MH231 Hall-effect sensor is a temperature stable, stress-resistant, Low Tolerance of Sensitivity nano-power switch. Superior high-temperature performance is made possible through a dynamic offset cancellation that utilizes chopper-stabilization. This method reduces the offset voltage normally caused by device over molding, temperature dependencies, and thermal stress.

MH231 is special made for low operation voltage, 1.65V, to active the chip which is includes the following on a single silicon chip: voltage regulator, Hall voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, CMOS output driver. Advanced CMOS wafer fabrication processing is used to take advantage of low-voltage requirements, component matching, very low input-offset errors, and small component geometries.This device requires the presence of omni-polar magnetic fields for operation.

The package type is in a Halogen Free version has been verified by third party Lab.

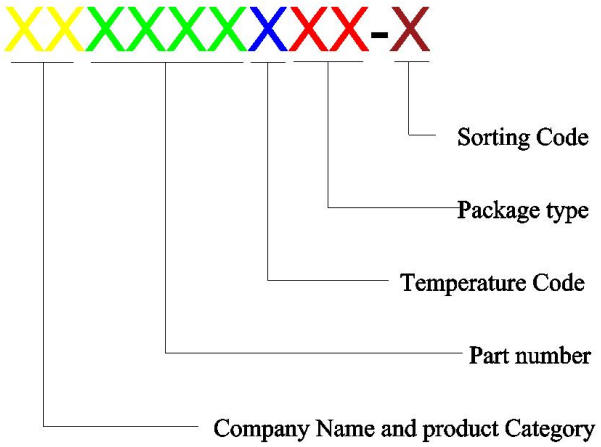
***Features and Benefits***

- CMOS Hall IC Technology
- Strong RF noise protection
- 1.65 to 5.5V for battery-powered applications
- Omni polar, output switches with absolute value of North or South pole from magnet
- Operation down to 1.65V, Nano power consumption
- High Sensitivity for reed switch replacement applications
- Multi Small Size option
- Low sensitivity drift in crossing of Temp. range
- Ultra Low power consumption at 900nA (Avg)
- High ESD Protection, HBM >±8KV( min )
- Totem-pole output
- RoHS compliant 2011/65/EU and Halogen Free.

***Applications***

- Solid state switch
- Handheld Wireless Handset Awake Switch ( Flip Cell/PHS Phone/Note Book/Flip Video Set)
- Lid close sensor for battery powered devices
- Magnet proximity sensor for reed switch replacement in low duty cycle applications
- Water Meter
- Floating Meter
- PDVD
- NB

## *Ordering Information*




**Company Name and Product Category**

**MH:MST Hall Effect/MP:MST Power IC**

**Part number**

**181,182,183,184,185,248,249,276,477,381,381F,381R,382…..**

**If part # is just 3 digits, the fourth digit will be omitted.**

**Temperature range**

**E: 85 ℃, I: 105 ℃, K: 125 ℃, L: 150 ℃**

**Package type**

**UA:TO-92S,VK:TO-92S(4pin),VF:TO-92S(5pin),SO:SOT-23,**

**SQ:QFN-3,ST:TSOT-23,SN:SOT-553,SF:SOT-89(5pin),**

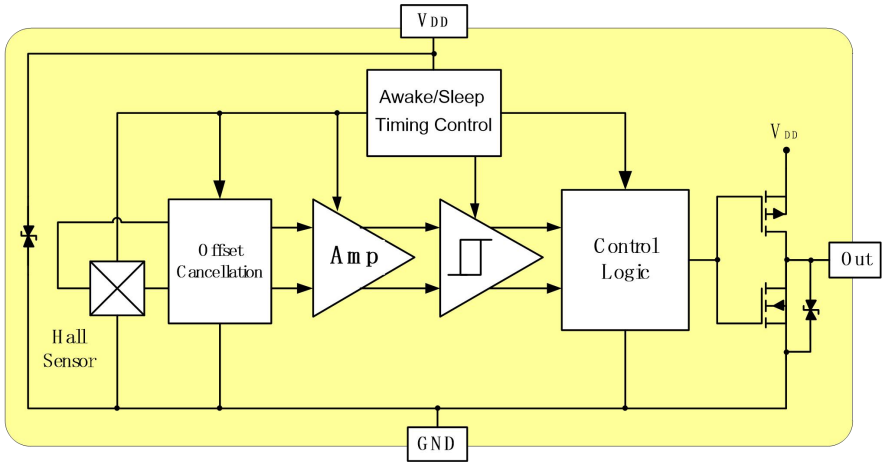
**SS:TSOT-26,SD:DFN-6； SA:Represents ATEC packaged TSOT-23.**

