

TMR134x

MicroAmpere High Frequency Response Omnipolar Magnetic Switch Sensor

Description

TMR134x is an omnipolar magnetic switch integrated the tunnel magnetoresistance (TMR) magnetic sensor and open-drain circuitry, which is able to detect the change of magnetic field and output high and low voltage signals for high accuracy position detection.

Unlike Hall/AMR sensors, TMR sensors with extremely high resistance values allows TMR134x to achieve the supply current as low as 1.5 μ A while operating in the full-time power supply mode, and maintaining the response frequency of the magnetic signal is 1 kHz. Therefore, TMR134x can provide true continuous detection of magnetic field signals, avoiding sampling errors from the traditional time-sharing power supply mode.

TMR134x allows a wide range of operating supply voltages from 1.8 V to 5.5 V with excellent temperature characteristics, and can meet the requirements of most applications. TMR134x is available in compact LGA3L (2 mm \times 1.5 mm \times 0.63 mm) and SOT23-3 packages.

Features and Benefits

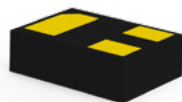
- Tunneling magnetoresistance (TMR) technology
- Low power consumption: supply current 1.5 μ A
- High frequency response: typ.1 kHz
- Omnipolar operation
- Wide range supply voltages: 1.8 V to 5.5 V
- Open-drain output
- High sensitivity
- Excellent temperature stability
- High tolerance to external magnetic field interference
- RoHS & REACH compliant

Applications

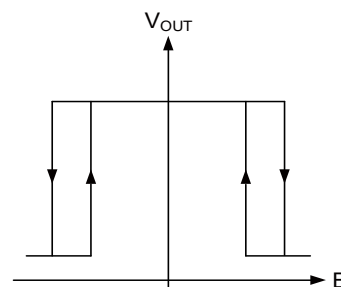
- Utility meters: water, gas, and heat meters
- Proximity switches
- Speed sensing
- Linear and rotation position sensing



SOT23-3



LGA3L



Selection Guide

Part Number	Supply Current	Response Frequency	Operating Ambient Temperature	Operating Point	Release Point	Package	Packing Form
TMR1341G	1.5 μ A	1 kHz	-40°C to 125°C	\pm 34 Gs	\pm 30 Gs	LGA3L	Tape & Reel
TMR1341S	1.5 μ A	1 kHz	-40 °C ~ 125 °C	\pm 34 Gs	\pm 30 Gs	SOT23-3	Tape & Reel
TMR1342G	1.5 μ A	1 kHz	-40°C to 125°C	\pm 42 Gs	\pm 37 Gs	LGA3L	Tape & Reel
TMR1342S	1.5 μ A	1 kHz	-40 °C ~ 125 °C	\pm 42 Gs	\pm 37 Gs	SOT23-3	Tape & Reel

Note: Please contact MultiDimension Technology local sales for customizing operating and release points.

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1. Functional Block Diagram

TMR134x series switch chips are composed of TMR sensors and signal processing circuits. The TMR sensor detects external magnetic field, generates an analog voltage signal, and outputs a logical switch level after processing by the circuits as shown in Figure 1.

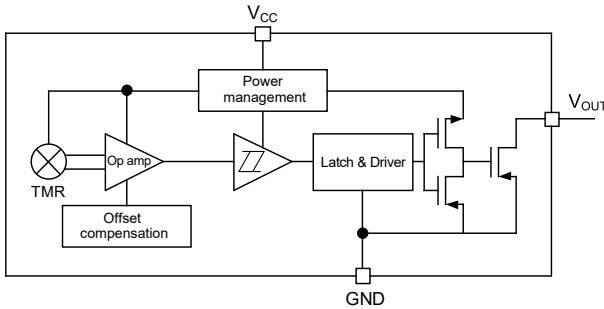


Figure 1. Block diagram

2. Switching Characteristics

The TMR134x sensing axis is parallel to the package top-marking surface; the sensing axis is defined from the N pole toward the S pole, as indicated by the arrow in the figure below.

