

ZXCT1082/83/84/85/86/87
PRECISION HIGH VOLTAGE HIGH-SIDE CURRENT MONITORS

NEW PRODUCT

Description

The ZXCT1082 and ZXCT1083 are high side unipolar current sense monitors. These devices eliminate the need to disrupt the ground plane when sensing a load current.

The ZXCT1082/1084/1086 have 60V maximum operating voltage and ZXCT1083/1085/1087 have 40V maximum operating voltage.

The wide common-mode input voltage range and low quiescent currents coupled with SOT25 packages make them suitable for a range of applications; including automotive and systems operating from industrial 24-28V rails.

Their quiescent current is only 0.6µA thereby minimizing current sensing error.

The ZXCT1082 and ZXCT1083 use three external transconductance/gain setting resistors which increase versatility by permitting wide gain ranges and optimization of bandwidths.

The ZXCT1084/5/6/7 are fixed gain voltage output counterparts of the ZXCT1082/3.

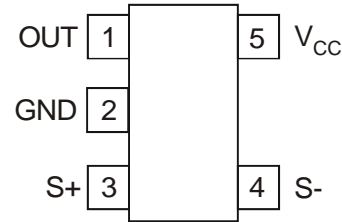
Features

- Wide supply and common-mode voltage range
 - 2.7V to 60V ZXCT1082/84/86
 - 2.7V to 40V ZXCT1083/85/87
- Independent supply and input common-mode voltage
- Low quiescent current (0.6µA).
- Extended industrial temperature range -40 to 125°C
- Package SOT25

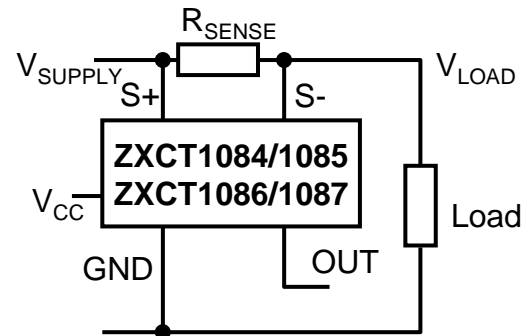
Applications

- Automotive current measurement
- Industrial applications current measurement
- Battery management
- Over current monitor
- Power Management
- Current sources

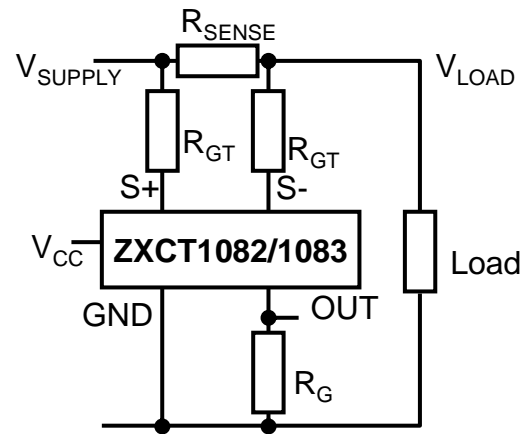
Pin Assignments



Typical Application Circuits



ZXCT1084/85: $V_{OUT} = 25 \times V_{SENSE}$
 ZXCT1086/87: $V_{OUT} = 50 \times V_{SENSE}$



ZXCT1082/83: $V_{OUT} = V_{SENSE} \times \frac{R_G}{R_{GT}}$

Pin Description

PIN	Name	Description		
		Common	ZXCT1082/3	ZXCT1084/5/6/7
1	OUT	Output pin.	Current output.	Voltage output
2	GND	Ground pin.		
3	S+	This is the positive input of the current monitor. It has a wide common-mode input range. The current through this pin varies with differential sense voltage.	An external resistor, R_{GT} , should be connected from S+ to the input side (V_{SUPPLY}) of the sense resistor	Should be directly connected to the input side (V_{SUPPLY}) of the sense resistor.
4	S-	This is the negative input of the current monitor. It has a wide common-mode input range.	An external resistor, R_{GT} , should be connected from S- to the load side (V_{LOAD}) of the sense resistor.	Should be directly connected to the load side (V_{LOAD}) of the sense resistor.
5	V_{CC}	This is the analogue supply and provides power to internal circuitry.		

Absolute Maximum Ratings

Parameter	Rating	Unit
Voltage on S- and S+ ZXCT1082, ZXCT1084, ZXCT1086 ZXCT1083, ZXCT1085, ZXCT1087	-0.3 to 65 -0.3 to 45	V
Voltage on V_{CC} ZXCT1082, ZXCT1084, ZXCT1086 ZXCT1083, ZXCT1085, ZXCT1087	-0.3 to 65 -0.3 to 45	V
Voltage on OUT	-0.3 to V_{S-}	V
Differential Input Voltage, $V_{S+} - V_{S-}$	± 800	mV
Input current into S+ or S- ^(†)	± 12	mA
Storage Temperature	-55 to 150	°C
Maximum Junction Temperature	150	°C
Package Power Dissipation	300 at $T_A = 25^\circ\text{C}$ (De-rate to zero at 150°C)	mW
ESD Rating		
Human Body Model	2	kV
Machine Model	200	V

Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

^(†) The differential input voltage limit, $V_{S+} - V_{S-}$ may be exceeded provided that the input current limit into S+ or S- is not exceeded

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units
V_{IN}	ZXCT1083/1085/1087 Common-Mode Input Range	2.7	40	V
	ZXCT1082/1084/1086 Common-Mode Input Range	2.7	60	
V_{CC}	ZXCT1083/1085/1087 Supply Voltage Range	2.7	40	V
	ZXCT1082/1084/1086 Supply Voltage Range	2.7	60	
V_{SENSE}	Differential Sense Input Voltage Range	0	0.5	V
V_{OUT}	Output Voltage Range	0	$V_{S-} - 1$	V
T_A	Ambient Temperature Range	-40	125	°C

Electrical Characteristics Test Conditions $T_A = 25^\circ\text{C}$, $V_{S+} = 12\text{V}$, $V_{CC} = 5\text{V}$, $V_{\text{SENSE}}^1 = 100\text{mV}$, ZXCT1082/3 $R_{GT} = 5\text{k}\Omega$, $R_G = 125\text{k}\Omega$; unless otherwise stated. (FT = -40°C to $+125^\circ\text{C}$)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Input						
I_{S+}	S+ input current	$V_{\text{SENSE}}^1 = 0\text{mV}$	$T_A = \text{FT}$	1.7	5	μA
I_{S-}	S- input current		$T_A = \text{FT}$	1.7	5	μA
I_{SO}	SENSE input offset current	$V_{\text{SENSE}} = -5\text{mV}$	ZXCT1082/3			μA
V_{IO}	Input Offset Voltage ²	$V_{\text{SENSE}} = 0\text{mV}$		± 0.2	± 1	mV
		ZXCT1082/3/4/5	$T_A = \text{FT}$		± 2.5	
		ZXCT1086/87	$T_A = \text{FT}$		± 3	
		Temperature co-efficient			± 4	$\mu\text{V/K}$
Output						
G_T	Transconductance	ZXCT1082/3 $V_{\text{SENSE}}^1 = 10\text{mV}$ ³ to 150mV		200		$\mu\text{A/V}$
G_{T-ERR}	Transconductance error ⁴		$T_A = \text{FT}$	-1	+1	%
G_{T-TC}	Transconductance temperature co-efficient		$T_A = \text{FT}$		10	
Z_{OUT}	Output impedance	ZXCT1082/3		115		$\text{G}\Omega/\text{pF}$
G_V	Gain	ZXCT1084/5/6/7 $V_{\text{SENSE}}^1 = 10\text{mV}$ to 150mV	1084/5	25		V/V
			1086/7	50		
G_{V-ERR}	Gain error ⁴		$T_A = \text{FT}$	-1	+1	%
G_{V-TC}	Voltage gain temperature co-efficient		$T_A = \text{FT}$		100	
Z_{OUT}	Output impedance	ZXCT1084/5/6/7		125		k Ω
V_{OUTH}	Output relative to common mode, V_{S-}	ZXCT1082/3	$V_{LOAD} - 1$	$V_{LOAD} - 0.8$		V
		ZXCT1084/5/6/7	$V_{S-} - 1$	$V_{S-} - 0.8$		
AC characteristics						
BW	-3dB Small Signal Bandwidth	$V_{\text{SENSE}}^1 (\text{AC}) = 10\text{mV}_{PP}$	$G = 25$ $G = 50$	500 200		kHz
$t_{s(0.1\%)}$	Settling time (0.1%)	$V_{\text{SENSE}} = 50\text{mV}$ to 300mV step	$G = 25$	5		μs
		$V_{\text{SENSE}} = 50\text{mV}$ to 200mV step	$G = 50$	7		
i_{N-OUT}	Output noise current density	$f = 1\text{kHz}$ $f = 10\text{kHz}$	ZXCT1082/3	12 10		pA/ $\sqrt{\text{Hz}}$
	Total output noise current	$f = 0.1\text{Hz}$ to 100kHz		3		nA _{RMS}
V_{N-OUT}	Output noise voltage density	$f = 1\text{kHz}$	ZXCT1084/5	1.5		$\mu\text{V}/\sqrt{\text{Hz}}$
			ZXCT1086/7	2.9		
	$f = 10\text{kHz}$	ZXCT1084/5	1.2		$\mu\text{V}/\sqrt{\text{Hz}}$	
		ZXCT1086/7	2.3			
Total output noise voltage	$f = 0.1\text{Hz}$ to 100kHz	ZXCT1084/5 ZXCT1086/7	390 730		μV_{RMS}	