**Sorting**

**α,β,Blank…..**

| Part No. | Temperature Suffix | Package Type |
|---|---|---|
| MH231EUA | E (-40°C to + 85°C) | UA (TO-92S) |
| MH231ESO | E (-40°C to + 85°C) | SO (SOT-23) |
| MH231ESO-AA | E (-40°C to + 85°C) | SO (SOT-23) |
| MH231ESA | E (-40°C to + 85°C) | SA (SOT-23) |
| MH231ESP | E (-40°C to + 85°C) | SP (PSOT-23) |
| MH231ESS | E (-40°C to + 85°C) | SS (DFN1x1-4L) |
| MH231ESM | E (-40°C to + 85°C) | SM (DFN1.6*1.6-6L) |

## *Functional Diagram*




***Note**: Static sensitive device; please observe ESD precautions. Reverse $V_{DD}$ protection is not included. For reverse voltage protection, a 100 Ω resistor in series with $V_{DD}$ is recommended.*
***MH231, HBM >±8KV which is verified by third party lab.***

## *Absolute Maximum Ratings* *At(Ta=25℃)*

| Characteristics | Values | Unit |
|---|---|---|
| Supply voltage,($V_{DD}$) | 6 | V |
| Output Voltage,($V_{out}$) | 6 | V |
| Reverse Voltage,($V_{DD}$) ($V_{OUT}$) | -0.3 | V |
| Magnetic flux density | Unlimited | Gauss |
| Output current,($I_{OUT}$) | 10 | mA |
| Operating temperature range, ($Ta$) | -40 to +85 | ℃ |
| Storage temperature range, ($Ts$) | -65 to +150 | ℃ |
| Maximum Junction Temp,($Tj$) | 150 | ℃ |

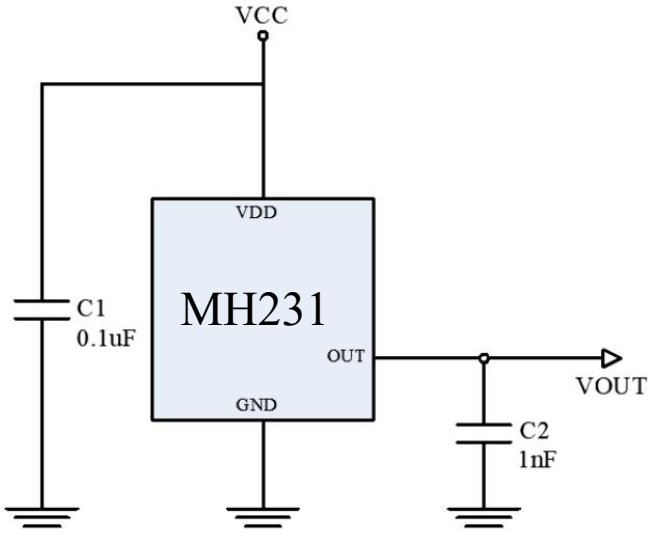
***Note:*** *Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.*