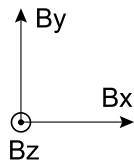


Figure 2-1. Definition of axis

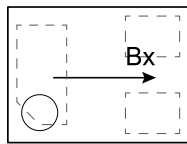


Figure 2-2. Axial diagram (LGA3L top view)

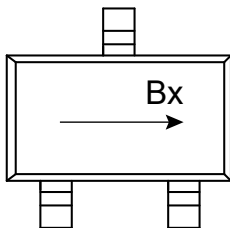


Figure 2-3. Axial diagram (SOT23-3 top view)

The output is “High”, when power is on at zero magnetic field. B is the external magnetic field along the sensing direction, B_{OPS} (B_{OPN}) is the operating point, B_{RPS} (B_{RPN}) is the release point, and hysteresis B_H is define as the difference between B_{OPS} and B_{RPS} (B_{OPN} and B_{RPN}).

The sensor outputs a low level, when the magnetic field along the sensing axis exceeds the operate point B_{OPS} (B_{OPN}), and the device outputs a high level, when the magnetic field is reduced below the release point B_{RPS} (B_{RPN}) as shown in Figure 3.

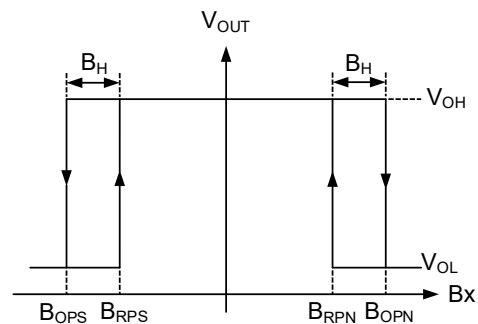


Figure 3. Switching characteristics

3. Pin Configuration

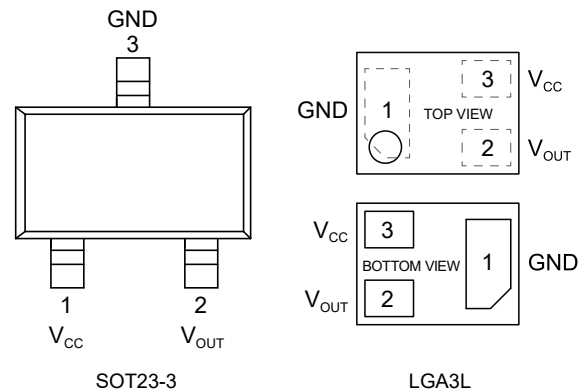


Figure 4. Pin configuration

Pin Number		Name	Function
LGA3L	SOT23-3		
1	3	GND	Ground
2	2	V_{OUT}	Output
3	1	V_{CC}	Power supply

4. Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Supply voltage	V_{CC}	-0.3	7	V
Output current	I_{SINK}	-	20	mA
Magnetic flux density	B	-	4000	Gs
ESD performance (HBM)	V_{ESD}	-	4	kV
Operating ambient temperature	T_A	-40	125	°C
Storage ambient temperature	T_{STG}	-50	150	°C

Note: I_{SINK} is the current flowing through the pin of sensor, when the output is turned on.

5. Electrical Specifications

$V_{CC} = 3\text{ V}$, $T_A = 25\text{ °C}$

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	operating	1.8	3.0	5.5	V
Output stress voltage	V_{stress}	-	-	-	5.5	V
Output leak current	I_{leak}	OUT = H	-	-	1	μA
On resistance of output	R_{ON}	OUT = L	-	-	10	Ω
Off resistance of output	R_{OFF}	OUT = H	-	10	-	M Ω
Output low voltage	V_{OL}	OP status	0	-	0.1	V
Supply current	I_{CC}	output open	-	1.5	-	μA
Response frequency	F	-	0 to 1000			Hz

Note: A 0.1 μF capacitor is connected between V_{CC} and GND, and 1 k Ω pull-up resistor is connected between V_{CC} and V_{OUT}

6. Magnetic Specifications

$V_{CC} = 3\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, a $0.1\text{ }\mu\text{F}$ capacitor is connected between V_{CC} and GND

TMR1341

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPN}	25	34	37	Gs
	B_{OPS}	-37	-34	-25	Gs
Release point	B_{RPN}	-	30	-	Gs
	B_{RPS}	-	-30	-	Gs
Hysteresis	B_H	-	4	-	Gs

