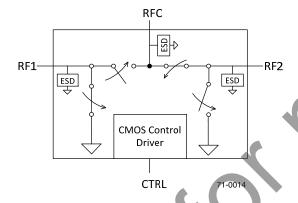


Product Description

The following specification defines an SPDT (single pole double throw) switch for use in cellular and other wireless applications. The PE42510A uses Peregrine's UltraCMOS® process and it also features HaRP™ technology enhancements to deliver high linearity and exceptional harmonics performance. HaRP™ technology is an innovative feature of the UltraCMOS® process providing upgraded linearity performance.

The PE42510A 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



Product Specification

PE42510A

SPDT High Power UltraCMOS® Reflective RF Switch 30 - 2000 MHz

Features

- No blocking capacitors required
- 50 Watt P1dB compression point
- 10 Watts <8:1 VSWR (Normal Operation)
- 29 dB Isolation @ 800 MHz
- <0.3 dB Insertion Loss at 800 MHz
- 2f₀ and 3f₀ < -84 dBc @ 42.5 dBm
- ESD rugged to 2.0 kV HBM
- 32-lead 5x5x0.85 mm QFN package

Figure 2. Package Type 32-lead 5x5x0.85 mm



Table 1. Electrical Specifications @ 25°C, V_{DD} = 3.3V (Z_{S} = Z_{L} = 50 Ω) unless otherwise noted

Parameter	Conditions	Min	Тур	Max	Units
RF Insertion Loss	30 MHz ≤ 1 GHz 1 GHz < 2 GHz		0.4 0.5	0.6 0.7	dB dB
0.1 dB Input Compression Point	800 MHz, 50% duty cycle		45.4		dBm
Isolation (Supply Biased): RF to RFC	800 MHz	25	29		dB
Unbiased Isolation: RF - RFC, V _{DD} , V1=0V	27 dBm, 800 MHz	5			dB
RF (Active Port) Return Loss		15	22		dB
2nd Harmonic 3rd Harmonic	800 MHz @ +42.5 dBm		-84	-81	dBc
Switching Time ^{2,3}	50% of CTRL to 10/90% of RF		25	31	μs

Notes: 1. The device was matched with 1.6 nH inductance per RF port

^{2.} For high power applications, harmonics settling needs to be accounted for. Harmonics settling time is defined to be 50% of CTRL to 2fo/3fo within 3 dB of final value

^{3.} For RF input power (50 Ω) \geq 31 dBm, and operation above 30 MHz, the switching time and harmonics settling time is 100 μ s Max



Figure 3. Pin Configuration (Top View)

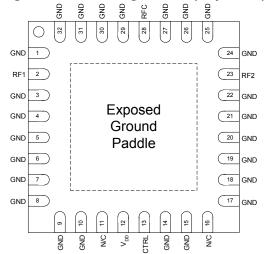


Table 2. Pin Descriptions

Table 2.1 III Descriptions						
Pin No.	Pin Name	Description				
1	GND	Ground				
2	RF1	RF1 port				
3	GND	Ground				
4	GND	Ground				
5	GND	Ground				
6	GND	Ground				
7	GND	Ground				
8	GND	Ground				
9	GND	Ground				
10	GND	Ground				
11	N/C	No Connect				
12	V_{DD}	Nominal 3.3 V supply connection				
13	CTRL	Control				
14	GND	Ground				
15	GND	Ground				
16	N/C	Do Not Connect				
17	GND	Ground				
18	GND	Ground				
19	GND 🗼	Ground				
20	GND	Ground				
21	GND	Ground				
22	GND	Ground				
23	RF2	RF2 port.				
24	GND	Ground				
25	GND	Ground				
26	GND	Ground				
27	GND	Ground				
28	RFC	Common RF port for switch				
29	GND	Ground				
30	GND	Ground				
31	GND	Ground				
32	GND	Ground				
paddle	GND	Exposed ground paddle				

Moisture Sensitivity Level

The Moisture Sensitivity Level rating for the 5x5x0.85 mm QFN package is MSL3.

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Table 3. Operating Ranges

Parameter	Min	Тур	Max	Units
Frequency Range	30		2000	MHz
RF Input Power¹ (VSWR ≤8:1)			40	dBm
RF Input Power ² (VSWR ≤8:1)			27	dBm
V _{DD} Power Supply Voltage	3.2	3.3	3.4	V
I _{DD} Power Supply Current		90	170	μΑ
Control Voltage High	1.4			٧
Control Voltage Low			0.4	٧
Operating Temperature Range (Case)	-40		85	ů
T _j Operating Junction Temperature		1	140	ů

Notes: 1. Supply biased 2. Supply unbiased

Table 4. Absolute Maximum Ratings

	Symbol	Parameter/Conditions	Min	Max	Units
	V_{DD}	Power Supply Voltage	-0.3	4	V
	VI	Voltage on Any DC Input	-0.3	V _{DD} + 0.3	V
	T _{ST}	Storage Temperature Range	-65	150	°C
	T _{CASE}	Maximum Case Temperature		85	°C
	T	Peak Maximum Junction Temperature (10 seconds max)		200	°C
		RF Input Power (VSWR 20:1, 10 seconds)		40	dBm
	P_{IN}	RF Input Power (50 Ω)		45	dBm
		RF Input Power, Unbiased (VSWR 20:1)		27	dBm
	P _D	Maximum Power Dissipation Due to RF Insertion Loss		2.2	W
	V_{ESD}	ESD Voltage (HBM, MIL_STD 883 Method 3015.7)		2000	V

Absolute Maximum Ratings

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.

