

## DRV5053-Q1 汽车类 模拟双极霍尔效应传感器

### 1 特性

- 线性输出霍尔传感器
- 符合汽车应用要求的 AEC-Q100 标准
  - 1 级:  $T_A = -40$  至  $125^\circ\text{C}$  (Q, 请见图 17)
  - 0 级:  $T_A = -40$  至  $150^\circ\text{C}$  (E, 请见图 17)
- 出色的温度稳定性
  - 温度范围内的灵敏度为  $\pm 10\%$
- 高灵敏度选项:
  - $-11\text{mV/mT}$  (OA, 请见图 17)
  - $-23\text{mV/mT}$  (PA)
  - $-45\text{mV/mT}$  (RA)
  - $-90\text{mV/mT}$  (VA)
  - $+23\text{mV/mT}$  (CA)
  - $+45\text{mV/mT}$  (EA)
- 支持宽电压范围
  - $2.7\text{V}$  至  $38\text{V}$
  - 无需外部稳压器
- 放大的输出级
  - $2.3\text{mA}$  灌电流,  $300\mu\text{A}$  拉电流
- 输出电压:  $0.2\text{V}$  至  $1.8\text{V}$ 
  - $B = 0\text{mT}$ ,  $\text{OUT} = 1\text{V}$
- 快速上电:  $35\mu\text{s}$
- 小型封装尺寸
  - 表面贴装 3 引脚小外形尺寸晶体管 (SOT)-23 (DBZ)
    - $2.92\text{mm} \times 2.37\text{mm}$
  - 插入式 3 引脚系统级封装 (SIP) (LPG)
    - $4.00\text{mm} \times 3.15\text{mm}$
- 保护特性
  - 反向电源保护 (高达  $-22\text{V}$ )
  - 支持高达  $40\text{V}$  抛负载
  - 输出短路保护
  - 输出电流限制
  - 电池输出短路保护

### 2 应用

- 流量计
- 对接调整
- 振动校正
- 减震器控制

### 3 说明

DRV5053-Q1 器件是一款斩波稳定霍尔 IC, 能够在整个温度范围内提供具有出色灵敏度稳定性和集成保护特性的磁场感测解决方案。

$0\text{V}$  至  $2\text{V}$  模拟输出可对施加的磁感应强度做出线性响应, 并且能够辨别磁场方向的极性。反向极性保护高达  $-22\text{V}$  的宽工作电压范围 ( $2.7\text{V}$  至  $38\text{V}$ ) 使得此器件适用于广泛的汽车和消费类应用。

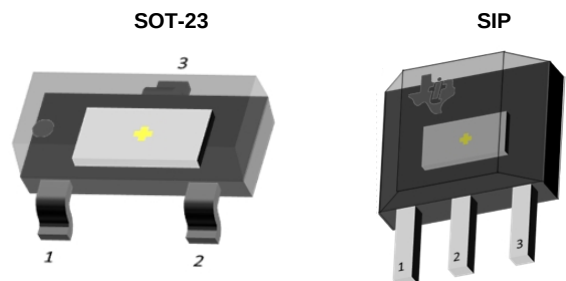
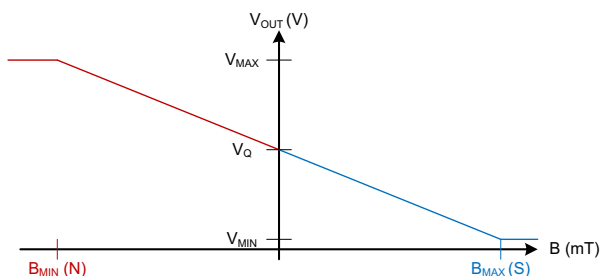
针对反向电源情况、负载突降和输出短路或过流提供内部保护功能。

器件信息<sup>(1)</sup>

| 器件型号       | 封装         | 封装尺寸 (标称值)                           |
|------------|------------|--------------------------------------|
| DRV5053-Q1 | SOT-23 (3) | $2.92\text{mm} \times 2.37\text{mm}$ |
|            | SIP (3)    | $4.00\text{mm} \times 3.15\text{mm}$ |

(1) 要了解所有可用封装, 请见数据表末尾的可订购产品附录。

### 4 输出状态



## 目录

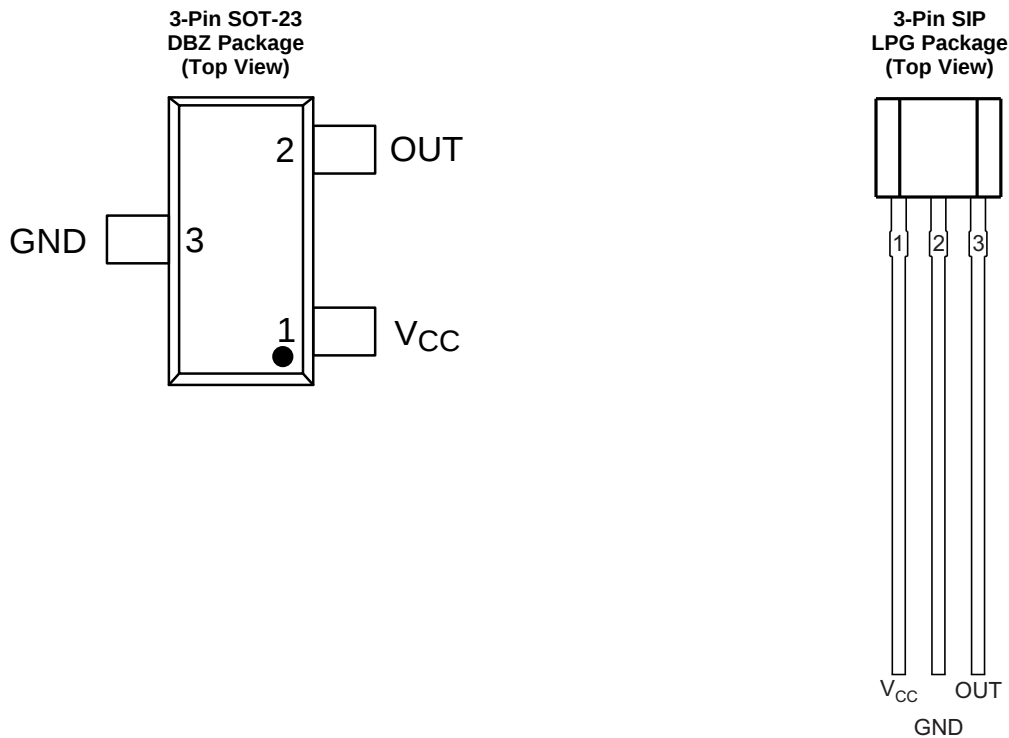
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## 5 修订历史记录

| 日期       | 修订版本 | 注释    |
|----------|------|-------|
| 2014年12月 | *    | 最初发布。 |

## 6 Pin Configuration and Functions

For additional configuration information, see [器件标记](#) and [机械封装和可订购信息](#).



**Pin Functions**

| PIN             |     |     | TYPE   | DESCRIPTION                                                                                                                     |
|-----------------|-----|-----|--------|---------------------------------------------------------------------------------------------------------------------------------|
| NAME            | DBZ | LPG |        |                                                                                                                                 |
| GND             | 3   | 2   | GND    | Ground pin                                                                                                                      |
| V <sub>CC</sub> | 1   | 1   | Power  | 2.7 to 38 V power supply. Bypass this pin to the GND pin with a 0.01-μF (minimum) ceramic capacitor rated for V <sub>CC</sub> . |
| OUT             | 2   | 3   | Output | Hall sensor analog output. 1 V output corresponds to B = 0 mT                                                                   |

## 7 Specifications

### 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                                                            |                                                             | MIN                | MAX                | UNIT |
|------------------------------------------------------------|-------------------------------------------------------------|--------------------|--------------------|------|
| Power supply voltage                                       | V <sub>CC</sub>                                             | –22 <sup>(2)</sup> | 40                 | V    |
|                                                            | Voltage ramp rate (V <sub>CC</sub> ), V <sub>CC</sub> < 5 V | Unlimited          |                    | V/μs |
|                                                            | Voltage ramp rate (V <sub>CC</sub> ), V <sub>CC</sub> > 5 V | 0                  | 2                  |      |
| Output pin voltage                                         | OUT                                                         | –0.5               | 2.5                | V    |
| Output pin reverse current during reverse supply condition | OUT                                                         | 0                  | –20                | mA   |
| Operating junction temperature, T <sub>J</sub>             | Q, see <a href="#">Figure 17</a>                            | –40                | 150 <sup>(3)</sup> | °C   |
|                                                            | E, see <a href="#">Figure 17</a>                            | –40                | 175 <sup>(4)</sup> |      |
| T <sub>stg</sub>                                           | Storage temperature range                                   | –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.
- (2) Ensured by design. Only tested to –20 V.
- (3) Tested in production to T<sub>A</sub> = 125°C.
- (4) Tested in production to T<sub>A</sub> = 150°C.

### 7.2 ESD Ratings

|                    |                         | VALUE                                                                                    | UNIT  |
|--------------------|-------------------------|------------------------------------------------------------------------------------------|-------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>              | ±2500 |
|                    |                         | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup> | ±500  |

- (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.

