TCP-3027HA

High Linearity 2.7 pF Passive Tunable Integrated Circuits (PTIC)

ON Semiconductor®

www.onsemi.com

QFN6
1.6x1.2
CASE 485DX

Introduction

ON Semiconductor's PTICs have excellent RF performance and power consumption, making them suitable for any mobile handset or radio application. The fundamental building block of our PTIC product line is a tunable material called ParaScan™, based on Barium Strontium Titanate (BST). PTICs have the ability to change their capacitance from a supplied bias voltage generated by the Control IC.

TCP−3027HA has improved linearity for use in applications where lower harmonic performance is required. The 2.7 pF high linearity PTICs are available in QFN packages for easy mounting directly on printed circuit boards.

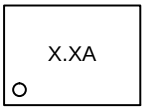
Key Features

- High Tuning Range and Operation up to 20 V
- Usable Frequency Range: from 700 MHz to 2.7 GHz
- High Quality Factor (Q) for Low Loss
- High Power Handling Capability
- Compatible with PTIC Control IC TCC-103, TCC−206
- QFN Package: 1.200 x 1.600 x 0.950 mm
- QFN: MSL−2 Moisture Sensitivity Level (per J−STD−020)
- These devices are Pb−Free and RoHS Compliant

Typical Applications

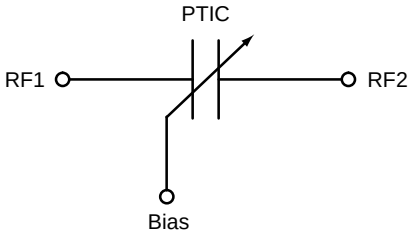
- Multi-band, Multi-standard, Advanced and Simple Mobile Phones
- Tunable Antenna Matching Networks
- Tunable RF Filters
- Active Antennas

MARKING DIAGRAM



X.X = 2.7
A = High Linearity

FUNCTIONAL BLOCK DIAGRAM



PTIC Functional Block Diagram

ORDERING INFORMATION

Device	Package	Shipping†
TCP−3027HA−QT	QFN6 (Pb−Free)	8000 Units / 13“ Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

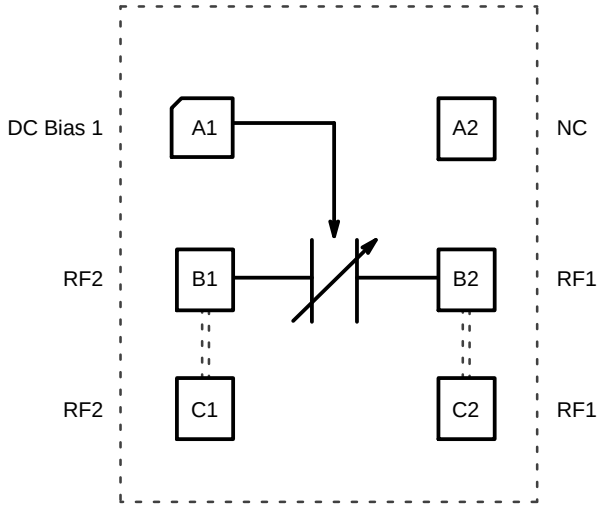


Figure 1. PTIC Functional Block Diagram (Top Level View)

Table 1. SIGNAL DESCRIPTIONS

Ball / Pad Number	Pin Name	Description
A1	DC Bias 1	DC Bias Voltage
B1	RF2	RF Input / Output
C1	RF2	RF Input / Output
A2	NC	Not Connected
B2	RF1	RF Input / Output
C2	RF1	RF Input / Output

TYPICAL SPECIFICATIONS

Representative Performance Data at 25°C

Table 2. PERFORMANCE DATA

Parameter	Min	Typ	Max	Units
Operating Bias Voltage	2.0		20	V
Capacitance (V_{bias} = 2 V)	2.43	2.70	2.97	pF
Capacitance (V_{bias} = 20 V)	0.621	0.675	0.729	pF
Tuning Range (2 V - 20 V)	3.60	4.00	4.50	
Leakage Current (WLCSP)			2.0	μA
Operating Frequency	700		2700	MHz
Quality Factor @ 700 MHz, 10 V [5]	55	60		
Quality Factor @ 2.4 GHz, 10 V [5]	30	35		
IP3 (V_{bias} = 2 V) [1,3]	70	72		dBm
IP3 (V_{bias} = 20 V) [1,3]	80	82		dBm
2nd Harmonic (V_{bias} = 2 V) [2,3]		−65		dBm
2nd Harmonic (V_{bias} = 20 V) [2,3]		−70		dBm
3rd Harmonic (V_{bias} = 2 V) [2,3]		−50		dBm
3rd Harmonic (V_{bias} = 20 V) [2,3]		−70		dBm
Transition Time (Cmin → Cmax) [4]		80		μs
Transition Time (Cmax → Cmin) [4]		70		μs

