CT100

1D Linear Sensor

FEATURES AND BENEFITS

- Operating magnetic field range: ±50 mT
- Stable magnetic performance over temperature
- Linearity error: ±0.5% from –20 mT to +20 mT
- Differential outputs
- Supply voltage: 1.0 to 5.5 V
- Operating temperature: –40°C to 150°C
- Package options:
  - □ 6-lead SOT23
  - □ 6-lead DFN, 1.50 mm × 1.50 mm × 0.45 mm
  - □ KGD (known good die) in wafer form

APPLICATIONS

- Linear measurements
- Proximity sensing
- Current sensing

DESCRIPTION

The CT100 is a 1D linear sensor in full-bridge configuration from Allegro developed on its patented XtremeSense™ TMR technology. The total magnetic field range for the CT100 is from –50 mT to 50 mT and it achieves a linearity error of ±0.5% for a range of –20 mT to 20 mT while providing XtremeSense performance to achieve unparalleled temperature stability across the full temperature range. The device supports a wide operating voltage range of 1.0 to 5.5 V.

The CT100 is available in a 6-lead SOT23 package, and for space-critical applications, a low-profile and small form factor 6-lead DFN package that is 1.50 mm × 1.50 mm × 0.45 mm in size. The CT100 is also available in die form where it will be shipped as unsawn wafers (wafer map files will be provided to indicate known good die).

FUNCTIONAL BLOCK DIAGRAMS

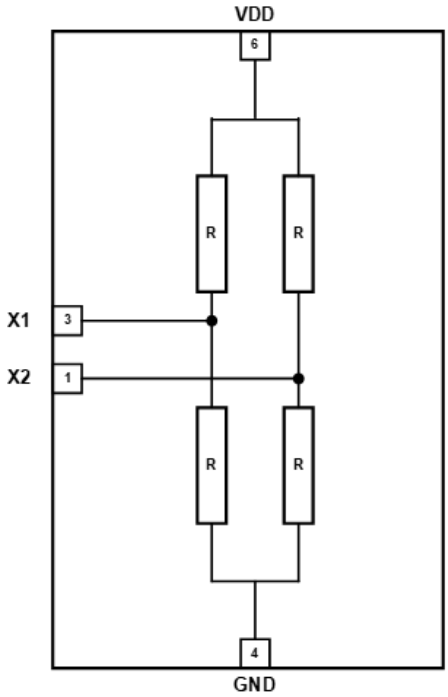

Figure 1: CT100 Functional Block Diagram for SOT23-6

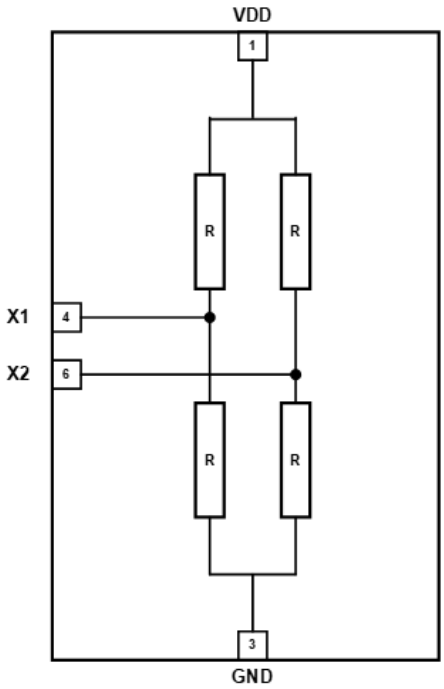

Figure 2: CT100 Functional Block Diagram for DFN-6

Table of Contents

SELECTION GUIDE

Part Number	Operating Temperature Range (°C)	Output Type	Package	Packing
CT100LW-IS6	–40 to 85	Differential	6-lead SOT23 2.90 mm × 2.80 mm × 1.20 mm	Tape and Reel
CT100LW-HS6	–40 to 125			
CT100LW-FS6	–40 to 150			
CT100LW-ID6	–40 to 85	Differential	6-lead DFN 1.50 mm × 1.50 mm × 0.45 mm	Tape and Reel
CT100LW-HD6	–40 to 125			
CT100LW-FD6	–40 to 150			
CT100LW-KGD	–40 to 150	Differential	Wafer Form	Unsawn Wafer

ABSOLUTE MAXIMUM RATINGS [1]

Characteristic	Symbol	Notes	Rating	Unit
Supply Voltage Strength	V_{DD}		–0.3 to 6.0	V
Analog Output Pins Maximum Voltage	V_{OUT}		±1560	mV
Electrostatic Discharge Protection Level	ESD	Human Body Model (HBM) per JESD22-A114	±4.0 (min)	kV
		Charged Device Model (CDM) per JESD22-C101	±1.0 (min)	kV
Maximum Magnetic Field	B_{MAX}	T_A = 25°C	±200	mT
Storage Temperature	T_{STG}		–65 to 160	°C
Lead Soldering Temperature	T_L	10 seconds	260	°C

[1] Stresses exceeding the absolute maximum ratings may damage the CT100 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.

