Product Brief
PE64904

UltraCMOS® Digitally Tunable Capacitor (DTC) 100-3000 MHz

For full datasheet, please visit dtc.psemi.com.

Product Description

The PE64904 is a DuNE™-enhanced Digitally Tunable Capacitor (DTC) based on Peregrine's UltraCMOS® technology. DTC products provide a monolithically integrated impedance tuning solution for demanding RF applications.

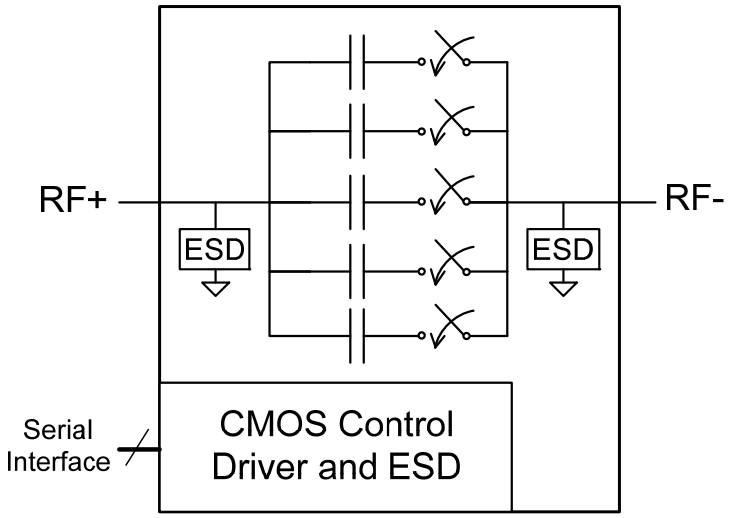
The PE64904 offers high RF power handling and ruggedness, while meeting challenging harmonic and linearity requirements.

This highly versatile product can be used in series or shunt configurations to support a wide variety of tuning circuit topologies.

The device is controlled through the widely supported 3-wire (SPI compatible) interface. All decoding and biasing is integrated on-chip and no external bypassing or filtering components are required.

Peregrine's DuNE™ technology enables excellent linearity and exceptional harmonic performance. DuNE devices deliver performance superior to GaAs devices with the economy and integration of conventional CMOS.

Figure 1. Functional Block Diagram



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Features

- 3-wire (SPI compatible) Serial Interface with built-in bias voltage generation and ESD protection
- DuNE™-enhanced UltraCMOS® device
- 5-bit 32-state Digitally Tunable Capacitor
- Series configuration C = 0.60 - 4.60 pF (7.7:1 tuning ratio) in discrete 129 fF steps
- Shunt configuration C = 1.14 - 5.10 pF (4.6:1 tuning ratio) in discrete 129 fF steps
- High RF Power Handling (up to 38 dBm, 30 V_{pk} RF) and High Linearity
- Wide power supply range (2.3 to 3.6V) and low current consumption (typ. 140 µA at 2.6V)
- Excellent 1.5 kV HBM ESD tolerance on all pins
- 2 x 2 x 0.45 mm QFN package
- Applications include:
  - Tunable Filter Networks
  - Tunable Antennas
  - RFID
  - Tunable Matching Networks
  - Phase Shifters
  - Wireless Communications

