LX5530

InGaP HBT 4.5 – 6.0GHz Power Amplifier

PRODUCTION DATA SHEET

DESCRIPTION

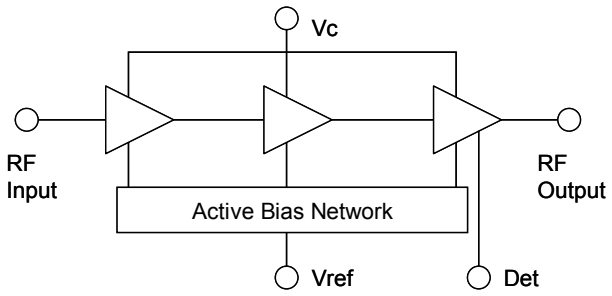
The LX5530 is a power amplifier optimized for the FCC Unlicensed National Information Infrastructure (U-NII) band, HyperLAN2 and Japan WLAN applications in the 4.9 – 5.9 GHz frequency range. The PA is implemented as a three-stage monolithic microwave integrated circuit (MMIC) with active bias, on-chip input matching and output pre-matching. The device is manufactured with an InGaP/GaAs Heterojunction Bipolar Transistor (HBT) IC process (MOCVD). It operates with a single positive voltage supply of 3 – 5V, with high power gain of up to 33dB. When operated at 5V supply voltage, it provides up to +25dBm linear output power for 802.11a OFDM spectrum mask compliance, and low EVM of 3% for up to +23dBm output power in the 4.9-5.9GHz band.

The LX5530 also features an on-chip power detector at the output port of the PA to help reduce BOM cost and PCB space for implementation of power control in a typical wireless system. The power detector is integrated with a temperature-compensated bias network and provides very stable response across a wide range of output power levels, over temperature extremes from -40 to +85°C.

The LX5530 is available in a 16-pin 3mmx3mm micro-lead package (MLP). The compact footprint, low profile, and excellent thermal capability makes the LX5530 an ideal solution for broadband, high-gain power amplifier requirements for IEEE 802.11a, and Hiperlan2 portable WLAN, as well as the emerging 802.16 WiMAX applications.

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

BLOCK DIAGRAM



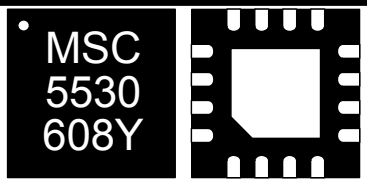
KEY FEATURES

- Broadband 4.9 – 5.9GHz Operation
- Advanced InGaP HBT
- Single-Polarity 3 – 5V Supply
- Power Gain up to ~ 33dB for V_C=5V, Icq = 250mA
- Power Gain > ~28dB across 4.9-5.85GHz
- OFDM Mask Compliance Power Pout ~ +25dBm over 4.9-5.85GHz (ACPR ~ -50dBc @ ±30MHz Offset)
- Pout up to +23dBm with EVM ~3% (V_C = 5V)
- EVM < ~2.5% for Pout=+21dBm across 4.9-5.85GHz (V_C = 5V)
- EVM < ~2.5% for Pout=+19dBm across 4.9-5.85GHz (V_C = 4V)
- Total Current ~250mA for Pout = +20dBm, Duty Cycle = 99% (V_C= 4V)
- Complete On-Chip Input Match
- Simple Output Match for Optimal Broadband EVM
- On-Chip RF Decoupling
- Temperature-Compensated On-Chip Output Power Detector with Wide Dynamic Range
- Small Footprint: 3x3mm
- Low Profile: 0.9mm

APPLICATIONS

- FCC U-NII Wireless
- IEEE 802.11a
- HiperLAN2
- 5GHz Cordless Phone
- IEEE 802.16 WiMAX

3X3MM MLP PACKAGE



PACKAGE ORDER INFO

LQ	**Plastic MLPQ** **16 pin** RoHS Compliant / Pb-free
LX5530LQ	

Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. LX5530LQ-TR)

Rev. 1.0a, 2006-09-12

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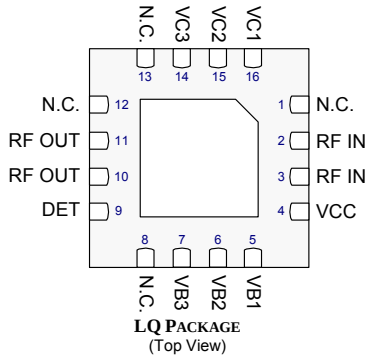
ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage, RF off.....7V
Collector Current 700mA
Total Power Dissipation.....4W
RF Input Power (With 50 Ohm Load at Output)..... +15dBm
Maximum Junction Temperature (TJ max)..... 150°C
Operation Ambient Temperature .....-40 to +85°C
Storage Temperature.....-65 to +150°C
Package Peak Temp. for Solder Reflow (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
(Top View)

RoHS / Pb-free 100% matte Tin Lead Finish

THERMAL DATA

LQ Plastic MLPQ 16-Pin

THERMAL RESISTANCE-JUNCTION TO CASE, θ_{JC}	2.2°C/W
THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	37.7°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.

