RF Reference Design Library

RF Power Field-Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

MRF5S21150HR3
MRF5S21150HSR3
UMTS

W-CDMA
2.11-2.17 GHz

Device Characteristics (From Device Data Sheet)

Designed for W-CDMA base station applications with frequencies from 2110 to 2170 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

- Typical 2-carrier W-CDMA Performance: V_{DD} = 28 Volts, I_{DQ} = 1300 mA, P_{out} = 33 Watts Avg., Full Frequency Band, Channel Bandwidth = 3.84 MHz, Peak/Avg. = 8.5 dB @ 0.01% Probability on CCDF.
  Power Gain — 12.5 dB
  Efficiency — 25%
  IM3 @ 10 MHz Offset — -37 dBc @ 3.84 MHz Channel Bandwidth
  ACPR @ 5 MHz Offset — -39 dBc @ 3.84 MHz Channel Bandwidth
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2140 MHz, 125 Watts CW Output Power
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched, Controlled Q, for Ease of Use
- Qualified Up to a Maximum of 32 V_{DD} Operation
- Integrated ESD Protection
- Lower Thermal Resistance Package
- Low Gold Plating Thickness on Leads, 40μ″ Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

Reference Design Characteristics

- Typical W-CDMA Performance for V_{DD} = 28 Volts, I_{DQ} = 1300 mA, Full Frequency Band

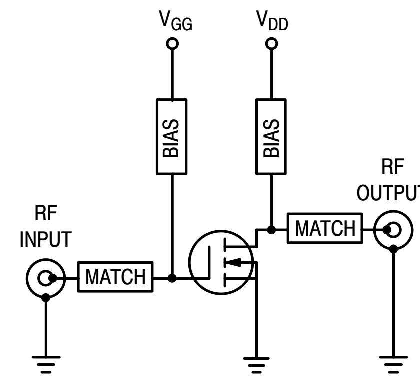


Figure 1. Block Diagram

MRF5S21150H UMTS 2.11-2.17 GHz REFERENCE DESIGN

Designed by: Frédéric Fernez

This reference design is designed to demonstrate the typical RF performance characteristics of the MRF5S21150H when applied for the UMTS 2.11-2.17 GHz frequency band. The reference design is tuned for the best tradeoff between good W-CDMA linearity and good power capability and efficiency. It is biased at V_{DD} = 28 Volts and I_{DQ} = 1300 mA, but data are given to derive the performances under different biasing conditions.

REFERENCE DESIGN LIBRARY TERMS AND CONDITIONS

Freescale is pleased to make this reference design available for your use in development and testing of your own product or products, without charge. The reference design contains easy-to-copy, fully functional amplifier designs. Where possible, it consists of "no tune" distributed element matching circuits designed to be as small as possible, includes temperature compensated bias circuitry, and is designed to be used as "building blocks" for our customers.

