

PE42446

Document Category: Product Specification



*High-isolation UltraCMOS® SP4T RF Switch,
10 MHz–8.5 GHz*

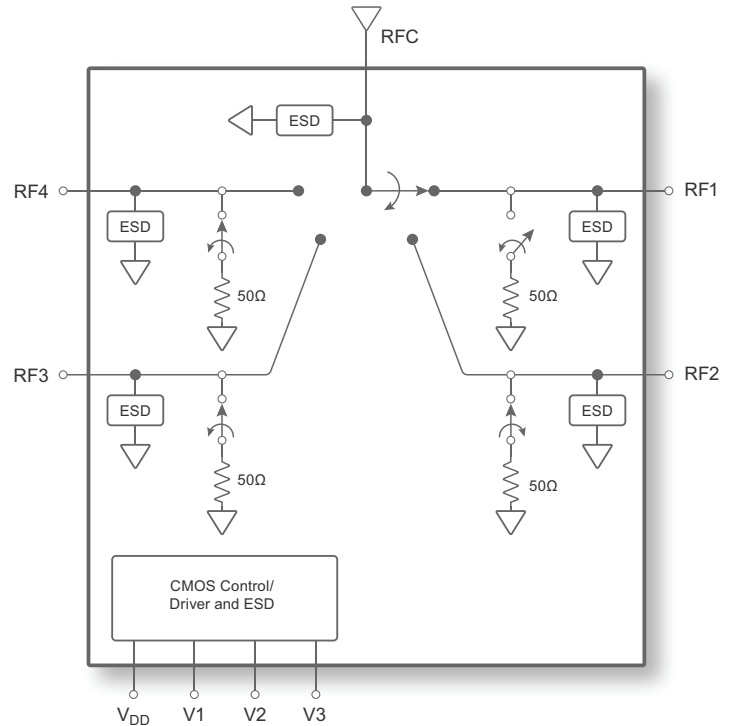
Features

- Operating frequency: Up to 8.5 GHz
- High isolation: 61 dB @ 4 GHz
- Low insertion loss: 0.75 dB @ 4 GHz
- High linearity IIP3: 65 dBm @ 3.8GHz
- Fast switching time: 200 ns
- Operating temperature: -40°C to +125°C
- Packaging: 24-lead 4×4 mm LGA

Applications

- DPD feedback loop and VSWR monitoring
- 5G massive MIMO active antenna systems
- Analog/hybrid beamforming RF front ends
- 4G/4.5G TD-LTE macro/micro cell/RRH
- Test and measurement'

Figure 1 • PE42446 Functional Diagram



Product Description

The PE42446 is a HaRP™ technology-enhanced SP4T RF switch designed for use in 4G/5G wireless infrastructure and other high performance RF applications. It consists of four symmetric RF ports with very high isolation up to 8.5 GHz.

The PE42446 is manufactured on pSemi's UltraCMOS® process, a patented variation of silicon-on-insulator (SOI) technology. pSemi's HaRP technology enhancements deliver high isolation, linearity and excellent harmonics performance.

Absolute Maximum Ratings

Exceeding the absolute maximum ratings listed in **Table 1** can 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 specified in **Table 1**.

Latch-up Immunity

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

Table 1 • PE42446 Absolute Maximum Ratings

Description	Min	Typ	Max	Unit
Power supply voltage	2.3	–	5.5	V
Digital input voltage (V1, V2, V3)	-0.3	–	3.6	V
Storage temperature range	-60	–	150	°C
Maximum junction temperature range	–	–	150	°C
RF input RMS power, RFX to RFC, hot switching, LTE PAR 9 dB, freq = 3.8 GHz @105 °C	–	–	29	dBm
RF input RMS power, RFX to RFC, hot switching, LTE PAR 9 dB, freq = 3.8 GHz @125 °C	–	–	26	dBm
RF input RMS power terminated port, hot switching, LTE PAR 9 dB, freq = 3.8 GHz @105 °C	–	–	29	dBm
RF input RMS power terminated port, hot switching, LTE PAR 9 dB, freq = 3.8 GHz @125 °C	–	–	26	dBm
ESD voltage HBM1, all pins ⁽¹⁾	–	–	2000	V
ESD voltage CDM2, all pins ⁽²⁾	–	–	1000	V
Notes: 1) Human body model (MIL-STD 883 Method 3015). 2) Charged device model (JEDEC JESD22-C101).				

