PE4245

Product Specification

UltraCMOS© RF SPDT Switch, DC–4000 MHz

Features

- Single 3.0V power supply
- Low insertion loss:
  - 0.6 dB at 1000 MHz
  - 0.7 dB at 2000 MHz
- High isolation:
  - 42 dB at 1000 MHz
  - 32 dB at 2000 MHz
- Typical 1 dB compression of +25 dBm
- Single-pin CMOS logic control
- Package: 6-lead 3 × 3 mm DFN

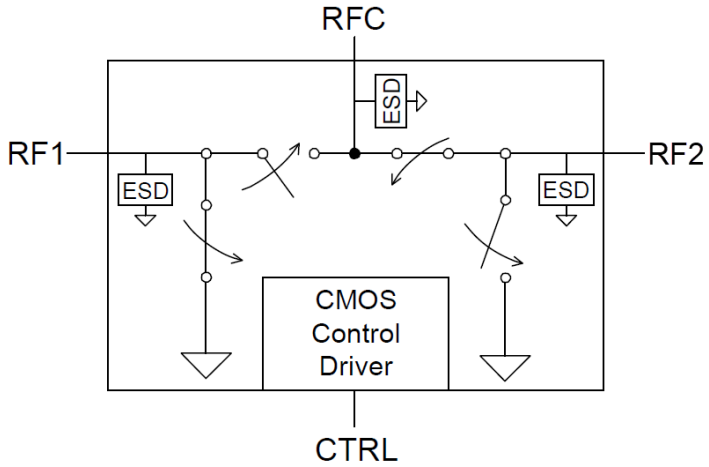


Figure 1. PE4245 functional diagram

Product description

The pSemi PE4245 RF switch covers a broad range of applications from near DC to 4000 MHz. This switch integrates on-board CMOS control logic with a low-voltage CMOS compatible control input. Using a +3V nominal power supply voltage, a 1 dB compression point of +25 dBm can be achieved. The PE4245 also exhibits excellent isolation of better than 42 dB at 1000 MHz and is offered in a small 6-lead 3 × 3 mm DFN package.

The PE4245 is manufactured using pSemi'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.

Absolute maximum ratings

Exceeding the absolute maximum ratings listed in Table 1 could cause permanent damage. Restrict operation to the limits in Table 2. Operation between the operating range maximum and the absolute maximum for extended periods could reduce reliability.

ESD precautions

When handling this UltraCMOS device, observe the same precautions as with any other ESD-sensitive devices. Although this device contains circuitry to protect it from damage due to ESD, do not exceed the rating listed in Table 1.

Latch-up immunity

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

Table 1. Absolute maximum ratings

Parameter or condition	Symbol	Min	Max	Unit
Power supply voltage	V_{DD}	-0.3	4.0	V
Voltage on any input	V_I	-0.3	V_{DD} + 0.3	V
Storage temperature range	T_{ST}	-65	150	°C
Input power, 50Ω	P_{IN}	–	30	dBm
ESD voltage, Human Body Model	V_{ESD}	–	1000	V

Recommended operating conditions

Table 2 lists the PE4245 recommended operating conditions. Do not operate devices outside the operating conditions listed below.

Table 2. Recommended operating conditions

Parameter	Symbol	Min	Typ	Max	Unit
Power supply voltage	V_{DD}	2.7	3.0	3.3	V
Power supply current, V_{DD} = 3V, V_{CTRL} = 3V	I_{DD}	–	250	500	nA
Operating temperature range	T_{OP}	-40	–	85	°C
Control voltage high	–	0.7 × V_{DD}	–	–	V
Control voltage low	–	–	–	0.3 × V_{DD}	V

Electrical specifications

Table 3 lists the PE4245 key electrical specifications at +25 °C T_{CASE} and V_{DD} = 3V (Z_S = Z_L = 50Ω), unless otherwise specified.

