NXP Semiconductors
Technical Data

Document Number: MMZ25332B
Rev. 3, 11/2017

Heterojunction Bipolar Transistor Technology (InGaP HBT)

High Efficiency/Linearity Amplifier

MMZ25332BT1

1500–2800 MHz, 26.5 dB, 33 dBm InGaP HBT LINEAR AMPLIFIER



QFN 3 × 3-12L

The MMZ25332B is a 2-stage, high linearity InGaP HBT broadband amplifier designed for femtocell, picocell, WLAN (802.11g/n), W-CDMA, TD-SCDMA and LTE wireless broadband applications. It provides exceptional linearity for LTE and W-CDMA air interfaces with an ACPR of –50 dBc at an output power of up to 22 dBm, covering frequencies from 1500 to 2800 MHz. It operates from a supply voltage of 3 to 5 V. The amplifier is fully input matched, requires minimal external matching on the output and is housed in a cost-effective, surface mount QFN 3 × 3 package. The device offers state-of-the-art reliability, ruggedness, temperature stability and ESD performance.

- Typical Performance: V_{CC1} = V_{CC2} = V_{BIAS} = 5 Vdc, I_{CQ} = 400 mA

Frequency	P_{out} (dBm)	G_{ps} (dB)	ACPR (dBc)	PAE (%)	Test Signal
2140 MHz	22	27.0	–50.0	7.0	W-CDMA
2620 MHz	21	26.0	–50.0	5.0	LTE 20 MHz

Features

- Frequency: 1500–2800 MHz
- P1dB: 33 dBm @ 2500 MHz
- Power gain: 26.5 dB @ 2500 MHz
- OIP3: 48 dBm @ 2500 MHz
- EVM ≤ 3% @ 23.5 dBm P_{out}, WLAN (802.11g)
- Active bias control (adjustable externally)
- Power down control via V_{BIAS} pin
- Class 3A HBM ESD rating
- Single 3 to 5 V supply
- Single-ended power detector
- Cost-effective 12-pin, 3 mm QFN surface mount plastic package

Table 1. Typical CW Performance (1)

Characteristic	Symbol	1800 MHz	2500 MHz	2800 MHz	Unit
Small-Signal Gain (S21)	G_p	27.6	26.5	25.0	dB
Input Return Loss (S11)	IRL	–26	–17	–16	dB
Output Return Loss (S22)	ORL	–9	–17	–16	dB
Power Output @1dB Compression	P1dB	32	33	32	dBm

1. V_{CC1} = V_{CC2} = V_{BIAS} = 5 Vdc, T_A = 25°C, 50 ohm system, CW Application Circuit

Table 2. Maximum Ratings

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	6	V
Supply Current	I_{CC}	1200	mA
RF Input Power	P_{in}	30	dBm
Storage Temperature Range	T_{stg}	–65 to +150	°C
Junction Temperature	T_J	175	°C

Table 3. Thermal Characteristics

Characteristic	Symbol	Value (2)	Unit
Thermal Resistance, Junction to Case Case Temperature 92°C, V_{CC1} = V_{CC2} = V_{BIAS} = 5 Vdc	$R_{\theta JC}$	16	°C/W

2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.nxp.com/RF and search for AN1955.

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Table 4. Electrical Characteristics[1] (V_{CC1} = V_{CC2} = V_{BIAS} = 5 Vdc, 2500 MHz, T_A = 25°C, 50 ohm system, in NXP CW Application Circuit)

Characteristic	Symbol	Min	Typ	Max	Unit
Small-Signal Gain (S21)	G_p	25	26.5	—	dB
Input Return Loss (S11)	IRL	—	–17	—	dB
Output Return Loss (S22)	ORL	—	–17	—	dB
Power Output @ 1dB Compression	P1dB	—	33	—	dBm
Third Order Output Intercept Point, Two-Tone CW	OIP3	—	48	—	dBm
Noise Figure	NF	—	5.8	—	dB
Supply Current	I_{CQ}	356	390	412	mA
Supply Voltage	V_{CC}	—	5	—	V

Table 5. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	3A
Machine Model (per EIA/JESD22-A115)	B
Charge Device Model (per JESD22-C101)	IV

Table 6. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD22-A113, IPC/JEDEC J-STD-020	1	260	°C

Table 7. Ordering Information

Device	Tape and Reel Information	Package
MMZ25332BT1	T1 Suffix = 1,000 Units, 12 mm Tape Width, 7-inch Reel	QFN 3 × 3-12L

1. See Appendix A for test fixture documentation.

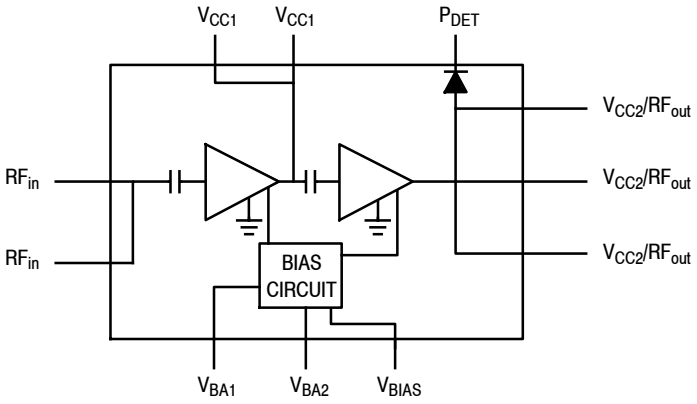


Figure 1. Functional Block Diagram

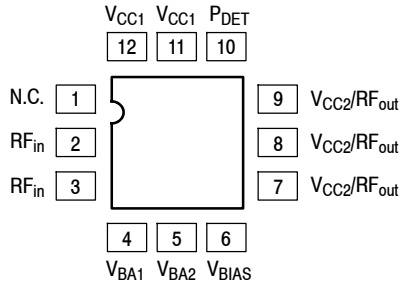
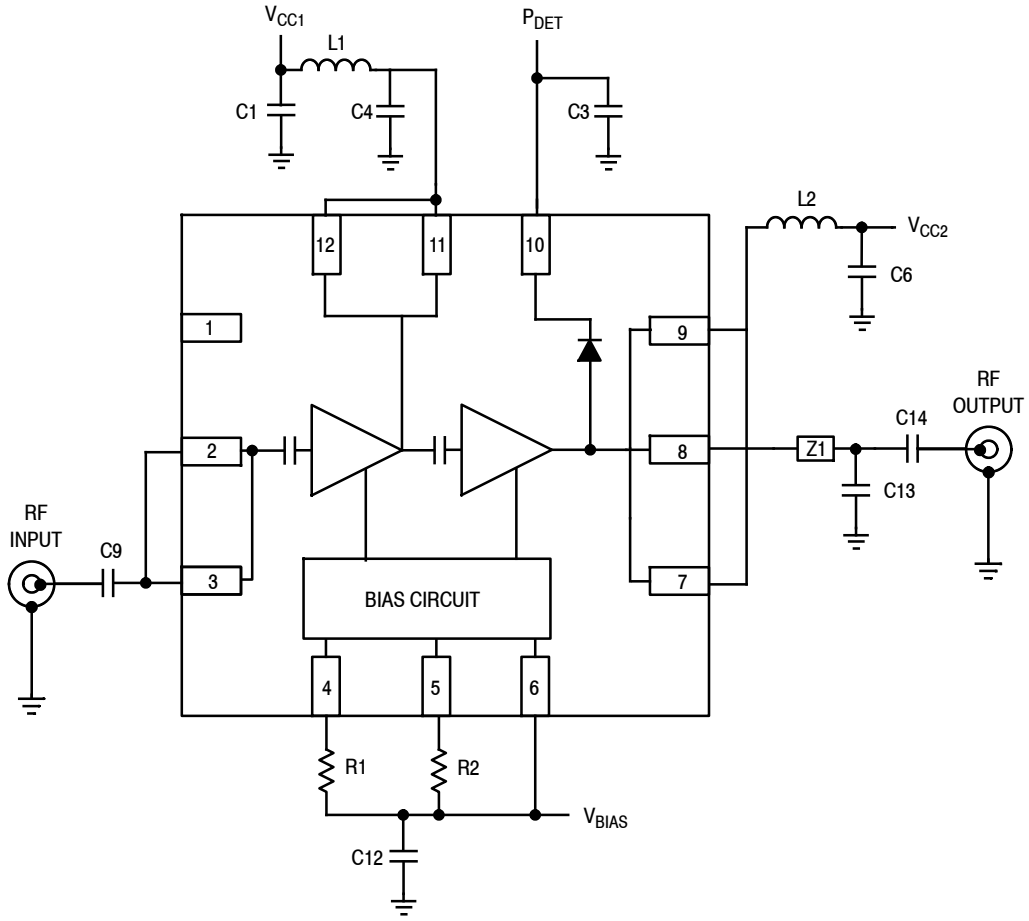


