

# TCT-102BB

## Product Preview Antenna Tuner

### INTRODUCTION

ON Semiconductor's TCT-102BB antenna tuner combines a Passive Tunable Integrated Circuit (PTIC) and an SPST switch in a single package to create a product which can be used in advanced antenna tuning designs. The high Q and wide tuning range of the PTIC give premium performance, and the SPST gives flexibility to design a variety of optimized tuner networks.

### Features

- PTIC:
  - ◆ High Quality Factor (Q) for Low Loss
  - ◆ Wide Tuning Range from 2.7 pF to 0.53 pF
  - ◆ High Power Handling Capability
  - ◆ Compatible with PTIC Control ICs from ON Semiconductor
- SPST:
  - ◆ Very Low  $R_{ON} = 1.3 \Omega$
  - ◆ Very Low  $C_{OFF} = 130 \text{ fF}$
  - ◆ High RF Handling Peak Voltage: 60 V

### Typical Applications

- Tunable Antenna Matching Networks
- Antenna Tuning for GSM, EDGE, WDCMA, LTE and 5 G Smartphones
- Main and Diversity Antenna Tuning
- Aperture and Impedance Tuning

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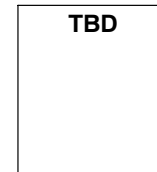
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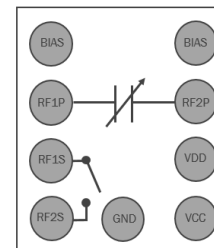


**ECP9  
CASE TBD**

### MARKING DIAGRAM



### FUNCTIONAL BLOCK DIAGRAM



### ORDERING INFORMATION

Device	Package	Shipping
TCT-102BB-FT	ECP9	

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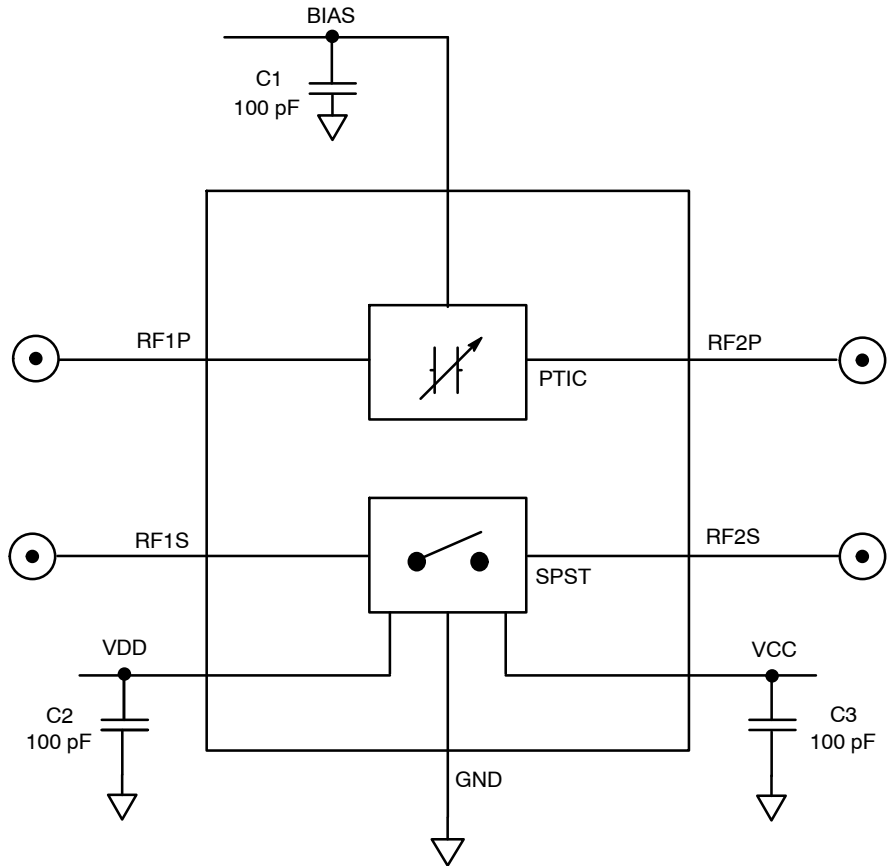


