CT51x Series

Unipolar Switch for Consumer & Industrial Applications

Product Description

The CT51x Series is an integrated unipolar magnetic sensor especially designed for consumer and industrial switching applications based on Crocus Technology's patented Magnetic Logic Unit™ (MLU™) technology with integrated CMOS circuitry to provide a monolithic solution for superior sensing performance.

The CT51x Series operates with industry leading low power consumption in low magnetic field and large air gap conditions with high sampling frequency performance. The CT51x is available in either push-pull or open drain configuration for design flexibility. The CT51x magnetic switches are available in either industry standard 3-lead SOT-23 or TO-92S packages and provides a cost-effective solution for high volume manufacturing.

Custom solutions are available upon request.

SOT-23 Package

TO-92S Package

Features and Benefits

- High sensitivity
- Resistant to mechanical stress
- Low power consumption
- High frequency performance
- Digital push-pull and open drain options
- Cost effective
- RoHS Compliant

Application Examples

- Door or lid closure detection
- Smart phones, tablets, and laptops
- Reed switch replacement
- Motor controllers
- Proximity detection
- Power switch or open-close detection
- Water, electric, and gas utility meters
- Fluid level detection

Figure 1: CT512 Digital Push-Pull Functional Block Diagram

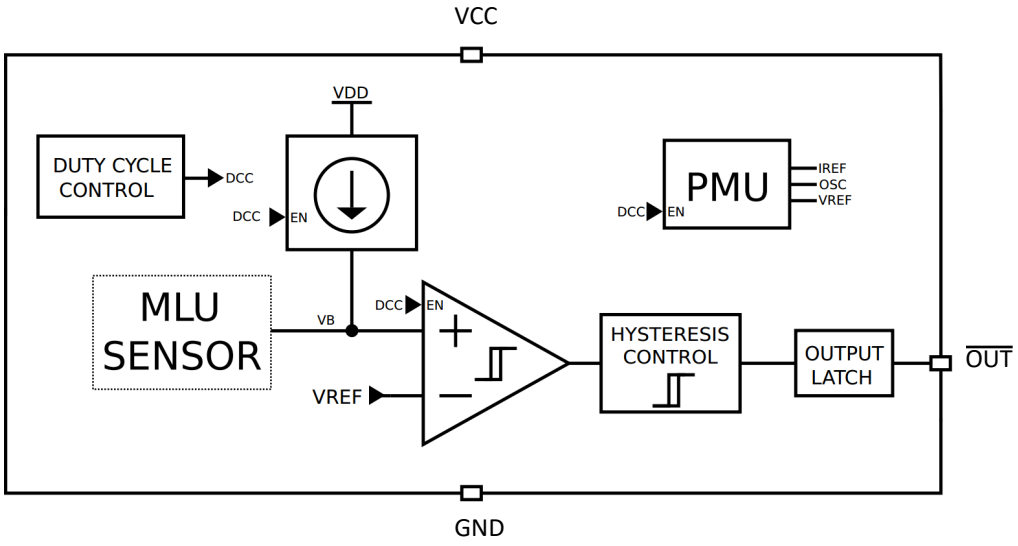


Figure 2: CT511 Digital Open Drain Functional Block Diagram

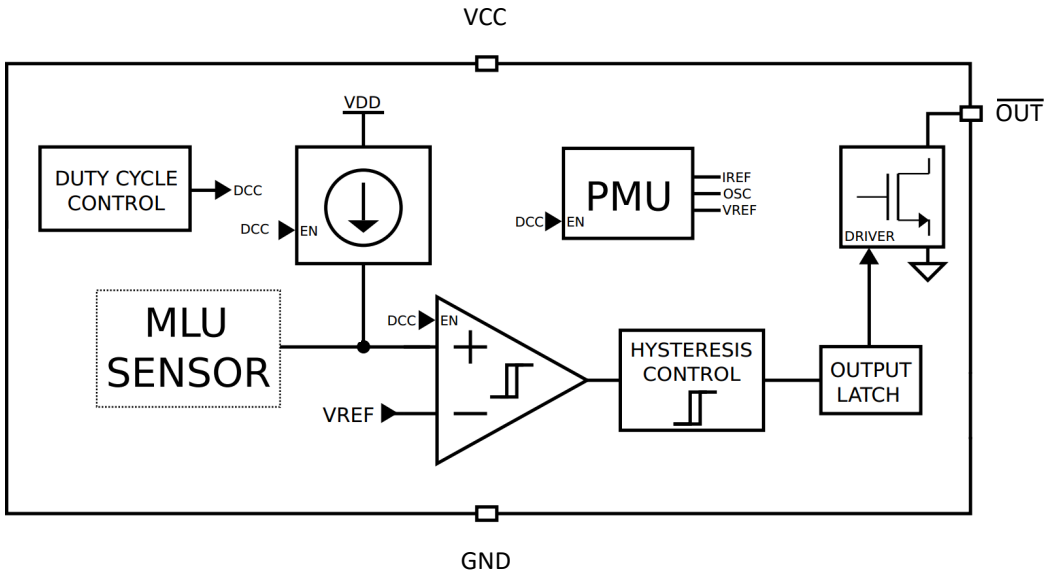
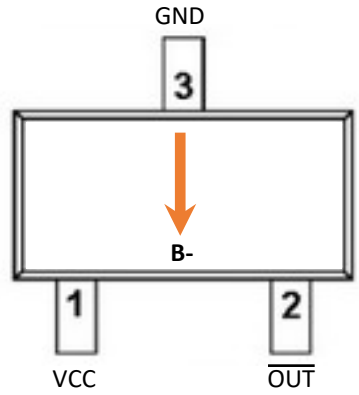
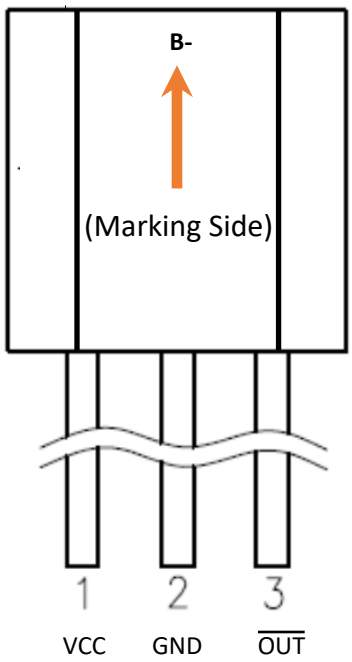


Figure 3: Package Pin-out with Axis of Sensitivity



SOT-23 Package



TO-92S Package

Table 1: Pin-out Information

Pin # for SOT23 Package	Pin # for TO-92S Package	Pin Name	Pin Description
1	1	VCC	Supply Voltage
2	3	$\overline{OUT}$	Output Signal (Active LOW)
3	2	GND	Ground

Table 2: Absolute Maximum Ratings

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}		4.0	V
Supply Current	I_{CC}		15	mA
Operating Temperature	T_A	-40	+85	°C
