Product Specification

PE42424

UltraCMOS® SPDT RF Switch
100 MHz–6 GHz

Product Description

The PE42424 is a HaRP™ technology-enhanced reflective 50Ω SPDT RF switch designed for use in high power and high performance WLAN 802.11 a/b/g/n/ac applications such as carrier and enterprise Wi-Fi products supporting bandwidths up to 6 GHz.

This switch features exceptional port-to-port isolation, fast switching speed, and high power handling, all in a compact 1.5 × 1.5 mm package. PE42424 also features high linearity that remains invariant over the full power supply range. In addition, this device has robust ESD and temperature performance and does not require blocking capacitors or any external matching components.

The PE42424 is manufactured on Peregrine's UltraCMOS® process, a patented variation of silicon-on-insulator (SOI) technology on a sapphire substrate.

Peregrine's HaRP technology enhancements deliver high linearity and excellent harmonics performance. It is an innovative feature of the UltraCMOS process, offering the performance of GaAs with the economy and integration of conventional CMOS.

Features

- 802.11 a/b/g/n/ac support
- Exceptional isolation
  - 48 dB @ 2.4 GHz
  - 35 dB @ 5.8 GHz
- Fast switching
  - 145 ns switching time
  - 125 kHz switching rate
- High power handling
  - 39 dBm Pulsed
  - 30 dBm CW
- High linearity across supply range
  - IIP3 of 61 dBm
  - IIP2 of 125 dBm
- 1.8V control logic compatible
- 105°C operating temperature
- ESD performance
  - 2500V HBM on RF pins to GND
  - 1000V CDM on all pins

Figure 1. Functional Diagram

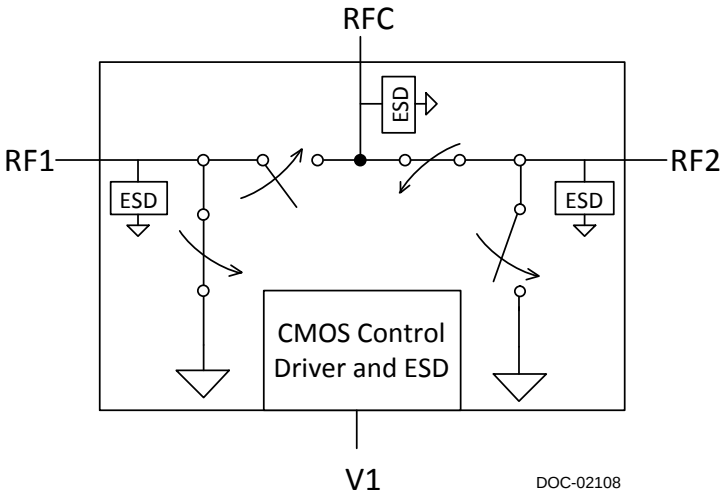


Figure 2. Package Type

6-lead 1.5 × 1.5 mm DFN



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Table 1. Electrical Specifications @ 25°C, V_{DD} = 3.3V, (Z_L = Z_S = 50Ω) unless otherwise specified

Parameter	Path	Condition	Min	Typ	Max	Unit
Operating frequency			100		6000	MHz
Insertion loss	RFC–RFX	100–2500 MHz 2500–5825 MHz 5825–6000 MHz		0.80 0.90 0.95	0.95 1.15 1.20	dB dB dB
Isolation	RFC–RFX	100–2500 MHz 2500–5825 MHz 5825–6000 MHz	45 33 33	47 35 34		dB dB dB
Isolation	RFX–RFX	100–2500 MHz 2500–5825 MHz 5825–6000 MHz	37 29 29	39 30 30		dB dB dB
Return loss (common and active port)	RFX	100–6000 MHz		21		dB
Input 1dB compression point[1]	RFC–RFX	6000 MHz		41		dBm
Input IP3[2]	RFC–RFX	1900 MHz		61		dBm
Input IP2[2]	RFC–RFX	1900 MHz		125		dBm
3rd harmonic	RFC–RFX	P_{IN} = +30 dBm @ 1900 MHz		74		dBc
2nd harmonic	RFC–RFX	P_{IN} = +30 dBm @ 1900 MHz		85		dBc
Switching time		50% CTRL to 90% or 10% of final value		145	230	ns