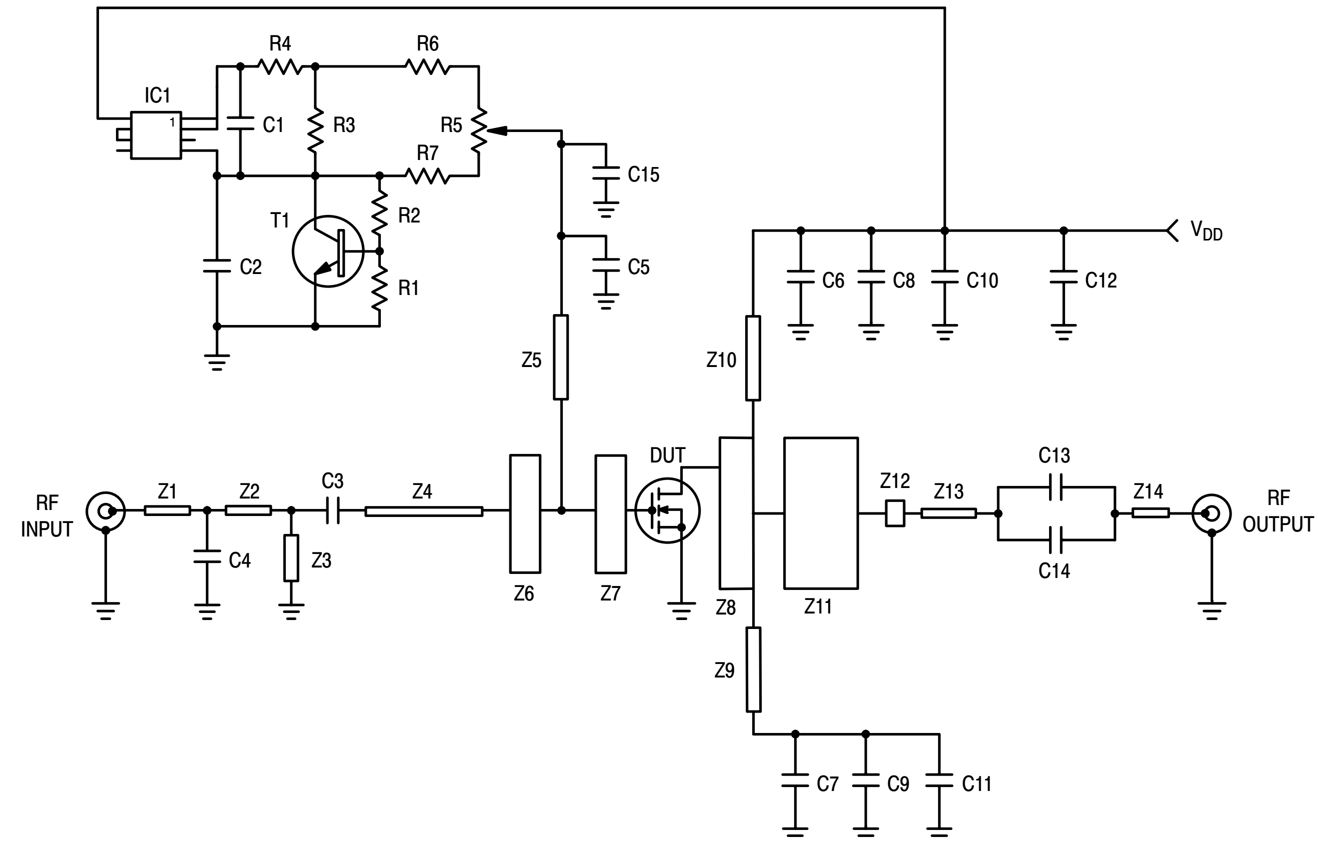
HEATSINKING

When operating this fixture please provide adequate heatsinking for the device. Excessive heating of the device will prevent repeating of the included measurements.

NONLINEAR SIMULATION

To aid the design process and help reduce time to market for our customers, Freescale provides device models for several commercially available harmonic balance simulators. Our model Library is available for all major computer platforms supported by these simulators. For details on the RF model library and supported harmonic balance simulators, go to the following url:

