Product Specification

PE42641

SP4T UltraCMOS™ RF Switch
DC – 3.0 GHz

Product Description

The PE42641 is a HaRP™-enhanced SP4T RF Switch developed on the UltraCMOS™ process technology. This switch contains 4 identical WEDGE/CDMA compliant TX paths and can be used in various GSM and WCDMA mobile applications as well as other wireless applications up to 3000MHz. It is also suitable for antenna band switching and switchable matching networks for cellular and non-cellular mobile applications. It integrates on-board CMOS control logic with a low voltage CMOS-compatible control interface and requires no DC blocking capacitors. This RoHS-compliant part is available in a standard 3x3x0.75mm QFN package.

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

Features

- Symmetric, High-Power SP4T: All ports WEDGE/CDMA-Compliant
- Very Low Insertion Loss: 0.45 dB @ 1000 MHz, 0.6 dB @ 2000 MHz
- HaRP™ - enhanced Technology for Unparalleled Linearity
  - Low harmonics of $2f_o$ = -86 dBc and $3f_o$ = -81 dBc at +35 dBm
  - IMD3 of -110 dBm at WCDMA Band I
  - IIP3 of +68 dBm
- Very high isolation: 35 dB @ 900 MHz, 29 dB @ 1900 MHz
- Exceptionally high ESD tolerance:
  - Class 3 (4.0 kV HBM) on ANT pin
  - Class 2 (2.0 kV HBM) on all pins
- Integrated decoder for 2-pin control
  - Accepts 1.8 V and 2.75 V levels
- Low 4.5 ohm series ON resistance
- No blocking capacitors required

Figure 1. Functional Diagram

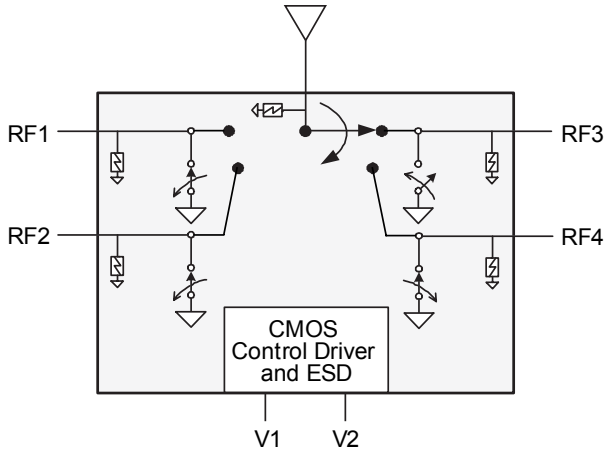


Figure 2. Package Type

16-lead 3x3 mm QFN

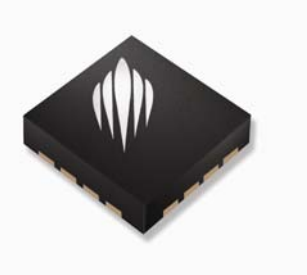


Table 1. Electrical Specifications Temp = 25°C, V_{DD} = 2.75 V (Z_S = Z_L = 50 Ω)

Parameter	Condition	Min	Typ	Max	Units
Operational Frequency		100		3000	MHz
Insertion Loss[1] (Symmetric Ports)	ANT - RF (850 / 900 MHz)	-	0.45	0.65	dB
	ANT - RF (1800 / 1900 MHz)	-	0.5	0.7	dB
	ANT - RF (1900 / 2200 MHz)	-	0.55	0.75	dB
Return Loss (Active Ports)	850 / 900 MHz	-	25	-	dB
	1800 / 1900 MHz	-	19	-	dB
	1900 / 2100 MHz	-	18	-	dB
Isolation	RF - ANT (850 / 900 MHz)	31	35	-	dB
	RF - ANT (1800 / 1900 MHz)	25	29	-	dB
	RF - ANT (1900 / 2200 MHz)	23.5	27.5	-	dB
2nd Harmonic	35 dBm output power, 850 / 900 MHz		-86	-80	dBc
	33 dBm output power, 1800 / 1900 MHz		-87	-78	dBc
3rd Harmonic	35 dBm output power, 850 / 900 MHz		-81	-73.5	dBc
	33 dBm output power, 1800 / 1900 MHz		-80	-72.5	dBc
IMD3 distortion at 2.14 GHz	RF Measured at 2.14 GHz at Ant port, input +20 dBm CW signal at 1.95 GHz and -15 dBm CW signal at 1.76 GHz		-110		dBm
Switching time	(10-90%) (90-10%) RF		2	5	µs

Note: 1. The typical ON Resistance value at DC is 4.5 Ω.

