



Peregrine
Semiconductor

2012
Product Selection Guide
Second Edition

www.datasheetdirectory.com

Changing RF Design. **Forever.**TM



Welcome to Peregrine Semiconductor



Peregrine Semiconductor is a fabless provider of high-performance radio-frequency (RF) integrated circuits (ICs).

Our solutions leverage our proprietary UltraCMOS® technology, which enables the design, manufacture, and integration of multiple RF, mixed-signal, and digital functions on a single chip. Our products deliver what we believe is an industry leading combination of performance and monolithic integration, and target a broad range of applications in the aerospace and defense, broadband, industrial, mobile wireless device, test and measurement equipment, and wireless infrastructure markets.

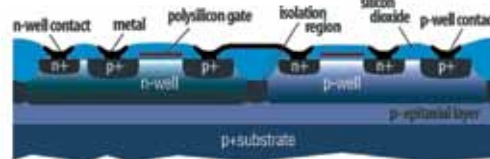
We leverage our extensive RF design expertise and systems knowledge to develop RFIC solutions that address the stringent performance, integration, and reliability requirements of these rapidly evolving wireless markets. Additionally, because UltraCMOS devices are fabricated in standard high-volume CMOS facilities, products benefit from the fundamental reliability, cost effectiveness, high yields, scalability and integration of CMOS, while achieving the high performance levels historically expected from SiGe and GaAs. It is this combination of attributes which enables ease-of-development essential to timely and cost-effective application design by our customers.

Peregrine's portfolio of high-performance RFICs includes switches, digital attenuators, frequency synthesizers, mixers/upconverters, prescalers, digitally tunable capacitors (DTCs) and DC-DC converter products with power amplifiers on the horizon. Our products are sold through our direct sales and field applications engineering team and through our network of independent sales representatives and distribution partners around the world.

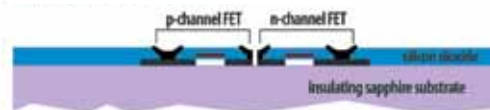
UltraCMOS® RF Process Technology

UltraCMOS technology combines the fundamental benefits of standard CMOS, the most widely used semiconductor process technology, with a synthetic sapphire substrate that enables significant improvements in performance for RF applications. We own fundamental intellectual property in UltraCMOS technology consisting of numerous U.S. and international patents and trade secrets covering manufacturing processes, basic circuit elements, RF circuit designs, and design know-how. We also have engineered design advancements, including our patented HaRP™ technology which significantly improves harmonic and linearity performance, and our patent-pending DuNE™ technology, a circuit design technique that we have used to develop our advanced digitally tunable capacitor (DTC) products.

Bulk Silicon CMOS Process



UltraCMOS® Process



The UltraCMOS process, with its insulating sapphire substrate, simple and improved power handling, isolation and ESD tolerance.

Quality and Reliability

We are committed to providing high quality products and services that meet or exceed our customers' expectations. We have developed and implemented a quality management system to create an organizational environment designed to meet the highest level of quality and reliability standards. Our quality management system has been certified and maintained to ISO 9001 standards since 2001. We achieved AS9100 Quality Management System Standards certification in 2003 to address the strict quality system requirements of the aerospace industry. In early 2012, we further improved the robustness of our quality management system by receiving our ISO/TS 16949:2009 Quality Management System certification by the automotive industry.

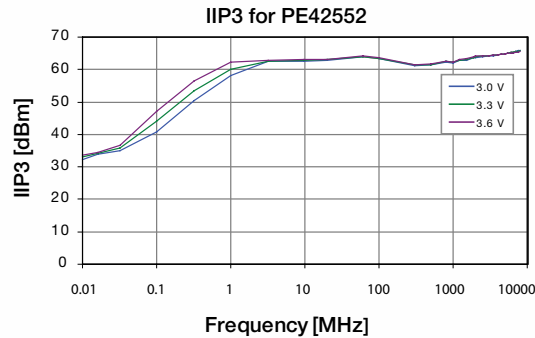


ESD

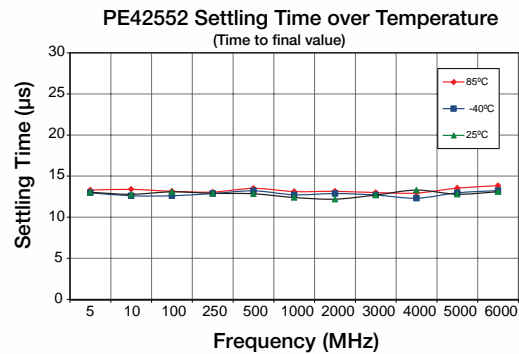
UltraCMOS® RFICs deliver extraordinary
ESD tolerance – up to 4.5kV HBM

The Innovative HaRP™ Technology Invention

Peregrine's HaRP™ technology enhancements significantly improve harmonic and linearity performance in the RF front-end. Because UltraCMOS® technology is composed of a stack of field effect transistors manufactured on an insulating sapphire substrate, it has an inherent ability to pass high power RF signals. The HaRP invention allows for highly linear FETs which, when stacked together, deliver RF performance. In demanding applications such as RF test equipment, HaRP-enhanced ATE switches settle very quickly, reducing gate lag and insertion loss drift while maintaining high linearity and isolation over an extended frequency range. In high-power applications, HaRP-enhanced devices meet critical harmonics specifications with improved power handling. In addition, the HaRP-enabled high-throw, high-power switches for quad-band GSM and GSM/WCDMA handset applications have delivered a long-awaited breakthrough in Intermodulation Distortion (IMD) handling, a specification required by the 3GPP standards body for GSM/WCDMA applications.



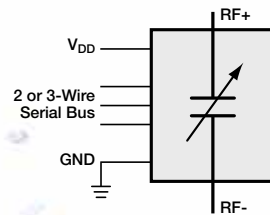
HaRP™ technology provides excellent linearity up to 7.5 GHz



With tight specs over process and temperature, UltraCMOS® will change the way you design.

