Peregrine Semiconductor

2016-2017 High Performance Analog Product Catalog

Welcome to

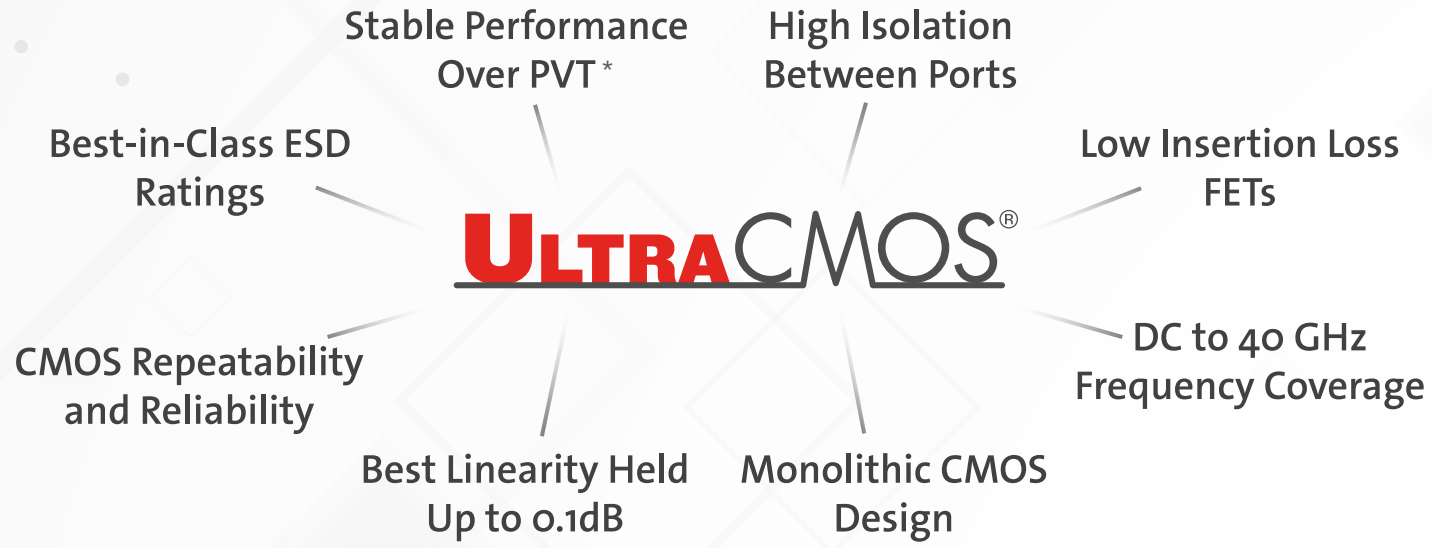
Peregrine Semiconductor

Peregrine Semiconductor Corporation, a Murata company, is the founder of RF silicon on insulator (SOI) and is a leading fabless provider of high-performance, integrated RF solutions. Since 1988 Peregrine and its founding team have been perfecting UltraCMOS® technology—a patented, advanced form of SOI—to deliver the performance edge needed to solve the RF market's biggest challenges, such as linearity. By delivering best-in-class performance and monolithic integration, Peregrine products are the trusted choice for market leaders in automotive, broadband, industrial, Internet of Things, mobile devices, smartphones, space, test-and-measurement equipment and wireless infrastructure. A Murata company since December 2014, Peregrine holds more than 240 filed and pending patents and has shipped over 3.5 billion UltraCMOS units.

From its roots in government research-and-development innovation, Peregrine continues to revolutionize the industry with high-performance, integrated RF solutions.

Core Technology Benefits

UltraCMOS solutions provide high-performance RF, mixed-signal, passive elements and digital functions on a single device.



* PVT = Process, Voltage & Temperature

Intelligent Integration

UltraCMOS®

Intelligent integration showcases Peregrine's ability to integrate RF, digital and analog components onto a single die. While integration has traditionally offered high-volume markets the benefit of lower cost, Peregrine uses intelligent integration to offer performance advantages such as configurability, flexibility, reliability, repeatability, ease-of-use and a reduced form factor.

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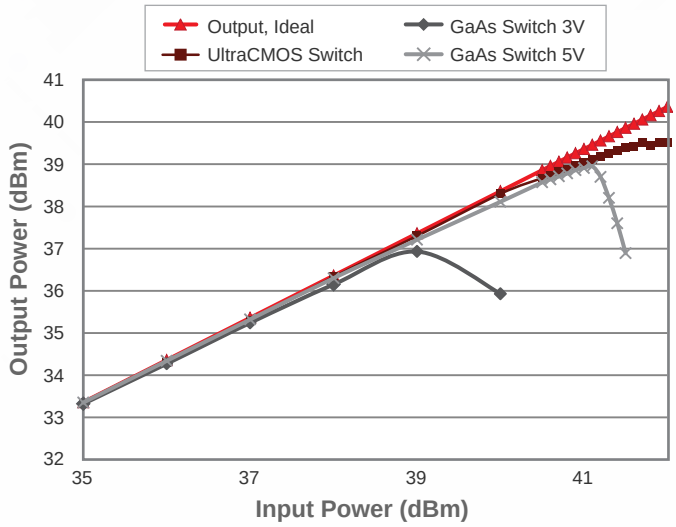
High-performance RF Products

RF complexity is growing exponentially as more wireless devices compete for signals throughout more frequency bands, and Peregrine continues to achieve several SOI industry firsts that offer RF engineers the widest range of high-performance RF choices. UltraCMOS products allow engineers the flexibility to prioritize attributes—like small form factor, low power consumption, high reliability, radiation tolerance, high ESD ratings, programmability, affordability, reduced board area—based on use case.

Linearity Figure of Merit: P0.1dB

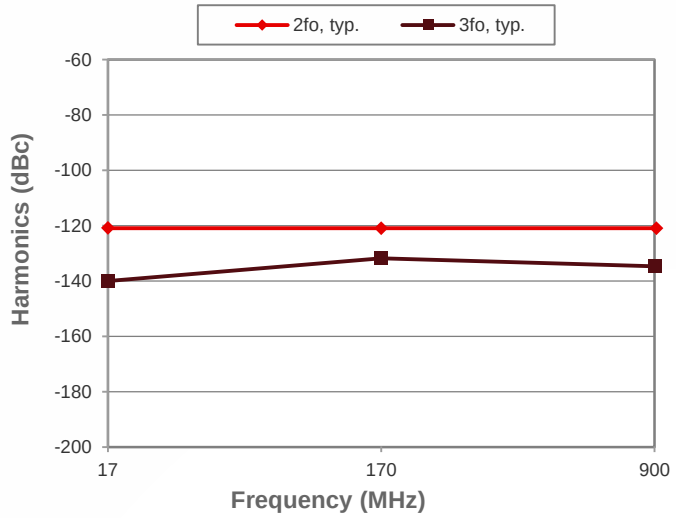
An UltraCMOS switch exhibits close to ideal linearity behavior up to the input 0.1dB compression point (P0.1dB), which remains invariant over power supply voltages.



UltraCMOS switches do not compress in the same manner as switches on other technology processes and a traditional P1dB measurement cannot be performed. Because UltraCMOS switch linearity is defined by the power handling capabilities of each switch, the P0.1dB compression point (derived from P_{MAX}) is used as the figure of merit to reflect each switch's true linearity performance.