## *Electrical Specifications*

*DC Operating Parameters：Ta=25℃, $V_{DD}$=3.0V*

| Parameters | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Supply Voltage,($V_{DD}$) | Operating | 1.65 | | 5.5 | V |
| Supply Current,($I_{DD}$) | Average | | 900 | | nA |
| Output Leakage Current,($Ioff$) | Output off | | | 1 | uA |
| Output High Voltage,($V_{OH}$) | $I_{OUT}$=0.5mA(Source) | $V_{DD}$-0.04 | | | V |
| Output Low Voltage,($V_{OL}$) | $I_{OUT}$=0.5mA(Sink) | | | 0.04 | V |
| Awake mode time,($Taw$) | Operating | | 25 | 50 | uS |
| Sleep mode time,($T_{SL}$) | Operating | | 35 | 50 | mS |
| Sampling period | | | 35 | | mS |
| Electro-Static Discharge | HBM | 8 | | | KV |

## *Typical Application Circuit*



## *MH231EUA/SP/SS/SM Magnetic Specifications*

*DC Operating Parameters：Ta=25℃, $V_{DD}$=3.0V*

| *Parameter* | *Symbol* | *Test Conditions* | *Min.* | *Typ.* | *Max.* | *Units* |
|---|---|---|---|---|---|---|
| **OperatingPoint** | $B_{OPS}$ | S pole to branded side, B > BOP, Vout On | 20 | | 40 | Gauss |
| | $B_{OPN}$ | N pole to branded side, B > BOP, Vout On | -40 | | -20 | Gauss |
| **Release Point** | $B_{RPS}$ | S pole to branded side, B < BRP, Vout Off | 10 | | 30 | Gauss |
| | $B_{RPN}$ | N pole to branded side, B < BRP, Vout Off | -30 | | -10 | Gauss |
| **Hysteresis** | $B_{HYS}$ | \|BOPx - BRPx\| | | 10 | | Gauss |

## *MH231ESO/SA Magnetic Specifications*

*DC Operating Parameters：Ta=25℃, $V_{DD}$=3.0V*

| *Parameter* | *Symbol* | *Test Conditions* | *Min.* | *Typ.* | *Max.* | *Units* |
|---|---|---|---|---|---|---|
| **Operating Point** | $B_{OPS}$ | N pole to branded side, B > BOP, Vout On | 20 | | 40 | Gauss |
| | $B_{OPN}$ | S pole to branded side, B > BOP, Vout On | -40 | | -20 | Gauss |
| **Release Point** | $B_{RPS}$ | N pole to branded side, B < BRP, Vout Off | 10 | | 30 | Gauss |
| | $B_{RPN}$ | S pole to branded side, B < BRP,Vout Off | -30 | | -10 | Gauss |
| **Hysteresis** | $B_{HYS}$ | \|BOPx - BRPx\| | | 10 | | Gauss |

## *MH231ESO-AA Magnetic Specifications*

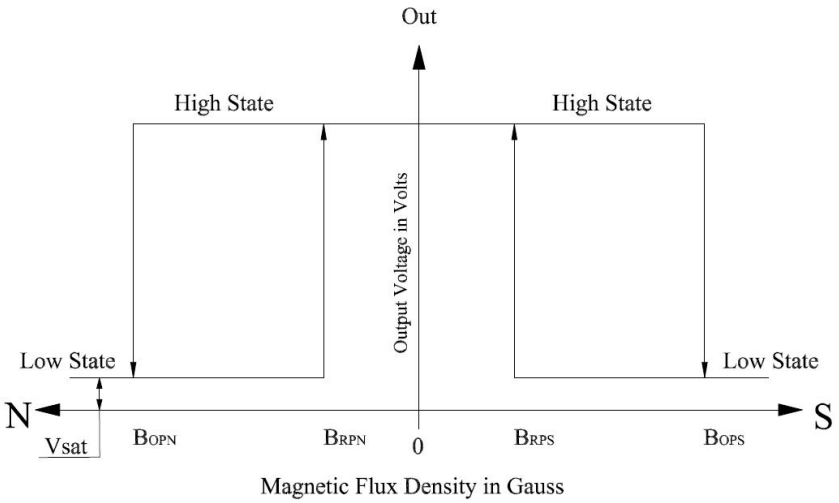
*DC Operating Parameters：Ta=25℃, $V_{DD}$=3.0V*

