2402A33KTR-G1	GAC	Tape & Reel
TSOT-23-6	-20 to 60°C	2.5V/1.8V	AP2402A21KTTR-E1	S8A	AP2402A21KTTR-G1	L8A	Tape & Reel
		2.8V/1.8V	AP2402A31KTTR-E1	S8B	AP2402A31KTTR-G1	L8B	Tape & Reel
		2.8V/2.8V	AP2402A33KTTR-E1	S8C	AP2402A33KTTR-G1	L8C	Tape & Reel
		2.8V/3.3V	AP2402A34KTTR-E1	S8D	AP2402A34KTTR-G1	L7A	Tape & Reel
		3.3V/3.3V	AP2402A44KTTR-E1	S8F	AP2402A44KTTR-G1	L7B	Tape & Reel
DFN-2×2-8	-20 to 60°C	2.5V/1.8V	AP2402A21DNTR-E1	6A	AP2402A21DNTR-G1	DA	Tape & Reel
		2.8V/1.8V	AP2402A31DNTR-E1	6B	AP2402A31DNTR-G1	DB	Tape & Reel
		2.8V/2.8V	AP2402A33DNTR-E1	6C	AP2402A33DNTR-G1	DC	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Input Voltage	V_{IN}	6.5		V
Enable Input Voltage	V_{CE}	6.5		V
Output Current (T_A=25°C)	$I_{OUT}1+I_{OUT}2$	700		mA
Power Dissipation (T_A=25°C)	P_D	SOT-23-6	250	mW
Junction Temperature	T_J	150		°C
Storage Temperature Range	T_{STG}	-65 to 150		°C
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260		°C
ESD (Human Body Model)	ESD	6000		V
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.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Input Voltage	V_{IN}		6	V
Operating Ambient Temperature Range	T_A	-20	60	°C

Electrical Characteristics

(Channel 1/Channel 2: $V_{IN}=V_{OUT}+1V$, $T_A=25^oC$, $C_{IN}=1\mu F$, $C_{OUT}=2.2\mu F$, unless otherwise specified.)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy	$\Delta V_{OUT}/V_{OUT}$	Variation from specified V_{OUT}, I_{OUT}=30mA		-2		2	%
Input Voltage	V_{IN}					6	V
Maximum Output Current	$I_{OUT(Max)}$			300			mA
Load Regulation	V_{RLOAD}	1mA≤I_{OUT}≤300mA			10	60	mV
Line Regulation	V_{RLINE}	V_{OUT}+1V≤V_{IN}≤6V I_{OUT}=30mA, V_{CE}=V_{IN}			0.01	0.2	%/V
Dropout Voltage	V_{DROP}	I_{OUT}=30mA	V_{OUT}=1.8V		30	36	mV
			V_{OUT}=2.5V		20	24	
			V_{OUT}=2.8V		20	24	
			V_{OUT}=3.3V		20	24	
		I_{OUT}=100mA	V_{OUT}=1.8V		100	120	
			V_{OUT}=2.5V		65	80	
			V_{OUT}=2.8V		65	80	
			V_{OUT}=3.3V		65	80	
Quiescent Current	I_Q	I_{OUT}=0mA			50	90	μA
Standby Current	I_{STD}	V_{CE} in OFF mode			0.1	1	μA
Power Supply Rejection Ratio	PSRR	Ripple 0.5Vp-p, f=1kHz V_{IN}=V_{OUT}+1V, I_{OUT}=30mA			70		dB
Output Voltage Temperature Coefficient	$(\Delta V_{OUT}/V_{OUT})/\Delta T$	I_{OUT}=30mA, -20°C≤T_A≤60°C			±100		ppm/°C
Current Limit	I_{LIMIT}	V_{CE}=V_{IN}			400		mA
Short Circuit Current	I_{SHORT}	V_{CE}=V_{IN}, V_{OUT} short to GND			50		mA
RMS Output Noise	V_{NOISE}	10Hz≤f≤100kHz			30		μVrms
CE "High" Voltage		CE input voltage "High"		1.3		6	V
CE "Low" Voltage		CE input voltage "Low"				0.4	V
Thermal Shutdown					165		°C
Thermal Shutdown Hysteresis					30		°C
Thermal Resistance (Junction to Case)	θ_{JC}	SOT-23-6			85		°C/W
		TSOT-23-6			85		
		DFN-2X2-8			130		

Typical Performance Characteristics

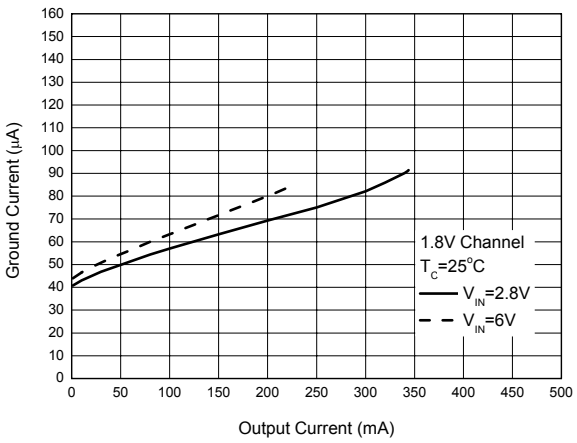


Figure 4. Ground Current vs. Output Current

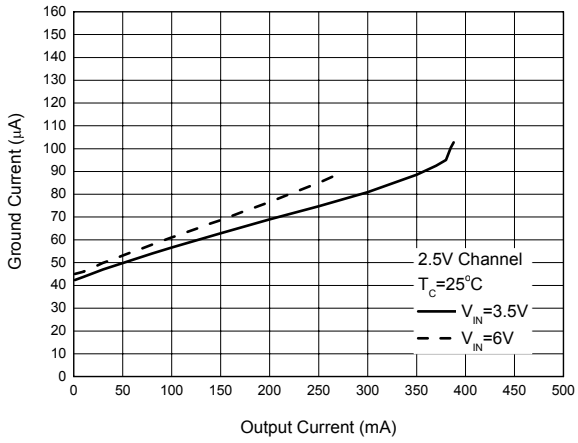


Figure 5. Ground Current vs. Output Current

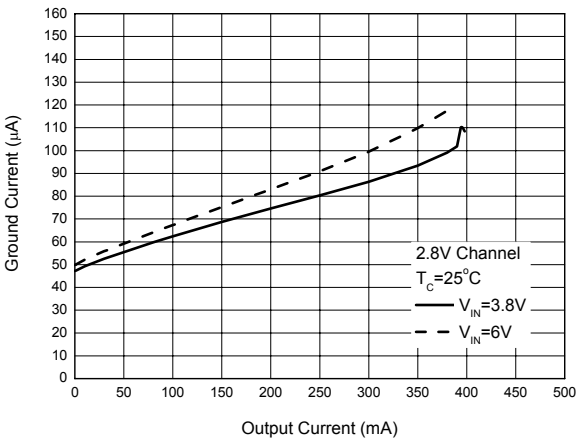


Figure 6. Ground Current vs. Output Current

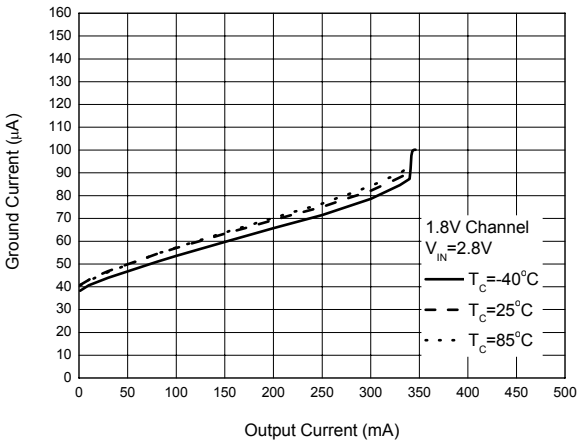


Figure 7. Ground Current vs. Output Current

Typical Performance Characteristics (Continued)