DuNE™ Digital Tuning Technology

By applying proven, patented UltraCMOS process and HaRP switch technologies, engineers at Peregrine developed DuNE™ tuning technology, a new circuit design technology used to develop Digitally Tunable Capacitors (DTCs). Supporting a wide range of tuning applications—from tuning the center frequency of mobile-TV and cellular antennas to tunable impedance matching and filters—DuNE-enhanced products offer power handling, performance and size advantages.



The DuNE™ DTC is a highly linear tuning solution with accurate capacitance, offering a 2-wire (I²C) or 3-wire (SPI) serial interface in a rugged, monolithic device.

Changing RF Design. Forever.™



Wireless and Broadband RF Products

RF Switches - 50 Ω

Product Description	Part Number	Operating Frequency (MHz)	IIP3 (dBm @ 2 GHz)	P1dB ¹ (dBm @ 2 GHz)	Insertion Loss (dB @ 1 GHz)	Isolation (dB @ 1 GHz)	Typical Idd (μA @ 3 V)	Vdd Range (V)	ESD HBM (V)	Package
SPST, Absorptive	PE4246	1-5000	53	33	0.80	55	33	2.7-3.3	200	6L 3x3 DFN
SPDT, Absorptive	PE4251	10-3000	59	30.5	0.60	62	55	3.0-3.6 ⁴	4000	8L MSOP (exposed)
SPDT, Absorptive	PE4257	5-3000	55	31 ³	0.75	64	8	2.7-3.3	1000	20L 4x4 QFN
SPDT, Absorptive	PE42552	9 kHz-7.5 GHz	65 @ 7.5 GHz	34.5 @ 7.5 GHz	0.65 @ 3 GHz	47	15 @ 3.3 V	3.0-3.6	1000	16L 3x3 QFN
SPDT, Absorptive	PE42556	9 kHz-13.5 GHz	56 @ 13.5 GHz	33 @ 13.5 GHz	0.92 @ 3 GHz	46	21.5 @ 3.3 V	3.0-3.6	4000	Flip Chip
SPDT, Reflective	PE4210	10-3000	34	15	0.30	36	0.25	2.7-3.3	200	8L MSOP
SPDT, Reflective	PE4230	10-3000	55	32	0.35	39	29	2.7-3.3	250	8L MSOP
SPDT, Reflective	PE4237	10-4000	55	32	0.35	43	29	2.7-3.3	250	6L 3x3 DFN
SPDT, Reflective	PE4239	10-3000 ²	45	27	0.70	32	0.25	2.7-3.3	1500	6L SC70
SPDT, Reflective	PE4242	10-3000	45	27	0.70	32	0.25	2.7-3.3	1500	6L SC70
SPDT, Reflective	PE4244	10-3000 ²	45	26	0.60	39	0.25	2.7-3.3	1500	8L MSOP
SPDT, Reflective	PE4245	10-4000 ²	45	27	0.60	42	0.25	2.7-3.3	1500	6L 3x3 DFN
SPDT, Reflective	PE4250	10-3000	59	30.5	0.65	51	55	3.0-3.6 ⁴	4000	8L MSOP
SPDT, Reflective	PE4259 ¹	10-3000 ²	55	33.5 ³	0.35	30	9	1.8-3.3	2000	6L SC70
NEW SPDT, Reflective	PE42421	10-3000	55 @ 1 GHz	30.5	0.35	30	9	1.8-3.3	2000	6L SC70
SPDT, Reflective	PE42510A	30-2000	Note 6	Note 7	0.4	29	90 @ 3.3 V	3.2-3.4	2000	32L 5x5 QFN
SPDT, Reflective	PE42551	9 kHz-6 GHz	50 @ 6 GHz	34 @ 6 GHz	0.65	29 @ 3 GHz	20 @ 2.75 V	2.5-3.0	500	20L 4x4 QFN
SPDT, Reflective	PE4283	10-4000	57	32	0.65	33.5	8	2.0-3.3	1500	6L SC70
NEW SP3T, Reflective	PE42430	100-3000	66	30	0.45	40	130	3.0-5.5	4500	8L 1.5x1.5 DFN
SP3T, Reflective	PE42650A	30-1000	Note 6	Note 7	0.3	38	90	3.2-3.4	2000	32L 5x5 QFN
SP4T, Reflective	PE42440	50-3000	67	41.5	0.45	34	13	2.65-3.0	2000	16L 3x3 QFN
NEW SP4T, Absorptive	PE42540	10 Hz-8.0 GHz	58 @ 8 GHz	33 @ 8 GHz	0.8 @ 3 GHz	45 @ 3 GHz	90 @ 3.3 V	3.0-3.55	1000	32L 5x5 QFN
SP5T, Absorptive	PE42451	450-4000	58	35	1.65	62	14	2.7-3.3	3500	24L 4x4 QFN
SP6T, Reflective	PE4268	100-3000	40	20	0.60	50	13	2.4-2.8	1500	20L 4x4 QFN
NEW SP8T, Reflective	PE42480	150-4000	69	38	0.70	40	140 @ 3.3 V	2.7-5.5	2000	24L 4x4 LTCC

Note 1: Power handling varies over frequency. See datasheet

Note 2: Can be used in a 75 Ω environment

Note 3: Measured at 1 GHz

Note 4: Idd range of 4.5-5.5 V also available

Note 5: To view S-parameter data for 50 Ω switches, visit the product section of our website at: www.psemi.com

