DRV5021-Q1 汽车用、低电压、单极、数字开关霍尔效应传感器

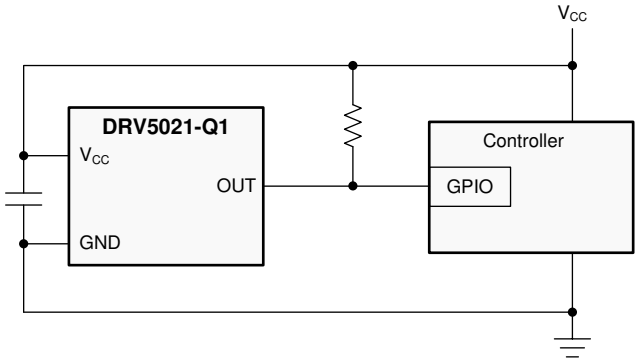
1 特性

- 适用于汽车电子 应用
- 下列性能符合 AEC-Q100 标准：
  - 器件温度等级 0：–40°C 至 150°C 环境工作温度范围
  - 器件 HBM ESD 分类等级 3A
  - 器件 CDM ESD 分类等级 C6
- 数字单极开关霍尔传感器
- 2.5V 至 5.5V 工作 V_{CC} 范围
- 磁性灵敏度选项 (B_{OP}，B_{RP})：
  - DRV5021A1-Q1：2.9mT、1.8mT
  - DRV5021A2-Q1：9.2mT、7.0mT
  - DRV5021A3-Q1：17.9mT、14.1mT
- 30kHz 高速感应带宽
- 漏极开路输出电流高达 20mA
- 经过优化的低电压架构
- 具有集成迟滞特性，可增强抗噪能力
- 标准行业封装：
  - 表面贴装 SOT-23

2 应用

- 汽车变速器、车身外壳
- 限位开关
- 一般接近感应
- 刷式直流电机反馈
- 门开关检测
- 阀定位
- 脉冲计数

典型应用电路原理图



3 说明

DRV5021-Q1 是一款低电压数字开关霍尔效应传感器，适用于高速汽车 应用。该器件由 2.5V 至 5.5V 的电源供电，可以检测磁通量密度并根据预定义的磁性阈值提供数字输出。

该器件会检测垂直于封装面的磁场。当施加的磁通量密度超过磁运行点 B_{OP} 阈值时，器件的漏极开路输出将驱动低电压。当磁通量密度降至磁释放点 (B_{RP}) 阈值时，输出会变为高阻抗。B_{OP} 和 B_{RP} 的分离所产生的滞后有助于防止输入噪声引起的输出误差。这种配置使得系统设计能够更加稳健地抵抗噪声干扰。

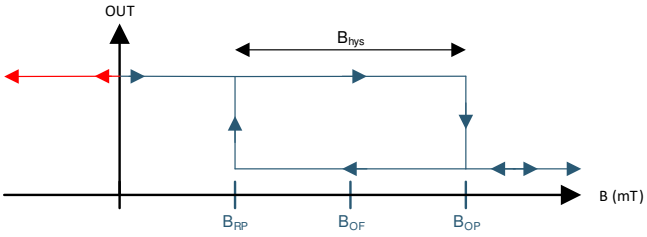
该器件可在 –40°C 至 +150°C 的宽环境温度范围内保持稳定的优异性能。

器件信息(1)

器件型号	封装	封装尺寸（标称值）
DRV5021-Q1	SOT-23 (3)	2.90mm x 1.30mm

(1) 如需了解所有可用封装，请参阅数据表末尾的封装选项附录。

磁响应



目录

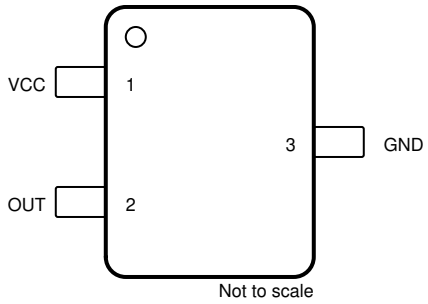
4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

日期	修订版本	说明
2019 年 2 月	*	初始发行版。

5 Pin Configuration and Functions

DBZ Package
3-Pin SOT-23
Top View



Pin Functions

PIN		TYPE	DESCRIPTION
NAME	DBZ		
GND	3	GND	Ground pin
OUT	2	Output	Hall sensor open-drain output. The open drain requires a pullup resistor.
V_{CC}	1	Power	2.5-V to 5.5-V power supply. Bypass this pin to the GND pin with a 0.1-μF (minimum) ceramic capacitor rated for V_{CC}.

6 Specifications

6.1 Absolute Maximum Ratings

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

	MIN	MAX	UNIT
Power supply voltage (VCC)	–0.3	6.0	V
Output voltage (OUT)	–0.3	6.0	V
Output current (OUT)		30	mA
Magnetic flux density, B_{MAX}		Unlimited	T
Operating junction temperature, T_J	–40	170	°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.

6.2 ESD Ratings

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

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per AEC Q100-002(1)	±6000	V
		Charged device model (CDM), per AEC Q100-011	±1000	

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

6.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
V_{CC}	Power supply voltage range	2.5	5.5	V
V_O	Output pin voltage	0	5.5	V
I_{OUT}	Output sinking current	0	20	mA
T_A	Operating ambient temperature	–40	150	°C

6.4 Thermal Information

THERMAL METRIC(1)		DRV5021-Q1 SOT-23 (DBZ) 3 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	356	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	128	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	94	°C/W
Y_{JT}	Junction-to-top characterization parameter	11.4	°C/W
Y_{JB}	Junction-to-board characterization parameter	92	°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

at V_{CC} = 2.5 V to 5.5 V, over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
I_{CC}	Operating supply current			2.3	2.8	mA
t_{ON}	Power-on time			40	70	µs
t_d	Propagation delay time(1)	B = B_{RP} – 10 mT to B_{OP} + 10 mT in 1 µs		13	25	µs
I_{OZ}	High-impedance output leakage current	5.5 V applied to OUT, while OUT is high-impedance			100	nA
V_{OL}	Low-level output voltage	I_{OUT} = 20 mA		0.15	0.4	V
$R_{DS(on)}$	Output FET resistance	I_{OUT} = 5 mA, V_{CC} = 3.3 V		8		Ω

(1) See the *Propagation Delay* section for more information.

6.6 Magnetic Characteristics

at V_{CC} = 2.5 V to 5.5 V, over operating free-air temperature range (unless otherwise noted)

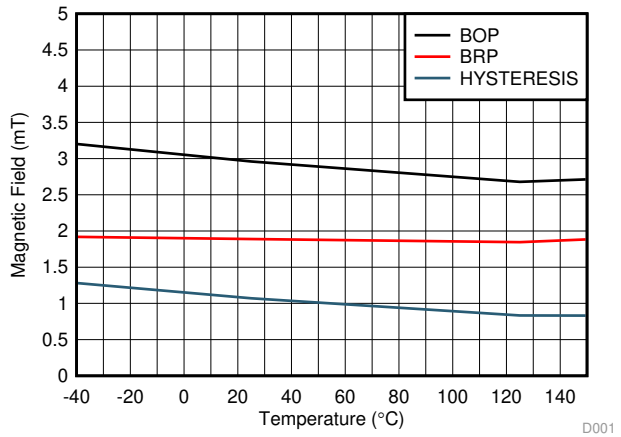
PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
DRV5021A1-Q1, DRV5021A2-Q1, DRV5021A3-Q1						
f_{BW}	Sensing bandwidth			30		kHz
DRV5021A1-Q1						
B_{OP}	Magnetic threshold Operate Point	T_A = –40°C to +125°C	1.3	2.9	4.4	mT
		T_A = –40°C to +150°C	1.1	2.9	4.7	mT
B_{RP}	Magnetic threshold Release Point	TA = –40°C to +125°C	0.2	1.8	3.0	mT
		T_A = –40°C to +150°C	0.1	1.8	3.3	mT
B_{HYS}	Magnetic hysteresis: $\lvert B_{OP} - B_{RP} \rvert$	TA = –40°C to +125°C	0.1	1.1	2.5	mT
B_{HYS}	Magnetic hysteresis: $\lvert B_{OP} - B_{RP} \rvert$	T_A = –40°C to +150°C	0.1	1.1	2.8	mT
DRV5021A2-Q1						
B_{OP}	Magnetic threshold Operate Point	T_A = –40°C to +125°C	5.0	9.2	13.0	mT
		T_A = –40°C to +150°C	4.5	9.2	14.0	mT
B_{RP}	Magnetic threshold Release Point	T_A = –40°C to +125°C	3.2	7.0	10.0	mT
		T_A = –40°C to +150°C	2.7	7.0	11.0	mT