http://www.freescale.com/rf/models

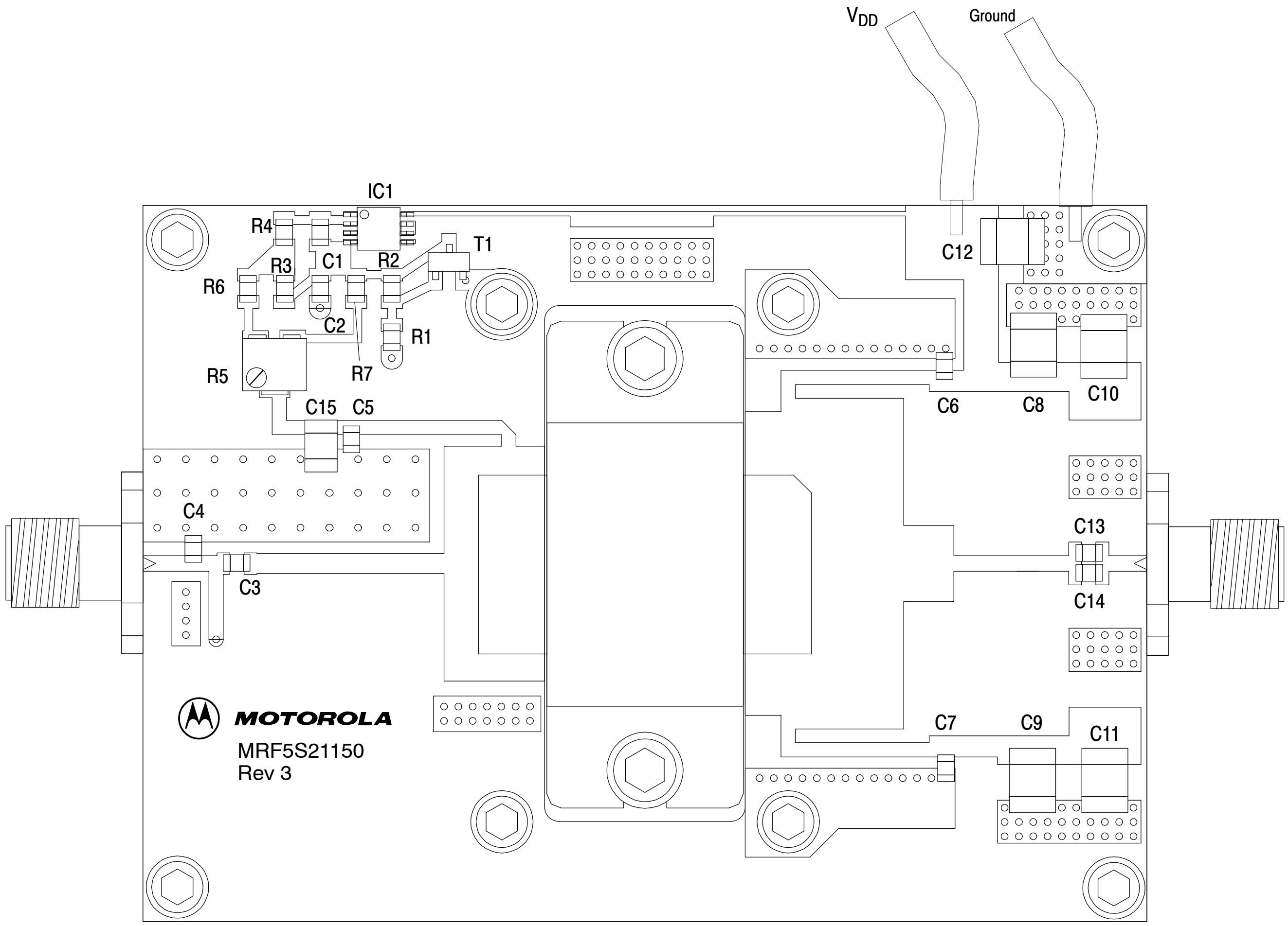


Z1	0.043″ x 0.138″ Microstrip	Z8	0.835″ x 0.134″ Microstrip
Z2	0.043″ x 0.063″ Microstrip	Z9, Z10	0.039″ x 0.512″ Microstrip
Z3	0.039″ x 0.209″ Microstrip	Z11	0.909″ x 0.317″ Microstrip
Z4	0.055″ x 0.514″ Microstrip	Z12	0.209″ x 0.138″ Microstrip
Z5	0.039″ x 0.482″ Microstrip	Z13	0.043″ x 0.315″ Microstrip
Z6	0.646″ x 0.177″ Microstrip	Z14	0.043″ x 0.104″ Microstrip
Z7	0.646″ x 0.098″ Microstrip	PCB	Rogers 4350, 0.020″, ε_r = 3.5