Storage Temperature	T_{STG}	-65	+150	°C
Soldering Temperature	T_{SOL}		+260	°C
ESD Level (HBM)	V_{ESD}	±4.0		kV

Table 3: Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for the actual device operation. Recommended operating conditions are specified to ensure optimal performance to the data sheet specifications. Crocus Technology does not recommend exceeding them or designing to absolute maximum ratings.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}		2.7	3.0	3.6	V
Output Voltage	V_{OUT}				3.6	V
Operating Magnetic Flux	B		0		10	mT
Ambient Temperature	T_A		-40	+25	+85	°C
Junction Temperature	T_J		-40		+125	°C

Table 4: Thermal Properties

Junction-to-ambient thermal resistance is a function of application and board layout and is determined in accordance to JEDEC standard JESD51 for a four (4) layer 2s2p FR-4 printed circuit board (PCB). Special attention must be paid not to exceed junction temperature $T_{J(MAX)}$ at a given ambient temperature.

Parameter	Symbol	Min	Typ	Max	Unit
Junction-to-Ambient Thermal Resistance for SOT23 Package	$\theta_{JA(SOT23)}$		202		°C/W
Junction-to-Ambient Thermal Resistance for TO-92S Package	$\theta_{JA(TO-92S)}$		130		°C/W

Table 5: Electrical Characteristics for CT51xVA Series

Unless otherwise specified: V_{CC} = 2.7 V to 3.6 V, T_A = -40°C to +85°C. Typical values are V_{CC} = 3.0 V and T_A = +25°C.

Characteristic	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage High	V_{OH}		0.9 × V_{CC}			V
Output Voltage Low	V_{OL}				0.1 × V_{CC}	V
Average Supply Current	$I_{CC(AVG)}$	t ≥ 10 s		250		nA
Sampling Frequency	f_S		5.1	12.5	20.0	Hz
Active Mode Time	t_{ACT}		50	80	190	µs
Idle Mode Time	t_{IDLE}		50	80	194	ms
Duty Cycle	DC			0.1		%
Output Voltage High (CT511)	V_{SYSH}		0.7 × V_{SYS}			V
Output Voltage Low (CT511)	V_{SYSL}				0.3 × V_{SYS}	V
I/O pin Sink Current[1] (CT511)	I_{OL}			-16		mA

Note: 1) Current measured using $R_{Pull\text{-}up}$ = 220 Ω, V_{SYS} = 3.6 V

Table 6: Electrical Characteristics for CT51xVB Series

Unless otherwise specified: V_{CC} = 2.7 V to 3.6 V, T_A = -40°C to +85°C. Typical values are V_{CC} = 3.0 V and T_A = +25°C.