FUNCTIONAL PIN DESCRIPTION

Name	Description
RF IN	RF input for the power amplifier. This pin is DC-shorted to GND, but RF-matched to 50 Ohm in the frequency range of operation.
VCC	Supply voltage for the bias reference and control circuits. This pin can be combined with VC1, VC2 and VC3 pins, resulting in a single supply voltage (referred to as V_C).
VB1 VB2 VB3	Bias control voltage for the first stage. Bias control voltage for the second stage. Bias control voltage for the third stage.
DET	Detector output for the third stage PA output power. Keep this pin OPEN if the on-chip power detection function is not used.
RF OUT	RF output for the power amplifier. This pin is DC-blocked from the collector of the output stage.
VC1 VC2 VC3	DC supply voltage for the first stage amplifier. DC supply voltage for the second stage amplifier. DC supply voltage for the third stage amplifier.
GND	The center metal base of the MLP package provides both DC/RF ground as well as heat sink for the power amplifier.
NC	These pins are unused and not connected to the device inside the package. They can be treated either as OPEN or SHORT in PCB layout.

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ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	LX5530									Units
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
For Nominal Bias of VC = 5.0V, ICQ = 250mA, @ Room Temperature												
Frequency Range	f		4.90	4.95	5.15	5.15	5.25	5.35	5.70	5.85	5.90	GHz
Gain	S21			33			33			28		dB
EVM @ P_{OUT} = +21dBm	EVM	64QAM / 54Mbps		2.5			2.0			2.0		%
EVM @ P_{OUT} = 22dBm	EVM	64QAM / 54Mbps		3.5			2.5			3.0		%
Total Current @ P_{OUT} = 22dBm	I_C	99% Duty Cycle		370			360			350		mA
Quiescent Current	I_{CQ}			250			250			250		mA
Bias Control Reference Current	I_{REF}	For I_{CQ} = 250mA		13.5			13.5			13.5		mA
Input Return Loss	S11			-10			-15			-10		dB
Output Return Loss	S22			-10			-10			-10		dB
Reverse Isolation	S12			-50			-50			-40		dB
Gain Flatness	ΔS21	Over 200MHz		±0.5			±0.5			±1.0		dB
Second Harmonic		P_{OUT} = +24dBm		-40			-35			-45		dBc
Third Harmonic		P_{OUT} = +24dBm		-40			-40			-45		dBc
Ramp-On Time	t_{ON}	10 ~ 90%		100			100			100		ns
For Nominal Bias of VC = 4.0V, ICQ = 150mA, @ Room Temperature												
Frequency Range	f		4.90	4.95	5.15	5.15	5.25	5.35	5.70	5.85	5.90	GHz
Gain	S21			31			31			27		dB
EVM @ P_{OUT} = +19dBm	EVM	64QAM / 54Mbps		2.5			2.0			2.0		%
EVM @ P_{OUT} = +20dBm	EVM	64QAM / 54Mbps		3.5			2.5			3.0		%
Total Current @ P_{OUT} = +20dBm	I_C	99% Duty Cycle		250			240			250		mA
Quiescent Current	I_{CQ}			150			150			150		mA
Bias Control Reference Current	I_{REF}	For I_{CQ} = 150mA		7.8			7.8			7.8		mA
Input Return Loss	S11			-10			-15			-10		dB
Output Return Loss	S22			-10			-10			-10		dB
Reverse Isolation	S12			-50			-50			-40		dB
Gain Flatness	ΔS21	Over 200MHz		±0.5			±0.5			±1.0		dB
Second Harmonic		P_{OUT} = +24dBm		-40			-40			-40		dBc
Third Harmonic		P_{OUT} = +24dBm		-40			-40			-40		dBc
Ramp-On Time	t_{ON}	10 ~ 90%		100			100			100		ns

Note: All measured data was obtained on a 10mil thick GETEK evaluation board without heat sink.

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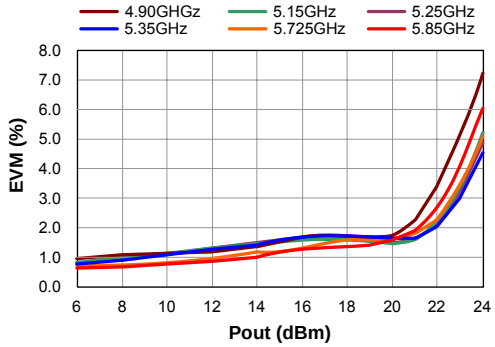
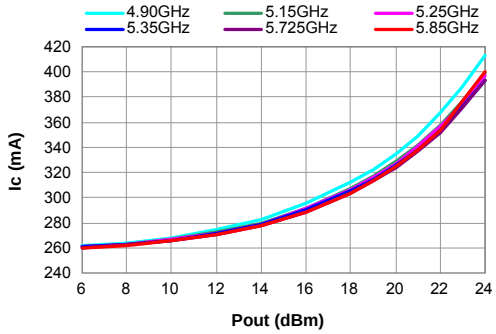
BROADBAND EVM VS. POUT (VC = 5V)



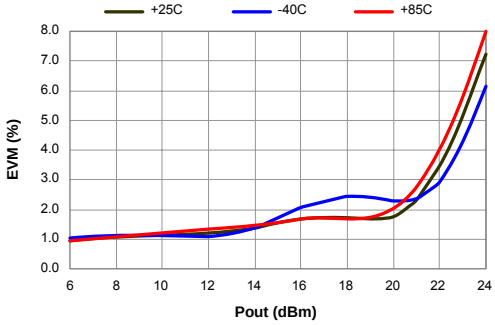
Typical EVM vs. Pout over 4.90-5.85GHz at Room Temperature
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps, 99% Duty Cycle)

