PE53211

Document Category: Product Specification

Dual Channel Switch LNA Module, 2.3 GHz - 2.7 GHz

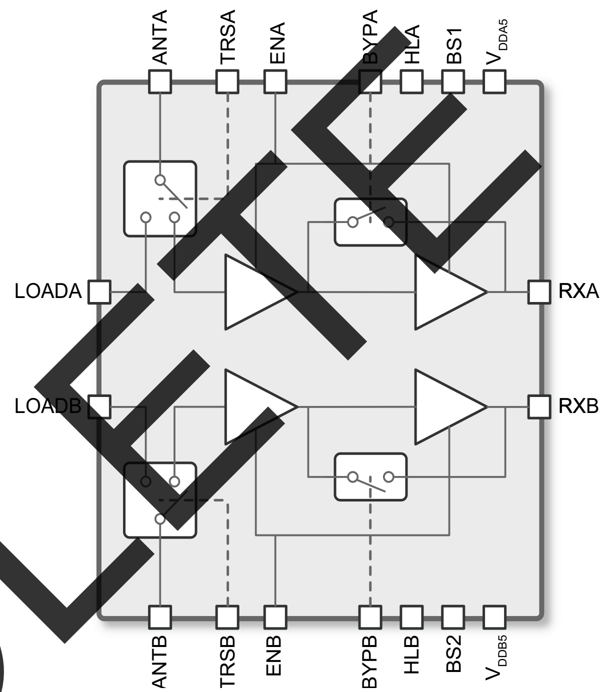
Features

- Wide frequency range with internal matching
- Integrates dual-channel LNA with bypass and high power switch
- Max RF input power
  - 5W Pavg for long term
  - 10W Pavg for short term
- 1.4 dB noise figure
- 30 dBm OIP3/ 34 dB gain at full gain mode
- +105 °C operating temperature
- Low power consumption: 90 mA per channel
- Compact package size of 32-lead 5x5 mm

Applications

- 4G/4.5G TD-LTE macro/micro cell
- Pre-5G/5G massive MIMO systems
- Receiver protection system

Figure 1 ▪ PE53211 Functional Diagram



OBSOLETE

Product Description

The PE53211 is a highly integrated front-end module targeted for wireless infrastructure applications such as TDD macro/micro base stations and MIMO application. It is designed for use at the front end of receiver chain of TDD-based systems. The PE53211 is ideally suited for 4G or next-generation 5G solutions, or small cell applications.

The dual-channel receiver integrates two independent LNAs with bypass function and a high power switch. The PE53211 can be utilized across the 2.3–2.7 GHz frequency range with internal impedance matching networks.

This receiver utilizes pSemi's UltraCMOS SOI technology which supports input RF power signal up to 5W average power, assuming 8 dB PAR and very low noise figure, excellent linearity and very low power consumption. Each channel is controlled individually within the selected frequency band, which allows more flexibility in the system design.

Absolute Maximum Ratings

Exceeding absolute maximum ratings listed in **Table 1** may cause permanent damage. Operation should be restricted to the limits in **Table 2**. Operation between operating range maximum and absolute maximum for extended periods may reduce reliability.

ESD Precautions

When handling this UltraCMOS device, observe the same precautions as with any other ESD-sensitive devices. Although this device contains circuitry to protect it from damage due to ESD, precautions should be taken to avoid exceeding the rating specified in **Table 1**.

Table 1 ▪ Absolute Maximum Ratings for PE53211

Parameter	Rating	Unit
Power supply voltage	5.50	V
Control input voltage	3.60	V
Storage temperature range	–65 to 150	°C
RF input power, single event, average(1)	40	dBm
LNA input power	22	dBm
Human-body model, all pins(2)	1000	V
Charged device model, all pins(3)	500	V

1) TX mode, 10 min duration, 105 °C, 8 dB PAR LTE signal, no hot switching
2) Human body model (MIL-STD 883 Method 3015)
3) Charged device model (JEDEC JESD22-C101)

Recommended Operating Conditions

Table 2 lists the recommending operating conditions for the PE53211. Devices should not be operated outside the recommended operating conditions listed below.

Table 2 ▪ Recommended Operating Conditions for PE53211

Parameter	Min	Typ	Max	Unit
V_{DD} positive supply voltage	4.75		5.25	V
Control voltage high	1.17		3.60	V
Control voltage low	–0.30		0.60	V
Digital input leakage current	–20	0	20	µA
Operating temperature range	–40	25	105	°C

Electrical Specifications

Table 3 provides the PE53211 key electrical specifications @ +25 °C, V_{DD} = 5V (Z_S = Z_L = 50Ω), unless otherwise specified.