### 7.3 Recommended Operating Conditions

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

|                     |                                 | MIN                              | MAX | UNIT |
|---------------------|---------------------------------|----------------------------------|-----|------|
| V <sub>CC</sub>     | Power supply voltage            | 2.7                              | 38  | V    |
| V <sub>OUT</sub>    | Output pin voltage (OUT)        | 0                                | 2   | V    |
| I <sub>SOURCE</sub> | Output pin current source (OUT) | 0                                | 300 | μA   |
| I <sub>SINK</sub>   | Output pin current sink (OUT)   | 0                                | 2.3 | mA   |
| T <sub>A</sub>      | Operating ambient temperature   | Q, see <a href="#">Figure 17</a> | –40 | 125  |
|                     |                                 | E, see <a href="#">Figure 17</a> | –40 | 150  |

### 7.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | DRV5053-Q1 |        | UNIT |
|-------------------------------|----------------------------------------------|------------|--------|------|
|                               |                                              | DBZ        | LPG    |      |
|                               |                                              | 3 PINS     | 3 PINS |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 333.2      | 180    | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 99.9       | 98.6   |      |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 66.9       | 154.9  |      |
| Ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 4.9        | 40     |      |
| Ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 65.2       | 154.9  |      |

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 7.5 Electrical Characteristics

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

| PARAMETER                              |                                   | TEST CONDITIONS                                                                    | MIN | TYP | MAX | UNIT |
|----------------------------------------|-----------------------------------|------------------------------------------------------------------------------------|-----|-----|-----|------|
| <b>POWER SUPPLIES (V<sub>CC</sub>)</b> |                                   |                                                                                    |     |     |     |      |
| V <sub>CC</sub>                        | V <sub>CC</sub> operating voltage |                                                                                    | 2.7 |     | 38  | V    |
| I <sub>CC</sub>                        | Operating supply current          | V <sub>CC</sub> = 2.7 to 38 V, T <sub>A</sub> = 25°C                               |     | 2.7 |     | mA   |
|                                        |                                   | V <sub>CC</sub> = 2.7 to 38 V, T <sub>A</sub> = T <sub>A, MAX</sub> <sup>(1)</sup> |     | 3   | 3.6 |      |
| t <sub>on</sub>                        | Power-on time                     |                                                                                    |     | 35  | 50  | μs   |
| <b>PROTECTION CIRCUITS</b>             |                                   |                                                                                    |     |     |     |      |
| V <sub>CCR</sub>                       | Reverse supply voltage            |                                                                                    | –22 |     |     | V    |
| I <sub>OCPSOURCE</sub>                 | Overcurrent protection level      | Sourcing current                                                                   |     | 300 |     | μA   |
| I <sub>OCPSINK</sub>                   | Overcurrent protection level      | Sinking current                                                                    |     | 2.3 |     | mA   |

(1) T<sub>A, MAX</sub> is 125°C for Q Grade 1 devices and 150°C for E Grade 0 devices (see [Figure 17](#))

## 7.6 Switching Characteristics

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

| PARAMETER                  |                   | TEST CONDITIONS       | MIN | TYP | MAX | UNIT |
|----------------------------|-------------------|-----------------------|-----|-----|-----|------|
| <b>ANALOG OUTPUT (OUT)</b> |                   |                       |     |     |     |      |
| t <sub>d</sub>             | Output delay time | T <sub>A</sub> = 25°C |     | 13  | 25  | μs   |

## 7.7 Magnetic Characteristics

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

| PARAMETER                   |                                      | TEST CONDITIONS                                                                | MIN   | TYP  | MAX  | UNIT <sup>(1)</sup> |
|-----------------------------|--------------------------------------|--------------------------------------------------------------------------------|-------|------|------|---------------------|
| V <sub>Q</sub>              | Quiescent output                     | B = 0 mT                                                                       | 0.9   | 1.02 | 1.15 | V                   |
| f <sub>BW</sub>             | Bandwidth <sup>(2)</sup>             |                                                                                | 20    |      |      | kHz                 |
| B <sub>N</sub>              | Input-referred noise <sup>(3)</sup>  | C <sub>OUT</sub> = 50 pF                                                       | 0.40  | 0.58 | 0.79 | mT <sub>pp</sub>    |
| Le                          | Linearity <sup>(4)</sup>             | –B <sub>SAT</sub> < B < B <sub>SAT</sub>                                       |       | 1%   |      |                     |
| V <sub>OUT MIN</sub>        | Output saturation voltage (min)      | B < –B <sub>SAT</sub>                                                          |       |      | 0.2  | V                   |
| V <sub>OUT MAX</sub>        | Output saturation voltage (max)      | B > B <sub>SAT</sub>                                                           | 1.8   |      |      | V                   |
| <b>DRV5053OA: –11 mV/mT</b> |                                      |                                                                                |       |      |      |                     |
| S                           | Sensitivity                          | V <sub>CC</sub> = 3.3 V                                                        | –17.5 | –11  | –5   | mV/mT               |
| V <sub>N</sub>              | Output-referred noise <sup>(3)</sup> | V <sub>CC</sub> = 3.3 V; R <sub>OUT</sub> = 10 kΩ;<br>C <sub>OUT</sub> = 50 pF |       | 6    |      | mV <sub>pp</sub>    |
| B <sub>SAT</sub>            | Input saturation field               | V <sub>CC</sub> = 3.3 V                                                        |       | 73   |      | mT                  |
| <b>DRV5053PA: –23 mV/mT</b> |                                      |                                                                                |       |      |      |                     |
| S                           | Sensitivity                          | V <sub>CC</sub> = 3.3 V                                                        | –35   | –23  | –10  | mV/mT               |
| V <sub>N</sub>              | Output-referred noise <sup>(3)</sup> | V <sub>CC</sub> = 3.3 V; R <sub>OUT</sub> = 10 kΩ;<br>C <sub>OUT</sub> = 50 pF |       | 13   |      | mV <sub>pp</sub>    |
| B <sub>SAT</sub>            | Input saturation field               | V <sub>CC</sub> = 3.3 V                                                        |       | 35   |      | mT                  |

(1) 1 mT = 10 Gauss

(2) Bandwidth describes the fastest changing magnetic field that can be detected and translated to the output.

(3) Not tested in production; limits are based on characterization data.

(4) Linearity describes the change in sensitivity across the B-range. The sensitivity near B<sub>SAT</sub> is typically within 1% of the sensitivity near B = 0.

**DRV5053-Q1**

ZHCSD3 – DECEMBER 2014

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**Magnetic Characteristics (continued)**

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

| PARAMETER                   |                                      | TEST CONDITIONS                                                                   | MIN  | TYP | MAX | UNIT <sup>(1)</sup> |
|-----------------------------|--------------------------------------|-----------------------------------------------------------------------------------|------|-----|-----|---------------------|
| <b>DRV5053RA: –45 mV/mT</b> |                                      |                                                                                   |      |     |     |                     |
| S                           | Sensitivity                          | $V_{CC} = 3.3\text{ V}$                                                           | –70  | –45 | –20 | mV/mT               |
| $V_N$                       | Output-referred noise <sup>(3)</sup> | $V_{CC} = 3.3\text{ V}; R_{OUT} = 10\text{ k}\Omega;$<br>$C_{OUT} = 50\text{ pF}$ |      | 26  |     | mV <sub>pp</sub>    |
| $B_{SAT}$                   | Input saturation field               | $V_{CC} = 3.3\text{ V}$                                                           |      | 18  |     | mT                  |
| <b>DRV5053VA: –90 mV/mT</b> |                                      |                                                                                   |      |     |     |                     |
| S                           | Sensitivity                          | $V_{CC} = 3.3\text{ V}$                                                           | –140 | –90 | –45 | mV/mT               |
| $V_N$                       | Output-referred noise <sup>(3)</sup> | $V_{CC} = 3.3\text{ V}; R_{OUT} = 10\text{ k}\Omega;$<br>$C_{OUT} = 50\text{ pF}$ |      | 52  |     | mV <sub>pp</sub>    |
| $B_{SAT}$                   | Input saturation field               | $V_{CC} = 3.3\text{ V}$                                                           |      | 9   |     | mT                  |
| <b>DRV5053CA: 23 mV/mT</b>  |                                      |                                                                                   |      |     |     |                     |
| S                           | Sensitivity                          | $V_{CC} = 3.3\text{ V}$                                                           | 10   | 23  | 35  | mV/mT               |
| $V_N$                       | Output-referred noise <sup>(3)</sup> | $V_{CC} = 3.3\text{ V}; R_{OUT} = 10\text{ k}\Omega;$<br>$C_{OUT} = 50\text{ pF}$ |      | 13  |     | mV <sub>pp</sub>    |
| $B_{SAT}$                   | Input saturation field               | $V_{CC} = 3.3\text{ V}$                                                           |      | 35  |     | mT                  |
| <b>DRV5053EA: 45 mV/mT</b>  |                                      |                                                                                   |      |     |     |                     |
| S                           | Sensitivity                          | $V_{CC} = 3.3\text{ V}$                                                           | 20   | 45  | 70  | mV/mT               |
| $V_N$                       | Output-referred noise <sup>(3)</sup> | $V_{CC} = 3.3\text{ V}; R_{OUT} = 10\text{ k}\Omega;$<br>$C_{OUT} = 50\text{ pF}$ |      | 26  |     | mV <sub>pp</sub>    |
| $B_{SAT}$                   | Input saturation field               | $V_{CC} = 3.3\text{ V}$                                                           |      | 18  |     | mT                  |

## 7.8 Typical Characteristics

$T_A > 125^\circ\text{C}$  data is valid for Grade 0 devices only (E, see [Figure 17](#))

