DATA SHEET

SE5023L: 5 GHz, +26 dBm Power Amplifier with Power Detector

Applications

- DSSS 5 GHz WLAN (IEEE 802.11ac)
- DSSS 5 GHz WLAN (IEEE 802.11n)
- Access points, PCMCIA, PC cards

Features

- 5 GHz matched +24 dBm 802.11ac power amplifier
- External analog reference voltage (VREF) for maximum flexibility
- Buffered, temperature compensated power detector
- 1.8% EVM, +24 dBm, 256 QAM, 802.11ac
  3% EVM, +26 dBm, 64 QAM, 802.11n
- 32 dB Gain
- Lead-free, RoHS-compliant and halogen-free (20-pin, 4 × 4 × 0.9 mm) QFN 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

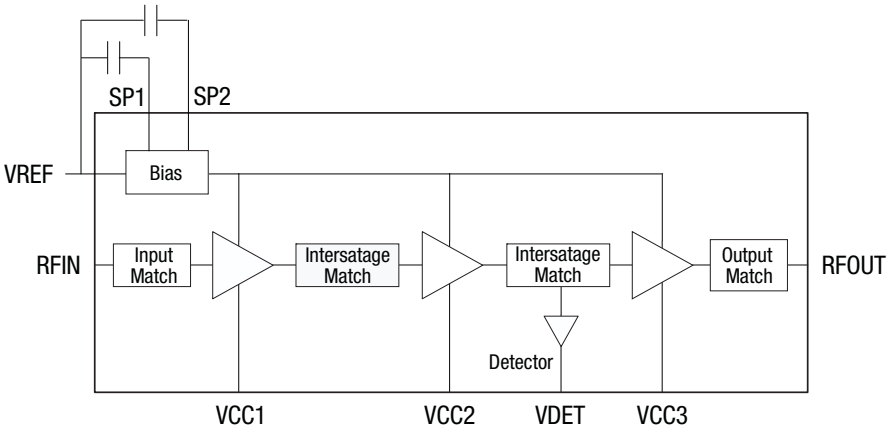
The SE5023L is a 5 GHz power amplifier offering high linear power for wireless LAN applications.

The SE5023L offers a high level of integration for a simplified design, providing quicker time to market and higher application board production yield. The device integrates all matching elements, a temperature compensated, load insensitive power detector with 15 dB of dynamic range and a 3.8 GHz notch filter.

For wireless LAN applications, the device meets the requirements of IEEE 802.11ac and 802.11n, and delivers approximately +24 dBm of 802.11ac output power or +26 dBm of 802.11n output power at 5 V.

A 2.85 V reference voltage on VREF is all that is required to enable or disable the power amplifier.

A block diagram of the SE5023L is shown in Figure 1. The device pinout for the 20-pin QFN are shown in Figure 2. Signal pin assignments and functional pin descriptions are described in Table 1.



Note: RFIN and RFOUT include DC shunt to Ground. External blocking capacitors are recommended.

Figure 1. SE5023L Block Diagram

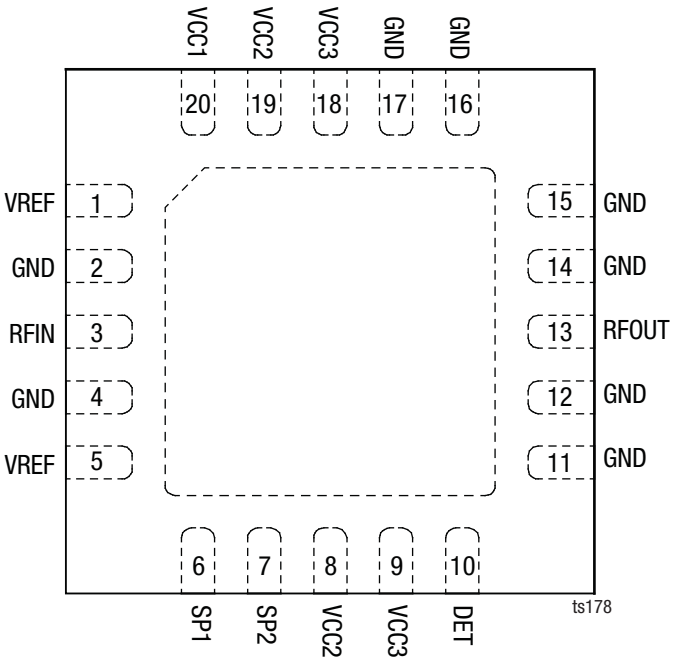


Figure 2. SE5023L Pinout – 20-Pin QFN (Top View)

