



# PE4140

### Ultra-High Linearity UltraCMOS™ Broadband Quad MOSFET Array

#### Features

- Ultimate Quad MOSFET array
- Ultra-high linearity, broadband performance beyond 6.0 GHz
- Ideal for mixer applications
- Up/down conversion
- Low conversion loss
- High LO Isolation
- Packaged in small 6-lead 3x3 mm DFN

### Product Description

The PE4140 is an ultra-high linearity passive broadband Quad MOSFET array with high dynamic range performance capable of operation beyond 6.0 GHz. This quad array operates with differential signals at all ports (RF, LO, IF), allowing mixers to be built that use LO powers from -7 dBm to +20 dBm. Typical applications range from frequency up/down-conversion to phase detection for Cellular/PCS Base Stations, Wireless Broadband Communications and STB/Cable modems.

The PE4140 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

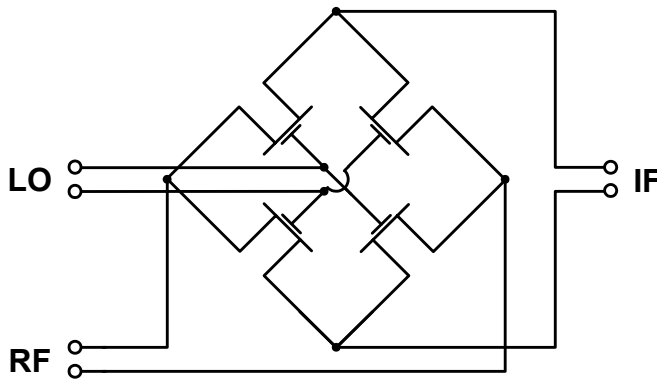


Figure 2. Package Type

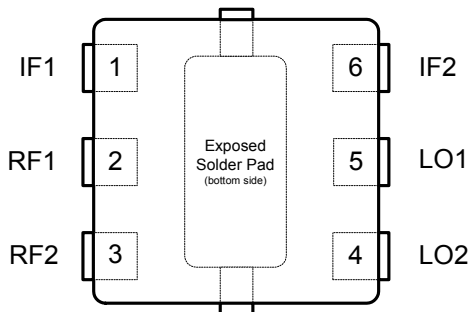
6-lead DFN



Table 1. AC and DC Electrical Specifications @ +25 °C

Symbol	Characteristics	Test Conditions	Min	Typ	Max	Units
F <sub>TYP</sub>	Operating Frequency Range <sup>1</sup>		DC		6.0	GHz
V <sub>DS</sub>	Drain-Source Voltage	V <sub>GS</sub> = +3V, I <sub>DS</sub> = 40 mA	260	320	380	mV
V <sub>DS Match</sub>	Drain-Source Voltage Match			12	40	mV
V <sub>T</sub>	Threshold Voltage	V <sub>DS</sub> = 0.1V; per ASTM F617-00		-100		mV
R <sub>DS</sub>	Drain-Source 'ON' Resistance	V <sub>GS</sub> = +3V, I <sub>DS</sub> = 40 mA	6.5	7.75	9.5	Ω

Note 1: Typical untested operating frequency range of Quad MOSFET transistors.

**Figure 3. Pin Configuration (Top View)**

**Table 2. Pin Descriptions**

Pin No.	Pin Name	Description
1	IF1	IF Output Connection (Drain)
2	RF1	RF Input Connection (Source)
3	RF2	RF Input Connection (Source)
4	LO2	LO Input Connection (Gate)
5	LO1	LO Input Connection (Gate)
6	IF2	IF Output Connection (Drain)

**Table 3. Absolute Maximum Ratings**

Symbol	Parameters/ Conditions	Min	Max	Units
$T_{ST}$	Storage temperature range	-65	150	°C
$T_{OP}$	Operating temperature range	-40	85	°C
$V_{DC+AC}$	Maximum DC plus peak AC voltage across Drain-Source		±3.3	V
$V_{DC+AC}$	Maximum DC plus peak AC voltage across Gate-Drain or Gate-Source		±4.2	V
$V_{ESD}$	ESD Sensitive Device		250	V

Absolute Maximum Ratings are those values listed in the above table. Exceeding these values may cause permanent device damage. Functional operation should be restricted to the limits in the DC Electrical Specifications table. Exposure to absolute maximum ratings for extended periods may affect device reliability.

