DRV5056 ユニポーラ・レシオメトリック・リニア・ホール効果センサ

1 特長

- ユニポーラのリニア・ホール効果磁気センサ
- 3.3V および 5V の電源で動作
- 0.6V の静止オフセット付きのアナログ出力
  - 電圧スイングの最大化により高精度
- 磁気感度オプション (V_{CC} = 5V 時) :
  - A1:200mV/mT、20mT 範囲
  - A2:100mV/mT、39mT 範囲
  - A3:50mV/mT、79mT 範囲
  - A4:25mV/mT、158mT 範囲
  - A6:100mV/mT、39mT 範囲
- 高速な 20kHz センシング帯域幅
- ±1mA 駆動の低ノイズ出力
- 磁石の温度ドリフトの補償
- 標準の産業用パッケージ :
  - 表面実装 SOT-23
  - スルーホール TO-92

2 アプリケーション

- 高精度の位置センシング
- 産業用オートメーションおよびロボティクス
- 家電製品
- ゲームパッド、ペダル、キーボード、トリガ
- 高さレベリング、傾き、重量の測定
- 液体の流量測定
- 医療機器
- 電流センシング

3 概要

DRV5056はリニア・ホール効果センサで、磁界のS極の磁束密度に比例して応答します。このデバイスは、広範なアプリケーションにおいて、正確な位置センシングに使用できます。

ユニポーラの磁気応答が特徴で、アナログ入力は磁界が存在しないとき0.6Vに駆動され、磁界のS極が印加されると増大します。この応答により、1つの磁極を検出するアプリケーションで、出力のダイナミック・レンジが最大化されます。4つの感度オプションにより、必要なセンシング範囲に基づいて、さらに出力スイングを最大化できます。

このデバイスは、3.3Vまたは5Vの電源で動作します。パッケージの上面に垂直な磁束が検出され、2つのパッケージ・オプションでセンシング方向が異なります。

デバイスは、レシオメトリック・アーキテクチャを使用し、外部のアナログ/デジタル・コンバータ(ADC)が基準として同じV_{CC}を使用しているとき、V_{CC}の許容範囲からの誤差を最小化できます。さらに、本デバイスには磁石温度補償が搭載されており、磁石のドリフトを補償することで、の広い温度範囲にわたって線形性を実現します。

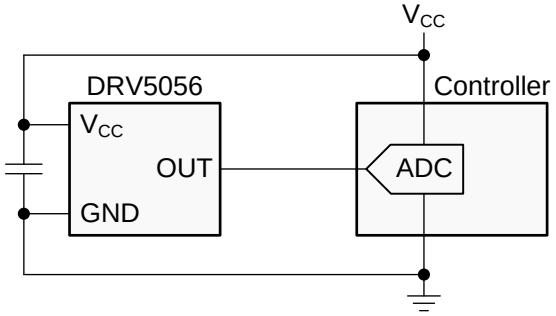
A1～A4 バージョンは –40°C～+125°C の温度範囲に対応します。A6 バージョンは 0°C～85°C の温度範囲に対応します。

製品情報(1)

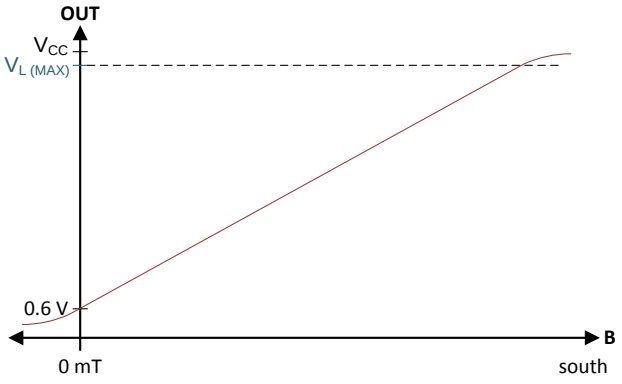
型番	パッケージ	本体サイズ(公称)
DRV5056	SOT-23 (3)	2.92mm×1.30mm
	TO-92 (3)	4.00mm × 3.15mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にあるパッケージ・オプションについての付録を参照してください。

代表的な回路図



磁気応答



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4 改訂履歴

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

2018年4月発行のものから更新 **Page**

- データシートに新しい A6 磁気感度オプションを 追加 ... 1

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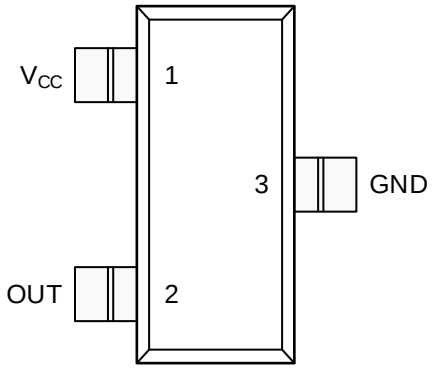
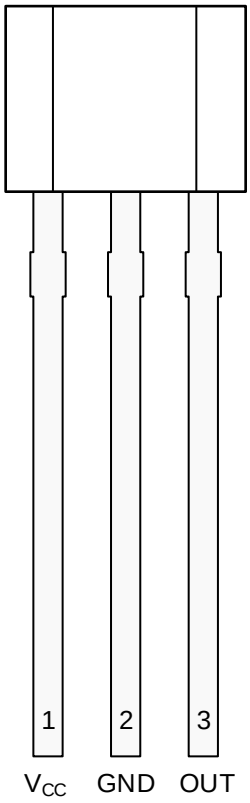
5 Pin Configuration and Functions

DBZ Package
3-Pin SOT-23
Top View



LPG Package
3-Pin TO-92
Top View



Pin Functions

PIN			I/O	DESCRIPTION
NAME	SOT-23	TO-92		
GND	3	2	—	Ground reference
OUT	2	3	O	Analog output
V_{CC}	1	1	—	Power supply. TI recommends connecting this pin to a ceramic capacitor to ground with a value of at least 0.1 µF.

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	7	V
Output voltage	OUT	–0.3	V_{CC} + 0.3	V
Magnetic flux density, B_{MAX}		Unlimited		T
Operating junction temperature, T_J		–40	150	°C
Storage temperature, T_{stg}		–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 (1)	±2500	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 (2)	±750	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V 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)	3	3.6	V
		4.5	5.5	
I_O	Output continuous current	–1	1	mA
T_A	A1-A4 versions operating ambient temperature (2)	–40	125	°C
T_A	A6 version operating ambient temperature (2)	0	85	°C

(1) There are two isolated operating V_{CC} ranges. For more information see the *Operating V_{CC} Ranges* section.
(2) Power dissipation and thermal limits must be observed.

6.4 Thermal Information

THERMAL METRIC (1)		DRV5056		UNIT
		SOT-23 (DBZ)	TO-92 (LPG)	
		3 PINS	3 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	170	121	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	66	67	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	49	97	°C/W
Y_{JT}	Junction-to-top characterization parameter	1.7	7.6	°C/W
Y_{JB}	Junction-to-board characterization parameter	48	97	°C/W

(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} = 3 V to 3.63 V and 4.5 V to 5.5 V, over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS (1)		MIN	TYP	MAX	UNIT
I_{CC}	Operating supply current				6	10	mA
t_{ON}	Power-on time (see 図 19)	B = 0 mT, no load on OUT			150	300	µs
f_{BW}	Sensing bandwidth				20		kHz
t_d	Propagation delay time	From change in B to change in OUT			10		µs
B_{ND}	Input-referred RMS noise density	V_{CC} = 5 V			130		nT/√Hz
		V_{CC} = 3.3 V			215		
B_N	Input-referred noise	$B_{ND} \times 6.6 \times \sqrt{20\ kHz}$	V_{CC} = 5 V		0.12		mT_{PP}
			V_{CC} = 3.3 V		0.2		
V_N	Output-referred noise (2)	$B_N \times S$	DRV5056A1		24		mV_{PP}
			DRV5056A2, DRV5056A6		12		
			DRV5056A3		6		
			DRV5056A4		3		

(1) B is the applied magnetic flux density.
(2) V_N describes voltage noise on the device output. If the full device bandwidth is not needed, noise can be reduced with an RC filter.

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6.6 Magnetic Characteristics

for V_{CC} = 3 V to 3.63 V and 4.5 V to 5.5 V, over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS(1)		MIN	TYP	MAX	UNIT
V_Q	Quiescent voltage	B = 0 mT, T_A = 25°C	DRV5056A1	0.535	0.6	0.665	V
			DRV5056A2, DRV5056A6	0.54	0.6	0.66	
			DRV5056A3, DRV5056A4	0.55	0.6	0.65	
$V_{Q\Delta T}$	Quiescent voltage temperature drift	B = 0 mT, T_A = –40°C to 125°C versus 25°C	V_{CC} = 5 V		0.08		V
			V_{CC} = 3.3 V		0.04		
$V_{Q\Delta L}$	Quiescent voltage lifetime drift	High-temperature operating stress for 1000 hours			< 0.5%		
S	Sensitivity	V_{CC} = 5 V, T_A = 25°C	DRV5056A1	190	200	210	mV/mT
			DRV5056A2, DRV5056A6	95	100	105	
			DRV5056A3	47.5	50	52.5	
			DRV5056A4	23.8	25	26.2	
		V_{CC} = 3.3 V, T_A = 25°C	DRV5056A1	114	120	126	
			DRV5056A2, DRV5056A6	57	60	63	
			DRV5056A3	28.5	30	31.5	
			DRV5056A4	14.3	15	15.8	
B_L	Linear magnetic sensing range(2)	V_{CC} = 5 V, T_A = 25°C	DRV5056A1	20			mT
			DRV5056A2, DRV5056A6	39			
			DRV5056A3	79			
			DRV5056A4	158			
		V_{CC} = 3.3 V, T_A = 25°C	DRV5056A1	19			
			DRV5056A2, DRV5056A6	39			
			DRV5056A3	78			
			DRV5056A4	155			
V_L	Linear range of output voltage(3)			V_Q		V_{CC} – 0.2	V
S_{TC}	Sensitivity temperature compensation for magnets(4)	DRV5056A6		0.05	0.12	0.19	%/°C
S_{TC}	Sensitivity temperature compensation for magnets(4)	DRV5056A1, DRV5056A2, DRV5056A3, DRV5056A4			0.12		%/°C
S_{LE}	Sensitivity linearity error(3)	V_{OUT} is within V_L			±1%		
S_{RE}	Sensitivity ratiometry error(5)	T_A = 25°C, with respect to V_{CC} = 3.3 V or 5 V		-2.5%		2.5%	
$S_{\Delta L}$	Sensitivity lifetime drift	High-temperature operating stress for 1000 hours			< 0.5%		

(1) B is the applied magnetic flux density.
(2) B_L describes the minimum linear sensing range at 25°C taking into account the maximum V_Q and Sensitivity tolerances.
(3) See the *Sensitivity Linearity* section.
(4) S_{TC} describes the rate the device increases Sensitivity with temperature. For more information, see the *Sensitivity Temperature Compensation For Magnets* section.
(5) See the *Ratiometric Architecture* section.