1. f_1 = 850 MHz, f_2 = 860 MHz, Pin 25 dBm/Tone
2. 850 MHz, Pin +34 dBm
3. IP3 and Harmonics are measured in the shunt configuration in a 50 Ω environment
4. RF_{IN} and RF_{OUT} are both connected to DC ground
5. Sample testing only

Representative performance data at 25°C for 2.7 pF WLCSP Package

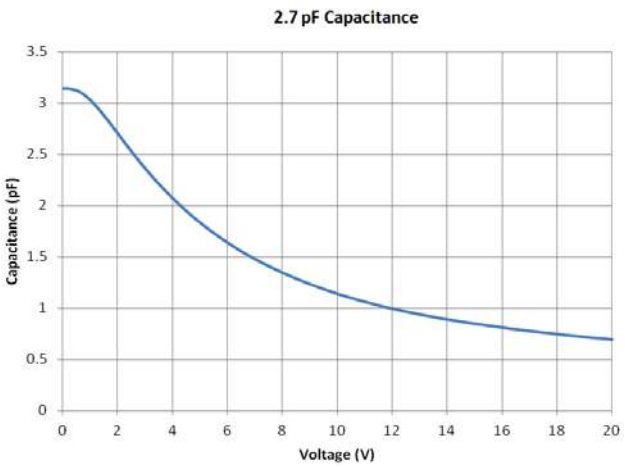


Figure 2. Capacitance

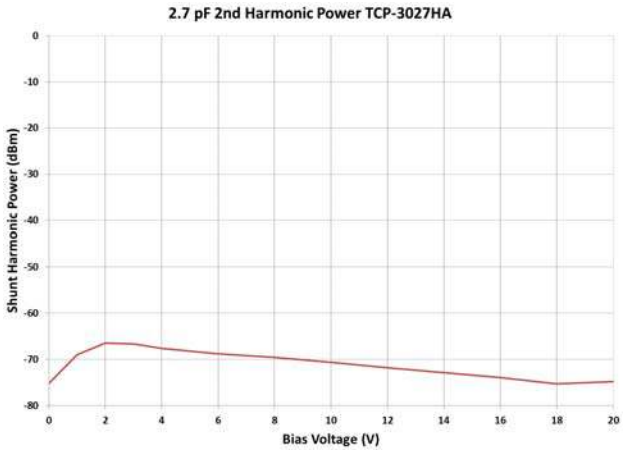


Figure 3. 2nd Harmonic Power

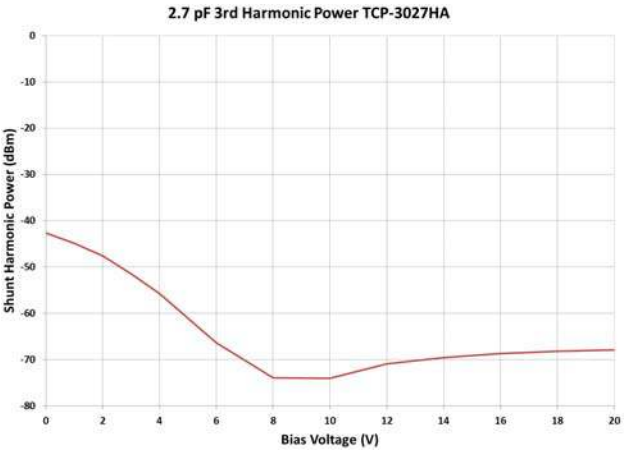


Figure 4. 3rd Harmonic Power

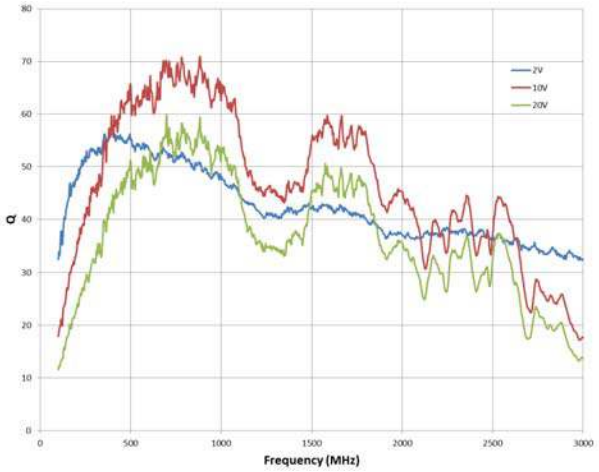


Figure 5. Q

Table 3. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Units
Input Power	+40	dBm
Bias Voltage	+25 (Note 6)	V
Operating Temperature Range	−30 to +85	°C
Storage Temperature Range	−55 to +125	°C
ESD − Human Body Model	Class 1A JEDEC HBM Standard (Note 7)	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

6. WLCSP: Recommended Bias Voltage not to exceed 20 V
7. Class 1A defined as passing 250 V, but may fail after exposure to 500 V ESD pulse

ASSEMBLY CONSIDERATIONS AND REFLOW PROFILE

The following assembly considerations should be observed:

Cleanliness

These chips should be handled in a clean environment.

Electro-static Sensitivity

ON Semiconductor's PTICs are ESD Class 1A sensitive. The proper ESD handling procedures should be used.