Notes: 1. The input 1dB compression point is a linearity figure of merit. Refer to *Table 3* for the operating RF input power (50Ω).
2. The input intercept point remains invariant over the full supply range as defined in *Table 3.*

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Figure 3. Pin Configuration (Top View)

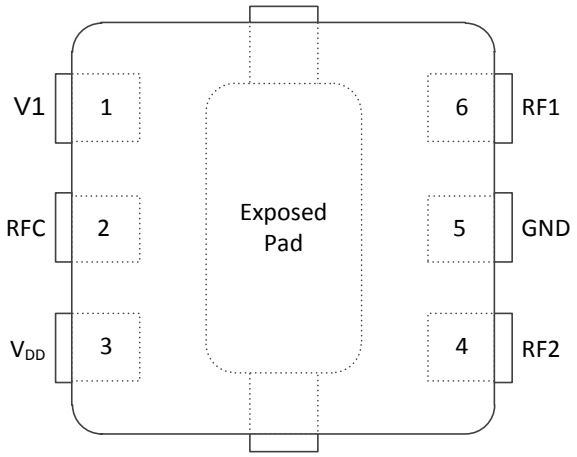


Table 2. Pin Descriptions

Pin #	Pin Name	Description
1	V1	Digital control logic input 1
2	RFC*	RF common
3	V_{DD}	Supply voltage (nominal 3.3V)
4	RF2*	RF port 2
5	GND	Ground
6	RF1*	RF port 1
Pad	GND	Exposed pad: ground for proper operation

Note: * RF pins 2, 4 and 6 must be at 0V DC. The RF pins do not require DC blocking capacitors for proper operation if the 0V DC requirement is met.

Table 3. Operating Ranges

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{DD}	2.3	3.3	5.5	V
Supply current	I_{DD}		130[1] 200[2]	200 300	µA µA
Digital input high (V1)	V_{IH}	1.4		3.6	V
Digital input low (V1)	V_{IL}	–0.3		0.6	V
RF input power, CW	$P_{MAX,CW}$			30	dBm
RF input power, pulsed[3]	$P_{MAX,PULSED}$			39	dBm
Operating temperature range	T_{OP}	–40	+25	+105	°C

Notes: 1. V_{IH} > 1.7V
2. 1.4V < V_{IH} < 1.7V
3. Pulsed, 5% duty cycle of 4620 µs period, 50Ω

Table 4. Absolute Maximum Ratings

Parameter/Condition	Symbol	Min	Max	Unit
Supply voltage	V_{DD}	–0.3	5.5	V
Digital input voltage (V1)	V_{CTRL}	–0.3	3.6	V
Maximum input power	$P_{MAX,ABS}$		41	dBm
Storage temperature range	T_{ST}	–65	+150	°C
ESD voltage HBM[1] All pins RF pins to GND	$V_{ESD,HBM}$		 1000 2500	 V V
ESD voltage CDM[2], all pins	$V_{ESD,MM}$		1000	V

Notes: 1. Human Body Model (MIL-STD 883 Method 3015)
2. Charged Device Model (JEDEC JESD22-C101)

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 5. Control Logic Truth Table

V1	RFC–RF1	RFC–RF2
0	OFF	ON
1	ON	OFF

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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.

Latch-Up Avoidance

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

Moisture Sensitivity Level

The Moisture Sensitivity Level rating for the PE42424 in the 6-lead 1.5 × 1.5 mm DFN package is MSL1.

Switching Capability

The PE42424 has a maximum 125 kHz switching rate with the control pin input capacitance of 2 pF. Switching rate describes the time duration between switching events.

Switching time is the time duration between the point the control signal reaches 50% of the final value and the point the output signal reaches within 10% or 90% of its target value.

Spurious Performance

The typical spurious performance of the PE42424 is –126 dBm.

