

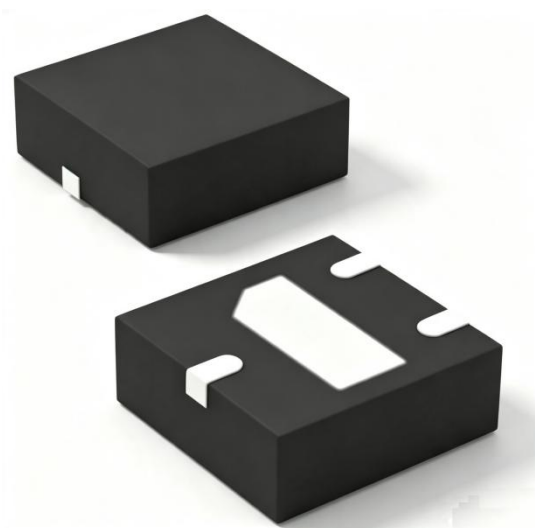
Product Data Sheet

TMR magnetic sensor chip

Product Series: FFE-020F16T21SJR

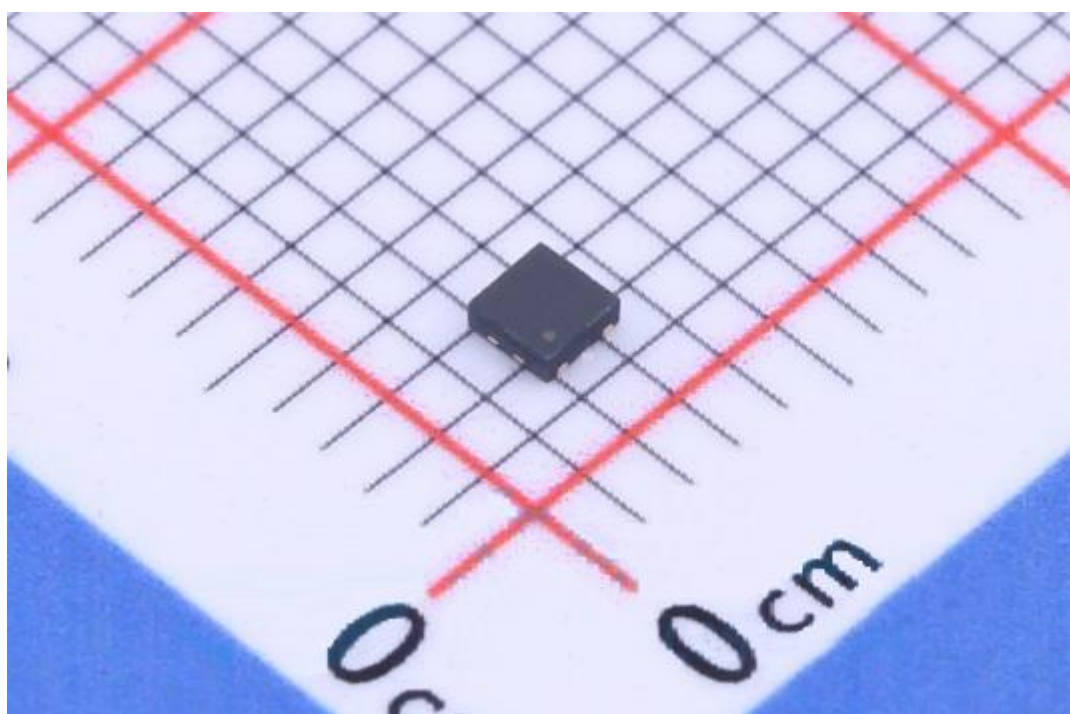
Part Number: FFE-020F16T21SJR

Version: Ver 1.1



CONTENTS

1. Key Features	3
2. Application	3
3. Description	3
4. Operating Characteristics	3
5. Absolute Maximum Ratings	4
6. Transfer Curve	4
7. Power-on response time	5
8. Typical output response time	5
9. Functional Diagram and Sensing Direction	6
10. Package Dimension & Sensing Area	6
11. Footprint on PCB	6
12. Keyboard Application Suggestions	7
13. Packing	8
14. Reflow Profile (Reference)	9



