Product Brief
PE64905

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

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

Product Description

The PE64905 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 PE64905 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 2-wire (I²C compatible) interface and has two selectable addresses for implementations with multiple DTCs. 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.

Features

- 2-wire (I²C 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 = 0.7-4.6 pF (6.6:1 tuning ratio) in discrete 131 fF steps
- Shunt configuration C = 1.12-5.18 pF (4.6:1 tuning ratio) in discrete 131 fF steps
- High RF Power Handling (up to 38 dBm, 30 V_{pk} RF) and High Linearity
- Wide power supply range (2.3-3.6 V) and low current consumption (typ. 140 µA at 2.6 V)
- Excellent 2 kV HBM ESD tolerance on all pins
- 2 x 2 x 0.45 mm QFN package
- Applications include:
  - Tunable Filters Networks
  - Tunable Antennas
  - RFID
  - Tunable Matching Networks
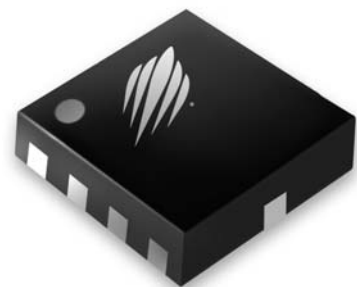 - Phase Shifters
  - Wireless Communications

Figure 1. Functional Block Diagram

Peregrine Specification 71-0066-01
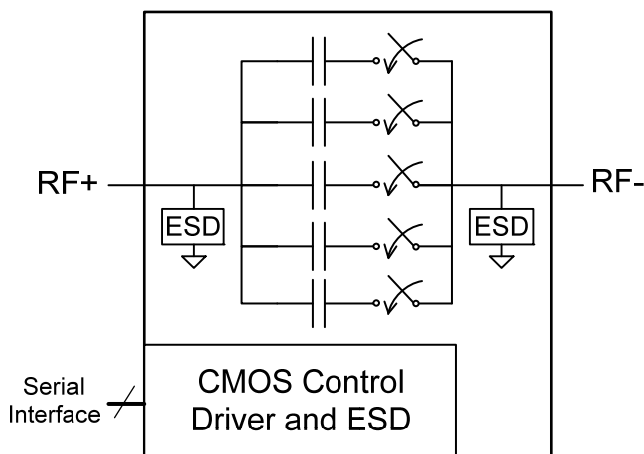
Figure 2. Package Type

10L 2 x 2 x 0.45 mm QFN package

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

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-)	-10% -10%	0.70 1.12	+10% +10%	pF
Maximum Capacitance	Series Shunt	State = 11111, 100 MHz (RF+ to RF-) State = 11111, 100 MHz (RF+ to Grounded RF-)	-10% -10%	4.60 5.18	+10% +10%	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		6.6:1 4.6:1		
Step Size	Both	5 bits (32 states), constant step size (100 MHz)		0.131		pF
Equivalent Series Resistance	Series	State = 00000 State = 11111		1.40 1.33		Ω
Quality Factor (C_{min})	Shunt	1 GHz		35		
Quality Factor (C_{max})	Shunt	1 GHz		25		
Harmonics (2fo)	Series	100 MHz-3 GHz			-36	dBm
Harmonics (3fo)	Series	100 MHz-3 GHz			-36	dBm

Figure 3. Pin Configuration (Top View)
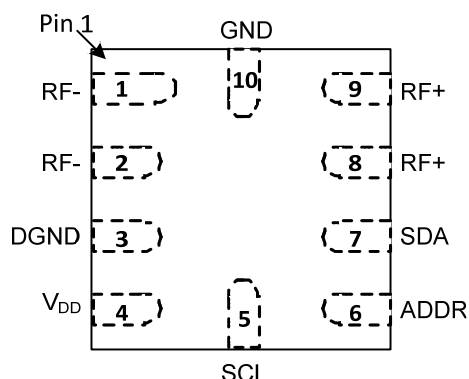
Table 2. Pin Descriptions

