CT415 and CT416

XtremeSense™ TMR Current Sensor with Ultra-Low Noise

Not for New Design

The CT415 and CT416 are in production but has been determined to be NOT FOR NEW DESIGN. This classification indicates that sale of these devices are currently restricted to existing customer applications. These devices should not be purchased for new design applications because obsolescence in the near future is probable. Samples are no longer available.

Date of status change: March 28, 2025

Recommended Substitutions:

For existing customer transition, and for new customers or new applications, refer to CT417 and CT418.

NOTE: For detailed information on purchasing options, contact your local Allegro field applications engineer or sales representative.

CT415 and CT416

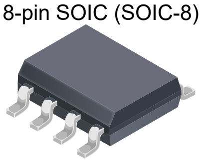
XtremeSense™ TMR Current Sensor with Ultra-Low Noise

FEATURES AND BENEFITS

- Integrated contact current sensing for low to medium current ranges
- Integrated current-carrying conductor (CCC)
- Linear analog output voltage
- 1 MHz bandwidth
- Response time: 300 ns
- UL/IEC 62368-1
  - □ Rated isolation voltage: 2.5 kV_{RMS}
  - □ Working voltage for basic isolation: 560 V_{RMS}
  - □ Working voltage for reinforced isolation: 280 V_{RMS}
- Low noise: 9 to 19 mA_{RMS} @ f_{BW} = 100 kHz
- 3.3 V and 5 V supply voltage variants
- Immunity to common-mode fields
- Filter function to reduce noise on output pin
- AEC-Q100 Grade 1, automotive qualified
- 8-lead SOIC package

PACKAGE

8-pin SOIC (SOIC-8)



Not to scale

DESCRIPTION

The CT415 and CT416 are high-bandwidth, ultralow-noise integrated contact current sensors that use Allegro patented XtremeSense™ tunneling magnetoresistive (TMR) technology to enable high-accuracy current measurements for industrial, consumer, and automotive applications. These devices support eight current ranges, and the integrated current-carrying conductor (CCC) of these devices handles up to 65 A of current and generates a current measurement as a linear analog output voltage.

The CT415 and CT416 have a 300 ns output response time, a current consumption of 6 mA, and are immune to common-mode fields. These devices also have a filter function to reduce the noise on the output pin.

The CT415 and CT416 are offered in an industry-standard 8-lead small-outline integrated circuit (SOIC) package that is green and restriction of hazardous substances (RoHS) compliant.

APPLICATIONS

- Solar/power inverters
- UPS, SMPS, and telecom power supplies
- Battery management systems
- Motor control
- Power utility meter

TÜV Certificate No.: R 72226133 0001

UL Certificate No.: UL-CA-2201235-0

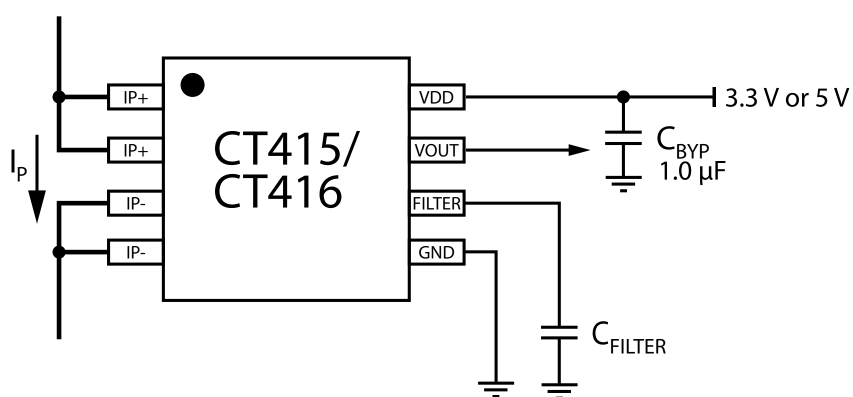


Figure 1: Typical Application Circuit of CT415 and CT416

The sensor outputs an analog signal, V_{OUT}, that varies linearly with the primary current, I_P , within the specified ranges.

SELECTION GUIDE

Part Number	Current Range (I_{PMAX}) (A)	Operating Voltage (V)	Sensitivity (mV/A)	Operating Temperature Range (°C)	Package	Packing
CT415-HSN820MR	±20	5.0	100.0	–40 to 125	8-lead SOIC 4.89 mm × 6.00 mm × 1.62 mm	Tape and Reel
CT416-HSN820MR	±20	3.3	50.0			
CT415-HSN830MR	±30	5.0	66.7			
CT416-HSN830MR	±30	3.3	33.3			
CT415-HSN840MR	±40	5.0	50.0			
CT415-HSN850MR	±50	5.0	40.0			
CT416-HSN850MR	±50	3.3	20.0			
CT415-HSN865MR	±65	5.0	30.8			
CT416-HSN865MR	±65	3.3	15.4			
CT415-HSN820DR	20	5.0	200.0			
CT416-HSN820DR	20	3.3	100.0			
CT415-HSN830DR	30	5.0	133.3			
CT416-HSN830DR	30	3.3	66.7			
CT415-HSN850DR	50	5.0	80.0			
CT416-HSN850DR	50	3.3	40.0			
CT415-HSN865DR	65	5.0	61.5			
CT416-HSN865DR	65	3.3	30.8			
CT415-ASN820MR	±20	5.0	100.0	AEC-Q100 Grade 1 –40 to 125		
CT416-ASN820MR	±20	3.3	50.0			
CT415-ASN830MR	±30	5.0	66.7			
CT416-ASN830MR	±30	3.3	33.3			
CT415-ASN850MR	±50	5.0	40.0			
CT416-ASN850MR	±50	3.3	20.0			
CT415-ASN865MR	±65	5.0	30.8			
CT416-ASN865MR	±65	3.3	15.4			
CT415-ASN820DR	20	5.0	200.0			
CT416-ASN820DR	20	3.3	100.0			
CT415-ASN830DR	30	5.0	133.3			
CT416-ASN830DR	30	3.3	66.7			
CT415-ASN850DR	50	5.0	80.0			
CT416-ASN850DR	50	3.3	40.0			
CT415-ASN865DR	65	5.0	61.5			
CT416-ASN865DR	65	3.3	30.8			