Magnetic Characteristics (continued)

at V_{CC} = 2.5 V to 5.5 V, over operating free-air temperature range (unless otherwise noted)

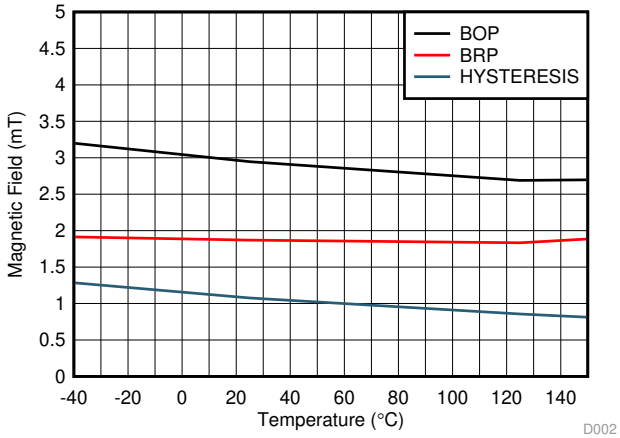
PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
B_{HYS}	Magnetic hysteresis: $\|B_{OP} - B_{RP}\|$	T_A = –40°C to +125°C	0.9	2.2	4.5	mT
B_{HYS}	Magnetic hysteresis: $\|B_{OP} - B_{RP}\|$	T_A = –40°C to +150°C	0.9	2.2	5.0	mT
DRV5021A3-Q1						
B_{OP}	Magnetic threshold Operate Point	T_A = –40°C to +125°C	8.8	17.9	23.4	mT
		T_A = –40°C to +150°C	7.7	17.9	25.4	mT
B_{RP}	Magnetic threshold Release Point	T_A = –40°C to +125°C	6.2	14.1	18.8	mT
		T_A = –40°C to +150°C	5.1	14.1	20.8	mT
B_{HYS}	Magnetic hysteresis: $\|B_{OP} - B_{RP}\|$	T_A = –40°C to +125°C	1.5	3.8	6.2	mT
B_{HYS}	Magnetic hysteresis: $\|B_{OP} - B_{RP}\|$	T_A = –40°C to +150°C	1.3	3.8	6.7	mT

6.7 Typical Characteristics



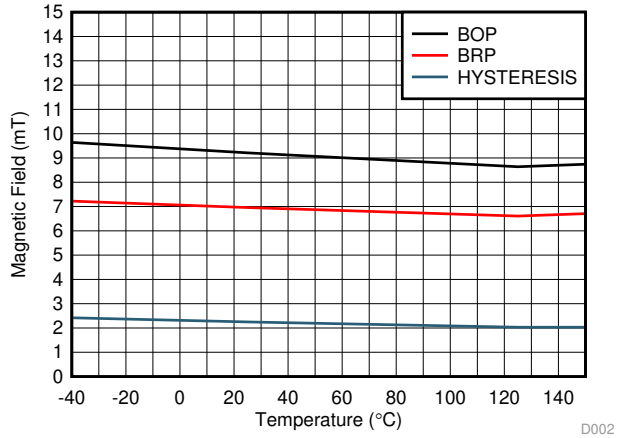
DRV5021A1-Q1, V_{CC} = 3.3 V

图 1. Magnetic Threshold vs Temperature



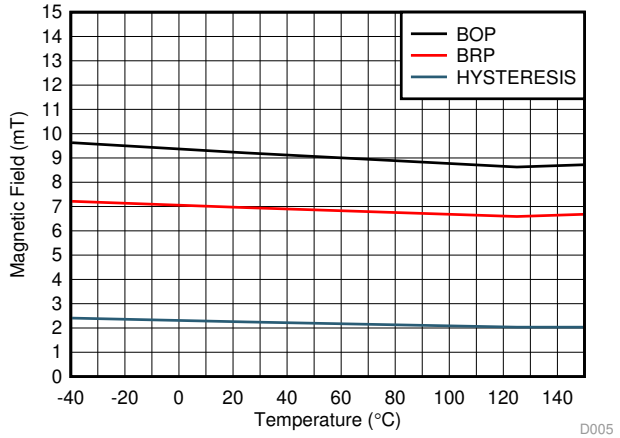
DRV5021A1-Q1, V_{CC} = 5.0 V

图 2. Magnetic Threshold vs Temperature



DRV5021A2-Q1, V_{CC} = 3.3 V

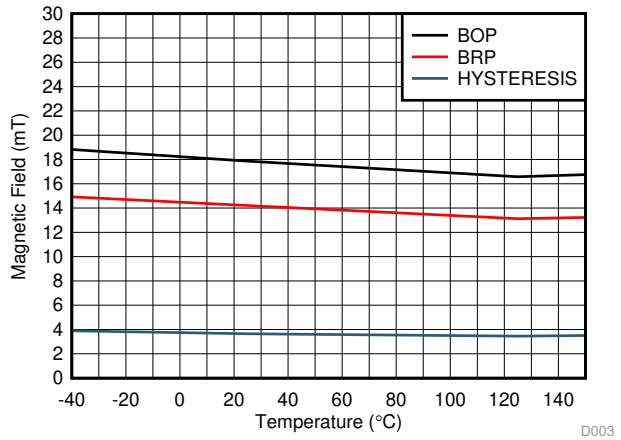
图 3. Magnetic Threshold vs Temperature



DRV5021A2-Q1, V_{CC} = 5.0 V

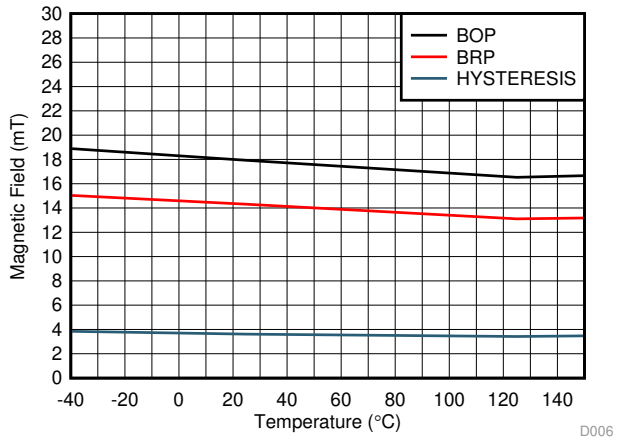
图 4. Magnetic Threshold vs Temperature

Typical Characteristics (接下页)