Figure 2. MRF5S21150H UMTS Reference Design Schematic

Table 1. MRF5S21150H UMTS Reference Design Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C2	1 μF Chip Capacitors (0805)	08053G105ZAT	AVX
C3, C5, C6, C7	5.6 pF ACCU-P Chip Capacitors (0805)	08051J5R6CBT	AVX
C4	2.2 pF ACCU-P Chip Capacitor (0805)	08051J2R2BBT	AVX
C8, C9	220 nF Chip Capacitors (1812)	VJ1812Y224KXA	Vishay-Vitramon
C10, C11, C12	2.2 μF Chip Capacitors (1812)	GCM43ER71H225KA02B	Murata
C13, C14	4.7 pF ACCU-P Chip Capacitors (0805)	08051J4R7CBT	AVX
C15	1000 pF, 100B Chip Capacitor	100B102JW	ATC
IC1	Voltage Regulator, Micro-8	LP2951	
R1	2.7 kΩ, 1/8 W Chip Resistor (0805)		
R2	1.5 kΩ, 1/8 W Chip Resistor (0805)		
R3	1 kΩ, 1/8 W Chip Resistor (0805)		
R4	10 Ω, 1/8 W Chip Resistor (0805)		
R5	5 kΩ Potentiometer CMS Cermet Multi-turn	3224W	Bourns
R6, R7	10 kΩ, 1/8 W Chip Resistors (0805)		
T1	Bipolar NPN Transistor SOT-23	BC847	



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 3. MRF5S21150H UMTS Reference Design Component Layout