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6.7 Typical Characteristics

at T_A = 25°C (unless otherwise noted)

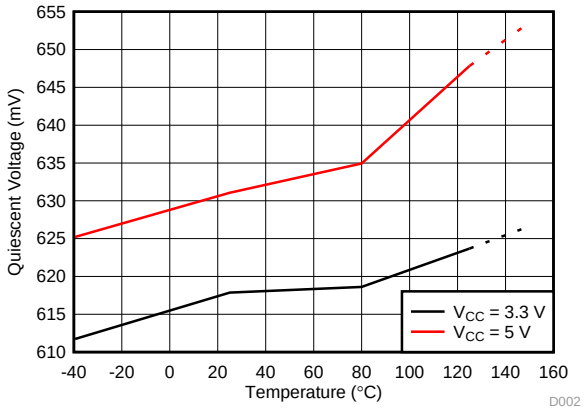


図 1. Quiescent Voltage vs Temperature

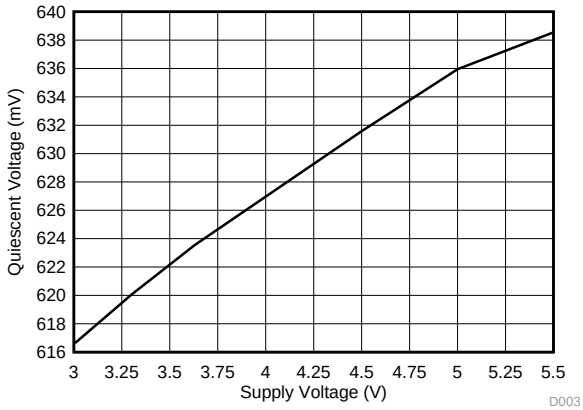
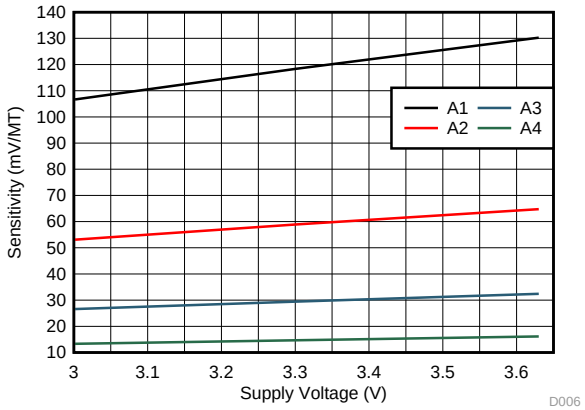
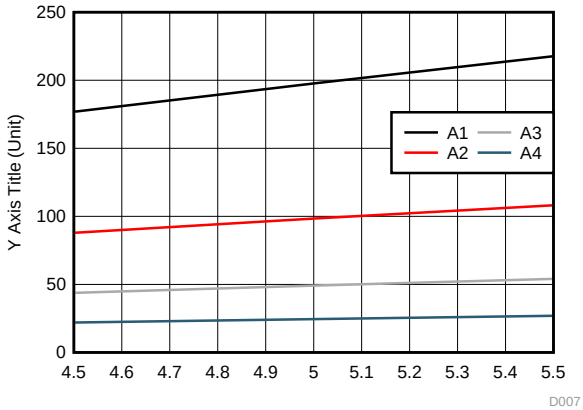


図 2. Quiescent Voltage vs Supply Voltage



V_{CC} = 3.3 V

図 3. Sensitivity vs Supply Voltage



V_{CC} = 5 V

図 4. Sensitivity vs Supply Voltage

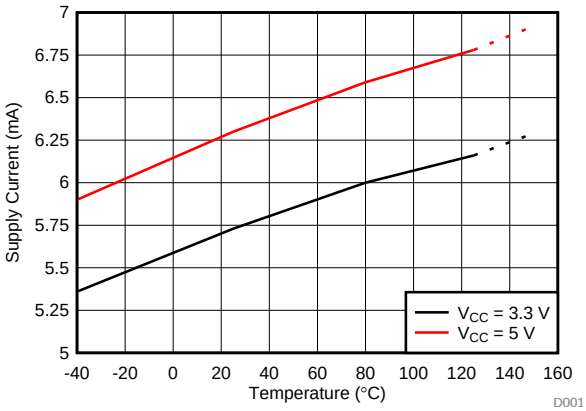
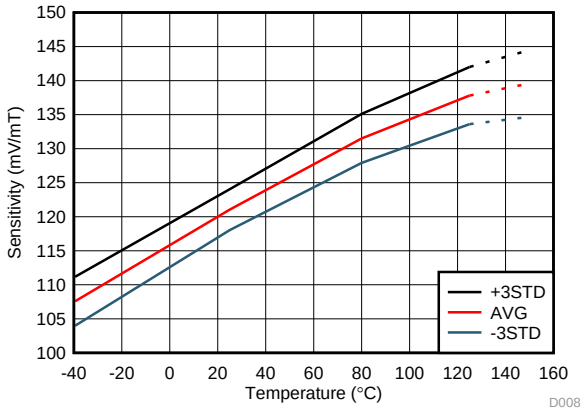


図 5. Supply Current vs Temperature



DRV5056A1, V_{CC} = 3.3 V

図 6. Sensitivity vs Temperature

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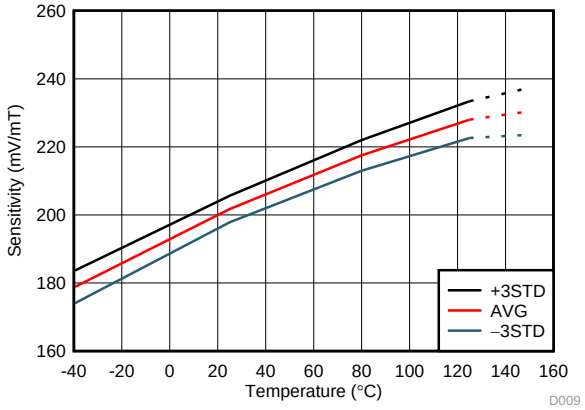
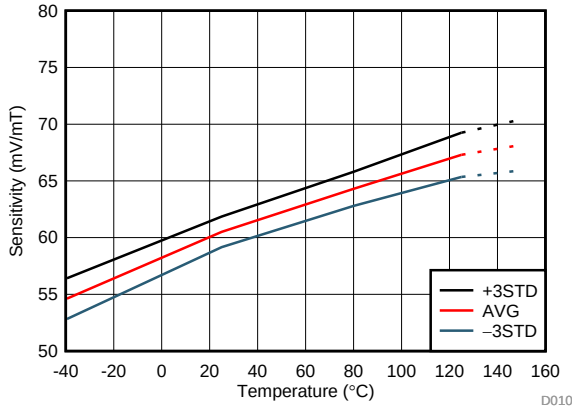
Typical Characteristics (continued)

at T_A = 25°C (unless otherwise noted)