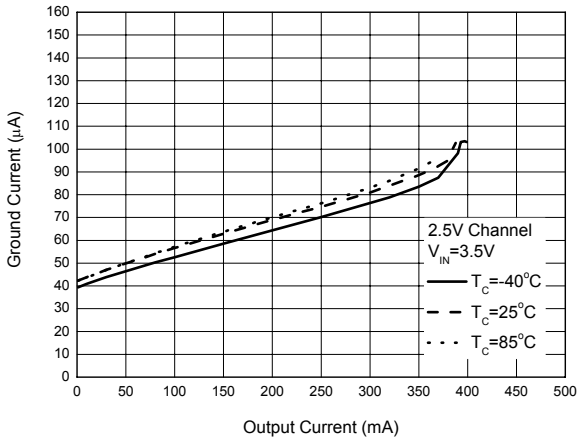


Figure 8. Ground Current vs. Output Current

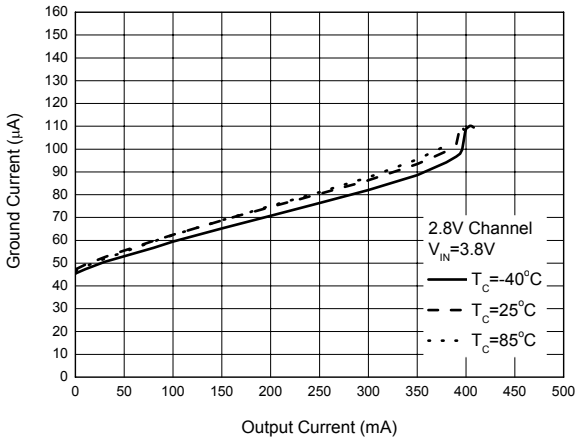


Figure 9. Ground Current vs. Output Current

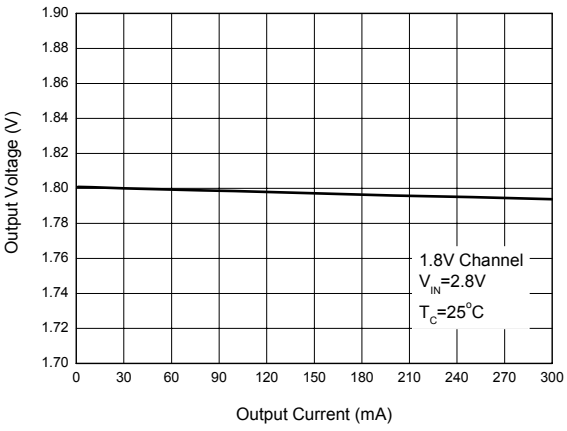


Figure 10. Output Voltage vs. Output Current

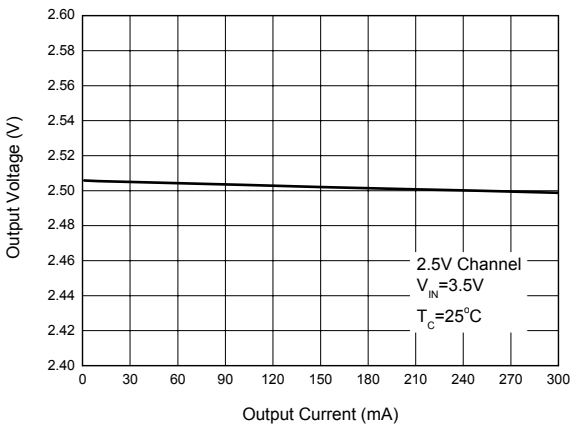


Figure 11. Output Voltage vs. Output Current

Typical Performance Characteristics (Continued)

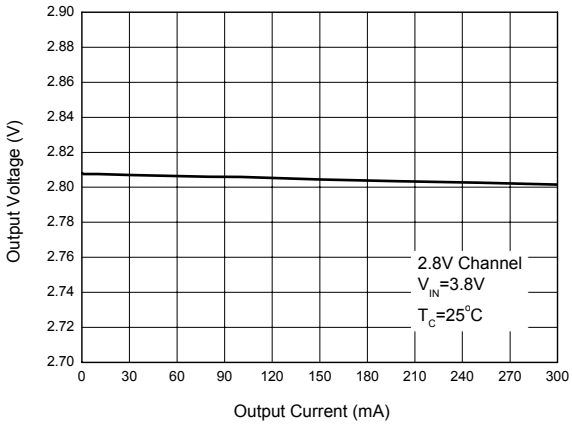


Figure 12. Output Voltage vs. Output Current

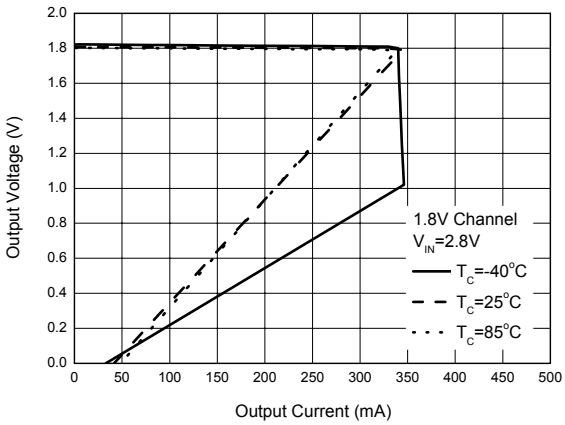


Figure 13. Output Voltage vs. Output Current

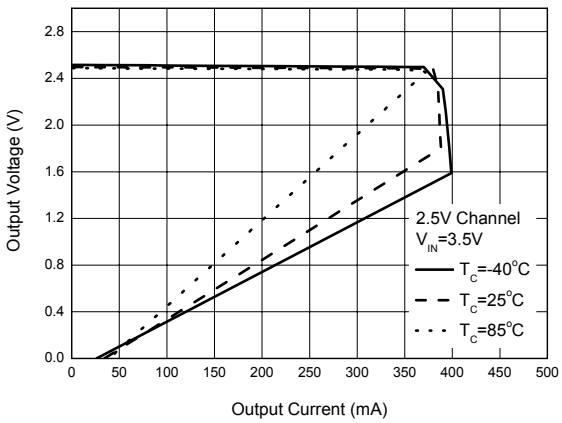


Figure 14. Output Voltage vs. Output Current

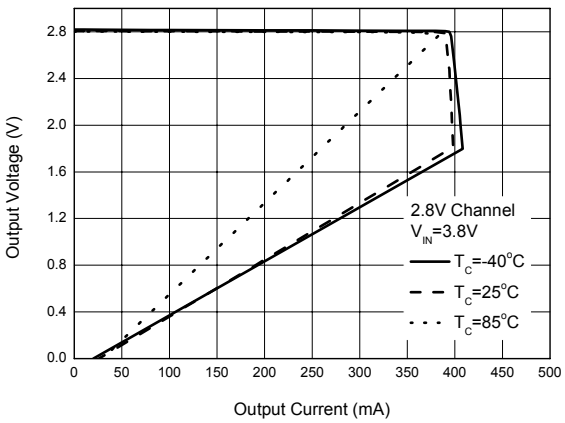


Figure 15. Output Voltage vs. Output Current

Typical Performance Characteristics (Continued)

