

## 400 kHz Current Sensor IC with High Accuracy in Low-Resistance High-Isolation Package

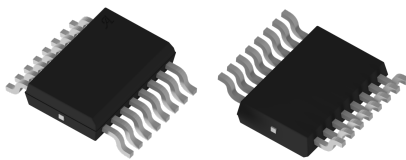
### FEATURES AND BENEFITS

- Low internal primary conductor resistance ( $265\ \mu\Omega$ ) for better power efficiency and low dissipation
- High operating bandwidth for fast control loops or where high-speed currents are monitored
  - 400 kHz bandwidth
  - 1.1  $\mu\text{s}$  typical response time
- High accuracy
  - As low as 1% maximum sensitivity error over temperature
  - 8 mV maximum offset voltage over temperature
  - Non-ratiometric operation with  $V_{\text{REF}}$  output
  - Differential sensing robust against external magnetic fields
  - No magnetic hysteresis
- UL-certified to 62368-1, highly isolated compact SOIC16W surface mount package
  - 5  $\text{kV}_{\text{RMS}}$  rated isolation test voltage
  - 1144  $\text{V}_{\text{RMS}}$  / 1618  $\text{V}_{\text{DC}}$  basic isolation voltages
  - 572  $\text{V}_{\text{RMS}}$  / 809  $\text{V}_{\text{DC}}$  reinforced isolation voltages
- Wide operating temperature,  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Maximum 70  $\text{A}_{\text{RMS}}$  continuous operating current at  $85^{\circ}\text{C}$

### PACKAGE:

16-pin SOICW  
(suffix MC)

*Not to scale*



### DESCRIPTION

The ACS37003 is a fully integrated current sensor IC that senses current flowing through the custom SOICW16 package. The current conductor has a very low ( $265\ \mu\Omega$ ) resistance, ideal for low power dissipation. The sensor is factory-trimmed to provide high accuracy over the entire operating range without the need for customer programming or calibration.

The internal construction provides high isolation by magnetically coupling the field generated by current flow in the conductor to the fully monolithic Hall sensor IC. The current is sensed differentially by two Hall plates that subtract out interfering common-mode magnetic fields. The IC has no physical connection to the integrated current conductor and provides 5  $\text{kV}_{\text{RMS}}$  isolation between the primary and secondary signal leads of the package. This high rating provides an industry-leading basic working voltage of 1140  $\text{V}_{\text{RMS}}$  and a reinforced working voltage of 572  $\text{V}_{\text{RMS}}$ .

The ACS37003KMC is provided in a custom SOICW16 surface mount package. The pin pitch is the same as a standard SOIC16, but the lead-frame is 2.5 times as thick to reduce the resistance. The package body is sized to achieve greater than 8.2 mm of creepage and clearance. The leadframe is plated with 100% matte tin, which is compatible with standard lead (Pb) free printed circuit board assembly processes. Internally, the device is Pb-free, making the device RoHS compliant.

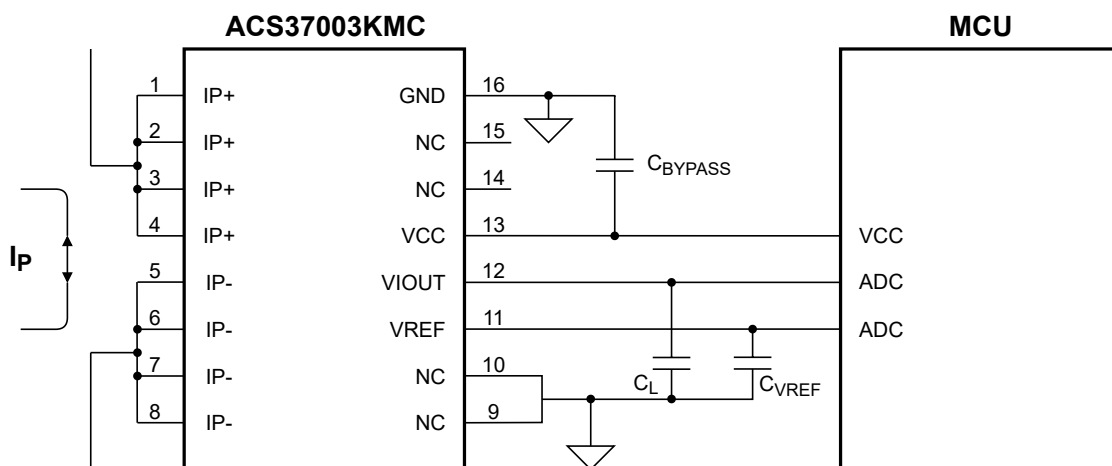
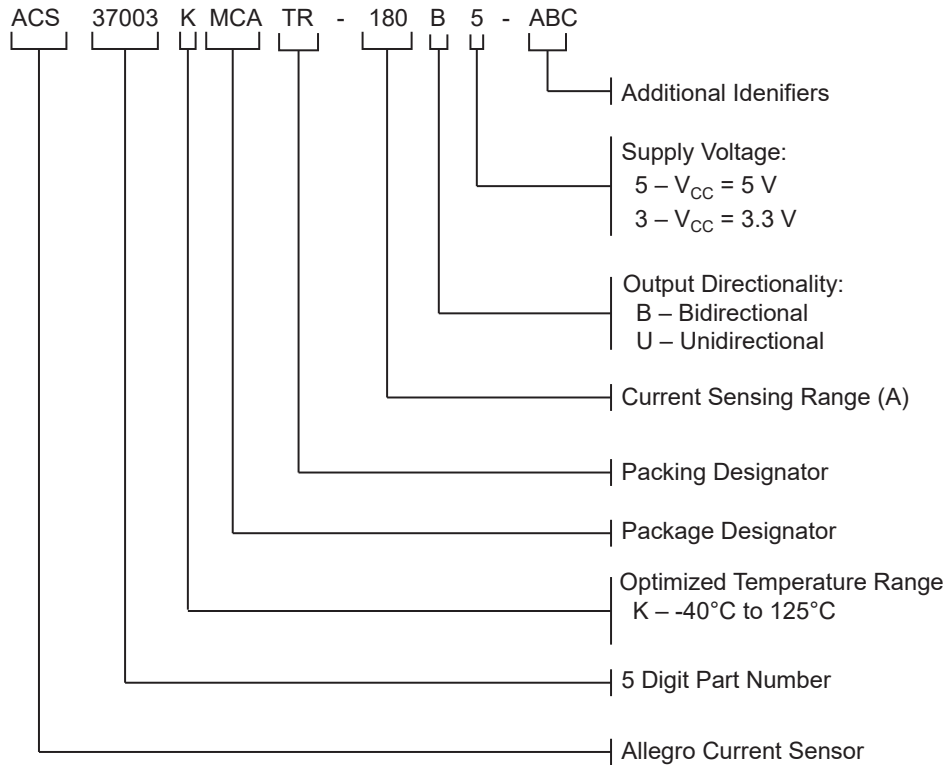


Figure 1: Typical Application Circuit

### SELECTION GUIDE

Part Number	Current Sensing Range, $I_{PR}$ (A)	Sensitivity (mV/A)	$V_{CC}$ (V)	$V_{IOUT(Q)}$ (V)	Temp. Range $T_A$ (°C)	Package	Packing
ACS37003KMCATR-120B3	±120	12	3.3	1.65	-40 to 125	16-pin SOIC	1000 pieces per 13-inch reel
ACS37003KMCATR-050B5	±50	40	5	2.5			
ACS37003KMCATR-085B5	±85	25					
ACS37003KMCATR-180B5	±180	12					



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## ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Notes	Rating	Unit
Forward Supply Voltage	$V_{CC}$		6.5	V
Reverse Supply Voltage	$V_{RCC}$		-0.5	V
Forward Output Voltage	$V_{FOUT}$	Applies to $V_{IOUT}$ and $V_{REF}$	$(V_{CC} + 0.7) \leq 6.5$	V
Reverse Output Voltage	$V_{ROUT}$	Applies to $V_{IOUT}$ and $V_{REF}$	-0.5	V
Forward Input Voltage	$V_{FNC}$	Applies to NC pins	$(V_{CC} + 0.7) \leq 6.5$	V
Reverse Input Voltage	$V_{RNC}$	Applies to NC pins	-0.5	V
Operating Ambient Temperature	$T_A$	K temperature range	-40 to 125	°C
Storage Temperature	$T_{stg}$		-65 to 165	°C
Maximum Junction Temperature	$T_{J(max)}$		165	°C

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Notes	Value	Unit
<b>MC Package, 16-Pin SOICW</b>				
Package Thermal Resistance (Junction to Ambient)	$R_{\theta JA}$	Mounted on the standard MC Current Sensor Evaluation Board (ACSEVB-MC16)	19	°C/W
Package Thermal Metric (Junction to Top)	$\Psi_{JT}$		2.4	°C/W
Package Thermal Resistance (Junction to Case)	$R_{\theta JC}$	Simulated per the methods in JESD51-1	15	°C/W
Package Thermal Resistance (Junction to Board)	$R_{\theta JB}$	Simulated per the methods in JESD51-8	7.3	°C/W