Note 6: Contact Peregrine's application support team for more information

Note 7: PE42510A and PE42650A High Power Switches: P0.1dB = 45.4 dBm @ 0.8 GHz

Broadband Switches¹ - 75 Ω

Product Description	Part Number	Operating Frequency (MHz)	IIP2 ² (dBm)	CTB ³ (dBc)	P1dB ⁴ (dBm)	Insertion Loss (dB @ 1 GHz)	Isolation (dB @ 50 MHz)	Isolation (dB @ 1 GHz)	Typical Idd (μA @ 3 V)	ESD HBM (V)	Package
SPST, Absorptive	PE4270	1-3000	80	-90	30	0.75	90	63	8	500	6L 3x3 DFN
SPST, Absorptive	PE4271	1-3000	80	-90	33	0.80	85	60	8	500	6L 3x3 DFN
SPDT, Absorptive	PE4256	5-3000	80	-90	31	0.90	80	65	8	1000	20L 4x4 QFN
SPDT, Absorptive	PE4280	5-2200	75	-85	26	1.10	72	60	8	1000	20L 4x4 QFN
SPDT, Reflective	PE4231	1-1300	80	-90	32	0.80	75	42	29	200	8L MSOP
SPDT, Reflective	PE4272	5-3000	80	-90	32	0.50	70	43	8	1500	8L MSOP
SPDT, Reflective	PE4273	5-3000	80	-90	32	0.50	63	34.5	8	1500	6L SC70

Broadband Switches¹ - 75 Ω - with Unpowered Operation

Product Description	Part Number	Operating Frequency (MHz)	IIP2 ² (dBm)	P1dB ⁴ pwr/unpwr (dBm)	Insertion Loss (pwr) (dB @ 0.8 GHz)	Isolation pwr/unpwr (dB @ 50 MHz)	Isolation pwr/unpwr (dB @ 0.8 GHz)	Typical Idd (μA @ 3 V)	ESD HBM (V)	Package
SPDT, Absorptive	PE42742	5-2200	90	32/26.5	0.7	94/90.5	75/77	8	3500	20L 4x4 QFN
SPDT, Absorptive	PE42750	5-2200	100	23.5	1.0	86/87	72/79	8	2000	12L 3x3 QFN

Note 1: Vdd Range for 75 Ω Broadband Switches = 2.7-3.3 V
Note 2: Measurement is limited by test equipment

Note 3: CTB/CSO measured with 77 and 110 channels; PO = 44

Note 4: Measured at 1 GHz

Test Equipment/ATE Switches

Peregrine offers complementary devices for TE/ATE applications. HaRP™ technology enhancements reduce gate lag and insertion loss drift while maintaining high linearity and isolation over an extended frequency range of 9 kHz-13.5 GHz, with the new PE42540 offering low-frequency performance down to 10 Hz.

Test Equipment/ATE Switches - 50 Ω

Product Description	Part Number	Operating Frequency	IIP3 / P1dB (dBm)	Insertion Loss (dB @ 3 GHz)	Isolation (dB @ 1 GHz)	Typical Idd (μA @ 3.3 V)	Vdd Range (V)	ESD HBM (V)	Package
SPDT, Reflective	PE42551 ¹	9 kHz-6 GHz	50 / 34 @ 6 GHz	0.65	29 @ 3 GHz	20 @ 2.75 V	2.5-3.0	500	20L 4x4 QFN
SPDT, Absorptive	PE42552 ¹	9 kHz-7.5 GHz	65 / 34.5 @ 7.5 GHz	0.65	47	15	3.0-3.6	1000	16L 3x3 QFN
SPDT, Absorptive	PE42556 ¹	9 kHz-13.5 GHz	56 / 33 @ 13.5 GHz	0.92	46	21.5	3.0-3.6	4000	Flip Chip
NEW SP4T, Absorptive	PE42540 ¹	10 Hz-8.0 GHz	58 / 33 @ 8.0 GHz	0.80	45 @ 3 GHz	90	3.0-3.55	1000	32L 5x5 QFN

Note 1: See also the PE43703 Digital Step Attenuator for TE/ATE designs

UltraCMOS® performs down to 10 Hz!

High-Power RF Switches

Peregrine's high-power switch products deliver a 50W P1dB compression point with high linearity, efficient power handling capabilities, and harmonic performance of less than -84 dBc @ 42.5 dBm.

High Power RF Switches - 50 Ω

Product Description	Part Number	Operating Frequency (MHz)	P0.1dB (dBm @ 0.8 GHz)	Insertion Loss (dB @ 0.8 GHz)	Isolation (dB @ 0.8 GHz)	Typical Idd (μA @ 3.4 V)	Vdd Range (V)	ESD HBM (V)	Package
SPDT, Reflective	PE42510A ¹	30-2000	45.4	0.4	29	90	3.2-3.4	2000	32L 5x5 QFN
SP3T, Reflective	PE42650A ¹	30-1000	45.4	0.3	38	90	3.2-3.4	2000	32L 5x5 QFN

Note 1: Market restrictions apply

Mobile Wireless Switches - 50 Ω

Product Description	Part Number ¹	2nd Harmonic (dBc)		3rd Harmonic (dBc)		Insertion Loss (dB @ 1 GHz)	Isolation (dB @ 1 GHz)	IMD3 (dBm)	Typical Idd (μA @ 2.75 V)	Vdd Range (V)	Package
		35 dBm TX Input 850/900 MHz	33 dBm TX Input 1800/1900 MHz	35 dBm TX Input 850/900 MHz	33 dBm TX Input 1800/1900 MHz						
SP4T - 2Tx/2Rx	*PE42612 ²	-82	-89	-74	-68	0.55	39	-	11 ³	2.4-2.95	Flip Chip
SP6T - 2Tx/4Rx	*PE42632 ²	-87	-86	-78	-76	0.65	38	-	13	2.5-2.8	Flip Chip
SP6T - 6Tx	*PE42662 ²	-75	-73	-75	-73	0.50	38	-111	120	2.4-3.0	Flip Chip
SP7T - 3Tx/4Rx	*PE42674 ²	-85	-84	-79	-76	0.65	39	-112	13	2.5-3.2	Flip Chip
SP9T - 2Tx/3TRx/4Rx	*PE42695	-77	-75	-77	-75	0.45	38	-111	115	2.4-3.0	Flip Chip
SP6T - 2Tx/4Rx	*PE42660	-85	-84	-83	-82	0.55	48	-	13	2.65-2.85	DIE
SP7T - 2Tx/2TRx/3Rx	*PE42671 ²	-83	-82	-77.5	-78	0.65	46	-111	13	2.65-2.85	DIE
SP7T - 3Tx/4Rx	*PE42672 ²	-85	-84	-79	-77	0.60	44	-109	13	2.65-2.85	DIE
SP4T - 4RF	PE42641 ²	-86	-87	-81	-80	0.45	35	-110	13	2.65-2.85	16L 3x3 QFN

Note 1: Operating Frequency 100-3000 MHz

*Contact factory for pricing and availability.