Table 3. Electrical specifications

Parameter	Path	Condition	Min	Typ	Max	Unit
Operating frequency(1)	–	–	DC	–	4000	MHz
Insertion loss	–	1000 MHz 2000 MHz	–	0.6 0.7	0.75 0.85	dB
Isolation	RFC to RF1/RF2	1000 MHz 2000 MHz	39 30	42 32	–	dB
Isolation	RF1 to RF2	1000 MHz 2000 MHz	34 27	36 29	–	dB
Return loss	–	1000 MHz 2000 MHz	21 20	23 22	–	dB
ON switching time	–	CTRL to 0.1 dB final value, 2 GHz	–	300	–	ns
OFF switching time	–	CTRL to 25 dB isolation, 2 GHz	–	200	–	ns
Video feedthrough(2)	–	–	–	15	–	mV_{PP}
Input 1-dB compression point	–	2000 MHz	23	25	–	dBm
Input IP3	–	2000 MHz, 14 dBm	43	45	–	dBm

Notes:
1. The device linearity can begin to degrade below 10 MHz.
2. The DC transient at the output of any port when the control voltage is switched from low-to-high or high-to-low in a 50Ω test set-up, measured with 1 ns risetime pulses and 500 MHz bandwidth.

Control logic

Table 4. Truth table

Control voltage	Signal path
CTRL = CMOS high	RFC to RF1
CTRL = CMOS low	RFC to RF2

Typical performance data

Figures 2–8 show the PE4245 typical performance data at +25 °C, unless otherwise specified.

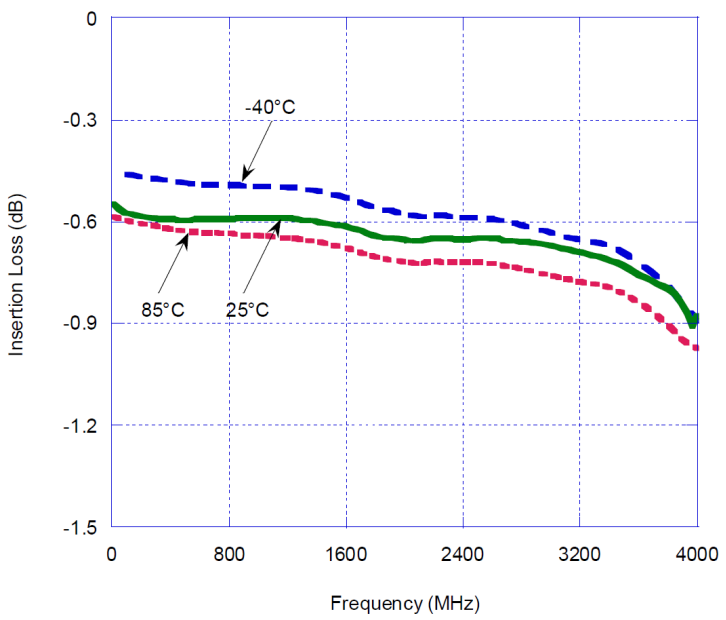


Figure 2. Insertion loss, RFC to RF1. T = -40 °C to 85 °C.

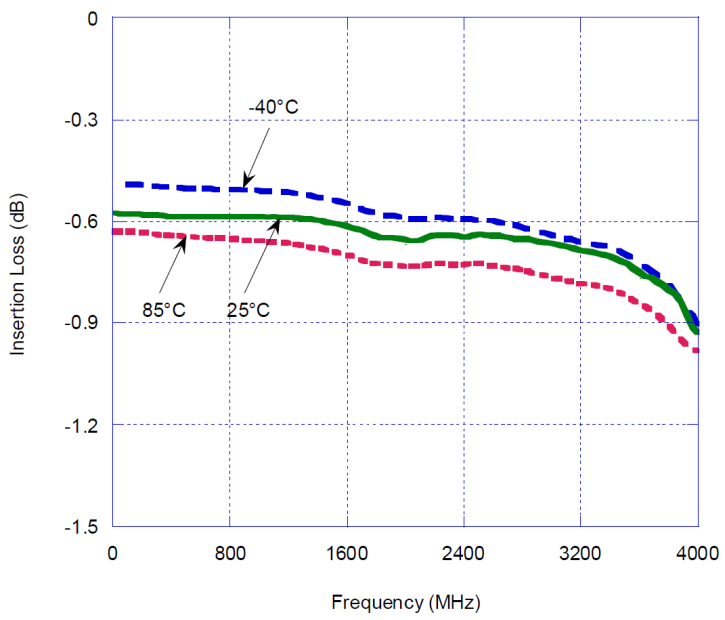


Figure 3. Insertion loss, RFC to RF2. T = -40 °C to 85 °C.

