CT455

High dV/dt Optimized XtremeSense™ TMR Coreless Current Sensor with 1 MHz Bandwidth and Programmable Gain

FEATURES AND BENEFITS

- User-programmable field range:
  - □ 6 to 8 mT
  - □ 12 to 48 mT
- Preset magnetic field ranges:
  - □ 0 to 6 mT
  - □ ±6 mT
  - □ 0 to 12 mT
  - □ ±12 mT
  - □ 0 to 24 mT
  - □ ±24 mT
  - □ ±48 mT
- Optimized for high dV/dt applications
- Linear analog output voltage
- 1 MHz bandwidth
- Response time: <300 ns
- Supply voltage: 3.5 to 5.0 V
- Low noise performance
- Package options:
  - □ 8-lead SOIC
  - □ 8-lead TSSOP

APPLICATIONS

- Solar/power inverters
- Battery management systems
- Industrial equipment
- Power utility meters
- Power conditioner
- DC/DC converters

DESCRIPTION

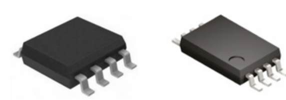
The CT455 is a high-bandwidth and low-noise integrated contactless current sensor that uses Allegro patented XtremeSense TMR technology to enable high-accuracy current measurements for many consumer, enterprise, and industrial applications. The device supports two standard field ranges where the CT455 senses and translates the magnetic field into a linear analog output voltage. It achieves a total error output of less than ±1.0% over supply voltage and temperature after calibration.

The CT455 is also available in a user-programmable variant, which enables end-of-line calibration of gain and offset. While the sensor is preprogrammed to compensate for gain and offset temperature drift, the ability to adjust offset and gain relaxes mechanical tolerances during sensor mounting.

The device has less than 300 ns output response time while the current consumption is ~6.0 mA.

The CT455 is assembled in an 8-lead SOIC package and a low-profile, industry-standard 8-lead TSSOP package that are both green and RoHS compliant.

PACKAGES:



8-lead SOIC 8-lead TSSOP

Not to scale

FUNCTIONAL BLOCK DIAGRAMS

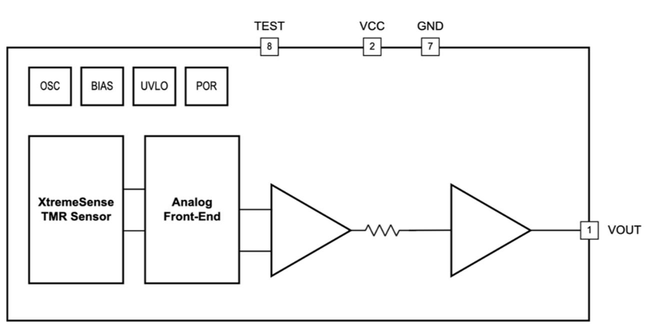


Figure 1: CT455 Functional Block Diagram for TSSOP-8

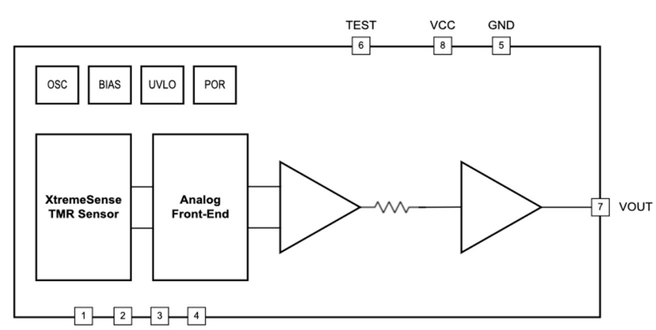


Figure 2: CT455 Functional Block Diagram for SOIC-8

Table of Contents

SELECTION GUIDE

Part Number	Polarity	Range (mT)	Supply Voltage (V)	Operating Temperature Range (°C)	Package	Packing
FACTORY-CALIBRATED SENSORS						
CT455-H06B3-TS08	Bipolar	±6	3.3	–40 to 125	8-lead TSSOP 3.00 mm × 6.40 mm × 1.10 mm	Tape and Reel
CT455-H06U3-TS08	Unipolar	0 to 6				
CT455-H06B5-TS08	Bipolar	±6	5.0			
CT455-H06U5-TS08	Unipolar	0 to 6				
CT455-H12B3-TS08	Bipolar	±12	3.3			
CT455-H12U3-TS08	Unipolar	0 to 12				
CT455-H12B5-TS08	Bipolar	±12	5.0			
CT455-H12U5-TS08	Unipolar	0 to 12				
CT455-H24B3-TS08	Bipolar	±24	3.3			
CT455-H24U3-TS08	Unipolar	0 to 24				
CT455-H24B5-TS08	Bipolar	±24	5.0			
CT455-H24U5-TS08	Unipolar	0 to 24				
CT455-H48B5-TS08	Bipolar	±48				
CT455-H48B5-SN08	Bipolar	±48	5.0	–40 to 125	8-lead SOIC 4.89 mm × 6.00 mm × 1.62 mm	Tape and Reel
PROGRAMMABLE SENSORS						
CT455-H00B3-TS08	Bipolar	±6 to ±8 and ±12 to ±48	3.3	–40 to 125	8-lead TSSOP 3.00 mm × 6.40 mm × 1.10 mm	Tape and Reel
CT455-H00U3-TS08	Unipolar					
CT455-H00B5-TS08	Bipolar	±6 to ±8 and ±12 to ±48	5.0			
CT455-H00U5-TS08	Unipolar					
CT455-H00B5-SN08	Bipolar	±6 to ±8 and ±12 to ±48	5.0	–40 to 125	8-lead SOIC 4.89 mm × 6.00 mm × 1.62 mm	Tape and Reel

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EVALUATION BOARD SELECTION GUIDE

Part Number	Magnetic Field Range (mT)	Supply Voltage (V)	Current Carrying Conductor	Operating Temperature Range (°C)
CTD455-BB-06B3	±6	3.3	Busbar	–40 to 125
CTD455-BB-06B5	±6	5.0		
CTD455-PT-06B3	±6	3.3	PCB Trace	
CTD455-PT-06B5	±6	5.0		

ABSOLUTE MAXIMUM RATINGS [1]

Characteristic	Symbol	Notes	Rating	Unit
Supply Voltage Strength	V_{CC}		–0.3 to 6.0	V
Analog Input/Output Pins Maximum Voltage	$V_{I/O}$		–0.3 to V_{CC} + 0.3 [2]	V
Electrostatic Discharge Protection Level	ESD	Human Body Model (HBM) per JESD22-A114	±2.0 (min)	kV
		Charged Device Model (CDM) per JESD22-C101	±0.5 (min)	kV
Junction Temperature	T_J		–40 to 150	°C
Storage Temperature	T_{STG}		–65 to 155	°C
Lead Soldering Temperature	T_L	10 seconds	260	°C

[1] Stresses exceeding the absolute maximum ratings may damage the CT455 and may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.
[2] The lower of V_{CC} + 0.3 V or 6.0 V.