Recommended Operating Conditions

Table 2 lists the PE42446 recommended operating conditions. Do not operate devices outside the operating conditions listed below.

Table 2 • PE42446 Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
V _{DD} supply voltage	2.3	3.3	5.5	V
Power supply current V _{DD} = 3.3V	–	95	250	μA
Control voltage high	1.07	–	3.6	V
Control voltage low	-0.3	–	0.68	V
Control current V1 high	–	2	–	μA
Control current V1 low	–	2	–	μA
Control current V2 high	–	2	–	μA
Control current V2 low	–	2	–	μA
Control current V3 high	–	2	–	μA
Control current V3 low	–	2	–	μA
Operating temperature range	-40	–	125	°C
Frequency range	10	–	8500	MHz
RF input power, CW (P _{MAX,CW} +105 °C)	–	–	34	dBm
RF input power, CW (P _{MAX,CW} +125 °C)	–	–	32	dBm
RF input power into terminated ports, CW (P _{MAX,CW} +105 °C)	–	–	25	dBm
RF input power into terminated ports, CW (P _{MAX,CW} +125 °C)	–	–	21	dBm

Electrical Specifications

Table 3 lists the PE42446 key electrical specifications @ +25 °C ($Z_S = Z_L = 50\Omega$), unless otherwise specified.

Table 3 • PE42446 Electrical Specifications

Parameter	Condition	Min	Typ	Max	Unit
Frequency range	–	10	–	8500	MHz
Insertion loss, RFx to RFc	10 to 900 MHz	–	0.60	0.72	dB
	900 to 2100 MHz	–	0.66	0.78	dB
	2100 to 2700 MHz	–	0.70	0.88	dB
	2700 to 4000 MHz	–	0.75	0.99	dB
	4000 to 6000 MHz	–	0.82	1.12	dB
	6000 to 8000 MHz	–	1.05	1.47	dB
	8000 to 8500 MHz	–	1.27	1.50	dB
Isolation, RFx to RFc	10 to 900 MHz	–	72	–	dB
	900 to 2100 MHz	–	66	–	dB
	2100 to 2700 MHz	–	65	–	dB
	2700 to 4000 MHz	–	61	–	dB
	4000 to 6000 MHz	–	55	–	dB
	6000 to 8000 MHz	–	47	–	dB
	8000 to 8500 MHz	–	45	–	dB
Isolation, RFx to RFx	10 to 900 MHz	–	59	–	dB
	900 to 2100 MHz	–	53	–	dB
	2100 to 2700 MHz	–	50	–	dB
	2700 to 4000 MHz	–	47	–	dB
	4000 to 6000 MHz	–	43	–	dB
	6000 to 8000 MHz	–	39	–	dB
	8000 to 8500 MHz	–	38	–	dB
Return loss, RF1/2/3/4 On state	10 to 900 MHz	–	24	–	dB
	900 to 2100 MHz	–	20	–	dB
	2100 to 2700 MHz	–	19	–	dB
	2700 to 4000 MHz	–	19	–	dB
	4000 to 6000 MHz	–	17	–	dB
	6000 to 8000 MHz	–	12	–	dB
	8000 to 8500 MHz	–	10	–	dB

Table 3 • PE42446 Electrical Specifications (Cont.)

Parameter	Condition	Min	Typ	Max	Unit
Return loss, RF1/2/3/4 Off state	10 to 900 MHz	–	25	–	dB
	900 to 2100 MHz	–	21	–	dB
	2100 to 2700 MHz	–	21	–	dB
	2700 to 4000 MHz	–	21	–	dB
	4000 to 6000 MHz	–	18	–	dB
	6000 to 8000 MHz	–	17	–	dB
	8000 to 8500 MHz	–	14	–	dB
Input 0.1dB compression	3800 MHz	–	36.8	–	dBm
Input IP3, RFx to RFc	3800 MHz	–	65.5	–	dBm
Input IP2, RFx to RFc	3800 MHz	–	110	–	dBm
Switching time	50% CTRL to 90% or 10% RF	–	200	–	ns

SP4T Control Logic

Table 4 lists the PE42446 control logic truth table.

Table 4 • PE42446 Truth Table

ON Port	V3	V2	V1
RF4 on ^(*)	0	0	0
RF1 on	0	0	1
RF2 on	0	1	0
RF3 on	0	1	1
RF4 on	1	0	0
All off	1	0	1
All off	1	1	0
All off	1	1	1

Note: * Pin 19 (V3) must be grounded for 2-pin control. You can use 2-pin control if All Off mode is not required.

