LX5551

2.4-2.5 GHz Front-End Module with Internally Matched Power Amplifier & SPDT for 11b/g/n

PRODUCTION DATA SHEET

DESCRIPTION

LX5551 is a high-performance WLAN front-end module (FEM) for 802.11b/g/n and other applications in the 2.4-2.5GHz frequency range. LX5551 integrates an advanced InGaP/GaAs Heterojunction Bipolar Transistor (HBT) power amplifier with both input/output impedance matching, and an InGaAs pseudomorphic HEMT (pHEMT) switch, into a single 3x3mm package.

The Tx path of LX5551 features a two-stage monolithic microwave integrated circuit (MMIC) power amplifier with active bias circuitry, and 50 Ω input/output matching inside the package. With 3.3V supply voltage and 90mA nominal bias current, the Tx path provides 27dB gain and +18dBm linear output power, with extremely low total EVM (<3%) for 64QAM/54Mbps OFDM. Both gain and power are readily measured at antenna port, with switch insertion loss included.

The Rx path of LX5551 includes a low-cost SPDT switch with excellent insertion loss and isolation. It features a very low Tx-to-Rx port leakage in receive mode.

LX5551 is available in a 16-pin, 3x3mm micro-lead package (MLPQ-16L). With its best-class performance and compact footprint, LX5551 offers an ideal front-end solution for the ever demanding design requirements of today's WLAN systems, including 802.11b/g and the latest 11n MIMO implementation.

IMPORTANT: For the most current data, consult *MICROSEMI*'s website: http://www.microsemi.com

KEY FEATURES

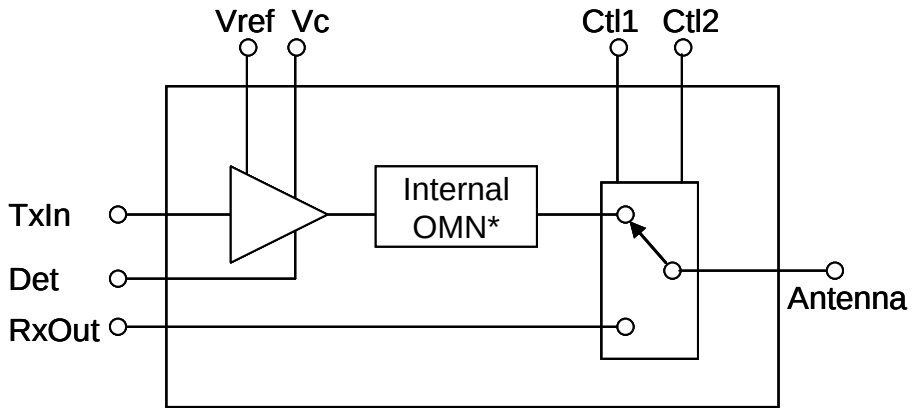
- 2.4-2.5GHz 11b/g/n Front-End Solution in a Single 3x3mm MLP Package
- All RF Ports Matched to 50 Ω
- Single-Polarity 3.3V Supply
- Tx Path Power Gain ~ 27dB
- Rx Path Loss ~ 0.6dB
- Pout ~ +18dBm at Antenna* for EVM = 3%
- Total Current ~140mA for +18dBm with 90% Duty Cycle
- Pout > +22dBm for 11b 1Mbps DSSS Mask Compliance
- Small Footprint: 3x3mm^2
- Low Profile: 0.9mm
- RoHS Compliant & Pb-Free

* Including SPDT switch loss

APPLICATIONS

- IEEE 802.11b/g
- IEEE 802.11n MIMO

BLOCK DIAGRAM



*OMN: Output Matching Network

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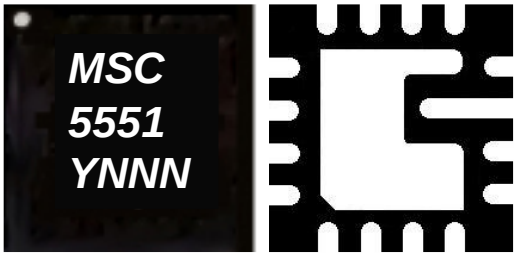
PRODUCTION DATA SHEET

PRODUCT HIGHLIGHT



(YNNN : Trace code)