Characteristic	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage High	V_{OH}		0.9 × V_{CC}			V
Output Voltage Low	V_{OL}				0.1 × V_{CC}	V
Average Supply Current	$I_{CC(AVG)}$	t ≥ 10 s		6.0		µA
Sampling Frequency	f_S		0.32	0.78	1.14	kHz
Active Mode Time	t_{ACT}		50	80	190	µs
Idle Mode Time	t_{IDLE}		0.83	1.2	2.9	ms
Duty Cycle	DC			6.2		%
Output Voltage High (CT511)	V_{SYSH}		0.7 × V_{SYS}			V
Output Voltage Low (CT511)	V_{SYSL}				0.3 × V_{SYS}	V
I/O pin Sink Current[1] (CT511)	I_{OL}			-16		mA

Note: 1) Current measured using $R_{Pull\text{-}up}$ = 220 Ω, V_{SYS} = 3.6 V

Table 7: Electrical Characteristics for CT51xVC Series

Unless otherwise specified: V_{CC} = 2.7 V to 3.6 V, T_A = -40°C to +85°C. Typical values are V_{CC} = 3.0 V and T_A = +25°C.

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage High	V_{OH}		0.9 × V_{CC}			V
Output Voltage Low	V_{OL}				0.1 × V_{CC}	V
Average Supply Current	$I_{CC(AVG)}$	t ≥ 10 s		20		µA
Sampling Frequency	f_S		1.3	3.1	5.0	kHz
Active Mode Time	t_{ACT}		50	80	190	µs
Idle Mode Time	t_{IDLE}		150	240	570	µs
Duty Cycle	DC			25		%
Output Voltage High (CT511)	V_{SYSH}		0.7 × V_{SYS}			V
Output Voltage Low (CT511)	V_{SYSL}				0.3 × V_{SYS}	V
I/O pin Sink Current[1] (CT511)	I_{OL}			-16		mA

Note: 1) Current measured using $R_{Pull\text{-}up}$ = 220 Ω, V_{SYS} = 3.6 V

Table 8: Magnetic Characteristics

Unless otherwise specified: V_{CC} = 2.7 V to 3.6 V, T_A = -40°C to +85°C. Typical values are V_{CC} = 3.0 V and T_A = +25°C.

Characteristic	Symbol	Conditions	Min	Typ	Max	Unit
Operate Point	B_{OP}		2.0	3.0	4.0	mT
Release point	B_{RP}		0.8	1.5	2.5	mT
Hysteresis	B_{HYS}	B_{OP} - B_{RP}		1.5		mT