Note 2: 1.8 V-compliant logic (VIH/VIL = 1.4/0.4 V)

Peregrine's new STeP5 Cellular/Communications Switches meet or exceed the following market performance specifications. Please contact Peregrine Semiconductor at sales@psemi.com to help determine which switch is best for your application.

STeP5 Mobile Wireless Switches - 50 Ω

Product Description	Part Number ¹	2nd Harmonic (dBm)		3rd Harmonic (dBm)		Insertion Loss (dB @ 1 GHz)	Isolation (dB @ 1 GHz)	IMD3 (dBm)	Typical Idd (μA @ 2.75 V)	Vdd Range (V)	Package
		35 dBm TX Input 850/900 MHz	33 dBm TX Input 1800/1900 MHz	35 dBm TX Input 850/900 MHz	33 dBm TX Input 1800/1900 MHz						
NEW SP8T - 8Tx	*PE426821	-42	-42	-42	-42	0.35	38	-111	120	2.3-4.8	Flip Chip
NEW SP8T - 8Tx	*PE426851	-42	-42	-42	-42	0.35	38	-111	120	2.3-4.8	Flip Chip
NEW SP10T - 8Tx/2Rx	*PE426151	-42	-42	-42	-42	0.40	38	-111	120 ²	2.3-4.8	Flip Chip
NEW SP10T - 8Tx/2Rx	*PE426152	-42	-42	-42	-42	0.40	38	-111	120 ²	2.3-4.8	Flip Chip
NEW SP10T - 8Tx/2Rx	*PE426153	-42	-42	-42	-42	0.40	38	-111	120 ²	2.3-4.8	Flip Chip
NEW SP10T - 10Tx	*PE426161	-42	-42	-42	-42	0.35	38	-111	120	2.3-4.8	Flip Chip
NEW SP12T - 12Tx	*PE426171	-42	-42	-42	-42	0.35	38	-111	120	2.3-4.8	Flip Chip

Note 1: Operating Frequency 100-3000 MHz

*Contact factory for pricing and availability

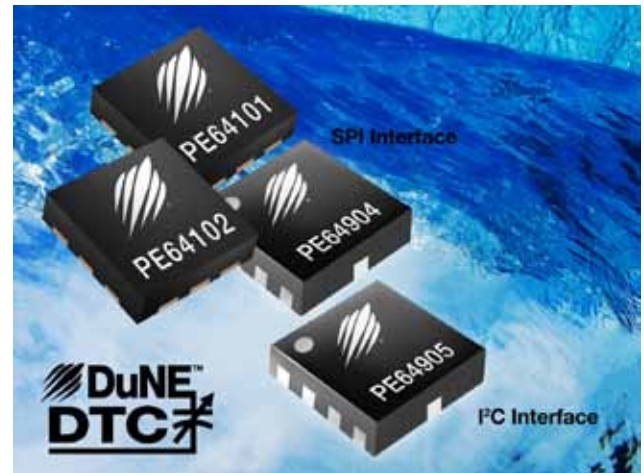
Note 2: Typical Idd @ 3.6 V

Wireless and Broadband RF Products (continued)

DuNE™ Digitally Tunable Capacitors

In complex radio designs where detuning can cause increased filter loss and PA inefficiencies, signal chain performance can be significantly improved with a monolithically integrated solid-state impedance tuning solution.

Peregrine's DuNE Digitally Tunable Capacitors (DTCs), offered in both SPI (3-wire) and I²C (2-wire) control interface versions, continue in a tradition of innovation, high performance and ease-of-use by offering tunability, high voltage handling and excellent linearity. Applications range from tunable filters and matching networks, RFID/NFC, HF/VHF/UHF radios and directional antennas, to phase shifters, antenna tuning and other wireless communications.



DuNE™ Digitally Tunable Capacitors*

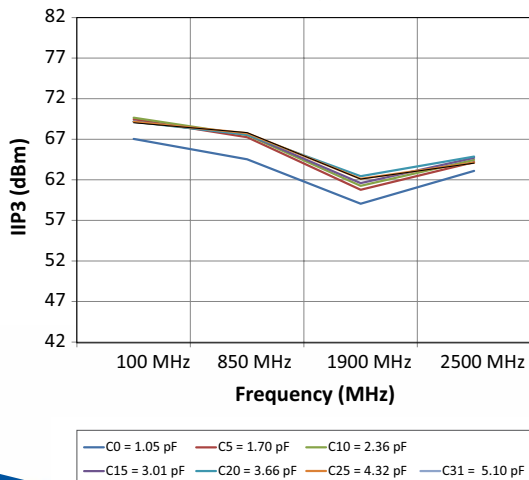
Part Number	Interface	Min Capacitance (pF)		Max Capacitance (pF)		Tuning Ratio		Quality Factor (Shunt, 1 GHz)		ESD HBM (V)	Package
		Series	Shunt	Series	Shunt	Series	Shunt	Cmin	Cmax		
PE64904	SPI Compatible	0.60	1.10	4.60	5.10	7.7:1	4.6:1	35	25	1500	10L 2x2 QFN
PE64905	I ² C Compatible	0.60	1.10	4.60	5.10	7.7:1	4.6:1	35	25	1500	10L 2x2 QFN
NEW PE64101	SPI Compatible	Note 1	1.4	Note 1	6.2	Note 1	4.4:1	45	12	1500	12L 2x2 QFN
NEW PE64102	SPI Compatible	Note 1	1.7	Note 1	15.5	Note 1	9.1:1	45	12	1500	12L 2x2 QFN