RECOMMENDED OPERATING CONDITIONS [1]

Characteristic	Symbol	Notes	Min.	Typ.	Max.	Unit
Supply Voltage Range	V_{DD}		1.0	3.0	5.5	V
Output Voltage Range	V_{OUT}		–1430	–	1430	mV
Operating Magnetic Field	B_{OP}		–	–	±50	mT
Operating Ambient Temperature	T_A	Industrial	–40	25	85	°C
		Extended Industrial	–40	25	125	°C
		Full Range	–40	25	150	°C

[1] The Recommended Operating Conditions table defines the conditions for actual operation of the CT100. 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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PINOUT DIAGRAMS AND TERMINAL LISTS

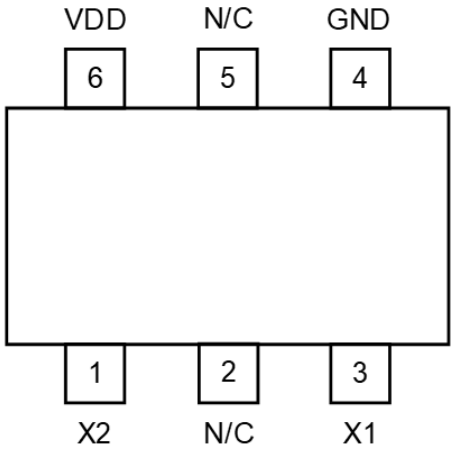

Figure 3: SOT23-6 Package, Top-Down View

Terminal List

Number	Name	Function
1	X2	Differential Output X2
2	N/C	No Connect
3	X1	Differential Output X1
4	GND	Ground
5	N/C	No Connect
6	VDD	Supply Voltage

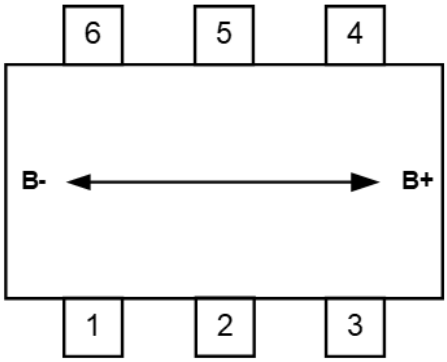

Figure 4: CT100 Axis of Sensitivity for SOT23-6 (Top Down View)

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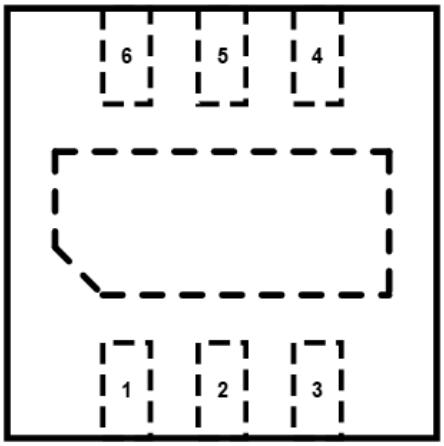

Figure 5: DFN-6,Top-Down View

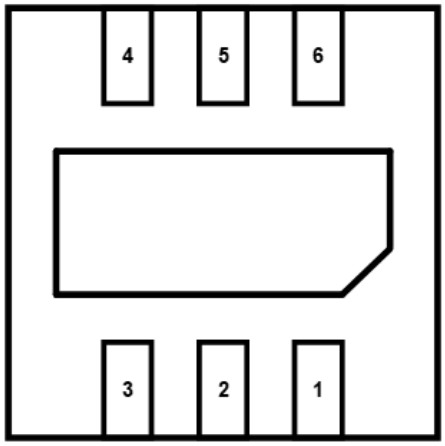

Figure 6: DFN-6, Bottom-Up View

Terminal List

Number	Name	Function
1	VDD	Supply Voltage
2	N/C	No Connect
3	GND	Ground
4	X1	Differential Output X1
5	N/C	No Connect
6	X2	Differential Output X2

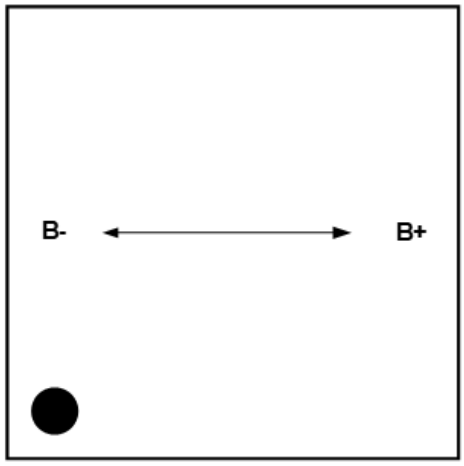

Figure 7: CT100 Axis of Sensitivity for DFN-6 (Top Down View)