1. Key Features

- TMR (Tunnel Magnetoresistance Effect) technology
- DFN1.6x1.6-3L package form exists half Wheatstone bridge
- Built-in high precision, low power operational amplifier
- The output signal is analog output
- Low power, low hysteresis, high frequency response
- Low output noise ensures excellent sensor resolution

2. Application

- Joystick
- Keyboard
- Magnetic field sensor
- Magnet position detection
- Motion detection

3. Description

FFE-020F16T21SJL series is a small-size linear reluctance sensor chip based on the TMR principle, with built-in high-precision ultra-low power operational amplifier. When the applied magnetic field changes parallel to the sensor's sensitive direction, the sensor provides a single terminal voltage output, and the output has good temperature stability.

Any source that can generate a magnetic field can drive this sensor. The matching magnetic circuit design enables the sensor to have the best performance in detecting current, magnetic field, Angle, position, etc.

The sensor is DFN1.6x1.6-3L package with dimensions of (L) 1.6mm × (W) 1.6mm × (H) 0.50mm.

4. Operating Characteristics

V_{CC} = 3.3 V, T_A = 25 deg.C, Otherwise Specified

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage	V _{CC}		1.8	3.3	5.5	V
Supply Current @ 3.3 V	I _{DD}			265		μA
Offset	V _{OFF}	H = 0 Gs	-10	0	10	mV/V
Offset Temperature Coefficient	TCO	H = 0 Gs		0.015		mV/V/°C
Range of working Field	H _{WORK}		-160		160	Gs
Linearity Error	£L	Fit ±50%*H _{WORK}		5		%
Sensitivity with x2 Gain	SEN	Hex: ±25 Gs		3.2		mV/V/Gs
Sensitivity Temperature Coefficient	TCS			1500		PPM/°C

Note: working field range is defined as when the sensitivity dropped to the 20% of SEN (@±25 Gs).

5. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Power Supply	V_{CC}	—	6	V
ESD (HBM)	V_{ESD}	—	4	KV
Storage Temperature	Tstg	-40	85	°C
Operation Temperature	TA	-40	85	°C
Range of working Field	H_{WORK}	-160	160	Gs

Note: When the operating conditions of the product exceed the limit parameters, it may cause irreparable damage to the product. Working at the limit parameters for a long time may lead to a decline in product performance and product reliability.