Table 5 lists the PE42446 for 2-pin control truth table.

Table 5 • PE42446 2-pin Control Truth Table

Mode	V2	V1
RF4 on ^(*)	0	0
RF1 on	0	1
RF2 on	1	0
RF3 on	1	1

Note: * Pin 19 (V3) must be grounded for 2-pin control. You can use 2-pin control if All Off mode is not required.

Typical Performance Data

Figure 2–Figure 17 show the typical performance data at +25 °C T_{CASE} and $V_{DD} = 5V$ ($Z_S = Z_L = 50\Omega$), unless otherwise specified.

Figure 2 • Insertion Loss vs. Switch Path

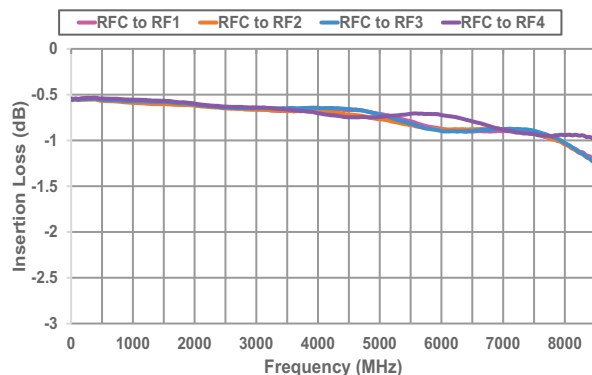


Figure 3 • Insertion Loss vs. Temperature