- Notes:
- For the ZXCT1082/83 $V_{\text{SENSE}} = "V_{SUPPLY}" - "V_{LOAD}"$ where V_{LOAD} is the load voltage or the lower potential side of the sense resistor. For the ZXCT1083/84/85/86 $V_{\text{SENSE}} = "V_{S+}" - "V_{S-}"$
 - V_{IO} is extrapolated from measurements for the gain-error test.
 - For $V_{\text{SENSE}} > 10\text{mV}$, the internal voltage-current converter is fully linear. This enables a true offset to be defined and used.
 - Gain or transconductance error is calculated by applying two values of V_{SENSE} and calculating the error of the slope vs. the ideal.

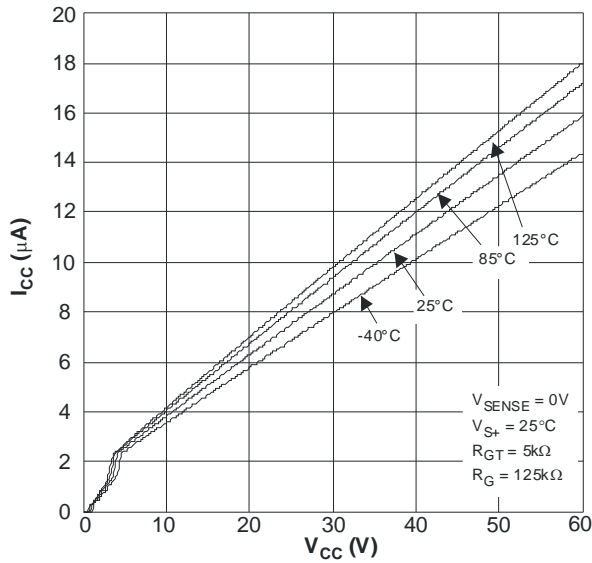
Electrical Characteristics Test Conditions $T_A = 25^\circ\text{C}$, $V_{S+} = 12\text{V}$, $V_{CC} = 5\text{V}$, $V_{SENSE}^1 = 100\text{mV}$, ZXCT1082/3 $R_{GT} = 5\text{k}\Omega$, $R_G = 125\text{k}\Omega$; unless otherwise stated. (FT = -40°C to $+125^\circ\text{C}$)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Power Supply						
I_{CC}	V_{CC} Supply current	$V_{SENSE} = 0\text{V}$	$T_A = \text{FT}$		0.6	μA
						2
PSRR^5	V_{CC} Supply rejection ratio	ZXCT1083/5: $V_{SENSE} = 60\text{mV}$; $V_{CC} = 2.7\text{V}$ to 40V	$T_A = \text{FT}$	80	100	dB
		ZXCT1087: $V_{SENSE} = 30\text{mV}$; $V_{CC} = 2.7\text{V}$ to 40V	$T_A = \text{FT}$	80	100	
		ZXCT1082/4: $V_{SENSE} = 60\text{mV}$; $V_{CC} = 2.7\text{V}$ to 60V	$T_A = \text{FT}$	80	100	
		ZXCT1086: $V_{SENSE} = 30\text{mV}$; $V_{CC} = 2.7\text{V}$ to 60V	$T_A = \text{FT}$	80	100	
				75		
				75		
CMRR^5	Common-mode sense rejection ratio	ZXCT1083/5: $V_{SENSE} = 60\text{mV}$; $V_{S+} = 2.7\text{V}$ to 40V	$T_A = \text{FT}$	80	100	dB
		ZXCT1087: $V_{SENSE} = 30\text{mV}$; $V_{S+} = 2.7\text{V}$ to 40V	$T_A = \text{FT}$	80	100	
		ZXCT1082/4: $V_{SENSE} = 60\text{mV}$; $V_{S+} = 2.7\text{V}$ to 60V	$T_A = \text{FT}$	80	100	
		ZXCT1086: $V_{SENSE} = 30\text{mV}$; $V_{S+} = 2.7\text{V}$ to 60V	$T_A = \text{FT}$	80	100	
				80		
				80		

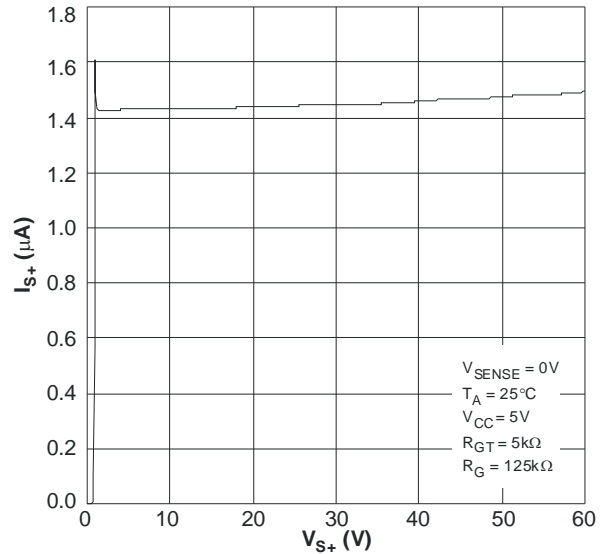
Notes: 5. Measured relative to input

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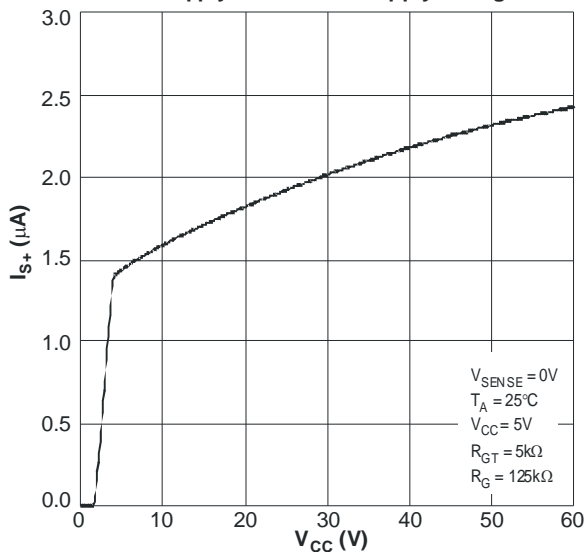
Typical Characteristics $V_{S+} = 12V$, $V_{CC} = 5V$, $V_{SENSE} = 100mV$, $R_{GT} = 5k\Omega$, $R_G = 125k\Omega$, $T_A = 25^\circ C$ unless otherwise stated