Figure 4: Magnetic Flux

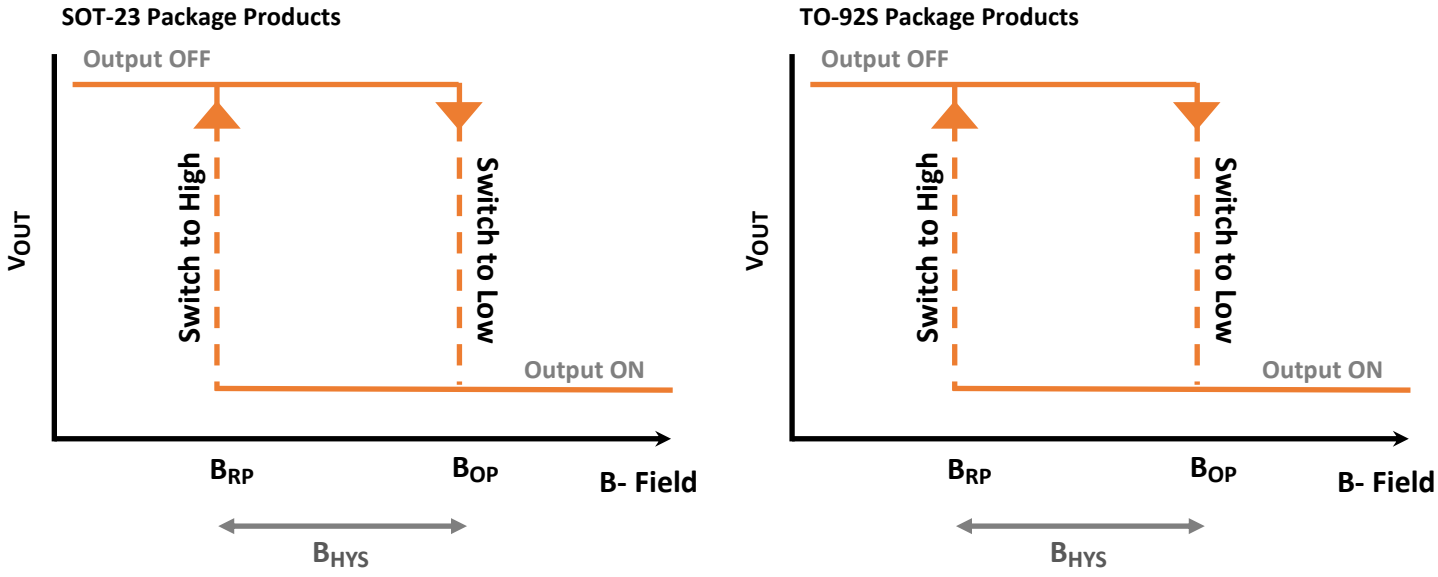


Table 9: Output Behavior versus Magnetic Field

SOT-23 Package Products

Characteristic	Conditions	Output
Positive Field	B > B_{OP}	High
Null or Weak Magnetic Field	B < B_{RP}	High
Negative Field	B > B_{OP}	Low

TO-92S Package Products

Characteristic	Conditions	Output
Negative Field	B > B_{OP}	High
Null or Weak Magnetic Field	B < B_{RP}	High
Positive Field	B > B_{OP}	Low