Figure 2. Pin Connections

50 OHM APPLICATION CIRCUIT: 2110–2170 MHz, 5 VOLT OPERATION



Z1 0.151″ × 0.030″ Microstrip

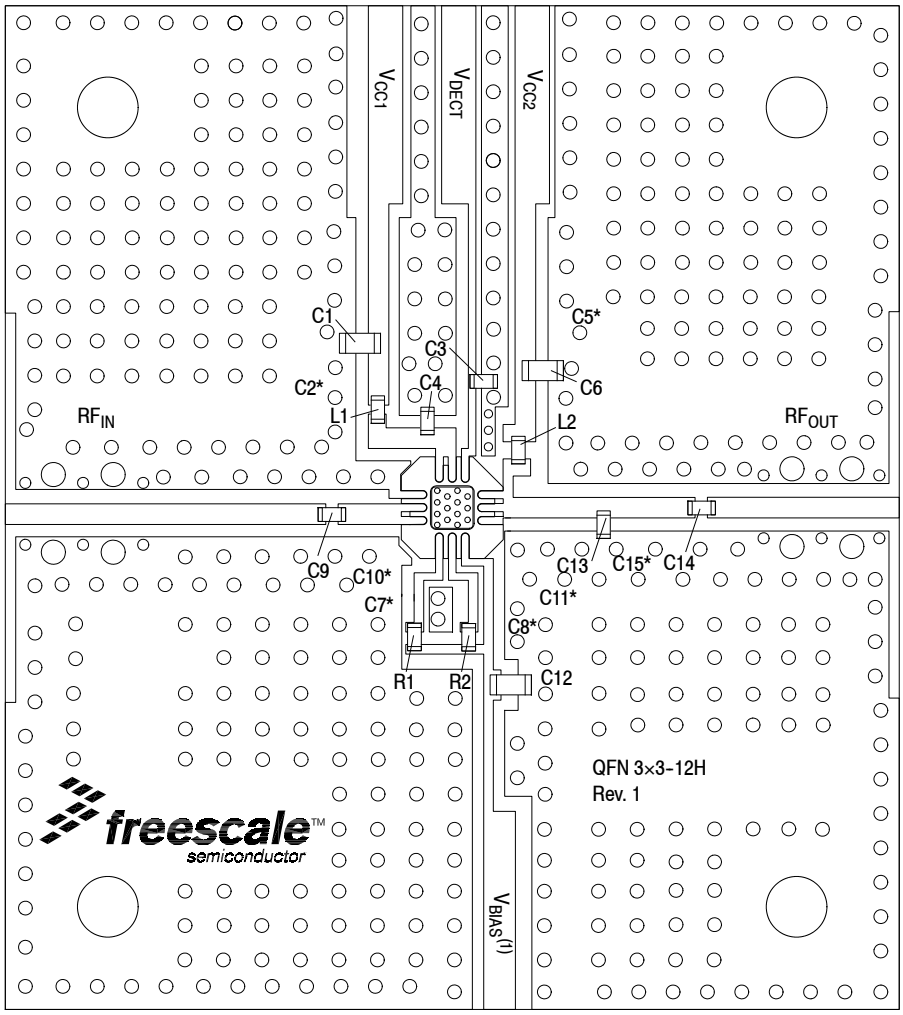
Figure 3. MMZ25332BT1 Test Circuit Schematic

Table 8. MMZ25332BT1 Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C12	1 μF Chip Capacitors	GRM155R61A105KE15	Murata
C2, C5, C7, C8, C10, C11, C15	Components Not Placed		
C3	470 pF Chip Capacitor	GRM1555C1H471JA01	Murata
C4	8.2 pF Chip Capacitor	04023J8R2BBS	AVX
C6	4.7 μF Chip Capacitor	GRM188R60J475KE19D	Murata
C9, C14	22 pF Chip Capacitors	04023J22R0BBS	AVX
C13	3.3 pF Chip Capacitor	04023J3R3BBS	AVX
L1	12 nH Chip Inductor	0603HC-12NXJLW	Coilcraft
L2	6.8 nH Chip Inductor	0603HC-6N8XJLW	Coilcraft
R1	1.2 kΩ, 1/16 W Chip Resistor	RC0402JR-071K2L	Yageo
R2	330 Ω, 1/16 W Chip Resistor	RC0402JR-07330L	Yageo
PCB	0.014″, ε_r = 3.7	FR408	Isola

Note: Component numbers C2, C5, C7, C8, C10, C11 and C15 are labeled on board but not placed.

50 OHM APPLICATION CIRCUIT: 2110–2170 MHz, 5 VOLT OPERATION



PCB actual size: 1.3″ × 1.46″.

(1) V_{BIAS} [Board] supplies V_{BA1}, V_{BA2} and V_{BIAS} [Device].

Note: Component numbers C2*, C5*, C7*, C8*, C10*, C11* and C15* are labeled on board but not placed.

Figure 4. MMZ25332BT1 Test Circuit Component Layout

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C6	4.7 μF Chip Capacitor	GRM188R60J475KE19D	Murata
C9, C14	22 pF Chip Capacitors	04023J22R0BBS	AVX
C13	3.3 pF Chip Capacitor	04023J3R3BBS	AVX
L1	12 nH Chip Inductor	0603HC-12NXJLW	Coilcraft
L2	6.8 nH Chip Inductor	0603HC-6N8XJLW	Coilcraft
R1	1.2 kΩ, 1/16 W Chip Resistor	RC0402JR-071K2L	Yageo
R2	330 Ω, 1/16 W Chip Resistor	RC0402JR-07330L	Yageo
PCB	0.014″, ε_r = 3.7	FR408	Isola

(Test Circuit Component Designations and Values table repeated for reference.)