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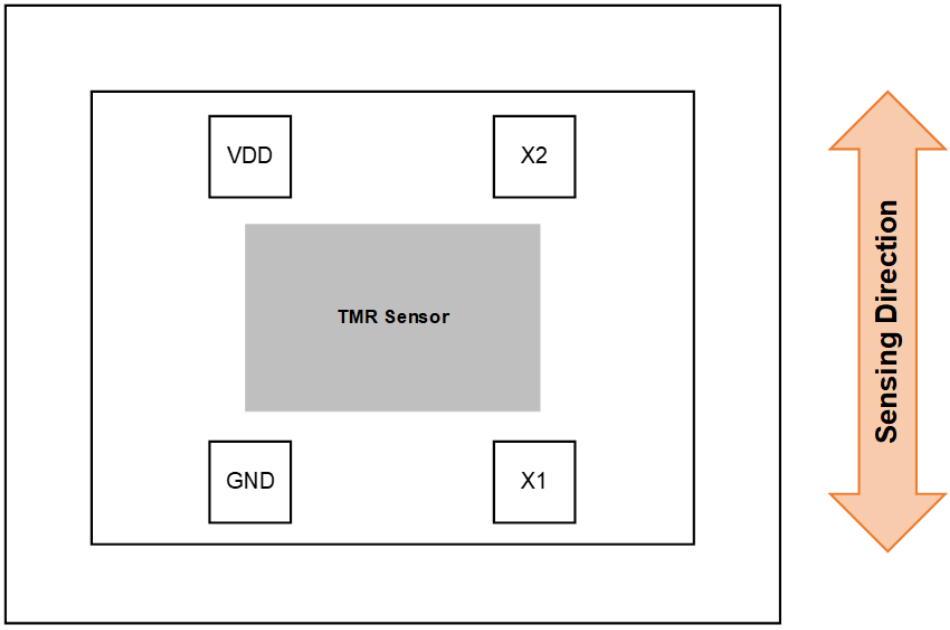

Figure 8: CT100 Die Layout and Axis of Sensitivity, Top-Down View

Pad List

Number	Name	Function
1	VDD	Supply Voltage
2	X2	Differential Output X2
3	X1	Differential Output X1
4	GND	Ground

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ELECTRICAL CHARACTERISTICS: Valid for V_{DD} = 1.0 V to 5.5 V and T_A = –40°C to 150°C, typical values are V_{DD} = 3.0 V and T_A = 25°C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
MAGNETIC						
Operating Magnetic Field	B_{OP}		–	–	±50	mT
ELECTRICAL						
Bridge Resistance	R_{BRIDGE}		20	–	40	kΩ
Power Consumption	P_D	V_{DD} = 3.0 V, R_{BRIDGE} = 30 kΩ	–	0.30	–	mW
Offset Voltage	V_{OFFSET}	B_{OP} = ±20 mT	–5		+5	mV/V
Sensitivity (Full-Bridge Gain)	S	B_{OP} = ±20 mT	3.8	4.5	5.2	mV/V/mT
Bridge Temperature Coefficient Resistance [1]	TCR_{BRIDGE}		–	–	–750	ppm/°C
Offset Voltage Temperature Coefficient [1]	TCO		–	–	±4.0	µV/V/°C
Sensitivity Temperature Coefficient [1]	TCS		–	–250	–350	ppm/°C
Linearity	L	B_{OP} = ±20 mT	–	–	±0.5	%
Hysteresis Error	E_{HYST}	B_{OP} = ±20 mT, T_A = 25°C	–	–	0.05	%
Output Noise [1]	e_N	f = 10 Hz, V_{DD} = 1.0 V, B_{OP} = 0 mT, T_A = 25°C	–	700	–	$nV_{RMS}/\sqrt{Hz}$

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

ELECTRICAL CHARACTERISTICS

V_{DD} = 1.0 V and T_A = 25°C (unless otherwise specified)