6. Transfer Curve

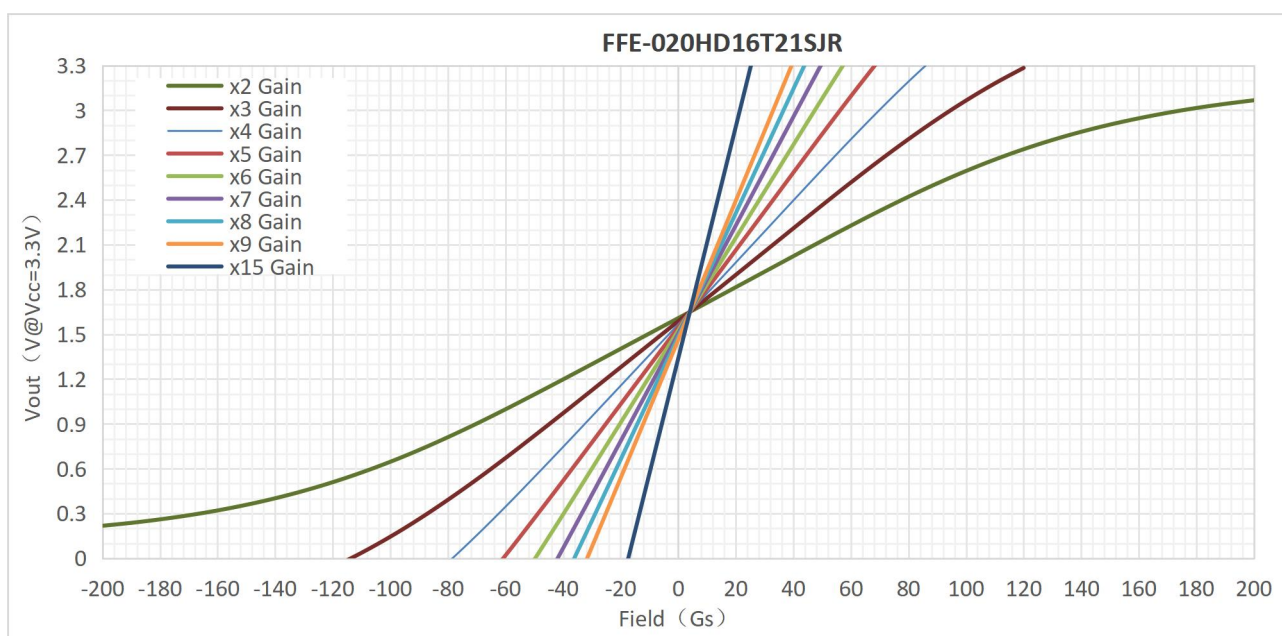


Fig.1 the output of FFE-020F16T21SJR series magnetic sensors with $V_{CC} = 3.3V$. The gain can be adjusted. The adjustment range is from 2 to 15.

