200 A Ultra-Compact High-Current Sensor with Reinforced Isolation in 100 mm² Package

FEATURES AND BENEFITS

- Low 50 µΩ primary conductor resistance for high efficiency and high inrush current capability in a thin surface-mount package with a small footprint suitable for space-constrained automotive applications
- 150 kHz analog output with a fast 4 µs response time
- High accuracy and low noise
  - □ ±1% sensitivity drift over temperature
  - □ ±7 mV offset drift over temperature
  - □ 3.3 V and 5 V non-ratiometric single supply operation
  - □ Differential sensing for common-mode field rejection
- Zero-current voltage reference output, VREF, for differential routing in noisy application environments
- Overcurrent fault output with adjustable threshold
- UL-certified, isolated, compact surface-mount package
  - □ 8 kV$_{PK}$ impulse withstand voltage
  - □ 1097 V$_{RMS}$ and 1550 V$_{DC}$ basic isolation voltage
  - □ 565 V$_{RMS}$ and 800 V$_{DC}$ reinforced isolation voltage
- Wide operating temperature, –40°C to 150°C
- AEC-Q100 Grade 0, automotive qualified

PACKAGE:

8-pin flat PSOF
(suffix LX)

Not to scale

DESCRIPTION

The ACS37200 is a fully integrated current sensor that senses current flowing through the primary conductor of a compact 8-pin PSOF package. The LX package has very low internal conductor resistance of 50 µΩ and is designed to measure currents of up to 200 A. The current is sensed differentially via two Hall plates that provide common-mode field rejection and optimized performance in the presence of external magnetic fields.

The ACS37200 is factory calibrated for high accuracy over the entire operating temperature range. It is an automotive qualified grade 0 device capable of operating at temperatures between –40°C and 150°C. 5 V and 3.3 V supply voltage variants are available with current sensing ranges from 100 A to 200 A. The device features an overcurrent fault output, with a user-configurable threshold, and a dedicated voltage reference pin that outputs the zero-current analog signal.

The ACS37200 is a lead-free (Pb-free) device plated with 100% matte tin, compatible with standard lead-free printed circuit board assembly processes.

TYPICAL APPLICATIONS

- Industrial Motor Control
- Solar and xEV Charging Infrastructure
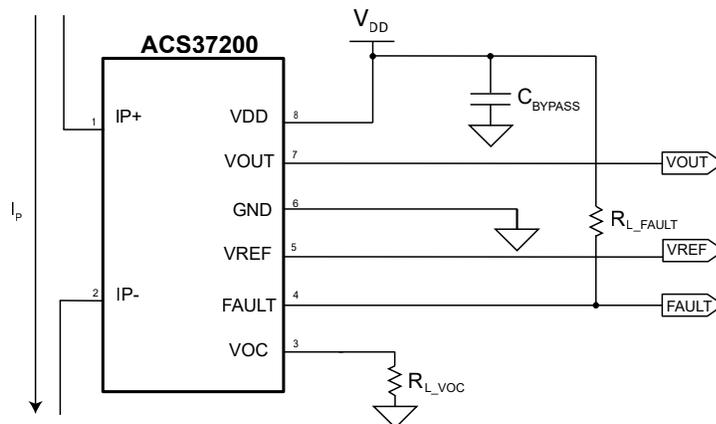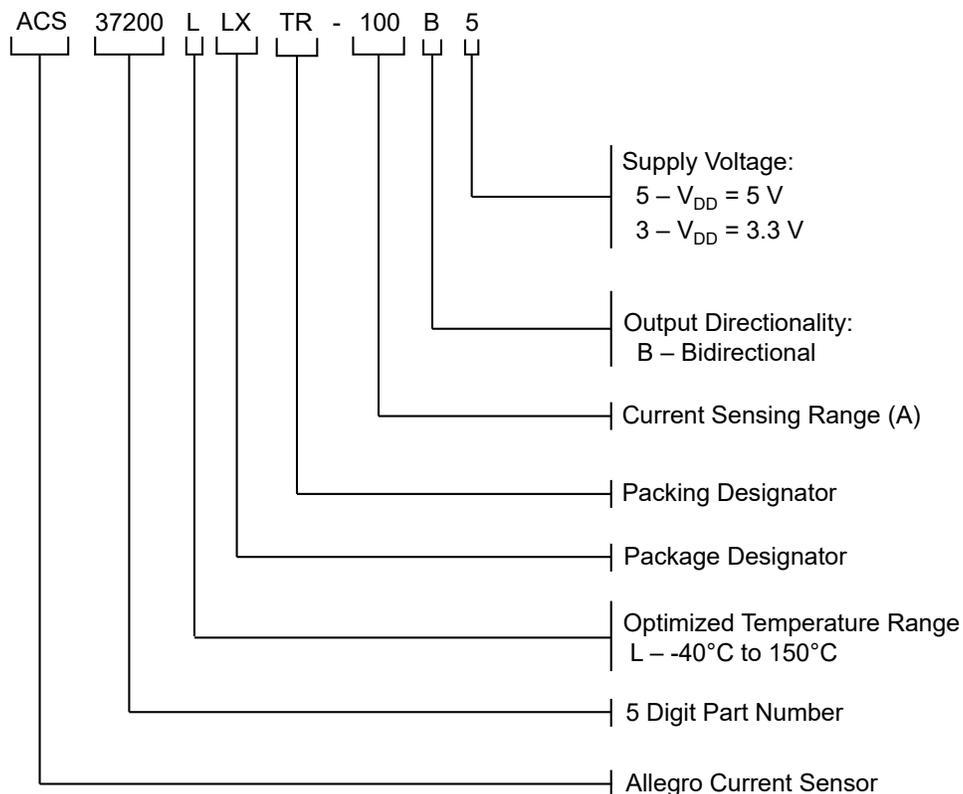- xEV On-Board Charger
- xEV DC-DC Converter

Figure 1: Typical Application Circuit
The ACS37200 outputs an analog signal at VOUT that varies linearly with the primary current, I$_P$.

200 A Ultra-Compact High Current Sensor with Reinforced Isolation in 100 mm² Package

SELECTION GUIDE

Part Number	Current Sensing Range, I_{PR} (A)	Sensitivity (mV/A)	V_{DD} (V)	V_{QVO} (V)	Optimized Temperature Range, T_A (°C)	Packing
ACS37200LLXTR-100B3	±100	13.2	3.3	1.65	–40 to 150	Tape and Reel, 2500 pieces per reel
ACS37200LLXTR-150B3	±150	8.8				
ACS37200LLXTR-200B3	±200	6.6				
ACS37200LLXTR-100B5	±100	20	5	2.5		
ACS37200LLXTR-150B5	±150	13.3				
ACS37200LLXTR-200B5	±200	10				

PART NAMING SPECIFICATION

ACS 37200 L LX TR - 100 B 5

Supply Voltage:
5 – V_{DD} = 5 V
3 – V_{DD} = 3.3 V

Output Directionality:
B – Bidirectional

Current Sensing Range (A)

Packing Designator

Package Designator

Optimized Temperature Range
L – -40°C to 150°C

5 Digit Part Number

Allegro Current Sensor

ABSOLUTE MAXIMUM RATINGS [1]

Characteristic	Symbol	Notes	Min.	Max.	Unit
Supply Voltage	V_{DD}		−0.5	6.5	V
Output Voltage	V_O	Applies to VOUT, VREF, VOC, and FAULT	−0.5	$(V_{DD} + 0.7) < 6.5$	V
Operating Ambient Temperature	T_A		−40	150	°C
Storage Temperature	T_{stg}		−65	165	°C
Maximum Junction Temperature	$T_{J(MAX)}$		−	165	°C