TOTAL CURRENT VS. POUT (VC = 5V)



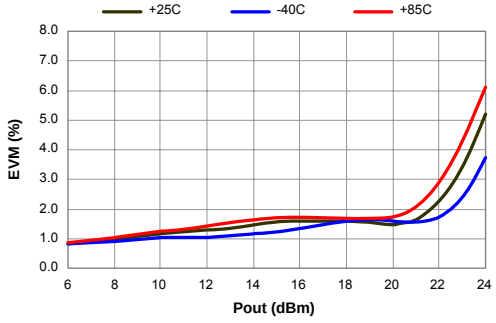
Typical Current vs. Pout over 4.90-5.85GHz at Room Temperature
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps, 99% Duty Cycle)

EVM OVER TEMPERATURE, 4.90GHZ



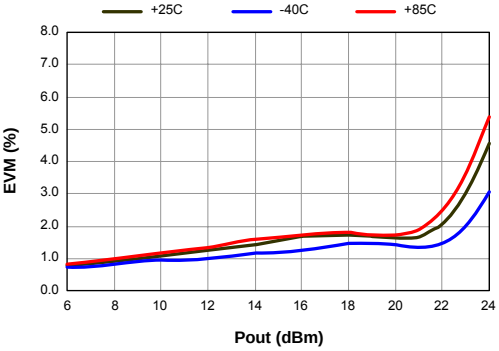
Typical EVM vs. Pout over Temperature at 4.90GHz
(Vc=5.0V, Icq=250mA at Room Temperature, 64QAM / 54Mbps)

EVM OVER TEMPERATURE, 5.15GHZ



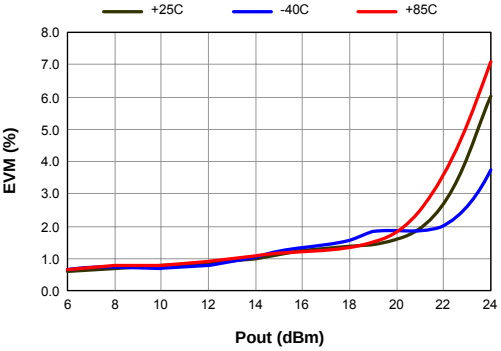
Typical EVM vs. Pout over Temperature at 5.15GHz
(Vc=5.0V, Icq=250mA at Room Temperature, 64QAM / 54Mbps)

EVM OVER TEMPERATURE, 5.35GHZ



Typical EVM vs Pout over Temperature at 5.35GHz
(Vc=5.0V, Icq=250mA at Room Temperature, 64QAM / 54Mbps)

EVM OVER TEMPERATURE, 5.85GHZ



Typical EVM vs Pout over Temperature at 5.85Hz
(Vc=5.0V, Icq=250mA at Room Temperature, 64QAM / 54Mbps)

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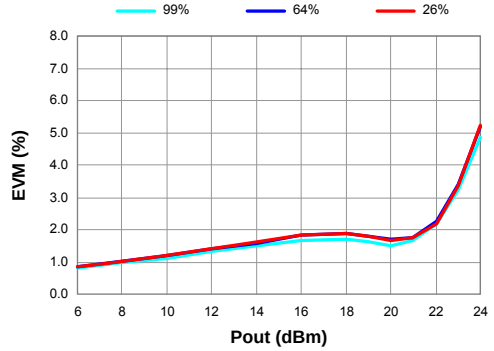
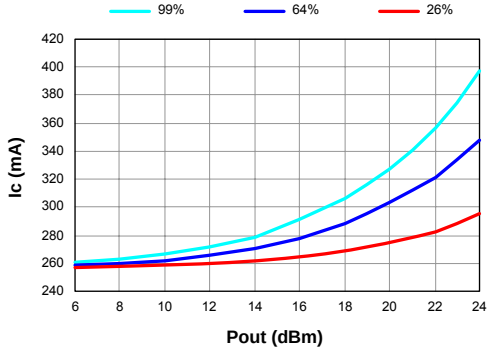
EVM VS. OFDM PACKET DUTY CYCLE



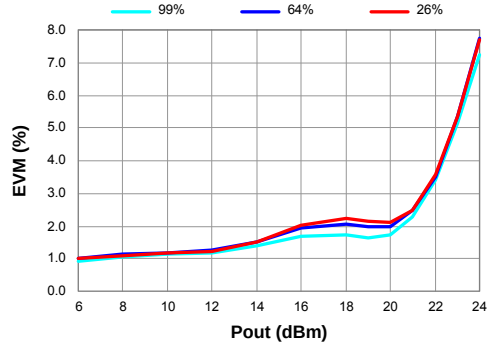
Typical EVM vs Pout over OFDM Packet Duty Cycle at 5.25GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