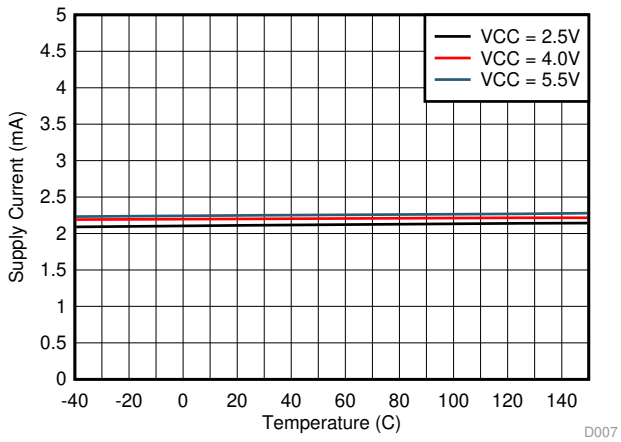
DRV5021A3-Q1, V_{CC} = 3.3 V

图 5. Magnetic Threshold vs Temperature



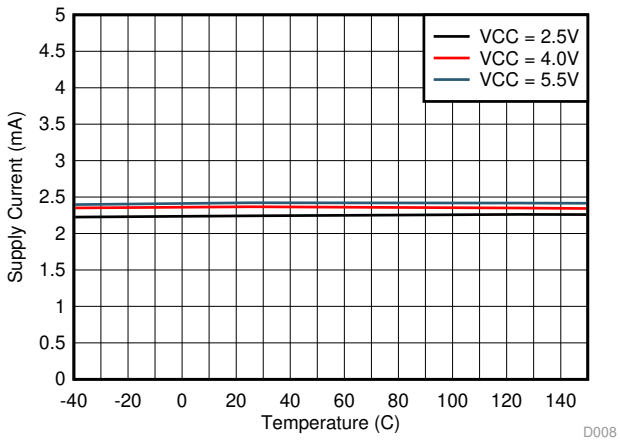
DRV5021A3-Q1, V_{CC} = 5.0 V

图 6. Magnetic Threshold vs Temperature



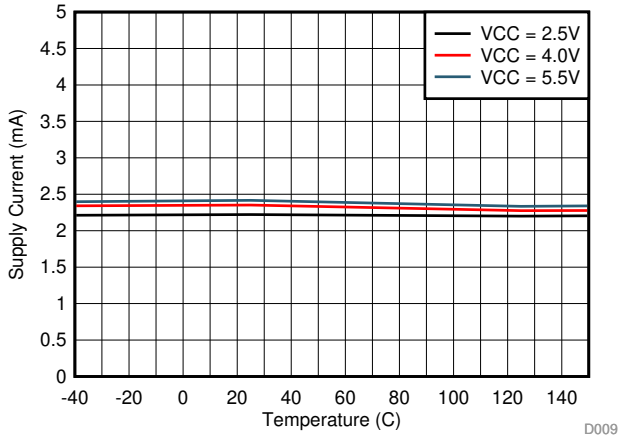
DRV5021A1-Q1

图 7. Supply Current vs Temperature



DRV5021A2-Q1

图 8. Supply Current vs Temperature



DRV5021A3-Q1

图 9. Supply Current vs Temperature

7 Detailed Description

7.1 Overview

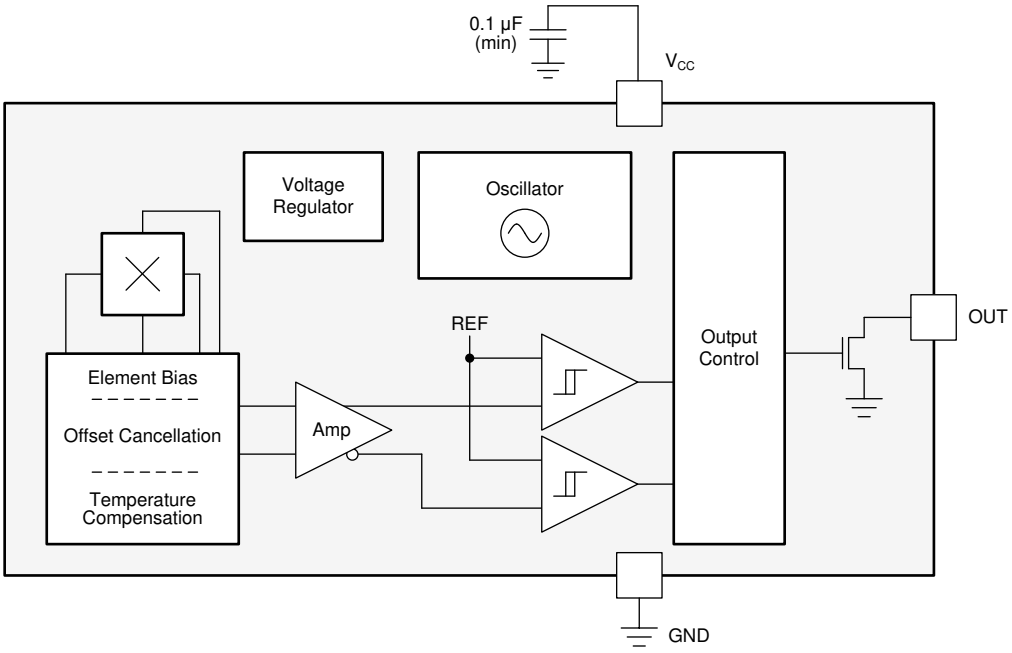
The DRV5021-Q1 device is a spinning-current Hall sensor with a digital output for magnetic-sensing applications. The DRV5021-Q1 can be powered with a supply voltage between 2.5 V and 5.5 V.

The field polarity is defined as follows: a south pole near the marked side of the package is a positive magnetic field. A north pole near the marked side of the package is a negative magnetic field. The output state depends on the magnetic field perpendicular to the package.

A strong south pole near the marked side of the package causes the output to pull low. A weak south pole, the absence of a field, or any north pole makes the output high impedance. Hysteresis is included in between the operate point and the release point to prevent toggling near the magnetic threshold.

An external pullup resistor is required on the OUT pin. The OUT pin can be pulled up to V_{CC}, or to a different voltage supply. This feature allows for easier interfacing with controller circuits.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Field Direction Definition

As shown in 图 10, the DRV5021-Q1 is sensitive to the magnetic field component that is perpendicular to the top of the package.

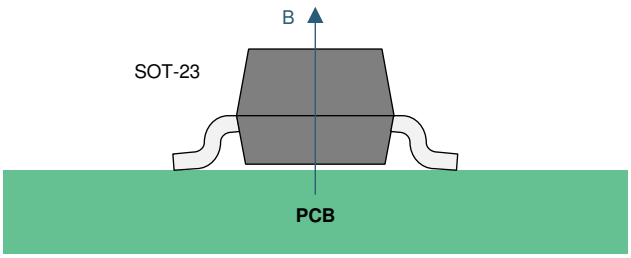


图 10. Direction of Sensitivity

Feature Description (接下页)

图 11 shows that a positive magnetic field is defined as a south pole near the marked side of the package.

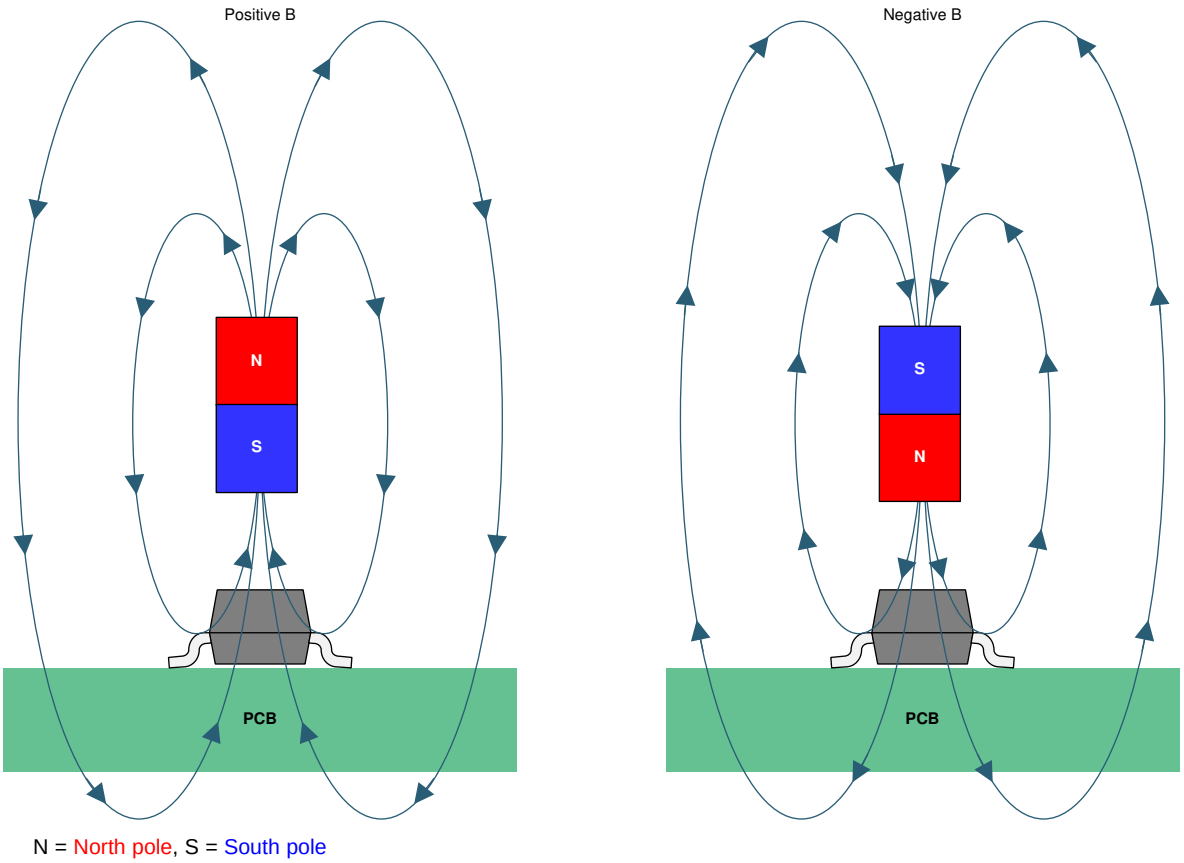


图 11. Field Direction Definition

7.3.2 Device Output

If the device is powered on with a magnetic field strength between B_{RP} and B_{OP}, then the device output is indeterminate. If the field strength is greater than B_{OP}, then the output is pulled low. If the field strength is less than B_{RP}, then the output is released.