[1] Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

ISOLATION CHARACTERISTICS

Characteristic	Symbol	Notes	Value	Units
Withstand Voltage [1][2]	V_{ISO}	Agency rated for 60 seconds per UL 62368-1 (edition 3)	5656	V_{RMS}
Working Voltage for Basic Isolation [2]	V_{WVBI}	Maximum approved working voltage for basic (single) isolation according to UL 62368-1 (edition 3)	1550	$V_{PK \text{ or }} V_{DC}$
			1097	V_{RMS}
Working Voltage for Reinforced Isolation [2]	V_{WVRI}	Maximum approved working voltage for reinforced isolation according to UL 62368-1 (edition 3)	800	$V_{PK \text{ or }} V_{DC}$
			565	V_{RMS}
Impulse Withstand Voltage	$V_{IMPULSE}$	Tested ±5 pulses at 2/minute in compliance to IEC 61000-4-5, 1.2 µs (rise) / 50 µs (width)	8000	V_{PK}
Clearance	D_{CL}	Minimum distance through air from IP leads to signal leads	8	mm
Creepage	D_{CR}	Minimum distance along package body from IP leads to signal leads	8	mm
Distance Through Insulation	DTI	Nominal internal distance through insulation	110	µm
Comparative Tracking Index	CTI	Material Group II	400 to 599	V

[1] Production tested for 1 second in accordance with UL 62368-1 (edition 3).
[2] Certification pending.

PACKAGE CHARACTERISTICS

Characteristic	Symbol	Notes	Min.	Typ.	Max.	Unit
Internal Conductor Resistance	R_{IC}	$T_A = 25°C$	−	50	100	µΩ
Internal Conductor Inductance	L_{IC}	$T_A = 25°C$	−	4.5	−	nH
Moisture Sensitivity Level	MSL	Per IPC/JEDEC J-STD-020	−	3	−	−

Figure 2: LX Package, 8-Pin PSOF Pinout Diagram (top view)
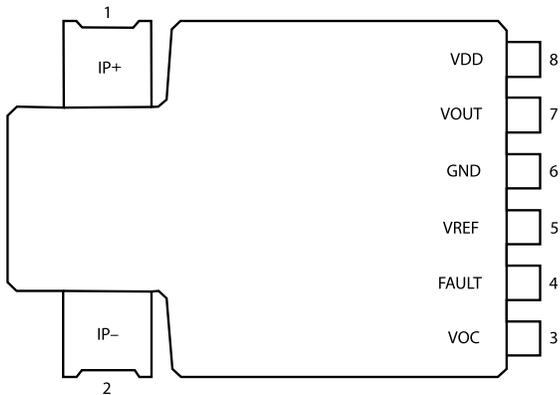
Terminal List Table

Number	Name	Description
1	IP+	Positive terminal for current being sensed
2	IP–	Negative terminal for current being sensed
3	VOC	User-configurable overcurrent fault threshold
4	FAULT	Overcurrent fault output, active low
5	VREF	Zero-current voltage reference output
6	GND	Device ground terminal
7	VOUT	Analog output
8	VDD	Device power supply terminal

Figure 3: Functional Block Diagram

COMMON ELECTRICAL CHARACTERISTICS: Valid through the full operating temperature range, T_A = –40°C to 150°C, C_{BYPASS} = 0.1μF, and V_{DD} = $V_{DD(Typ.)}$, unless specified otherwise. Minimum and maximum values are tested in production or validated by design and characterization.

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Supply Voltage	V_{DD}	5 V variant	4.5	5	5.5	V
		3.3 V variant	3.15	3.3	3.45	V
Supply Current	I_{DD}	No load on VOUT, FAULT, and VOC	–	–	21	mA
Supply Bypass Capacitor	C_{BYPASS}		–	0.1	–	μF
Output Capacitive Load [1]	C_{L_VOUT}		–	–	4.7	nF
Output Resistive Load [1]	R_{L_VOUT}	VOUT to GND, VOUT to VDD	10	–	–	kΩ
Power-On Reset Voltage	V_{POR}	T_A = 25°C, V_{DD} rising 1 V/ms	2.6	–	3	V
Power-On Reset Hysteresis	V_{POR_HYS}	T_A = 25°C	150	–	450	mV
Power-On Time	t_{PO}		–	80	–	μs
OUTPUT SIGNAL CHARACTERISTICS (VOUT)						
Saturation Voltage [2]	V_{SAT_H}	R_{L_VOUT} = 10 kΩ, V_{DD} = $V_{DD(Typ.)}$	$V_{DD} - 0.3$	–	–	V
	V_{SAT_L}	R_{L_VOUT} = 10 kΩ, V_{DD} = $V_{DD(Typ.)}$	–	–	0.2	V
Short Circuit Current	I_{SC_VOUT}	VOUT to GND	–	30	–	mA
Bandwidth	BW	Small signal –3 dB, C_{L_VOUT} = 100 pF	–	150	–	kHz
Rise Time	t_R	C_{L_VOUT} = 100 pF	–	2.3	–	μs
Response Time [1]	t_{RESP}	C_{L_VOUT} = 100 pF	–	3	4	μs
Propagation Delay	t_{PD}	C_{L_VOUT} = 100 pF	–	1.6	–	μs
Noise Density	N_D	5 V variant, C_{L_VOUT} = 1 nF, T_A = 25°C	–	360	–	μA/√Hz
		3.3 V variant, C_{L_VOUT} = 1 nF, T_A = 25°C	–	590	–	μA/√Hz
Common-Mode Field Rejection	CMFR	Input-referred error due to common-mode field	–	2	–	mA/G
OVERCURRENT FAULT OUTPUT CHARACTERISTICS (FAULT)						
Overcurrent FAULT Threshold Range	I_{OCR}	T_A = 25°C	50	–	200	%$I_{PR(Max.)}$
VOC Input Linear Operating Range	V_{OR_VOC}	5 V variant, T_A = 25°C	0.5	1	2	V
		3.3 V variant, T_A = 25°C	0.33	0.66	1.32	V
VOC Input Low Voltage	V_{VOC_L}		–	0.1	–	V
Overcurrent FAULT Pull-Up Resistor	R_{L_FAULT}		–	10	–	kΩ
Overcurrent FAULT Output Error	E_{OC}	T_A = 25°C	–12	–	12	%$I_{PR(Max.)}$
Overcurrent FAULT Output Low Voltage	V_{FAULT_L}	R_{L_FAULT} = 10 kΩ, fault condition present	–	0.3	–	V
Overcurrent FAULT Leakage Current	I_{FAULT_OFF}	R_{L_FAULT} = 10 kΩ, no fault condition present	–	100	–	nA
Overcurrent FAULT Hysteresis	I_{OC_HYS}	T_A = 25°C	3.5	–	–	%$I_{PR(Max.)}$
Overcurrent FAULT Response Time	t_{OC_RESP}		–	3	–	μs
ZERO-CURRENT VOLTAGE REFERENCE OUTPUT CHARACTERISTICS (VREF)						
VREF Resistive Load	R_{L_VREF}		10	–	–	kΩ
VREF Capacitive Load	C_{L_VREF}		–	–	4.7	nF
VREF Short-Circuit Current	I_{SC_VREF}	VREF shorted to GND	–	25	–	mA
		VREF shorted to VDD	–	–2.1	–	mA

[1] Validated by design and characterization.