CHARACTERISTICS

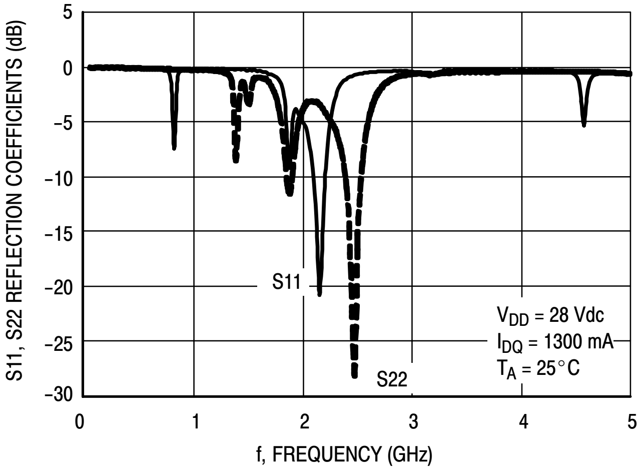


Figure 4. W-CDMA Reference Design Reflection Coefficients Magnitude

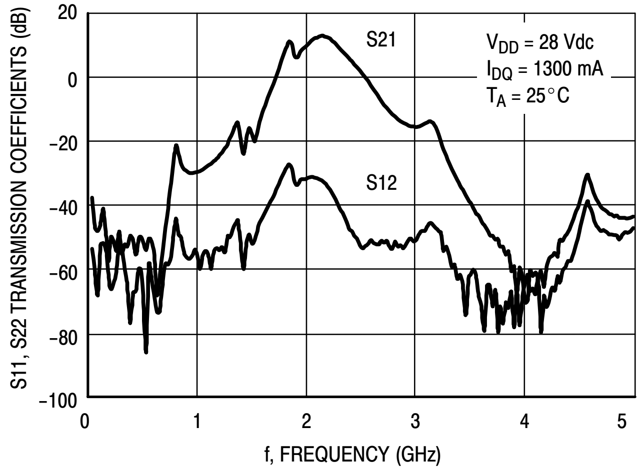


Figure 5. W-CDMA Reference Design Transmission Coefficients Magnitude

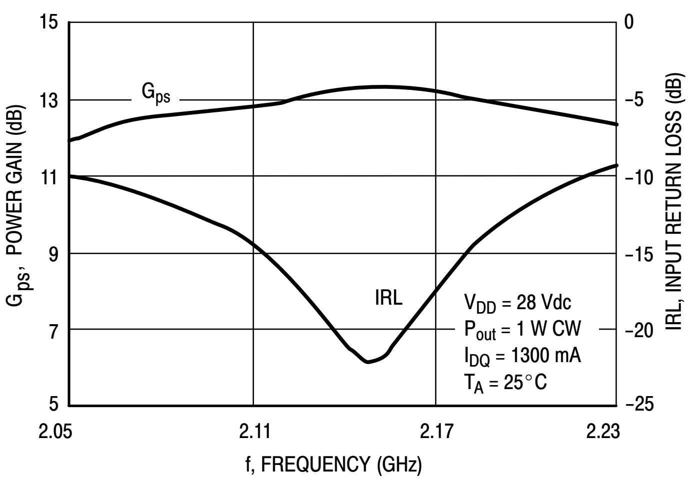


Figure 6. Power Gain and Input Return Loss versus Frequency

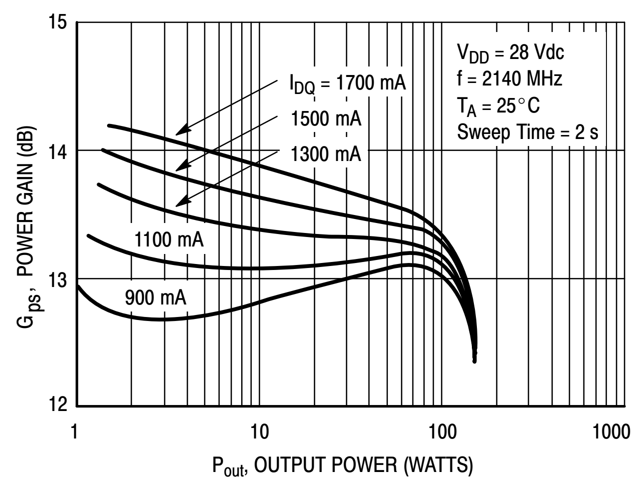


Figure 7. Power Gain versus Output Power

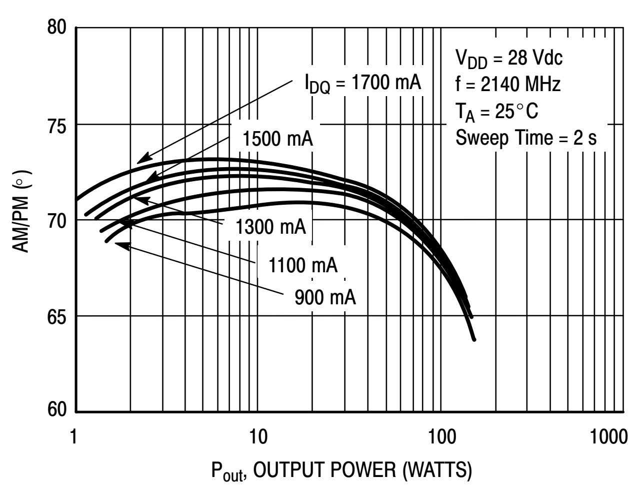


Figure 8. AM/PM Conversion versus Output Power

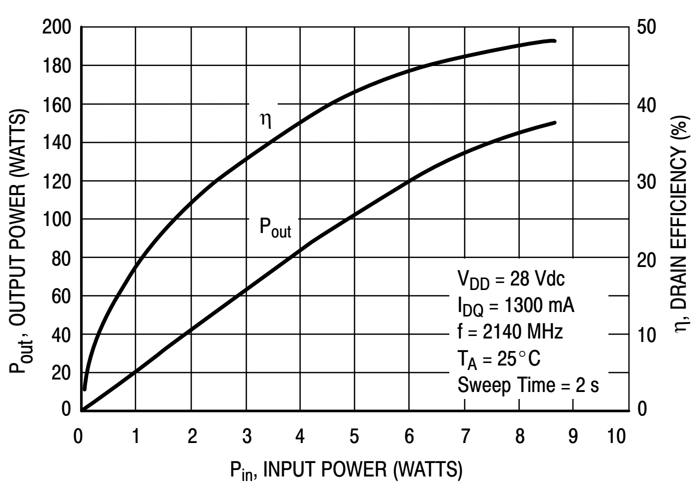