Note 1: For series configuration see equivalent circuit model in datasheet

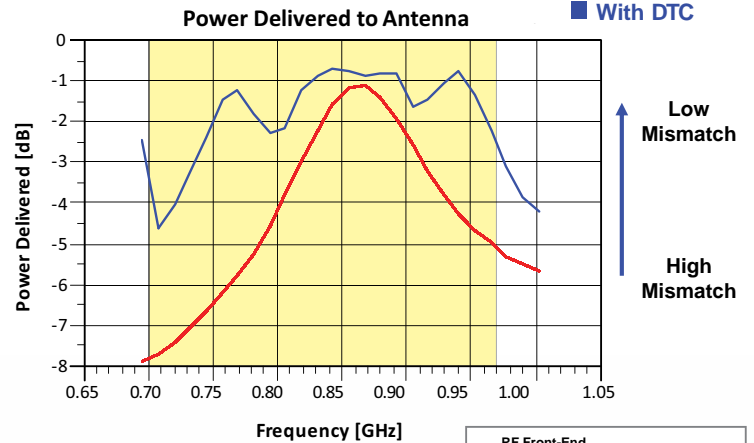
*Operating Frequency: 100-3000 MHz, V_{dd} Range: 2.3-3.6 V

Highly-Linear Performance

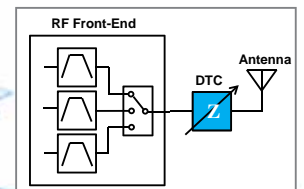
IIP3 vs. Frequency at Major Capacitance States



Application Example



The DTC tuner increases power delivered to the antenna by eliminating mismatch loss.



dtc.psemi.com

RF Digital Step Attenuators (Monolithic) - 50 Ω

Product Description	Attenuation	Programming Mode	Operating Freq. (MHz)	Insertion Loss (dB)	Input IP3 (dBm)	Attenuation Accuracy (dB @ 1 GHz)	Switching Speed (μs)	ESD HBM (V)	Package
2-bit - PE43204	18 range / 6, 12 dB steps	Parallel	50 - 3000	0.6	61	-0.25 / +0.40	0.03	2000	12L 3x3 QFN
5-bit - PE4305	15.5 range / 0.5 dB steps	Parallel ¹ , Serial	1 - 4000	1.5	52	±(0.25+3% of setting)	1	500	20L 4x4 QFN
5-bit - PE4306	31 range / 1.0 dB steps	Parallel ¹ , Serial	1 - 4000	1.5	52	±(0.30+3% of setting)	1	500	20L 4x4 QFN
5-bit - PE43501	7.75 range / 0.25 dB steps	Parallel ¹ , Ser-Add. ²	20 - 6000	2.3	58	±(0.15+4% of setting)	0.65	500	32L 5x5 QFN
5-bit - PE43502	15.5 range / 0.5 dB steps	Parallel ¹ , Serial	20 - 6000	2.4	58	±(0.3+3% of setting)	0.65	500	24L 4x4 QFN
5-bit - PE43503	31 range / 1 dB steps	Parallel ¹ , Serial	20 - 6000	2.4	58	±(0.3+3% of setting)	0.65	500	24L 4x4 QFN
6-bit - PE4302	31.5 range / 0.5 dB steps	Parallel ¹ , Serial	1 - 4000	1.5	52	±(0.10+3% of setting)	1	500	20L 4x4 QFN
6-bit - PE4309	31.5 range / 0.5 dB steps	Parallel	5 - 4000	1.6	52	±(0.10+3% of setting)	1	2000	24L 4x4 QFN, DIE
6-bit - PE43601	15.75 range / 0.25 dB steps	Parallel ¹ , Ser-Add. ²	20 - 6000	2.3	57	±(0.2+4% of setting)	0.65	500	32L 5x5 QFN
6-bit - PE43602	31.5 range / 0.5 dB steps	Parallel ¹ , Serial	20 - 5000	2.2	58	±(0.3+3% of setting)	0.65	500	24L 4x4 QFN
7-bit - PE43701	31.75 range / 0.25 dB steps	Parallel ¹ , Ser-Add. ²	20 - 4000	1.9	59	±(0.2+1.5% of setting)	0.65	500	32L 5x5 QFN
7-bit - PE43702	31.75 range / 0.25 dB steps	Parallel ¹ , Serial	20 - 4000	2.0	57	±(0.2+3% of setting)	0.65	500	24L 4x4 QFN
7-bit - PE43703	31.75 / 0.25, 0.5, 1.0 steps	Parallel ¹ , Ser-Add. ²	9kHz-6GHz	1.9	59	±(0.2+1.5% of setting)	0.65	500	32L 5x5 QFN

Note 1: Parallel Modes: Latched and Direct

Note 2: Serial-Addressable Mode

Broadband Digital Step Attenuators (Monolithic) - 75 Ω

Product Description	Attenuation	Programming Mode	Operating Freq. (MHz)	Insertion Loss (dB)	Input IP3 (dBm)	Attenuation Accuracy (1 GHz)	Switching Speed (μs)	ESD HBM (V)	Package
4-bit - PE43404	15 range / 1.0 steps	Parallel ¹ , Serial	1 - 2000	1.4	52	±(0.25+7% of setting)	1	500	20L 4x4 QFN
5-bit - PE4307	15.5 range / 0.5 steps	Parallel ¹ , Serial	1 - 2000	1.4	52	±(0.15+4% of setting)	1	500	20L 4x4 QFN
5-bit - PE4308	31 range / 1.0 steps	Parallel ¹ , Serial	1 - 2000	1.4	52	±(0.20+4% of setting)	1	500	20L 4x4 QFN
6-bit - PE4304	31.5 range / 0.5 steps	Parallel ¹ , Serial	1 - 2000	1.4	52	±(0.15+4% of setting)	1	500	20L 4x4 QFN