Table 3 ▪ PE53211 Electrical Specifications

Parameter	Condition	Min	Typ	Max	Unit
Frequency range		2300		2700	MHz
Input return loss	ANTA or ANTBRx mode at 2300 MHz at 2500 MHz at 2700 MHz		 13 20 13		dB
Output return loss	At RXA or RXB, Rx mode at 2300 MHz at 2500 MHz at 2700 MHz		 10 9 9		dB
Insertion loss	Tx operation mode, ANT-Load		0.3		dB
RF max input power (Pavg)	Average value; No damage for long time operation. RF load connected to load with -10 dB return loss. LTE Signal PAR 8dB	5			W
TX/RX switching time	RX to TX or TX to RX, 50% cntl to 10/90 RF		710		ns
Bypass switching time	Bypass enable or disable, 50% cntl to 10/90 RF		220		ns
Switch isolation	RX mode, ANT to load termination		25		dB
Switch isolation	TX mode, LNA off, ANT to RX OUT		60		dB
Channel isolation	RX mode, RX to RX		42		dB
Channel isolation	TX mode, TX to TX		45		dB
Cross isolation	RX mode, ANT1 to RX2		75		dB
Cross isolation	RX mode, LNA 2 bypass, ANT1 to RX2		67		dB
In-band spurious emission	Rx mode at Rx out with Pin=-49 dBm Pin is a CW signal swept across frequency range. Spec refers to any spurious mixing product that occurs across frequency range.		–85		dBc
Out-of-band emission	Rx mode at Rx out from DC to 12275 MHz Measure Pout with IBW = 4.5 MHz over frequency range with no input power applied.		–65		dBm
Full Gain Mode					
Supply current	5V supply, per channel, at max gain		90		mA
Bypass mode supply current	5V supply, per channel, second amp bypassed		25		mA
Gain	Full gain mode at 2300 MHz at 2500 MHz at 2700 MHz	 32 32 31	 34.5 34 33		dB
Gain flatness	Any 100 MHz bandwidth, at full gain		0.6		dB
Bypass gain	Bypass mode	15	17		dB
Bypass gain flatness	Any 100 MHz bandwidth		0.60		dB

Table 3 ▪ PE53211 Electrical Specifications (Cont.)

Parameter	Condition	Min	Typ	Max	Unit
NF	Full gain or bypass mode		1.45	1.75	dB
OIP3(1)	Full gain mode	28	30		dBm
Bypass OIP3(2)	Bypass mode	23.5	26		dBm
OP1dB	Full gain mode		19		dBm
Bypass OP1dB	Bypass mode		12		dBm
Low Power Mode					
Low power mode current	5V supply, per channel		75		mA
Bypass mode supply current	5V supply, per channel, second amp bypassed		25		mA
Gain	Full gain mode	31	33.5		dB
Gain flatness	Any 100 MHz bandwidth, at full gain		0.6		dB
Bypass gain	Bypass mode	15	17		dB
Bypass gain flatness	Any 100 MHz bandwidth, second amp bypassed		0.6		dB
NF	Full gain or bypass mode		1.45	1.75	dB
OIP3	Full gain mode	26	28		dBm
Bypass OIP3	Bypass mode	22	24.5		dBm
OP1dB	Full gain mode		18		dBm
Bypass OP1dB	Bypass mode		12.5		dBm

1) -35 dBm input power, 1 MHz tone spacing
2) -25 dBm input power, 1 MHz tone spacing

Typical Performance Data

Figure 2 through **Figure 18** show the typical performance data at nominal condition, unless otherwise specified.