Table 1. SE5023L Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	VREF	Reference voltage	9	VCC3	Third stage supply voltage
2	GND	Ground	10	DET	Analog power detector output
3	RFIN	Power amplifier RF input, DC block required	11, 12	GND	Ground
4	GND	Ground	13	RFOUT	Power amplifier RF output
5	VREF	Reference voltage	14, 15, 16, 17	GND	Ground
6	SP1	Port for optional capacitor to improve dynamic EVM	18	VCC3	Third stage supply voltage
7	SP2	Port for optional capacitor to improve dynamic EVM	19	VCC2	Second stage supply voltage
8	VCC2	Second stage supply voltage	20	VCC1	First stage supply voltage

Electrical and Mechanical Specifications

The absolute maximum ratings of the SE5023L are provided in Table 2. Recommended operating conditions are specified in Table 3. Electrical specifications are provided in Tables 4 through 6. Figure 3 shows the power detector characteristics.

Table 2. SE5023L Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage on pins VCC3	V_{CC}	–0.3	+6	V
Supply voltage on pins VCC1, VCC2		–0.3	V_{CC3}	V
Power amplifier enable and reference voltage	V_{REF}	–0.3	+3.6	V
RF input power, RFOUT into 50 Ω match, T_{CASE_MAX} = 85 °C	RF_{IN}		+6	dBm
Storage temperature range	T_{STG}	–40	+160	°C
Maximum junction temperature	T_J		+160	°C
Electrostatic discharge: Human Body Model (HBM), Class 1B	ESD		500	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. SE5023L Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage VCC3	V_{CC}	3.0	5.5	V
Supply voltage VCC1, VCC2		3.0	V_{CC3}	V
Maximum case temperature	T_{CASE_MAX}	–40	+85	°C
Reference voltage	V_{REF}	2.8	2.9	V

Table 4. SE5023L Electrical Specifications: DC Characteristics (Note 1)
(V_{CC} = 5.0 V, V_{REF} = 2.85 V, T_A = +25 °C as Measured on Skyworks' SE5023L-EK1 Evaluation Board, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Supply current	$I_{CC\_802.11a}$	P_{OUT} = 26 dBm, 54 Mbps, 64 QAM,			600	mA
Quiescent current	I_{QC}	No RF	150		300	mA
Supply current	I_{OFF}	V_{REF} = 0 V, no RF		0.5	10	µA
Bias control current	I_{EN}	V_{REF} = V_{REF_H}, Internal 2 kΩ pull down resistor		10		mA
Reference voltage enabled	V_{REF_H}		2.80	2.85	2.9	V
Reference voltage current	I_{REF}	V_{REF} voltage set to 2.85 V		10		mA
Reference voltage disabled	V_{REF_L}		0		0.5	V

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

Table 5. SE5023L Electrical Specifications: AC Characteristics (Note 1)
(V_{CC} = 5.0 V, V_{REF} = 2.85 V, f = 5.4 GHz, T_A = +25 °C as Measured on the SE5023L-EK1 Evaluation Board, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Frequency range	f_{L_U}		5.15		5.85	GHz
Output power	P_{OUT}	MCS9, –35 dB DEVM, UNII-1 UNII-2 & 3	 +17 +22	 +19 +24		 dBm dBm
		MCS9, –30 dB DEVM UNII-1 UNII-2 & 3	 +22 +24	 +24 +26		 dBm dBm
		MCS0, mask limited UNII-1 UNII-2 & 3	 +25 +27	 +27 +29		 dBm dBm
Output 1 dB compression point	P_{1dB}	No modulation		+34		dBm
Small signal gain	S21	P_{IN} = –25 dBm	28	32	34	dB
Small signal gain variation	$\Delta S21$	Within each UNII Band		3		dB
Gain at 3.8 GHz	$S21\_3.8$	P_{IN} = –25 dBm			0	dB
Harmonic	2f 3f	P_{OUT} = +26 dBm, 5 V			–45	dBm/MHz
Rise and fall time	t_R, t_F			0.15	0.3	µs
Stability	STAB	P_{OUT} = +26 dBm, V_{CC} = 5 V, 54 Mbps, 64QAM, VSWR = 6:1, all phases	All non-harmonically related outputs less than –50 dBc/100 kHz			
Tolerance to constant input power into a mismatch load	Ruggedness	P_{IN} = –10 dBm, CW, VSWR = 6:1, all phases	No damage			

