DATA SHEET

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

Applications

- IEEE 802.11b DSSS WLAN
- IEEE 802.11g/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, ROHS compliant QFN (20-pin, 3 × 3 × 0.6 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.

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 (LNA), 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.

The device package and pinout for the 20-pin QFN are shown in Figure 1. A block diagram of the SE2611T is shown in Figure 2.

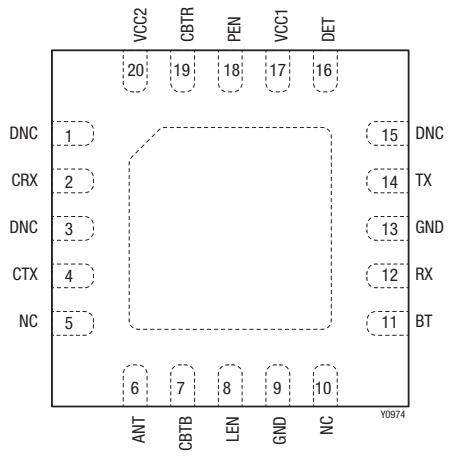


Figure 1. SE2611T Pinout – 20-Pin QFN (Top View)

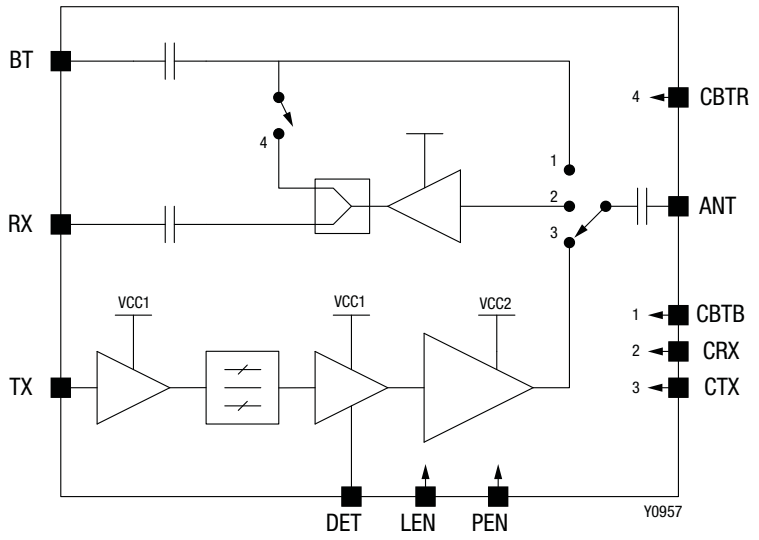


Figure 2. SE2611T Block Diagram

Electrical and Mechanical Specifications

Signal pin assignments and functional pin descriptions are described in Table 1. The absolute maximum ratings of the SE2611T are provided in Table 2. Recommended operating conditions are specified in Table 3. Electrical specifications are provided in Tables 4 through 10, and Figure 3.

Table 1. SE2611T Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	DNC	Do not connect	11	BT	Bluetooth port
2	CRX	WLAN receive antenna switch control	12	RX	WLAN receive port
3	DNC	Do not connect	13	GND	Ground
4	CTX	WLAN transmit antenna switch control	14	TX	WLAN transmit port
5	NC	No connect	15	DNC	Do not connect
6	ANT	Antenna port	16	DET	Transmit power detector output
7	CBTB	Bluetooth antenna switch control	17	VCC1	Power amplifier power supply
8	LEN	LNA enable	18	PEN	Power amplifier enable
9	GND	Ground	19	CBTR	Bluetooth back-end switch control
10	NC	No connect	20	VCC2	Power amplifier power supply
			Die paddle	GND	Ground

Table 2. SE2611T Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage on VCC	V_{CC}	–0.3	+6	V
DC input on EN	V_{IN}	–0.3	+3.6	V
Tx input power. ANT terminated in 50 Ω match	P_{TXIN}		5	dBm
Operating temperature range	T_A	–40	+85	°C
Storage temperature range	T_{STG}	–40	+150	°C
Electrostatic discharge: Human Body Model (HBM), Class 1C	ESD		 1000	 V