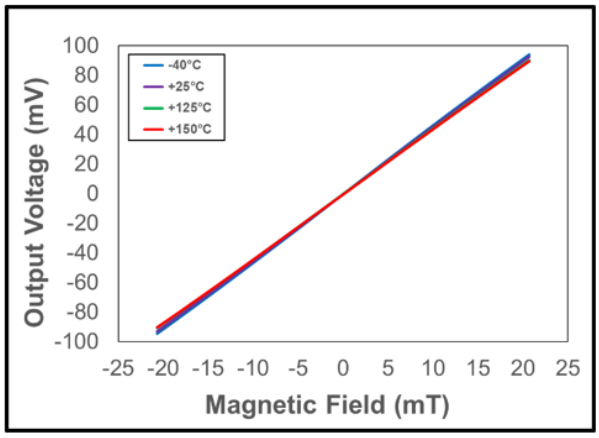

Figure 9: Sensitivity – Output Voltage vs. Magnetic Field vs. Temperature

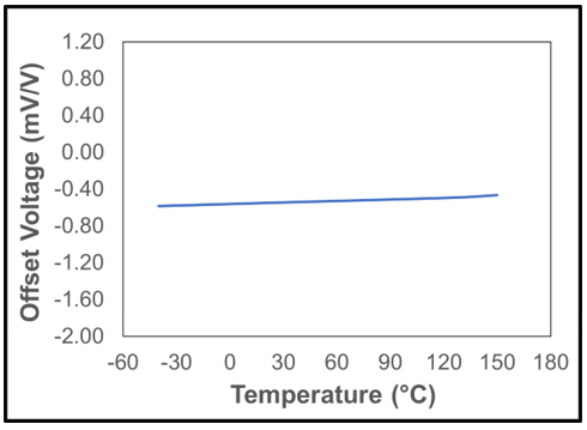

Figure 10: Offset Voltage vs. Temperature

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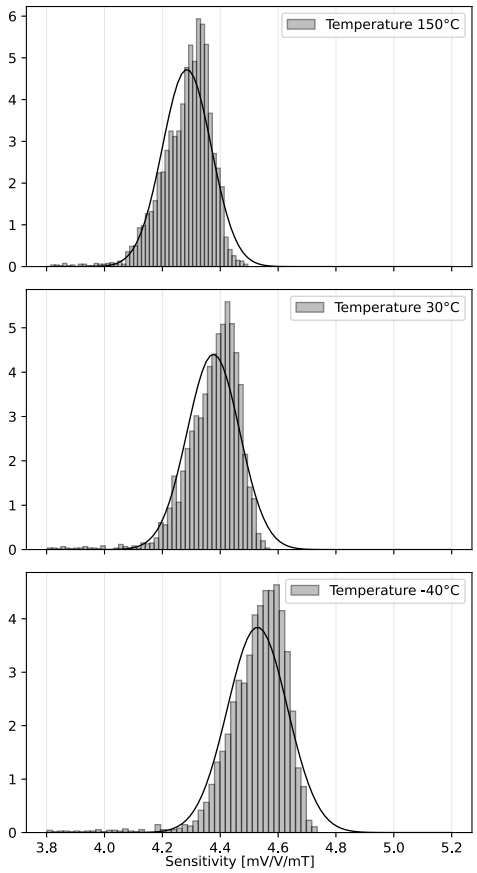

Figure 11: Sensitivity Distribution and Normal Fit Curve from production samples (N = 4019)

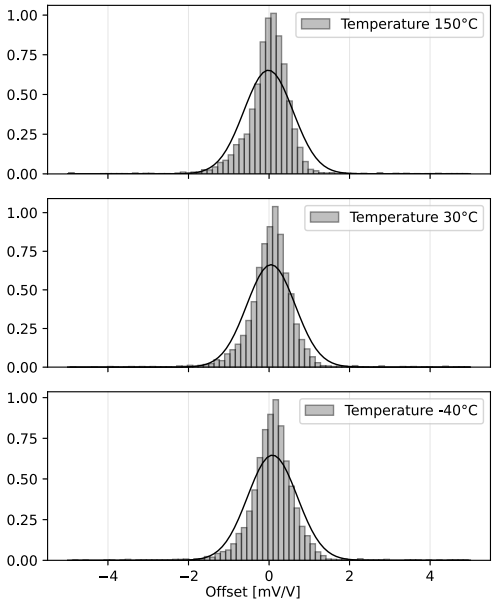

Figure 12: Offset Voltage Distribution and Normal Fit Curve from production samples (N = 4019)

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RECOMMENDED APPLICATION CIRCUIT

