TMAG5131-Q1 Automotive Low-Power, High-Precision, Hall-Effect Switch

1 Features

- AEC-Q100 qualified for automotive applications:
  - Temperature grade 1: –40°C to +125°C, T_A
- Z-axis Hall-effect switch
- Ultra-low power consumption (typical $I_{CC(AVG)}$):
  - 10Hz version: 1.25μA at 3V
  - 20Hz versions: 1.37μA at 3V
- Operating V_{CC} range: 1.65V to 5.5V
- High-precision magnetic thresholds (typical B_{OP}):
  - 1.8mT with 0.6mT hysteresis
  - 3mT with 1.2mT or 1.5mT hysteresis
- Omnipolar or unipolar magnetic response
- Push-pull or open-drain output options
- Active-low or active-high output options
- Industry-standard SOT-23 (DBZ) package

2 Applications

- Door handles and E-latches
- Steering column stalk shifter
- Visor, vanity mirror, or glove box light up
- Open, close sensor for trunks
- Wiper motor position sensor
- Brake pedal or rear light actuator
- Sunroofs and tailgates
- Power seat and rocker switches
- Automotive body motor position feedback

3 Description

The TMAG5131-Q1 is a low-power, low-voltage, high-precision, Hall-effect sensor, designed for the most compact and battery-critical automotive applications. The device is offered in multiple magnetic thresholds, sampling rates and output types to accommodate various applications.

When the applied magnetic flux density exceeds the operating point (B_{OP}) threshold, the device outputs a low voltage (for active-low versions). The output stays low until the flux density decreases to less than the release point (B_{RP}), at which point the device outputs a high voltage. The output (low/high) behavior is inversed for active high versions. The omnipolar magnetic response allows the device output to be sensitive to positive and negative magnetic flux through the Z-axis of the package, while the unipolar version responds only to a positive magnetic flux.

The TMAG5131-Q1 is internally power cycled to operate at a very low current consumption. At 3V, the 10Hz version has an average current consumption of 1.25μA, and the 20Hz versions consume 1.37μA.

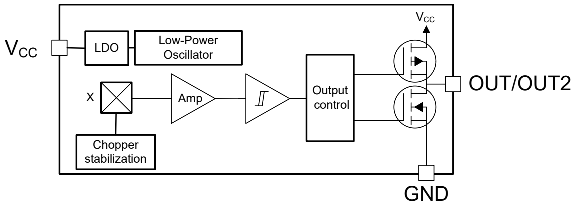
The TMAG5131-Q1 is available in an industry-standard SOT-23 package and pin out.

The device operates at a V_{CC} range of 1.65V to 5.5V as well as an extended temperature range of –40°C to 125°C.

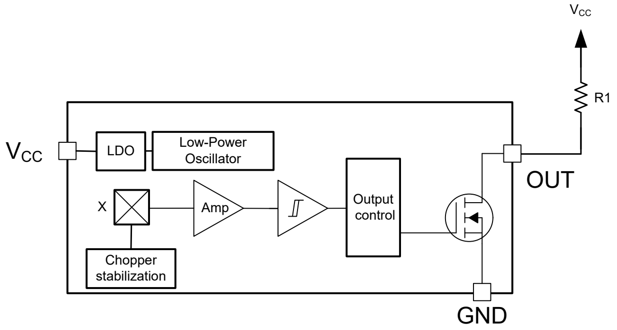
Package Information

PART NUMBER	PACKAGE(1) (2)	PACKAGE SIZE(3)
TMAG5131-Q1	DBZ (SOT-23, 3)	2.92mm × 2.37mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) See the *Device Comparison* table.
(3) The package size (length × width) is a nominal value and includes pins, where applicable.



Block Diagram (Push-Pull)



Block Diagram (Open-Drain)

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4 Device Comparison

Table 4-1. Device Comparison

VERSION	TYPICAL THRESHOLD	TYPICAL HYSTERESIS	MAGNETIC RESPONSE	OUTPUT TYPE	SENSOR ORIENTATION	SAMPLING RATE	PACKAGES AVAILABLE
TMAG5131A1C	1.8mT	0.6mT	Omnipolar Active Low	Push-pull	Z	10Hz	SOT-23
TMAG5131C1D	3mT	1.5mT	Omnipolar Active Low	Push-pull	Z	20Hz	SOT-23
TMAG5131C5D	3mT	1.2mT	Unipolar Active High	Push-pull	Z	20Hz	SOT-23
TMAG5131C7D	3mT	1.5mT	Omnipolar Active Low	Open-drain	Z	20Hz	SOT-23

5 Pin Configuration and Functions

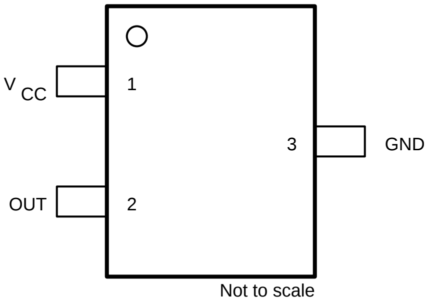


Figure 5-1. DBZ Package 3-Pin SOT-23 (Top View): A1C, C1D, C7D Versions

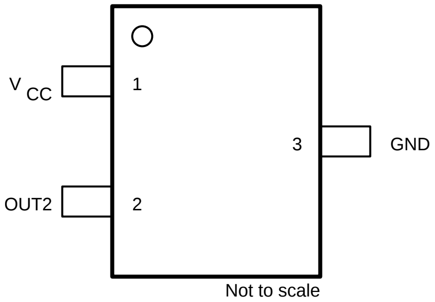


Figure 5-2. DBZ Package 3-Pin SOT-23 (Top View): C5D Version

Table 5-1. Pin Functions

PIN			TYPE(1)	DESCRIPTION
NAME	SOT-23 (A1C, C1D, C7D)	SOT-23 (C5D)		
V_{CC}	1	1	—	1.65V to 5.5V power supply. TI recommends connecting this pin to a ceramic capacitor to ground with a value of at least 0.1µF.
OUT	2		O	Omnipolar output that responds to north and south magnetic poles near the top of the package
OUT2		2	O	Unipolar output that responds to south magnetic poles near the top of the package
GND	3	3	—	Ground reference

(1) O = output

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

		MIN	MAX	UNIT
Power supply voltage	V_{CC}	–0.3	5.5	V
Output pin voltage	OUT, OUT2	GND – 0.3	V_{CC} + 0.3	
Output pin current	OUT, OUT2	–5	5	mA
Magnetic flux density, BMAX		Unlimited		T
Junction temperature, T_J			150	°C
Storage temperature, T_{stg}		–65	150	°C

(1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)	±2000	V
		Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002, all pins(2)	± 500	

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{CC}	Power supply voltage	1.65	5.5	V
V_O	Output voltage	0	5.5	V
I_O	Output current	–5	5	mA
T_A	Ambient temperature	–40	125	°C

6.4 Thermal Information

THERMAL METRIC(1)		TMAG5131-Q1	UNIT
		SOT-23 (DBZ)	
		3 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	227.4	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	122.7	
$R_{\theta JB}$	Junction-to-board thermal resistance	61.2	
Ψ_{JT}	Junction-to-top characterization parameter	21.3	
Ψ_{JB}	Junction-to-board characterization parameter	60.8	

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report.

6.5 Electrical Characteristics

for V_{CC} = 1.65V to 5.5V, over operating free-air temperature range (unless otherwise noted)

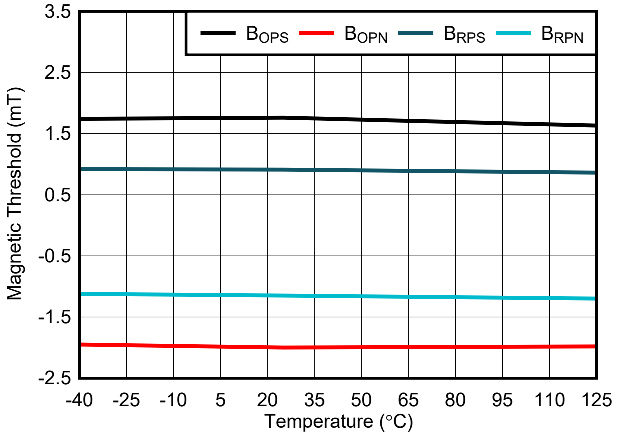
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
OPEN-DRAIN OUTPUT						
I_{OZ}	High impedance output leakage current	V_{CC} = 5.5V, OUT = 5.5V		5	100	nA
V_{OL}	Low-level output voltage	I_{OUT} = 1mA		0.1	0.3	V
PUSH-PULL OUTPUT DRIVER						
V_{OH}	High-level output voltage	I_{OUT} = -0.5mA	Vcc-0.35	Vcc-0.1		V
V_{OL}	Low-level output voltage	I_{OUT} = 0.5mA		0.1	0.3	V
A1C VERSION						
f_s	Frequency of magnetic sampling		7	10	14.5	Hz
t_s	Period of magnetic sampling		68	100	143	ms
$I_{CC(AVG)}$	Average current consumption	V_{CC} = 3V Temperature = 25°C		1.25	1.6	μA
		V_{CC} = 3V Temperature = -40°C to 125°C		1.25	2.2	μA
C1D, C5D, C7D VERSIONS						
f_s	Frequency of magnetic sampling		13	20	29	Hz
t_s	Period of magnetic sampling		35	50	77	ms
$I_{CC(AVG)}$	Average current consumption	V_{CC} = 3V Temperature = 25°C		1.37	2.1	μA
		V_{CC} = 3V Temperature = -40°C to 125°C		1.37	2.7	μA
ALL VERSIONS						
$I_{CC(PK)}$	Peak current consumption		0.8	1.25	2	mA
$I_{CC(SLP)}$	Sleep current consumption			0.8	1.4	μA
t_{ON}	Power-on time			55	100	μs
t_{ACTIVE}	Active time period		20	30	40	