RECOMMENDED OPERATING CONDITIONS [1]

Characteristic	Symbol	Notes	Min.	Typ.	Max.	Unit
Supply Voltage Range	V_{CC}	5.0 V_{CC} variant (-x5)	4.75	5.00	5.50	V
		3.3 V_{CC} variant (-x3)	3.0	3.3	3.6	V
Output Voltage Range	V_{OUT}		0	–	V_{CC}	V
Output Current	I_{OUT}		–	–	±1.0	mA
Operating Ambient Temperature	T_A	Extended Industrial	–40	25	125	°C

[1] The Recommended Operating Conditions table defines the conditions for actual operation of the CT455. Recommended operating conditions are specified to ensure optimal performance to the specifications. Allegro does not recommend exceeding them or designing to absolute maximum ratings.

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APPLICATION DIAGRAMS

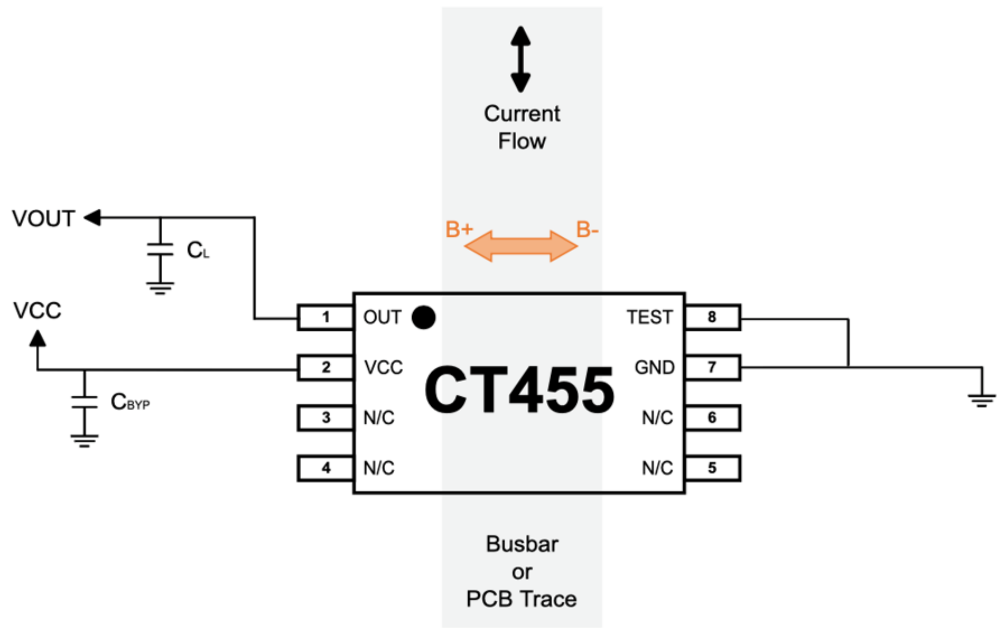

Figure 3: CT455 Application Diagram for Measuring Uniform Magnetic Field

Table 1: Recommended External Components

Component	Description	Vendor and Part Number	Min.	Typ.	Max.	Unit
C_{BYP}	1.0 µF, X5R or better	Murata GRM155C81A105KA12	–	1.0	–	µF

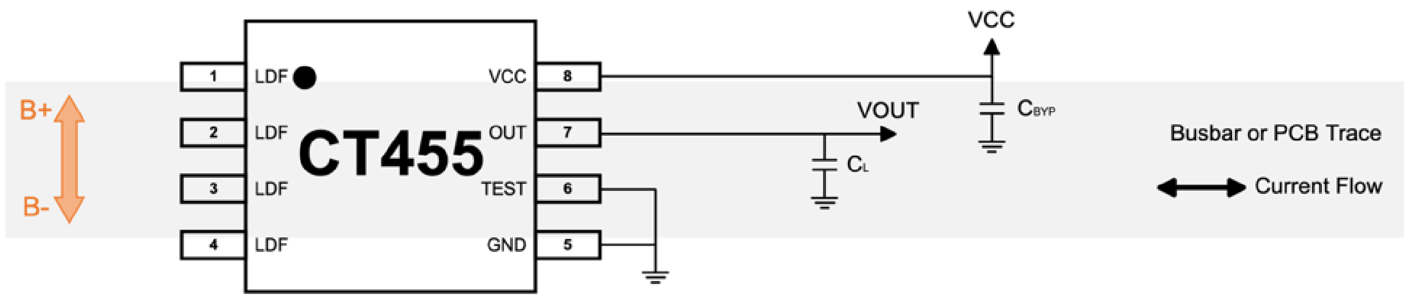

Figure 4: CT455 Application Diagram for SOIC-8

Table 2: Recommended External Components

Component	Description	Vendor and Part Number	Min.	Typ.	Max.	Unit
C_{BYP}	1.0 µF, X5R or better	Murata GRM155C81A105KA12	–	1.0	–	µF

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PINOUT DIAGRAMS AND TERMINAL LISTS

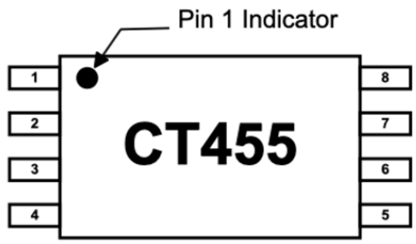

Figure 5: CT455 Pinout Diagram for 8-lead TSSOP Package (Top-Down View)

Terminal List

Number	Name	Function
1	OUT	Analog output voltage that represents the measured current/field.
2	VCC	Supply voltage.
3, 4, 5, 6	NC	No connect (do not use).
7	GND	Ground.
8	TEST	Pin used for factory calibration. Connect to Ground.

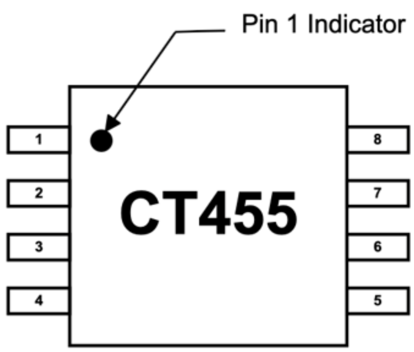

Figure 6: CT455 Pinout Diagram for 8-lead SOIC Package (Top-Down View)

Terminal List

Number	Name	Function
1, 2, 3, 4	LDF	Lead frame Pin – A single (1) LDF pin should be connected to GND. The other three (3) LDF pins should be left unconnected to avoid ground loops through the lead frame.
5	GND	Ground.
6	TEST	Pin used for factory calibration. Connect to Ground.
7	OUT	Analog output voltage that represents the measured current/field.
8	VCC	Supply voltage.