## ISOLATION AND PACKAGE CHARACTERISTICS

Characteristic	Symbol	Notes	Rating	Unit
Withstand Voltage <sup>[1][2]</sup>	$V_{ISO}$	Agency rated for 60 seconds per UL 62368-1 (edition 3)	5000	$V_{RMS}$
Working Voltage for Basic Isolation <sup>[2]</sup>	$V_{WVBI}$	Maximum approved working voltage for basic (single) isolation according to UL 62368-1 (edition 3)	1618	$V_{PK}$ or $V_{DC}$
			1144	$V_{RMS}$
Working Voltage for Reinforced Isolation <sup>[2]</sup>	$V_{WVRI}$	Maximum approved working voltage for reinforced isolation according to UL 62368-1 (edition 3)	809	$V_{PK}$ or $V_{DC}$
			572	$V_{RMS}$
Surge Voltage	$V_{SURGE}$	1.2 / 50 $\mu s$ waveform, tested in dielectric fluid to determine intrinsic surge immunity of isolation barrier	13000	$V_{PK}$
Impulse Voltage	$V_{IMPULSE}$	1.2 / 50 $\mu s$ waveform, tested in air	7071	$V_{PK}$
Clearance	$D_{CL}$	Minimum distance through air from IP leads to signal leads	8.7	mm
Creepage	$D_{CR}$	Minimum distance along package body from IP leads to signal leads	8.7	mm
Distance Through Insulation	DTI	Minimum internal distance through insulation	110	$\mu m$
Comparative Track Index	CTI	Material Group II	400 to 599	V

<sup>[1]</sup> Production-tested in accordance with UL 62368-1 (edition 3).

<sup>[2]</sup> Certification pending.

PINOUT DIAGRAM AND TERMINAL LIST TABLE

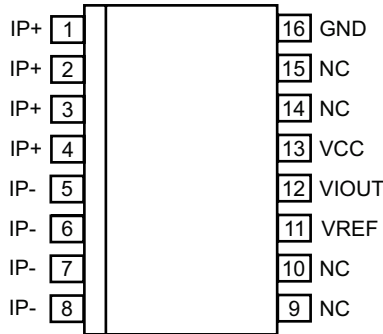


Figure 2: MC Package Pinout Diagram

Terminal List Table

Number	Name	Description
1, 2, 3, 4	IP+	Terminals for current being sensed; fused internally
5, 6, 7, 8	IP-	Terminals for current being sensed; fused internally
9	NC	Terminal can be left open or grounded
10	NC	Terminal can be left open or grounded
11	VREF	Zero current voltage reference
12	VIOOUT	Analog output representing the current flowing through $I_P$
13	VCC	Device power supply terminal
14	NC	Terminal can be left open or grounded
15	NC	Terminal can be left open or grounded
16	GND	Device ground terminal

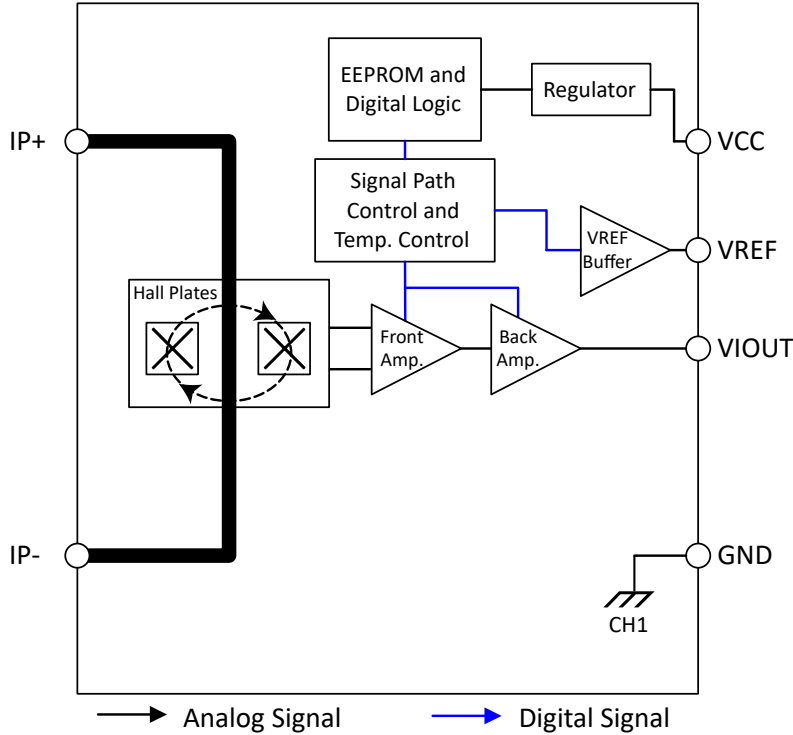


Figure 3: Functional Block Diagram

**COMMON ELECTRICAL CHARACTERISTICS:** Valid through full operating temperature range,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ ,  
 $C_{\text{BYPASS}} = 0.1 \mu\text{F}$ , and  $V_{\text{CC}} = 3.3 \text{ V}$  or  $5 \text{ V}$ , unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Supply Voltage	$V_{\text{CC}}$	$V_{\text{CC}} = 5 \text{ V}$	4.5	5	5.5	V
		$V_{\text{CC}} = 3.3 \text{ V}$	3.15	3.3	3.6	V
Supply Current	$I_{\text{CC}}$	$V_{\text{CC}} = 5 \text{ V}$ ; no load on VIOOUT or VREF	–	15	18	mA
		$V_{\text{CC}} = 3.3 \text{ V}$ ; no load on VIOOUT or VREF	–	12	15	mA
Supply Bypass Capacitor	$C_{\text{BYPASS}}$	VCC to GND	0.1	–	–	$\mu\text{F}$
Primary Conductor Resistance	$R_{\text{IP}}$	$T_A = 25^\circ\text{C}$	–	265	–	$\mu\Omega$
Primary Conductor Inductance	$L_{\text{IP}}$		–	4.45	–	nH
Output Buffer Resistance	$R_{\text{OUT}}$	Internal output buffer resistance on VIOOUT and VREF	–	4	–	$\Omega$
Magnetic Coupling	B		–	4.55	–	G/A
Power-On Reset Voltage	$V_{\text{POR(H)}}$	$V_{\text{CC}}$ rising [1]	2.6	2.9	3.1	V
	$V_{\text{POR(L)}}$	$V_{\text{CC}}$ falling [1]	2.2	2.5	2.8	V
POR Hysteresis	$V_{\text{POR(HYS)}}$		250	–	–	mV
Power-On Time	$t_{\text{POD}}$	Time from $V_{\text{CC}}$ rising $\geq V_{\text{POR(H)}}$ after a POR event until power-on	–	100	–	$\mu\text{s}$
Overvoltage Detection (OVD) Threshold	$V_{\text{OVD(H)}}$	$V_{\text{CC}}$ rising [1]	6.1	6.4	6.8	V
	$V_{\text{OVD(L)}}$	$V_{\text{CC}}$ falling [1]	5.6	5.8	6.1	V
OVD Hysteresis	$V_{\text{OVD(HYS)}}$		–	660	–	mV
OVD Delay Time	$t_{\text{dOVD(EN)}}$	Time from $V_{\text{CC}}$ rising $\geq V_{\text{OVD(EN)}}$ until OVD asserts	60	64	120	$\mu\text{s}$
	$t_{\text{dOVD(DIS)}}$	Time from $V_{\text{CC}}$ falling $\leq V_{\text{OVD(DIS)}}$ until OVD clears	–	7	–	$\mu\text{s}$