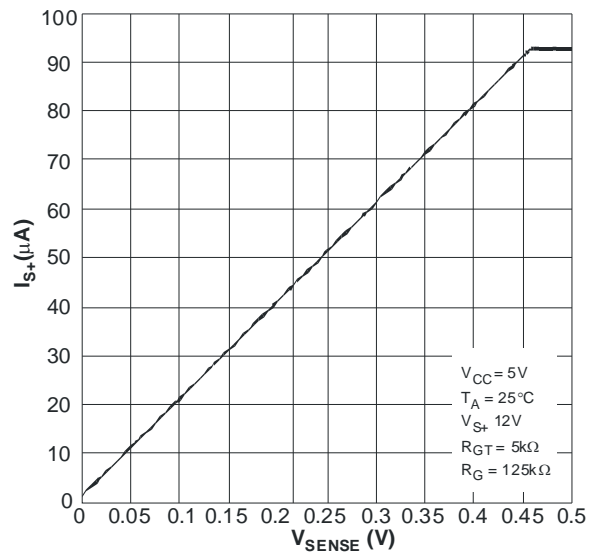
Supply Current vs. Supply Voltage



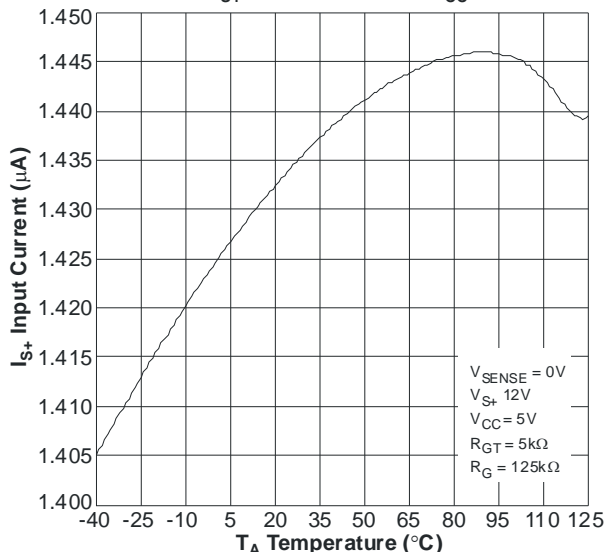
$S+$ Input Current vs. $S+$ Voltage



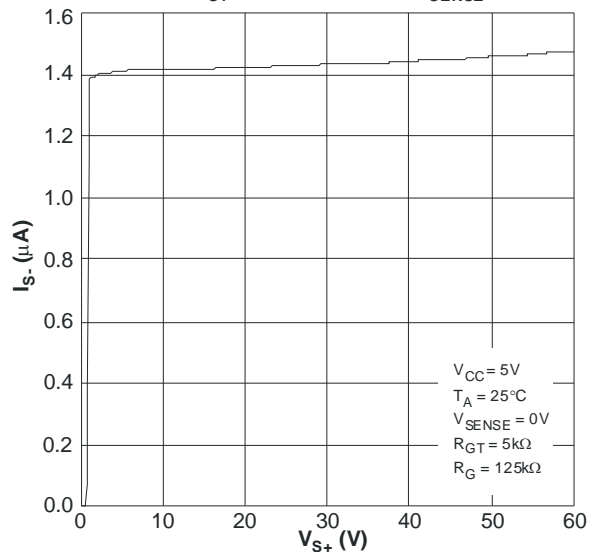
I_{S+} Input Current vs. V_{CC}



I_{S+} Input Current vs. V_{SENSE}

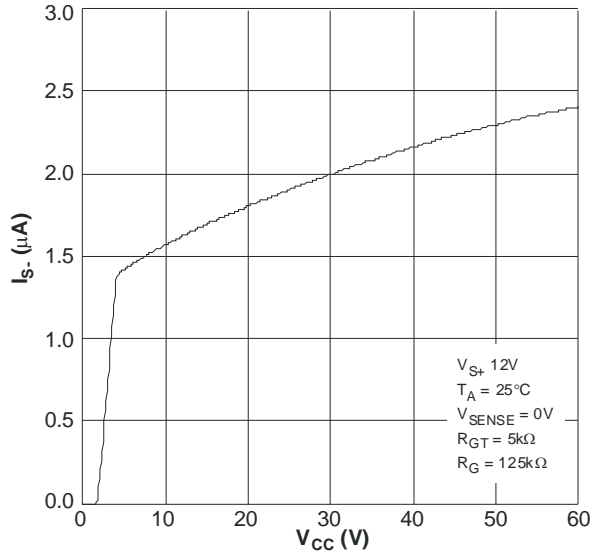


I_{S+} Input Current vs. Ambient Temperature

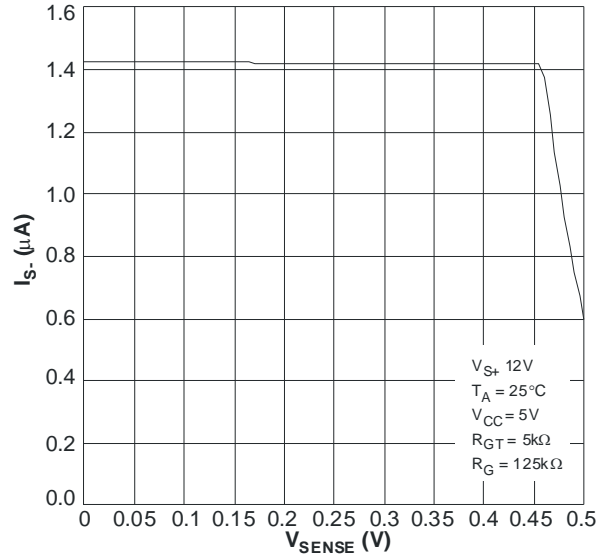


I_{S-} Input Current vs. $S+$ Voltage

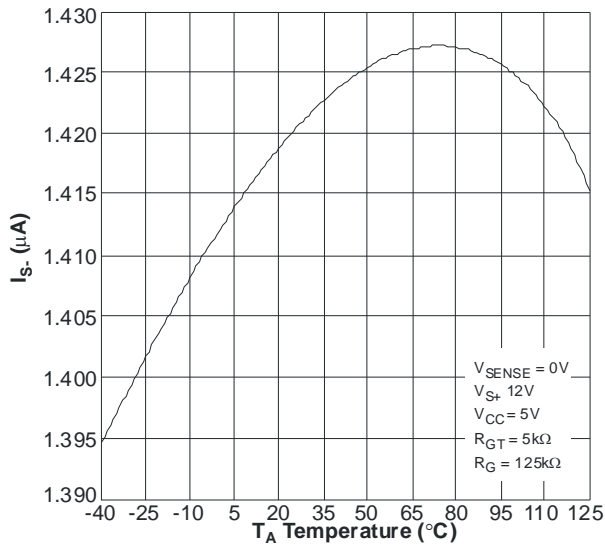
Typical Characteristics (cont.) $V_{S+} = 12V$, $V_{CC} = 5V$, $V_{SENSE} = 100mV$, $R_{GT} = 5k\Omega$, $R_G = 125k\Omega$, $T_A = 25^\circ C$