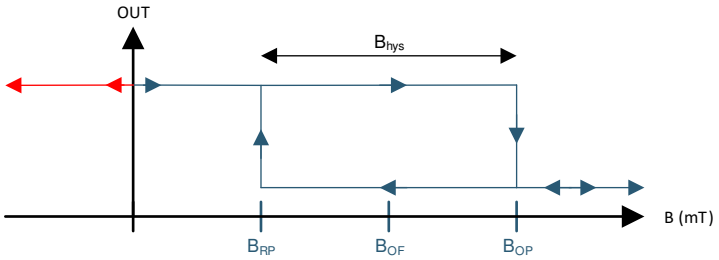


图 12. Output State

Feature Description (接下页)

7.3.3 Power-On Time

After applying V_{CC} to the DRV5021-Q1, t_{on} must elapse before the OUT pin is valid. In case 1 (图 13) and case 2 (图 14), the output is defined assuming that magnetic field $B_{APPLIED} > B_{OP}$, and $B_{APPLIED} < B_{RP}$, respectively.

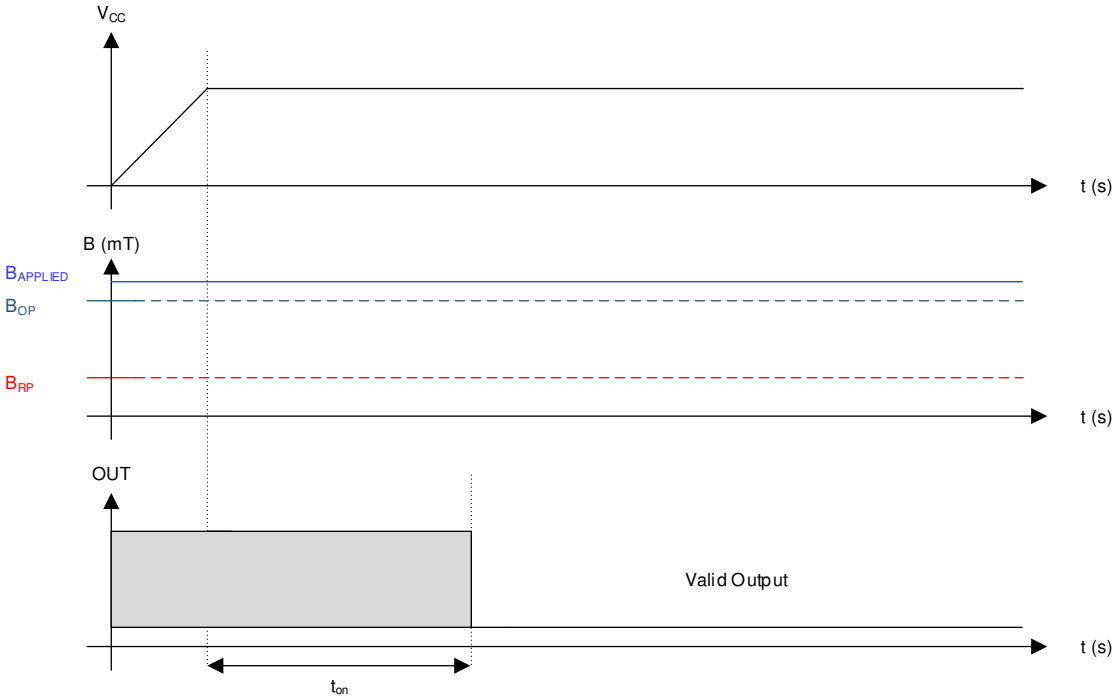


图 13. Case 1: Power On When B > B_{OP}

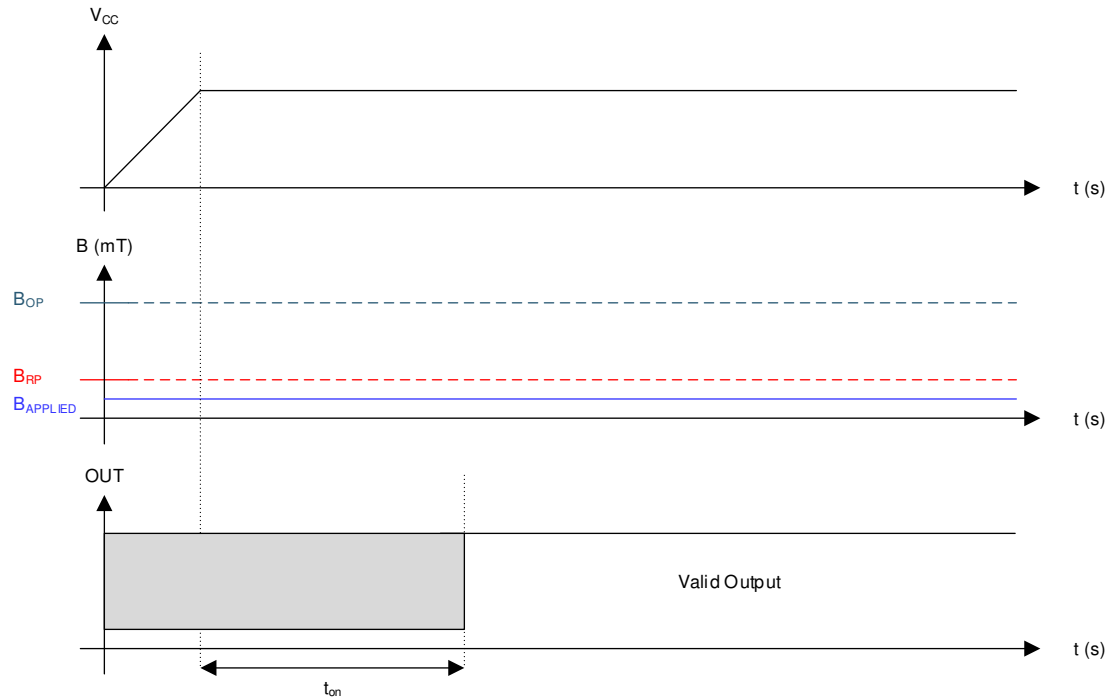


图 14. Case 2: Power On When B < B_{RP}

Feature Description (接下页)

If the device is powered on with $B_{RP} < B_{APPLIED} < B_{OP}$, then the device output remains in indeterminate state until the magnetic field changes. After the change in magnetic field results in a condition that meets either $B_{OP} < B_{APPLIED}$ or $B_{RP} > B_{APPLIED}$, the output turns to valid state after t_d time elapses. Case 3 (图 15) and case 4 (图 16) show examples of this behavior.