Table 2. Electrical Specifications, Worst Case Conditions: Temp = 85°C, V_{DD} = 2.65 V (Z_S = Z_L = 50 Ω)

Parameter	Condition	Min	Typ	Max	Units
Insertion loss (2.65V, 85C)	ANT - RF (850 / 900 MHz)	-	0.5	0.7	dB
	ANT - RF (1800 / 1900 MHz)	-	0.55	0.75	dB
	ANT - RF (1900 / 2200 MHz)	-	0.6	0.8	dB
Return Loss (Active Ports) (2.65V, 85C)	850 / 900 MHz	-	25	-	dB
	1800 / 1900 MHz	-	19	-	dB
	1900 / 2100 MHz	-	18	-	dB
Isolation (2.65V, 85C)	RF - ANT (850 / 900 MHz)	30.5	34.5	-	dB
	RF - ANT (1800 / 1900 MHz)	24.5	28.5	-	dB
	RF - ANT (1900 / 2200 MHz)	23	27	-	dB
2nd Harmonic (2.65V, 85C)	35 dBm output power, 850 / 900 MHz		-84	-78	dBc
	33 dBm output power, 1800 / 1900 MHz		-85	-76	dBc
3rd Harmonic (2.65V, 85C)	35 dBm output power, 850 / 900 MHz		-79	-71.5	dBc
	33 dBm output power, 1800 / 1900 MHz		-78	-70.5	dBc
IMD3 distortion at 2.14 GHz (2.65V, 85C)	RF Measured at 2.14 GHz at Ant port, input +20 dBm CW signal at 1.95 GHz and -15 dBm CW signal at 1.76 GHz		-108		dBm
Switching time	(10-90%) (90-10%) RF		2	5	µs

Figure 3. Pin Configuration (Top View)

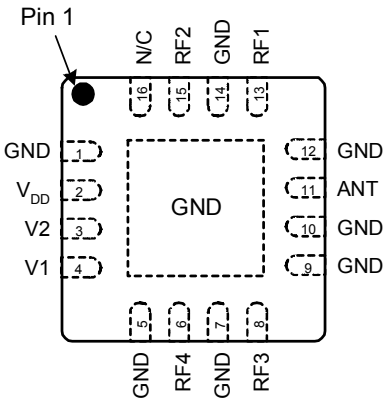


Table 3. Pin Descriptions

Pin No.	Pin Name	Description
1	GND	Ground
2	V_{DD}	Supply
3	V2	Switch control input, CMOS logic level
4	V1	Switch control input, CMOS logic level
5	GND	Ground
6	RF4	RF Port 4
7	GND	Ground
8	RF3	RF Port 3
9	GND	Ground
10	GND	Ground
11	ANT	RF Common – Antenna
12	GND	Ground
13	RF1	RF Port 1
14	GND	Ground
15	RF2	RF Port 2
16	N/C	No Connect

Table 4. Operating Ranges

Parameter	Symbol	Min	Typ	Max	Units
Temperature range	T_{OP}	-40		+85	°C
V_{DD} Supply Voltage	V_{DD}	2.65	2.75	2.85	V
I_{DD} Power Supply Current (V_{DD} = 2.75 V)	I_{DD}		13	50	µA
RF input power[2] (VSWR ≤ 3:1) 824-915 MHz	P_{IN}			+35	dBm
RF input power[2] (VSWR ≤ 3:1) 1710-1910 MHz				+33	
Control Voltage High	V_{IH}	1.4			V
Control Voltage Low	V_{IL}			0.4	V

Note: 2. Assumes RF input period of 4620 µs and duty cycle of 50%.