[2] The sensor may continue to respond to current beyond the specified Current Sensing Range, I_{PR}, until the output saturates at the high or low saturation voltage; however, the linearity and performance beyond the specified Current Sensing Range are not validated.

ACS37200LLXTR-100B3 PERFORMANCE CHARACTERISTICS: Valid through the full operating temperature range, T_A = –40°C to 150°C, C_{BYPASS} = 0.1 µF, and V_{DD} = 3.3 V, unless specified otherwise. Minimum and maximum values are tested in production.

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
NOMINAL PERFORMANCE						
Current Sensing Range [1]	I_{PR}	Limited by $T_{J(MAX)}$ = 165°C	–100	–	100	A
Sensitivity [2]	Sens	$I_{PR(Min.)} < I_P < I_{PR(Max.)}$	–	13.2	–	mV/A
Quiescent Voltage Output	V_{QVO}	I_P = 0 A	–	1.65	–	V
Overcurrent FAULT Threshold	I_{OC}	V_{VOC} = 0.66 V or $V_{VOC} < V_{VOC\_L}$	–	100	–	%I_{PR}
Reference Voltage Output	V_{REF}		–	1.65	–	V
OVERCURRENT FAULT OUTPUT						
Overcurrent FAULT Error	I_{OC_E}	V_{VOC} = 0.66 V, T_A = 25°C	–12	–	12	A
ERROR COMPONENTS						
Sensitivity Error [2]	E_{SENS}	On Allegro evaluation board, T_A = 25°C, T_A = –40°C, T_A = 150°C	–2	–	2	%
Quiescent Voltage Output Error	V_{QVO_E}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–10	–	10	mV
Sensitivity Temperature Drift	E_{SENS_T}		–	±1	–	%
Quiescent Voltage Output Temperature Drift	V_{QVO_T}		–	±7	–	mV
Offset Error	V_{OE}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–7	–	7	mV
Noise	N	T_A = 25°C, C_{L_VOUT} = 1 nF, BW = 150 kHz	–	2.6	–	mV$_{RMS}$
Power Supply QVO Error	V_{QVO_PS}	V_{DD} = 3.15 V, V_{DD} = 3.45 V	–15	–	15	mV
Power Supply Sensitivity Error	E_{SENS_PS}	V_{DD} = 3.15 V, V_{DD} = 3.45 V	–2.5	–	2.5	%
LIFETIME DRIFT						
Sensitivity Lifetime Drift	E_{SENS_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–1.6	±0.9	1.6	%
Quiescent Voltage Output Lifetime Drift	V_{QVO_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV
Offset Error Lifetime Drift	V_{OE_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV

[1] Validated by design and characterization.
[2] See the Layout Guidelines section of this datasheet.

ACS37200LLXTR-150B3 PERFORMANCE CHARACTERISTICS: Valid through the full operating temperature range, T_A = –40°C to 150°C, C_{BYPASS} = 0.1 µF, and V_{DD} = 3.3 V, unless specified otherwise. Minimum and maximum values are tested in production.

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
NOMINAL PERFORMANCE						
Current Sensing Range [1]	I_{PR}	Limited by $T_{J(MAX)}$ = 165°C	–150	–	150	A
Sensitivity [2]	Sens	$I_{PR(Min.)} < I_P < I_{PR(Max.)}$	–	8.8	–	mV/A
Quiescent Voltage Output	V_{QVO}	I_P = 0 A	–	1.65	–	V
Overcurrent FAULT Threshold	I_{OC}	V_{VOC} = 0.66 V or $V_{VOC} < V_{VOC\_L}$	–	150	–	%I_{PR}
Reference Voltage Output	V_{REF}		–	1.65	–	V
OVERCURRENT FAULT OUTPUT						
Overcurrent FAULT Error	I_{OC_E}	V_{VOC} = 0.66 V, T_A = 25°C	–18	–	18	A
ERROR COMPONENTS						
Sensitivity Error [2]	E_{SENS}	On Allegro evaluation board, T_A = 25°C, T_A = –40°C, T_A = 150°C	–2	–	2	%
Quiescent Voltage Output Error	V_{QVO_E}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–10	–	10	mV
Sensitivity Temperature Drift	E_{SENS_T}		–	±1	–	%
Quiescent Voltage Output Temperature Drift	V_{QVO_T}		–	±7	–	mV
Offset Error	V_{OE}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–7	–	7	mV
Noise	N	T_A = 25°C, C_{L_VOUT} = 1 nF, BW = 150 kHz	–	2.2	–	mV$_{RMS}$
Power Supply QVO Error	V_{QVO_PS}	V_{DD} = 3.15 V, V_{DD} = 3.45 V	–15	–	15	mV
Power Supply Sensitivity Error	E_{SENS_PS}	V_{DD} = 3.15 V, V_{DD} = 3.45 V	–2.5	–	2.5	%
LIFETIME DRIFT						
Sensitivity Lifetime Drift	E_{SENS_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–1.6	±0.9	1.6	%
Quiescent Voltage Output Lifetime Drift	V_{QVO_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV
Offset Error Lifetime Drift	V_{OE_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV

[1] Validated by design and characterization.
[2] See the Layout Guidelines section of this datasheet.

ACS37200LLXTR-200B3 PERFORMANCE CHARACTERISTICS: Valid through the full operating temperature range, T_A = –40°C to 150°C, C_{BYPASS} = 0.1 μF, and V_{DD} = 3.3 V, unless specified otherwise. Minimum and maximum values are tested in production.

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
NOMINAL PERFORMANCE						
Current Sensing Range [1]	I_{PR}	Limited by $T_{J(MAX)}$ = 165°C	–200	–	200	A
Sensitivity [2]	Sens	$I_{PR(Min.)} < I_P < I_{PR(Max.)}$	–	6.6	–	mV/A
Quiescent Voltage Output	V_{QVO}	I_P = 0 A	–	1.65	–	V
Overcurrent FAULT Threshold	I_{OC}	V_{VOC} = 0.66 V or $V_{VOC} < V_{VOC\_L}$	–	100	–	%I_{PR}
Reference Voltage Output	V_{REF}		–	1.65	–	V
OVERCURRENT FAULT OUTPUT						
Overcurrent FAULT Error	I_{OC_E}	V_{VOC} = 0.66 V, T_A = 25°C	–24	–	24	A
ERROR COMPONENTS						
Sensitivity Error [2]	E_{SENS}	On Allegro evaluation board, T_A = 25°C, T_A = –40°C, T_A = 150°C	–2	–	2	%
Quiescent Voltage Output Error	V_{QVO_E}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–10	–	10	mV
Sensitivity Temperature Drift	E_{SENS_T}		–	±1	–	%
Quiescent Voltage Output Temperature Drift	V_{QVO_T}		–	±7	–	mV
Offset Error	V_{OE}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–7	–	7	mV
Noise	N	T_A = 25°C, C_{L_VOUT} = 1 nF, BW = 150 kHz	–	1.7	–	mV$_{RMS}$
Power Supply QVO Error	V_{QVO_PS}	V_{DD} = 3.15 V, V_{DD} = 3.45 V	–15	–	15	mV
Power Supply Sensitivity Error	E_{SENS_PS}	V_{DD} = 3.15 V, V_{DD} = 3.45 V	–2.5	–	2.5	%
LIFETIME DRIFT						
Sensitivity Lifetime Drift	E_{SENS_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–1.6	±0.9	1.6	%
Quiescent Voltage Output Lifetime Drift	V_{QVO_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV
Offset Error Lifetime Drift	V_{OE_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV

[1] Validated by design and characterization.
[2] See the Layout Guidelines section of this datasheet.

