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.

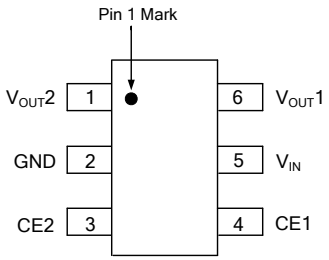
The 2.5V/1.8V, 2.8V/1.8V and 2.8V/2.8V versions are available in SOT-23-6, TSOT-23-6 and DFN-2x2-8 packages. The 2.8V/3.3V and 3.3V/3.3V versions are available in TSOT-23-6 package only.

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

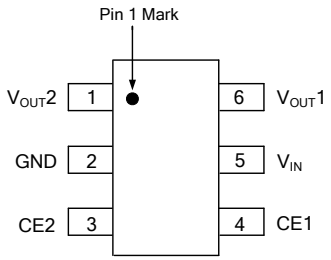
Pin Assignments

(Top View)



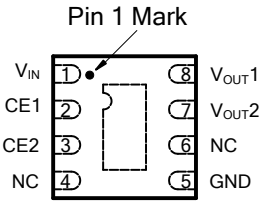
SOT-23-6

(Top View)



TSOT-23-6

(Top View)



DFN-2×2-8

Applications

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

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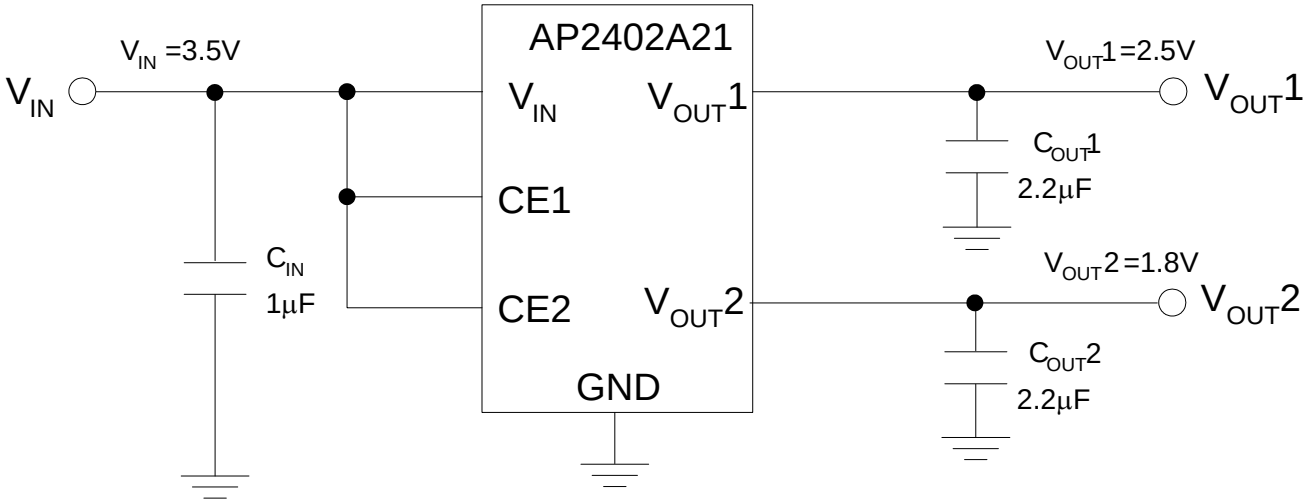
Typical Applications Circuit



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

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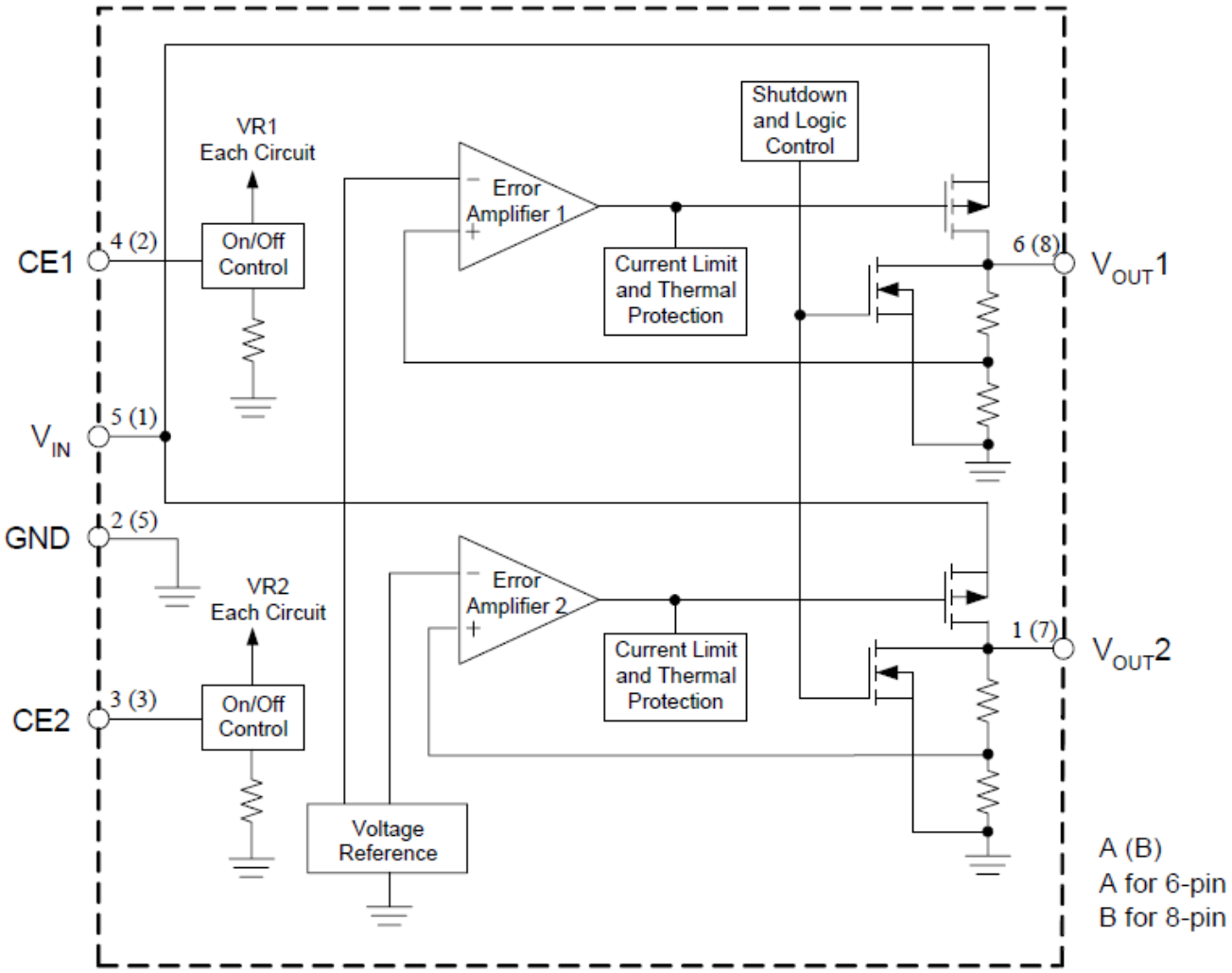
Functional Block Diagram



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Absolute Maximum Ratings (Note 1)