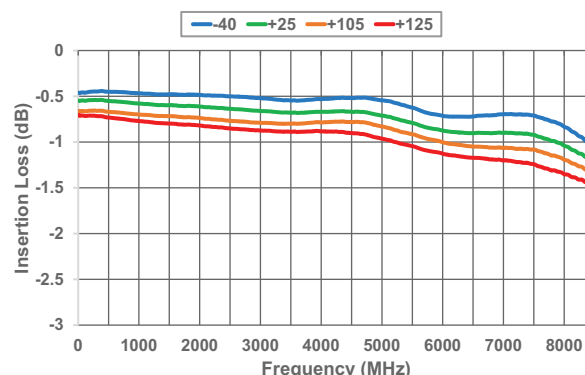


Figure 4 • Insertion Loss vs. Voltage

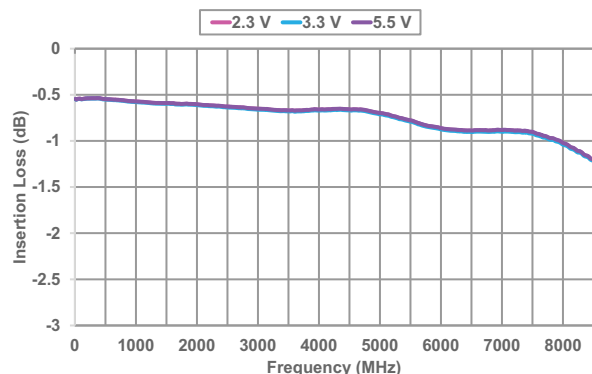


Figure 5 • Isolation (RFC–RFX) vs. Switch Path

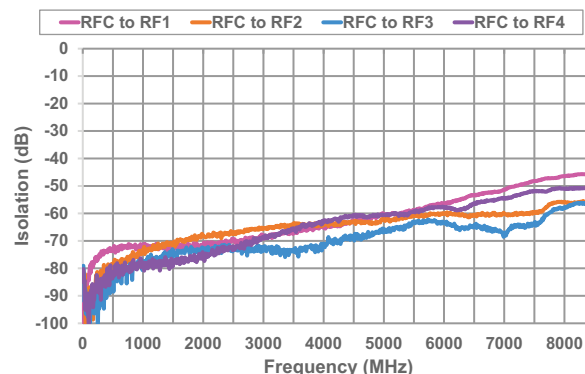


Figure 6 • Isolation (RFC–RFX) vs. Temperature

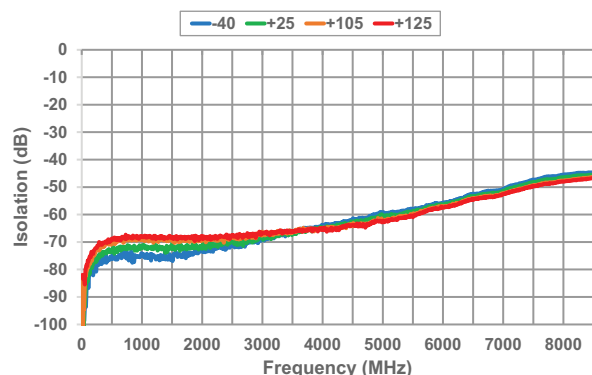


Figure 7 • Isolation (RFC–RFX) vs. Voltage

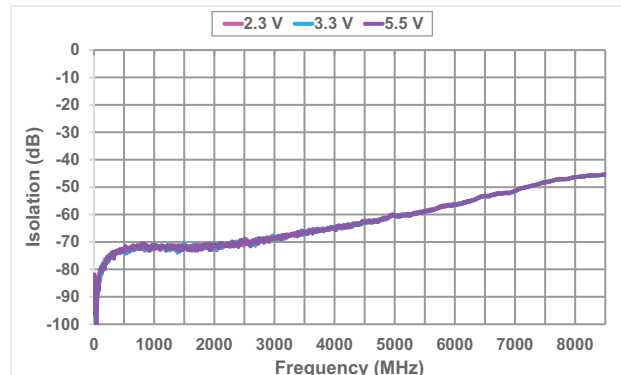


Figure 8 • Isolation (RFX-RFX) vs. Temperature

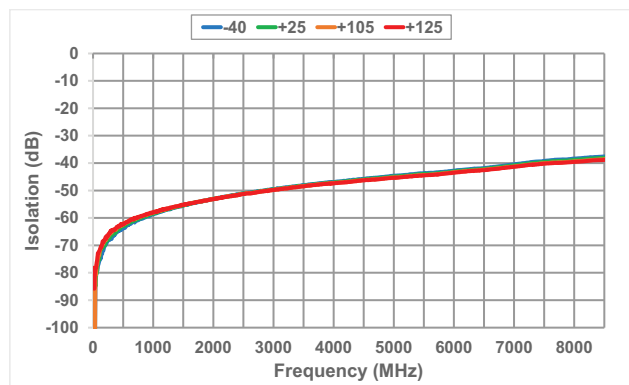


Figure 9 • Isolation (RFX-RFX) vs. Voltage

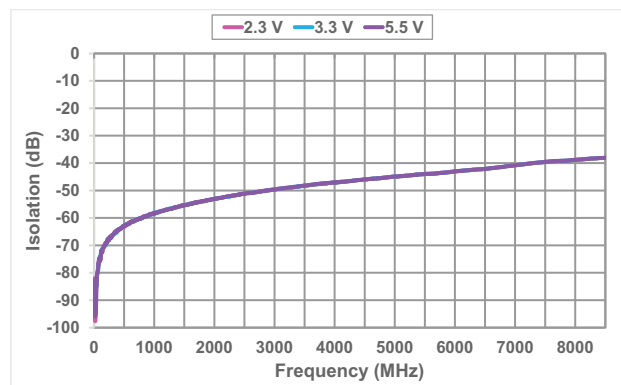


Figure 10 • RFX Return Loss vs. Switch Path