6.6 Magnetic Characteristics

for VCC = 1.65V to 5.5V, over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
A1C VERSION						
B_{OP}	Magnetic operate point	Temperature = 25°C	±1.2	±1.8	±2.5	mT
		Temperature = –40°C to 125°C	±0.9	±1.8	±2.7	mT
B_{RP}	Magnetic release point	Temperature = 25°C	±0.5	±1.2	±1.5	mT
		Temperature = –40°C to 125°C	±0.3	±1.2	±2	mT
B_{HYS}	Magnetic hysteresis	Temperature = 25°C	±0.3	±0.6	±1.4	mT
		Temperature = –40°C to 125°C	±0.2	±0.6	±1.4	mT
C1D, C7D VERSIONS						
B_{OP}	Magnetic operate point	Temperature = 25°C	±2.4	±3	±3.8	mT
		Temperature = –40°C to 125°C	±2	±3	±4	mT
B_{RP}	Magnetic release point	Temperature = 25°C	±0.8	±1.5	±1.9	mT
		Temperature = –40°C to 125°C	±0.5	±1.5	±2.4	mT
B_{HYS}	Magnetic hysteresis	Temperature = 25°C	±1.2	±1.5	±2.4	mT
		Temperature = –40°C to 125°C	±1	±1.5	±2.5	mT
C5D VERSION						
B_{OP}	Magnetic operate point	Temperature = 25°C	2.4	3	3.6	mT
		Temperature = –40°C to 125°C	2	3	3.8	mT
B_{RP}	Magnetic release point	Temperature = 25°C	1.2	1.8	2.3	mT
		Temperature = –40°C to 125°C	1	1.8	2.6	mT
B_{HYS}	Magnetic hysteresis	Temperature = 25°C	0.7	1.2	1.7	mT
		Temperature = –40°C to 125°C	0.6	1.2	2	mT

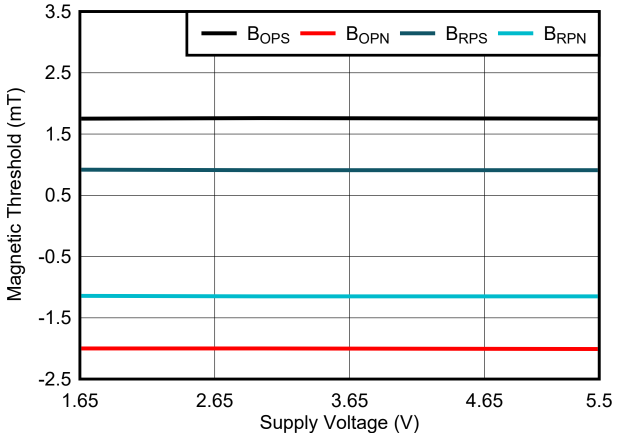
6.7 Typical Characteristics



V_{CC} = 3V

Version: A1C

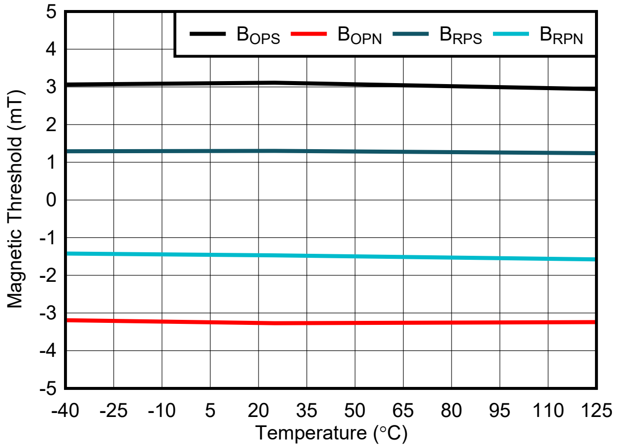
Figure 6-1. 1.8mT B_{OP}: Thresholds vs Temperature



T_A = 25°C

Version: A1C

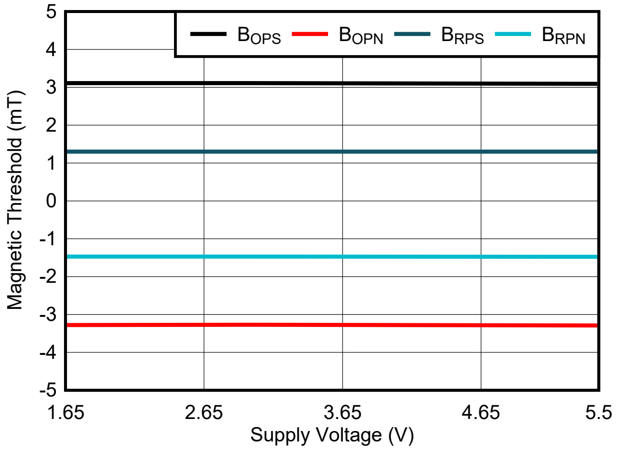
Figure 6-2. 1.8mT B_{OP}: Thresholds vs Supply Voltage



V_{CC} = 3V

Versions: C1D, C7D

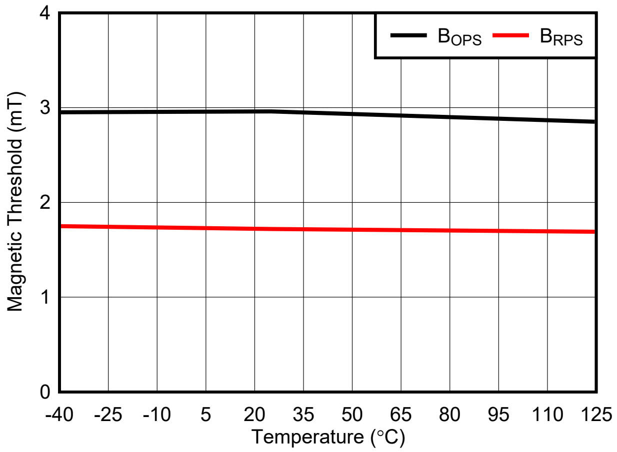
Figure 6-3. 3mT B_{OP}, 1.5mT B_{HYS}: Thresholds vs Temperature



T_A = 25°C

Versions: C1D, C7D

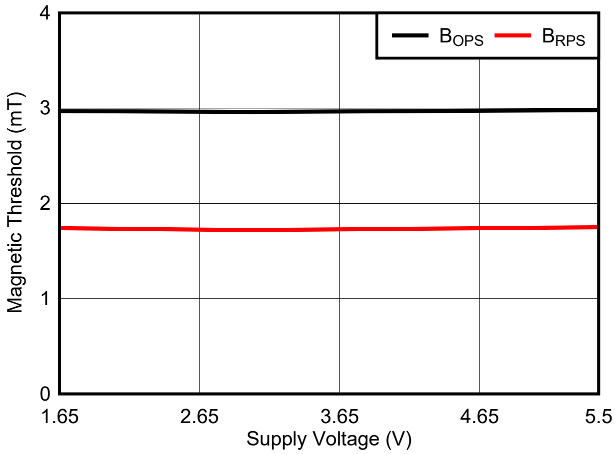
Figure 6-4. 3mT B_{OP}, 1.5mT B_{HYS}: Thresholds vs Supply Voltage



V_{CC} = 3V

Version: C5D

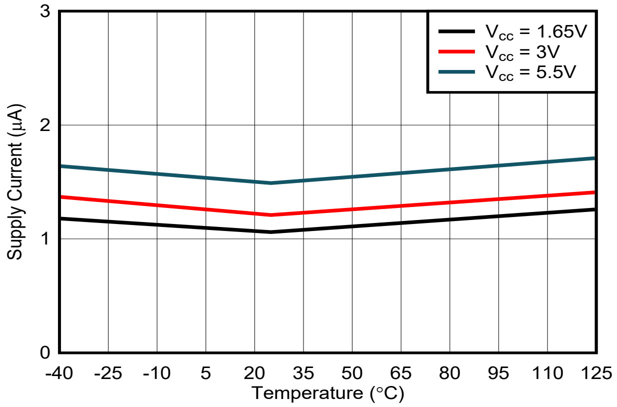
Figure 6-5. 3mT B_{OP}, 1.2mT B_{HYS}: Thresholds vs Temperature



T_A = 25°C

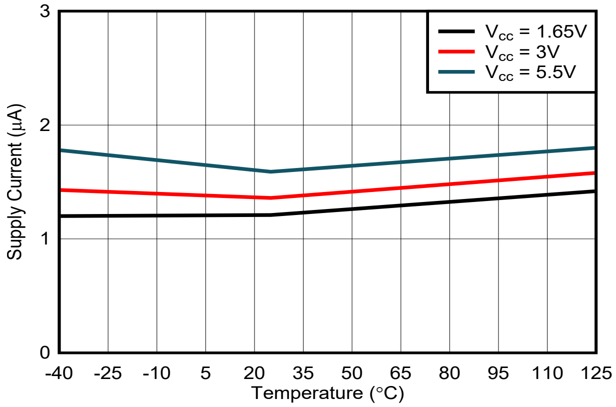
Version: C5D

Figure 6-6. 3mT B_{OP}, 1.2mT B_{HYS}: Thresholds vs Supply Voltage



Version: A1C

Figure 6-7. 10Hz: Average I_{CC} vs Temperature



Versions: C1D, C5D, C7D

Figure 6-8. 20Hz: Average I_{CC} vs Temperature

7 Detailed Description

7.1 Overview

The TMAG5131-Q1 device is a Z-axis Hall-effect sensor with a digital output that indicates when the magnetic flux density threshold has been crossed. The output type is available in a push-pull or open-drain configuration, and can be either active-low (outputs low when B_{OP} has been crossed) or active-high (outputs high when B_{OP} has been crossed). The magnetic output response of the device is available as an omnipolar or unipolar switch. The device integrates a Hall-effect element, analog signal conditioning, and a low-frequency oscillator that enables ultra-low power consumption. To achieve this low power consumption, the device periodically measures the magnetic flux density, updates its output, and then enters into a low-power sleep state in between measurements. With a temperature range of –40°C to 125°C and a supply range of 1.65V to 5.5V, the TMAG5131-Q1 is designed for a wide range of applications, including those that require low power operation.