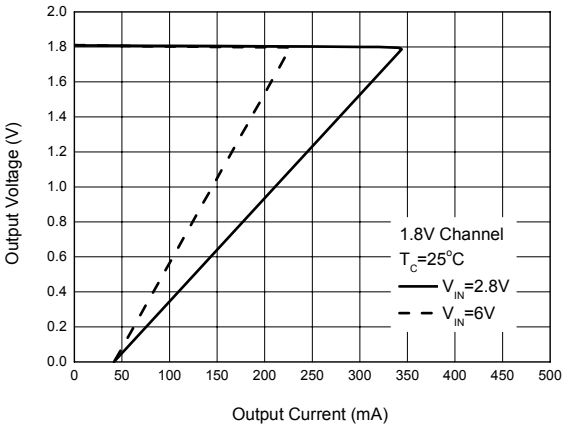


Figure 16. Output Voltage vs. Output Current

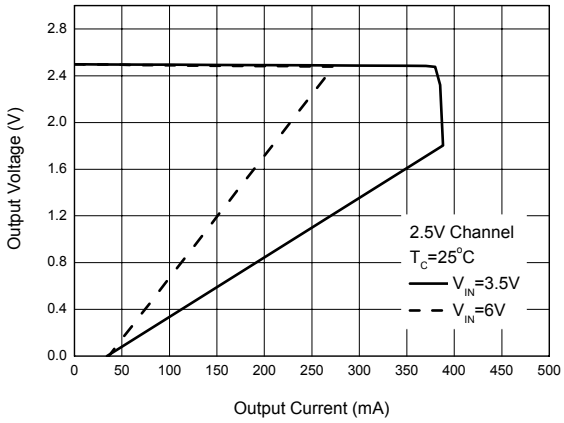


Figure 17. Output Voltage vs. Output Current

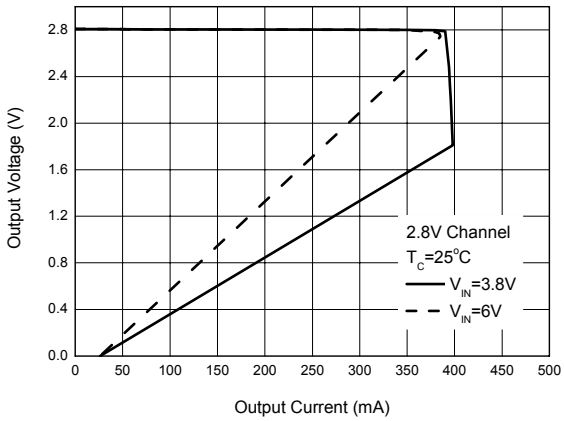


Figure 18. Output Voltage vs. Output Current

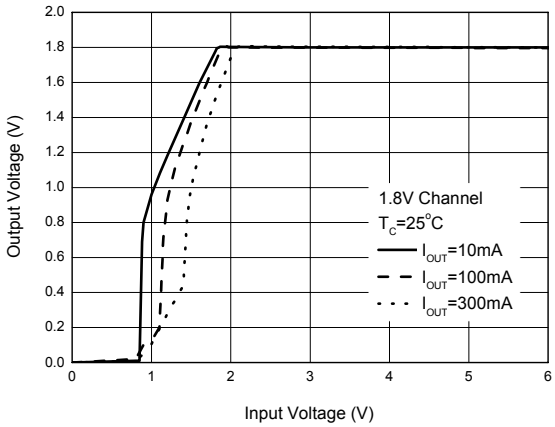


Figure 19. Output Voltage vs. Input Voltage

Typical Performance Characteristics (Continued)

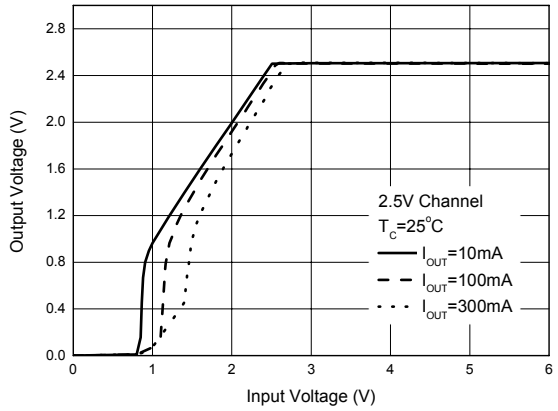


Figure 20. Output Voltage vs. Input Voltage

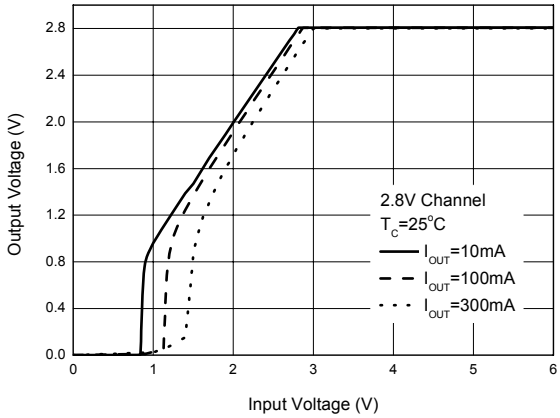


Figure 21. Output Voltage vs. Input Voltage

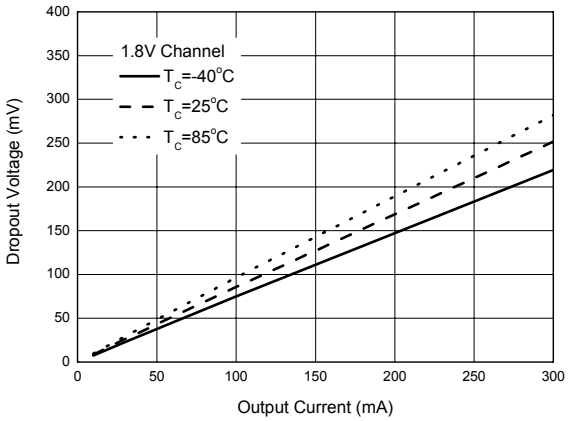


Figure 22. Dropout Voltage vs. Output Current

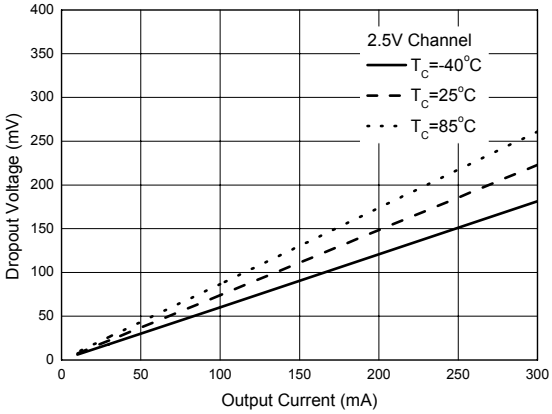


Figure 23. Dropout Voltage vs. Output Current

Typical Performance Characteristics (Continued)