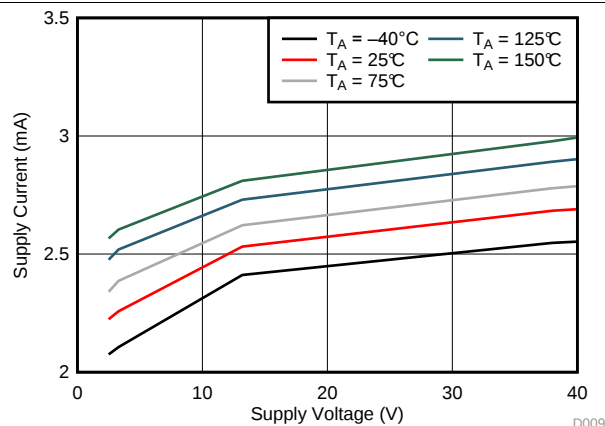


Figure 1.  $I_{CC}$  vs  $V_{CC}$

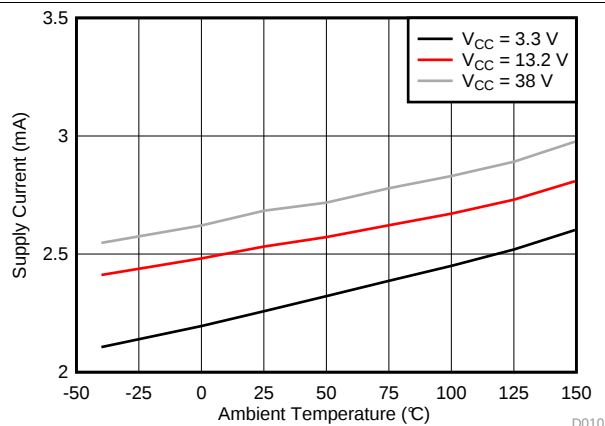


Figure 2.  $I_{CC}$  vs Temperature

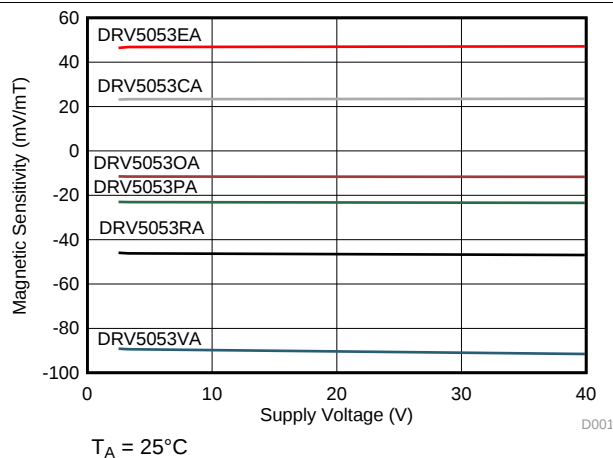


Figure 3. Sensitivity vs  $V_{CC}$

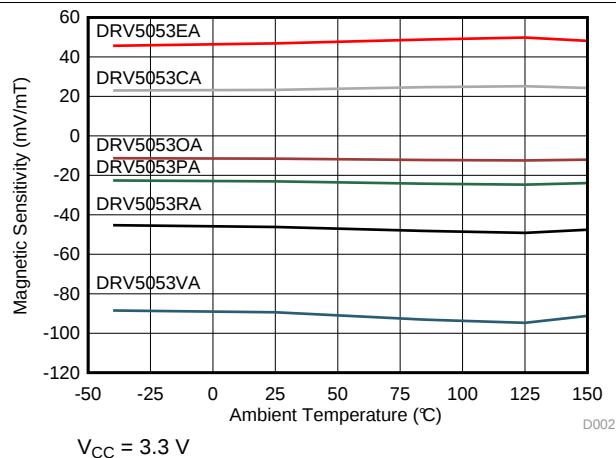


Figure 4. Sensitivity vs Temperature

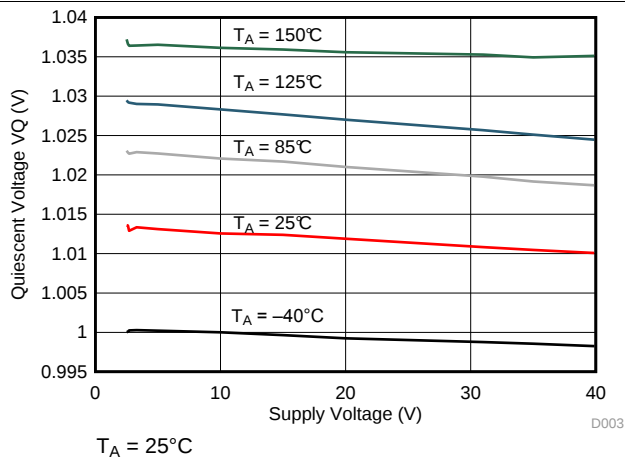


Figure 5. DRV5053-Q1AD,  $V_Q$  vs  $V_{CC}$

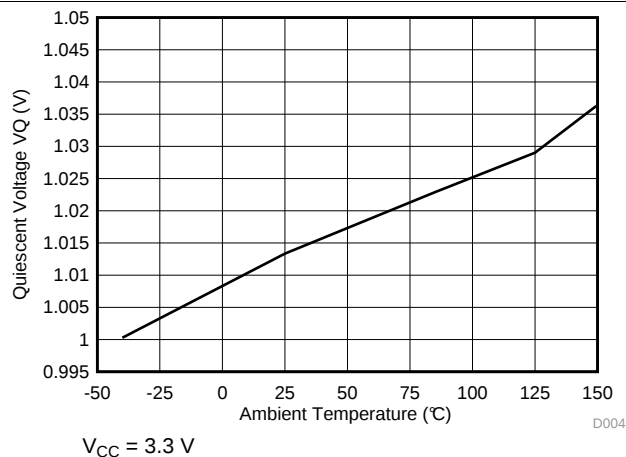


Figure 6. DRV5053-Q1AD,  $B_N$  vs Temperature

## 8 Detailed Description

### 8.1 Overview

The DRV5053-Q1 device is a chopper-stabilized hall sensor with an analog output for magnetic sensing applications. The DRV5053-Q1 device can be powered with a supply voltage between 2.7 and 38 V, and will survive  $-22$  V reverse battery conditions continuously. Note that the DRV5053-Q1 device will not be operating when approximately  $-22$  to  $2.4$  V is applied to  $V_{CC}$  (with respect to GND). In addition, the device can withstand supply voltages up to  $40$  V for transient durations.

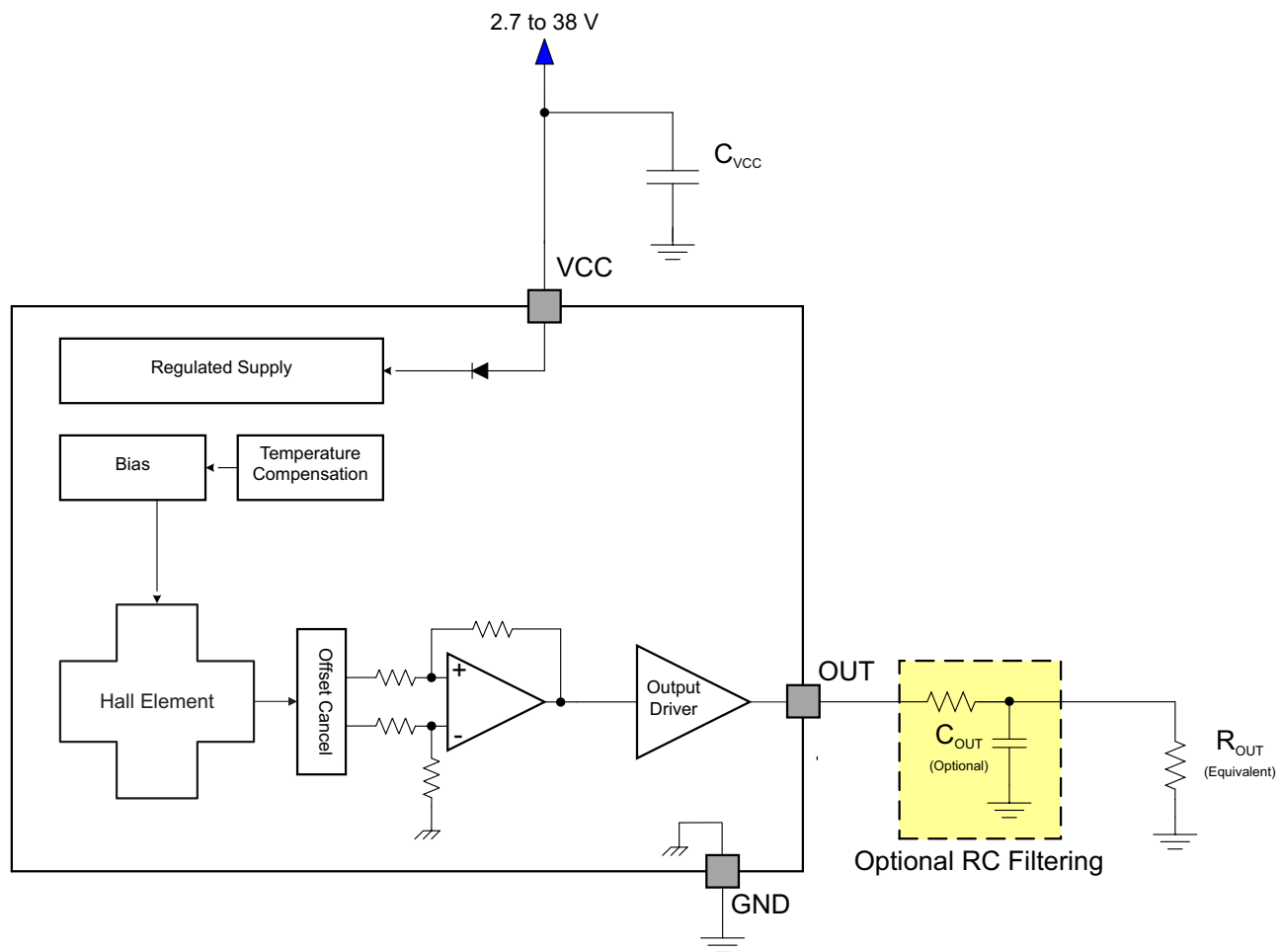
The output voltage is dependent on the magnetic field perpendicular to the package. The absence of a magnetic field will result in  $OUT = 1$  V. A magnetic field will cause the output voltage to change linearly with the magnetic field.

