

DRV5013 数字锁存霍尔效应传感器

1 特性

- 数字双极锁存霍尔传感器
- 出色的温度稳定性
 - 在温度范围内 $B_{OP} \pm 10\%$
- 多种灵敏度选项 (B_{OP}/B_{RP})
 - 1.3/-1.3mT (FA, 请参见图 23)
 - 2.7/-2.7mT (AD, 请参见图 23)
 - 6/-6mT (AG, 请参见图 23)
 - 12/-12mT (BC, 请参见图 23)
- 支持宽电压范围
 - 2.5V 至 38V
 - 无需外部稳压器
- 宽运行电压范围
 - $T_A = -40$ 至 125°C (Q, 请见 图 23)
- 开漏输出 (30mA 灌电流)
- 35 μs 短暂上电时间
- 小型封装尺寸
 - 表面贴装 3 引脚小外形尺寸晶体管 (SOT)-23 (DBZ)
 - 2.92mm x 2.37mm
 - 插入式 3 引脚 TO-92 (LPG)
 - 4.00mm x 3.15mm
- 保护 特性
 - 反向电源保护 (高达 -22V)
 - 支持高达 40V 抛负载
 - 输出短路保护

– 输出电流限制

2 应用

- 电动工具
- 流量计
- 阀门和螺线管状态
- 无刷直流电机
- 接近感测
- 转速计

3 说明

DRV5013 器件是一款斩波稳定霍尔效应传感器，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。

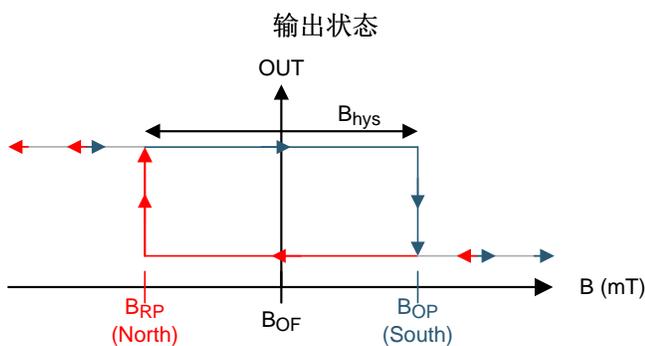
磁场由数字双极锁存输出表示。该集成电路 (IC) 配有一个灌电流能力达 30mA 的漏极开路输出级。反向极性保护高达 -22V 的宽工作电压范围 (2.5 至 38V) 使得此器件广泛适用于各种工业 应用。

提供针对反向电源情况、抛负载和输出短路或者过流的内部保护功能。

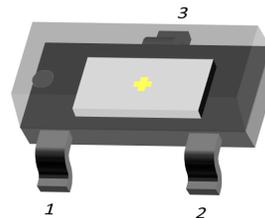
器件信息⁽¹⁾

器件型号	封装	封装尺寸 (标称值)
DRV5013	SOT-23 (3)	2.92mm x 1.30mm
	TO-92 (3)	4.00mm x 3.15mm

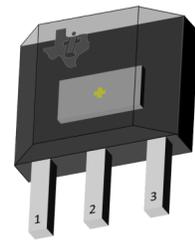
(1) 要了解所有可用封装，请见数据表末尾的可订购产品附录。



SOT-23



TO-92



目录

1 特性	1	7.1 Overview	9
2 应用	1	7.2 Functional Block Diagram	9
3 说明	1	7.3 Feature Description	10
4 修订历史记录	2	7.4 Device Functional Modes	15
5 Pin Configuration and Functions	4	8 Application and Implementation	16
6 Specifications	5	8.1 Application Information	16
6.1 Absolute Maximum Ratings	5	8.2 Typical Applications	16
6.2 ESD Ratings	5	9 Power Supply Recommendations	18
6.3 Recommended Operating Conditions	5	10 器件和文档支持	19
6.4 Thermal Information	5	10.1 器件支持	19
6.5 Electrical Characteristics	6	10.2 社区资源	20
6.6 Switching Characteristics	6	10.3 商标	20
6.7 Magnetic Characteristics	6	10.4 静电放电警告	20
6.8 Typical Characteristics	7	10.5 Glossary	20
7 Detailed Description	9	11 机械、封装和可订购信息	20

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。

Changes from Revision E (February 2016) to Revision F Page

• Revised preliminary limits for the FA version	6
---	---

Changes from Revision D (December 2015) to Revision E Page

• 已添加 FA 器件选项	1
• Added the typical bandwidth value to the <i>Magnetic Characteristics</i> table	6

Changes from Revision C (September 2014) to Revision D Page

• 已更正 SOT-23 封装体尺寸并将 SIP 封装名称更正为 TO-92	1
• Added B_{MAX} to <i>Absolute Maximum Ratings</i>	5
• Removed table note from junction temperature	5
• 已更新封装卷带选项 M 和空白	19
• 已添加 社区资源	20

Changes from Revision B (July 2014) to Revision C Page

• 已更新高灵敏度选项	1
• Updated the max operating junction temperature to 150°C	5
• Updated the output rise and fall time typical values and removed max values in <i>Switching Characteristics</i>	6
• Updated the values in <i>Magnetic Characteristics</i>	6
• Updated all <i>Typical Characteristics</i> graphs	7
• Updated Equation 4	17
• 已更新 图 23	19

Changes from Revision A (March 2014) to Revision B **Page**

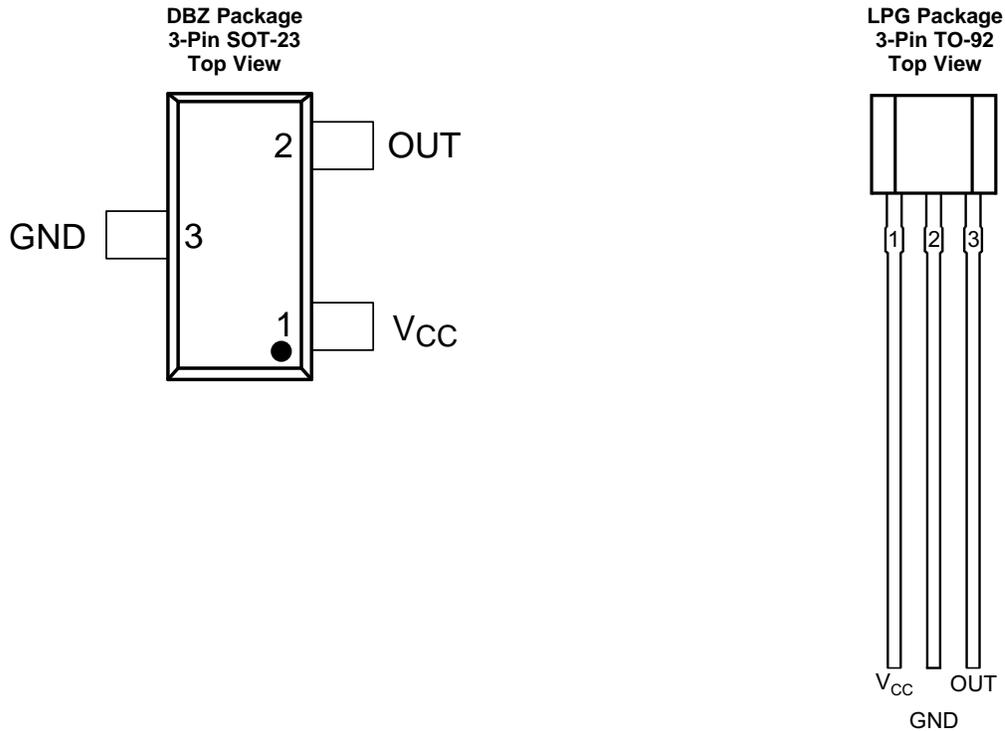
- Changed I_{OCP} minimum and maximum values from 20 and 40 to 15 and 45 (respectively) in the *Electrical Characteristics* table 6
 - Updated the hysteresis values for each device option in the *Magnetic Characteristics* table..... 6
 - Changed the MIN value for the +2.3 / – 2.3 mT B_{RP} parameter from –4 to –5 in the *Magnetic Characteristics* table 6
-

Changes from Original (March 2014) to Revision A **Page**

- 已更改 特性分类等级 1
 - 已更改 *RPM* 转速表至转速计 (应用分类等级)..... 1
 - 已更改 将所有提到霍尔 IC 的地方改为霍尔效应传感器 1
 - Changed the type of the OUT terminal from OD to Output in the *Pin Functions* table 4
 - Deleted the Output terminal current row in the *Absolute Maximum Ratings* table and changed V_{CCmax} to V_{CC} after the voltage ramp rate for the power supply voltage 5
 - Changed R_O to R_1 in the test conditions for t_r and t_f in the *Switching Characteristics* table..... 6
 - Added the bandwidth parameter to the *Magnetic Characteristics* table 6
 - Changed the MIN value for the +2.3 / – 2.3 mT B_{RP} parameter from +2.3 to –2.3 in the *Magnetic Characteristics* table 6
 - Deleted the condition statement from the *Typical Characteristics* section and changed all references of T_J to T_A in the graph condition statements 7
 - Deleted *Number* from the Power-On Time case names and added conditions to the captions of the case timing diagrams 11
 - Added the R_1 tradeoff and lower current text after the equation in the *Output Stage* section 13
 - Added the C2 not required for most applications text after the second equation in the *Output Stage* section..... 14
 - Changed I_O to I_{SINK} in the condition statement of the FET overload fault condition in the *Reverse Supply Protection* section 15
-

5 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

NAME	PIN		TYPE	DESCRIPTION
	DBZ	LPG		
GND	3	2	GND	Ground pin
OUT	2	3	Output	Hall sensor open-drain output. The open drain requires a resistor pullup.
V _{CC}	1	1	PWR	2.5 to 38 V power supply. Bypass this pin to the GND pin with a 0.01- μ F (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	V _{CC}	-22 ⁽²⁾	40	V
	Voltage ramp rate (V _{CC}), V _{CC} < 5 V	Unlimited		V/μs
	Voltage ramp rate (V _{CC}), V _{CC} > 5 V	0	2	
Output pin voltage		-0.5	40	V
Output pin reverse current during reverse supply condition		0	100	mA
Magnetic flux density, B _{MAX}		Unlimited		
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.
- (2) Ensured by design. Only tested to -20 V.