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ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
POWER SUPPLIES						
Supply Current	I_{CC}	f_{BW} = 1 MHz, no load, B_{OP} = 0 mT	–	6.0	9.0	mA
OUT Maximum Drive Capability	I_{OUT}	OUT covers 10% to 90% of V_{CC} span	–1.0	–	+1.0	mA
OUT Capacitive Load	C_{L_OUT}		–	–	100	pF
OUT Resistive Load	R_{L_OUT}		–	100	–	kΩ
Power Supply Rejection Ratio [1]	PSRR		–	35	–	dB
Sensitivity Power Supply Rejection Ratio [1]	SPSRR		–	35	–	dB
Offset Power Supply Rejection Ratio [1]	OPSRR		–	40	–	dB
Bandwidth [1]	f_{BW}	Small Signal = –3 dB	–	1.0	–	MHz
ANALOG OUTPUT (OUT)						
OUT Voltage Linear Range	V_{OUT}	5.0 V_{CC} variant (-x5)	0.50	–	4.50	V
		3.3 V_{CC} variant (-x3)	0.65	–	2.65	V
Output High Saturation Voltage	V_{OUT_SAT}	T_A = 25°C	V_{CC} – 0.30	V_{CC} – 0.25	–	V
Voltage Output Quiescent	V_{OQ}	T_A = 25°C, B_{OP} = 0 mT; 5.0 V_{CC}, bipolar (-xB5)	2.490	2.500	2.510	V
		T_A = 25°C, B_{OP} = 0 mT; 5.0 V_{CC}, unipolar (-xU5)	0.495	0.500	0.505	V
		T_A = 25°C, B_{OP} = 0 mT; 3.3 V_{CC}, bipolar (-xB3)	1.645	1.650	1.655	V
		T_A = 25°C, B_{OP} = 0 mT; 3.3 V_{CC}, unipolar (-xU3)	0.645	0.650	0.655	V
TIMINGS						
Power-On Time	t_{ON}	V_{CC} ≥ 4.0 V variant (-x5), V_{CC} ≥ 2.5 V variant (-x3)	–	100	200	µs
Rise Time [1]	t_{RISE}	$B_{OP} = B_{RNG(MAX)}$, T_A = 25°C, C_L = 100 pF	–	200	–	ns
Response Time [1]	$t_{RESPONSE}$	$B_{OP} = B_{RNG(MAX)}$, T_A = 25°C, C_L = 100 pF	–	300	–	ns
Propagation Delay [1]	t_{DELAY}	$B_{OP} = B_{RNG(MAX)}$, T_A = 25°C, C_L = 100 pF	–	250	–	ns
PROTECTION						
Undervoltage Lockout	V_{UVLO}	Rising V_{CC}	–	2.50	–	V
		Falling V_{CC}	–	2.45	–	V
UVLO Hysteresis	V_{UV_HYS}		–	50	–	mV
LIFETIME DRIFT						
Total Output Error Lifetime Drift [1]	E_{TOT_DRIFT}		–	±0.35	1%	% FS

[1] Guaranteed by design and characterization; not tested in production.

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ELECTRICAL CHARACTERISTICS

V_{CC} = 3.3 or 5.0 V, T_A = 25°C, and C_{BYP} = 1.0 µF (unless otherwise specified)

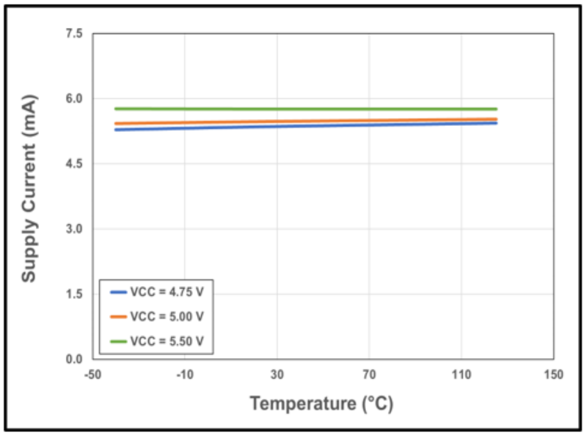

Figure 7: 5.0 V_{CC} variant (-x5) Supply Current vs. Temperature vs. Supply Voltage

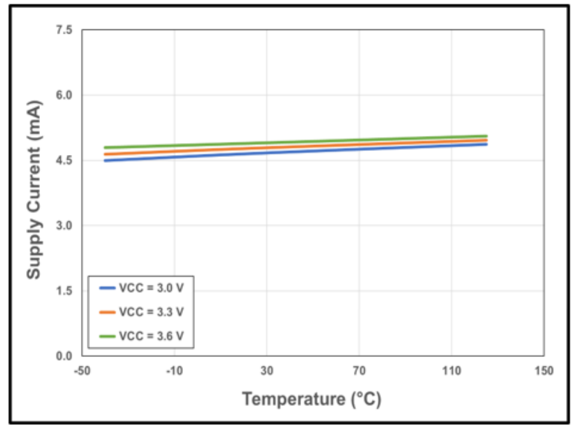

Figure 8: 3.3 V_{CC} variant (-x3) Supply Current vs. Temperature vs. Supply Voltage

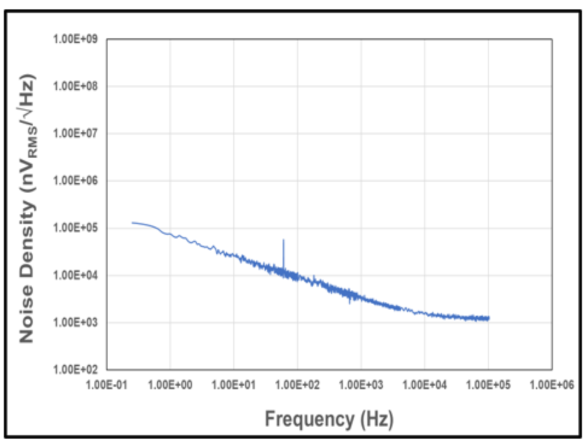

Figure 9: Noise Density vs. Frequency

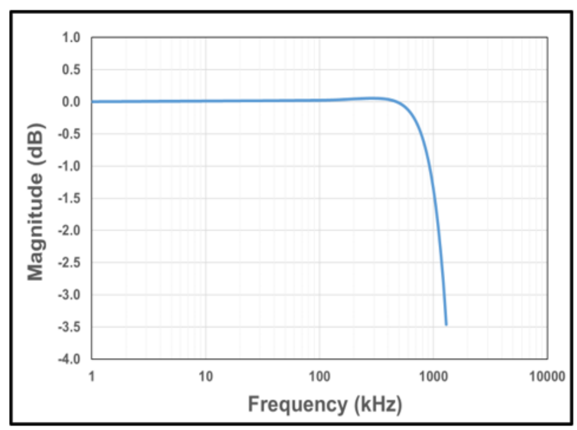

Figure 10: CT455 Bandwidth

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CT455-x06Ux: 0 to 6 mT – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Magnetic Field Range	B_{RNG}		0	–	6	mT
Sensitivity	S	5.0 V_{CC} variant (-x5)	–	666.7	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	333.3	–	mV/mT
Noise [1]	e_N	T_A = 25°C, f_{BW} = 100 kHz	–	2.45	–	$µT_{RMS}$
OUT ACCURACY PERFORMANCE						
Non-Linearity Error	E_{LIN}		–	±0.2	–	% FS
Sensitivity Error	E_{SENS}		–	±0.3	–	% FS
Offset Voltage	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