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PART NAMING SPECIFICATION

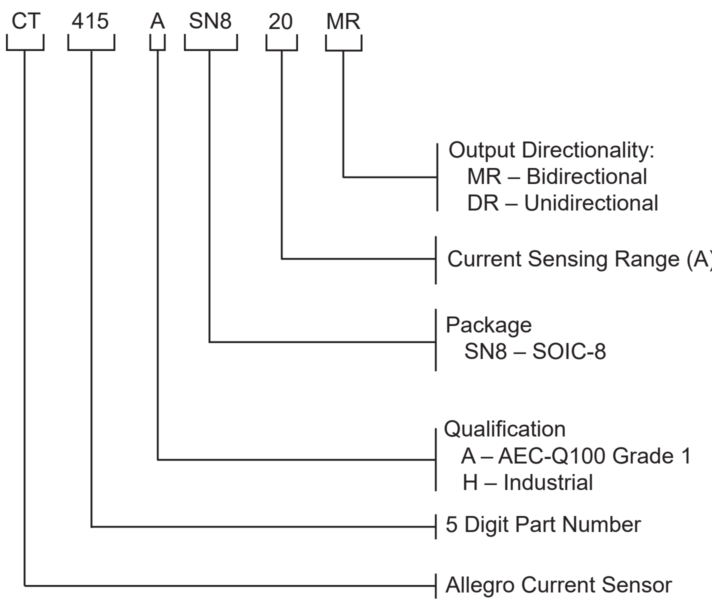

Table of Contents

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ABSOLUTE MAXIMUM RATINGS [1]

Characteristic	Symbol	Notes	Min.	Max.	Unit
Supply Voltage	V_{DD}		–0.3	6.0	V
Output Voltage	V_O	Applies to VOUT	–0.3	$(V_{DD}+0.3)<6$	V
Input Current	I_P	A current above this value can cause a permanent drift in sensitivity and quiescent output voltage beyond the limits of the datasheet.	–	350	A
Operating Ambient Temperature	T_A		–40	125	°C
Storage Temperature	T_{STG}		–65	150	°C
Junction Temperature	T_J		–	150	°C

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

PACKAGE CHARACTERISTICS

Characteristic	Symbol	Notes	Min.	Typ.	Max.	Unit
Internal Conductor Resistance	R_{IC}	T_A = 25°C	–	1	–	mΩ
Internal Conductor Inductance	L_{IC}	T_A = 25°C	–	4.2	–	nH
Moisture Sensitivity Level	MSL	Per IPC/JEDEC J-STD-020	–	3	–	–

ISOLATION CHARACTERISTICS

Characteristic	Symbol	Notes	Rating	Unit
Withstand Voltage [1]	V_{ISO}	Agency rated for 60 seconds per UL 62368-1 (edition 3)	3500	V_{RMS}
Working Voltage for Basic Isolation	V_{WVBI}	Maximum approved working voltage for basic (single) isolation according to UL 62368-1 (edition 3)	792	V_{PK} or V_{DC}
			560	V_{RMS}
Working Voltage for Reinforced Isolation	V_{WVRI}	Maximum approved working voltage for reinforced isolation according to UL 62368-1 (edition 3)	396	V_{PK} or V_{DC}
			280	V_{RMS}
Impulse Voltage	$V_{IMPULSE}$	1.2 µs/50 µs waveform, tested in air	5000	V_{PK}
Clearance	D_{CL}	Minimum distance through air from IP leads to signal leads	4	mm
Creepage	D_{CR}	Minimum distance along package body from IP leads to signal leads	4	mm
Distance Through Insulation	DTI	Minimum 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).

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PINOUT DIAGRAM AND TERMINAL LIST

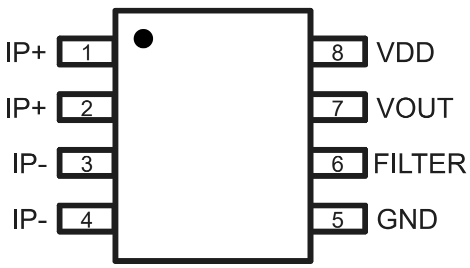

Figure 2: CT415 and CT416 Pinout Diagram for 8-Lead SOIC Package (Top-Down View)

Terminal List

Number	Name	Function
1, 2	IP+	Positive terminal for current being sensed
3, 4	IP–	Negative terminal for current being sensed
5	GND	Device ground terminal
6	FILTER	Filter pin to improve noise performance by connecting an external capacitor to set the cutoff frequency. Do not connect if the FILTER pin is not used.
7	VOUT	Analog output voltage
8	VDD	Device power supply terminal