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

Table 6. SE5023L Electrical Specifications: Power Detector Characteristics (Note 1)
(V_{CC} = 5.0 V, V_{REF} = 2.85 V, f = 5.4 GHz, T_A = +25 °C as Measured on the SE5023L-EK1 Evaluation Board, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
P_{OUT} detect range	P_{DR}		0		P_{1dB}	dBm
Detector voltage	V_{DET}	P_{OUT} = +26 dBm	0.8		1.2	V
		P_{OUT} = No RF	0.22		0.33	V
Detector accuracy	ERR_{DET}	ΔP_{OUT} at constant V_{DET}, 5.15 GHz to 5.70 GHz 5.70 GHz to 5.85 GHz	 –0.5 –0.5		 +0.5 +0.5	 dB dB
		ΔP_{OUT} at constant V_{DET}, VSWR = 3:1	–1.5		+1.5	dB
Output impedance	PDZ_{OUT}			0.7		kΩ
DC load impedance	PDZ_{LOAD}			26.5		kΩ

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

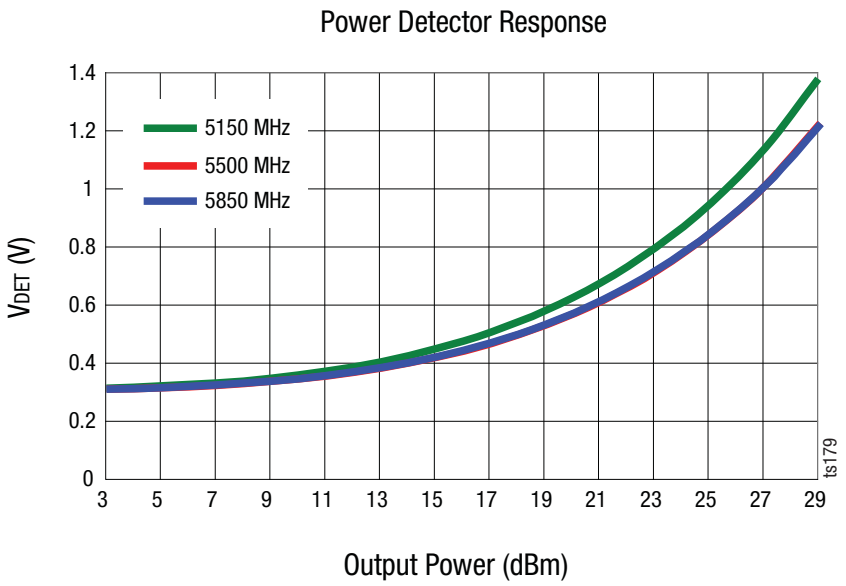


Figure 3. SE5023L Power Detector Characteristic over Frequency

Package Dimensions

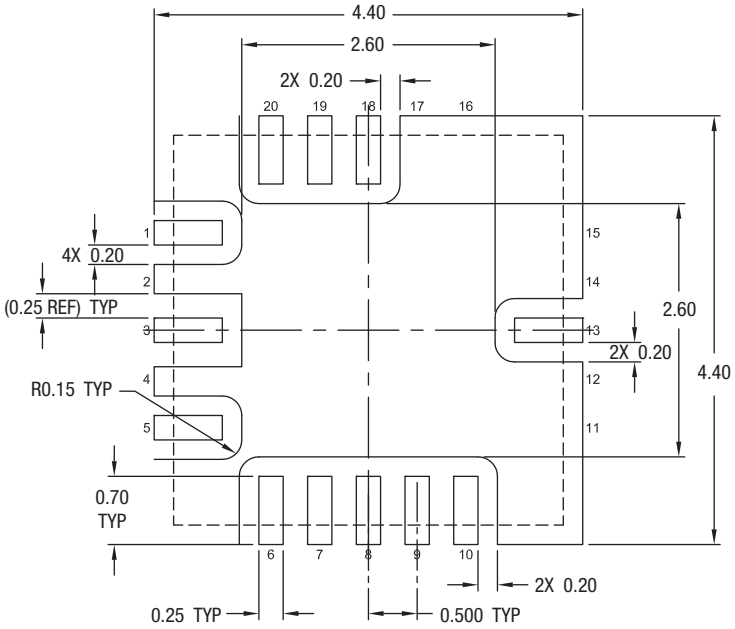
The PCB layout footprint for the SE5023L is provided in Figure 4. Typical part markings are shown in Figure 5. Package dimensions for the 20-pin QFN are shown in Figure 6, and carrier tape dimensions are provided in Figure 7.

