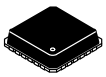
MMZ25333B

InGaP HBT Linear Amplifier

Rev. 2 — 4 April 2024 **Product data sheet**



1 General description

The MMZ25333B is a versatile 3–stage power amplifier targeted at driver and pre–driver applications for macro and micro base stations and final–stage applications for small cells. Its versatile design allows operation in any frequency band from 1500 to 2700 MHz providing gain of more than 40 dB. The device operates off a 5 V supply, and its bias currents and portions of the matching networks are adjustable for optimum performance in any specific application. It is housed in a QFN 4 × 4 surface mount package.

2 Typical performance

Table 1. Typical PA Driver Performance

$V_{CC1} = V_{CC2} = V_{CC3} = V_{BIAS}$ = 5 Vdc, I_{CQ} = 265 mA

Frequency	P_{out} (dBm)	G_{ps} (dB)	ACPR (dBc)	I_{CC} Total	Test Signal
2600 MHz	18.0	42.6	–50.8	296	W–CDMA
2140 MHz	17.0	43.7	–50.7	293	W–CDMA

Table 2. Typical Output PA Performance

$V_{CC1} = V_{CC2} = V_{CC3} = V_{BIAS}$ = 5 Vdc, I_{CQ} = 450 mA

Frequency	P_{out} (dBm)	G_{ps} (dB)	ACPR (dBc)	I_{CC} Total	Test Signal
2600 MHz	22.2	42.7	–48.0	501	W–CDMA

3 Features and benefits

- P1dB: up to 33 dBm
- Gain: More than 40 dB
- 5 V Supply
- Excellent Linearity
- High Efficiency
- Single–ended Power Detector
- Band Tunable

4 Functional block diagram

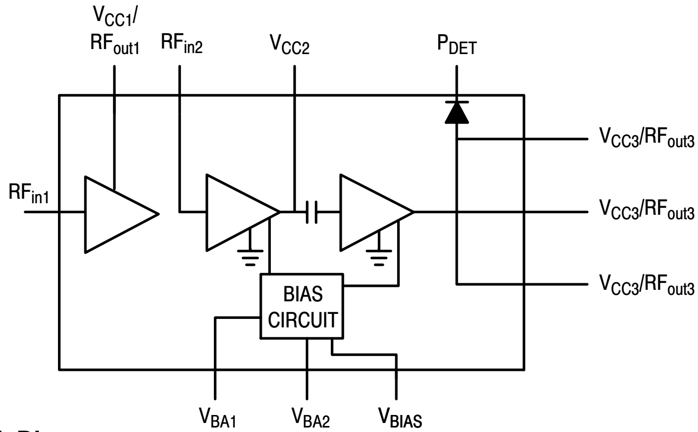


Figure 1. Functional Block Diagram

5 Ordering information

Table 3. Ordering Information

Device	Tape and Reel Information	Package
MMZ25333BT1	T1 Suffix = 1,000 Units, 12 mm Tape Width, 7−inch Reel	QFN 4 × 4

6 Maximum ratings

Table 4. Maximum Ratings

Rating		Symbol	Value	Unit
Supply Voltage		V_{CC}	6	V
Supply Current	I_{CC1} I_{CC2} I_{CC3}	I_{CC}	66 240 960	mA
RF Input Power		P_{in}	10	dBm
Storage Temperature Range		T_{stg}	–65 to +150	°C
Junction Temperature		T_J	175	°C

7 Thermal characteristics

Table 5. Thermal Characteristics

Characteristic		Symbol	Value [(1)]	Unit
Thermal Resistance, Junction to Case Case Temperature 104°C, V_{CC1} = V_{CC2} = V_{CC3} = V_{BIAS} = 5 Vdc	 Stage 1 Stage 2 Stage 3	$R_{\theta JC}$	 28 68 21	°C/W

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

8 Electrical characteristics

Table 6. Electrical Characteristics

(V_{CC1} = V_{CC2} = V_{CC3} = V_{BIAS} = 5 Vdc, 2600 MHz, T_A = 25°C, 50 ohm system, in NXP PA Driver Application Circuit)

Characteristic	Symbol	Min	Typ	Max	Unit
Small−Signal Gain (S21)	G_p	40.4	43.0	—	dB
Input Return Loss (S11)	IRL	—	–12.2	—	dB
Output Return Loss (S22)	ORL	—	–7.1	—	dB
Power Output @ 1dB Compression	P1dB	—	32.0	—	dBm
Third Order Output Intercept Point, Two−Tone CW	OIP3	—	42.8	—	dBm
Total Supply Current (I_{CC1} + I_{CC2} + I_{CC3} + I_{BIAS})	I_{CQ}	244	265	284	mA
Supply Voltage	V_{CC}	—	5	—	V

9 ESD protection characteristics

Table 7. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22−A114)	1C
Machine Model (per EIA/JESD22−A115)	A
Charge Device Model (per JESD22−C101)	IV