Industry-leading Linearity Performance

PE42723 second and third harmonics (P_{IN} = 65 dBmV)



The PE42723 SPDT RF switch for DOCSIS 3.1/3.0 features unmatched linearity performance enabled by UltraCMOS, the only technology capable of addressing the linearity challenges of the future.

General-purpose RF Switches

Peregrine's broadband and general-purpose RF switches deliver an industry-leading combination of insertion loss, isolation, linearity and settling time, while routing RF signals to their respective transmit or receive paths.

General-purpose RF Switches — 50Ω

Product Description[1]	Part Number	Product Highlight	Operating Frequency (MHz)		Linearity IIP3/IIP2 (dBm)	P0.1dB (dBm)	Insertion Loss (dB)		Isolation (dB)		V_{DD} Range (V)	Switching Time (µs)[2]	ESD HBM (V)	Package
			Min	Max			Min	Max	Min	Max				
SPST, A	PE4246	Low Insertion Loss	1	5000	53 / –	33	0.8	1.3	44	55	2.7–3.3	2	200	6L 3×3 DFN
SPST, OR	PE613010	Tuning Control	100	3000	70 / –	–	0.20	0.80	4	11	2.3–5.5	7	2000	10L 2×2 QFN
SPDT, A	PE4251	Low Insertion Loss	10	3000	59 / –	30.5	0.55	0.75	43	62	3.0–3.6	0.15	4000	8L MSOP
SPDT, A	PE4257	High Isolation	5	3000	55 / 80	31	0.75	1.2	44	64	2.7–3.3	2	1000	20L 4×4 QFN
SPDT, A/OR	PE42020	True DC	0 Hz	8000	62 / 115	38	0.6	1.1	34	48	11–15[3]	10	1000	20L 4×4 QFN
SPDT, A	PE42420[4]	High Isolation	100	6000	65 / 110	33	0.95	1.6	50	69	2.7–5.5	0.3	4000	20L 4×4 LGA
SPDT, A	PE42520	Broadband	0.009	13000	66 / 120	39	0.6	2.0	18	90	2.3–5.5	5.5	4000	16L 3×3 QFN
SPDT, A	PE42521	Broadband, FS[5]	0.009	13000	65 / 120	38	0.6	1.85	17	90	2.3–5.5	0.5	3000	16L 3×3 QFN
SPDT, A	PE42522	Broadband	0.009	26500	59 / 121	33	0.7	5.3	22	73	2.3–5.5	3	3500	29L 4×4 LGA
SPDT, A	PE42553	Broadband	0.009	8000	66 / 120	39	0.6	0.85	41	90	2.3–5.5	5.5	4000	16L 3×3 QFN
SPDT, R	PE4239	Low Insertion Loss	10	3000	45 / –	27	0.7	0.9	23	32	2.7–3.3	0.3	1500	6L SC70
SPDT, R	PE4245	Low Insertion Loss	10	4000	45 / –	27	0.6	0.7	32	42	2.7–3.3	0.2	1500	6L 3×3 DFN
SPDT, R	PE4250	Low Insertion Loss	10	3000	59 / –	30.5	0.6	0.75	40	51	3.0–3.6	0.15	4000	8L MSOP
SPDT, R	PE4259	Low Insertion Loss	10	3000	55 / –	34	0.35	0.5	20	30	1.8–3.3	1.5	2000	6L SC70
SPDT, R	PE423422[4]	Automotive	100	6000	73.5 / 115	34	0.25	0.9	16	41	2.3–5.5	2	1000	12L 2×2 QFN
SPDT, R	PE42359[4]	Automotive	10	3000	55 / –	33.5	0.35	1.1	14	35	1.8–3.3	2	2000	6L SC70
SPDT, R	PE42421	Low Insertion Loss	10	3000	55 / –	30.5	0.35	0.5	20	30	1.8–3.3	1.5	2000	6L SC70
SPDT, R	PE42422	Low Insertion Loss	5	6000	70 / 115	34	0.23	0.9	17	68	2.3–5.5	2	4000	12L 2×2 QFN
SPDT, A	PE42423	High Isolation	100	6000	65 / 120	39.5	0.8	0.95	41	51	2.3–5.5	0.5	3000	16L 3×3 QFN
SPDT, R	PE42424[4]	High Isolation, FS[5]	100	6000	61 / 125	41	0.8	0.95	34	47	2.3–5.5	0.145	2500	6L 1.5×1.5 DFN
SPDT, R	PE42524	Wideband	10	40000	50 / –	32.5	0.6	5.5	33	84	–	0.225	2000	Flip Chip
SPDT, R	PE42820	High Power	30	2700	85 / –	45.5	0.3	0.7	24	35	2.3–5.5	15	1500	32L 5×5 QFN
SPDT, R	PE42821	High Power, FS[5]	100	2700	82 / –	45.5	0.4	0.8	24	35	2.3–5.5	7	1500	32L 5×5 QFN
NEW SPDT, A	PE42822	High Power	700	3800	65 / –	39.5	0.8	1.05	39	47	2.3–5.5	0.500	1500	16L 3×3 QFN
SP3T, R	PE42430	Low Insertion Loss	100	3000	66 / 100	30	0.45	0.55	30	40	3.0–5.5	0.500	4500	8L 1.5×1.5 DFN
SP4T, A	PE42441	Low Insertion Loss	10	8000	58 / 110	31	0.8	1.2	31	45	3.0–3.55	5	2000	32L 5×5 LGA
SP4T, A	PE42442[4]	High Isolation	30	6000	58 / 97	35	0.9	1.9	32	61	2.3–5.5	0.255	2000	24L 4×4 QFN
SP4T, A	PE42540	Broadband	0.00001	8000	58 / 100	33	0.7	1.2	31	84	3.0–3.6	5	1000	32L 5×5 LGA
SP4T, A	PE42542	Broadband	0.009	18000	58 / 118	33	0.7	3.1	27	90	2.3–5.5	3	3500	29L 4×4 LGA
SP4T, A	PE42543	Broadband, FS[5]	0.009	18000	59 / 113	33	0.7	3.2	29	90	2.3–5.5	0.5	2500	29L 4×4 LGA
SP4T, OR	PE613050	Tuning Control	100	3000	72 / –	–	0.20	0.55	17	28	2.3–5.5	7	2000	10L 2×2 QFN
SP4T, R	PE423641[4]	Automotive	50	3000	68 / 115	37	0.5	0.95	22	32	2.65–3.3	1	2000	16L 3×3 QFN
SP4T, R	PE42440	Low Insertion Loss	50	3000	67 / 96	41.5	0.45	0.85	22	34	2.7–3.3	2	2000	16L 3×3 QFN
SP4T, R	PE42641	Low Insertion Loss	100	3000	–	–	0.45	0.55	27.5	35	2.65–2.85	2	2000	16L 3×3 QFN
SP5T, A	PE42451	High Isolation	450	4000	58 / 95	35	1.6	2.25	50	68	2.7–3.3	0.200	3500	24L 4×4 QFN
SP5T, A	PE42452[4]	High Isolation	450	4000	57 / 96	35	0.95	1.6	44	61	2.3–5.5	0.265	3500	24L 4×4 QFN
SP(3/5)T, R	PE42850	High Power	30	1000	80 / –	45.5	0.25	0.35	30	36	2.3–5.5	15	1500	32L 5×5 QFN
SP(3/5)T, R	PE42851	High Power, FS[5]	100	1000	80 / –	45.5	0.25	0.4	30	36	2.3–5.5	6	1500	32L 5×5 QFN
NEW DDSPDT[6], OR	PE42920	High Isolation	0.01	6000	50 / –	13	0.7	1.0	26	30	2.97–3.63	0.270	2000	16L 3×3 QFN

Note 1: Absorptive (A), reflective (R) or open reflective (OR).
Note 2: 50% CTRL to 90% or 10% RF.
Note 3: Requires external negative voltage (V_{SS}, –11V to –15V) for operation. See datasheet for details.
Note 4: Operating temperature up to +105 °C.
Note 5: Fast switching (FS).
Note 6: Dual differential single pole double throw (DDSPDT).