Package Handling Information

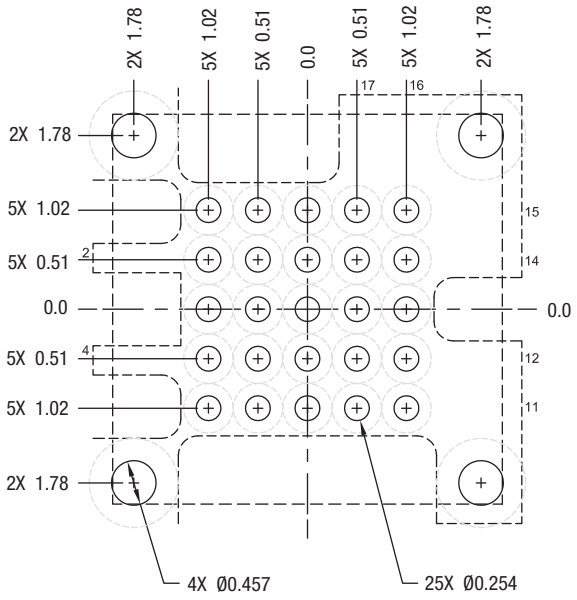
Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SE5023L is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

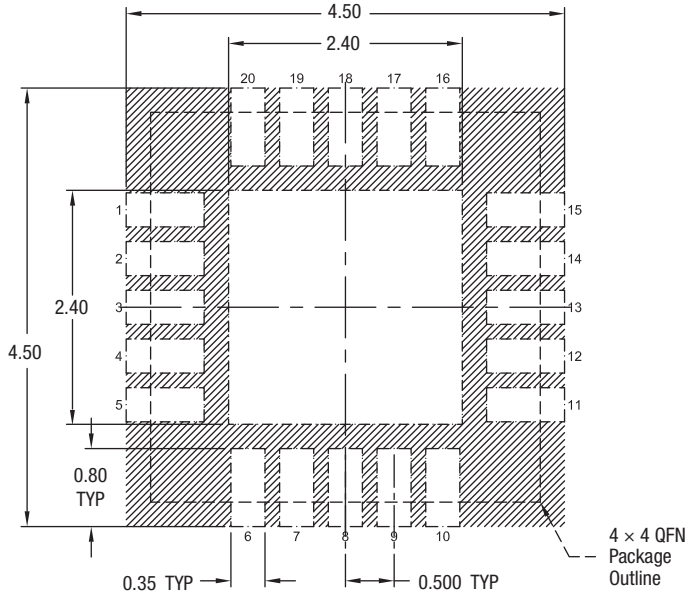
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



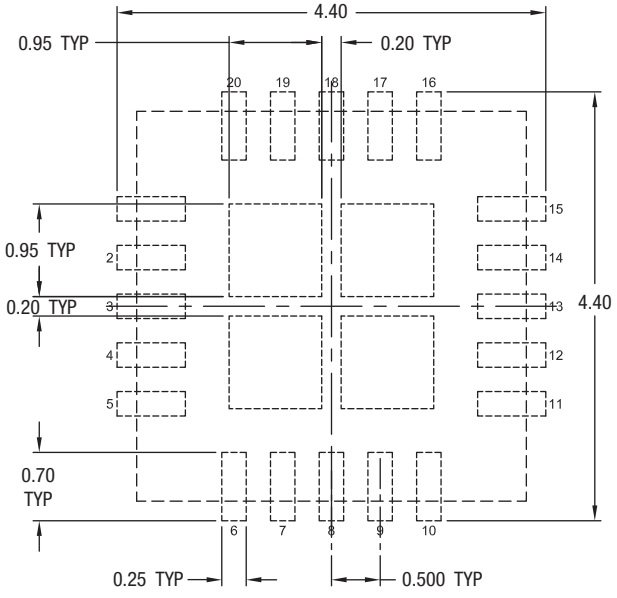
Board Metal



Via Pattern (Note 4)



Solder Mask Pattern (Note 6)



Stencil Pattern (Note 5)
(61% solder coverage on center Pad)

Notes:
1. All dimensions are in millimeters.
2. Interpret dimensioning and tolerancing per 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 holes to be filled with conductive paste and plated over.
5. Stencil recommendations: 0.125 mm stencil thickness., laser cut apertures, trapezodial walls and rounded corners will offer better paste release.
6. Solder mask recommendations: contact board fabricator for recommended solder mask offset and tolerance. **ts181**