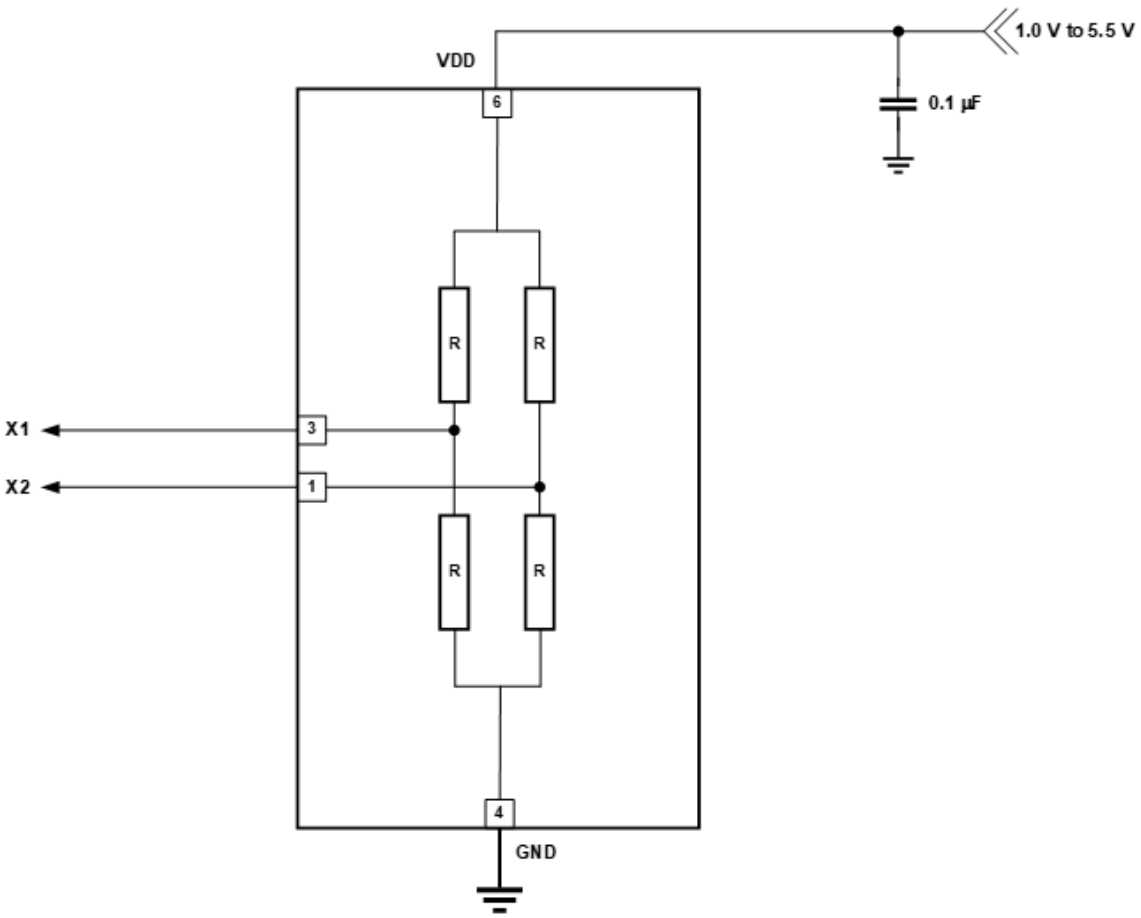

Figure 13: CT100 (SOT23-6) Application Diagram

Table 1: Recommended External Components

Component	Description	Vendor and Part Number	Parameter	Min.	Typ.	Max.	Unit
C_{BYP}	0.1 µF, X7R	Murata GRM033Z71A104KE14	C	–	0.1	–	µF

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Applications Information

The XtremeSense TMR sensor location for the CT100 for the x, y dimensions are shown in Figure 14 and Figure 15 for the SOT23-6 and DFN-6 packages, respectively. Figure 16 and Figure 17 illustrates the location of the CT100 XtremeSense TMR sensor from the z dimension. All dimensions in the figures below are nominal.

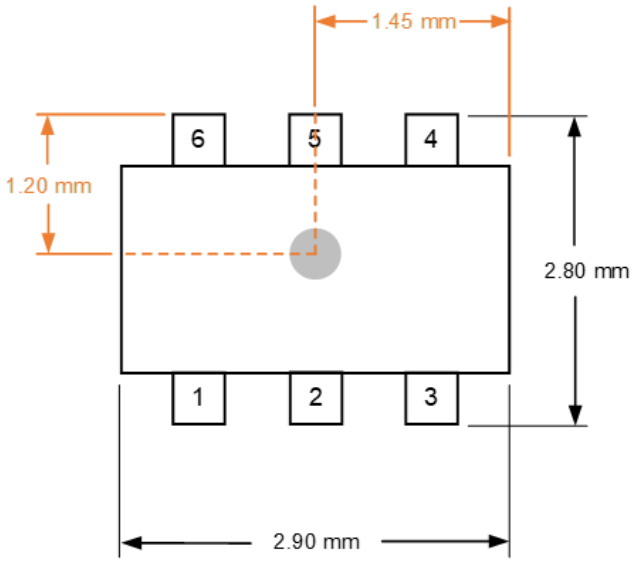

Figure 14: XtremeSense TMR Sensor Location in x-y Plane for CT100 in SOT23-6 Package

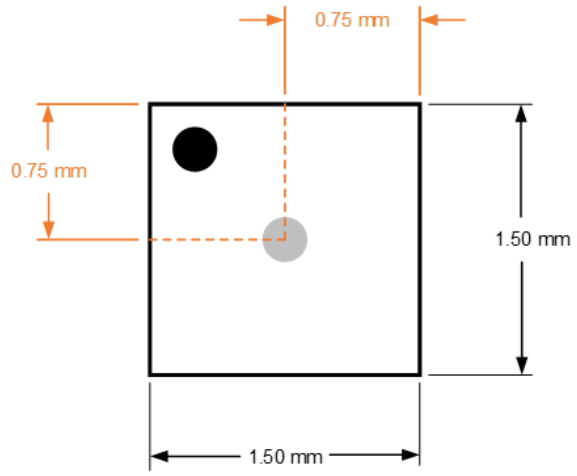

Figure 15: XtremeSense TMR Sensor Location in x-y Plane for CT100 in DFN-6 Package