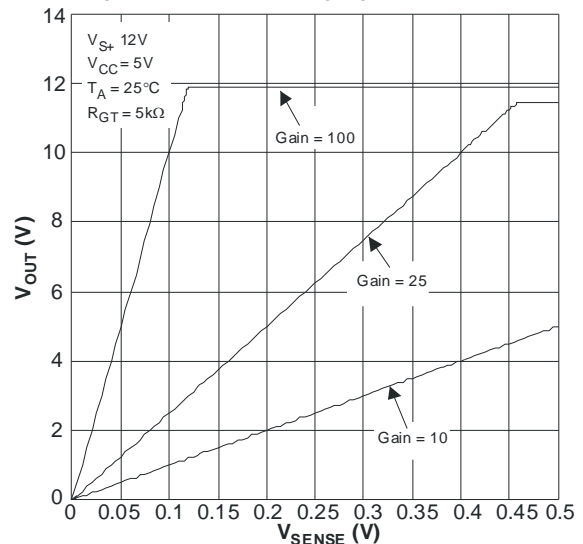
I_s Input Current vs. Supply Voltage



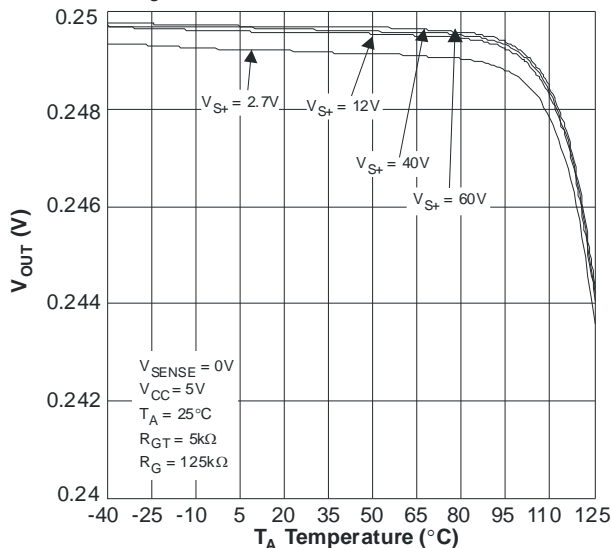
I_s Input Current vs. V_{SENSE} Different Voltage



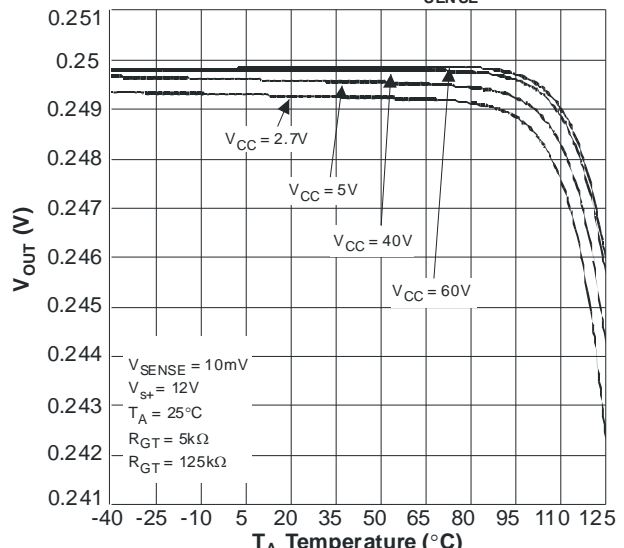
I_s Input Current vs. Ambient Temperature



Output Voltage vs. V_{SENSE}

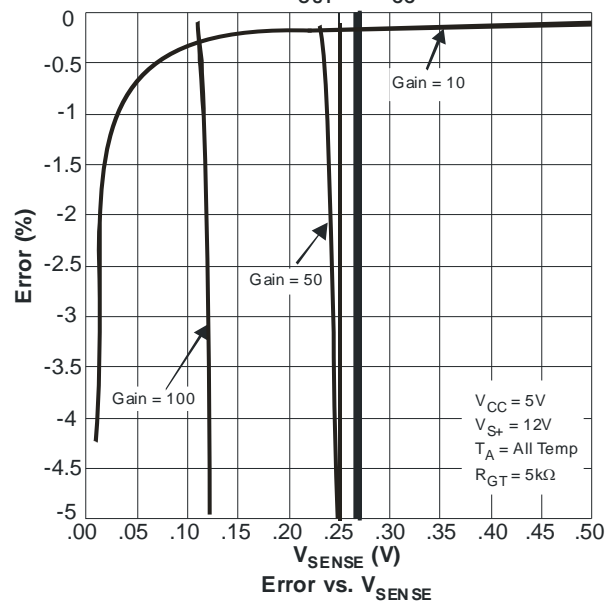
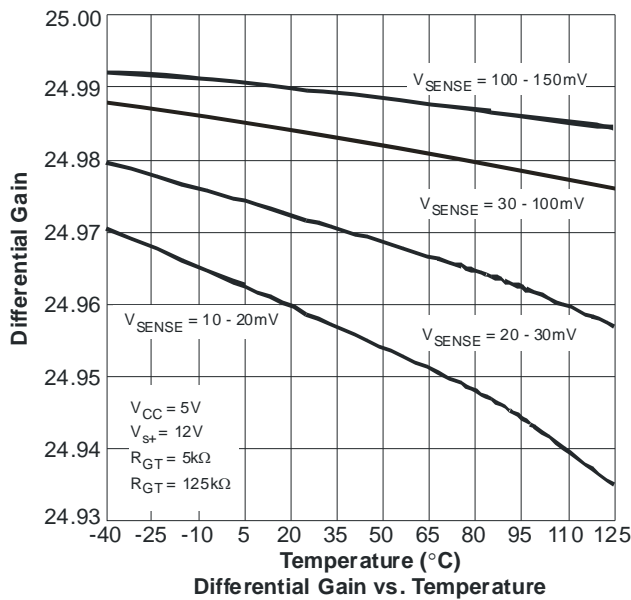
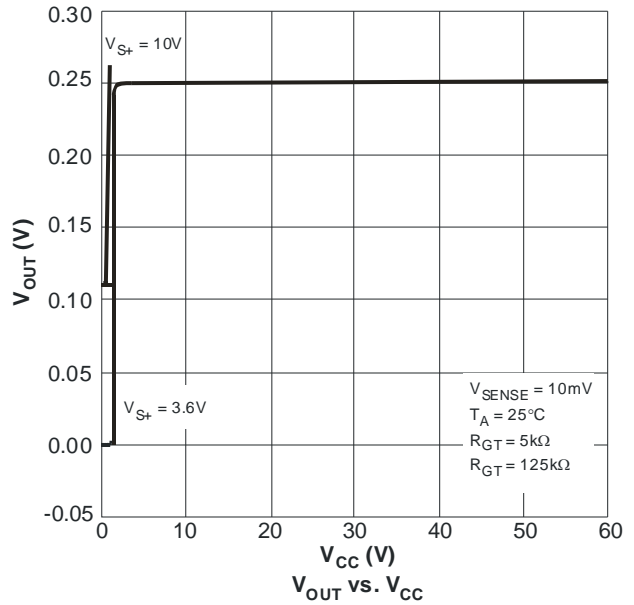
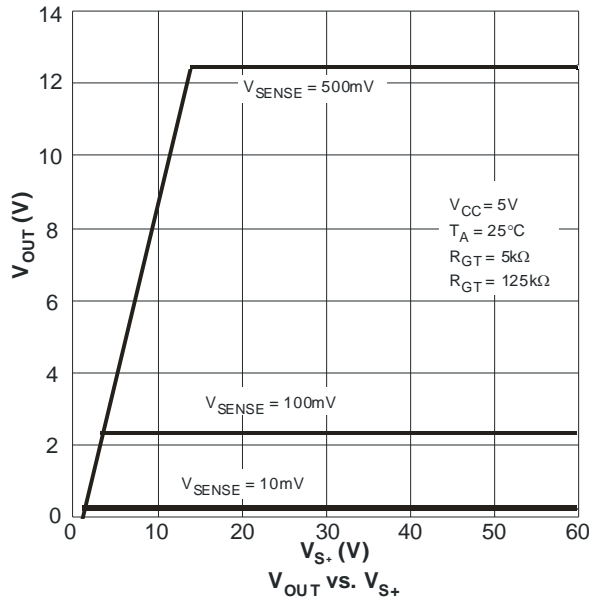