Figure 10: CT51xVA Typical Performance Characteristics

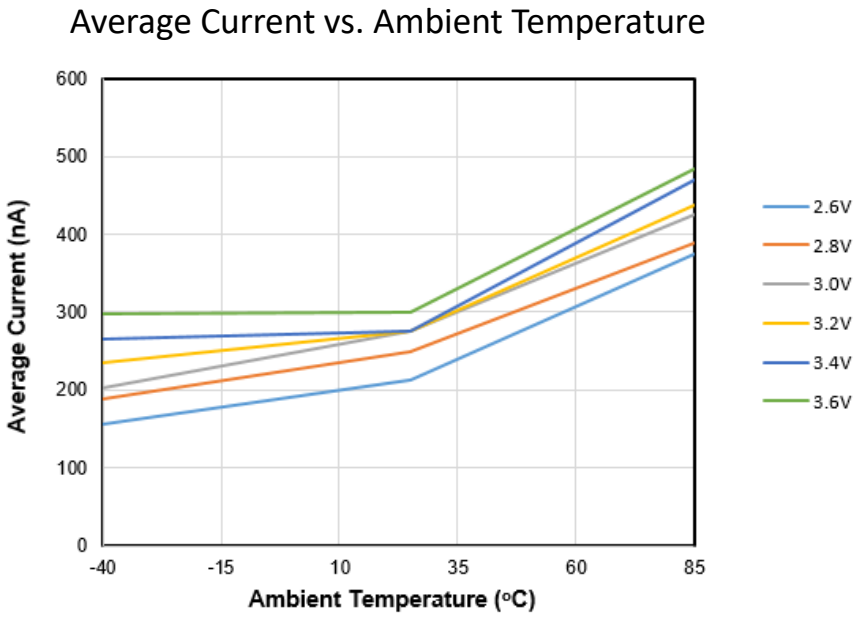


Figure 11: CT51xVB Typical Performance Characteristics

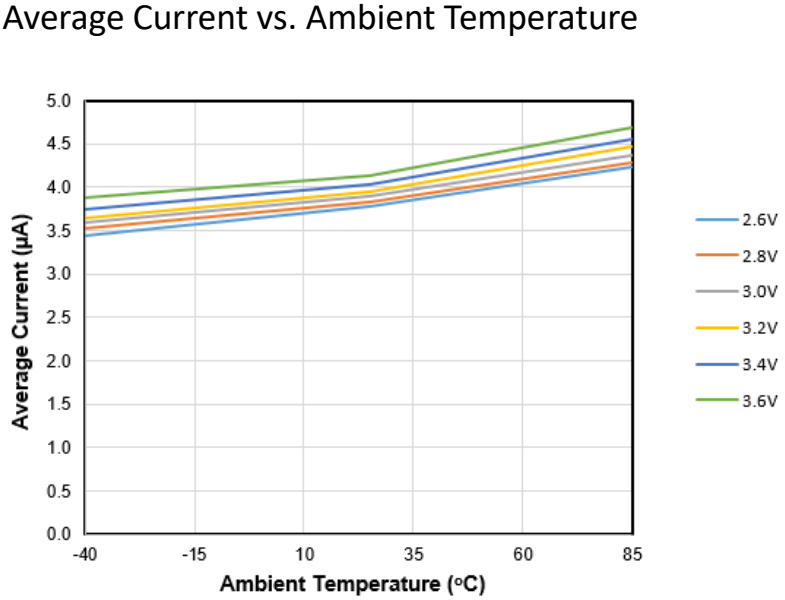


Figure 12: CT51xVC Typical Performance Characteristics

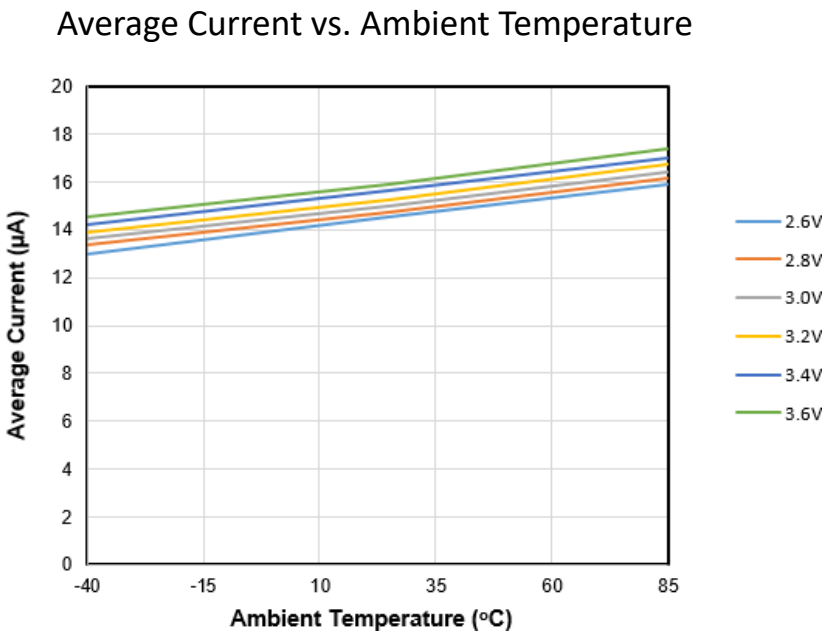
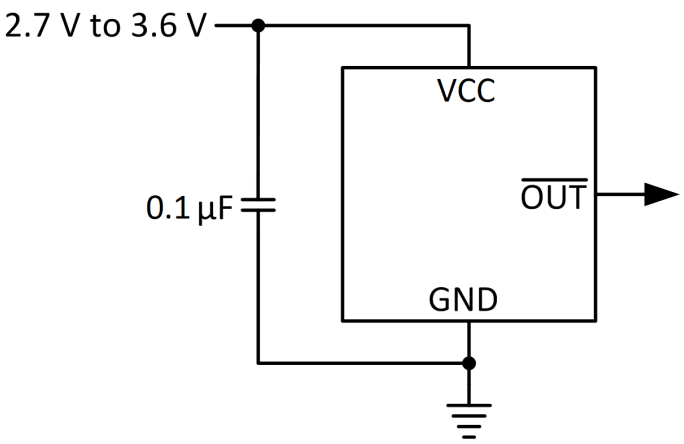
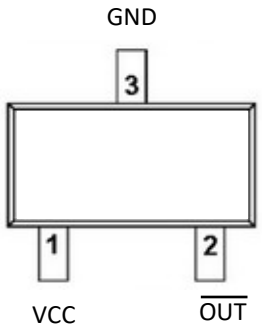


Figure 13: Application Circuits

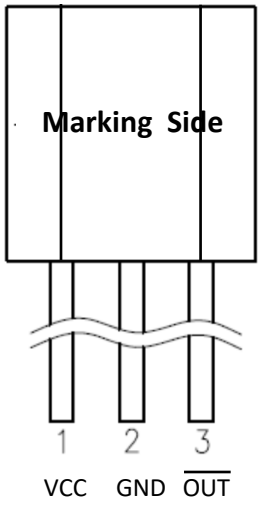
A decoupling capacitor between the supply voltage and ground is required with placement close to the magnetic sensor. A typical capacitor value of 0.1 µF will suffice.

