DATA SHEET
SE2611T: 2.4 GHz High Efficiency Wireless LAN/BT Front End

Applications

- IEEE802.11b DSSS WLAN
- IEEE802.11g,n OFDM WLAN
- Embedded applications with Bluetooth (Mobile)

Features

- Dual Mode IEEE802.11b & IEEE802.11g
- Integrated PA, Harmonic Filter, LNA and BT port
- Integrated Positive Slope Power Detector
- 19 dBm @ 4.0 % EVM, 802.11g, 54 Mbps
- Simultaneous WLAN and Bluetooth receive mode
- Direct connection to battery with 3.3 V nominal supply
- Lead free, Halogen free and RoHS compliant
- Compact package, 3 x 3 x 0.6 mm, MSL 1

Ordering Information

Part No.	Package	Remark
SE2611T	20 pin QFN	Samples
SE2611T-R	20 pin QFN	Tape and Reel
SE2611T-EK1	N/A	Evaluation kit

Product Description

The SE2611T is a complete 802.11 b/g/n WLAN RF front-end module with a Bluetooth port. The device provides all the functionality of the power amplifier, power detector, filter, Switch, Low Noise Amplifier, 2170 MHz notch filtering and associated matching. The SE2611T provides a complete 2.4 GHz WLAN RF solution from the output of the transceiver to the antennas, and from the antennas to the input of the transceiver, in an ultra compact form factor.

The SE2611T is designed for ease of use, with all the critical matching and harmonic filtering integrated, also offering a simple 50 Ω interface to the antenna.

The SE2611T includes a low noise amplifier to increase the receive sensitivity of embedded solutions to improve range or to overcome the insertion loss of cellular filters often included for mobile applications. It offers simultaneous WLAN and Bluetooth receive mode.

The SE2611T also includes a transmitter power detector with 20 dB of dynamic range and a digital enable control for transmitter power ramp on/off control. The power ramp rise/fall time is 0.5 µs typical.