10 Moisture sensitivity level

Table 8. Moisture Sensitivity Level

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

11 Pinning information

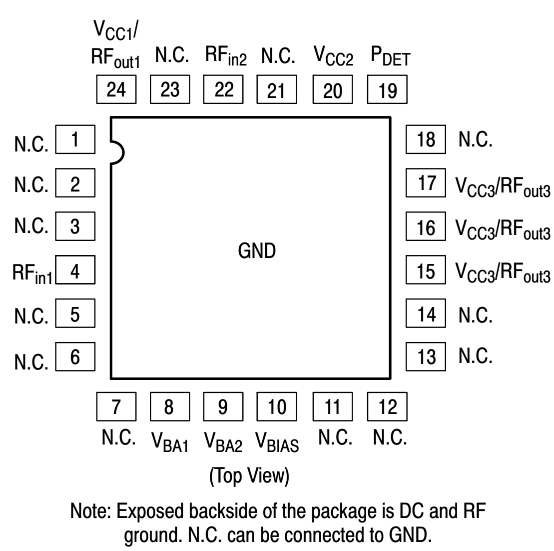
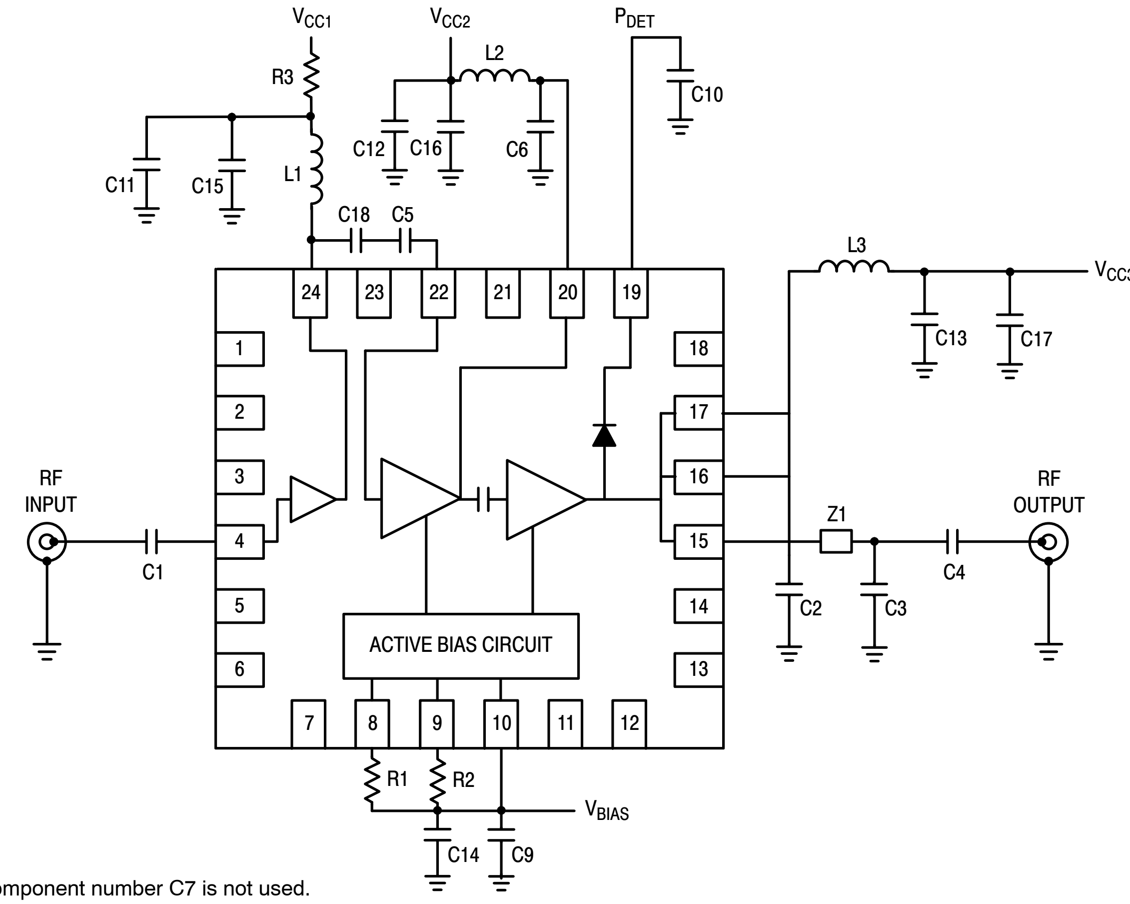


Figure 2. Pin Connections

12 Application circuit, 50 ohm — 2500–2700 MHz

12.1 Test circuit schematic — 2500–2700 MHz



Note: Component number C7 is not used.

Z1 0.143″ x 0.022″ Microstrip

Figure 3. MMZ25333B Test Circuit Schematic

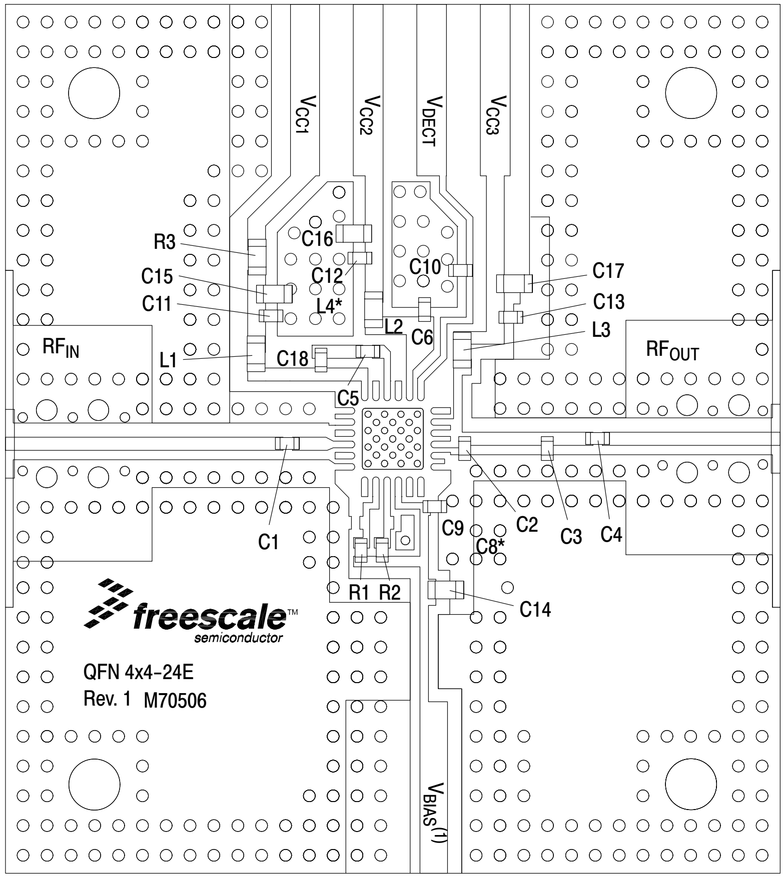
12.2 Component designations and values — 2500–2700 MHz

Table 9. MMZ25333B Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C4, C5	22 pF Chip Capacitors	04023J220BBS	AVX
C2	2 pF Chip Capacitor	04023J2R0BBS	AVX
C3	1.5 pF Chip Capacitor	04023J1R5BBS	AVX
C6	7.5 pF Chip Capacitor	04023J7R5BBS	AVX
C8	Component Not Placed		
C9, C11, C12, C13	1000 pF Chip Capacitors	GCM155R71E103KA37	Murata
C10	470 pF Chip Capacitor	GRM1555C1H471JA01	Murata
C14, C16	1 μF Chip Capacitors	GRM188R61A105KE15	Murata
C15	0.01 μF Chip Capacitor	C0603C103J5RAC	Kemet
C17	4.7 μF Chip Capacitor	GRM188R60J475KE19	Murata
C18	2.2 pF Chip Capacitor	04023J12R2BBS	AVX
L1	56 nH Chip Inductor	0603HC-56NX	Coilcraft
L2	10 nH Chip Inductor	0603HC-10NX	Coilcraft
L3	6.8 nH Chip Inductor	0603HC-6N8X	Coilcraft
L4	Component Not Placed		
R1 (I_{CQ} = 265 mA)	1.8 kΩ, 1/16 W Chip Resistor	CR05-182J-B	Kyocera
R2 (I_{CQ} = 265 mA)	680 Ω, 1/16 W Chip Resistor	CR05-681J-B	Kyocera
R1 (I_{CQ} = 450 mA)	1.2 kΩ, 1/16 W Chip Resistor	CR05-122J-B	Kyocera
R2 (I_{CQ} = 450 mA)	330 Ω, 1/16 W Chip Resistor	CR05-331J-B	Kyocera
R3	27 Ω, 1/10 W Chip Resistor	CR10-270J-T	Kyocera
PCB	Rogers RO4350B, 0.010″, ε_r = 3.66	M70506	MTL

Note: Component numbers C8 and L4 are labeled on board but not placed.

12.3 Component layout — 2500–2700 MHz



PCB actual size: 1.3″ × 1.46″.