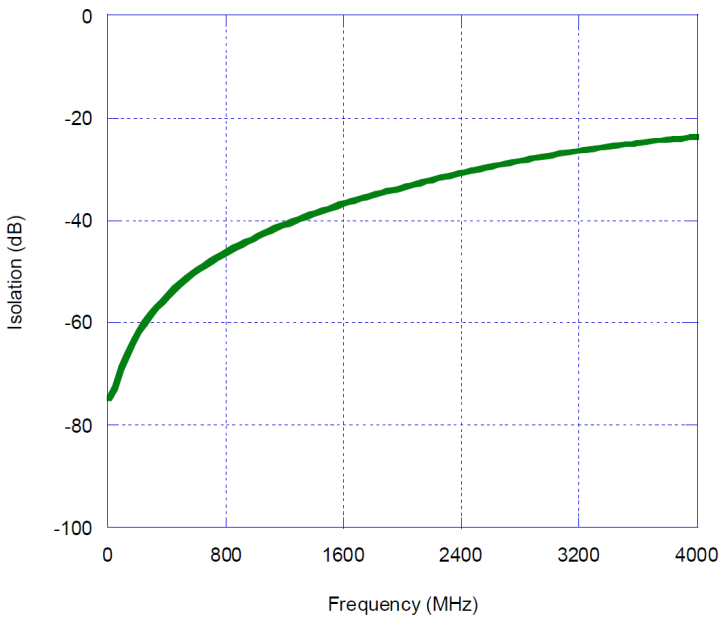


Figure 4. Isolation, RFC to RF1

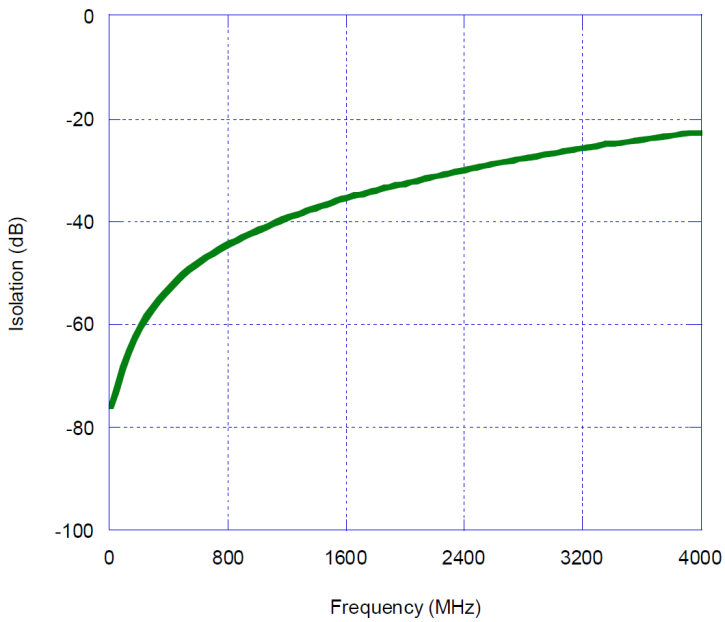


Figure 5. Isolation, RFC to RF2

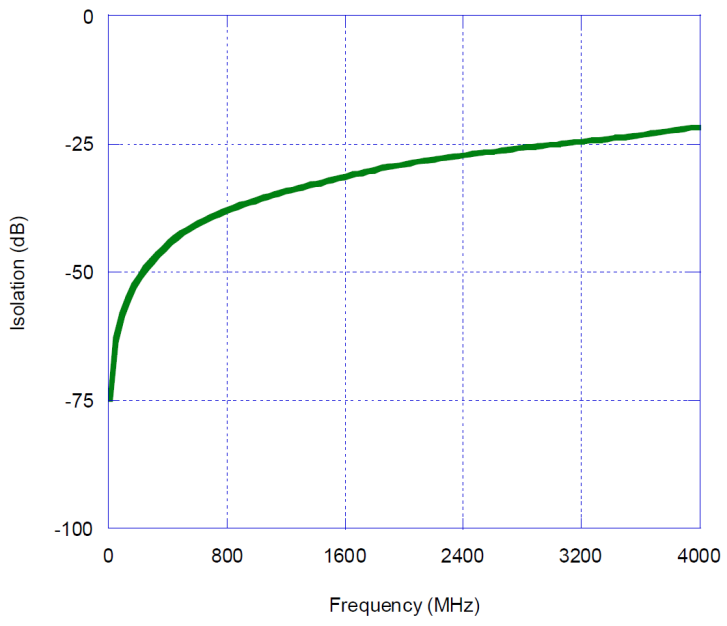


Figure 6. Isolation, RF1 to RF2, RF2 to RF1

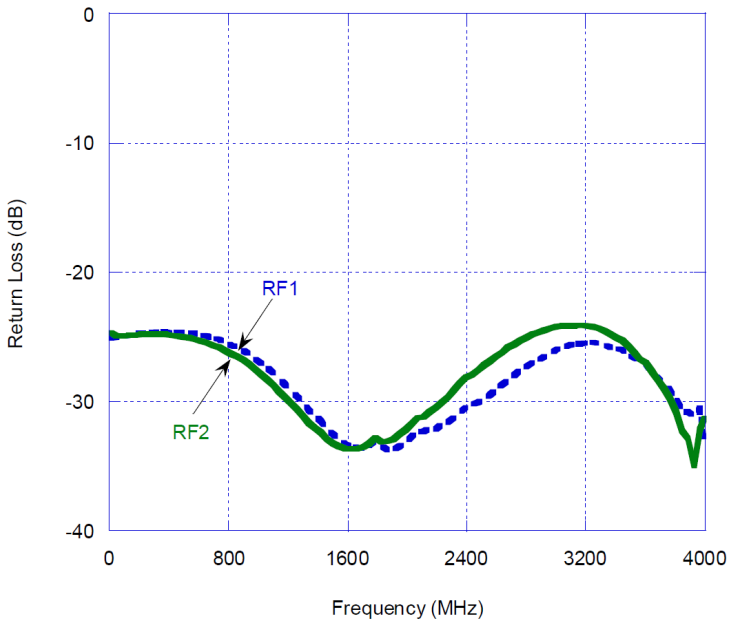


Figure 7. Return loss, RFC to RF1, RFC to RF2

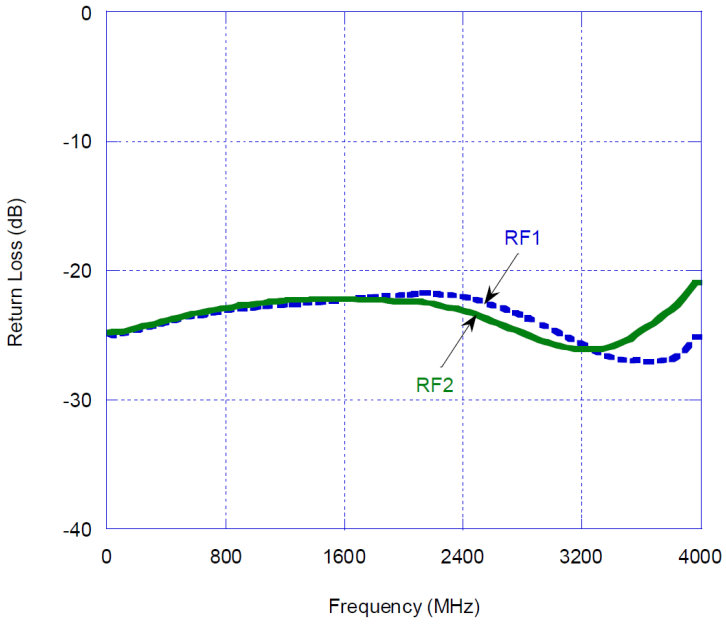


Figure 8. Return loss, RF1, RF2

Evaluation board

pSemi designed the SPDT switch evaluation board to ease your evaluation of the PE4245 SPDT switch. The RF common port connects through a 50Ω transmission line to the top left SMA connector, J1. RF ports 1 and 2 connect through 50Ω transmission lines to the top two SMA connectors on the right side of the board, J2 and J3, respectively. A through transmission line connects SMA connectors J4 and J5. Use this transmission line to estimate the loss of the PCB over the environmental conditions being evaluated.

The board is constructed of a two metal layer FR4 material with a total thickness of 0.031”. The bottom layer provides ground for the RF transmission lines. The transmission lines were designed using a coplanar waveguide with ground plane model using a trace width of 0.0476”, trace gaps of 0.030”, dielectric thickness of 0.028”, metal thickness of 0.0021”, and εr of 4.4.

