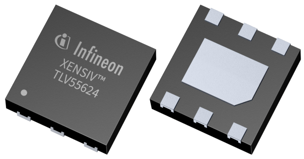
TLV55624-1O

Datasheet

XENSIV™ ultra-low-power TMR - based switch



Features

- **Omnipolar** magnetic switch
- **Ultra-low power** consumption: **~7 nA** (at V_{DD} = 1.55 V; T_{Amb} = 25 °C; f_s = 1.2 Hz)
- Supply voltage range: **1.1 V to 3.6 V**
- Capable of **high output current** to drive loads directly
- Operating point: **±1.0 mT**
- Release point: **±4.5 mT**
- Dedicated pins for extended functionalities:
  - Lock output state (***LOCK* pin**)
  - Force sensor to sleep mode (***FSLP* pin**)
- Wide operating temperature range: **-40°C to +85°C**
- Small PG-XQFN-7-1 package **(1.50 mm x 1.50 mm x 0.38 mm)**

Potential applications

- **Wake-up sensing for energy-constrained systems**
  - Medical devices
  - Wearables
  - IoT edge nodes
- **Battery-powered products**
- **Low-energy utility infrastructure**
  - Smart metering and tamper detection
- **Always-on motion and event detection applications**

Product validation

Qualified for applications listed above based on the test conditions in the relevant tests of JEDEC20/22.

Description

The TLV55624-1O is an ultra-low power omnipolar TMR-based switch with approximately 7 nA typical current consumption in a duty-cycled operation mode to enable a magnetic switch with almost zero power consumption. The part operates in a voltage range from 1.1 V to 3.6 V while the operating temperature is from -40°C to +85°C. It is assembled in a space-saving PG-XQFN-7-1 package.

With its outstanding energy-saving design, the sensor is perfectly suited as a wake-up switch for ultra-low power applications of any kind, as well as specifically for single-cell battery-powered applications with low supply voltages.