50 OHM TYPICAL CHARACTERISTICS — 2110–2170 MHz, 5 VOLT OPERATION

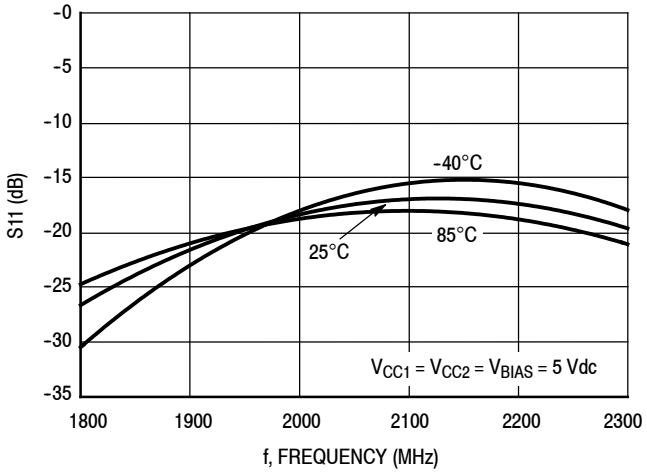


Figure 5. S11 versus Frequency versus Temperature

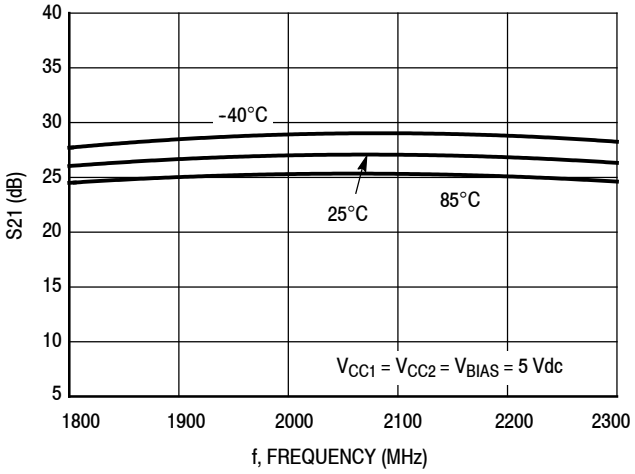


Figure 6. S21 versus Frequency versus Temperature

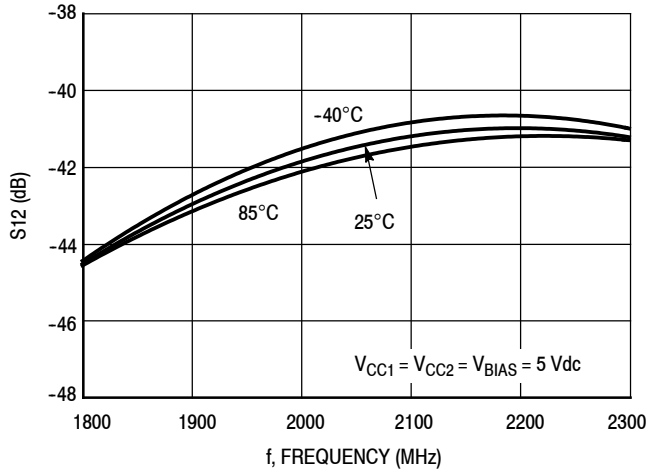


Figure 7. S12 versus Frequency versus Temperature

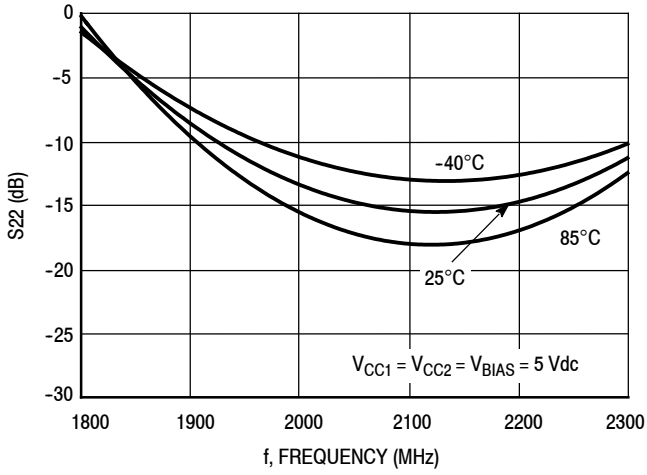


Figure 8. S22 versus Frequency versus Temperature

50 OHM TYPICAL CHARACTERISTICS — 2110–2170 MHz, 5 VOLT OPERATION

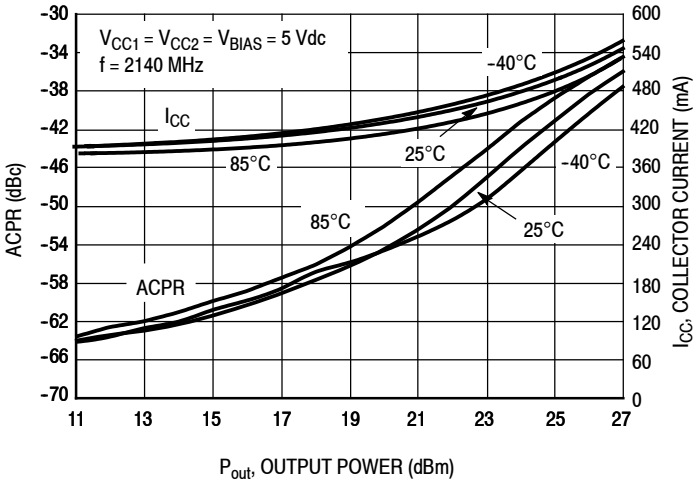


Figure 9. ACPR and Collector Current versus Output Power versus Temperature — 2140 MHz

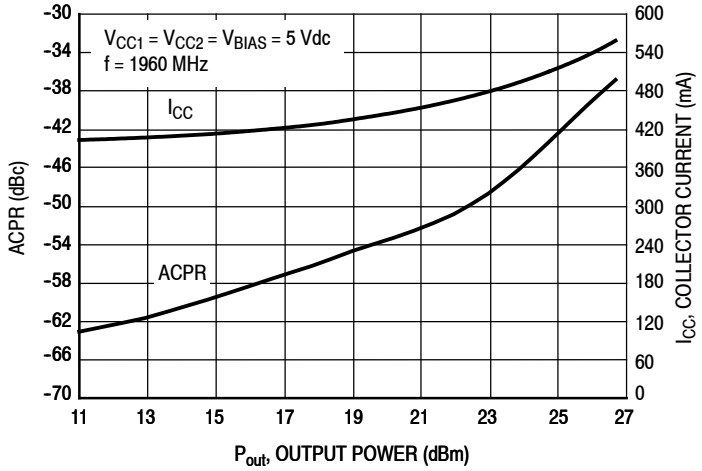


Figure 9a. ACPR and Collector Current versus Output Power — 1960 MHz

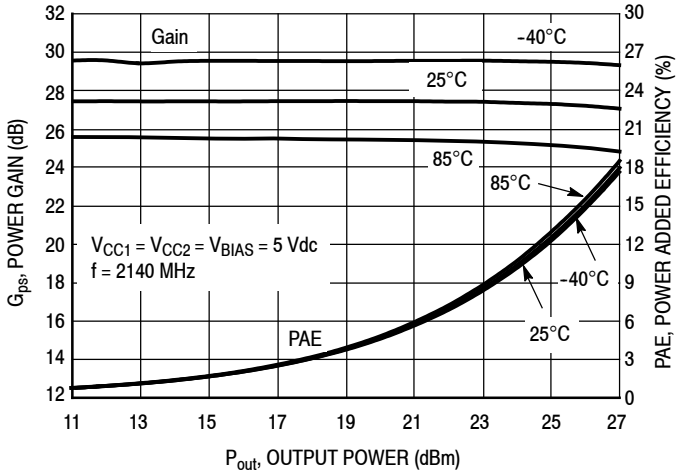


Figure 10. Power Gain and Power Added Efficiency versus Output Power versus Temperature

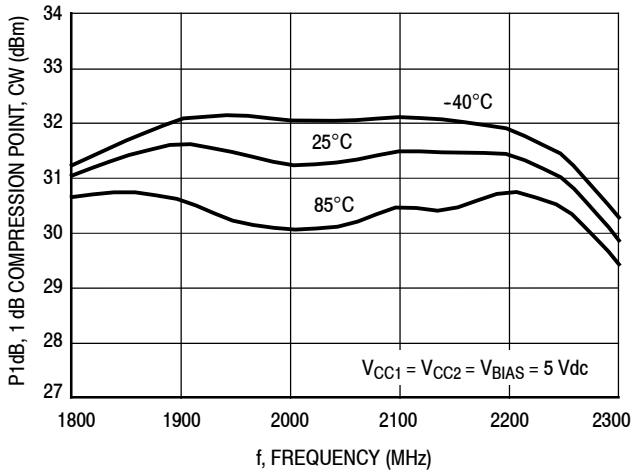


Figure 11. P1dB versus Frequency versus Temperature, CW

50 OHM TYPICAL CHARACTERISTICS — 2110–2170 MHz, 5 VOLT OPERATION

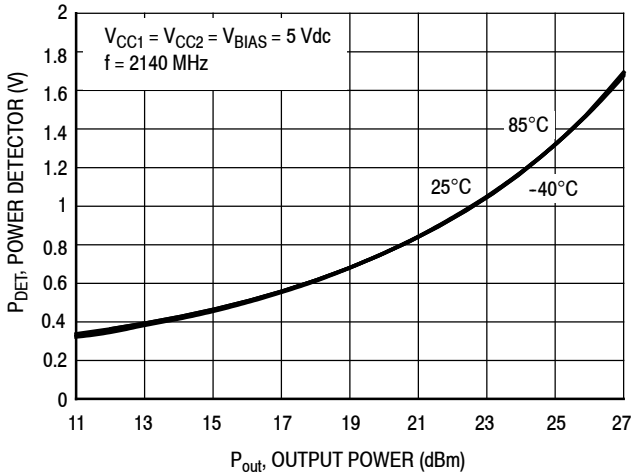
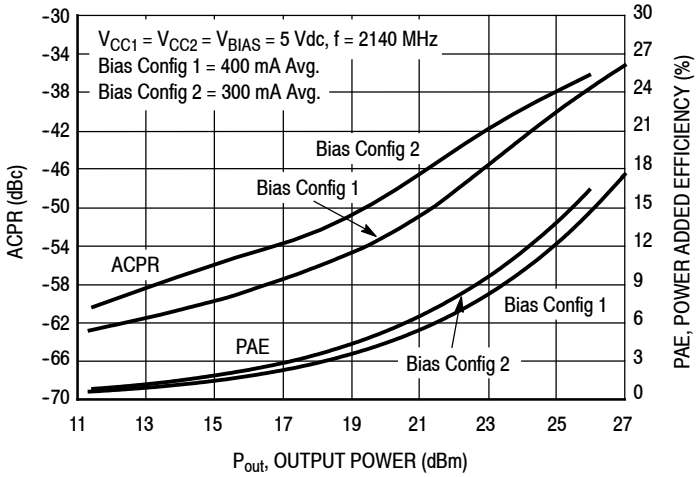
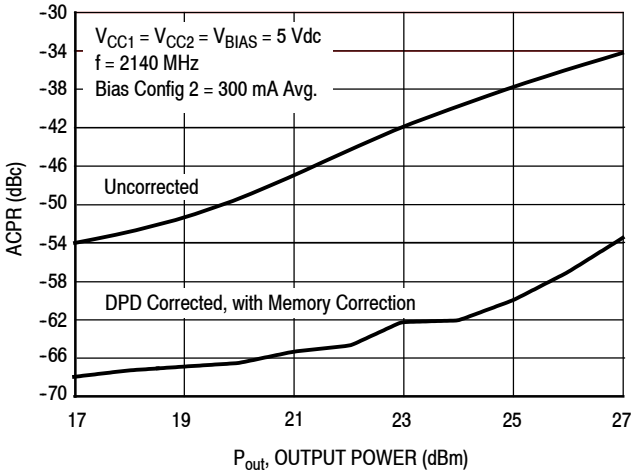