6.2 ESD Ratings

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

6.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
V _{CC}	Power supply voltage	2.5	38	V
V _O	Output pin voltage (OUT)	0	38	V
I _{SINK}	Output pin current sink (OUT) ⁽¹⁾	0	30	mA
T _A	Operating ambient temperature	-40	125	°C

- (1) Power dissipation and thermal limits must be observed

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾	DRV5013		UNIT	
	DBZ (SOT-23)	LPG (TO-92)		
	3 PINS	3 PINS		
R _{θJA}	Junction-to-ambient thermal resistance	333.2	180	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	99.9	98.6	°C/W
R _{θJB}	Junction-to-board thermal resistance	66.9	154.9	°C/W
ψ _{JT}	Junction-to-top characterization parameter	4.9	40	°C/W
ψ _{JB}	Junction-to-board characterization parameter	65.2	154.9	°C/W

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

6.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
POWER SUPPLIES (V_{CC})						
V _{CC}	V _{CC} operating voltage		2.5		38	V
I _{CC}	Operating supply current	V _{CC} = 2.5 to 38 V, T _A = 25°C		2.7		mA
		V _{CC} = 2.5 to 38 V, T _A = 125°C		3	3.5	
t _{on}	Power-on time			35	50	μs
OPEN DRAIN OUTPUT (OUT)						
r _{DS(on)}	FET on-resistance	V _{CC} = 3.3 V, I _O = 10 mA, T _A = 25°C		22		Ω
		V _{CC} = 3.3 V, I _O = 10 mA, T _A = 125°C		36	50	
I _{lkg(off)}	Off-state leakage current	Output Hi-Z			1	μA
PROTECTION CIRCUITS						
V _{CCR}	Reverse supply voltage		-22			V
I _{OCP}	Overcurrent protection level	OUT shorted V _{CC}	15	30	45	mA

6.6 Switching Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
OPEN DRAIN OUTPUT (OUT)						
t _d	Output delay time	B = B _{RP} – 10 mT to B _{OP} + 10 mT in 1 μs		13	25	μs
t _r	Output rise time (10% to 90%)	R1 = 1 kΩ, C _O = 50 pF, V _{CC} = 3.3 V		200		ns
t _f	Output fall time (90% to 10%)	R1 = 1 kΩ, C _O = 50 pF, V _{CC} = 3.3 V		31		ns

6.7 Magnetic Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT ⁽¹⁾
f _{BW}	Bandwidth ⁽²⁾		20	30		kHz
DRV5013FA: 1.3 / -1.3 mT						
B _{OP}	Operate point; see Figure 12	T _A = -40°C to 125°C	-0.6	1.3	3.2	mT
B _{RP}	Release point; see Figure 12		-3.2	-1.3	0.6	mT
B _{hys}	Hysteresis; B _{hys} = (B _{OP} – B _{RP})		1.2	2.6		mT
B _O	Magnetic offset; B _O = (B _{OP} + B _{RP}) / 2		-1.5	0	1.5	mT
DRV5013AD: 2.7 / -2.7 mT						
B _{OP}	Operate point; see Figure 12	T _A = -40°C to 125°C	1	2.7	5	mT
B _{RP}	Release point; see Figure 12		-5	-2.7	-1	mT
B _{hys}	Hysteresis; B _{hys} = (B _{OP} – B _{RP})			5.4		mT
B _O	Magnetic offset; B _O = (B _{OP} + B _{RP}) / 2		-1.5	0	1.5	mT
DRV5013AG: 6 / -6 mT						
B _{OP}	Operate point; see Figure 12	T _A = -40°C to 125°C	3	6	9	mT
B _{RP}	Release point; see Figure 12		-9	-6	-3	mT
B _{hys}	Hysteresis; B _{hys} = (B _{OP} – B _{RP})			12		mT
B _O	Magnetic offset; B _O = (B _{OP} + B _{RP}) / 2		-1.5	0	1.5	mT

(1) 1 mT = 10 Gauss

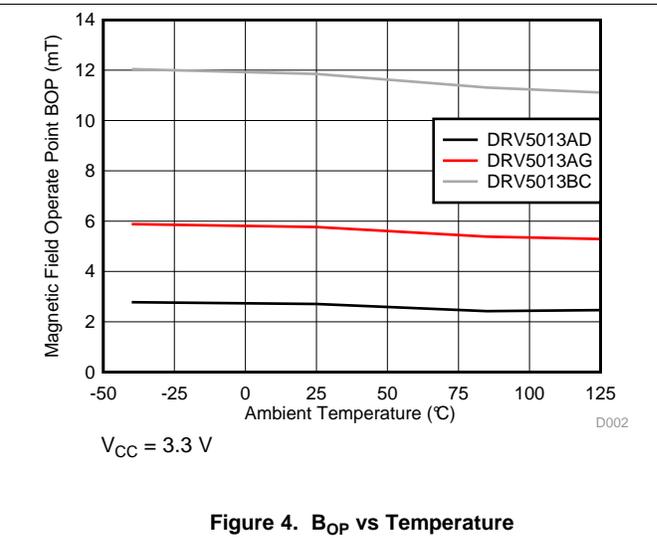
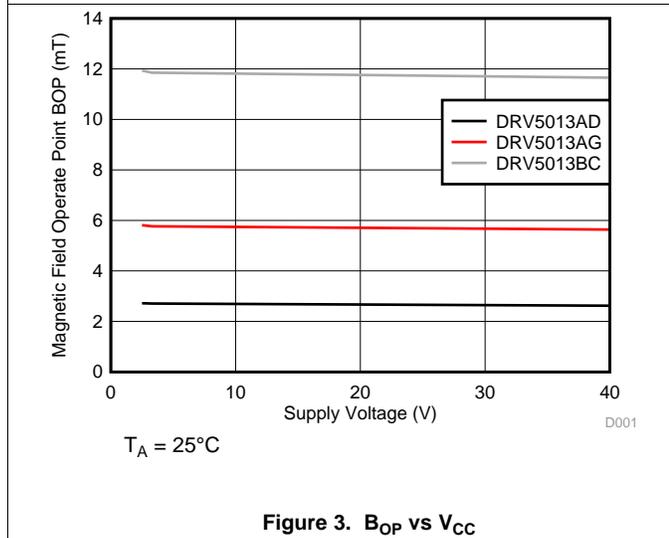
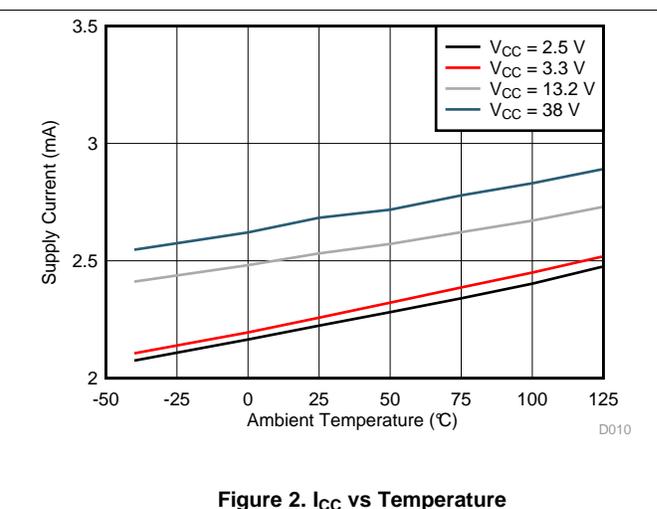
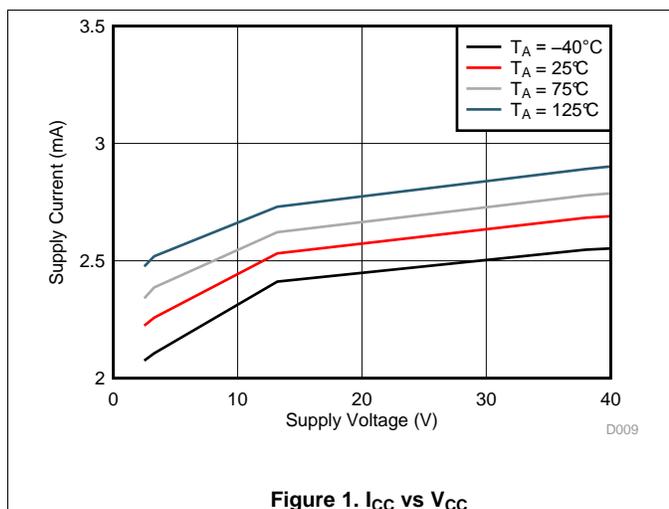
(2) Bandwidth describes the fastest changing magnetic field that can be detected and translated to the output.

Magnetic Characteristics (continued)