7. Power-on response time

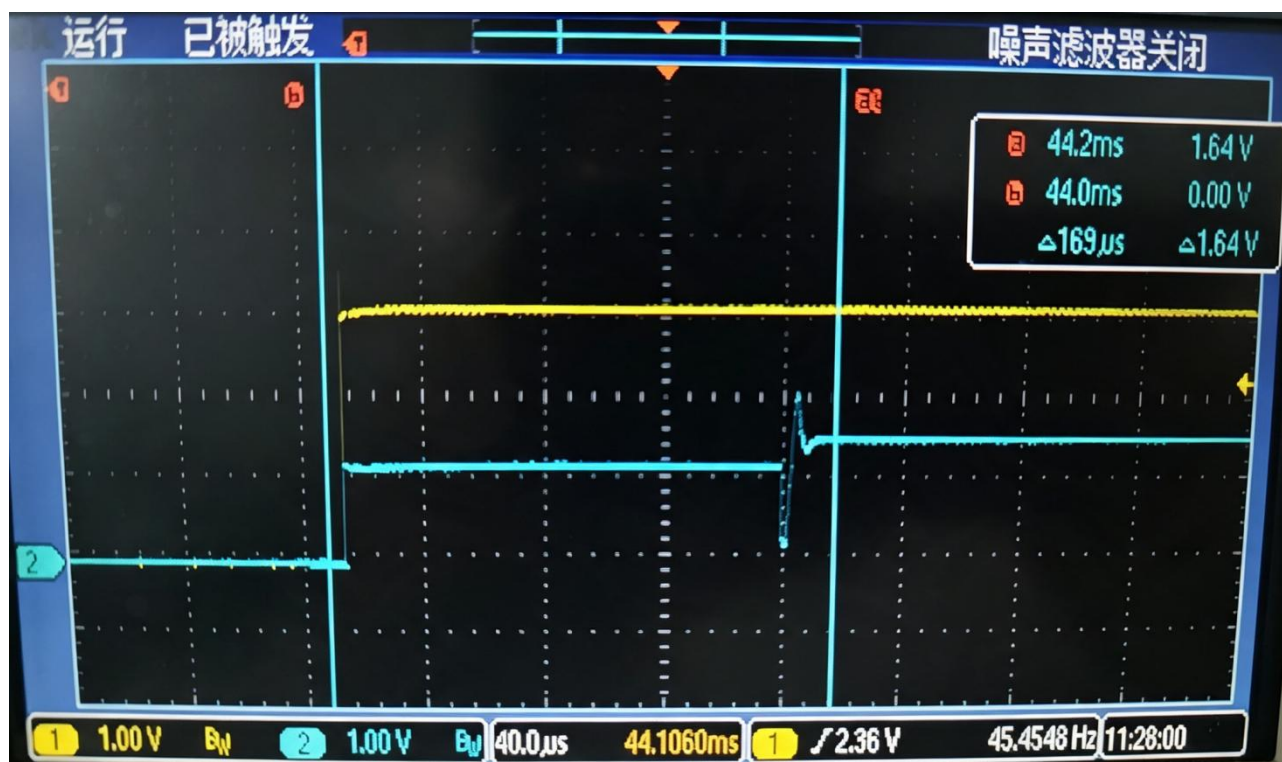


Fig.2 CH1 is Vcc voltage, and CH2 is output voltage; FFE-020F16T21SJR-020K series show Power-on response time of 170μs.

8. Typical output response time



Fig.3 CH1 is primary magnetic field, and CH2 is output voltage; FFE-020F16T21SJR-020K series show output response time of 2.16 μs (~2 μs)

9. Functional Diagram and Sensing Direction

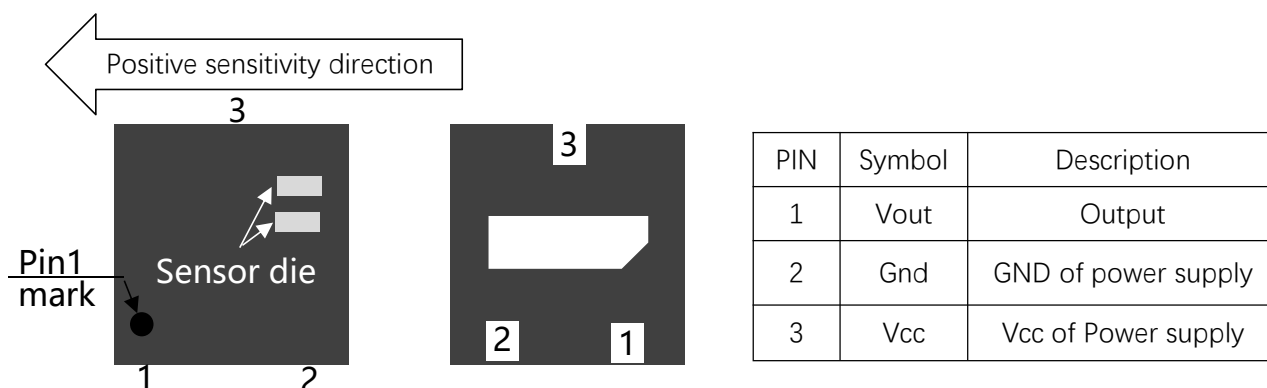


Fig.4 the functional diagram of the sensors, and the definition on the positive sensing direction, along this direction, the output voltage of the sensor increased with the increasing magnetic field.