Note 1: Parallel Modes: Latched and Direct

Integer-N Phase Locked-Loop (PLL) Frequency Synthesizers¹

Product Description	Φ Det Type	Programming Mode	Max Input Operating Freq.				Main Counters M, A	Reference Counters	Typical Idd (mA @ 3 V)	ESD HBM (V)	Package
			(GHz) RF PLL	(MHz) Ref.	(MHz) Compare	Prescaler					
PE3336	PD	Parallel, Serial, Hardwire	3.0	100	20	10/11	9bit, 4bit	6bit	19	1000	48L 7x7 QFN
PE3341	CP	Serial, EEPROM ²	2.7 ³	100	20	10/11	9bit, 4bit	6bit	20	1000	20L 4x4 QFN
PE3342	PD	Serial, EEPROM ²	2.7 ³	100	20	10/11	9bit, 4bit	6bit	20	1000	20L 4x4 QFN
PE83336 ⁴	PD	Par, Ser, Hardwire	3.0	100	20	10/11	9bit, 4bit	6bit	20	1000	44L CQFJ

Note 1: Vdd Range = 2.85-3.15 V

Note 2: Programming Kit available-contains 10 samples

Note 3: 3 GHz available. See datasheet

Note 4: Not available for Space Level Screening

MOSFET Quad Array Mixer Core¹

Part Number	Operating Frequency (MHz)			LO Drive (dBm)	Conv. Loss (dB)	Isolation (dB, typ.)		Input IP3 (dBm, typ.)	ESD HBM (V)	Package
	LO	RF	IF, Nom.			LO-RF	LO-IF			
PE4140 ²	0.01-6000	0.01-6000	0.01-6000	0-20	6.5-7.5	25-40	25-40	36	100	6L 3x3 DFN, DIE
NEW PE4141 ²	0.01-1000	0.01-1000	0.01-1000	0-20	7.0-8.0	40	40	33	100	8L MSOP
PE4150 ³	245.65-885.65	136-941	44.85-109.65	-10 to -6	6.5-8.7	30	30	25	1000	20L 4x4 QFN

Note 1: Fully differential DC coupled ports. External baluns required

Note 2: MOSFET Quad Array

Note 3: Buffered Quad FET Array

Prescalers

Product Description	Input Operating Frequency (MHz)	Divide Ratio	Typical Idd (mA @ 3 V)	Vdd Range (V)	ESD HBM (V)	Package
PE3511 - Divide-by-2	DC - 1500	2	8	2.85-3.15	2000	6L SC70
PE3512 - Divide-by-4	DC - 1500	4	8	2.85-3.15	2000	6L SC70
PE3513 - Divide-by-8	DC - 1500	8	8	2.85-3.15	2000	6L SC70

High-Reliability Products

High-Reliability RF Products for Space

Peregrine Semiconductor's S-level standard and semi-custom UltraCMOS® Silicon-on-Sapphire RFICs are based on our high-volume commercial products, yet designed to meet the rad-hard, low-power needs of space applications.

High-Rel Switches									
Product Description	Operating Frequency (MHz)	IIP3 (dBm @ 2 GHz)	P1dB (dBm @ 2 GHz)	Insertion Loss (dB @ 1 GHz)	Isolation (dB @ 1 GHz)	Typical Idd (µA @ 3 V)	Vdd Range (V)	ESD HBM (V)	Package
PE9354 - SPDT	10-3000	55	31	0.55	32	28	2.7-3.3	200	8L CFP, DIE
PE95420 - SPDT	1-8500	60	33	0.85	55	100 @ 3.3 V	3.0-3.6	2000	7L CQFP, DIE

High-Rel RF Digital Step Attenuators (Monolithic) - 50 Ω									
Product Description	Attenuation	Programming Mode	Operating Freq. (MHz)	Insertion Loss (dB)	Input IP3 (dBm)	Attenuation Accuracy (1 GHz)	Switching Speed (µs)	ESD HBM (V)	Package
PE94302 - 6-bit	31.5 range / 0.5 steps	Parallel, Serial	1-4000	1.5	52	±(0.55dB+7% of setting)	1	500	28L CQFP, DIE

High-Rel Prescalers							
Product Description	Input Operating Frequency (MHz)	Divide Ratio	Typical Idd (mA @ 3V)	Vdd Range (V)	ESD HBM (V)	Package	
PE9301 - Divide-by-2	1500 - 3500	2	13	2.85-3.15	250	8L CFP, DIE	
PE9303 - Divide-by-8	1500 - 3500	8	14	2.85-3.15	250	8L CFP, DIE	
PE9304 - Divide-by-2	1000 - 7000	2	14	2.85-3.15	500	8L CFP, DIE	
PE9309 - Divide-by-4	3000 - 13500	4	16 @ 2.6 V	2.45-2.75	250	8L CFP, DIE	
PE9311 - Divide-by-2	DC - 1500	2	6.5	2.85-3.15	1000	8L CFP, DIE	
PE9312 - Divide-by-4	DC - 1500	4	6.5	2.85-3.15	1000	8L CFP, DIE	
PE9313 - Divide-by-8	DC - 1500	8	6.5	2.85-3.15	1000	8L CFP, DIE	