Figure 12. Power Detector versus Output Power versus Temperature



Note: Bias Config 1: 400 mA Avg. using R2 = 330 Ω
Bias Config 2: 300 mA Avg. using R2 = 470 Ω

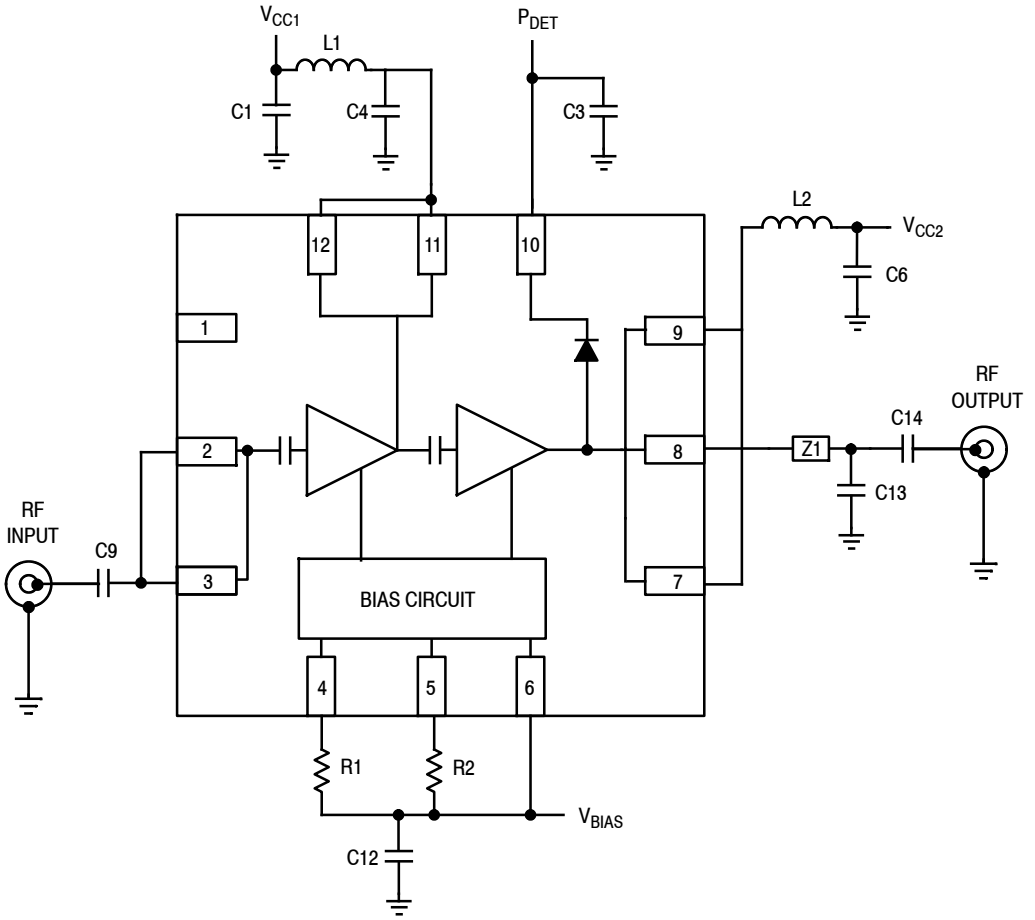
Figure 13. ACPR and Power Added Efficiency versus Output Power



Note: Bias Config 2: 300 mA Avg. using R2 = 470 Ω

Figure 14. ACPR versus Output Power with Bias Config 2 Uncorrected and Bias Config 2 DPD Corrected

50 OHM APPLICATION CIRCUIT: 2110–2170 MHz, 3.3 VOLT OPERATION



Z1 0.151″ × 0.030″ Microstrip

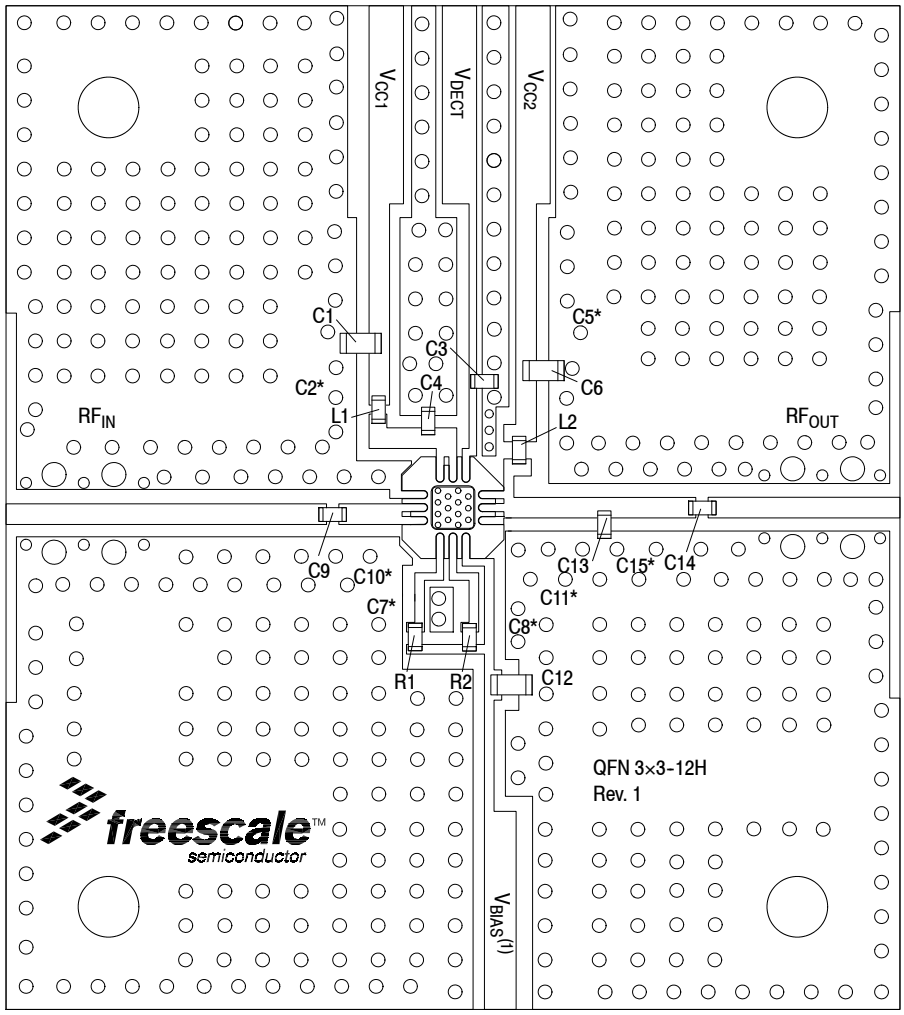
Figure 15. MMZ25332BT1 Test Circuit Schematic

Table 9. MMZ25332BT1 Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C12	1 μF Chip Capacitors	GRM155R61A105KE15	Murata
C2, C5, C7, C8, C10, C11, C15	Components Not Placed		
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C4	8.2 pF Chip Capacitor	04023J8R2BBS	AVX
C6	4.7 μF Chip Capacitor	GRM188R60J475KE19D	Murata
C9, C14	22 pF Chip Capacitors	04023J22R0BBS	AVX
C13	3.3 pF Chip Capacitor	04023J3R3BBS	AVX
L1	12 nH Chip Inductor	0603HC-12NXJLW	Coilcraft
L2	6.8 nH Chip Inductor	0603HC-6N8XJLW	Coilcraft
R1	500 Ω, 1/16 W Chip Resistor	RC0402JR-07500L	Yageo
R2	90 Ω, 1/16 W Chip Resistor	RC0402JR-0790L	Yageo
PCB	0.014″, ε_r = 3.7	FR408	Isola

Note: Component numbers C2, C5, C7, C8, C10, C11 and C15 are labeled on board but not placed.