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

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

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$\Delta V_{OUT}/V_{OUT}$	Output Voltage Accuracy	Variation from Specified V_{OUT}, I_{OUT} = 30mA		-2	—	2	%
V_{IN}	Input Voltage	—		—	—	6	V
$I_{OUT(Max)}$	Maximum Output Current	—		300	—	—	mA
V_{RLOAD}	Load Regulation	$1mA \le I_{OUT} \le 300mA$		—	10	60	mV
V_{RLINE}	Line Regulation	$V_{OUT}+1V \le V_{IN} \le 6V$, I_{OUT} = 30mA, $V_{CE} = V_{IN}$		—	0.01	0.2	%/V
V_{DROP}	Dropout Voltage	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	
I_Q	Quiescent Current	I_{OUT} = 0mA		—	50	90	µA
I_{STD}	Standby Current	V_{CE} in OFF mode		—	0.1	1	µA
PSRR	Power Supply Rejection Ratio	Ripple 0.5Vp-p, f = 1kHz, $V_{IN} = V_{OUT}+1V$, I_{OUT} = 30mA		—	70	—	dB
$(\Delta V_{OUT}/V_{OUT})/\Delta T$	Output Voltage Temperature Coefficient	I_{OUT} = 30mA, $-20°C \le T_A \le +60°C$		—	±100	—	ppm/°C
I_{LIMIT}	Current Limit	$V_{CE} = V_{IN}$		—	400	—	mA
I_{SHORT}	Short Circuit Current	$V_{CE} = V_{IN}$, V_{OUT} short to GND		—	50	—	mA
V_{NOISE}	RMS Output Noise	$10Hz \le f \le 100kHz$		—	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
θ_{JC}	Thermal Resistance (Junction to Case)	SOT-23-6		—	85	—	°C/W
		TSOT-23-6		—	85	—	
		DFN-2x2-8		—	130	—	

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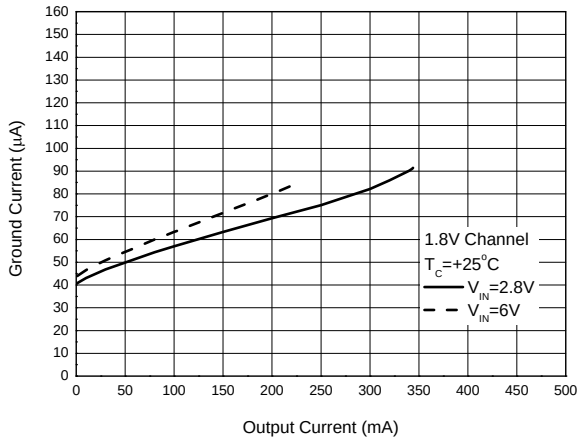
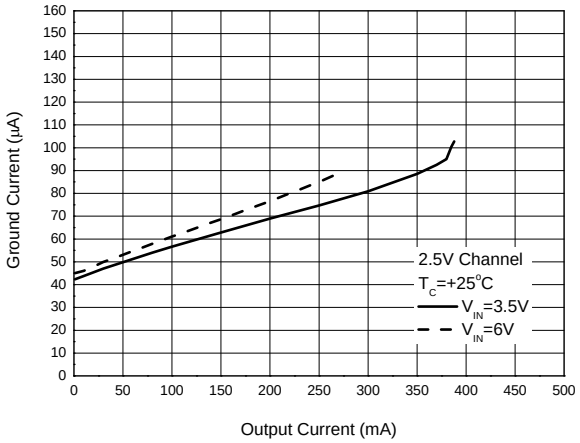
Performance Characteristics

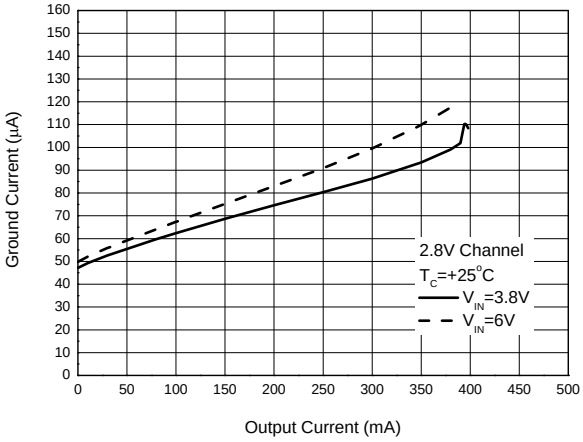
Ground Current vs. Output Current



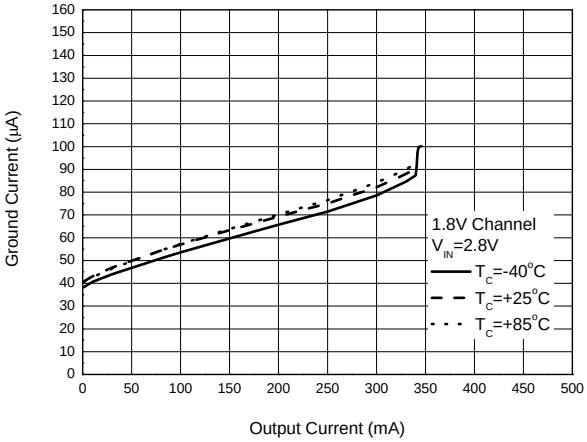
Ground Current vs. Output Current



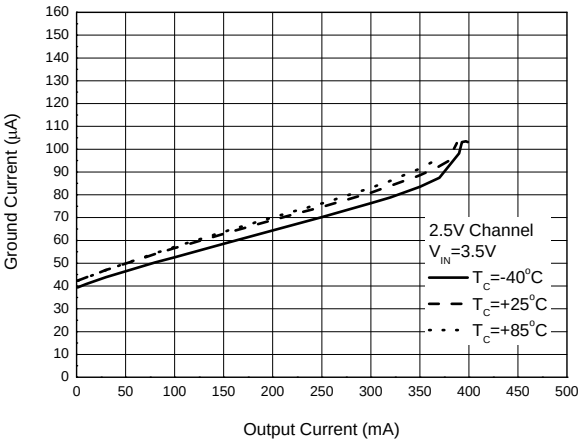
Ground Current vs. Output Current



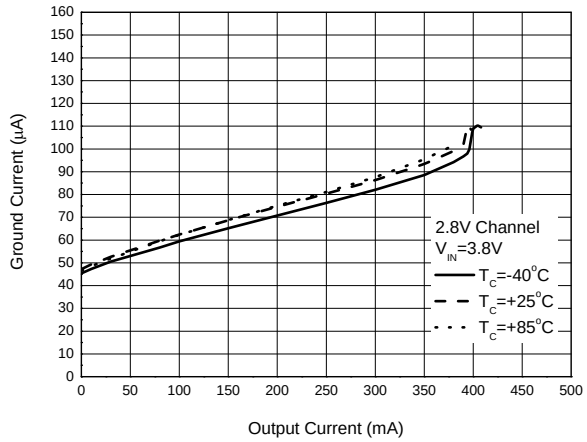
Ground Current vs. Output Current



Ground Current vs. Output Current



Ground Current vs. Output Current



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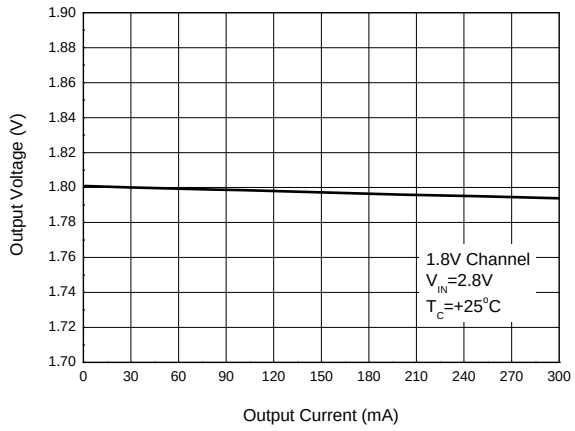
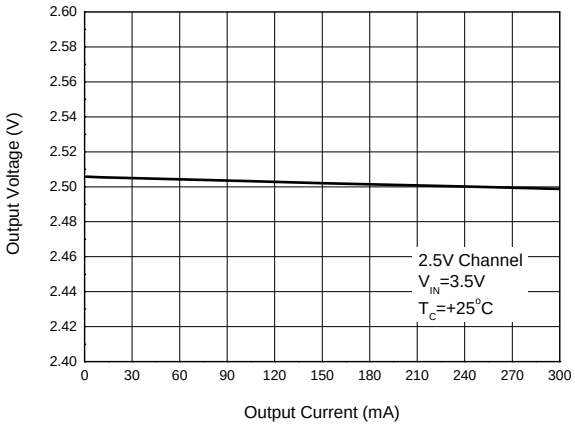
Performance Characteristics (Cont.)