Note 1: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

***CAUTION**: Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.*

Table 3. SE2611T Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Ambient temperature	T_A	–40	25	85	°C
Supply voltage, relative to GND = 0 V	V_{CC}	2.7	3.3	4.8	V

Table 4. SE2611T Electrical Specifications: DC Characteristics (Note 1)
(V_{CC} = V_{PEN} = 3.3 V, T_A = +25 °C, as Measured on SE2611T-EK1 Evaluation Board, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Total supply current	I_{CC_G}	P_{OUT} = 18 dBm, 54 Mbps OFDM signal, 64QAM		185	210	mA
Total supply current	I_{CC_B}	P_{OUT} = 20 dBm, 11 Mbps CCK signal, BT = 0.45		215	248	mA
Quiescent current	I_{CQ}	No RF		133	165	mA
Total supply current	I_{CC_OFF}	PEN = 0 V, no RF applied, CBTR = CBTB = CTX =CRX= 0 V		5	10	µA
Total supply current	I_{CC_LNA}	LEN = V_{CC}		8	12	mA
Total supply current in bypass mode	$I_{CC\_LNA\_BYP}$	LEN = 0 V		250	280	µA

Note 1: Performance is guaranteed only under the conditions listed in this table.

Table 5. SE2611T Electrical Specifications: Control Logic Characteristics (Note 1)
(V_{CC} = V_{PEN} = 3.3 V, T_A = +25 °C, as Measured on SE2611T-EK1 Evaluation Board, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Logic high voltage	V_{IH}		1.2		3.3	V
Logic low voltage	V_{IL}		0		0.4	V
Input current logic high voltage	I_{IH}				10	µA
Input current logic low voltage	I_{IL}				1	µA

Note 1: Performance is guaranteed only under the conditions listed in this table.

Table 6. SE2611T 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

Table 7. SE2611T Electrical Specifications: AC Characteristics (802.11g Transmit) (Note 1)
(V_{CC} = V_{PEN} = 3.3 V, T_A = +25 °C, as Measured on SE2611T-EK1 Evaluation Board, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency range	f_{IN}		2400		2500	MHz
EVM	EVM	V_{CC} = 3.3 V, P_{OUT} = 19 dBm, 54 Mbps OFDM signal, 64QAM			4	%
		V_{CC} = 3.0 V, P_{OUT} = 18 dBm, 54 Mbps OFDM signal, 64QAM				
		V_{CC} = 2.7 V, P_{OUT} = 17 dBm, 54 Mbps, OFDM signal, 64QAM				
Adjacent channel power ratio 11b	ACPRb	P_{OUT} = 20 dBm, 11 Mbps CCK, BT = 0.45 ±11 MHz offset ±22 MHz offset		 –37 –58	 –32 –55	dBc
Adjacent channel power ratio 11g	ACPRg	P_{OUT} = 18 dBm, 54 Mbps OFDM, 64QAM ±11 MHz offset ±20 MHz offset ±30 MHz offset			 –20 –28 –40	dBc
Out-of-band limited output power	P_{MAX_OOB}	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
Small signal gain	S21		25	27	30	dB
Small signal gain variation over band	ΔS21				2.0	dBpp
2nd and 3rd harmonics	2f	P_{OUT} = 20 dBm, 1 Mbps, 802.11b		–35	–25	dBm/MHz
	3f	P_{OUT} = 18 dBm, 54 Mbps OFDM signal, 64QAM		–52	–43	dBm/MHz
Delay & rise/fall time	t_{DR}, t_{DF}	50 % of V_{PEN} edge and 90/10 % of final output power level		0.5	1	µs
Input return loss	S11	Tx port		–15	–10	dB
Small signal gain in WCDMA band	S21WCDMA	2110 ~ 2170 MHz, relative to min in-band gain			–10	dBr
Output noise power in WCDMA band	P_{NWCDMA}	2110 ~ 2170 MHz P_{OUT} = 20 dBm, 1 Mbps, 802.11b P_{OUT} = 18 dBm, 54 Mbps OFDM signal, 64QAM		–130	–127	dBm/Hz
Stability	STAB	CW, P_{IN} = –5 dBm, 0.1 GHz ~ 20 GHz, load VSWR = 6:1	All non-harmonically related outputs less than –43 dBm/MHz			
Ruggedness	RGGD	CW, P_{IN} = –5 dBm, 0.1 GHz ~ 20 GHz, load VSWR = 10:1	No permanent damage or performance degradation			

Note 1: Performance is guaranteed only under the conditions listed in this table.