### Electrostatic Discharge (ESD) Precautions

This MOSFET device has minimally protected inputs and is highly susceptible to ESD damage. When handling this UltraCMOS™ device, observe the same precautions that you would use with other ESD-sensitive devices.

### Latch-Up Avoidance

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

### Device Description

The PE4140 passive broadband Quad MOSFET array is designed for use in up-conversion and down-conversion applications for high performance systems such as cellular infrastructure equipment and STB/CATV systems.

The PE4140 is an ideal mixer core for a wide range of mixer products, including module level solutions that incorporate baluns or other single-ended matching structures enabling three-port operation.

The performance level of this passive mixer is made possible by the very high linearity afforded by Peregrine's UltraCMOS™ process.

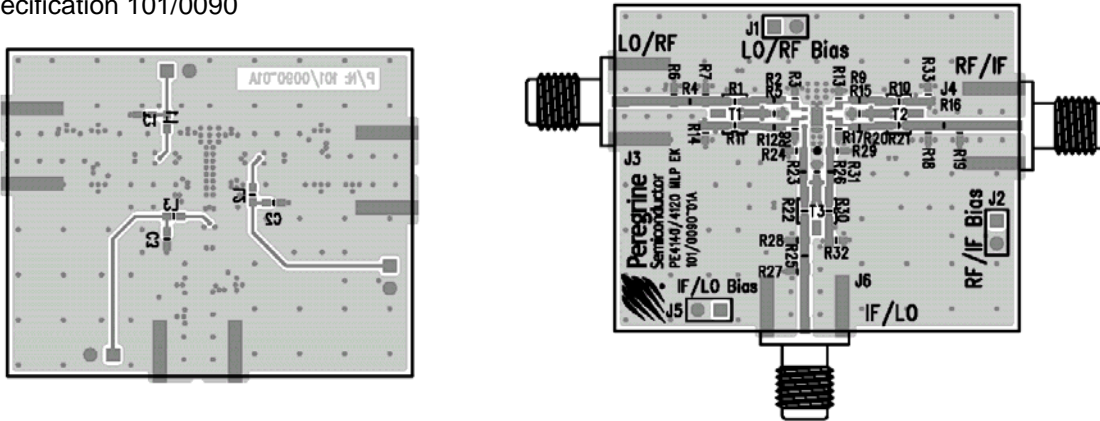
### Marking

Packaged devices are marked with part number "4140", date code and lot code.