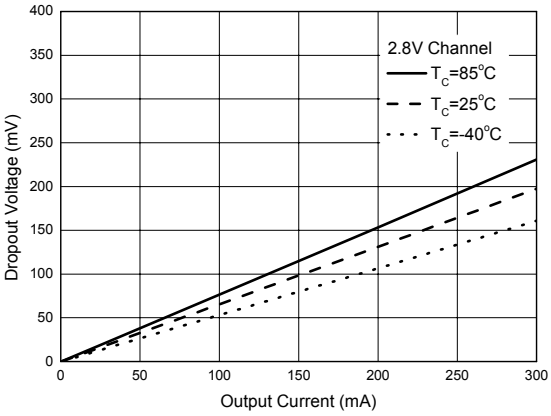


Figure 24. Dropout Voltage vs.Output Current

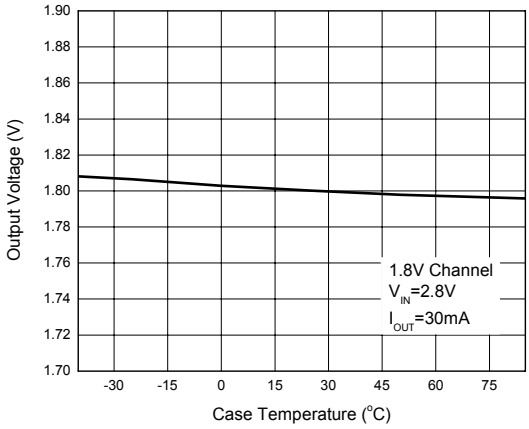


Figure 25. Output Voltage vs. Case Temperature

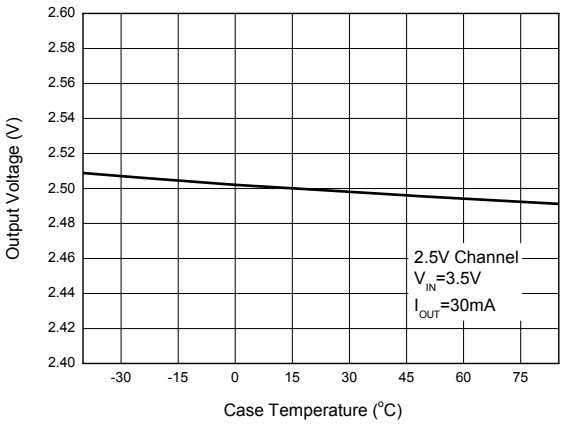


Figure 26. Output Voltage vs. Case Temperature

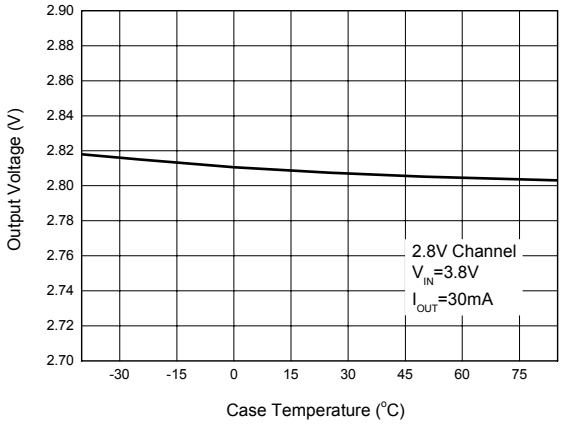


Figure 27. Output Voltage vs. Case Temperature

Typical Performance Characteristics (Continued)

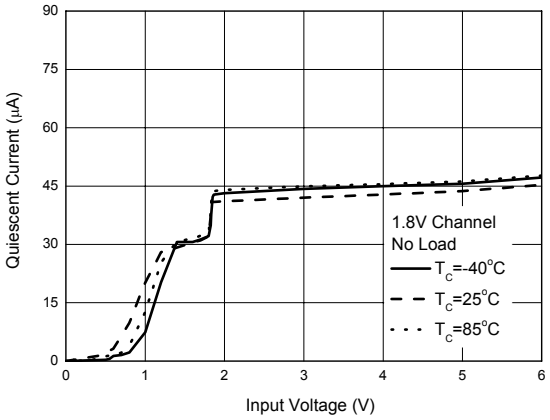


Figure 28. Quiescent Current vs. Input Voltage

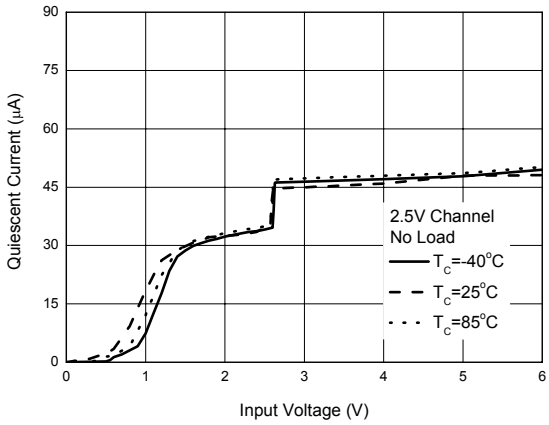


Figure 29. Quiescent Current vs. Input Voltage

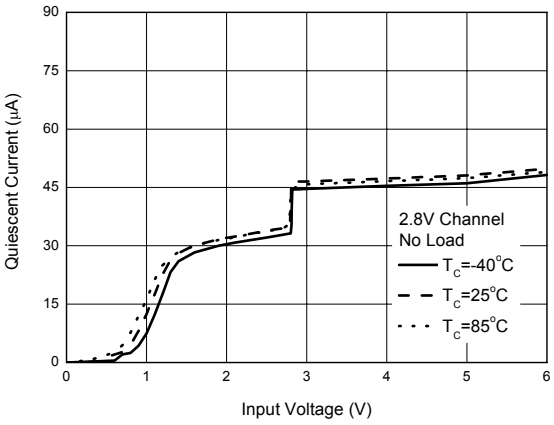


Figure 30. Quiescent Current vs. Input Voltage

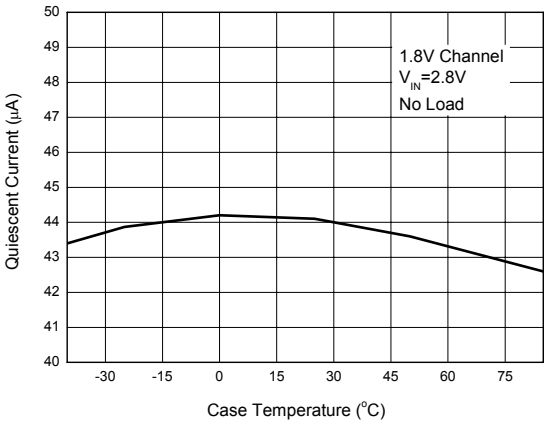


Figure 31. Quiescent Current vs. Case Temperature

Typical Performance Characteristics (Continued)

