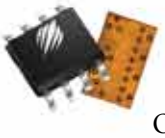
Peregrine Semiconductor

2012
Product Selection Guide

First Edition

Changing RF Design. Forever.™

Welcome to Peregrine Semiconductor



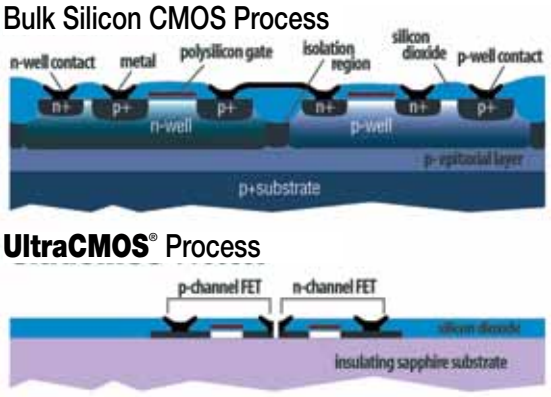
Peregrine Semiconductor is a fabless provider of high-performance radio-frequency (RF) integrated circuits (ICs). Our solutions leverage our proprietary UltraCMOS® technology, which enables the design, manufacture, and integration of multiple RF, mixed-signal, and digital functions on a single chip. 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 meet 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 peak 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 broad portfolio of high performance RFICs includes switches, digital attenuators, frequency synthesizers, mixers, prescalers and digitally tunable capactitors (DTCs), with power amplifiers, DVGAs and DC-DC converters 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. In addition to the sale of our products, we have established a technology licensing program to accelerate the adoption and deployment of UltraCMOS technology.

UltraCMOS® – The Green 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.



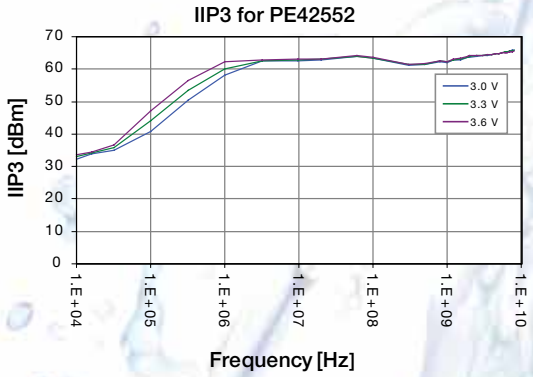
The UltraCMOS process, with its insulating sapphire substrate, enables simpler RF circuit designs, and improved power handling, isolation and ESD tolerance.

Quality and Reliability

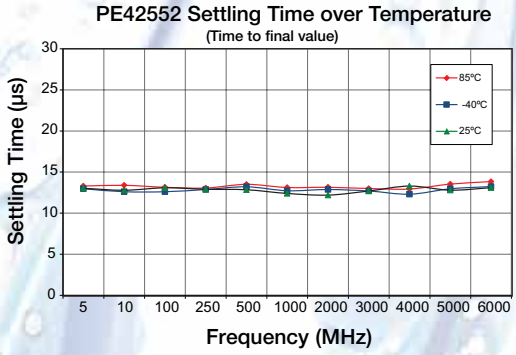
At Peregrine Semiconductor, we are committed to achieving excellence through customer satisfaction. We are actively pursuing TS-16949 certification to complement our existing ISO9001-2008 and AS9100C certified quality management systems. Quality is an integral part of all of our advanced designs, progressive process technologies, and industry-leading product performance, enabling us to consistently provide our customers with a high-quality, reliable product.

The Innovative HaRP™ Technology Invention

Peregrine's HaRP™ technology enhancements provide for new RF architectures and excellent linearity in the RF front-end. Because UltraCMOS technology is composed of a stack of field effect transistors manufactured on a highly 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 exceptional RF performance. In demanding applications such as RF test equipment, HaRP-enhanced ATE switches settle very quickly, eliminating 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.



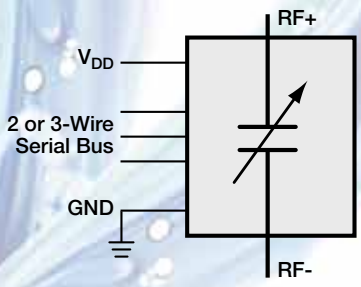
HaRP™ technology provides excellent linearity up to 7.5 GHz



With the industry's tightest specs over process and temperature - UltraCMOS® will change the way you design.