**Evaluation Kit**

**Figure 4. Evaluation Board Layout**

Peregrine Specification 101/0090



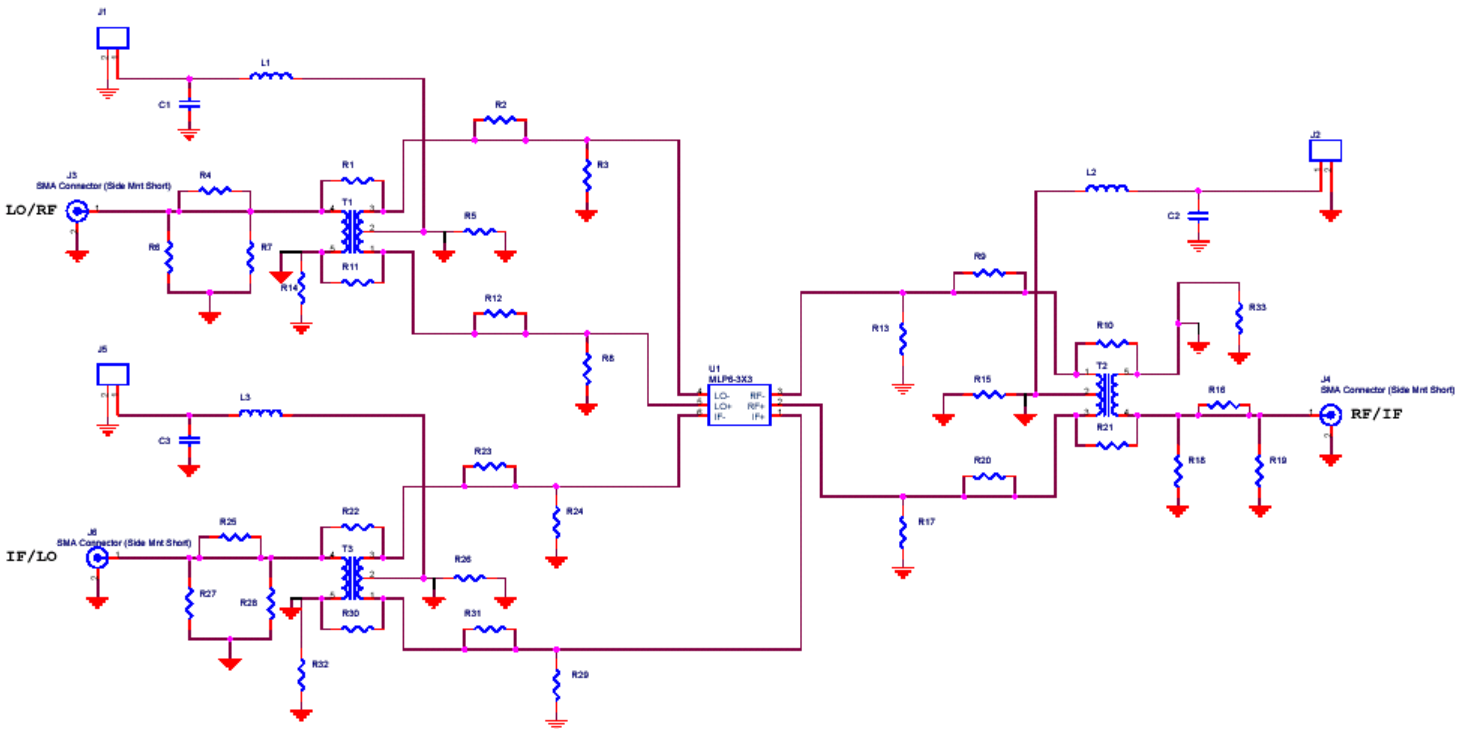
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E-Mail: [help@psemi.com](mailto:help@psemi.com) (fastest response)  
Phone: (858) 731-9400

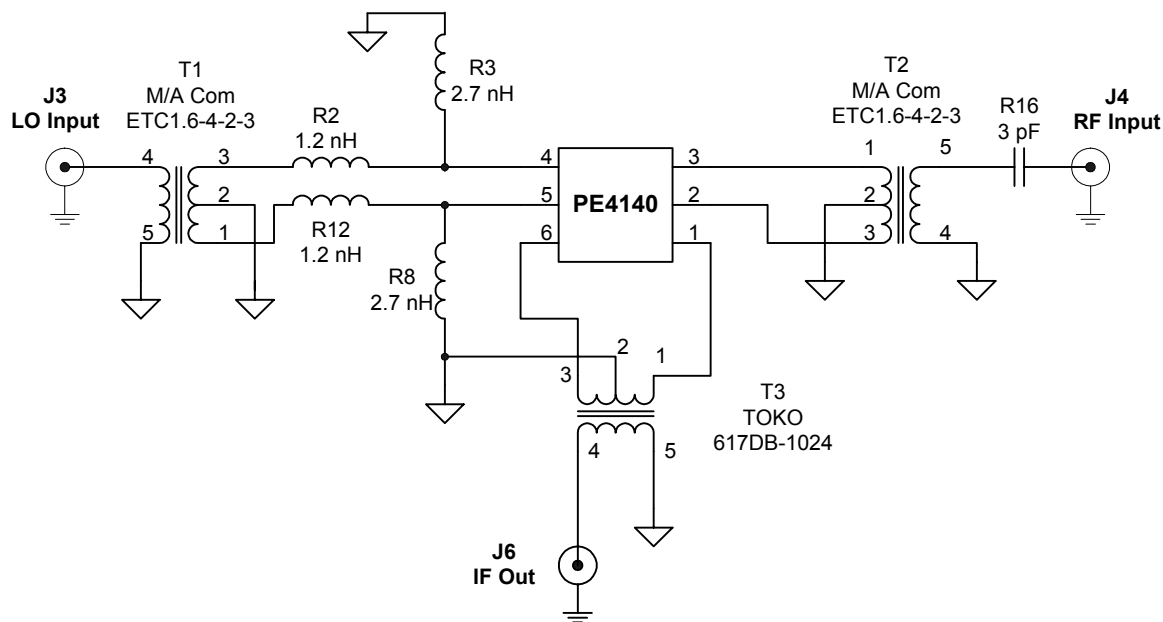
**Figure 5. Evaluation Board Schematic**