PACKAGE ORDER INFO

LQ	Plastic MLPQ 16 pin 3x3mm RoHS Compliant /Pb-Free
LX5551LQ	

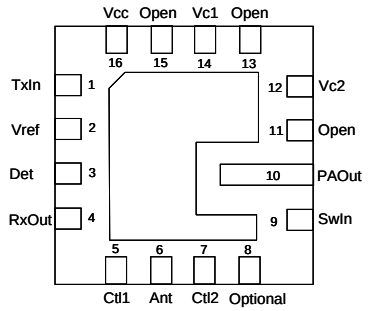
Note: Available in Tape & Reel.
Append the letters "TR" to the part number.
(i.e. LX5551LQ-TR)

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage, RF off (PA) 5V
(Switch) 5V
Collector Current (PA) 500mA
Total Power Dissipation 2W
RF Input Power 10dbm
Maximum Junction Temperature (Tj max) ..... +150°C
Operation Ambient Temperature ..... -40°C to +85°C
Storage Temperature ..... -65°C to +150°C
RoHs/Pb Free Peak Package Solder Reflow Temperature (40 seconds maximum exposure)..... 260°C(+0, -5)

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

PACKAGE PIN OUT



LQ PACKAGE
("See-Through" View from Top)

RoHS/Pb-free 100% Matte Tin Lead finish

THERMAL DATA

LQ Plastic MLPQ 16-Pin

THERMAL RESISTANCE-JUNCTION TO CASE, θ_{JC}	17°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	55.2°C/W

Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
The θ_{JA} numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

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FUNCTION PIN DESCRIPTION		
Name	**PIN#**	**Description**
TxIn	1	RF input into the power amplifier. This pin is RF-matched to 50 Ohm, and shorted to ground at DC.
Vref	2	Bias control voltage for the power amplifier.
Det	3	Detector output for monitoring output power from the power amplifier.
RxOut	4	Receiver port. This port is matched to 50 Ohm, and needs a DC-block capacitor.
Ant	6	Antenna port. This port is matched to 50 Ohm, and needs a DC-block capacitor.
Ctl1	5	SPDT switch DC control voltage 1. For Rx mode, set Ctl1=High and Ctl2=Low.
Ctl2	7	SPDT switch DC control voltage 2. For Tx mode, set Ctl2=High and Ctl1=Low.
Optional	8	This pin can be left OPEN or used for an optional harmonic trap with discrete L&C.
SwIn	9	SPDT input port for Tx. This port is matched to 50 Ohm and connected to Pin 10 with a DC block capacitor.
PAOut	10	Output of the power amplifier. This port is matched to 50 Ohm and connected to Pin 9 with a DC block capacitor.
Vc2	12	Supply voltage for second stage of the power amplifier.
Vc1	14	Supply voltage for first stage of the power amplifier.
Vcc	16	Supply voltage for the active bias control circuitry of the power amplifier.
Open	11,13,15	These pins must be left OPEN in PCB layout.
GND	Center Pad	The center metal base provides both DC/RF ground as well as heat dissipation for the device.

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ELECTRICAL CHARACTERISTICS

Unless otherwise specified, the following specifications apply over the following test conditions: Vc = 3.3V, Vref = 2.90V, Icq ~ 90mA, T_A = 25°C.

Tx Specifications (Ctl2=High, Ctl1=Low):

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Frequency Range	f		2.4	2.45	2.5	GHz
Output Power for 3% EVM	Pout	64QAM/54Mbps (2.4-2.5GHz)		+18		dBm
Total Current at Pout = +18dBm	Ic_total			140		mA
Output Power for 11b		1 Mbps DSSS Mask Compliant		+22		dBm
Total Current at Pout=+22dBm				210		mA
Small-Signal Gain	S21			27		dB
Input Return Loss	S11			-10		dB
Output Return Loss	S22			-10		dB
Quiescent Current	Icq			90		mA
Bias Control Current	Iref	For Icq=90mA		2.5		mA
Second Harmonic		Pout=22dBm		-40		dBc
Third Harmonic		Pout=22dBm		-50		dBc
Detector Response	Det	22dBm DSSS		1.35		V

Rx Specifications (Ctl1=High, Ctl2=Low, Vref=0V):

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Frequency Range	f		2.4	2.45	2.5	GHz
Insertion Loss	IL			0.6		dB
Equivalent Noise Figure	NF			0.6		dB
Input Return Loss	S11			-20		dB
Output Return Loss	S22			-20		dB

Note: All measured data was obtained on a 10 mil GETEK evaluation board without heat sink. Power and gain measurement includes the insertion loss of the SPDT switch.