Figure 2 ▪ ***Gain vs. Frequency (Rx Full Gain Mode)***

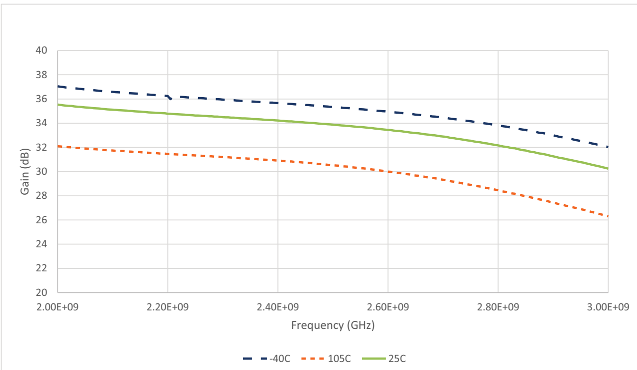


Figure 3 ▪ ***ANT Return Loss vs. Frequency (Rx Full Gain Mode)***

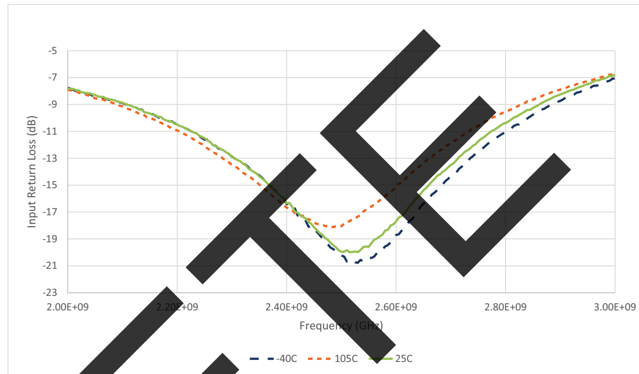


Figure 4 ▪ ***Rx Out Return Loss vs. Frequency (Rx Full Gain Mode)***

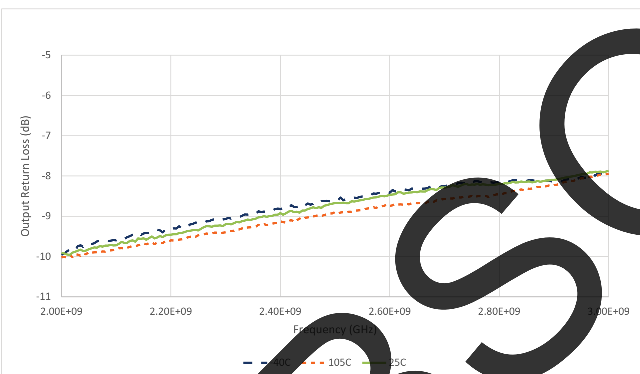


Figure 5 ▪ ***Noise Figure vs. Frequency (Rx Full Gain Mode)***

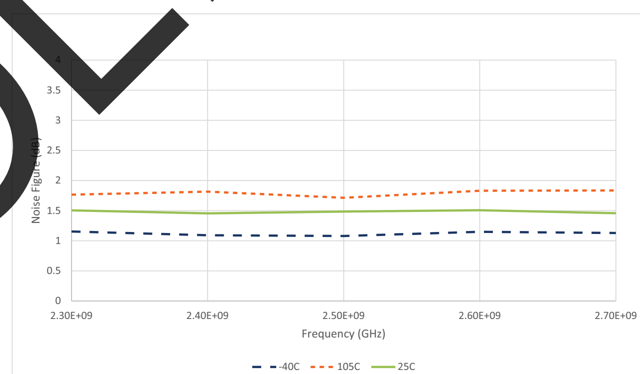


Figure 6 ▪ ***OIP3 vs. Frequency (Rx Full Gain Mode)***

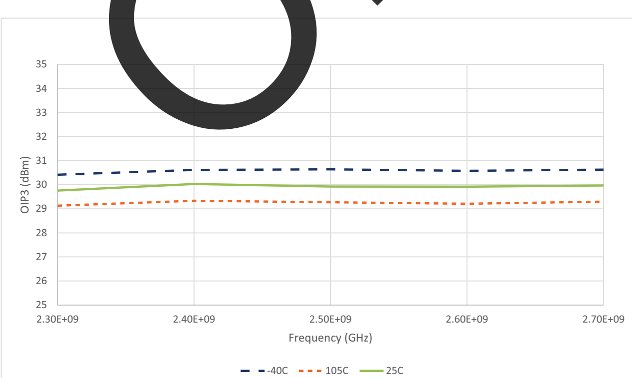


Figure 7 ▪ ***Output P1dB vs. Frequency (Rx Full Gain Mode)***

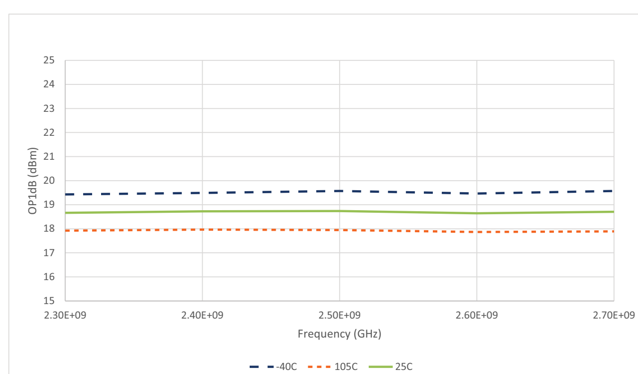


Figure 8 ▪ ***CH-CH Isolation vs. Frequency (Rx Full Gain Mode)***

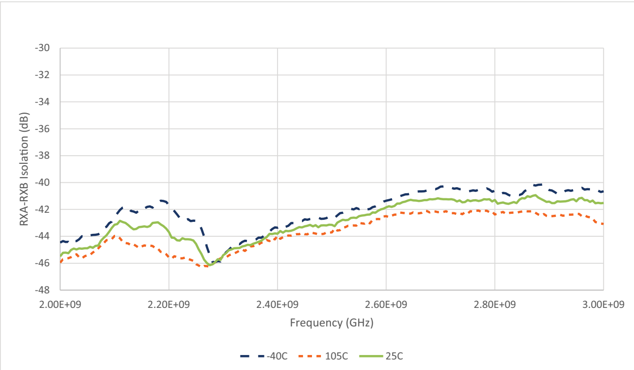


Figure 9 ▪ ***Gain Over Temp vs. Frequency (Rx Bypass Mode)***

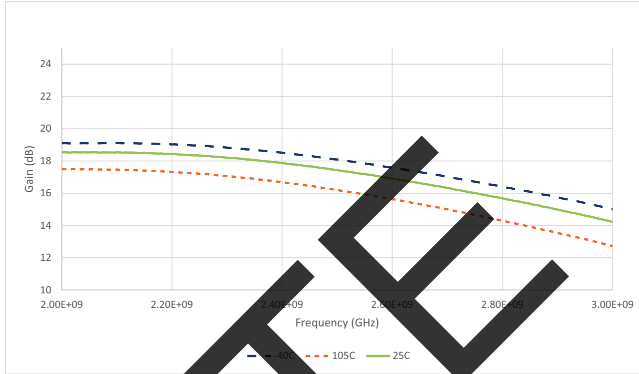


Figure 10 ▪ ***ANT Return Loss Over Temp vs. Frequency (Rx Bypass Mode)***

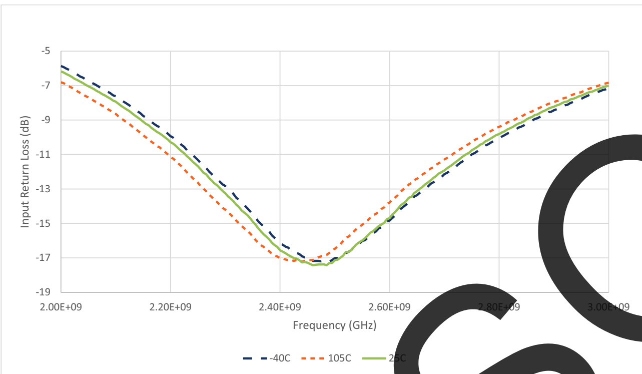