Table 8. SE2611T Electrical Specifications: Power Detector Characteristics (Note 1)
(V_{CC} = V_{PEN} = 3.3 V, T_A = +25 °C, as Measured on SE2611T-EK1 Evaluation Board, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency range	f_{OUT}		2400		2500	MHz
Power detect range, CW	PDR	Measured at ANT	0		22	dBm
Output impedance	PDZ_{LOAD}			2.2		kΩ
Output voltage, P_{OUT} = no RF	PDV_{NORF}	Measured into 1 MΩ	0.1	0.125	0.15	V
Output voltage, P_{OUT} = 18.5 dBm CW	$PDV_{P18.5}$	Measured into 1 MΩ	0.56	0.66	0.76	V
Output voltage, P_{OUT} = 20 dBm CW	PDV_{P20}	Measured into 1 MΩ	0.70	0.80	0.90	V
Detector variation over temperature	$PDtt_{VAR}$	–30 to 25 °C 25 to 85 °C given detector voltage	–0.6		0.5	dB
Detector variation over frequency	PDF_{VAR}	2400 ~ 2500 MHz, given detector voltage	–0.5		0.5	dB
Detector variation over load VSWR	PDV_{SWR}	Forward power, ANT VSWR 3:1, all phases, given detector voltage	–2		1	dB
Detector bandwidth	PD_{BW}			1		MHz

Note 1: Performance is guaranteed only under the conditions listed in this table.

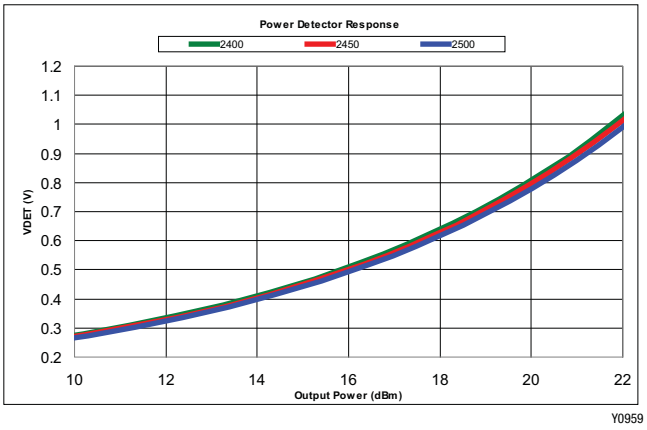


Figure 3. SE2611T Power Detector Characteristics

Table 9. SE2611T Electrical Specifications: Bluetooth Characteristics
(V_{CC} = 3.3 V, T_A = +25 °C, as Measured on Skyworks Solutions' SE2611T-EK1 Evaluation Board, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency range	f_{OUT}		2400		2500	MHz
Insertion loss	BT_{IL}	BT-ANT, CBTB = High, CBTR = CTX = CRX = Low		1.2	1.5	dB
Bt port return loss	S11	CBTB = High, CBTR = CTX = CRX = Low			–12	dB
Switch isolation	$ISOL_{SW}$	ANT-RX, CBTB = High, CBTR = CTX = CRX = Low	20			dB