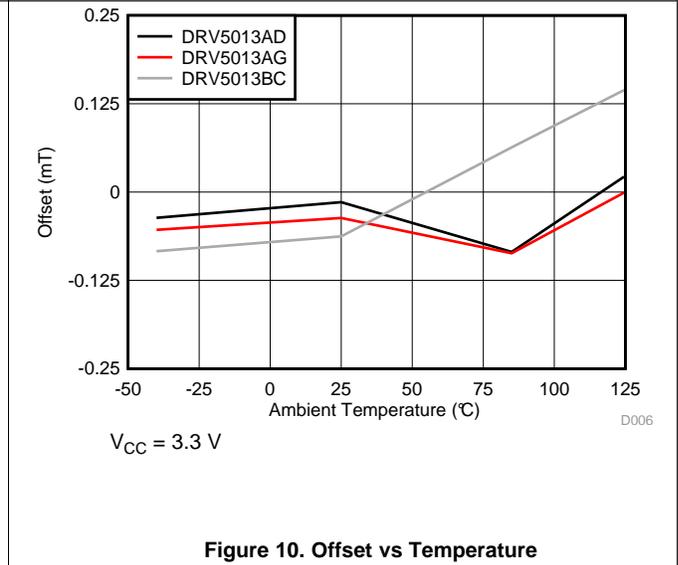
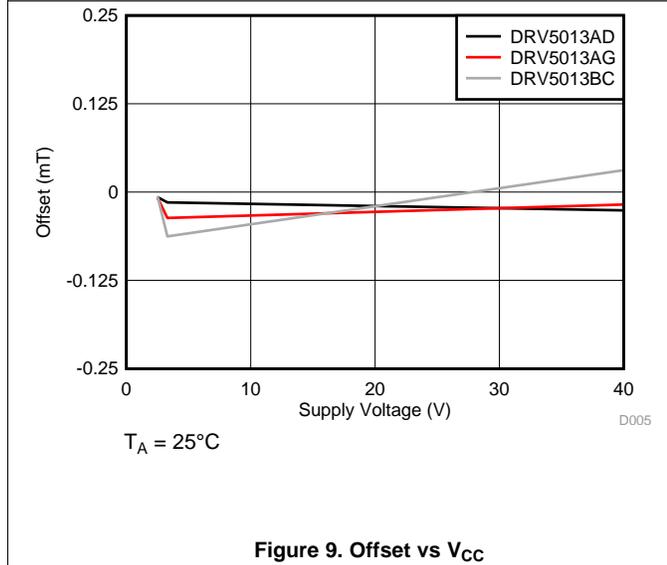
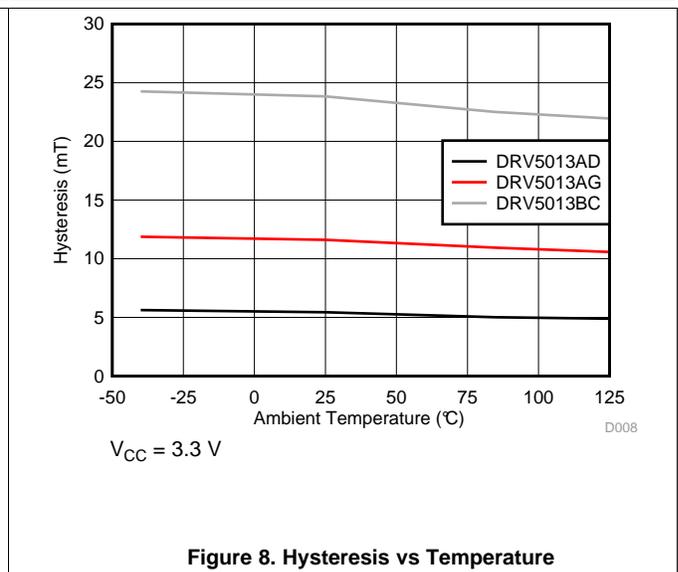
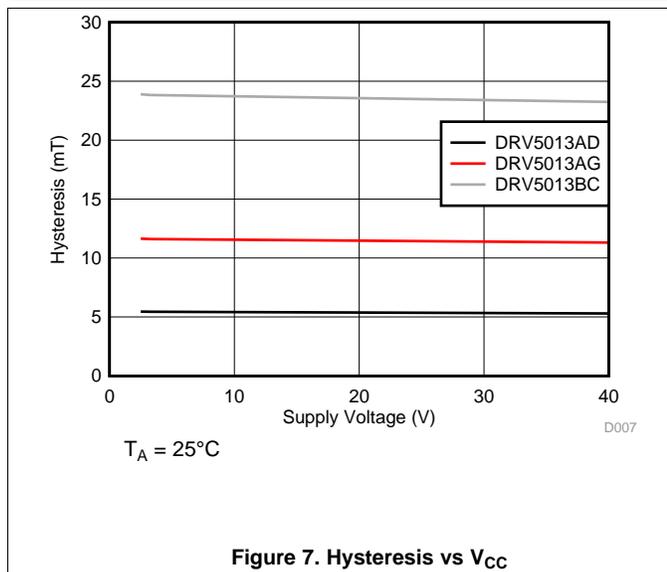
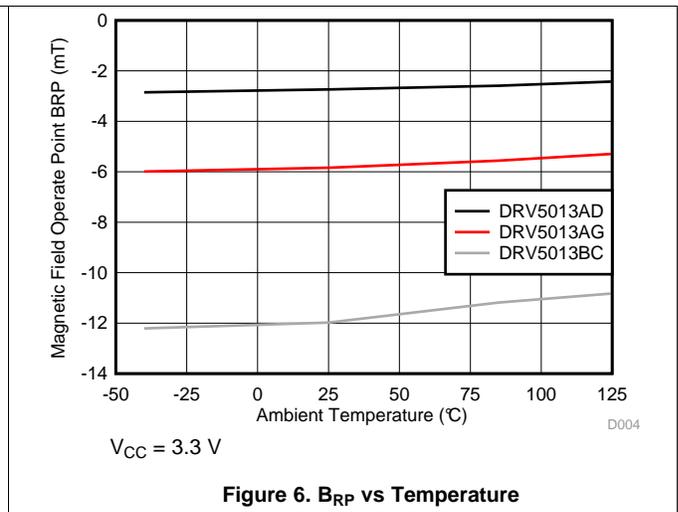
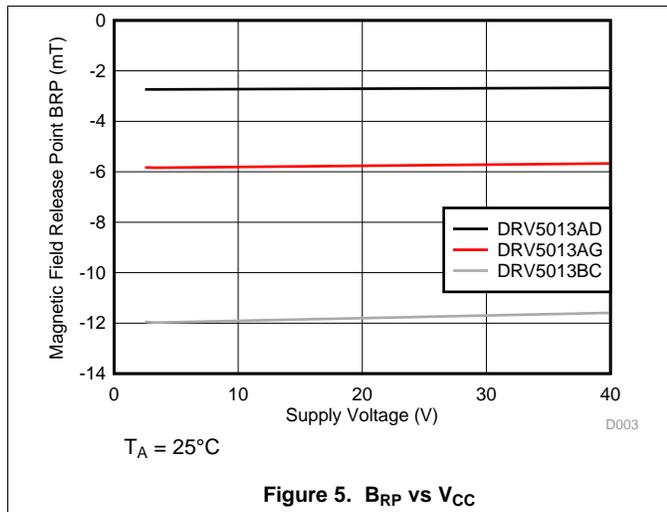
over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT ⁽¹⁾
DRV5013BC: 12 / -12 mT						
B _{OP}	Operate point; see Figure 12	T _A = -40°C to 125°C	6	12	18	mT
B _{RP}	Release point; see Figure 12		-18	-12	-6	mT
B _{hys}	Hysteresis; B _{hys} = (B _{OP} - B _{RP})			24		mT
B _O	Magnetic offset; B _O = (B _{OP} + B _{RP}) / 2		-1.5	0	1.5	mT

6.8 Typical Characteristics



Typical Characteristics (continued)



7 Detailed Description

7.1 Overview

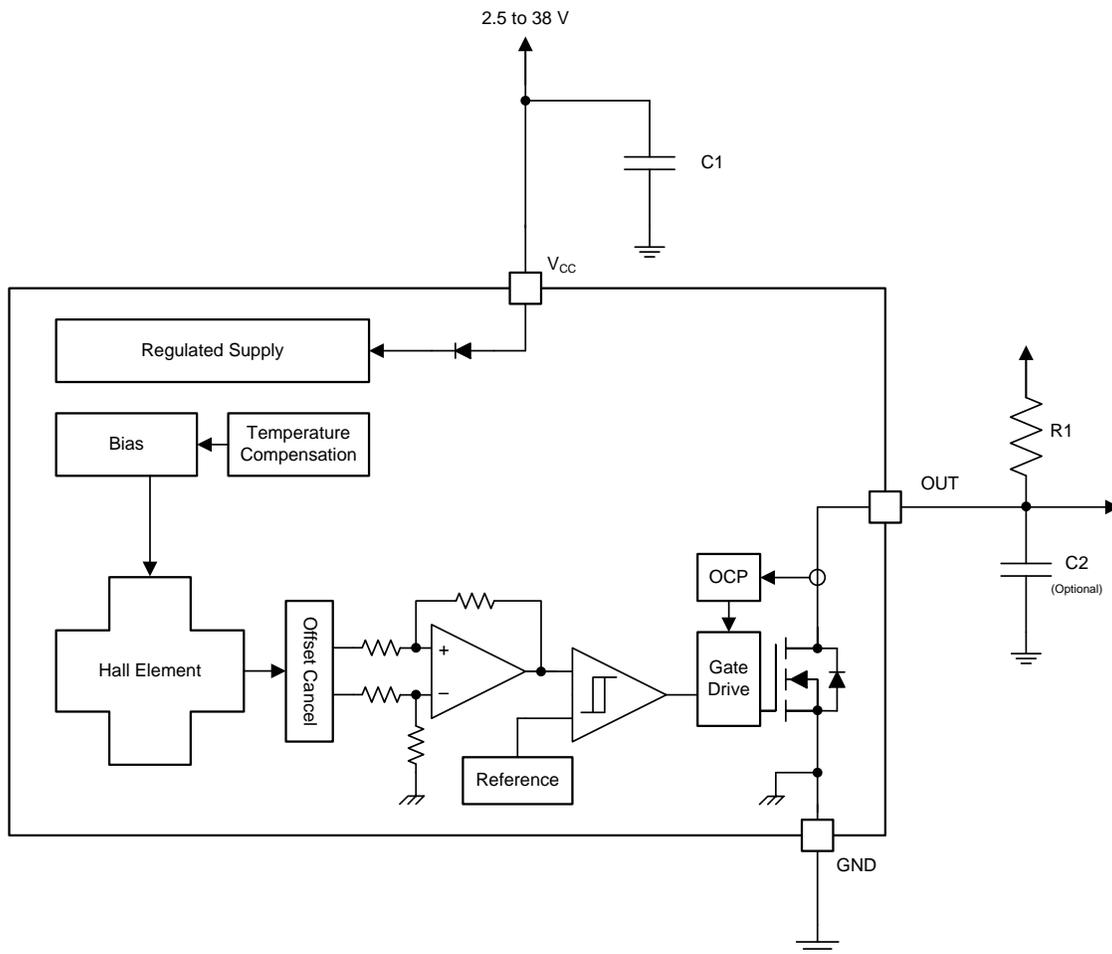
The DRV5013 device is a chopper-stabilized Hall sensor with a digital latched output for magnetic sensing applications. The DRV5013 device can be powered with a supply voltage between 2.5 and 38 V, and continuously survives continuous -22-V reverse-battery conditions. The DRV5013 device does not operate when -22 to 2.4 V is applied to the V_{CC} pin (with respect to the GND pin). In addition, the device can withstand voltages up to 40 V for transient durations.

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 is dependent on the magnetic field perpendicular to the package. A **south pole** near the marked side of the package causes the output to pull low (operate point, B_{OP}), and a **north pole** near the marked side of the package causes the output to release (release point, B_{RP}). Hysteresis is included in between the operate point and the release point therefore magnetic-field noise does not accidentally trip the output.

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 allows for easier interfacing with controller circuits.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Field Direction Definition

A positive magnetic field is defined as a south pole near the marked side of the package as shown in Figure 11.