Figure 11 ▪ ***Rx Out Return Loss Over Temp vs. Frequency (Rx Bypass Mode)***

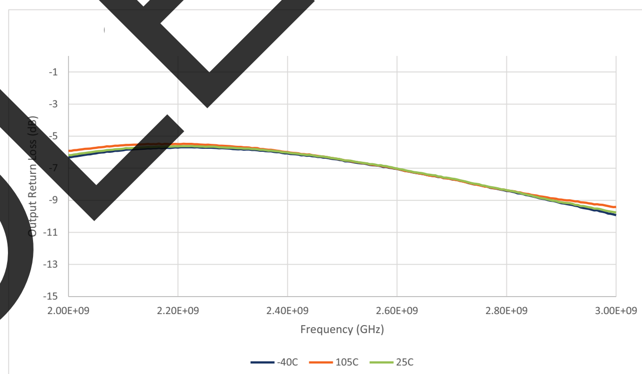


Figure 12 ▪ ***Noise Figure Over Temp vs. Frequency (Rx Bypass Mode)***

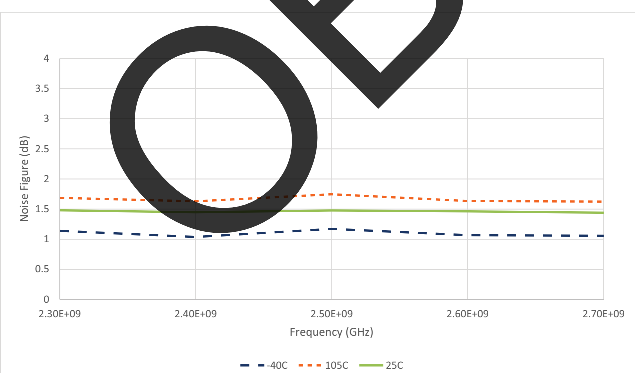


Figure 13 ▪ ***OIP3 Over Temp vs. Frequency (Rx Bypass Mode)***

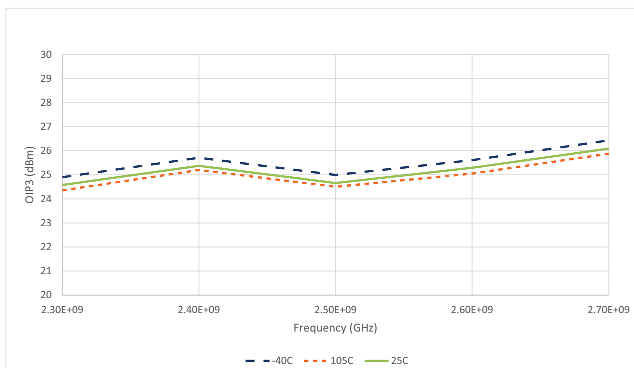


Figure 14 ▪ ***Output P1dB Over Temp vs. Frequency (Rx Bypass Mode)***

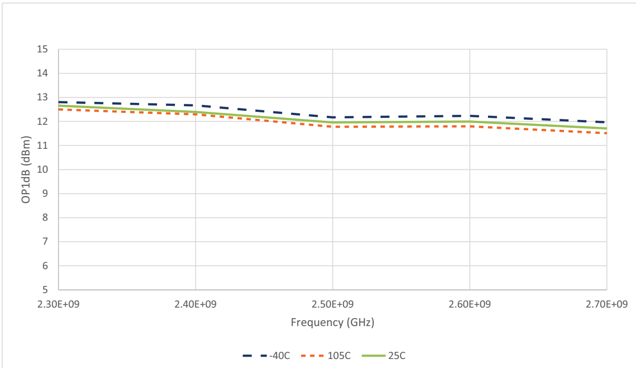


Figure 15 ▪ ***CH-CH Isolation Over Temp vs. Frequency (Rx Bypass Mode)***

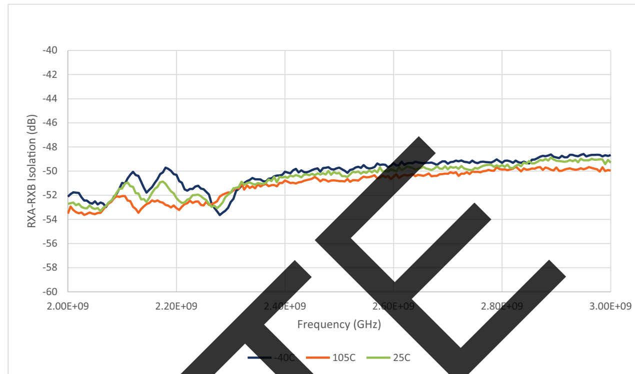


Figure 16 ▪ ***Insertion Loss vs. Frequency (Tx Mode)***

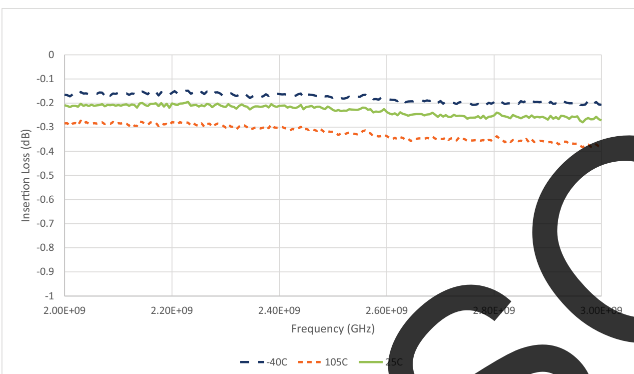


Figure 17 ▪ ***ANT Return Loss vs. Frequency (Tx Mode)***

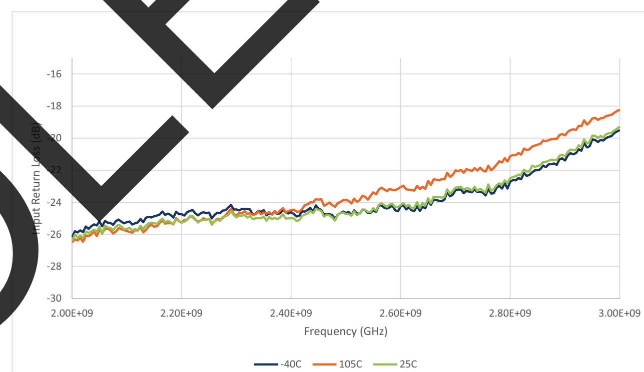


Figure 18 ▪ ***Rx Out Return Loss vs. Frequency (Tx Mode)***

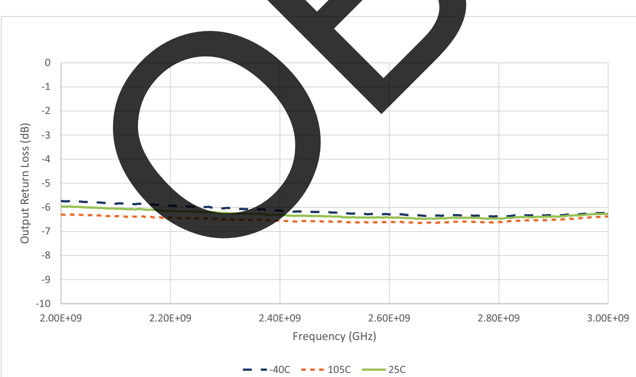


Figure 19 ▪ ***ANT-Rx,Isolation vs. Frequency (Tx Mode)***

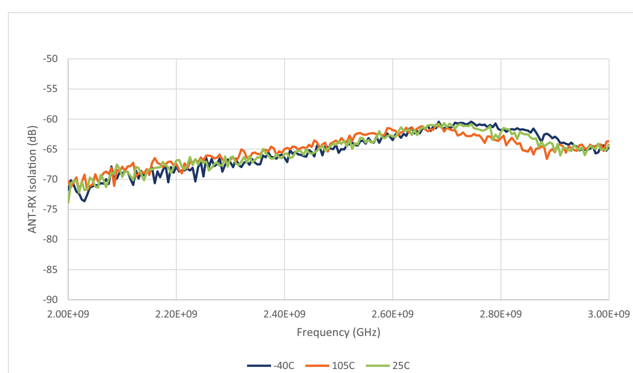