Figure 9. Output Power and Drain Efficiency versus Input Power

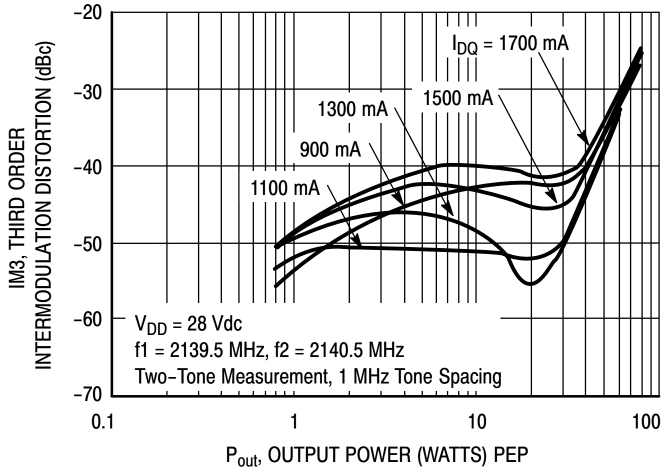


Figure 10. Third Order Intermodulation Distortion versus Output Power

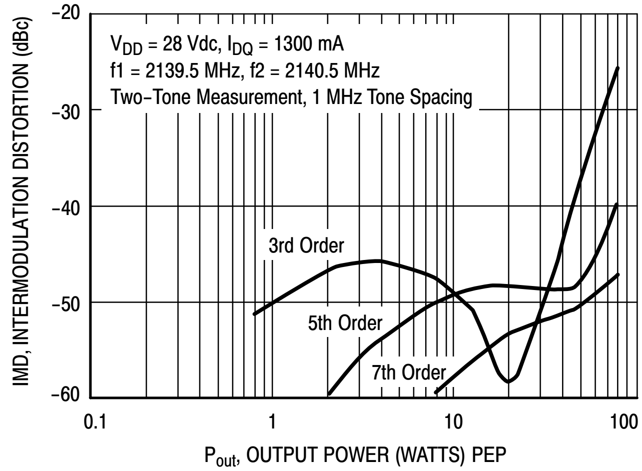


Figure 11. Intermodulation Distortion Products versus Output Power

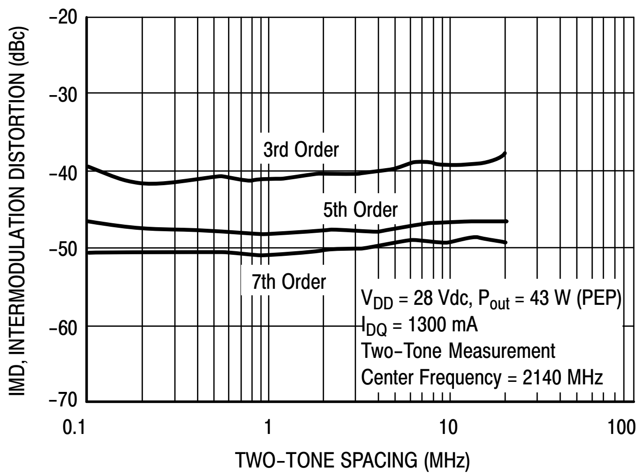


Figure 12. Intermodulation Distortion Products versus Tone Spacing

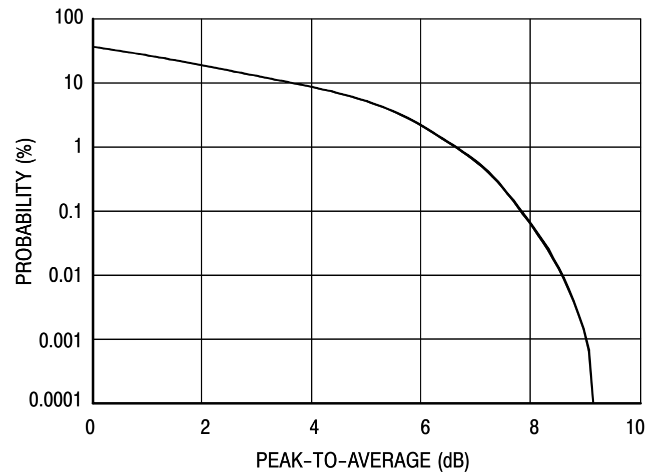


Figure 13. CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 67% Clipping, Single Carrier Test Signal

