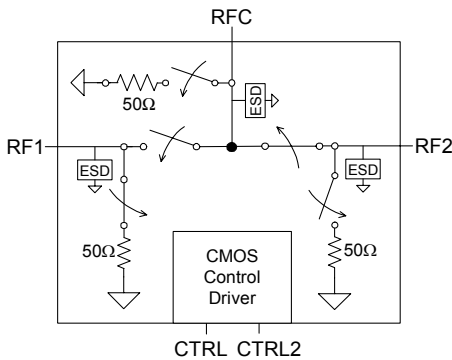


Product Description

The PE4257 is a high-isolation UltraCMOS™ Switch designed for wireless applications, covering a broad frequency range from near DC up to 3000 MHz. This single-supply SPDT switch integrates a two-pin CMOS control interface. It also provides low insertion loss with extremely low bias requirements while operating on a single 3-volt supply. In a typical wireless application, the PE4257 provides unprecedented isolation and integration.

The PE4257 is manufactured on Peregrine’s UltraCMOS™ process, a patented variation of silicon-on-insulator (SOI) technology on a sapphire substrate, offering the performance of GaAs with the economy and integration of conventional CMOS.

Figure 1. Functional Diagram



**50 Ω SPDT Absorptive UltraCMOS™
DC – 3.0 GHz RF Switch**

Features

- 50 Ω characteristic impedance
- Integrated 50 Ω 0.25 watt terminations
- High input IP3 > +55 dBm
- High isolation 64 dB at 1000 MHz
- Low insertion loss: typically 0.75 dB at 1000 MHz and 0.95 dB at 2000 MHz
- LV CMOS two-pin control
- Single +3 volt supply operation
- Low current consumption: 8 μA

Figure 2. Package Type

20-Lead 4x4 mm QFN



Table 1. Electrical Specifications @ +25 °C, V_{DD} = 3.0 V (Z_S = Z_L = 50 Ω)

| Parameter | Condition | Minimum | Typical | Maximum | Units |
|------------------------------------|------------------------|---------|---------|---------|------------------|
| Operating Frequency ¹ | | DC | | 3000 | MHz |
| Insertion Loss | 1000 MHz | | 0.75 | 0.95 | dB |
| | 2000 MHz | | 0.95 | 1.15 | |
| | 3000 MHz | | 1.2 | 1.4 | |
| Isolation Input to Output | 1000 MHz | 61 | 64 | | dB |
| | 2000 MHz | 46 | 50 | | |
| | 3000 MHz | 40 | 44 | | |
| Isolation Output to Output | 1000 MHz | 57 | 63 | | dB |
| | 2000 MHz | 54 | 60 | | |
| | 3000 MHz | 42 | 48 | | |
| Input IP2 | 5 MHz - 1000 MHz | | 80 | | dBm |
| Input IP3 | 5 MHz - 1000 MHz | 50 | 55 | | dBm |
| Input 1dB Compression ² | 1000 MHz | 29 | 31 | | dBm |
| Switching Time | 50% CTRL to 10 / 90 RF | | 2 | | μs |
| Video Feedthrough ³ | 5 MHz - 1000 MHz | | | 15 | mV _{pp} |

Notes: 1. Device linearity will begin to degrade below 5 MHz.
 2. Note Absolute Maximum ratings in Table 3.
 3. Measured with a 1 ns risetime, 0/3 V pulse and 500 MHz bandwidth

Figure 3. Pin Configuration (Top View)