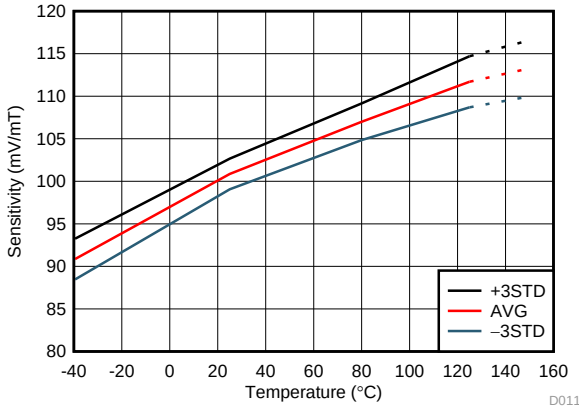
DRV5056A1, V_{CC} = 5.0 V

図 7. Sensitivity vs Temperature



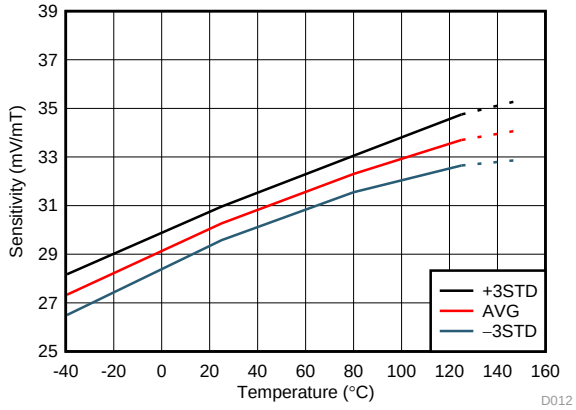
DRV5056A2, V_{CC} = 3.3 V

図 8. Sensitivity vs Temperature



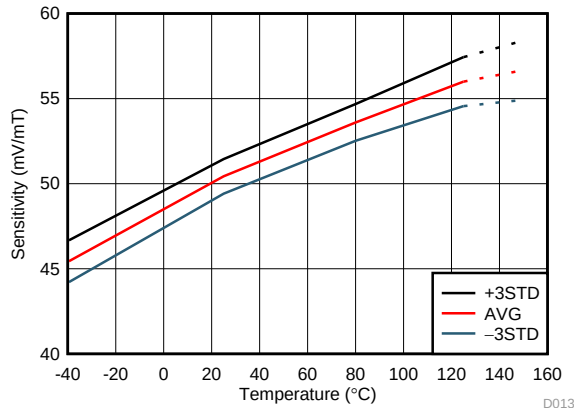
DRV5056A2, V_{CC} = 5.0 V

図 9. Sensitivity vs Temperature



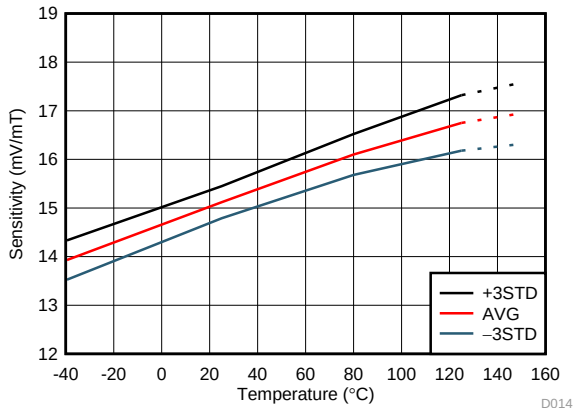
DRV5056A3, V_{CC} = 3.3 V

図 10. Sensitivity vs Temperature



DRV5056A3, V_{CC} = 5.0 V

図 11. Sensitivity vs Temperature



DRV5056A4, V_{CC} = 3.3 V

図 12. Sensitivity vs Temperature

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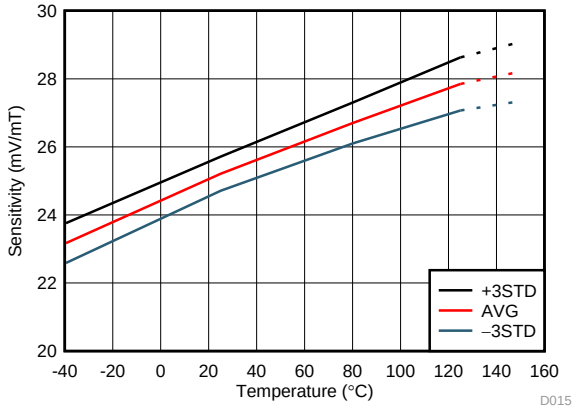
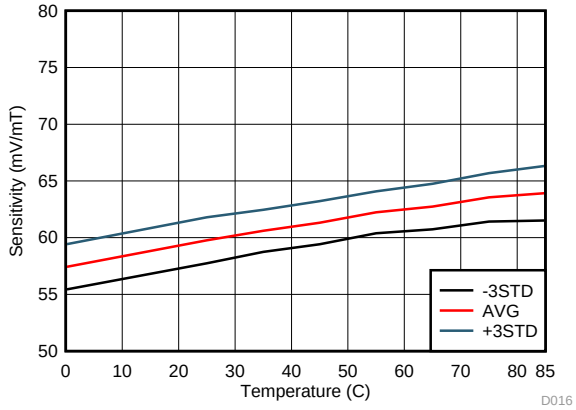
Typical Characteristics (continued)

at T_A = 25°C (unless otherwise noted)



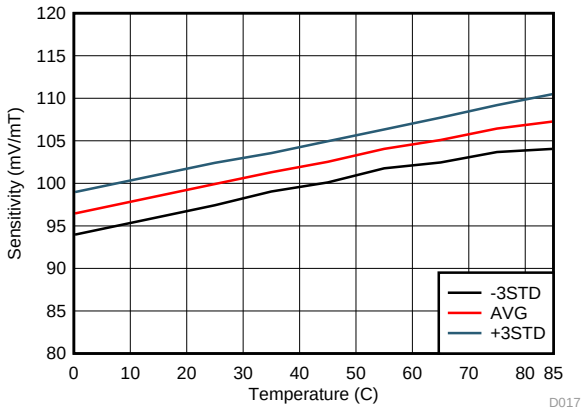
DRV5056A4, V_{CC} = 5.0 V

図 13. Sensitivity vs Temperature



DRV5056A6, V_{CC} = 3.3 V

図 14. Sensitivity vs Temperature



DRV5056A6, V_{CC} = 5.0 V

図 15. Sensitivity vs Temperature

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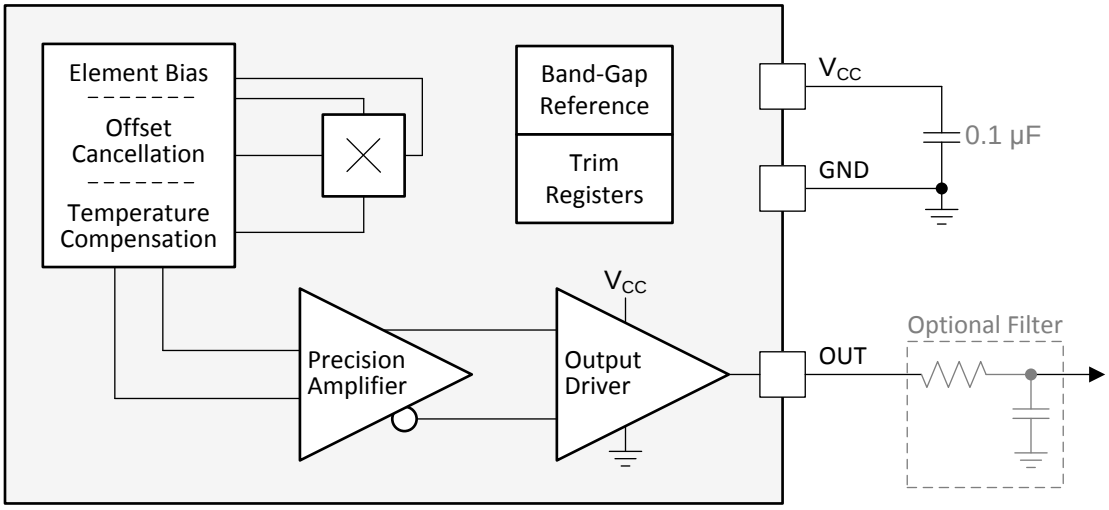
7 Detailed Description

7.1 Overview

The DRV5056 is a 3-pin linear Hall effect sensor with fully integrated signal conditioning, temperature compensation circuits, mechanical stress cancellation, and amplifiers. The device operates from 3.3-V and 5-V (±10%) power supplies, measures magnetic flux density, and outputs a proportional analog voltage that is referenced to V_{CC}.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Magnetic Flux Direction

As shown in 図 16, the DRV5056 is sensitive to the magnetic field component that is perpendicular to the die inside the package.

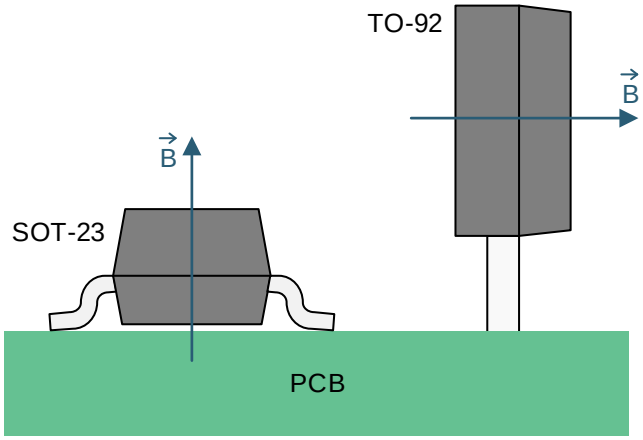


図 16. Direction of Sensitivity

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Feature Description (continued)

Magnetic flux that travels from the bottom to the top of the package is considered positive. This condition exists when a south magnetic pole is near the top (marked-side) of the package. Magnetic flux that travels from the top to the bottom of the package results in negative millitesla values.

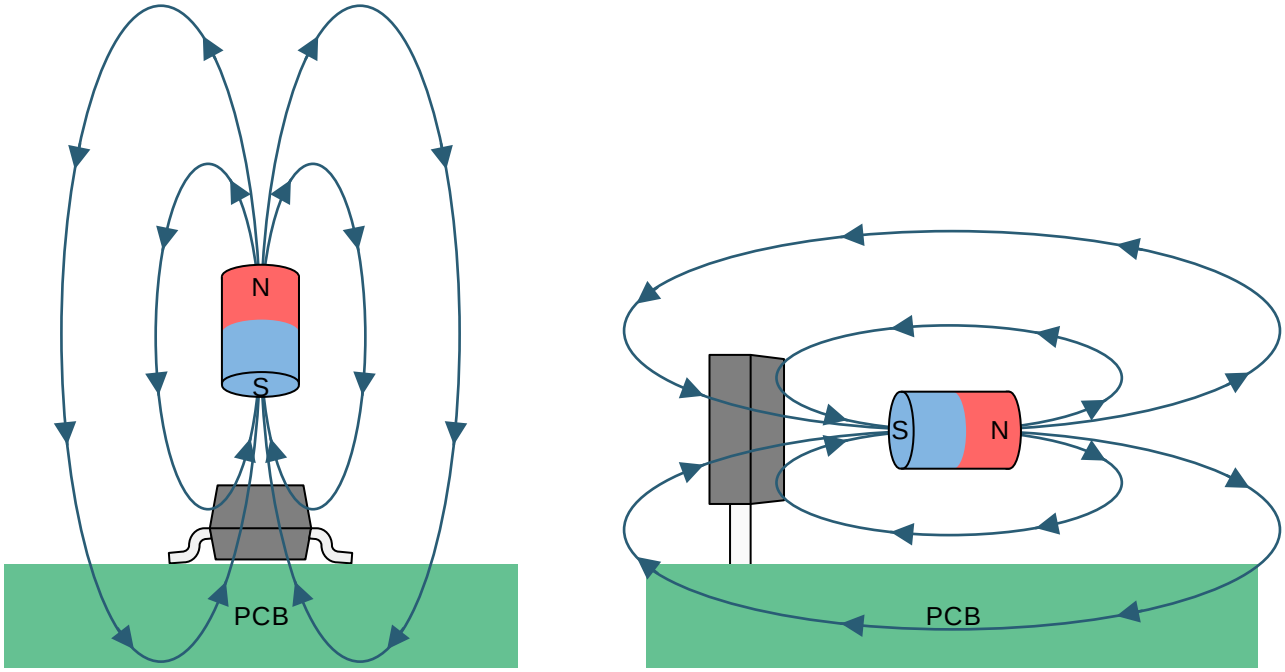

図 17. The Flux Direction for Positive B

7.3.2 Magnetic Response

The DRV5056 outputs an analog voltage according to 式 1 when in the presence of a magnetic field:

$$V_{OUT} = V_Q + B \times \left(\text{Sensitivity}_{(25°C)} \times (1 + S_{TC} \times (T_A - 25°C))\right) \quad (1)$$

where

- V_Q is typically 600 mV
- B is the applied magnetic flux density
- $\text{Sensitivity}_{(25°C)}$ depends on the device option and V_{CC}
- S_{TC} is typically 0.12%/°C
- T_A is the ambient temperature
- V_{OUT} is within the V_L range

As an example, consider the DRV5056A3 with V_{CC} = 3.3 V, a temperature of 50°C, and 67 mT applied. Excluding tolerances, V_{OUT} = 600 mV + 67 mT × (30 mV/mT × [1 + 0.0012/°C × (50°C – 25°C)]) = 2.67 V.

The DRV5056 only responds to the flux density of a magnetic south pole.

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Feature Description (continued)

7.3.3 Sensitivity Linearity

The device produces a linear response when the output voltage is within the specified V_L range. Outside this range, sensitivity is reduced and nonlinear. 図 18 graphs the magnetic response.

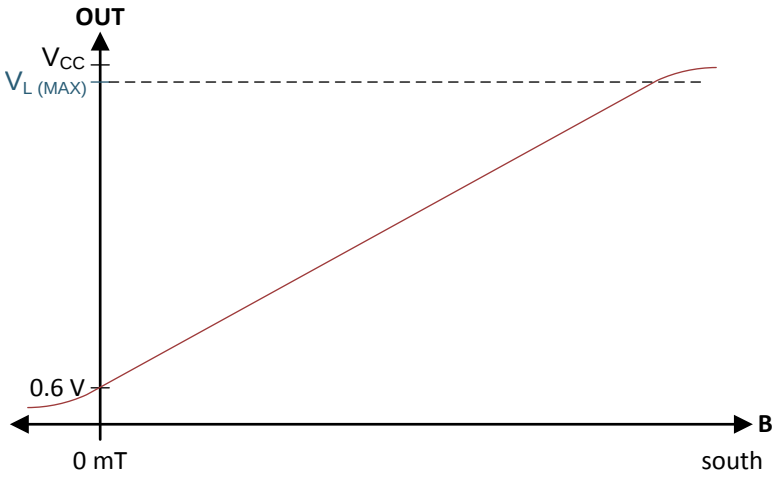

図 18. Magnetic Response

式 2 calculates parameter B_L, the minimum linear sensing range at 25°C taking into account the maximum quiescent voltage and sensitivity tolerances.

$$B_{L(MIN)} = \frac{V_{L(MAX)} - V_{Q(MAX)}}{S_{(MAX)}} \quad (2)$$

The parameter S_{LE} defines linearity error as the difference in sensitivity between any two positive B values when the output is within the V_L range.

7.3.4 Ratiometric Architecture

The DRV5056 has a ratiometric analog architecture that scales the sensitivity linearly with the power-supply voltage. For example, the sensitivity is 5% higher when V_{CC} = 5.25 V compared to V_{CC} = 5 V. This behavior enables external ADCs to digitize a more consistent value regardless of the power-supply voltage tolerance, when the ADC uses V_{CC} as its reference.

式 3 calculates sensitivity ratiometry error:

$$S_{RE} = 1 - \frac{S_{(VCC)} / S_{(5V)}}{V_{CC} / 5V} \text{ for } V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}, \qquad S_{RE} = 1 - \frac{S_{(VCC)} / S_{(3.3V)}}{V_{CC} / 3.3V} \text{ for } V_{CC} = 3 \text{ V to } 3.6 \text{ V}$$

where

- $S_{(VCC)}$ is the sensitivity at the current V_{CC} voltage
- $S_{(5V)}$ or $S_{(3.3V)}$ is the sensitivity when V_{CC} = 5 V or 3.3 V
- V_{CC} is the current V_{CC} voltage

(3)

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Feature Description (continued)

7.3.5 Operating V_{CC} Ranges

The DRV5056 has two recommended operating V_{CC} ranges: 3 V to 3.6 V and 4.5 V to 5.5 V. When V_{CC} is in the middle region between 3.6 V to 4.5 V, the device continues to function, but sensitivity is less known because there is a crossover threshold near 4 V that adjusts device characteristics.

7.3.6 Sensitivity Temperature Compensation For Magnets

Magnets generally produce weaker fields as temperature increases. The DRV5056 compensates by increasing sensitivity with temperature, as defined by the parameter S_{TC}. The sensitivity at T_A = 125°C is typically 12% higher than at T_A = 25°C.

7.3.7 Power-On Time

After the V_{CC} voltage is applied, the DRV5056 requires a short initialization time before the output is set. The parameter t_{ON} describes the time from when V_{CC} crosses 3 V until OUT is within 5% of V_Q, with 0 mT applied and no load attached to OUT. 図 19 shows this timing diagram.

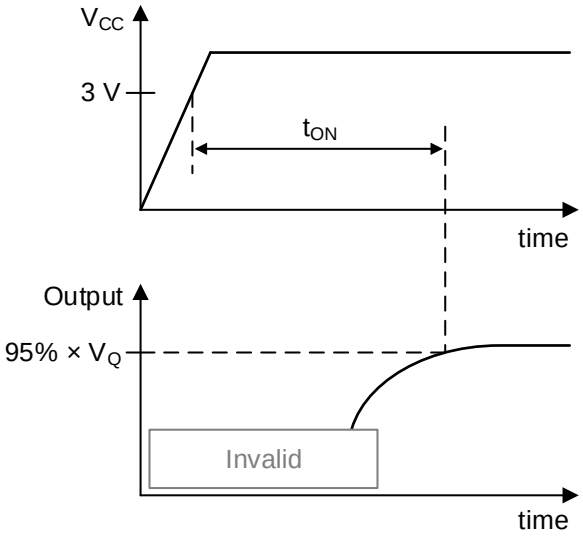

図 19. t_{ON} Definition

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Feature Description (continued)

7.3.8 Hall Element Location

図 20 shows the location of the sensing element inside each package option.

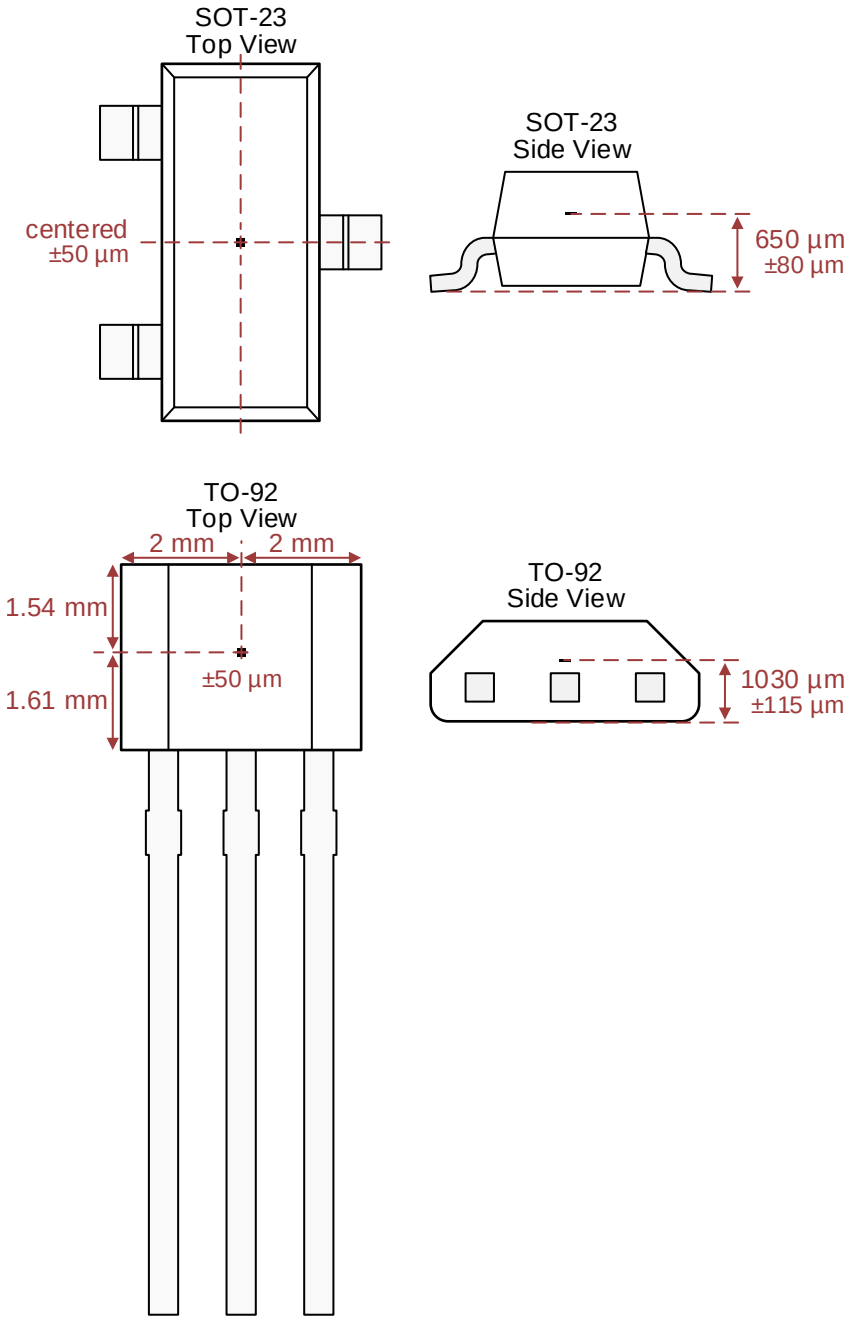

図 20. Hall Element Location

7.4 Device Functional Modes

The DRV5056 has one mode of operation that applies when the *Recommended Operating Conditions* are met.