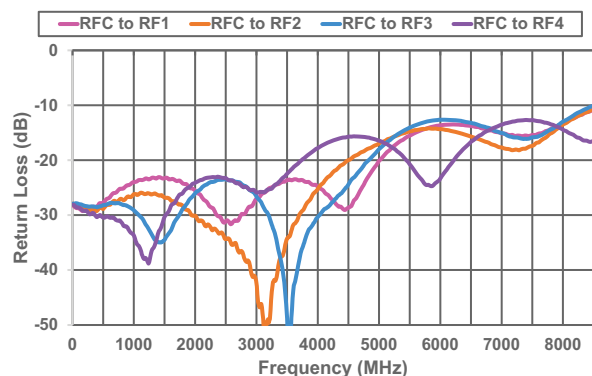


Figure 11 • RFX Return Loss vs. Temperature

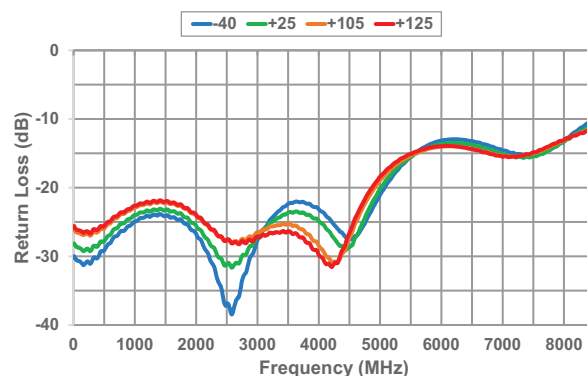


Figure 12 • RFX Return Loss vs. Voltage

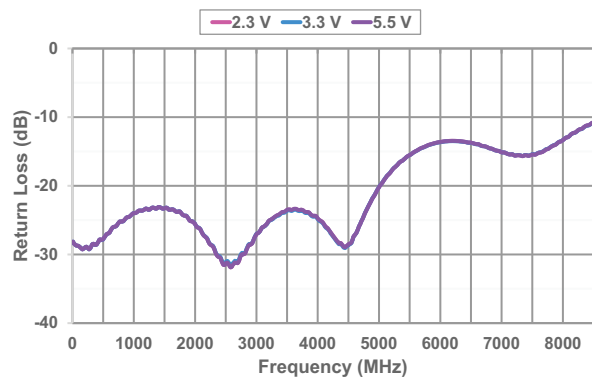


Figure 13 • RFC Return Loss vs. Switch Path

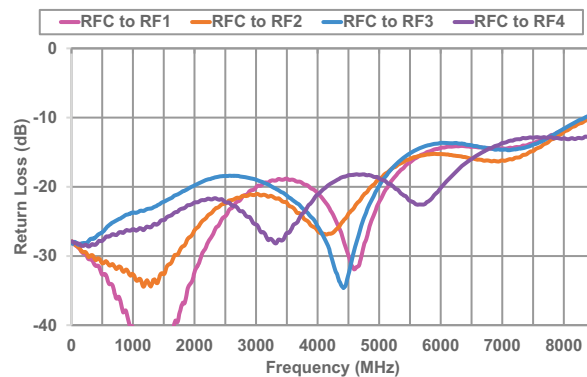


Figure 14 • RFC Return Loss vs. Temperature

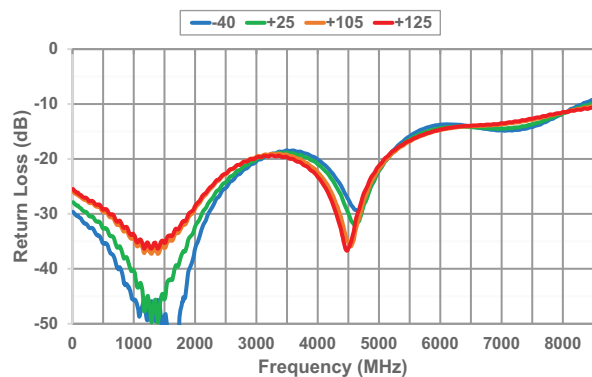


Figure 15 • RFC Return Loss vs. Voltage

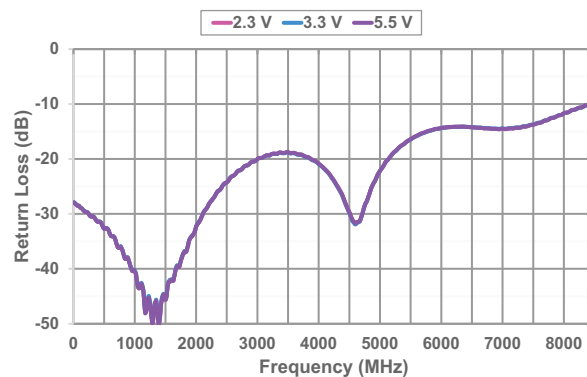


Figure 16 • RFX Terminated, Return Loss

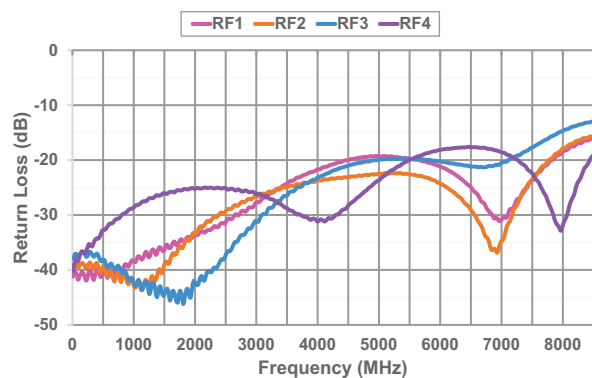
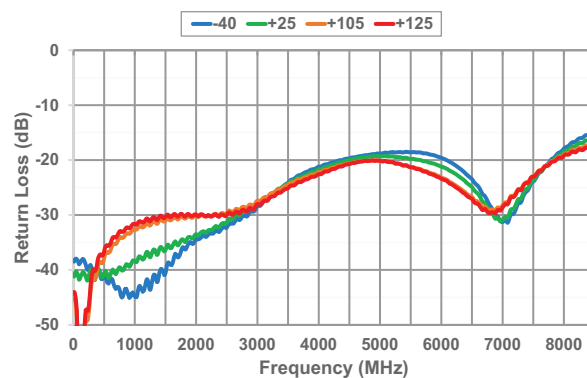