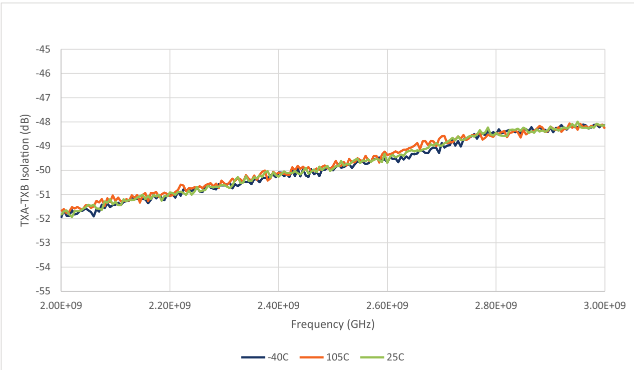


Figure 20 ▪ ***CH-CH Isolation vs. Frequency (Tx Mode)***



Supply Current vs. Resistor Value

Table 4 ▪ Supply Current vs. Resistor Value

Part Number	Resistor Value	Supply Current—Rx Full Gain Mode	Supply Current—Rx Bypass Mode
PE53210/PE53211	120 KΩ (R9, R10)	90 mA	25 mA
	200 KΩ (R9, R10)	75 mA	25 mA
PE53110/PE53111	120 KΩ (R9)	90 mA	25 mA
	200 KΩ (R9)	75 mA	25 mA

Pin Configuration

This section provides pin information for the PE53211. **Figure 21** shows the pin configuration of this device. **Table 5** provides a description for each pin.

Figure 21 ▪ Pin Configuration (Top View)

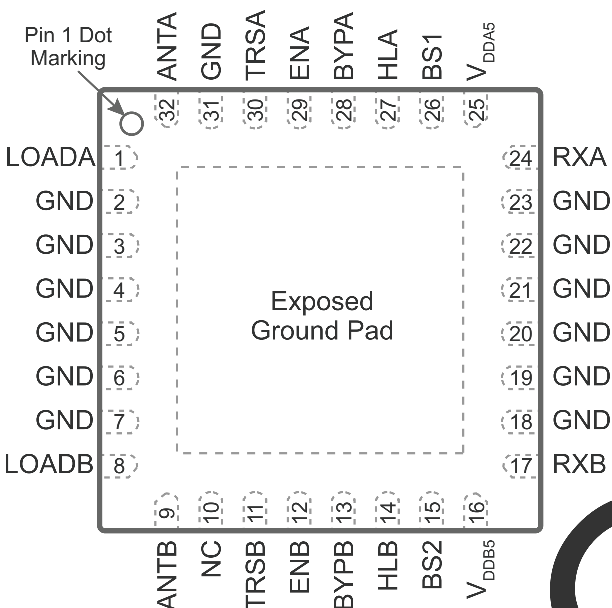


Table 5 ▪ Pin Descriptions for PE53211

Pin No.	Pin Name	Description
1	LOADA	Channel A load
2–7, 18–23, 31	GND	Ground
8	LOADB	Channel B load
9	ANTB	Channel B antenna
10	NC	Not connected. Pin 10 (NC) must be left NOT CON-NECTED at the application board for proper operation.
11	TRSB	Channel B high power switch control
12	ENB	Channel B LNA enable
13	BYPB	Channel B LNA bypass control
14	HLB	Channel B bias. HLB requires a 120k Ohm resistor to the application board GND to set 90 mA in Rx Full Gain mode, BYPA=0.
15	BS2	Isolation. BS2 can be left NOT CONNECTED for internally-tied logic high. If BS2 is con-nected to the TRSB control pin, it will improve ANTB to RXB isolation in TX mode for channel B. This pin is internally logic high if left floating.
16	V_{DDB5}	Supply voltage
17	RXB	Channel B RF output port External 39pF DC blocking capacitor is required.
24	RXA	Channel A RF output port External 39pF DC blocking capacitor is required.
25	V_{DDA5}	Supply voltage
26	BS1	Isolation. BS1 can be left NOT CONNECTED for internally-tied logic high. If BS1 is con-nected to the TRSA control pin, it will improve ANTA to RXA isolation in TX mode for channel A. This pin is internally logic high if left floating.

Table 5 ▪ Pin Descriptions for PE53211 (Cont.)