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**COMMON ELECTRICAL CHARACTERISTICS (continued):** Valid through full operating temperature range,  
 $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $C_{\text{BYPASS}} = 0.1 \mu\text{F}$ , and  $V_{\text{CC}} = 3.3 \text{ V}$  or  $5 \text{ V}$ , unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>OUTPUT SIGNAL CHARACTERISTICS (VIOUT)</b>						
Output Resistive Load	$R_L$	VIOUT to GND, VIOUT to VCC	10	–	–	k $\Omega$
Output Capacitive Load	$C_L$	VIOUT to GND	–	1	6	nF
Saturation Voltage	$V_{\text{SAT(H)}}$	$R_L = 10 \text{ k}\Omega$ to GND	$V_{\text{CC}} - 0.25$	–	–	V
	$V_{\text{SAT(L)}}$	$R_L = 10 \text{ k}\Omega$ to VCC	–	–	0.15	V
Output Current Limit	$I_{\text{OUT(src)}}$	VIOUT shorted to GND	–	25	–	mA
	$I_{\text{OUT(snk)}}$	VIOUT shorted to VCC	–	25	–	mA
Internal Bandwidth	BW	Small signal $-3 \text{ dB}$ , $C_L = 5.7 \text{ nF}$	–	400	–	kHz
Rise Time	$t_r$	$T_A = 25^\circ\text{C}$ , $C_L = 5.7 \text{ nF}$	–	0.7	–	$\mu\text{s}$
Response Time	$t_{\text{RESPONSE}}$	$T_A = 25^\circ\text{C}$ , $C_L = 5.7 \text{ nF}$	–	1.1	–	$\mu\text{s}$
Propagation Delay	$t_{\text{pd}}$	$T_A = 25^\circ\text{C}$ , $C_L = 5.7 \text{ nF}$	–	0.7	–	$\mu\text{s}$
Noise Density	$I_{\text{ND}}$	Input-referenced noise density; $T_A = 25^\circ\text{C}$ , $C_L = 5.7 \text{ nF}$ ; $V_{\text{CC}} = 5 \text{ V}$	–	350	–	$\mu\text{A}/\sqrt{\text{Hz}}$
		Input-referenced noise density; $T_A = 25^\circ\text{C}$ , $C_L = 5.7 \text{ nF}$ ; $V_{\text{CC}} = 3.3 \text{ V}$	–	450	–	$\mu\text{A}/\sqrt{\text{Hz}}$
Noise	$I_{\text{N}}$	BW = 400 kHz; $T_A = 25^\circ\text{C}$ , $C_L = 5.7 \text{ nF}$ ; $V_{\text{CC}} = 5 \text{ V}$	–	277	–	mA
		BW = 400 kHz; $T_A = 25^\circ\text{C}$ , $C_L = 5.7 \text{ nF}$ ; $V_{\text{CC}} = 3.3 \text{ V}$	–	357	–	mA
Nonlinearity	$E_{\text{LIN}}$	Comparison of $I_P = I_{\text{P(MAX)}} \leq 65\text{A}$ and $I_P = I_{\text{P(MAX)}}/2 \leq 32.5 \text{ A}$	–	$\pm 0.5$	–	%
Power Supply Rejection Ratio Offset	$\text{PSRR}_O$	DC to 1 kHz; 100 mV pk-pk ripple on $V_{\text{CC}}$ , $I_P = 0 \text{ A}$ , change in $V_{\text{OE}}$ relative to $V_{\text{CC}}$ , $T_A = 25^\circ\text{C}$	–	–40	–	dB
		1 to 100 kHz; 100 mV pk-pk ripple on $V_{\text{CC}}$ , $I_P = 0 \text{ A}$ , change in $V_{\text{OE}}$ relative to $V_{\text{CC}}$ , $T_A = 25^\circ\text{C}$	–	–30	–	dB
Power Supply Rejection Ratio Sens	$\text{PSRR}_S$	DC to 1kHz; 100 mV pk-pk ripple on $V_{\text{CC}}$ , $I_P = 0 \text{ A}$ , change in $E_{\text{SENS}}$ relative to $V_{\text{CC}}$ , $T_A = 25^\circ\text{C}$	–	–15	–	dB
		1 to 100 kHz; 100 mV pk-pk ripple on $V_{\text{CC}}$ , $I_P = 0 \text{ A}$ , change in $E_{\text{SENS}}$ relative to $V_{\text{CC}}$ , $T_A = 25^\circ\text{C}$	–	–6	–	dB
Power Supply Offset Error	$V_{\text{OE(PS)}}$	Additional $V_{\text{OE}}$ at $V_{\text{CC}} = V_{\text{CC(min)}}$ or $V_{\text{CC(max)}}$ from $V_{\text{OE}}$ at $V_{\text{CC}}$ , $T_A = 25^\circ\text{C}$	–15	$\pm 1$	15	mV
Power Supply Sensitivity Error	$E_{\text{SENS(PS)}}$	Additional $E_{\text{SENS}}$ at $V_{\text{CC}} = V_{\text{CC(min)}}$ or $V_{\text{CC(max)}}$ from $E_{\text{SENS}}$ at $V_{\text{CC}}$ , $T_A = 25^\circ\text{C}$	–1.5	$\pm 0.3$	1.5	%
Common-Mode Field Rejection	CMFR	Input-referred error due to a common-mode field	–	4	–	mA/G

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COMMON ELECTRICAL CHARACTERISTICS (continued): Valid through full operating temperature range,  
 $T_A = -40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ,  $C_{\text{BYPASS}} = 0.1 \mu\text{F}$ , and  $V_{\text{CC}} = 3.3 \text{ V}$  or  $5 \text{ V}$ , unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>REFERENCE OUTPUT CHARACTERISTICS (VREF)</b>						
Zero Current Reference Voltage	$V_{\text{REF}}$	Bidirectional; $V_{\text{CC}} = 5 \text{ V}$	2.49	2.5	2.51	V
		Bidirectional; $V_{\text{CC}} = 3.3 \text{ V}$	1.64	1.65	1.66	V
		Unidirectional; $V_{\text{CC}} = 5 \text{ V}$	0.49	0.5	0.51	V
		Unidirectional; $V_{\text{CC}} = 3.3 \text{ V}$	0.32	0.33	0.34	V
Reference Resistive Load	$R_{\text{VREF}}$	VREF to GND; VREF to VCC	10	–	–	k $\Omega$
Reference Capacitive Load	$C_{\text{VREF}}$	VREF to GND	–	–	6	nF
Reference Source Current Limit	$I_{\text{REF(SRC)}}$	Max. current VREF can passively source	–	25	–	mA
	$I_{\text{REF(SNK)}}$	Max. current VREF can passively sink	–	–25	–	mA

[1]  $V_{\text{CC}}$  rate +1 V/ms, for best accuracy.



**ACS37003KMCATR-120B3 PERFORMANCE CHARACTERISTICS:** Valid through full operating temperature range,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $C_{\text{BYPASS}} = 0.1 \mu\text{F}$ , and  $V_{\text{CC}} = 3.3 \text{ V}$ , unless otherwise specified

Characteristic	Symbol	Test Conditions	Min. <sup>[1]</sup>	Typ. <sup>[1]</sup>	Max. <sup>[1]</sup>	Units
<b>NOMINAL PERFORMANCE</b>						
Current Sensing Range	$I_{\text{PR}}$		-120	-	120	A
Sensitivity	Sens	$I_{\text{PR}(\text{min})} < I_{\text{P}} < I_{\text{PR}(\text{max})}$	-	12	-	mV/A
Zero Current Output Voltage	$V_{\text{IOUT}(\text{Q})}$	Ideal Voltage of $V_{\text{REF}}$ and $V_{\text{IOUT}(\text{Q})}$	-	1.65	-	V
<b>TOTAL ERROR (<math>V_{\text{IOUT}(\text{ACTUAL})} - (\text{Sens}_{(\text{IDEAL})} \times I_{\text{PR}} + V_{\text{REF}})</math>) / (<math>\text{Sens}_{(\text{IDEAL})} \times I_{\text{PR}}</math>) × 100 AND TOTAL ERROR COMPONENTS</b>						
Total Error	$E_{\text{TOT}}$	Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = 25^\circ\text{C}$	-0.9	-	0.9	%
		Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.1	-	1.1	%
Sensitivity Error	$E_{\text{SENS}}$	Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = 25^\circ\text{C}$	-0.9	-	0.9	%
		Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.1	-	1.1	%
Reference Error	$V_{\text{RE}}$	$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV
Offset Error	$V_{\text{OE}}$	$V_{\text{IOUT}(\text{Q})} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-5	-	5	mV
		$V_{\text{IOUT}(\text{Q})} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-5	-	5	mV
QVO Error	$V_{\text{QE}}$	$V_{\text{IOUT}(\text{Q})} - V_{\text{IOUT}(\text{Q})\text{ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{IOUT}(\text{Q})} - V_{\text{IOUT}(\text{Q})\text{ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV

<sup>[1]</sup> "Min." and "Max." interval for performance characteristics is determined such that 99.73% of devices lie within the interval during initial characterization. The worst case of mean  $\pm 3 \sigma$  was calculated and applied symmetrically. These values can drift after solder reflow and over lifetime operation.

**ACS37003KMCATR-050B5 PERFORMANCE CHARACTERISTICS:** Valid through full operating temperature range,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $C_{\text{BYPASS}} = 0.1 \mu\text{F}$ , and  $V_{\text{CC}} = 5 \text{ V}$ , unless otherwise specified

Characteristic	Symbol	Test Conditions	Min. <sup>[1]</sup>	Typ. <sup>[1]</sup>	Max. <sup>[1]</sup>	Units
<b>NOMINAL PERFORMANCE</b>						
Current Sensing Range	$I_{\text{PR}}$		-50	-	50	A
Sensitivity	Sens	$I_{\text{PR}(\text{min})} < I_{\text{P}} < I_{\text{PR}(\text{max})}$	-	40	-	mV/A
Zero Current Output Voltage	$V_{\text{IOUT(Q)}}$	Ideal Voltage of $V_{\text{REF}}$ and $V_{\text{IOUT(Q)}}$	-	2.5	-	V
<b>TOTAL ERROR (<math>V_{\text{IOUT(ACTUAL)}} - (\text{Sens}_{\text{IDEAL}} \times I_{\text{PR}} + V_{\text{REF}})) / (\text{Sens}_{\text{IDEAL}} \times I_{\text{PR}}) \times 100</math>) AND TOTAL ERROR COMPONENTS</b>						
Total Error	$E_{\text{TOT}}$	Measured at $I_{\text{P}} = \pm I_{\text{PR}(\text{max})}$ , $T_A = 25^\circ\text{C}$	-0.7	-	0.7	%
		Measured at $I_{\text{P}} = \pm I_{\text{PR}(\text{max})}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.3	-	1.3	%
Sensitivity Error	$E_{\text{SENS}}$	Measured at $I_{\text{P}} = \pm I_{\text{PR}(\text{max})}$ , $T_A = 25^\circ\text{C}$	-0.7	-	0.7	%
		Measured at $I_{\text{P}} = \pm I_{\text{PR}(\text{max})}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.3	-	1.3	%
Reference Error	$V_{\text{RE}}$	$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV
Offset Error	$V_{\text{OE}}$	$V_{\text{IOUT(Q)}} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-5	-	5	mV
		$V_{\text{IOUT(Q)}} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-5	-	5	mV
QVO Error	$V_{\text{QE}}$	$V_{\text{IOUT(Q)}} - V_{\text{IOUT(Q)ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{IOUT(Q)}} - V_{\text{IOUT(Q)ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV

[1] "Min." and "Max." interval for performance characteristics is determined such that 99.73% of devices lie within the interval during initial characterization. The worst case of mean  $\pm 3 \sigma$  was calculated and applied symmetrically. These values can drift after solder reflow and over lifetime operation.