Functional Block Diagram

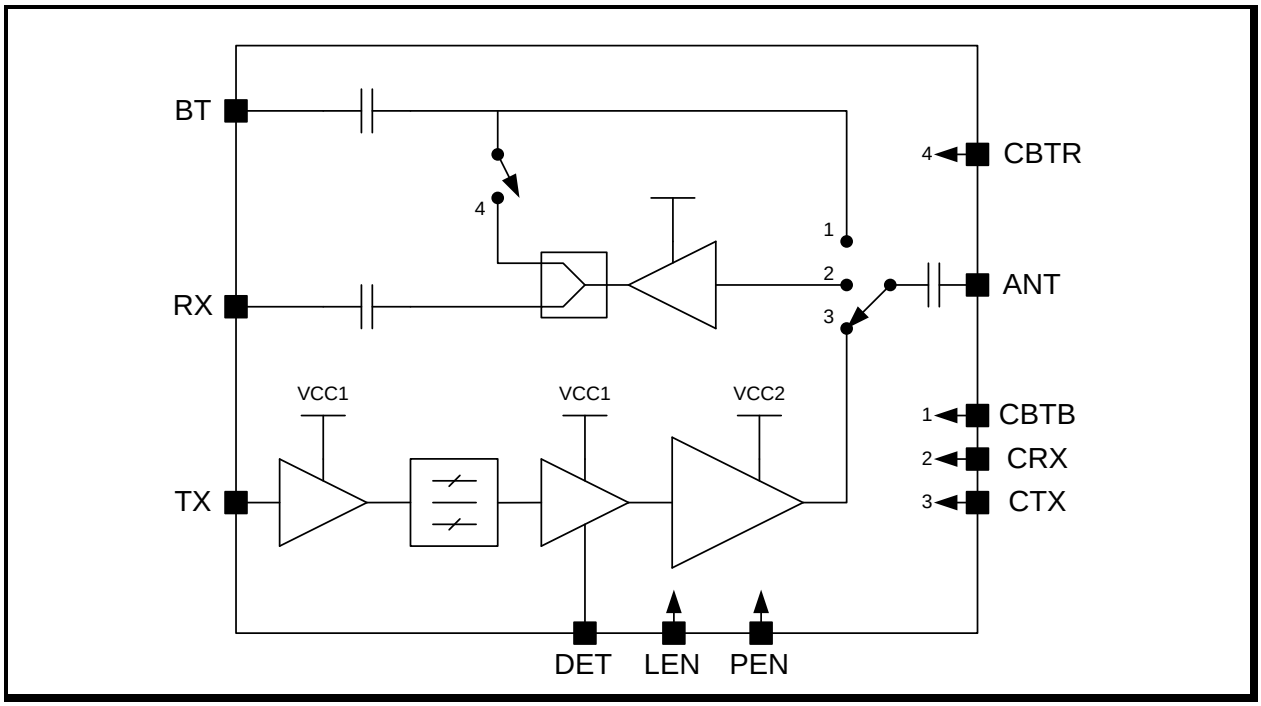


Figure 1: Functional Block Diagram

Pin Out Diagram

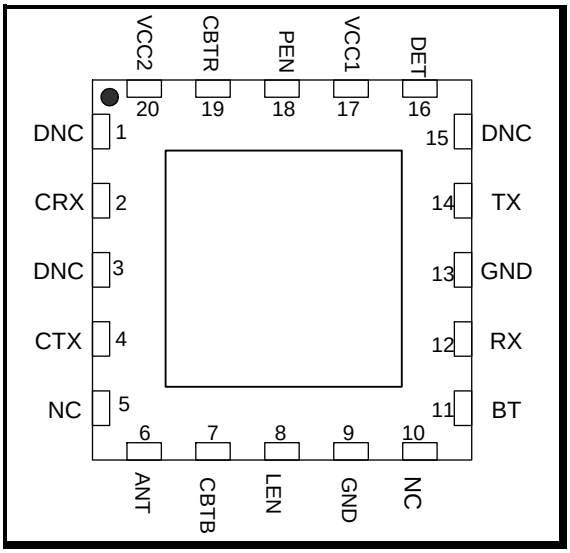


Figure 2: SE2611T Pin out (Top View through Package)

Pin Out Description

Pin No.	Name	Description
1	DNC	Do Not Connect
2	CRX	WLAN Receive antenna switch control
3	DNC	Do Not Connect
4	CTX	WLAN Transmit antenna switch control
5	NC	No connect
6	ANT	Antenna Port
7	CBTB	Bluetooth antenna switch control
8	LEN	LNA Enable
9	GND	Ground
10	NC	No connect
11	BT	Bluetooth Port
12	RX	WLAN Receive Port
13	GND	Ground
14	TX	WLAN Transmit Port
15	DNC	Do Not Connect
16	DET	Transmit Power Detector Output
17	VCC1	Power Amplifier Power Supply
18	PEN	Power Amplifier Enable
19	CBTR	Bluetooth back-end switch control
20	VCC2	Power Amplifier Power Supply
Die paddle	GND	Ground

Absolute Maximum Ratings

These are stress ratings only. Exposure to stresses beyond these maximum ratings (one rating applied at a time) for extended periods may cause permanent damage to, or affect the reliability of the device. Avoid operating the device outside the recommended operating conditions defined below. This device is ESD sensitive. Handling and assembly of this device should be at ESD protected workstations.