CT455-x06Bx: ±6 mT – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Magnetic Field Range	B_{RNG}		–6	–	6	mT
Sensitivity	S	5.0 V_{CC} variant (-x5)	–	333.3	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	166.7	–	mV/mT
Noise [1]	e_N	T_A = 25°C, f_{BW} = 100 kHz	–	2.77	–	$µT_{RMS}$
OUT ACCURACY PERFORMANCE						
Non-Linearity Error	E_{LIN}		–	±0.1	–	% FS
Sensitivity Error	E_{SENS}		–	±0.3	–	% FS
Offset Voltage	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

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CT455-x12Ux: 0 to 12 mT – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Magnetic Field Range	B_{RNG}		0	–	12	mT
Sensitivity	S	5.0 V_{CC} variant (-x5)	–	333.3	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	166.7	–	mV/mT
Noise [1]	e_N	T_A = 25°C, f_{BW} = 100 kHz	–	3.90	–	μT_{RMS}
OUT ACCURACY PERFORMANCE						
Non-Linearity Error	E_{LIN}		–	±0.2	–	% FS
Sensitivity Error	E_{SENS}		–	±0.3	–	% FS
Offset Voltage	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

CT455-x12Bx: ±12 mT – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Magnetic Field Range	B_{RNG}		–12	–	12	mT
Sensitivity	S	5.0 V_{CC} variant (-x5)	–	166.7	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	83.3	–	mV/mT
Noise [1]	e_N	T_A = 25°C, f_{BW} = 100 kHz	–	4.50	–	μT_{RMS}
OUT ACCURACY PERFORMANCE						
Non-Linearity Error	E_{LIN}		–	±0.1	–	% FS
Sensitivity Error	E_{SENS}		–	±0.3	–	% FS
Offset Voltage	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

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CT455-x24Ux: 0 to 24 mT – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Magnetic Field Range	B_{RNG}		0	–	24	mT
Sensitivity	S	5.0 V_{CC} variant (-x5)	–	166.7	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	83.3	–	mV/mT
Noise [1]	e_N	T_A = 25°C, f_{BW} = 100 kHz	–	2.77	–	$µT_{RMS}$
OUT ACCURACY PERFORMANCE						
Non-Linearity Error [1]	E_{LIN}		–	±0.3	–	% FS
Sensitivity Error [1]	E_{SENS}		–	±0.3	–	% FS
Offset Voltage [1]	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

CT455-x24Bx: ±24 mT – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Magnetic Field Range	B_{RNG}		–24	–	24	mT
Sensitivity	S	5.0 V_{CC} variant (-x5)	–	83.3	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	41.6	–	mV/mT
Noise [1]	e_N	T_A = 25°C, f_{BW} = 100 kHz	–	4.56	–	$µT_{RMS}$
OUT ACCURACY PERFORMANCE						
Non-Linearity Error [1]	E_{LIN}		–	±0.1	–	% FS
Sensitivity Error [1]	E_{SENS}		–	±0.3	–	% FS
Offset Voltage [1]	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

CT455-x48B5: ±48 mT – ELECTRICAL CHARACTERISTICS: V_{CC} = 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Magnetic Field Range	B_{RNG}		–48	–	48	mT
Sensitivity	S	5.0 V_{CC} variant (-x5)	–	41.5	–	mV/mT
OUT ACCURACY PERFORMANCE						
Non-Linearity Error [1]	E_{LIN}		–	±0.1	–	% FS
Sensitivity Error [1]	E_{SENS}		–	±0.3	–	% FS
Offset Voltage [1]	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

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CT455-x00Ux: Programmable Gain – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Programmable Magnetic Field Range	B_{PRNG}		6	–	8	mT
			12	–	48	mT
Maximum Programmable Sensitivity	S_{PMAX}	5.0 V_{CC} variant (-x5)	–	666.7	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	333.3	–	mV/mT
Minimum Programmable Sensitivity	S_{PMIN}	5.0 V_{CC} variant (-x5)	–	166.7	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	83.4	–	mV/mT
OUT ACCURACY PERFORMANCE						
Non-Linearity Error	E_{LIN}		–	±0.3	–	% FS
Sensitivity Error	E_{SENS}		–	±0.3	–	% FS
Offset Voltage	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

CT455-x00Bx: Programmable Gain – ELECTRICAL CHARACTERISTICS: V_{CC} = 3.0 to 3.6 V or 4.75 to 5.50 V, T_A = –40°C to 125°C, C_{BYP} = 1.0 µF, unless otherwise specified; typical values are V_{CC} = 3.3 or 5.00 V and T_A = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Programmable Magnetic Field Range	B_{PRNG}		±6	–	±8	mT
			±12	–	±48	mT
Maximum Programmable Sensitivity	S_{PMAX}	5.0 V_{CC} variant (-x5)	–	333.3	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	166.7	–	mV/mT
Minimum Programmable Sensitivity	S_{PMIN}	5.0 V_{CC} variant (-x5)	–	83.4	–	mV/mT
		3.3 V_{CC} variant (-x3)	–	41.7	–	mV/mT
OUT ACCURACY PERFORMANCE						
Non-Linearity Error	E_{LIN}		–	±0.2	–	% FS
Sensitivity Error	E_{SENS}		–	±0.3	–	% FS
Offset Voltage	V_{OFFSET}	B_{OP} = 0 mT	–	±0.3	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

Calibration Description

The CT455-x00MR is factory-trimmed for sensitivity and offset temperature drift. The sensor provides the ability to adjust gain to allow for all the mechanical tolerances during manufacturing. Gain calibration is recommended to be performed at room temperature (25°C) using the Allegro CTC4000 Calibration Box.