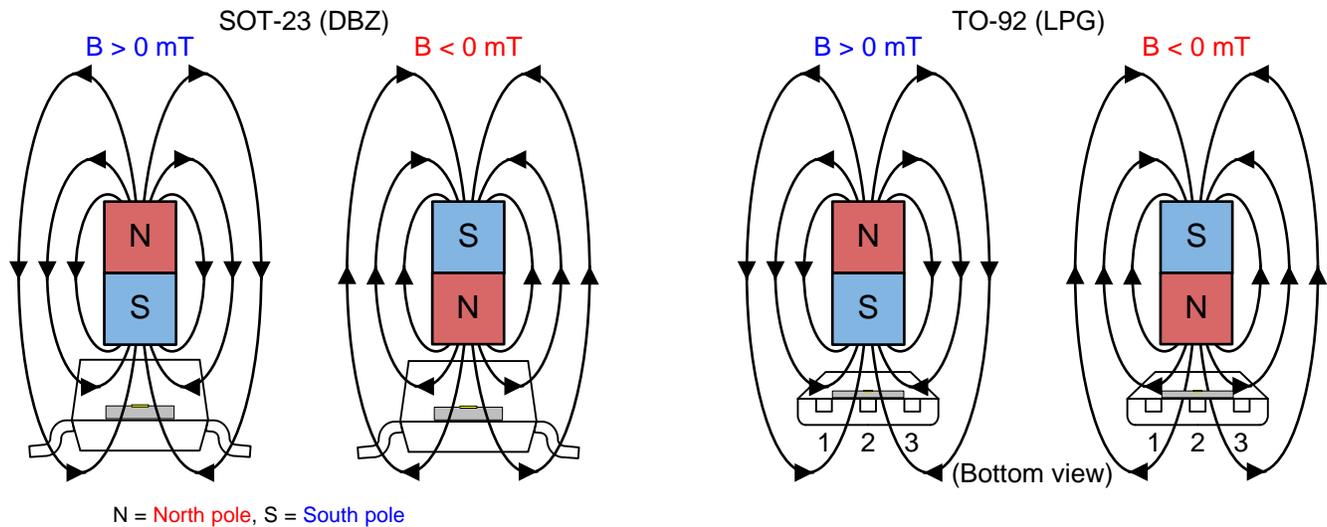


Figure 11. Field Direction Definition

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 and can either be Hi-Z or Low. 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.

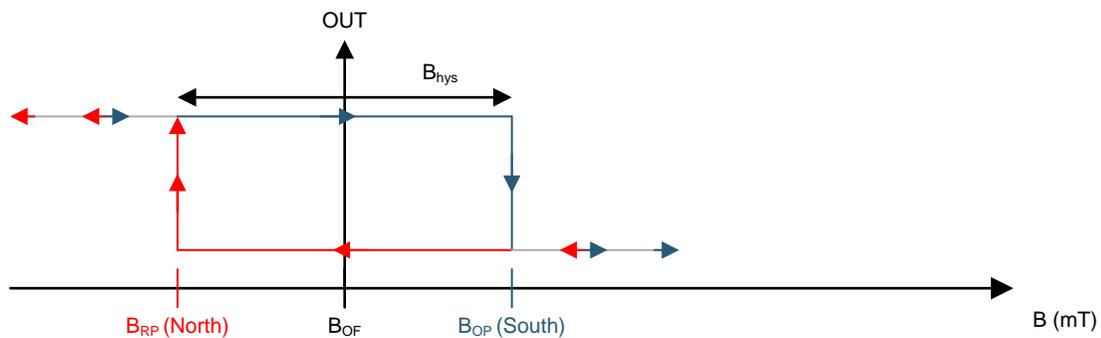


Figure 12. DRV5013— $B_{OP} > 0$

Feature Description (continued)

7.3.3 Power-On Time

After applying V_{CC} to the DRV5013 device, t_{on} must elapse before the OUT pin is valid. During the power-up sequence, the output is Hi-Z. A pulse as shown in Figure 13 and Figure 14 occurs at the end of t_{on} . This pulse can allow the host processor to determine when the DRV5013 output is valid after startup. In Case 1 (Figure 13) and Case 2 (Figure 14), the output is defined assuming a constant magnetic field $B > B_{OP}$ and $B < B_{RP}$.

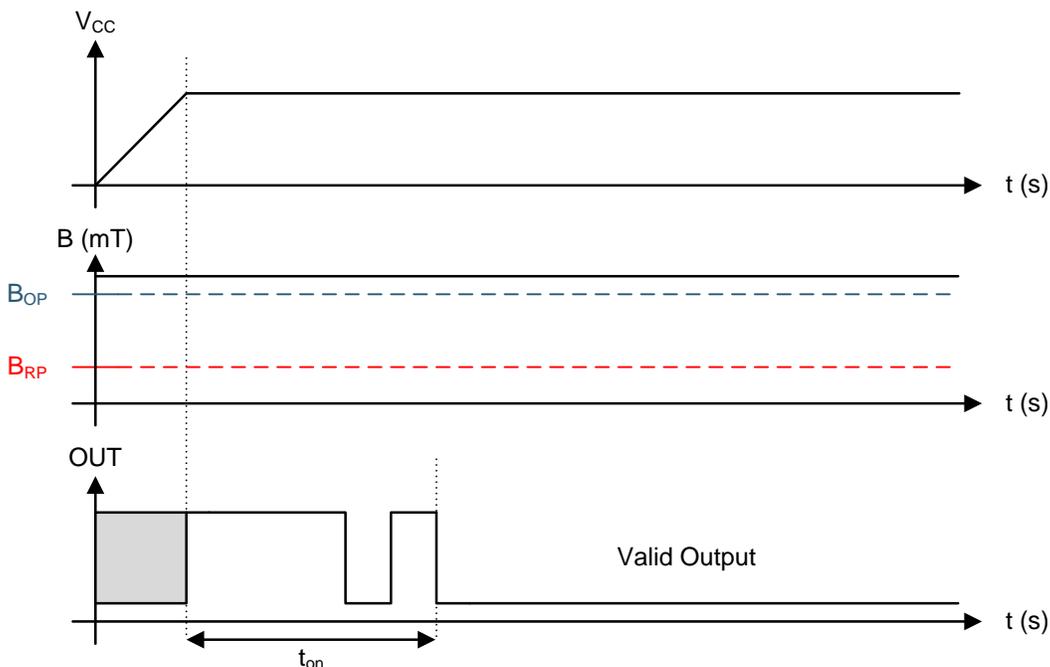


Figure 13. Case 1: Power On When $B > B_{OP}$

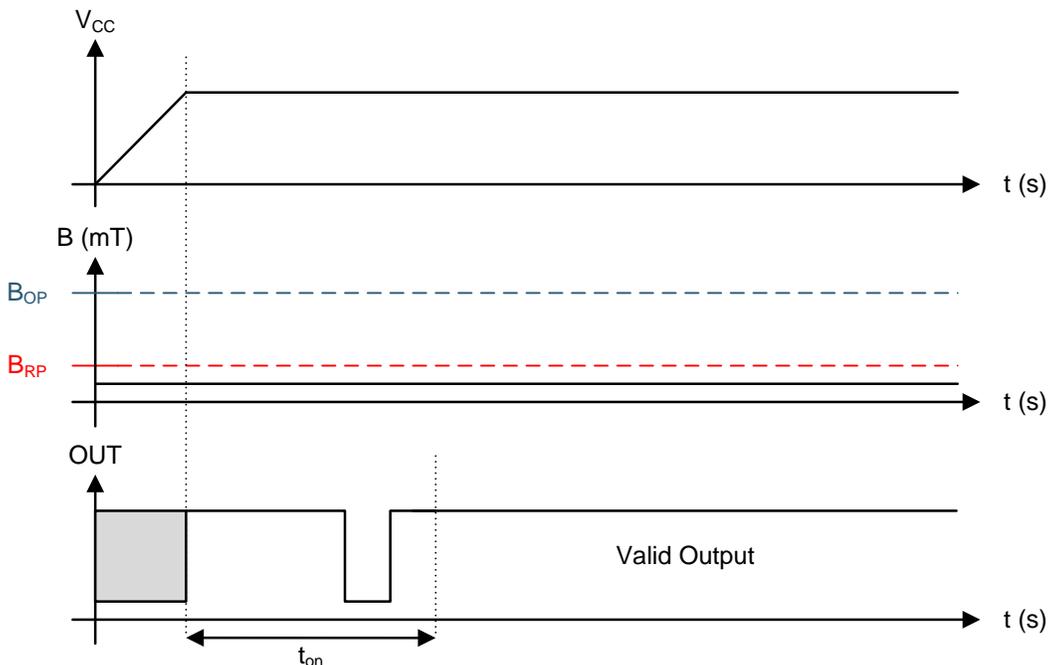


Figure 14. Case 2: Power On When $B < B_{RP}$

Feature Description (continued)

If the device is powered on with the magnetic field strength $B_{RP} < B < B_{OP}$, then the device output is indeterminate and can either be Hi-Z or pulled low. During the power-up sequence, the output is held Hi-Z until t_{on} has elapsed. At the end of t_{on} , a pulse is given on the OUT pin to indicate that t_{on} has elapsed. After t_{on} , if the magnetic field changes such that $B_{OP} < B$, the output is released. Case 3 (Figure 15) and Case 4 (Figure 16) show examples of this behavior.

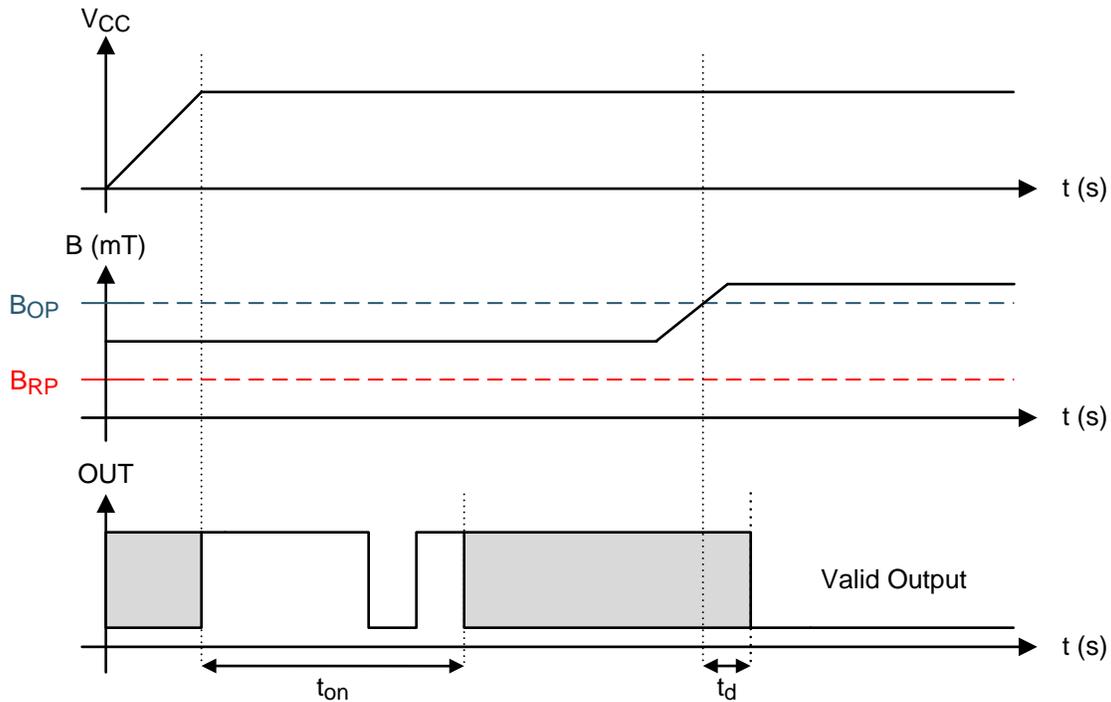


Figure 15. Case 3: Power On When $B_{RP} < B < B_{OP}$, Followed by $B > B_{OP}$

Feature Description (continued)