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Typical Performance Data @ 25°C and V_{DD} = 3.3V, unless otherwise specified

Figure 4. Insertion Loss (RFC–RFX)

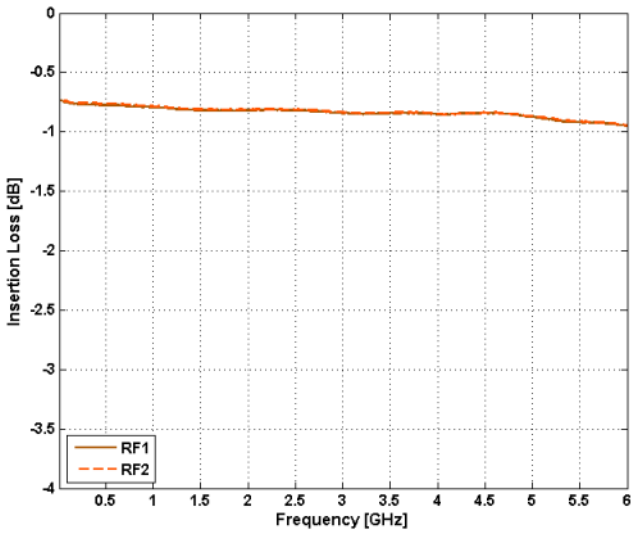


Figure 5. Insertion Loss vs. Temp (RFC–RFX)

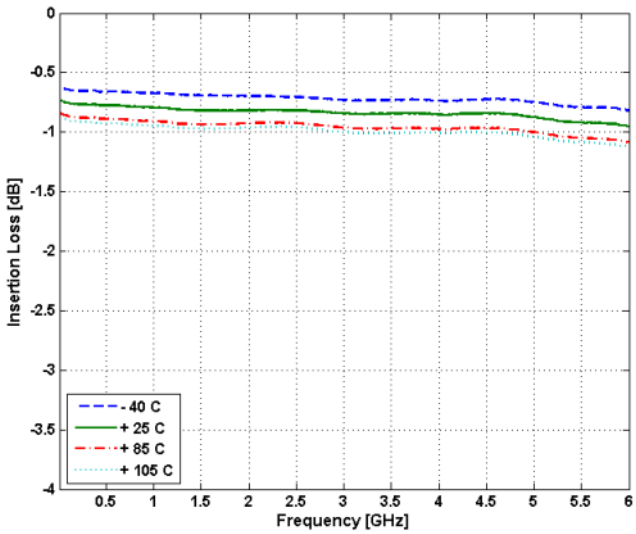
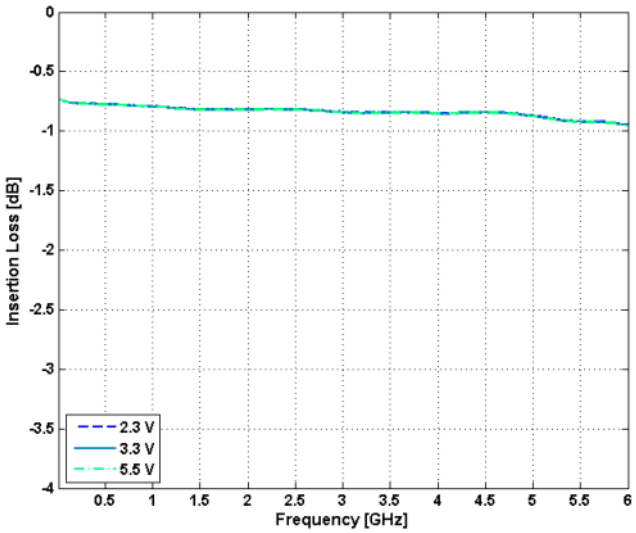


Figure 6. Insertion Loss vs. V_{DD} (RFC–RFX)



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Typical Performance Data @ 25°C and V_{DD} = 3.3V, unless otherwise specified

Figure 7. Return Loss vs. Temp (RFC–RFX)