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ELECTRICAL CHARACTERISTICS

V_{CC} = 5.0 V and C_{BYP} = 1.0 µF

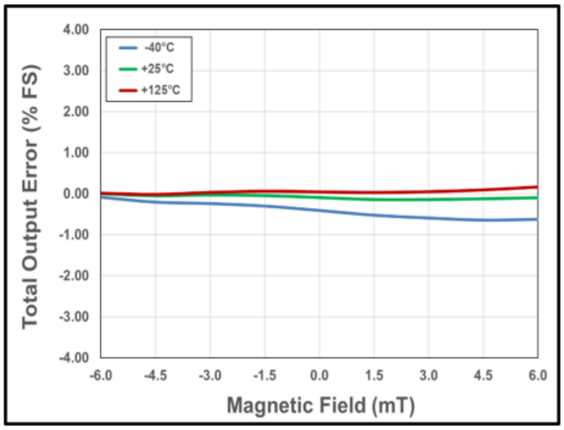

Figure 11: CT455-x06B5x Total Output Error vs. B Field

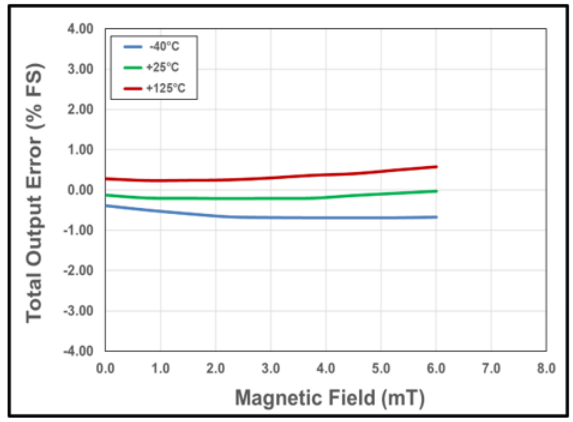

Figure 12: CT455-x06U5x Total Output Error vs. B Field

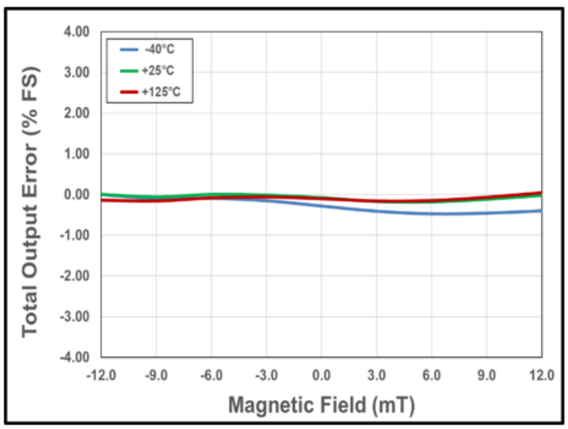

Figure 13: CT455-x12B5x Total Output Error vs. B Field

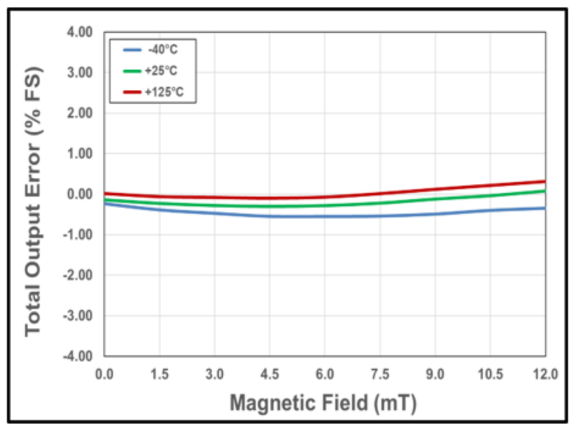

Figure 14: CT455-x12U5x Total Output Error vs. B Field

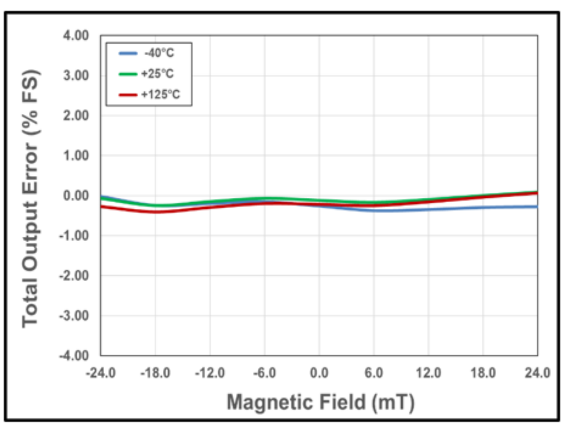

Figure 15: CT455-x24B5x Total Output Error vs. B Field

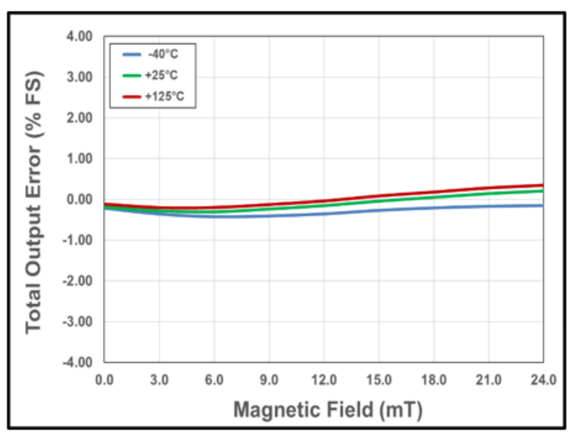

Figure 16: CT455-x24U5x Total Output Error vs. B Field

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FUNCTIONAL DESCRIPTION

Overview

The CT455 is a very high accuracy coreless and contactless current sensor that can sense magnetic fields from 6 to 48 mT. The device has high sensitivity and a wide dynamic range with excellent accuracy (low total output error) across temperature.

The CT455 is also available in a user-programmable variant which enables end-of-line calibration of gain. While the sensor is pre-programmed to adjust sensitivity and offset temperature drift, the ability to adjust gain relaxes mechanical tolerances during sensor mounting.

When current is flowing through a busbar above or below the CT455, the XtremeSense TMR sensor inside the chip senses the field which in turn generates a differential voltage signals that then goes through the Analog Front-End (AFE) to output a current measurement as low as ±1.0% full-scale total output error (E_{OUT}).

The chip is designed to enable a fast response time of 300 ns for the current measurement from the OUT pin as the bandwidth for the CT455 is 1.0 MHz. Even with a high bandwidth, the chip consumes a minimal amount of power.

Linear Output Current Measurement

The CT455 provides a continuous linear analog output voltage which represents the magnetic field generated by the current flowing through the busbar. The output voltage range of OUT is from 0.50 to 4.50 V with a V_{OQ} of 0.50 and 2.50 V for unidirectional and bidirectional fields, respectively. Figure 17 illustrates the output voltage range of the OUT pin as a function of the measured field.

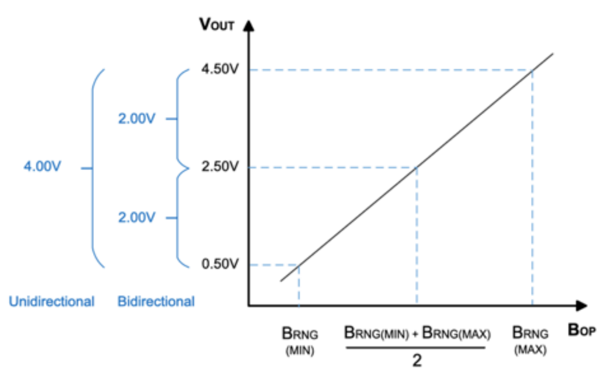

Figure 17: Linear Output Voltage Range (OUT) vs. Measured Magnetic Field (B_{OP})

Power-On Time (t_{ON})

Power-On Time (t_{ON}) of 100 µs is the amount of time required by CT455 to start up, fully power the chip, and becoming fully operational from the moment the supply voltage is greater than the UVLO voltage. 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_{CC}.

Response Time ($t_{RESPONSE}$)

Response Time ($t_{RESPONSE}$) of 300 ns for the CT455 is the time interval between the following terms:

1. When the primary current signal reaches 90% of its final value,
2. When the chip reaches 90% of its output corresponding to the applied current.