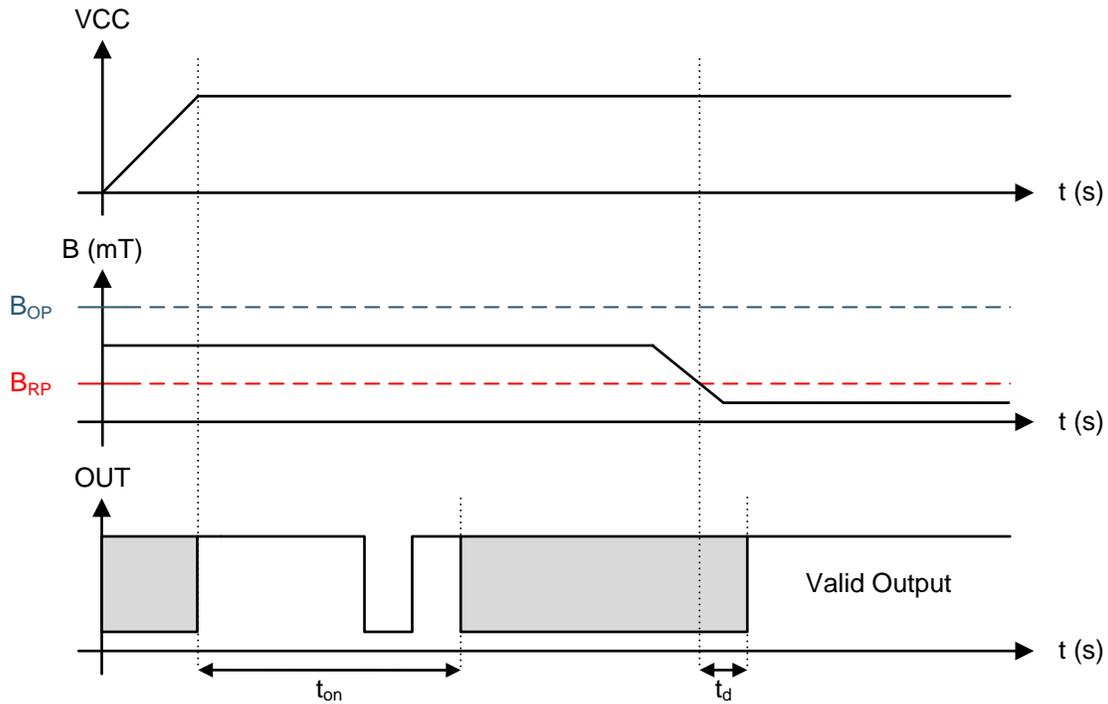


Figure 16. Case 4: Power On When B_{RP} < B < B_{OP}, Followed by B < B_{RP}

7.3.4 Output Stage

The DRV5013 output stage uses an open-drain NMOS, and it is rated to sink up to 30 mA of current. For proper operation, calculate the value of the pullup resistor R1 using Equation 1.

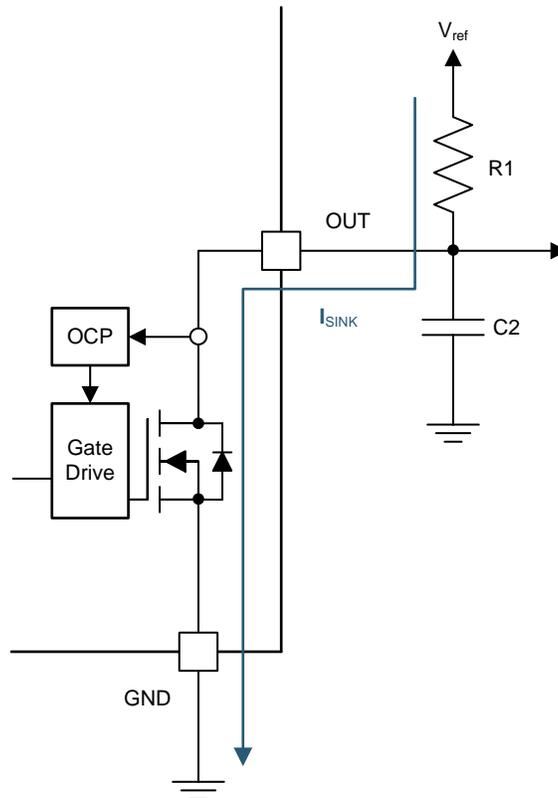
$$\frac{V_{ref \ max}}{30 \ mA} \leq R1 \leq \frac{V_{ref \ min}}{100 \ \mu A} \tag{1}$$

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, ensure that the value of R1 > 500 Ω to ensure the output driver can pull the OUT pin close to GND.

NOTE

V_{ref} is not restricted to V_{CC}. The allowable voltage range of this pin is specified in the [Absolute Maximum Ratings](#).

Feature Description (continued)

Figure 17.

Select a value for C2 based on the system bandwidth specifications as shown in [Equation 2](#).

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

Most applications do not require this C2 filtering capacitor.

Feature Description (continued)

7.3.5 Protection Circuits

The DRV5013 device is fully protected against overcurrent and reverse-supply conditions.

7.3.6 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.

7.3.7 Load Dump Protection

The DRV5013 device operates at DC V_{CC} conditions up to 38 V nominally, and can additionally withstand $V_{CC} = 40$ V. No current-limiting series resistor is required for this protection.

7.3.8 Reverse Supply Protection

The DRV5013 device is protected in the event that the V_{CC} pin and the GND pin are reversed (up to -22 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	$V_{CC} \geq 2.5\text{ V}$

7.4 Device Functional Modes

The DRV5013 device is active only when V_{CC} is between 2.5 and 38 V.

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

8 Application and Implementation

NOTE

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

8.1 Application Information

The DRV5013 device is used in magnetic-field sensing applications.

8.2 Typical Applications

8.2.1 Standard Circuit

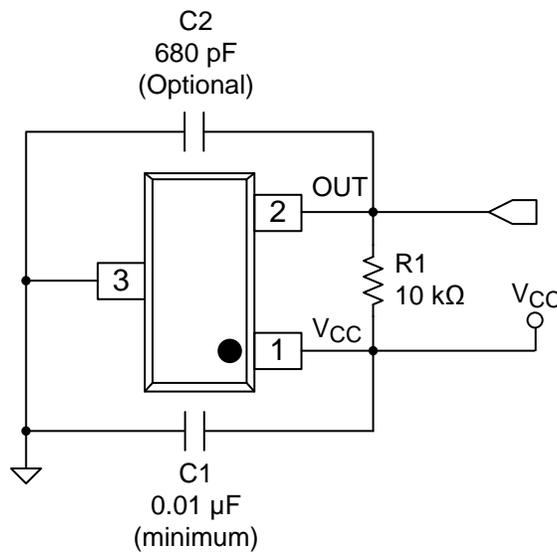


Figure 18. Typical Application Circuit

8.2.1.1 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
Supply voltage	V_{CC}	3.2 to 3.4 V
System bandwidth	f_{BW}	10 kHz

8.2.1.2 Detailed Design Procedure

Table 3. External Components

COMPONENT	PIN 1	PIN 2	RECOMMENDED
C1	V_{CC}	GND	A 0.01- μ F (minimum) ceramic capacitor rated for V_{CC}
C2	OUT	GND	Optional: Place a ceramic capacitor to GND
R1	OUT	REF ⁽¹⁾	Requires a resistor pullup

(1) REF is not a pin on the DRV5013 device, but a REF supply-voltage pullup is required for the OUT pin; the OUT pin may be pulled up to V_{CC} .

8.2.1.2.1 Configuration Example

In a 3.3-V system, $3.2\text{ V} \leq V_{\text{ref}} \leq 3.4\text{ V}$. Use Equation 3 to calculate the allowable range for R1.

$$\frac{V_{\text{ref max}}}{30\text{ mA}} \leq R1 \leq \frac{V_{\text{ref min}}}{100\text{ }\mu\text{A}} \quad (3)$$

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

$$\frac{3.4\text{ V}}{30\text{ mA}} \leq R1 \leq \frac{3.2\text{ V}}{100\text{ }\mu\text{A}} \quad (4)$$

Therefore:

$$113\text{ }\Omega \leq R1 \leq 32\text{ k}\Omega \quad (5)$$

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

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

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

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

$$2 \times 10\text{ kHz} < \frac{1}{2\pi \times R1 \times C2} \quad (7)$$

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

A selection of R1 = 10 k Ω and C2 = 680 pF would cause a low-pass filter with a corner frequency of 23.4 kHz.

8.2.1.3 Application Curves

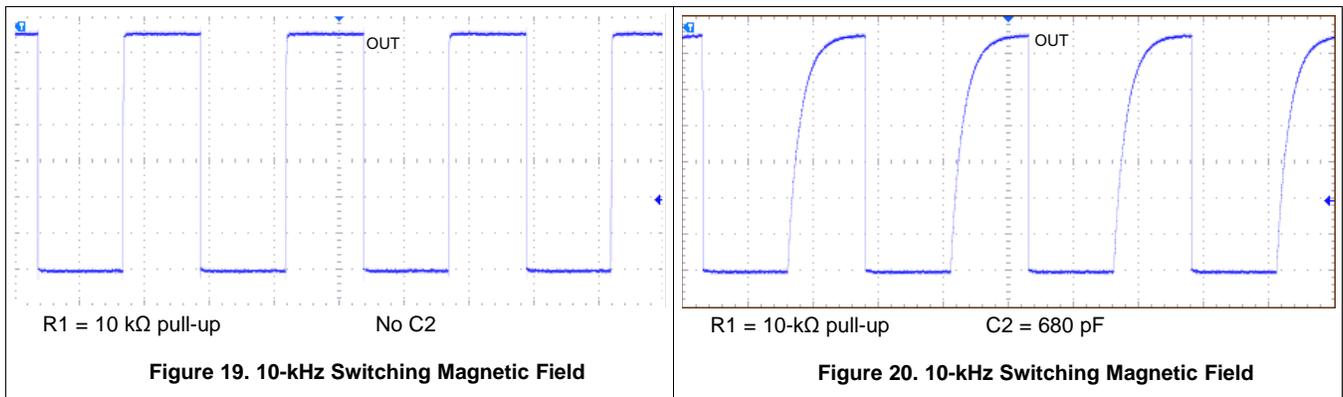


Figure 19. 10-kHz Switching Magnetic Field

Figure 20. 10-kHz Switching Magnetic Field

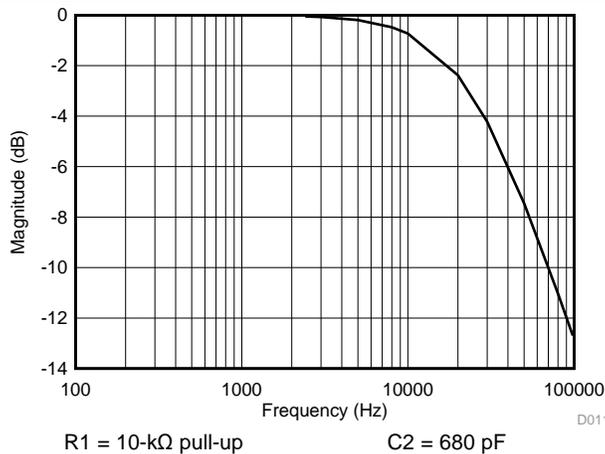


Figure 21. Low-Pass Filtering

8.2.2 Alternative Two-Wire Application

For systems that require minimal wire count, the device output can be connected to V_{CC} through a resistor, and the total supplied current can be sensed near the controller.