TMR1342

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operate point	B_{OPN}	-	42	-	Gs
	B_{OPS}	-	-42	-	Gs
Release point	B_{RPN}	-	37	-	Gs
	B_{RPS}	-	-37	-	Gs
Hysteresis	B_H	-	5	-	Gs

7. Typical Supply Voltage Characteristics

TMR1341G, 1342G Supply Voltage Characteristics

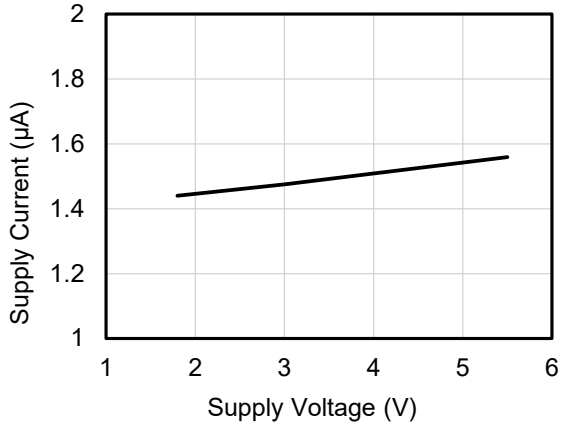


Figure 5. Supply current versus supply voltage ($T_A=25^\circ\text{C}$)

TMR1341G Supply Voltage Characteristics

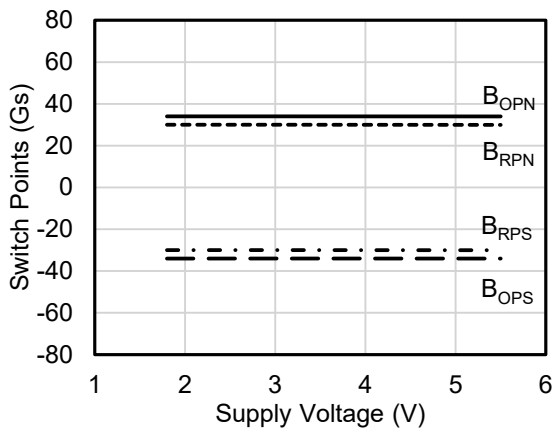


Figure 6. Switch points versus supply voltage ($T_A=25^\circ\text{C}$)

TMR1342G Supply Voltage Characteristics

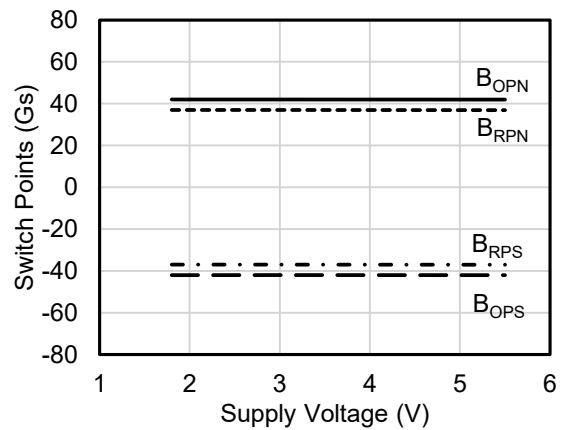


Figure 7. Switch points versus supply voltage ($T_A=25^\circ\text{C}$)

8. Typical Temperature Characteristics

TMR1341G, 1342G Temperature Characteristics

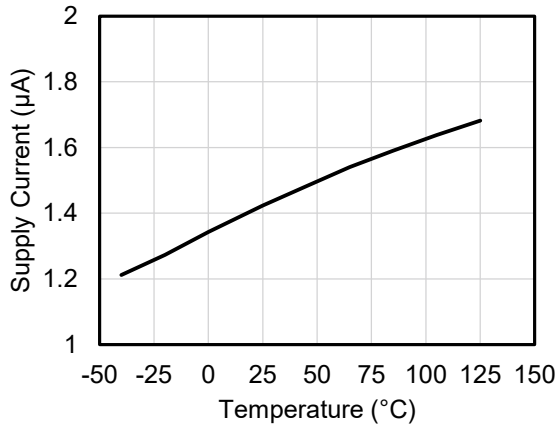


Figure 8. Supply current versus temperature ($V_{CC} = 3\text{ V}$)