J6 provides a means for controlling DC and digital inputs to the device. Starting from the lower left pin, the second pin to the right (J6-3) connects to the device CTRL input. The fourth pin to the right (J6-7) connects to the device V_{DD} input.

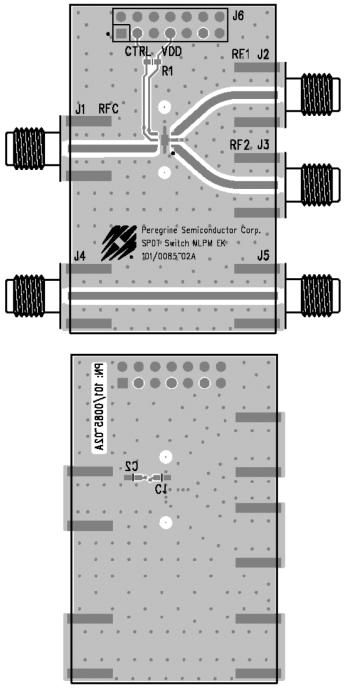


Figure 9. Evaluation board layout (pSemi 101/0085)

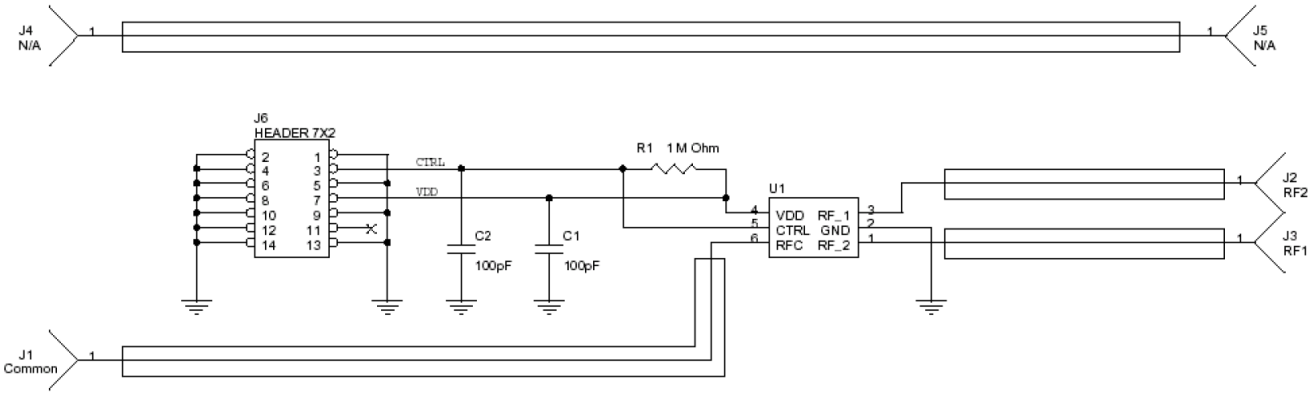


Figure 10. Evaluation board schematic (pSemi 102/0110)

Pin configuration

Figure 11 shows the pin configuration for the 6-lead 3 × 3 mm DFN package, and Table 5 lists the description for each pin.

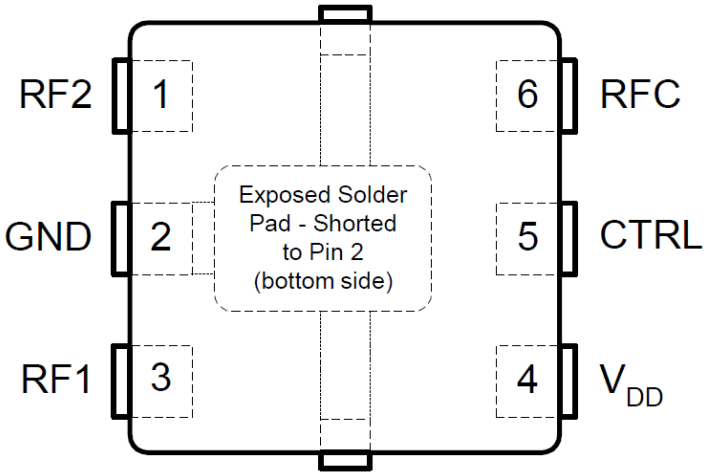


Figure 11. Pin configuration, top view

Table 5. Pin descriptions

Pin no.	Pin name	Description
1[1]	RF2	RF port 2
2[2]	GND	Ground
3[1]	RF1	RF port 1
4	VDD	Nominal 3V supply connection
5	CTRL	CMOS logic level: • High: RFC to RF1 signal path • Low: RFC to RF2 signal path
6[1]	RFC	RF common port

Notes:
1. RF pins 1, 3, and 6 must be DC blocked with an external series capacitor or held at 0 VDC.
2. Traces must be physically short and connected to the ground plane. This pin is connected to the exposed solder pad that must also be soldered to the ground plane for the best performance.