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.

For devices with a negative sensitivity (that is, DRV5053-Q1RA:  $-40$  mV/mT), a **south pole** will cause the output voltage to drop below  $1$  V, and a north pole will cause the output to rise above  $1$  V.

For devices with a positive sensitivity (that is, DRV5053-Q1EA:  $+40$  mV/mT), a **south pole** will cause the output voltage to rise above  $1$  V, and a north pole will cause the output to drop below  $1$  V.

### 8.2 Functional Block Diagram



## 8.3 Feature Description

### 8.3.1 Field Direction Definition

A positive magnetic field is defined as a **south pole** near the marked side of the package as shown in [Figure 7](#).

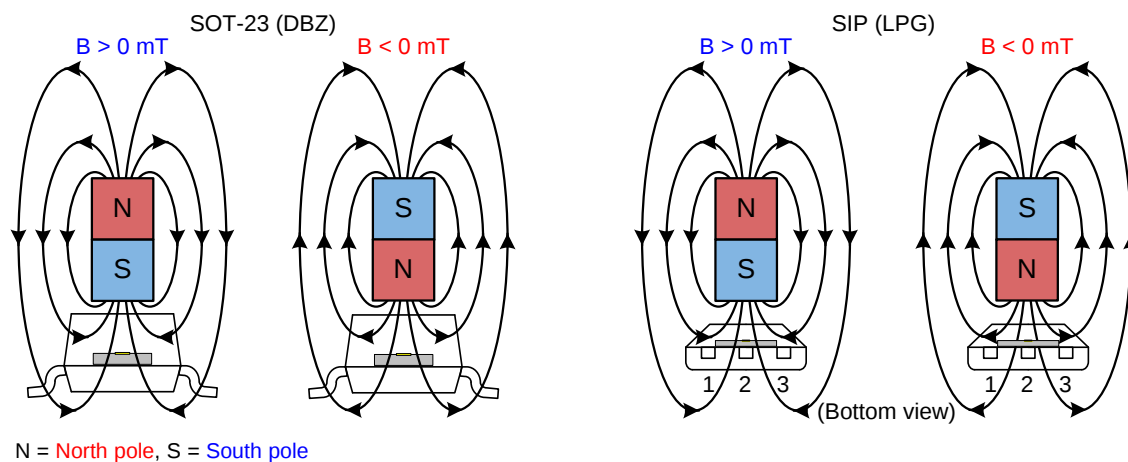


Figure 7. Field Direction Definition

### 8.3.2 Device Output

The DRV5053-Q1 device output is defined below for negative sensitivity (that is,  $-45$  mV/mT, RA) and positive sensitivity (that is,  $+45$  mV/mT, EA):

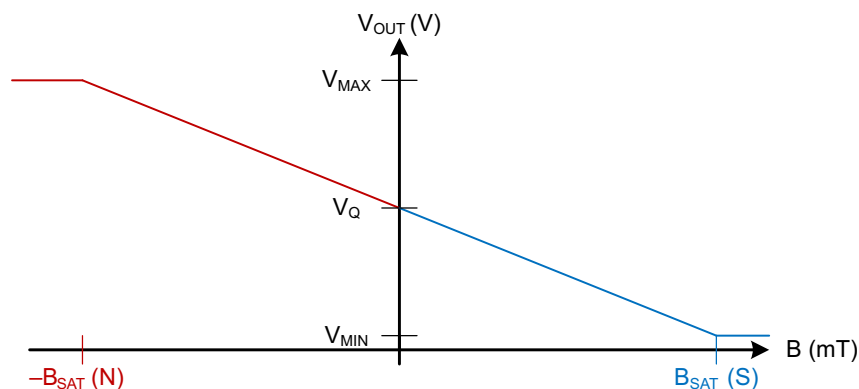


Figure 8. DRV5053-Q1 – Negative Sensitivity

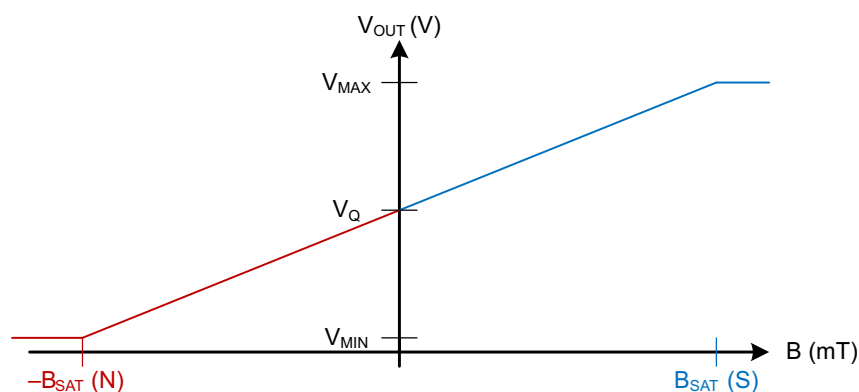


Figure 9. DRV5053-Q1 – Positive Sensitivity

## Feature Description (continued)

### 8.3.3 Power-On Time

After applying  $V_{CC}$  to the DRV5053-Q1 device,  $t_{ON}$  must elapse before OUT is valid. Figure 10 shows Case 1 and Figure 11 shows case 2; the output is defined assuming a negative sensitivity device and a constant magnetic field  $-B_{SAT} < B < B_{SAT}$ .

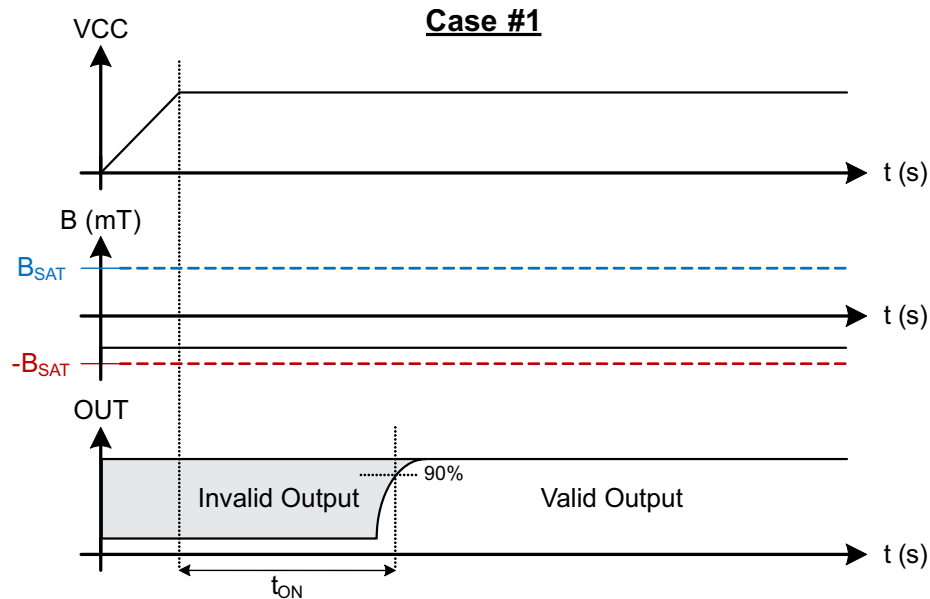


Figure 10. Case 1: Power On When  $B < 0$ , North

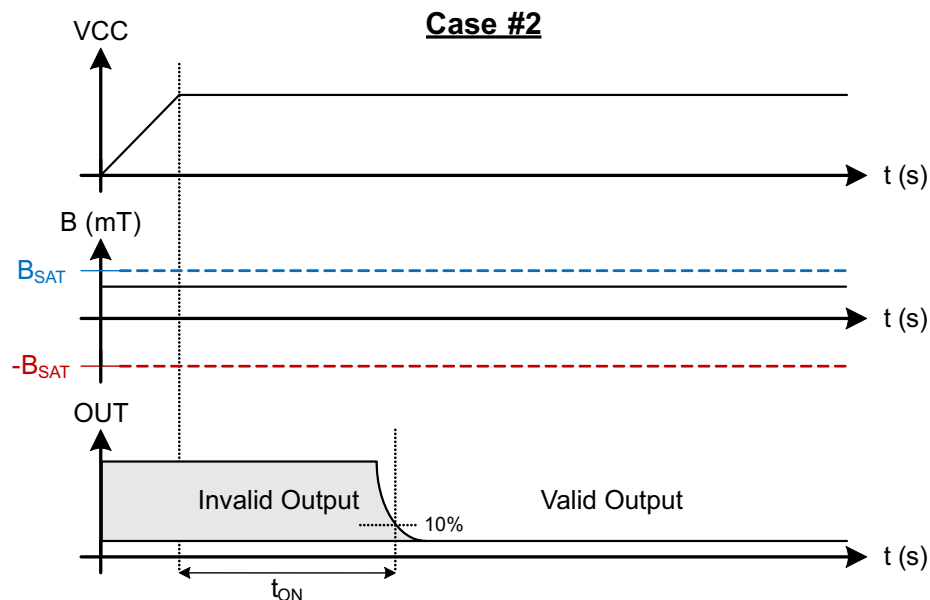


Figure 11. Case 2: Power On When  $B > 0$ , South

## Feature Description (continued)

### 8.3.4 Output Stage

The DRV5053-Q1 output stage is capable of up to 300  $\mu$ A of current source or 2.3 mA sink.

For proper operation, ensure that equivalent output load  $R_{OUT} > 10\text{ k}\Omega$ . In addition, ensure that the load capacitance  $C_{OUT} < 10\text{ nF}$ .