Table 5. Absolute Maximum Ratings

Symbol	Parameter/Conditions	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
T_{ST}	Storage temperature range	-65	+150	°C
P_{IN}(50 Ω)	RF input power (50 Ω) [3,4] 824-915 MHz		+38	dBm
	RF input power (50 Ω) [3,4] 1710-1910 MHz		+36	
P_{IN} (∞:1)	RF input power (VSWR = (∞:1)[3,4] 824-915 MHz		+35	dBm
	RF input power (VSWR = (∞:1)[3,4] 1710-1910 MHz		+33	
V_{ESD} [5]	ESD Voltage, ANT pin		4000	V
	ESD Voltage, all pins		2000	V

Note: 3. Assumes RF input period of 4620 µs and duty cycle of 50%.
4. V_{DD} within operating range specified in Table 3.
5. ESD Voltage (HBM, MIL-STD-883 Method 3015.7)

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 6. Truth Table

Path	V2	V1
ANT – RF1	0	0
ANT – RF2	1	0
ANT – RF3	0	1
ANT – RF4	1	1

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 specified rating.

Latch-Up Avoidance

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

Evaluation Kit

The SP4T switch EK Board was designed to ease customer evaluation of Peregrine's PE42641. The RF common port is connected through a 50 Ω transmission line via the top SMA connector, J1. RF1, RF2, RF3 and RF4 are connected through 50 Ω transmission lines via SMA connectors J3, J5, J2 and J4, respectively. A through 50 Ω transmission is available via SMA connectors J6 and J7. 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 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 0.044", trace gaps of 0.020", dielectric thickness of 0.028", metal thickness of 0.0021" and ε_r of 4.3.