TMR1341G Temperature Characteristics

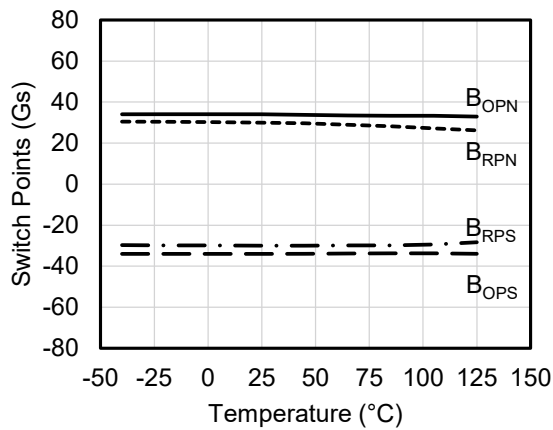


Figure 9. Switch points versus temperature ($V_{CC} = 3\text{ V}$)

TMR1342G Temperature Characteristics

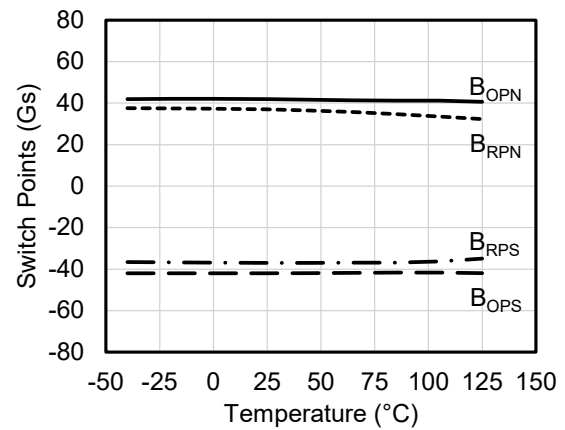


Figure 10. Switch points versus temperature ($V_{CC} = 3\text{ V}$)

9. Application Information

It is recommended to add a filter capacitor between the sensor power supply and ground (close to the sensor) to reduce external noise. As shown in Figure 11, the typical value is 0.1 μF .

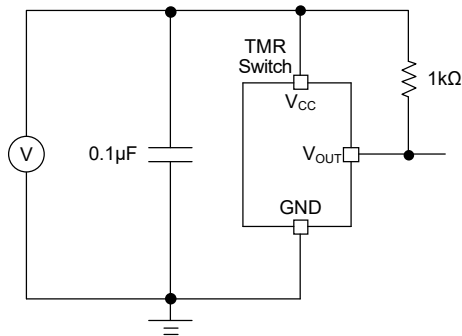


Figure 11. Application circuit diagram

The TMR134x series sensor chips are not suitable for driving power loads. The general method of use is utilizing the output voltage of V_{OUT} pin as a signal to input the MCU or drive a triode or MOS as shown in Figure 12.

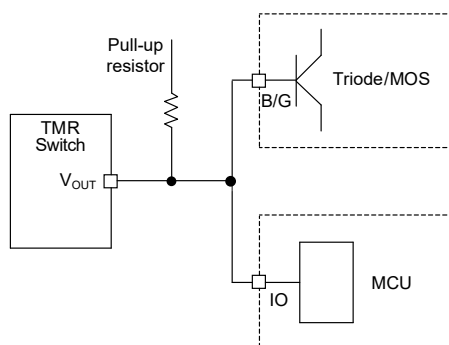


Figure 12. Application diagram for driving power load

Common failure conditions:

- The device is exposed to conditions exceeding any absolute maximum rating.
- The external circuit does not include properly matched supply-pin decoupling/filter capacitors.
- The device's V_{OUT} pin is used to directly drive power devices (e.g., relays), causing the output current to exceed the "Absolute Maximum Ratings".
- The device operates in a humid environment for an extended period.
- The maximum soldering temperature exceeds 260°C, or exposure above 250°C lasts longer than 10s.
- The device is exposed to temperatures above the maximum operating temperature while the external magnetic field exceeds 20 Gs.
- The device is exposed to an ultrasonic environment.
- Excessive deformation of the device leads/pins.
- Applying a voltage to the V_{OUT} pin, or powering the device through the V_{OUT} pin.