7.2 Functional Block Diagrams

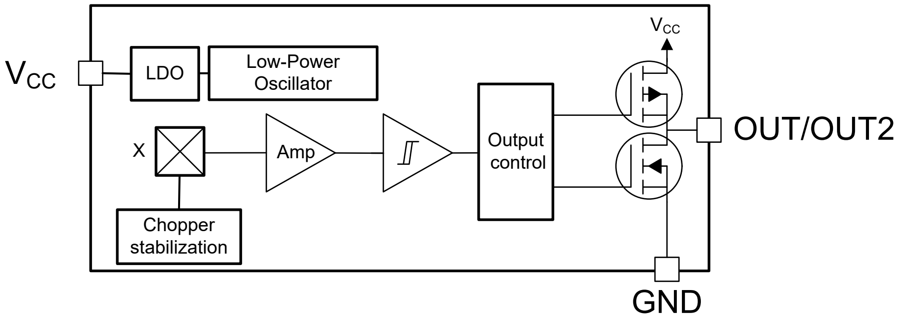


Figure 7-1. Block Diagram (Push-Pull)

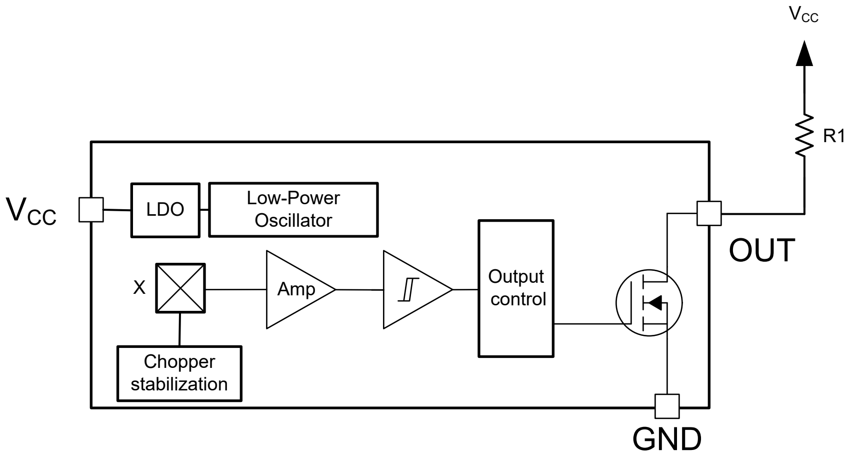


Figure 7-2. Block Diagram (Open-Drain)

7.3 Feature Description

7.3.1 Magnetic Flux Direction

Figure 7-3 shows that the TMAG5131-Q1 device is sensitive to the magnetic field component that is perpendicular to the top of the package.

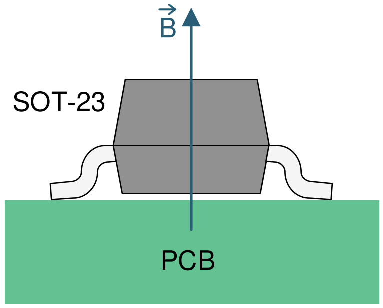


Figure 7-3. Direction of Sensitivity

Magnetic flux that travels from the bottom to the top of the package is considered positive in this data sheet. This condition exists when a south magnetic pole is near the top of the package. Magnetic flux that travels from the top to the bottom of the package is considered negative in this data sheet. This condition exists when a north magnetic pole is near the top of the package.

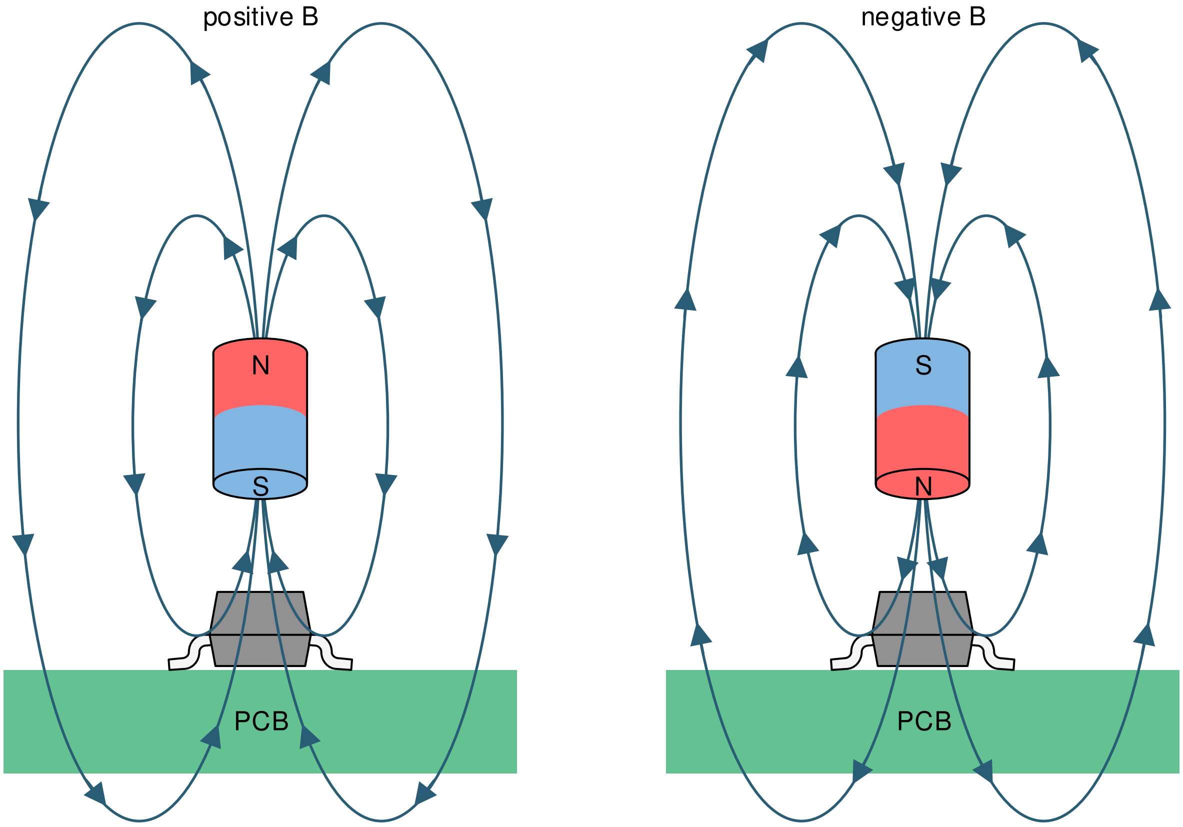


Figure 7-4. Flux Direction Polarity

7.3.2 Magnetic Response

The TMAG5131-Q1 A1C, C1D, and C7D versions have an omnipolar magnetic response and an active low output. Figure 7-5 shows that the onmipolar output responds to both positive and negative magnetic flux, and goes low when B_{OP} is crossed.

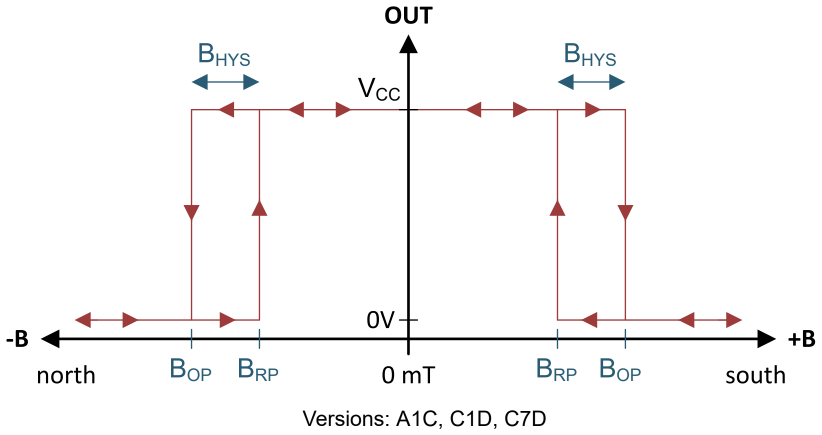


Figure 7-5. Omnipolar Active Low Functionality

The TMAG5131-Q1 C5D version has a unipolar magnetic response and an active high output. Figure 7-6 shows that the unipolar output responds to a positive magnetic flux, and goes high when B_{OP} is crossed.