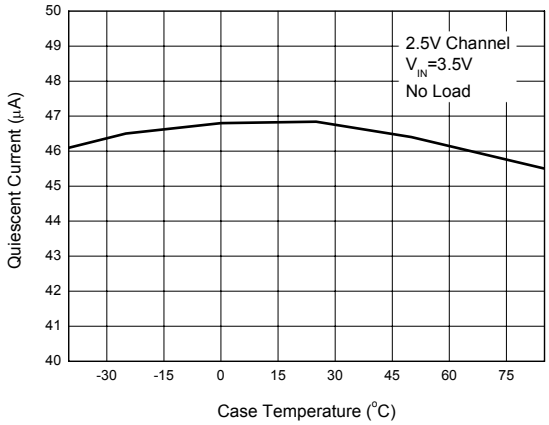


Figure 32. Quiescent Current vs. Case Temperature

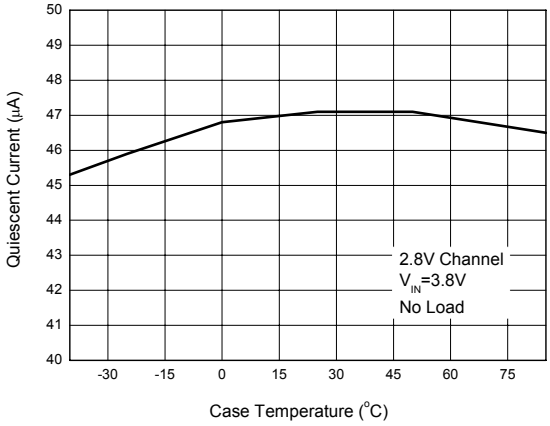


Figure 33. Quiescent Current vs. Case Temperature

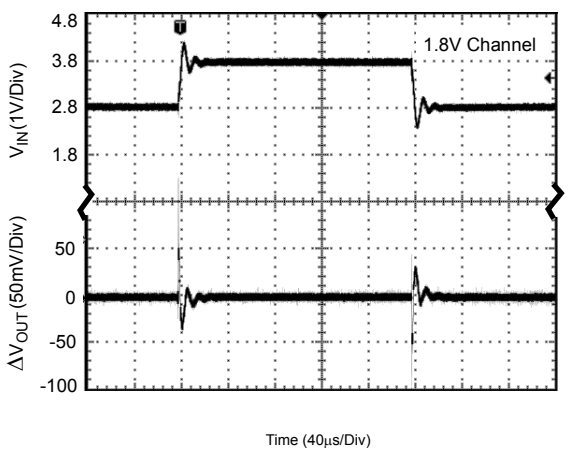


Figure 34. Line Transient
(Conditions: I_{OUT}=50mA, C_{IN}=0.68μF, C_{OUT}=1μF)

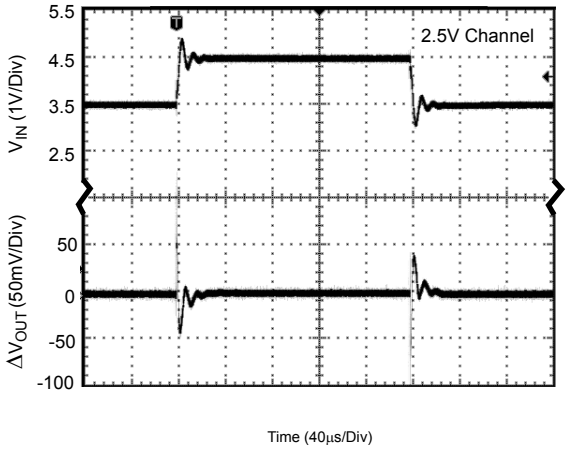


Figure 35. Line Transient
(Conditions: I_{OUT}=50mA, C_{IN}=0.68μF, C_{OUT}=1μF)

Typical Performance Characteristics (Continued)

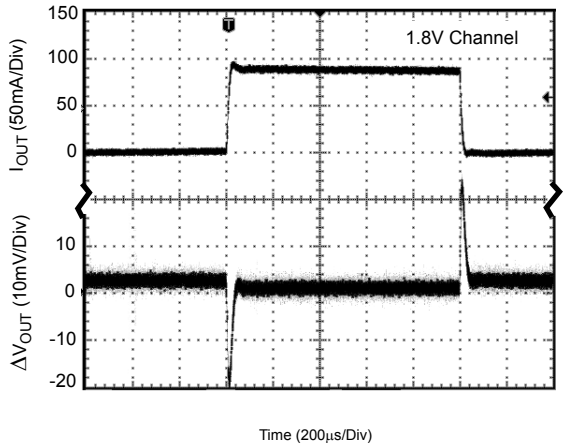


Figure 36. Load Transient
(Conditions: V_{IN}=2.8V, I_{OUT}=10 to 100mA, C_{IN}=C_{OUT}=1μF)

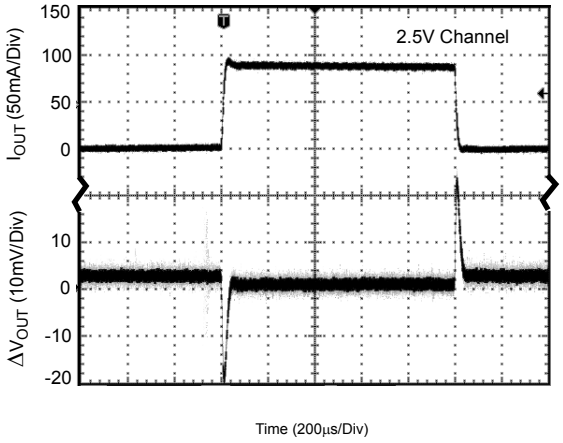


Figure 37. Load Transient
(Conditions: V_{IN}=3.5V, I_{OUT}=10 to 100mA, C_{IN}=C_{OUT}=1μF)

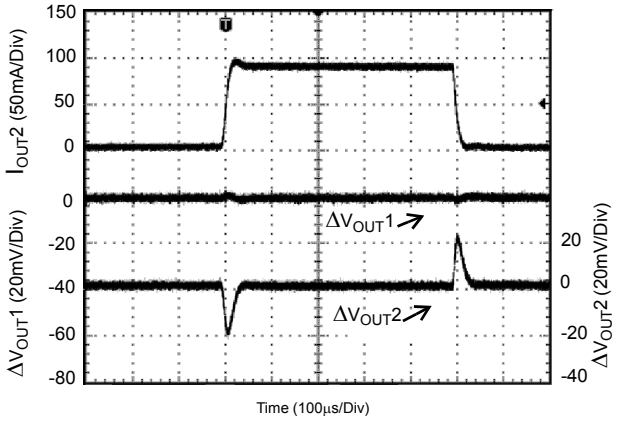


Figure 38. Cross Talk 1
(Conditions: channel 1 and 2 on, I_{OUT}1=30mA,
I_{OUT}2=10 to 100mA, C_{IN}=C_{OUT}=1μF)

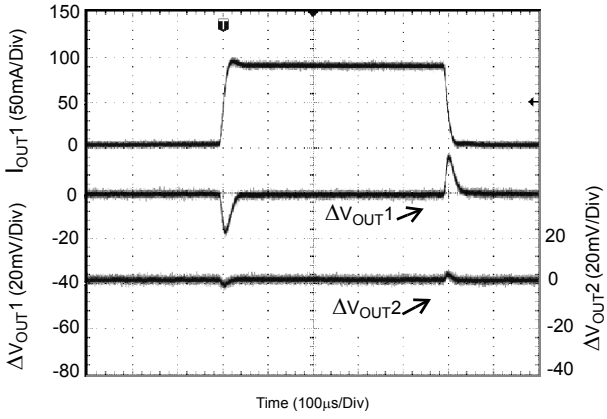


Figure 39. Cross Talk 2
(Conditions: channel 1 and 2 on, I_{OUT}1=10 to 100mA,
I_{OUT}2=30mA, C_{IN}=C_{OUT}=1μF)