TOTAL CURRENT VS. DUTY CYCLE



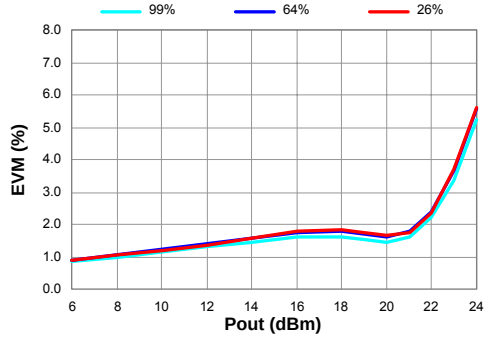
Typical Total Current vs Pout over Packet Duty Cycle at 5.25GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

EVM VS. DUTY CYCLE, 4.90GHZ



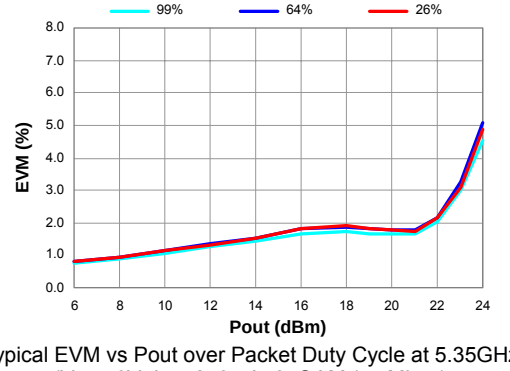
Typical EVM vs Pout over Packet Duty Cycle at 4.90GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

EVM VS. DUTY CYCLE, 5.15GHZ



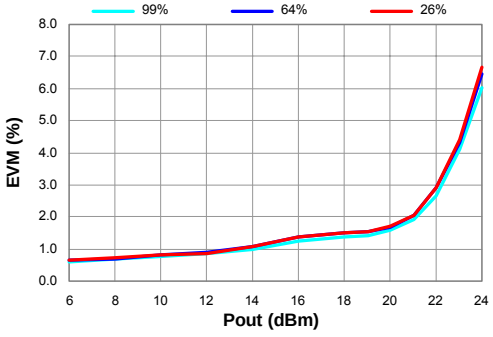
Typical EVM vs Pout over Packet Duty Cycle at 5.15GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

EVM VS. DUTY CYCLE, 5.35GHZ



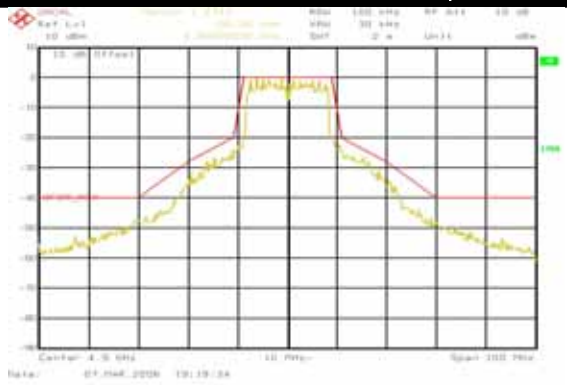
Typical EVM vs Pout over Packet Duty Cycle at 5.35GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

EVM VS. DUTY CYCLE, 5.85GHZ



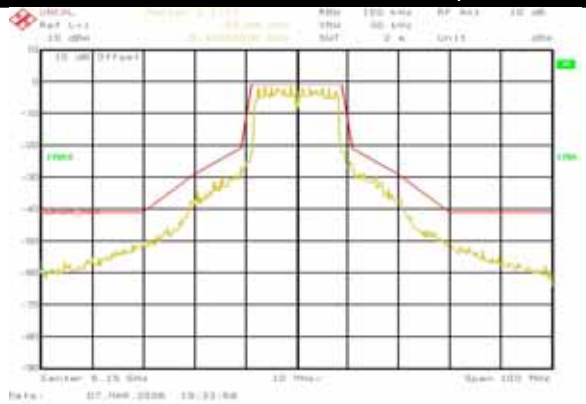
Typical EVM vs Pout over Packet Duty Cycle at 5.85GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +25DBM, 4.90GHZ



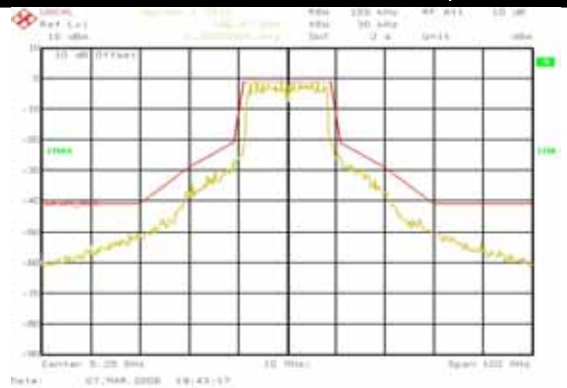
Typical OFDM Output Spectrum at Pout=+25dBm, 4.90GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +25DBM, 5.15GHZ



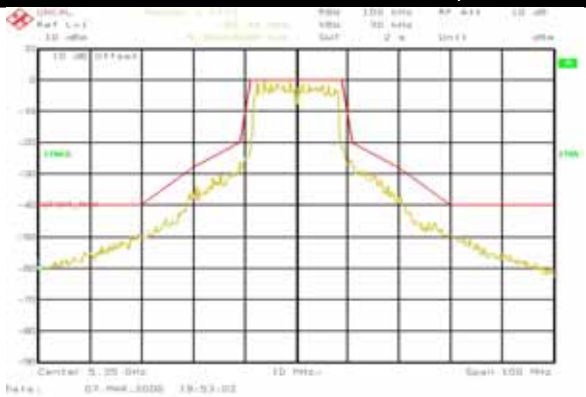
Typical OFDM Output Spectrum at Pout=+25dBm, 5.15GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +25DBM, 5.25GHZ