Product Name	Ordering Code	Package
TLV55624-1O	SP006114849	PG-XQFN-7-1

Table of contents

1 Functional block diagram

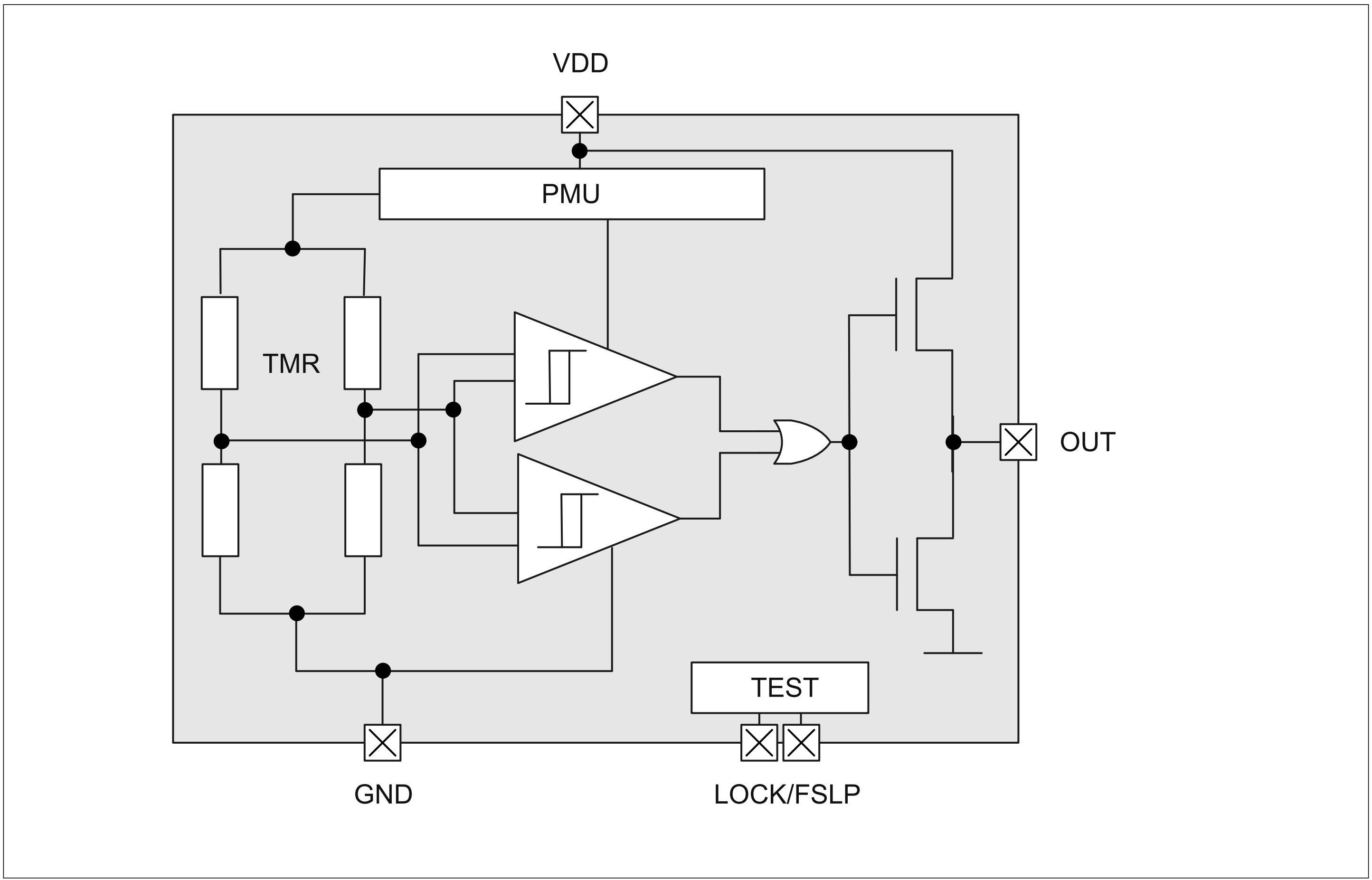


Figure 1 Functional block diagram

2 Pin configuration

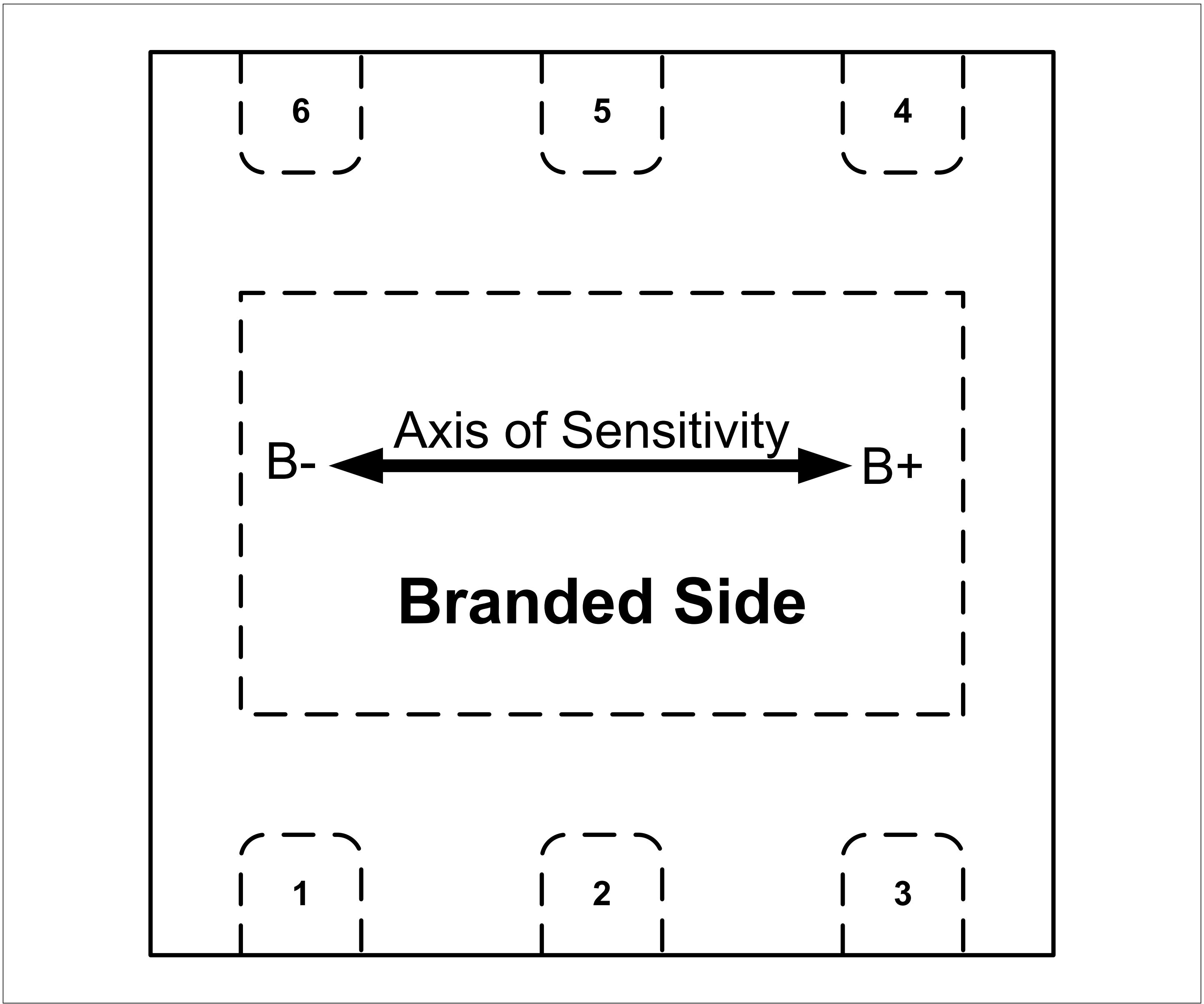


Figure 2 **Pin out - top-down view (PG-XQFN-7-1)**

Table 1 **Pin definition and function**

Pin No.	Symbol	Function
1	*LOCK*	Input to lock device output
2	*N/C*	Not connected
3	V_{DD}	Supply voltage
4	*Q*	Switch output
5	*FSLP*	Input to force device to sleep state
6	*GND*	Ground

***Note**: GND is reference of all voltages*

3 General product characteristics

3.1 Absolute maximum ratings

Attention: ***Stresses above those listed under this chapter may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the section "functional range" is not implied. Furthermore, only single error cases are assumed. More than one stress/error case may also damage the device. A positive current is flowing out of the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. During absolute maximum rating overload conditions the voltage on VDD pins with respect to ground shall not exceed the values defined by the absolute maximum ratings. Lifetime statements are an anticipation based on an extrapolation of Infineon's qualification test results. The actual lifetime of a component depends on its form of application and type of use etc. and may deviate from such statement. Lifetime statements shall in no event extend the agreed warranty period.***

Table 2 Absolute maximum ratings

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
Supply voltage	V_{DD}	-0.3	-	3.6	V	
Output voltage	V_Q	-0.3	-	V_{DD} + 0.3 [1)]	V	
FSLP pin maximum voltage	V_{FSLP}	-0.3	-	*3.6*	V	
LOCK pin maximum voltage	V_{LOCK}	-0.3	-	*3.6*	V	
Continuous output current	I_Q	-	-	50.0	mA	
Maximum external in-plane magnetic field	B_{MAX}	-75.0	-	75.0	mT	
Ambient temperature	T_{Amb}	-40.0	-	85.0	°C	
Storage temperature	T_S	-40.0	-	85.0	°C	Device unsoldered without application circuit

1) The lower of V_{DD} + 0.3 or 3.6 V

Table 3 ESD protection

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
ESD-HBM voltage	$V_{ESD\text{-}HBM}$	-2.0		2.0	kV	

(table continues...)