Typical Performance Characteristics (Continued)

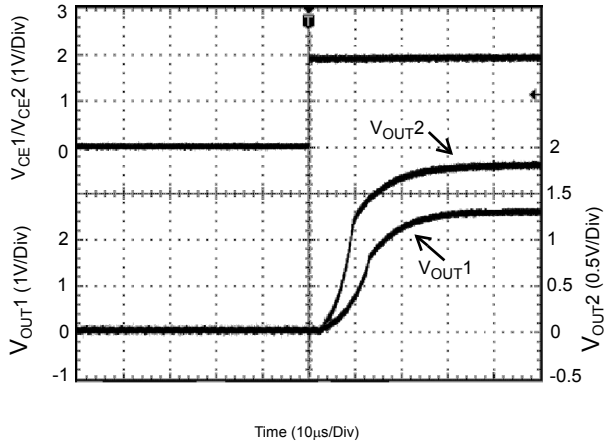


Figure 40. Enable Voltage vs. Output Voltage
(Conditions: $V_{CE}1=V_{CE}2=0$ to 2V, $I_{OUT}=0$mA, $C_{IN}=C_{OUT}=1\mu F$)

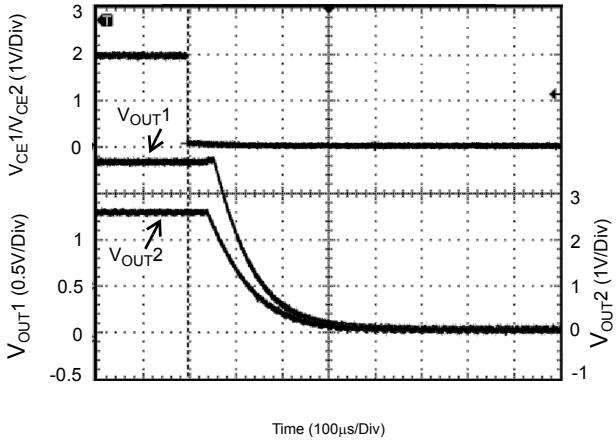


Figure 41. Auto Discharge Function
(Conditions: $V_{CE}1=V_{CE}2=0$ to 2V, $I_{OUT}=0$mA, $C_{IN}=C_{OUT}=1\mu F$)

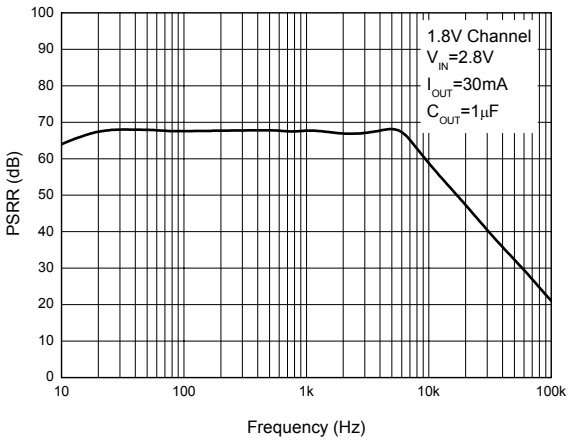


Figure 42. PSRR vs. Frequency

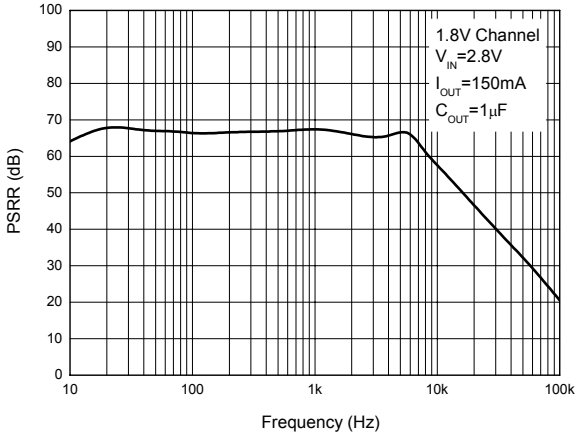


Figure 43. PSRR vs. Frequency

Typical Performance Characteristics (Continued)

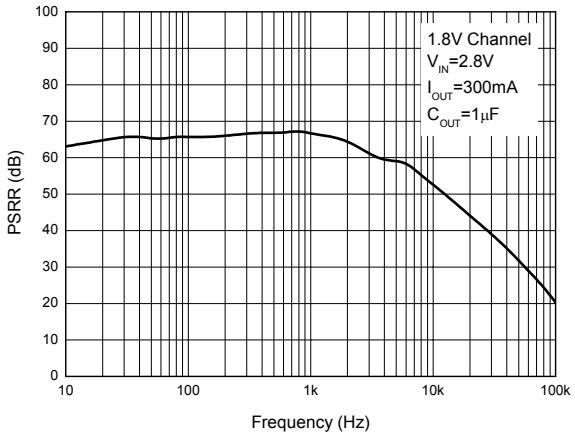


Figure 44. PSRR vs. Frequency

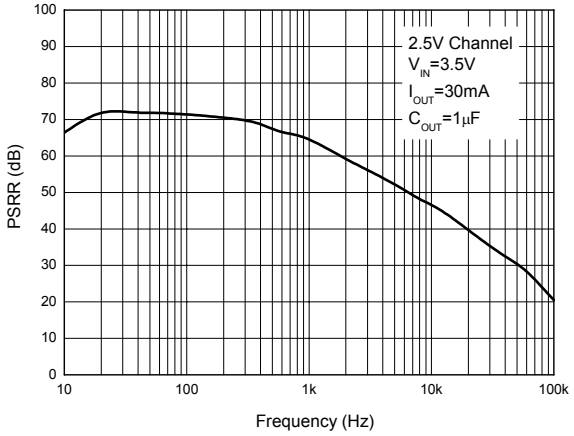


Figure 45. PSRR vs. Frequency

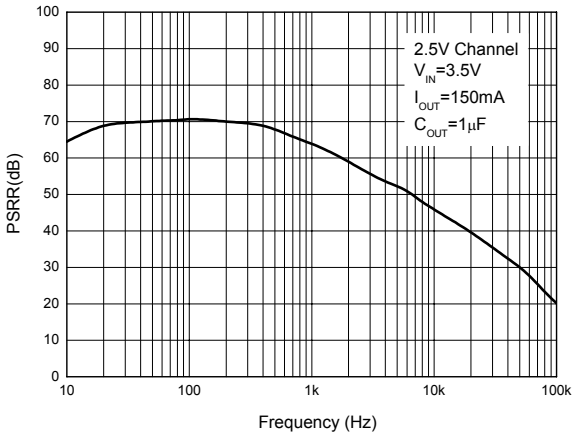


Figure 46. PSRR vs. Frequency

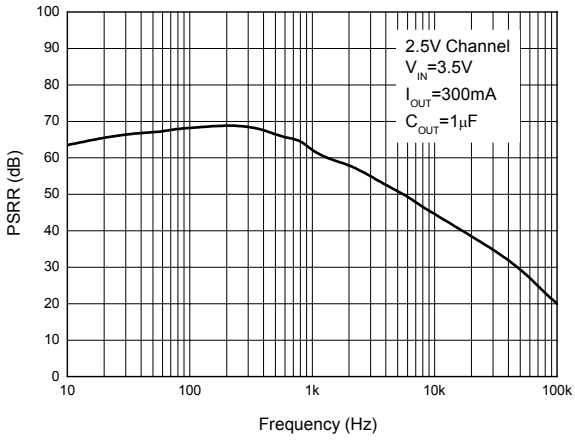


Figure 47. PSRR vs. Frequency

Typical Performance Characteristics (Continued)