75Ω 50Ω *Our general-purpose reflective 50Ω switches can also be used in a 75Ω environment.*

TE/ATE Switches

Peregrine offers complementary devices for test equipment (TE) and automated test equipment (ATE) applications. HaRP™ technology enhancements reduce gate lag and insertion loss drift while maintaining high linearity and isolation over an extended frequency range up to 40 GHz.

TE/ATE Switches — 50Ω

Product Description[1]	Part Number	Operating Frequency (MHz)		Linearity IIP3/IIP2 (dBm)	P0.1dB (dBm)	Insertion Loss (dB)		Isolation (dB)		Settling Time (µs)[2]	Switching Time (µs)[3]	ESD HBM (V)	Package
		Min	Max			Min	Max	Min	Max				
SPDT, A	PE42520	0.009	13000	66 / 120	39	0.6	2.0	18	90	15	5.5	4000	16L 3×3 QFN
SPDT, A	PE42521	0.009	13000	65 / 120	38	0.6	1.85	17	90	2	0.5	3000	16L 3×3 QFN
SPDT, A	PE42522	0.009	26500	59 / 121	33	0.7	5.3	22	73	7	3	3500	29L 4×4 LGA
SPDT, A	PE42553	0.009	8000	66 / 120	39	0.6	0.85	41	90	15	5.5	4000	16L 3×3 QFN
SPDT, R	PE42524	10	40000	50 / –	32.5	0.6	5.5	33	84	0.84	0.225	2000	Flip Chip
SP4T, A	PE42540	.00001	8000	58 / 100	33	0.7	1.2	31	84	15	5	2000	32L 5×5 LGA
SP4T, A	PE42542	0.009	18000	58 / 118	33	0.7	3.1	27	90	7	3	3500	29L 4×4 LGA
SP4T, A	PE42543	0.009	18000	59 / 113	33	0.7	3.2	29	90	2	0.5	2500	29L 4×4 LGA

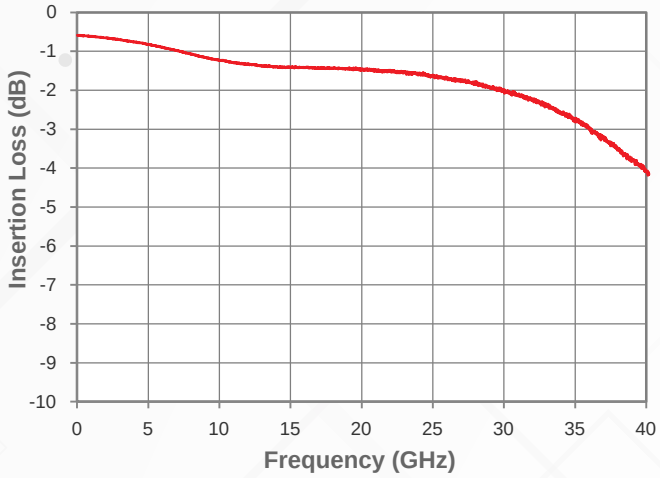
Note 1: Absorptive (A) or reflective (R).
Note 2: 50% CTRL to 0.05 dB final value.
Note 3: 50% CTRL to 90% or 10% RF.

High-frequency Examples: Breakthrough RF Performance

UltraCMOS high-frequency switches provide best-in-class, stable and consistent performance across the entire frequency range.

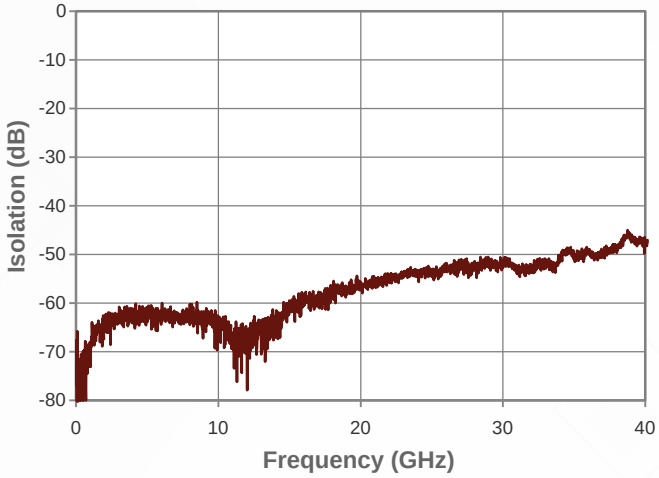
PE42524 Insertion Loss

Predictable and smooth insertion loss behavior over a broad frequency range.



PE42524 Isolation

Groundbreaking port-to-port isolation of 50 dB at 35 GHz.



For additional information about optimizing high-frequency performance, please see application note AN42.

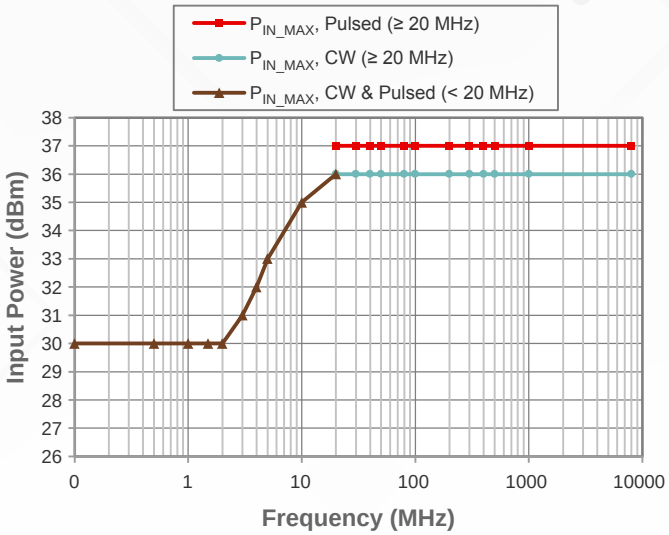
True DC RF Switch

Peregrine's new UltraCMOS PE42020 is the industry's first and only RF integrated switch to operate at zero Hz. This True DC RF switch features high power handling and maintains excellent RF performance and linearity from DC through 8000 MHz.