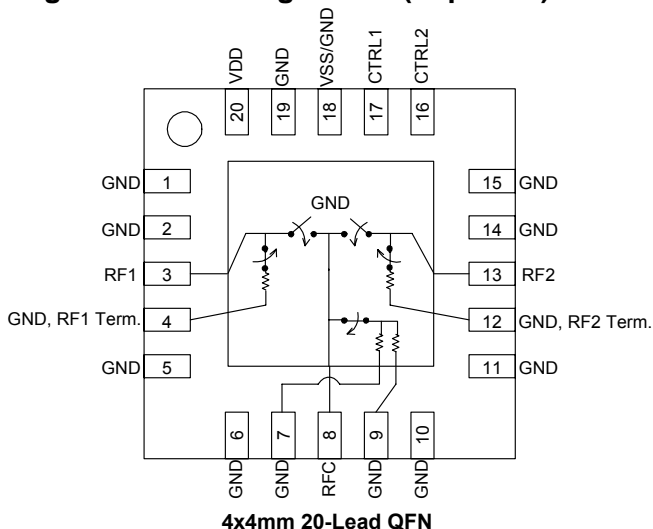


Table 2. Pin Descriptions

| No. | Name | Description |
|-----------------|-----------|------------------------|
| 1 | GND | RF Ground |
| 2 | GND | RF Ground |
| 3 ¹ | RF1 | RF I/O |
| 4 | GND | RF Ground |
| 5 | GND | RF Ground |
| 6 | GND | RF Ground |
| 7 | GND | RF Ground |
| 8 ¹ | RFC | RF Common |
| 9 | GND | RF Ground |
| 10 | GND | RF Ground |
| 11 | GND | RF Ground |
| 12 | GND | RF Ground |
| 13 ¹ | RF2 | RF I/O |
| 14 | GND | RF Ground |
| 15 | GND | RF Ground |
| 16 ² | CTRL2 | Control 2 |
| 17 ² | CTRL1 | Control 1 |
| 18 ³ | VSS / GND | Negative Supply Option |
| 19 | GND | Digital Ground |
| 20 | VDD | Supply |
| Pad | GND | RF Ground Pad |

- Notes: 1. RF pins 3, 8, and 13 must be at 0 VDC. The RF pins do not require DC blocking capacitors for proper operation if the 0 VDC requirement is met.
2. Pins 16 and 17 are the CMOS controls that set the four operating states.
3. Connect pin 18 to GND to enable the negative voltage generator. Connect pin 18 to V_{SS} (-3 V) to bypass and disable internal -3 V supply generator. See paragraph "Switching Frequency."

Table 3. Absolute Maximum Ratings

| Symbol | Parameter/Condition | Min | Max | Units |
|------------------|--|------|-----------------------|-------|
| V _{DD} | Power supply voltage | -0.3 | 4.0 | V |
| V _i | Voltage on any DC input | -0.3 | V _{DD} + 0.3 | V |
| P _{RF} | RF power on RFC, RF1, RF2 On Port/ Terminated Port | | 33/24 | dBm |
| T _{ST} | Storage temperature | -65 | +150 | °C |
| T _{OP} | Operating temperature | -40 | +85 | °C |
| V _{ESD} | ESD voltage (Human Body Model) | 1000 | | V |

Exceeding absolute maximum ratings may cause permanent damage. Operation should be restricted to the limits in the Operating Ranges table. Operation between operating range maximum and absolute maximum for extended periods may reduce reliability.

Table 4. Operating Ranges @ 25 °C

| Parameter | Min | Typ | Max | Unit |
|---|----------------------|-----|----------------------|------|
| V _{DD} Power Supply | 2.7 | 3.0 | 3.3 | V |
| I _{DD} Power Supply Current (V _{DD} = 3V, V _{CNTL} = 3V) | | 8 | 20 | μA |
| Control Voltage High | 0.70 V _{DD} | | | V |
| Control Voltage Low | 0 | | 0.30 V _{DD} | V |

Latch-Up Avoidance

Unlike conventional CMOS devices, UltraCMOS™ devices are immune to latch-up.

Electrostatic Discharge (ESD) Precautions

When handling this UltraCMOS™ device, observe the same precautions that you would use with other ESD-sensitive devices. Although this device contains circuitry to protect it from damage due to ESD, precautions should be taken to avoid exceeding the rating specified.

Switching Frequency

The PE4257 has a maximum 25 kHz switching rate when the internal negative voltage generator is used (pin 18=GND). The rate at which the PE4257 can be switched is only limited to the switching time if an external -3 V supply is provided at (pin18=V_{SS}).