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8 Application and Implementation

注

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. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

8.1.1 Selecting the Sensitivity Option

Select the highest DRV5056 sensitivity option that can measure the required range of magnetic flux density, so that the output voltage swing is maximized.

Larger magnets and greater sensing distances can generally enable better positional accuracy than very small magnets at close distances, because magnetic flux density increases exponentially with the proximity to a magnet.

8.1.2 Temperature Compensation for Magnets

The DRV5056 temperature compensation is designed to directly compensate the average drift of neodymium (NdFeB) magnets and partially compensate ferrite magnets. The residual flux density (B_r) of a magnet typically reduces by 0.12%/°C for NdFeB, and 0.20%/°C for ferrite. When the operating temperature range of a system is reduced, temperature drift errors are also reduced.

8.1.3 Adding a Low-Pass Filter

As illustrated in the *Functional Block Diagram*, an RC low-pass filter can be added to the device output for the purpose of minimizing voltage noise when the full 20-kHz bandwidth is not needed. This filter can improve the signal-to-noise ratio (SNR) and overall accuracy. Do not connect a capacitor directly to the device output without a resistor in between because doing so can make the output unstable.

8.1.4 Designing for Wire Break Detection

Some systems must detect if interconnect wires become open or shorted. The DRV5056 can support this function.

First, select a sensitivity option that causes the output voltage to stay within the V_L range during normal operation. Second, add a pullup resistor between OUT and V_{CC}. TI recommends a value between 20 kΩ to 100 kΩ, and the current through OUT must not exceed the I_O specification, including current going into an external ADC. Then, if the output voltage is ever measured to be within 150 mV of V_{CC} or GND, a fault condition exists. 図 21 shows the circuit, and 表 1 describes fault scenarios.

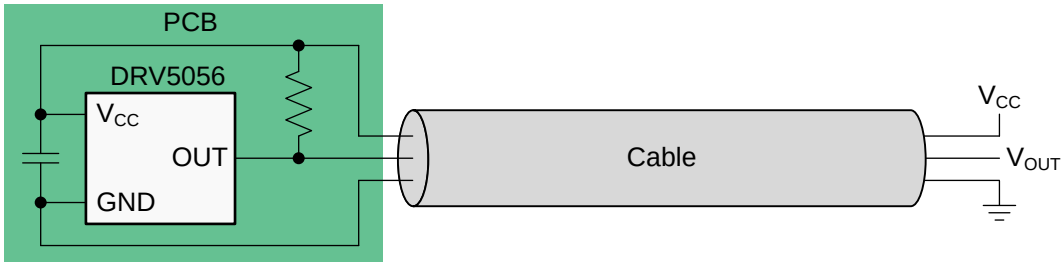

図 21. Wire Fault Detection Circuit

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表 1. Fault Scenarios and the Resulting V_{OUT}

FAULT SCENARIO	V_{OUT}
V_{CC} disconnects	Close to GND
GND disconnects	Close to V_{CC}
V_{CC} shorts to OUT	Close to V_{CC}
GND shorts to OUT	Close to GND

8.2 Typical Application

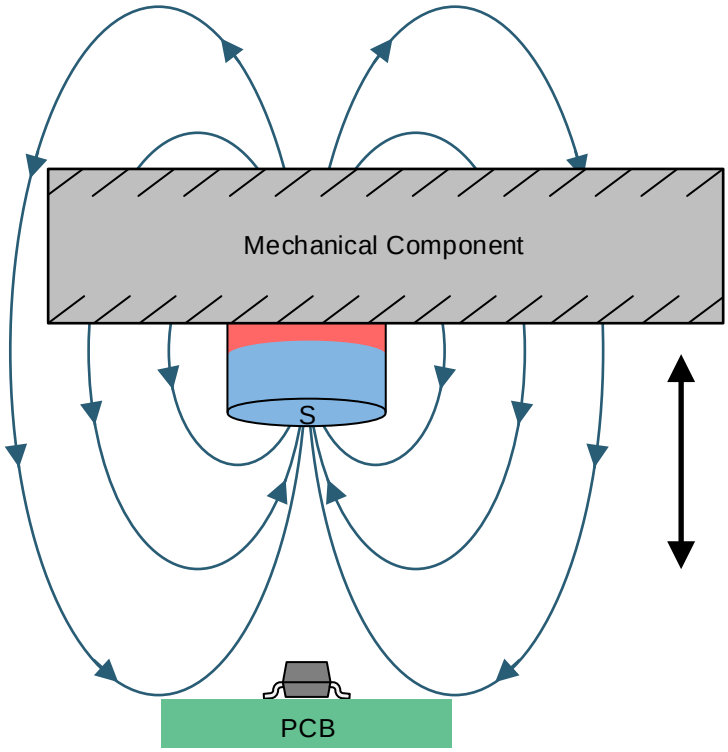

図 22. Unipolar Sensing Application

8.2.1 Design Requirements

Use the parameters listed in 表 2 for this design example.

表 2. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
V_{CC}	3.3 V
Magnet	10-mm diameter × 6-mm long cylinder, ferrite
Distance from magnet to sensor	From 20 mm to 3 mm
Maximum B at the sensor at 25°C	72 mT at 3 mm
Device option	DRV5056A3-Q1

8.2.2 Detailed Design Procedure

This design example consists of a mechanical component that moves back and forth, an embedded magnet with the south pole facing the printed-circuit board, and a DRV5056. The DRV5056 outputs an analog voltage that describes the precise position of the component. The component must not contain ferromagnetic materials such as iron, nickel, and cobalt because these materials change the magnetic flux density at the sensor.

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When designing a linear magnetic sensing system, always consider these three variables: the magnet, sensing distance, and range of the sensor. Select the DRV5056 with the highest sensitivity that has a B_L (linear magnetic sensing range) that is larger than the maximum magnetic flux density in the application.

Magnets are made from various ferromagnetic materials that have tradeoffs in cost, drift with temperature, absolute maximum temperature ratings, remanence or residual induction (B_r), and coercivity (H_c). The B_r and the dimensions of a magnet determine the magnetic flux density (B) produced in 3-dimensional space. For simple magnet shapes, such as rectangular blocks and cylinders, there are simple equations that solve B at a given distance centered with the magnet. 図 23 shows diagrams for 式 4 and 式 5.

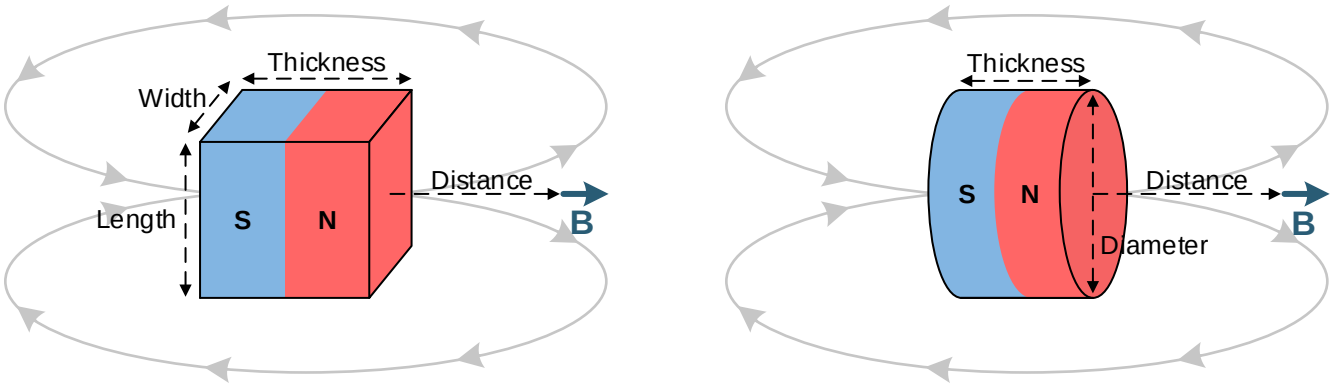

図 23. Rectangular Block and Cylinder Magnets

Use 式 4 for the rectangular block shown in 図 23:

$$\vec{B} = \frac{B_r}{\pi}\left(\arctan\left(\frac{WL}{2D\sqrt{4D^2 + W^2 + L^2}}\right) - \arctan\left(\frac{WL}{2(D+T)\sqrt{4(D+T)^2 + W^2 + L^2}}\right)\right) \quad (4)$$

Use 式 5 for the cylinder shown in 図 23:

$$\vec{B} = \frac{B_r}{2}\left(\frac{D+T}{\sqrt{(0.5C)^2 + (D+T)^2}} - \frac{D}{\sqrt{(0.5C)^2 + D^2}}\right) \quad (5)$$

where

- W is width
- L is length
- T is thickness (the direction of magnetization)
- D is distance
- C is diameter

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8.2.3 Application Curve

図 24 shows the magnetic flux density versus distance for a 10-mm × 6-mm cylinder ferrite magnet.