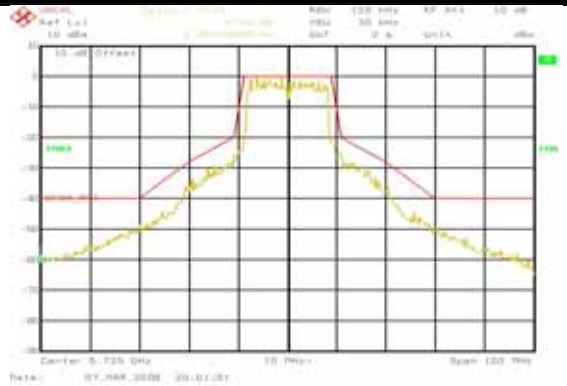
Typical OFDM Output Spectrum at Pout=+25dBm, 5.25GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +25DBM, 5.35GHZ



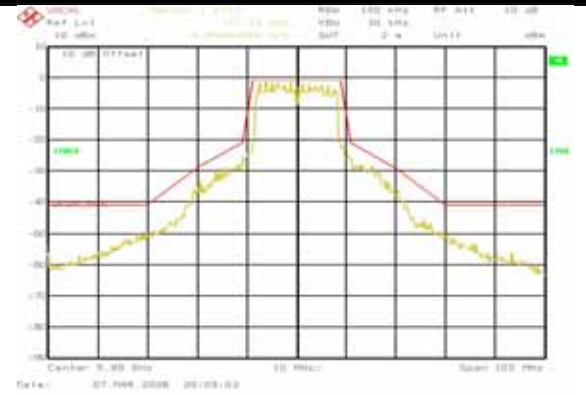
Typical OFDM Output Spectrum at Pout=+25dBm, 5.35GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +25DBM, 5.725GHZ



Typical OFDM Output Spectrum at Pout=+25dBm, 5.725GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +25DBM, 5.85GHZ



Typical OFDM Output Spectrum at Pout=+25dBm, 5.85GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

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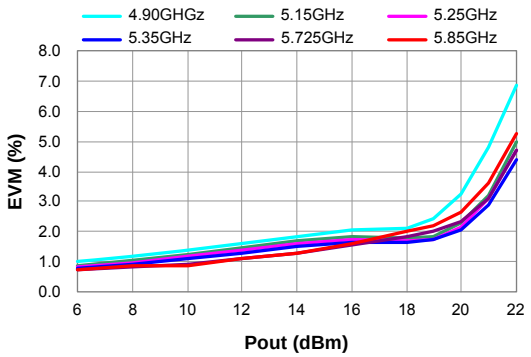
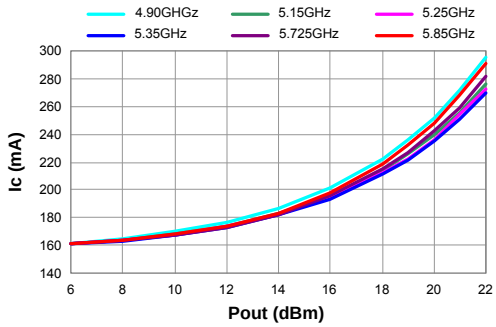
BROADBAND EVM VS. POUT (VC=4V)



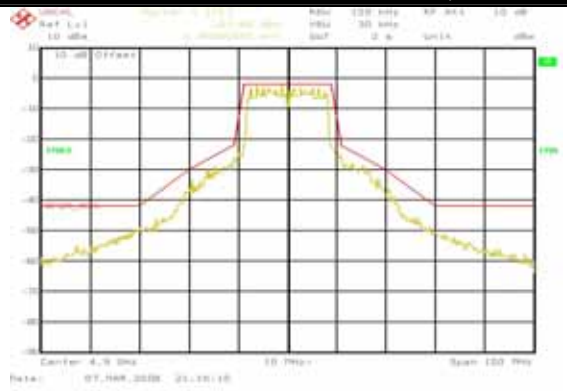
Typical EVM vs. Pout over 4.90-5.85GHz at Room Temperature
(Vc=4.0V, Icq=150mA, 64QAM / 54Mbps, 99% Duty Cycle)

TOTAL CURRENT VS. POUT (VC=4V)



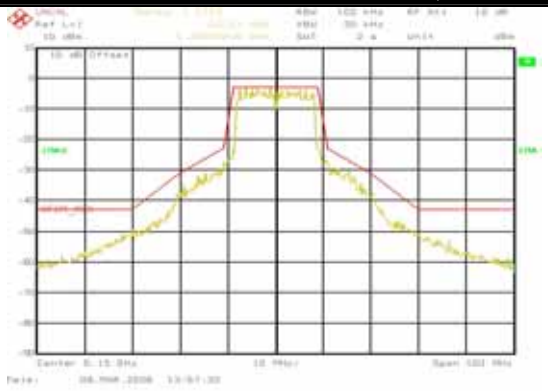
Typical Current vs. Pout over 4.90-5.85GHz at Room Temperature
(Vc=4.0V, Icq=150mA, 64QAM / 54Mbps, 99% Duty Cycle)