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

Note: Component number C7 is not used. Component numbers C8* and L4* are labeled on board but not placed.

Figure 4. MMZ25333B Test Circuit Component Layout

13 Typical performance graphs, 50 ohm — 2500–2700 MHz

13.1 2500–2700 MHz, I_{CQ} = 265 mA

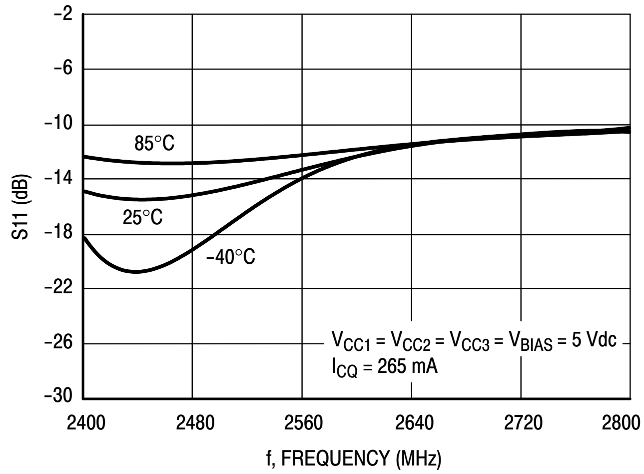


Figure 5. S11 versus Frequency versus Temperature

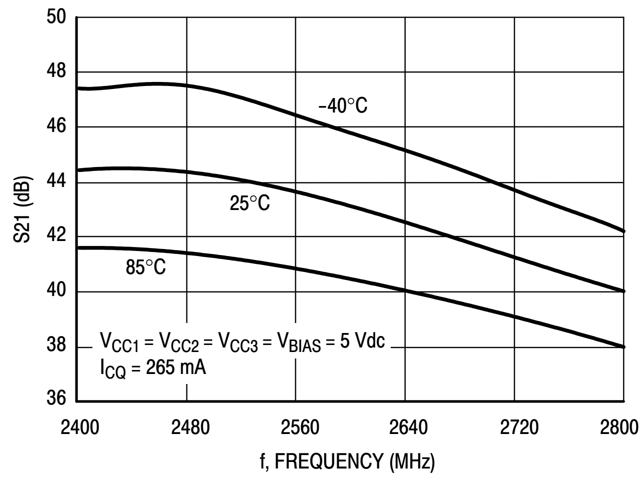


Figure 6. S21 versus Frequency versus Temperature

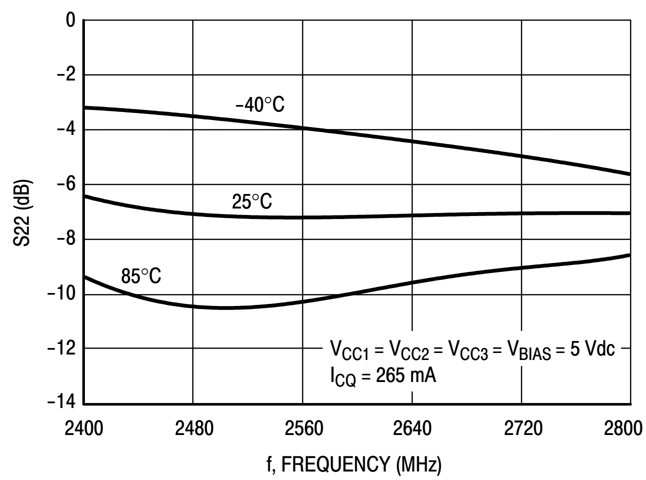


Figure 7. S22 versus Frequency versus Temperature

13.1 2500–2700 MHz, I_{CQ} = 265 mA (continued)

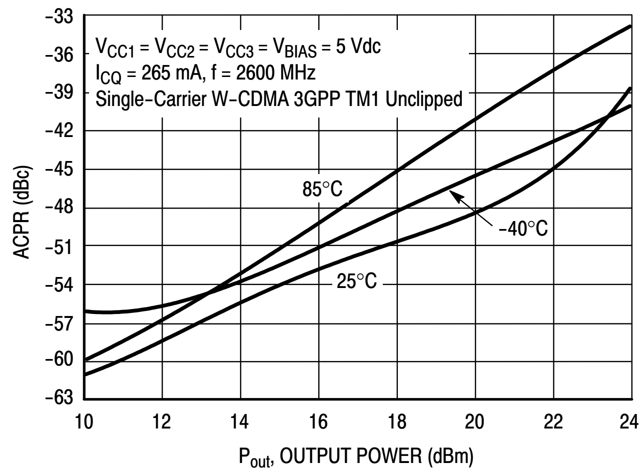


Figure 8. ACPR versus Output Power versus Temperature

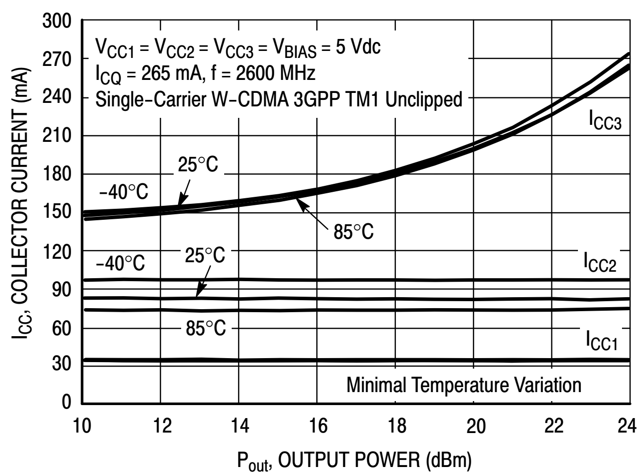


Figure 9. Stage Collector Current versus Output Power versus Temperature

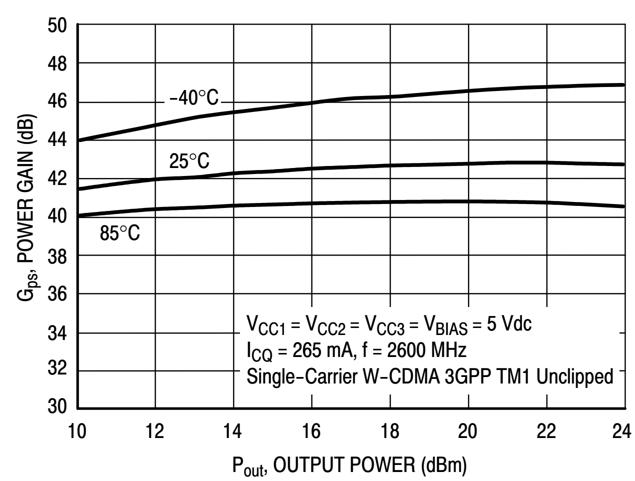


Figure 10. Power Gain versus Output Power versus Temperature

13.1 2500–2700 MHz, I_{CQ} = 265 mA (continued)