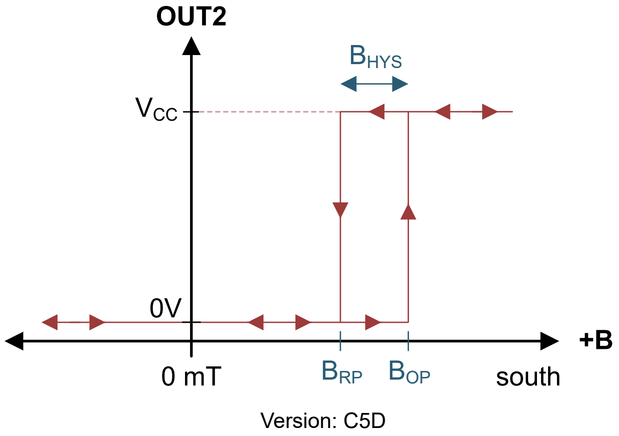
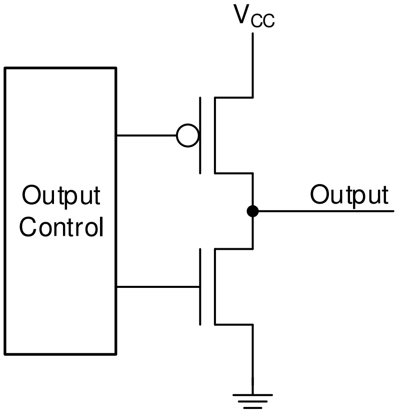


Figure 7-6. Unipolar Active High Functionality

7.3.3 Output Type

The TMAG5131-Q1 A1C, C1D, and C5D versions have a push-pull CMOS output which can drive a V_{CC} or ground voltage level.

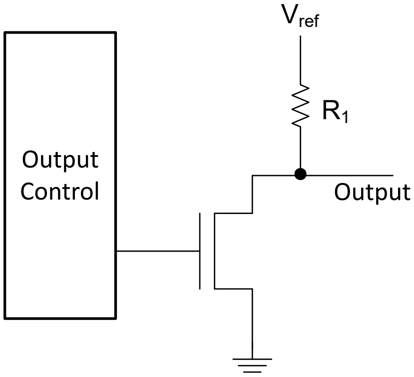


Versions: A1C, C1D, C5D

Figure 7-7. Push-Pull Output (Simplified)

The C7D version has an open-drain output. For this open-drain output version, an external pullup resistor must be used. Use Equation 1 to calculate the minimum resistance value required for this pullup resistor. Use 1mA as the I_{OL} maximum for this device to achieve the V_{OL} maximum specification listed in the data sheet. Generally, TI recommends to use a resistor with a 10kΩ nominal value.

$$R_1 > \frac{V_{ref}}{I_{OL\ max}} \tag{1}$$



Version: C7D

Figure 7-8. Open-Drain Output (Simplified)

7.3.4 Sampling Rate

When the TMAG5131-Q1 powers up, the device measures the first magnetic sample and sets the output within the t_{ON} time. The output is latched, and the device enters an ultra low power sleep state. After each t_S time has passed, the device measures a new sample and updates the output if necessary. If the magnetic field has not changed between periods, the output also does not change.

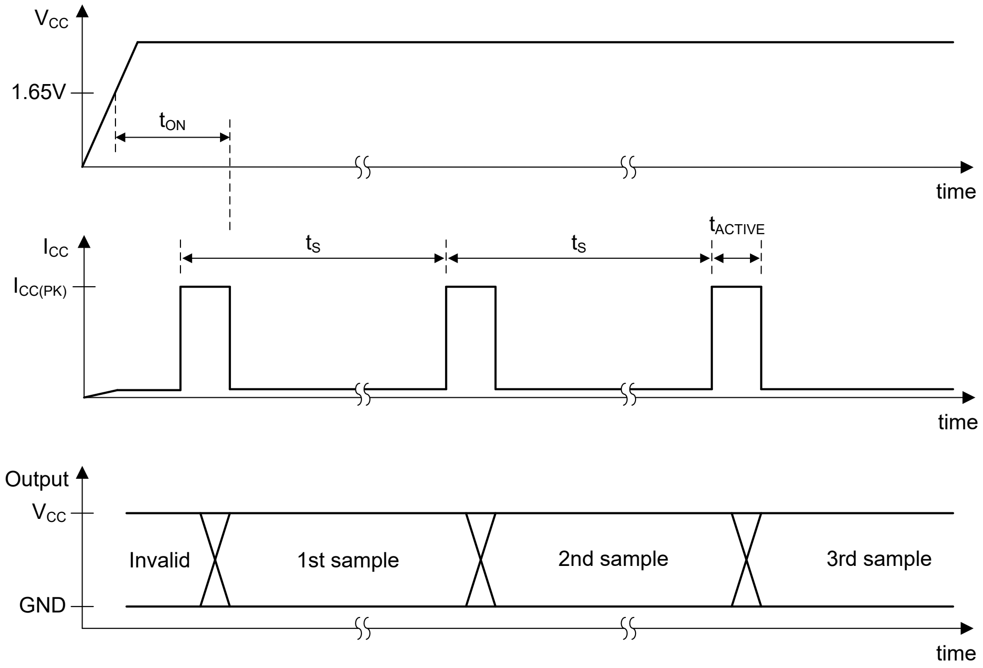


Figure 7-9. Timing Diagram

7.3.5 Hall Element Location

The sensing element inside the device is in the center of the SOT-23 package when viewed from the top. Figure 7-10 shows the tolerances and side-view dimensions.

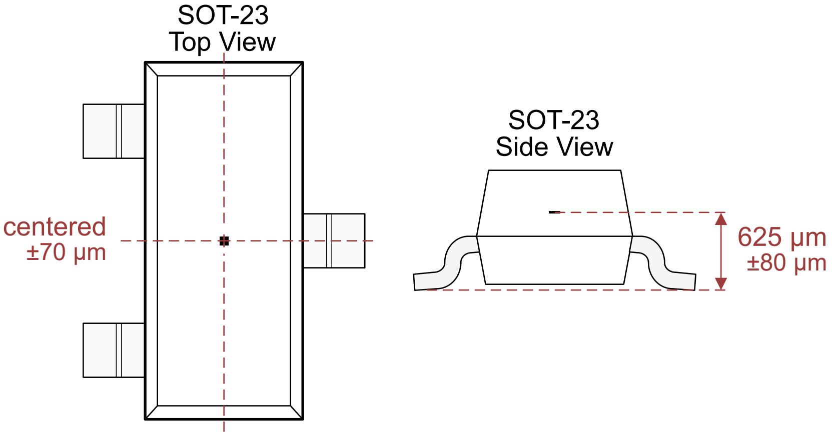


Figure 7-10. Hall Element Location

7.4 Device Functional Modes

The TMAG5131-Q1 device has one mode of operation that applies when operated within the *Recommended Operating Conditions*.

8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

The TMAG5131-Q1 device is typically used to detect the proximity of a magnet. The magnet is often attached to a movable component in the system.

8.1.1 Defining the Design Implementation

The first step of the design is identifying the general design implementation. Define whether the magnet that needs to be detected is sliding past the sensor, moving head-on toward the sensor, or swinging toward the sensor on a hinge. Figure 8-1 shows examples for each of the aforementioned design implementations.

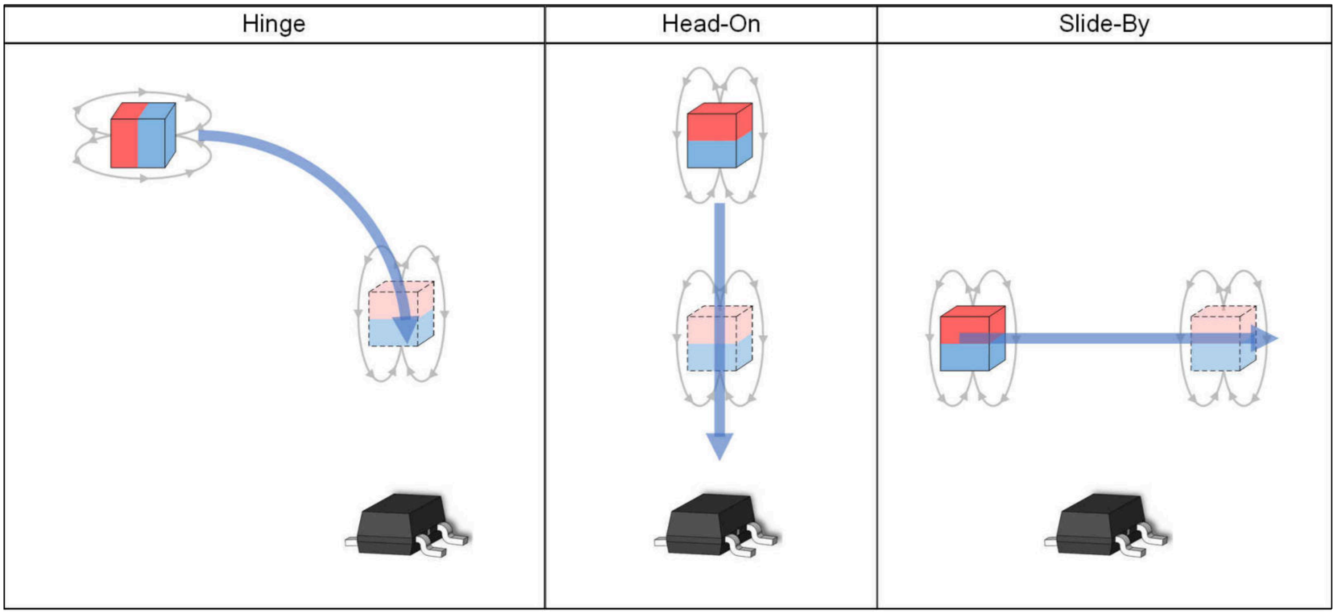


Figure 8-1. Design Implementations

With each implementation, the objective is to design the system such that the spatial coordinates of the transition region fall within the spatial coordinates associated with the B_{OP} maximum and B_{RP} minimum specifications. Figure 8-2 shows a head-on example that shows how the location corresponding to the device B_{OPMAX} and B_{RPMIN} fall within the desired transition region. To facilitate rapid design iteration, TI's *Magnetic Sense Simulator (TIMSS)* webtool is leveraged in the following design examples.