Table 3 (continued) ESD protection

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
ESD-CDM voltage	V_{ESD_CDM}	-500.0	-	500.0	V	Method AEC-Q100 -011. No degradation of the IC performance shall result.

3.2 Functional range

The following functional range shall not be exceeded in order to ensure correct operation of the device. All parameters specified in the following sections refer to these operating conditions unless otherwise indicated.

Table 4 Functional range

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
Supply voltage operating	V_{DD}	1.1	1.55	3.6	V	
Voltage on digital and I/O pins	$V_{I/O}$	0.0	-	V_{DD}	V	
Operating temperature	T_A	-40.0	25.0	85.0	°C	
Recommended bypass capacitor	C_{BYP}	-	1.0	-	µF	
Thermal resistance junction ambient	R_{th}	112.0	140.0	168.0	K/W	Soldered on PCB

3.2.1 Electrical characteristics

Electrical product characteristics involve the spread of values guaranteed within the specified voltage and ambient temperature range.

The below listed specification is valid in combination with the application circuit shown in Figure 6.

Table 5 Electrical characteristics

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
Supply current average	I_{DD_Avg}	-	10.0	-	nA	T_{Amb}= -40°C to 25°C
Supply current average	I_{DD_Avg}	-	7.0	-	nA	T_{Amb} = 25°C; V_{DD} = 1.55 V
Supply current average	I_{DD_Avg}	-	15.0	-	nA	T_{Amb}= 25°C to 50°C

(table continues...)

Table 5 (continued) Electrical characteristics

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
Supply current average	I_{DD_Avg}	-	50.0	-	nA	T_{Amb}= 50°C to 85°C
Transient peak supply current in measure mode	$I_{DD\_Measuring}$	-	200.0	-	µA	
LOCK setup time	t_{LOCK_Setup}	0.5	-	-	µs	
LOCK hold time	t_{LOCK_Hold}	1.0	-	-	µs	
FSLP pulse width	t_{FSLP_PW}	1.0	-	-	µs	
Power-on time	t_{PON}	–	8.0	100.0	ms	From V_{DD} in operating range to first measurement
Output rise time	t_r	1.0	2.25	4.0	ms	V_{DD} = 1.5 V; C_Q = 10.0 µF; From 10 % to 90 %
Output fall time	t_f	-	1.5	4.0	ms	V_{DD} = 1.5 V; C_Q = 10.0 µF; From 90 % to 10 %
Glitch filter time duration	t_{Glitch_Filter}	80.0	250.0	750.0	ms	
Output resistance on	R_{Q_ON}	-	2.0	5.0	Ω	Output in HIGH state; 20 mA load current
Output resistance off	R_{Q_OFF}	-	80.0	350.0	Ω	Output in LOW state; 1.3 mA sink current

3.2.2 Magnetic characteristics

In Figure 3 the magnetic working principle of an omnipolar switch is illustrated. When the applied magnetic field is released and the release point B_{OP} is passed, the device output switches on. When a magnetic field is applied and the operating point B_{RP} is passed the device output switches off. As an omnipolar device, the switch reacts to positive fields (S) as well as to negative fields (N). Operating point and release point are separated by hysteresis B_{HYS} to avoid transient fast-switching events between both states.

What is special about this device is that it is a TMR switch that operates in a duty-cycling ultra low power mode to sense the magnetic fields. A glitch filter is implemented to ignore transient fields with a glitch filter time t_{Glitch_Filter} to detect a constant magnetic field before transitioning from output deactivated State to output active state. Transient fields shorter than t_{Glitch_Filter} will be ignored so that the device does not switch to high state by accident. Once the device is in active state the LOCK function may be enabled (logic HIGH) to lock the output to HIGH and not be affected by external magnetic fields. When the *LOCK* pin is asserted HIGH, the current state of output pin *Q* is locked. Conversely, when the *LOCK* pin is asserted LOW again, the output pin *Q* is allowed to change its state according to the measured magnetic field.