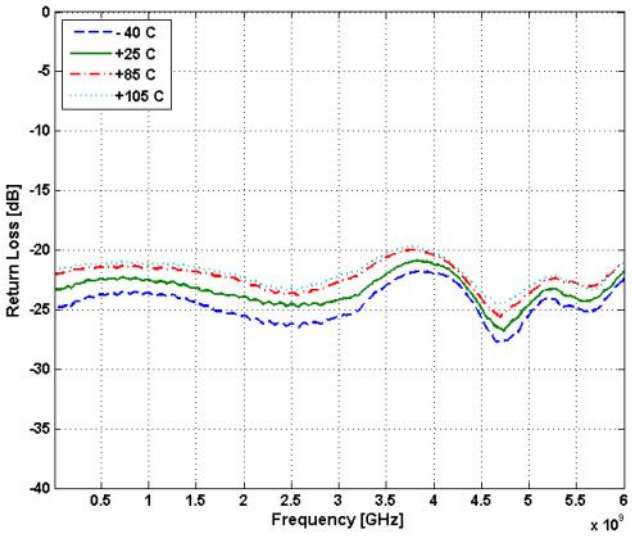


Figure 8. Return Loss vs. V_{DD} (RFC–RFX)

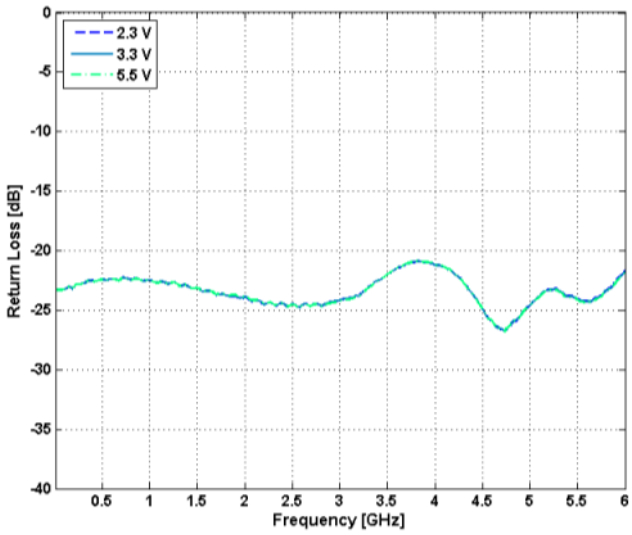


Figure 9. Isolation vs. Temp (RFC–RFX)

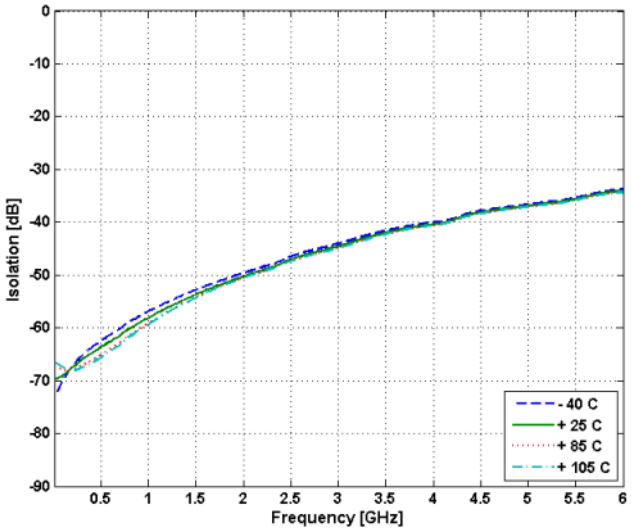
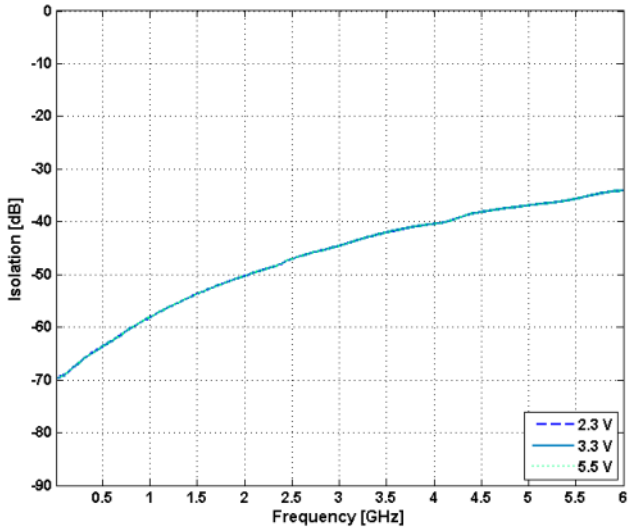


Figure 10. Isolation vs. V_{DD} (RFC–RFX)



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Typical Performance Data @ 25°C and V_{DD} = 3.3V, unless otherwise specified