| *Parameter* | *Symbol* | *Test Conditions* | *Min.* | *Typ.* | *Max.* | *Units* |
|---|---|---|---|---|---|---|
| **Operating Point** | $B_{OPS}$ | N pole to branded side, B > BOP, Vout On | 25 | | 35 | Gauss |
| | $B_{OPN}$ | S pole to branded side, B > BOP, Vout On | -35 | | -25 | Gauss |
| **Release Point** | $B_{RPS}$ | N pole to branded side, B < BRP, Vout Off | 15 | | 28 | Gauss |
| | $B_{RPN}$ | S pole to branded side, B < BRP,Vout Off | -28 | | -15 | Gauss |
| **Hysteresis** | $B_{HYS}$ | \|BOPx - BRPx\| | | 10 | | Gauss |

## *MH231EUA/SO/SA/SP/SS/SM/MH231ESO-AA Output Behavior versus Magnetic Polarity*

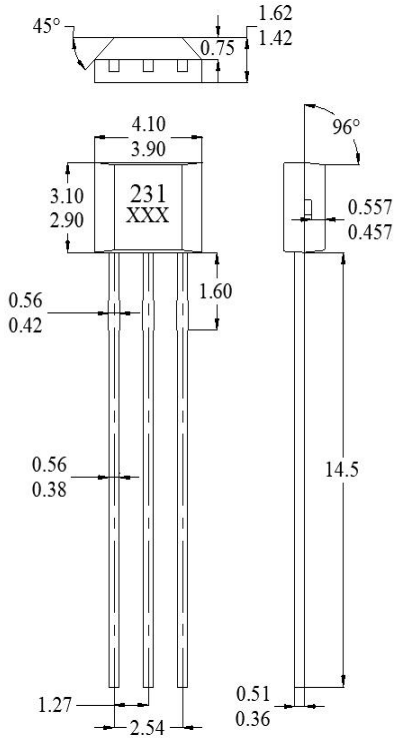
*DC Operating Parameters ：Ta = -40 to 85℃, $V_{DD}$=1.65Vto 5.5V*

| *Parameter* | *Test condition* | *OUT(SO/SA)* | *Test condition* | *OUT(UA/SP/SS/SM)* |
|---|---|---|---|---|
| **South pole** | B<$B_{OPN}$ | Low | B>$B_{OPS}$ | Low |
| **Null or weak magnetic field** | B=0 or B < \|BRP\| | High | B=0 or B < \|BRP\| | High |
| **North pole** | B>$B_{OPS}$ | Low | B<$B_{OPN}$ | Low |



## *Sensor Location, Package Dimension and Marking*

### UA Package (TO-92S)

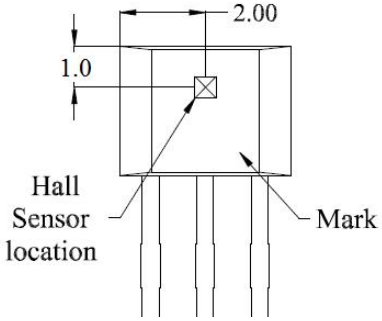



**NOTES:**

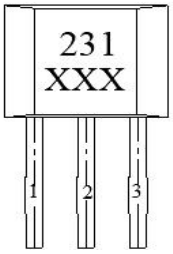
1.Controlling dimension: mm
2.Leads must be free of flash and plating voids
3.Do not bend leads within 1 mm of lead to package interface.
4.PINOUT:

| | |
|---|---|
| Pin 1 | VCC |
| Pin 2 | GND |
| Pin 3 | Output |

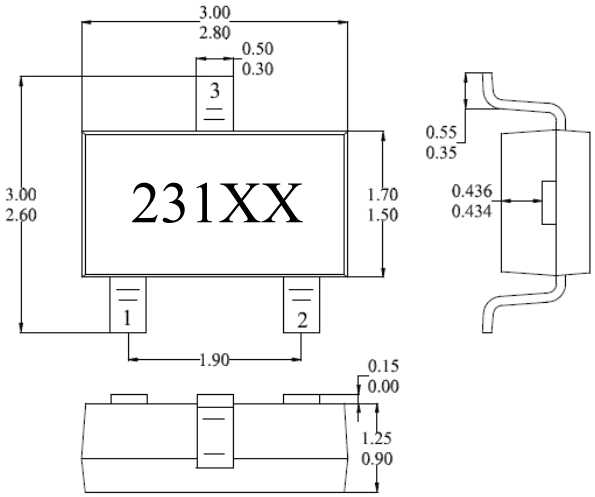
### Hall Chip Location




### Output Pin Assignment (Top view)



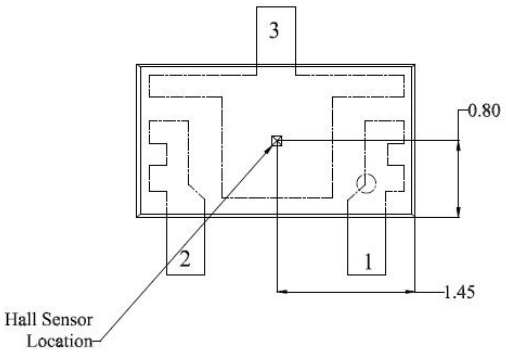

### SO Package (SOT-23) (Top View)



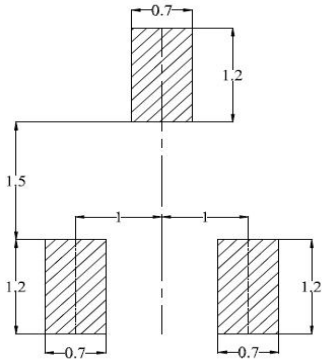

**NOTES:**

1 PINOUT (See Top View at left :)
Pin 1 $V_{DD}$； Pin 2 Output； Pin 3 GND
2 Controlling dimension: mm
3 Lead thickness after solder plating will be 0.254mm maximum
4 XX: Date Code, Refer to DC table

### Hall Plate Chip Location

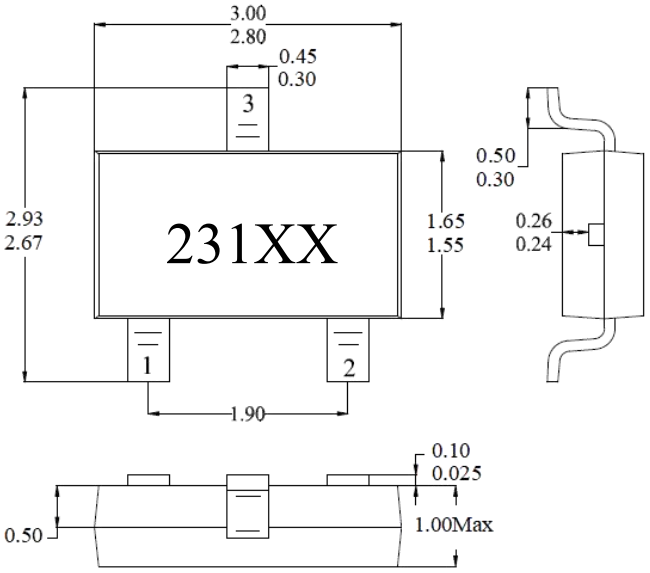



### (For reference only)Land Pattern



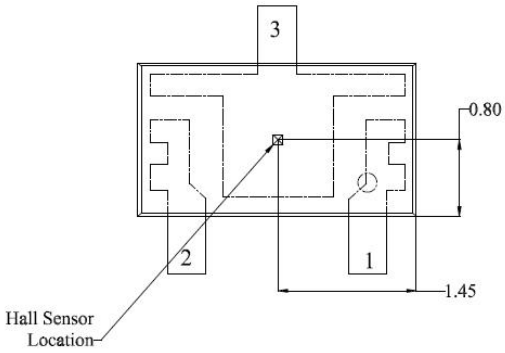
### SA Package (SOT-23)