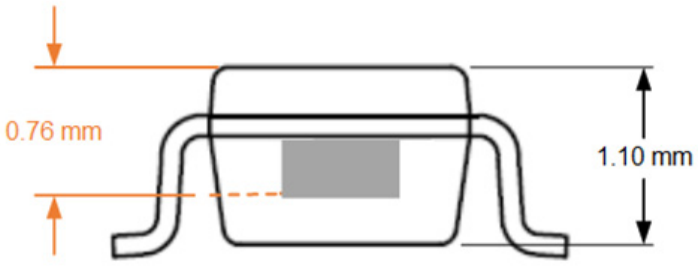

Figure 16: XtremeSense TMR Sensor Location in z Dimension for CT100 in SOT23-6 Package

Figure 17: XtremeSense TMR Sensor Location in z Dimension for CT100 in DFN-6 Package

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PACKAGE OUTLINE DRAWINGS

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

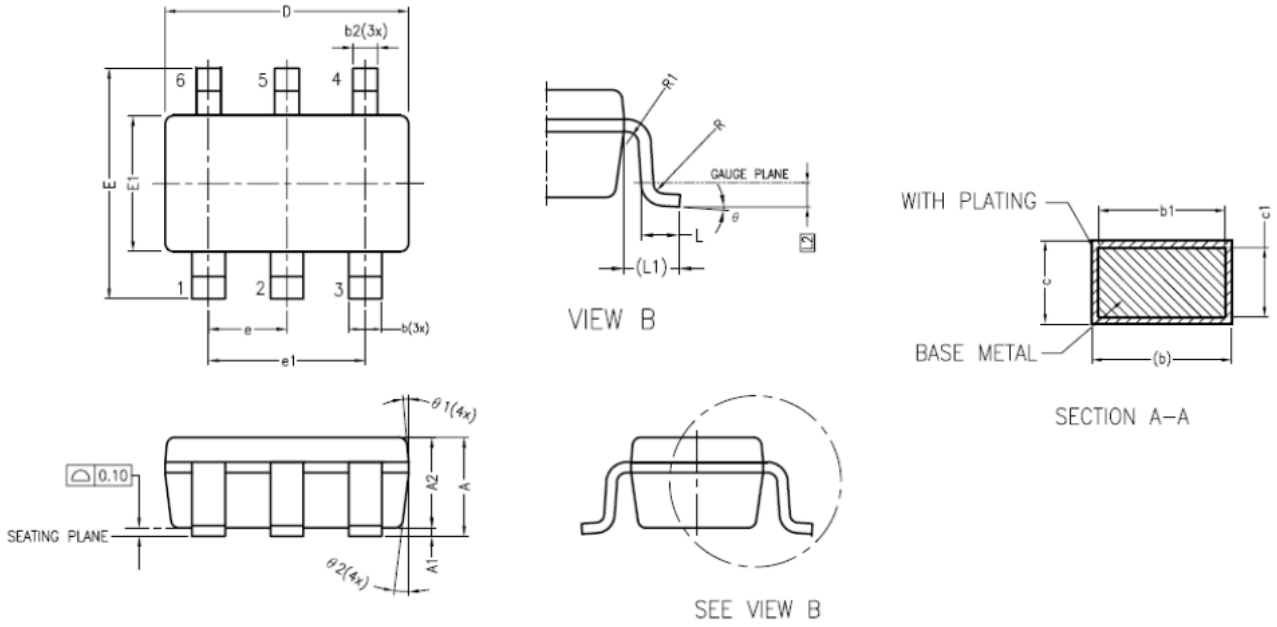

Figure 18: 6-Lead SOT23 Package Drawing

Table 2: CT100 6-Lead SOT23 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	1.05	1.20	1.35
A1	0.00	0.10	0.15
A2	1.00	1.10	1.20
b	0.40	–	0.50
b1	0.40	–	0.45
b2	0.30	–	0.40
c	0.08	–	0.22
c1	0.08	0.13	0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
e		0.95 BSC	
e1		1.90 BSC	
L	0.35	0.43	0.60
L1		0.60 REF	
L2		0.25 BSC	
R	0.10	–	–
R1	0.10	–	0.25
θ	0°	4°	8°
θ1	5°	6°	15°
θ2	5°	8°	15°