Output Voltage Current vs. Ambient Temperature



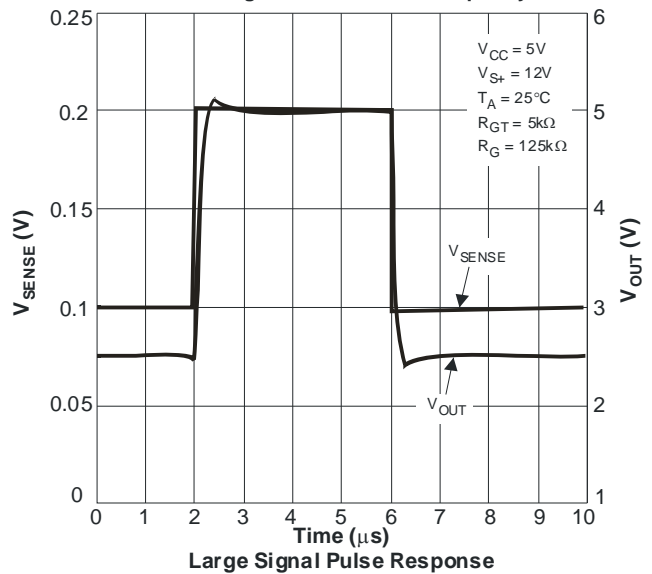
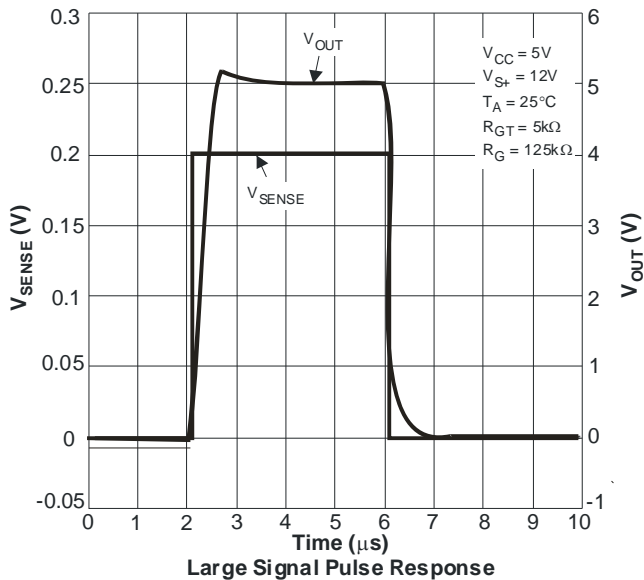
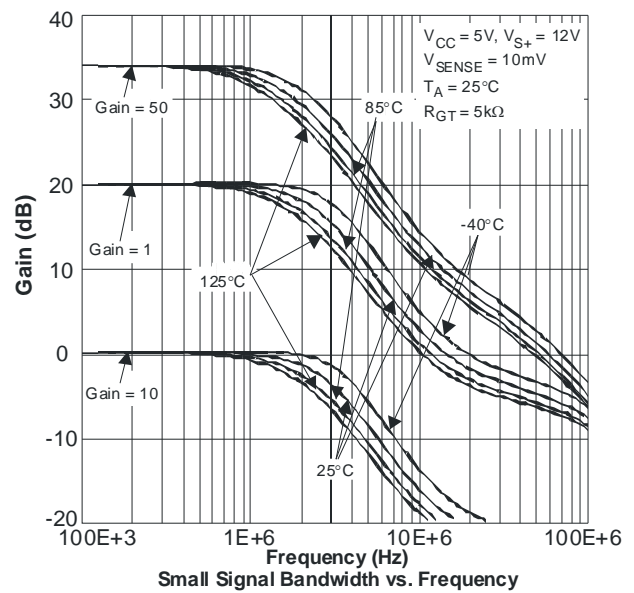
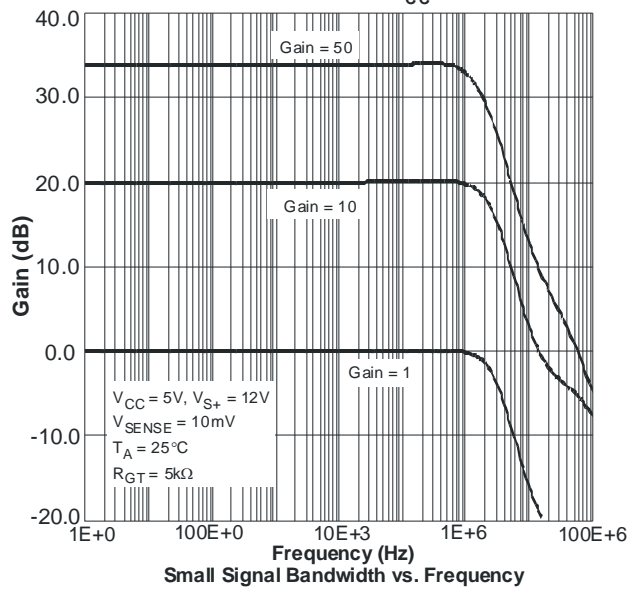
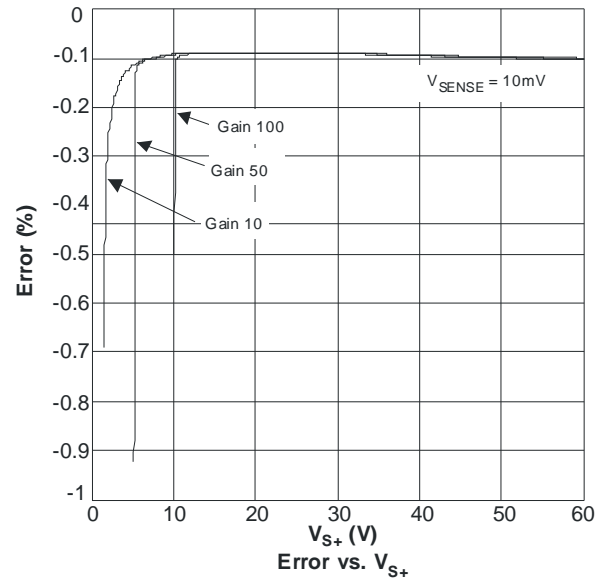
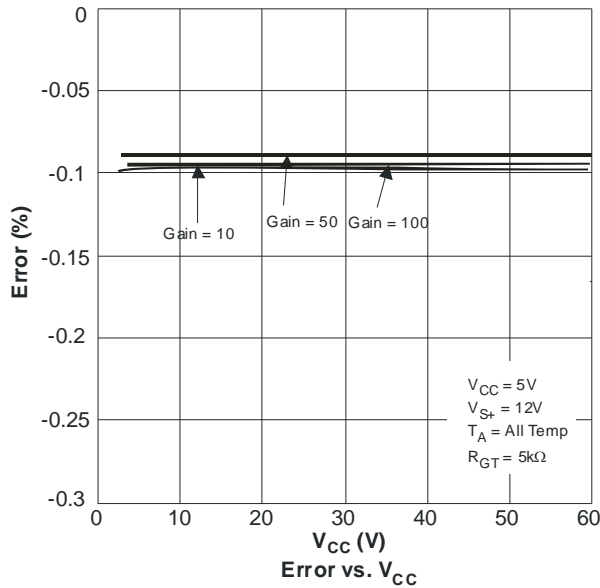
V_{OUT} vs. Ambient Temperature