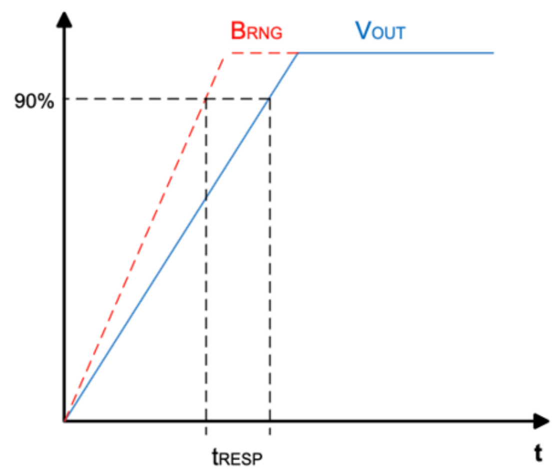

Figure 18: CT455 Response Time Curve

Rise Time (t_{RISE})

Rise Time (t_{RISE}) is the time interval of when it reaches 10% and 90% of the full-scale output voltage. The t_{RISE} of the CT455 is 200 ns.

Propagation Delay (t_{DELAY})

Propagation Delay (t_{DELAY}) is the time difference between these two events:

1. When the primary current reaches 20% of its final value
2. When the chip reaches 20% of its output corresponding to the applied current.

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The CT455 has a propagation delay of 250 ns.

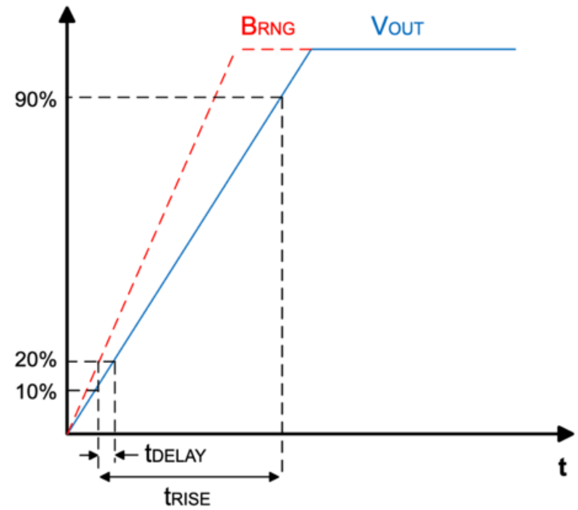

Figure 19: CT455 Propagation Delay and Rise Time Curve

Undervoltage Lockout (UVLO)

The Undervoltage Lockout protection circuitry of the CT455 is activated when the supply voltage (V_{CC}) falls below 2.45 V. The CT455 remains in a low quiescent state until V_{CC} rises above the UVLO threshold (2.50 V). In the condition where the V_{CC} is less than 2.45 V and UVLO is triggered, the output from the CT455 is not valid. Once V_{CC} rises above 2.5 V, then the UVLO is cleared.

Current Sensing

The CT455 can sense and therefore measure the current by either placing a current-carrying busbar above or under the device. The chip is also sensitive enough to measure the current from a PCB trace that is routed beneath it.

Bypass Capacitor

A single 1.0 µF capacitor is needed for the VCC pin to reduce the noise from the power supply and other circuits. This capacitor should be placed as close as possible to the CT455 to minimize inductance and resistance between the two devices.

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XtremeSense TMR Current Sensor Location

The XtremeSense TMR current sensor location of the CT455 is shown below. All dimensions in the figures are nominal.

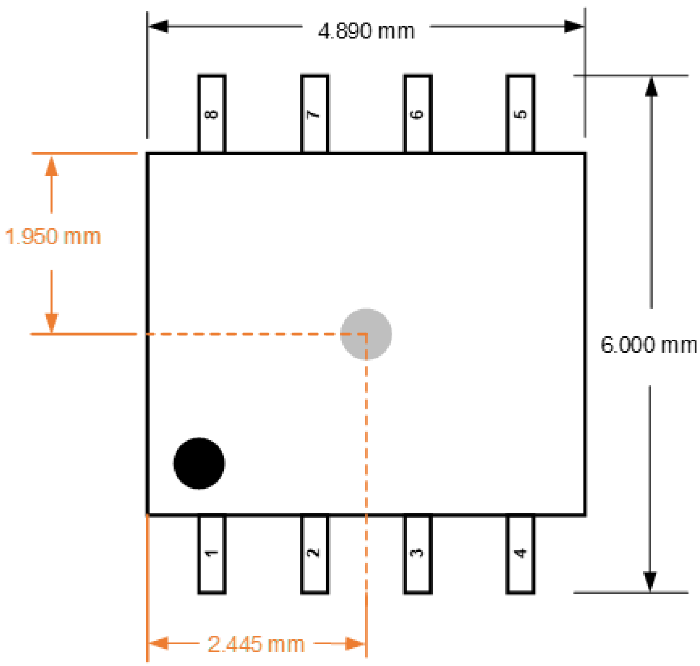

Figure 20: XtremeSense TMR Current Sensor Location in x-y Plane for CT455 in SOIC-8 Package

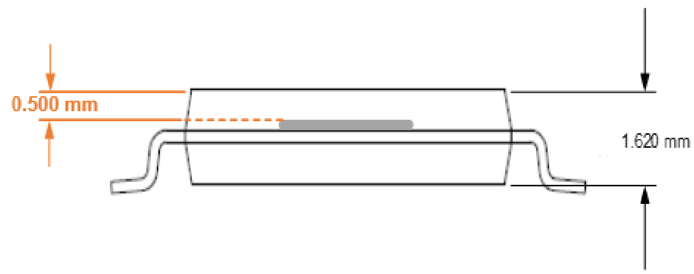

Figure 21: XtremeSense TMR Current Sensor Location in z Dimension for CT455 in SOIC-8 Package

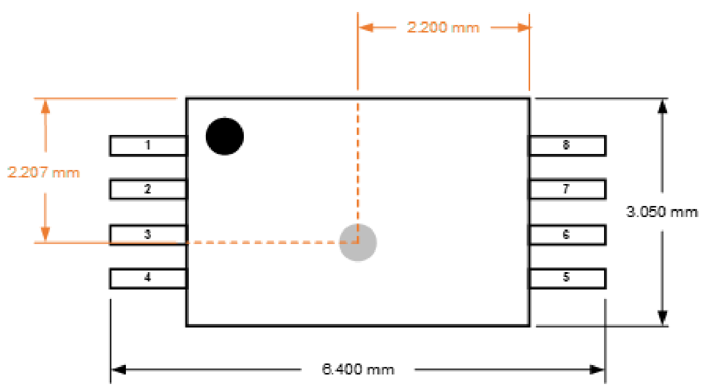

Figure 22: XtremeSense TMR Current Sensor Location in x-y Plane for CT455 in TSSOP-8 Package

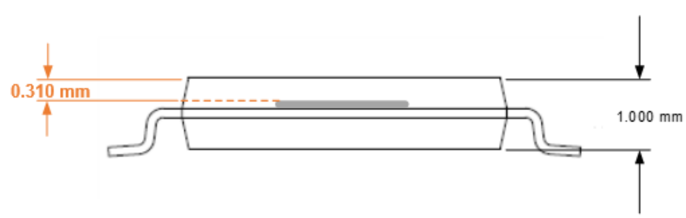

Figure 23: XtremeSense TMR Current Sensor Location in z Dimension for CT455 in TSSOP-8 Package