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.

Table 5. Control Logic Truth Table

Path	CTRL	
RFC – RF1	Н	
RFC – RF2	L	

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UltraCMOS® RFIC Solutions



Evaluation Kit

The PE42510A Evaluation Kit board was designed to ease customer evaluation of the PE42510A RF switch.

DC power is supplied through J10, with V_{DD} on pin 9, and GND on the entire lower row of even numbered pins. To evaluate a switch path, add or remove jumpers on CTRL/V1 (pin 3) using *Table 5* (adding a jumper pulls the CMOS control pin low and removing it allows the on-board pull-up resistor to set the CMOS control pin high). J10 pins 1, 11, and 13 are N/C.

The RF common port (RFC) is connected through a 50Ω transmission line via the top SMA connector, J1. RF1 and RF2 paths are also connected through $50~\Omega$ transmission lines via SMA connectors. A $50~\Omega$ through transmission line is available via SMA connectors J8 and J9. This transmission line can be used to estimate the loss of the PCB over the environmental conditions being evaluated. An openended $50~\Omega$ transmission line is also provided at J7 for calibration if needed.

Figure 4. Evaluation Board Layouts

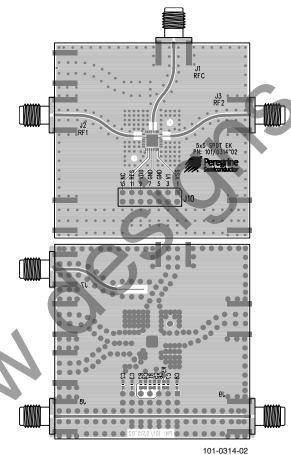
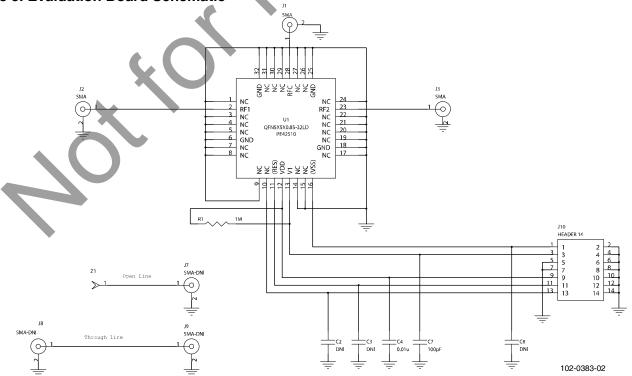


Figure 5. Evaluation Board Schematic



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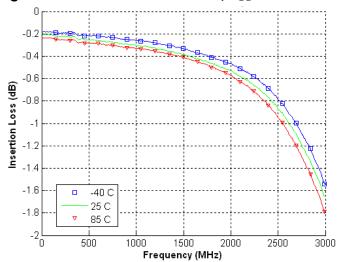


Figure 9. RFC-RF Isolation, +25°C

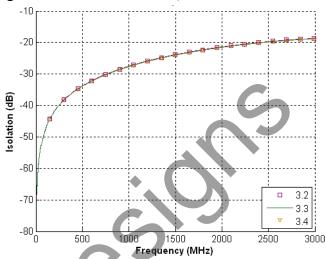


Figure 7. RF-RFC Insertion Loss, +25°C

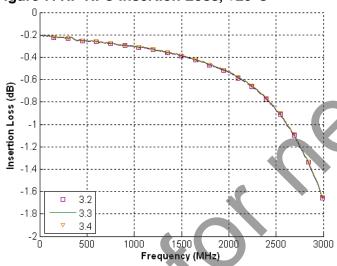


Figure 10. RF Return Loss, $V_{DD} = 3.3V$

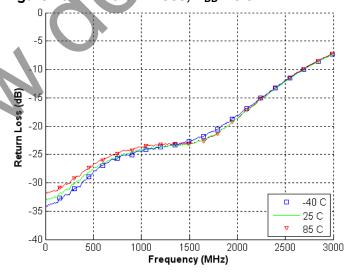


Figure 8. RFC-RF Isolation, V_{DD} = 3.3V

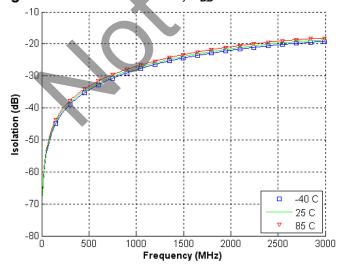
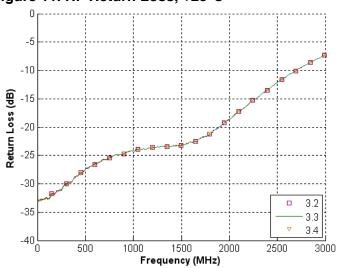


Figure 11. RF Return Loss, +25°C



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Thermal Data

Though the insertion loss for this part is very low, when handling high power RF signals, the part can get quite hot.