Table 5. Truth Table

| CTRL1 | CTRL2 | RFC – RF1 | RFC – RF2 |
|-------|-------|------------------|------------------|
| Low | Low | OFF | OFF |
| Low | High | OFF | ON |
| High | Low | ON | OFF |
| High | High | N/A ¹ | N/A ¹ |

- Notes: 1. The operation of the PE4257 is not supported or characterized in the C1=V_{DD} and C2=V_{DD} state.

**Typical Performance Data @ 25°C (Unless Otherwise Noted)
(50-ohm impedance)**

Figure 4. Insertion Loss – Input - Output

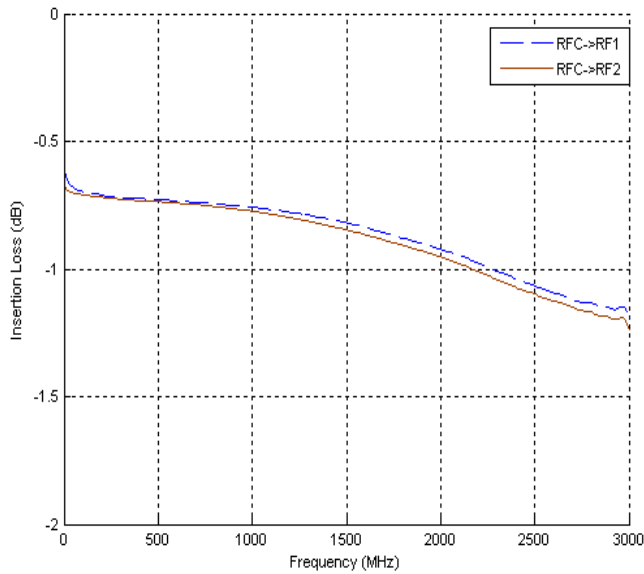


Figure 5. RF1 to RF2 Isolation

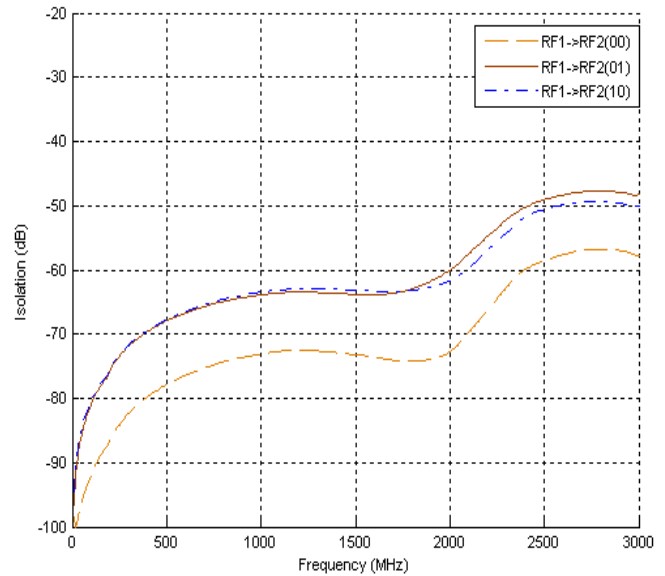


Figure 6. Isolation – RFC to RF1/RF2

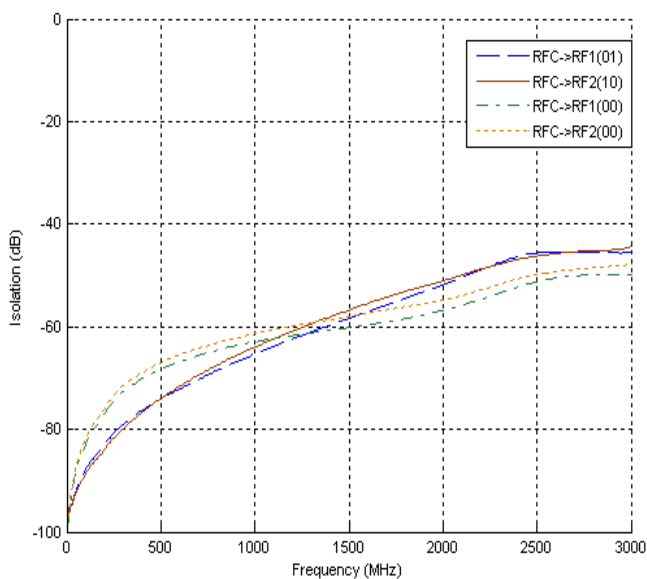
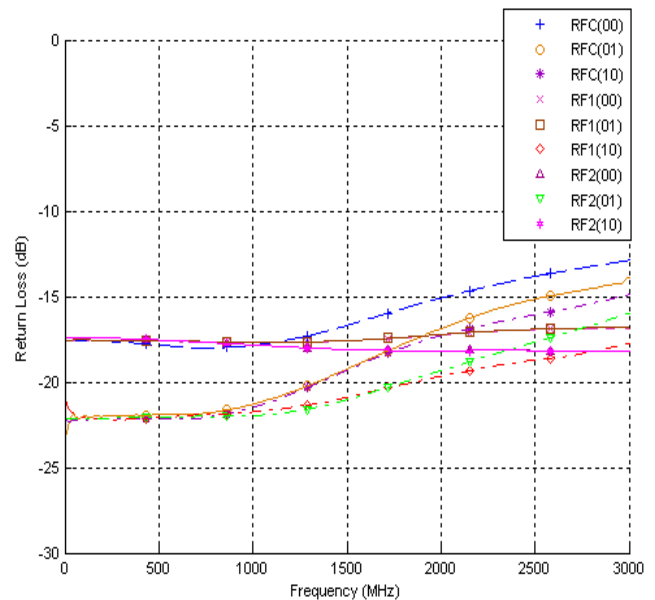


Figure 7. Return Loss



Evaluation Kit

The SPDT Switch Evaluation Kit board was designed to ease customer evaluation of the PE4257 SPDT switch. The RF common port is connected through a 50 Ω transmission line to J2. Port 1 and Port 2 are connected through 50 Ω transmission lines to J1 and J3. A through transmission line connects SMA connectors J4 and J5. This transmission line can be used to estimate the loss of the PCB over the environmental conditions being evaluated.

The board is constructed of a four metal layer FR4 material with a total thickness of 0.031". The transmission lines were designed using a coplanar waveguide with ground plane (28 mil core, 47.6 mil width, 30mil gap).

Note the number of vias surrounding the device in the layout shown in Figure 8. These vias are critical for obtaining the specified isolation performance for the device shown in this datasheet.

J6 provides a means for controlling DC and digital inputs to the device. The provided jumpers short the package pin to ground for logic low. When the jumper is removed, the pin is pulled up to VDD for logic high. When the jumper is in place, 3 μA of current will flow through the 1 MΩ pull up resistor. This extra current should not be attributed to the requirements of the device.