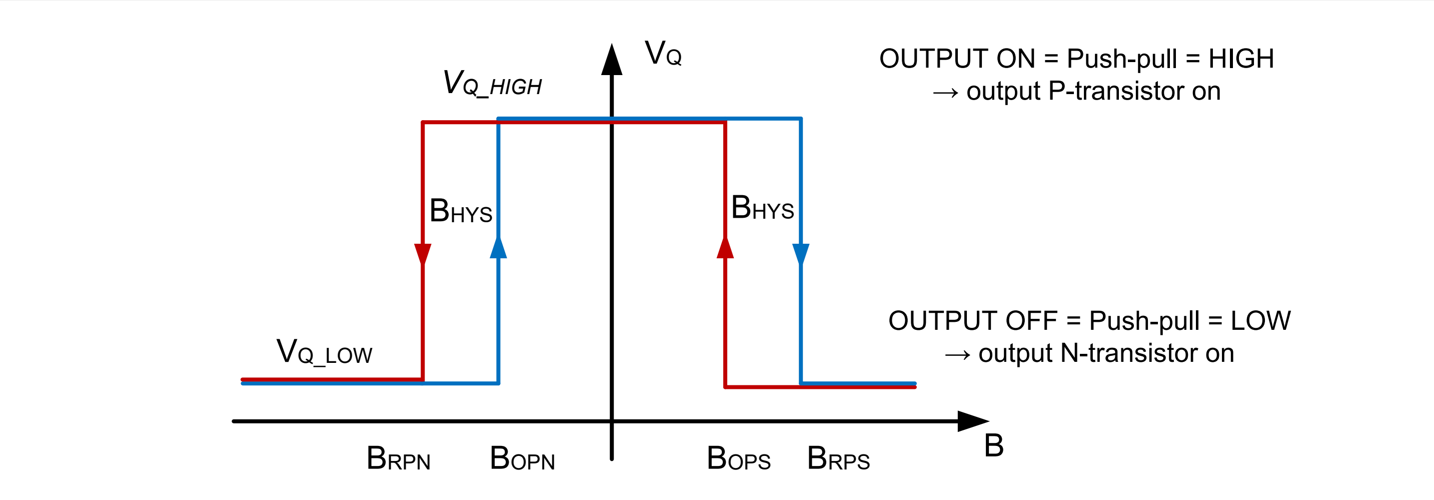


Figure 3 **Output signal curve**

Magnetic product characteristics involve the spread of values guaranteed within the specified voltage and ambient temperature range.

The below listed specification is valid in combination with the application circuit shown in Figure 6.

Figure 4 shows the position of the sensitive area relative to the center of the package.

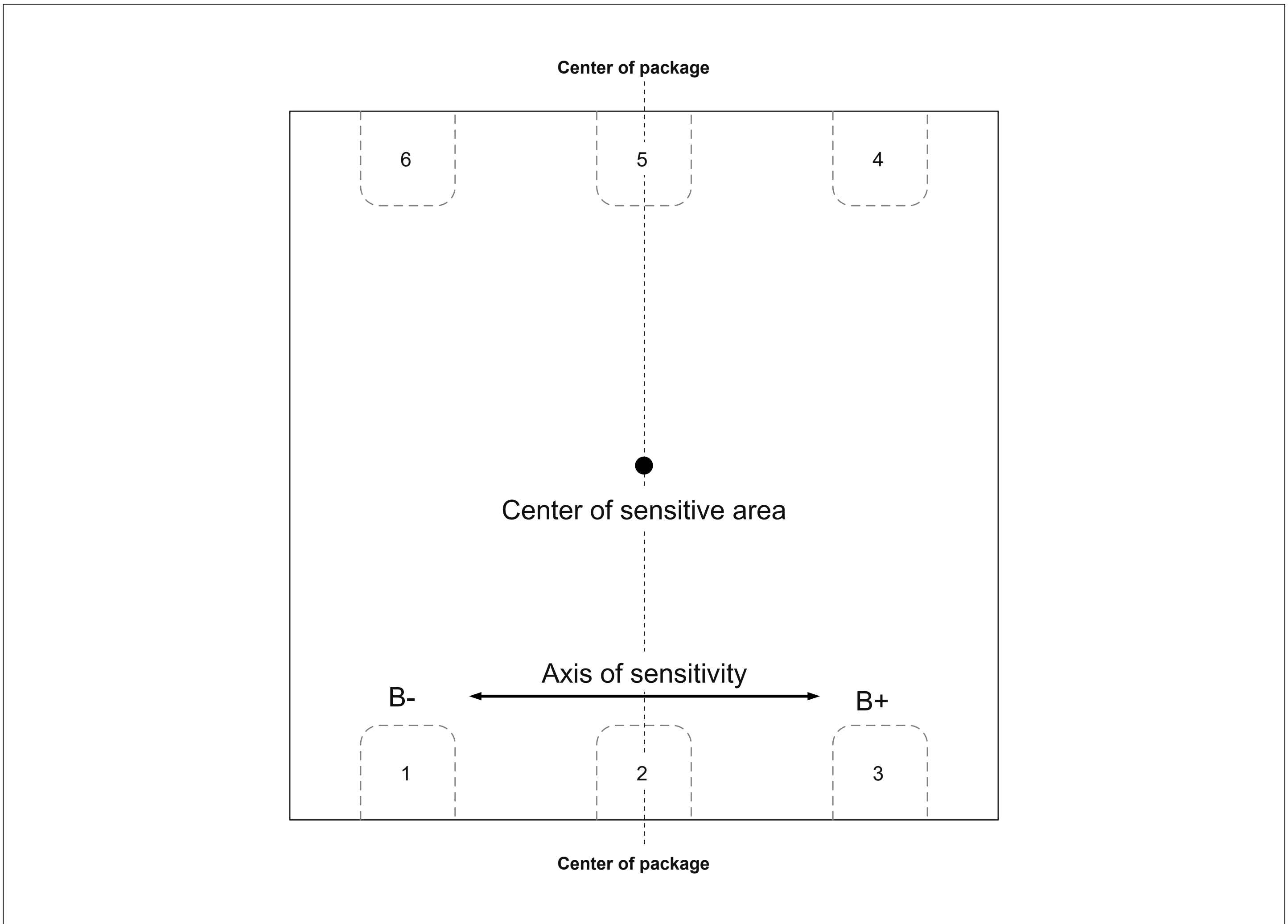


Figure 4 **Position of sensitive area**

Table 6 **Magnetic characteristics**

Parameter	Symbol	Values			Unit	Note or condition
		Min.	Typ.	Max.		
Magnetic operating point south	B_{OPS}	0.5	1.0	1.5	mT	
Magnetic release point south	B_{RPS}	2.5	4.5	7.0	mT	
Magnetic operating point north	B_{OPN}	-1.5	-1.0	-0.5	mT	
Magnetic release point north	B_{RPN}	-7.0	-4.5	-2.5	mT	
Magnetic hysteresis	B_{HYS}	1.0	3.5	5.0	mT	
Magnetic sample rate	f_S	0.4	1.2	2.4	Hz	