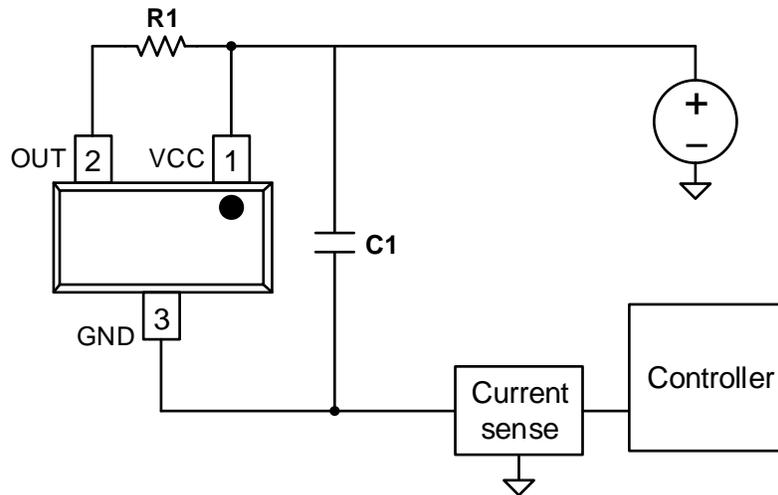


Figure 22. 2-Wire Application

Current can be sensed using a shunt resistor or other circuitry.

8.2.2.1 Design Requirements

Table 4 lists the related design parameters.

Table 4. Design Parameters

DESIGN PARAMETER	REFERENCE	EXAMPLE VALUE
Supply voltage	V_{CC}	12 V
OUT resistor	R1	1 k Ω
Bypass capacitor	C1	0.1 μ F
Current when $B < B_{RP}$	$I_{RELEASE}$	About 3 mA
Current when $B > B_{OP}$	$I_{OPERATE}$	About 15 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 3 mA).

When the output pulls low, a parallel current path is added, equal to $V_{CC} / (R1 + r_{DS(on)})$. Using 12 V and 1 k Ω , the parallel current is approximately 12 mA, making the total current approximately 15 mA.

The local bypass capacitor C1 should be at least 0.1 μ F, and a larger value if there is high inductance in the power line interconnect.

9 Power Supply Recommendations

The DRV5013 device is designed to operate from an input voltage supply (V_M) range between 2.5 and 38 V. A 0.01- μ F (minimum) ceramic capacitor rated for V_{CC} must be placed as close to the DRV5013 device as possible.

10 器件和文档支持

10.1 器件支持

10.1.1 器件命名规则

图 23 显示了读取 DRV5013 器件完整器件名称的图例。

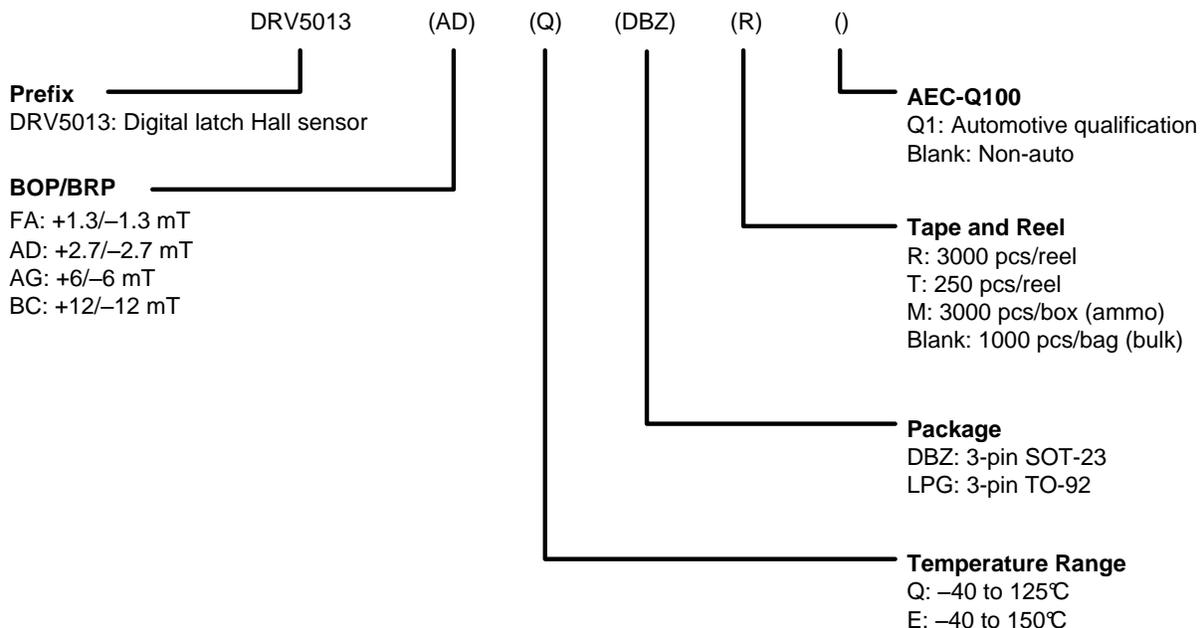


图 23. 器件命名规则

10.1.2 器件标记

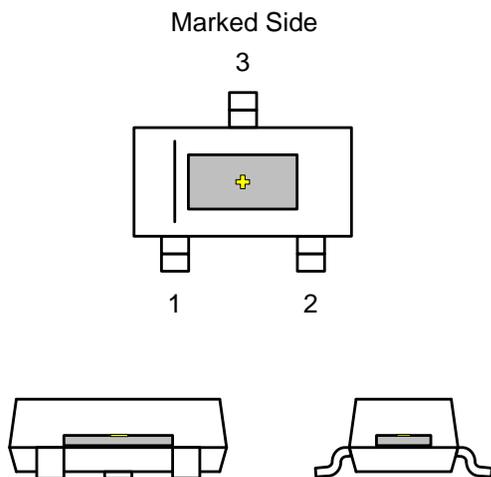


图 24. SOT-23 (DBZ) 封装

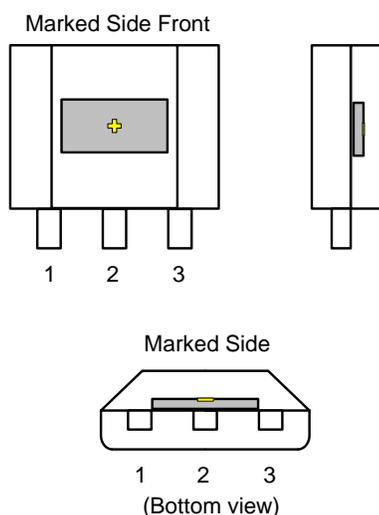


图 25. TO-92 (LPG) 封装

✚ 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 $0.987\text{mm} \pm 50\mu\text{m}$ 。

10.2 社区资源

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

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

10.3 商标

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

10.4 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。

10.5 Glossary

[SLYZ022](#) — *TI Glossary*.

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

11 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。

重要声明

德州仪器(TI)及其下属子公司有权根据 JESD46 最新标准, 对所提供的产品和服务进行更正、修改、增强、改进或其它更改, 并有权根据 JESD48 最新标准中止提供任何产品和服务。客户在下订单前应获取最新的相关信息, 并验证这些信息是否完整且是最新的。所有产品的销售都遵循在订单确认时所提供的TI 销售条款与条件。

TI 保证其所销售的组件的性能符合产品销售时 TI 半导体产品销售条件与条款的适用规范。仅在 TI 保证的范围内, 且 TI 认为有必要时才会使用测试或其它质量控制技术。除非适用法律做出了硬性规定, 否则没有必要对每种组件的所有参数进行测试。

TI 对应用帮助或客户产品设计不承担任何义务。客户应对其使用 TI 组件的产品和应用自行负责。为尽量减小与客户产品和应用相关的风险, 客户应提供充分的设计与操作安全措施。

TI 不对任何 TI 专利权、版权、屏蔽作品权或其它与使用了 TI 组件或服务的组合设备、机器或流程相关的 TI 知识产权中授予的直接或隐含权限作出任何保证或解释。TI 所发布的与第三方产品或服务有关的信息, 不能构成从 TI 获得使用这些产品或服务的许可、授权、或认可。使用此类信息可能需要获得第三方的专利权或其它知识产权方面的许可, 或是 TI 的专利权或其它知识产权方面的许可。

对于 TI 的产品手册或数据表中 TI 信息的重要部分, 仅在没有对内容进行任何篡改且带有相关授权、条件、限制和声明的情况下才允许进行复制。TI 对此类篡改过的文件不承担任何责任或义务。复制第三方的信息可能需要服从额外的限制条件。

在转售 TI 组件或服务时, 如果对该组件或服务参数的陈述与 TI 标明的参数相比存在差异或虚假成分, 则会失去相关 TI 组件或服务的所有明示或暗示授权, 且这是不正当的、欺诈性商业行为。TI 对任何此类虚假陈述均不承担任何责任或义务。

客户认可并同意, 尽管任何应用相关信息或支持仍可能由 TI 提供, 但他们将独立负责满足与其产品及其在应用中使用的 TI 产品相关的所有法律、法规和安全相关要求。客户声明并同意, 他们具备制定与实施安全措施所需的全部专业技术和知识, 可预见故障的危险后果、监测故障及其后果、降低有可能造成人身伤害的故障的发生机率并采取适当的补救措施。客户将全额赔偿因在此类安全关键应用中使用任何 TI 组件而对 TI 及其代理造成的任何损失。