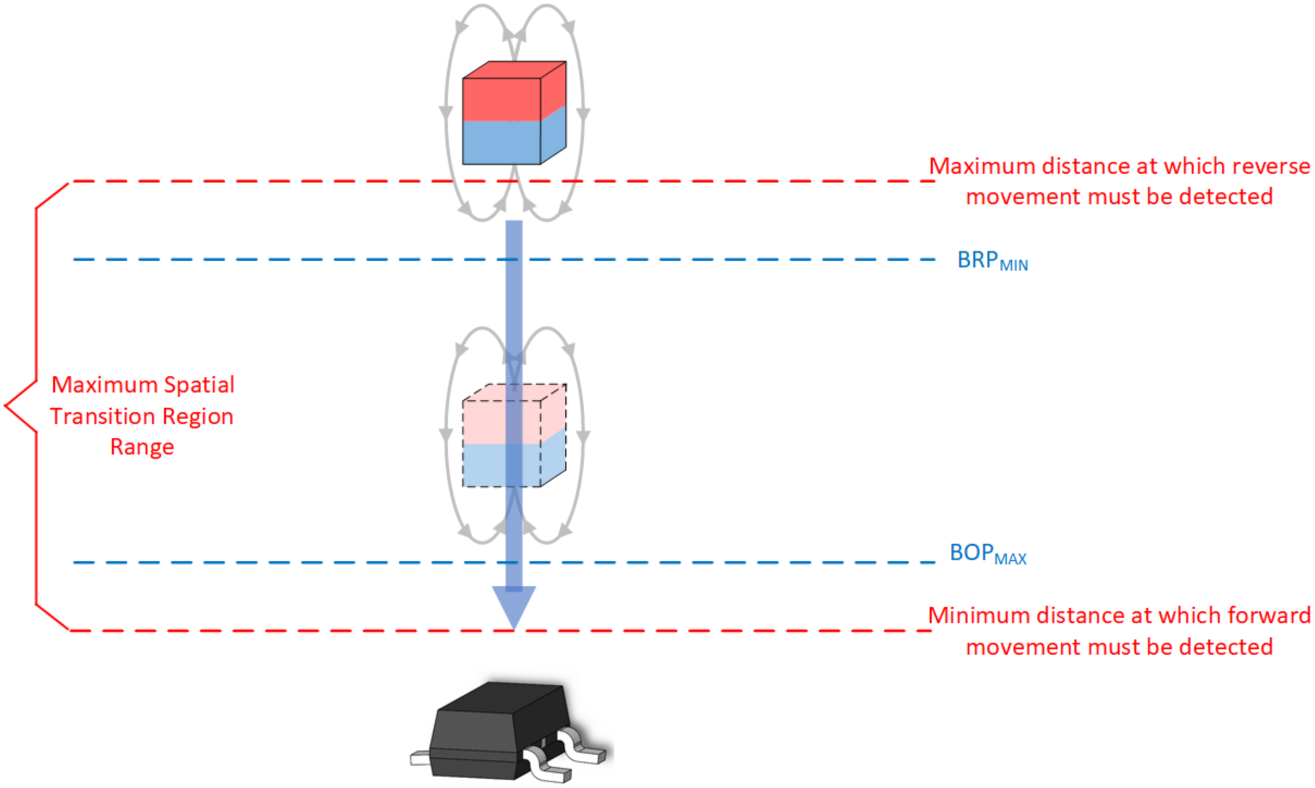


Figure 8-2. Head-On Example

8.2 Typical Applications

8.2.1 Hinge

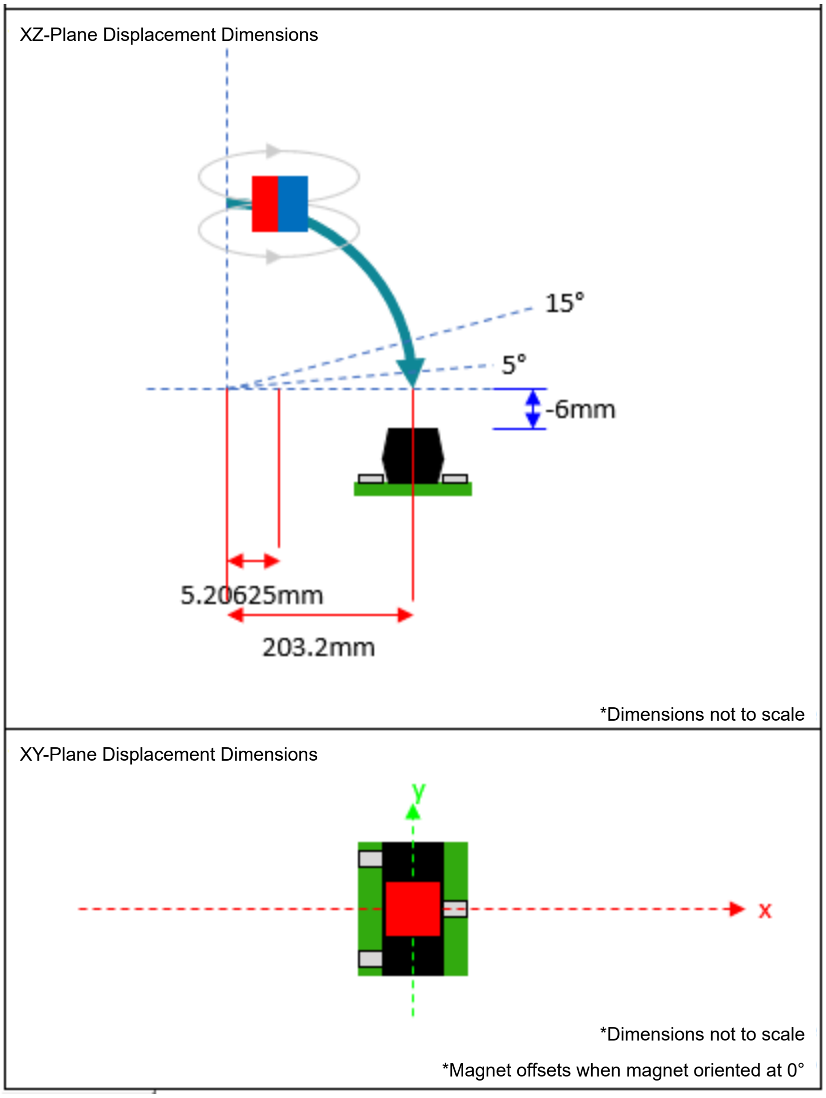


Figure 8-3. Typical Application Diagram

8.2.1.1 Design Requirements

Table 8-1 lists the design parameters for this example.

Table 8-1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
V_{CC}	3.3V
Switch Region	5° to 15°
Max Magnet Height	9.525mm (⅜ inch)
Max Magnet Width or Length	25.4mm (1 inches)
Fixture Width	304.8mm (12 inches)
Fixture Length	228.6mm (9 inches)
Sensor Distance from Hinge Origin	6mm (0.23622 inch)
Center of Magnet Offset from Hinge Origin	≥ (6mm – Magnet Height/2)

8.2.1.2 Detailed Design Procedure

Due to the complex non-linear behavior magnets and the number of variables that can influence it, some experimentation is required to solve for a design that will work. This application uses a simple axial, dipole, block magnet. Users can consider other shapes for different field strengths or prices. A neodymium type of magnet (N52) is used. At the time of this writing, N52 can be commonly found with heights of 1/16", 1/8", 3/16", and 1/4". As price often increases with size, the first design attempt will be with a 1/16" thick magnet, which has a width and length equal to 0.25". Based on the sensor distance from hinge origin and fixture dimension constraints, there is a lot of flexibility on where the sensor can be placed. Due to other hardware within the fixture, the TMAG5131C1DQDBZRQ1 sensor is placed 203.2mm (8") from the origin. From there, the user can assess a design with the following displacement dimensions.

Figure 8-4 shows that the b-field magnitude for the TMAG5131C1DQDBZRQ1 is not adequate for the spatial constraints of 5° and 15°, as the B_Z magnitude only surpasses the B_{RP} minimum. There are a few options on how to proceed. As the $B_{OP(Max)}$ does not fall within our range, the user must increase field strength. This can be accomplished with a thicker magnet or by adjusting sensor and magnet z-offsets. The magnet cannot get any closer due to enclosure constraints, therefore the only option allowed is to increase the magnet thickness. After a few more iterations with the tool, a 0.25" × 0.25" × 0.375" magnet can work (see Figure 8-5 and Figure 8-6).