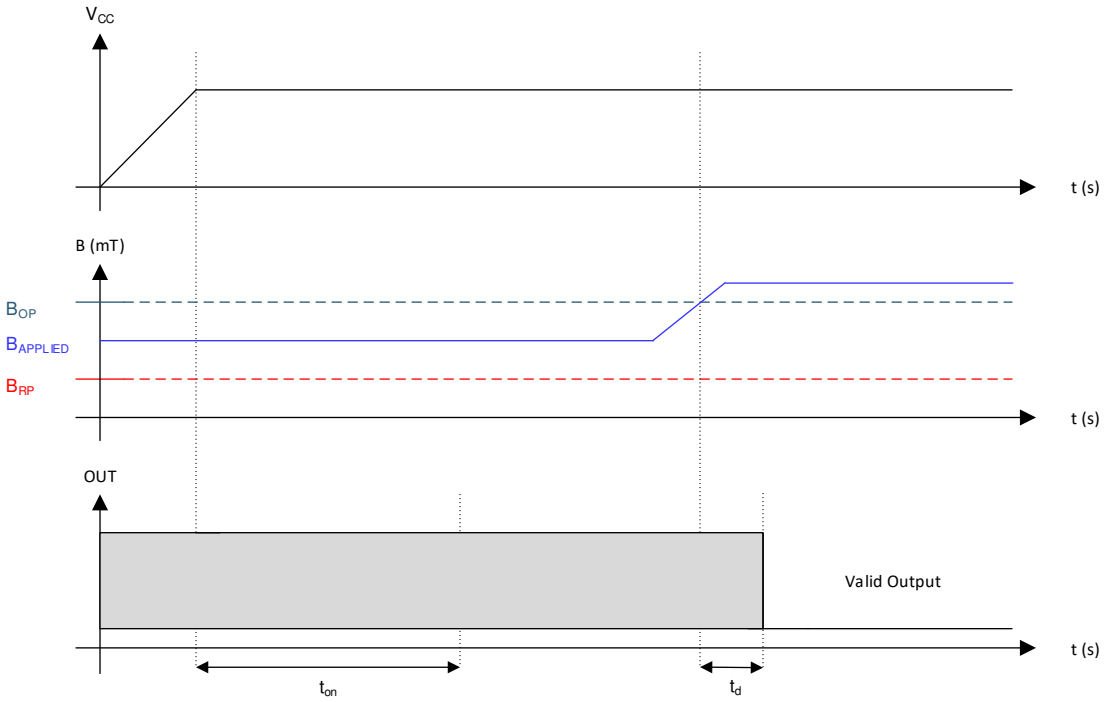


图 15. Case 3: Power On When $B_{RP} < B < B_{OP}$, Followed by $B > B_{OP}$

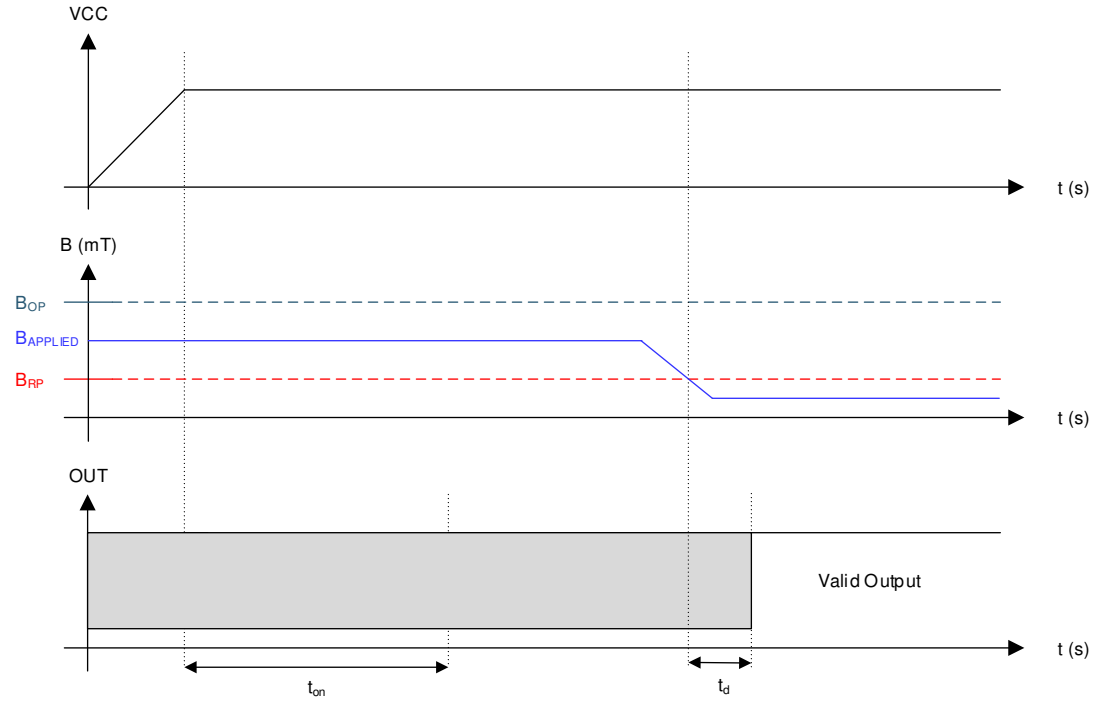


图 16. Case 4: Power On When $B_{RP} < B < B_{OP}$, Followed by $B < B_{RP}$

Feature Description (接下页)

7.3.4 Hall Element Location

The sensing element inside the device is in the center of both packages when viewed from the top. 图 17 shows the tolerances and side-view dimensions.

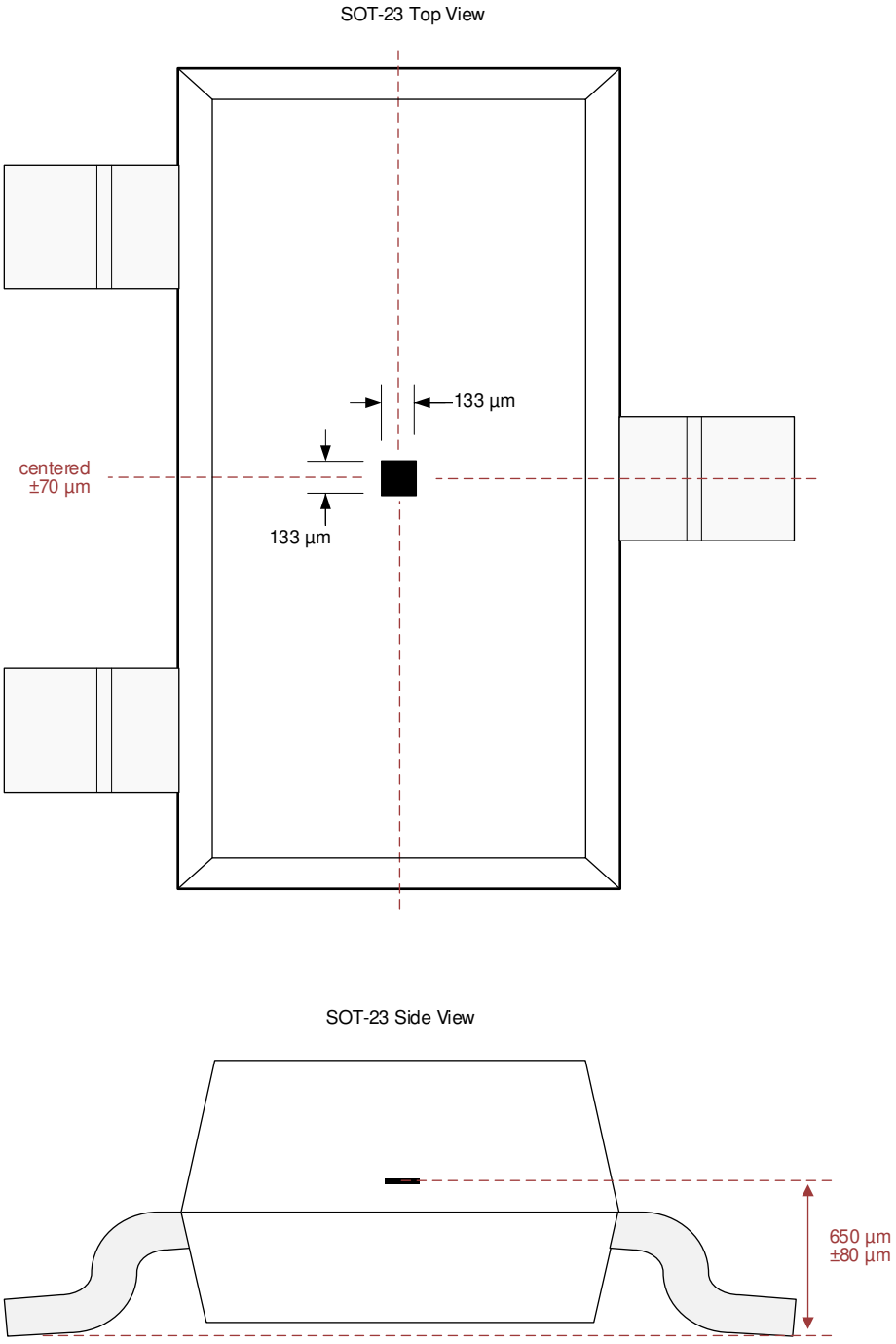


图 17. Hall Element Location

Feature Description (接下页)

7.3.5 Propagation Delay

The DRV5021-Q1 samples the Hall element at a nominal sampling period of 16.67 µs to detect the presence of a magnetic north or south pole. At each sampling point, the device takes the average of the current sampled value and immediately preceding sampled value of the magnetic field. If this average value crosses the B_{OP} or B_{RP} threshold, the device output changes according to the transfer function.