FUNCTIONAL BLOCK DIAGRAM

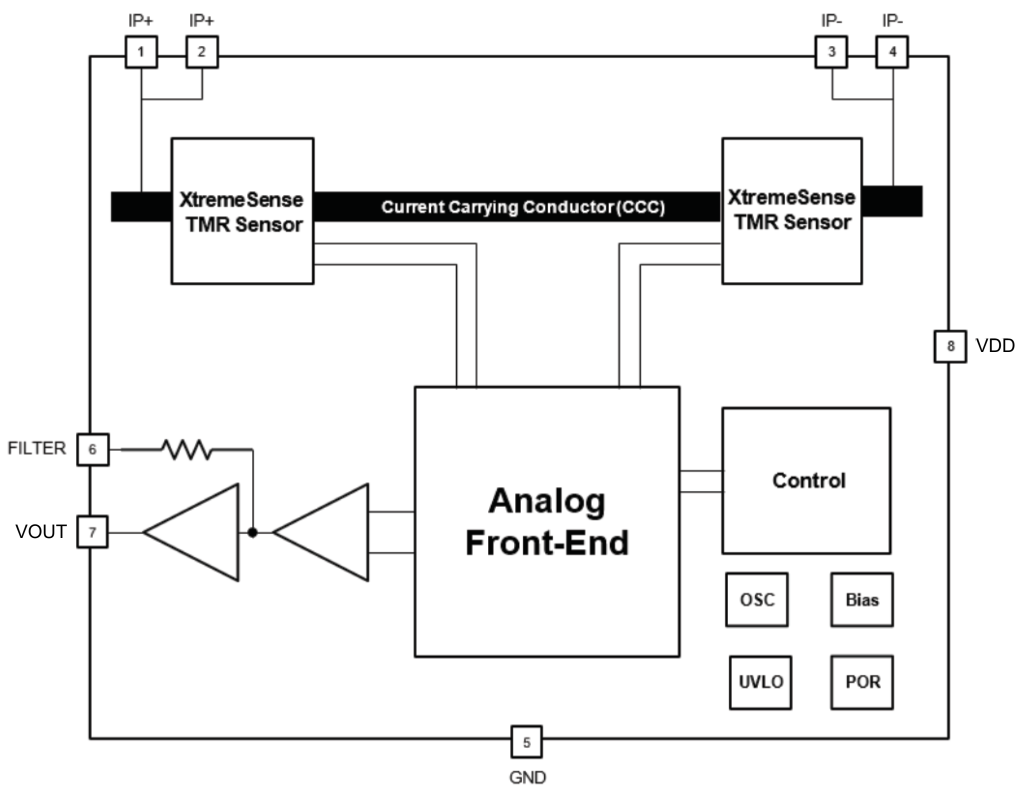

Figure 3: CT415 and CT416 Functional Block Diagram for Eight-Lead SOIC Package

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COMMON ELECTRICAL CHARACTERISTICS: Valid over full operating temperature range, $V_{DD} = V_{DD(Typ.)}$, C_{BYP} = 1.0 µF

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
POWER SUPPLIES						
Supply Current	I_{DD}	VOUT open, I_P = 0 A	–	6	9	mA
VOUT Maximum Drive Capability [1]	I_{OUT}	VOUT covers 10% to 90% of V_{DD} span	–1	–	1	mA
Supply Bypass Capacitor	C_{BYPASS}		1	–	–	µF
Output Resistive Load [1]	R_{L_VOUT}	Resistance between VOUT and GND	100	–	–	kΩ
Output Capacitive Load [1]	C_{L_VOUT}	Capacitance between VOUT and GND	–	–	100	pF
Sensitivity Power Supply Rejection Ratio [1]	$PSRR_S$		–	35	–	dB
Offset Power Supply Rejection Ratio [1]	$PSRR_O$		–	40	–	dB
OUTPUT SIGNAL CHARACTERISTICS (VOUT)						
Output Operating Range	V_{OOR}	5 V supply voltage (CT415)	0.5	–	4.5	V
		3.3 V supply voltage (CT416)	0.65	–	2.65	V
Bandwidth	BW	Small signal –3 dB	1	–	–	MHz
Common Mode Field Rejection [1]	CMFR		–	0.5	–	mA/G
Internal Filter Resistance [1]	R_{FILTER}		–	15	–	kΩ
TIMINGS						
Power-On Delay [1]	t_{PO}	$V_{DD} \geq 2.5$ V	–	100	200	µs
Rise Time [1]	t_R	$I_P = I_{RANGE(MAX)}$, T_A = 25°C, C_{L_VOUT} = 100 pF	–	200	–	ns
Response Time [1]	t_{RESP}	$I_P = I_{RANGE(MAX)}$, T_A = 25°C, C_{L_VOUT} = 100 pF	–	300	–	ns
Propagation Delay [1]	t_{PD}	$I_P = I_{RANGE(MAX)}$, T_A = 25°C, C_{L_VOUT} = 100 pF	–	250	–	ns
PROTECTION						
Undervoltage Lockout Voltage	V_{UVLO}	Rising V_{DD}	–	2.5	–	V
		Falling V_{DD}	–	2.45	–	V
UVLO Hysteresis	V_{UV_HYS}		–	50	–	mV

[1] Validated by design and characterization.

CT415-xSN820MR: ±20 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–20	–	20	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	2.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	100.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	9.9	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±39	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±47	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
[3] Validated by design and characterization.

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CT416-xSN820MR: ±20 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 3.0 to 3.6 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–20	–	20	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	1.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	50.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	11.8	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±23	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±28	–	mV

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CT415-xSN830MR: ±30 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–30	–	30	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	2.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	66.7	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	10.8	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±28	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±37	–	mV

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CT416-xSN830MR: ±30 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 3.0 to 3.6 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–30	–	30	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	1.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	33.3	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	13.7	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±19	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±22	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
[3] Validated by design and characterization.

CT415-xSN840MR: ±40 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–40	–	40	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	2.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	50.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	11.8	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±23	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±32	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
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CT415-xSN850MR: ±50 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–50	–	50	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	2.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	40.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	12.7	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±20	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±29	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
[3] Validated by design and characterization.

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CT416-xSN850MR: ±50 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 3.0 to 3.6 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–50	–	50	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	1.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	20.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	17.5	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±17	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±20	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
[3] Validated by design and characterization.