ACS37200LLXTR-100B5 PERFORMANCE CHARACTERISTICS: Valid through the full operating temperature range, T_A = –40°C to 150°C, C_{BYPASS} = 0.1 µF, and V_{DD} = 5 V, unless specified otherwise. Minimum and maximum values are tested in production.

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
NOMINAL PERFORMANCE						
Current Sensing Range [1]	I_{PR}	Limited by $T_{J(MAX)}$ = 165°C	–100	–	100	A
Sensitivity [2]	Sens	$I_{PR(Min.)}$ < I_P < $I_{PR(Max.)}$	–	20	–	mV/A
Quiescent Voltage Output	V_{QVO}	I_P = 0 A	–	2.5	–	V
Overcurrent FAULT Threshold	I_{OC}	V_{VOC} = 1 V or V_{VOC} < V_{VOC_L}	–	100	–	%I_{PR}
Reference Voltage Output	V_{REF}		–	2.5	–	V
OVERCURRENT FAULT OUTPUT						
Overcurrent FAULT Error	I_{OC_E}	V_{VOC} = 1 V, T_A = 25°C	–12	–	12	A
ERROR COMPONENTS						
Sensitivity Error [2]	E_{SENS}	On Allegro evaluation board, T_A = 25°C, T_A = –40°C, T_A = 150°C	–2	–	2	%
Quiescent Voltage Output Error	V_{QVO_E}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–10	–	10	mV
Sensitivity Temperature Drift	E_{SENS_T}		–	±1	–	%
Quiescent Voltage Output Temperature Drift	V_{QVO_T}		–	±7	–	mV
Offset Error	V_{OE}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–7	–	7	mV
Noise	N	T_A = 25°C, C_{L_VOUT} = 1 nF, BW = 150 kHz	–	2.4	–	mV$_{RMS}$
Power Supply QVO Error	V_{QVO_PS}	V_{DD} = 4.5 V, V_{DD} = 5.5 V	–15	–	15	mV
Power Supply Sensitivity Error	E_{SENS_PS}	V_{DD} = 4.5 V, V_{DD} = 5.5 V	–2.5	–	2.5	%
LIFETIME DRIFT						
Sensitivity Lifetime Drift	E_{SENS_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–1.6	±0.9	1.6	%
Quiescent Voltage Output Lifetime Drift	V_{QVO_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV
Offset Error Lifetime Drift	V_{OE_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV

[1] Validated by design and characterization.
[2] See the Layout Guidelines section of this datasheet.

ACS37200LLXTR-150B5 PERFORMANCE CHARACTERISTICS: Valid through the full operating temperature range, T_A = –40°C to 150°C, C_{BYPASS} = 0.1 μF, and V_{DD} = 5 V, unless specified otherwise. Minimum and maximum values are tested in production.

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
NOMINAL PERFORMANCE						
Current Sensing Range [1]	I_{PR}	Limited by $T_{J(MAX)}$ = 165°C	–150	–	150	A
Sensitivity [2]	Sens	$I_{PR(Min.)} < I_P < I_{PR(Max.)}$	–	13.3	–	mV/A
Quiescent Voltage Output	V_{QVO}	I_P = 0 A	–	2.5	–	V
Overcurrent FAULT Threshold	I_{OC}	V_{VOC} = 1 V or $V_{VOC} < V_{VOC\_L}$	–	150	–	%I_{PR}
Reference Voltage Output	V_{REF}		–	2.5	–	V
OVERCURRENT FAULT OUTPUT						
Overcurrent FAULT Error	I_{OC_E}	V_{VOC} = 1 V, T_A = 25°C	–18	–	18	A
ERROR COMPONENTS						
Sensitivity Error [2]	E_{SENS}	On Allegro evaluation board, T_A = 25°C, T_A = –40°C, T_A = 150°C	–2	–	2	%
Quiescent Voltage Output Error	V_{QVO_E}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–10	–	10	mV
Sensitivity Temperature Drift	E_{SENS_T}		–	±1	–	%
Quiescent Voltage Output Temperature Drift	V_{QVO_T}		–	±7	–	mV
Offset Error	V_{OE}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–7	–	7	mV
Noise	N	T_A = 25°C, C_{L_VOUT} = 1 nF, BW = 150 kHz	–	2.4	–	mV$_{RMS}$
Power Supply QVO Error	V_{QVO_PS}	V_{DD} = 4.5 V, V_{DD} = 5.5 V	–15	–	15	mV
Power Supply Sensitivity Error	E_{SENS_PS}	V_{DD} = 4.5 V, V_{DD} = 5.5 V	–2.5	–	2.5	%
LIFETIME DRIFT						
Sensitivity Lifetime Drift	E_{SENS_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–1.6	±0.9	1.6	%
Quiescent Voltage Output Lifetime Drift	V_{QVO_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV
Offset Error Lifetime Drift	V_{OE_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV

[1] Validated by design and characterization.
[2] See the Layout Guidelines section of this datasheet.

ACS37200LLXTR-200B5 PERFORMANCE CHARACTERISTICS: Valid through the full operating temperature range, T_A = –40°C to 150°C, C_{BYPASS} = 0.1µF, and V_{DD} = 5V, unless specified otherwise. Minimum and maximum values are tested in production.

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
NOMINAL PERFORMANCE						
Current Sensing Range [1]	I_{PR}	Limited by $T_{J(MAX)}$ = 165°C	–200	–	200	A
Sensitivity [2]	Sens	$I_{PR(Min.)} < I_P < I_{PR(Max.)}$	–	10	–	mV/A
Quiescent Voltage Output	V_{QVO}	I_P = 0 A	–	2.5	–	V
Overcurrent FAULT Threshold	I_{OC}	V_{VOC} = 1 V or $V_{VOC} < V_{VOC\_L}$	–	100	–	%I_{PR}
Reference Voltage Output	V_{REF}		–	2.5	–	V
OVERCURRENT FAULT OUTPUT						
Overcurrent FAULT Error	I_{OC_E}	V_{VOC} = 1 V, T_A = 25°C	–24	–	24	A
ERROR COMPONENTS						
Sensitivity Error [2]	E_{SENS}	On Allegro evaluation board, T_A = 25°C, T_A = –40°C, T_A = 150°C	–2	–	2	%
Quiescent Voltage Output Error	V_{QVO_E}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–10	–	10	mV
Sensitivity Temperature Drift	E_{SENS_T}		–	±1	–	%
Quiescent Voltage Output Temperature Drift	V_{QVO_T}		–	±7	–	mV
Offset Error	V_{OE}	I_P = 0 A; T_A = 25°C, T_A = –40°C, T_A = 150°C	–7	–	7	mV
Noise	N	T_A = 25°C, C_{L_VOUT} = 1 nF, BW = 150 kHz	–	1.5	–	mV$_{RMS}$
Power Supply QVO Error	V_{QVO_PS}	V_{DD} = 4.5 V, V_{DD} = 5.5 V	–15	–	15	mV
Power Supply Sensitivity Error	E_{SENS_PS}	V_{DD} = 4.5 V, V_{DD} = 5.5 V	–2.5	–	2.5	%
LIFETIME DRIFT						
Sensitivity Lifetime Drift	E_{SENS_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–1.6	±0.9	1.6	%
Quiescent Voltage Output Lifetime Drift	V_{QVO_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV
Offset Error Lifetime Drift	V_{OE_LT}	Based on six-sigma drift of worst-case distribution observed after AEC-Q100 qualification stresses	–11	±6	11	mV

[1] Validated by design and characterization.
[2] See the Layout Guidelines section of this datasheet.