Table 10. SE2611T Electrical Specifications: 2.4 GHz Receive Characteristics
(V_{CC} = 3.3 V, LEN = CRX = CBTR = 3.3 V, PEN = CBTB = CTX = 0 V, T_A = +25 °C, as Measured on Skyworks Solutions' SE2611T-EK1 Evaluation Board, All Unused Ports Terminated with 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency range	f_{OUT}		2400		2500	MHz
Receive gain, LNA enabled.	S_{21}	(BT + WLAN) Rx, high gain	11	13	15	dB
		WLAN Rx, high gain only, LEN = CRX = 3.3 V, PEN = CBTB = CTX =CBTR= 0 V	14	16	18	dB
Gain variation	ΔS_{21}	2400 ~ 2485 MHz, over any 20 MHz band			0.5	dB
Noise figure	NF			2.0	2.5	dB
Third order intercept	IIP3		–3			dBm
Input return loss	S_{11}				–8	dB
Reverse isolation	S_{12}				–20	dB
Input P1dB	IP1dB	CW	–8			dBm
Enable time	t_{EN}	10% to 90% of RX RF power, from time that LEN is at 50%			500	ns
Receive gain, LNA bypassed	S_{21_BYP}	LEN = 0 V	–20		–10	dB
Input return loss, LNA bypassed	S_{11_BYP}	LEN = 0 V			–7	dB
Switch isolation	$ISOL_{SW}$	CBTB = CBTR = Low, CRX = High, ANT_BT + BT_RX	20			dB

Package Dimensions

The PCB layout footprint for the SE2611T is provided in Figure 4. Typical case markings are shown in Figure 5. Package dimensions for the 20-pin QFN are shown in Figure 6, and carrier tape dimensions are provided in Figure 7.

Package and Handling Information

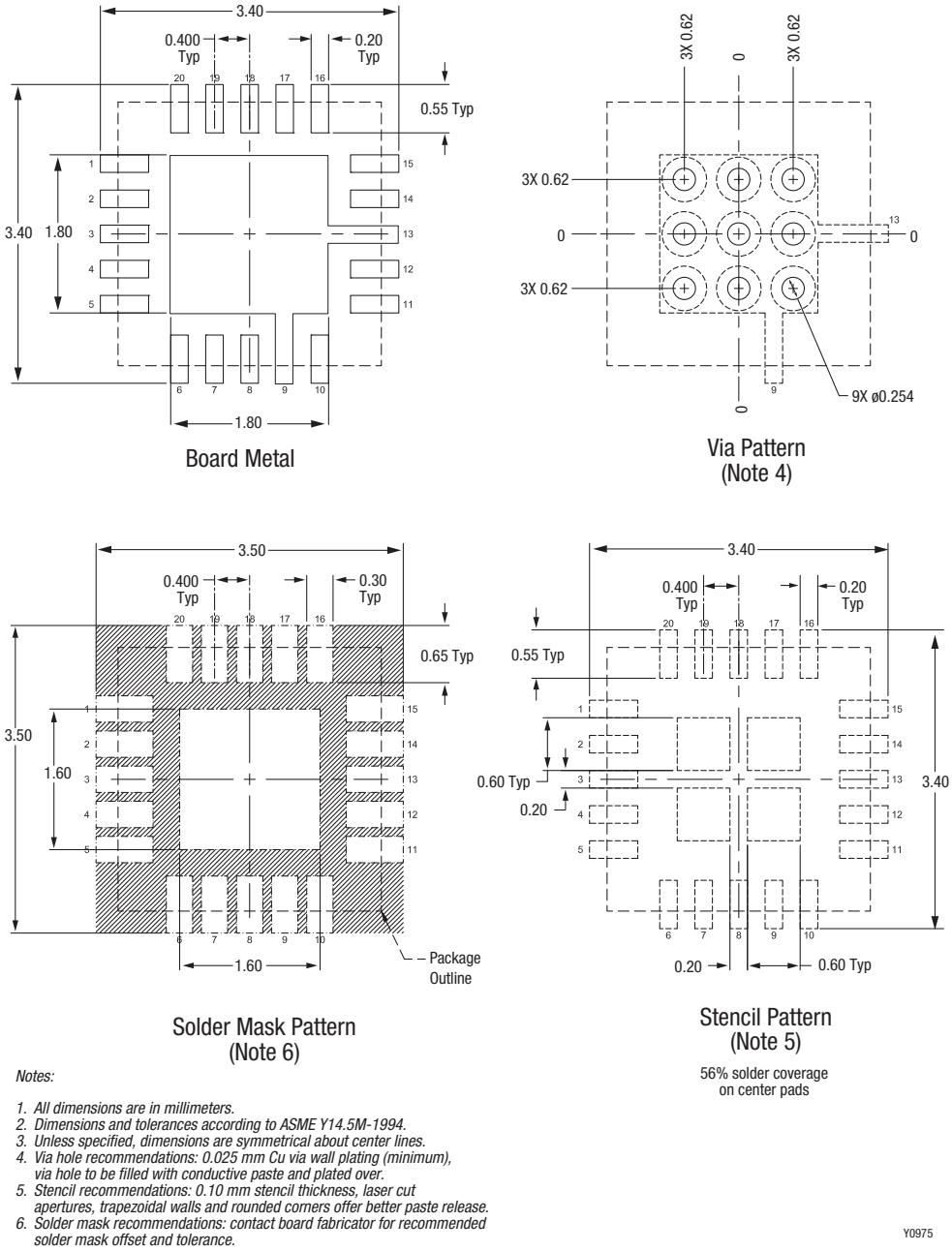
Because of its sensitivity to moisture absorption, instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SE2611T is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It is capable of withstanding a Pb-free solder reflow. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