Typical Characteristics (Cont.) $V_{S+} = 12V$, $V_{CC} = 5V$, $V_{SENSE} = 100mV$, $R_{GT} = 5k\Omega$, $R_G = 125k\Omega$, $T_A = 25^\circ C$



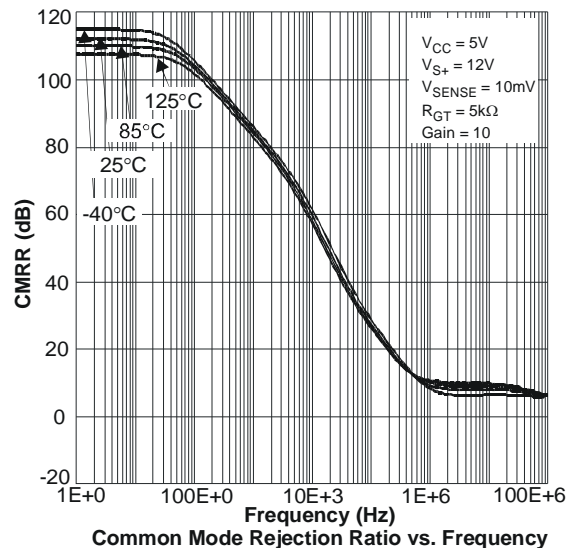
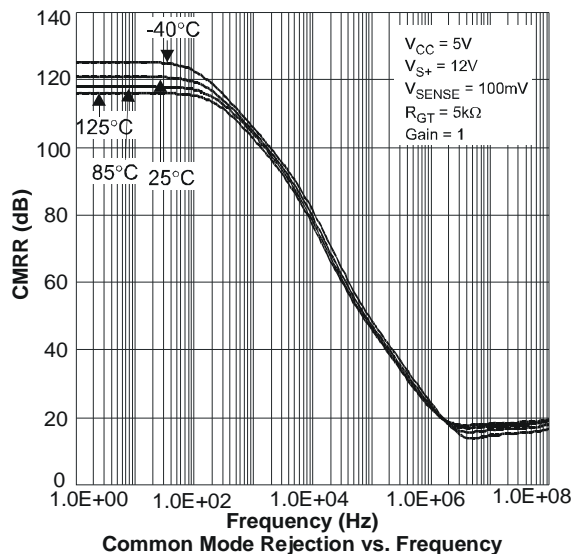
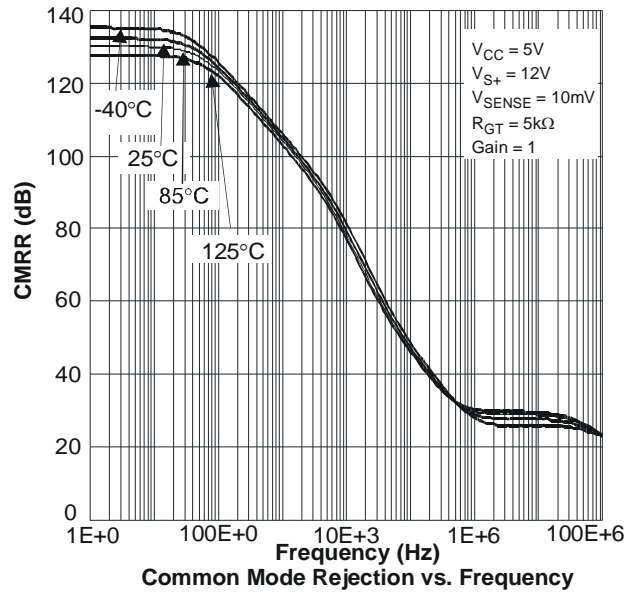
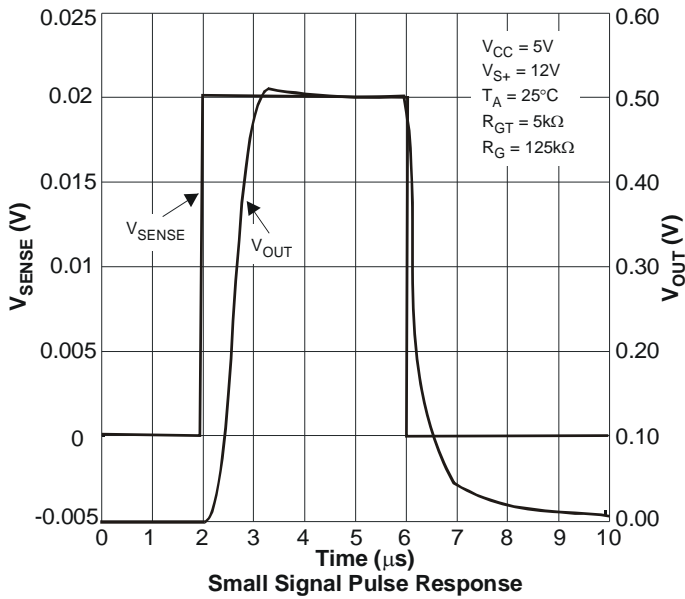
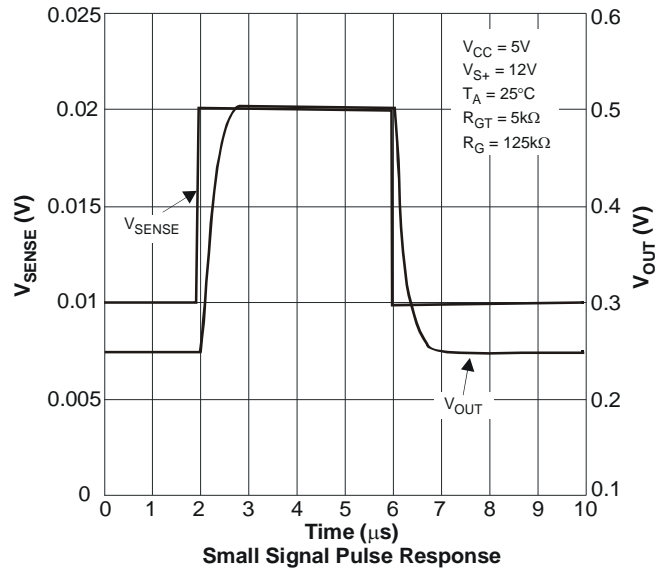
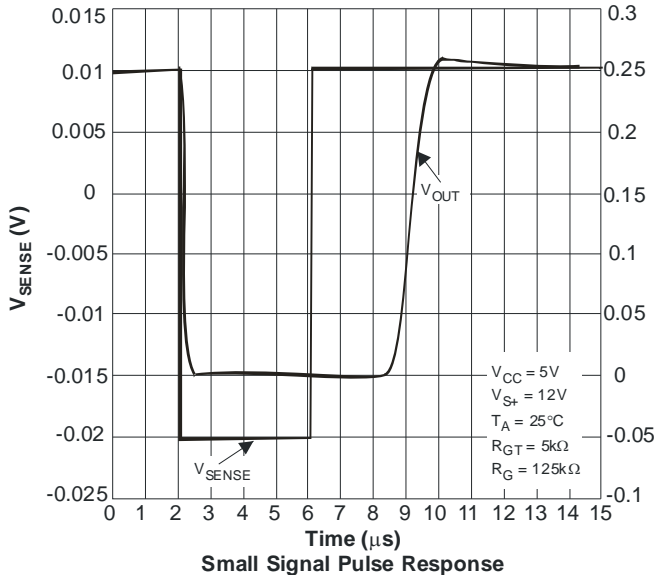
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Typical Characteristics (Cont.) $V_{S+} = 12V$, $V_{CC} = 5V$, $V_{SENSE} = 100mV$, $R_{GT} = 5k\Omega$, $R_G = 125k\Omega$, $T_A = 25^\circ C$