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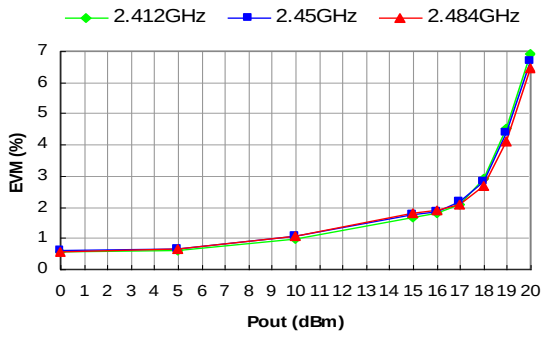
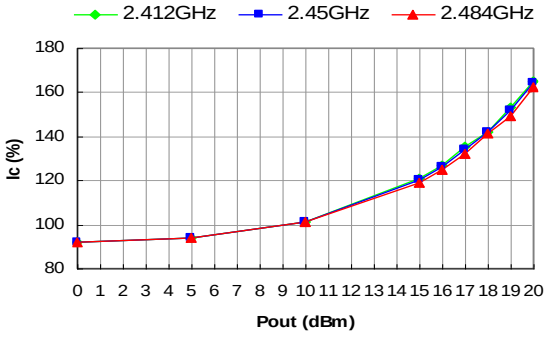
EVM VS. POUT



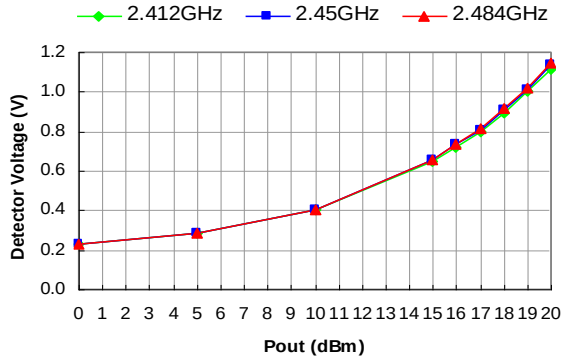
Typical EVM vs. Pout over 2.412-2.484GHz at Room Temperature
(Vc=3.3V, Vref=2.9V, Icq~90mA, 64QAM/54Mbps, 90% Duty Cycle)

TOTAL CURRENT VS. POUT



Typical Current vs. Pout over 2.412-2.484GHz at Room Temperature
(Vc=3.3V, Vref=2.9V,Icq~90mA, 64QAM/54Mbps, 90% Duty Cycle)

DETECTOR RESPONSE

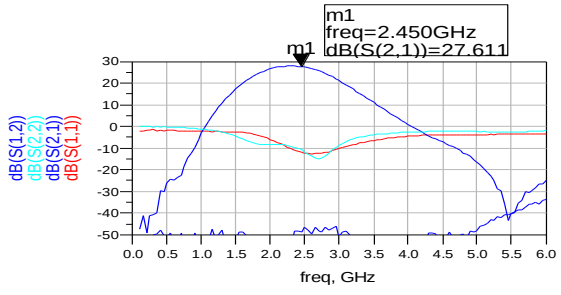


Typical Detector Output Voltage vs. Pout over 2.412-2.484GHz
(Vc=3.3V, Vref=2.9V, Icq~90mA, 64QAM/54Mbps, 90% Duty Cycle)

1MBPS DSSS SPECTRUM

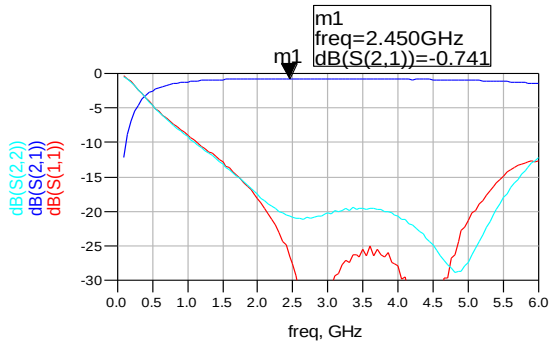
Typical 1Mbps DSSS Spectrum at 2.45GHz
(Vc=3.3V, Vref=2.9V,Icq~90mA, Pout=22dBm, Ictotal=210mA)