Figure 1. Application Schematic

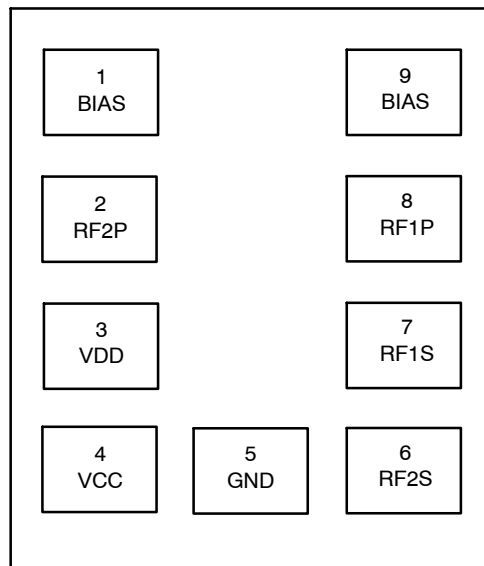


Figure 2. Pin Connections

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**Table 1. PIN FUNCTION DESCRIPTION**

Pin No.	Symbol	Description
1	BIAS	PTIC DC Bias Voltage
2	RF2P	PTIC RF Output
3	VDD	SPST DC Supply Voltage
4	VCC	SPST Logic Control Voltage
5	GND	SPST Ground
6	RF2S	SPST RF Port 2
7	RF1S	SPST RF Port 1
8	RF1P	PTIC RF Input
9	BIAS	PTIC DC Bias Voltage

**Table 2. VCC TRUTH TABLE FOR RF CHANNEL OPERATING MODE**

VCC	Mode
Low	RF1S to RF2S Isolated
High	RF1S to RF2S On

**Table 3. MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
RF Input Power (all RF Ports) ( $F_0=950\text{MHz}$ , 20% DC, $V_{\text{SWR}}=1:1$ , $T_A=25\text{C}$ )	Pin	+38.5	dBm
DC Supply Voltage	$V_{\text{DD}}$	-0.3 to 3.6	V
Control Pin Voltage	$V_{\text{CC}}$	-0.3 to 3.3	V
Operating Temperature Range	$T_{\text{OP}}$	-30 to +85	°C
Storage Temperature Range	TSTG	-55 to 125	°C
ESD Capability, HBM	ESDHBM	500	V
ESD Capability, CDM	ESDCDM	500	V

1. 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.

**Table 4. RECOMMENDED OPERATING RANGES**

Rating	Symbol	Min	Typ	Max	Unit
Operating Frequency		0.6		3.8	GHz
DC Supply Voltage	$V_{\text{DD}}$	1.7	2.8	3.3	V
Control Voltage High	$V_{\text{CCH}}$	1.5	1.8	3.0	V
Control Voltage Low	$V_{\text{CCL}}$	0	0	0.3	V
PTIC Operating Bias Voltage	$V_{\text{BIAS}}$	1.0		24	V

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**Table 5. ELECTRICAL CHARACTERISTICS – LINEAR PARAMETERS**

( $V_{DD} = 2.8\text{ V}$ ,  $V_{CCL} = 0\text{ V}$ ,  $V_{CCH} = 1.8\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ ,  $Z_0 = 50\text{ }\Omega$ )

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>SPST</b>						
Insertion Loss (RF1S to RF2S)	$F_0 = 0.6\text{--}1.0\text{ GHz}$	IL		0.13	0.15	dBm
	$F_0 = 1.0\text{--}2.2\text{ GHz}$	IL		0.15	0.20	dBm
	$F_0 = 2.2\text{--}3.0\text{ GHz}$	IL		0.18	0.26	dBm
	$F_0 = 3.0\text{--}3.8\text{ GHz}$	IL		0.23	0.36	dBm
Isolation (RF1S to RF2S)	$F_0 = 0.6\text{--}1.0\text{ GHz}$	ISO	21	23		dBm
	$F_0 = 1.0\text{--}2.2\text{ GHz}$	ISO	15	17		dBm
	$F_0 = 2.2\text{--}3.0\text{ GHz}$	ISO	11	13		dBm
	$F_0 = 3.0\text{--}3.8\text{ GHz}$	ISO	9	11		dBm
On Resistance (RF1S to RF2S)	$F_0 = \text{DC}$	$R_{ON}$		1.3	1.4	$\Omega$
Off Capacitance (RF1S to RF2S)	$F_0 = 500\text{ MHz}$	$C_{OFF}$		130	140	fF
P 0.1 dB	$F_0 = 950\text{ MHz}$ , 20%DC	$P_{0.1\text{ dB}}$		+45		dBm
RF Peak Voltage (RF1S to RF2S, RF2S to RF1S)	$F_0 = 950\text{ MHz}$ . RF1S to RF2S isolated	V		60		V