50 OHM APPLICATION CIRCUIT: 2110–2170 MHz, 3.3 VOLT OPERATION



PCB actual size: 1.3″ × 1.46″.
(1) V_{BIAS} [Board] supplies V_{BA1}, V_{BA2} and V_{BIAS} [Device].
Note: Component numbers C2*, C5*, C7*, C8*, C10*, C11* and C15* are labeled on board but not placed.

Figure 16. MMZ25332BT1 Test Circuit Component Layout

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C2, C5, C7, C8, C10, C11, C15	Components Not Placed		
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C6	4.7 μF Chip Capacitor	GRM188R60J475KE19D	Murata
C9, C14	22 pF Chip Capacitors	04023J22R0BBS	AVX
C13	3.3 pF Chip Capacitor	04023J3R3BBS	AVX
L1	12 nH Chip Inductor	0603HC-12NXJLW	Coilcraft
L2	6.8 nH Chip Inductor	0603HC-6N8XJLW	Coilcraft
R1	500 Ω, 1/16 W Chip Resistor	RC0402JR-07500L	Yageo
R2	90 Ω, 1/16 W Chip Resistor	RC0402JR-0790L	Yageo
PCB	0.014″, ε_r = 3.7	FR408	Isola

(Test Circuit Component Designations and Values table repeated for reference.)