4 Functional modules

4.1 General functional overview

After applying the supply voltage the device starts up and enters the low power state meaning where with the repetition frequency of f_S, the chip enters a long time period where it is idle and a short time period where it is in the measure state. During the idle state, the current consumption is at its minimum reaching the overall average current consumption I_{DD_Avg}. However, in measure mode, the sensor starts sensing the magnetic field and decides with the comparators, if the switching levels have been reached. For a switching from HIGH magnetic field to LOW magnetic field, the chip enters the deglitching state, to filter the decision of the comparators, and samples the external magnetic field with a slightly higher frequency. When all these decisions show a state transition (i. e. magnetic field change) the output *Q* is switched. With the *LOCK* functionality the output is held in the current state. The forced sleep mode, can be activated by providing two pulses on the *FSLP* pin whilst the *LOCK* input is HIGH. When activated the device even switches off its internal low power mode which reduces the power consumption to an absolute minimum. This mode can be deactivated by sending another pulse on the *FSLP* pin whilst *LOCK pin* is low to reset to the low power state. The following diagram visualizes the described behaviour of the device and gives an overview on different output states of the devices output pin Q. The allowed pulse combinations for entering and leaving the forced sleep mode can be found in Table 7.

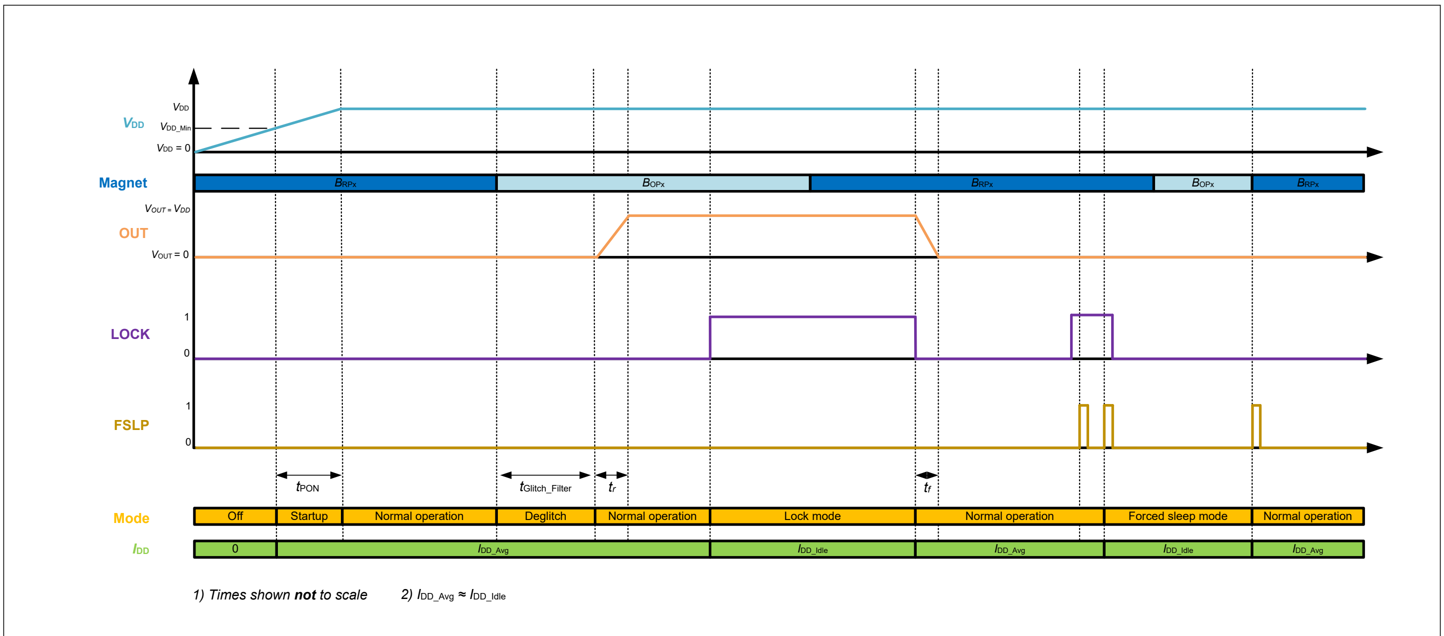


Figure 5 State and timing diagram

Table 7 Forced sleep mode pulse combinations

***LOCK* pin (first rising edge of *FSLP* Pin)**	***LOCK* pin (second rising edge of *FSLP* Pin)**	**Action**
1	1	Enter forced sleep mode
1	0	Leave forced sleep mode
0	1	Leave forced sleep mode
0	0	Forbidden

4.2 Lock output state function

The *LOCK* function is a logic input pin to allow an external microcontroller to control the output of the magnetic sensing function. If the *LOCK* pin is HIGH, then the *Q* pin will be locked in the current state and not affected by the external magnetic field.

4.3 Force sensor to sleep mode function

The forced sleep state pin *FSLP*, in conjunction with the *LOCK* pin, is used to force the device into and latch it in a forced sleep state. This means that the device current consumption is minimal and *Q* is pulled to *GND*, regardless of external magnetic field conditions. Applying two consecutive rising edges to *FSLP* while holding *LOCK* high, forces the device into forced sleep state. This state is held until it is explicitly cleared by applying a rising edge to *FSLP* while holding *LOCK* LOW which leads to resume of normal operation. Removing and reapplying V_{DD} voltage clears the forced sleep state and the device resumes in normal operation after power-up.