Mounting

The QFN PTIC is fabricated for Flip Chip solder mounting. The output pads are plated with pure tin, and the device is rated as MSL2. The PTIC QFN is RoHS-compliant and compatible with lead-free soldering profile.

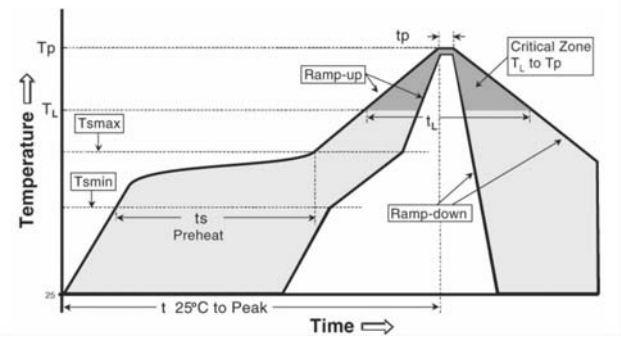


Figure 6. Reflow Profile

Table 4. Reflow Profile Chart

Profile Feature	Pb−Free Assembly
Average ramp−up rate (Ts_{max} to T_p)	3°C / second max
Preheat Temperature Min (Ts_{min}) Temperature Max (Ts_{max}) Time (Ts_{min} to Ts_{max}) (ts)	 150°C 200°C 60−180 seconds
Time maintained above Temperature (T_L) Time (t_L)	 217°C 60−150 seconds
Peak Temperature (Tp)	260°C (maximum for the customer)
Time within 5°C of actual Peak Temperature $(tp)^2$	20−40 seconds
Ramp−down Rate	6°C / second max
Time 25°C to Peak Temperature	8 minutes max

ORIENTATION OF THE PTIC FOR OPTIMUM LOSSES

When configuring the PTIC in your specific circuit design, at least one of the RF terminals must be connected to DC ground. If minimum transition times are required, DC ground on both RF terminals is recommended. To minimize losses, the PTIC should be oriented such that RF2 is at the lower RF impedance of the two RF nodes. A shunt PTIC, for example, should have RF2 connected to RF ground.