Figure 4. PCB Layout Footprint for the SE5023L

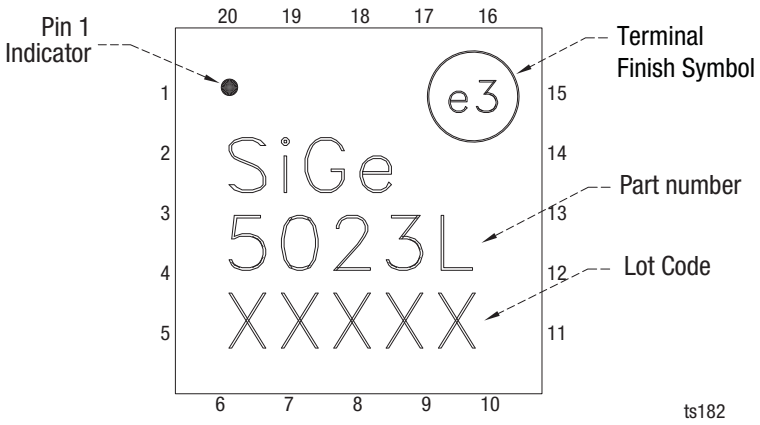
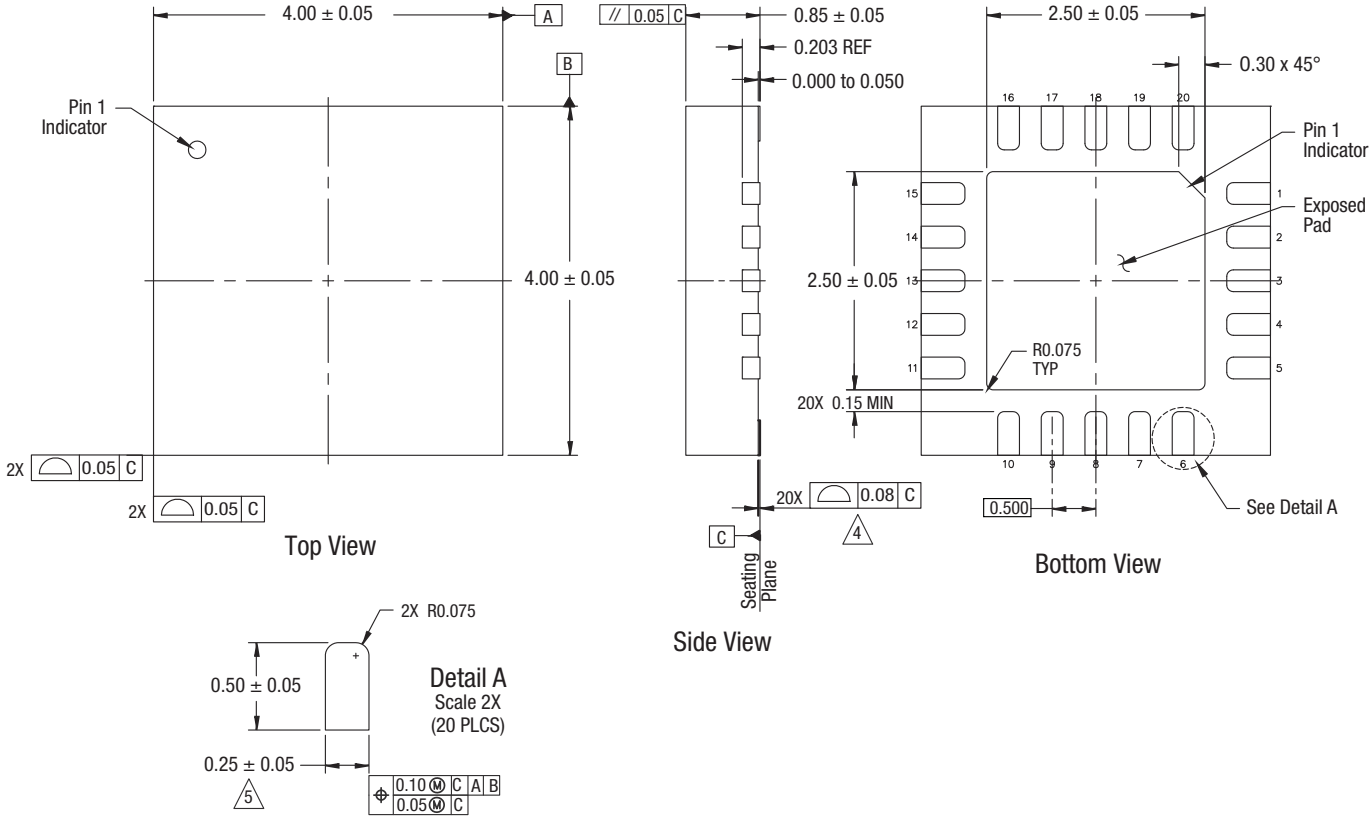