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CT415-xSN865MR: ±65 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–65	–	65	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	2.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	30.8	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	14.2	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±18	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±27	–	mV

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CT416-xSN865MR: ±65 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 3.0 to 3.6 V, C_{BYP} = 1.0 μF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	–65	–	65	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	1.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	15.4	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	20.3	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±17	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±20	–	mV

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CT415-xSN820DR: 0 to 20 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	20	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	200.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	8.9	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±12	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±73	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±79	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
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CT416-xSN820DR: 0 to 20 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 3.0 to 3.6 V, C_{BYP} = 1.0 μF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	20	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	100.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	9.9	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±39	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±44	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
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CT415-xSN830DR: 0 to 30 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	30	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	133.3	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	9.4	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±8	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±50	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±58	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
[3] Validated by design and characterization.

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CT416-xSN830DR: 0 to 30 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 3.0 to 3.6 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	30	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	66.7	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	10.8	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±28	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±33	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
[3] Validated by design and characterization.

ALLEGRO microsystems

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CT415-xSN850DR: 0 to 50 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 4.75 to 5.5 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	50	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	80.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	10.4	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±32	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±41	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
[3] Validated by design and characterization.

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CT416-xSN850DR: 0 to 50 A – PERFORMANCE CHARACTERISTICS: Valid for V_{DD} = 3.0 to 3.6 V, C_{BYP} = 1.0 µF, and T_A = –40°C to 125°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	50	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	40.0	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	12.7	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±20	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±24	–	mV

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Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	65	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.5	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	61.5	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	11.1	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±26	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.3	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±35	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
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Characteristics	Symbol	Test Conditions	Min.	Typ.[1]	Max.	Unit
Current Range	I_{PR}	Limited by $T_{J(MAX)}$ = 150°C	0	–	65	A
Quiescent Voltage Output	V_{QVO}	T_A = 25°C, I_P = 0 A	–	0.65	–	V
Sensitivity	Sens	$I_{PR(MIN)} < I_P < I_{PR(MAX)}$	–	30.8	–	mV/A
Noise [3]	N	T_A = 25°C, BW = 100 kHz, I_P = 0 A	–	14.2	–	mA_{RMS}
VOUT ACCURACY PERFORMANCE						
Linearity Error	E_{LIN}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±0.3	–	% FS
Sensitivity Error	E_{SENS}	$I_P = I_{PR(MAX)}$, T_A = 25°C	–	±1.0	–	%
		$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±2.9	–	%
Offset Voltage Error	V_{QVO_E}	I_P = 0 A, T_A = 25°C	–	±6	–	mV
		I_P = 0 A, T_A = –40°C to 125°C	–	±18	–	mV
LIFETIME DRIFT						
Sensitivity Error Including Lifetime Drift	E_{SENS_LT}	$I_P = I_{PR(MAX)}$, T_A = –40°C to 125°C	–	±3.7	–	%
Offset Voltage Error Including Lifetime Drift	V_{QVO_LT}	I_P = 0 A, T_A = –40°C to 125°C	–	±22	–	mV

[1] Typical values are the mean ±3 sigma of production distributions.
[2] Lifetime drift characteristics are based on a statistical combination of production distributions and worst-case distribution drift observed during AEC-Q100 qualification.
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CHARACTERISTIC PERFORMANCE

$V_{DD} = V_{DD(TYP)}$, T_A = 25°C, and C_{BYP} = 1 µF (unless otherwise specified)

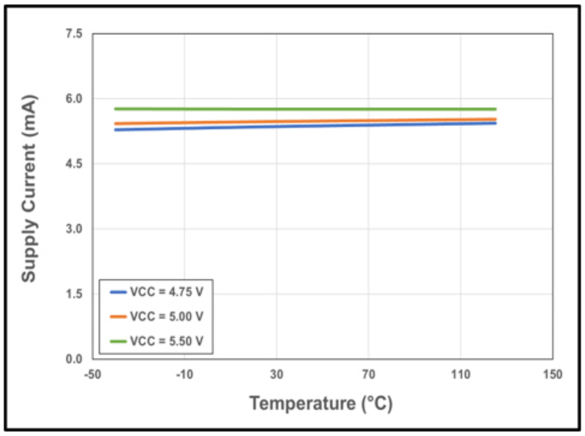

Figure 4: Supply Current vs. Temperature vs. Supply Voltage

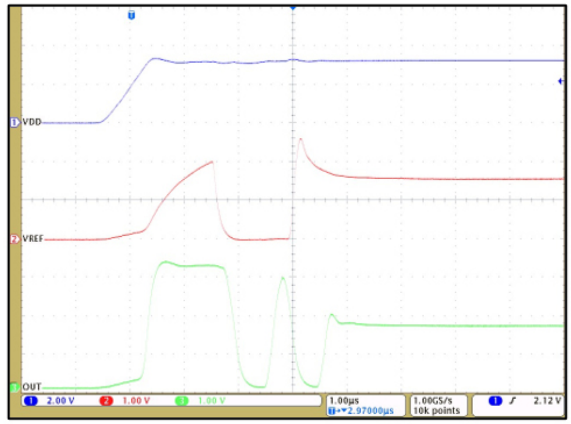

Figure 5: Startup Waveforms

COMMON CHARACTERISTIC PERFORMANCE

$V_{DD} = V_{DD(TYP)}$, T_A = 25°C, and C_{BYP} = 1 μF (unless otherwise specified)