Peregrine Specification 102/0115



**Note:** This is the complete evaluation board schematic; which can be used for multiple configurations. Not all components need be populated. Refer to 'typical schematics' on following pages.

**Figure 6. Typical Schematic for a PCS Application**



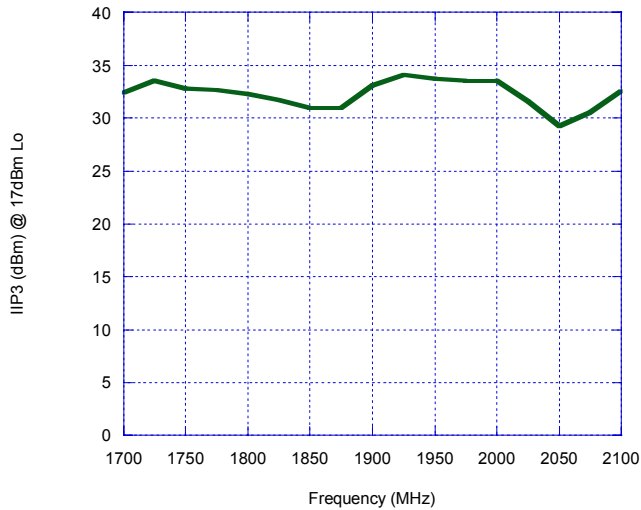
**Table 4. Typical Performance in a PCS Application @ +25 °C**

Parameter	Minimum	Typical	Maximum	Units
Frequency Range**				
LO	1630	--	2130	MHz
RF	1700	--	2200	MHz
IF		70		MHz
Conversion Loss** (Includes balun losses)		8.5		dB
Isolation**				
LO-RF		36		dB
LO-IF		26		dB
Input IP3**		32		dBm
Input 1 dB Compression**		22		dBm

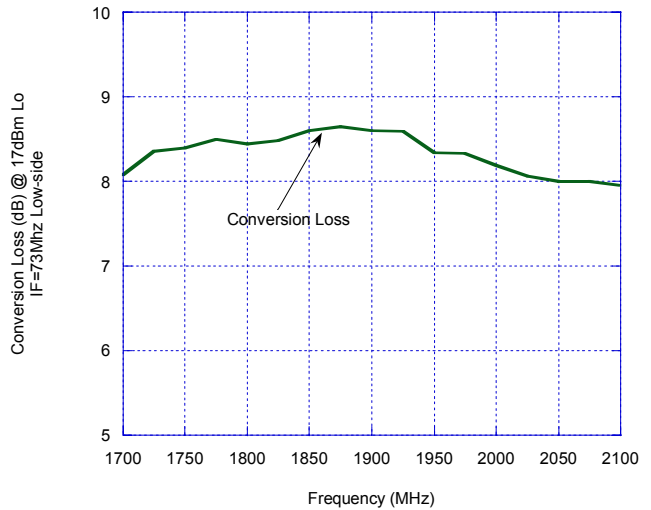
\*\* Data taken on an Evaluation Board narrow-band tuned to cover the PCS band, IF = 73MHz low-side, LO drive = 17dBm.