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 by Skyworks, please refer to the following Skyworks Application Notes:

- *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.

Production quantities of this product are shipped in a standard tape and reel format.



Notes:

1. *All dimensions are in millimeters.*
2. *Dimensions and tolerances according to ASME Y14.5M-1994.*
3. *Unless specified, dimensions are symmetrical about center lines.*
4. *Via hole recommendations: 0.025 mm Cu via wall plating (minimum), via hole to be filled with conductive paste and plated over.*
5. *Stencil recommendations: 0.10 mm stencil thickness, laser cut apertures, trapezoidal walls and rounded corners offer better paste release.*
6. *Solder mask recommendations: contact board fabricator for recommended solder mask offset and tolerance.*

Figure 4. PCB Layout Footprint for the SE2611T

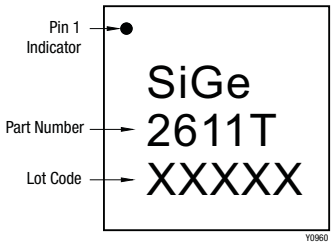
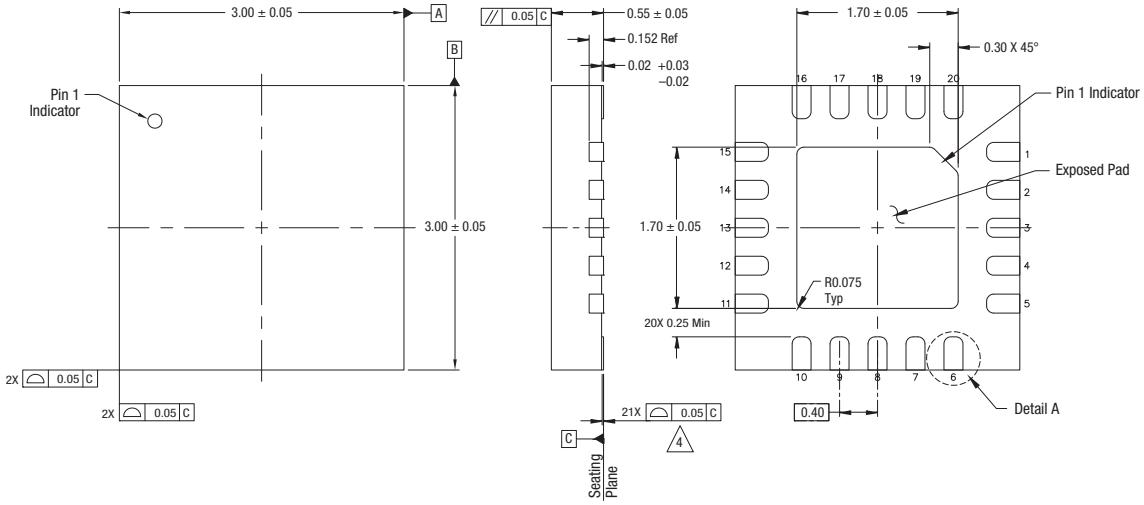