10. Package Dimension & Sensing Area

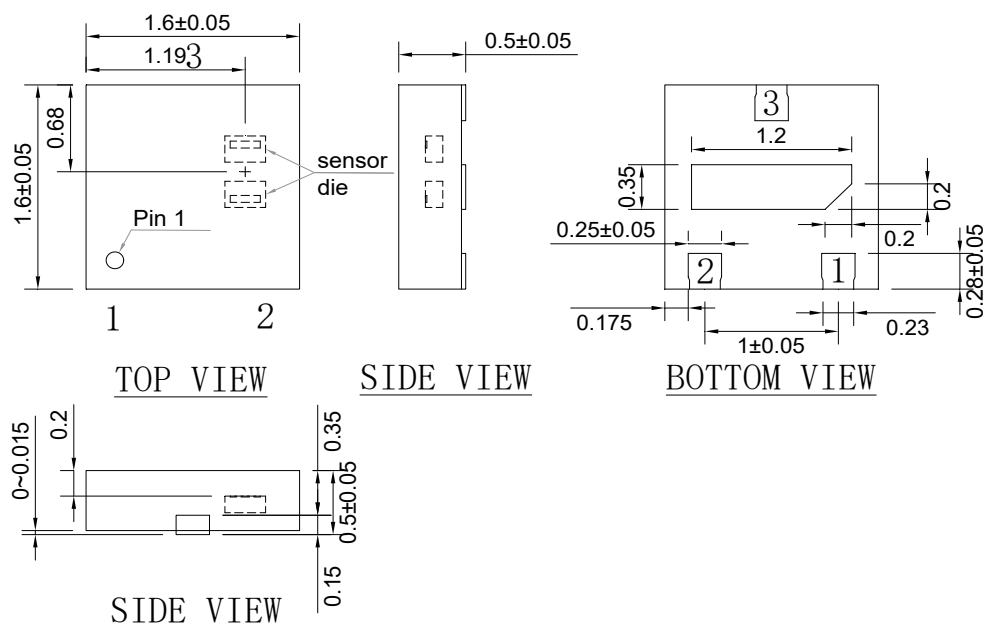


Fig.5 the dimensions of the packaged chips, and the position of sensing area(unit: mm).

11. Footprint on PCB

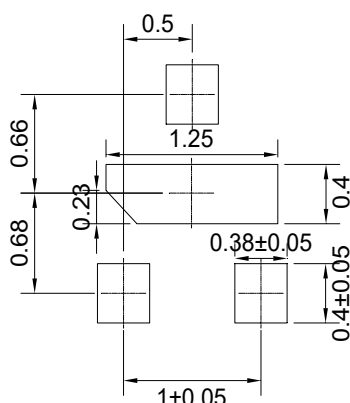


Fig.6 footprint of the sensor chips with DFN1616H055-4L package(unit: mm).