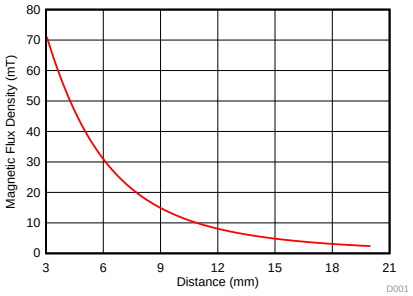

図 24. Magnetic Profile of a 10-mm × 6-mm Cylindrical Ferrite Magnet

8.3 What to Do and What Not to Do

Because the Hall element is sensitive to magnetic fields that are perpendicular to the top of the package, a correct magnet approach must be used for the sensor to detect the field. 図 25 illustrates correct and incorrect approaches.

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What to Do and What Not to Do (continued)

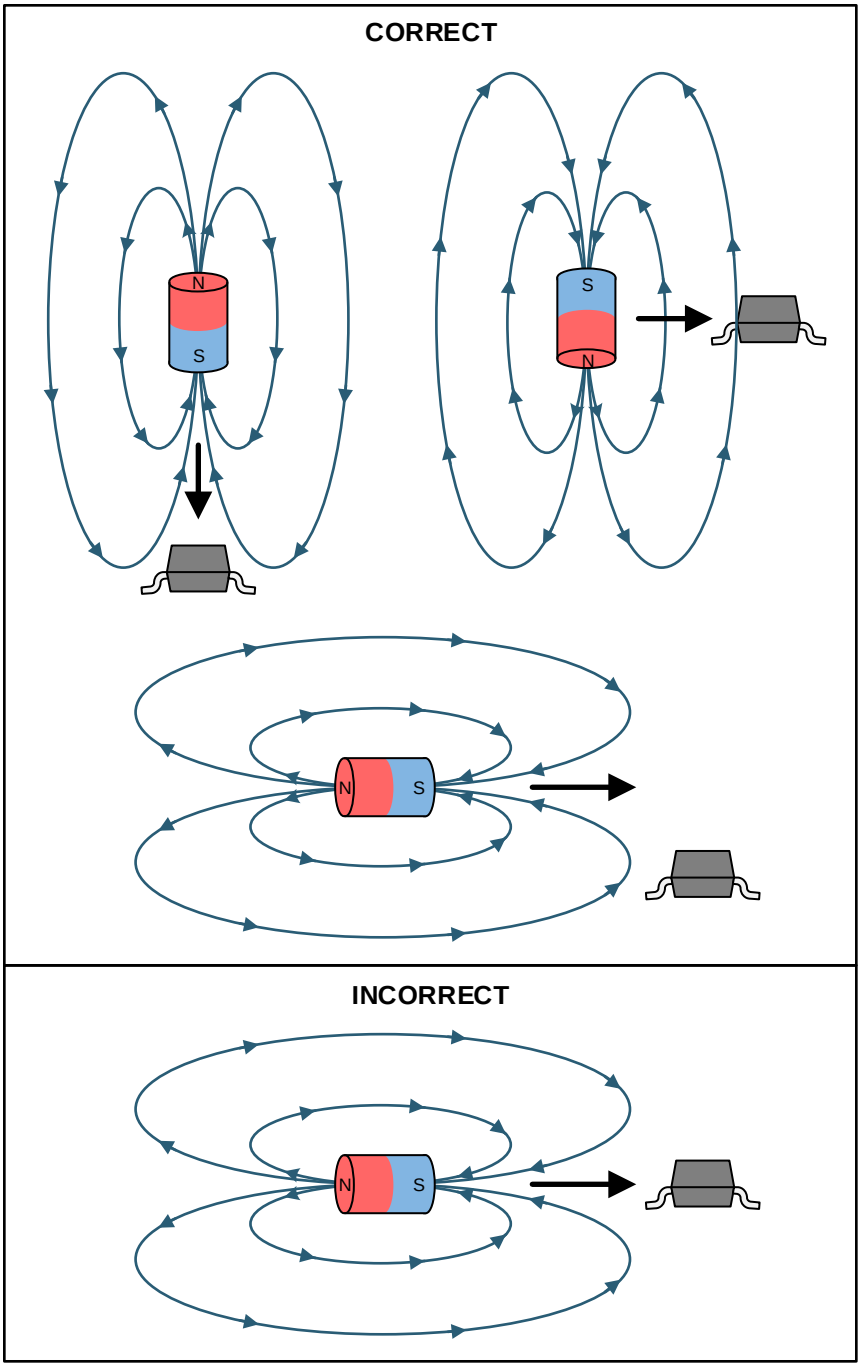

図 25. Correct and Incorrect Magnet Approaches

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9 Power Supply Recommendations

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 0.01 µF.

10 Layout

10.1 Layout Guidelines

Magnetic fields pass through most nonferromagnetic 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, which makes placing the magnet on the opposite side possible.

10.2 Layout Examples

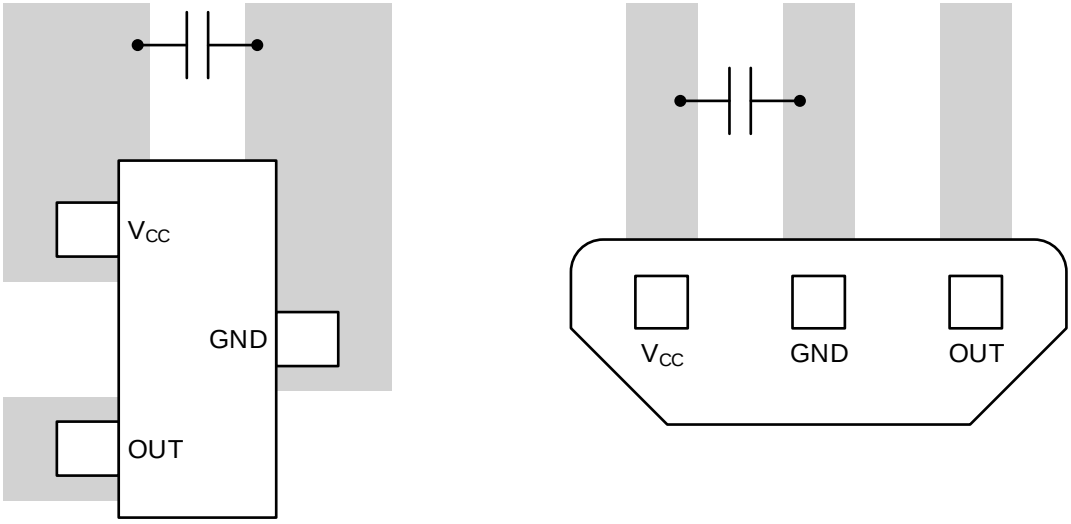

図 26. Layout Examples

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11 デバイスおよびドキュメントのサポート

11.1 ドキュメントのサポート

11.1.1 関連資料

関連資料については、以下を参照してください。

- テキサス・インスツルメンツ、*『増分式ロータリー・エンコーダ設計の考慮事項』アプリケーション・ノート*
- テキサス・インスツルメンツ、*『リニア・ホール効果センサによる角度の測定』アプリケーション・ノート*
- テキサス・インスツルメンツ、*『リニア・ホール効果センサによる角度の測定』*

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Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

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11.6 Glossary

SLYZ022 — *TI Glossary*.

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

12 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

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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
DRV5056A1QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56A1	Samples
DRV5056A1QLPG	ACTIVE	TO-92	LPG	3	1000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A1	Samples
DRV5056A1QLPGM	ACTIVE	TO-92	LPG	3	3000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A1	Samples
DRV5056A2QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56A2	Samples
DRV5056A2QLPG	ACTIVE	TO-92	LPG	3	1000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A2	Samples
DRV5056A2QLPGM	ACTIVE	TO-92	LPG	3	3000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A2	Samples
DRV5056A3QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56A3	Samples
DRV5056A3QLPG	ACTIVE	TO-92	LPG	3	1000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A3	Samples
DRV5056A3QLPGM	ACTIVE	TO-92	LPG	3	3000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A3	Samples
DRV5056A4QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56A4	Samples
DRV5056A4QLPG	ACTIVE	TO-92	LPG	3	1000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A4	Samples
DRV5056A4QLPGM	ACTIVE	TO-92	LPG	3	3000	RoHS & Green	SN	N / A for Pkg Type	-40 to 125	56A4	Samples
DRV5056A6QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56A6	Samples
DRV5056Z1QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56Z1	Samples
DRV5056Z2QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56Z2	Samples
DRV5056Z3QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56Z3	Samples
DRV5056Z4QDBZR	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 125	56Z4	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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OTHER QUALIFIED VERSIONS OF DRV5056 :

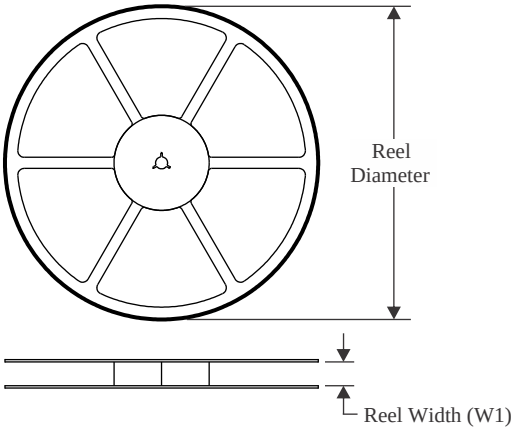
- Automotive : DRV5056-Q1

NOTE: Qualified Version Definitions:

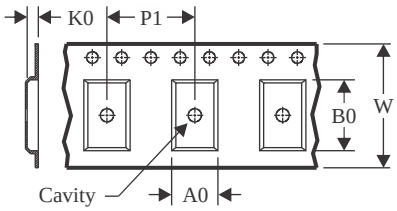
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