Figure 2. Package Type

10L 2 x 2 x 0.45 mm QFN package

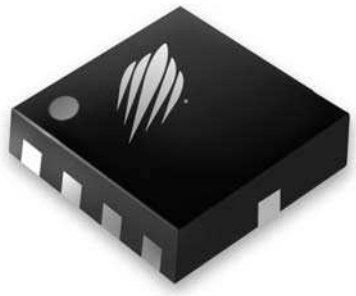


Table 1. Electrical Specifications @ 25°C, V_{DD} = 2.6V

Parameter	Configuration	Condition	Min	Typ	Max	Unit
Operating Frequency Range	Both		100		3000	MHz
Minimum Capacitance	Series Shunt	State = 00000, 100 MHz (RF+ to RF-) State = 00000, 100 MHz (RF+ to Grounded RF-)	0.49 0.99	0.60 1.10	0.71 1.21	pF
Maximum Capacitance	Series Shunt	State = 11111, 100 MHz (RF+ to RF-) State = 11111, 100 MHz (RF+ to Grounded RF-)	4.09 4.59	4.60 5.10	5.11 5.61	pF
Parasitic Capacitance	Series	All States, 100 MHz (RF+ to GND, RF- to GND)		0.5		pF
Tuning Ratio	Series Shunt	100 MHz 100 MHz		7.7:1 4.6:1		
Step Size	Both	5 bits (32 states), constant step size (100 MHz)		0.129		pF
Equivalent Series Resistance	Series	State = 00000 State = 11111		1.40 1.33		Ω
Quality Factor (C_{min})	Shunt	1GHz		35		
Quality Factor (C_{max})	Shunt	1GHz		25		
Harmonics (2fo)	Series	100 MHz - 3 GHz			-36	dBm
Harmonics (3fo)		100 MHz - 3 GHz			-36	dBm

Figure 3. Pin Configuration (Top View)

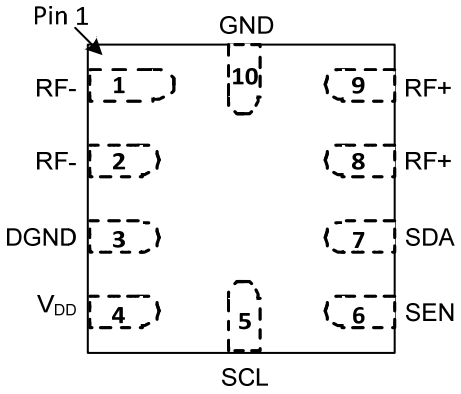


Table 2. Pin Descriptions

Pin #	Pin Name	Description
1	RF-	Negative RF Port[1]
2	RF-	Negative RF Port[1]
3	DGND	Ground
4	V_{DD}	Power supply pin
5	SCL	Serial interface Clock input
6	SEN	Serial Interface Latch Enable Input
7	SDA	Serial interface Data input
8	RF+	Positive RF Port[1]
9	RF+	Positive RF Port[1]
10	GND	RF Ground

Note: 1. Pins 1-2 and 8-9 must be tied together on PCB for optimal performance

Latch-Up Avoidance

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

Moisture Sensitivity Level

The Moisture Sensitivity Level rating for the PE64904 in the 10-lead 2 x 2 x 0.45 mm QFN package is MSL1.

Table 3. Operating Ranges

Parameter	Min	Typ	Max	Units
V_{DD} Supply Voltage	2.3	2.6	3.6	V
I_{DD} Power Supply Current (V_{DD} = 2.6V)		140	200	µA
V_{IH} Control Voltage High	1.2	1.8	3.6	V
V_{IL} Control Voltage Low	0	0	0.57	V
Peak Operating RF Voltage @100 MHz[1] RF+ to RF- RF+ and/or RF- to Ground			 30 30	 Vpk Vpk
T_{OP} Operating Temperature Range	-40		+85	°C
T_{ST} Storage Temperature Range	-65		+150	°C

Note: 1. De-rated over frequency

Table 4. Absolute Maximum Ratings

Symbol	Parameter/Conditions	Min	Max	Units
V_{DD}	Power supply voltage	-0.3	4.0	V
V_I	Voltage on any DC input	-0.3	4.0	V
V_{ESD}	ESD Voltage (HBM, MIL_STD 883 Method 3015.7)		1500	V