Packaging information

This section provides the following information:

- Moisture sensitivity level
- Package drawing
- Package marking
- Tape and reel information

Moisture sensitivity level

The PE4245 moisture sensitivity level rating for the 6-lead 3 × 3 mm DFN package is MSL1.

Package drawing

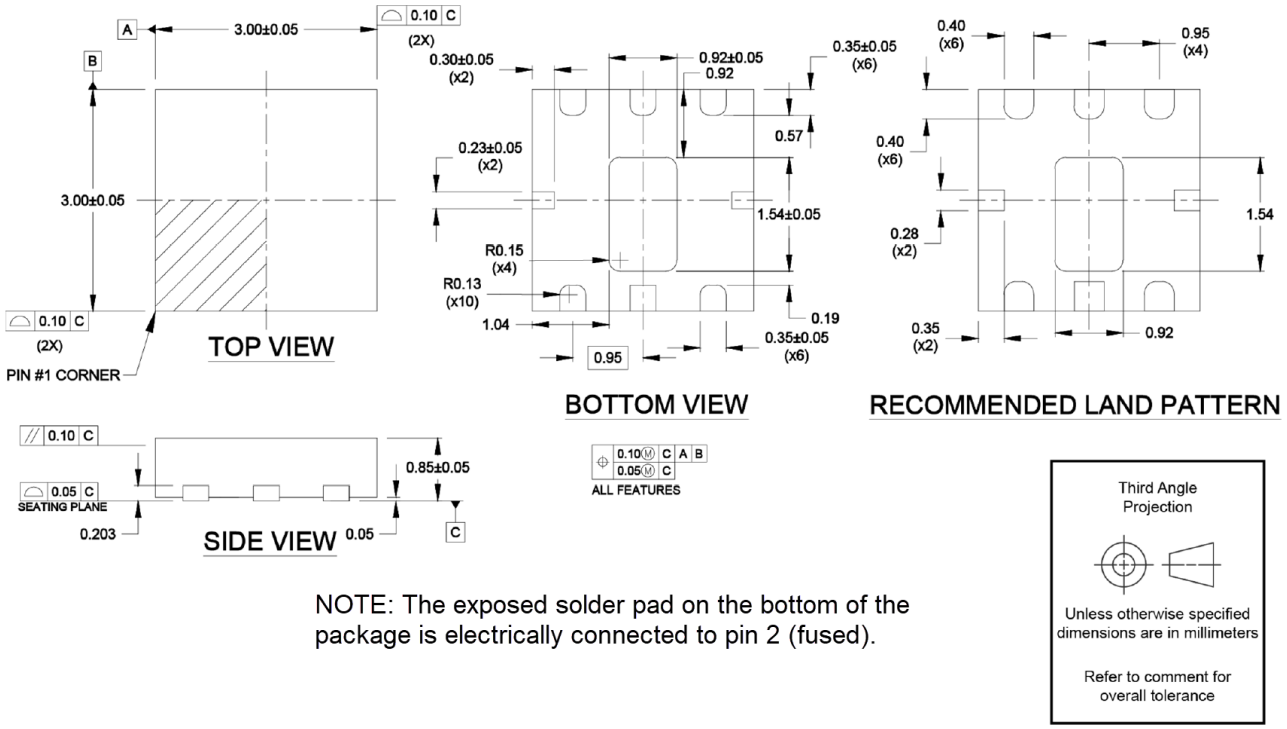


Figure 12. Package mechanical drawing for the 6-lead 3 × 3 mm DFN package

Top-marking specification

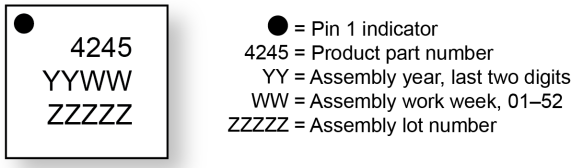
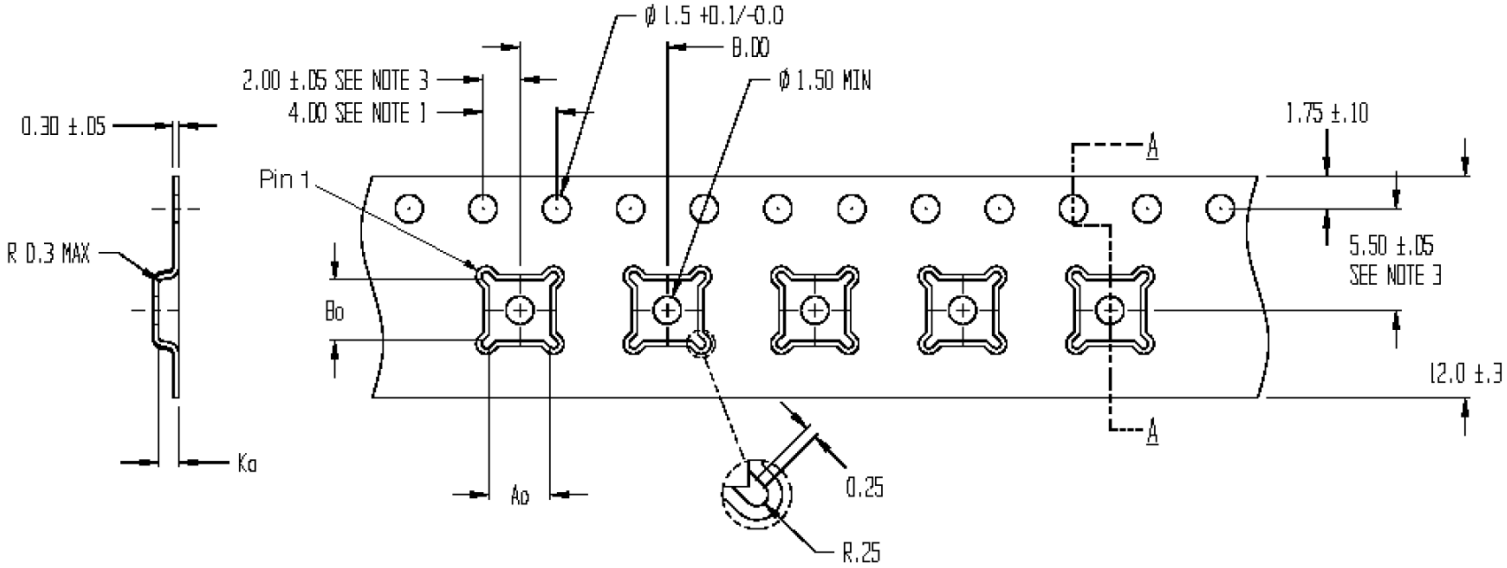
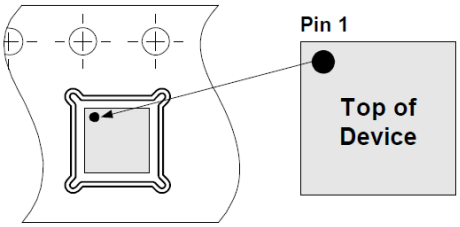


Figure 13. Package marking specification

Tape and reel specification





Device Orientation in Tape

Table 6. Dimensions

Dimension	DFN 3x3 mm
Ao	3.23 ± 0.1
Bo	3.17 ± 0.1
Ko	1.37 ± 0.1
P	4 ± 0.1
W	8 +0.3, -0.1
T	0.254 ± 0.02
R7 Quantity	3000
R13 Quantity	N.A.

Note: R7 = 7 inch Lock Reel, R13 = 13 inch Lock Reel

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. CAMBER IN COMPLIANCE WITH EIA 481
3. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE

Figure 14. Tape and reel specification for the 6-lead 3 × 3 mm DFN package

Ordering information

Order code	Description	Packaging	Shipping method
PE4245A-Z	PE4245 SPDT RF switch	Green 6-lead 3 × 3 mm DFN	3000 units/T&R
EK4245-01	PE4245 evaluation kit	Evaluation kit	1/box

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