**Typical Performance Plots in a PCS Application @ +25 °C (LO=17 dBm, IF=73 MHz Low-side)**

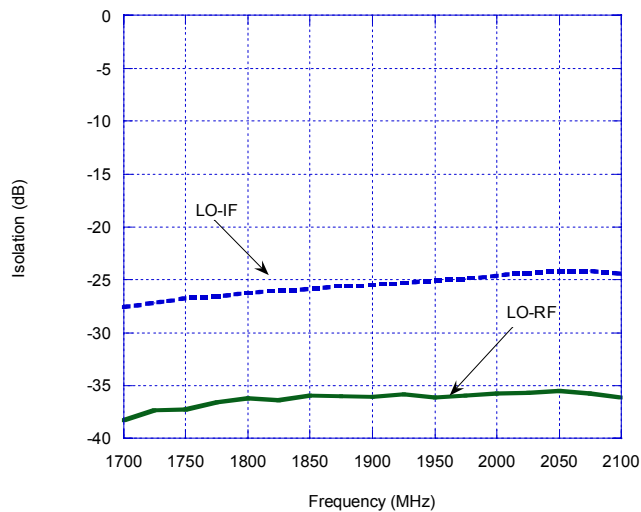
**Figure 7. IIP3 vs. Frequency**



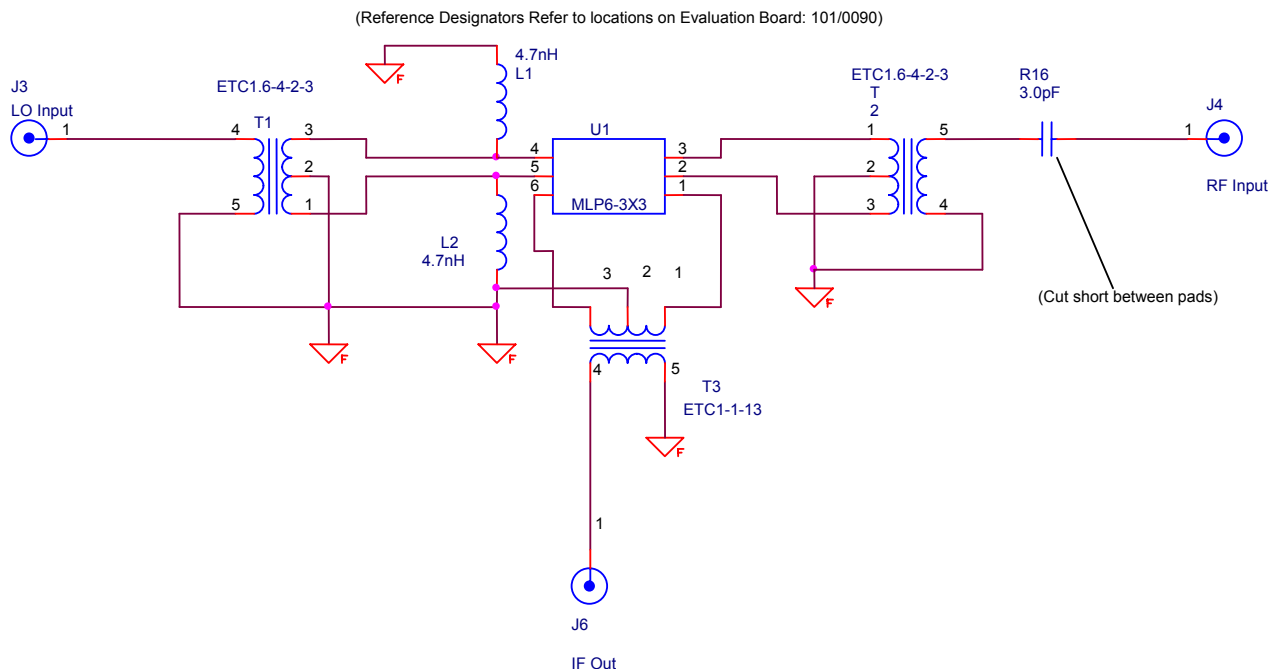
**Figure 8. Conversion Loss vs. Frequency**



**Figure 9. LO-RF & LO-IF Isolation**



**Figure 10. Typical Schematic for a CATV Application**



Note: L1 and L2 provide LO port matching for optimum performance. Typical gate capacitance is approximately 2.5 pF.