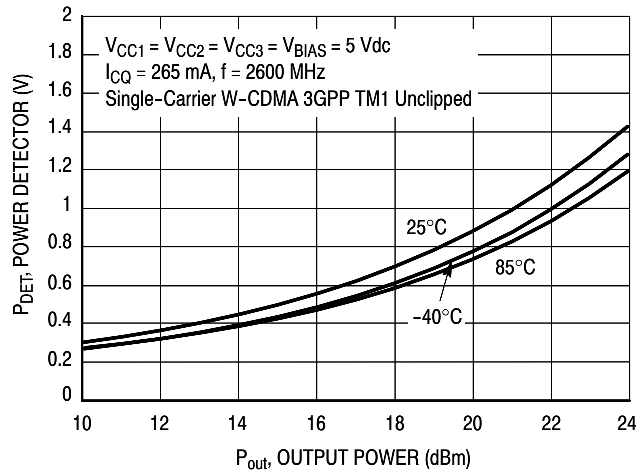


Figure 11. Power Detector versus Output Power versus Temperature

13.2 2500–2700 MHz, I_{CQ} = 450 mA

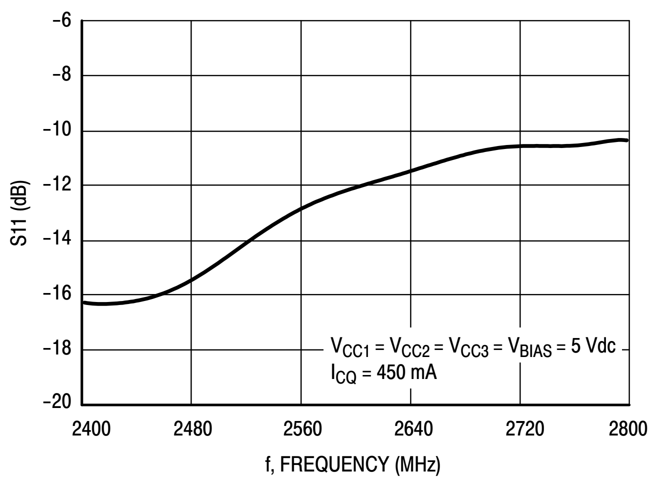


Figure 12. S11 versus Frequency

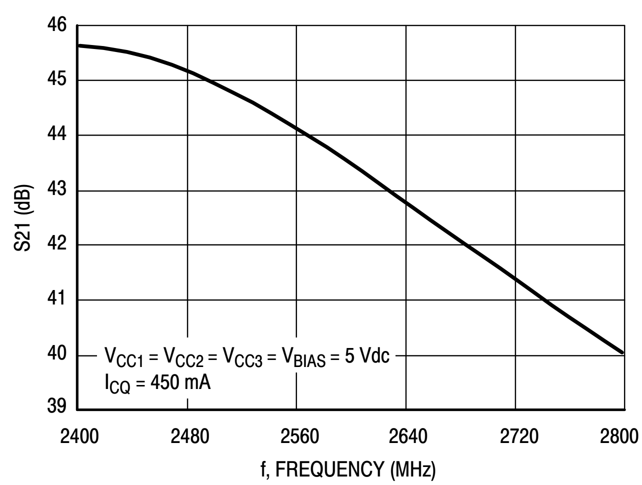


Figure 13. S21 versus Frequency

13.2 2500–2700 MHz, I_{CQ} = 450 mA (continued)

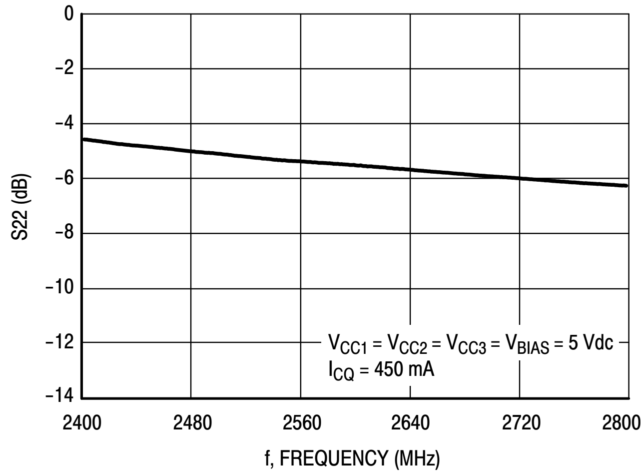


Figure 14. S22 versus Frequency

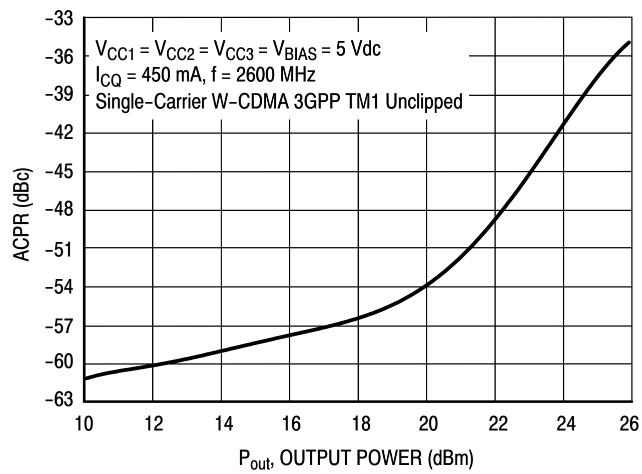


Figure 15. ACPR versus Output Power

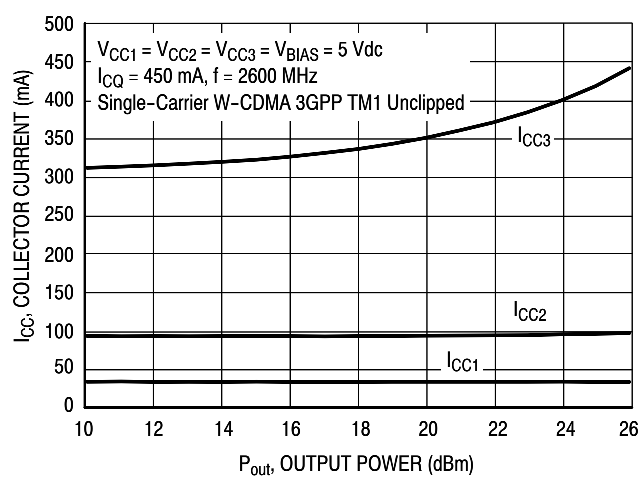


Figure 16. Stage Collector Current versus Output Power

13.2 2500–2700 MHz, I_{CQ} = 450 mA (continued)