8.2.1.3 Application Curves

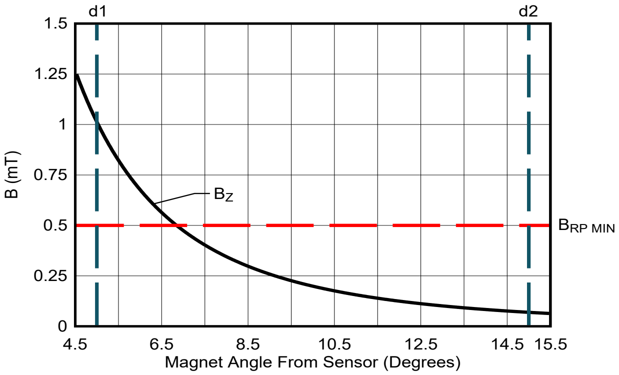


Figure 8-4. B-Field Hypothesis One

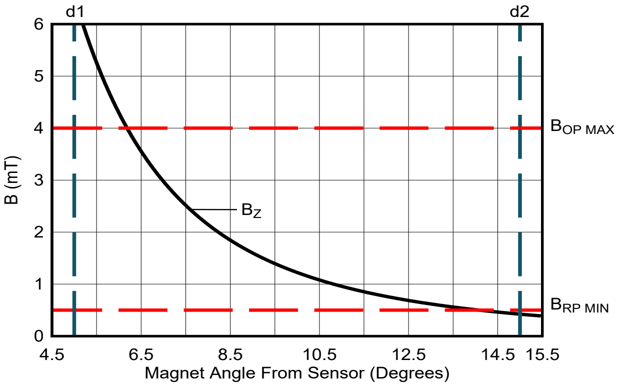


Figure 8-5. B-Field Hypothesis Two

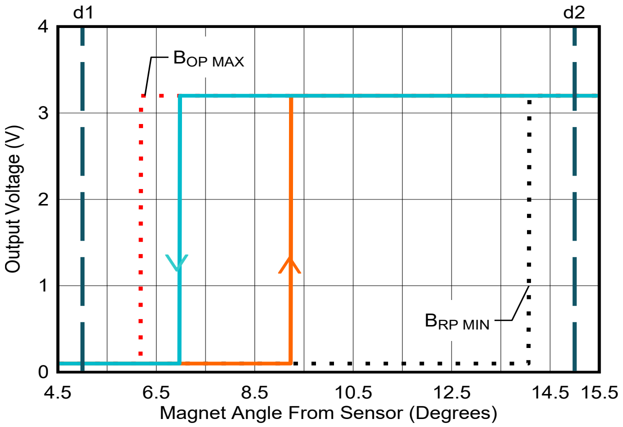


Figure 8-6. Thresholds From Hypothesis Two

8.2.2 Head-On

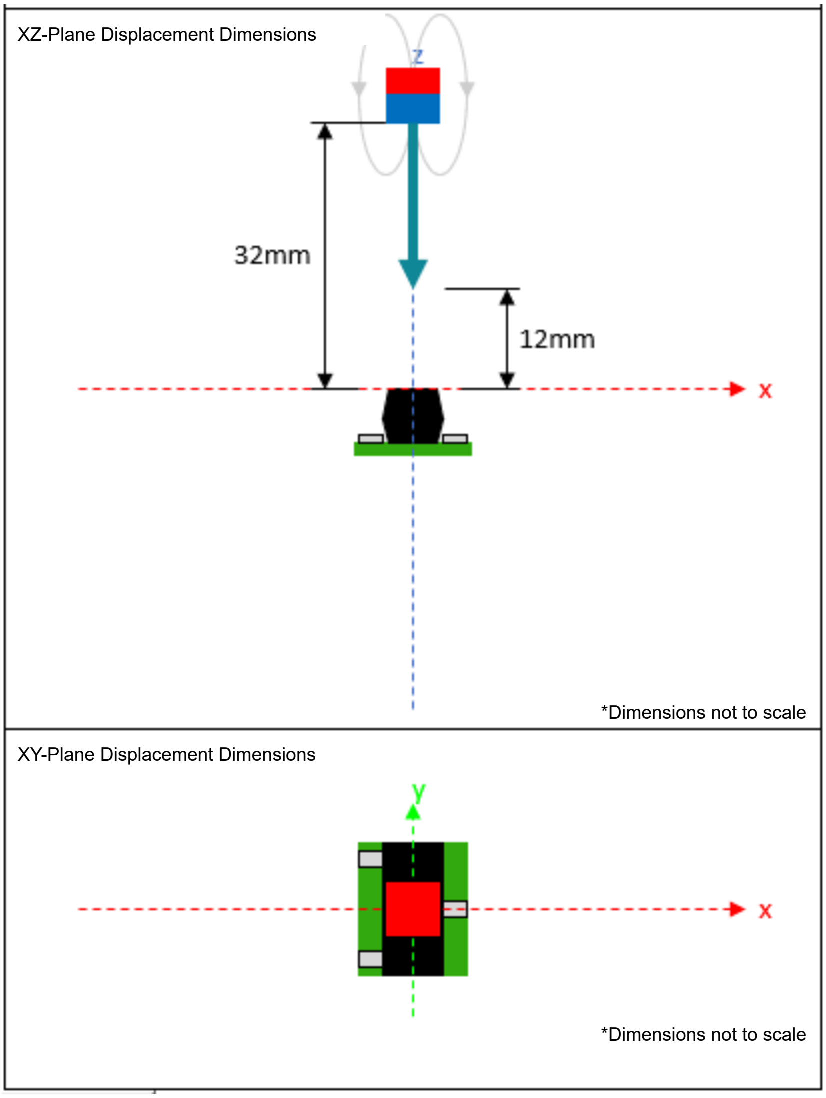


Figure 8-7. Typical Application Diagram

8.2.2.1 Design Requirements

Table 8-2 lists the design parameters for this example.

Table 8-2. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
V_{CC}	3.3V
Switch Region	Between 10mm and 30mm from sensor fixture surface
Sensor Distance from Equipment Outer Surface	2mm (0.0787 inch)
Magnet Length	25.4mm (< 1 inch)
Magnet Width	25.4mm (< 1 inch)
Magnet Height	6.35mm (< 1/4 inch)
Magnet Type	N42

8.2.2.2 Detailed Design Procedure

In this particular case, there are several N42 magnets available from prior projects. As the desired transition region is where the magnet surface is at least 12mm (10mm + 2mm) away from the sensor, we try an initial design with one of our larger magnets (3/8" × 3/16" × 3/16"). Figure 8-8 shows the respective curve for this magnet along the movement along with the magnetic thresholds of the TMAG5131C1DQDBZRQ1.

While the B_Z magnitude adequately exceeds the B_{OPMAX}, the B_Z does not quite reach the B_{RPMIN}. Therefore, the user must make some adjustments so that B_Z falls below B_{RPMIN} within the desired operating range. To reduce B_Z, there are a few options. The user can offset the magnet or choose a smaller magnet. After iterating through increasing x-offsets and y-offsets as well as decreasing magnet thicknesses, the user can eventually find a solution that works. In this case, a 3/8" × 3/16" × 1/16" N42 magnet with no x or y offset from the sensor center is used. Figure 8-9 and Figure 8-10 shows the curves corresponding to the final magnet parameters.