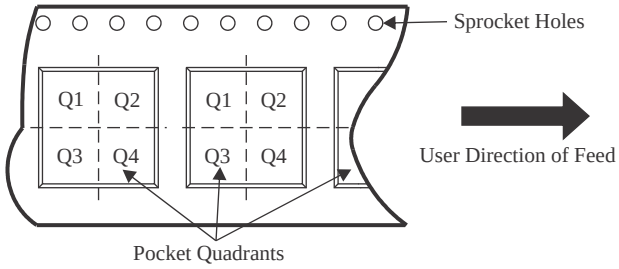


TAPE DIMENSIONS



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

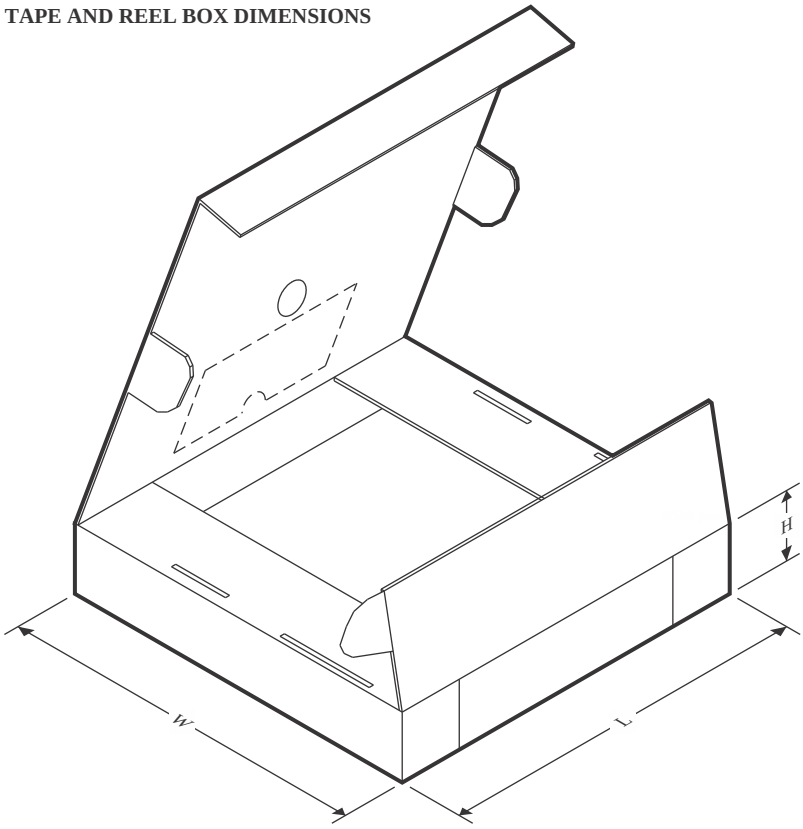
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
DRV5056A1QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
DRV5056A2QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
DRV5056A3QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
DRV5056A4QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
DRV5056A6QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.15	2.77	1.22	4.0	8.0	Q3
DRV5056A6QDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
DRV5056Z1QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
DRV5056Z2QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
DRV5056Z3QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
DRV5056Z4QDBZR	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

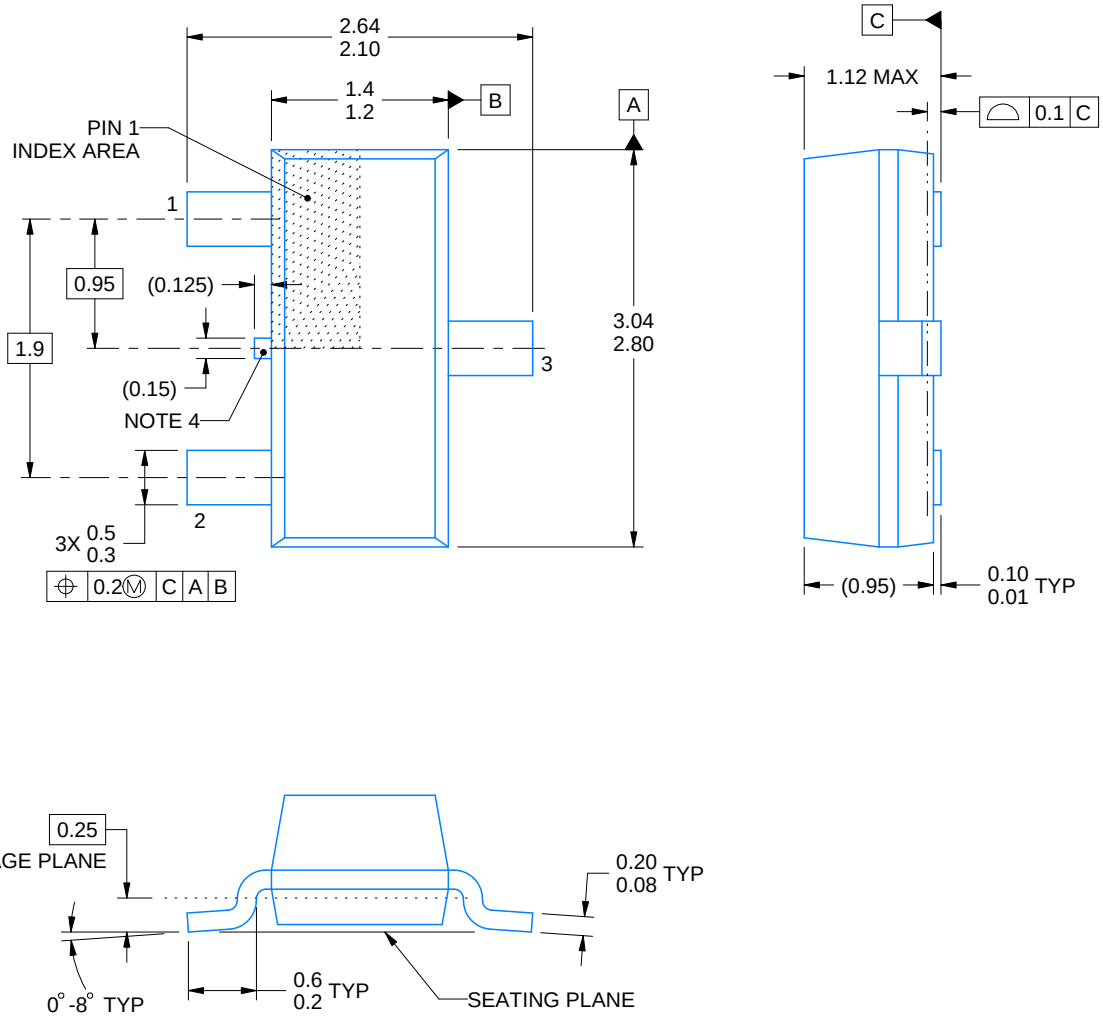
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DRV5056A1QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
DRV5056A2QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
DRV5056A3QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
DRV5056A4QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
DRV5056A6QDBZR	SOT-23	DBZ	3	3000	213.0	191.0	35.0
DRV5056A6QDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
DRV5056Z1QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
DRV5056Z2QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
DRV5056Z3QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
DRV5056Z4QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0

PACKAGE OUTLINE

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



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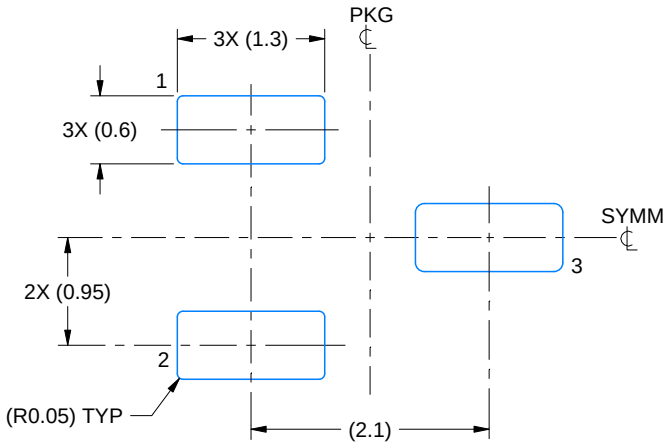
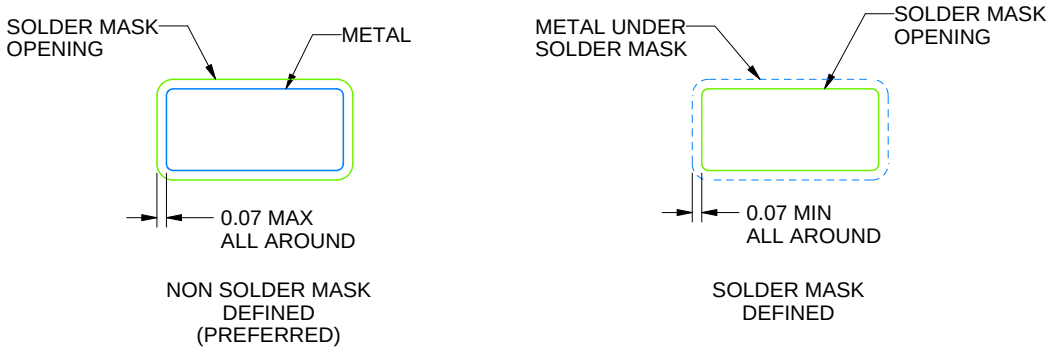
NOTES:

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

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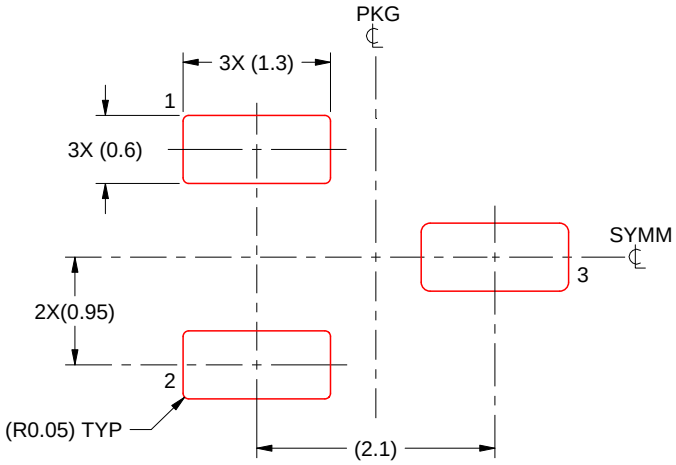
NOTES: (continued)

