

### Features

- μPower Operation (15 μW typical at 25°C)
- Omnipolar (switches with N or S pole)
- 2.5V to 5.5V Operation
- Simple Digital Open-Drain Output
- Ultra Low Offset Canceling Amplifiers Provide Sensitive, Accurate, Stable Switching Points and Immunity to Mechanical Stress
- Solid State Reliability
- Operating Temperature Range: -40°C to +85°C
- RoHS Compliant TSOT23 3-Lead Package

### Applications

- Handheld Portable Devices
- White Goods
- Automotive - Body Systems
- Security Systems
- High Reliability Reed Switch Replacement

### Description

The MX887D integrated Hall-Effect switch targets the requirements of low-power portable devices with battery operating voltages from 2.5V to 5.5V. On-chip power management circuitry reduces the effective average current to just 5μA at  $V_{SUPPLY} = 3V_{DC}$ .

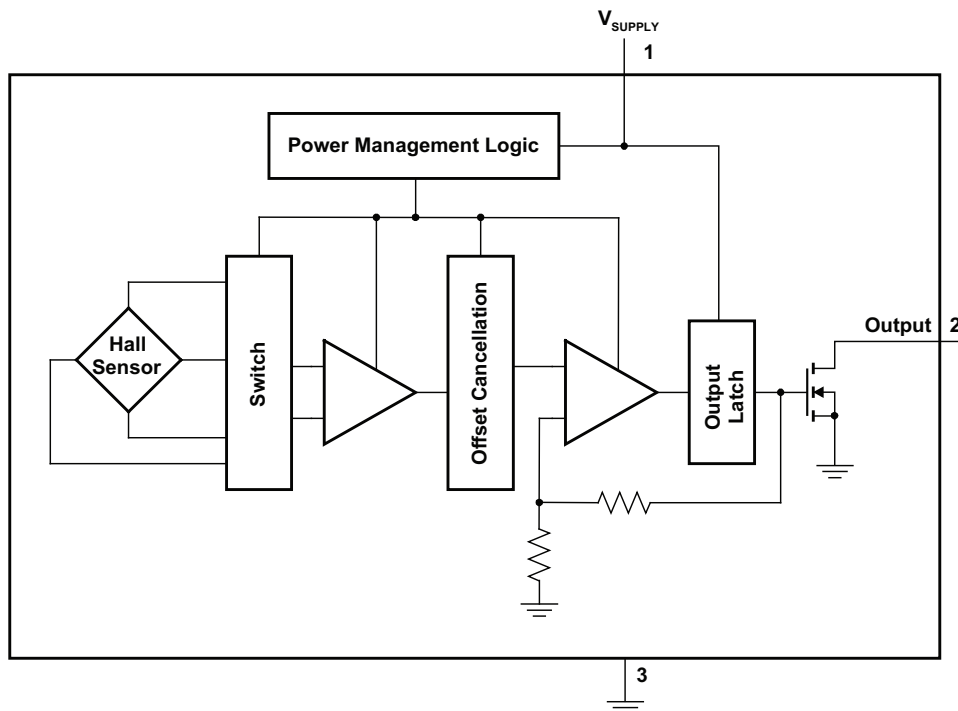
The switch output will turn “on” when either a north or south magnetic pole is applied. The absence of a magnetic field will set the switch into the high-impedance “off” state. Emulating the behavior of a traditional reed switch, together with the advantages of high integration and solid state reliability, makes the MX887D an ideal replacement in low-power portable device applications.



### Ordering Information

| Part       | Description                       |
|------------|-----------------------------------|
| MX887DHTTR | TSOT23 3L Tape & Reel (3000/Reel) |

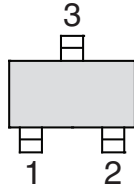
Figure 1. Functional Block Diagram



|   |          |
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## 1 Specifications

### 1.1 Package Pinout



### 1.2 Pin Description

| Pin# | Name                | Description               |
|------|---------------------|---------------------------|
| 1    | V <sub>SUPPLY</sub> | 2.5V to 5.5V              |
| 2    | OUT                 | Open-Drain, N-Channel FET |
| 3    | GROUND              | Ground                    |

### 1.3 Absolute Maximum Ratings

| Parameter                     | Symbol              | Min  | Max       | Units           |
|-------------------------------|---------------------|------|-----------|-----------------|
| Supply Voltage                | V <sub>SUPPLY</sub> | -0.5 | 6         | V <sub>DC</sub> |
| Output Voltage                | V <sub>OUT</sub>    | -0.5 | 6         | V               |
| Magnetic Flux Density         | B                   | -    | Unlimited | G               |
| Output Current                | I <sub>OUT</sub>    | -    | 5         | mA              |
| Junction Temperature          | T <sub>J</sub>      | -    | 150       | °C              |
| Operating Ambient Temperature | T <sub>A</sub>      | -40  | 85        |                 |
| Storage Temperature           | T <sub>STG</sub>    | -40  | 150       |                 |

Absolute maximum electrical ratings are at 25°C.