Figure 11. Isolation vs. Temp (RFX–RFX)

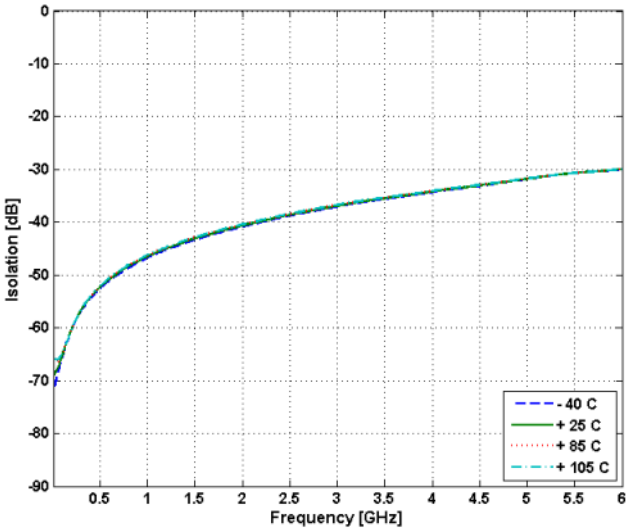
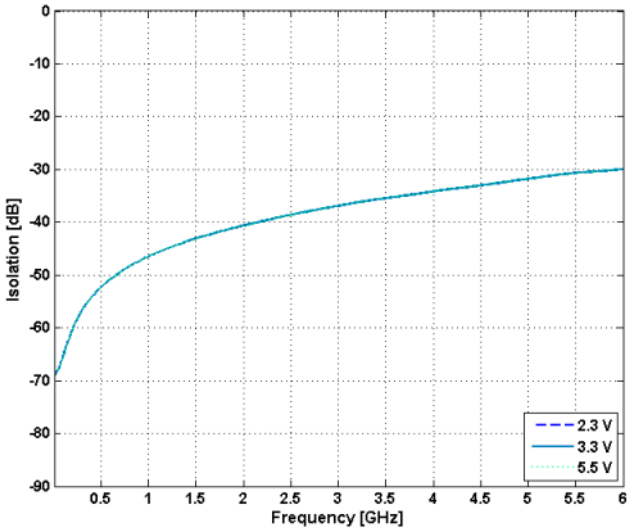


Figure 12. Isolation vs. V_{DD} (RFX–RFX)



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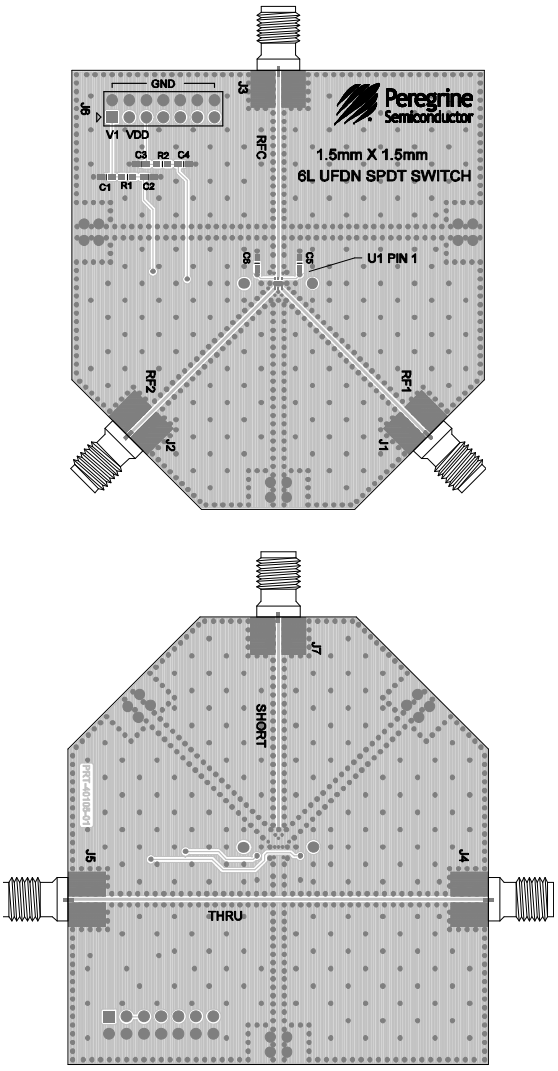
Evaluation Kit