### 8.3.5 Protection Circuits

An analog current limit circuit limits the current through the output driver. The driver current will be clamped to  $I_{OCP}$ .

#### 8.3.5.1 Overcurrent Protection (OCP)

An analog current-limit circuit limits the current through the FET. The driver current is clamped to  $I_{OCP}$ . During this clamping, the  $r_{DS(on)}$  of the output FET is increased from the nominal value.

#### 8.3.5.2 Load Dump Protection

The DRV5053-Q1 device operates at DC  $V_{CC}$  conditions up to 38 V nominally, and can additionally withstand  $V_{CC} = 40\text{ V}$ . No current-limiting series resistor is required for this protection.

#### 8.3.5.3 Reverse Supply Protection

The DRV5053-Q1 device is protected in the event that the  $V_{CC}$  pin and the GND pin are reversed (up to  $-22\text{ V}$ ).

#### NOTE

In a reverse supply condition, the OUT pin reverse-current must not exceed the ratings specified in the [Absolute Maximum Ratings](#).

**Table 1.**

| FAULT              | CONDITION                            | DEVICE    | DESCRIPTION                                  | RECOVERY                   |
|--------------------|--------------------------------------|-----------|----------------------------------------------|----------------------------|
| FET overload (OCP) | $I_{SINK} \geq I_{OCP}$              | Operating | Output current is clamped to $I_{OCP}$       | $I_O < I_{OCP}$            |
| Load Dump          | $38\text{ V} < V_{CC} < 40\text{ V}$ | Operating | Device will operate for a transient duration | $V_{CC} \leq 38\text{ V}$  |
| Reverse Supply     | $-22\text{ V} < V_{CC} < 0\text{ V}$ | Disabled  | Device will survive this condition           | $V_{CC} \geq 2.7\text{ V}$ |

## 8.4 Device Functional Modes

The DRV5053-Q1 device is active only when  $V_{CC}$  is between 2.7 and 38 V.

When a reverse supply condition exists, the device is inactive.

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

### 9.1 Application Information

The DRV5053-Q1 device is used in magnetic-field sensing applications.

### 9.2 Typical Applications

#### 9.2.1 Typical Application With No Filter

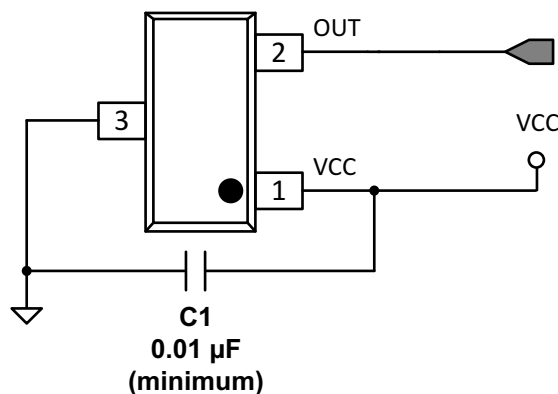


Figure 12. Typical Application Schematic – No Filter

##### 9.2.1.1 Design Requirements

For this design example, use the parameters listed in Table 2 as the input parameters.

Table 2. Design Parameters

| DESIGN PARAMETER | REFERENCE | EXAMPLE VALUE |
|------------------|-----------|---------------|
| System bandwidth | $f_{BW}$  | 15 kHz        |

##### 9.2.1.2 Detailed Design Procedure

The DRV5053-Q1 has internal filtering that limits the bandwidth to at least 20 kHz. For this application no external components are required other than the C1 bypass capacitor, which is 0.01  $\mu$ F minimum. If the analog output OUT is tied to a microcontroller ADC input, the equivalent load must be  $R > 10$  k $\Omega$  and  $C < 10$  nF.

Table 3. External Components

| COMPONENT | PIN 1           | PIN 2 | RECOMMENDED                                                           |
|-----------|-----------------|-------|-----------------------------------------------------------------------|
| C1        | V <sub>CC</sub> | GND   | A 0.01- $\mu$ F (minimum) ceramic capacitor rated for V <sub>CC</sub> |

### 9.2.1.3 Application Curve

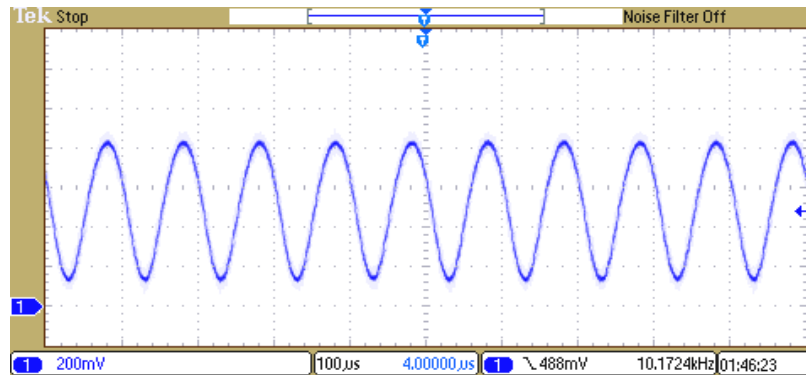


Figure 13. 10-kHz Switching Magnetic Field

### 9.2.2 Filtered Typical Application

For lower noise on the analog output OUT, additional RC filtering can be added to further reduce the bandwidth.

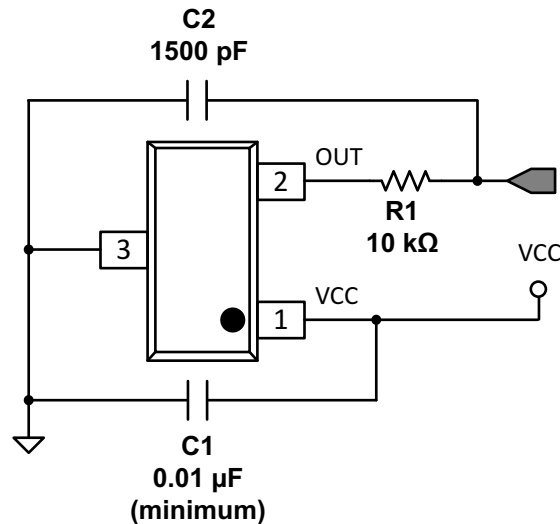


Figure 14. Filtered Typical Application Schematic

#### 9.2.2.1 Design Requirements

For this design example, use the parameters listed in Table 4 as the input parameters.

Table 4. Design Parameters

| DESIGN PARAMETER | REFERENCE | EXAMPLE VALUE |
|------------------|-----------|---------------|
| System bandwidth | $f_{BW}$  | 5 kHz         |

### 9.2.2.2 Detailed Design Procedure

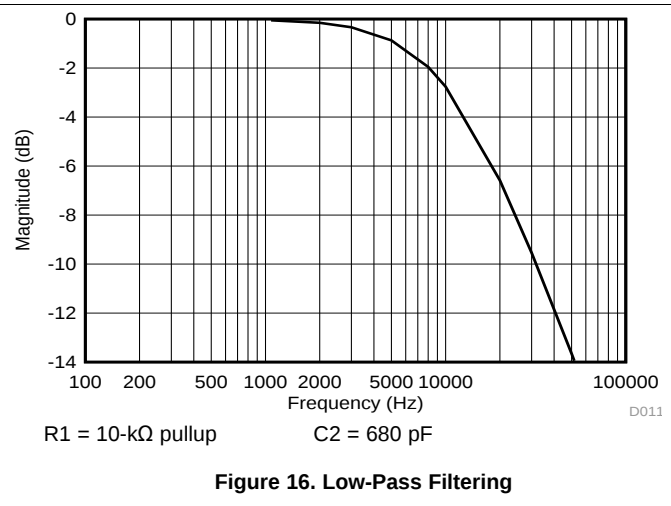
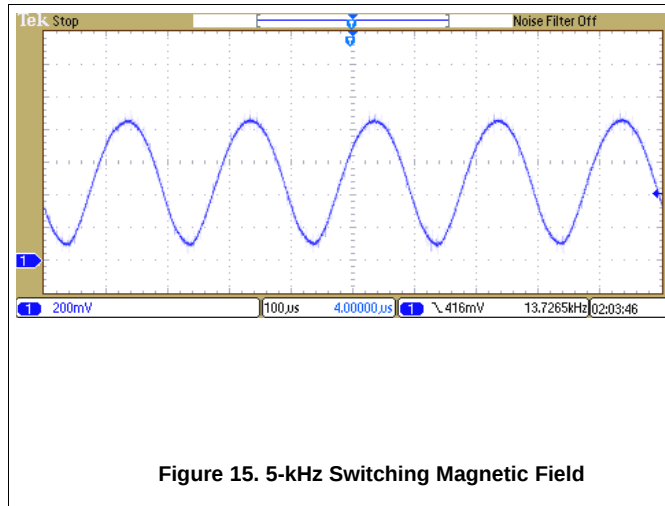
In this example we will add an external RC filter in order to reduce the output bandwidth.

In order to preserve the signal at the frequencies of interest, we will conservatively select a low-pass filter bandwidth (–3-dB point) at twice the system bandwidth (10 kHz).

$$10 \text{ kHz} < \frac{1}{2\pi \times R_1 \times C_2} \quad (1)$$

If we guess  $R_1 = 10 \text{ k}\Omega$ , then  $C_2 < 1590 \text{ pF}$ . So we select  $C_2 = 1500 \text{ pF}$ .

### 9.2.2.3 Application Curves



## 10 Power Supply Recommendations

The DRV5053-Q1 device is designed to operate from an input voltage supply (VM) range between 2.7 and 38 V. A 0.01-µF (minimum) ceramic capacitor rated for  $V_{CC}$  must be placed as close to the DRV5053-Q1 device as possible.