TX PATH S-PARAMETERS



Typical Small-Signal S-Parameters for Tx Path
(Vc=3.3V, Vref=2.9V, Icq~90mA, Ctl1=Low, Ctl2=High)

RX PATH S-PARAMETERS



Typical Small-Signal S-Parameters for Rx Path
(Ctl1=High, Ctl2=Low)

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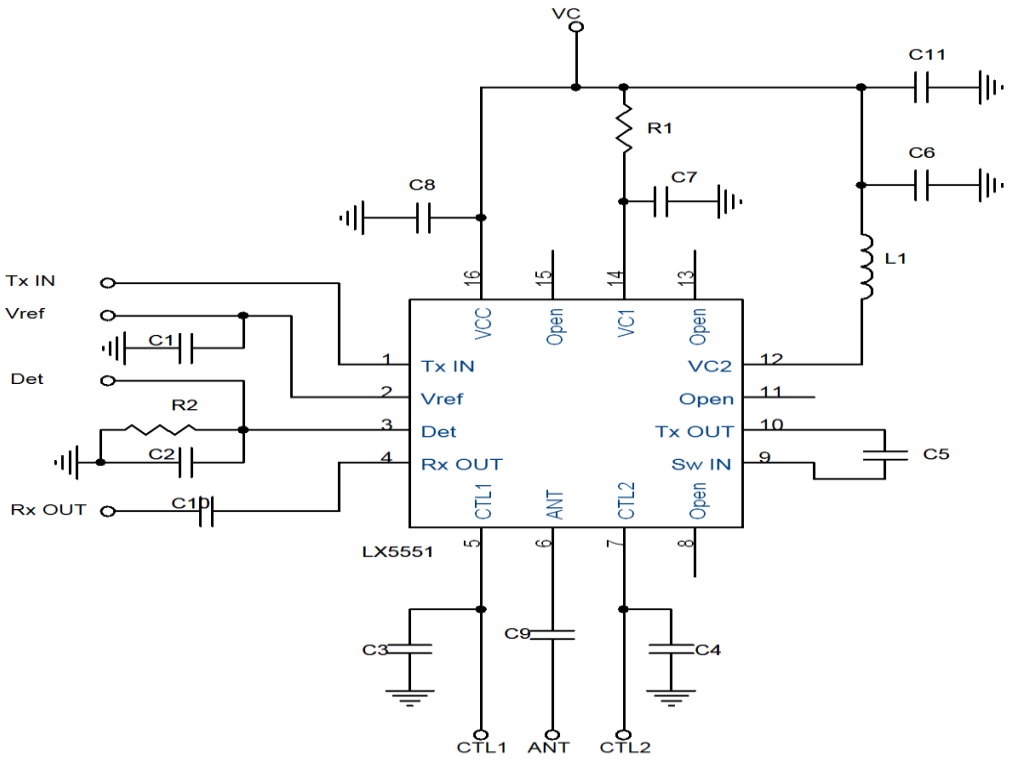
APPLICATION SCHEMATIC



EVAL BOARD BILL OF MATERIALS

MISCELLANEOUS COMPONENTS

Line Item	Part Description	Manufacturer & Part #	Case	Reference Designators	Qty
1	Microsemi Front-end Module	Microsemi LX5551	MLPQ	U1	1

CAPACITORS, INDUCTORS

Line Item	Part Description	Manufacturer & Part #	Case	Reference Designators	Qty
1	Capacitor, 10µF	Panasonic ECJ-2FF1A106Z or Equivalent	0805	C11	1
2	Capacitor, 1nF	muRata GRM033R71C102KD01B or Equivalent	0201	C1	1
3	Capacitor, 0.1uF	muRata GRM03360J104KE19B or Equivalent	0201	C8	1
4	Capacitor, 100pF	muRata GRM033R71C101KD01B or Equivalent	0201	C2, C3, C4	3
5	Capacitor, 220pF	muRata GRM033R71C221KD01B or Equivalent	0201	C6	1