**ACS37003KMCATR-085B5 PERFORMANCE CHARACTERISTICS:** Valid through full operating temperature range,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $C_{\text{BYPASS}} = 0.1 \mu\text{F}$ , and  $V_{\text{CC}} = 5 \text{ V}$ , unless otherwise specified

Characteristic	Symbol	Test Conditions	Min. [1]	Typ. [1]	Max. [1]	Units
<b>NOMINAL PERFORMANCE</b>						
Current Sensing Range	$I_{\text{PR}}$		-85	-	85	A
Sensitivity	Sens	$I_{\text{PR}(\text{min})} < I_{\text{P}} < I_{\text{PR}(\text{max})}$	-	25	-	mV/A
Zero Current Output Voltage	$V_{\text{IOUT(Q)}}$	Ideal Voltage of $V_{\text{REF}}$ and $V_{\text{IOUT(Q)}}$	-	2.5	-	V
<b>TOTAL ERROR (<math>V_{\text{IOUT(ACTUAL)}} - (\text{Sens}_{\text{IDEAL}} \times I_{\text{PR}} + V_{\text{REF}})) / (\text{Sens}_{\text{IDEAL}} \times I_{\text{PR}}) \times 100</math>) AND TOTAL ERROR COMPONENTS</b>						
Total Error	$E_{\text{TOT}}$	Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = 25^\circ\text{C}$	-0.9	-	0.9	%
		Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.3	-	1.3	%
Sensitivity Error	$E_{\text{SENS}}$	Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = 25^\circ\text{C}$	-0.9	-	0.9	%
		Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.3	-	1.3	%
Reference Error	$V_{\text{RE}}$	$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV
Offset Error	$V_{\text{OE}}$	$V_{\text{IOUT(Q)}} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-5	-	5	mV
		$V_{\text{IOUT(Q)}} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-5	-	5	mV
QVO Error	$V_{\text{QE}}$	$V_{\text{IOUT(Q)}} - V_{\text{IOUT(Q)ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{IOUT(Q)}} - V_{\text{IOUT(Q)ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV

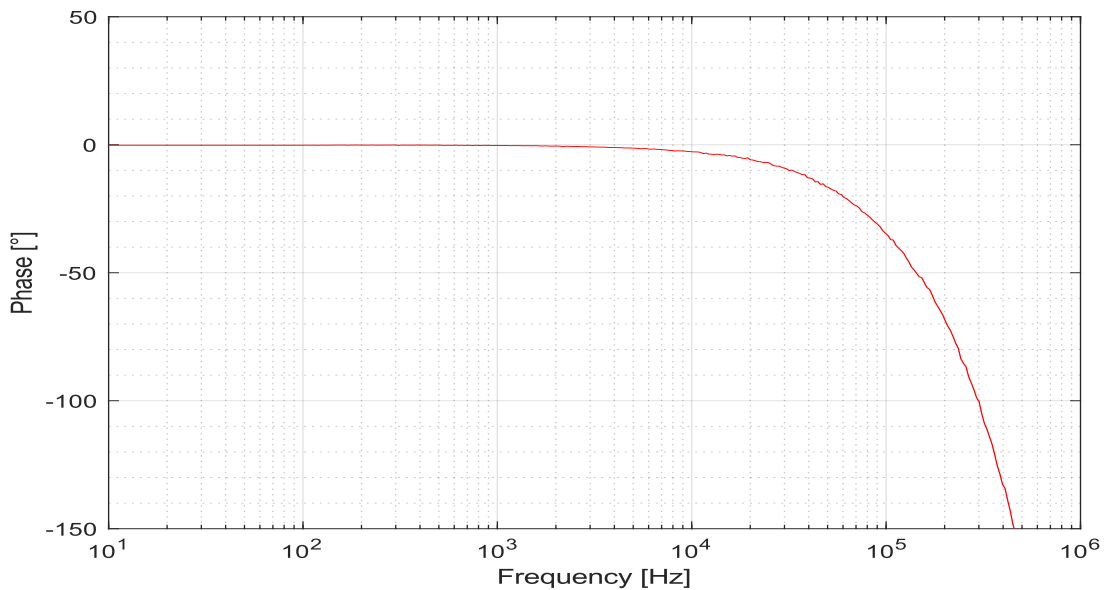
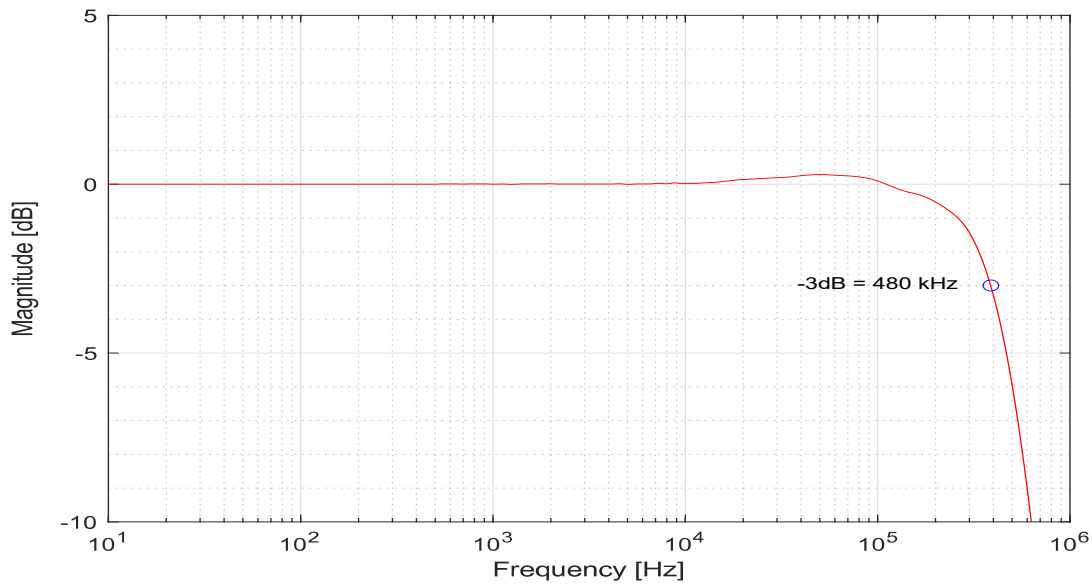
[1] "Min." and "Max." interval for performance characteristics is determined such that 99.73% of devices lie within the interval during initial characterization. The worst case of mean  $\pm 3 \sigma$  was calculated and applied symmetrically. These values can drift after solder reflow and over lifetime operation.

**ACS37003KMCATR-180B5 PERFORMANCE CHARACTERISTICS:** Valid through full operating temperature range,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $C_{\text{BYPASS}} = 0.1 \mu\text{F}$ , and  $V_{\text{CC}} = 5 \text{ V}$ , unless otherwise specified

Characteristic	Symbol	Test Conditions	Min. [1]	Typ. [1]	Max. [1]	Units
<b>NOMINAL PERFORMANCE</b>						
Current Sensing Range	$I_{\text{PR}}$		-180	-	180	A
Sensitivity	Sens	$I_{\text{PR}(\text{min})} < I_{\text{P}} < I_{\text{PR}(\text{max})}$	-	12	-	mV/A
Zero Current Output Voltage	$V_{\text{IOUT(Q)}}$	Ideal Voltage of $V_{\text{REF}}$ and $V_{\text{IOUT(Q)}}$	-	2.5	-	V
<b>TOTAL ERROR (<math>V_{\text{IOUT(ACTUAL)}} - (\text{Sens}_{\text{IDEAL}} \times I_{\text{PR}} + V_{\text{REF}})</math>) / (<math>\text{Sens}_{\text{IDEAL}} \times I_{\text{PR}}</math>) × 100 AND TOTAL ERROR COMPONENTS</b>						
Total Error	$E_{\text{TOT}}$	Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = 25^\circ\text{C}$	-0.8	-	0.8	%
		Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.1	-	1.1	%
Sensitivity Error	$E_{\text{SENS}}$	Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = 25^\circ\text{C}$	-0.8	-	0.8	%
		Measured at $I_{\text{P}} = \pm 65 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-1.2	-	1.2	%
Reference Error	$V_{\text{RE}}$	$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{REFactual}} - V_{\text{REFideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV
Offset Error	$V_{\text{OE}}$	$V_{\text{IOUT(Q)}} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-5	-	5	mV
		$V_{\text{IOUT(Q)}} - V_{\text{REF}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-5	-	5	mV
QVO Error	$V_{\text{QE}}$	$V_{\text{IOUT(Q)}} - V_{\text{IOUT(Q)ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = 25^\circ\text{C}$	-10	-	10	mV
		$V_{\text{IOUT(Q)}} - V_{\text{IOUT(Q)ideal}}$ , $I_{\text{P}} = 0 \text{ A}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-10	-	10	mV

[1] "Min." and "Max." interval for performance characteristics is determined such that 99.73% of devices lie within the interval during initial characterization. The worst case of mean  $\pm 3 \sigma$  was calculated and applied symmetrically. These values can drift after solder reflow and over lifetime operation.