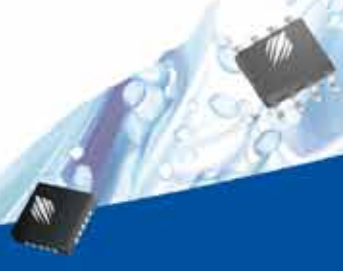
DuNE™ Digital Tuning Technology

By applying proven, patented UltraCMOS™ process and HaRP™ switch technologies, engineers at Peregrine developed DuNE™ tuning technology, a new design methodology 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 that are unrivaled by any other commercially-available digital tuning technology.



DuNE™ DTC

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



ESD

UltraCMOS® RFICs deliver extraordinary ESD tolerance – up to 4kV HBM

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[3]	0.35	30	9	2.3-3.3	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 @ 2.75V	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	35	130	3.0-5.5	1000	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	250 @ 5.5 V	2.7-5.5	2000	24L 4x4 QFN

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 Switches[1] - 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	10-3000	80	-90	32	0.50	63	34.5	8	1500	6L SC70

Broadband Switches[1] - 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	80	30/24	0.7	94/90.5	75/77	8	3500	20L 4x4 QFN
SPDT, Absorptive	PE42750	5-2200	100	23.5	1.0	86/87	73/74	8	2000	12L 3x3 QFN

Note 1: Vdd Range for 75 Ω Broadband Switches = 2.7-3.3V
Note 2: Measurement is limited by test equipment
Note 3: CTB/CSO measured with 77 and 110 channels; PO = 44 dBmV
Note 4: Measured at 1 GHz

Test Equipment/ATE Switches

*Peregrine offers complementary devices ideal for TE/ATE applications. HaRP™ technology enhancements eliminate 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, outstanding power handling capabilities, and excellent 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) 35 dBm TX Input 850/900 MHz	2nd Harmonic (dBc) 33 dBm TX Input 1800/1900 MHz	3rd Harmonic (dBc) 35 dBm TX Input 850/900 MHz	3rd Harmonic (dBc) 33 dBm TX Input 1800/1900 MHz	Insertion Loss (dB @ 1 GHz)	Isolation (dB @ 1 GHz)	IMD3 (dBm)	Typical Idd (µA @ 2.75 V)	Vdd Range (V)	Package
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
Note 2: 1.8 V-compliant logic (VIH / VIL = 1.4 / 0.4 V)

*Contact factory for pricing and availability.

Changing RF Design. Forever.™

Wireless and Broadband RF Products (continued)

New 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.

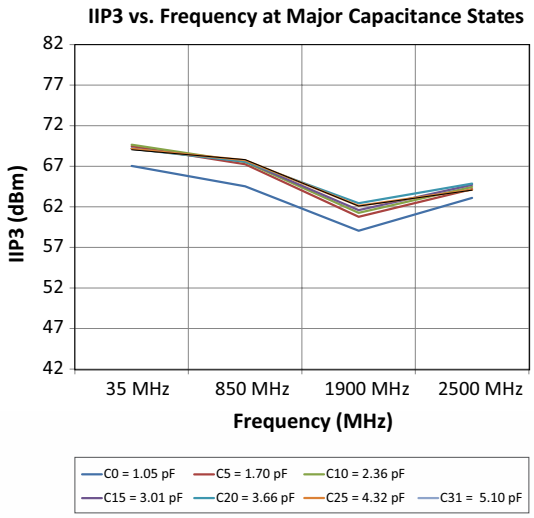
Peregrine's DuNE Digitally Tunable Capacitors (DTCs), offered in both SPI (3-wire) and I²C (2-wire) control interface versions, continue in a tradition of innovation, high performance and ease-of-use by offering tunability, high voltage handling and excellent linearity. Applications range from tunable 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