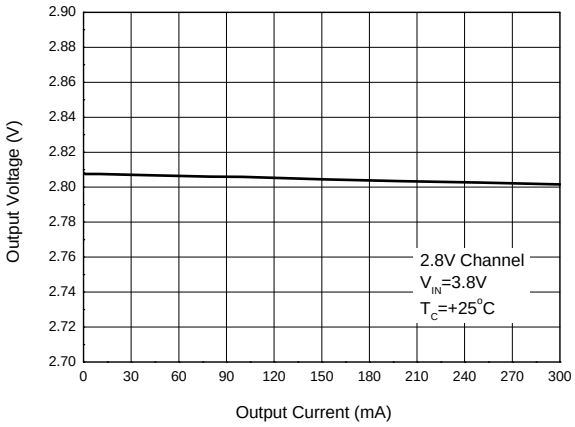
Output Voltage vs. Output Current



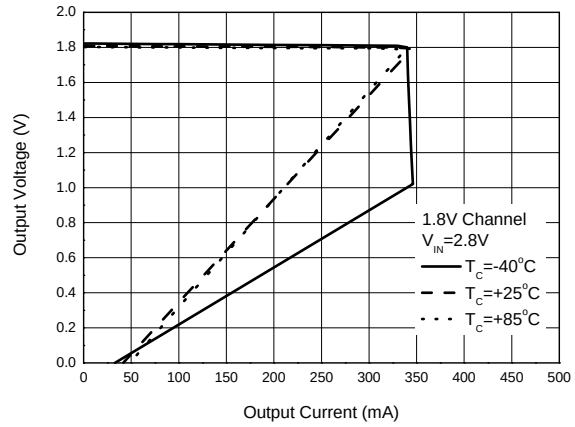
Output Voltage vs. Output Current



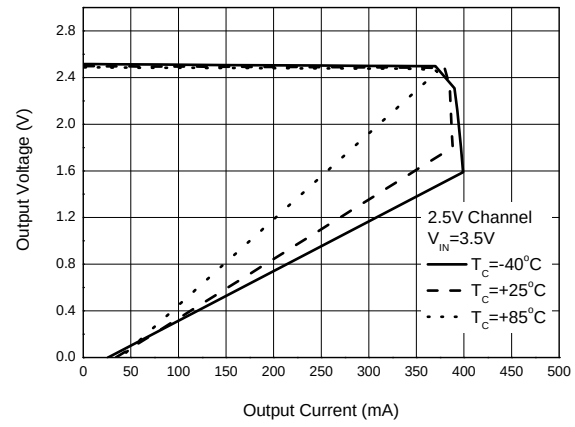
Output Voltage vs. Output Current



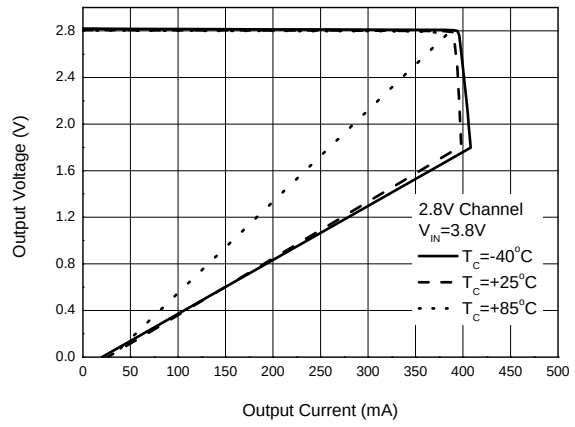
Output Voltage vs. Output Current



Output Voltage vs. Output Current



Output Voltage vs. Output Current



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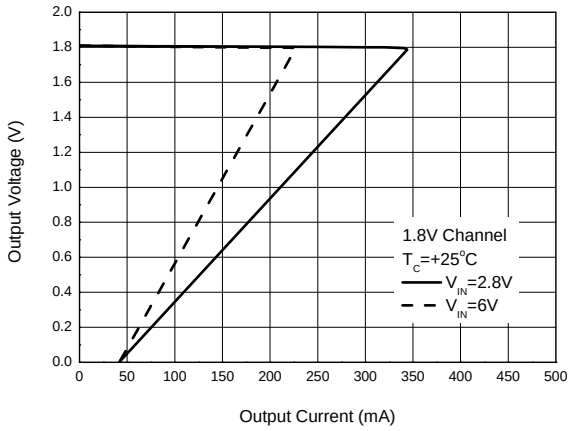
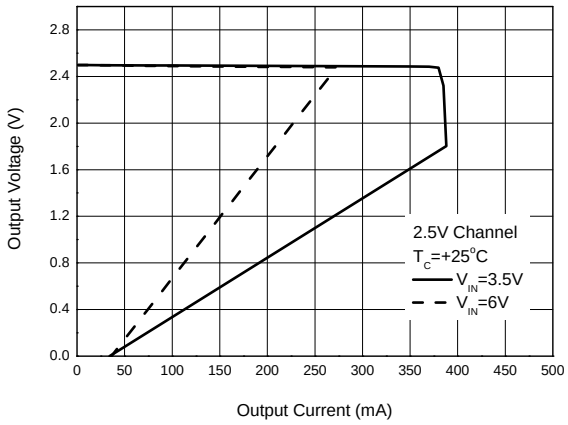
Performance Characteristics (Cont.)