True DC RF Switch — 50Ω

Product Description	Part Number	Operating Frequency		Linearity IIP3/IIP2 (dBm)	P0.1dB (dBm)	Insertion Loss (dB)		Isolation (dB)		Settling Time (µs)[1]	Switching Time (µs)[2]	ESD HBM (V)	Package
		Min	Max			Min	Max	Min	Max				
SPDT, A & OR[3]	PE42020	0 Hz	8000 MHz	62 / 115	38	0.6	1.1	34	48	35	10	1000	20L 4×4 QFN

Note 1: 50% CTRL to 0.05 dB final value.
Note 2: 50% CTRL to 90% or 10% RF.
Note 3: Configurable 50Ω absorptive (A) or open reflective (OR) switch.



PE42020 Power Handling

The PE42020 exhibits high power handling of 30 dBm at 0 Hz and 36 dBm at 8 GHz. This graph shows the maximum RF input power (P_{IN_MAX}) for pulsed, CW and CW/pulsed at 0 °C to +85 °C ambient temperature, V_{DD} = +15V, and V_{SS} = –15V.

High-power RF Switches

UltraCMOS high-power switches change the paradigm of high-power switch design by providing a solution that delivers a cost-effective, simple to design-in long-term solution—a small footprint, monolithic, turnkey design with extremely low power consumption, excellent harmonic performance and high power handling.

High-power RF Switches — 50Ω

Product Description[1]	Part Number	Operating Frequency (MHz)		P0.1dB (dBm)	Insertion Loss (dB)		Isolation (dB)		RF input power, CW (dBm)	Harmonics[2] 2fo/3fo (dBc)	ESD HBM (V)	Package
		Min	Max		Min	Max	Min	Max				
SPDT, R	PE42820	30	2700	45.5	0.3	0.7	24	35	43	–94 / –84	1500	32L 5×5 QFN
SPDT, R	PE42821	100	2700	45.5	0.4	0.8	24	35	43	–82 / –85	1500	32L 5×5 QFN
NEW SPDT, A	PE42822	700	3800	39.5	0.8	1.05	39	47	32	–	3000	16L 3×3 QFN
SP3T/SP5T, R	PE42850	30	1000	45.5	0.25	0.35	30	36	42.5	–90 / –90	1500	32L 5×5 QFN
SP3T/SP5T, R	PE42851	100	1000	45.5	0.25	0.4	30	36	42.5	–80 / –80	1500	32L 5×5 QFN

Note 1: Absorptive (A) or reflective (R).
Note 2: See datasheet for RF input power conditions.

Automotive AEC-Q100 Certified Switches

Peregrine's automotive RF switches are AEC-Q100 Grade 2 certified and capable of supporting operating temperatures up to +105 °C.

AEC-Q100 Certified

Automotive AEC-Q100 Certified Switches, Up to +105 °C

Product Description*	Part Number	Operating Frequency (MHz)		Linearity IIP3/IIP2 (dBm)	P0.1dB (dBm)	Insertion Loss (dB)		Isolation (dB)		Typical I_{DD} (µA @ 3V)	V_{DD} Range (V)	ESD HBM (V)	Package
		Min	Max			Min	Max	Min	Max				
SPDT, R	PE423422	100	6000	73.5 / 115	34	0.25	0.9	16	41	120	2.3–5.5	1000	12L 2×2 QFN
SPDT, R	PE42359	10	3000	55 / –	33.5	0.35	1.1	14	35	9	1.8–3.3	2000	6L SC70
SP4T, R	PE423641	50	3000	68 / 115	37	0.5	0.95	22	32	13	2.65–3.3	2000	16L 3×3 QFN

Note: * Reflective (R).

Wired Broadband 75Ω Switches

Simplify your next RF design with high-performance UltraCMOS 75Ω switches. Excellent isolation, low insertion loss and a CMOS/TTL compatible control address the needs of wired broadband applications.

Wired Broadband Switches — 75Ω

Product Description[1]	Part Number	Product Highlight	Operating Frequency (MHz)		CTB/CSO (dBc)	P0.1dB (dBm)	Insertion Loss (dB)		Isolation (dB)		V_{DD} Range (V)	ESD HBM (V)	Package
			Min	Max			Min	Max	Min	Max			
SPST, A	PE4270	Low Insertion Loss	1	3000	–90[2]	30	0.5	0.7	63	90	2.7–3.3	500	6L 3×3 DFN
SPDT, A	PE4256	Low Insertion Loss	5	3000	–90[2]	31	0.5	1.1	52	80	2.7–3.3	1000	20L 4×4 QFN
SPDT, A	PE4280	High Isolation	5	2200	–85[2]	26	0.5	1.1	47	72	2.7–3.3	1000	20L 4×4 QFN
SPDT, A	PE42721	Low Insertion Loss	5	2200	–99 / <–105	27	0.4	0.65	53	85	2.3–5.5	3000	12L 3×3 QFN

Note 1: Absorptive (A) or reflective (R).

Note 2: CTB/CSO measured with 77 and 110 channels; PO = 44 dBmV.

DOCSIS 3.1/3.0 High Linearity Wired Broadband Switches — 75Ω

Product Description*	Part Number	Operating Frequency (MHz)		Harmonics, fo = 17 MHz, P_{IN} = 65 dBmV (dBc)		P0.1dB (dBmV)	Insertion Loss (dB)		Isolation (dB)		V_{DD} Range (V)	ESD HBM (V)	Package
		Min	Max	2fo	3fo		Min	Max	Min	Max			
SPDT, R	PE42722	5	1794	–118	–140	88	0.2	0.85	29	50	2.3–5.5	1500	32L 5×5 QFN
NEW SPDT, R	PE42723	5	1794	–121	–140	87	0.1	0.4	34	54	2.3–5.5	3000	12L 3×3 QFN

Note: * Reflective (R).

Wired Broadband Switches — 75Ω — With Unpowered Operation[1]

Product Description[2]	Part Number	Operating Frequency (MHz)		CTB/CSO (dBc)	P1dB[3] PWR/UNPWR (dBm)	Insertion Loss PWR (dB)		Isolation PWR/UNPWR (dB)		V_{DD} Range (V)	ESD HBM (V)	Package
		Min	Max			Min	Max	Min	Max			
SPDT, A	PE42742	5	2200	–90 / –77[4]	32 / 26.5	0.45	1.7	53 / 52.5	94 / 90.5	2.7–3.3	3500	20L 4×4 QFN
SPDT, A	PE42750	5	2200	–81 / –110[5]	23.5	0.7	1.7	57 / 72	84 / 90	2.7–3.6	2000	12L 3×3 QFN

Note 1: Unpowered state: PE42742: RFC–RF1 ON; PE42750: All ports terminated.

Note 2: Absorptive (A).

Note 3: Measured at 1 GHz.

Note 4: CTB/CSO measured with 77 and 110 channels; PO = 44 dBmV.

Note 5: CTB/CSO measured with 159 channels; PO = 42 dBmV.

75Ω 50Ω

Our general-purpose reflective 50Ω switches can also be used in a 75Ω environment.

Glitch-less Digital Step Attenuators (DSA)

Peregrine's new glitch-less DSAs feature a novel architecture to provide the best-in-class glitch-less transition behavior when changing attenuation states and is specified to support temperatures all the way up to +105 ˚C.