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	ADDR	Serial Interface Address 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 PE64905 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	3.63	V
I_{DD} Power Supply Current (V_{DD} = 2.75 V)		140		µA
V_{IH} Control Voltage High	1.2	1.8	3.63	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
				V
				V

T_{OP} Operating Temperature Range	-40		+85	°C
T_{ST} Storage Temperature Range	-65		+150	°C

Note: 1. Derated 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)		2000	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

TOP VIEW

BOTTOM VIEW

A		ETSLP
	MAX.	0.500
	NOM.	0.450
	MIN.	0.400

SIDE VIEW
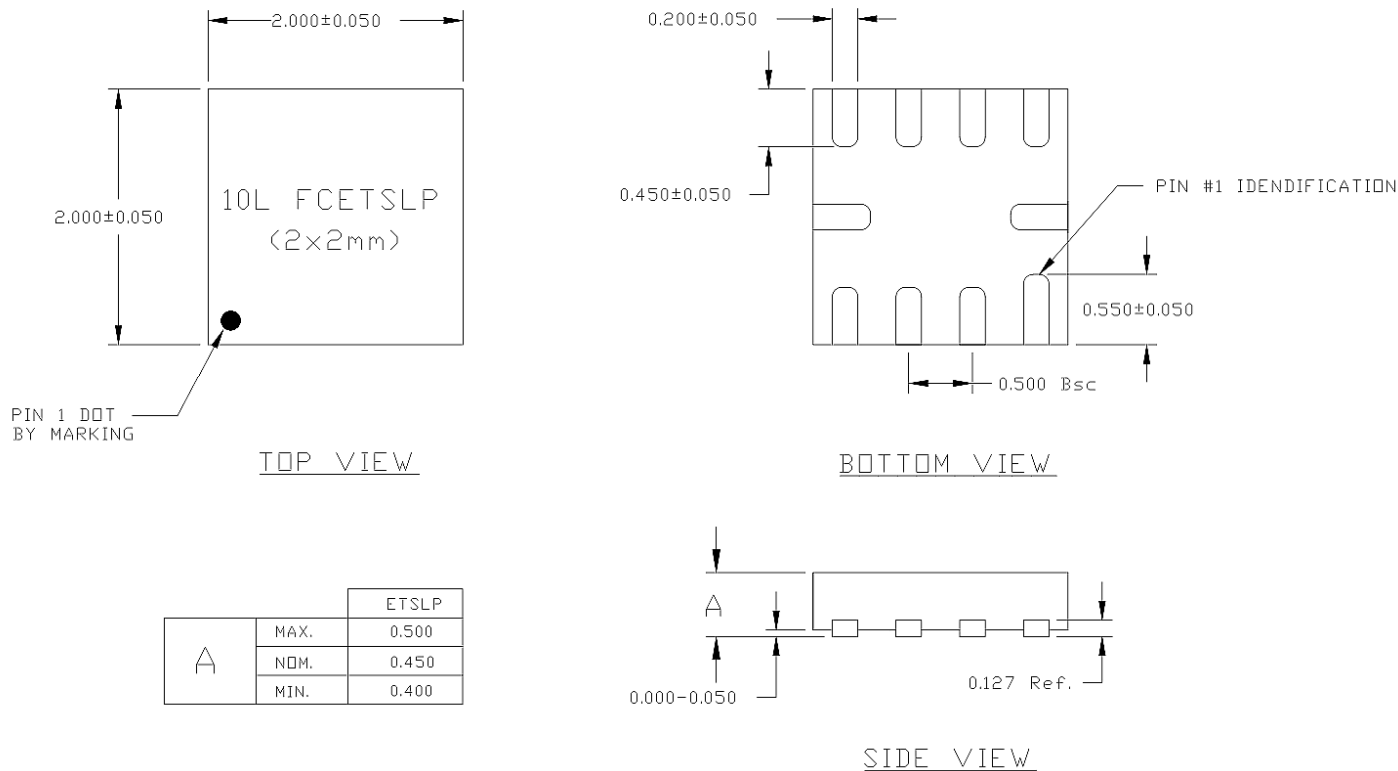
Figure 5. Marking Specifications