8.2.2.3 Application Curve

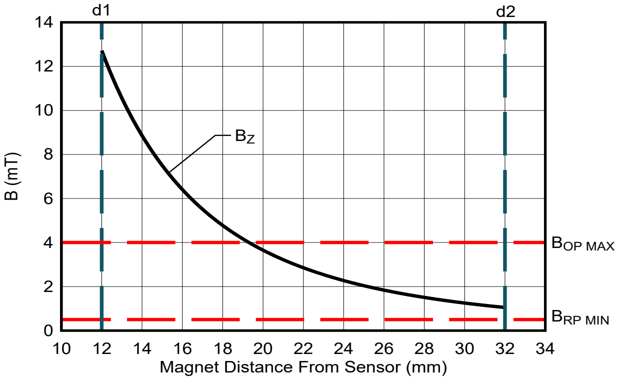


Figure 8-8. B-Field Hypothesis One

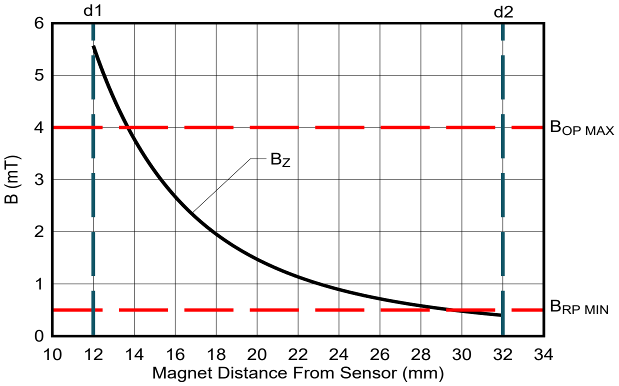


Figure 8-9. B-Field Hypothesis Two

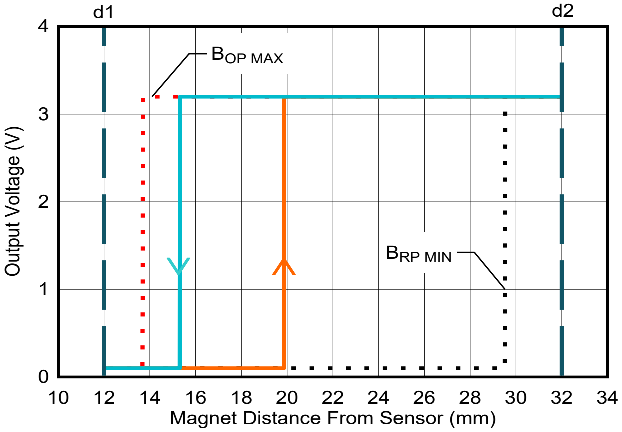


Figure 8-10. Thresholds From Hypothesis Two

8.2.3 Slide-By

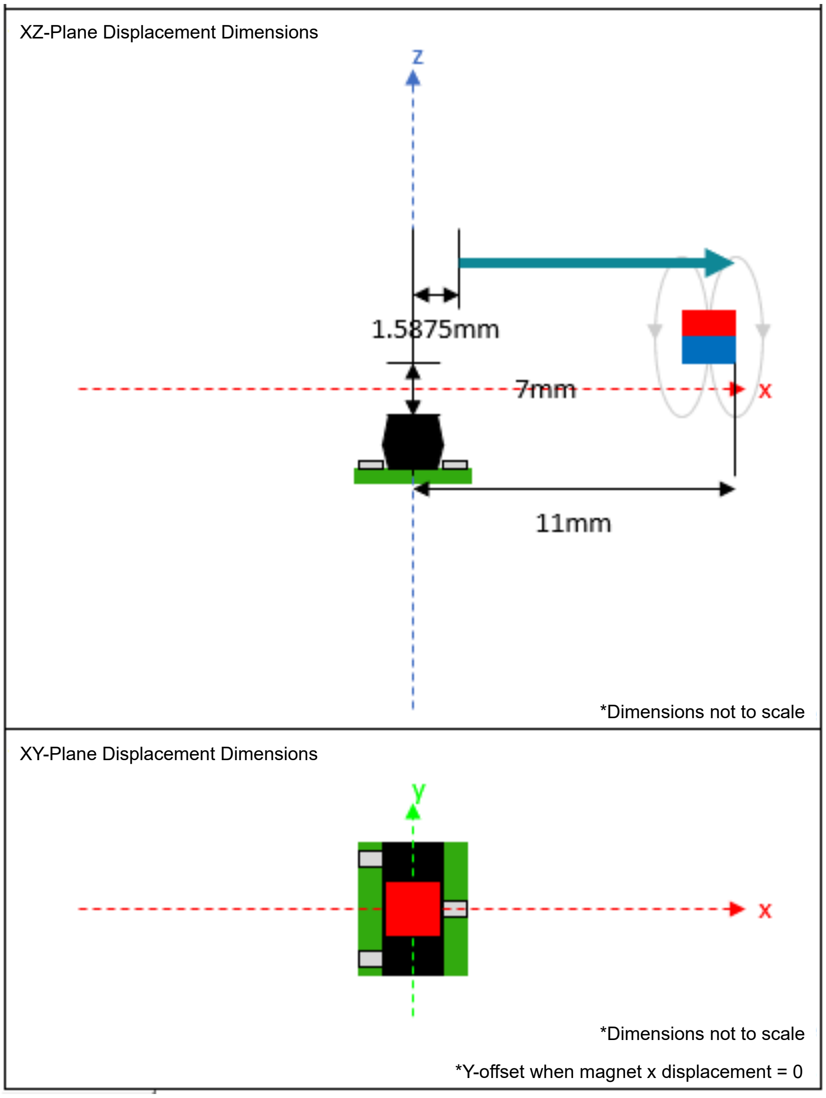


Figure 8-11. Typical Application Diagram

8.2.3.1 Design Requirements

Table 8-3 lists the sign parameters for this example.

Table 8-3. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
V_{CC}	3.3V
Magnet Range of Motion	11mm (< 0.433 inch)
Sensor Distance from Equipment Outer Surface	6mm (> 0.236 inch)
Magnet Length	12.7mm (< 1/2 inch)
Magnet Width	12.7mm (< 1/2 inch)
Magnet Height	3.175mm (< 1/8 inch)
Magnet Type	N42

8.2.3.2 Detailed Design Procedure

For this particular case involving the TMAG5131C1DQDBZRQ1, the user can arbitrarily start with a 1/8" × 1/8" × 1/16" magnet, a z-offset of 7mm (>6mm), and an initial displacement of one half of the magnet length (1/8"/2 = 1/16") and serendipitously get something that works (see Figure 8-12 and Figure 8-13). The right edge of the magnet cannot exceed 11mm, meaning the center of the magnet cannot exceed 9.4125mm (11 - 1.5875). Had the B-field not exceeded B_{OPMAX}, the user can try moving the magnet closer on the z-axis, made the magnet larger, or changed the magnet to one with higher permeability. Alternatively, if the b-field was too large, the magnet can be moved further away in each axis or a smaller magnet can be used.

8.2.3.3 Application Curve

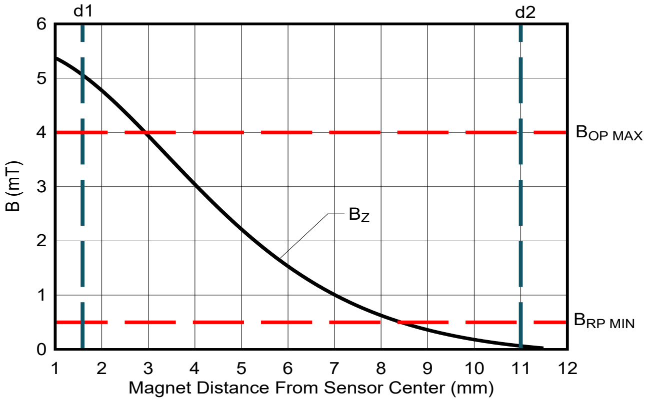


Figure 8-12. B-Field Hypothesis One

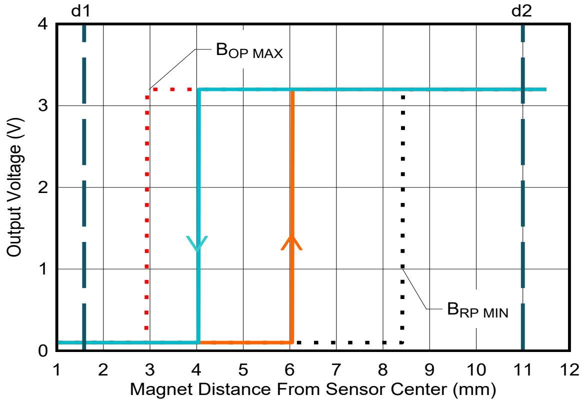


Figure 8-13. Thresholds From Hypothesis One

8.3 Power Supply Recommendations

The TMAG5131-Q1 device is powered from 1.65V to 5.5V DC power supplies. A decoupling capacitor close to the device must be used to provide local energy with minimal inductance. TI recommends using a ceramic capacitor with a value of at least 0.1µF.

8.4 Layout

8.4.1 Layout Guidelines

Magnetic fields pass through most non-ferromagnetic materials with no significant disturbance. Embedding Hall effect sensors within plastic or aluminum enclosures and sensing magnets on the outside is common practice. Magnetic fields also easily pass through most printed circuit boards (PCBs), which makes the placement of the magnet on the opposite side possible.

8.4.2 Layout Example

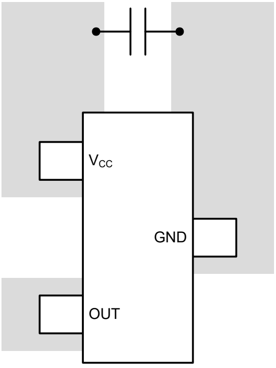


Figure 8-14. SOT-23 Layout Example

9 Device and Documentation Support

9.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

9.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

9.3 Trademarks

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All trademarks are the property of their respective owners.

9.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

9.5 Glossary

TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

Changes from Revision A (February 2024) to Revision B (February 2024) **Page**

- Changed Figure 7-10 13

Changes from Revision * (April 2023) to Revision A (February 2024) **Page**

- Changed data sheet status from: Advanced Information to: Production Data.......... 1
- Added the A1C and C5D device versions to the data sheet.......... 1

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11 Mechanical and Packaging Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TMAG5131A1CQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33EH	Samples
TMAG5131C1DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	32ZH	Samples
TMAG5131C5DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33BH	Samples
TMAG5131C7DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33AH	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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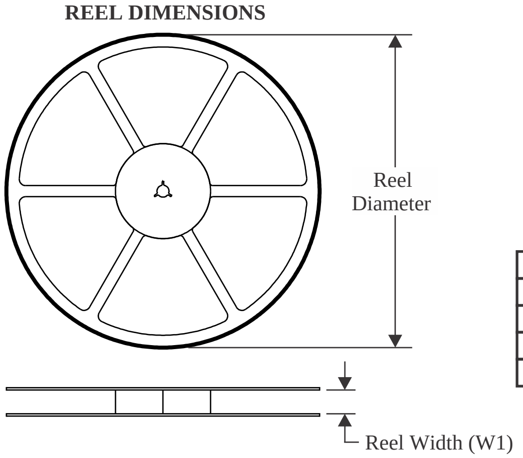
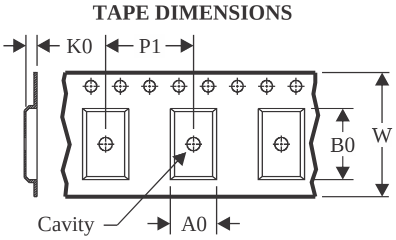
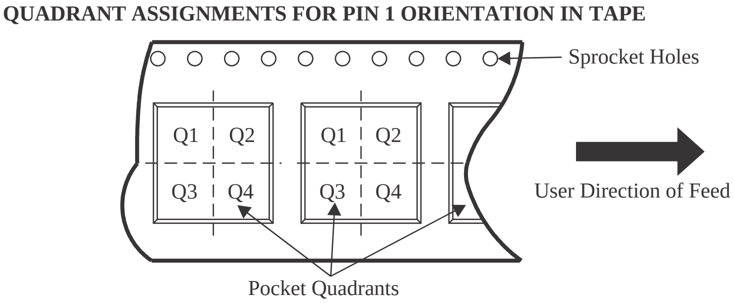
TAPE AND REEL INFORMATION