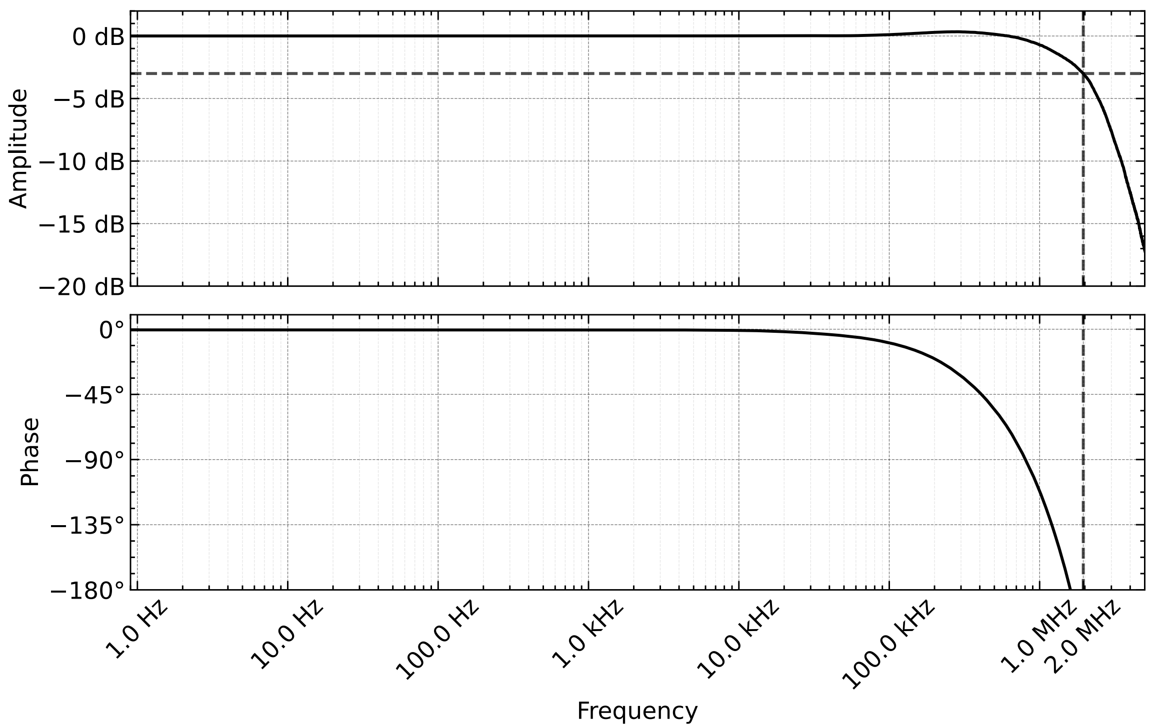

Figure 6: Frequency Response

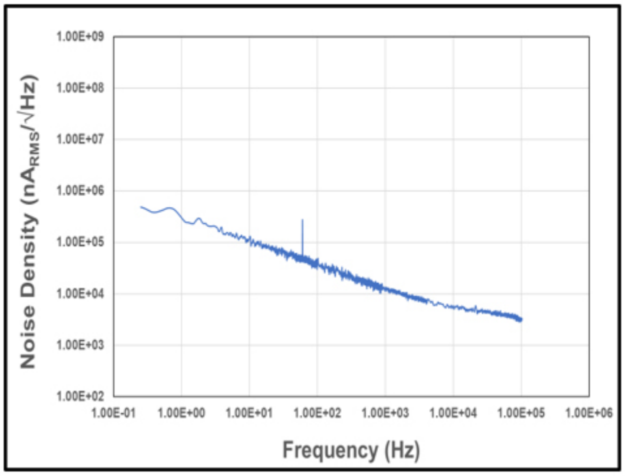

Figure 7: Noise Density vs. Frequency

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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.

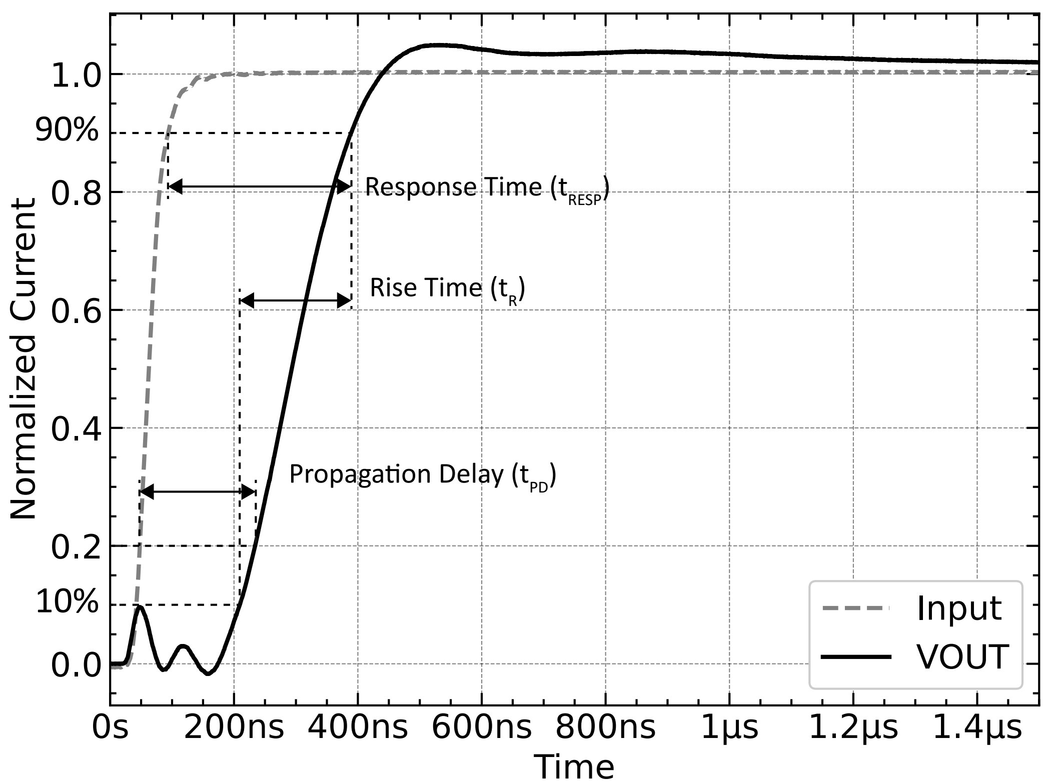

Figure 8: CT416 and CT415 Step Response Characteristics

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DEFINITIONS OF OPERATING AND PERFORMANCE CHARACTERISTICS

Overview

The CT415 and CT416 are high-accuracy contact current sensors with an integrated current-carrying conductor that handles up to 65 A. It has high sensitivity and a wide dynamic range with excellent accuracy across temperature.