ACS37200 TYPICAL FREQUENCY RESPONSE
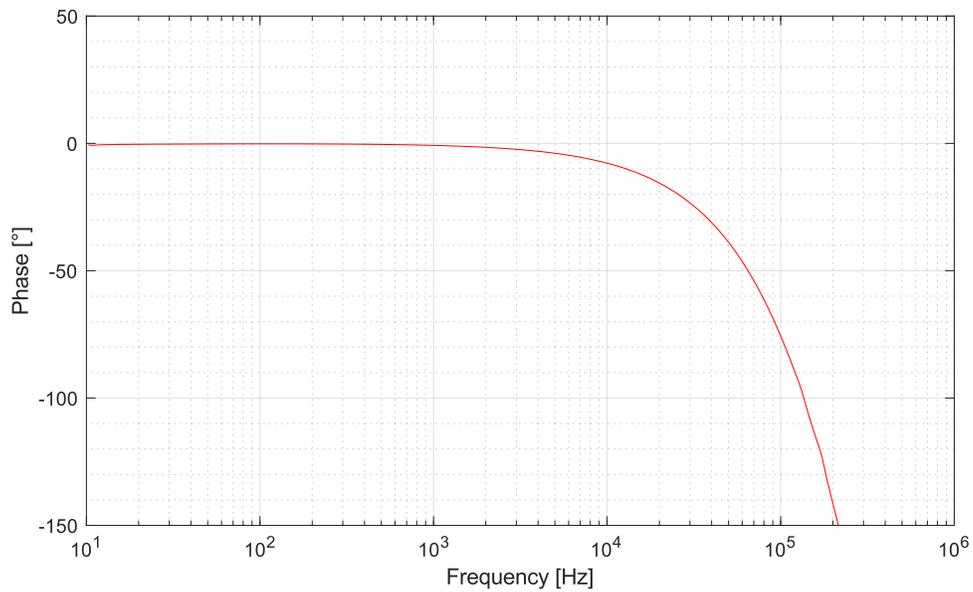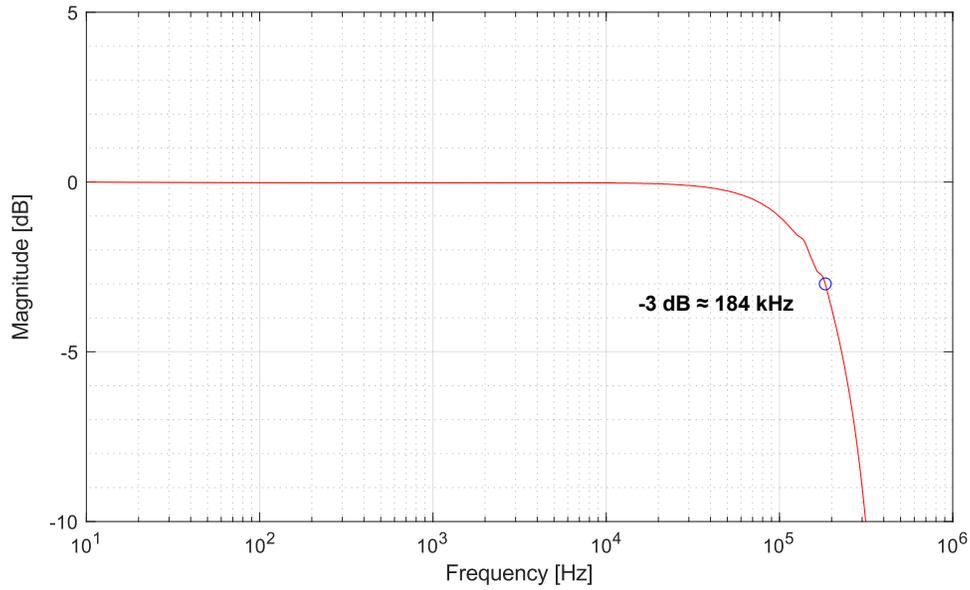
RESPONSE CHARACTERISTICS DEFINITIONS AND PERFORMANCE DATA

Response Time (t$_{RESP}$)

The time interval between a) when the sensed input current reaches 90% of its full-scale value, and b) when the sensor output, V$_{OUT}$, reaches 90% of its full-scale output value.
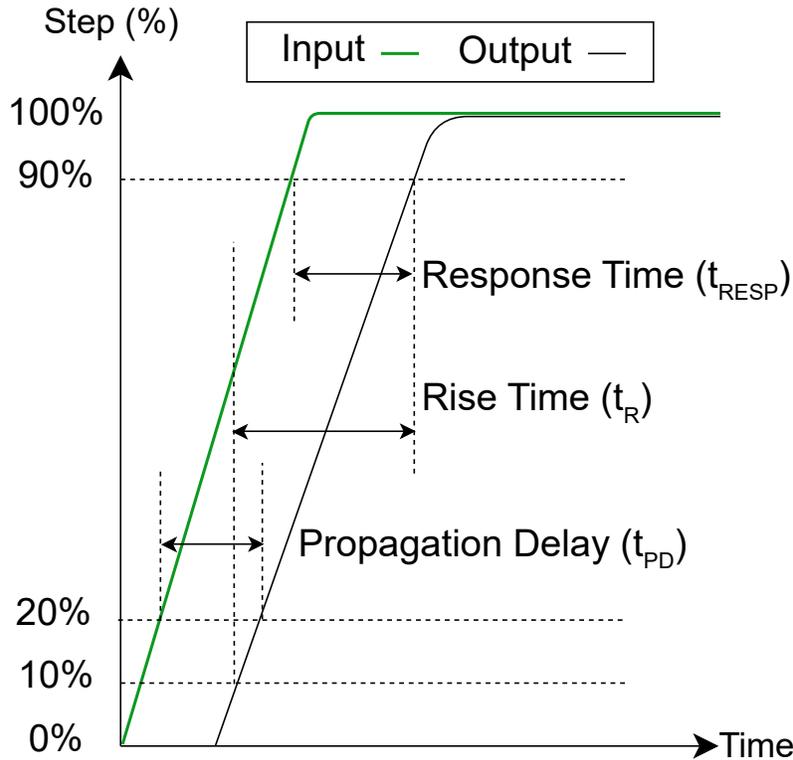
Propagation Delay (t$_{PD}$)

The time interval between a) when the sensed input current reaches 20% of its full-scale value, and b) when the sensor output, V$_{OUT}$, reaches 20% of its full-scale output value.

Rise Time (t$_R$)

The time interval between a) when the sensor output, V$_{OUT}$, reaches 10% of its full-scale value, and b) when the sensor output, V$_{OUT}$, reaches 90% of its full-scale value.

Figure 4: Step Response Characteristics

FUNCTIONAL DESCRIPTION OF POWER ON/OFF OPERATION

Introduction

The graphs in this section show the behavior of V_{OUT} as V_{DD} reaches or falls below the required power-on voltage. Figure 5 and Figure 6 use the same labeling convention for different voltage thresholds. References in brackets "[ ]" are valid for each of these graphs.

POWER-ON OPERATION

As V_{DD} ramps up, the VOUT pin is in a high-impedance (high-Z) state until V_{DD} reaches and passes V_{POR} [1]. Once V_{DD} has passed V_{POR} [1], V_{OUT} enters normal operation and starts responding to applied current, I_P.