The SPDT switch evaluation board was designed to ease customer evaluation of Peregrine's PE42424 RF switch. The RF common port is connected to the device through a 50Ω transmission line via SMA connector J3. RF1 and RF2 ports are connected to the device through 50Ω transmission lines via SMA connectors J1 and J2, respectively. A transmission line has been included on the reverse side of the PCB, accessible via SMA connectors J4 and J5. This transmission line provides an equivalent length to de-embed PCB trace losses. DC and digital inputs are provided to the device via J6.

This PCB is constructed of a four metal layer material with total thickness of 62 mils. The top and bottom RF layers are Rogers RO4003 material with an 8 mil RF core. The middle layers provide ground for the RF transmission lines. The transmission lines were designed using a coplanar waveguide with ground plane model using a trace width of 16 mils and 10 mil trace gap, with 2.1 mils of metal thickness.

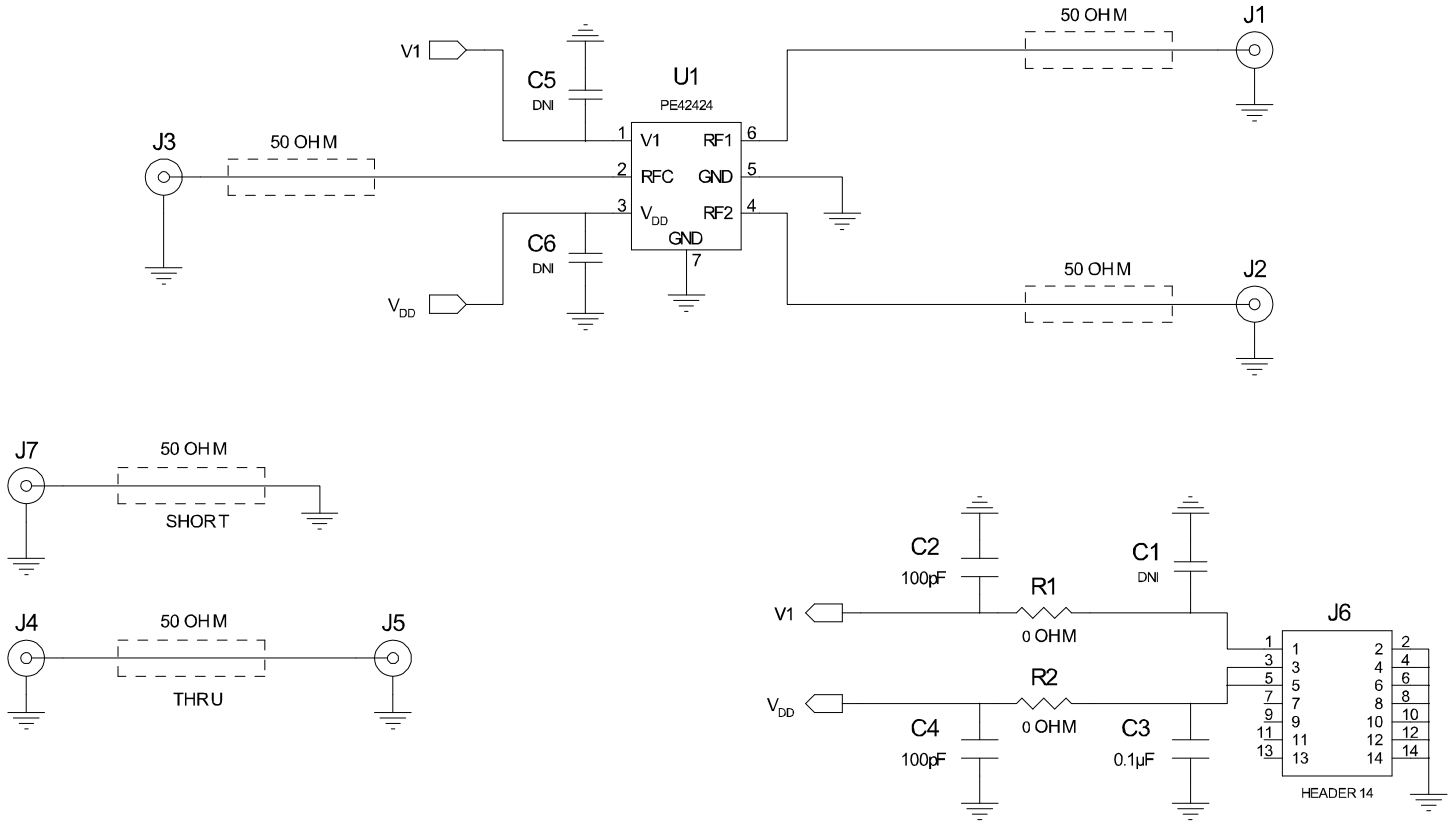
For the true performance of the PE42424 to be realized, the PCB should be designed in such a way that RF transmission lines and sensitive DC I/O traces are heavily isolated from one another.