Glitch-less Digital Step Attenuators (Monolithic) — 50Ω, Up to +105 ˚C

Product Description, Part Number	Attenuation (dB) (Range/Steps)	Programming Mode	Operating Frequency (MHz)		Insertion Loss (dB)		Input IP3 (dBm)	Attenuation Accuracy (dB @ 2.2 GHz)	Switching Time (ns)	ESD HBM (V)	Package
			Min	Max	Min	Max					
7-bit – PE43711	31.75 / 0.25, 0.5, 1.0	Parallel[1], Serial	0.009	6000	1.3	2.4	57	±(0.15 + 1.5% of setting)	275	3000	24L 4×4 QFN
7-bit – PE43712	31.75 / 0.25, 0.5, 1.0	Parallel[1], Ser-Add[2]	0.009	6000	1.3	2.45	57	±(0.20 + 1.5% of setting)	275	3000	32L 5×5 QFN
7-bit – PE43713[3]	31.75 / 0.25, 0.5, 1.0	Parallel[1], Ser-Add[2]	0.009	6000	1.3	2.45	57	±(0.20 + 1.5% of setting)	275	3000	32L 5×5 QFN

Note 1: Parallel modes: latched and direct. **Note 2:** Serial-addressable mode. **Note 3:** External V_{SS} option.

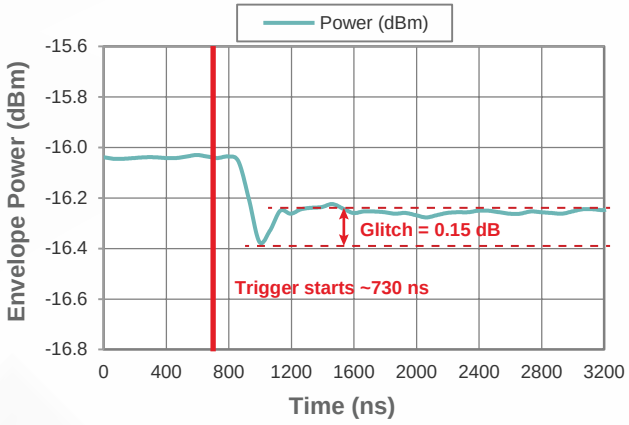
Glitch-less Digital Step Attenuator (Monolithic) — 75Ω, Up to +105 ˚C

Product Description, Part Number	Attenuation (dB) (Range/Steps)	Programming Mode	Operating Frequency (MHz)		Insertion Loss (dB)		Input IP3 (dBm)	Attenuation Accuracy (dB @ 1.2 GHz)	Switching Time (ns)	ESD HBM (V)	Package
			Min	Max	Min	Max					
NEW 6-bit – PE4314[1]	31.5 / 0.25	Parallel[2], Serial	1	2500	1	1.5	58	±(0.15 + 3% of setting)	370	1500	20L 4×4 QFN

Note 1: External V_{SS} option. **Note 2:** Parallel modes: latched and direct.

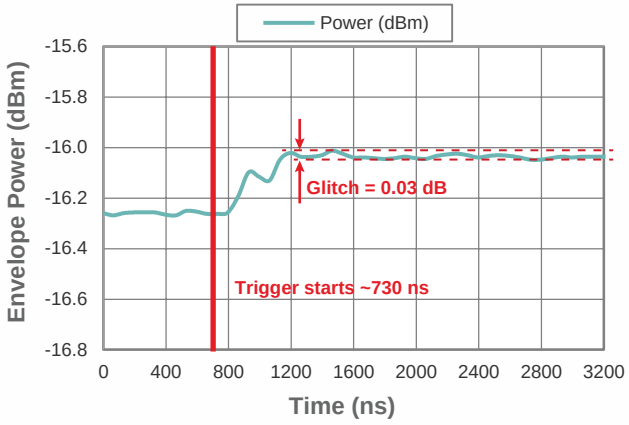
Glitch-less Attenuation Transient: 15.75–16 dB

Typical Switching Time = 275 ns



Glitch-less Attenuation Transient: 16–15.75 dB

Typical Switching Time = 275 ns



50Ω Digital Step Attenuators

Digital Step Attenuators (Monolithic) — 50Ω

Product Description, Part Number	Attenuation (dB) (Range/Steps)	Programming Mode	Operating Frequency (MHz)		Insertion Loss (dB)		Input IP3 (dBm)	Attenuation Accuracy (dB @ 1 GHz)	Switching Time (µs)	ESD HBM (V)	Package
			Min	Max	Min	Max					
2-bit – PE43205[1]	18 / 6, 12	Parallel	35	6000	0.5	1.05	61	+0.10	0.029	2000	12L 3×3 QFN
6-bit – PE4312[1,2]	31.5 / 0.5	Parallel[3], Serial	1	4000	1.3	2.1	59	±(0.15 + 2% of setting)	0.6	2000	20L 4×4 QFN
7-bit – PE43704[2]	31.75 / 0.25, 0.5, 1.0	Par[3], Ser, Ser-Add[4]	0.009	8000	1.3	2.4	61	+(0.15 + 3% of setting) –(0.1 + 1% of setting)	1.1	1500	32L 5×5 QFN
7-bit – PE43705[1,2]	31.75 / 0.25, 0.5, 1.0	Par[3], Ser, Ser-Add[4]	50	8000	1.3	2.4	65	+(0.15 + 1.5% of setting) –(0.1 + 1% of setting)	1	1500	32L 5×5 QFN

Note 1: Operating temperature up to +105 °C.
Note 2: Glitch-safe: negative glitch only.
Note 3: Parallel modes: latched and direct.
Note 4: Serial-addressable mode.

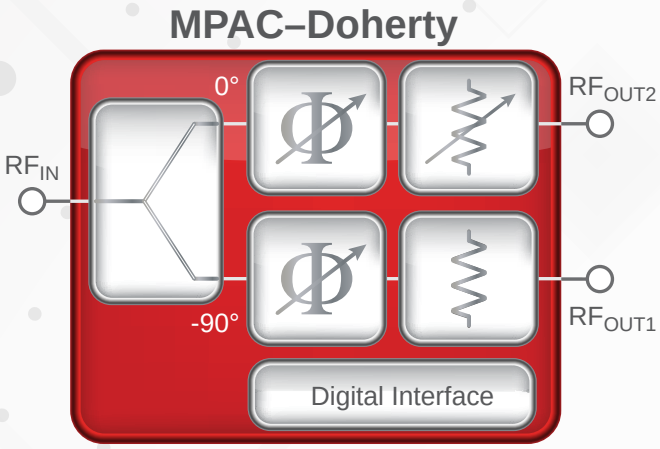
Monolithic Phase and Amplitude Controller (MPAC) Devices