图 18 shows the DRV5021-Q1 propagation delay analysis in the proximity of a magnetic south pole. The Hall element of the DRV5021-Q1 experiences an increasing magnetic field as the magnetic south pole approaches near the device. At time t_2, the average magnetic field is $(B_2 + B_1) / 2$, which is less than the B_{OP} threshold of the device. At time t_3, the actual magnetic field has crossed the B_{OP} threshold. However, the average $(B_3 + B_2) / 2$ is still less than the B_{OP} threshold. Thus, the device waits for next sample time, t_4, to start the output transition through the analog signal chain. The propagation delay, t_d, is measured as the delay from the time the magnetic field crosses the B_{OP} threshold to the time output transitions.

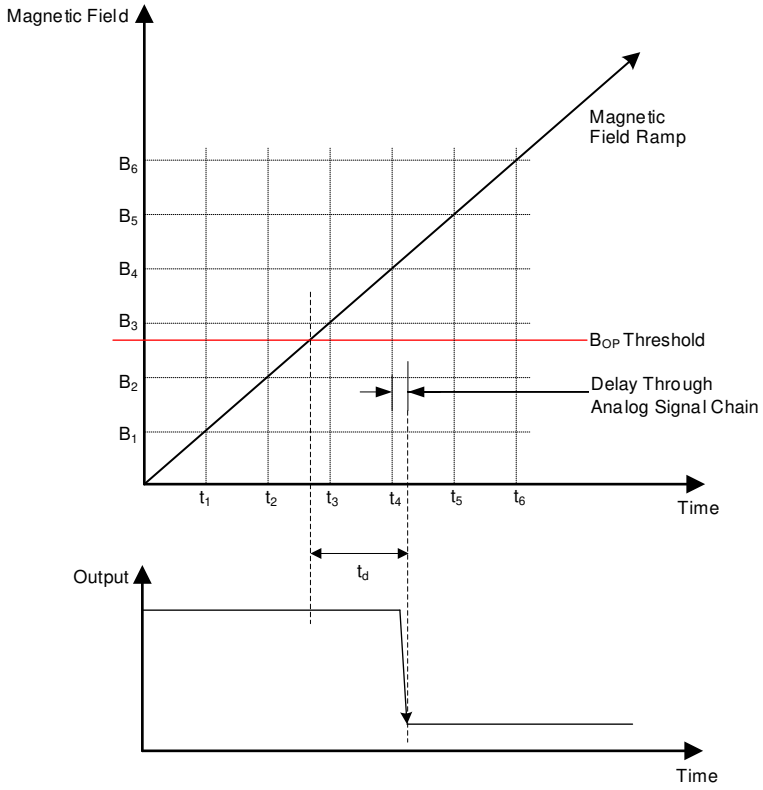


图 18. Propagation Delay

Feature Description (接下页)

7.3.6 Output Stage

The DRV5021-Q1 output stage uses an open-drain NMOS transistor that is rated to sink up to 20 mA of current. For proper operation, calculate the value of pullup resistor R1 using 公式 1.

$$\frac{V_{ref}\,max}{20\ mA} \le R1 \le \frac{V_{ref}\,min}{100\ \mu A} \quad (1)$$

The size of R1 is a tradeoff between the OUT rise time and the current when OUT is pulled low. A lower current is generally better; however, faster transitions and bandwidth require a smaller resistor for faster switching.

In addition, the value of R1 must be > 500 Ω in order to make sure that the output driver can pull the OUT pin close to GND.

注

V_{ref} is not restricted to V_{CC}. The allowable voltage range of this pin is specified in the *Recommended Operating Conditions*.

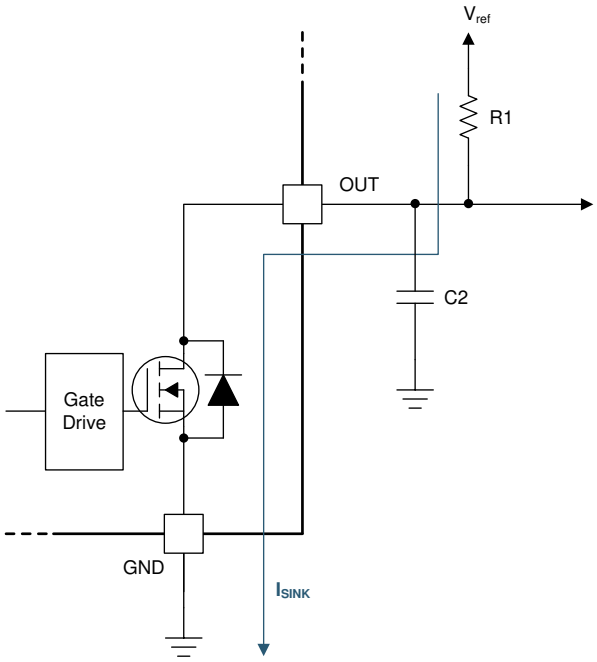


图 19. Open-Drain Output

Select a value for C2 based on the system bandwidth specifications shown in 公式 2.

$$2 \times f_{BW}\ (Hz) < \frac{1}{2\pi \times R1 \times C2} \quad (2)$$

Most applications do not require this C2 filtering capacitor.

7.4 Device Functional Modes

The DRV5021-Q1 device is active only when V_{CC} is between 2.5 V and 5.5 V.

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

The DRV5021-Q1 device is used in magnetic-field sensing applications.

8.2 Typical Applications

8.2.1 Proximity Sensing Circuit

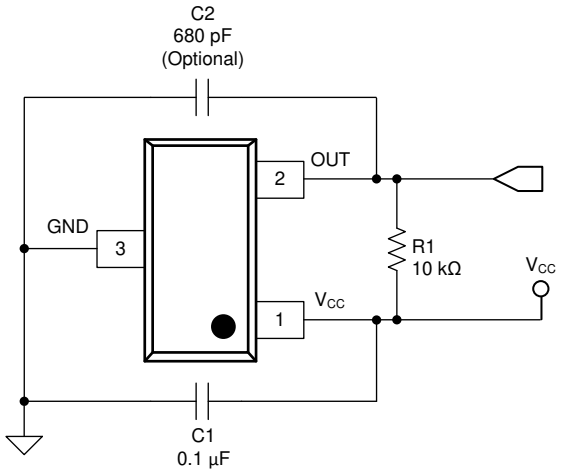


图 20. Proximity Sensing Circuit

8.2.1.1 Design Requirements

For this design example, use the parameters listed in 表 1 as the input parameters.

表 1. Design Parameters

DESIGN PARAMETER	REFERENCE	EXAMPLE VALUE
Supply voltage	V_{CC}	3.2 V to 3.4 V
System bandwidth	f_{BW}	10 kHz

8.2.1.2 Detailed Design Procedure

表 2 shows the external components needed to create this design example.

表 2. External Components

COMPONENT	CONNECTED BETWEEN		RECOMMENDED
C1	V_{CC}	GND	A 0.1-µF ceramic capacitor rated for V_{CC}
C2	OUT	GND	Optional: Place a ceramic capacitor to GND
R1	OUT	V_{CC} (1)	Requires a pullup resistor

(1) Pullup resistor may be connected to a voltage source other than V_{CC}; see the *Recommended Operating Conditions* for the valid range of the output pin voltage.