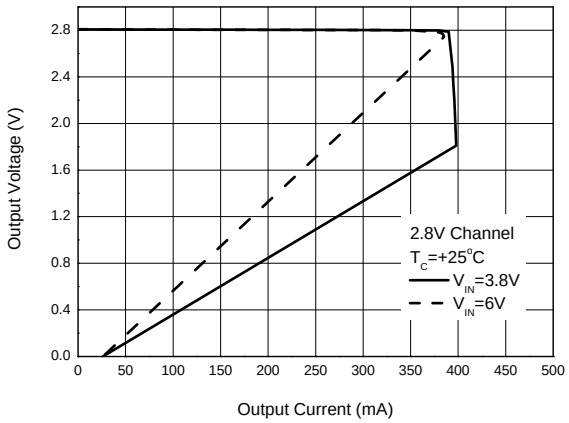
Output Voltage vs. Output Current



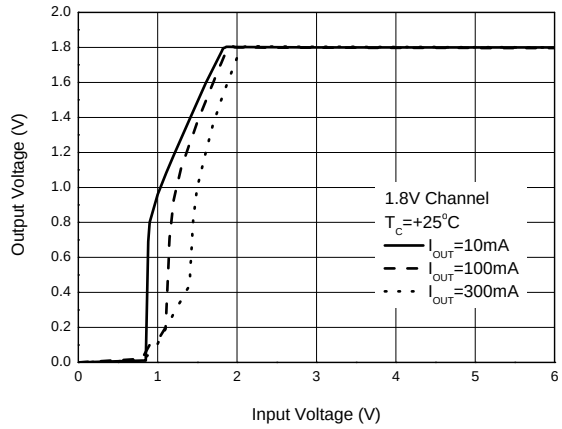
Output Voltage vs. Output Current



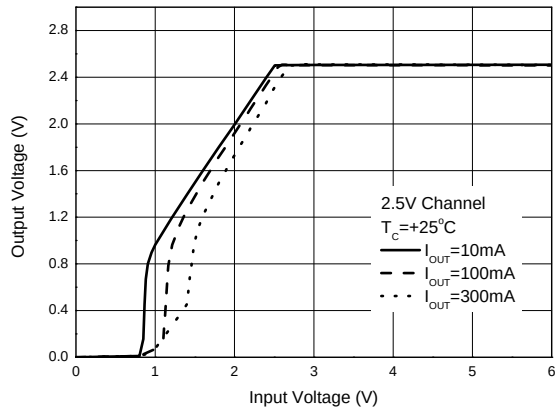
Output Voltage vs. Output Current



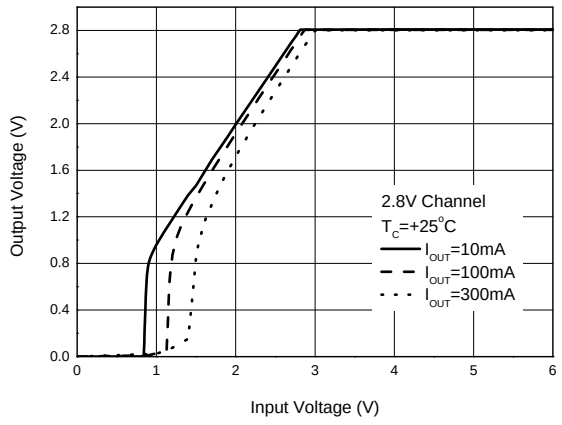
Output Voltage vs. Input Voltage



Output Voltage vs. Input Voltage



Output Voltage vs. Input Voltage



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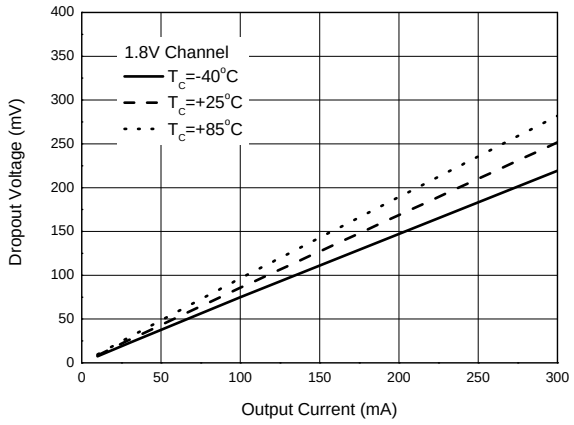
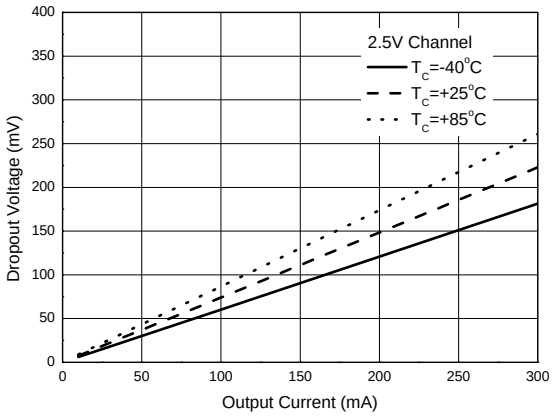
Performance Characteristics (Cont.)

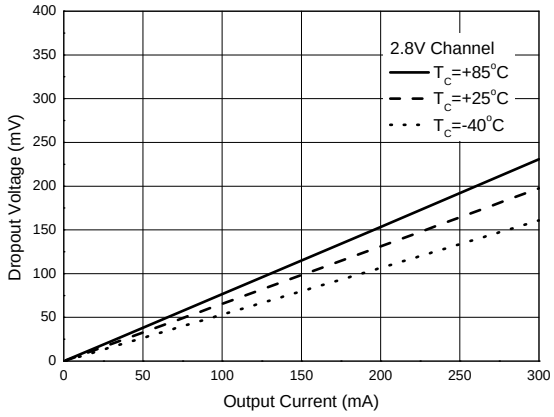
Dropout Voltage vs. Output Current



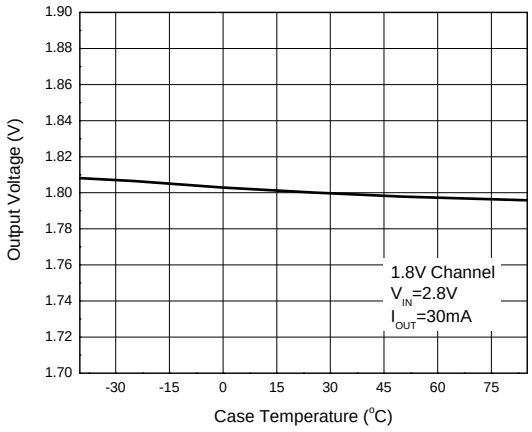
Dropout Voltage vs. Output Current



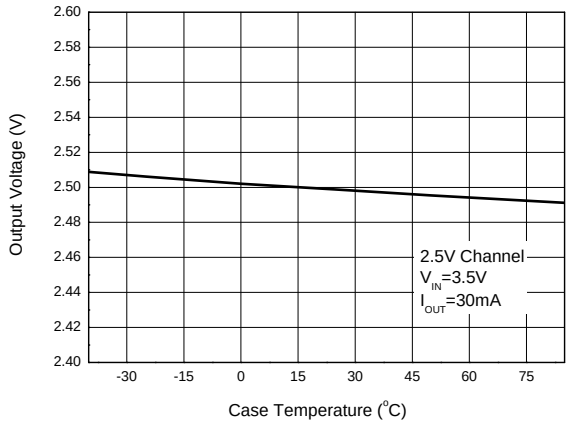
Dropout Voltage vs. Output Current



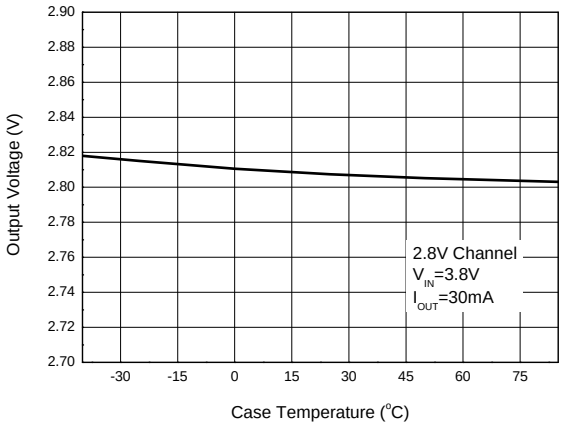
Output Voltage vs. Case Temperature



Output Voltage vs. Case Temperature



Output Voltage vs. Case Temperature



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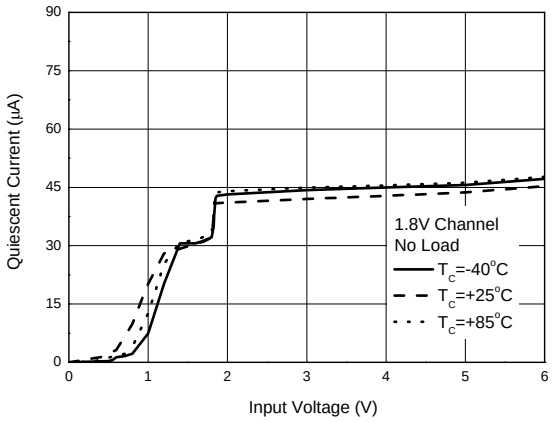
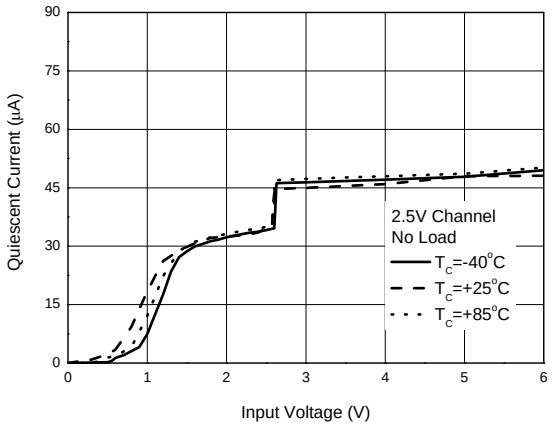
Performance Characteristics (Cont.)