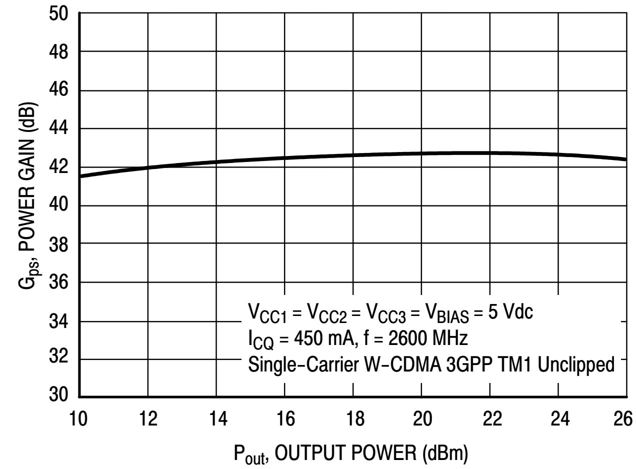


Figure 17. Power Gain versus Output Power

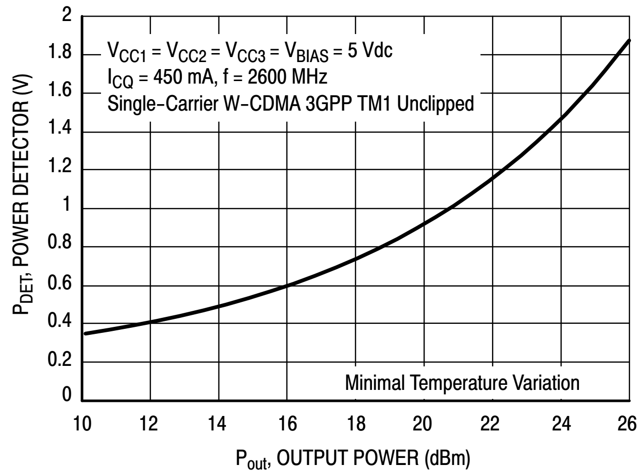
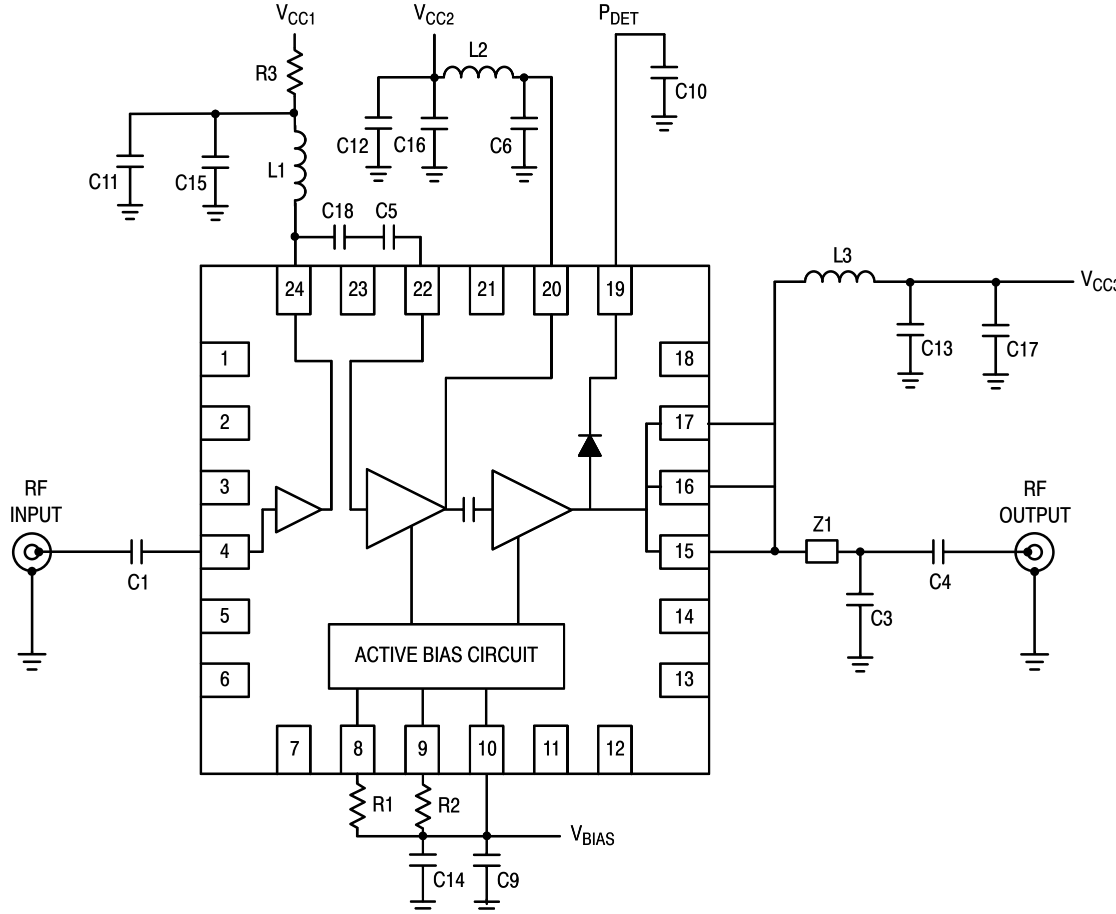


Figure 18. Power Detector versus Output Power

14 Application circuit, 50 ohm — 2110–2170 MHz, I_{CQ} = 265 mA

14.1 Test circuit schematic — 2110–2170 MHz, I_{CQ} = 265 mA



Note: Component number C7 is not used.

Z1 0.163″ x 0.022″ Microstrip

Figure 19. MMZ25333B Test Circuit Schematic

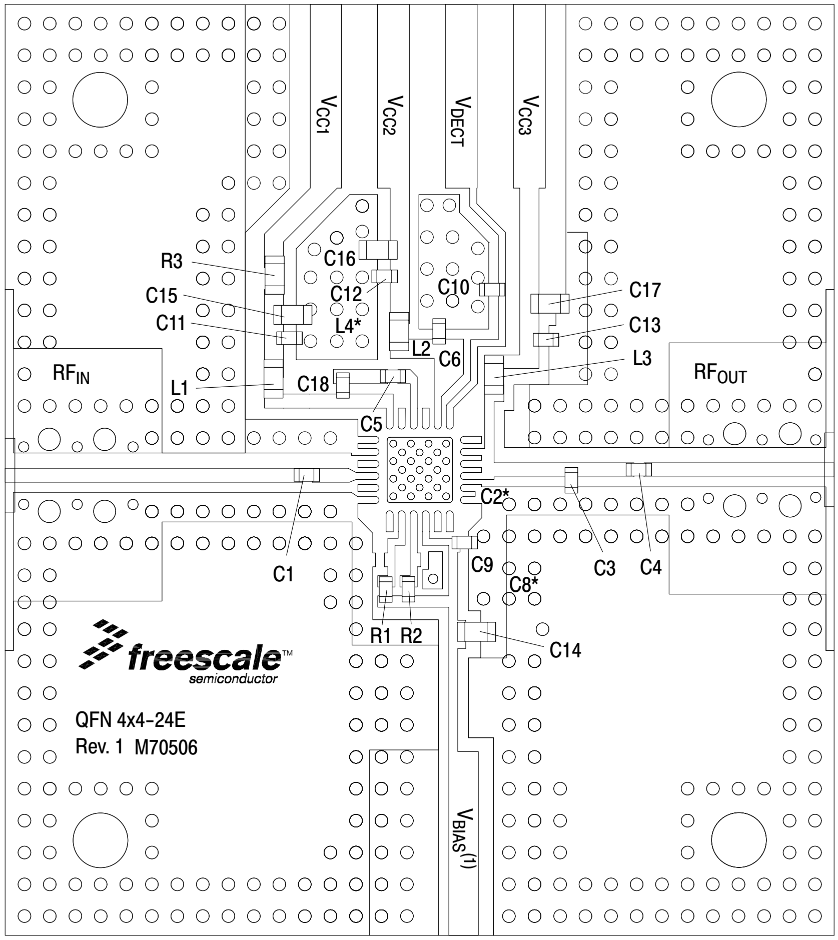
14.2 Component designations and values — 2110–2170 MHz, I_{CQ} = 265 mA