When current flows through the current-carrying conductor, the XtremeSense TMR sensors inside the chip sense the field that, in turn, generates differential voltage signals that pass through the analog front end (AFE) to output a current measurement.

The chip is designed to enable a fast response time of 300 ns for the current measurement from the VOUT pin, as the bandwidth for the CT416 and CT415 is 1 MHz. Even with a high bandwidth, the chip consumes a minimal amount of power.

Quiescent Voltage Output (V_{QVO})

Quiescent voltage output, V_{QVO}, is defined as the voltage on the output, V_{OUT}, when current is not applied, $I_P = 0$.

$$V_{QVO} = V_{OUT\_@0A}\ [mV]$$

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 value in production testing.

$$V_{QVO\_E} = V_{QVO\_MEASURED} - V_{QVO\_IDEAL}\ [mV]$$

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:

$$Sens = \frac{V_{OUT\_IP1} - V_{OUT\_IP2}}{I_{P1} - I_{P2}}\ [mV/A]$$

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.

$$E_{SENS} = \frac{SENS_{MEASURED} - SENS_{IDEAL}}{SENS_{IDEAL}} \times 100\ [\%]$$

Error Including Lifetime Drift (E_{SENS_LT} and V_{QVO_LT})

Lifetime drift characteristics are based on the mean drift of the worst-case distribution observed during AEC-Q100 qualification stresses.

Sensitivity Power Supply Rejection Ratio ($PSRR_S$)

The Sensitivity Power Supply Rejection Ratio or $PSRR_S$ is defined as 20 × log of the ratio of the % change the sensitivity over the % change in V_{DD} (±100 mV variable AC V_{DD} centered at 5 V) reported as dB in a specified frequency range. The equation is shown below:

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

Offset Power Supply Rejection Ratio ($PSRR_O$)

The Offset Power Supply Rejection Ratio or $PSRR_O$ is defined as 20 × log of the ratio of the change of QVO in volts over a ±100 mV variable AC V_{DD} centered at 5 V reported as dB in a specified frequency range. The equation is shown below:

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

Power-On Delay (t_{PO})

Power-on delay (t_{PO}) of 100 µs is the amount of time required by the sensor to start up, fully power the chip, and become fully operational, from the moment the supply voltage is applied to it. This time includes the ramp-up time and the settling time (within 10% of steady-state voltage under an applied magnetic field) after the power supply has reached the minimum V_{DD}.

Undervoltage Lockout (UVLO)

The undervoltage lockout protection circuitry of the CT415 and CT416 is activated when the supply voltage (V_{DD}) reduces to less than 2.45 V. The sensor remains in a low-quiescent state until V_{DD} increases to greater than the UVLO threshold (2.5 V). In this condition, where V_{DD} is less than 2.45 V and UVLO is triggered, the output from the sensor is not valid. Once V_{DD} increases to greater than 2.5 V, the UVLO is cleared.

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Immunity to Common-Mode Fields

The CT415 and CT416 are housed in a custom plastic package that uses a U-shaped leadframe to reduce the common-mode fields generated as current flows through the current-carrying conductor. With the U-shaped leadframe, the stray fields cancel one another, thus reducing electromagnetic interference (EMI).

Also, a good printed circuit board (PCB) layout for the sensor can optimize performance and reduce EMI. For PCB layout recommendations, see the Recommended PCB Layout section.

Creepage and Clearance

Two important terms that are related to isolation provided by the package are creepage and clearance. Creepage is defined as the shortest distance across the surface of the package from one side of the leads to the other side of the leads. Clearance is defined as the shortest distance between the leads of the opposite side through the air.

Application

The CT415 and CT416 is an integrated contact current sensor that can be used in many applications from measuring current in power supplies, to motor control. It is a plug-and-play solution in that calibration is not required, and it outputs to a microcontroller a simple linear analog output voltage that corresponds to a current measurement value.

Bypass Capacitor

A single 1 µF capacitor is needed for the VDD pin to reduce the noise from the power supply and other circuits. This capacitor should be placed as close as practical to the sensor to minimize inductance and resistance between the two devices.

Filter Function (FILTER)

The CT415 and CT416 have a pin for the FILTER function which will enable it to improve the noise performance by changing the cutoff frequency. The bandwidth is 1.0 MHz; however, adding a capacitor to the FILTER pin—which will be in-series with an internal resistance of approximately 15 kΩ—will set the cutoff frequency to reduce noise.

Experimentally measured Bandwidth does not necessarily match the calculated bandwidth value obtained by using the equation

$$f_{BW} = \frac{1}{2\pi RC}$$

because of the parasitic capacitances due to PCB manufacturing and layout. This is further impacted by the small, picofarad level C_{FILTER} recommendations.

Recommended PCB Layout

Because the sensor can measure up to 65 A of current, special care must be taken in the printed circuit board (PCB) layout of the sensor and the surrounding circuitry. It is recommended that the CCC pins be connected to as much copper area as practical. It is also recommended that 2 oz. or heavier copper be used for PCB traces. Additional layers of the PCB should also be used to carry current, and these should be connected using the arrangement of vias. The recommended PCB layout is shown in Figure 9 and Figure 10.