CHARACTERISTIC PERFORMANCE  
ACS37003 TYPICAL FREQUENCY RESPONSE



For information regarding bandwidth characterization methods used for the ACS37003, see the “Characterizing System Bandwidth” application note (<https://allegromicro.com/en/insights-and-innovations/technical-documents/hall-effect-sensor-ic-publications/an-effective-method-for-characterizing-system-bandwidth-an296169>) on the Allegro website.

FUNCTIONAL DESCRIPTION

Power-On Reset Operation

The provided graphs in this section show  $V_{IOUT}$  moving with  $V_{CC}$ . The voltage of  $V_{IOUT}$  during a high-impedance state will be most consistent with a known load ( $R_L, C_L$ ). Figure 4, Figure 5, and Figure 6 all use the same labeling scheme for different power thresholds. References in brackets “[ ]” are valid for each of these plots.

POWER-ON/POWER-OFF

As  $V_{CC}$  ramps up, the  $V_{IOUT}$  and  $V_{REF}$  outputs are high impedance until  $V_{CC}$  reaches and passes  $V_{POR(H)}$  [1] in Figure 4.  $V_{REF}$  and  $V_{IOUT}$  will continue to report until  $V_{CC}$  is less than  $V_{POR(L)}$  [5] in Figure 4, at which point they will go high Z. Note that the time it takes the output to reach a steady state will depend on the external circuitry used.

POWER-ON DELAY ( $t_{POD}$ )

When the supply is ramped to  $V_{POR(H)}$  [2] in Figure 4, the device will require a finite time to power its internal components before the outputs are released from high Z and can respond to an input magnetic field. Power-On Time,  $t_{POD}$ , is defined as the time it takes for the output voltage to settle within  $\pm 10\%$  of its steady-state value under an applied magnetic field, which can be seen as the time from [1] to [A] in Figure 5. After this delay, the output will quickly approach  $V_{IOUT(IP)} = Sens \times IP + V_{REF}$ .

Overvoltage Detection (OVD)

To ensure that the device output is reporting accurately, the device contains an overvoltage flag. This flag on  $V_{IOUT}$  can be used to alert the system that the supply voltage is outside of the operational limits. When  $V_{CC}$  raises above  $V_{OVD(H)}$  [3] in Figure 4,  $V_{IOUT}$  will go high Z and be pulled by the load resistor to  $V_{CC}$  or GND.  $V_{REF}$  continues to output normally.

There is hysteresis between OVD enable and disable thresholds to reducing nuisance flagging and clears. There is approximately 1 V of hysteresis seen between [3] and [4] in Figure 4.

The enable time for OVD,  $t_{OVD(E)}$ , is the time from  $V_{OVD(H)}$  [4] to OVD flag [B] in Figure 6. The enable flag for OVD has a counter to reduce transients faster than 64  $\mu s$  from triggering nuisance flags. The disable time for OVD,  $t_{OVD(D)}$ , is the time from  $V_{OVD(L)}$  [5] until the device returns to normal operation [C] in Figure 6. The OVD disable time does not have a counter.

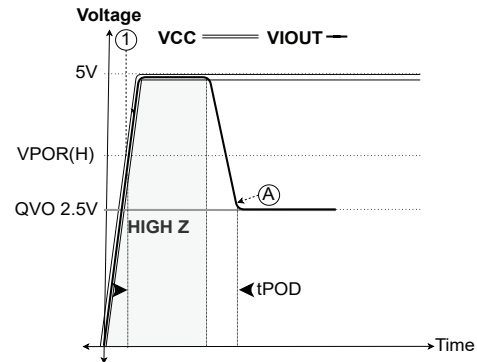


Figure 5:  $t_{POD}$ ,  $R_L =$  Pull-Up

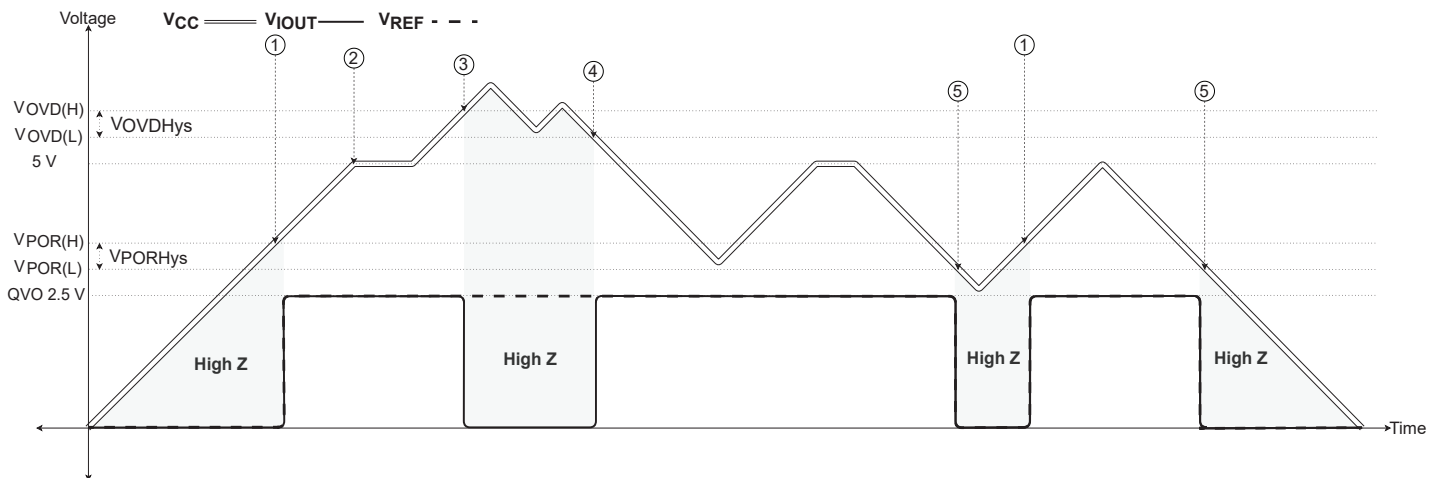


Figure 4: Power States Thresholds with  $V_{IOUT}$  Behavior for a 5 V Device,  $R_L =$  Pull-Down

**Absolute Maximum Ratings**

These are the maximum application or environmental conditions that the device can be subjected before damage may occur.

**SUPPLY ZENER CLAMP VOLTAGES**

If the voltage applied to the device continues to increase past overvoltage detection, there is a point when the Zener diodes will turn on. These internal diodes are in place to protect the device from short high voltage or ESD events and should NOT be used as a feature to reduce the voltage on a line. Continued exposure to voltages higher than normal operating voltage,  $V_{CC}$ , can weaken or damage the Zener diodes, which will potentially damage the part.

**FORWARD AND REVERSE SUPPLY VOLTAGE**

This is the greatest voltage that can be supplied to  $V_{CC}$  from GND during programming or transient switching. This voltage should not be used as a DC voltage bias for an extended time.

**FORWARD AND REVERSE OUTPUT VOLTAGE**

The Forward Output Voltage,  $V_{FOUT}$ , should be no greater than  $V_{CC} + 0.5$  up to 6.5 V. This is the greatest voltage that the output and reference output can be biased with from GND during programming or transient switching. The Reverse Output Voltage,  $V_{ROUT}$ , should not drop below  $-0.5$  V during programming or transient switching. These voltages should not be used as a DC voltage bias for an extended time.

These voltage levels apply to the no connect pins as well.

**OUTPUT SOURCE AND SINK CURRENT**

This is the maximum current that  $V_{IOUT}$  can passively sink or source before damage may occur.

**AMBIENT TEMPERATURE ( $T_A$ )**

This is the ambient temperature of the device. The Operating Ambient Temperature Range is the ambient temperature range in which the Common Electricals and Common Performance Characteristics limits are valid. ACS37003 devices have optimized performance in the  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  (“K” temperature) range.