Symbol	Definition	Min.	Max.	Unit
VCC	Supply Voltage on VCC	-0.3	6.0	V
V_{IN}	DC input on control pins	-0.3	3.6	V
P_{TXIN}	TX Input Power, ANT terminated in 50Ω match	-	5	dBm
T_A	Operating Temperature Range	-40	85	°C
T_{STG}	Storage Temperature Range	-40	150	°C
ESD $_{HBM}$	JEDEC JESD22-A114 All pins	1000		V

Recommended Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_A	Ambient temperature	-40	25	85	°C
V_{CC}	Supply voltage, relative to GND = 0 V	2.7	3.3	4.8	V

DC Electrical Characteristics

Conditions: V_{CC} = PEN = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE2611T-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{CC-G}	Total Supply Current	POUT = 18 dBm, 54 Mbps OFDM signal, 64QAM	-	185	210	mA
I_{CC-B}	Total Supply Current	P_{OUT} = 20 dBm, 11 Mbps CCK signal, BT = 0.45	-	215	248	mA
I_{CQ}	Quiescent Current	No RF	-	133	148	mA
I_{CC_OFF}	Total Supply Current	PEN = 0 V, No RF Applied, CBTR = CBTB = CTX =CRX= 0 V	-	5	10	µA
Icc_LNA	Total Supply Current	LEN = Vcc	-	8	12	mA
ICC_LNA_BYP	Total Supply Current in bypass mode	LEN = 0 V	-	250	280	µA

Control Logic Characteristics

Conditions: V_{CC} = PEN = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE2611T-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IH}	Logic High Voltage	-	1.2	-	3.3	V
V_{IL}	Logic Low Voltage	-	0	-	0.4	V
I_{IH}	Input Current Logic High Voltage	-	-		10	µA
I_{IL}	Input Current Logic Low Voltage	-	-		1	µA

Control Logic Table

Mode#	Mode Description	CTX	CRX	CBTB	PEN	LEN	CBTR
0	All Off	0	0	0	0	0	0
1	BT	0	0	1	0	0	0
2	WLAN Rx, high gain	0	1	0	0	1	0
3	WLAN Rx, low gain	0	1	0	0	0	0
4	WLAN TX	1	0	0	0	0	0
5	WLAN TX + PA enabled	1	0	0	1	0	0
6	(BT+WLAN) Rx, high gain	0	1	0	0	1	1
7	(BT+WLAN) Rx, low gain	0	1	0	0	0	1
8	ANT to (BT+WLAN) connect	0	0	1	0	0	1

AC Electrical Characteristics

802.11g Transmit Characteristics

Conditions: V_{CC} = PEN = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE2611T-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{IN}	Frequency Range	-	2400	-	2500	MHz
EVM	EVM	VCC = 3.3 V, P_{OUT} = 19 dBm, 54 Mbps OFDM signal, 64 QAM	-	-	4	%
		Vcc = 3.0V, POUT = 18 dBm, 54Mbps, OFDM signal, 64 QAM				
		Vcc = 2.7V, POUT = 17 dBm, 54Mbps, OFDM signal, 64 QAM				
ACPRb	Adjacent Channel Power Ratio 11b	Pout = 20dBm, 11Mbps CCK, BT = 0.45 ±11 MHz offset ±22 MHz offset	-	 -37 -58	 -32 -55	dBc
ACPRg	Adjacent Channel Power Ratio 11g	Pout = 18 dBm, 54 Mbps OFDM, 64QAM ±11 MHz offset ±20 MHz offset ±30 MHz offset			 -20 -28 -40	dBc
$P_{max-OOB}$	Out-of-band limited output power	11g - 54 Mbps 11b – 11 Mbps PSD_{OOB} = -43 dBm/MHz, RB = 1 MHz 2310-2390 MHz 2483.5-2500 MHz	16 20	17 20	-	dBm
S_{21}	Small Signal Gain	-	25	27	30	dB
ΔS_{21}	Small Signal Gain Variation Over Band	-	-	-	2.0	dBpp
2f	Harmonics	P_{OUT} = 20 dBm, 1 Mbps, 802.11b	-	-35	-25	dBm/MHz
3f		P_{OUT} = 18 dBm, 54Mbps OFDM signal, 64 QAM		-52	-43	dBm/MHz
t_{dr}, t_{df}	Delay and rise/fall Time	50 % of V_{PEN} edge and 90/10 % of final output power level	-	0.5	1	µs
S_{11}	Input Return Loss	TX port	-	-15	-10	dB
$S_{21WCDMA}$	Small Signal Gain in WCDMA band	2110-2170 MHz, relative to min in-band gain			-10	dBr