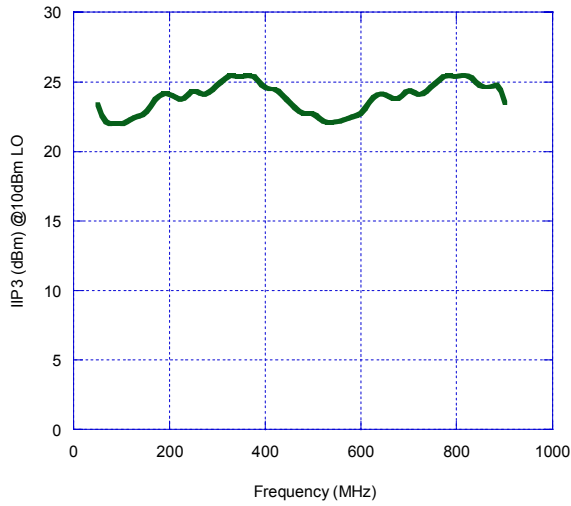
**Table 5. Typical Performance in a CATV Application @ +25 °C**

Parameter	Minimum	Typical	Maximum	Units
Frequency Range**				
LO	1116	--	1926	MHz
RF	54	--	864	MHz
IF		1062		MHz
Conversion Loss** (Includes balun losses)		6.5		dB
Isolation**				
LO-RF		40		dB
LO-IF		28		dB
Input IP3**		23		dBm
Input 1 dB Compression**		13		dBm

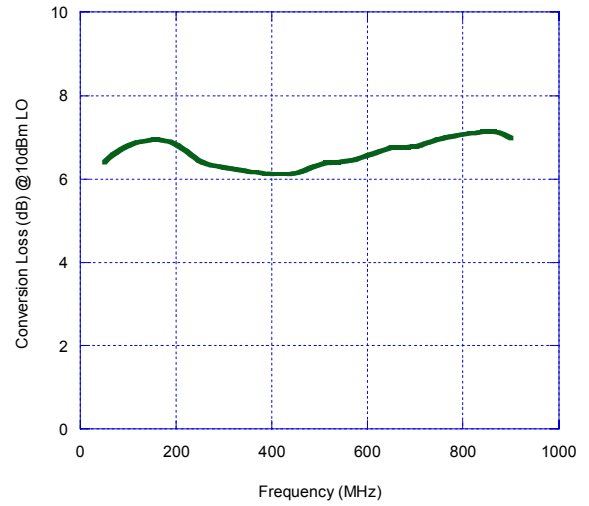
\*\* Data taken on an Evaluation Board tuned for a broadband CATV application, IF = 1062 MHz, RF drive = -5 dBm, LO drive = 10 dBm.