Figure 8. Evaluation Board Layouts

Peregrine Specification 101/0151

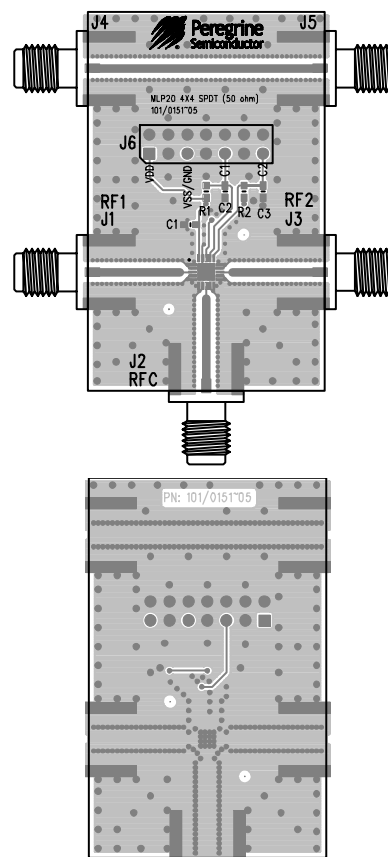


Figure 9. Evaluation Board Schematic

Peregrine Specification 102/0198

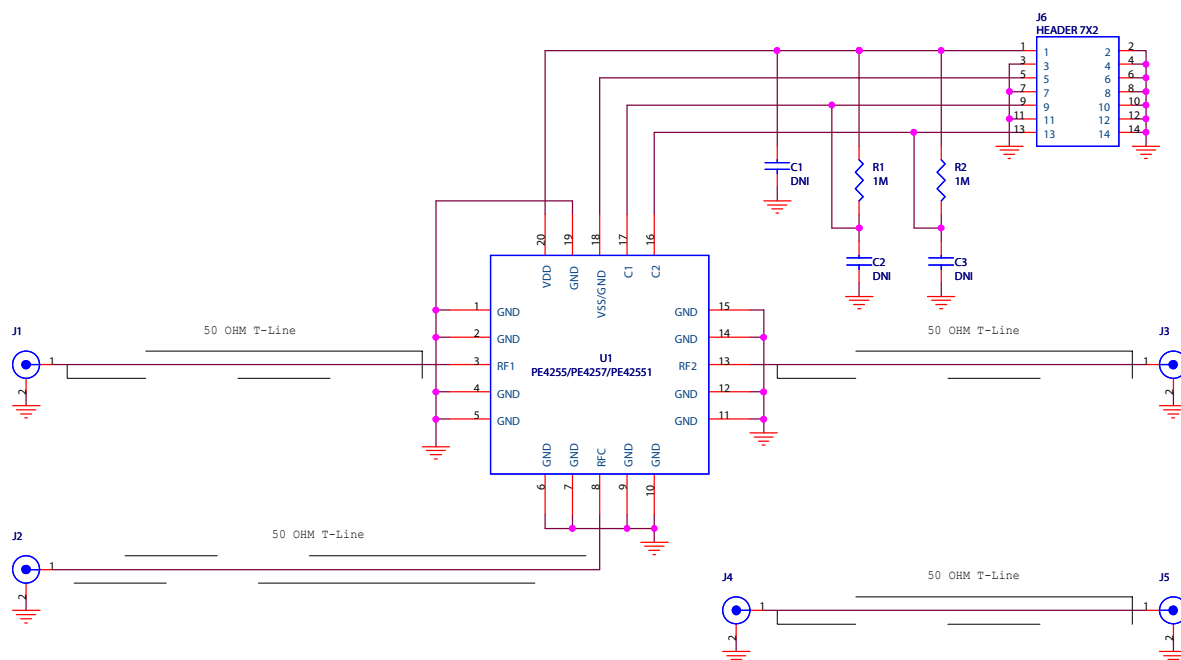
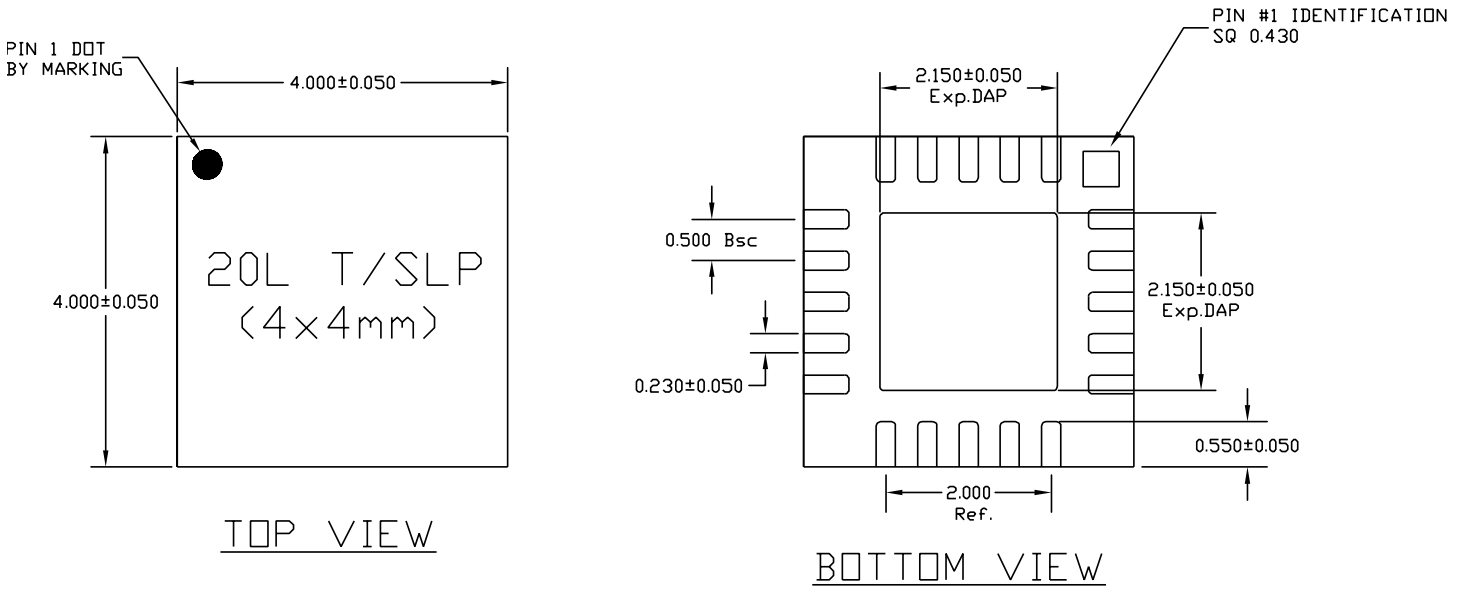