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
P_{NWCDMA}	Output noise power in WCDMA band	2110-2170 MHz P_{OUT} = 20 dBm, 1 Mbps, 802.11b P_{OUT} = 18 dBm, 54Mbps OFDM signal, 64 QAM		-130	-127	dBm/Hz
STAB	Stability	CW, P_{in} = -5 dBm 0.1 GHz – 20 GHz Load VSWR = 6:1	All non-harmonically related outputs less than -43 dBm/MHz			
RGGD	Ruggedness	CW, P_{IN} = -5 dBm 0.1 GHz – 20 GHz Load VSWR = 10:1	No permanent damage or performance degradation			

Power Detector Characteristics

Conditions: V_{CC} = PEN = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE2611T-EK1 evaluation board (de-embedded to device), unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{OUT}	Frequency Range	-	2400	-	2500	MHz
PDR	Power detect range, CW	Measured at ANT	0	-	22	dBm
PDZ_{LOAD}	Output Impedance	-		2.2		KΩ
PDV_{NoRF}	Output Voltage, P_{OUT} = No RF	Measured in to 1MΩ	0.1	0.125	0.15	V
$PDV_{p18.5}$	Output Voltage, P_{OUT} = 18.5 dBm CW	Measured in to 1MΩ	0.56	0.66	0.76	V
PDV_{p20}	Output Voltage, P_{OUT} = 20 dBm CW	Measured in to 1MΩ	0.70	0.80	0.90	V
PD_{tTVAR}	Detector variation over temperature	-30 to 25 deg C 25 to 85 deg C given detector voltage	-0.6		+0.5	dB
PD_{FVAR}	Detector variation over frequency	2400-2500 MHz given detector voltage	-0.5		0.5	dB
PD_{VSWR}	Detector variation over load VSWR	Forward power ANT VSWR 3:1 all phases given detector voltage	-2		+1	dB
PD_{BW}	Detector bandwidth			1		MHz