**PTIC**

Capacitance	VBIAS = 2 V		2.46	2.7	2.94	pF
	VBIAS = 24 V		0.42	0.53	0.64	pF
Q (Note 2)	$F_0 = 0.6\text{ GHz}$ , VBIAS = 2 V			70		
	$F_0 = 0.6\text{ GHz}$ , VBIAS = 24 V			35		
	$F_0 = 2.7\text{ GHz}$ , VBIAS = 2 V			40		
	$F_0 = 2.7\text{ GHz}$ , VBIAS = 24 V			20		
	$F_0 = 3.8\text{ GHz}$ , VBIAS = 2 V			10		
	$F_0 = 3.8\text{ GHz}$ , VBIAS = 24 V			10		
Transition Time (Note 3)	$C_{MIN}$ to $C_{MAX}$			66	72	$\mu\text{S}$
	$C_{MAX}$ to $C_{MIN}$			48	52	$\mu\text{S}$

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Sample testing only. RF1P and R2P must be connected to DC ground
3. Sample testing only. PTIC Control IC Turbo Mode must be used

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**Table 6. ELECTRICAL CHARACTERISTICS - NON-LINEAR PARAMETERS**

( $V_{DD} = 2.8\text{ V}$ ,  $V_{CCL} = 0\text{ V}$ ,  $V_{CCH} = 1.8\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ ,  $Z_0 = 50\text{ }\Omega$ )

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>SPST</b>						
Second Harmonic	LTE TX $F_0 = 0.6\text{--}3.8\text{ GHz}$ , $P_{IN} = 26\text{ dBm}$	$2 F_0$		-90	-80	dBm
	GSM LB $F_0 = 824\text{--}915\text{ Mhz}$ , $P_{IN} = 35\text{ dBm}$	$2 F_0$		-65	-55	dBm
	GSM HB $F_0 = 1710\text{--}1910\text{ Mhz}$ , $P_{IN} = 33\text{ dBm}$	$2 F_0$		-70	-60	dBm
Third Harmonic	LTE TX $F_0 = 0.6\text{--}3.8\text{ GHz}$ , $P_{IN} = 26\text{ dBm}$	$3 F_0$		-90	-80	dBm
	GSM LB $F_0 = 824\text{--}915\text{ MHz}$ , $P_{IN} = 35\text{ dBm}$	$3 F_0$		-65	-55	dBm
	GSM HB $F_0 = 1710\text{--}1910\text{ MHz}$ , $P_{IN} = 33\text{ dBm}$	$3 F_0$		-75	-65	dBm
2 <sup>nd</sup> Order Intermodulation	Refer to Table 7	IMD2		-115	-105	dBm
3 <sup>rd</sup> Order Intermodulation	Refer to Table 8	IMD3		-115	-105	dBm

**PTIC**

Second Harmonic (Note 4)	$F_0 = 0.9\text{ GHz}$ , $V_{BIAS} = 2\text{ V}$ , $P_{IN} = +23\text{ dBm}$	$2 F_0$		-75	-70	dBm
	$F_0 = 0.9\text{ GHz}$ , $V_{BIAS} = 24\text{ V}$ , $P_{IN} = +23\text{ dBm}$	$2 F_0$		-85	-80	dBm
Third Harmonic (Note 4)	$F_0 = 0.9\text{ GHz}$ , $V_{BIAS} = 2\text{ V}$ , $P_{IN} = +23\text{ dBm}$	$3 F_0$		-63	-58	dBm
	$F_0 = 0.9\text{ GHz}$ , $V_{BIAS} = 24\text{ V}$ , $P_{IN} = +23\text{ dBm}$	$3 F_0$		-98	-90	dBm
Third Order Intercept Point	$F_1 = 850\text{ MHz}$ , $F_2 = 860\text{ MHz}$ , $P_{IN} = 25\text{ dBm/Tone}$ , $V_{BIAS} = 2\text{ V}$	IIP3		73		dB
	$F_1 = 850\text{ MHz}$ , $F_2 = 860\text{ MHz}$ , $P_{IN} = 25\text{ dBm/Tone}$ , $V_{BIAS} = 24\text{ V}$	IIP3		83		dB

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. PTIC Harmonics are measured in the reflect configuration

**Table 7. IMD2 TEST CONDITIONS**

Band	IN-Band Frequency MHz	CW Carrier MHz	dBm	CW Interferer MHz	dBm
1 Low	2140	1950	+20	190	-15
1 High	2140	1950	+20	1090	-15
5 High	881.5	836.5	+20	45	-15
5 High	881.5	836.5	+20	1718	-15