**(Top View)**

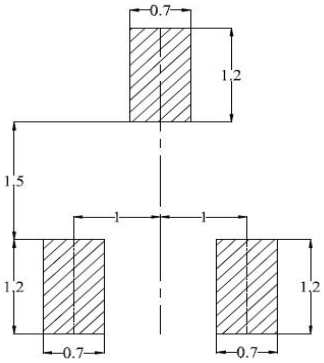



### Hall Plate Chip Location

**(Bottom view)**




**(For reference only) Land Pattern**

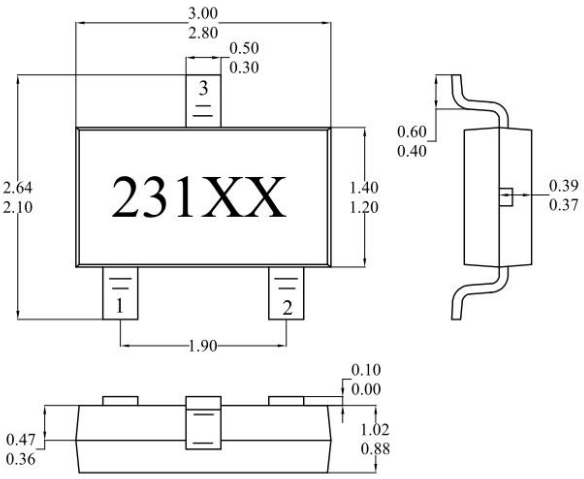



**NOTES:**

1. PINOUT (See Top View at left :)
   Pin 1 $V_{DD}$； Pin 2 Output； Pin 3 GND
2. Controlling dimension: mm
3. Lead thickness after solder plating will be 0.254mm maximu
4. XX: Date Code, Refer to DC table

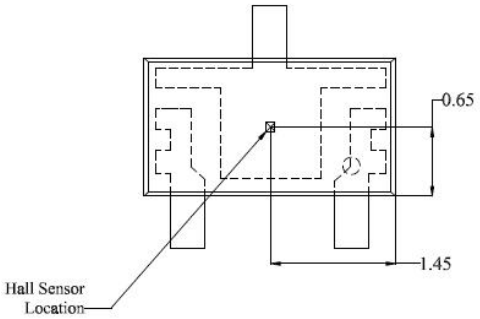
### SP Package (PSOT-23)