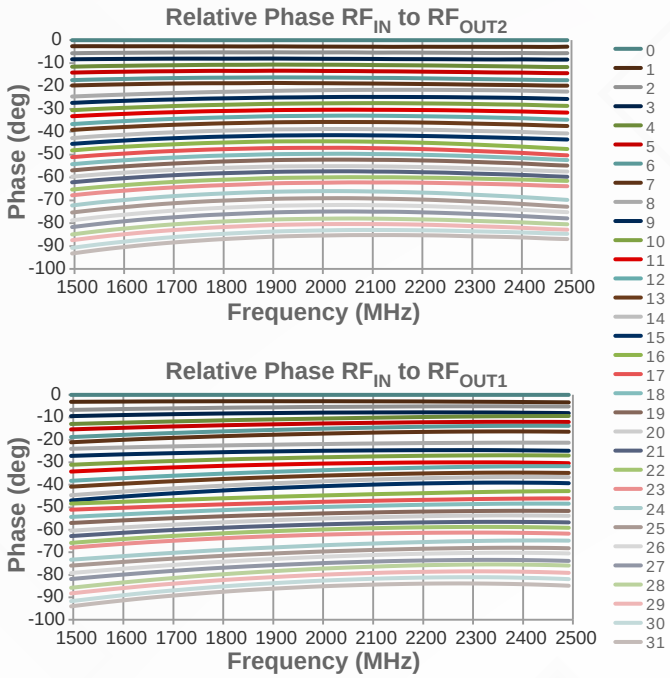
As well as being ideal for Doherty power amplifier architectures, other products in the MPAC family are ideal for beamforming, full wireless duplex and 5G by enhancing system performance, lowering bill of material (BoM) costs, increasing reliability and providing maximum tuning flexibility.

MPAC–Doherty — 50Ω

Product Description, Part Number	Phase (°) (Range/Steps) 5 bits	Attenuation (dB) (Range/Steps) 4 bits	Programming Mode	Operating Frequency (GHz)		Insertion Loss (dB)	Input IP3 (dBm)	P0.1dB (dBm)	V_{DD} Range (V)	I_{DD} (µA)	ESD HBM (V)	Package
				Min	Max							
5/4-bit – PE46120	–87.2 / 2.8	7.5 / 0.5	Serial	1.8	2.2	6.9	60	35	2.3–5.5	350	1000	32L 6×6 QFN
NEW 5/4-bit – PE46130	–87.2 / 2.8	7.5 / 0.5	Serial	2.3	2.7	7.2	70	35	2.3–5.5	350	1500	32L 6×6 QFN
NEW 5/4-bit – PE46140	–87.2 / 2.8	7.5 / 0.5	Serial	3.4	3.8	6.5	60	35	2.3–5.5	350	1500	32L 6×6 QFN

Relative Phase RF_{IN} to RF_{OUT} (All Phase States)



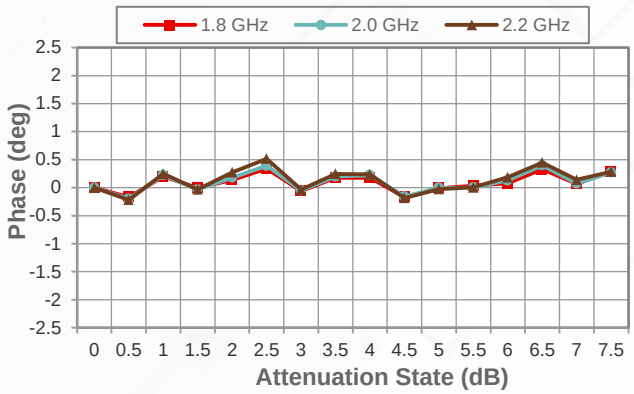


Pin-compatible MPAC—Doherty Family

These devices are highly monotonic over a broad frequency range for all RF_{OUT1}/RF_{OUT2} phase states.

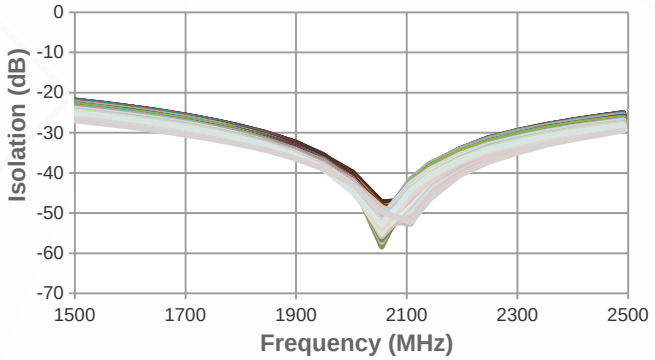
Phase Variation Across Atten State

Excellent phase stability across all RF_{OUT} attenuation states.

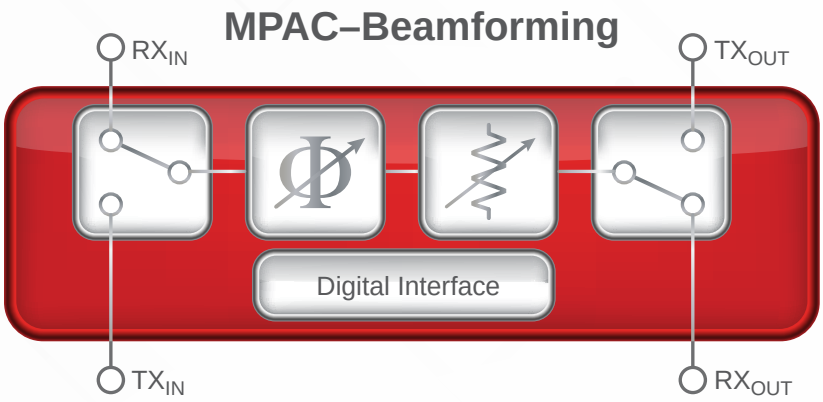


Isolation Output Ports (All States)

High isolation across all phase and attenuation states.



MPAC–Beamforming — 50Ω											
Product Description, Part Number	Phase (°) (Range/Steps) 6 bits	Attenuation (dB) (Range/Steps) 6 bits	Programming Mode	Operating Frequency (GHz)		Insertion Loss (dB)	Input IP3 (dBm)	P0.1dB (dBm)	V_{DD} Range (V)	ESD HBM (V)	Package
				Min	Max						
NEW PE19601	355 / 5	31.5 / 0.5	Serial	8	12	10	44	17	3.3	1000	Die



MPAC—Beamforming

This high-frequency device will revolutionize synthetic aperture radar and flat panel arrays. A single chip that uses monolithic microwave integrated circuit (MMIC) design techniques controlled through a standard digital interface, this product delivers the high linearity, fine resolution and degree of control critical for radar and beamforming applications.

Power Limiting Devices

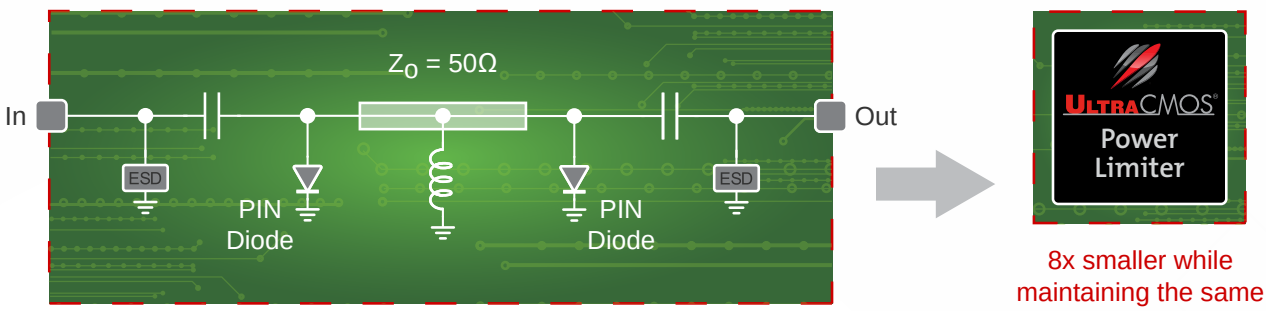
UltraCMOS power limiters deliver simple, repeatable and reliable protection, ideal for test-and-measurement (T&M), land-mobile-radio (LMR), wireless infrastructure, military and radar systems in the industry's first turnkey, monolithic solutions.