10. Dimensions

LGA3L Package

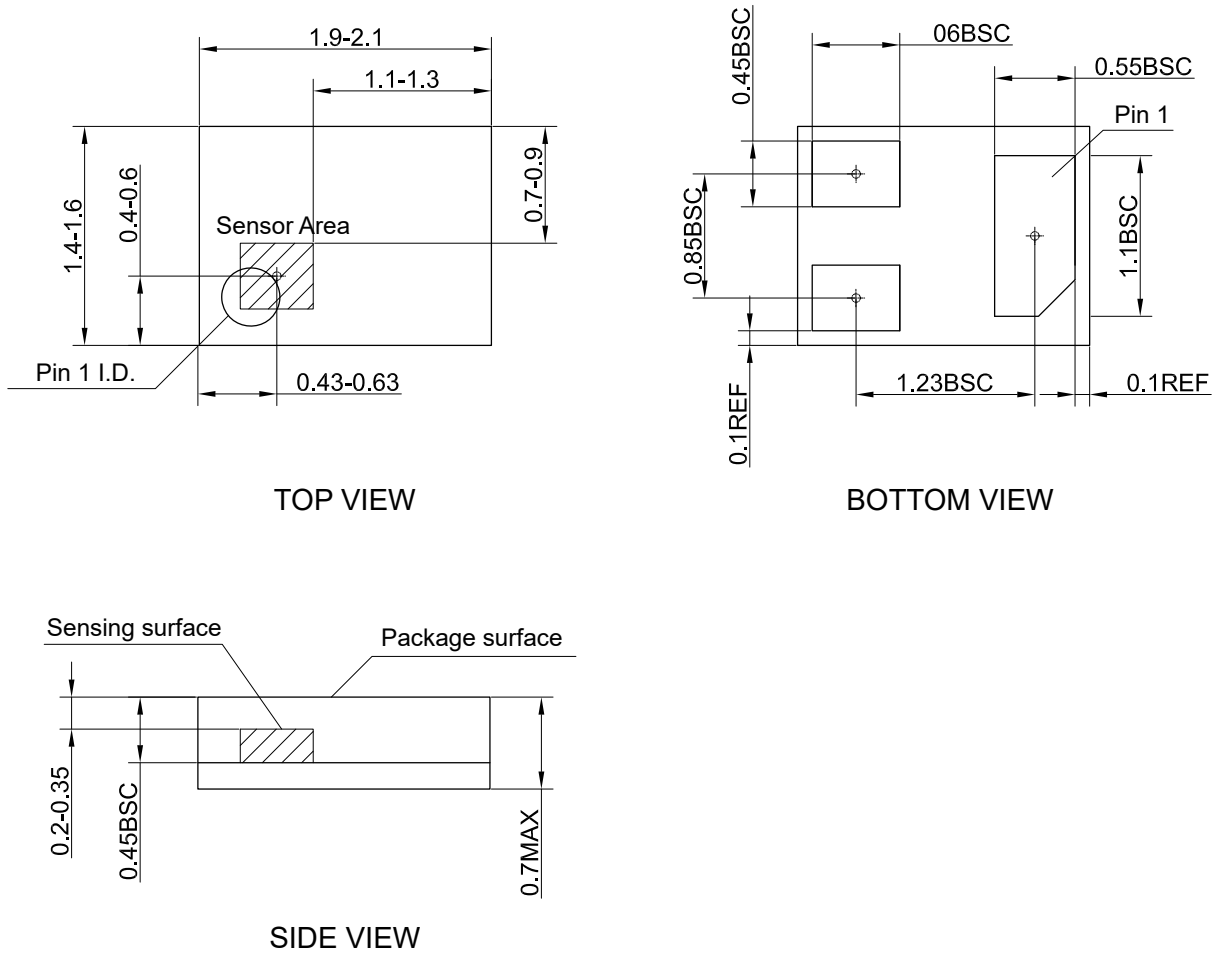


Figure 13. Package outline of LGA3L (unit: mm)