Figure 10. Package Drawing

20-Lead 4x4 QFN



NOTE:

1) TSLP AND SLP SHARE THE SAME EXPOSE OUTLINE BUT WITH DIFFERENT THICKNESS:

| | | TSLP | SLP |
|---|------|-------|-------|
| A | MAX. | 0.800 | 0.900 |
| | NOM. | 0.750 | 0.850 |
| | MIN. | 0.700 | 0.800 |

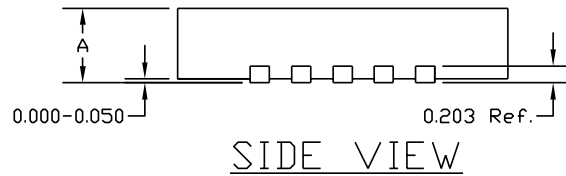


Figure 11. Tape and Reel Drawing

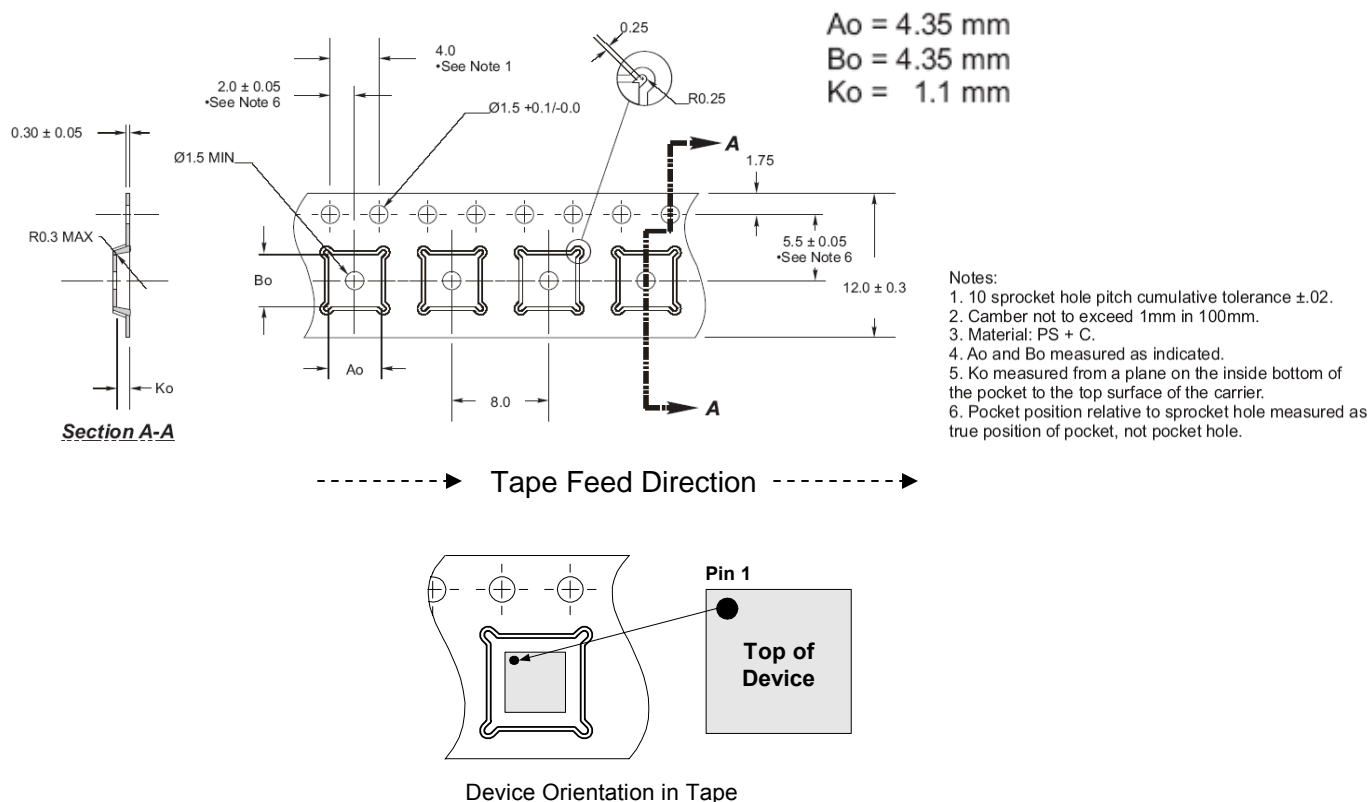


Figure 12. Marking Specifications

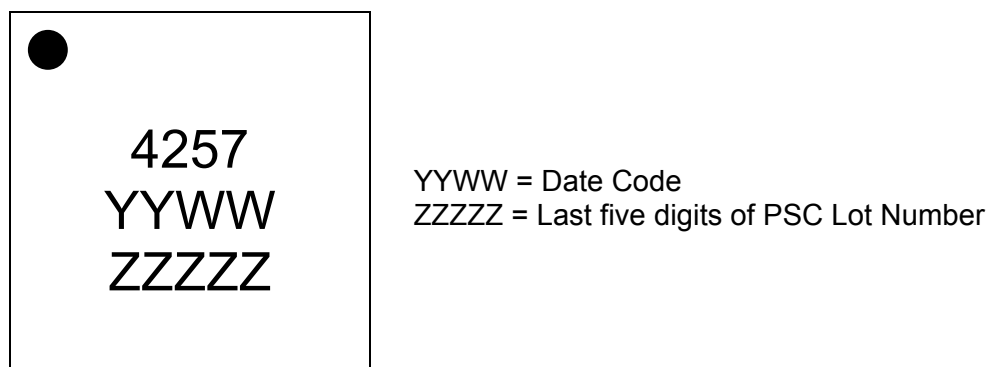


Table 6. Ordering Information

| Order Code | Part Marking | Description | Package | Shipping Method |
|------------|--------------|---------------------------|-------------------------|-------------------------------|
| 4257-00 | PE4257-EK | PE4257-20QFN 4x4mm-EK | Evaluation Kit | 1 / Box |
| 4257-51 | 4257 | PE4257G-20QFN 4x4mm-75A | Green 20-lead 4x4mm QFN | 75 units / cut tape from reel |
| 4257-52 | 4257 | PE4257G-20QFN 4x4mm-3000C | Green 20-lead 4x4mm QFN | 3000 units / T&R |

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