Absolute maximum ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional

operation of the device at conditions beyond those indicated in the operational sections of this data sheet is not implied.

### 1.4 Electrical Characteristics

Over operating voltage and temperature range unless otherwise specified.

| Parameter              | Conditions  | Symbol              | Minimum | Typical | Maximum | Units           |
|------------------------|---|---------------------|---------|---------|---------|-----------------|
| Supply Voltage Range   | Operating   | V <sub>SUPPLY</sub> | 2.5     | -       | 5.5     | V <sub>DC</sub> |
| Output Leakage Current | V <sub>OUT</sub> =5.5V, B <sub>RPN</sub> < B < B <sub>RPS</sub> | I <sub>LKG</sub>    | -       | -       | 1       | μA              |
| Output On Voltage      | I <sub>OUT</sub> =1mA, V <sub>DD</sub> =3.0V                    | V <sub>OUT</sub>    | -       | 100     | 300     | mV              |
| Awake Time             | -   | -                   | -       | -       | 90      | μs              |
| Period                 | -   | -                   | -       | -       | 90      | ms              |
| Duty Cycle             | -   | -                   | -       | 0.1     | -       | %               |
| Supply Current         | Awake (enabled)   | I <sub>SUPPLY</sub> | -       | -       | 2       | mA              |
|                        | Asleep (disabled)   |                     | -       | -       | 8       | μA              |
|                        | Average (Calculated)  |                     | -       | 5       | 15      | μA              |

- Notes: 1. B<sub>OPX</sub> = operating point (output turns ON); B<sub>RPX</sub> = release point (output turns OFF).  
 2. Typical data is at 25°C and V<sub>SUPPLY</sub> = 3V.

1.5 ESD Rating

| ESD Rating (Human Body Model) |
|-------------------------------|
| 2000V                         |

1.6 Magnetic Characteristics

Over operating voltage and temperature range unless otherwise specified.

| Parameter                 | Conditions                          | Symbol           | Minimum | Typical | Maximum | Units |
|---------------------------|-------------------------------------|------------------|---------|---------|---------|-------|
| Operating Points          |                                     |                  |         |         |         |       |
| Due to North Pole Applied | North Pole to Branded Side          | B <sub>OPN</sub> | -60     | -       | -       | G     |
| Due to South Pole Applied | South Pole to Branded Side          | B <sub>OPS</sub> | -       | -       | 60      |       |
| Release Points            |                                     |                  |         |         |         |       |
| Due to North Pole Applied | North Pole to Branded Side          | B <sub>RPN</sub> | -       | -       | -6      | G     |
| Due to South Pole Applied | South Pole to Branded Side          | B <sub>RPS</sub> | 6       | -       | -       |       |
| Hysteresis                | B <sub>OPX</sub> - B <sub>RPX</sub> | B <sub>HYS</sub> | -       | 5       | -       | G     |

- Notes:
- As used here, negative flux densities are defined as less than zero (algebraic convention); -50G<+10G.
  - B<sub>OPX</sub> = operating point (output turns ON); B<sub>RPX</sub> = release point (output turns OFF).
  - Typical data is at 25°C and V<sub>SUPPLY</sub> = 3V.

2 Circuit Description

The MX887D  $\mu$ Power Hall-Effect Switch consists of a Hall element, small signal amplifier, latch, and N-channel open-drain output. Offset cancellation circuitry rejects errors in signal stages and the influence of mechanical stress on the Hall element. This technique, together with a precision threshold

generator and comparator, produces highly accurate magnetic switch points. The Hall element is activated for a small fraction of an operating cycle, then latched in that sample state for the remainder of the period. By using this technique, very low power consumption is achieved.

### 3 Manufacturing Information

#### 3.1 Moisture Sensitivity



All plastic encapsulated semiconductor packages are susceptible to moisture ingress. IXYS Integrated Circuits Division classified all of its plastic encapsulated devices for moisture sensitivity according to the latest version of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL) rating** as shown below, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

| Device | Moisture Sensitivity Level (MSL) Rating |
|--------|---|
| MX887D | MSL 3                                   |

#### 3.2 ESD Sensitivity



This product is **ESD Sensitive**, and should be handled according to the industry standard **JESD-625**.