OFDM SPECTRUM AT +23DBM, 4.90GHZ



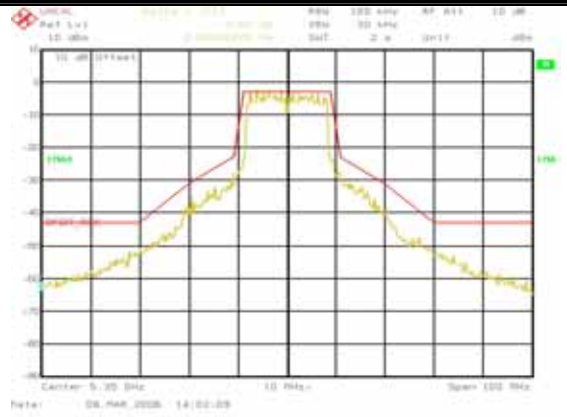
Typical OFDM Output Spectrum at Pout=+23dBm, 4.90GHz
(Vc=4.0V, Icq=150mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +23DBM, 5.15GHZ



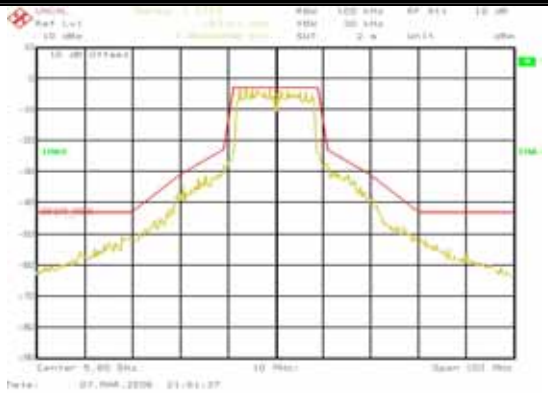
Typical OFDM Output Spectrum at Pout=+23dBm, 5.15GHz
(Vc=4.0V, Icq=150mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +23DBM, 5.35GHZ



Typical OFDM Output Spectrum at Pout=+23dBm, 5.35GHz
(Vc=4.0V, Icq=150mA, 64QAM / 54Mbps)

OFDM SPECTRUM AT +23DBM, 5.85GHZ



Typical OFDM Output Spectrum at Pout=+23dBm, 5.85GHz
(Vc=4.0V, Icq=150mA, 64QAM / 54Mbps)

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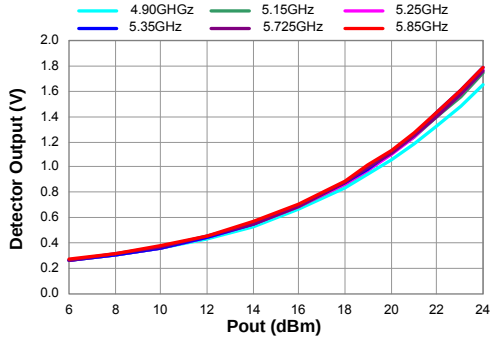
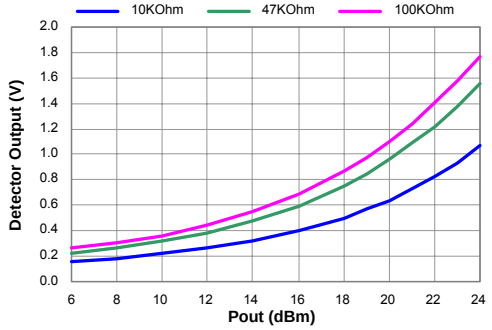
POWER DETECTOR OUTPUT (4.90-5.85GHZ)



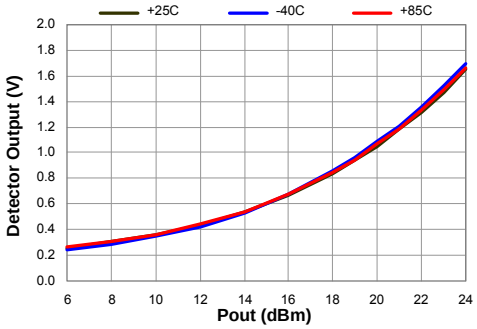
Typical Output Power Detector Response over 4.90-5.85GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

DETECTOR OUTPUT VS. LOAD IMPEDANCE



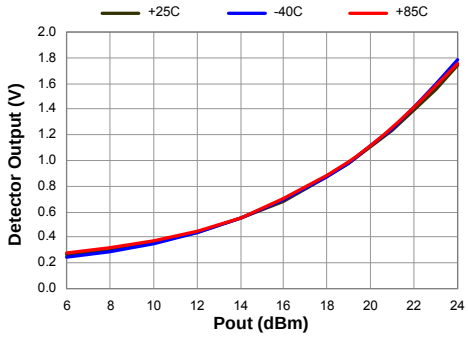
Power Detector Output Voltage for Different Load Impedances
(Vc=5.0V, Icq=250mA, 64QAM // 54Mbps)