Table 10. MMZ25333B Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C4, C5	22 pF Chip Capacitors	04023J220BBS	AVX
C2	Component Not Placed		
C3	3.6 pF Chip Capacitor	04023J3R6BBS	AVX
C6	8.2 pF Chip Capacitor	04023J8R2BBS	AVX
C8	Component Not Placed		
C9, C11, C12, C13	1000 pF Chip Capacitors	GCM155R71E103KA37	Murata
C10	470 pF Chip Capacitor	GRM1555C1H471JA01	Murata
C14, C16	1 μF Chip Capacitors	GRM188R61A105KE15	Murata
C15	0.01 μF Chip Capacitor	C0603C103J5RAC	Kemet
C17	4.7 μF Chip Capacitor	GRM188R60J475KE19	Murata
C18	2.2 pF Chip Capacitor	04023J12R2BBS	AVX
L1	56 nH Chip Inductor	0603HC-56NX	Coilcraft
L2	12 nH Chip Inductor	0603HC-12NX	Coilcraft
L3	6.8 nH Chip Inductor	0603HC-6N8X	Coilcraft
L4	Component Not Placed		
R1 (I_{CQ} = 265 mA)	1.8 kΩ, 1/16 W Chip Resistor	CR05-182J-B	Kyocera
R2 (I_{CQ} = 265 mA)	680 Ω, 1/16 W Chip Resistor	CR05-681J-B	Kyocera
R3	27 Ω, 1/10 W Chip Resistor	CR10-270J-T	Kyocera
PCB	Rogers RO4350B, 0.010″, ε_r = 3.66	M70506	MTL

Note: Component numbers C2, C8 and L4 are labeled on board but not placed.

14.3 Component layout — 2110–2170 MHz, I_{CQ} = 265 mA



PCB actual size: 1.3″ × 1.46″.

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

Note: Component number C7 is not used. Component numbers C2*, C8* and L4* are labeled on board but not placed.

Figure 20. MMZ25333B Test Circuit Component Layout

15 Typical performance graphs, 50 ohm — 2110–2170 MHz, I_{CQ} = 265 mA

15.1 2110–2170 MHz, I_{CQ} = 265 mA

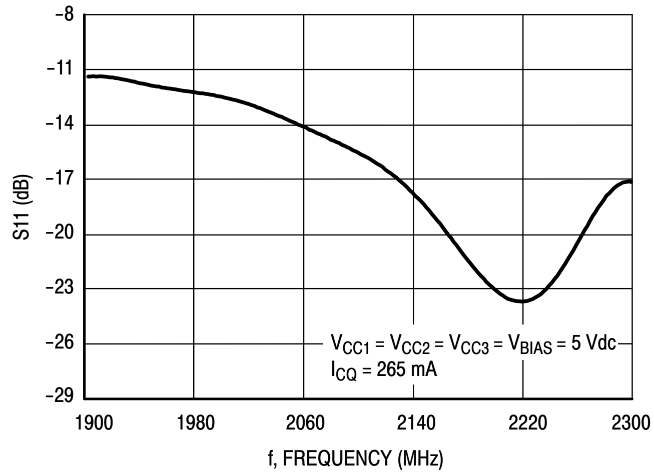


Figure 21. S11 versus Frequency

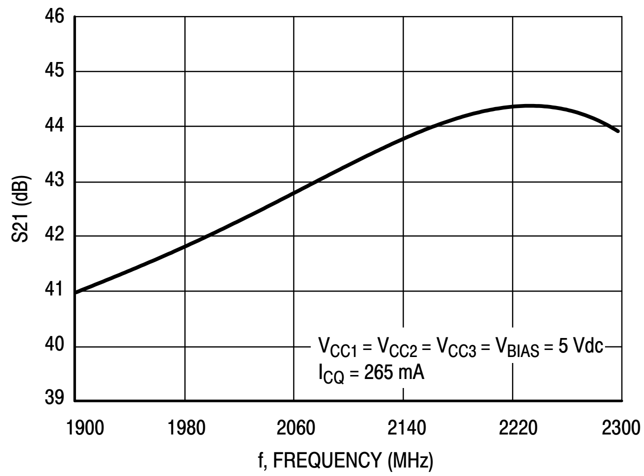


Figure 22. S21 versus Frequency

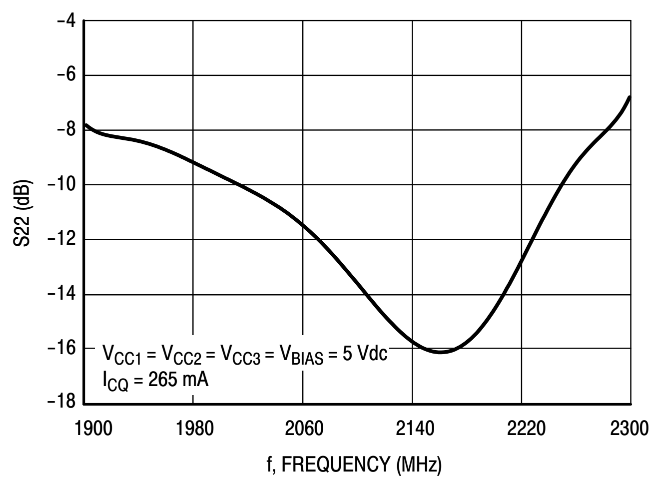


Figure 23. S22 versus Frequency

15.1 2110–2170 MHz, I_{CQ} = 265 mA (continued)