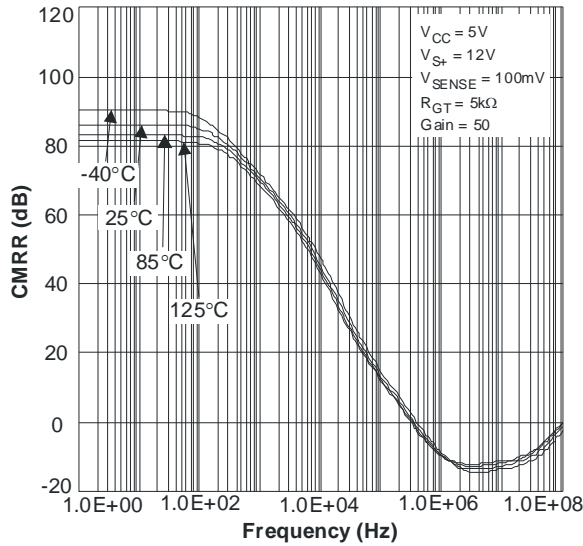


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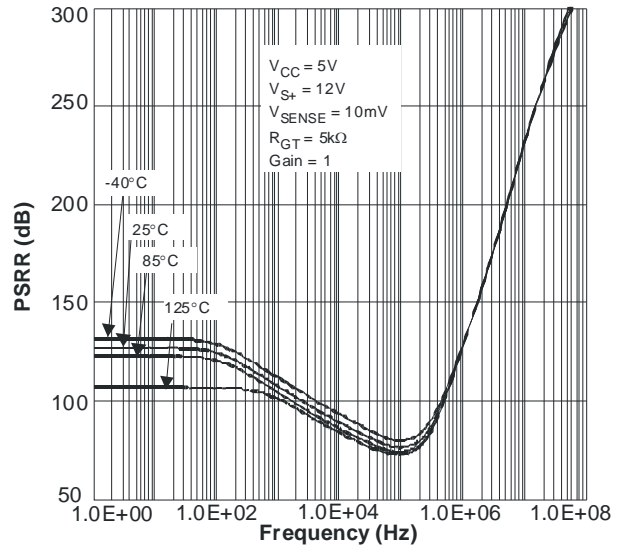
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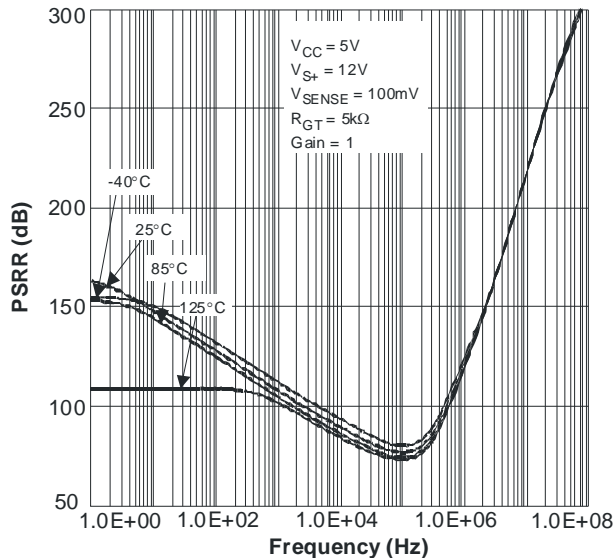
Typical Characteristics (Cont.) $V_{S+} = 12V$, $V_{CC} = 5V$, $V_{SENSE} = 100mV$, $R_{GT} = 5k\Omega$, $R_G = 125k\Omega$, $T_A = 25^\circ C$



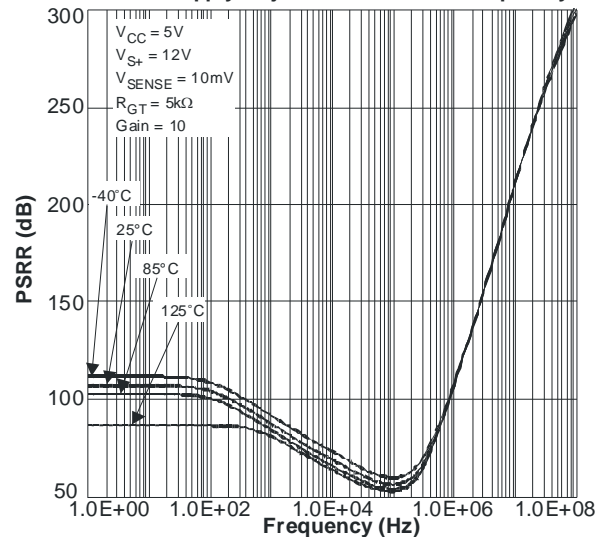
Common Mode Rejection Ratio vs. Frequency



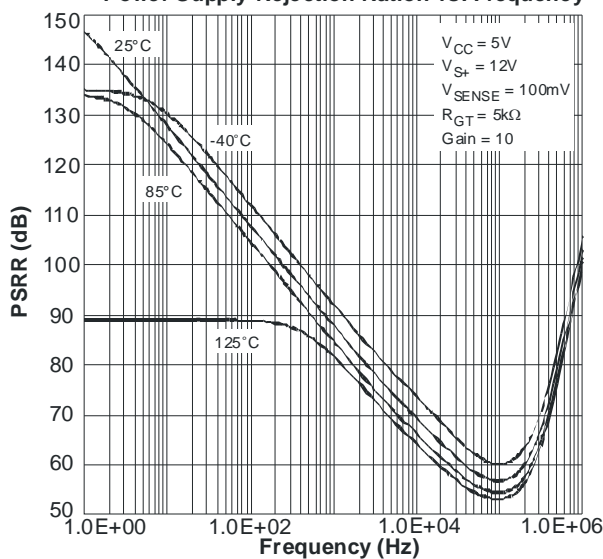
Power Supply Rejection Ratio vs. Frequency



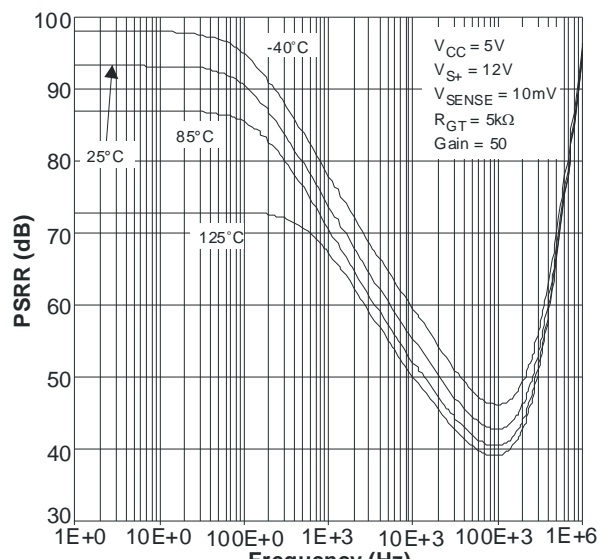
Power Supply Rejection Ratio vs. Frequency