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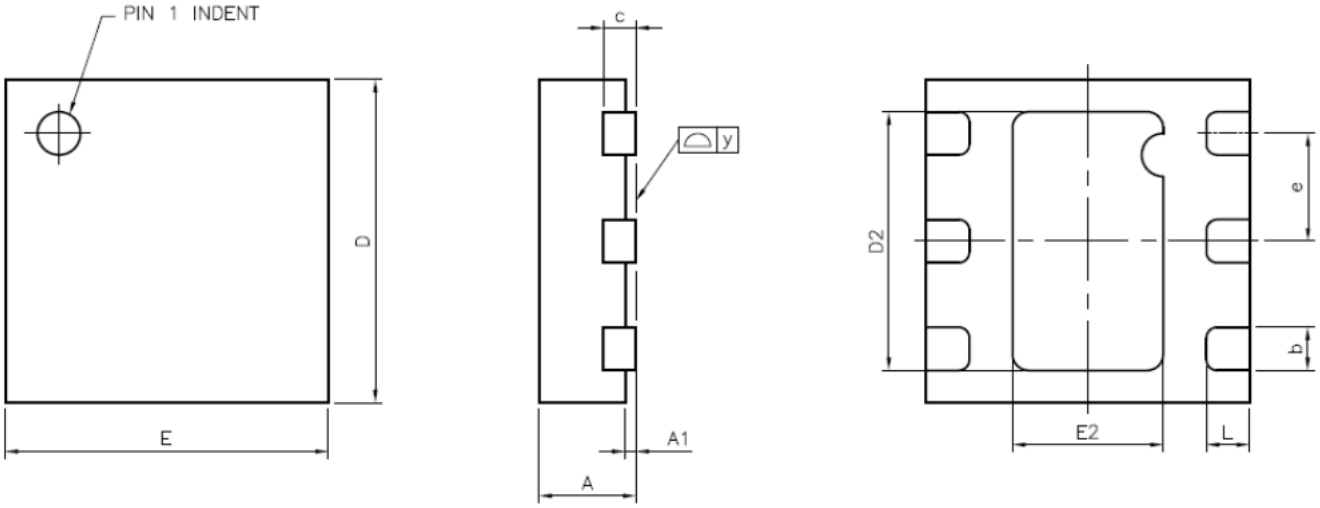

Figure 19: DFN-6 Package Drawing

Table 3: CT100 DFN-6 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	0.40	0.45	0.50
A1	0.00	0.02	0.05
b	0.15	0.20	0.25
c	–	0.15 REF	–
D	1.40	1.50	1.60
D2	1.15	1.20	1.25
E	1.40	1.50	1.60
E2	0.65	0.70	0.75
e	–	0.50	–
L	0.15	0.20	0.25
y	0.000	–	0.075

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TAPE AND REEL POCKET DRAWINGS AND DIMENSIONS

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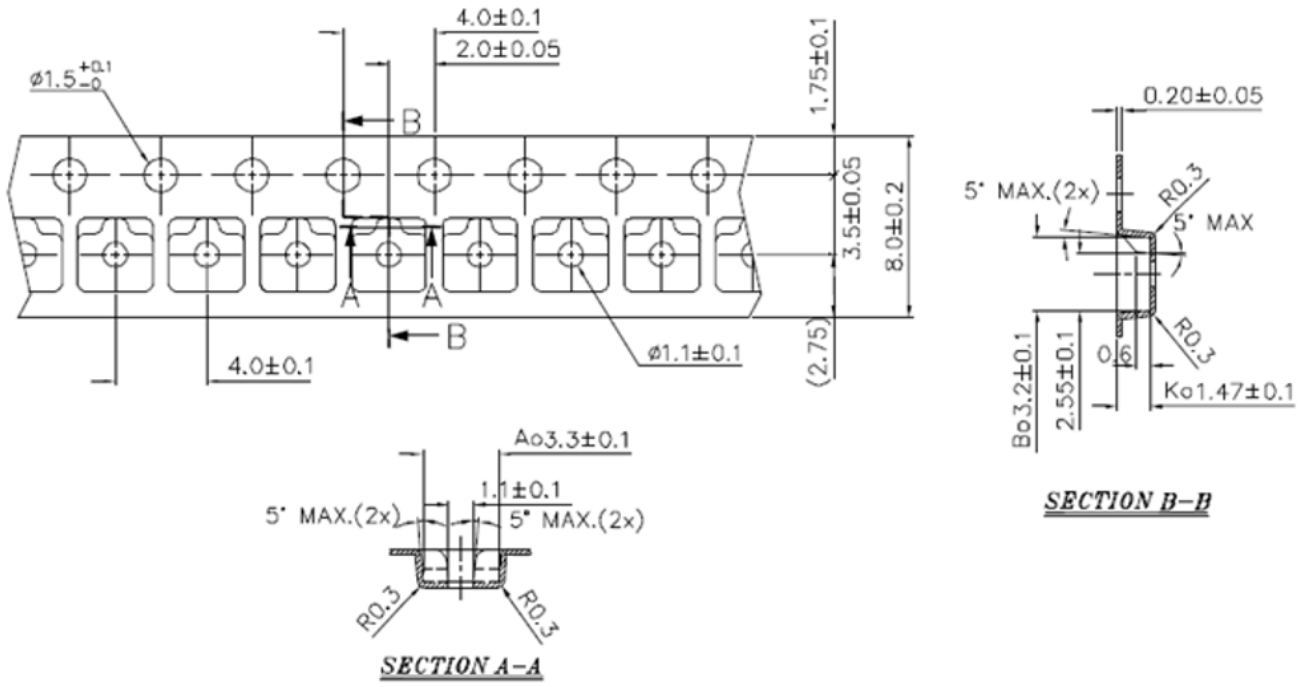
Dimensions in millimeters – NOT TO SCALE
Dimensions exclusive of mold flash, gate burs, and dambar protrusions
Exact case and lead configuration at supplier discretion within limits shown



NOTES:

1. Material: Conductive Polystyrene.
2. Dimensions in mm.
3. 10 sprocket hole pitch cumulative tolerance ±0.20 mm.
4. Camber not to exceed 1 mm in 100 mm.
5. Pocket position relative to sprocket hole measured as true position of pocket and not pocket hole.
6. (S.R. Ω/sq) means surface electric resistivity of the carrier tape.