Figure 4. Evaluation Board Layouts
Peregrine Specification 101/0287

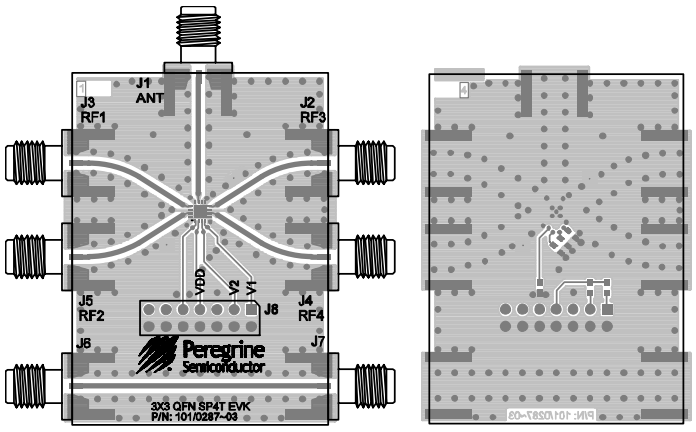


Figure 5. Evaluation Board Schematic
Peregrine Specification 102/0339

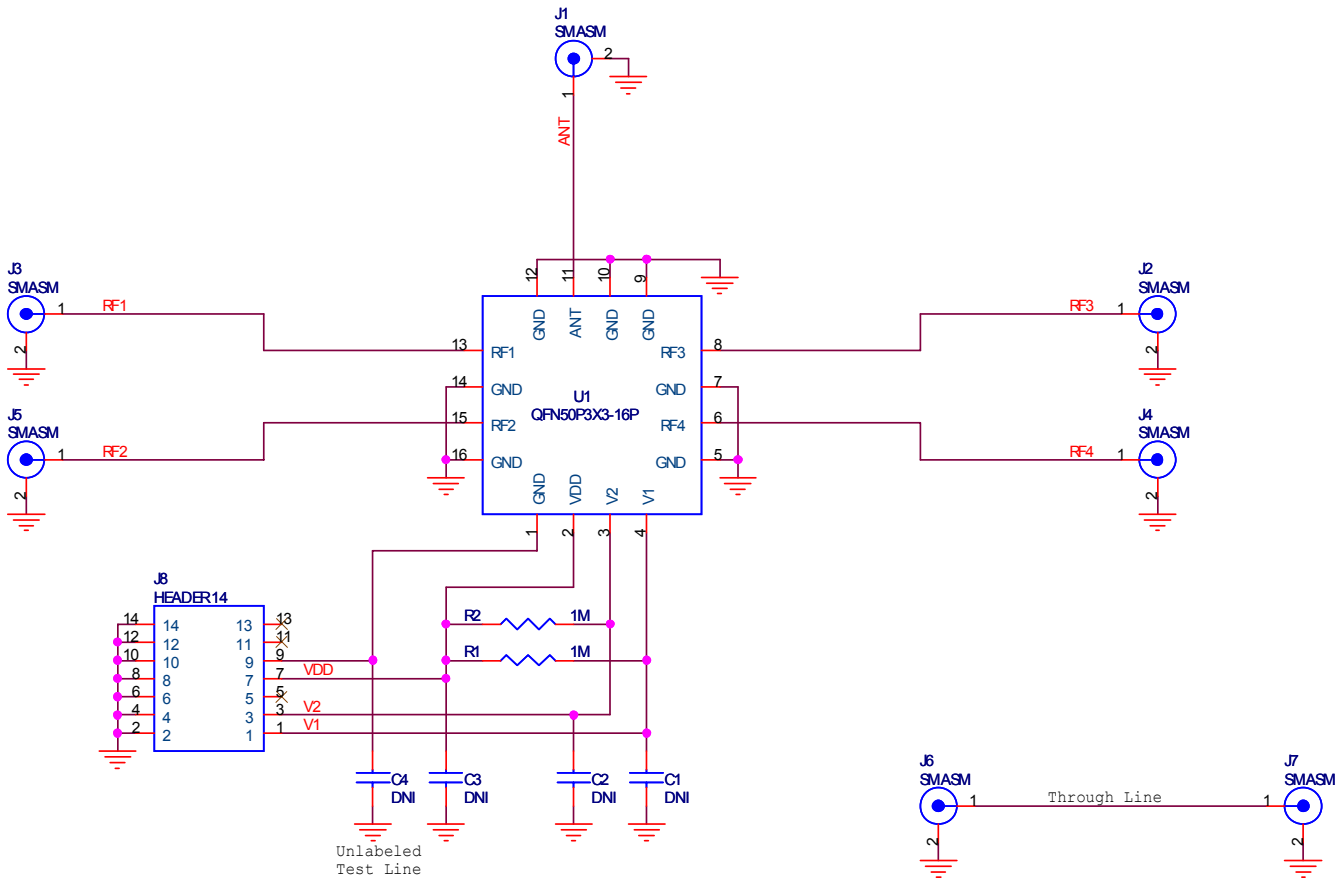


Figure 6. Insertion Loss: ANT-RF @ 25 °C