CT512 Digital Output





SOT-23 Package



TO-92S Package

Please keep in mind the supply to the CT511 and V_{SYS} must remain at 3.6 V or less with a pull-up resistor of 10 kΩ. A decoupling capacitor between the supply voltage and ground is required with placement close to the magnetic sensor. A typical capacitor value of 0.1 µF will be sufficient.

CT511 Open Drain Output

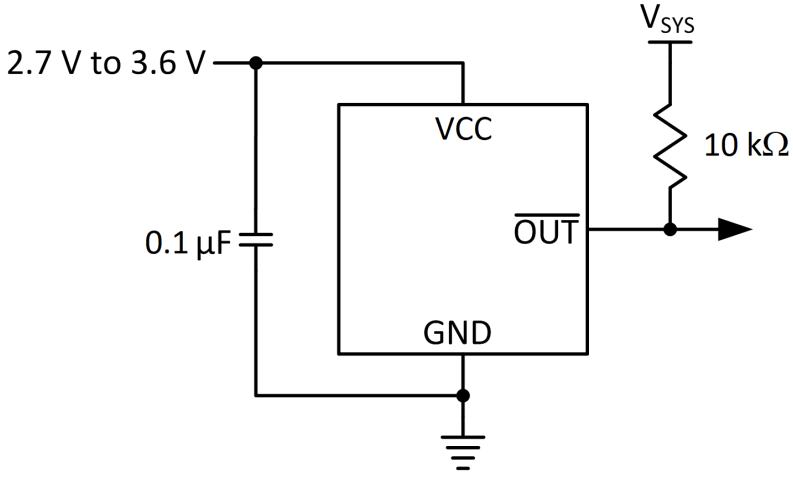
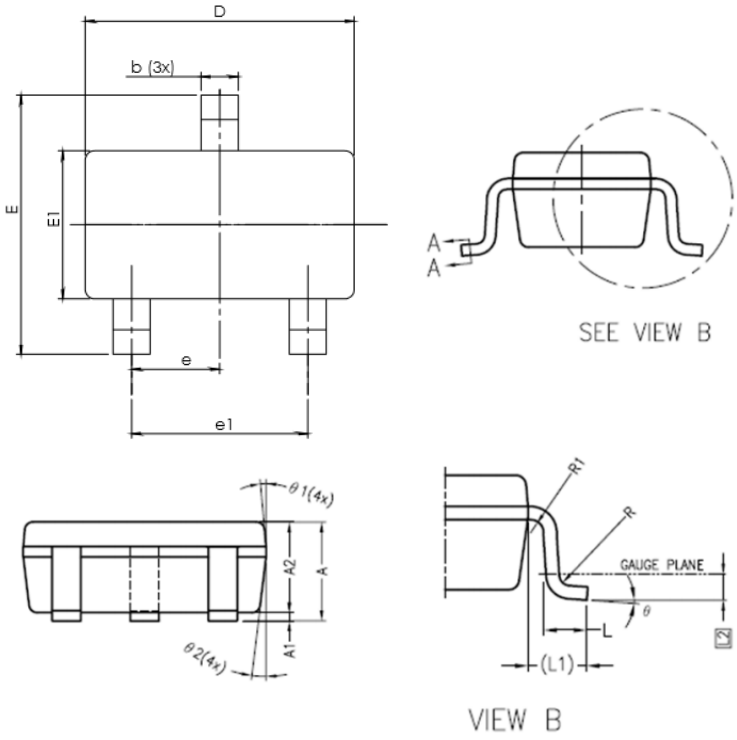
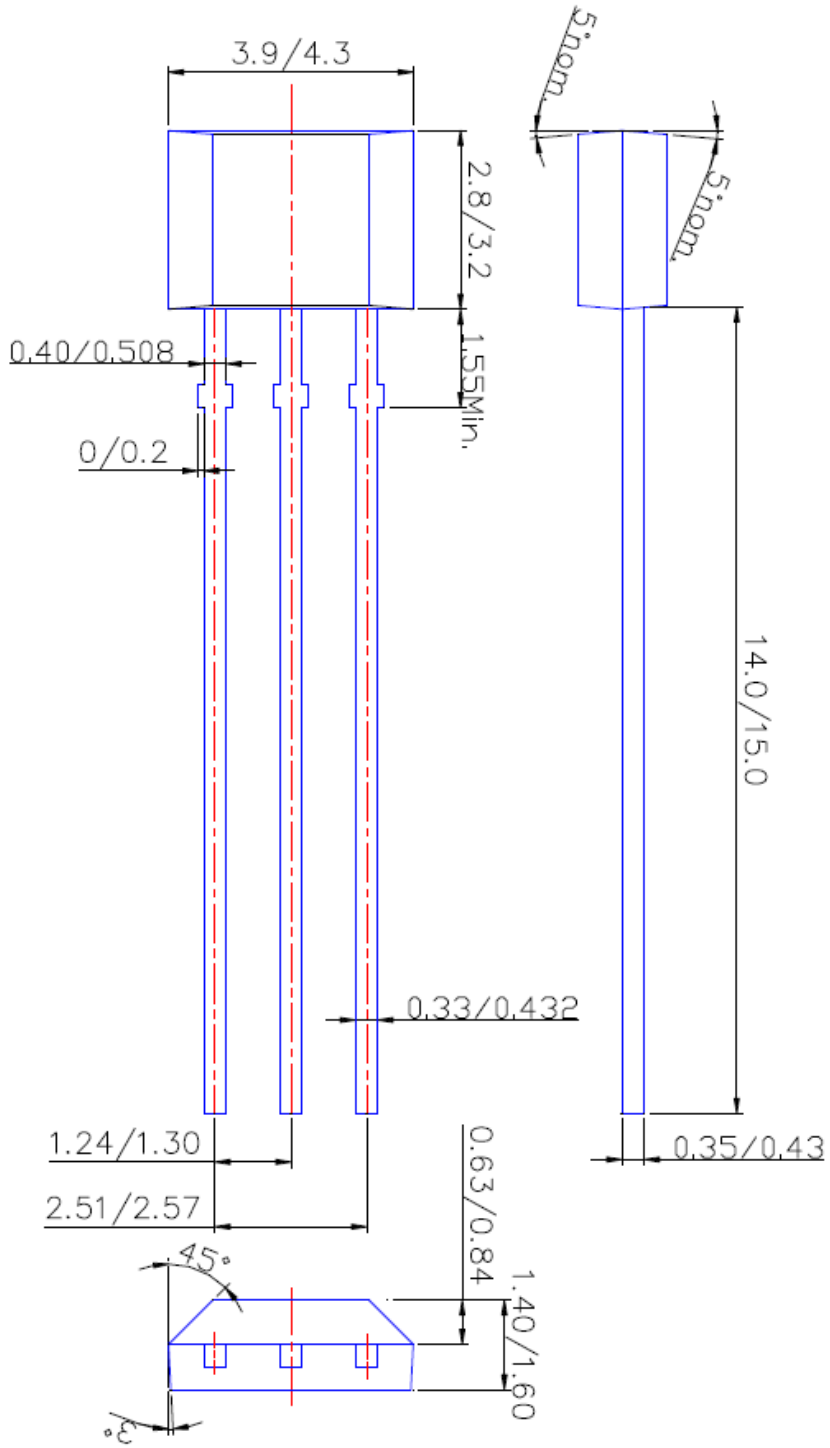