Figure 13. Evaluation Board Layout



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Figure 14. Evaluation Board Schematic



CAUTION: Contains parts and assemblies susceptible to damage by electrostatic discharge (ESD).

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Figure 15. Package Drawing
6-lead 1.5 × 1.5 mm DFN

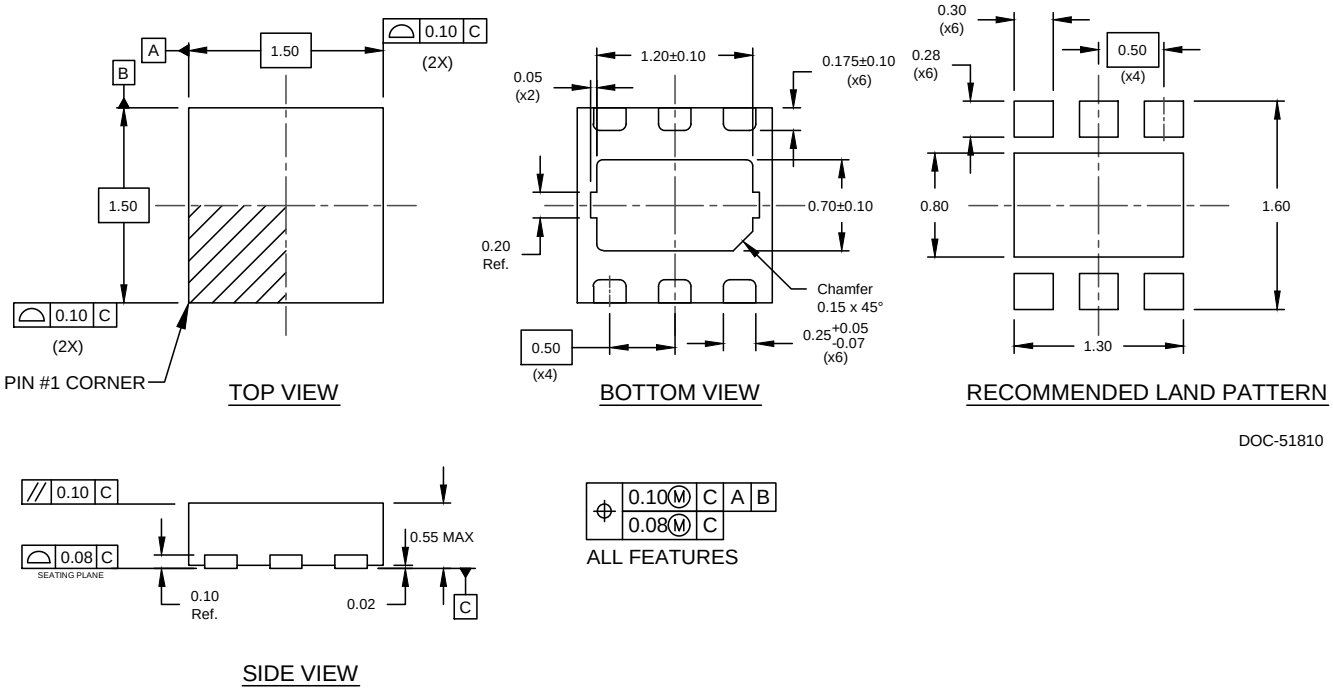
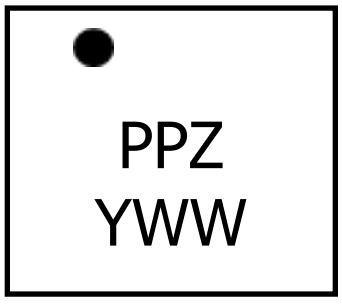