## 11 器件和文档支持

### 11.1 器件支持

#### 11.1.1 器件命名规则

图 17 显示了读取 DRV5053-Q1 器件完整器件名称的图例。

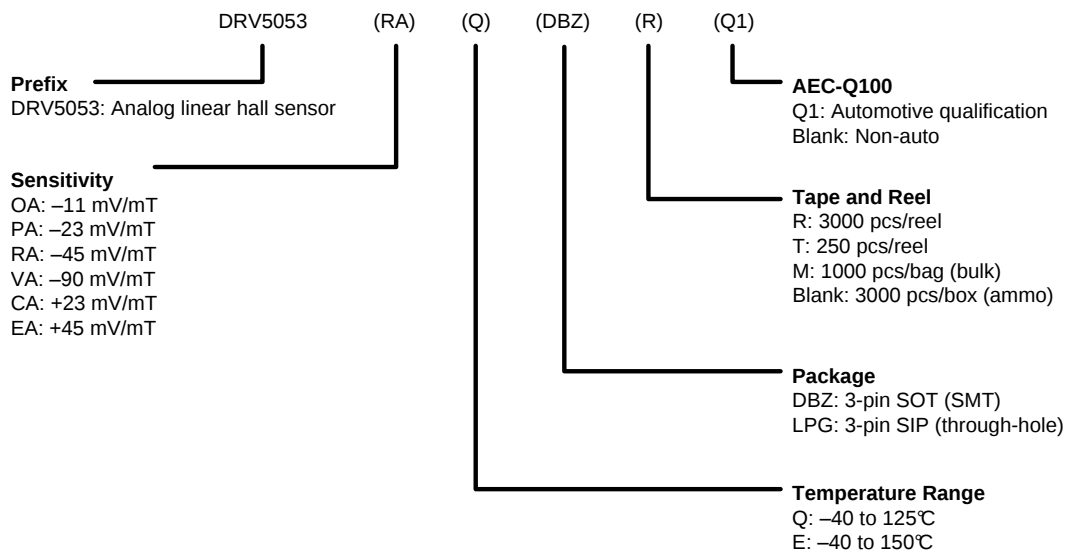


图 17. 器件命名规则

#### 11.1.2 器件标记

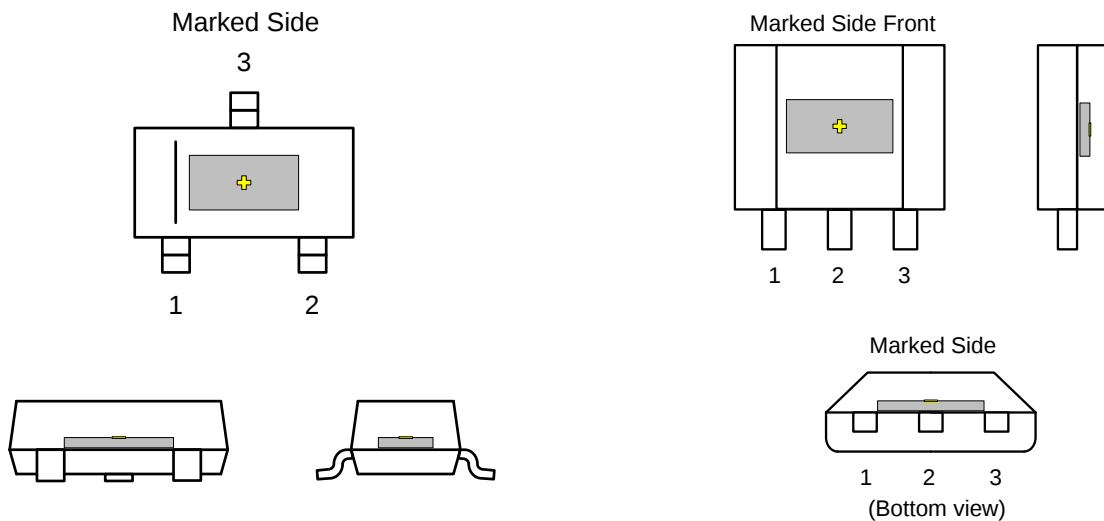


图 18. SOT-23 (DBZ) 封装

图 19. SIP (LPG) 封装

✚ 表示霍尔效应传感器（未按比例显示）。霍尔元件置于封装中央位置，容差为  $\pm 100\mu\text{m}$ 。在 DBZ 封装中，霍尔元件与封装底部的距离为  $0.7\text{mm} \pm 50\mu\text{m}$ ；在 LPG 封装中，霍尔元件与封装底部的距离为  $0.987\text{mm} \pm 50\mu\text{m}$ 。

## 11.2 商标

All trademarks are the property of their respective owners.

## 11.3 静电放电警告



这些装置包含有限的内置 ESD 保护。存储或装卸时，应将导线一起截短或将装置放置于导电泡棉中，以防止 MOS 门极遭受静电损伤。

## 11.4 术语表

[SLYZ022](#) — TI 术语表。

这份术语表列出并解释术语、首字母缩略词和定义。

## 12 机械封装和可订购信息

以下页中包括机械封装和可订购信息。 这些信息是针对指定器件可提供的最新数据。 这些数据会在无通知且不对本文档进行修订的情况下发生改变。 欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

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| 放大器和线性器件      | <a href="http://www.ti.com.cn/amplifiers">www.ti.com.cn/amplifiers</a>                     | 计算机及周边       | <a href="http://www.ti.com.cn/computer">www.ti.com.cn/computer</a>           |
| 数据转换器         | <a href="http://www.ti.com.cn/dataconverters">www.ti.com.cn/dataconverters</a>             | 消费电子         | <a href="http://www.ti.com.cn/consumer-apps">www.ti.com.cn/consumer-apps</a> |
| DLP® 产品       | <a href="http://www.dlp.com">www.dlp.com</a>                                               | 能源           | <a href="http://www.ti.com.cn/energy">www.ti.com.cn/energy</a>               |
| DSP - 数字信号处理器 | <a href="http://www.ti.com.cn/dsp">www.ti.com.cn/dsp</a>                                   | 工业应用         | <a href="http://www.ti.com.cn/industrial">www.ti.com.cn/industrial</a>       |
| 时钟和计时器        | <a href="http://www.ti.com.cn/clockandtimers">www.ti.com.cn/clockandtimers</a>             | 医疗电子         | <a href="http://www.ti.com.cn/medical">www.ti.com.cn/medical</a>             |
| 接口            | <a href="http://www.ti.com.cn/interface">www.ti.com.cn/interface</a>                       | 安防应用         | <a href="http://www.ti.com.cn/security">www.ti.com.cn/security</a>           |
| 逻辑            | <a href="http://www.ti.com.cn/logic">www.ti.com.cn/logic</a>                               | 汽车电子         | <a href="http://www.ti.com.cn/automotive">www.ti.com.cn/automotive</a>       |
| 电源管理          | <a href="http://www.ti.com.cn/power">www.ti.com.cn/power</a>                               | 视频和影像        | <a href="http://www.ti.com.cn/video">www.ti.com.cn/video</a>                 |
| 微控制器 (MCU)    | <a href="http://www.ti.com.cn/microcontrollers">www.ti.com.cn/microcontrollers</a>         |              |                                                                              |
| RFID 系统       | <a href="http://www.ti.com.cn/rfidsys">www.ti.com.cn/rfidsys</a>                           |              |                                                                              |
| OMAP应用处理器     | <a href="http://www.ti.com.cn/omap">www.ti.com.cn/omap</a>                                 |              |                                                                              |
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**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| DRV5053CAEDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJCA                   | <a href="#">Samples</a> |
| DRV5053CAEDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJCA                   | <a href="#">Samples</a> |
| DRV5053CAELPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJCA                   | <a href="#">Samples</a> |
| DRV5053CAELPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJCA                   | <a href="#">Samples</a> |
| DRV5053CAQDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKCA                   | <a href="#">Samples</a> |
| DRV5053CAQDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKCA                   | <a href="#">Samples</a> |
| DRV5053CAQLPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKCA                   | <a href="#">Samples</a> |
| DRV5053CAQLPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKCA                   | <a href="#">Samples</a> |
| DRV5053EAEDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJEA                   | <a href="#">Samples</a> |
| DRV5053EAEDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJEA                   | <a href="#">Samples</a> |
| DRV5053EAELPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJEA                   | <a href="#">Samples</a> |
| DRV5053EAELPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJEA                   | <a href="#">Samples</a> |
| DRV5053EAQDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AKEA                   | <a href="#">Samples</a> |
| DRV5053EAQDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AKEA                   | <a href="#">Samples</a> |
| DRV5053EAQLPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AKEA                   | <a href="#">Samples</a> |
| DRV5053EAQLPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKEA                   | <a href="#">Samples</a> |
| DRV5053OAEDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJOA                   | <a href="#">Samples</a> |
| DRV5053OAEDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJOA                   | <a href="#">Samples</a> |
| DRV5053OAELPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJOA                   | <a href="#">Samples</a> |
| DRV5053OAELPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJOA                   | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| DRV5053OAQDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKOA                   | <a href="#">Samples</a> |
| DRV5053OAQDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKOA                   | <a href="#">Samples</a> |
| DRV5053OAQLPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKOA                   | <a href="#">Samples</a> |
| DRV5053OAQLPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKOA                   | <a href="#">Samples</a> |
| DRV5053PAEDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJPA                   | <a href="#">Samples</a> |
| DRV5053PAEDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJPA                   | <a href="#">Samples</a> |
| DRV5053PAELPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJPA                   | <a href="#">Samples</a> |
| DRV5053PAELPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJPA                   | <a href="#">Samples</a> |
| DRV5053PAQDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKPA                   | <a href="#">Samples</a> |
| DRV5053PAQDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKPA                   | <a href="#">Samples</a> |
| DRV5053PAQLPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKPA                   | <a href="#">Samples</a> |
| DRV5053PAQLPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKPA                   | <a href="#">Samples</a> |
| DRV5053RAEDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJRA                   | <a href="#">Samples</a> |
| DRV5053RAEDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJRA                   | <a href="#">Samples</a> |
| DRV5053RAELPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJRA                   | <a href="#">Samples</a> |
| DRV5053RAELPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJRA                   | <a href="#">Samples</a> |
| DRV5053RAQDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKRA                   | <a href="#">Samples</a> |
| DRV5053RAQDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKRA                   | <a href="#">Samples</a> |
| DRV5053RAQLPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKRA                   | <a href="#">Samples</a> |
| DRV5053RAQLPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   |              | +AKRA                   | <a href="#">Samples</a> |
| DRV5053VAEDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJVA                   | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| DRV5053VAEDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 150   | +AJVA                   | <a href="#">Samples</a> |
| DRV5053VAELPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJVA                   | <a href="#">Samples</a> |
| DRV5053VAELPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 150   | +AJVA                   | <a href="#">Samples</a> |
| DRV5053VAQDBZRQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 3000           | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKVA                   | <a href="#">Samples</a> |
| DRV5053VAQDBZTQ1 | ACTIVE        | SOT-23       | DBZ                | 3    | 250            | RoHS & Green    | NIPDAUAG                             | Level-1-260C-UNLIM   | -40 to 125   | +AKVA                   | <a href="#">Samples</a> |
| DRV5053VAQLPGMQ1 | ACTIVE        | TO-92        | LPG                | 3    | 3000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKVA                   | <a href="#">Samples</a> |
| DRV5053VAQLPGQ1  | ACTIVE        | TO-92        | LPG                | 3    | 1000           | RoHS & Green    | SN                                   | N / A for Pkg Type   | -40 to 125   | +AKVA                   | <a href="#">Samples</a> |