8.2.1.2.1 Configuration Example

In a 3.3-V system, 3.2 V ≤ V_{ref} ≤ 3.4 V. Use 公式 3 to calculate the allowable range for R1.

$$\frac{V_{ref}\,max}{20\ mA} \le R1 \le \frac{V_{ref}\,min}{100\ \mu A} \tag{3}$$

For this design example, use 公式 4 to calculate the allowable range of R1.

$$\frac{3.4\ V}{20\ mA} \le R1 \le \frac{3.2\ V}{100\ \mu A} \tag{4}$$

Therefore:

$$170\ \Omega \le R1 \le 32\ k\Omega \tag{5}$$

After finding the allowable range of R1 (公式 5), select a value between 500 Ω and 32 kΩ for R1.

Assuming a system bandwidth of 10 kHz, use 公式 6 to calculate the value of C2.

$$2 \times f_{BW}\ (Hz) < \frac{1}{2\pi \times R1 \times C2} \tag{6}$$

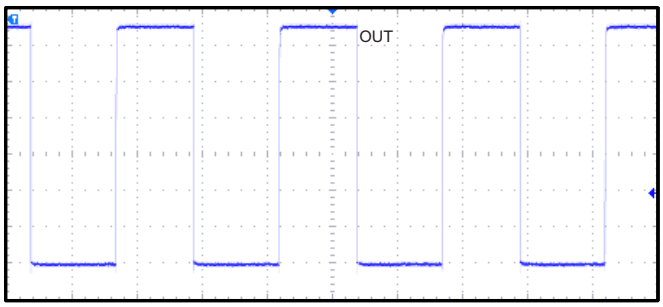
For this design example, use 公式 7 to calculate the value of C2.

$$2 \times 10\ kHz < \frac{1}{2\pi \times R1 \times C2} \tag{7}$$

An R1 value of 10 kΩ and a C2 value less than 820 pF satisfy the requirement for a 10-kHz system bandwidth.

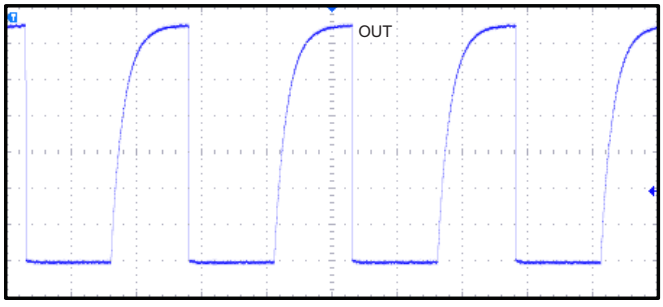
For R1 = 10 kΩ and C2 = 680 pF, the corner frequency for the low-pass filter is 23.4 kHz.

8.2.1.3 Application Curves



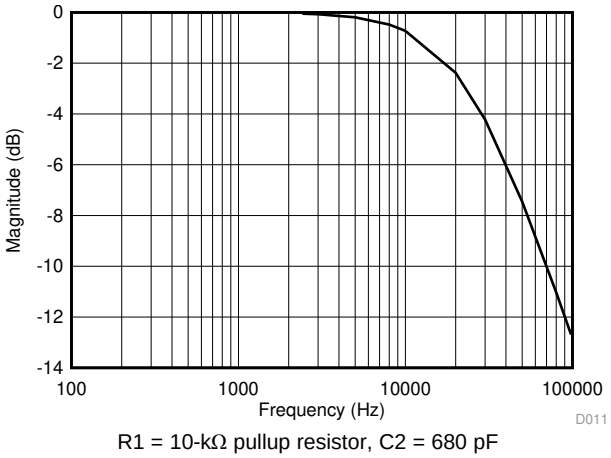
R1 = 10-kΩ pullup resistor, no C2 capacitor

图 21. 10-kHz Switching Magnetic Field



R1 = 10-kΩ pullup, C2 = 680 pF

图 22. 10-kHz Switching Magnetic Field



R1 = 10-kΩ pullup resistor, C2 = 680 pF

图 23. Low-Pass Filtering

8.2.2 Alternative Two-Wire Application

For systems that require a minimal wire count, connect the device output to V_{CC} through a resistor, and sense the total supplied current near the controller. Use a shunt resistor or other circuitry to sense the current.

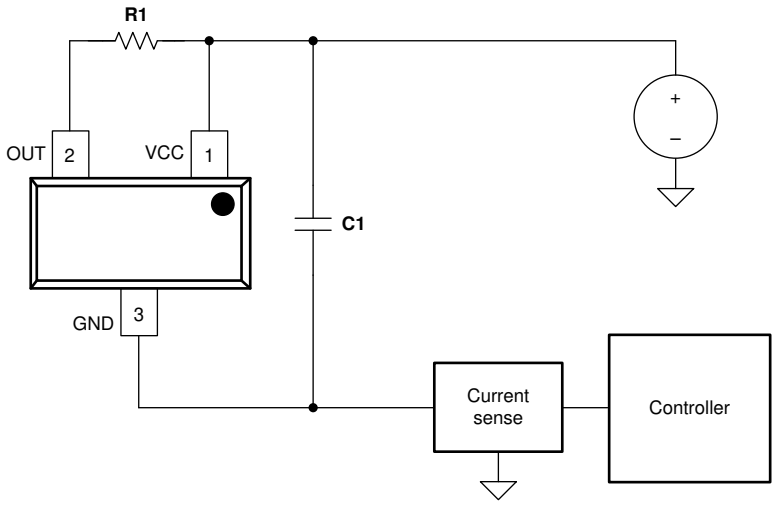


图 24. 2-Wire Application

8.2.2.1 Design Requirements

表 3 lists the related design parameters.

表 3. Design Parameters

DESIGN PARAMETER	REFERENCE	EXAMPLE VALUE
Supply voltage	V_{CC}	5 V
OUT resistor	R1	1 kΩ
Bypass capacitor	C1	0.1 µF
Current when B < B_{RP}	$I_{RELEASE}$	About 2.3 mA
Current when B > B_{OP}	$I_{OPERATE}$	About 7.3 mA

8.2.2.2 Detailed Design Procedure

When the open-drain output of the device is high-impedance, current through the path equals the I_{CC} of the device (approximately 2.3 mA).

When the output pulls low, a parallel current path is added, equal to V_{CC} / (R1 + $r_{DS(on)}$). Using 5 V and 1 kΩ, the parallel current is approximately 5 mA, making the total current approximately 7.3 mA.

Local bypass capacitor C1 must be at least 0.1 µF. Use a larger value capacitor if there is high inductance in the power line interconnect.

9 Power Supply Recommendations

The DRV5021-Q1 device is designed to operate from an input voltage supply (VM) range between 2.5 V and 5.5 V. A 0.1-µF (minimum) ceramic capacitor rated for V_{CC} must be placed as close to the DRV5021-Q1 device as possible.

10 Layout

10.1 Layout Guidelines

Place the bypass capacitor near the DRV5021-Q1 device for efficient power delivery with minimal inductance. Place the external pullup resistor near the microcontroller input to provide the most stable voltage at the input. Alternatively, an integrated pullup resistor within the GPIO of the microcontroller can be used.

Generally, PCB copper planes underneath the DRV5021-Q1 have no effect on magnetic flux, and do not interfere with device performance because copper is not a ferromagnetic material. However, If nearby system components contain iron or nickel, they may redirect magnetic flux in unpredictable ways.