Pin No.	Pin Name	Description
27	HLA	Channel A bias. HLA requires a 120k Ohm resistor to the application board GND to set 90 mA in Rx Full Gain mode, BYPA=0.
28	BYPA	Channel A LNA bypass mode
29	ENA	Channel A LNA enable
30	TRSA	Channel A high power switch control
32	ANTA	Channel A antenna
PAD	GND	Exposed pad: ground for proper operation

Truth Table

Table 6 ▪ Receiver Module Dual Channel Tx-Rx Control Logic Truth Table

Mode	BS1	BS2	ENA	ENB	TRSA	TRSB	BYPA	BYPB
Receive—Full Gain	1	1	1	1	1	1	0	0
Receive—Bypass	1	1	1	1	1	1	1	1
Transmit	1	1	0	0	0	0	0	0

Packaging Information

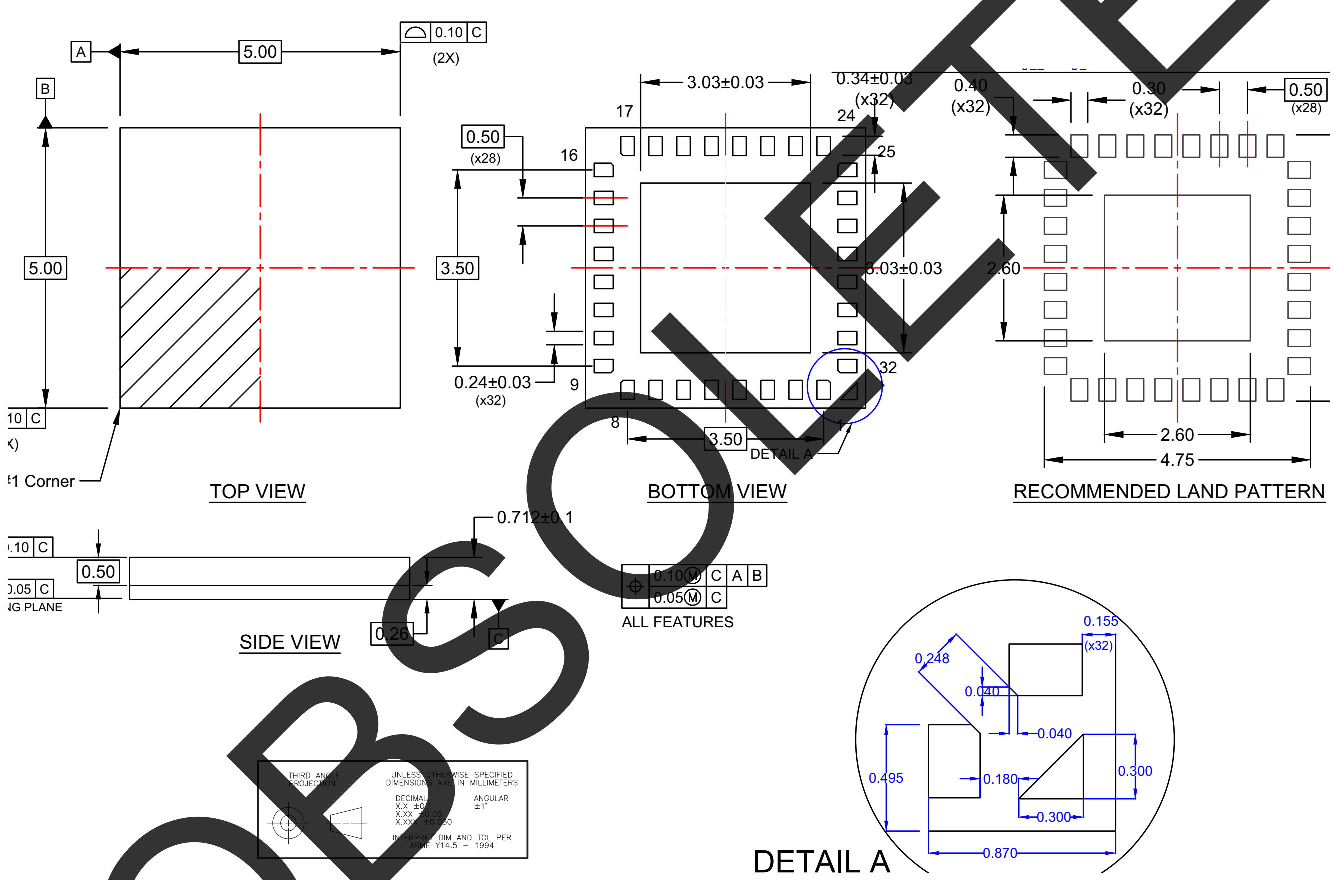
This section provides packaging data including the moisture sensitivity level, package drawing, package marking and tape-and-reel information.

Moisture Sensitivity Level

The moisture sensitivity level rating for the PE53211 in the 32-lead 5 × 5 × 0.71 mm LGA package is MSL 3.