(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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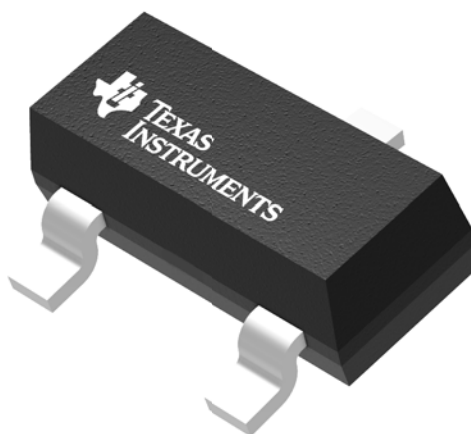
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## GENERIC PACKAGE VIEW

**DBZ 3**

**SOT-23 - 1.12 mm max height**

SMALL OUTLINE TRANSISTOR



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4203227/C

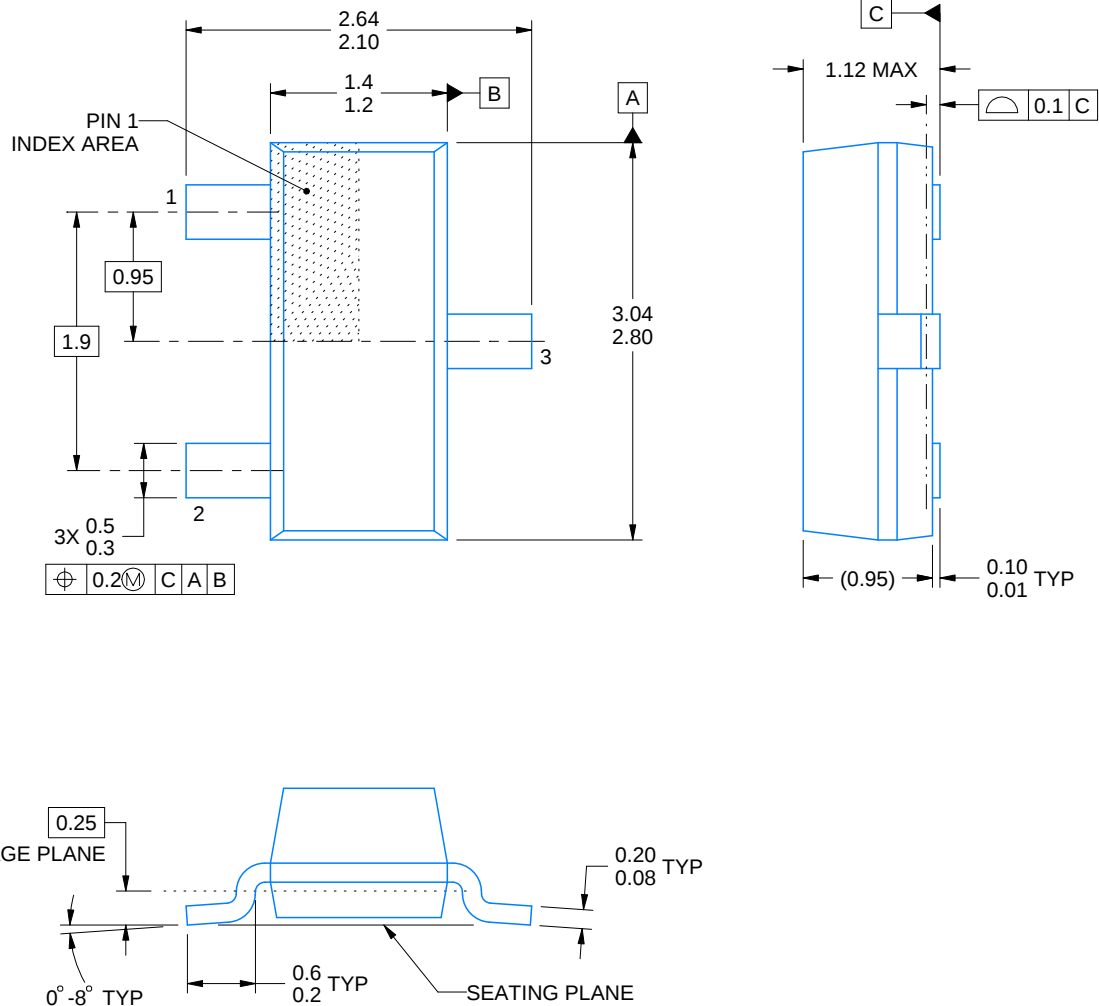
DBZ0003A



## PACKAGE OUTLINE

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



4214838/C 04/2017

### NOTES:

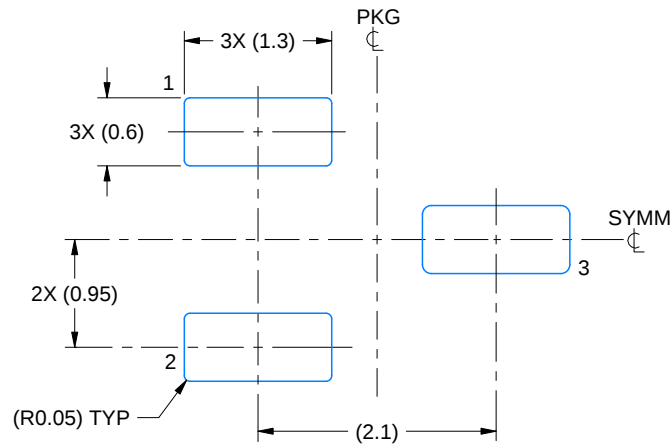
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.

# EXAMPLE BOARD LAYOUT

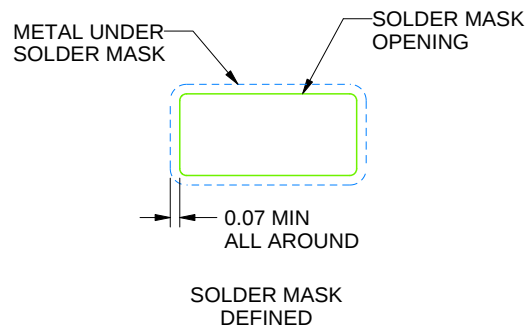
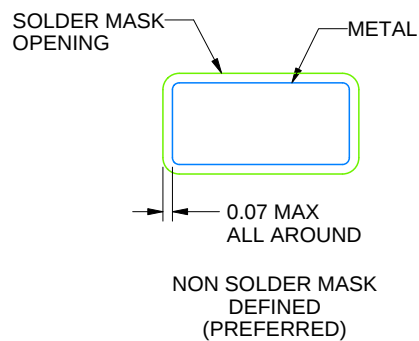
DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
SCALE:15X



SOLDER MASK DETAILS

4214838/C 04/2017

NOTES: (continued)

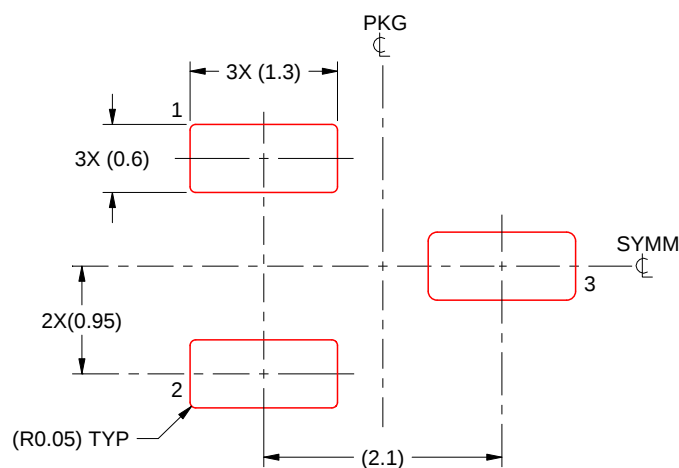
4. Publication IPC-7351 may have alternate designs.
5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR

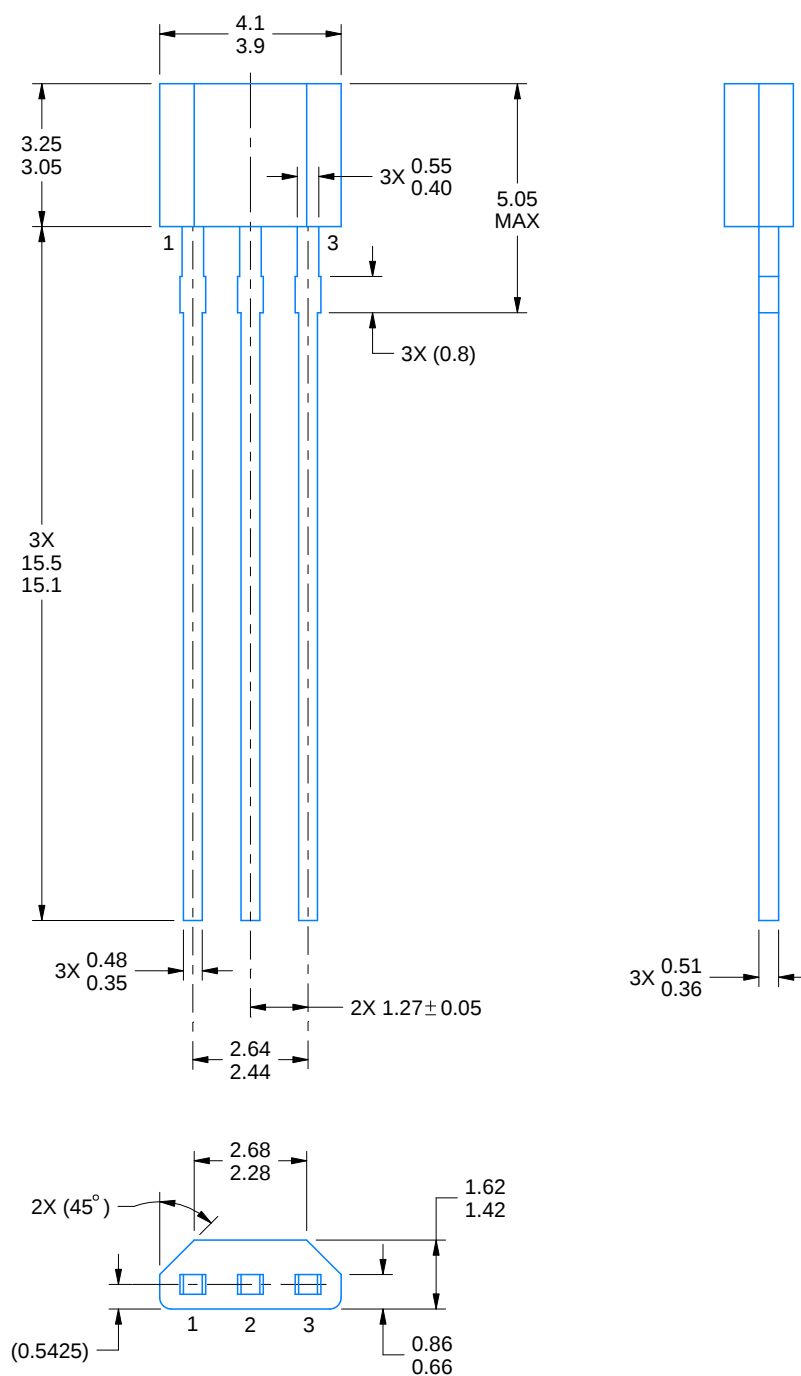
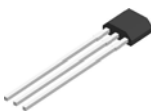


SOLDER PASTE EXAMPLE  
BASED ON 0.125 THICK STENCIL  
SCALE:15X

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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.



4221343/C 01/2018

## NOTES:

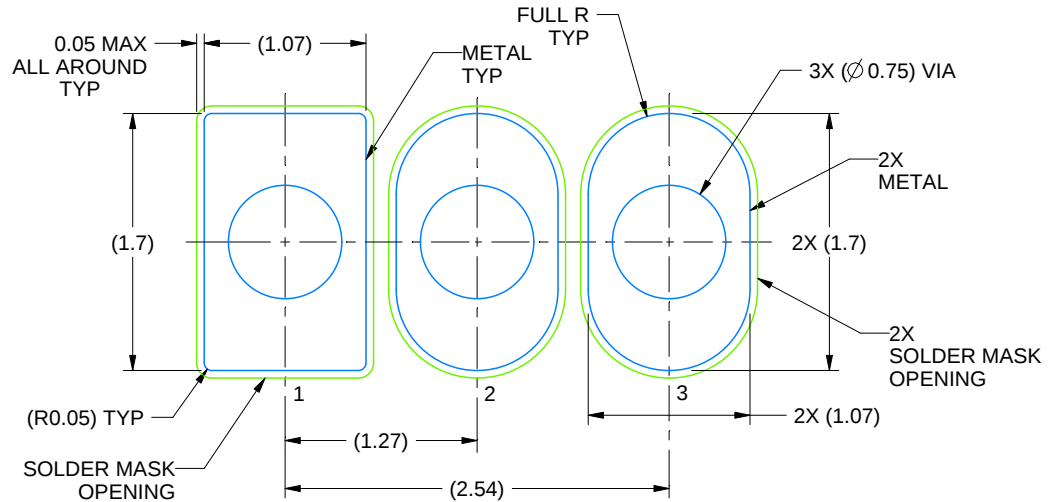
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

LPG0003A

TO-92 - 5.05 mm max height

TRANSISTOR OUTLINE



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

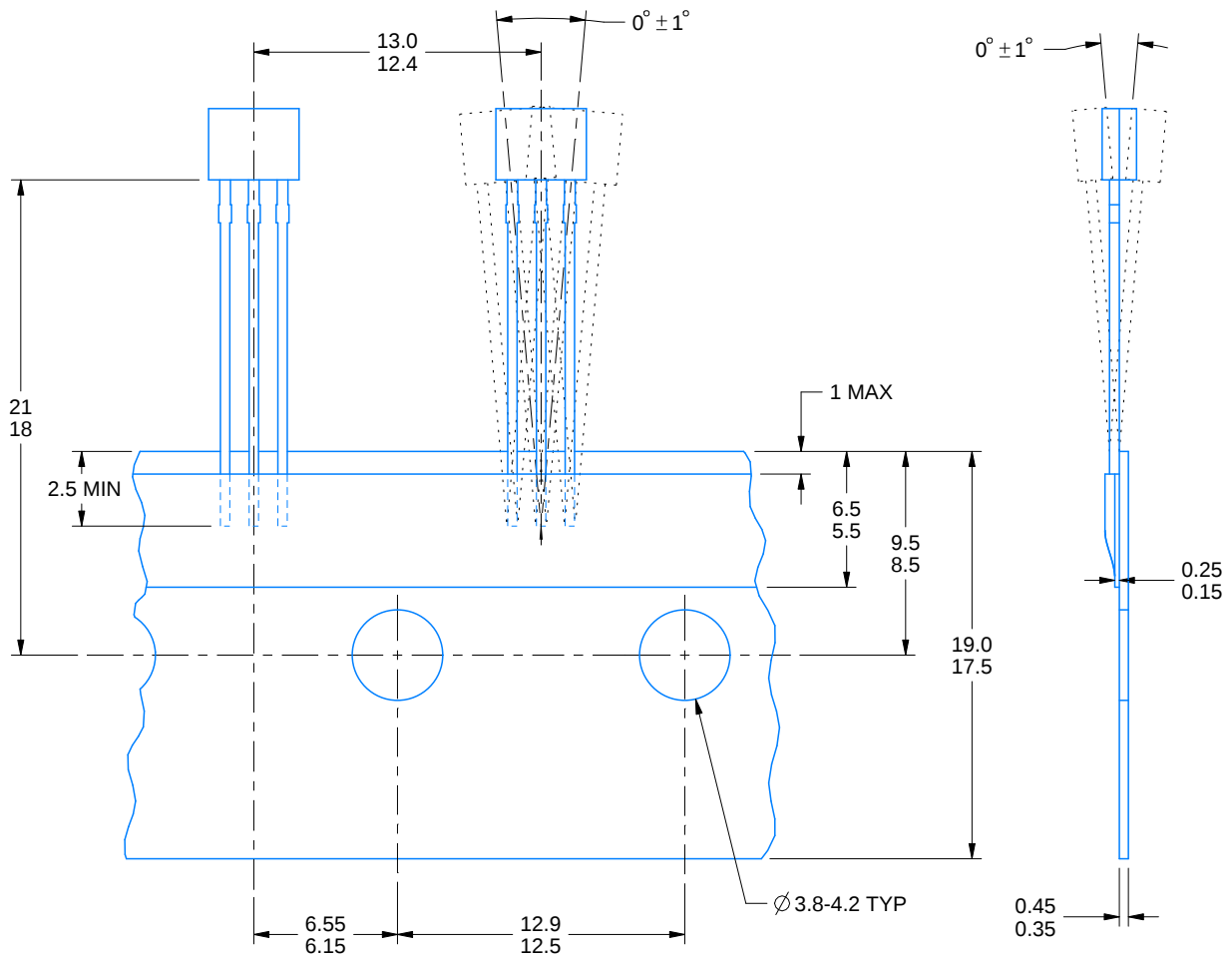
4221343/C 01/2018

# TAPE SPECIFICATIONS

LPG0003A

TO-92 - 5.05 mm max height

TRANSISTOR OUTLINE



4221343/C 01/2018

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