**Table 8. IMD2 TEST CONDITIONS**

Band	IN-Band Frequency MHz	CW Carrier MHz	dBm	CW Interferer MHz	dBm
1 Low	2140	1950	+20	190	-15
5 High	881.5	836.5	+20	791.5	-15

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## TYPICAL PERFORMANCE CURVES

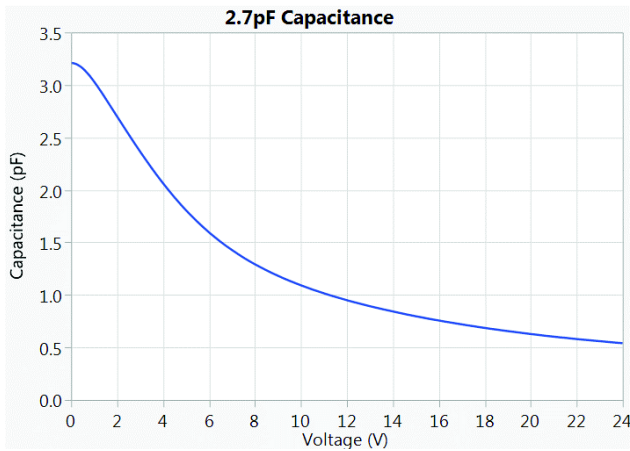


Figure 3.

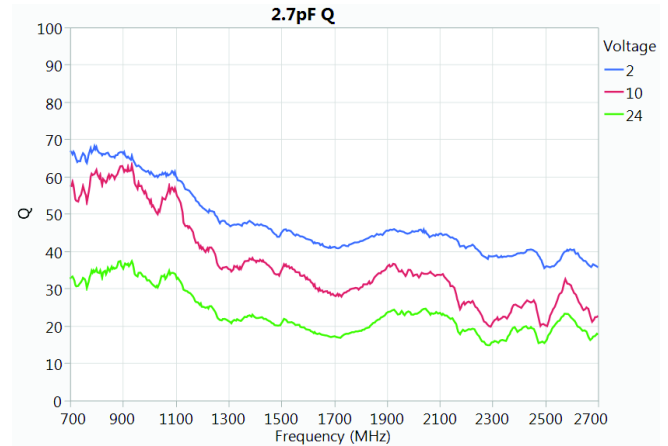


Figure 4.

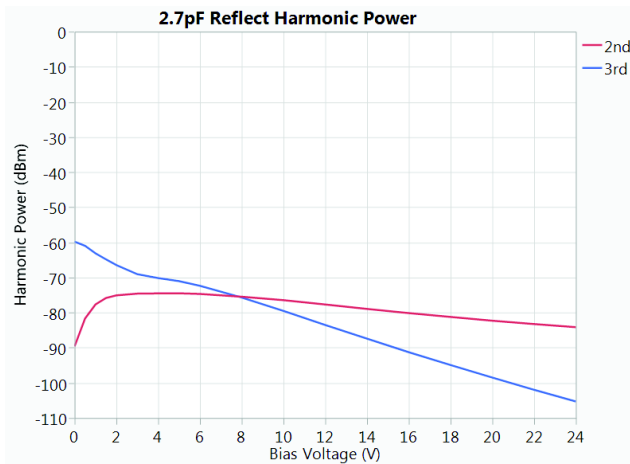


Figure 5.

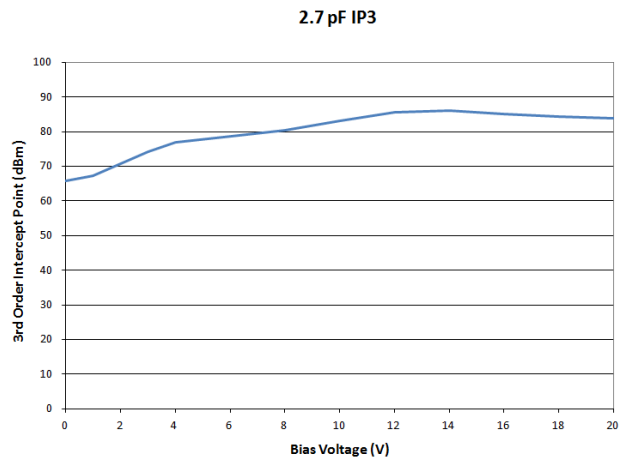



Figure 6.

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## PACKAGE DIMENSIONS

ECP9

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