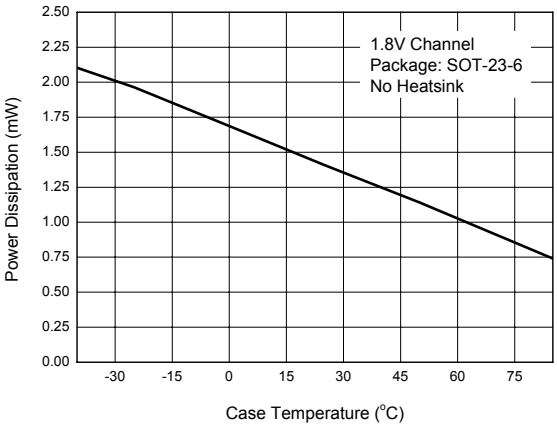


Figure 48. Power Dissipation vs. Case Temperature

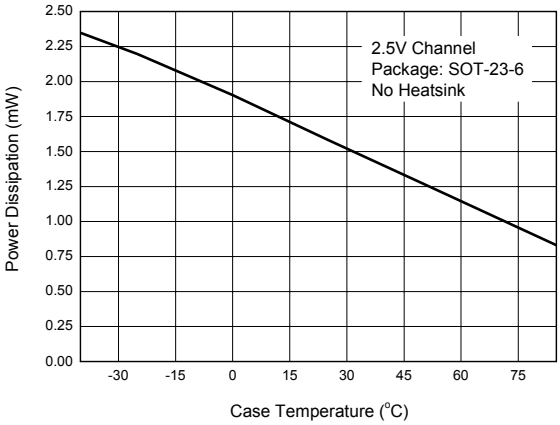


Figure 49. Power Dissipation vs. Case Temperature

Typical Application

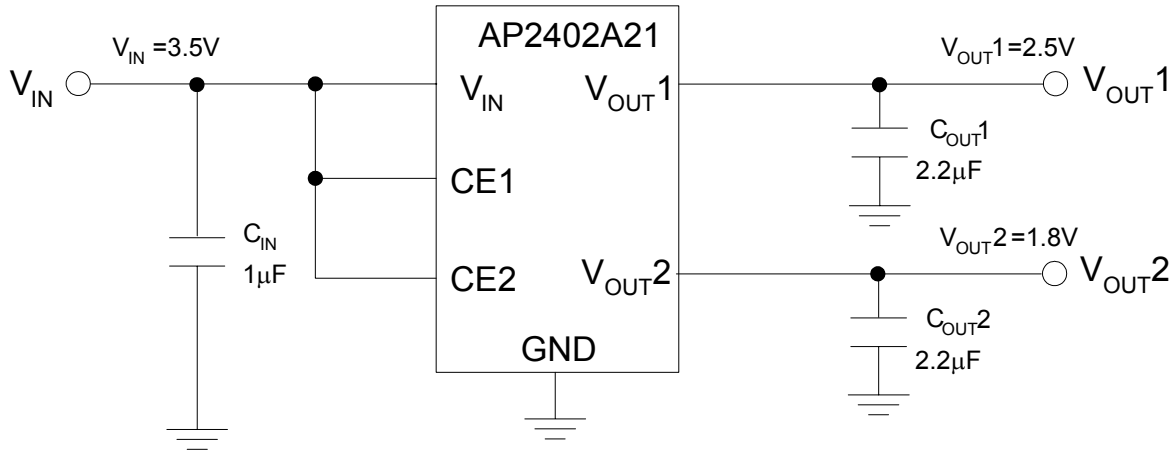
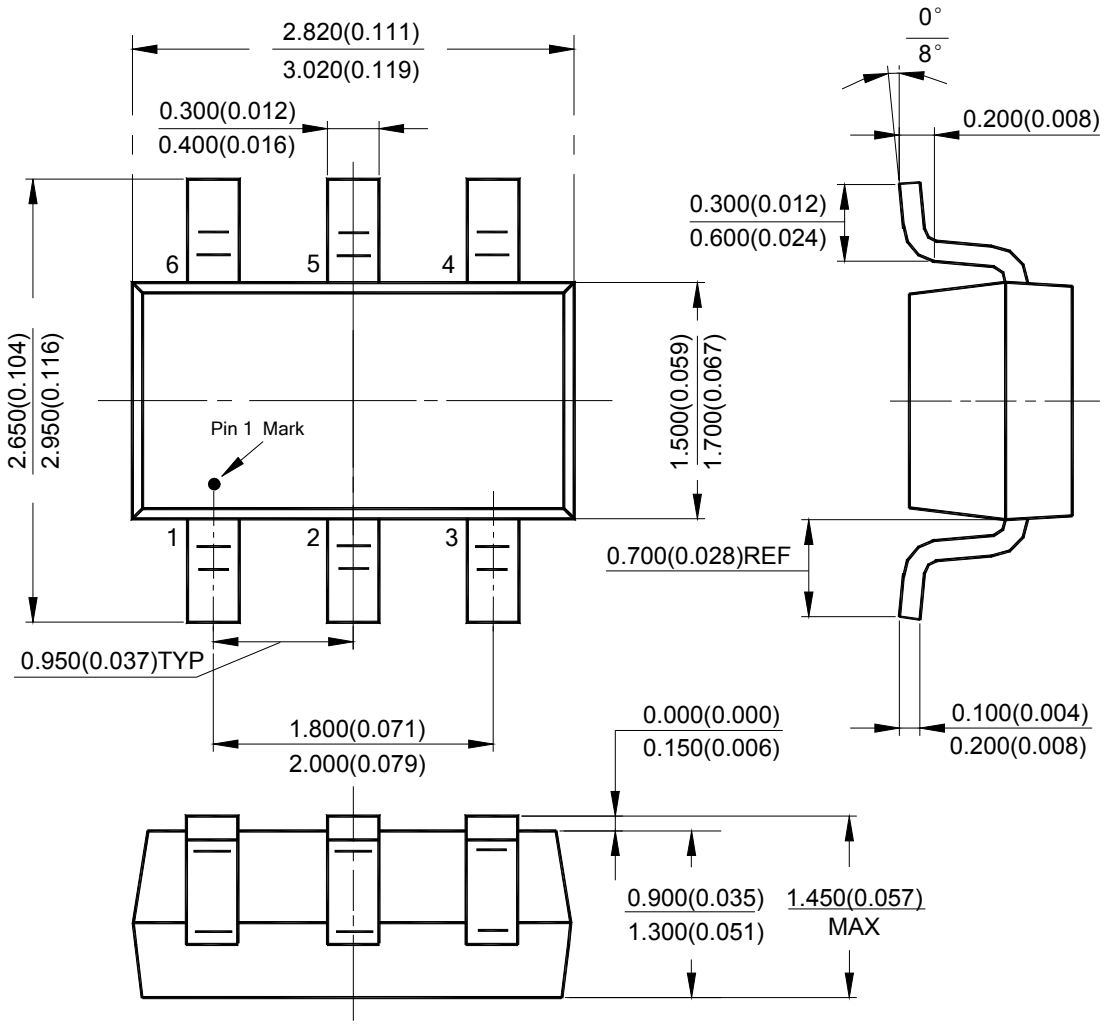