Figure 20: Tape and Pocket Drawing for SOT23 Package

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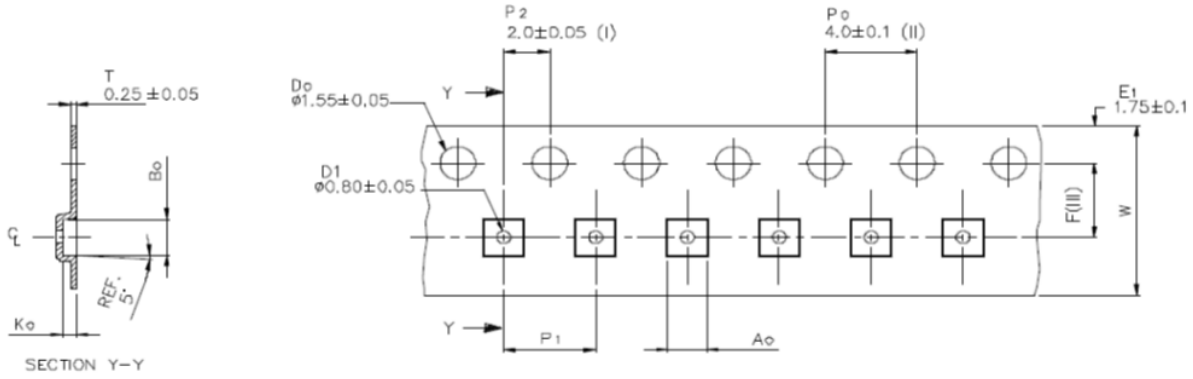

NOTES:

1. Measured from centerline of sprocket hole to centerline of pocket.
2. Cumulative tolerance of 10 sprocket holes is ±0.20.
3. Measured from centerline of sprocket hole to centerline of pocket.
4. Other material available.

Figure 21: Tape and Pocket Drawing for DFN-6 Package

Table 4: DFN-6 Tape and Pocket Dimensions

Symbol	Dimension (mm)
Ao	1.70 ± 0.05
Bo	1.70 ± 0.05
Ko	0.60 ± 0.05
F	3.50 ± 0.05
P1	4.00 ± 0.10
DW	8.00 ± 0.30

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PACKAGE INFORMATION

Table 5: CT100 Package Information

Part Number	Package Type	# of Leads	Package Quantity	Lead Finish	Eco Plan [1]	MSL Rating [2]	Operating Temperature [3]	Device Marking [4]
CT100LW-IS6	SOT23	6	3000	Sn	Green & RoHS	1	–40°C to 85°C	CT YWWS
CT100LW-HS6	SOT23	6	3000	Sn	Green & RoHS	1	–40°C to 125°C	CT YWWS
CT100LW-FS6	SOT23	6	3000	Sn	Green & RoHS	1	–40°C to 150°C	CT YWWS
CT100LW-ID6	DFN	6	3000	Sn	Green & RoHS	1	–40°C to 85°C	C YZ
CT100LW-HD6	DFN	6	3000	Sn	Green & RoHS	1	–40°C to 125°C	C YZ
CT100LW-FD6	DFN	6	3000	Sn	Green & RoHS	1	–40°C to 150°C	C YZ

[1] RoHS is defined as semiconductor products that are compliant to the current EU RoHS requirements. It also will meet the requirement that RoHS substances do not exceed 0.1% by weight in homogeneous materials. Green is defined as the content of chlorine (Cl), bromine (Br), and antimony trioxide based flame retardants satisfy JS709B low halogen requirements of ≤ 1,000 ppm.
[2] MSL Rating = Moisture Sensitivity Level Rating as defined by JEDEC standard classifications.
[3] Package will withstand ambient temperature range of –40°C to 150°C and storage temperature range of –65°C to 160°C.
[4] Device Marking for SOT23 is defined as XZ YWWS where XZ = part number, Y = year, WW = work week, and S = sequential number. DFN is defined as X where X = part number and YZ = date code information.

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Revision History

Number	Date	Description
3	November 2, 2023	Document rebranded and minor editorial updates
4	June 4, 2024	Added notes to package outline drawing (pages 9 and 11)
5	August 20, 2024	Added distribution graphs (page 7)
6	December 9, 2024	Updated Electrical Characteristics table (page 6), updated Sensitivity Distribution graph (page 7)

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