POWER-ON RESET RELEASE VOLTAGE

If V_{DD} falls below $V_{POR} - V_{POR\_HYS}$ [2] while the sensor is in operation, the digital circuitry turns off and the output re-enters a high-Z state. After V_{DD} recovers and exceeds V_{POR} [1], the output enters normal operation after a delay of t_{PO}.

POWER-ON DELAY (t_{PO})

When the supply voltage reaches V_{POR} [1], the device requires a finite time to power its internal components before the outputs are released from the high-impedance state and start responding to the measured current, I_P. Power-On Time, t_{PO}, is defined as the time it takes for the output voltage to settle within ±10% of its steady-state value under an applied current, I_P, which can be seen as the time from [1] to [A] in Figure 6.
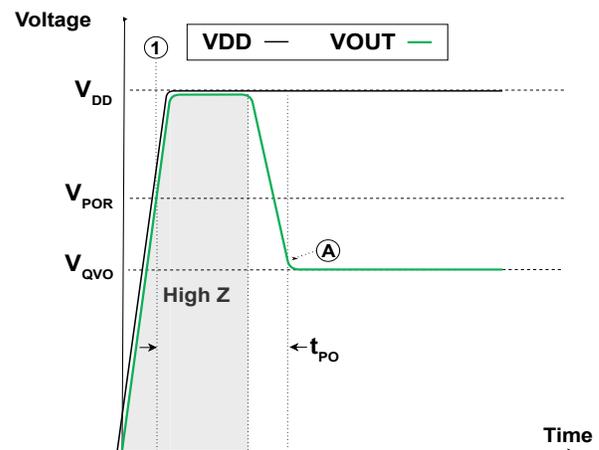

Figure 5: Power-On And Power-Off Operation

Figure 6: Power-On Delay, t_{PO}

POWER-OFF OPERATION

As V_{DD} drops below $V_{POR} - V_{POR\_HYS}$ the outputs enters a high-Z state. The hysteresis on the power-on voltage prevents noise on the supply line from causing V_{OUT} to repeatedly enter and exit the high-Z state around the V_{POR} level.

NOTE: Because the device is entering a high-Z state and not driving the output, the time it takes the output to reach a steady state depends on the external circuitry.

DEFINITIONS OF OPERATING AND PERFORMANCE CHARACTERISTICS

Quiescent Voltage Output (V_{QVO})

Quiescent Voltage Output, V_{QVO}, is defined as the voltage on the output, V_{OUT}, when no current is applied, $I_P = 0$.

Quiescent Voltage Output Error (V_{QVO_E})

Quiescent Voltage Output Error, V_{QVO_E}, is defined as the deviation of V_{QVO} from the nominal target zero-current output value in production testing.

Quiescent Voltage Output Temperature Drift (V_{QVO_T})

Quiescent Voltage Output Temperature Drift, V_{QVO_T}, is defined as the expected deviation of V_{QVO} from its value at $T_A = 25°C$ over the temperature range $T_A = –40$ to $150°C$, based on observed three-sigma temperature drifts.

Offset Error (V_{OE})

The Offset Error, V_{OE}, is the difference between the Quiescent Voltage Output, V_{QVO}, and the voltage at the zero-current voltage output pin VREF, $V_{OE} = V_{REF} – V_{QVO}$.

Output Saturation Voltage (V_{SAT_H} and V_{SAT_L})

Output Saturation Voltage, V_{SAT}, is defined as the low or high voltage that V_{OUT} does not exceed. V_{SAT_H} is the highest voltage the output can reach, while V_{SAT_L} is the lowest. Note that changing the sensitivity does not change the V_{SAT} points.

Sensitivity (Sens)

Sensitivity, or Sens, is defined as the ratio of the V_{OUT} swing and the current through the primary conductor, I_P. The current causes a voltage change on V_{OUT} away from V_{QVO} until V_{SAT}. The magnitude and direction of the output voltage is proportional to the magnitude and direction of the current, I_P. The proportional relationship between output voltage and current is Sensitivity, defined as:

$$Sens = [\ V_{OUT}(I_{P1}) – V_{OUT}(I_{P2})\ ] / [\ I_{P1} – I_{P2}\ ]$$

where I_{P1} and I_{P2} are two different currents, and $V_{OUT}(I_{P1})$ and $V_{OUT}(I_{P2})$ are the respective output voltages, at VOUT, at those currents.

Sensitivity Error (E_{SENS})

Sensitivity Error, E_{SENS}, is the deviation of Sensitivity from the nominal sensitivity target value in production testing.

Sensitivity Temperature Drift (E_{SENS_T})

Sensitivity Temperature Drift, E_{SENS_T}, is defined as the expected deviation of Sens from its value at $T_A = 25°C$ over the temperature range $T_A = –40$ to $150°C$, based on observed three-sigma temperature drifts.

Lifetime Drift (E_{SENS_LT}, V_{QVO_LT}, and V_{OE_LT})

Sensitivity Lifetime Drift, E_{SENS_LT}, Quiescent Voltage Output Lifetime Drift, V_{QVO_LT}, and Offset Error Lifetime Drift, V_{OE_LT}, are derived from the worst-case distribution observed during population testing under AEC-Q100 qualification stresses at $T_A = 25°C$, $T_A = –40°C$ and $T_A = 150°C$. Lifetime drift is the change of Sens, V_{QVO}, or V_{OE} from the pre-stress value. The minimum and maximum limits are population mean ±6 sigma, and the typical specification is mean ±3 sigma.

Power Supply Sensitivity Error (E_{SENS_PS})

Power Supply Sensitivity Error, E_{SENS_PS}, is defined as the percent change in Sens when V_{DD} varies within the specified test voltages.

Power Supply QVO Error (V_{QVO_PS})

Power Supply QVO Error, V_{QVO_PS}, is defined as the change in V_{QVO} when V_{DD} varies within the specified test voltages.

OVERCURRENT FAULT FUNCTION

The Overcurrent Fault function pulls the open-drain FAULT pin low when the applied current, I_P, exceeds a set threshold, I_{OC}. The threshold I_{OC} is adjustable via the VOC pin. Overcurrent FAULT activates symmetrically for positive and negative applied currents.

VOLTAGE OVERCURRENT PIN (VOC)

The VOC pin is a voltage input that is used to set the Overcurrent FAULT Threshold, I_{OC}. There are two ways to set the threshold: 1) via a resistor, R_{L_VOC}, between VOC and GND, or 2) by an external low-impedance voltage source connected to the VOC pin.

The ACS37200 has an internal factory-calibrated 10 µA current source at VOC. Connecting a resistor between VOC and GND sets the voltage at VOC via $V_{VOC}[V] = R_{L\_VOC}[\Omega] \times 10^{-5}[A]$. R_{L_VOC} must be chosen such that V_{VOC} is between 0.5 V and 2 V for 5 V supply variants, or between 0.33 V and 1.32 V for 3.3 V supply variants. The relationship between V_{VOC} and I_{OC} is shown in Table 1. I_{OC} is set as a percentage of the full-scale sensing range of the device, $I_{P(Max)}$, and can be between 50% $I_{P(Max)}$ and 200% $I_{P(Max)}$.

Additionally, the VOC pin has an internal voltage comparator and when $V_{VOC} < V_{VOC\_L}$, the device internally sets $I_{OC} = 100\%$ $I_{P(Max)}$.

The voltage at VOC can also be set using an external low-impedance voltage source that overdrives the pin's internal 10 µA current source.