50 OHM TYPICAL CHARACTERISTICS — 2110–2170 MHz, 3.3 VOLT OPERATION

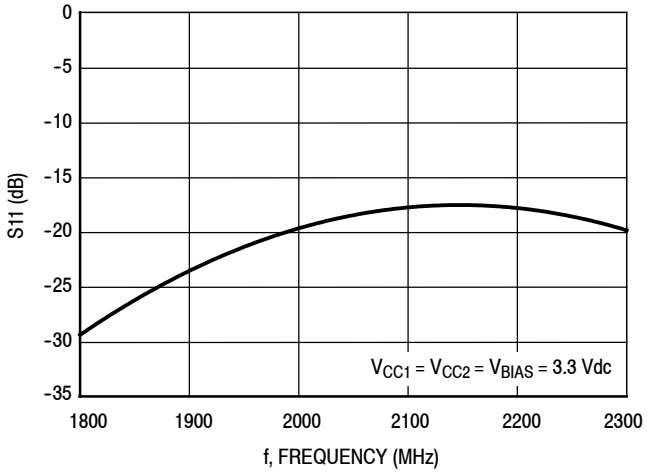


Figure 17. S11 versus Frequency

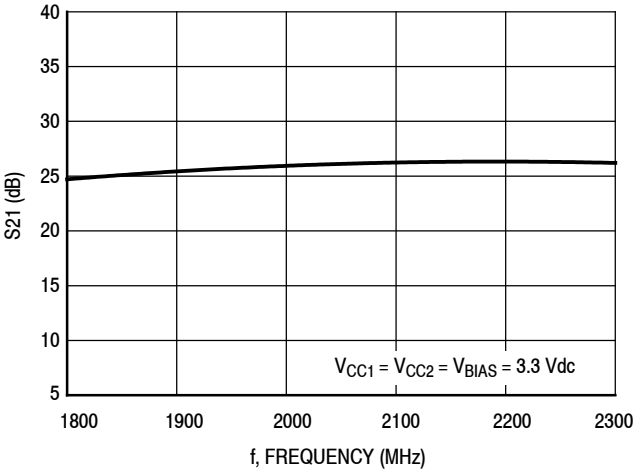


Figure 18. S21 versus Frequency

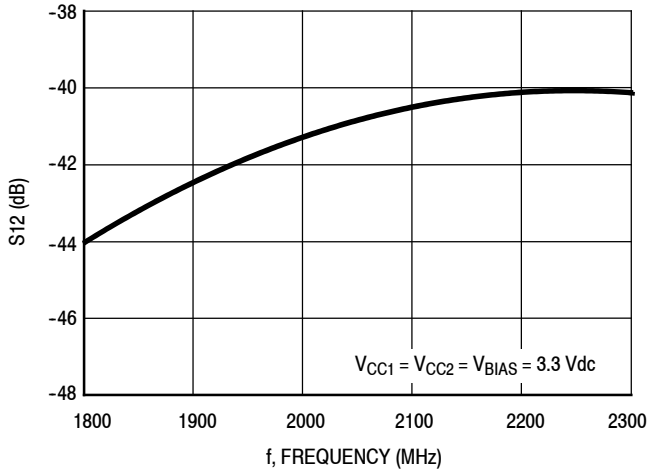


Figure 19. S12 versus Frequency

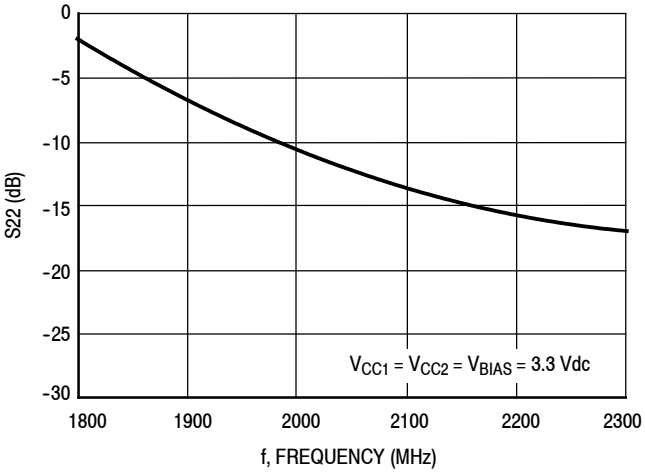


Figure 20. S22 versus Frequency

50 OHM TYPICAL CHARACTERISTICS — 2110–2170 MHz, 3.3 VOLT OPERATION

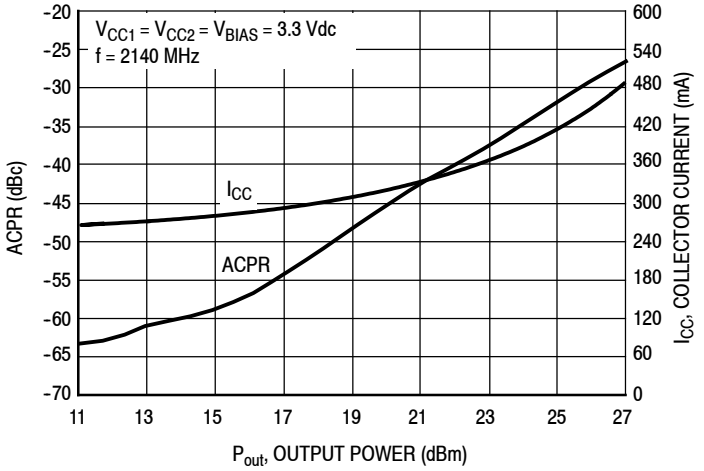


Figure 21. ACPR and Collector Current versus Output Power

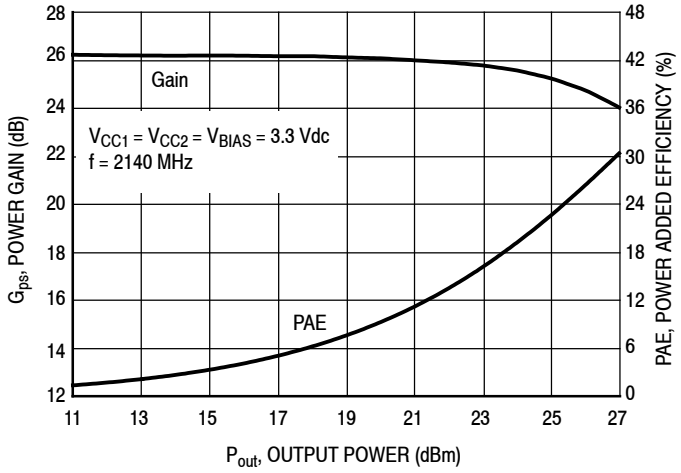


Figure 22. Power Gain and Power Added Efficiency versus Output Power

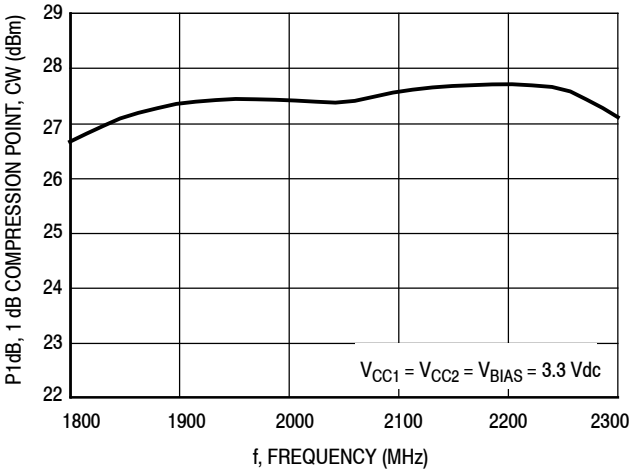


Figure 23. P1dB versus Frequency, CW

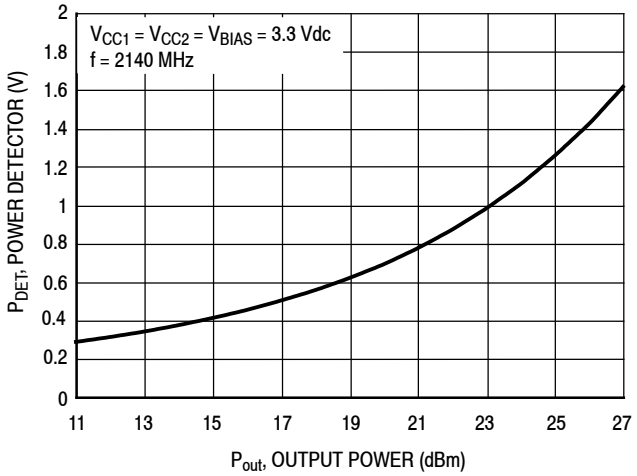


Figure 24. Power Detector versus Output Power

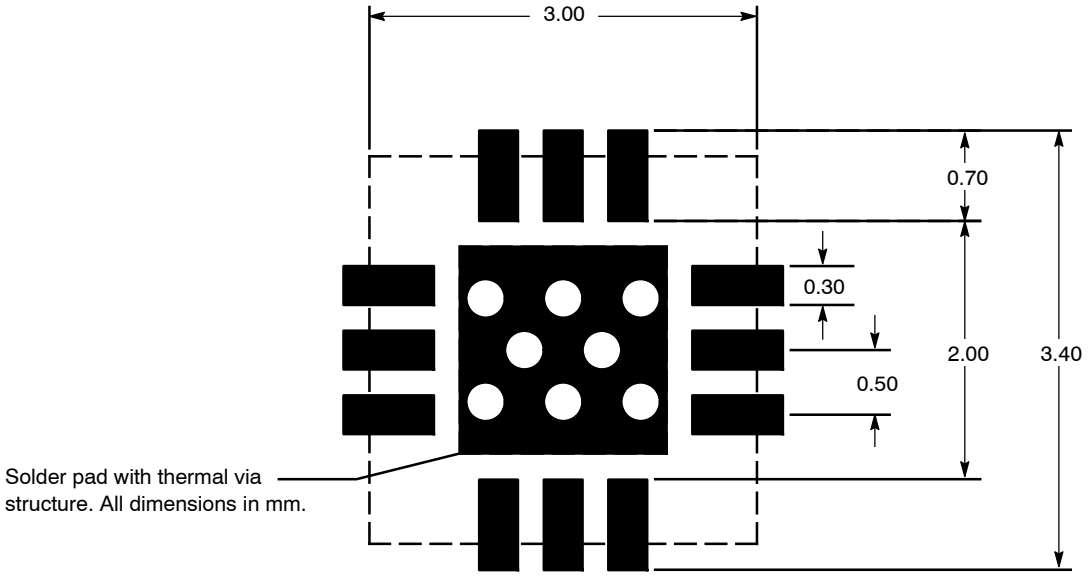
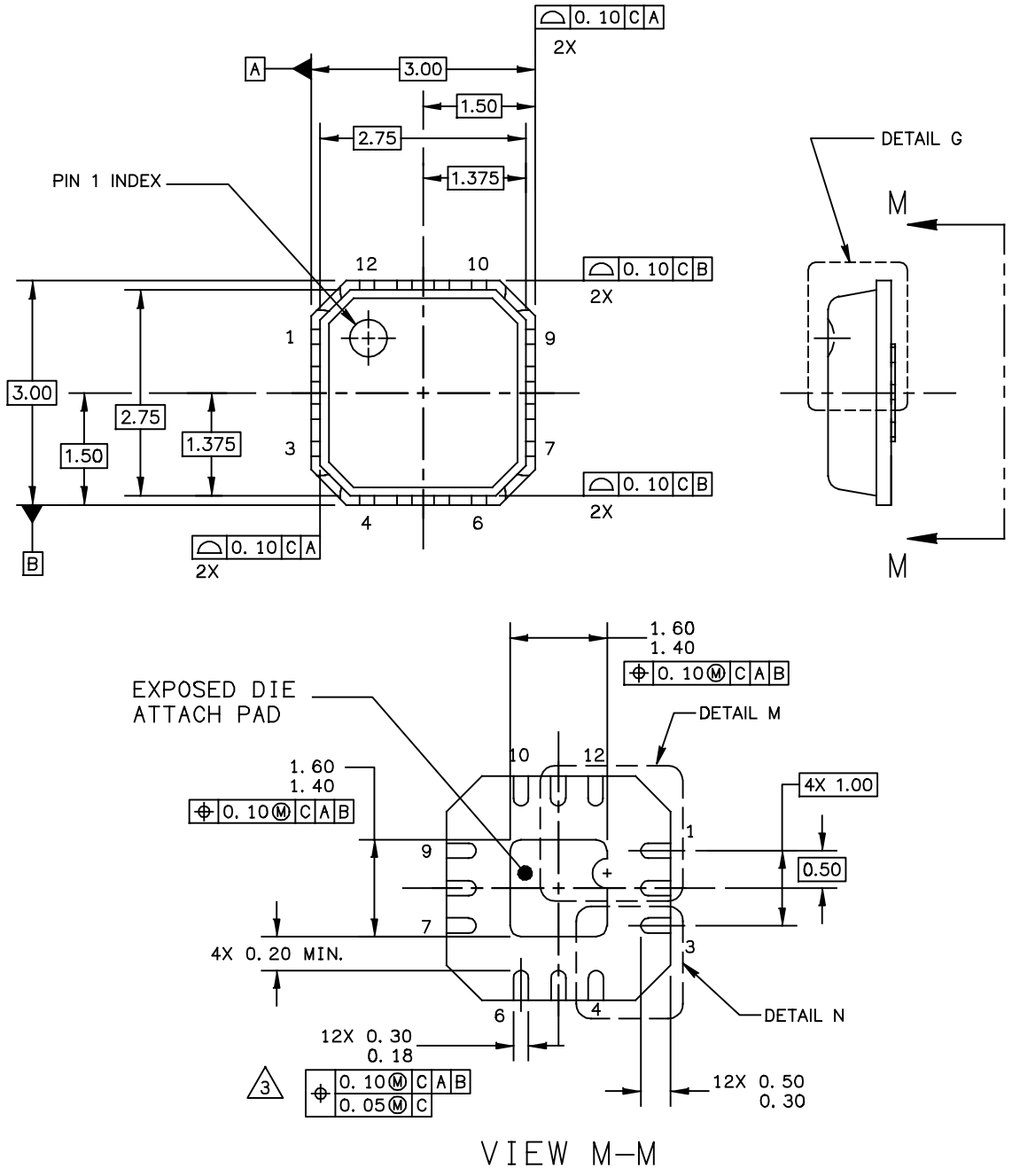