**Typical Performance Plots in a CATV Application @ +25 °C**

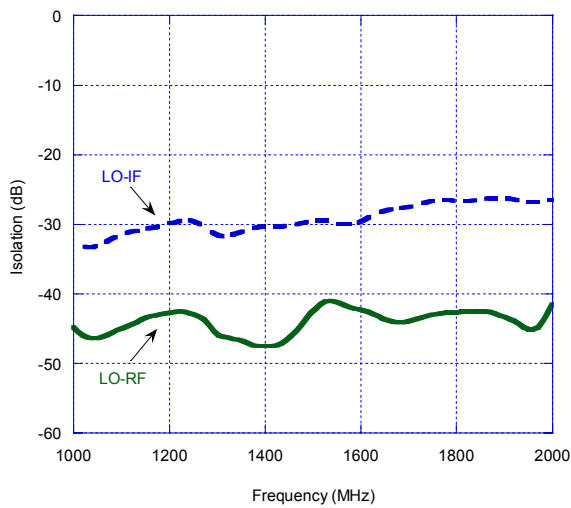
**Figure 11. IIP3 vs. Frequency**



**Figure 12. Conversion Loss vs. Frequency**

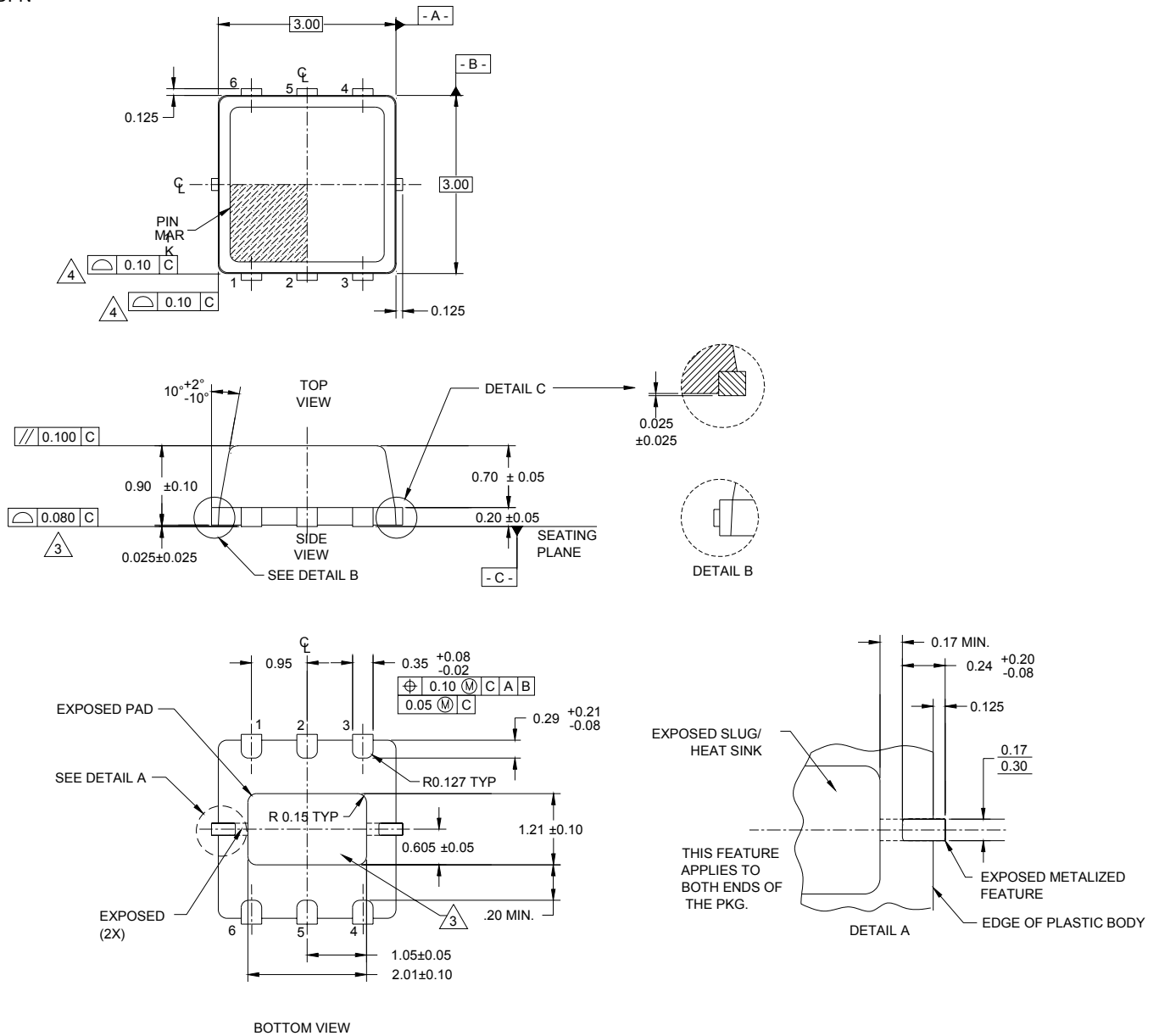


**Figure 13. LO-RF & LO-IF Isolation**



**Figure 14. Package Drawing**

6-lead DFN

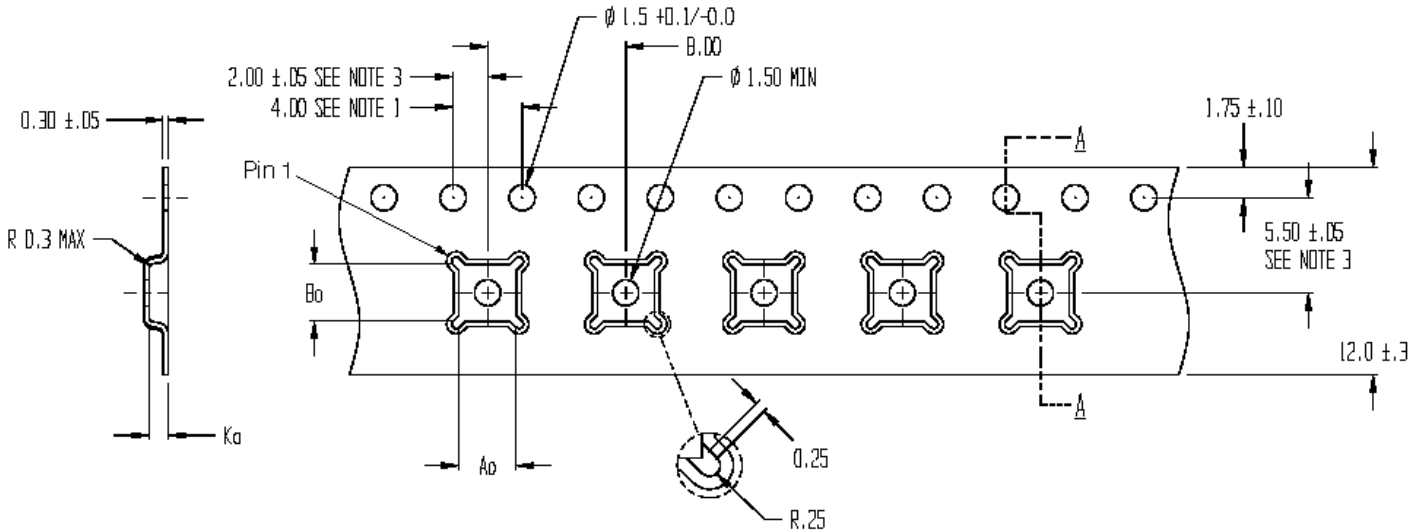


1. DIMENSIONS AND TOLERANCES ARE PER ANSI Y14.5
2. DIMENSIONS ARE IN MILLIMETERS, ANGLES ARE IN DEGREES.
3. COPLANARITY APPLIES TO EXPOSED HEAT SLUG AS WELL AS THE TERMINALS.
4. PROFILE TOLERANCE APPLIES TO PLASTIC BODY ONLY.



**Figure 15. Tape and Reel Specifications**

6-lead DFN



SECTION A - A

NOTES:

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

A<sub>0</sub> = 3.30  
B<sub>0</sub> = 3.30  
K<sub>0</sub> = 1.10

**Table 6. Dimensions**

Dimension	DFN 3x3 mm
A <sub>0</sub>	3.23 ± 0.1
B <sub>0</sub>	3.17 ± 0.1
K <sub>0</sub>	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

**Table 7. Ordering Information**

Order Code	Part Marking	Description	Package	Shipping Method
4140-01	4140	PE4140-06DFN 3x3mm-12800F	6-lead 3x3 mm DFN	12800 units / Canister
4140-02	4140	PE4140-06DFN 3x3mm-3000C	6-lead 3x3 mm DFN	3000 units / T&R
4140-00	PE4140-EK	PE4140-06DFN 3x3mm-EK	Evaluation Kit	1 / Box
4140-51	4140	PE4140G-06DFN 3x3mm-12800F	Green 6-lead 3x3 mm DFN	12800 units / Canister
4140-52	4140	PE4140G-06DFN 3x3mm-3000C	Green 6-lead 3x3 mm DFN	3000 units / T&R

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