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PACKAGE OUTLINE DRAWINGS

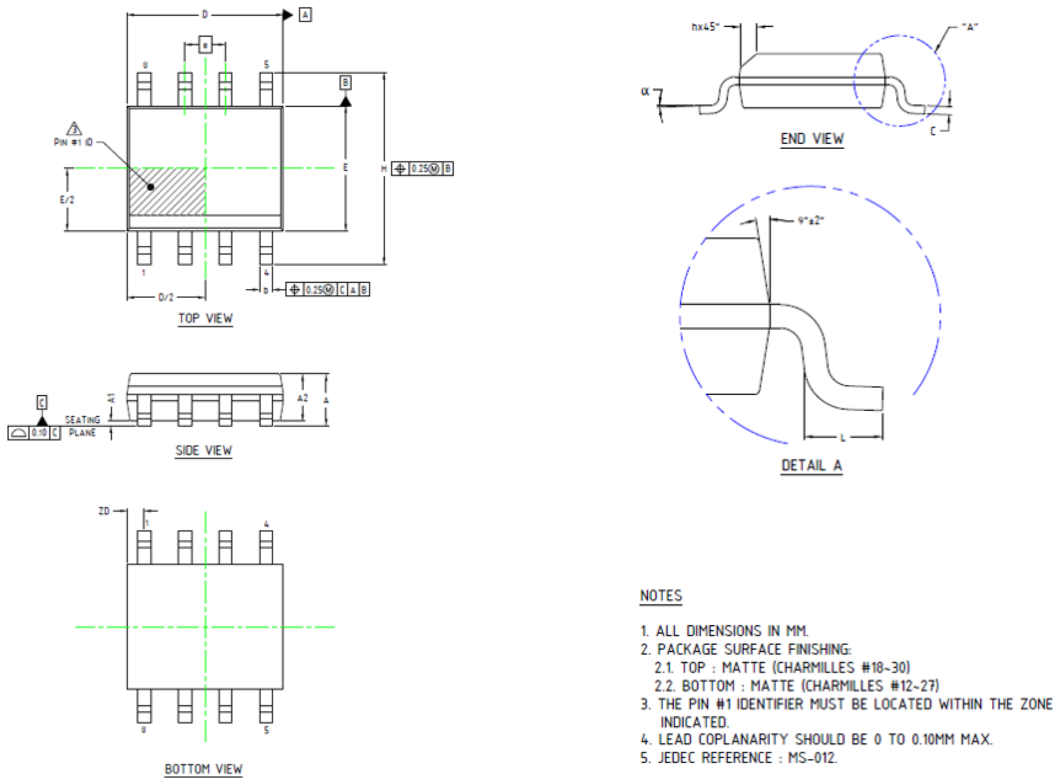

Figure 24: SOIC-8 Package Drawing and Dimensions

Table 3: CT455 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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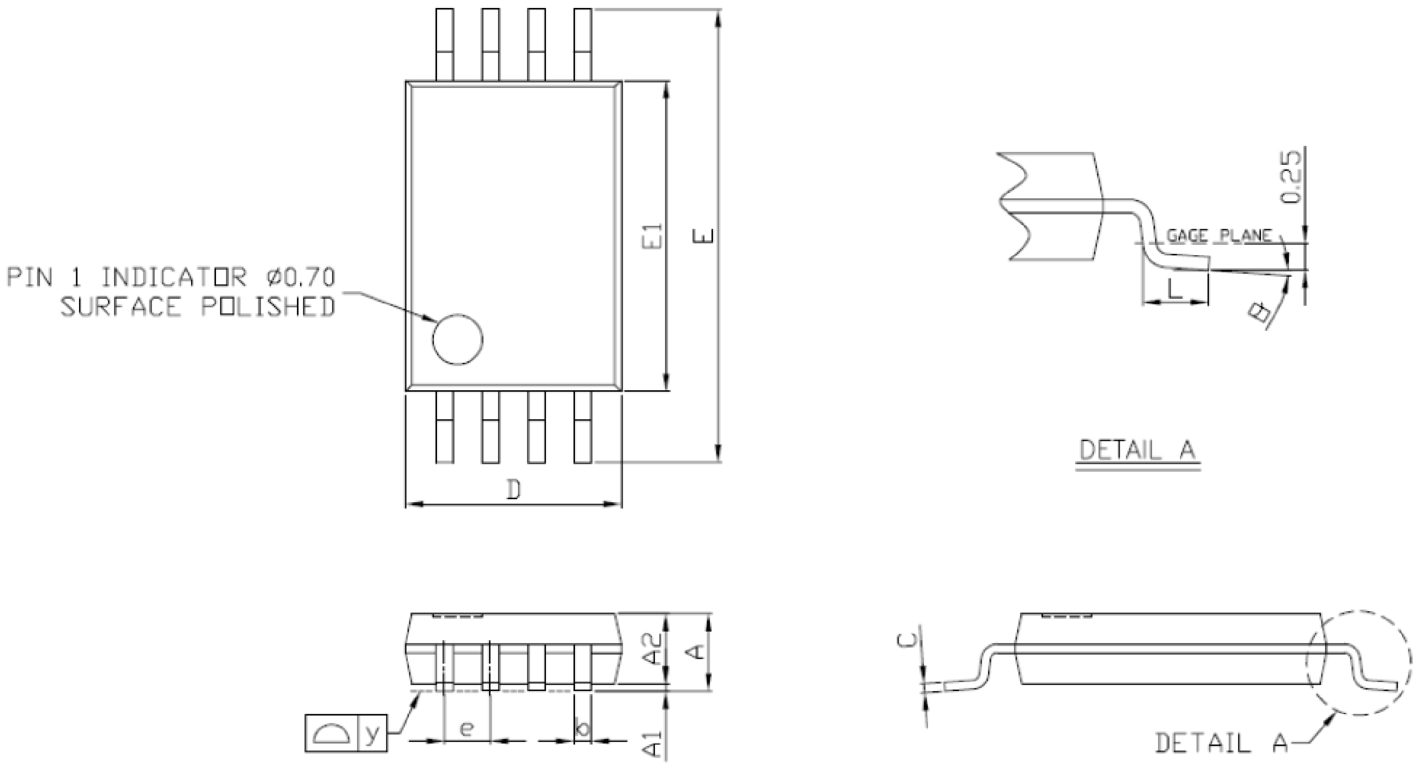

Figure 25: TSSOP-8 Package Drawing and Dimensions

Table 4: CT455 TSSOP-8 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	1.05	1.10	1.20
A1	0.05	0.10	0.15
A2	–	1.00	1.05
b	0.25	–	0.30
C	–	0.127	–
D	2.90	3.05	3.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	–	0.65	–
L	0.50	0.60	0.70
y	–	–	0.076
θ	0°	4°	8°