DET OUTPUT VS. TEMPERATURE, 4.90GHZ



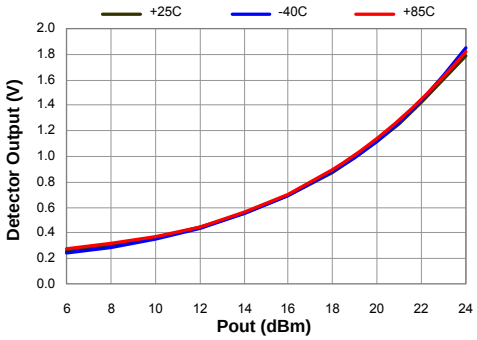
Power Detector Response over Temperature at 4.90GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

DET OUTPUT VS. TEMPERATURE, 5.15GHZ



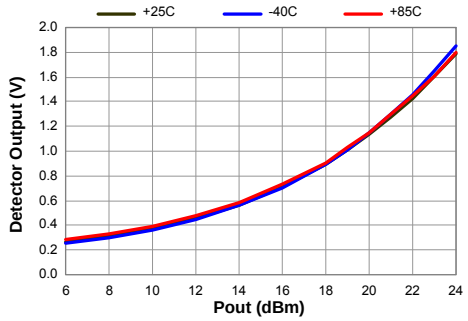
Power Detector Response over Temperature at 5.15GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

DET OUTPUT VS. TEMPERATURE, 5.35GHZ



Power Detector Response over Temperature at 5.35GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

DET OUTPUT VS. TEMPERATURE, 5.85GHZ



Power Detector Response over Temperature at 5.85GHz
(Vc=5.0V, Icq=250mA, 64QAM / 54Mbps)

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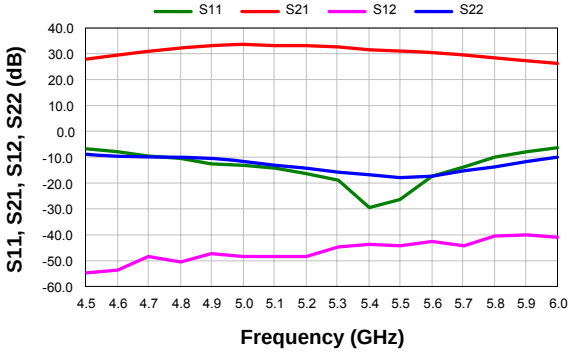
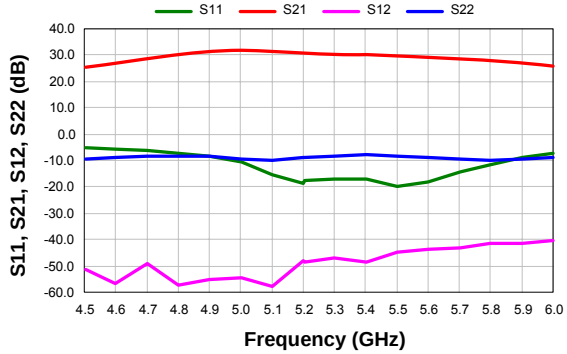
S-PARAMETERS (VC=5V,ICQ=250MA)



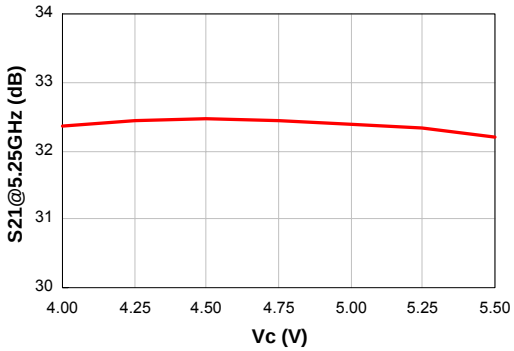
Typical Small-Signal S-Parameters over 4.5-6.0GHz
(Vc=5.0V, Icq=250mA, Room Temperature)

S-PARAMETERS (VC=4V,ICQ=150MA)



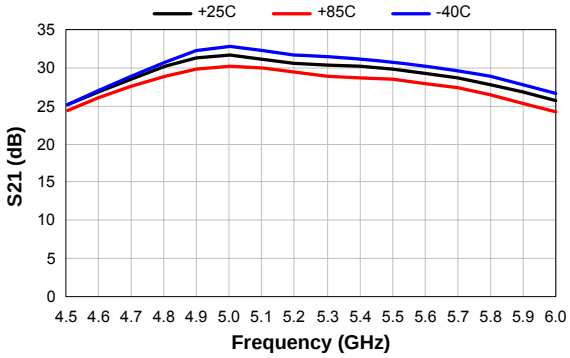
Typical Small-Signal S-Parameters over 4.5-6.0GHz
(Vc=4.0V, Icq=150mA, Room Temperature)

SMALL-SIGNAL GAIN VS. SUPPLY VC



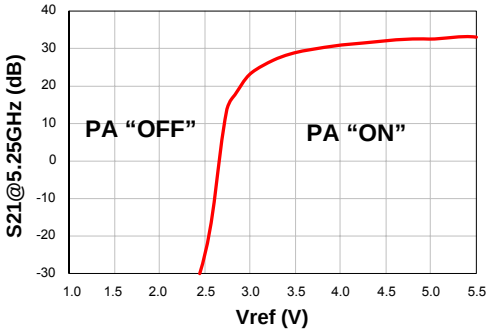
Typical Small-Signal Gain vs. Supply Voltage Vc
(Nominal Bias: Vc=5.0V, Icq=250mA)