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6	Capacitor, 2pF	muRata GRM0335C1E2R0CD01B or Equivalent	0201	C5	1
7	Inductor, 1nH	muRata LQP03TN1N0B04 or Equivalent	0201	L1	1
8	Capacitor 47pF	Panasonic ECJ-0EC1H470J or Equivalent	0201	C7	1

RESISTORS

Line Item	Part Description	Manufacturer & Part #	Case	Reference Designators	Qty
1	Resistor, 5.6Ω	Rohm RHM5.6AGCT-ND or Equivalent	0201	R1	1
2	Resistor, 49.9kΩ	Panasonic ERJ-2RKF4992X or Equivalent	0402	R2	1

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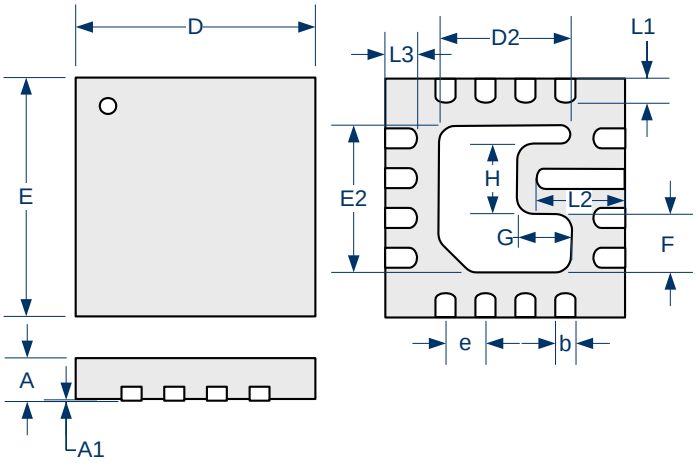
PACKAGE DIMENSIONS

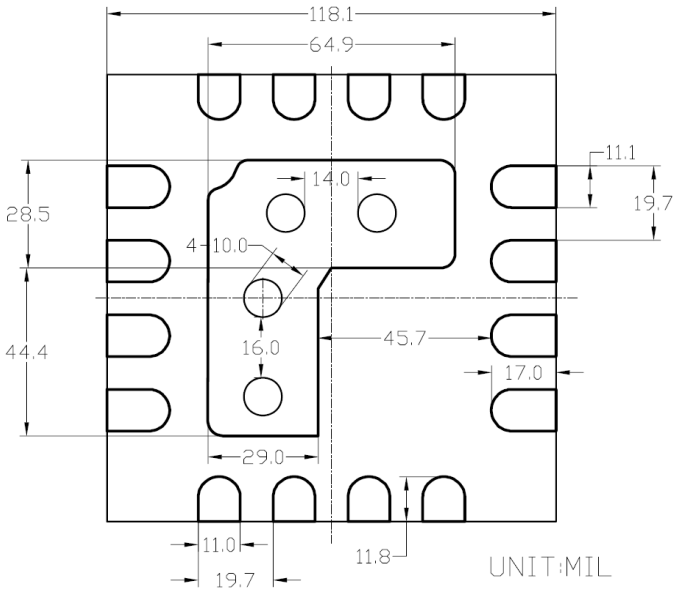
LQ — **16-Pin 3x3mm QFN – LX5551**



Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.80	1.00	0.031	0.039
A1	0.00	0.05	0	0.002
b	0.18	0.30	0.007	0.012
D	3.00 BSC		0.118 BSC	
E	3.00 BSC		0.118 BSC	
e	0.50 BSC		0.02 BSC	
D2	1.5	1.75	0.059	0.069
E2	1.7	1.95	0.067	0.077
F	0.58	0.83	0.023	0.033
G	0.61	0.86	0.024	0.034
H	0.80	1.05	0.031	0.041
L1	0.20	0.40	0.007	0.016
L2	1.00	1.20	0.039	0.047
L3	0.30	0.50	0.012	0.02

Note:

1. Dimensions do not include protrusions; these shall not exceed 0.155mm (.00
   Lead dimension shall not include solder coverage.



Recommended Land Pattern

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NOTES

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