#### 3.3 Reflow Profile

This product has a maximum body temperature and time rating as shown below. All other guidelines of **J-STD-020** must be observed.

| Device | Maximum Temperature x Time |
|--------|----------------------------|
| MX887D | 260°C for 30 seconds       |

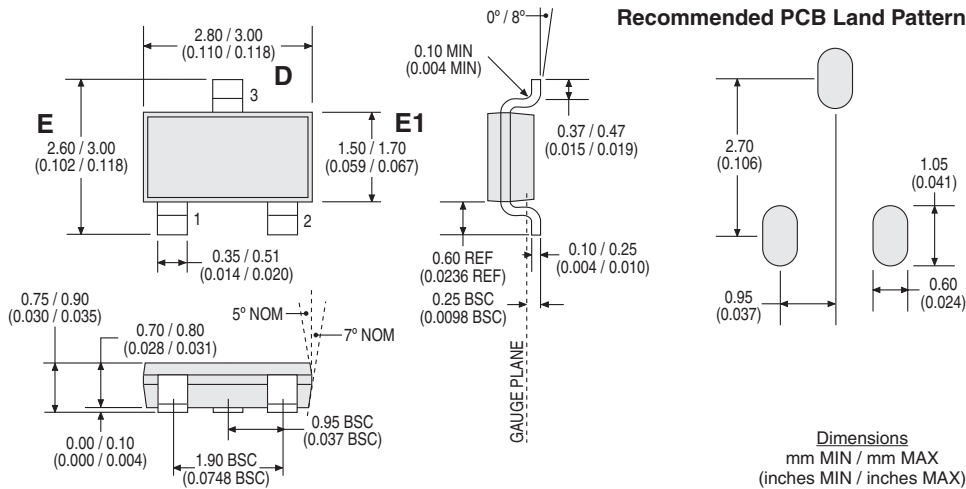
#### 3.4 Board Wash

IXYS Integrated Circuits Division recommends the use of no-clean flux formulations. However, board washing to remove flux residue is acceptable, and the use of a short drying bake may be necessary. Chlorine-based or Fluorine-based solvents or fluxes should not be used. Cleaning methods that employ ultrasonic energy should not be used.



### 3.5 Mechanical Dimensions

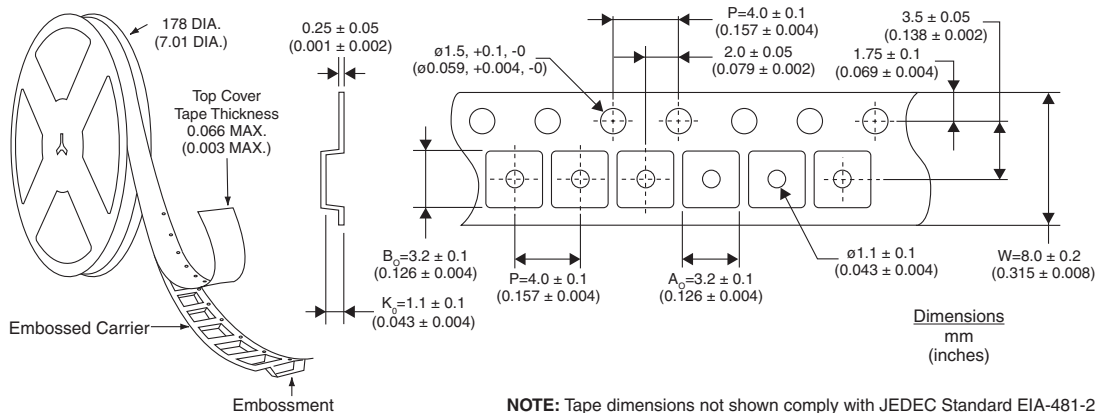
#### 3.5.1 MX887DHT TSOT23 3-Lead Package



Notes: (Unless otherwise specified)

1. Dimension "D" does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, and gate burrs shall not exceed 0.10mm (0.004 inches) per side.
2. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 0.15mm (0.006 inches) per side.
3. Package top may be smaller than package bottom. Dimensions "D" and "E1" are determined at the outermost extreme of the plastic body excluding mold flash, tie bar burrs, gate burrs, and interlead flash, but including any mismatch between top and bottom of the plastic body.

#### 3.5.2 MX887DHTR Tape & Reel Packaging



For additional information please visit [www.ixysic.com](http://www.ixysic.com)

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