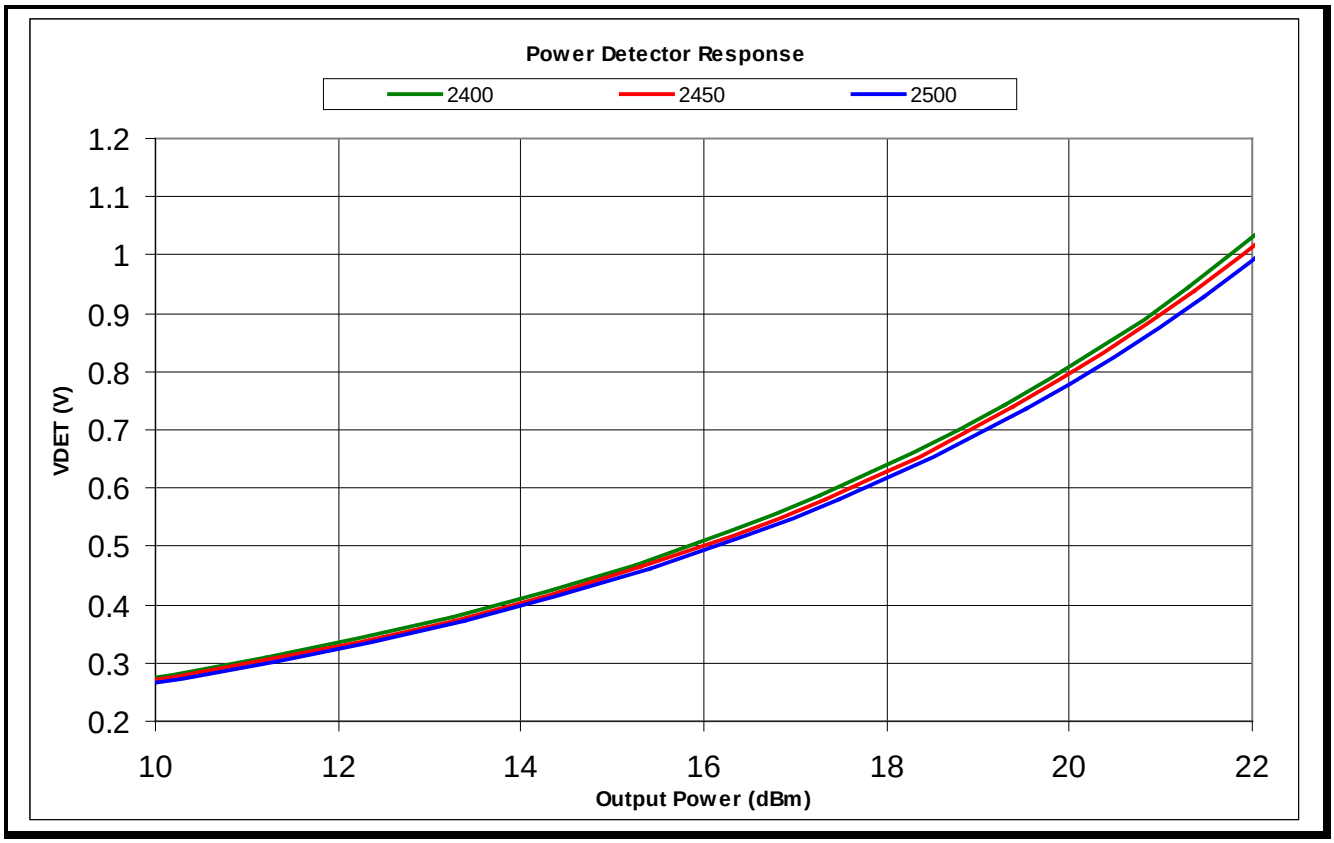


Figure 3: Power Detector Characteristic

Bluetooth Characteristics

Conditions: V_{CC} = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE2611T-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{OUT}	Frequency Range	-	2400	-	2500	MHz
BT_{IL}	Insertion Loss	BT-ANT, CBTB=hi, CBTR=CTX=CRX=lo	-	1.2	1.5	dB
S_{11}	BT Port Return Loss	CBTB=hi, CBTR=CTX=CRX=lo			-12	dB
$ISOL_{SW}$	Switch Isolation	ANT-RX, CBTB=hi, CBTR=CTX=CRX=lo	20			dB

2.4 GHz Receive Characteristics

Conditions: VCC = 3.3 V, LEN = CRX = CBTR= 3.3V, PEN = CBTB = CTX = 0 V, T_A = 25 °C, as measured on Skyworks Solutions' SE2611T-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{OUT}	Frequency Range	-	2400	-	2500	MHz
S_{21}	Receive Gain, LNA enabled.	(BT+WLAN) Rx, high gain	11	13	15	dB
		WLAN Rx, high gain only, LEN = CRX = 3.3V, PEN = CBTB = CTX =CBTR= 0 V	14	16	18	dB
ΔS_{21}	Gain Variation	2400 – 2485 MHz, Over any 20MHz band	-	-	0.5	dB
NF	Noise Figure		-	2.0	2.5	dB
IIP3	Third Order Intercept		-3		-	dBm
S_{11}	Input Return Loss	-			-8	dB
S_{12}	Reverse Isolation				-20	dB
IP1dB	Input P1dB	CW	-8			dBm
T_{EN}	Enable Time	10% to 90% of RX RF power, from time that LEN is at 50%			500	nsec
S21-BYP	Receive Gain, LNA bypassed	LEN = 0 V	-20		-10	dB
S11-BYP	Input Return Loss, LNA bypassed	LEN = 0 V			-7	dB
$ISOL_{SW}$	Switch Isolation	CBTB=CBTR=lo, CRX=hi, ANT-BT + BT-RX	20			dB

Package Handling Information

Branding Information

The device branding is shown in Figure 4.