10.2 Layout Example

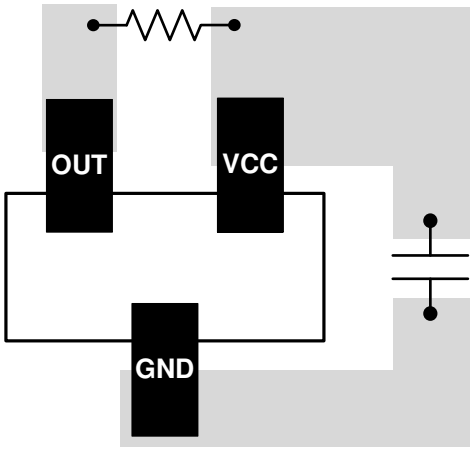


图 25. DRV5021-Q1 Layout Example

11 器件和文档支持

11.1 文档支持

11.1.1 相关文档

请参阅如下相关文档：

- 德州仪器 (TI)，*《霍尔适配器 EVM 用户指南》*
- 德州仪器 (TI)，*《了解和应用霍尔效应传感器数据表应用报告》*

11.2 接收文档更新通知

要接收文档更新通知，请导航至 TI.com.cn 上的器件产品文件夹。单击右上角的*通知我* 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

11.3 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 《使用条款》。

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ESD 的损坏小至导致微小的性能降级，大至整个器件故障。 精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

11.6 术语表

SLYZ022 — *TI 术语表*。

这份术语表列出并解释术语、缩写和定义。

12 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

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
DRV5021A1EDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 150	211Z	Samples
DRV5021A2EDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 150	212Z	Samples
DRV5021A3EDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 150	213Z	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.

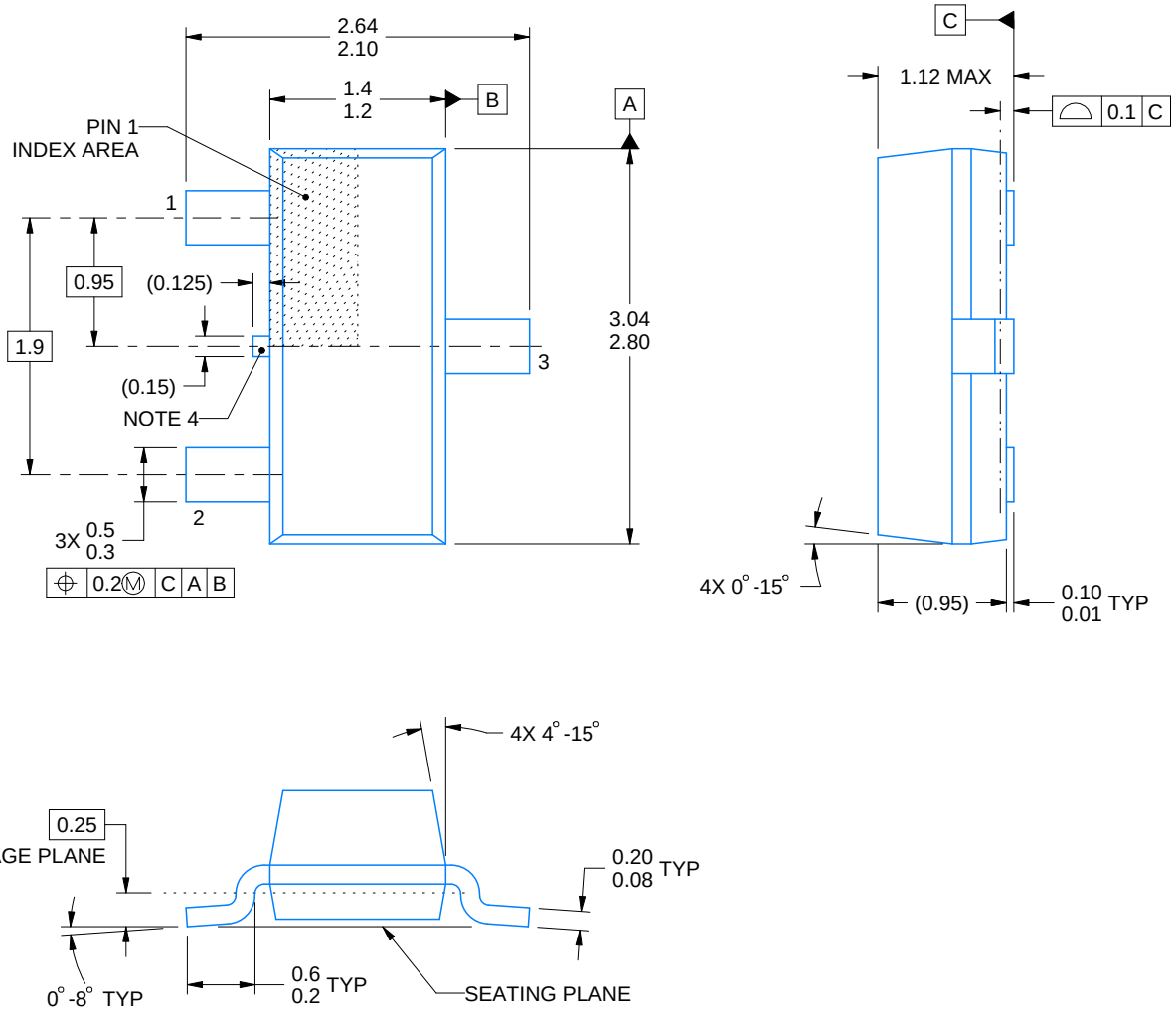
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

PACKAGE OUTLINE

DBZ0003A

SOT-23 - 1.12 mm max height

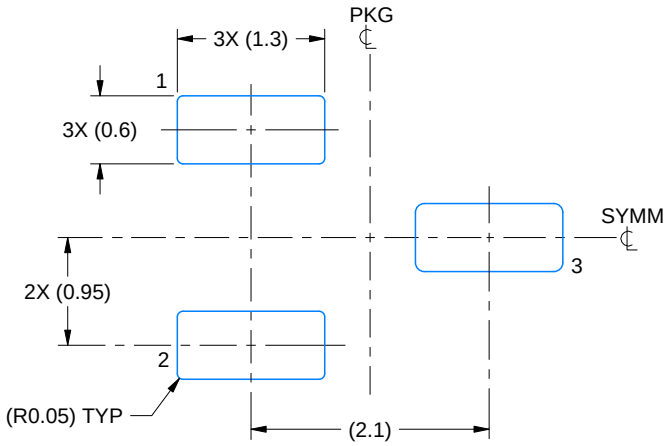
SMALL OUTLINE TRANSISTOR



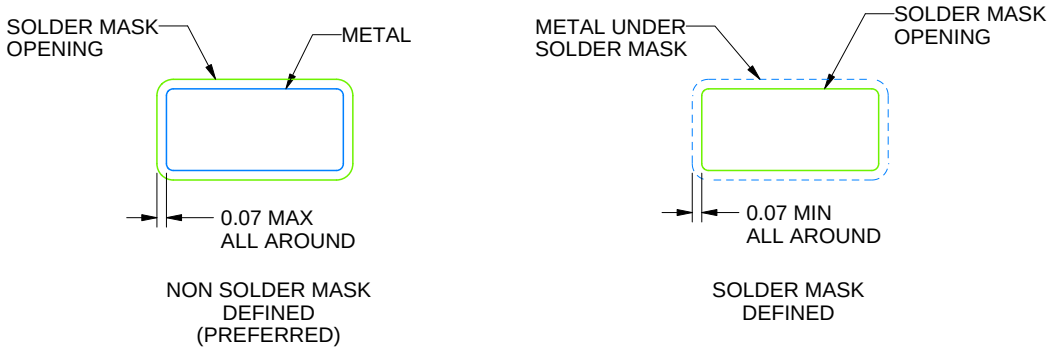
4214838/F 08/2024

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.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE
SCALE:15X



SOLDER MASK DETAILS

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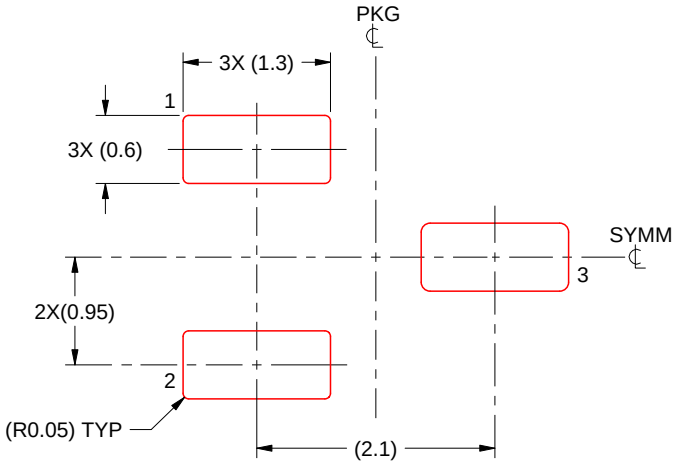
NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. 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)

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

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