在某些场合中, 为了推进安全相关应用有可能对 TI 组件进行特别的促销。TI 的目标是利用此类组件帮助客户设计和创立其特有的可满足适用的功能安全性标准和要求的终端产品解决方案。尽管如此, 此类组件仍然服从这些条款。

TI 组件未获得用于 FDA Class III (或类似的生命攸关医疗设备) 的授权许可, 除非各方授权官员已经达成了专门管控此类使用的特别协议。

只有那些 TI 特别注明属于军用等级或“增强型塑料”的 TI 组件才是设计或专门用于军事/航空应用或环境的。购买者认可并同意, 对并非指定面向军事或航空航天用途的 TI 组件进行军事或航空航天方面的应用, 其风险由客户单独承担, 并且由客户独立负责满足与此类使用相关的所有法律和法规要求。

TI 已明确指定符合 ISO/TS16949 要求的产品, 这些产品主要用于汽车。在任何情况下, 因使用非指定产品而无法达到 ISO/TS16949 要求, TI 不承担任何责任。

	产品		应用
数字音频	www.ti.com.cn/audio	通信与电信	www.ti.com.cn/telecom
放大器和线性器件	www.ti.com.cn/amplifiers	计算机及周边	www.ti.com.cn/computer
数据转换器	www.ti.com.cn/dataconverters	消费电子	www.ti.com.cn/consumer-apps
DLP® 产品	www.dlp.com	能源	www.ti.com.cn/energy
DSP - 数字信号处理器	www.ti.com.cn/dsp	工业应用	www.ti.com.cn/industrial
时钟和计时器	www.ti.com.cn/clockandtimers	医疗电子	www.ti.com.cn/medical
接口	www.ti.com.cn/interface	安防应用	www.ti.com.cn/security
逻辑	www.ti.com.cn/logic	汽车电子	www.ti.com.cn/automotive
电源管理	www.ti.com.cn/power	视频和影像	www.ti.com.cn/video
微控制器 (MCU)	www.ti.com.cn/microcontrollers		
RFID 系统	www.ti.com.cn/rfidsys		
OMAP应用处理器	www.ti.com/omap		
无线连通性	www.ti.com.cn/wirelessconnectivity	德州仪器在线技术支持社区	www.deyisupport.com

邮寄地址: 上海市浦东新区世纪大道1568号, 中建大厦32楼邮政编码: 200122
Copyright © 2016, 德州仪器半导体技术(上海)有限公司

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
DRV5013ADQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(+NLAD, TAIG)	Samples
DRV5013ADQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(+NLAD, TAIG)	Samples
DRV5013ADQLPG	ACTIVE	TO-92	LPG	3	1000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 125	+NLAD	Samples
DRV5013ADQLPGM	ACTIVE	TO-92	LPG	3	3000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 125	+NLAD	Samples
DRV5013AGQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	+NLAG	Samples
DRV5013AGQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	+NLAG	Samples
DRV5013AGQLPG	ACTIVE	TO-92	LPG	3	1000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 125	+NLAG	Samples
DRV5013AGQLPGM	ACTIVE	TO-92	LPG	3	3000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 125	+NLAG	Samples
DRV5013BCQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	+NLBC	Samples
DRV5013BCQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	+NLBC	Samples
DRV5013BCQLPG	ACTIVE	TO-92	LPG	3	1000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 125	+NLBC	Samples
DRV5013BCQLPGM	ACTIVE	TO-92	LPG	3	3000	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	-40 to 125	+NLBC	Samples
DRV5013FAQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	+NLFA	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 ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm 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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

OTHER QUALIFIED VERSIONS OF DRV5013 :

- Automotive: [DRV5013-Q1](#)

NOTE: Qualified Version Definitions:

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

TAPE AND REEL INFORMATION



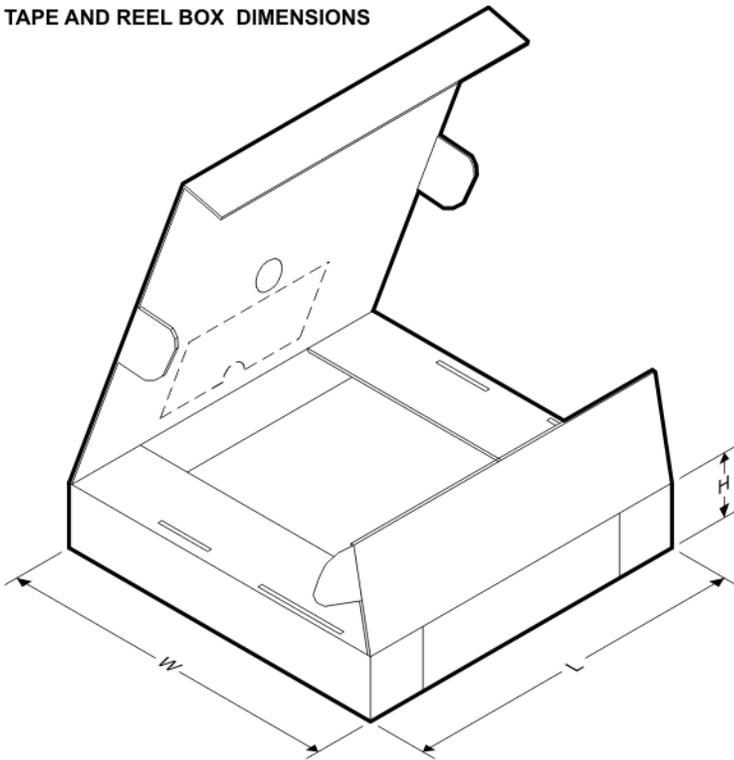
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

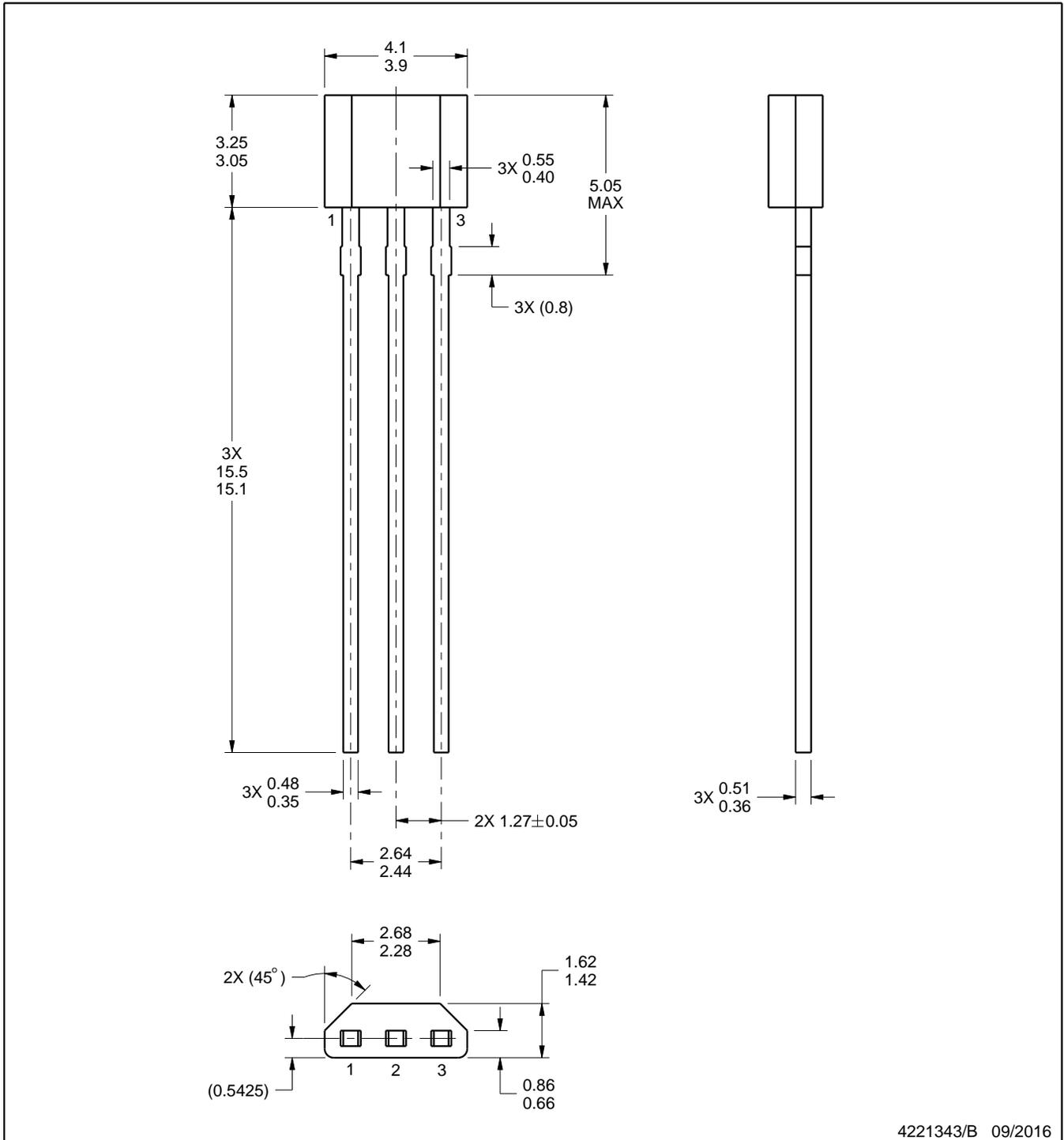
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DRV5013ADQDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.15	2.77	1.22	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DRV5013ADQDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0



4221343/B 09/2016

NOTES:

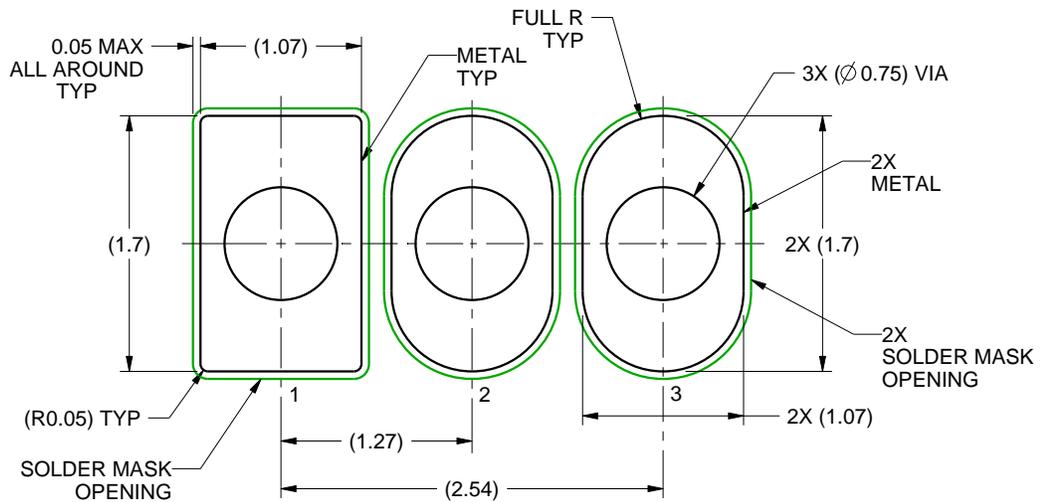
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

LPG0003A

TO-92 - 5.05 mm max height

TO-92



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

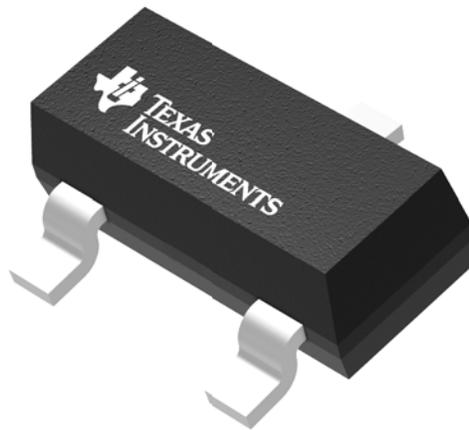
4221343/B 09/2016

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.