12. Keyboard Application Suggestions

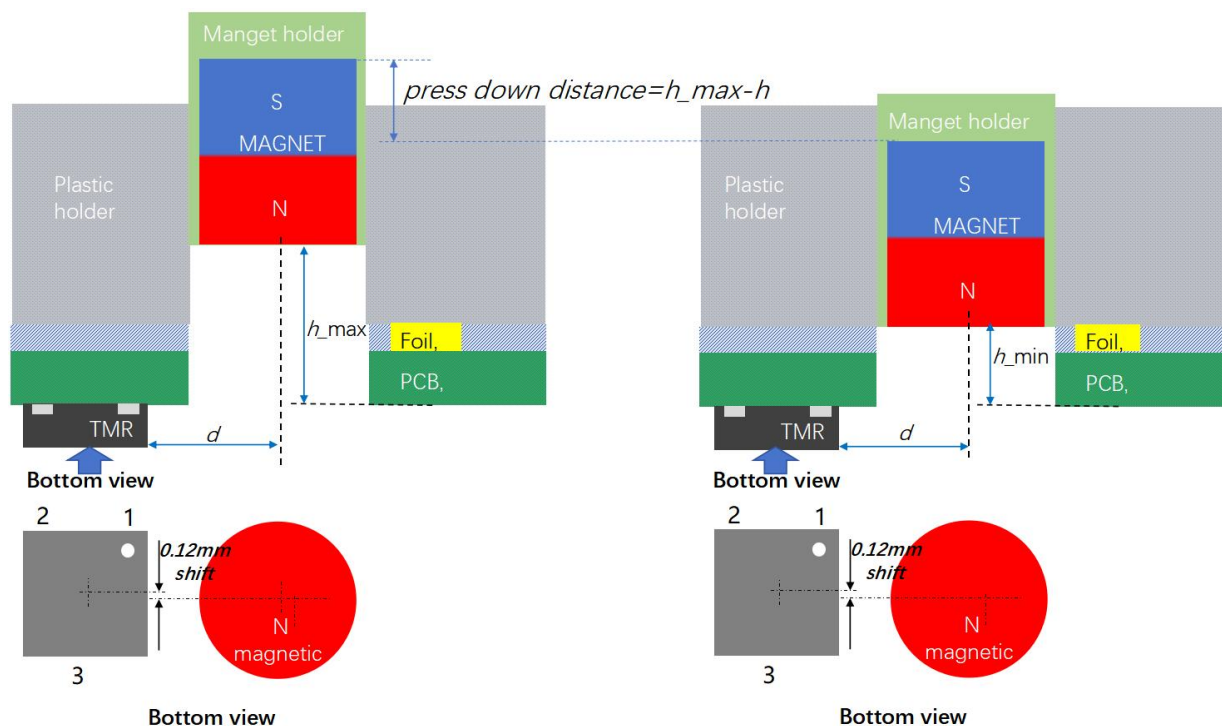
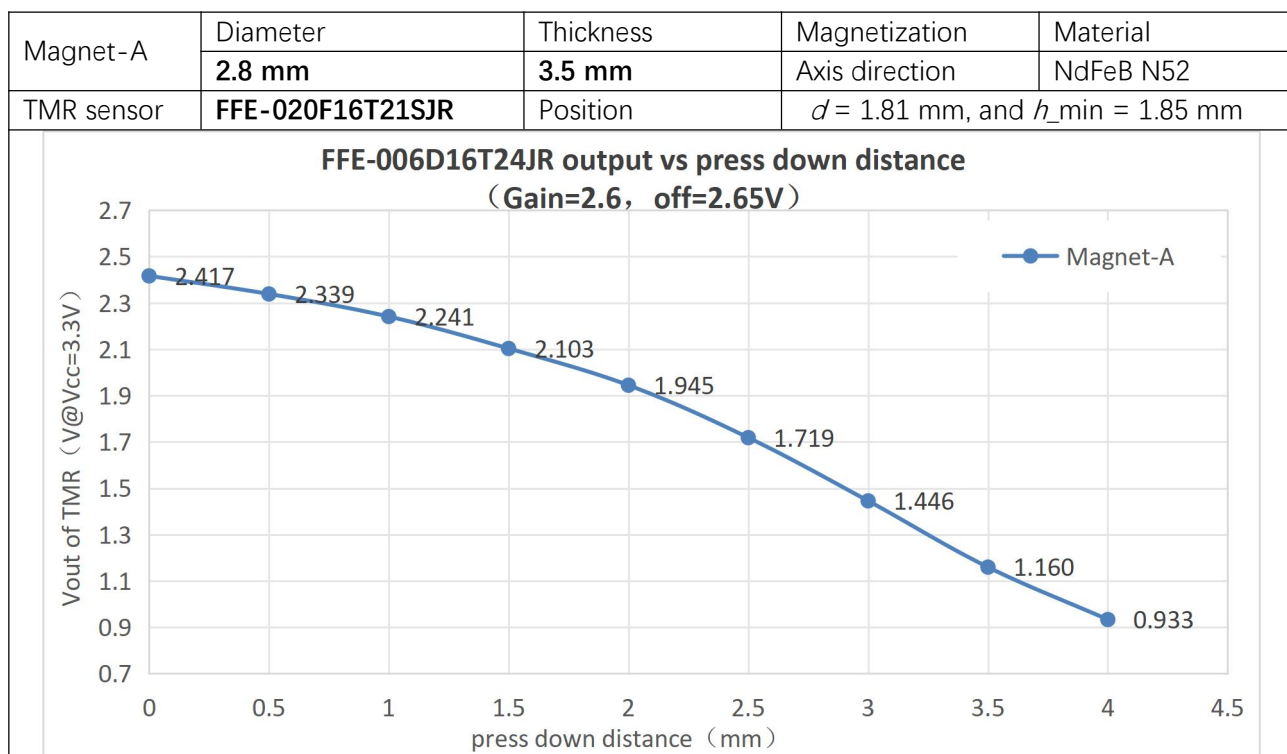