Figure 12 shows the estimated power dissipation for a given incident RF power level. Multiple curves are presented to show the effect of poor VSWR conditions. VSWR conditions that present short circuit loads to the part can cause significantly more power dissipation than with proper matching.

Figure 13 shows the estimated maximum junction temperature of the part for similar conditions.

Note that both of these charts assume that the case (GND slug) temperature is held at 85°C. Special consideration needs to be made in the design of the PCB to properly dissipate the heat away from the part and maintain the 85°C maximum case temperature. It is recommended to use best design practices for high power QFN packages: multi-layer PCBs with thermal vias in a thermal pad soldered to the slug of the package. Special care also needs to be made to alleviate solder voiding under the part.

Table 6. Theta JC

Parameter	Min	Тур	Max	Units
Theta JC (+85°C)		24.0		C/W

Figure 12. Power Dissipation

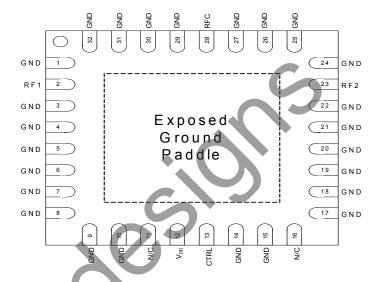
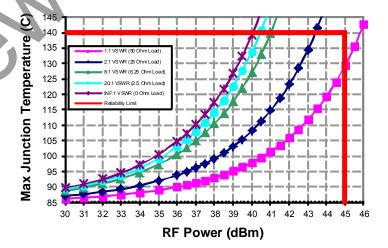


Figure 13. Maximum Junction Temperature

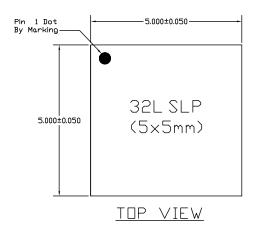


Note: Case temperature = 85°C

19-0146



Figure 14. Package Drawing



		SLP
	MAX.	0.900
ΙΑ	N□M.	0.850
	MIN.	0.800

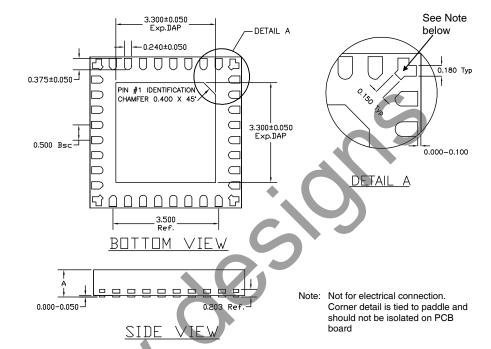


Figure 14. Top Marking Specification

42510A YYWW ZZZZZZ = Pin 1 designator

I2510A = Six digit part number

YYWW = Date Code, last two digits of the year and work week

ZZZZZZ = Six digits of the lot number



Figure 15. Tape and Reel Specs

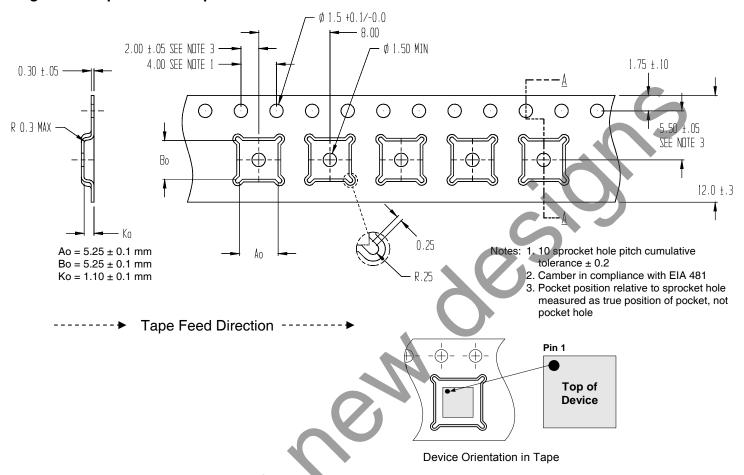


Table 7. Ordering Information

Order Code	Description	Package	Shipping Method
PE42510AMLI	Parts in Tubes or Cut Tape	Green 32-lead 5x5mm QFN	73 units/Tube
PE42510AMLI-X	Parts on Tape and Reel	Green 32-lead 5x5mm QFN	500 units/T&R
EK42510-01	Evaluation Kit	Evaluation Kit	1/Box

Sales Contact and Information

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

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