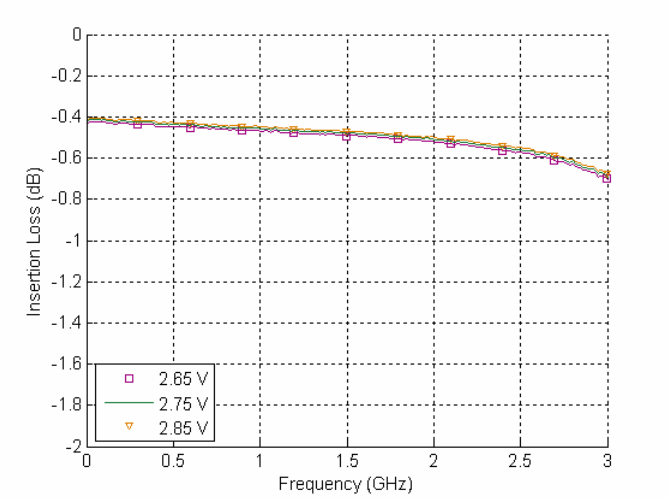


Figure 7. Insertion Loss: ANT-RF @ 2.75 V

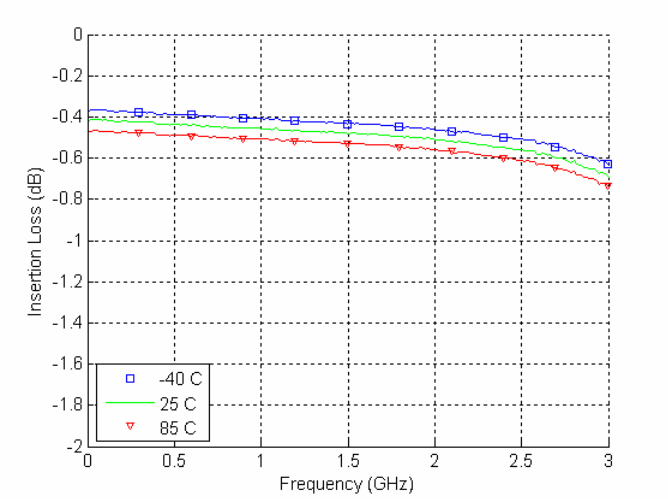


Figure 8. Isolation: ANT-RF @ 25 °C

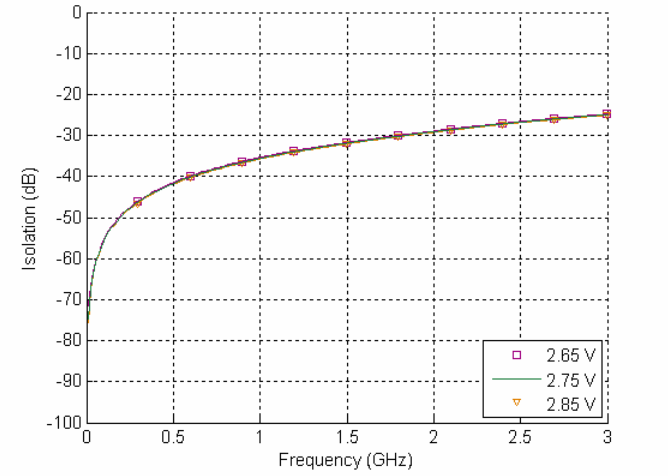


Figure 9. Isolation: ANT-RF @ 2.75 V