Package Drawing

Figure 22 ▪ Package Mechanical Drawing for 32-lead 5 × 5 × 0.71 mm LGA



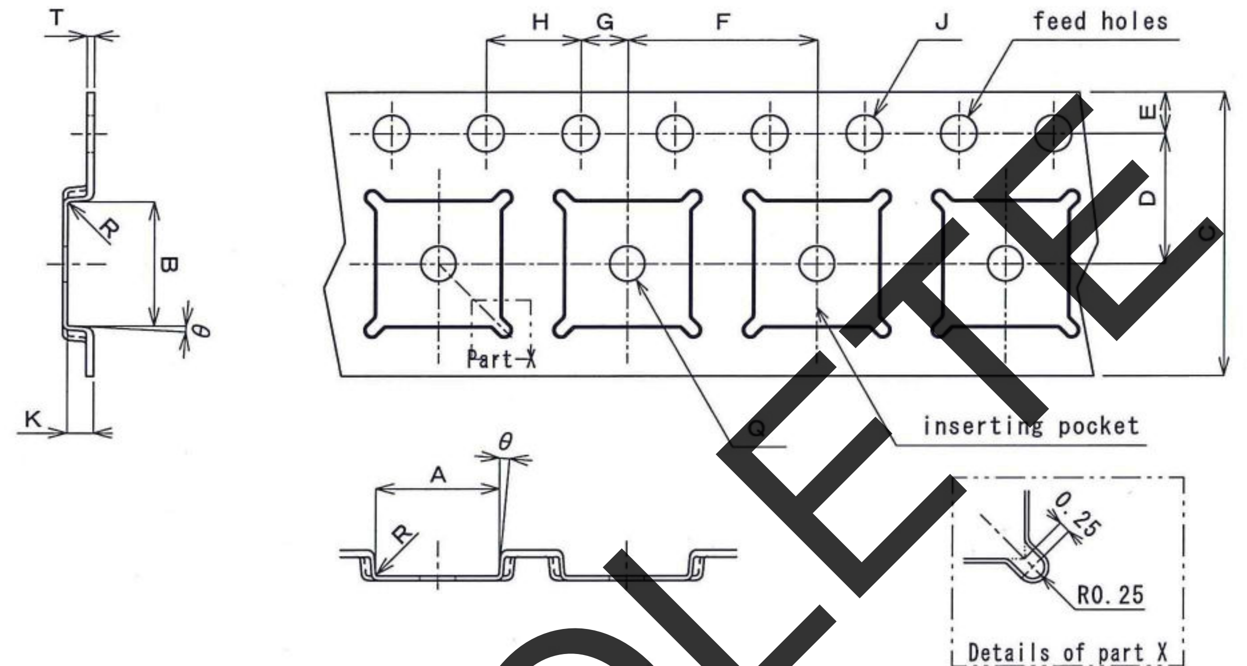
Top-Marking Specification

Figure 23 ▪ Package Marking Specifications for PE53211

● = Pin 1 indicator
YY = Last two digits of assembly year
WW = Assembly work week
ZZZZZZZ = Assembly lot code (maximum seven characters)

Tape and Reel Specification

Figure 24 • Tape and Reel Specification for PE53211



symbol	A	B	C	D	E	F	G
size	5.25±0.10	5.25±0.10	12.00 +0.30 −0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05

symbol	H	J	K	Q	T	R	θ
size	4.00±0.10	1.50 +0.10 0	1.10±0.10	1.50 +0.10 0	0.30±0.05	0.30max	5.00° max

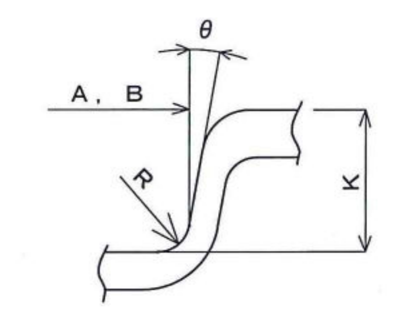
※accumulation 10pitch(10H) 40.0±0.20mm

※A, B, dimensions are in base dimensions (see the figure on the right)

◎K dimensions are measured with depth gauge.
T dimensions are measured with caliper
Other dimensions are measured with a projector.

◎Do not enter R, θ measurements in inspection date as reference values.

◎D, G dimensions shall be pocket center values.



inside of the pocket R detail drawing

Ordering Information

Table 7 lists the available ordering codes for the PE53211 as well as available shipping methods.

Table 7 • Order Codes for PE53211

Order Codes	Description	Packaging	Shipping Method
PE53211A–Z	PE53211 Switch and LNA	32-lead 5x5 mm LGA	3000 units/T&R
EK53211–01	PE53211 Evaluation kit	Evaluation kit	1/Box

Document Categories

Advance Information

The product is in a formative or design stage. The datasheet contains design target specifications for product development. Specifications and features may change in any manner without notice.

Preliminary Specification

The datasheet contains preliminary data. Additional data may be added at a later date. pSemi reserves the right to change specifications at any time without notice in order to supply the best possible product.

Product Specification

The datasheet contains final data. In the event pSemi decides to change the specifications, pSemi will notify customers of the intended changes by issuing a CNF (Customer Notification Form).

Sales Contact

For additional information, contact Sales at sales@psemi.com.

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