Table 1: Overcurrent FAULT Threshold, I_{OC}, as set by V_{VOC}

V_{VOC} (V)		I_{OC} (%$I_{P(Max)}$)
5 V variants	3.3 V variants	
< V_{VOC_L}		100
0.5	0.33	50
0.75	0.495	75
1	0.66	100
1.25	0.825	125
1.5	0.99	150
1.75	1.155	175
2	1.32	200

VOC INPUT LINEAR OPERATING RANGE (V_{OR_VOC})

VOC Input Linear Operating Range, V_{OR_VOC}, is the voltage range for V_{VOC} in which the Overcurrent FAULT Threshold, I_{OC}, varies linearly with V_{VOC}. I_{OC} can be set between 50% $I_{P(Max)}$ and 200% $I_{P(Max)}$ within the VOC Input Linear Operating Range.

VOC INPUT LOW VOLTAGE (V_{VOC_L})

VOC Input Low Voltage, V_{VOC_L}, is defined as the voltage at the VOC pin below which the Overcurrent FAULT Threshold is internally set to $I_{OC} = 100\%$ $I_{P(Max)}$.

OVERCURRENT FAULT OUTPUT ERROR (E_{OC})

Overcurrent FAULT Error, E_{OC}, is defined as the difference between the set threshold, I_{OC}, and the measured current, I_P, at which Overcurrent FAULT activates.

OVERCURRENT FAULT HYSTERESIS (I_{OC_HYST})

Overcurrent FAULT Hysteresis, I_{OC_HYST}, is defined as the required decrease of I_P below I_{OC} before assertion at the FAULT pin is cleared. This can be seen as the difference between the levels [9] and [10] in Figure 7.

OVERCURRENT FAULT RESPONSE TIME (t_{OC_RESP})

Overcurrent FAULT Response Time, t_{OC_RESP}, is defined as the time between the current reaching the set threshold I_{OC} and the FAULT pin falling below V_{FAULT_L}.
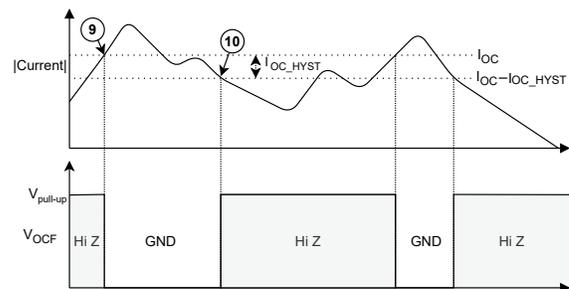

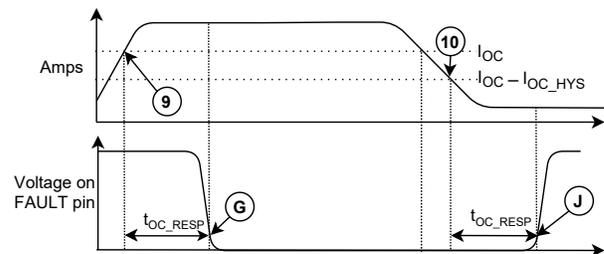**Figure 7: Overcurrent FAULT Hysteresis**

Figure 8: Fault Timing Diagram

LAYOUT GUIDELINES

Introduction

The ACS37200 is factory calibrated to achieve the specified typical sensitivity when placed on the ACS37200 evaluation board (ACSEVB-LX8). Using the sensor on a PCB with substantially different layout, or layer stack-up, than the ACSEVB-LX8 can lead to systemic shifts of the typical value for sensitivity, Sens, specified in this datasheet. Design support files for the ACSEVB-LX8 are available for download from the Allegro website.

When the sensor is mounted on a PCB, three important factors might cause a shift in the typical value for Sens:

- PCB layer stack-up
- Trace layout for the measured current
- Thickness of the solder layer

Design support files to minimize sensitivity shifts due to PCB layout and solder variability will be available for download from the Allegro website. For more information, check the technical documents section of the ACS37200 website.

Solder Stencil Grid and Voids

Voids in the solder on pins 1 and 2 (IP+ and IP–) increase the resistance of the solder joints and reduce heat conduction to the PCB. Voids can develop from solder flux outgassing. Trapped gas requires escape routes under the package during reflow soldering. To help create a path for outgassing, a grid can be added in the solder stencil.

For an example solder stencil, see Figure 12.

PCB Layout and Stack-Up

To minimize PCB layout-induced sensitivity shifts, it is recommended to use the general trace layout for the measured current as in the ACSEVB-LX8 evaluation board. See Figure 9 and check for design support document on how to minimize sensitivity shifts due to PCB layout in the technical documents section of the ACS37200 website.

Evaluation Board Layout

The reported thermal performance and typical sensitivity are based on data collected using the LX Package Allegro Evaluation Board (ACSEVB-LX8) shown in Figure 10. Design support files are available for download from the Allegro website.
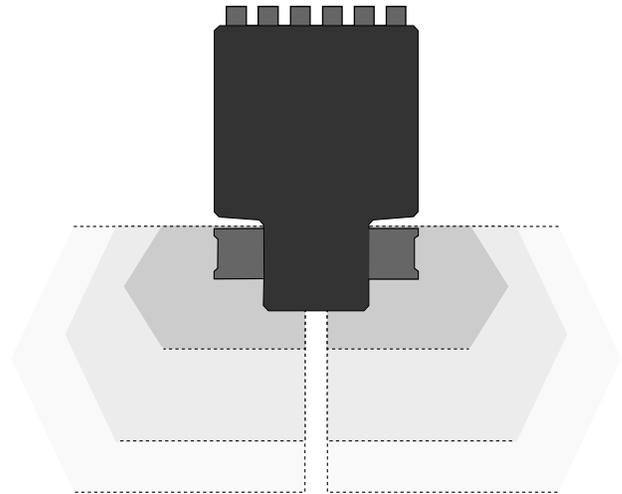

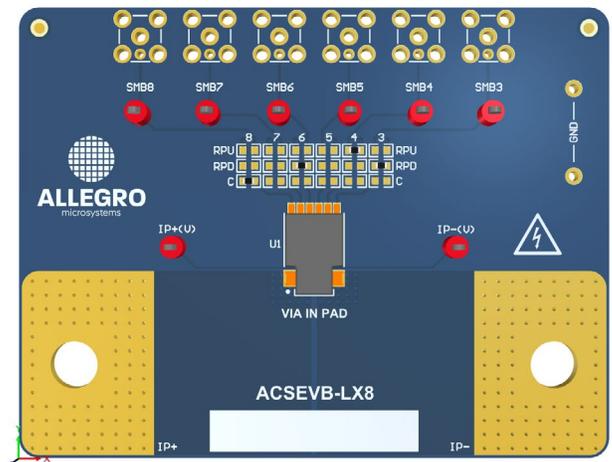**Figure 9: Recommended Trace Layout for Pins 1 and 2 (IP+ and IP–)**