High-Rel Integer-N Phase Locked-Loop (PLL) Frequency Synthesizers ¹												
Product Description	Φ Det Type	Programming Mode	Normalized Phase Noise (dBc/Hz)	Max Input Operating Freq. (GHz) RF PLL (MHz) Ref. (MHz) Compare			Main Counters M, A	Reference Counters	Typical Idd (mA @ 3 V)	Vdd Range (V)	ESD HBM (V)	Package
PE97022	PD	Par, Ser, Hardwire	-216	3.5	100	50	9bit, 4bit	6bit	45 ²	2.85-3.45	1000	44L CQFJ, DIE
PE97042	PD	Serial, Hardwire	-216	3.5	100	50	9bit, 4bit	6bit	45 ²	2.85-3.45	1000	44L CQFJ, DIE
PE9702	PD	Par, Ser, Hardwire	-210	3.0	100	20	9bit, 4bit	6bit	24	2.85-3.15	1000	44L CQFJ, DIE
PE9704	PD	Serial, Hardwire	-210	3.0	100	20	9bit, 4bit	6bit	24	2.85-3.15	1000	44L CQFJ, DIE
PE9701	CP	Par, Ser, Hardwire	-210	3.0	100	20	9bit, 4bit	6bit	24	2.85-3.15	1000	44L CQFJ, DIE
PE9601	CP	Par, Ser, Hardwire	-210	2.2	100	20	9bit, 4bit	6bit	24	2.85-3.15	1000	44L CQFJ, DIE

Note 1: Prescaler=10/11

Note 2: Typical Idd = 45 mA @ 3.3 V

High-Rel Delta-Sigma Modulated Fractional-N Frequency Synthesizers ¹												
Product Description	Programming Mode	Normalized Phase Noise (dBc/Hz)	Max Input Operating Freq. (GHz) RF PLL (MHz) Ref. (MHz) Compare			Main Counters M, A, K	Reference Counters	Typical Idd (mA @ 3 V)	Vdd Range (V)	ESD HBM (V)	Package	
PE97632 ² Ultra-Low Phase Noise 3rd Order DSM	Ser, Hardwire	-216	3.5	100	50	9bit, 4bit, 18 bit	6bit	40 ³	2.85-3.45	1000	68L CQFJ, DIE	
PE9763 Low Phase Noise 3rd Order DSM	Ser, Hardwire	-210	3.2	100	50	9bit, 4bit, 18 bit	6bit	30	2.85-3.15	1000	68L CQFJ, DIE	

Note 1: Prescaler=10/11

Note 2: The PE97632 is pin for pin compatible with the PE9763 in up/down mode

Note 3: Typical Idd = 40 mA @ 3.3 V



High-Reliability Power Management Products for Space

Peregrine's new Power Management Products follow a steep tradition of high-performance and efficiency. The flagship power management family supports DC-DC conversion with radiation hardened Point-of-Load (POL) Synchronous Buck Regulators with integrated switches. These devices offer Single Event Effects (SEE) immunity to a Linear Energy Transfer (LET) greater than 90 MeV·cm²/mg and radiation hardness of 100 KRad(Si), and replace multi-chip modules by offering superior performance, smaller size and reduced weight in sensitive space applications.

Rad-Hard Point-of-Load DC-DC Buck Regulators

Part Number	Part Description	Iout (Max) (A)	Vin (Min) (V)	Vin (Max) (V)	Vout (Min) (V)	Vout (Max) (V)	Async Switching Frequency (kHz)	Sync Switching Frequency (kHz)	ESD HBM (V)	Package
NEW PE99151	2A DC-DC Buck Regulator	2	4.6	6	1	3.6	500/1000	100 - 5000	1000	32L CQFP, DIE
NEW PE99153	6A DC-DC Buck Regulator	6	4.6	6	1	3.6	500/1000	100 - 5000	1000	32L CQFP, DIE
NEW PE99155	10A DC-DC Buck Regulator	10	4.6	6	1	3.6	500/1000	100 - 5000	1000	32L CQFP, DIE

Single Event Effects and the UltraCMOS® Solution

Peregrine's new radiation-hardened Point-of-Load (POL) buck regulators were tested for Single Event Effects (SEE) at load currents from zero (no-load) to rated max as well as intermediate points. These parts were tested for single event effects (SEE) and no Single Event Upsets (SEU), Single Event Functional Interrupt (SEFI), Single Event Latch-up (SEL), Single Event Burnout (SEB), Single Event Gate Rupture (SEGR) and Single Event Transient (SET) were observed.

Products manufactured on UltraCMOS technology do not contain the bulk parasitics which cause latchup and are typically found in Bulk CMOS designs. Additionally, UltraCMOS offers superior resistance to all single event effects and tolerance to total dose radiation of 100 KRad (Si) or greater if needed.

Ceramic Packaging. Hermetically Sealed, Rigorously Tested.



Simply Designed. Simply Green. Only UltraCMOS®



For years, IC and process designers have been interested in UltraCMOS® Silicon-on-Sapphire (SOS) technology as high-performance alternative to high-voltage RF processes such as SiGe and GaAs.

Today, engineers around the world benefit from not only the performance advantages, but also the fundamental properties of UltraCMOS which make it an **environmentally friendly** option.

Leave a Smaller Footprint...And Less eWaste

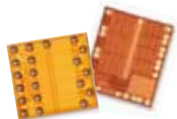
Adding to the potential environmental advantages, UltraCMOS technology enables high levels of monolithic integration, resulting in smaller die and fewer external components in the design.

Go Green...Not Toxic

As semiconductor processing materials and eWaste are scrutinized by governments and industries around the globe, growing concern over the toxicity and carcinogenic nature of GaAs, along with its associated arsenic slurries, continues to drive market leaders toward more eco friendly technology solutions.

Low Power Consumption

Low parasitic advantages of standard silicon-on-insulator (SOI) are strengthened with the UltraCMOS process, which delivers minimum parasitic capacitance and industry leading dispersion. When compared to the high-voltage RF processes, UltraCMOS devices consume less power.



Wire-bond Die and Flip Chip

Going Green Starts on the Inside

The UltraCMOS process, a high-performance variation of Silicon-on-Insulator (SOI) process, is not based on arsenic (as are all GaAs-based devices) but instead incorporates a sapphire substrate, which intrinsically offers both environmental as well as RF benefits. See Peregrine's Green Package Information sheet and Certificate of Conformance to learn more.