Figure 5. Typical Part Markings (Top View)



Notes:
1. *All measurements are in millimeters.*
2. *Dimensioning and tolerancing according to ASME Y14.5M-1994.*
3. *Tolerancing (unless otherwise specified):*
   Decimal Tolerance: *Angular Tolerance:*
   X.X (1 PLC) ± 0.1 mm *±1°/2°*
   X.XX (2 PLCs) ± 0.05 mm
   X.XXX (3 PLCs) ± 0.025 mm
4. *Coplanarity applies to the exposed center ground pad as well as the terminal.*
5. *Dimension applies to metalized terminal. If the terminal has a radius, the dimension should not be measured in the radius area.*
6. *Plating requirements per source control drawing (SCD) 2504.*
7. *Unless specified, dimensions are symmetrical about center lines.*

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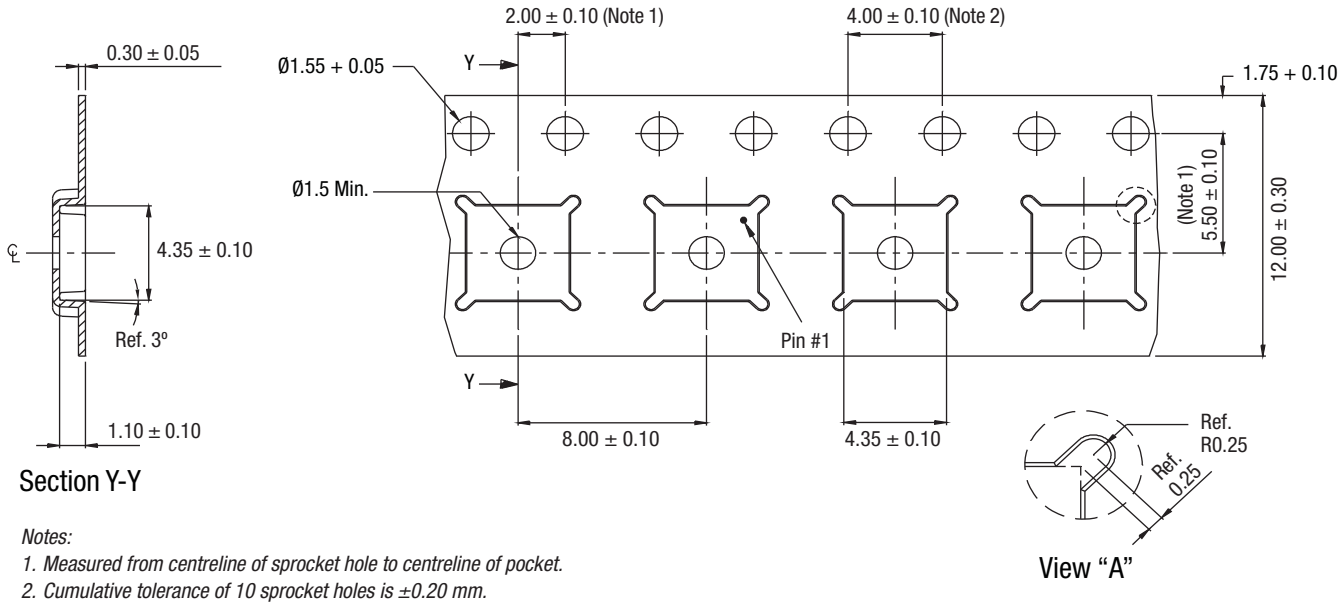
Figure 6. SE5023L 20-Pin QFN Package Dimensions



Notes:

1. Measured from centreline of sprocket hole to centreline of pocket.

2. Cumulative tolerance of 10 sprocket holes is ±0.20 mm.

3. Other material available.

4. All measurements are in millimeters unless otherwise stated.

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Figure 7. SE5023L 20-pin QFN Carrier Tape Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SE5023L: 5 GHz, 26 dBm Power Amplifier with Power Detector	SE5023L	SE5023L-EK1

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Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331