Figure 17 • RFX Terminated, Return Loss vs. Temperature



Pin Information

Figure 18 shows the PE42446 pin map for 24-lead 4×4 mm LGA package. Table 6 lists the description for each pin.

Figure 18 • Pin Configuration (Top View)

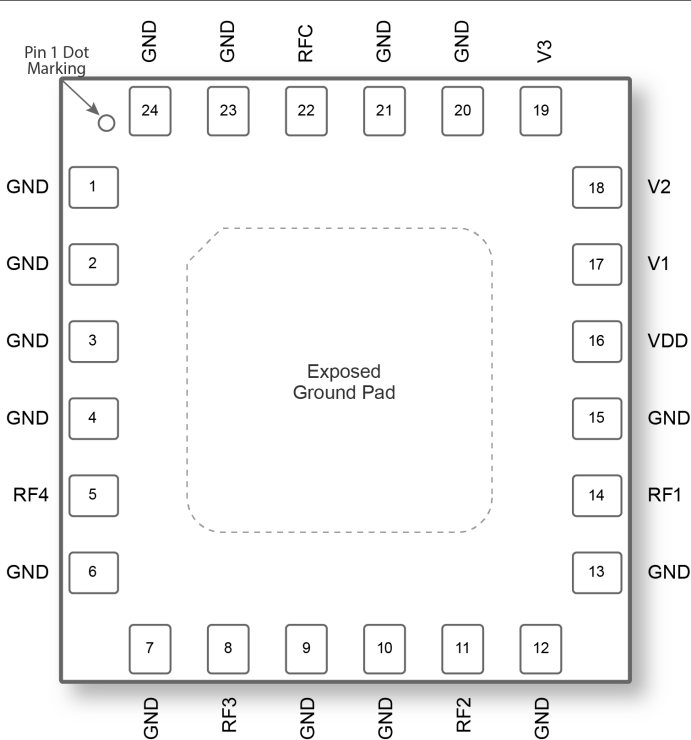


Table 6 • PE42446 Pin Descriptions

Pin No.	Pin Name	Description
1,2,3,4,6,7,9,10,12,13,15,20,21,23,24	GND	Ground
5(*)	RF4	RF port 4
8(*)	RF3	RF port 3
11(*)	RF2	RF port 2
14(*)	RF1	RF port 1
16	VDD	Supply voltage
17	V1	Digital control logic input 1
18	V2	Digital control logic input 2
19	V3	Digital control logic input 3
22	RFC	RF common
25	GND	Exposed pad. Ground for proper operation.

Note: * RF pins 5, 8, 11, and 14 must be at 0 VDC. The RF pins do not require DC blocking capacitors for proper operation if the 0 VDC requirement is met.