RoHS-Compliant Commercial Packaging Options

Peregrine is proud to offer RoHS-compliant, lead-free (Pb-free) packaging for its UltraCMOS RFICs. Pb-free packages utilize matte tin (Sn) plating, or for select QFN packages NiPdAu plating, on to copper lead frames. The reliability aspects of matte Sn plating have been well-researched, including solderability with both Pb-free and standard SnPb solders, and whisker growth in accelerated temperature/humidity conditions. NiPdAu plating provides a solderable surface for both eutectic and Pb-free solders, is less

susceptible to oxidation, and provides long-term storage and solderability.

As regulatory conditions change and new Pb-free packaging solutions become available, Peregrine will maintain its commitment to doing its part to preserve our environment. If the Pb-free solution that you require is not shown, please consult with Peregrine or any of its worldwide sales representatives for solutions to your specific need.



6L SC70
1.3 x 2.0 x 1.0



8L 1.5x1.5 DFN
1.5 x 1.5 x 0.50



10L 2x2 QFN
2.0 x 2.0 x 0.45



12L 2x2 QFN
2.0 x 2.0 x 0.60



8L MSOP
3.0 x 3.0 x 1.1
Regular and exposed
ground paddle



6L DFN
3.0 x 3.0 x 0.9
Fused and Isolated
versions



12L 3x3 QFN
3.0 x 3.0 x 0.75



16L 3x3 QFN
3.0 x 3.0 x 0.75



20L 4x4 QFN
4.0 x 4.0 x 0.9



24L 4x4 QFN
4.0 x 4.0 x 0.9



32L 5x5 QFN
5.0 x 5.0 x 0.9



48L QFN
7.0 x 7.0 x 0.9

All dimensions are listed in millimeters (width x length x height) and are approximate. See product datasheets for exact dimensions.

Design and Application Support

Designing for tomorrow's challenging RF applications requires great products *and* great technical support. From our engineering excellence, to streamlined manufacturing and technical sales and applications support, Peregrine Semiconductor is committed

to a complete product solution. Choose among comprehensive datasheets, application notes, tutorials, reference designs and other engineering resources, all developed to help get your design to market on time.

Online Applications Support Materials

Product Documentation: Reference libraries show all documentation available for each product.

Application Notes: Use our application notes to help design for tomorrow's challenging RF applications.

Datasheet Library: Links to all datasheets, organized by part type and part number.

Package Information: Shows package dimensions and includes material listing for each package.

Technical FAQs: Search our Frequently Asked Questions database.

Contact Apps Support: Submit a help ticket to our Applications Engineering team.

Application Notes

- | | | | |
|------|--|------|--|
| AN10 | Connecting the PE3336, PE9601, and PE9701 to a Serial Bus Interface | AN23 | Migrating from PE9704 to PE97042 |
| AN12 | Considerations for Using the PE323x/PE333x in Fractional-N or Sigma-Delta Designs | AN24 | Migrating from PE9763 to PE97632 |
| AN15 | Impedance Matching the PE4210/20/30 RF Switches for 75 Ω Applications | AN26 | Advantages of UltraCMOS [®] DSAs with Serial-Addressability |
| AN16 | Using Peregrine PLL in System Clock Applications | AN27 | Using Blocking Capacitors with UltraCMOS [®] Devices |
| AN17 | OC-12 622.08 MHz Reference Clock Design | AN28 | Using the DTC with I ² C Operation |
| AN18 | RF Switch Performance Advantages of UltraCMOS [®] Technology over GaAs Technology | AN29 | DTC Theory of Operation |
| AN20 | Multi-Port Handset Switch S-Parameters | AN32 | Radiation-Hardened Power Management Solution for Xilinx Virtex-5 Space-Grade FPGAs |
| AN22 | Migrating from PE9702 to PE97022 | AN33 | 5-bit and 6-bit RF Digital Step Attenuator Compatibility |
| | | AN34 | Implementing Design Features of the PE9915x Point-of-Load Buck Regulator |

Online Support System – support.psemi.com

Visit our website to find the technical resource you need.



Product Documentation



**Knowledge Base
and FAQs**



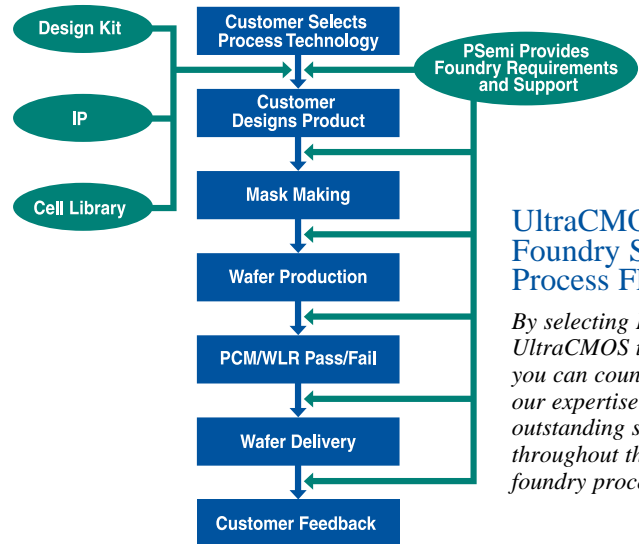
Ask a Question



UltraCMOS® Foundry Services

Peregrine's UltraCMOS RF and mixed-signal wafer foundry services offer benefits in speed, power, integration and cost. Our comprehensive portfolio of Process Design Kits, standard cell libraries, IP offerings and design services delivers many solutions for today's competitive RF wireless and broadband application challenges. For quick-turn prototyping service, we offer Multi-Project Runs (MPR) on a scheduled basis. This approach enables rapid, low-cost device evolution from design to limited or full production volumes.

At Peregrine Semiconductor, our goal is to ensure customers achieve higher performance integrated circuits without a higher price tag. Contact us at foundry@psemi.com for more information.



UltraCMOS® Foundry Services Process Flow

By selecting Peregrine's UltraCMOS technology, you can count on our expertise and outstanding support throughout the entire foundry process.

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