Power Limiters									
Part Number	Operation Modes	Operating Frequency	Adjustable Power Limiting Threshold (dBm)	Max Power Handling (dBm)		Input IP3 (dBm)	Control Voltage Range (V)*	ESD HBM (V)	Package
				Pulsed (50W)	CW (10W)				
PE45140	Limiting, Reflecting	20–2000 MHz	22–32	47	40	64	–2.5 to –0.5	8000	12L 3×3 QFN
PE45450	Limiting, Reflecting	9 kHz–6 GHz	25–35	47	40	70	–2.5 to –0.5	8000	12L 3×3 QFN

Note: * Limiting mode.

Replacing GaAs Solutions

An UltraCMOS power limiting device is up to eight times smaller than traditional gallium arsenide (GaAs) solutions and offers better linearity, versatility and reliability.



8x smaller while maintaining the same power dissipation

ESD

UltraCMOS® RFICs deliver extraordinary ESD tolerance—up to 8 kV HBM in the new power limiting devices.

Mixers

Peregrine's UltraCMOS mixers are broadband, quad metal-oxide-semiconductor field-effect transistor (MOSFET) array cores. The integrated receive mixers feature high linearity, image rejection, LO isolation, strong low-frequency performance, monolithic integration and high reliability, making them easier to implement and more dependable than GaAs-based MOSFET arrays.

Mixer Core

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[1,2]	0.01–6000	0.01–6000	0.01–6000	0 to +20	6.5–7.5	25–40	25–40	36	100	6L 3×3 DFN, DIE
PE4141[1,2]	0.01–1000	0.01–1000	0.01–1000	0 to +20	7.0–8.0	40	40	33	100	8L MSOP
PE4151[1]	245–410	136–520	44.85–109.65	–10 to –6	6.5–8.5	43	40	26	1000	10L MSOP
NEW PE4152[1]	245–831	136–941	109.65	–10 to +23	6.5–7.5	30–60	22–58	26	1000	20L 4×4 QFN
NEW PE41901	12–19 GHz	10–19 GHz	DC–4 GHz	+13 to +17	10–12	40	25	21	250	20L 4×4 QFN

Note 1: Fully differential DC coupled ports. External baluns required. **Note 2:** Quad MOSFET array.

Digital Phase Shifter

Get flexibility for the most design-stringent requirements with high linearity, excellent harmonic performance, extended phase range, high resolution, low RMS phase and amplitude error and dual programming options.

Digital Phase Shifter (Monolithic) — 50Ω, Up to +105 ˚C

Part Number	Operating Frequency (GHz)	Bit #	Range (°)	Resolution (°)	Insertion Loss (dB)	RMS Phase Error (°)	RMS Amplitude Error (dB)	Settling Time (ns)	V_{DD} Range (V)	ESD HBM (V)	Package
NEW PE44820*	1.7–2.2	8	358.6	1.4	6	1.0	0.1	355	2.3–5.5	1000	32L 5×5 QFN

Note: * With extended frequency support from 1–3 GHz.

Prescaler

Prescalers divide the frequency of a wireless signal to extend the operating range of a phase-locked loop (PLL) beyond its base capability. UltraCMOS prescalers enable exceptional low phase noise performance in C, X and Ku frequency bands while consuming extremely low power.

Prescaler

Part Number	Type	Description	Operating Frequency (MHz)		ESD HBM (V)	Package
			Min	Max		
NEW PE35400	Divide by 4	Low Power	3000	13500	250	DIE

Phase-locked Loop (PLL) Frequency Synthesizer

Capable of frequency synthesis up to 3.0 GHz with superior phase noise, the PE83336 addresses the needs of rugged military environments including: radio handsets, radar, avionics, missiles, etc.

Integer-N Phase-locked Loop (PLL) Frequency Synthesizer

Part Number	Φ Det Type	Programming Mode	Max Input Operating Frequency			Prescaler	Main Counters M, A	Reference Counters	Typical I_{DD} (mA @ 2.8V)	ESD HBM (V)	Package
			(GHz) RF PLL	(MHz) Ref	(MHz) Compare						
PE83336[1,2]	PD	Parallel, Serial, Hardwire	3	100	20	10/11	9-bit, 4-bit	6-bit	20	1000	44L CQFJ

Note 1: V_{DD} range = 2.85–3.15V. **Note 2:** Not available for space-level screening.

Digital Tuning Solutions

In complex radio designs where detuning can cause increased filter loss, power amplifier (PA) inefficiencies and antenna mismatch, signal-chain performance can be significantly improved with a monolithically integrated solid-state impedance tuning solution. Peregrine's digitally tunable capacitor (DTC) and tunable control switch products continue a tradition of innovation, high performance and ease-of-use by offering tunability, high-voltage handling and excellent linearity.

Digitally Tunable Capacitors

Part Number	Interface	Operating Frequency (MHz)		Min Shunt Capacitance (pF)	Max Shunt Capacitance (pF)	Tuning Ratio (Shunt)	Quality Factor (Shunt, 1 GHz)		Peak Operating Voltage (V_{PK})	V_{DD} Range (V)	ESD HBM (V)	Package
		Min	Max				Cmin	Cmax				
PE64101	SPI	100	3000	1.38	5.90	4.3:1	50	20	6	2.3–3.6	2000	12L 2×2 QFN
PE64102	SPI	100	3000	1.88	14	7.4:1	50	20	6	2.3–3.6	2000	12L 2×2 QFN
PE64904	SPI	100	3000	1.10	5.10	4.6:1	35	25	30	2.3–3.6	1500	10L 2×2 QFN
PE64906	SPI	100	3000	0.90	4.60	5.1:1	40	19	30	2.3–4.8	2000	10L 2×2 QFN
PE64907	SPI	100	3000	0.85	2.40	2.82:1	40	34	30	2.3–4.8	2000	10L 2×2 QFN
PE64908	SPI	100	3000	2.15	7.70	3.6:1	40	13	30	2.3–4.8	2000	10L 2×2 QFN
PE64909	SPI	100	3000	0.60	2.35	3.9:1	40	27	30	2.3–4.8	2000	10L 2×2 QFN