Fig 7. suggested configuration when detecting moving position of small magnet. When the magnet is pressed down, the value of h decreased. ($h_{\max} - h$) is defined as “**Press down distance**”.

The figure describes the relative position of the magnet and the sensor. The cylinder magnet is magnetized along axis direction. The distance from the axis of the magnet to the edge of the sensor chip is defined as “ d ”. The distance from bottom of magnet to the bottom of the PCB is defined as “ h ”.

☆For application magnets, the following is a typical N-type magnetic potential downward application example, if it is other magnetic pole direction application, please contact us, need to adjust the chip on the PCB board and magnet relative position.



13. Packing

Item	Request	Remark
Reel	7 inch	Fig.8
Carrier width	8 mm	Fig.9
Leader empty length	400 mm	REF: EIA-481
Trailer empty length	160 mm	REF: EIA-481
Quantity of reel	3000pcs/ 7" Reel; 10000pcs/ 13" Reel	Full of tape reel
MSL Level	L3	J-STD-020E

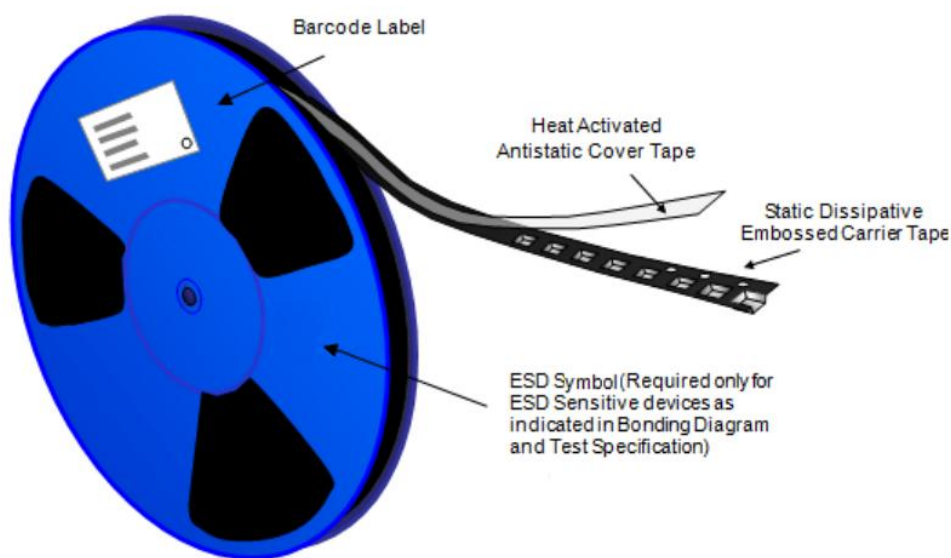


Fig.8 Tape diagram

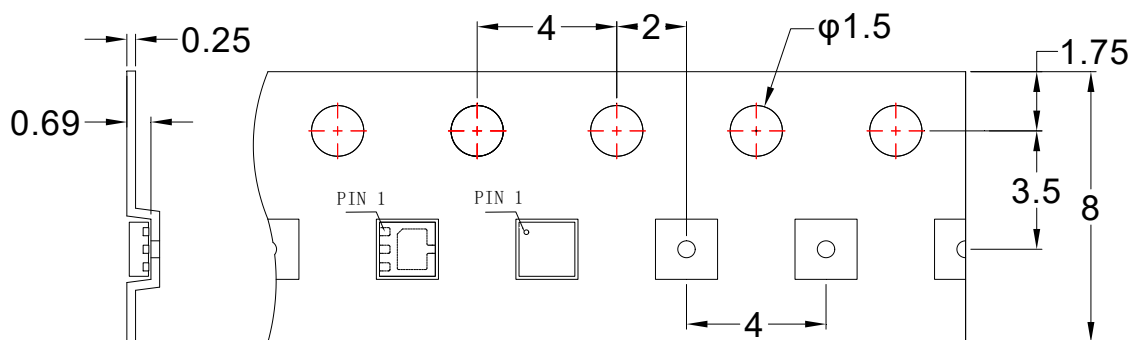
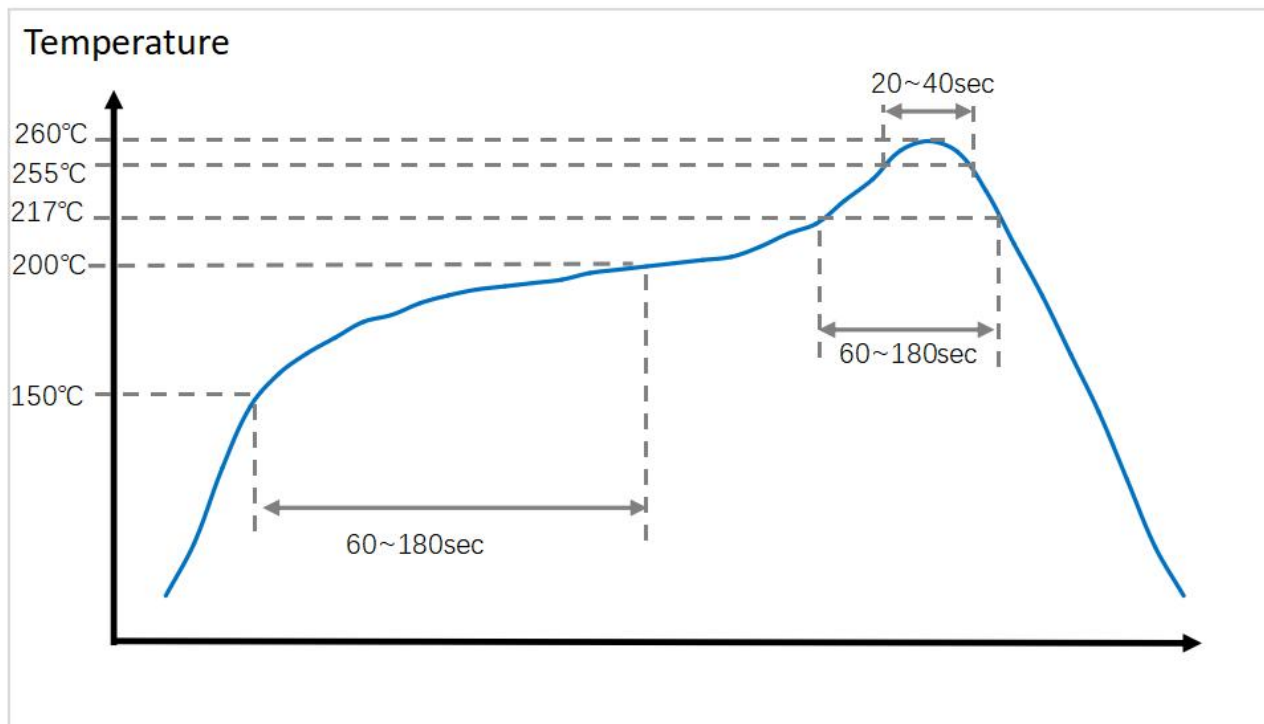


Fig.9 Carrier diagram

14. Reflow Profile (Reference)

Peak Temperature should not exceed 260 degC.

Below Profile is Reference. Please confirm productivity in assembly process.



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