Figure 14: 3-Lead SOT-23 Package Dimensions



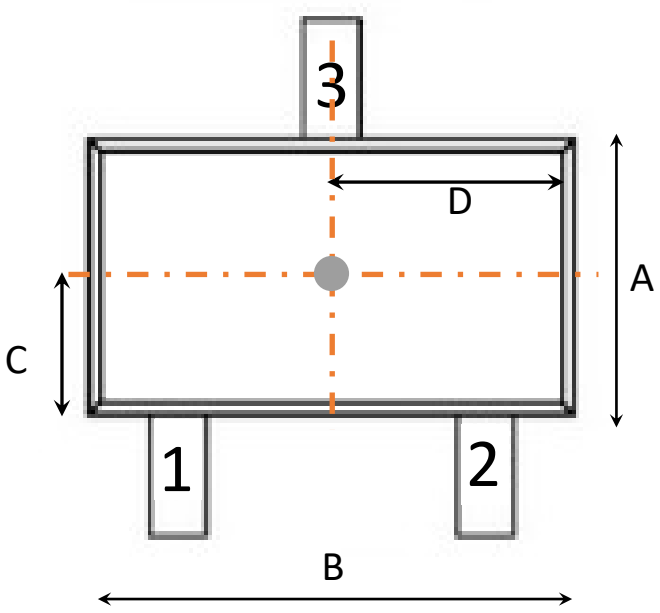
SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.05	1.20	1.35
A1	0.00	0.10	0.15
A2	1.00	1.10	1.20
b	0.30	———	0.50
b1	0.30	0.35	0.45
c	0.08	———	0.22
c1	0.08	0.13	0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e		0.95 BSC	
e1		1.90 BSC	
L	0.35	0.43	0.60
L1		0.60 REF	
L2		0.25 BSC.	
R	0.10	———	———
R1	0.10	———	0.25
θ	0°	4°	8°
θ1	5°	6°	15°
θ2	5°	8°	15°