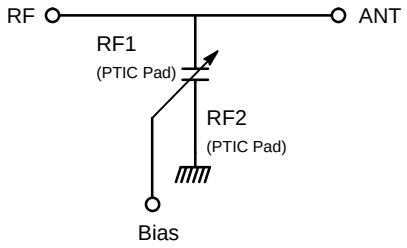


Figure 7. PTIC Orientation Functional Block Diagram

PART NUMBER DEFINITION

Example: TCP−3027HA−QT

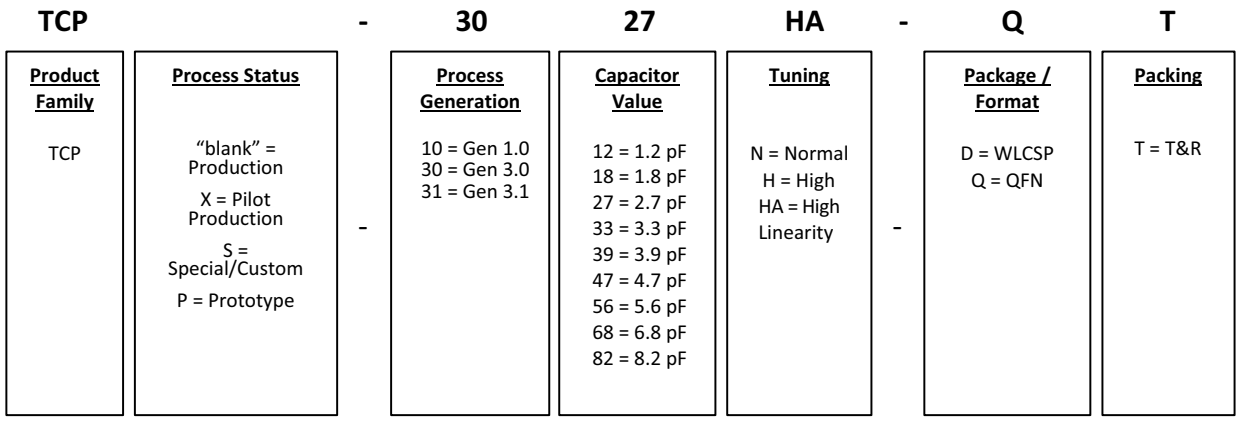
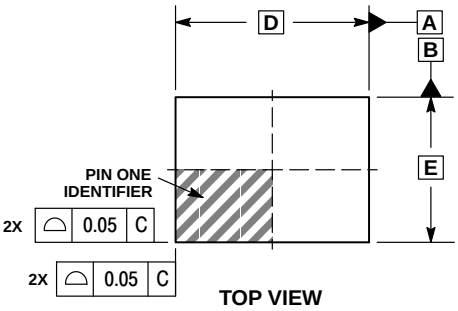


Table 5. PART NUMBERS

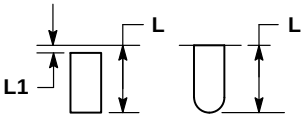
Part Number	Capacitance		Package
	2 V	20 V	
TCP-3027HA-QT	2.70	0.675	6-Pin QFN

PACKAGE DIMENSIONS

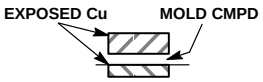
QFN6 1.6x1.2, 0.5P
CASE 485DX
ISSUE O



TOP VIEW



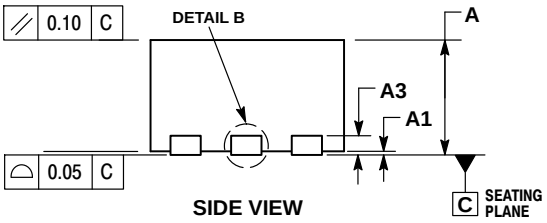
DETAIL A
ALTERNATE TERMINAL
CONSTRUCTIONS



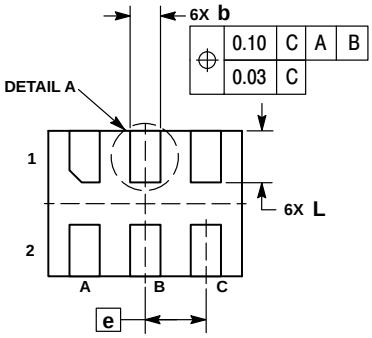
DETAIL B
ALTERNATE
CONSTRUCTIONS

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.90	1.00
A1	0.00	0.05
A3	0.15 REF	
b	0.22	0.28
D	1.60 BSC	
E	1.20 BSC	
e	0.50 BSC	
L	0.39	0.46
L1	−−−	0.15

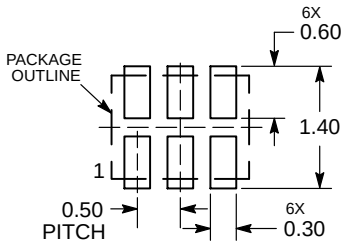


SIDE VIEW



BOTTOM VIEW

RECOMMENDED MOUNTING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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PUBLICATION ORDERING INFORMATION

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