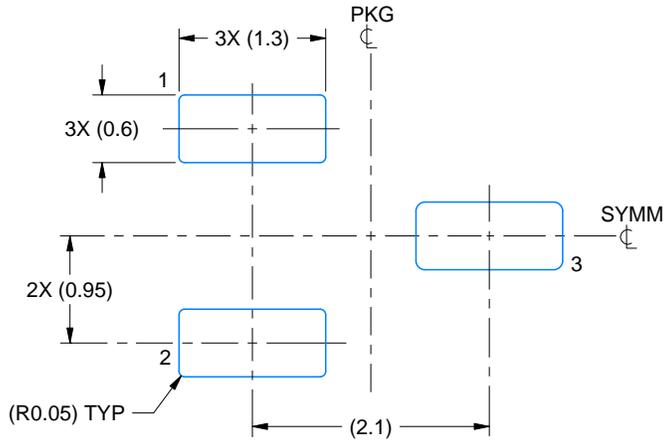
4203227/C

EXAMPLE BOARD LAYOUT

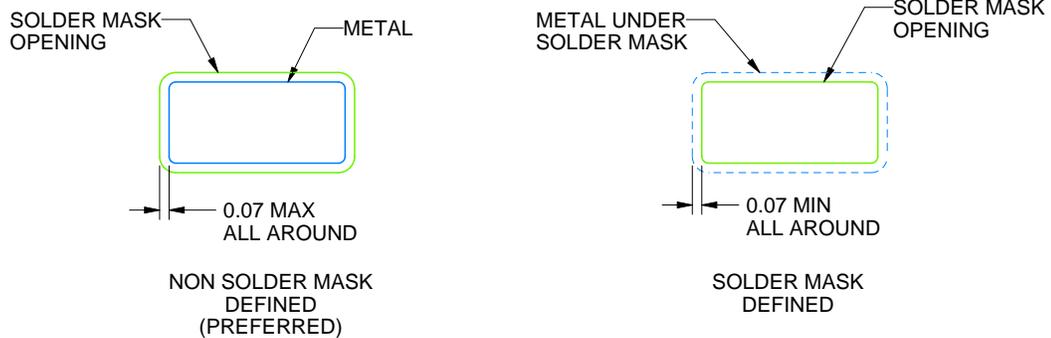
DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
SCALE:15X



SOLDER MASK DETAILS

4214838/C 04/2017

NOTES: (continued)

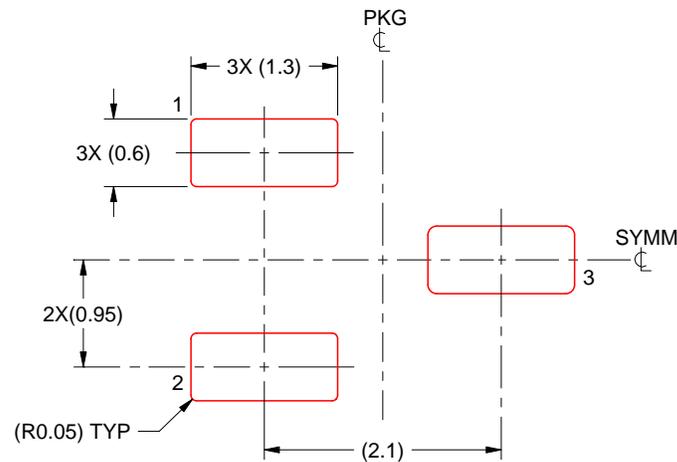
- 4. Publication IPC-7351 may have alternate designs.
- 5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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

4214838/C 04/2017

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.

重要声明

德州仪器 (TI) 公司有权按照最新发布的 JESD46 对其半导体产品和服务进行纠正、增强、改进和其他修改，并不再按最新发布的 JESD48 提供任何产品和服务。买方在下订单前应获取最新的相关信息，并验证这些信息是否完整且是最新的。

TI 公布的半导体产品销售条款 (<http://www.ti.com/sc/docs/stdterms.htm>) 适用于 TI 已认证和批准上市的已封装集成电路产品的销售。另有其他条款可能适用于其他类型 TI 产品及服务的使用或销售。

复制 TI 数据表上 TI 信息的重要部分时，不得变更该等信息，且必须随附所有相关保证、条件、限制和通知，否则不得复制。TI 对该等复制文件不承担任何责任。第三方信息可能受到其它限制条件的制约。在转售 TI 产品或服务时，如果存在对产品或服务参数的虚假陈述，则会失去相关 TI 产品或服务的明示或暗示保证，且构成不公平的、欺诈性商业行为。TI 对此类虚假陈述不承担任何责任。

买方和在系统中整合 TI 产品的其他开发人员（总称“设计人员”）理解并同意，设计人员在设计应用时应自行实施独立的分析、评价和判断，且应全权负责并确保应用的安全性，及设计人员的应用（包括应用中使用的 TI 产品）应符合所有适用的法律法规及其他相关要求。设计人员就自己设计的应用声明，其具备制订和实施下列保障措施所需的一切必要专业知识，能够 (1) 预见故障的危险后果，(2) 监视故障及其后果，以及 (3) 降低可能导致危险的故障几率并采取适当措施。设计人员同意，在使用或分发包含 TI 产品的任何应用前，将彻底测试该等应用和该等应用中所用 TI 产品的功能。

TI 提供技术、应用或其他设计建议、质量特点、可靠性数据或其他服务或信息，包括但不限于与评估模块有关的参考设计和材料（总称“TI 资源”），旨在帮助设计人员开发整合了 TI 产品的应用，如果设计人员（个人，或如果是代表公司，则为设计人员的公司）以任何方式下载、访问或使用任何特定的 TI 资源，即表示其同意仅为该等目标，按照本通知的条款使用任何特定 TI 资源。

TI 所提供的 TI 资源，并未扩大或以其他方式修改 TI 对 TI 产品的公开适用的质保及质保免责声明；也未导致 TI 承担任何额外的义务或责任。TI 有权对其 TI 资源进行纠正、增强、改进和其他修改。除特定 TI 资源的公开文档中明确列出的测试外，TI 未进行任何其他测试。

设计人员只有在开发包含该等 TI 资源所列 TI 产品的应用时，才被授权使用、复制和修改任何相关 TI 资源。但并未依据禁止反言原则或其他法律授予您任何 TI 知识产权的任何其他明示或暗示的许可，也未授予您 TI 或第三方的任何技术或知识产权的许可，该等许可包括但不限于任何专利权、版权、屏蔽作品权或与美国 TI 产品或服务的任何整合、机器制作、流程相关的其他知识产权。涉及或参考了第三方产品或服务的信息不构成使用此类产品或服务的许可或与其相关的保证或认可。使用 TI 资源可能需要您向第三方获得对该等第三方专利或其他知识产权的许可。

TI 资源系“按原样”提供。TI 兹免除对资源及其使用作出所有其他明确或默认为的保证或陈述，包括但不限于对准确性或完整性、产权保证、无屡发故障保证，以及适销性、适合特定用途和不侵犯任何第三方知识产权的任何默认保证。TI 不负责任何申索，包括但不限于因组合产品所致或与之有关的申索，也不为或对设计人员进行辩护或赔偿，即使该等产品组合已列于 TI 资源或其他地方。对因 TI 资源或其使用引起或与之有关的任何实际的、直接的、特殊的、附带的、间接的、惩罚性的、偶发的、从属或惩戒性损害赔偿，不管 TI 是否获悉可能会产生上述损害赔偿，TI 概不负责。

除 TI 已明确指出特定产品已达到特定行业标准（例如 ISO/TS 16949 和 ISO 26262）的要求外，TI 不对未达到任何该等行业标准要求而承担任何责任。

如果 TI 明确宣称产品有助于功能安全或符合行业功能安全标准，则该等产品旨在帮助客户设计和创作自己的符合相关功能安全标准和要求的的应用。在应用内使用产品的行为本身不会配有安全特性。设计人员必须确保遵守适用于其应用的相关安全要求和标准。设计人员不可将任何 TI 产品用于关乎性命的医疗设备，除非已由各方获得授权的管理人员签署专门的合同对此类应用专门作出规定。关乎性命的医疗设备是指出现故障会导致严重身体伤害或死亡的医疗设备（例如生命保障设备、心脏起搏器、心脏除颤器、人工心脏泵、神经刺激器以及植入设备）。此类设备包括但不限于，美国食品药品监督管理局认定为 III 类设备的设备，以及在美国以外的其他国家或地区认定为同等类别设备的所有医疗设备。

TI 可能明确指定某些产品具备某些特定资格（例如 Q100、军用级或增强型产品）。设计人员同意，其具备一切必要专业知识，可以为自己的应用选择适合的产品，并且正确选择产品的风险由设计人员承担。设计人员单方面负责遵守与该等选择有关的所有法律或监管要求。

设计人员同意向 TI 及其代表全额赔偿因其不遵守本通知条款和条件而引起的任何损害、费用、损失和/或责任。

邮寄地址：上海市浦东新区世纪大道 1568 号中建大厦 32 楼，邮政编码：200122
Copyright © 2017 德州仪器半导体技术（上海）有限公司