SMALL-SIGNAL GAIN VS. TEMPERATURE



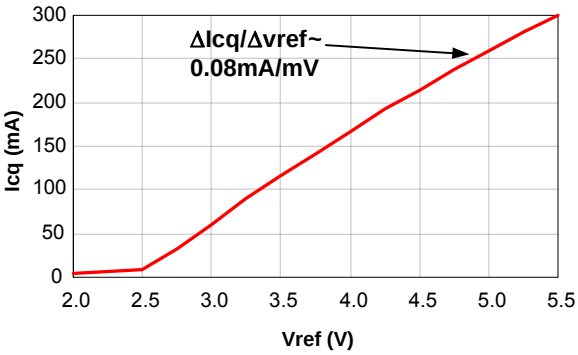
Typical Small-Signal Gain vs. Temperature
(Nominal Bias: Vc=4.0V, Icq=150mA at Room Temperature)

SMALL-SIGNAL GAIN VS. BIAS VREF



Typical Small-Signal Gain vs. Bias Control Voltage Vref
(Nominal Bias: Vc=Vref=5.0V, Icq=250mA)

QUIESCENT CURRENT VS. BIAS VREF



Typical Quiescent Current Icq vs. Bias Control Voltage Vref
(Nominal Bias: Vc=Vref=5.0V, Icq=250mA)

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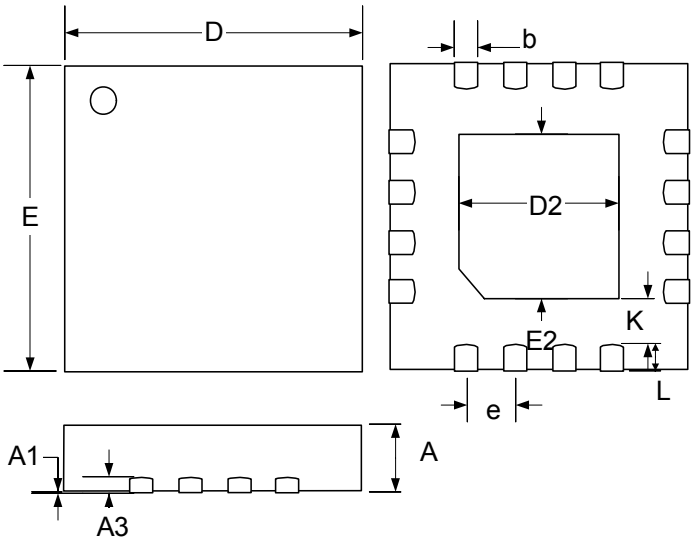
PACKAGE DIMENSIONS

LQ 16-Pin MLPQ 3x3 (75 x 75 mil DAP)



Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.80	1.00	0.031	0.039
A1	0	0.05	0	0.002
A3	0.20 REF		0.008 REF	
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		0.020 BSC	
D2	1.55	1.80	0.061	0.071
E2	1.55	1.80	0.061	0.071
K	0.2	-	0.008	-
L	0.35	0.50	0.012	0.020

Note:

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

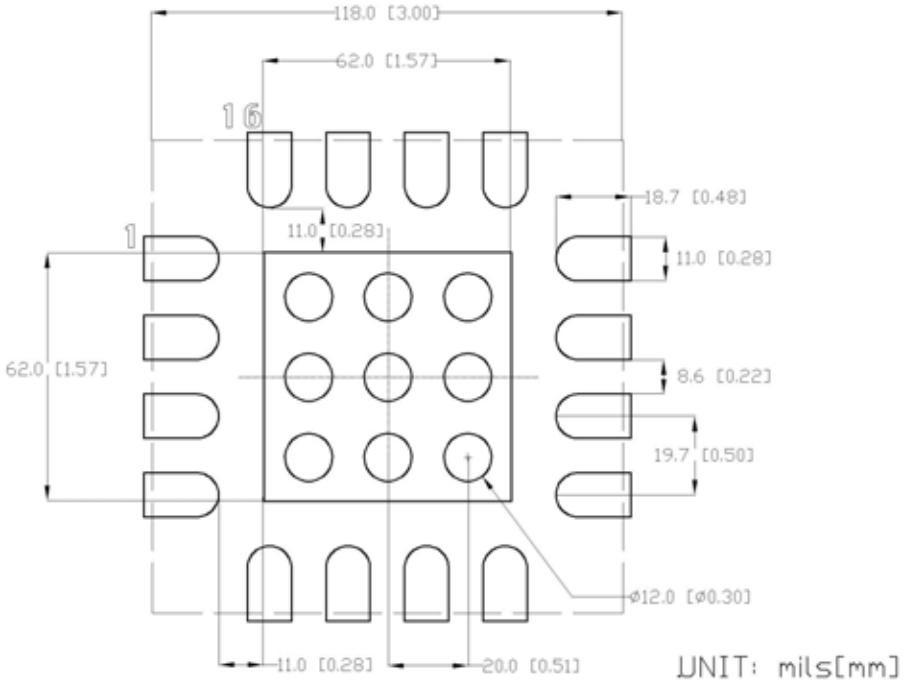


Figure – Recommended Land Pattern

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NOTES