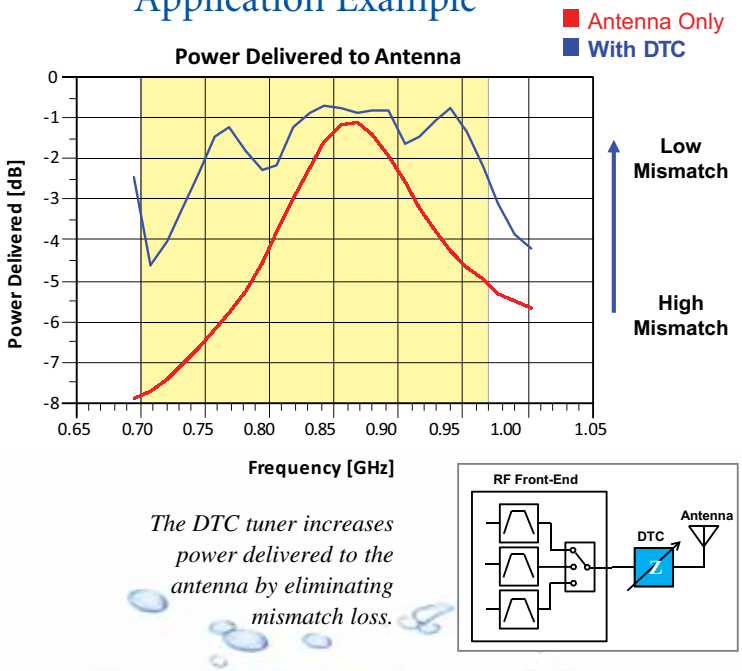
Part Number	Interface	Min Capacitance (pF)		Max Capacitance (pF)		Tuning Ratio		Equivalent Series Resistance (Ohm)		Quality Factor (Shunt, 1 GHz)		ESD	Package
		Series	Shunt	Series	Shunt	Series	Shunt	00000	11111	Cmin	Cmax	HBM (V)	
NEW PE64904	SPI Compatible	0.60	1.10	4.60	5.10	7.7:1	4.6:1	1.40	1.33	35	25	1500	10L 2x2 QFN
NEW PE64905	I²C Compatible	0.60	1.10	4.60	5.10	7.7:1	4.6:1	1.40	1.33	35	25	1500	10L 2x2 QFN

Note: Operating Frequency: 100-3000 MHz, Vdd Range: 2.3-3.6V

Highly-Linear Performance



Application Example



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

DuNE™ DTC

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 **Note2:** 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 Synthesizers[1]

Product Description	Φ Det Type	Programming Mode	Max Input Operating Freq. (GHz) RF PLL	(MHz) Ref.	(MHz) Compare	Prescaler	Main Counters M, A	Reference Counters	Typical Idd (mA @ 3 V)	ESD HBM (V)	Package
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

Note 1: Vdd Range = 2.85-3.15V **Note 2:** Programming Kit available-contains 10 samples. **Note 3:** 3 GHz available. See datasheet.

MOSFET Quad Array Mixer Core[1]

Part Number	Operating Frequency (MHz) LO	RF	IF, Nom.	LO Drive (dBm)	Conv. Loss (dB)	Isolation (dB, typ.) LO-RF	LO-IF	Input IP3 (dBm, typ.)	ESD HBM (V)	Package
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
NEW PE4150[3]	245.65-885.65	136-941	44.85-109.65	-10 to -6	6.5-8.7	25-30	20-30	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-Relability **RF** Products for Space

Peregrine Semiconductor's advancements on UltraCMOS® silicon-on-sapphire technology have enabled superior performance in the rad-hard product portfolio. Our S-level standard and semi-custom 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 CSOIC, DIE
NEW PE95220 - SPDT	100-3000	70	36	0.30	44	120 @ 3.3V	2.7-5.5	2000	8L CSOIC, DIE
PE95420 - SPDT	1-8500	60	33	0.85	55	100 @ 3.3 V	3.0-3.6	2000	7L CSOIC, 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 @ 3 V)	Vdd Range (V)	ESD HBM (V)	Package
PE9301 - Divide-by-2	1500 - 3500	2	13	2.85-3.15	250	8L CSOIC, DIE
PE9303 - Divide-by-8	1500 - 3500	8	14	2.85-3.15	250	8L CSOIC, DIE
PE9304 - Divide-by-2	1000 - 7000	2	14	2.85-3.15	500	8L CSOIC, DIE
PE9309 - Divide-by-4	**3000 - 13500**	4	16 @ 2.6 V	2.45-2.75	250	8L CSOIC, DIE
PE9311 - Divide-by-2	DC - 1500	2	6.5	2.85-3.15	1000	8L CSOIC, DIE
PE9312 - Divide-by-4	DC - 1500	4	6.5	2.85-3.15	1000	8L CSOIC, DIE
PE9313 - Divide-by-8	DC - 1500	8	6.5	2.85-3.15	1000	8L CSOIC, 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
PE83336[3]	PD	Par, Ser, Hardwire	-212	3.0	100	20	9bit, 4bi	6bit	20	2.85-3.15	1000	44L CQFJ

Note 1: Prescaler=10/11 **Note 2:**Typical Idd = 45 mA @ 3.3 V **Note 3:** Not available for Space Level Screening

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

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Visit our website for the most current list of technical resources.

New Power Management Products

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 Point-of-Load (POL) Synchronous Buck Regulators with integrated switches. These devices offer Single Event Effects (SEE) immunity and radiation hardness to a Linear Energy Transfer (LET) greater than 90MeV.mg/cm², and replace multi-chip modules by offering superior performance, smaller size and reduced weight in sensitive space applications.