Figure 10: LX Package Allegro Evaluation Board

PACKAGE OUTLINE DRAWING

For Reference Only – Not For Tooling Use

(PRELIMINARY, Reference Allegro DWG-000938, Rev. 2)
NOT TO SCALE
Dimensions in millimeters
Dimensions exclusive of mold flash, gate burrs, and dambar protrusions
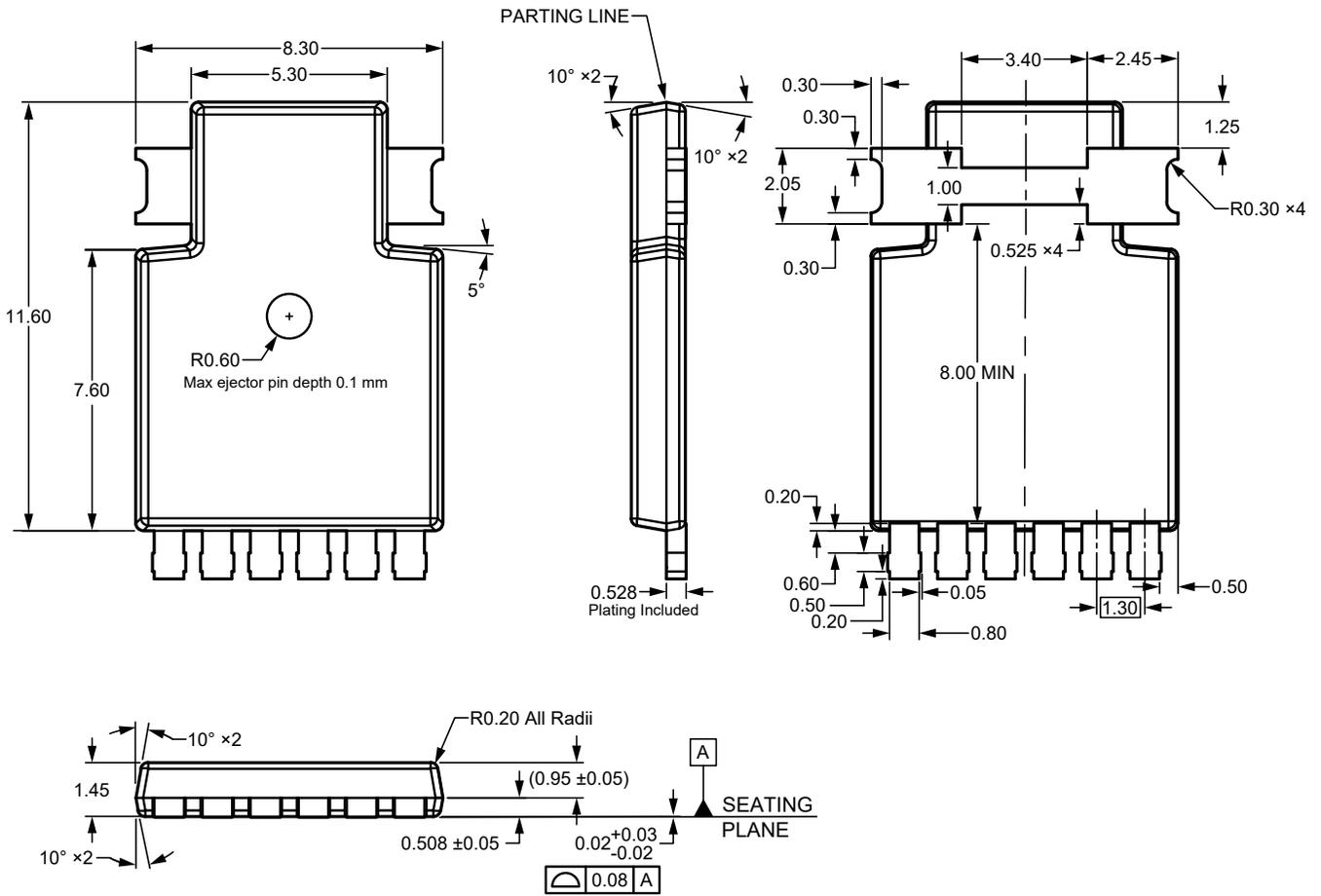Exact case and lead configuration at supplier discretion within limits shown

Figure 11: LX Package, 8-pin flat PSOF
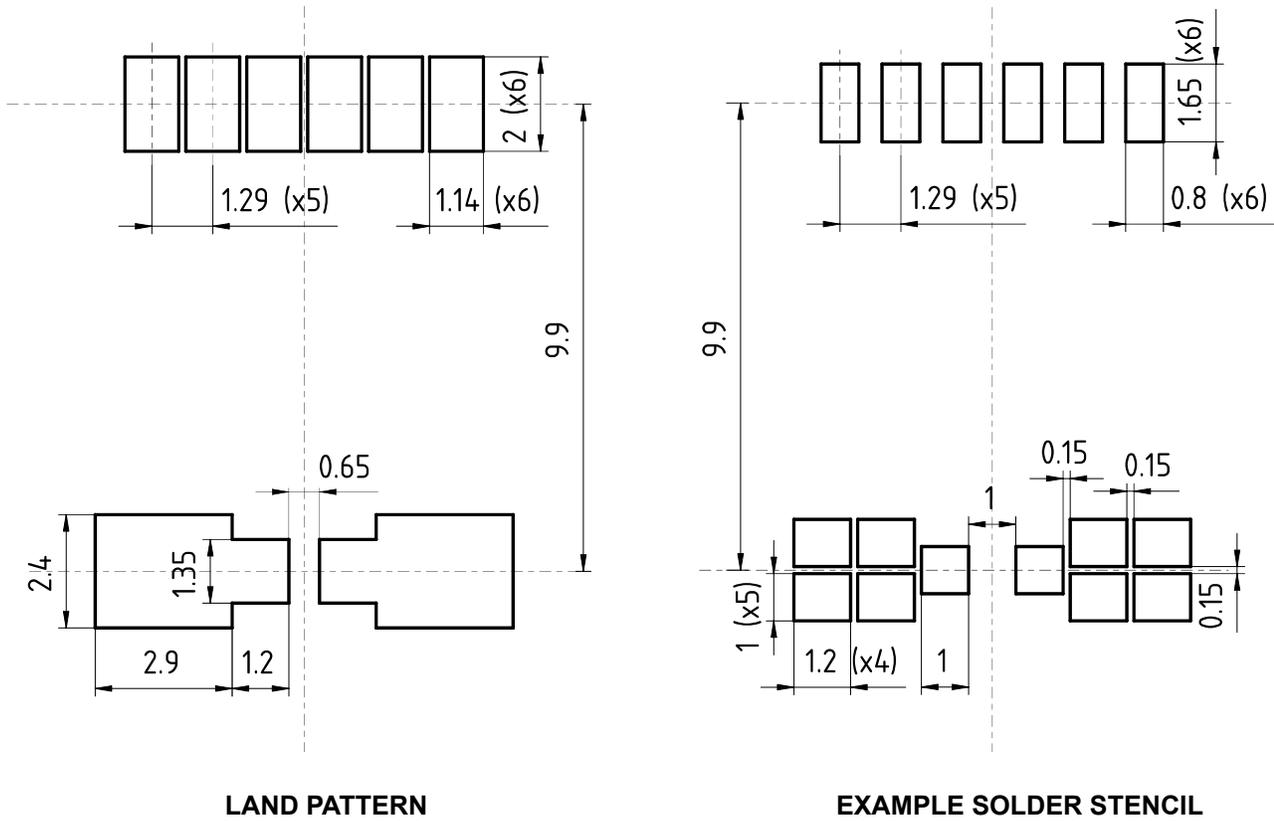
LAND PATTERN AND SOLDER STENCIL

LAND PATTERN

EXAMPLE SOLDER STENCIL

Figure 12: LX Package Land Pattern And Example Solder Stencil. All dimensions are in mm.

Revision History

Number	Date	Description
–	March 12, 2026	Initial release

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