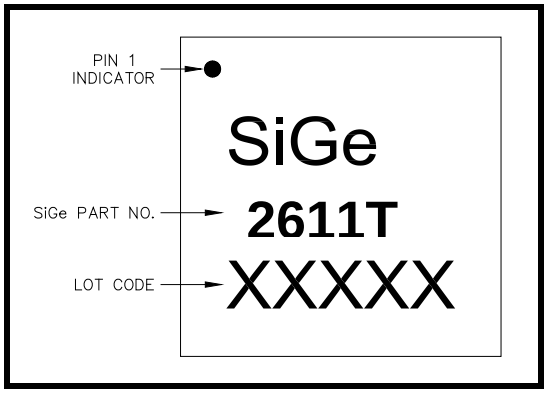


Figure 4: SE2611T Branding and Pin 1 Location

Package Diagram

The package diagram is shown in Figure 5.

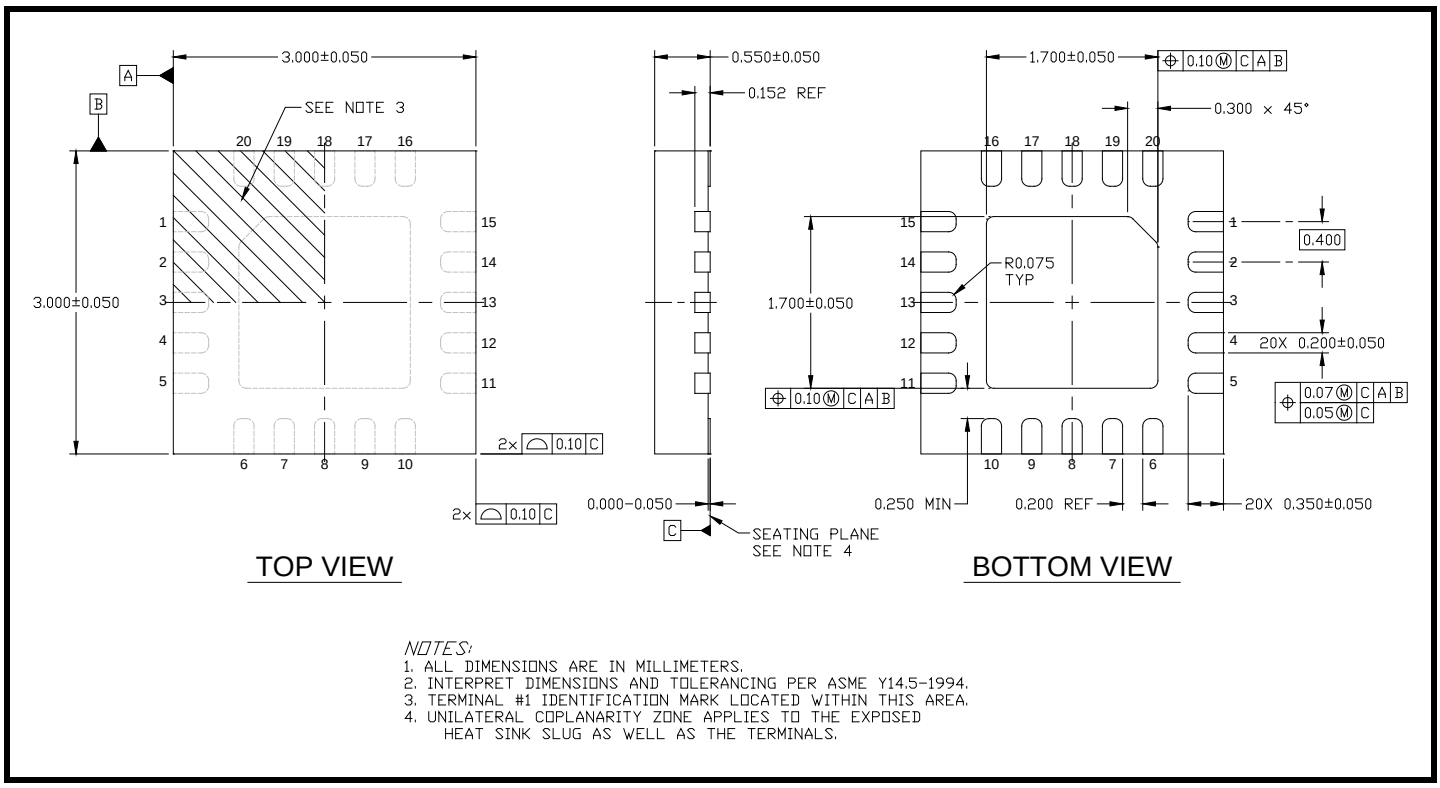


Figure 5: SE2611T Package Diagram

Recommended PCB Footprint and Solder pattern

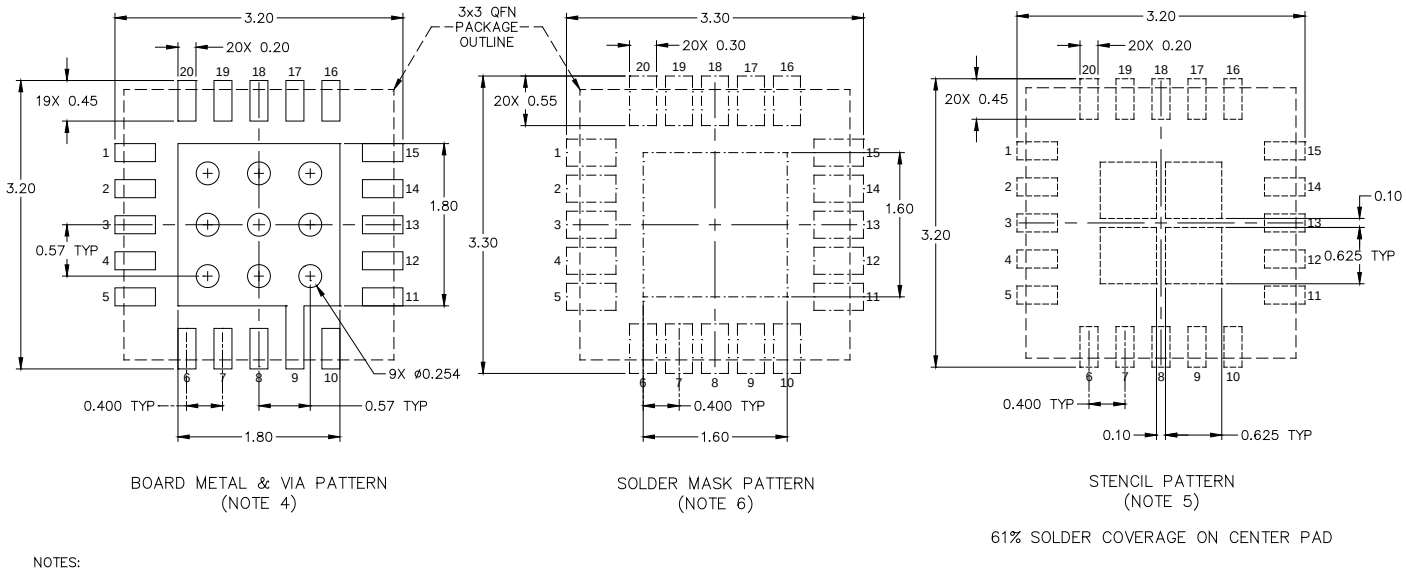


Figure 6: PCB Footprint and Solder pattern

Package Handling Information

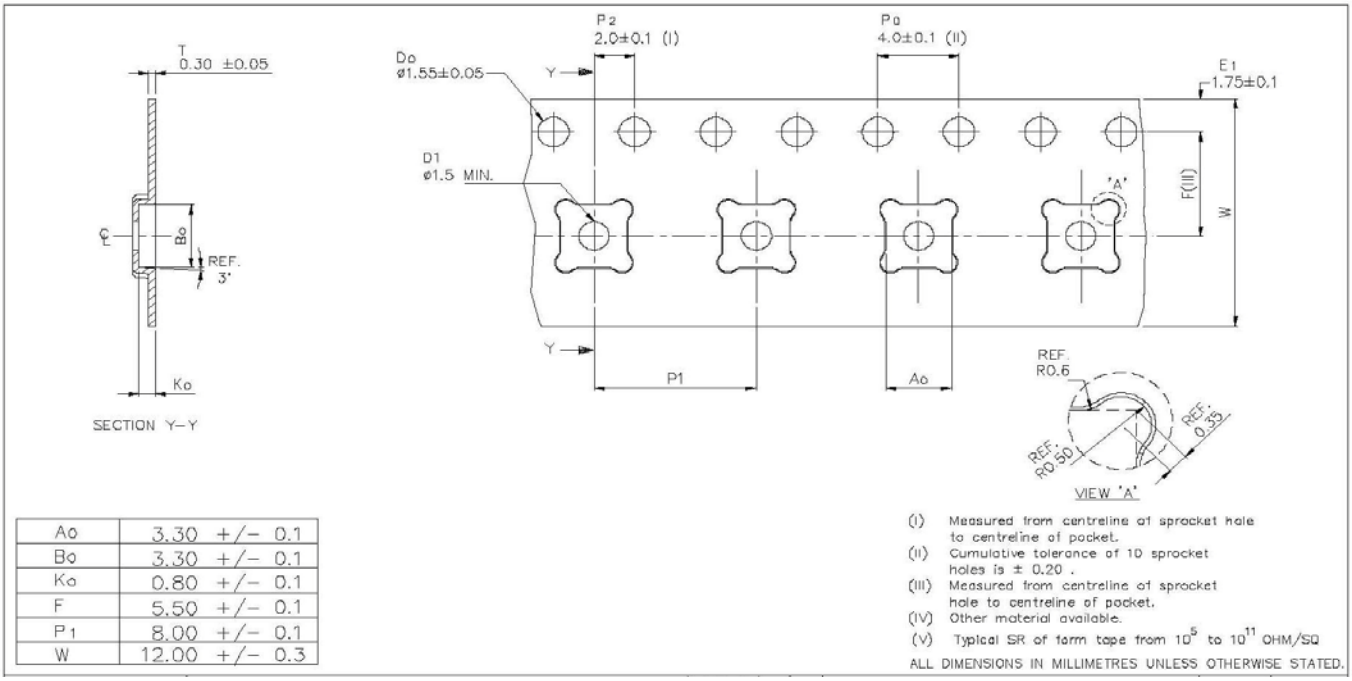
Because of its sensitivity to moisture absorption, instructions on the shipping container label must be followed regarding exposure to moisture after the container seal is broken, otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly. The SE2611T is capable of withstanding a Pb free solder reflow. Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. If the part is manually attached, precaution should be taken to insure that the device is not subjected to temperatures above its rated peak temperature for an extended period of time. For details on both attachment techniques, precautions, and handling procedures recommended, please refer to:

- "*QFN solder reflow and rework information application note*", *Document Number QAD-00045*
- "*Handling, packing, shipping and use of moisture sensitive QFN application note*", *Document Number QAD-00044*

Tape and Reel Information

Parameter	Value
Devices Per Reel	3000
Reel Diameter	13 inches
Tape Width	12 millimeters

Figure 7: SE2611T-R Tape and Reel Information.



Document Change History

Revision	Date	Notes
1.0	June-14-2010	Initial Release
1.1	September-20-2010	Updated RX S11
1.2	September-23-2010	Updated TX gain flatness and $S_{21WCDMA}$
1.3	November-10-2010	Updated Operating Temperature range to -40C
1.4	April-11-2012	Updated with Skyworks logo and disclaimer statement