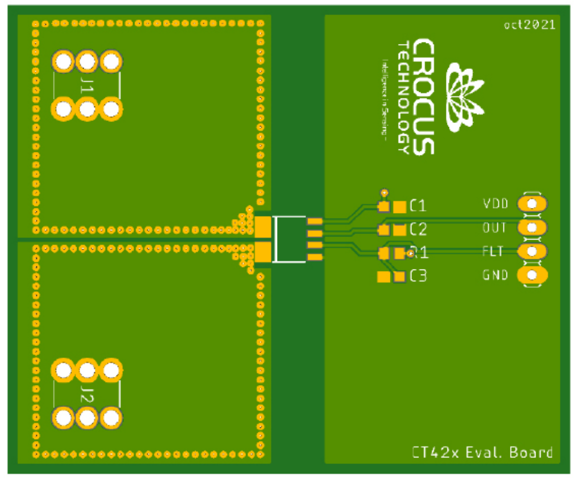

Figure 9: Recommended PCB Layout (Top Layer)

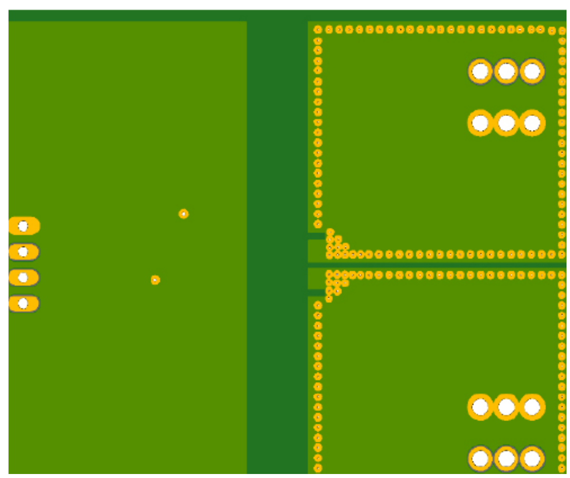

Figure 10: Recommended PCB Layout (Bottom Layer)

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 generate heat as current moves through the system.

The thermal response is highly dependent on PCB layout, copper thickness, cooling techniques, and 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 values can be used to approximate thermal response for both AC signals and current pulses.

The measured rise in steady-state die temperature of the current sensor versus continuous current at an ambient temperature, T_A, of 25 °C is shown in Figure 11. The thermal offset curves can be directly applied to other values of T_A.