Packaging Information

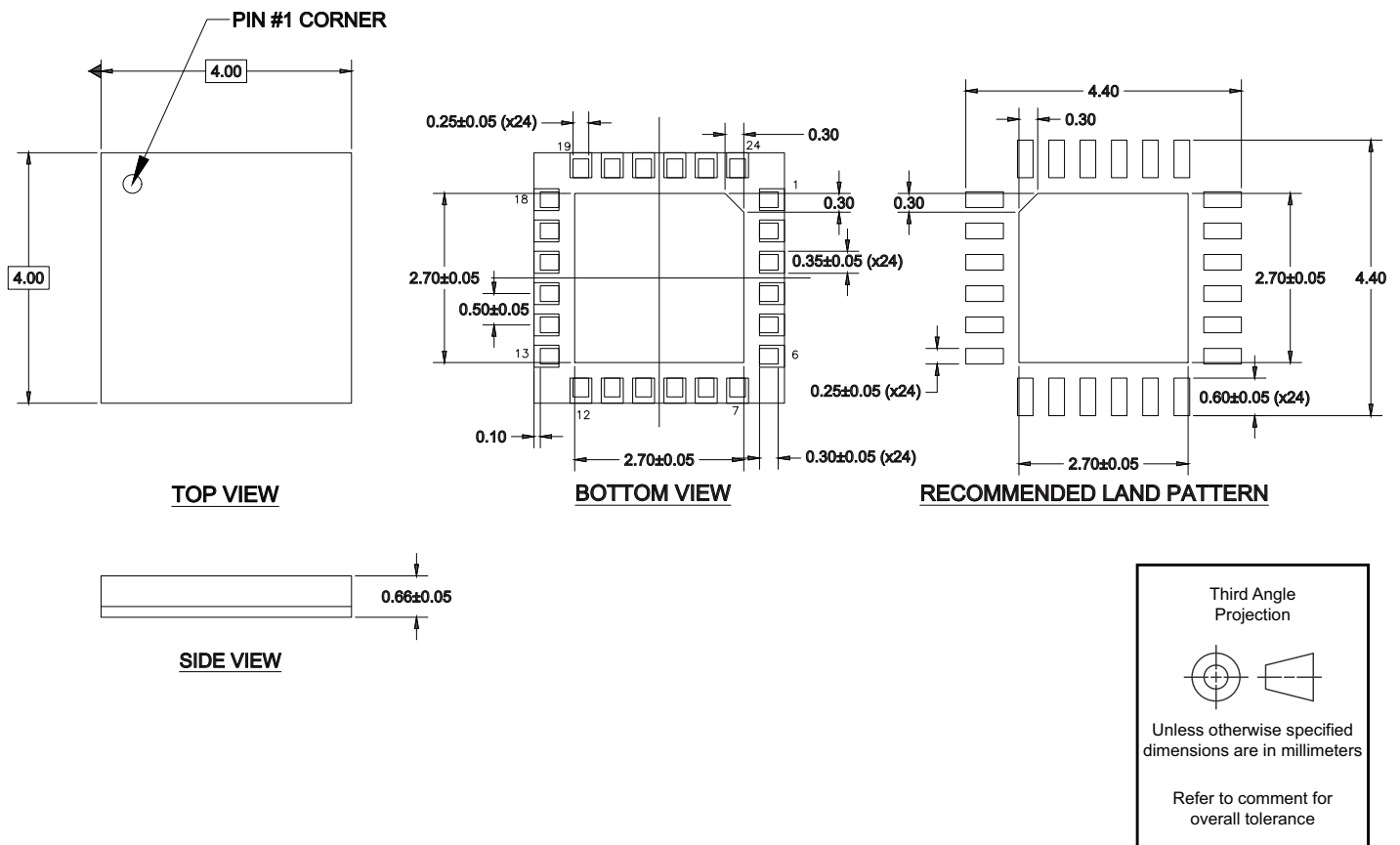
This section provides packaging data, including the moisture sensitivity level, package drawing, package marking and tape-and-reel information.

Moisture Sensitivity Level

The PE42446 moisture sensitivity level rating for the 24-lead 4×4 mm LGA package is MSL3.