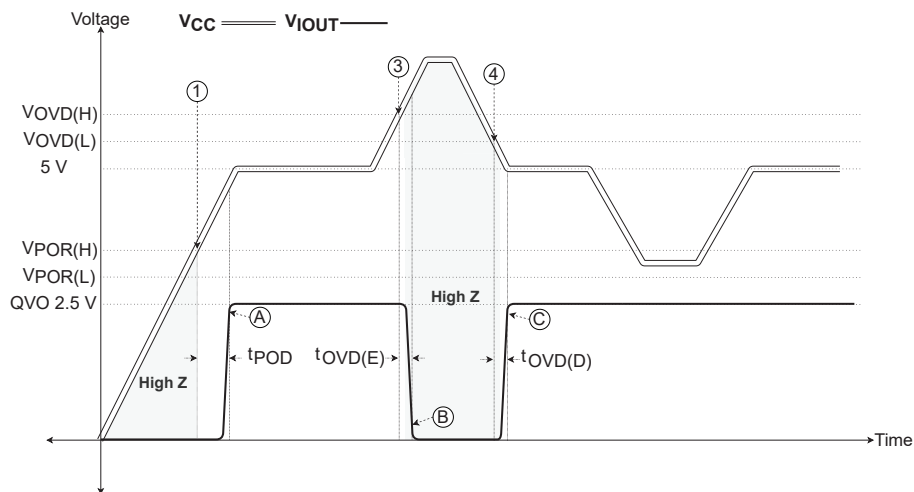


Figure 6:  $t_{POD}$ , and  $t_{OVD(E/D)}$  with  $R_L = \text{Pull-Up}$

DEFINITIONS OF OPERATING AND PERFORMANCE CHARACTERISTICS

Zero Current Voltage Output ( $V_{IOUT(Q)}$ , QVO)

Zero Current Voltage Output,  $V_{IOUT(Q)}$  (also called QVO), is defined as the voltage on the output,  $V_{IOUT}$ , when no current is applied through  $I_p$ .

QVO Temperature Drift ( $V_{QE}$ )

QVO Temperature Drift,  $V_{QE}$ , is defined as the drift of QVO from room to hot or room to cold (25°C to 125°C or 25°C to -40°C, respectively). To improve over temperature performance, the temperature drift is compensated with Allegro factory trim to remain within the limits across temperature.

Reference Voltage ( $V_{REF}$ )

There is a Voltage Reference Output,  $V_{REF}$ , on the ACS37003. This output reports the zero current voltage for the output channel allowing for differential measurement.

Reference Voltage Temperature Drift ( $V_{RE}$ )

Reference Voltage Temperature Drift,  $V_{RE}$ , is defined as the drift of  $V_{REF}$  from room to hot or room to cold (25°C to 125°C or 25°C to -40°C, respectively).

Offset Voltage ( $V_{OE}$ )

Offset Voltage,  $V_{OE}$ , is defined as the difference between QVO and  $V_{REF}$  (see Figure 7).  $V_{OE}$  includes the drift of QVO minus  $V_{REF}$  from room to hot or room to cold (25°C to 125°C or 25°C to -40°C, respectively).

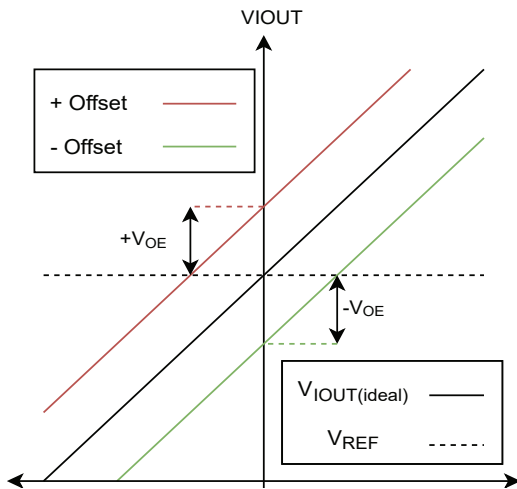


Figure 7: Offset ( $V_{OE}$ ) Between  $V_{IOUT}$  and  $V_{REF}$

Output Saturation Voltage ( $V_{SAT(HIGH/LOW)}$ )

Output Saturation Voltage,  $V_{SAT}$ , is defined as the voltage that  $V_{IOUT}$  does not pass as a result to an increasing magnitude of current.  $V_{SAT(HIGH)}$  is the highest voltage the output can drive to while,  $V_{SAT(LOW)}$  is the lowest. This can be seen in Figure 8. Note that changing the sensitivity does not change the  $V_{SAT}$  points.

Output Voltage Operating Range (VOOR)

The Output Voltage Operating Range, or  $V_{OOR}$ , is the functional range for linear performance of  $V_{IOUT}$  and its related datasheet parameters. This can be seen in Figure 8. The  $V_{OOR}$  is the output region that the performance accuracy parameters are valid. It is possible for the output to report beyond these voltages until  $V_{SAT}$ , but operation cannot be guaranteed. The output performance is demonstrated in Figure 8 through and beyond the  $V_{OOR}$ .

Voltage Output Operating Range for $V_{CC}$ and Output Modes, $V_{OOR}(V_{CC}, Mode)$		
$V_{CC}$ (V)	Bidirectional	Unidirectional
3.3	$\pm 1.32$	+2.64
5	$\pm 2$	+4

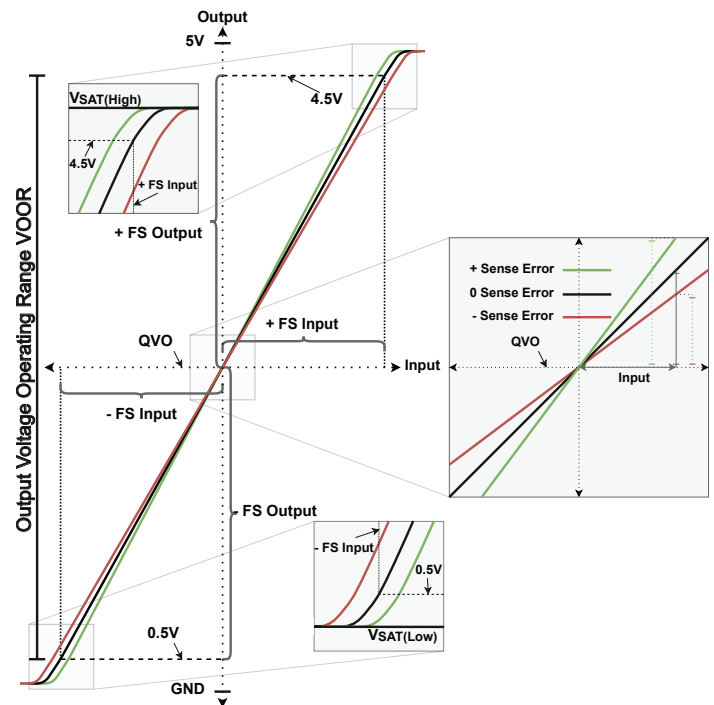


Figure 8:  $V_{OOR}$ ,  $V_{SAT}$  and SENS with Full Scale



**Sensitivity (Sens)**

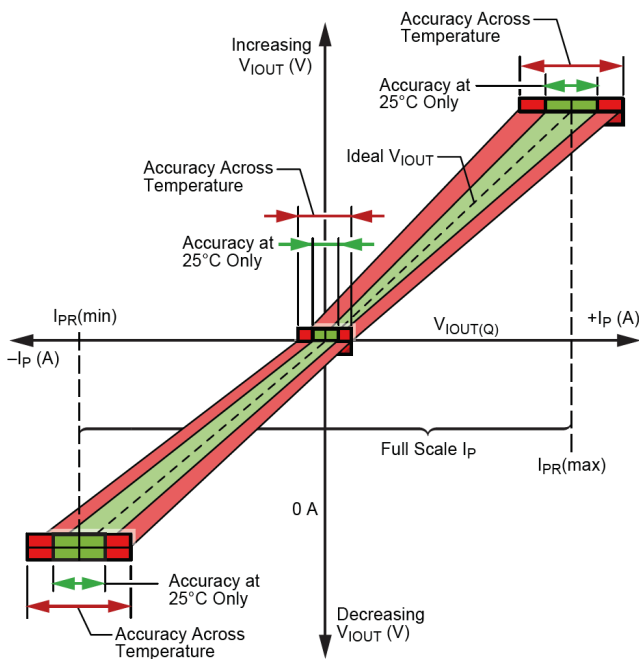
Sensitivity, or Sens, is the ratio of the output swing versus the applied current through the primary conductor,  $I_p$ . This current causes a voltage deviation away from QVO on the  $V_{IOUT}$  output until  $V_{SAT}$ . The magnitude and direction of the output voltage swing is proportional to the magnitude and direction of the applied current. This proportional relationship between output and input is Sensitivity and is defined as:

$$Sens = \frac{V_{IOUT(I1)} - V_{IOUT(I2)}}{I_1 - I_2}$$

where  $I_1$  and  $I_2$  are two different currents, and  $V_{IOUT(I1)}$  and  $V_{IOUT(I2)}$  are the voltages of the device with the applied currents. One of these measurement points can be with no current applied.

**Sensitivity Error ( $E_{sens}$ )**

Sensitivity Temperature Drift, or  $E_{sens}$ , is defined as the drift of Sens from room to hot or room to cold (25°C to 125°C or 25°C to -40°C, respectively). No trimming/programming is needed as temperature drift is compensated with Allegro factory trim to remain within the datasheet limits across temperature.