Figure 16. Top Marking Specification

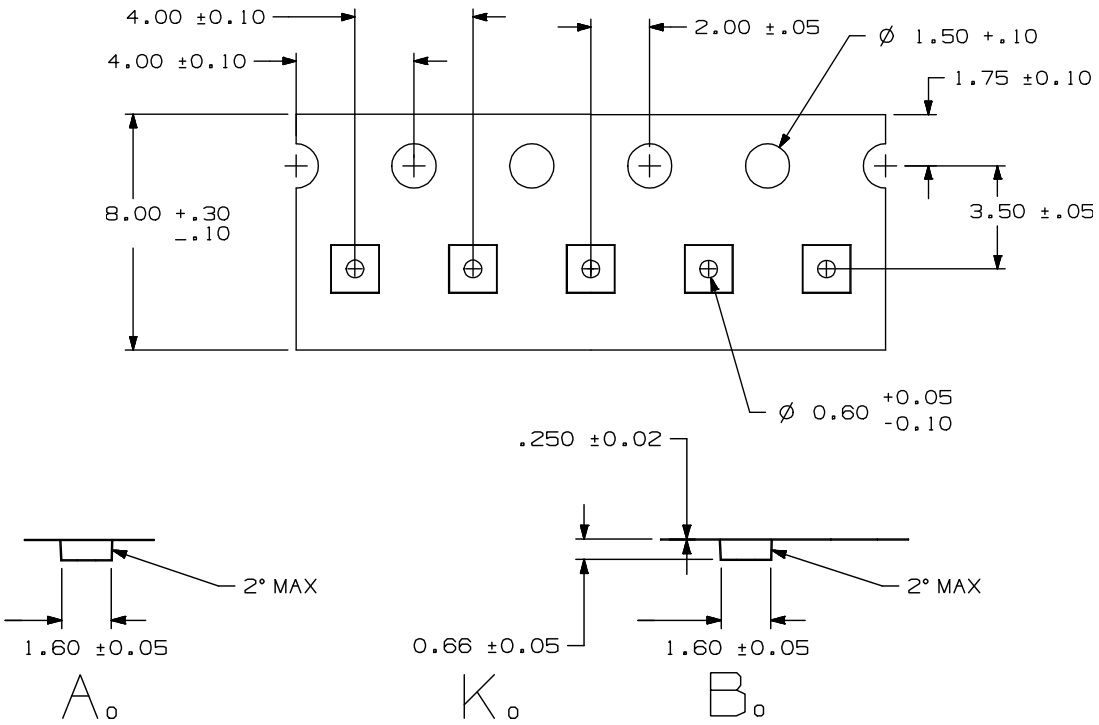


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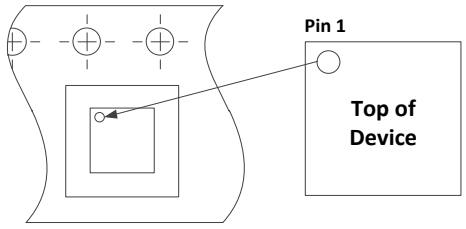
● = Pin 1 designator
PP = Part number code
Z = character of the assembly lot code
Y = Last digit of year, starting from 2009
WW = Work week of assembly lot molding

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Figure 17. Tape and Reel Specifications



Drawing not drawn to scale
Pocket hole diameter 0.6 ± 0.05 mm
Bumped die are oriented active side down
Maximum cavity angle 5°



Device Orientation in Tape

Table 6. Ordering Information

Ordering Code	Description	Package	Shipping Method
PE42424A-Z	PE42424 SPDT RF switch	Green 6-lead 1.5x1.5 mm DFN	3000 units/T&R
EK42424-01	PE42424 Evaluation kit	Evaluation kit	1/Box

Sales Contact and Information

For Sales and contact information please visit www.psemi.com.

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