5 Application information

The following Figure 6 shows one possible option of a basic application circuit. Depending on the capacitance of the load connected to the output pin *Q* and the voltage stability of the supply voltage V_{DD}, the capacitor C_{BYP} must be adjusted.

One possible example usage of the sensor is shown in the application diagram in Figure 7. In this case the whole supply current of an application is switched through the magnetic sensor, while the sensor can be locked and put to sleep by an external microcontroller. But other applications are also conceivable in which the output signal *Q* of the sensor does not switch a supply current, but instead the output is evaluated for example by a microcontroller.

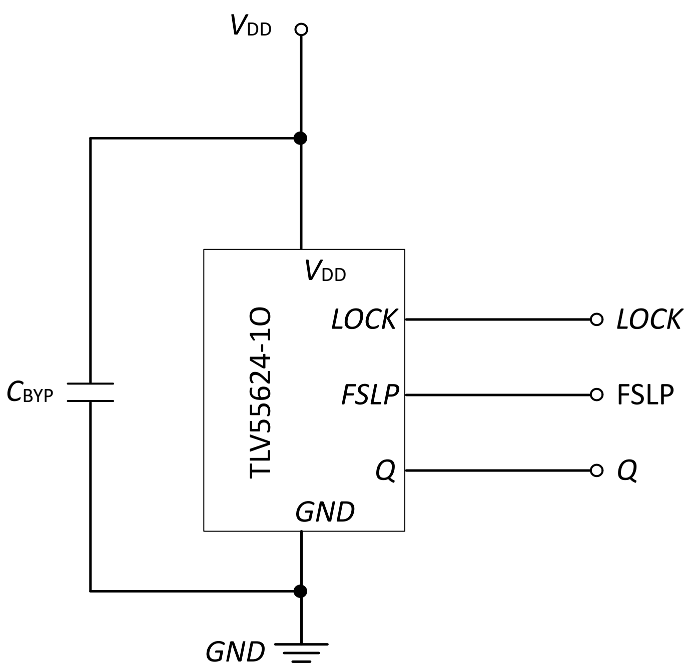


Figure 6 Basic application circuitry

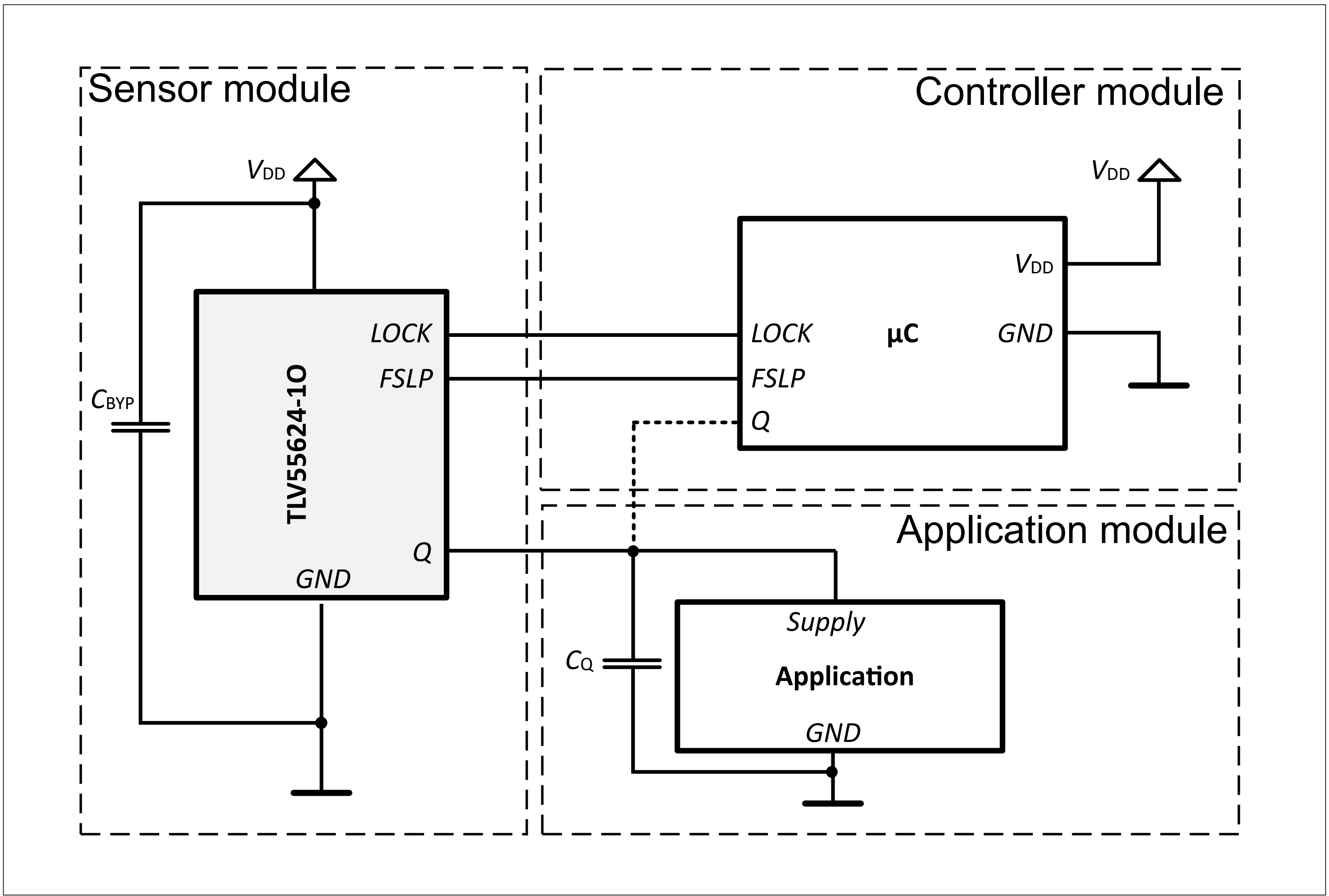


Figure 7 **Example application diagram**

6 Package

This sensor is available in a space-saving, non-magenetic PG-XQFN-7-1 package. Figure 8 and Figure 9 are showing the exact dimensions of the package as well as the carrier tape packaging. Figure 10 shows the PCB footprint.