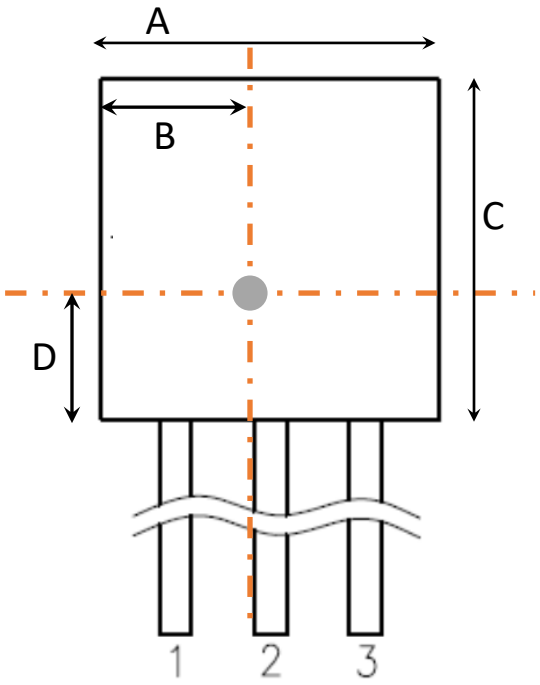
Figure 15: 3-Lead TO-92S Package Dimensions



All Dimensions in mm.

Figure 16: MLU Sensor Location





Symbols	Nominal Dimensions (mm)
A	1.60
B	2.90
C	0.80
D	1.45

Symbols	Nominal Dimensions (mm)
A	4.52
B	1.90
C	4.57
D	1.30

Table 10: Order Guide

Part Number	Digital Output	Average Current	Switching Frequency	Description
CT512VA-IS3	Push-Pull	250 nA	12 Hz	Unipolar Magnetic Switch SOT-23 Package, Tape-and-Reel Package
CT512VB-IS3		6 µA	780 Hz	
CT512VC-IS3		20 µA	3.1 kHz	
CT512VA-IT3		250 nA	12 Hz	Unipolar Magnetic Switch TO-92S Package
CT512VB-IT3		6 µA	780 Hz	
CT512VC-IT3		20 µA	3.1 kHz	
CT511VA-IS3	Open Drain	250 nA	12 Hz	Unipolar magnetic switch SOT-23 Package, Tape-and-Reel Package
CT511VB-IS3		6 µA	780 Hz	
CT511VC-IS3		20 µA	3.1 kHz	
CT511VA-IT3		250 nA	12 Hz	Unipolar Magnetic Switch TO-92S Package
CT511VB-IT3		6 µA	780 Hz	
CT511VC-IT3		20 µA	3.1 kHz	

Table 11. Packaging Information

Orderable Part Number	Package Type	Pins	Package Quantity	Lead Finish	Eco Plan(1)	MSL Rating(2)	Operating Temperature	Device Marking(3)
CT511VA-IS3	SOT-23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	EE YWWZ
CT511VB-IS3	SOT-23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	EE YWWZ
CT511VC-IS3	SOT-23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	EE YWWZ
CT511VA-IT3	TO-92S	3	1,000	Sn	Green & RoHS	N/A	-40°C to +85°C	EE YWWZ
CT511VB-IT3	TO-92S	3	1,000	Sn	Green & RoHS	N/A	-40°C to +85°C	EE YWWZ
CT511VC-IT3	TO-92S	3	1,000	Sn	Green & RoHS	N/A	-40°C to +85°C	EE YWWZ
CT512VA-IS3	SOT-23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	DE YWWZ
CT512VB-IS3	SOT-23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	DE YWWZ
CT512VC-IS3	SOT-23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	DE YWWZ
CT512VA-IT3	TO-92S	3	1,000	Sn	Green & RoHS	N/A	-40°C to +85°C	DE YWWZ
CT512VB-IT3	TO-92S	3	1,000	Sn	Green & RoHS	N/A	-40°C to +85°C	DE YWWZ
CT512VC-IT3	TO-92S	3	1,000	Sn	Green & RoHS	N/A	-40°C to +85°C	DE YWWZ

(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 industry standard classifications.

(3) Device Marking for CT511 is defined as EE YWWZ where EE = part number (CT511), Y = year, WW = work week and S = sequential number. For the CT512 is defined as DE YWWZ where DE = part number (CT512), Y = year, WW = work week and S = sequential number.