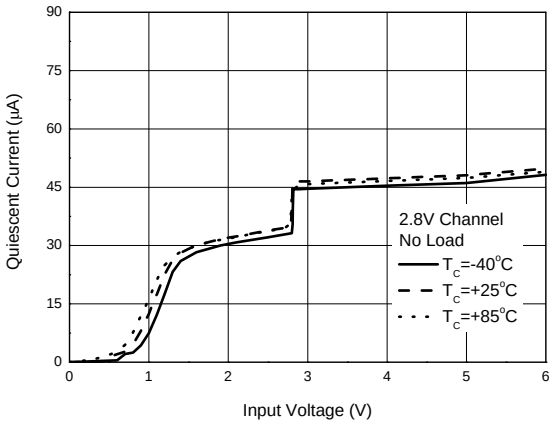
Quiescent Current vs. Input Voltage



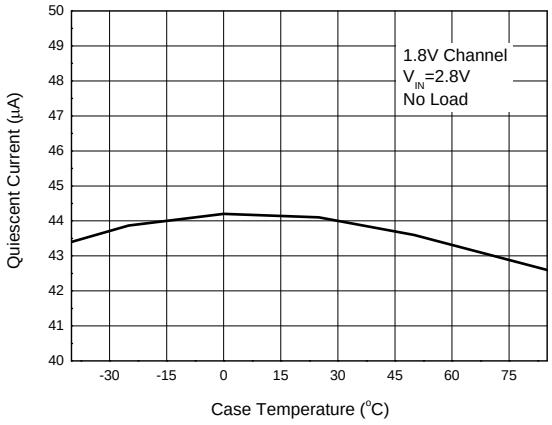
Quiescent Current vs. Input Voltage



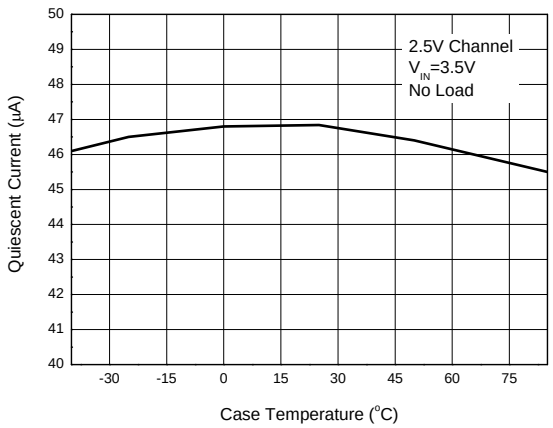
Quiescent Current vs. Input Voltage



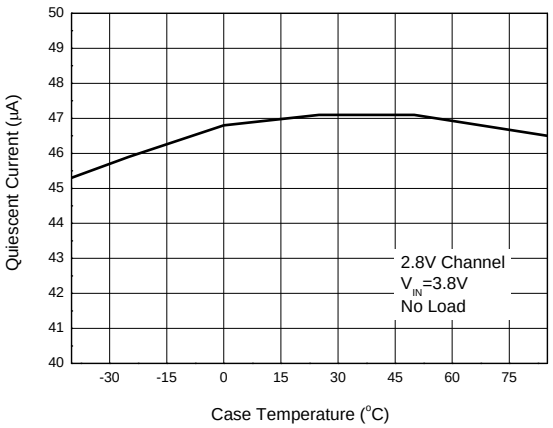
Quiescent Current vs. Case Temperature



Quiescent Current vs. Case Temperature



Quiescent Current vs. Case Temperature



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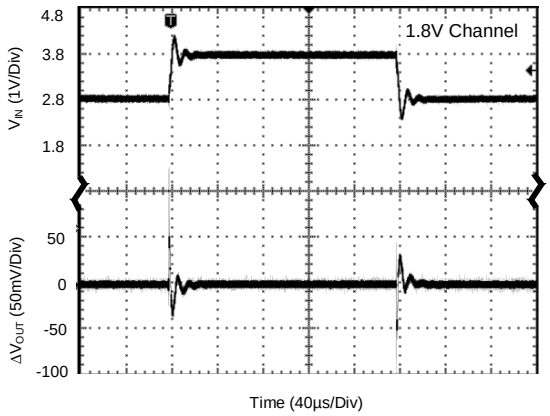
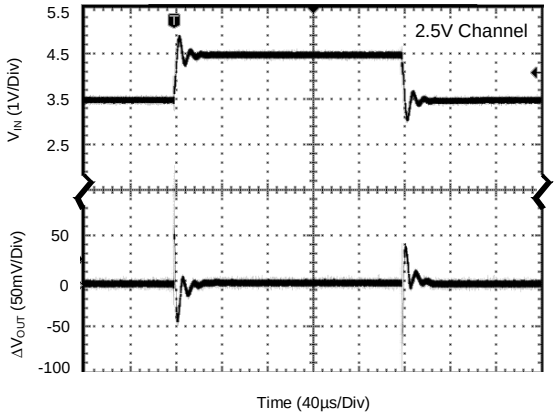
Performance Characteristics (Cont.)

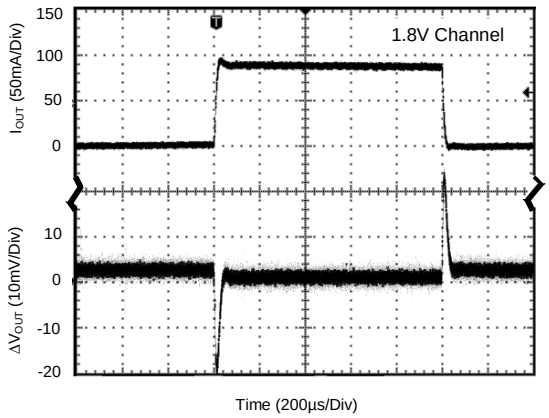
Line Transient
(Conditions: I_{OUT}=50mA, C_{IN}=0.68μF, C_{OUT}=1μF)



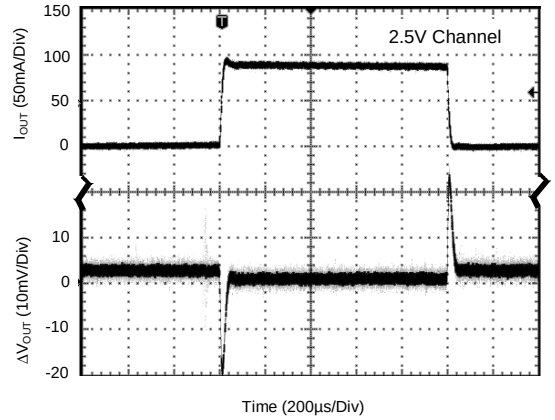
Line Transient
(Conditions: I_{OUT}=50mA, C_{IN}=0.68μF, C_{OUT}=1μF)



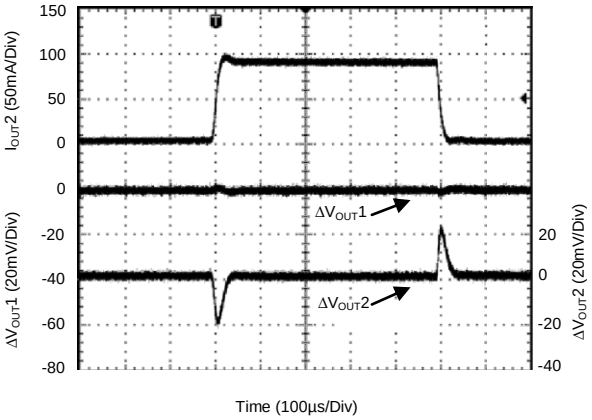
Load Transient
(Conditions: V_{IN}=2.8V, I_{OUT}=10 to 100mA, C_{IN}=C_{OUT}=1μF)