**Figure 9: Output Accuracy Pocket for Room and Across Temperature**

**Full Scale (FS)**

Full Scale, or FS, is a method to relate an input and/or output to the maximum input and/or output of the device. For example, 50%FS of a 10 A sensor is 5 A, or 50% of its maximum input current. The 50% input of 5 A will cause the output to move 50%, or 50%FS. FS is used to interchangeably refer to input and output deviations when discussing input steps and relating input to output performance.  $FS_{INPUT}$  is the input bias that results in  $FS_{OUTPUT}$  and these two are directly related by the device sensitivity. Both polarities of FS can be seen in Figure 8, labeled as positive or negative FS input and FS output. The equation for input referred FS for a 5 V bidirectional device is:

$$FS = \frac{V_{OOR(SV, Bi)}}{Sens_{Actual}} = \pm \frac{2V}{Sens_{Actual}}$$

Note: a percentage change in  $FS_{INPUT}$  is equivalent to a resultant percentage change of  $FS_{OUTPUT}$  and visa versa.

**Nonlinearity ( $E_{LIN}$ )**

As the amount of current applied to the part changes, the sensitivity of the device can also change slightly. This is referred to as Linearity Error or  $E_{LIN}$  (see Figure 10). Consider two currents,  $I_1$  (1/2 FS) and  $I_2$  (FS). Ideally, the sensitivity of the device is the same for both currents. Linearity Error is calculated as the percent change in sensitivity from one current to another. Error is calculated separately for positive ( $E_{LIN(+)}$ ) and negative ( $E_{LIN(-)}$ ) currents, and the percent errors are defined as:

$$E_{LIN(\pm)} = \left( 1 - \frac{Sens_{I2\pm}}{Sens_{I1\pm}} \right) \times 100\%$$

where the sensitivities are defined as:

$$Sens_{IX+} = \frac{V_{IOUT(IX+)} - V_{REF}}{I_{X+}}$$

$$Sens_{IX-} = \frac{V_{IOUT(IX-)} - V_{REF}}{I_{X-}}$$

$I_X$  are positive and negative currents through  $I_p$  such that:

$$I_{2+} = 2 \times I_{1+}$$

$$I_{2-} = 2 \times I_{1-}$$

Linearity error is the maximum of the positive and negative linearity error.

**Total Output Error (E<sub>TOT</sub>)**

Total Output Error is the current measurement error from the sensor IC as a percentage of the actual applied current. This is equivalent to the difference between the ideal output voltage and the actual output voltage, divided by the ideal sensitivity, relative to the current applied to the device, or simplified to:

$$E_{TOT} = \frac{V_{IOUT(ACTUAL)} - (Sens_{(IDEAL)} \times I_{PR} + V_{REF})}{(Sens_{(IDEAL)} \times I_{PR})} \times 100$$

Total Output Error incorporates all sources of error and is a function of current. At relatively high currents Sensitivity Error will be the largest contributor to Total Output Error. At relatively low inputs, Offset Voltage, V<sub>OE</sub>, will be the largest contributor to Total Output Error. At I = 0 A, Total Output Error approaches infinity due to the offset. An example of total error at FS can be seen in Figure 10.

Note: Total Output Error goes to infinity as the amount of applied field approaches 0 A.

**Power Supply Offset Error (V<sub>OE(PS)</sub>)**

Power Supply Offset Error, V<sub>OE(PS)</sub>, is defined as the difference in offset error when V<sub>CC</sub> is at the nominal and V<sub>CC</sub> is 10% high or low. For a 5 V device, this is 5 to 4.5 V and 5 to 5.5 V. For a 3.3 V device, this is 3.3 to 3 V and 3.3 to 3.6 V.

**Offset Power Supply Rejection Ratio (PSRR<sub>O</sub>)**

The Offset Power Supply Rejection Ratio, PSRR<sub>O</sub>, is an AC test of the V<sub>OE(PS)</sub> parameter. A 100 mV peak AC signal is added on top of the nominal supply voltage. Any AC impact on the output offset of the sensor is measured and recorded as PSRR<sub>O</sub>. The equation used to calculate PSRR<sub>O</sub> shown below:

$$PSRR_O = 20 \times \log \left( \frac{\Delta QVO}{\Delta V_{CC}} \right)$$

**Power Supply Sensitivity Error (E<sub>SENS(PS)</sub>)**

Power Supply Sensitivity Error, or E<sub>SENS(PS)</sub>, is defined as the percent sensitivity error measured between V<sub>CC</sub> and V<sub>CC</sub> ±10%. For a 5 V device, this is 5 to 4.5 V and 5 to 5.5 V. For a 3.3 V device, this is 3.3 to 3 V and 3.3 to 3.6 V.

**Sensitivity Power Supply Rejection Ratio (PSRR<sub>S</sub>)**

The Sensitivity Power Supply Rejection Ratio or PSRR<sub>S</sub> is defined as 20 × log of the ratio of the % change the sensitivity over the % change in V<sub>CC</sub> (±100 mV variable AC V<sub>CC</sub> centered at 5 V) reported as dB in a specified frequency range. This is the AC version of the E<sub>SENS(PS)</sub> parameter. The equation is shown below:

$$PSRR_S = 20 \times \log \left( \frac{\Delta \% Sens}{\Delta V_{CC}} \right)$$

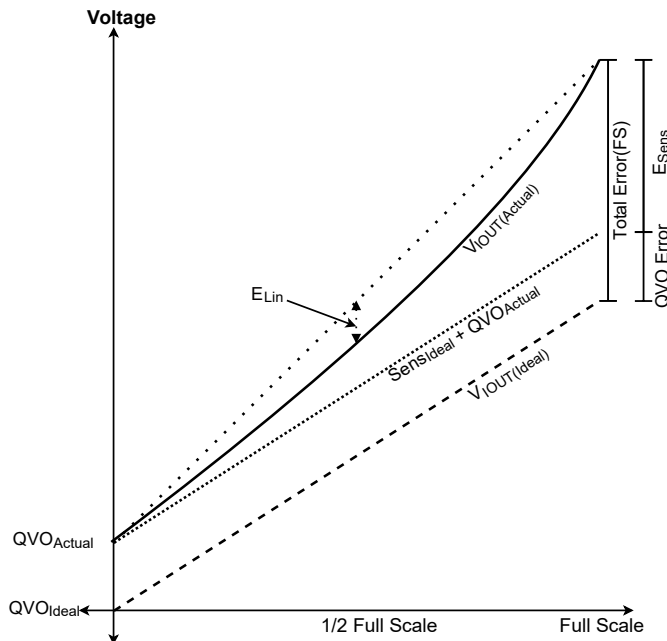


Figure 10: Accuracy Error

## DYNAMIC RESPONSE PARAMETERS

The descriptions in this section assume an ambient temperature of 25°C and output loads within limits provided in the Common Electricals table. The step applied is an input step that corresponds to 1 V deviation on the output, unless otherwise stated.

### Propagation Time ( $t_{pd}$ )

The time interval between a) when the sensed current reaches 10% of its stable value, and b) when the sensor output reaches 10% of its stable value for a step input. See Figure 11.

### Rise Time ( $t_R$ )

The time interval between a) when the sensor reaches 10% of its stable value, and b) when it reaches 90% of the stable value for a step input. See Figure 11.

### Response Time ( $t_{RESPONSE}$ )

The time interval between a) when the sensed current reaches 90% of its stable value, and b) when the sensor output reaches 90% of its stable value. See Figure 11.

### Temperature Compensation

To help compensate for the effects temperature has on performance, the ACS37003 has an integrated internal temperature sensor. This sensor and compensation algorithms help to standardize device performance over the full range of optimized temperatures. This allows for room temperature system calibration and validation of end-of-line modules.

### Temperature Compensation Update Rate

There is an 8 ms update time that is required to maintain a valid temperature compensated output; that is, temperature compensations are calculated and applied every 8 ms.

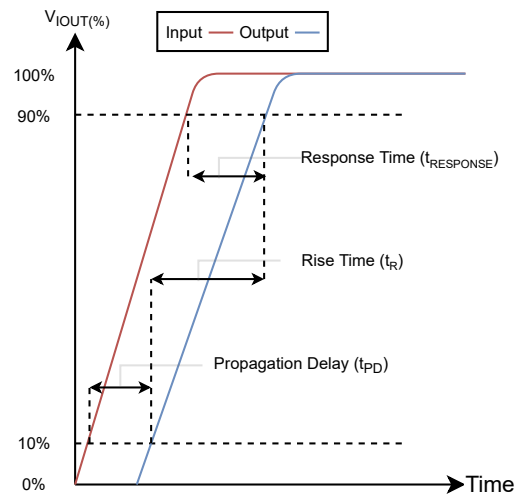


Figure 11: Dynamic Response Parameters

APPLICATION INFORMATION

Thermal Rise vs. Primary Current

Self-heating due to the flow of current should be considered during the design of any current sensing system. The sensor, printed circuit board (PCB), and contacts to the PCB will generate heat as current moves through the system.

The thermal response is highly dependent on PCB layout, copper thickness, cooling techniques, and the profile of the injected current. The current profile includes peak current, current “on-time”, and duty cycle. While the data presented in this section was collected with direct current (DC), these numbers may be used to approximate thermal response for both AC signals and current pulses.

The plot in Figure 12 shows the measured rise in steady-state die temperature of the ACS37003KMC versus continuous current at an ambient temperature,  $T_A$ , of 25 °C. The thermal offset curves may be directly applied to other values of  $T_A$ . Conversely, Figure 13 shows the maximum continuous current at a given  $T_A$ . Surges beyond the maximum current listed in Figure 13 are allowed given the maximum junction temperature,  $T_{J(MAX)}$  (165°C), is not exceeded.