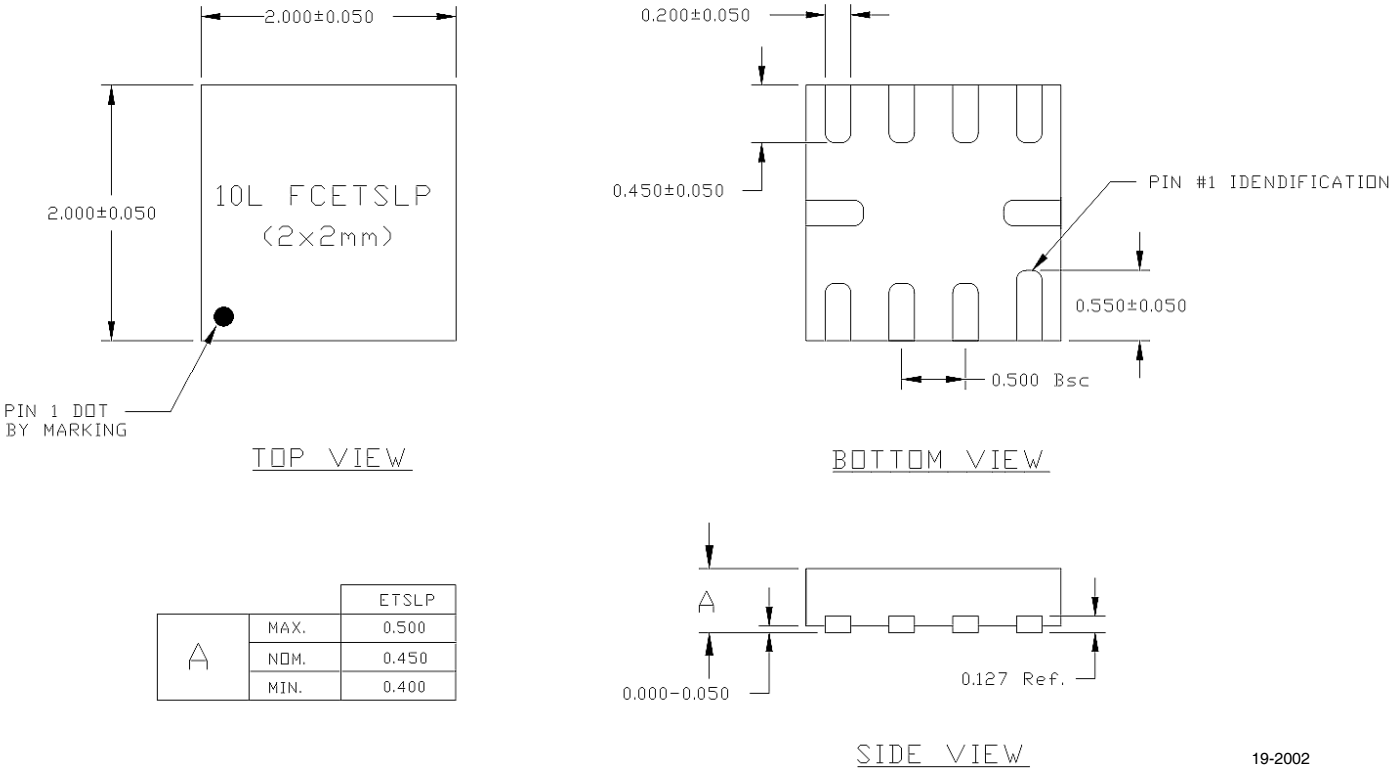
Exceeding absolute maximum ratings may cause permanent damage. Operation should be restricted to the limits in the Operating Ranges table. Operation between operating range maximum and absolute maximum for extended periods may reduce reliability.

Electrostatic Discharge (ESD) Precautions

When handling this UltraCMOS® device, observe the same precautions that you would use with other ESD-sensitive devices. Although this device contains circuitry to protect it from damage due to ESD, precautions should be taken to avoid exceeding the specified rating.