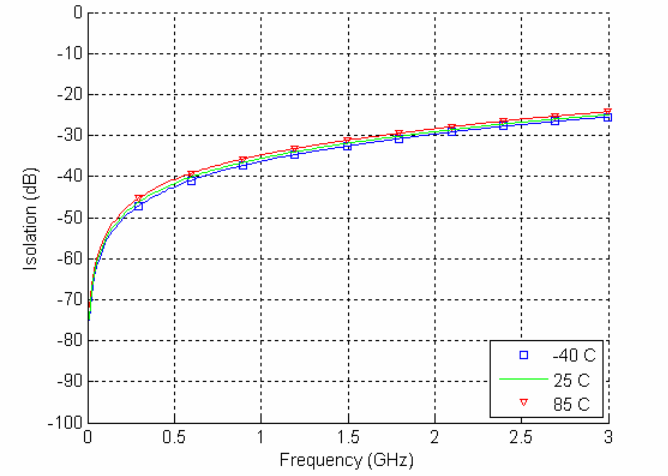


Figure 10. Return Loss at active port @ 25 °C

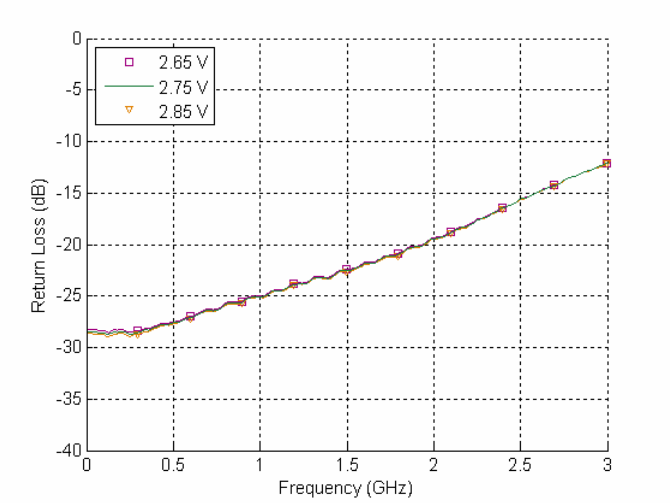


Figure 11. Return Loss at active port @ 2.75 V

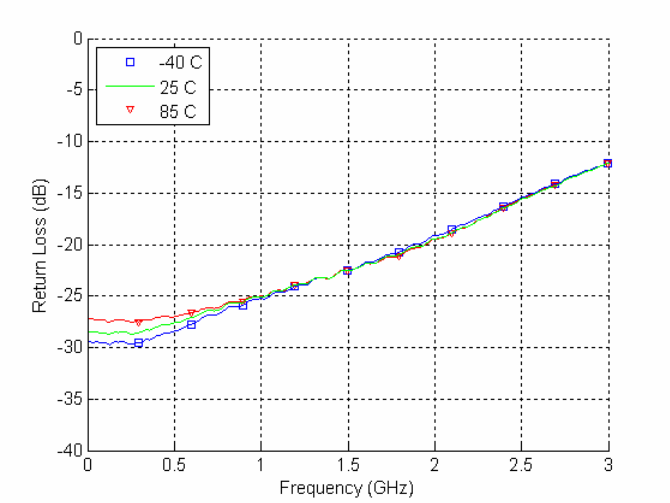
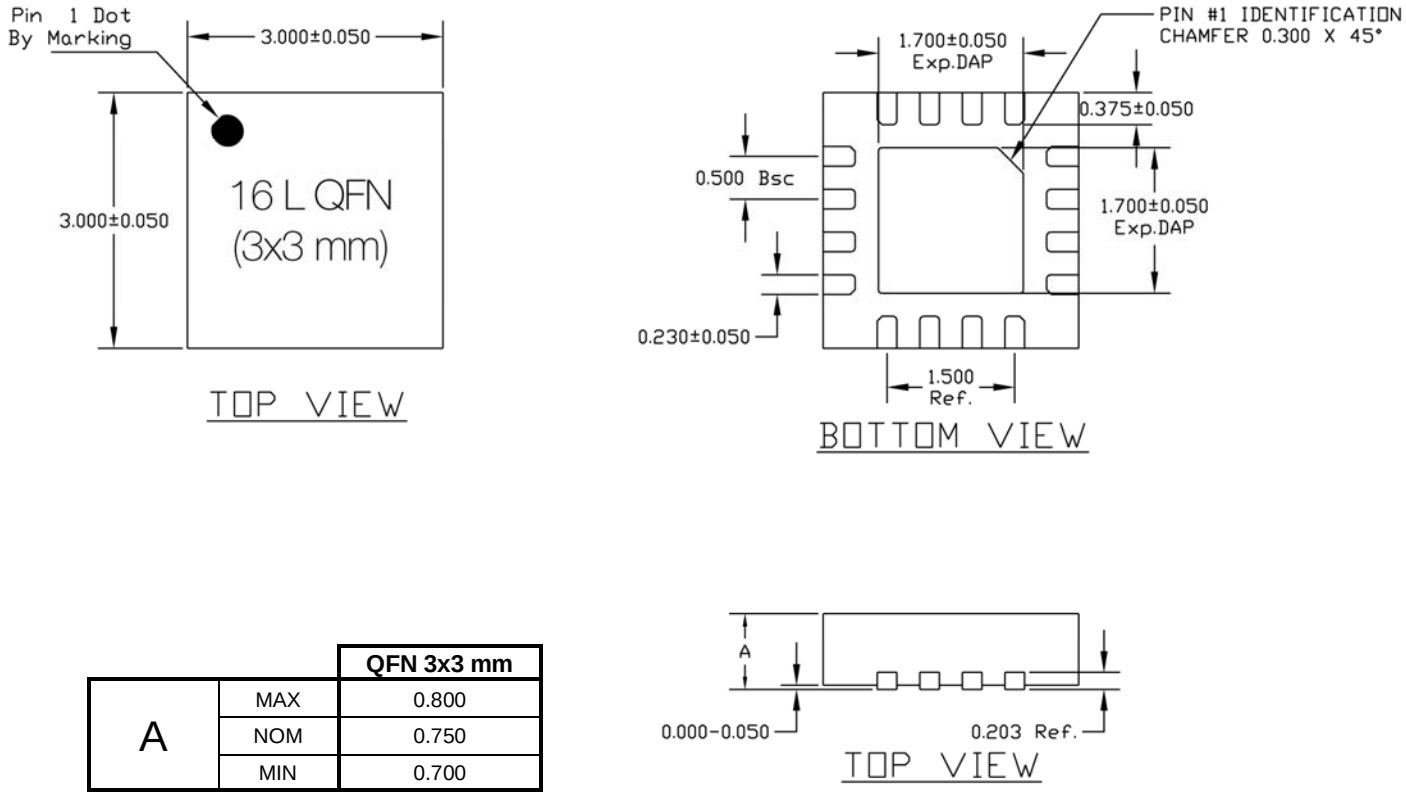