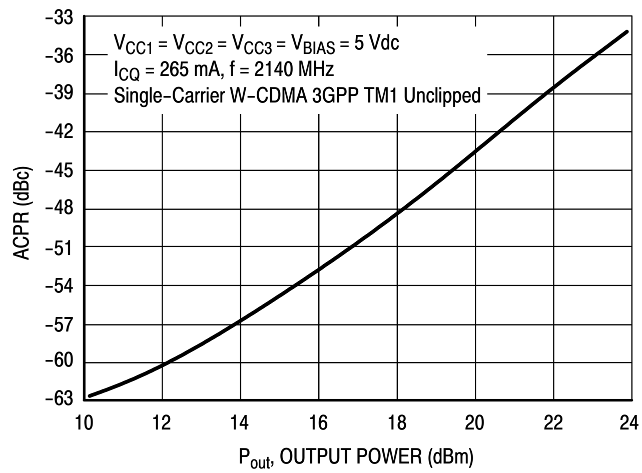


Figure 24. ACPR versus Output Power

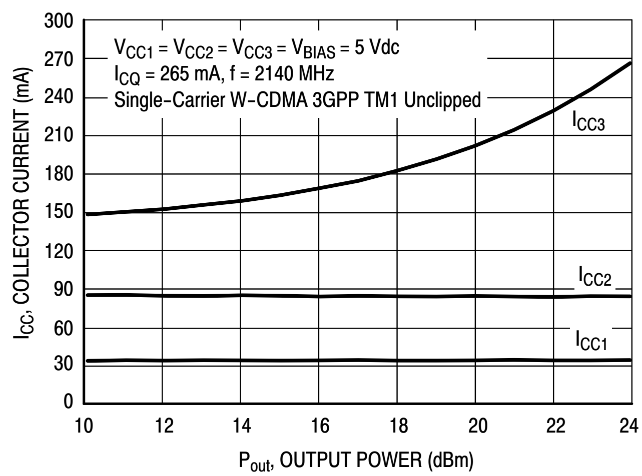


Figure 25. Stage Collector Current versus Output Power

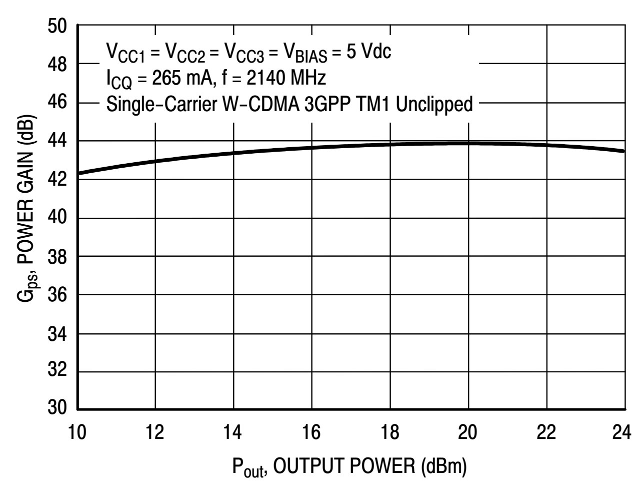


Figure 26. Power Gain versus Output Power

15.1 2110–2170 MHz, I_{CQ} = 265 mA (continued)