Figure 25. PCB Pad Layout for 12-Lead QFN 3 × 3



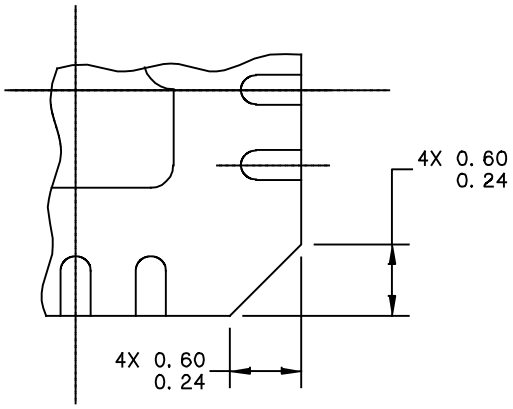
Figure 26. Product Marking

PACKAGE DIMENSIONS

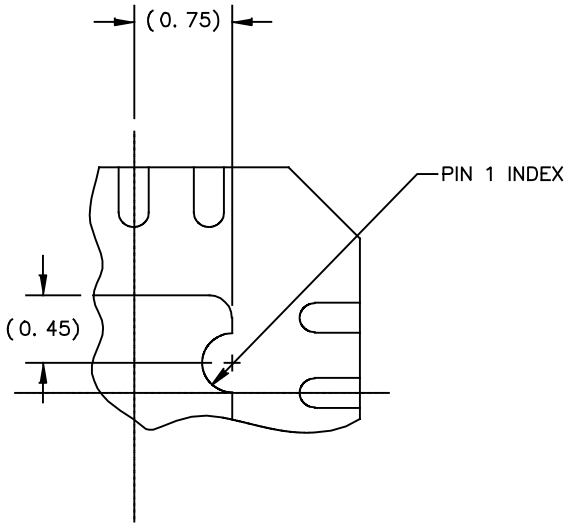


VIEW M–M

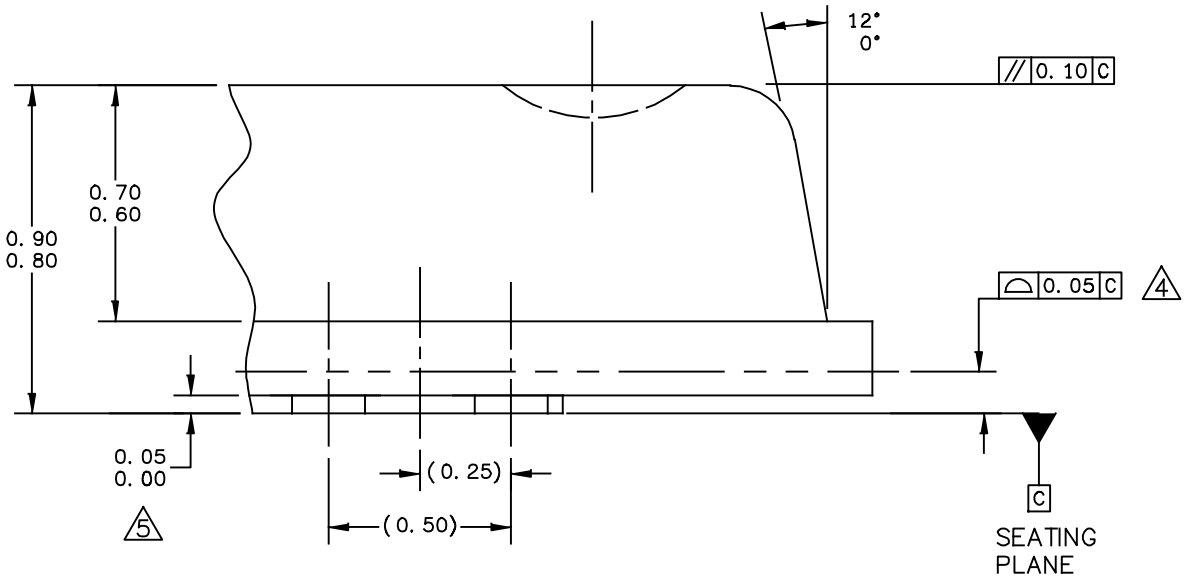
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TITLE: THERMALLY ENHANCED QUAD FLAT NON–LEADED PACKAGE (QFN) 12 TERMINAL, 0.5 PITCH (3X3X0.85)	DOCUMENT NO: 98ASA00227D	REV: O
	CASE NUMBER: 2131–01	14 MAY 2010
	STANDARD: NON–JEDEC	



DETAIL N
CORNER CONFIGURATION



DETAIL M
PIN 1 BACKSIDE INDEX



DETAIL G
VIEW ROTATED 90° CW

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TITLE: THERMALLY ENHANCED QUAD FLAT NON-LEADED PACKAGE (QFN) 12 TERMINAL, 0.5 PITCH (3X3X0.85)	DOCUMENT NO: 98ASA00227D	REV: O
	CASE NUMBER: 2131-01	14 MAY 2010
	STANDARD: NON-JEDEC	

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING & TOLERANCING PER ASME Y14.5 – 2009.
3. THIS DIMENSION APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. THIS DIMENSION APPLIED ONLY FOR TERMINALS.

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MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE: THERMALLY ENHANCED QUAD FLAT NON–LEADED PACKAGE (QFN) 12 TERMINAL, 0.5 PITCH (3X3X0.85)	DOCUMENT NO: 98ASA00227D	REV: O
	CASE NUMBER: 2131–01	14 MAY 2010
	STANDARD: NON–JEDEC	