Figure 5. Typical Case Markings (Top View)



Notes:

1. *All measurements are in millimeters.*
2. *Dimensions and tolerances according to ASME Y14.5M-1994.*
3. *Unless otherwise specified, the following values apply:*
   Decimal Tolerance: Angular Tolerance:
   X.X (1 place) ± 0.1 mm ±1/2°
   X.XX (2 places) ± 0.05 mm
   X.XXX (3 places) ± 0.025 mm
4. *Coplanarity applies to the terminals as well as all other bottom surface metallization.*
5. *Dimension applies to metallized terminal. If terminal tip has a radius, dimension should not be measured in that radius area.*
6. *Unless specified, dimensions are symmetrical about center lines.*

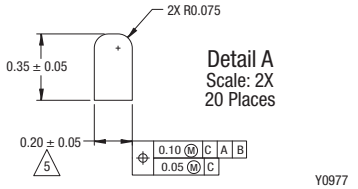
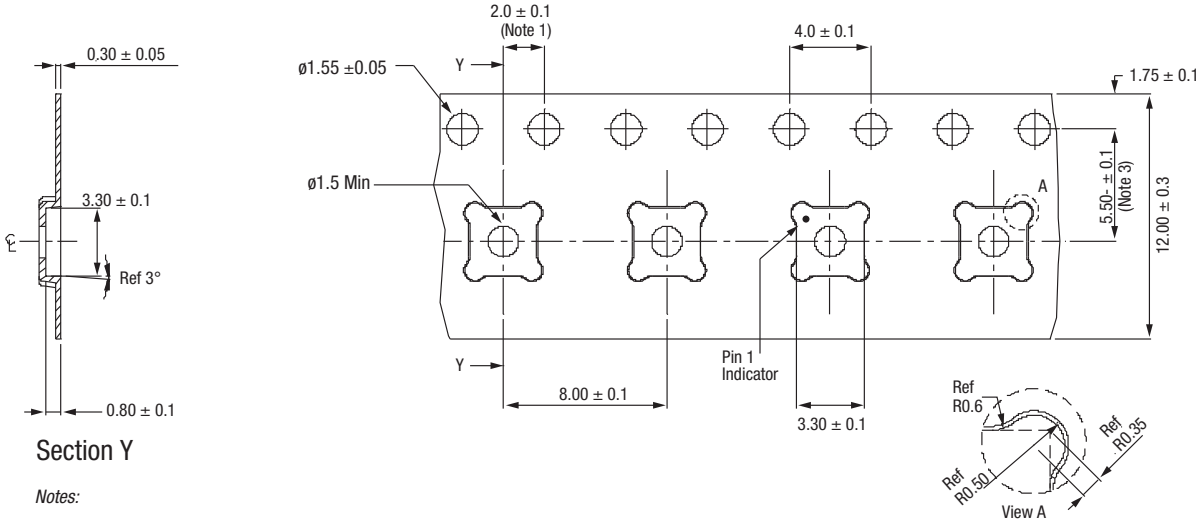


Figure 6. SE2611T 20-Pin QFN Package Dimensions



Notes:

1. *Measured from center line of sprocket hole to center line of pocket.*
2. *10-sprocket hole pitch cumulative tolerance: ±0.20.*
3. *Measured from center line of sprocket hole to center line of pocket.*
4. *Other material available.*
5. *Typical SR of form tape from 10^5 to 10^{11} Ω/sq.*
6. *All dimensions are in millimeters.*

Figure 7. SE2611T 20-Pin QFN Carrier Tape Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SE2611T: 2.4 GHz High Efficiency Wireless LAN/BT Front End	SE2611T	SE2611T-EK1

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
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