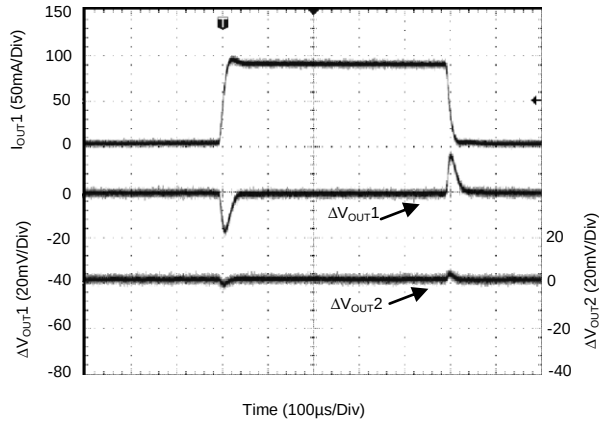
Load Transient
(Conditions: V_{IN}=3.5V, I_{OUT}=10 to 100mA, C_{IN}=C_{OUT}=1μF)



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



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



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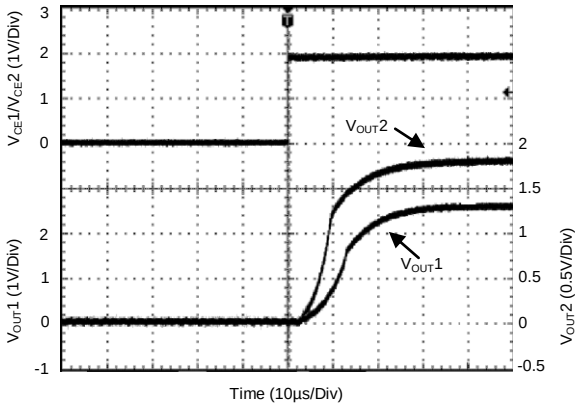
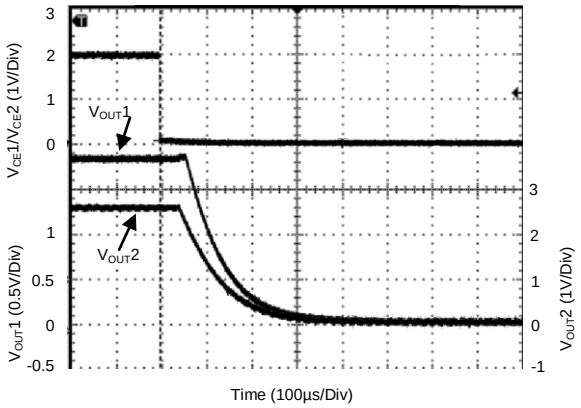
Performance Characteristics (Cont.)

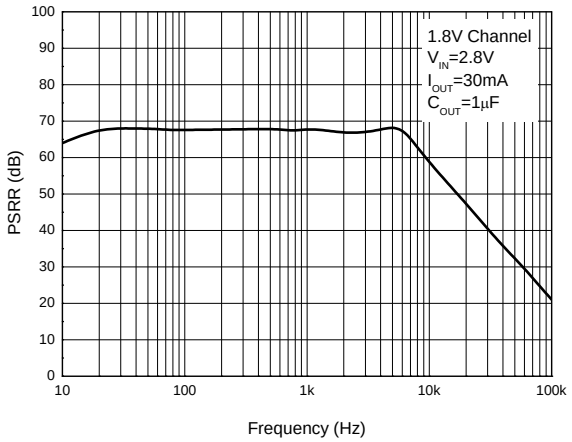
Enable Voltage vs. Output Voltage
(Conditions: $V_{CE}1=V_{CE}2=0$ to 2V, $I_{OUT}=0$mA, $C_{IN}=C_{OUT}=1\mu$F)



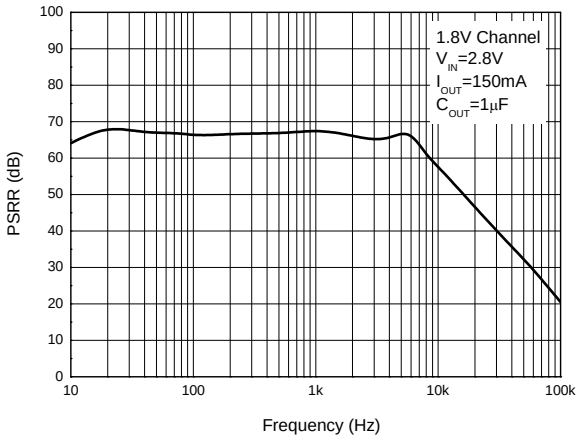
Auto Discharge Function
(Conditions: $V_{CE}1=V_{CE}2=0$ to 2V, $I_{OUT}=0$mA, $C_{IN}=C_{OUT}=1\mu$F)



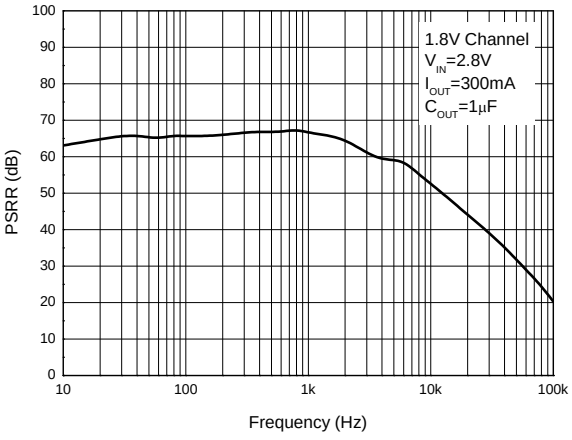
PSRR vs. Frequency



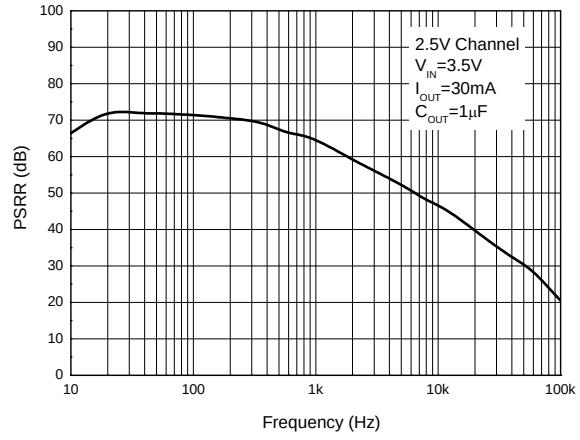
PSRR vs. Frequency



PSRR vs. Frequency



PSRR vs. Frequency



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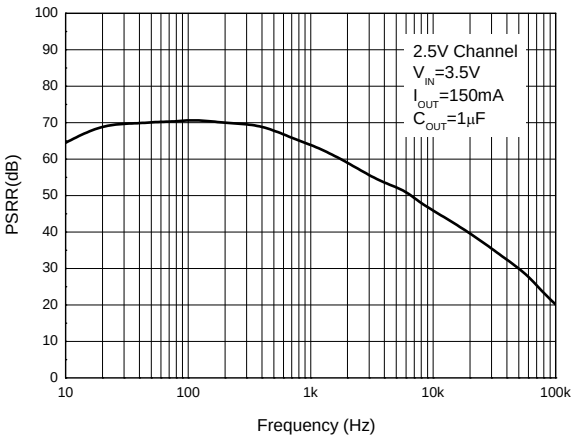
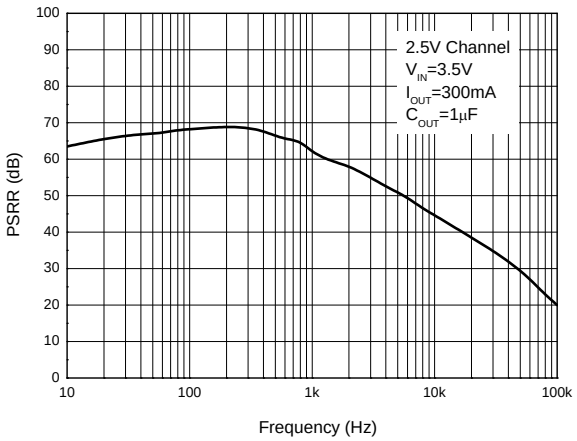
Performance Characteristics (Cont.)