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

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NOTES: (continued)

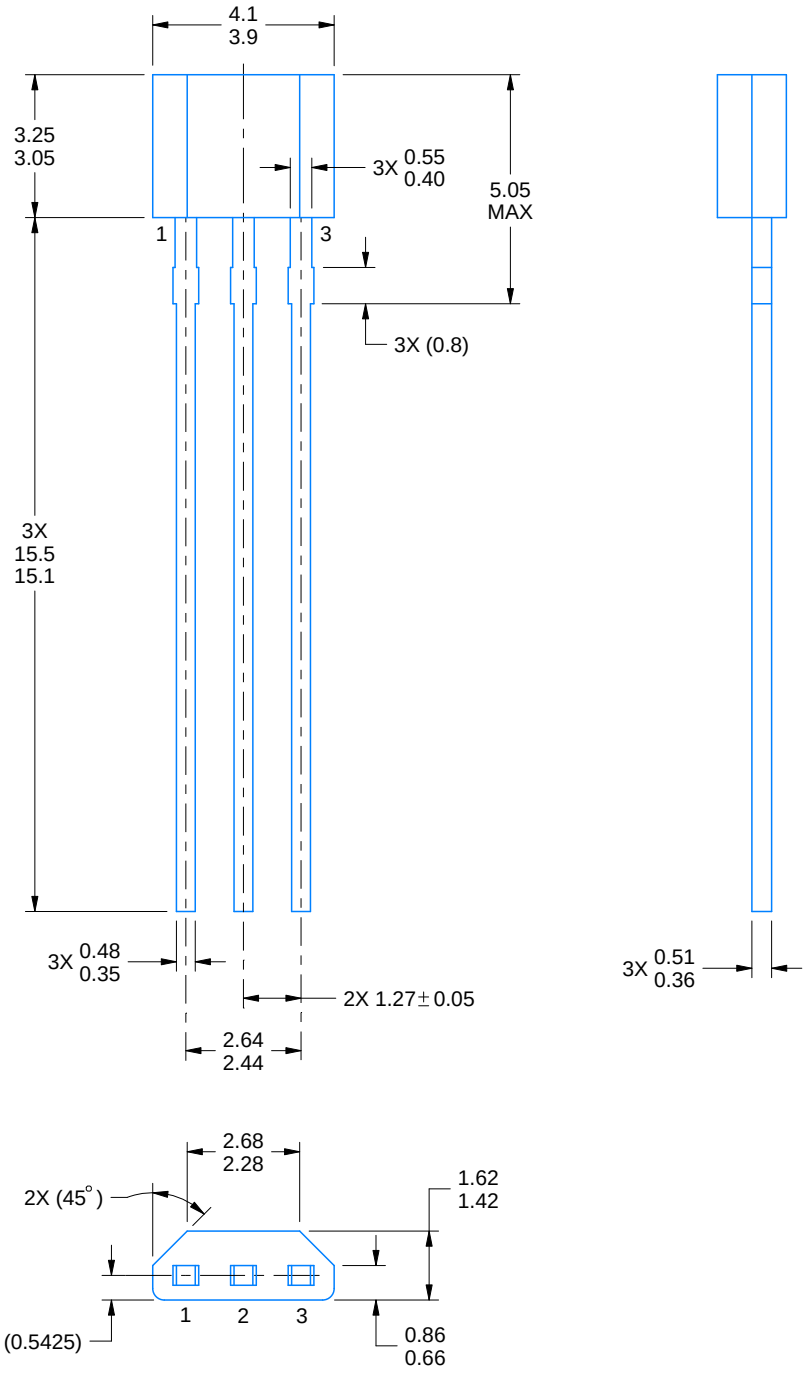
6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
7. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

LPG0003A

TO-92 - 5.05 mm max height

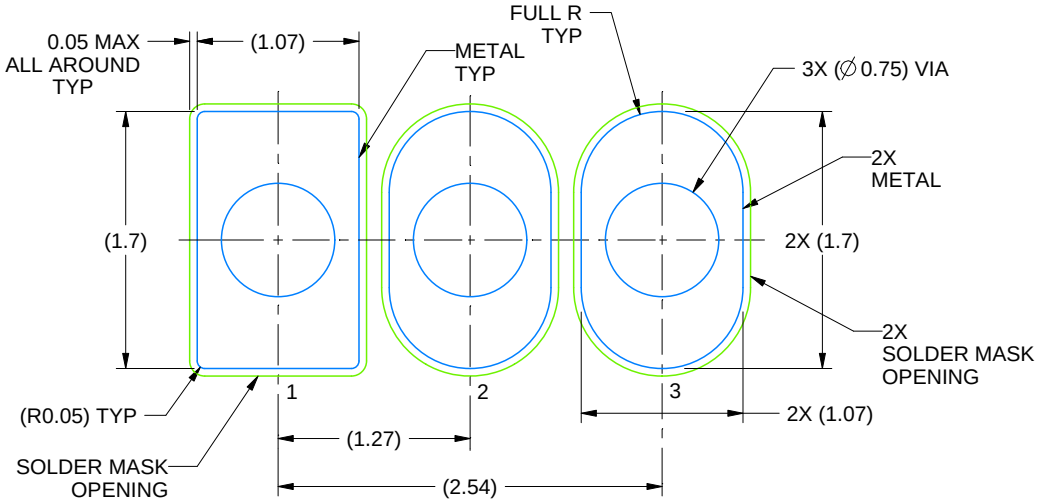
TRANSISTOR OUTLINE



4221343/C 01/2018

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.



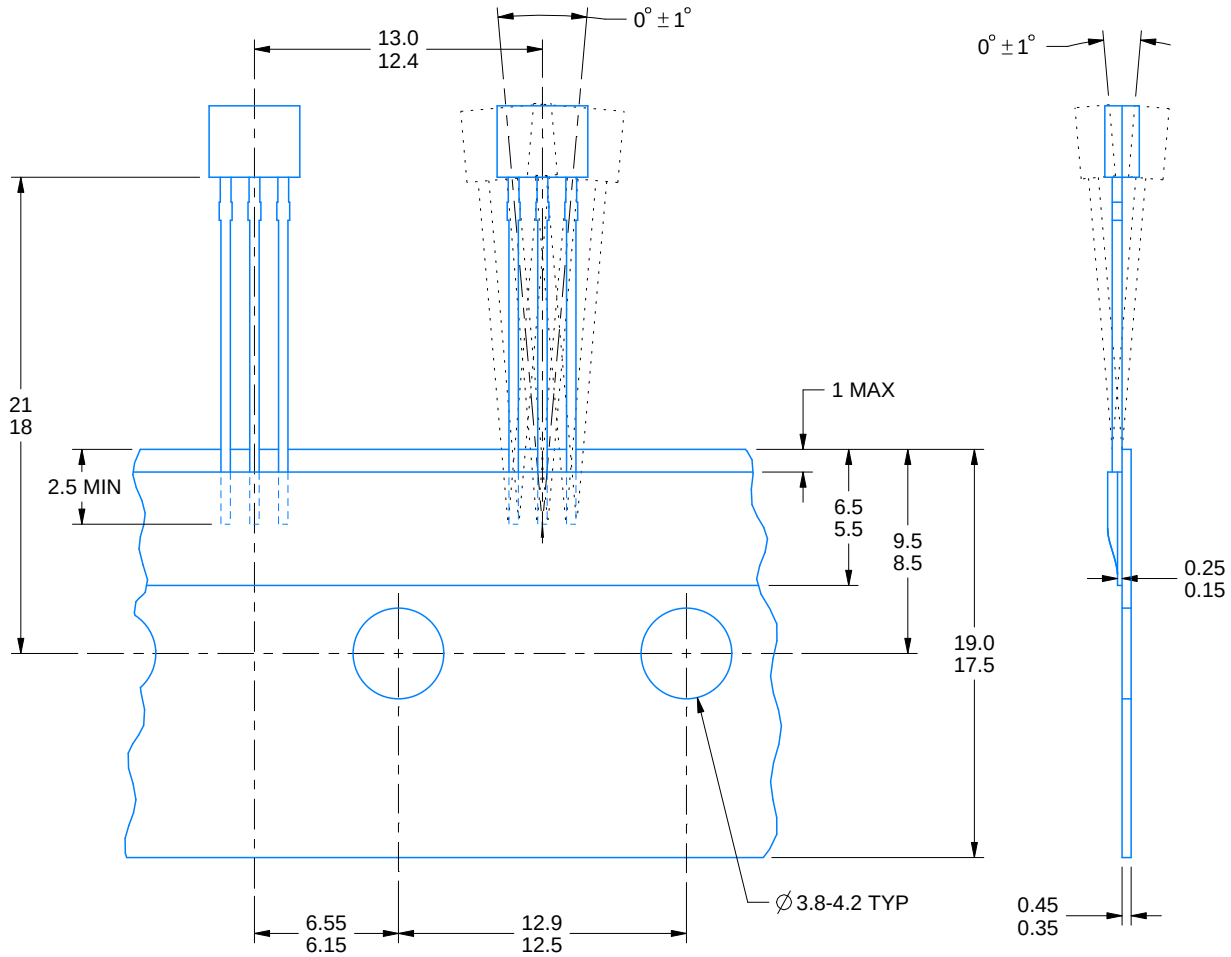
LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE:20X

4221343/C 01/2018

LPG0003A

TO-92 - 5.05 mm max height

TRANSISTOR OUTLINE



4221343/C 01/2018

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