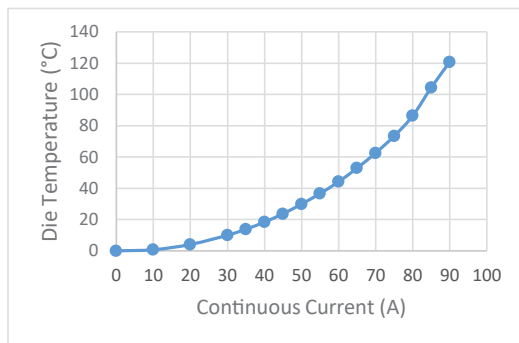


Figure 12: Self-heating in the MC package due to current flow

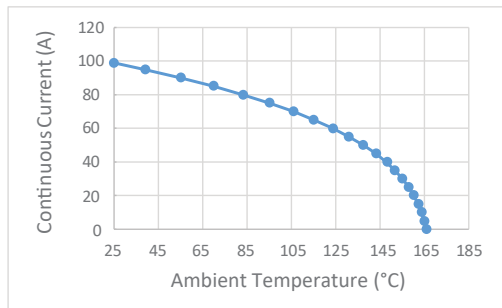


Figure 13: Maximum continuous current at a given  $T_A$

The thermal capacity of the ACS37003KMC should be verified by the end user in the application’s specific conditions. The

maximum junction temperature,  $T_{J(MAX)}$ , should not be exceeded. Further information on this application testing is available in the “DC and Transient Current Capability” application note [1] on the Allegro website.

ASEK37003-Panel Evaluation Board Layout

Thermal data shown in Figure 12 and Figure 13 was collected using the ASEK37003-Panel Evaluation Board (TED-0003314). This board includes 750 mm<sup>2</sup> of 4 oz. (0.1388 mm) copper connected to pins 1 through 4, and to pins 5 through 8, with thermal vias connecting the layers. Top and bottom layers of the PCB are shown below in Figure 14.

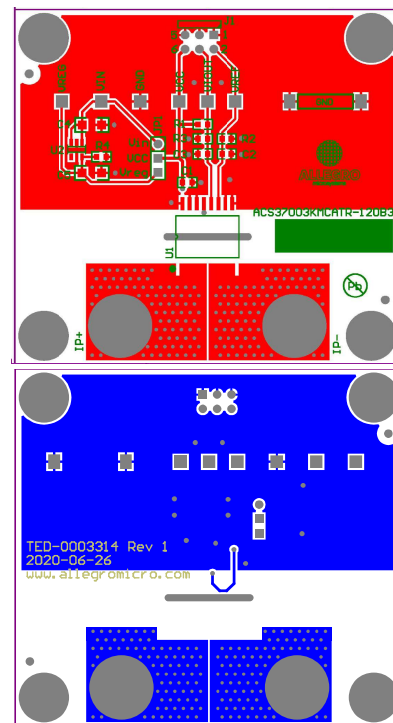


Figure 14: Top and bottom layers for ASEK37003-Panel evaluation board

Gerber files for the ASEK37003-Panel evaluation board are available for download from the Allegro website. See the technical documents section of the ACS37003KMC device webpage [2].

[1] <http://www.allegromicro.com/en/Design-Center/Technical-Documents/Hall-Effect-Sensor-IC-Publications/DC-and-Transient-Current-Capability-Fuse-Characteristics.aspx>

[2] <https://www.allegromicro.com/en/products/sense/current-sensor-ics/zero-to-fifty-amp-integrated-conductor-sensor-ics/acs37003>

PACKAGE OUTLINE DRAWING

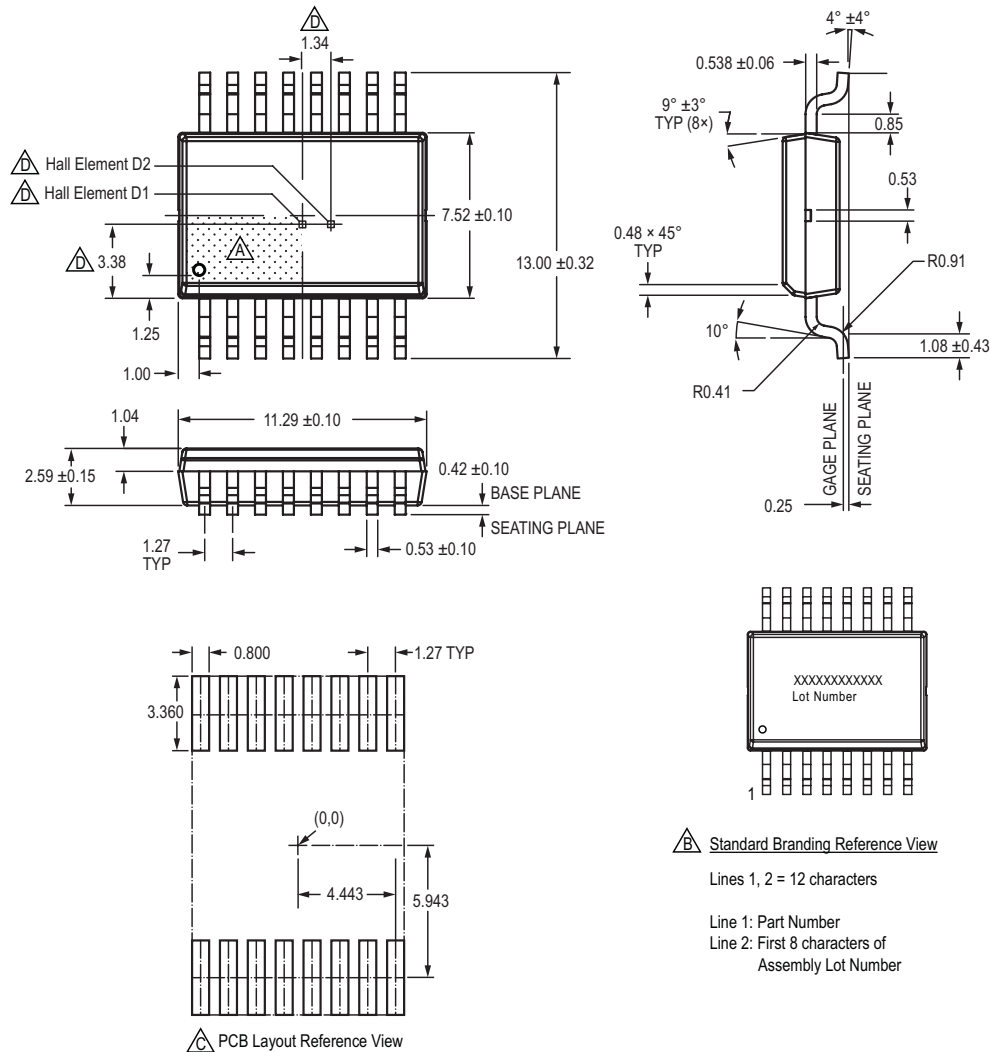
For Reference Only; Not for Tooling Use

(reference DWG-0000714, Rev. 2)

Dimensions in millimeters

Dimensions exclusive of mold flash, gate burrs, and dambar protrusions

Exact case and lead configuration at supplier discretion within limits shown



**B** Standard Branding Reference View

Lines 1, 2 = 12 characters

Line 1: Part Number

Line 2: First 8 characters of Assembly Lot Number

**A** Terminal #1 mark area

**B** Branding scale and appearance at supplier discretion

**C** Reference land pattern layout; all pads a minimum of 0.20 mm from all adjacent pads; adjust as necessary to meet application process requirements and PCB layout tolerances; when mounting on a multilayer PCB, thermal vias at the exposed thermal pad land can improve thermal dissipation (reference EIA/JEDEC Standard JESD51-5)

**D** Hall elements D1, D2 (not to scale)

Figure 15: Package MC, 16-Pin SOICW

## Revision History

Number	Date	Description
–	December 16, 2020	Initial Release
1	April 6, 2021	Addition of RoHS and Pb free symbols on page 2. Update to Total Error and Total Error Components tables and footnote on pages 8-11. Added Output Buffer Resistance characteristic to page 5. Editorial updates to all pages.
2	May 13, 2021	Updated sections of Performance Characteristics tables: Reference Error, Offset Error, and QVO Error minimum and maximum values, pages 8-11
3	July 23, 2021	Added bullet to Features and Benefits (page 1)
4	November 15, 2021	Updated Total Output Error equation (page 17); removed RoHS and Pb free symbols (page 2)
5	January 11, 2022	Updated package drawing (page 20)
6	October 19, 2023	Updated Selection Guide (page 2); corrected Part Naming Schematic (page 2); removed Maximum Continuous Current from Absolute Maximum Ratings Table (page 3); updated Isolation Characteristics table (page 3); added Thermal Characteristics Table (page 3); minor editorial updates (all pages)
7	February 1, 2024	Added Hall elements to Package Outline Drawing (page 20)
8	July 10, 2024	Added Table of Contents (page 3); updated Isolation Characteristics table (page 4)

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