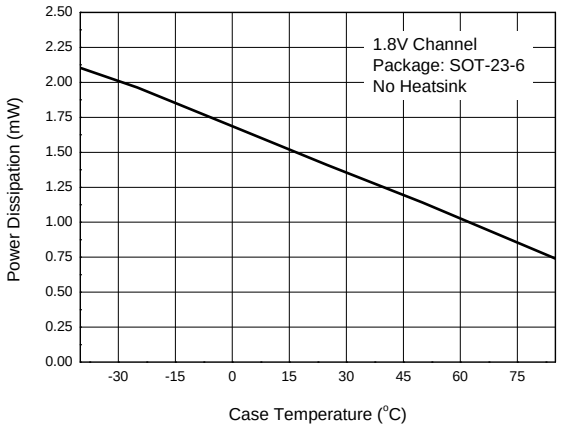
PSRR vs. Frequency



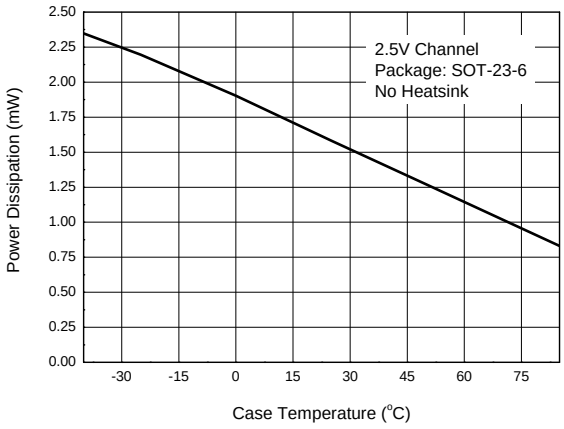
PSRR vs. Frequency



Power Dissipation vs. Case Temperature



Power Dissipation vs. Case Temperature



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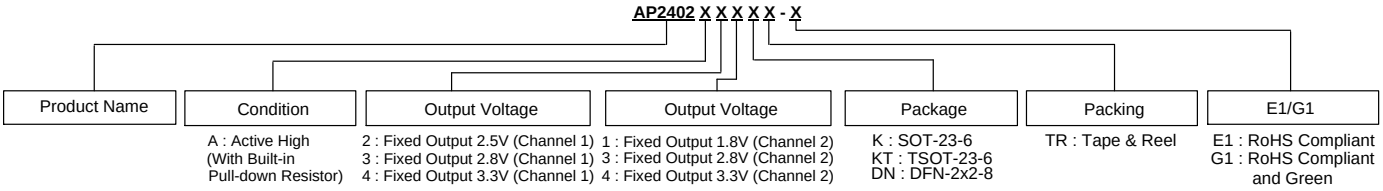
Ordering Information



Package	Temperature Range	Output Voltages	Part Number		Marking ID		Packing
			RoHS Compliant	RoHS Compliant and Green	RoHS Compliant	RoHS Compliant and Green	
SOT-23-6	-20 to +60°C	2.5V/1.8V	AP2402A21KTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A21KTR-G1 (EOL Note 2) (No Alternate Part)	EAA	GAA	Tape & Reel
		2.8V/1.8V	AP2402A31KTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A31KTR-G1 (EOL Note 2) (No Alternate Part)	EAB	GAB	Tape & Reel
		2.8V/2.8V	AP2402A33KTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A33KTR-G1 (EOL Note 2) (No Alternate Part)	EAC	GAC	Tape & Reel
TSOT-23-6	-20 to +60°C	2.5V/1.8V	AP2402A21KTTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A21KTTR-G1	S8A	L8A	Tape & Reel
		2.8V/1.8V	AP2402A31KTTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A31KTTR-G1 (EOL Note 2) (No Alternate Part)	S8B	L8B	Tape & Reel
		2.8V/2.8V	AP2402A33KTTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A33KTTR-G1	S8C	L8C	Tape & Reel
		2.8V/3.3V	AP2402A34KTTR-E1	AP2402A34KTTR-G1 (EOL Note 2) (Use AP7332-2833W6-7)	S8D	L7A	Tape & Reel
		3.3V/3.3V	AP2402A44KTTR-E1	AP2402A44KTTR-G1 (EOL Note 2) (Use AP7332-3333W6-7)	S8F	L7B	Tape & Reel
DFN-2×2-8	-20 to +60°C	2.5V/1.8V	AP2402A21DNTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A21DNTR-G1	6A	DA	Tape & Reel
		2.8V/1.8V	AP2402A31DNTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A31DNTR-G1 (EOL Note 2) (No Alternate Part)	6B	DB	Tape & Reel
		2.8V/2.8V	AP2402A33DNTR-E1 (EOL Note 2) (No Alternate Part)	AP2402A33DNTR-G1	6C	DC	Tape & Reel

Note 2: EOL = End of life.

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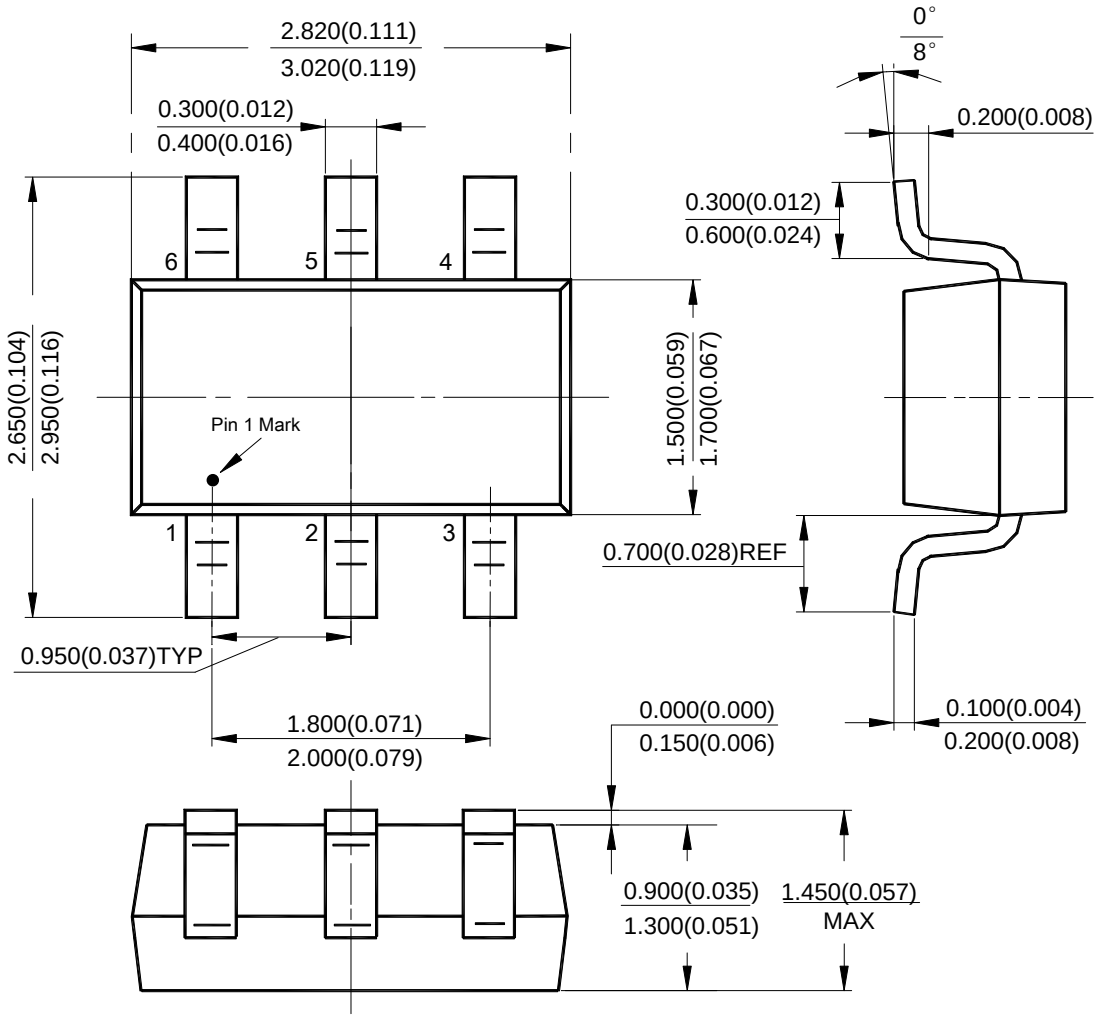
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT-23-6