Figure 12. Package Drawing



		QFN 3x3 mm
A	MAX	0.800
	NOM	0.750
	MIN	0.700

Figure 13. Tape and Reel Specifications

16-lead 3x3 mm QFN

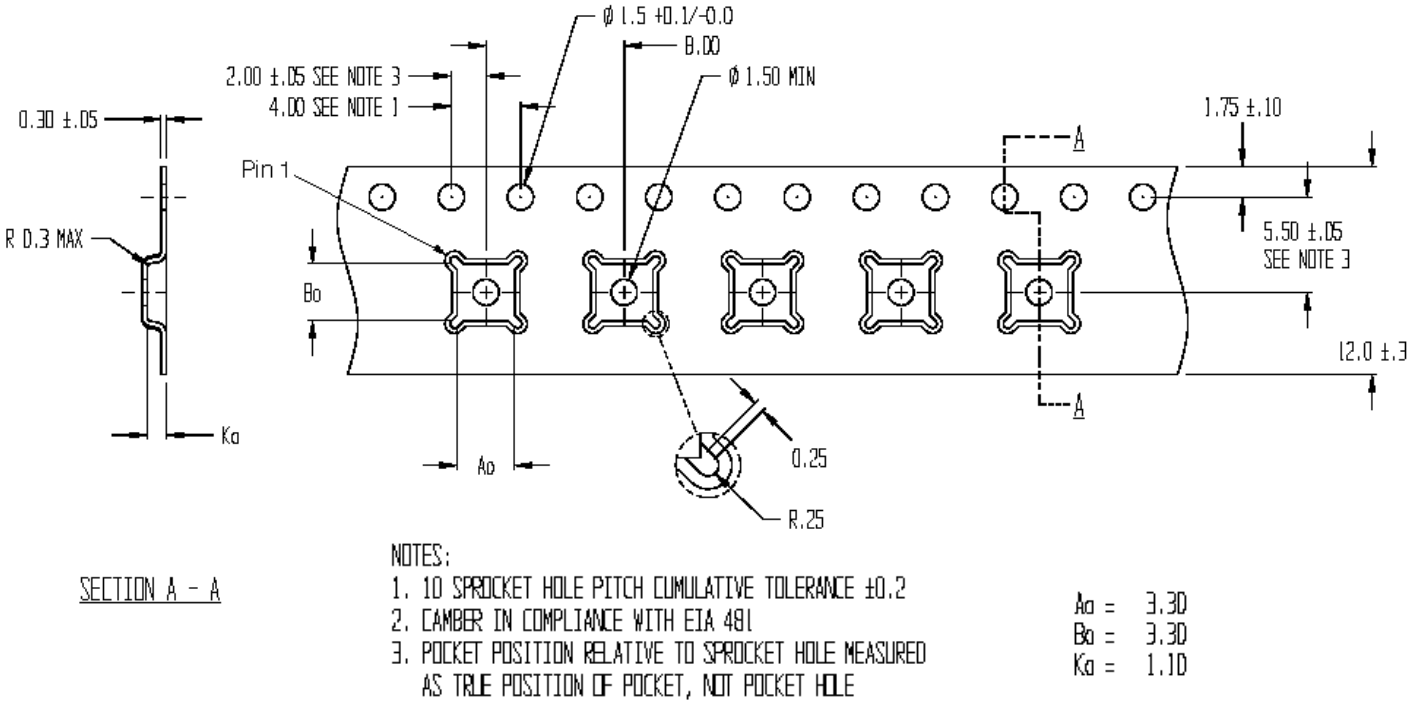


Table 7. Ordering Information

Order Code	Part Marking	Description	Package	Shipping Method
EK-42641-01	PE42641-EK	PE42641-16QFN 3x3mm-EK	Evaluation Kit	1 / Box
PE42641MLI	42641	PE42641G-16QFN 3x3mm-75A	Green 16-lead 3x3mm QFN	75 units / Tube
PE42641MLI-Z	42641	PE42641G-16QFN 3x3mm-3000C	Green 16-lead 3x3mm QFN	3000 units / T&R

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Data Sheet Identification

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