PPZZ
YWW
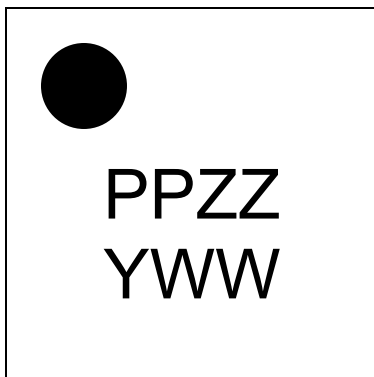
Marking Spec Symbol	Package Marking	Definition
PP	CF*	Part number marking for PE64905
ZZ	00-99	Last two digits of lot code
Y	0-9	Last digit of year, starting from 2009 (0 for 2010, 1 for 2011, etc)
WW	01-53	Work week

*(PP), the package marking specific to the PE64905, is shown in the figure instead of the standard Peregrine package marking symbol (P).

Document No. 70-0359-02   │   UltraCMOS™ RFIC Solutions

Figure 6. Tape and Reel Specifications

10-lead 2 x 2 x 0.45 mm
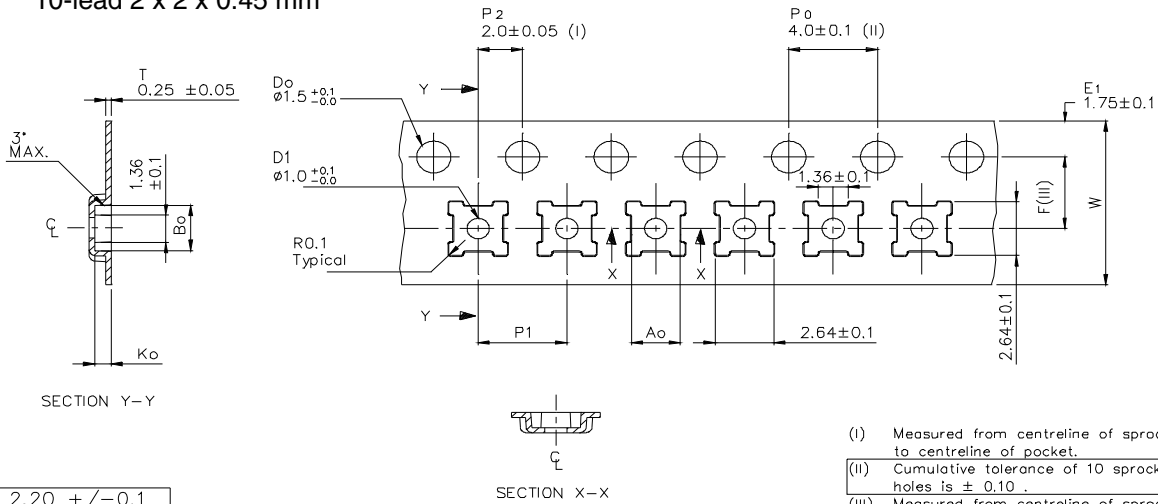
Ao	2.20 +/−0.1
Bo	2.20 +/−0.1
Ko	0.75 +/−0.1
F	3.50 +/−0.05
P1	4.00 +/−0.1
W	8.00 +/−0.3

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.10 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.

This part shall not contain any banned substance as Sony standard SS−00259

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

- - - - - - - - ➤ Tape Feed Direction - - - - - - - - ➤

Pin 1

Top of Device
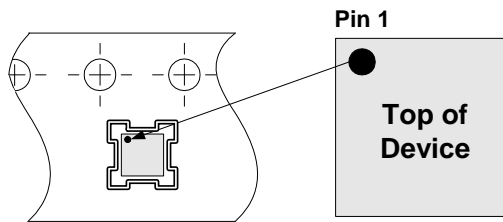
Device Orientation in Tape

Table 5. Ordering Information

Order Code	Package	Description	Shipping Method
PE64905MLAA-Z	10-lead QFN 2 x 2 x 0.45 mm	Package Part in Tape and Reel	3000 units/T&R
EK64905-11	Evaluation Kit	Evaluation Kit	1 Set/Box

Sales Contact and Information

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