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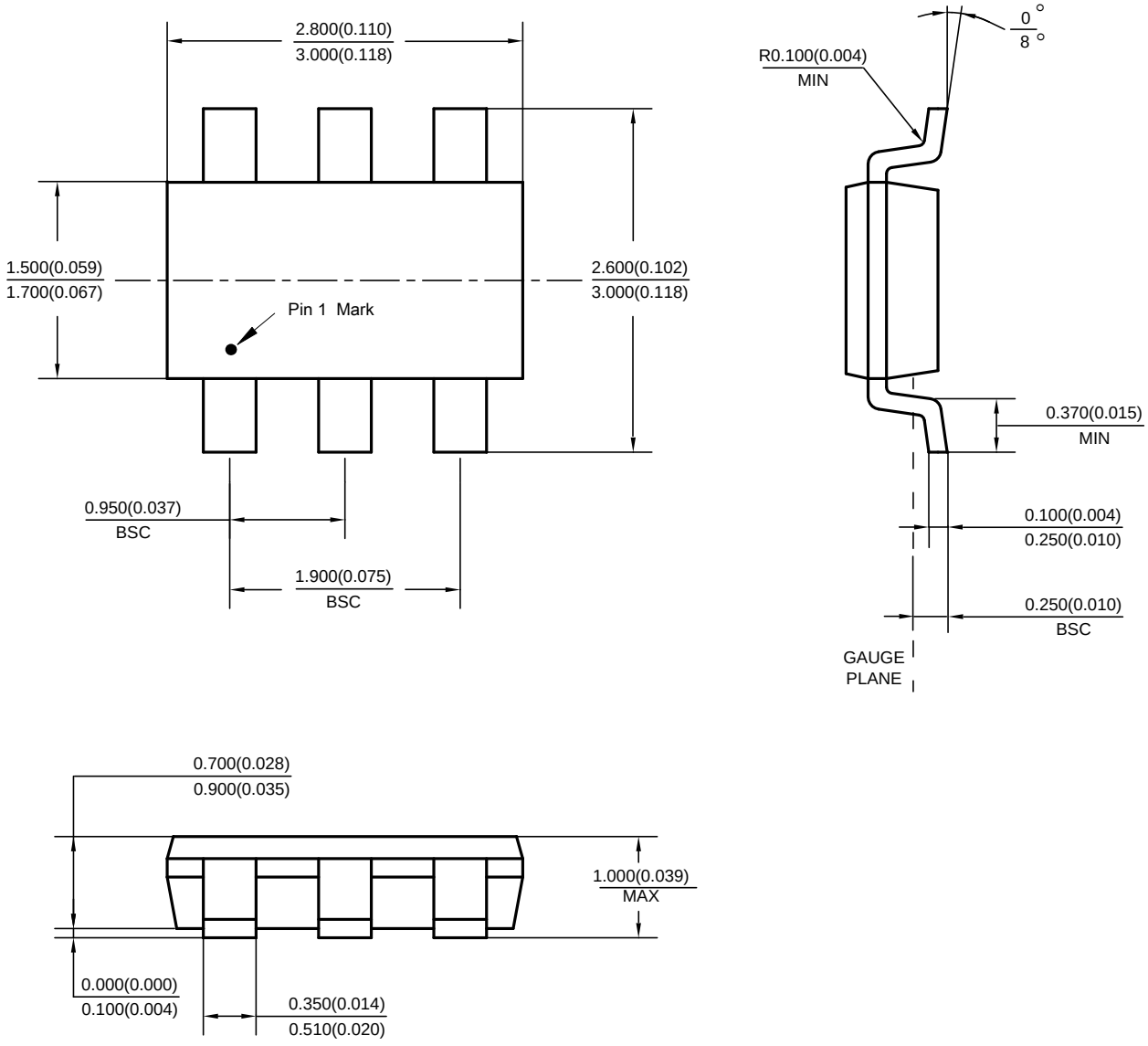
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

(2) Package Type: TSOT-23-6



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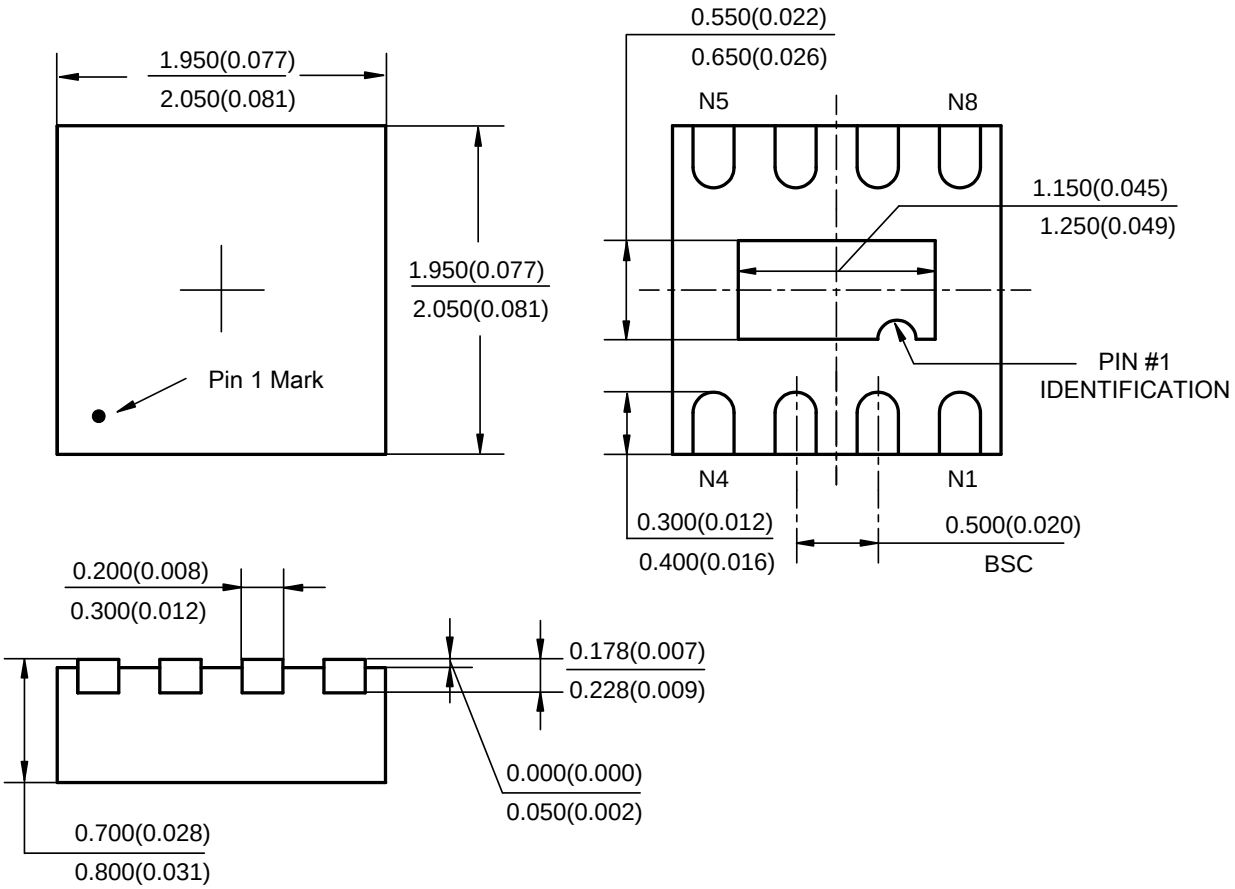
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

(3) Package Type: DFN-2×2-8



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