APPENDIX A

MMZ25332BT1 TEST CIRCUIT SCHEMATIC, FIXTURE AND PARTS LIST

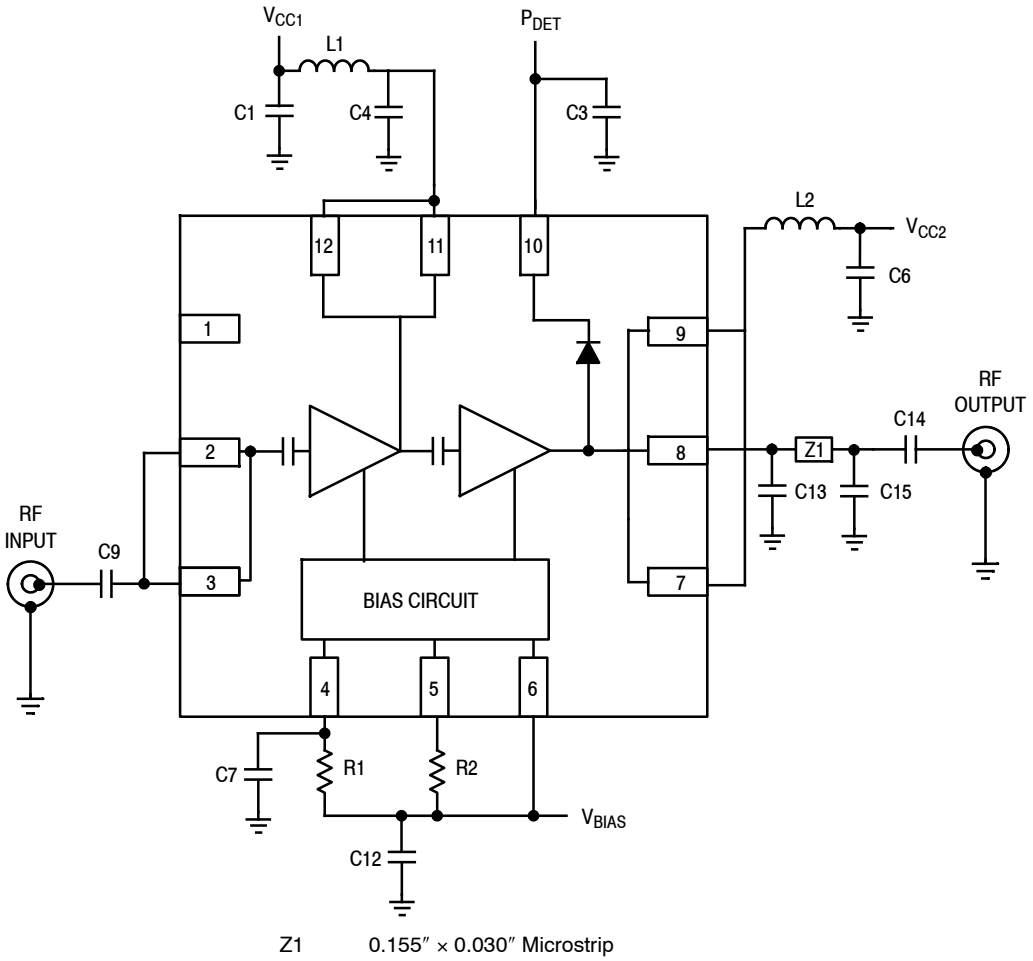


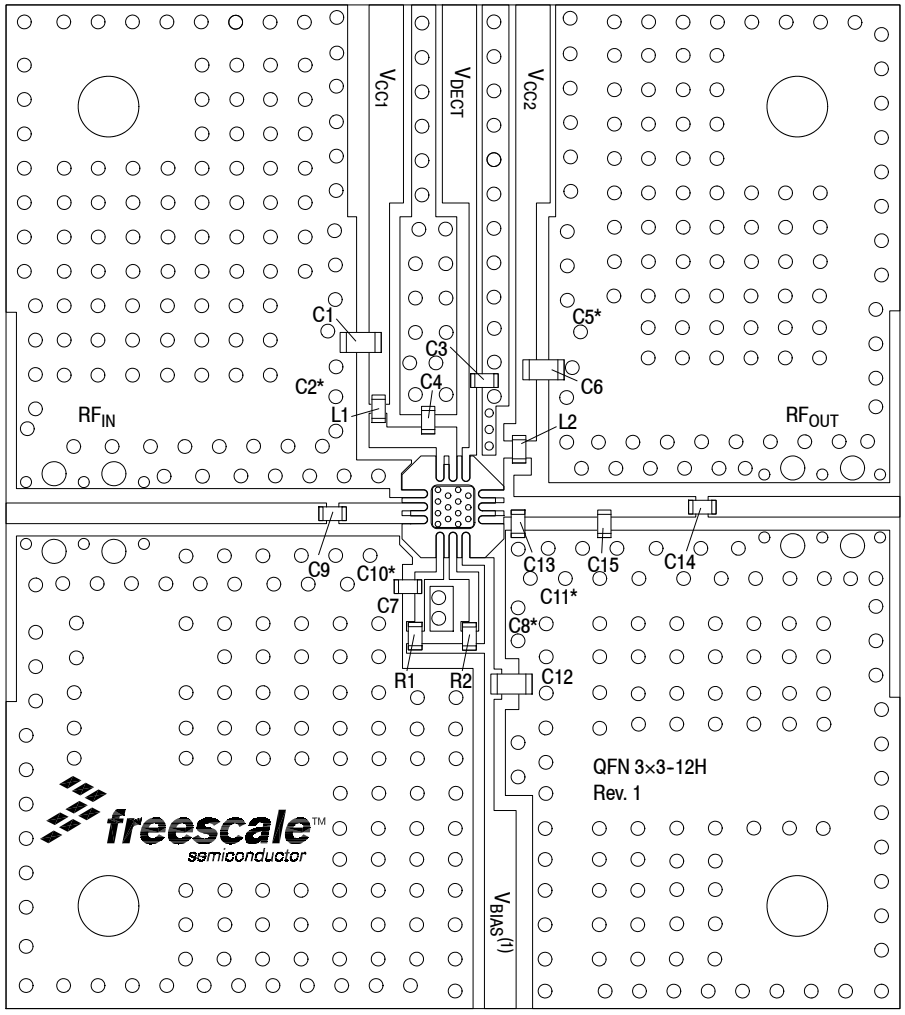
Figure A-1. MMZ25332BT1 Test Circuit Schematic — 2500 MHz, 5 Volt Operation

Table A-1. MMZ25332BT1 Test Circuit Component Designations and Values — 2500 MHz, 5 Volt Operation

Part	Description	Part Number	Manufacturer
C1, C12	1 μF Chip Capacitors	GRM155R61A105KE15	Murata
C2, C5, C8, C10, C11	Components Not Placed		
C3	470 pF Chip Capacitor	GRM1555C1H471JA01D	Murata
C4	7.5 pF Chip Capacitor	04023J7R5BBS	AVX
C6	4.7 μF Chip Capacitor	GRM188R60J475KE19D	Murata
C7	120 pF Chip Capacitor	GRM1555C1H121JA01D	Murata
C9, C14	22 pF Chip Capacitors	04023J22R0BBS	AVX
C13	2.4 pF Chip Capacitor	04023J2R4BBS	AVX
C15	1.8 pF Chip Capacitor	04023J1R8BBS	AVX
L1	24 nH Chip Inductor	0603HC-24NXJLW	Coilcraft
L2	22 nH Chip Inductor	0603HC-22NXJLW	Coilcraft
R1	1.2 kΩ, 1/16 W Chip Resistor	RC0402JR-071K2L	Yageo
R2	330 Ω, 1/16 W Chip Resistor	RC0402JR-07330L	Yageo
PCB	0.014″, ε_r = 3.7	FR408	Isola

Note: Component numbers C2, C5, C8, C10 and C11 are labeled on board but not placed.

Appendix A (continued)



PCB actual size: 1.3″ × 1.46″.

(1) V_{BIAS} [Board] supplies V_{BA1}, V_{BA2} and V_{BIAS} [Device].

Note: Component numbers C2*, C5*, C8*, C10* and C11* are labeled on board but not placed.

Figure A-2. MMZ25332BT1 Test Circuit Component Layout — 2500 MHz, 5 Volt Operation

Table A-1. MMZ25332BT1 Test Circuit Component Designations and Values — 2500 MHz, 5 Volt Operation

Part	Description	Part Number	Manufacturer
C1, C12	1 μF Chip Capacitors	GRM155R61A105KE15	Murata
C2, C5, C8, C10, C11	Components Not Placed		
C3	470 pF Chip Capacitor	GRM1555C1H471JA01D	Murata
C4	7.5 pF Chip Capacitor	04023J7R5BBS	AVX
C6	4.7 μF Chip Capacitor	GRM188R60J475KE19D	Murata
C7	120 pF Chip Capacitor	GRM1555C1H121JA01D	Murata
C9, C14	22 pF Chip Capacitors	04023J22R0BBS	AVX
C13	2.4 pF Chip Capacitor	04023J2R4BBS	AVX
C15	1.8 pF Chip Capacitor	04023J1R8BBS	AVX
L1	24 nH Chip Inductor	0603HC-24NXJLW	Coilcraft
L2	22 nH Chip Inductor	0603HC-22NXJLW	Coilcraft
R1	1.2 kΩ, 1/16 W Chip Resistor	RC0402JR-071K2L	Yageo
R2	330 Ω, 1/16 W Chip Resistor	RC0402JR-07330L	Yageo
PCB	0.014″, ε_r = 3.7	FR408	Isola

(Test Circuit Component Designations and Values table repeated for reference.)

PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following documents, software and tools to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Software

- .s2p File

Development Tools

- Printed Circuit Boards

For Software and Tools, do a Part Number search at http://www.nxp.com, and select the “Part Number” link. Go to the Software & Tools tab on the part’s Product Summary page to download the respective tool.

FAILURE ANALYSIS

At this time, because of the physical characteristics of the part, failure analysis is limited to electrical signature analysis. In cases where NXP is contractually obligated to perform failure analysis (FA) services, full FA may be performed by third party vendors with moderate success. For updates contact your local NXP Sales Office.

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	May 2012	• Initial release of data sheet
1	Dec. 2012	• Added 2140 MHz, 5 Volt Operation, as follows: – Fig. 3, Test Circuit Schematic, p. 3 – Table 7, Test Circuit Component Designations and Values, p. 3 – Fig. 4, Test Circuit Component Layout, p. 4 – Fig. 5, S11 versus Frequency versus Temperature, p. 5 – Fig. 6, S21 versus Frequency versus Temperature, p. 5 – Fig. 7, S12 versus Frequency versus Temperature, p. 5 – Fig. 8, S22 versus Frequency versus Temperature, p. 5 – Fig. 9. ACPR and Collector Current versus Output Power versus Temperature — 2140 MHz, p.6 – Fig. 9a. ACPR and Collector Current versus Output Power — 1960 MHz, p.6 – Fig. 10. Power Gain and Power Added Efficiency versus Output Power versus Temperature, p. 6 – Fig. 11. P1dB versus Frequency versus Temperature, CW, p. 6 – Fig. 12. Power Detector versus Output Power versus Temperature, p. 7 – Fig. 13. ACPR and Power Added Efficiency versus Output Power, p. 7 – Fig. 14. ACPR versus Output Power with Bias Config 2 Uncorrected and Bias Config 2 DPD Corrected, p. 7 • Added 2140 MHz, 3.3 Volt Operation, as follows: – Fig. 15, Test Circuit Schematic, p. 8 – Table 8, Test Circuit Component Designations and Values, p. 8 – Fig. 16, Test Circuit Component Layout, p. 9 – Fig. 17, S11 versus Frequency versus Temperature, p. 10 – Fig. 18, S21 versus Frequency versus Temperature, p. 10 – Fig. 19, S12 versus Frequency versus Temperature, p. 10 – Fig. 20, S22 versus Frequency versus Temperature, p. 10 – Fig. 21, ACPR and Collector Current versus Output Power, p .11 – Fig. 22, Power Gain and Power Added Efficiency versus Output Power, p. 11 – Fig. 23, P1dB versus Frequency, CW, p. 11 – Fig. 24, Power Detector versus Output Power, p. 11 • Added Appendix A, Test Circuit Schematic, Fixture and Parts List (for 2500 MHz, 5 Volt Operation) as follows: – Moved former Fig. 3 (now Fig. 27), Test Circuit Schematic, to p. 16 – Moved former Table 7 (now Table 9), Test Circuit Component Designations and Values, to p.16 – Moved former Fig. 4 (now Fig. 28), Test Circuit Component Layout, to p.17

(continued)

REVISION HISTORY (cont.)

Revision	Date	Description
2	May 2014	• Updated frequency from 1800–2800 MHz to 1500–2800 MHz and Junction Temperature from 150°C to 175°C to reflect recent test results of the device, p. 1 • Added Failure Analysis information, p. 18
3	Nov. 2017	• Fig. 26, updated date code line to reflect improved traceability information, p. 12

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