SOT23-3 Package

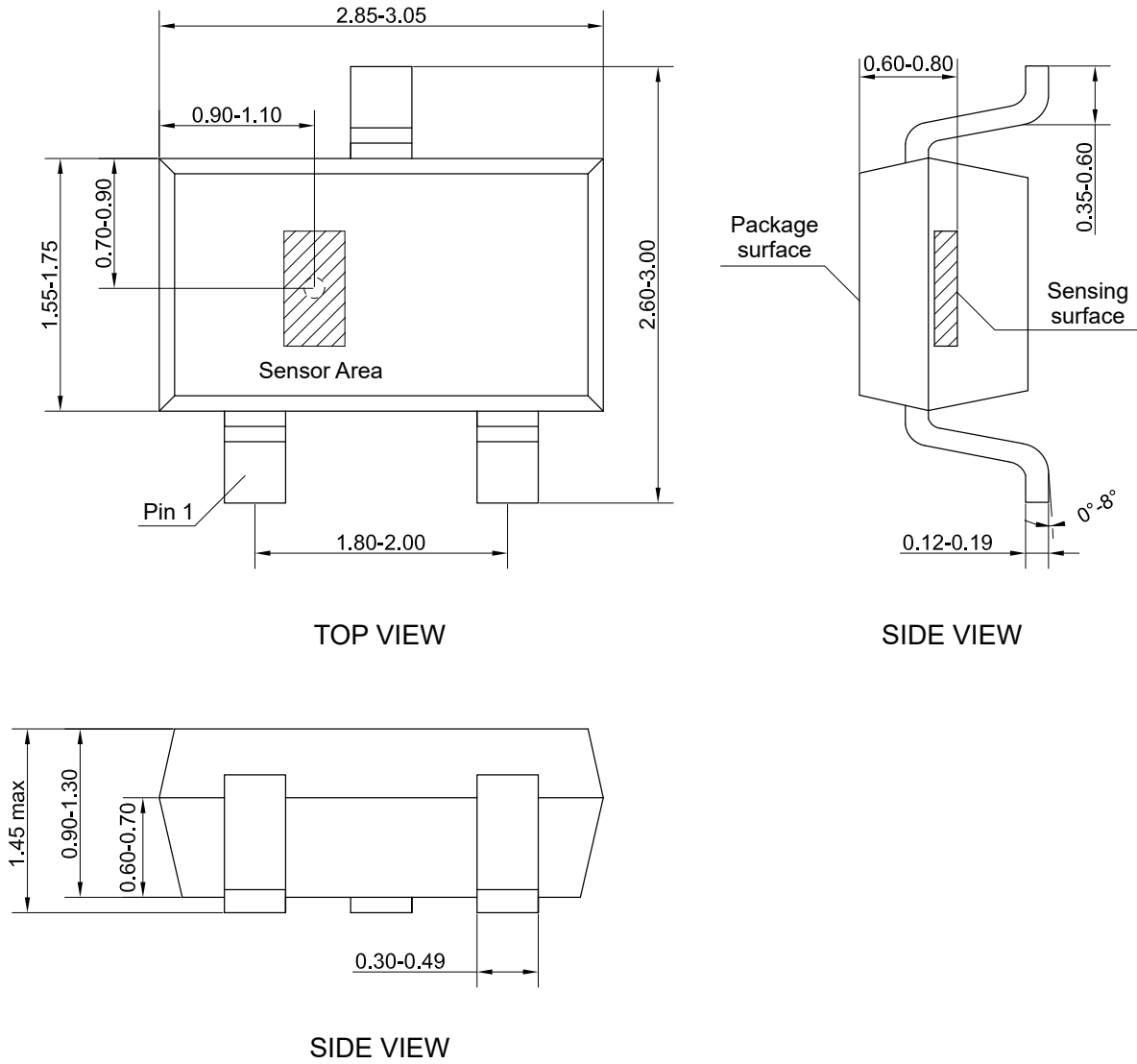


Figure 14. Package outline of SOT23-3 (unit: mm)

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