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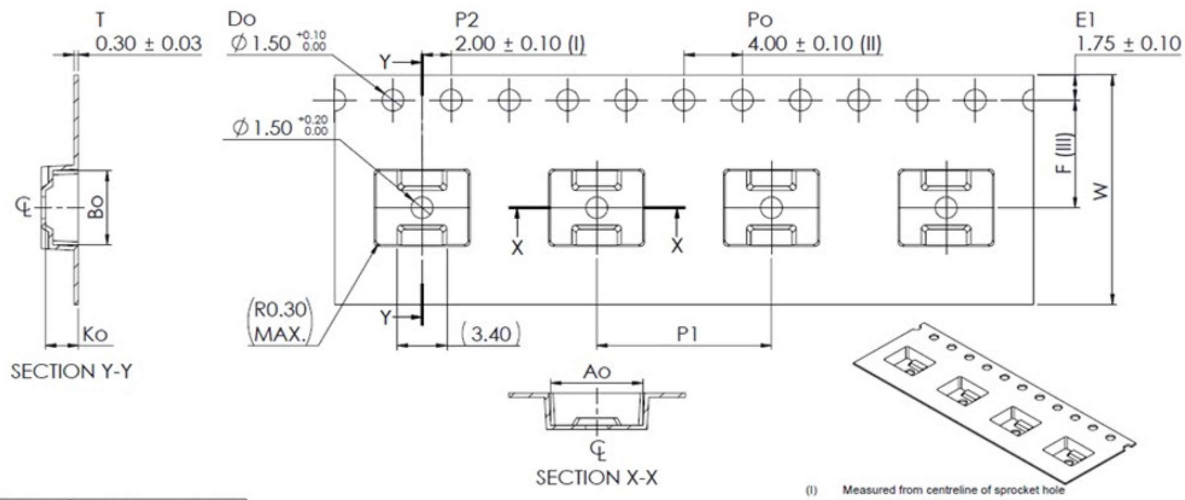
TAPE AND REEL POCKET DRAWINGS AND DIMENSIONS

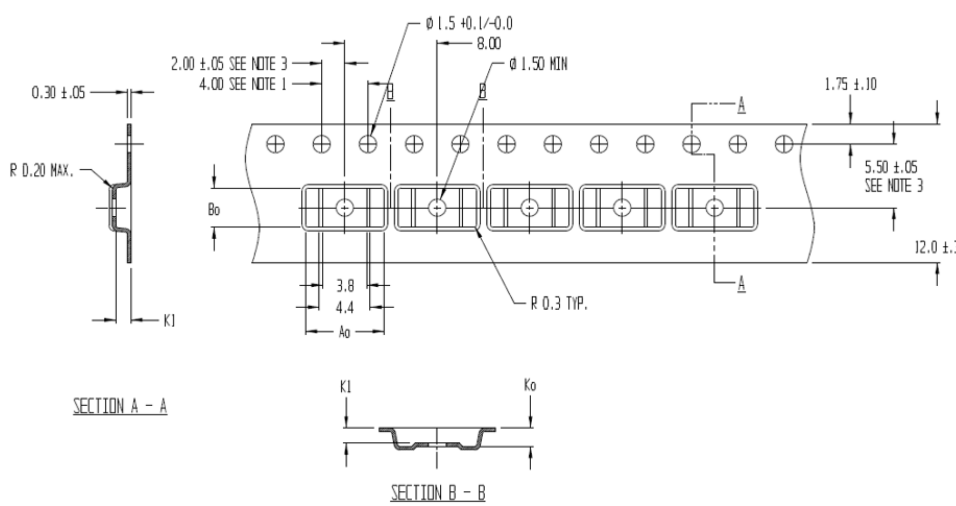


Ao	6.35	+/- 0.10
Bo	5.13	+/- 0.10
Ko	2.25	+/- 0.15
K1	1.75	+/- 0.10
F	7.50	+/- 0.10
P1	12.00	+/- 0.10
W	16.00	+0.30 / -0.10

(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 26: Tape and Pocket Drawing for SOIC-8 Package



Ao = 6.80
Bo = 3.40
Ko = 1.60
K1 = 1.30

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. CAMBER IN COMPLIANCE WITH EIA 481
3. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE

Figure 27: Tape and Pocket Drawing for TSSOP-8 Package

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DEVICE MARKINGS

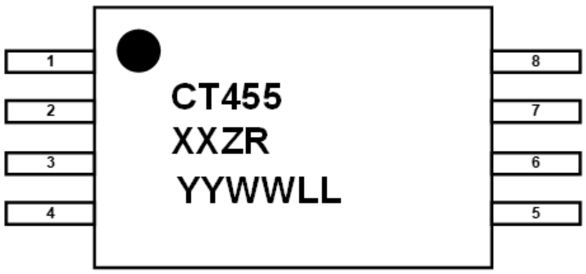

Figure 28: CT455 Device Marking for 8-Lead TSSOP Package

Table 5: CT455 Device Marking Definition for 8-lead TSSOP Package

Row No.	Code	Definition
1	•	Pin 1 Indicator
2	CT455	Allegro Part Number
2	XX	Maximum Magnetic Field Rating
2	B	Sensing Polarity
2	V	Supply Voltage
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

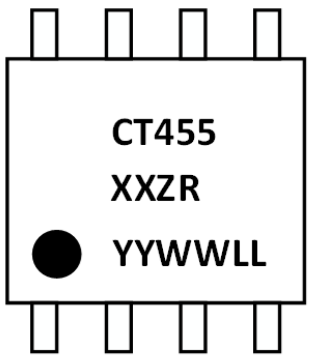

Figure 29: CT455 Device Marking for 8-Lead SOIC Package

Table 6: CT455 Device Marking Definition for 8-lead SOIC Package

Row No.	Code	Definition
3	•	Pin 1 Indicator
1	CT455	Allegro Part Number
2	XX	Maximum Field Rating
2	B	Sensing Polarity
2	V	Supply Voltage
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

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PART ORDERING NUMBER LEGEND

CT 4 5 5 - T FR X V - PKG

- **PKG – Package Type**
  - SN08 = 8-lead SOIC
  - TS08 = 8-lead TSSOP
- **V – Voltage**
  - 5 = Vcc is 5.0V
  - 3 = Vcc is 3.3V
- **X – Polarity**
  - U = Unipolar Magnetic Field
  - B = Bipolar Magnetic Field
- **FR – Field Range**
  - 00 = User Programmable
  - 06 = 6 mT
  - 12 = 12 mT
  - 24 = 24 mT
  - 48 = 48 mT
- **T – Temperature Range**
  - H = –40°C TO +125°C
- **5 – Current Sensor Variant**
  - 5 = dV/dt Optimized Sensor
- **5 – Current Sensor Type**
  - 5 = Contactless Current Sensor
- **4 – Product Family**
  - 4 = Current Sensor
- CT = Part Number Prefix

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Revision History

Number	Date	Description
2	November 2, 2023	Document rebranded and minor editorial updates
3	January 25, 2024	Corrected packaging column in Selection Guide table (page 3)
4	March 6, 2024	Removed AEC-Q100 (pages 1, 2, 19-20) Updated Offset Voltage (pages 8-11); removed Out Accuracy Performance (pages 8-11); updated Sensitivity and removed Noise (page 11)

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