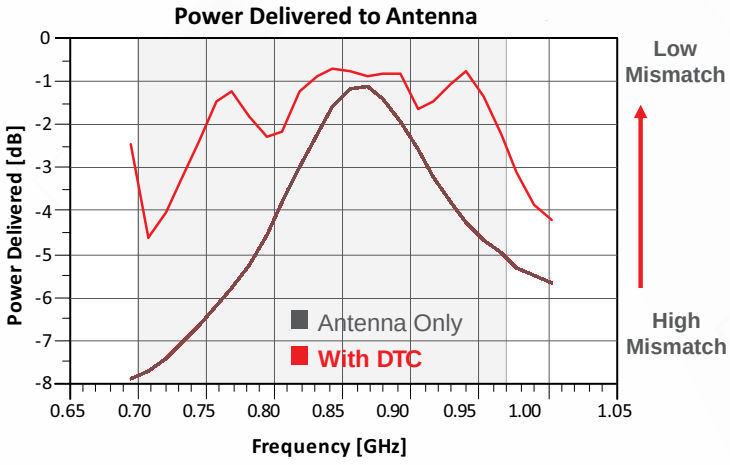
Tuning Control Switches

Product Description*	Part Number	Operating Frequency (MHz)		Interface	R_{ON} (Ω)	C_{OFF} (pF)	Peak RF Voltage (Vpk)	V_{DD} Range (V)	ESD HBM (V)	Package
SPST	PE613010	100	3000	GPIO	1.2	0.40	25	2.3–5.5	2000	10L 2×2 QFN
SP4T	PE613050	100	3000	GPIO	1.6	0.14	27	2.3–5.5	2000	12L 2×2 QFN

Note: * Open reflective switches.

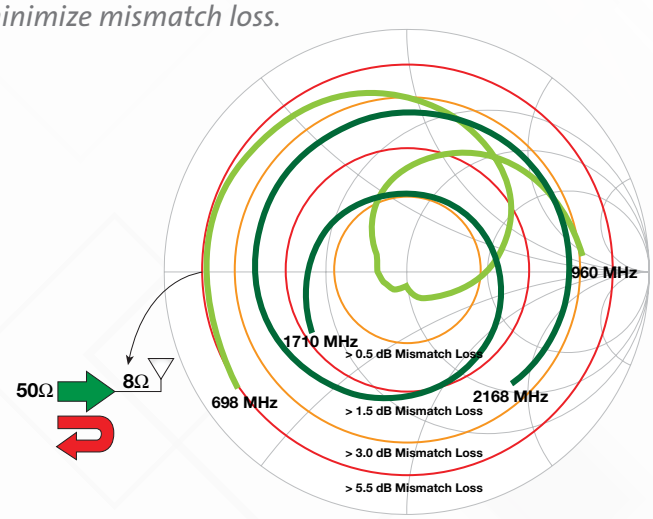
Antenna Impedance Tuning

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



Tunable Matching Networks

Match the desired impedance to 50Ω or other impedance over broadband (700–2200 MHz) to minimize mismatch loss.



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.

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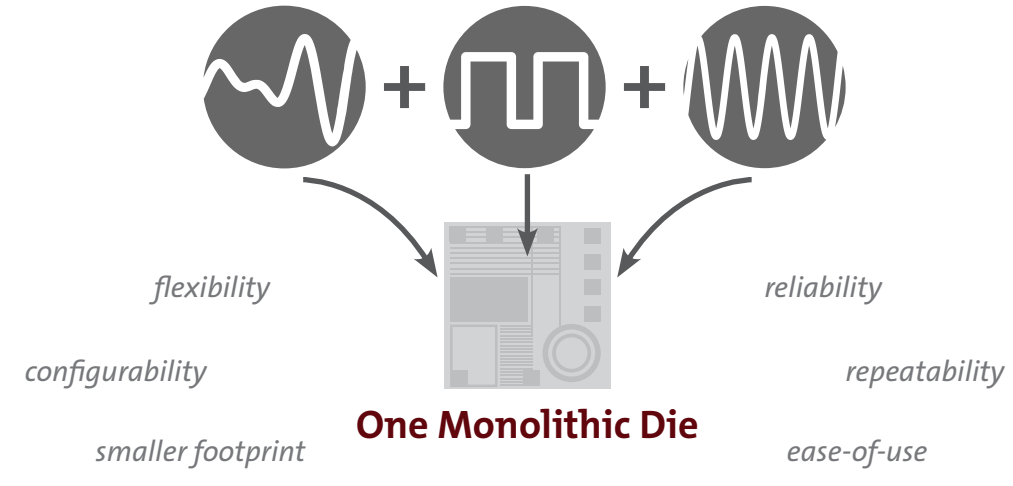
Intelligent Integration

UltraCMOS®

Peregrine products feature intelligent integration—the ability to integrate RF, digital and analog components on a single die. With intelligent integration, a single chip can integrate features such as analog DC tracking, digital logic control, high performance switching, phase shifters and digital step attenuators.



ULTRACMOS® GREEN

Going Green Starts on the Inside

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

RoHS-compliant Commercial Packaging Options

6L SC70
1.3 × 2.0 × 1.0

8L 1.5×1.5 DFN
1.5 × 1.5 × 0.50

10L 2×2 QFN
2.0 × 2.0 × 0.45

12L 2×2 QFN
2.0 × 2.0 × 0.60

8L MSOP
3.0 × 3.0 × 1.1

10L MSOP
3.0 × 3.0 × 0.86

6L DFN
3.0 × 3.0 × 0.9

12L 3×3 QFN
3.0 × 3.0 × 0.75

16L 3×3 QFN
3.0 × 3.0 × 0.75

20L 4×4 LGA
4.0 × 4.0 × 0.9

20L 4×4 QFN
4.0 × 4.0 × 0.9

24L 4×4 QFN
4.0 × 4.0 × 0.9

24L 4×4 LGA
4.0 × 4.0 × 0.9

29L 4×4 LGA
4.0 × 4.0 × 0.9

32L 5×5 QFN
5.0 × 5.0 × 0.9

32L 5×5 LGA
5.0 × 5.0 × 0.9

32L 6×6 QFN
6.0 × 6.0 × 0.9

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

Design and Application Support

Designing for tomorrow's challenging RF applications requires high-performance products and outstanding technical support. From our engineering excellence to streamlined manufacturing and technical sales and applications support, Peregrine Semiconductor is committed to providing a complete product solution. Choose among our comprehensive library of datasheets, application notes, tutorials, reference designs and other engineering resources, all developed to help get your design to market on time.

Online Support System—support.psemi.com

Visit our website to find the technical resources you need.

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Peregrine Semiconductor

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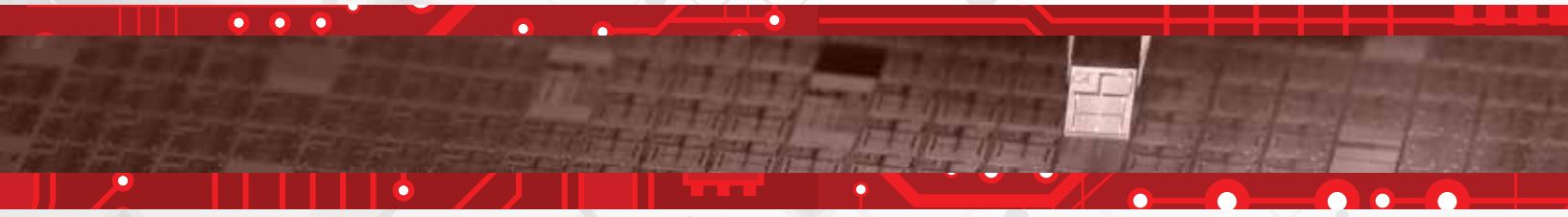

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