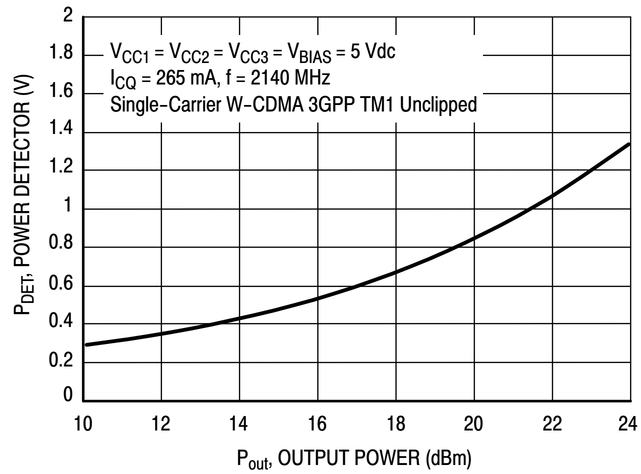


Figure 27. Power Detector versus Output Power

16 PCB pad layout

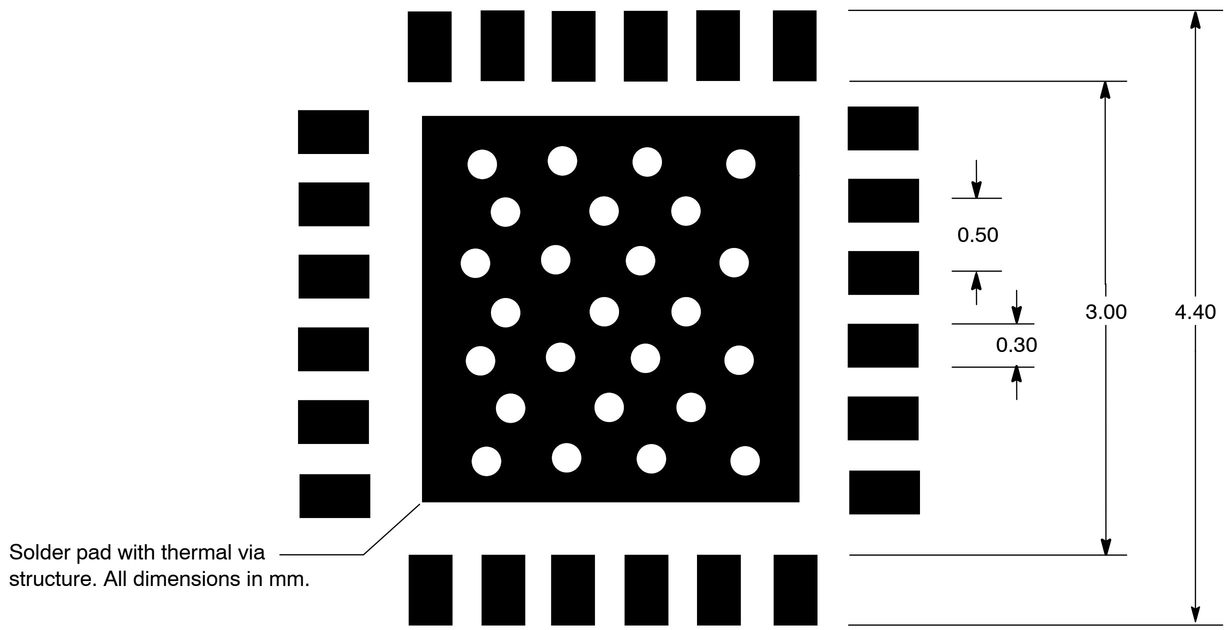


Figure 28. PCB Pad Layout for QFN 4 × 4

17 Product marking

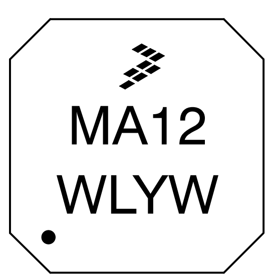
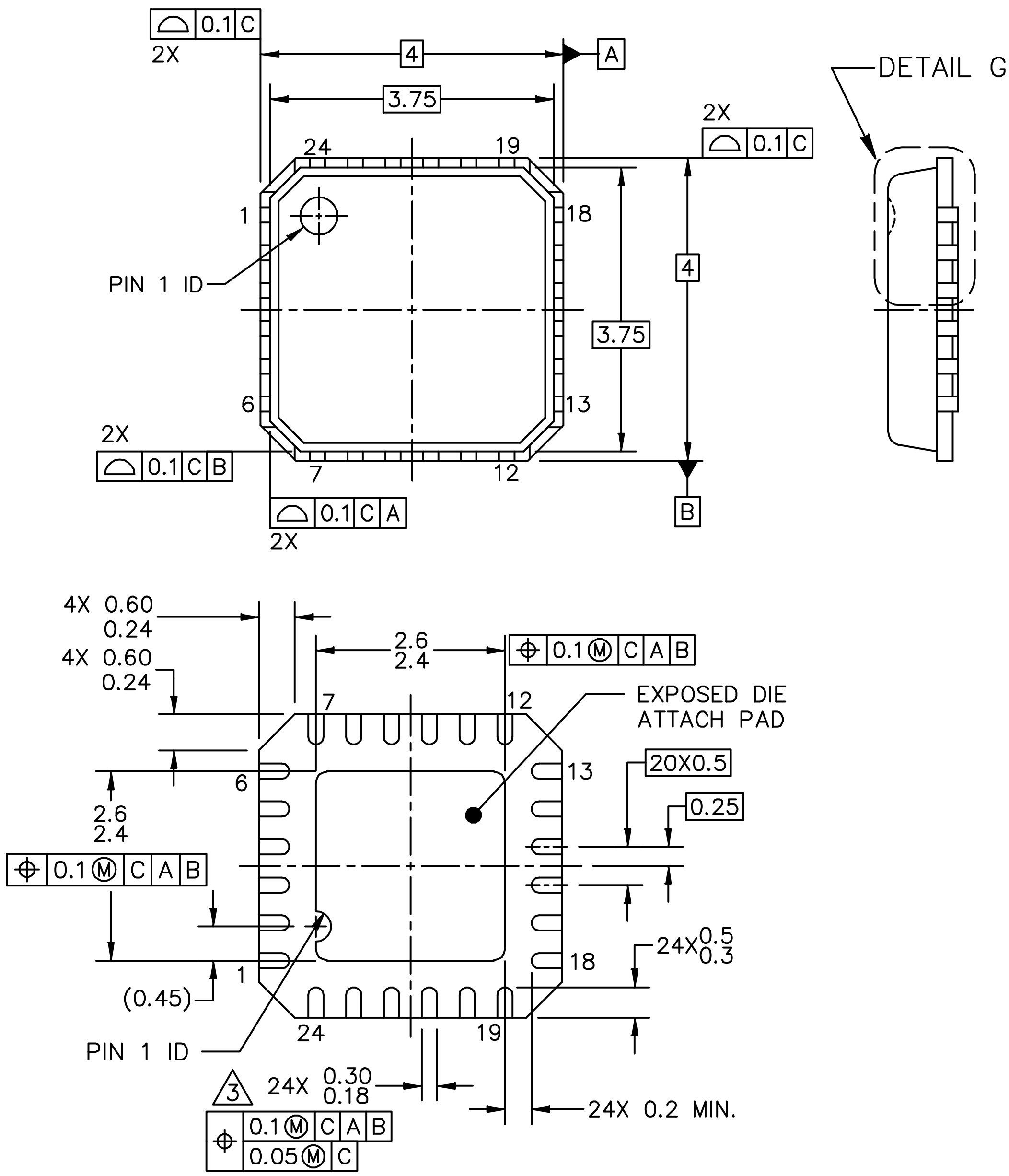


Figure 29. Product Marking

18 Package information



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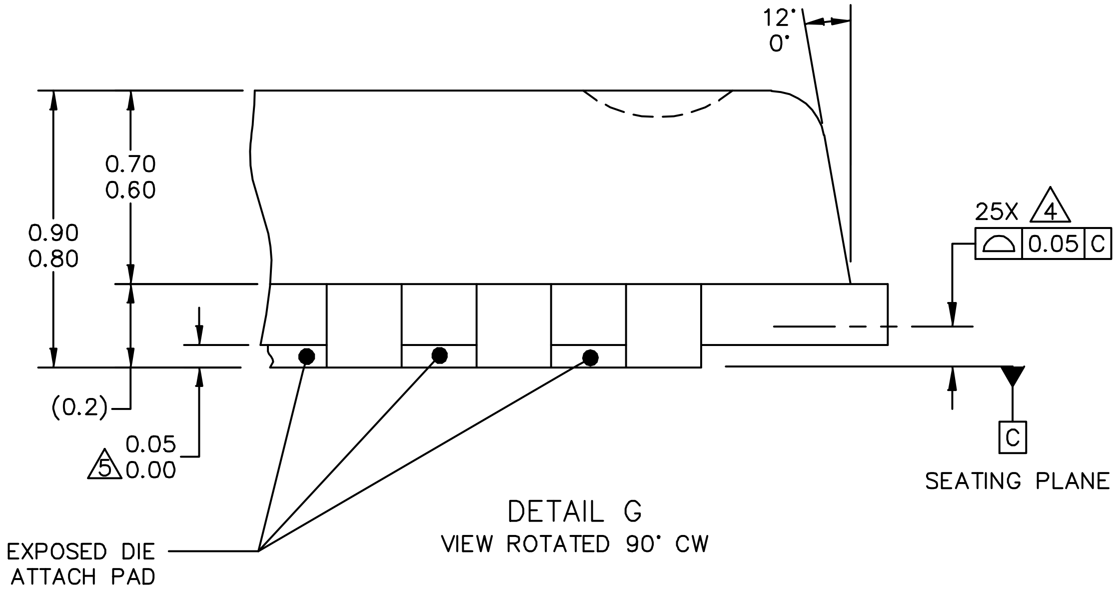
	STANDARD: NON-JEDEC	
	SOT616-7	12 JAN 2016



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TITLE: QFN (PUNCH), THERMALLY ENHANCED 4 X 4 X 0.85, 0.5 PITCH, 24 TERMINAL	DOCUMENT NO: 98ASA00462D	REV: A
	STANDARD: NON-JEDEC	
	SOT616-7	12 JAN 2016

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2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M—1994.
3. (△) THIS DIMENSION APPLIES TO METALIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM TERMINAL TIP.
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	STANDARD: NON-JEDEC	
	SOT616-7	12 JAN 2016

19 Product documentation, software and tools

Refer to the following resources to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Software

- .s2p File

Development Tools

- Printed Circuit Boards

20 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.

21 Revision history

The following table summarizes revisions to this document.

Table 11. Revision History

Document ID	Release date	Description
MMZ25333B Rev. 2	4 April 2024	• Fig. 29, Product Marking: updated to show location of Pin 1 on Product Marking, p. 17 • Package Information: updated to Rev. A, pp. 18–20 • Added Legal Information section, pp. 22–23
MMZ25333B Rev. 1	1 August 2014	• Table 1, Maximum Ratings: updated Junction Temperature from 150°C to 175°C to reflect recent test results of the device, p. 2
MMZ25333B Rev. 0	3 June 2014	• Initial release of product data sheet

Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term ‘short data sheet’ is explained in section “Definitions”.
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL https://www.nxp.com.

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