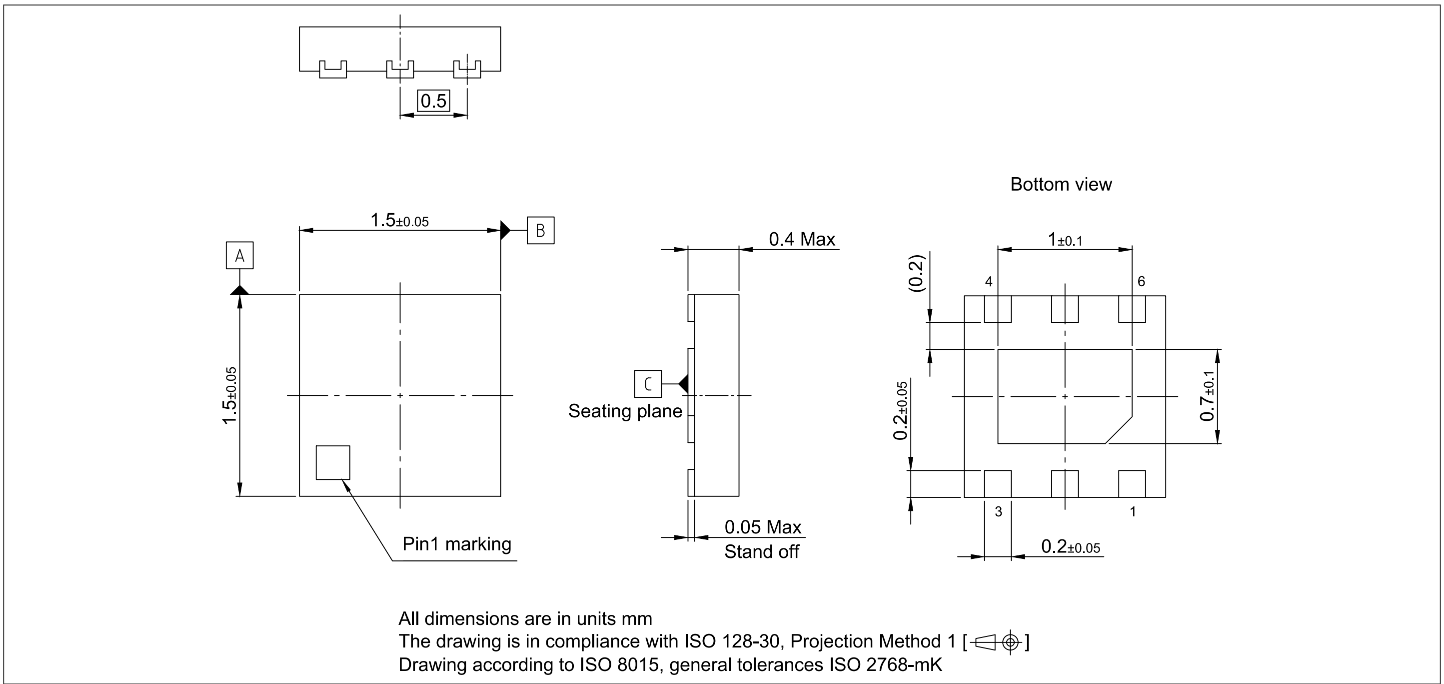


Figure 8 **PG-XQFN-7-1 package outlines**

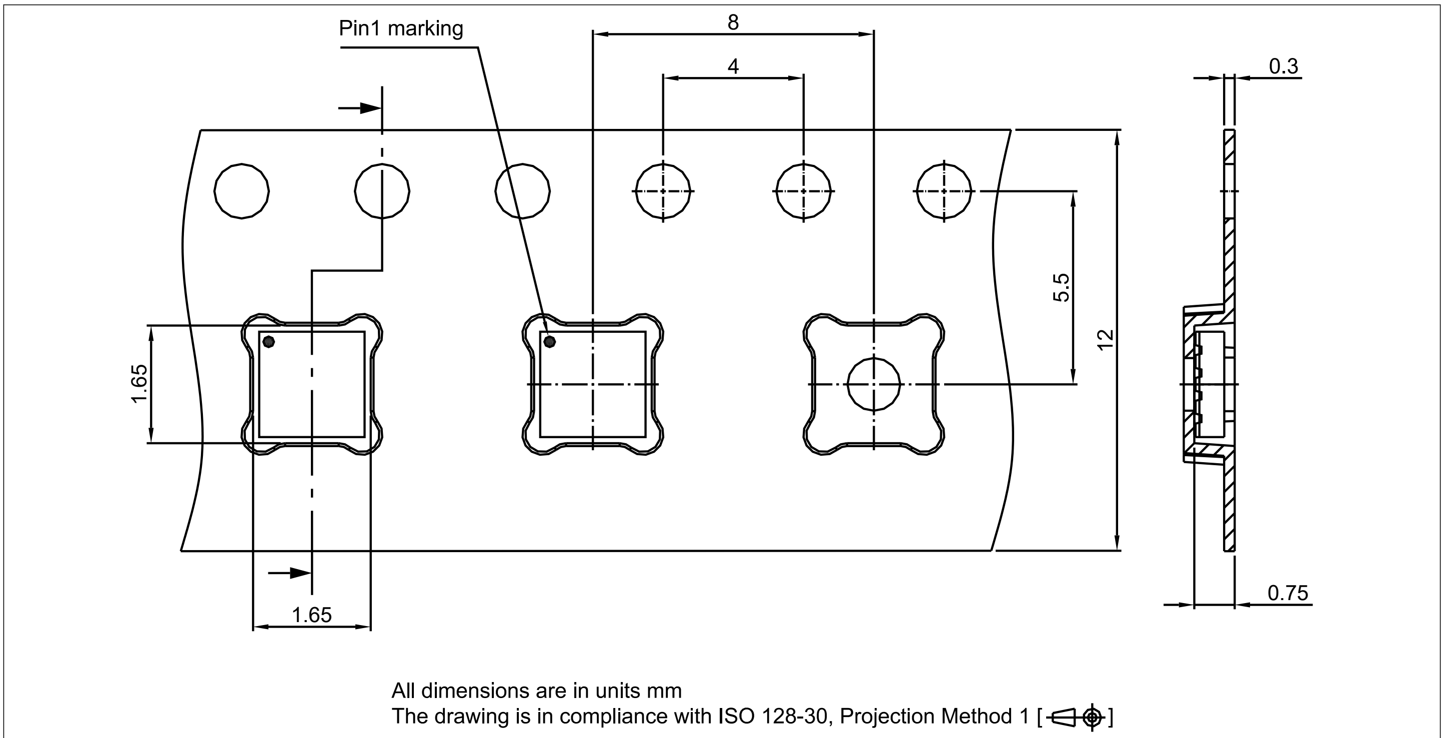


Figure 9 **PG-XQFN-7-1 carrier tape packaging**

Further information about the package can be found online at infineon.com

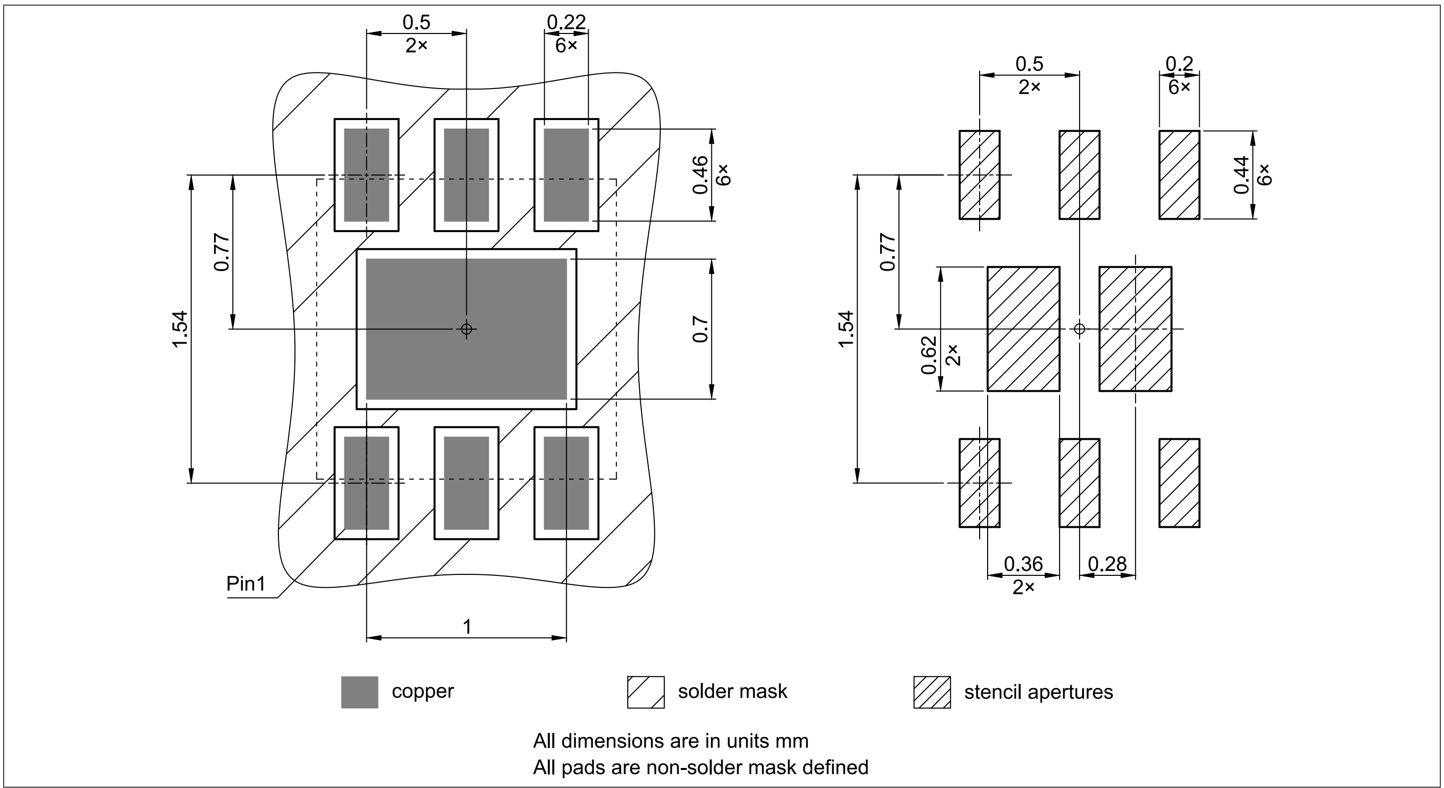


Figure 10 **Footprint of the PG-XQFN-7-1**

7 Revision history

Revision number	Date of release	Description of changes
Rev. 1.00	2026-07-29	Initial release

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2026-07-29

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-eah1784799300152