**(Top View)**

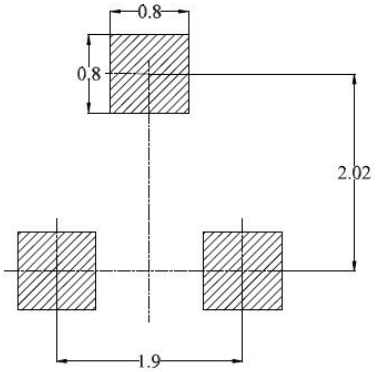



### Hall Plate Chip Location

**(Bottom view)**




**(For reference only)Land Pattern**

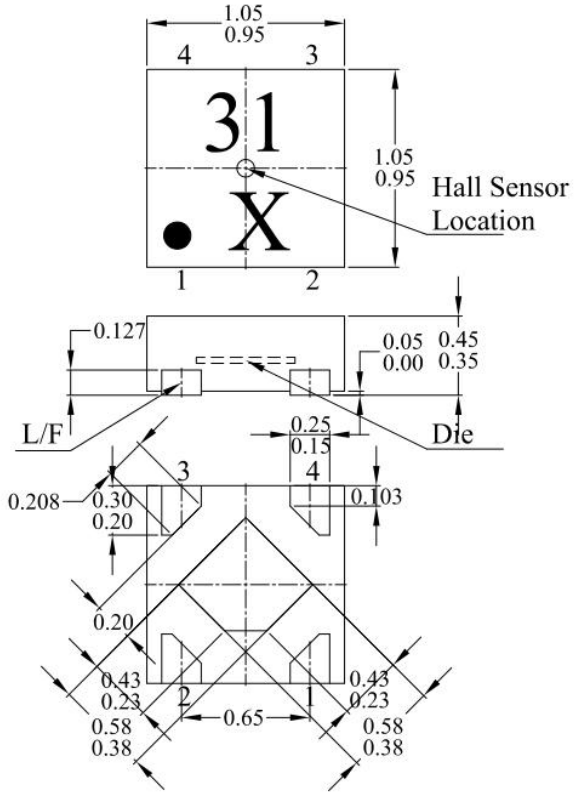



**NOTES:**

1. PINOUT (See Top View at left :)
   Pin 1 $V_{DD}$
   Pin 2 Output
   Pin 3 GND
2. Controlling dimension: mm
3. Lead thickness after solder plating will be 0.254mm maximum

**SS Package (DFN1x1-4L)**

**(Top View)**




**(Bottom View)**

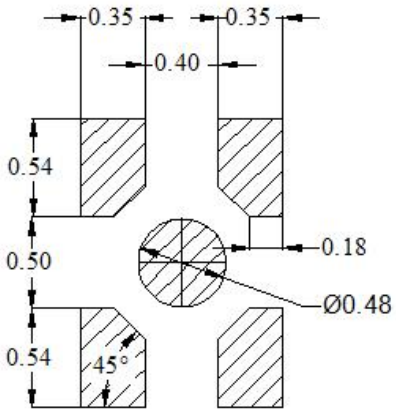
**NOTES:**

Controlling dimension: mm

1. Leads must be free of flash and plating voids
2. Lead thickness after solder plating will be 0.254mm maximum
3. X: Date Code, Refer to DC table
4. PINOUT:

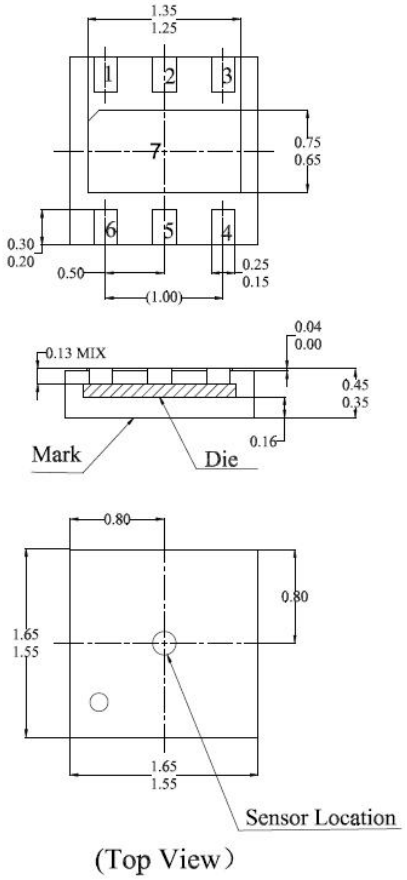
| Pin No. | Pin Name | Function |
|---|---|---|
| 1 | VCC | Power Supply |
| 2 | GND | Ground |
| 3 | NC | - |
| 4 | OUT | Output |

**（For reference only）Land pattern**



***SM Package*(DFN1.6*1.6-6L)**

**(Bottom View)**




(Top View)

**NOTES:**

1. Controlling dimension: mm
2. Leads must be free of flash and plating voids
3. Lead thickness after solder plating will be 0.254mm maximum
4. PINOUT:

| Pin No. | Pin Name | Function |
|---|---|---|
| 1 | $V_{DD}$ | Power Supply |
| 2 | N.C | N.C |
| 3 | $V_{OUT}$ | Output |
| 4 | N.C | N.C |
| 5 | $V_{SS}$ | Ground |
| 6 | N.C | N.C |
| 7 | N.C | N.C |

**（For reference only）Land pattern**