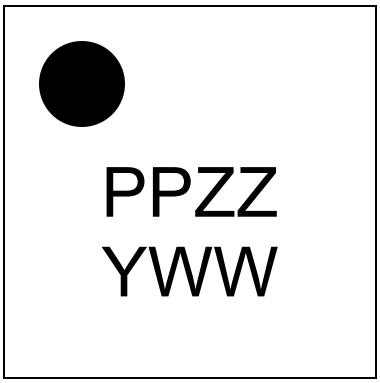
Figure 4. Package Drawing

10L 2 x 2 x 0.45 mm



		ETSLP
A	MAX.	0.500
	NOM.	0.450
	MIN.	0.400

Figure 5. Marking Specifications



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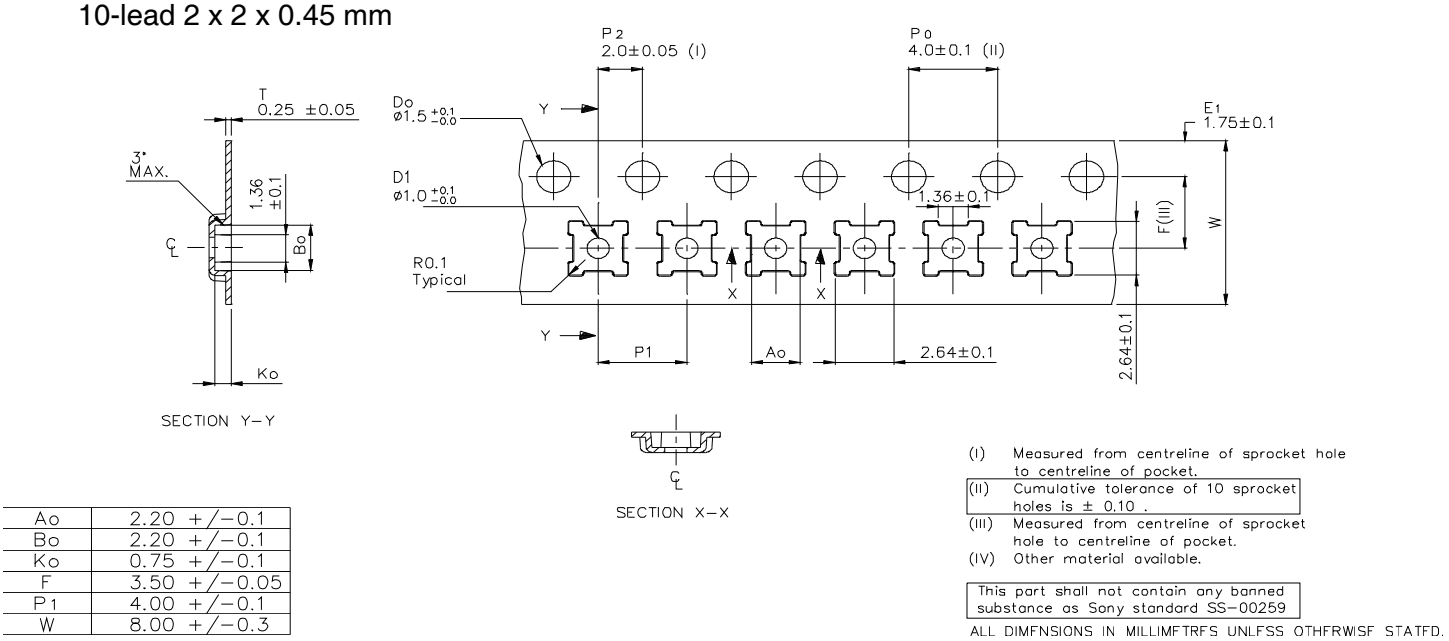
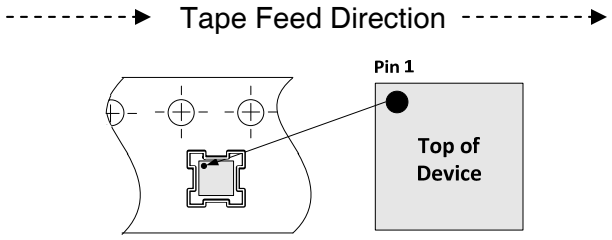
Marking Spec Symbol	Package Marking	Definition
PP	CG	Part number marking for PE64904
ZZ	00-99	Last two digits of lot code
Y	0-9	Last digit of year, starting from 2009 (0 for 2010, 1 for 2011, etc)
WW	01-53	Work week

Figure 24. Tape and Reel Specifications

10-lead 2 x 2 x 0.45 mm



Ao	2.20 +/−0.1
Bo	2.20 +/−0.1
Ko	0.75 +/−0.1
F	3.50 +/−0.05
P1	4.00 +/−0.1
W	8.00 +/−0.3



Device Orientation in Tape

Table 9. Ordering Information

Order Code	Package	Description	Shipping Method
PE64904MLBA-Z [1]	10-lead QFN 2 x 2 x 0.45 mm	Package Part in Tape and Reel	3000 units/T&R
PE64904MLBB-Z [1]	10-lead QFN 2 x 2 x 0.45 mm	Package Part in Tape and Reel	3000 units/T&R
EK64904-12	Evaluation Kit	Evaluation Kit	1 Set/Box

Note 1: Unisem (Malaysia) assembly house. Please contact factory for assembly house details.

Sales Contact and Information

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

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