Figure 50. Typical Application of AP2402

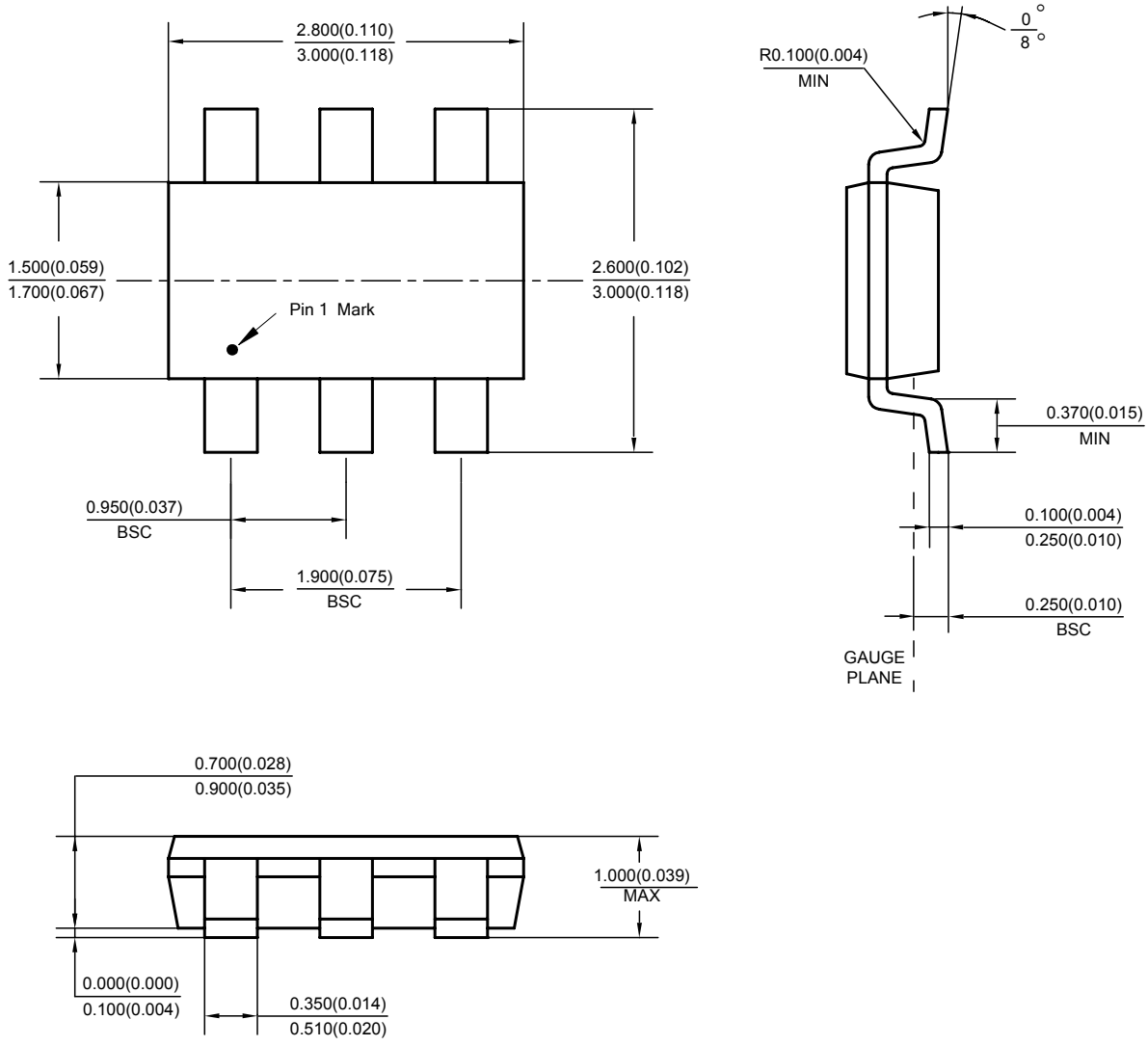
Mechanical Dimensions

SOT-23-6 **Unit: mm(inch)**



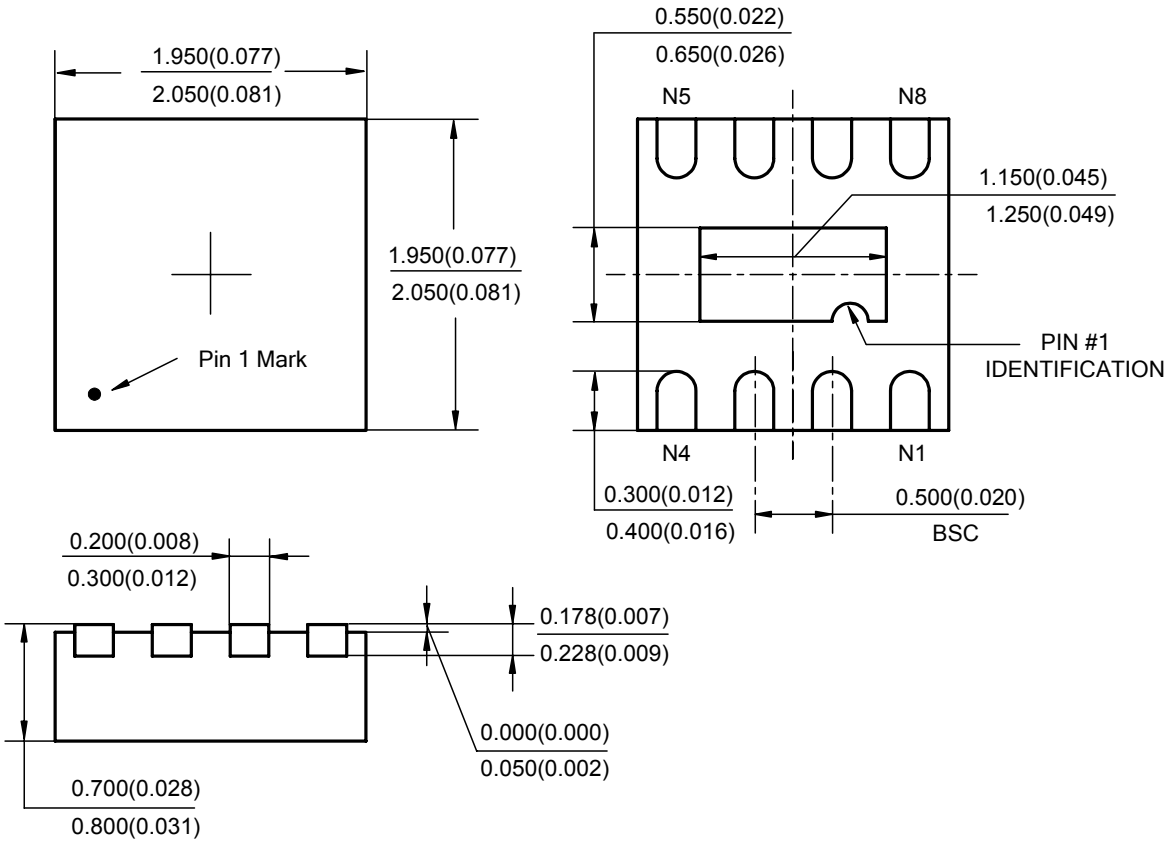
Mechanical Dimensions (Continued)

TSOT-23-6 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

DFN-2x2-8 **Unit: mm(inch)**



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