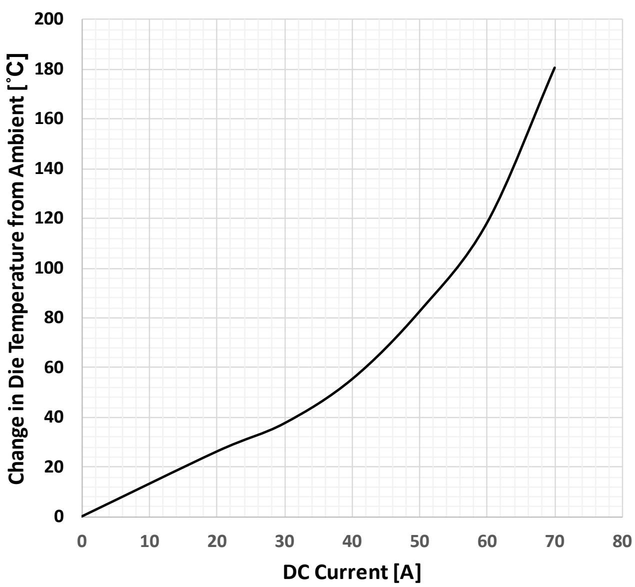

Figure 11: Self-Heating in the SOIC-8 Package Due to Current Flow

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PACKAGE OUTLINE DRAWING

For Reference Only – Not for Tooling Use

Dimensions in millimeters – NOT TO SCALE

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

Exact case and lead configuration at supplier discretion within limits shown

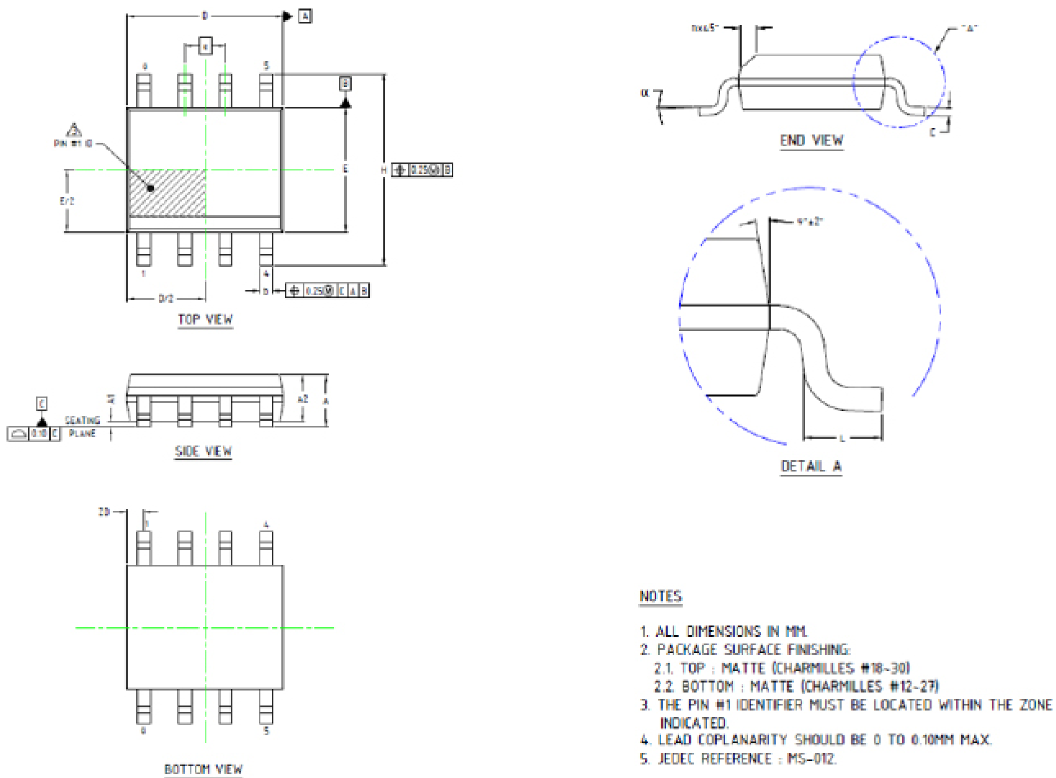

Figure 12: SOIC-8 Package Drawing and Dimensions

Table 1: CT415 SOIC-8 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	**Typ.**	**Max.**
A1	0.10	0.18	0.25
b	0.36	0.41	0.46
C	0.19	0.22	0.25
D	4.80	4.89	4.98
E	3.81	3.90	3.99
e		1.27 BSC	
H	5.80	6.00	6.20
h	0.25	0.37	0.50
L	0.41	–	1.27
A	1.52	1.62	1.72
α	0°	–	8°
ZD		0.53 REF	
A2	1.37	1.47	1.57

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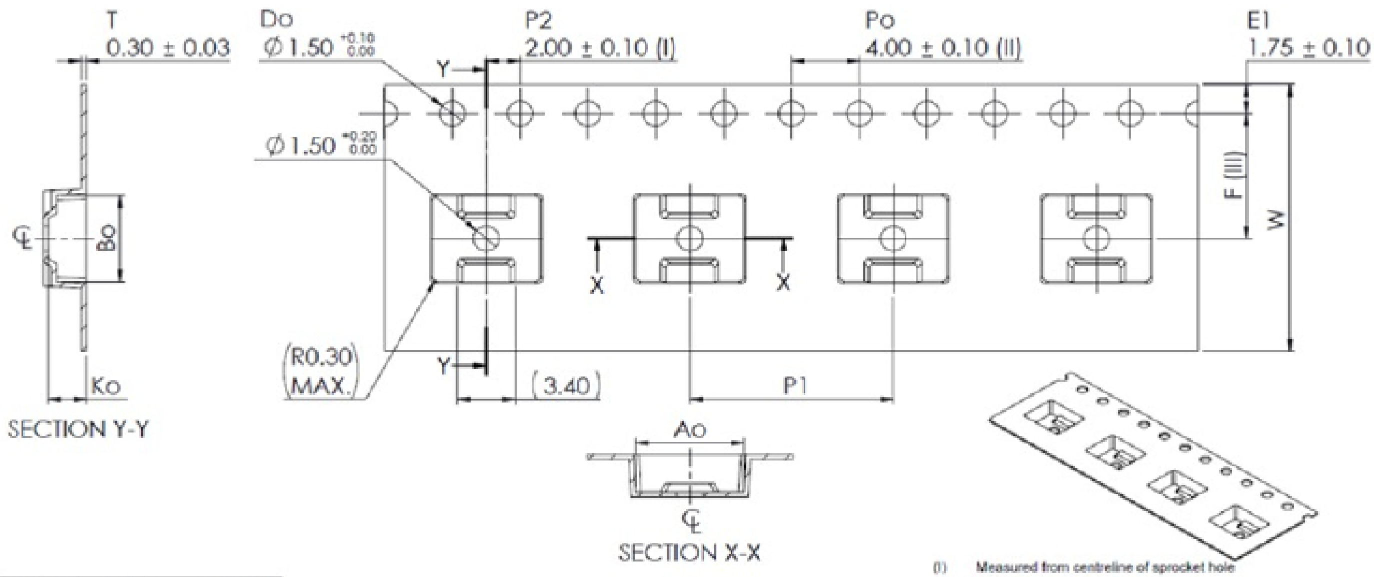
TAPE AND REEL POCKET DRAWING AND DIMENSIONS

For Reference Only – Not for Tooling Use

Dimensions in millimeters – NOT TO SCALE

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

Exact case and lead configuration at supplier discretion within limits shown



Ao	6.35	+/- 0.10
Bo	5.13	+/- 0.10
Ko	2.25	+/- 0.15
K1	1.75	+/- 0.10
F	7.50	+/- 0.10
P1	12.00	+/- 0.10
W	16.00	+0.30 / -0.10

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.
(V) Dimension with ( ) is used for design reference purposes, No measurement required.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Figure 13: Tape and Pocket Drawing for SOIC-8 Package

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DEVICE MARKING

Figure 15: CT415 Device Marking for 8-lead Package

Table 2: CT415 Device Marking Definition for 8-Lead SOIC Package

Row No.	Code	Definition
3	•	Pin 1 Indicator
1	CT415	Allegro Part Number
1	A	AEC-Q100 Qualified
2	P	Package Type
2	N	Number of Pins
2	XX	Current Range
2	ZR	Polarity
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

Figure 14: CT416 Device Marking for 8-Lead Package

Table 3: CT416 Device Marking Definition for 8-lead SOIC Package

Row No.	Code	Definition
3	•	Pin 1 Indicator
1	CT416	Allegro Part Number
1	A	AEC-Q100 Qualified
2	P	Package Type
2	N	Number of Pins
2	XX	Current Range
2	ZR	Polarity
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

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Revision History

Number	Date	Description
7	July 16, 2026	Comprehensive overhaul of the whole document. Removal of Total Output Error definition and specification.

For the latest version of this document, visit our website:

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