Package Drawing

Figure 19 • Package Mechanical Drawing for the 24-lead 4×4 mm LGA package



Top-Marking Specification

Figure 20 • PE42446 Package Marking Specification

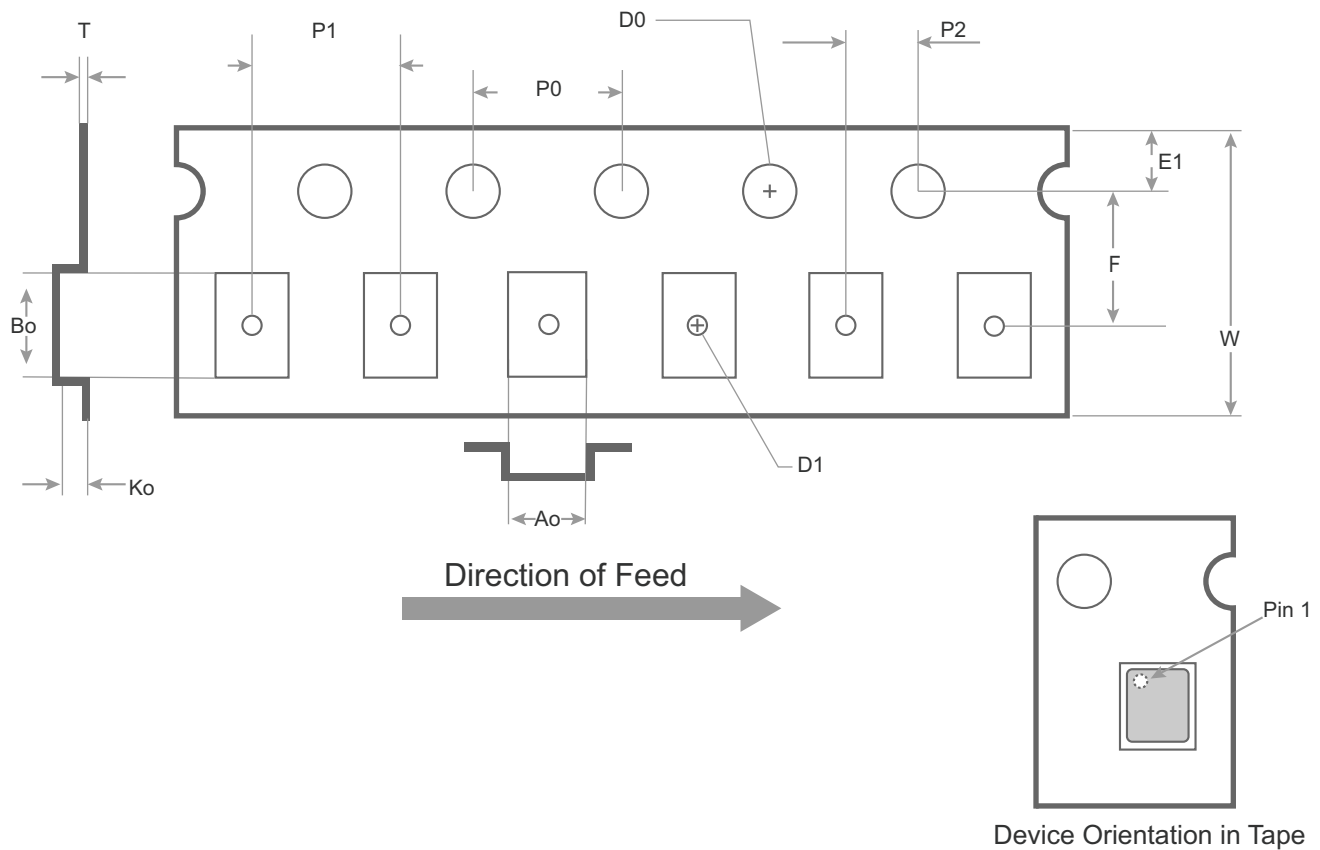


- = Pin 1 indicator
- 42446 = Product part number
- YY = Last two digits of assembly year (2022 = 22)
- WW = Work week of assembly lot start date (01, ..., 52)
- ZZZZZZ = Assembly lot code (max six characters)

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Tape and Reel Specification

Figure 21 • Tape and Reel Specification for the 24-lead 4×4 mm LGA package



Notes:

- The diagram is not drawn to scale.
- The units are in millimeters (mm).
- The maximum cavity angle is five degrees.
- The bumped die are oriented active side down.

Table 7 • Tape and Reel Dimensions

Carrier Tape Dimensions					
Pocket	Nominal	Tolerance	Pocket	Nominal	Tolerance
Ao	4.35	±0.10	D1	1.50	Minimum
Bo	4.35	±0.10	D0	1.55	±0.05
Ko	1.10	±0.10	E1	1.75	±0.10
P1	8.00	±0.10	P0	4.00	±0.10
W	12.00	±0.30	P2	2.00	±0.10
F	5.50	±0.10	T	0.30	±0.05

Ordering Information

Table 8 • PE42446 Order Codes and Shipping Methods

Order Codes	Description	Packaging	Shipping Method
PE42446A-Z	PE42446 SP4T RF switch	Green 24-lead 4×4 mm LGA	3000 units/T&R
EK42446-01	PE42446 Evaluation kit	Evaluation kit	1/box

Document Categories

Advance Information

The product is in a formative or design stage. The datasheet contains design target specifications for product development. Specifications and features may change in any manner without notice.

Preliminary Specification

The datasheet contains preliminary data. Additional data may be added at a later date. pSemi reserves the right to change specifications at any time without notice in order to supply the best possible product.

Product Specification

The datasheet contains final data. In the event pSemi decides to change the specifications, pSemi will notify customers of the intended changes by issuing a CNF (Customer Notification Form).

Product Brief

This document contains a shortened version of the datasheet. For the full datasheet, contact sales@psemi.com.

Sales Contact

For additional information, contact Sales at sales@psemi.com.

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