Power Supply Rejection Ratio vs. Frequency



Power Supply Rejection Ratio vs. Frequency

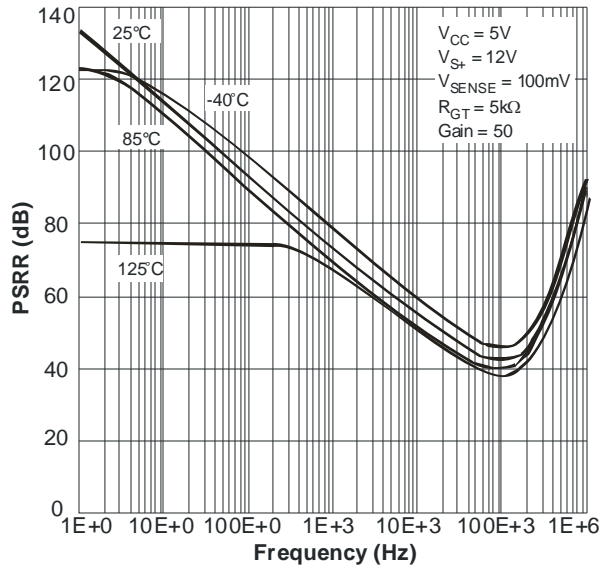


Power Supply Rejection Ratio vs. Frequency

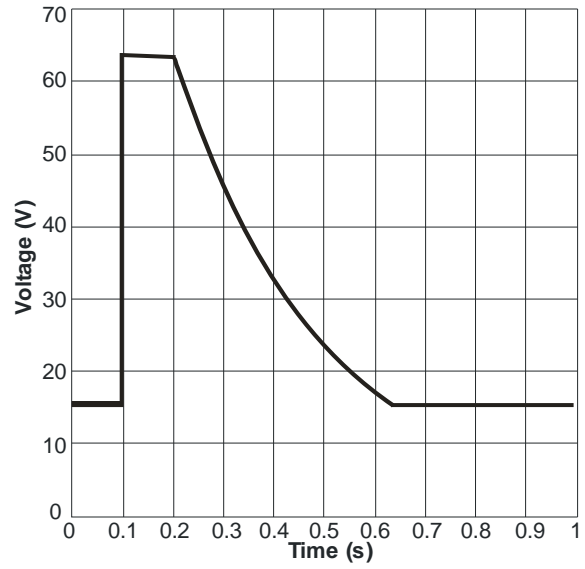
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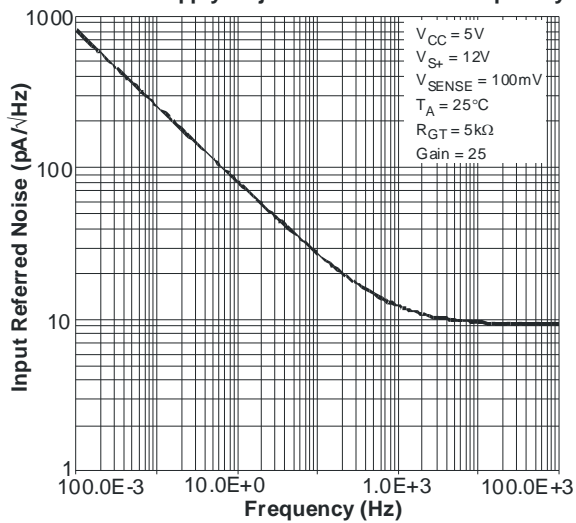
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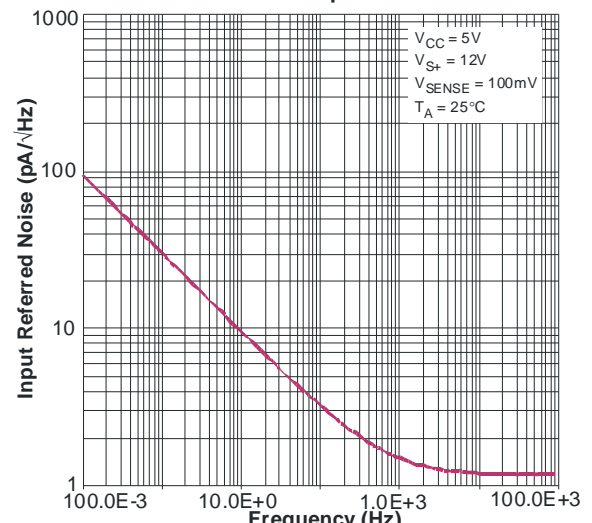
Power Supply Rejection Ratio vs. Frequency



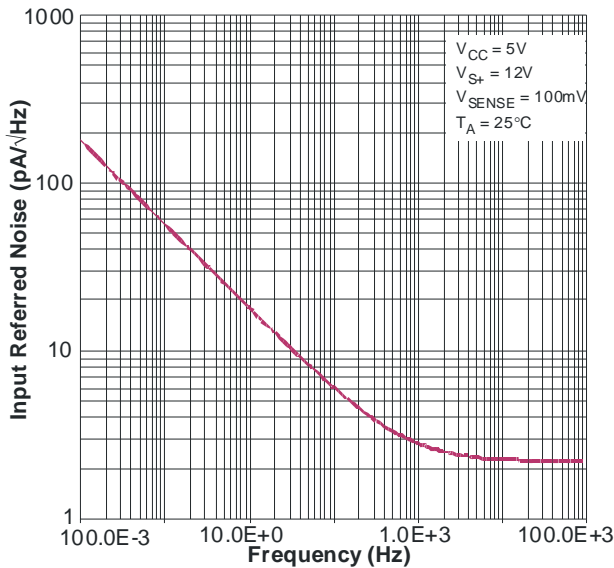
Load Dump vs. Time



Input Referred Noise Current vs. Frequency



Input Referred Noise Current vs. Frequency



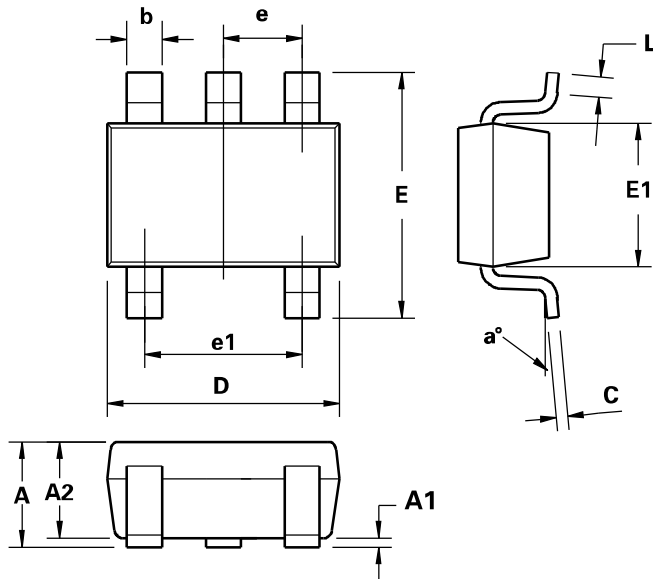
Input Referred Noise Current vs. Frequency

Package Outline Dimensions

Part Number	Status	Pack	Part mark	Reel Size	Tape width	Quantity per reel
ZXCT1082E5TA	Preview	SOT25	1082	7", 180mm	8mm	3000
ZXCT1083E5TA	Preview	SOT25	1083	7", 180mm	8mm	3000
ZXCT1084E5TA	Preview	SOT25	1084	7", 180mm	8mm	3000
ZXCT1085E5TA	Preview	SOT25	1085	7", 180mm	8mm	3000
ZXCT1086E5TA	Preview	SOT25	1086	7", 180mm	8mm	3000
ZXCT1087E5TA	Preview	SOT25	1087	7", 180mm	8mm	3000

Package Outline Dimensions

SOT25



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	0.90	1.45	0.0354	0.0570
A1	0.00	0.15	0.00	0.0059
A2	0.90	1.3	0.0354	0.0511
b	0.20	0.50	0.0078	0.0196
C	0.09	0.26	0.0035	0.0102
D	2.70	3.10	0.1062	0.1220
E	2.20	3.20	0.0866	0.1181
E1	1.30	1.80	0.0511	0.0708
e	0.95 REF		0.0374 REF	
e1	1.90 REF		0.0748 REF	
L	0.10	0.60	0.0039	0.0236
a°	0	30	0	30

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