High-Rel 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	4.5	6	1	3.6	500/1000	100 - 5000	1000	32L CQFP, DIE
NEW PE99153	6A DC-DC Buck Regulator	6	4.5	6	1	3.6	500/1000	100 - 5000	1000	32L CQFP, DIE
NEW PE99155	10A DC-DC Buck Regulator	10	4.5	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 DC-DC converters 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.

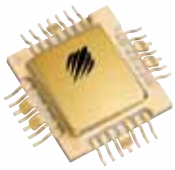
Products manufactured on UltraCMOS technology do not contain the bulk parasitics which cause latchup and are typically found in Bulk CMOS designs. Additionally, UltraCMOS offers superior resistance to all single event effects and tolerance to total dose radiation of 100Krads (Si) or greater if needed.

Ceramic Packaging. Hermetically Sealed, Rigorously Tested.

8L CSOIC
4.6 x 4.6 x 1.8

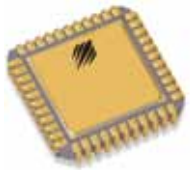
7L CSOIC
6.6 x 5.5 x 1.7

28L CQFP
9.1 x 9.9 x 1.3

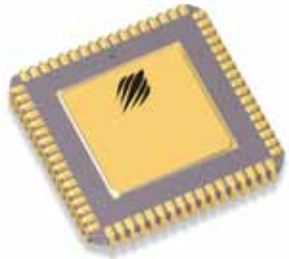


32L CQFP
13.1 x 12.8 x 1.15

44L CQF
16.5 x 16.5 x 2.9



68L CQFJ
24.1 x 24.1 x 3.1



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 a more **environmentally friendly** option.

Leave a Smaller Footprint…And Less eWaste

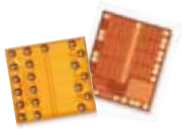
To add to all the potential environmental advantages, UltraCMOS technology enables high levels of monolithic integration, resulting in smaller die and fewer external components in the design.

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 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 performance leader among SOI technologies, 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 termperature/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 1.5x 0.50

10L 2x2 QFN
2.0 x 2.0 x 0.45

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

AN12 Considerations for Using the PE323x/PE333x in Fractional-N or Sigma-Delta Designs

AN15 Impedance Matching the PE4210/20/30 RF Switches for 75 Ω Applications

AN16 Using Peregrine PLL in System Clock Applications

AN17 OC-12 622.08 MHz Reference Clock Design

AN18 RF Switch Performance Advantages of UltraCMOS® Technology over GaAs Technology

AN20 Multi-Port Handset Switch S-Parameters

AN22 Migrating from PE9702 to PE97022

AN23 Migrating from PE9704 to PE97042

AN24 Migrating from PE9763 to PE97632

AN26 Advantages of UltraCMOS® DSAs with Serial-Addressability

AN27 Using Blocking Capacitors with UltraCMOS® Devices

AN28 Using the DTC with I^2C Operation

AN29 DTC Theory of Operation

AN33 5-bit and 6-bit RF Digital Step Attenuator Compatibility Attenuators

AN34 General Purpose Application Note for PE9915x Point-of-Load DC-DC Converter

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Product Documentation

Knowledge Base and FAQs

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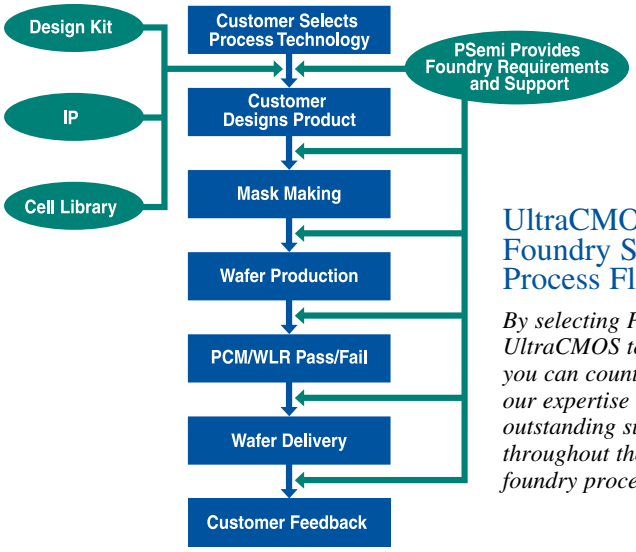
UltraCMOS® Foundry Services

Peregrine's UltraCMOS RF and mixed-signal wafer foundry services offer unprecedented benefits in speed, power, integration and cost. Our comprehensive portfolio of Process Design Kits, standard cell libraries, IP offerings and design services delivers leading-edge 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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