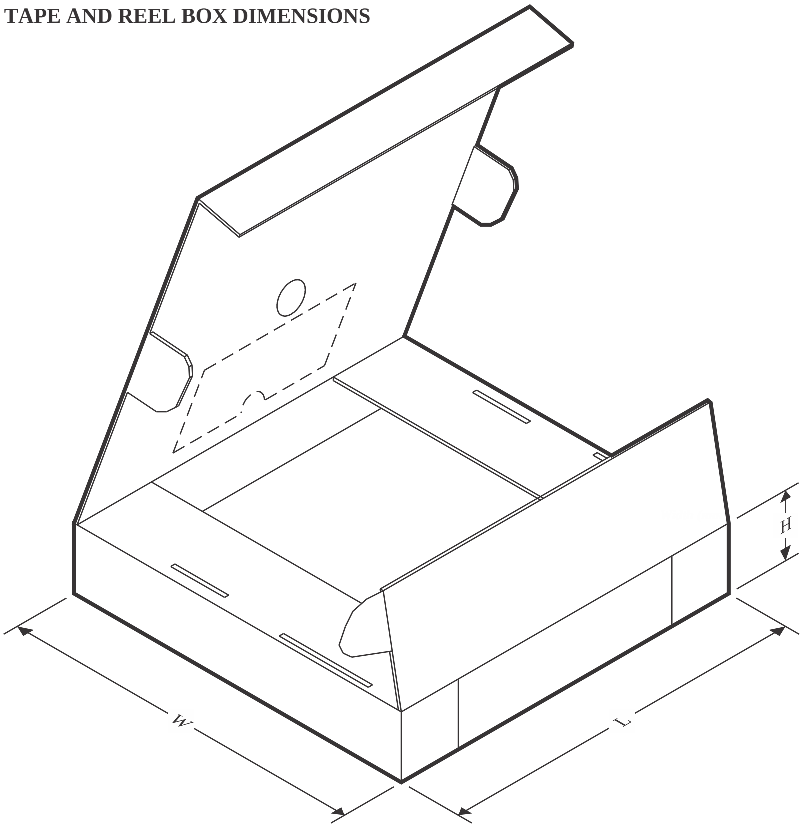
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TMAG5131A1CQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131C1DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131C5DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131C7DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3

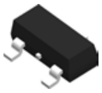
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TMAG5131A1CQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131C1DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131C5DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131C7DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0

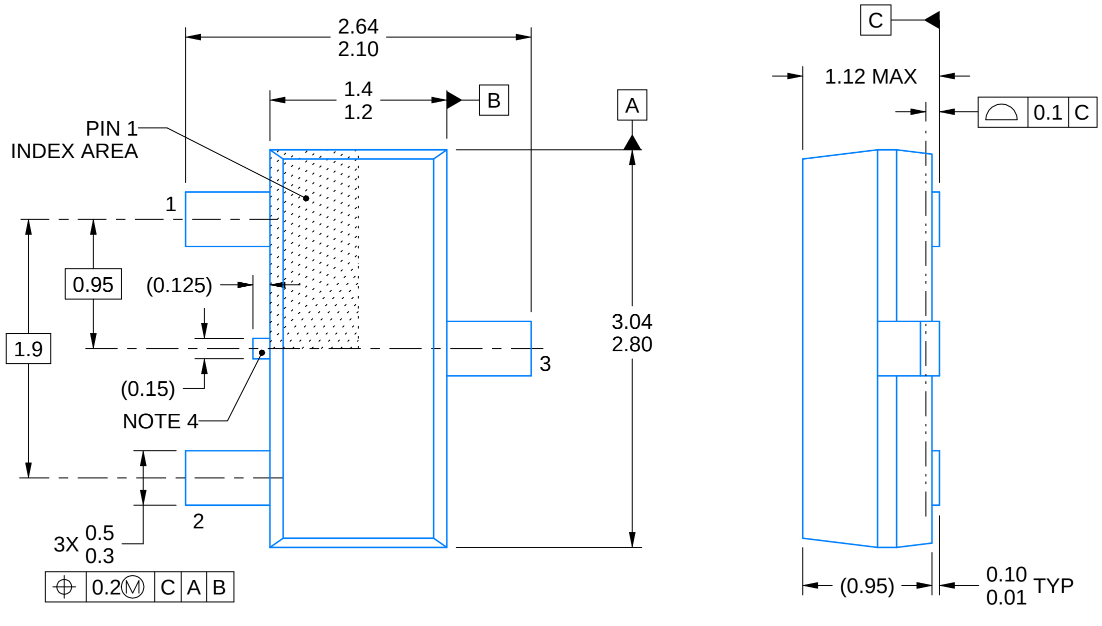
PACKAGE OUTLINE

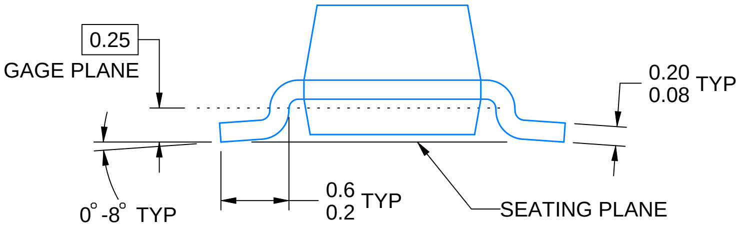


DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR

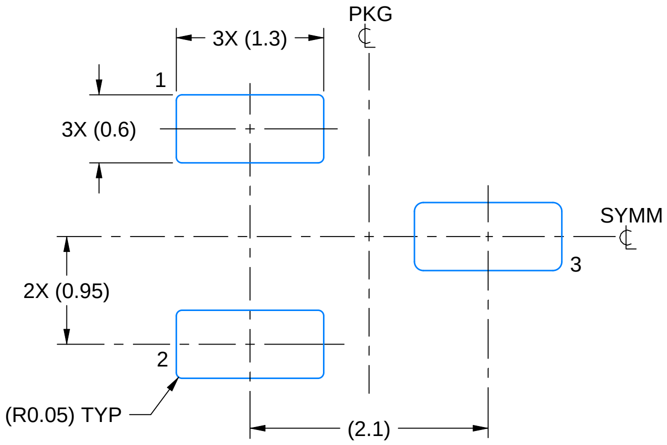




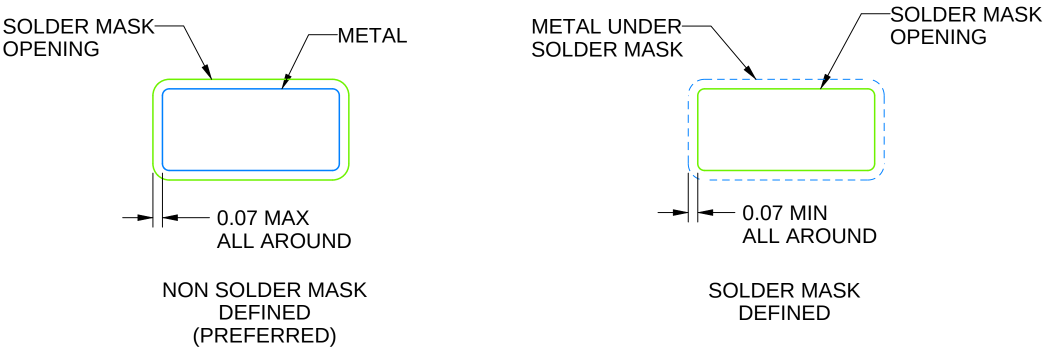
4214838/D 03/2023

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.



LAND PATTERN EXAMPLE
SCALE:15X

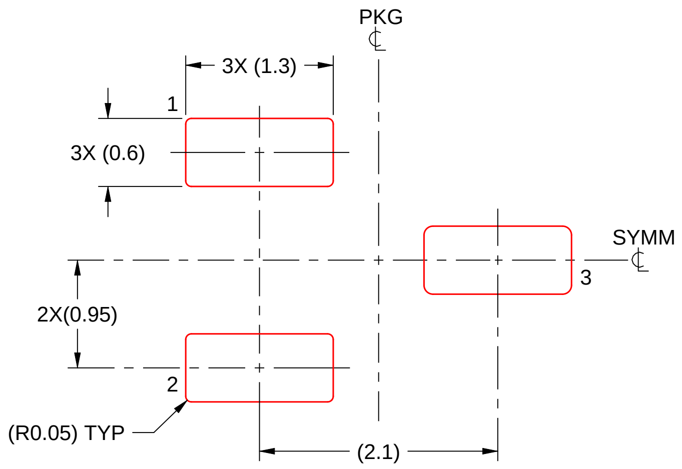


SOLDER MASK DETAILS

4214838/D 03/2023

NOTES: (continued)

4. Publication IPC-7351 may have alternate designs.
5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
7. Board assembly site may have different recommendations for stencil design.

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