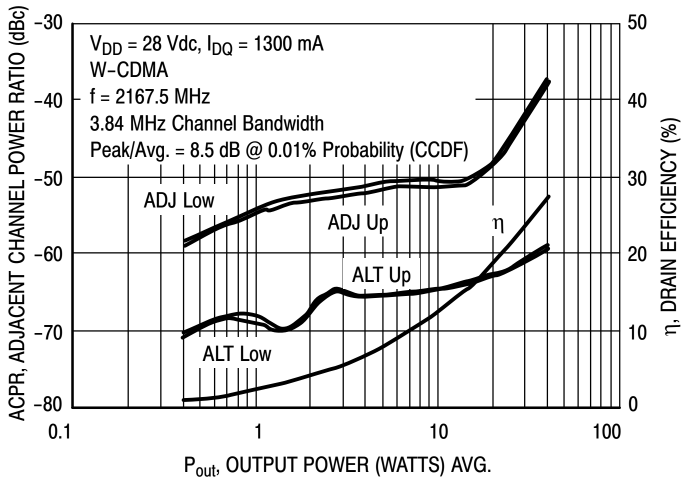


Figure 14. W-CDMA ACPR and Drain Efficiency versus Output Power

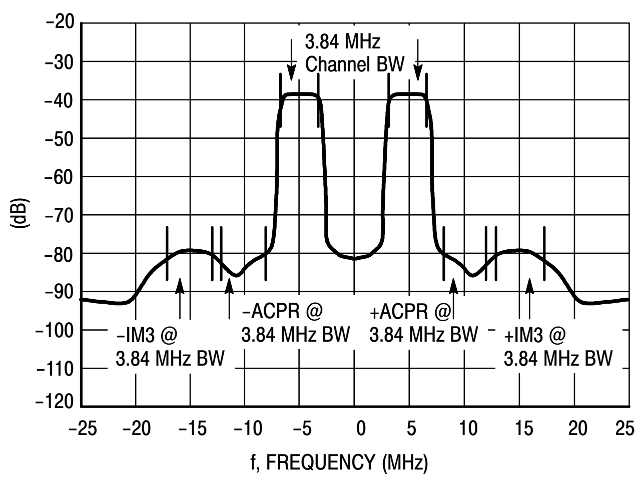


Figure 15. 2-Carrier W-CDMA Spectrum

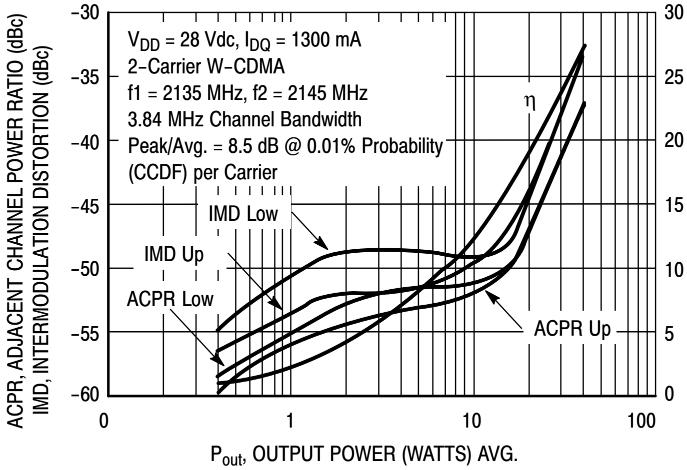


Figure 16. 2-Carrier W-CDMA ACPR, IM3 and Drain Efficiency versus Output Power

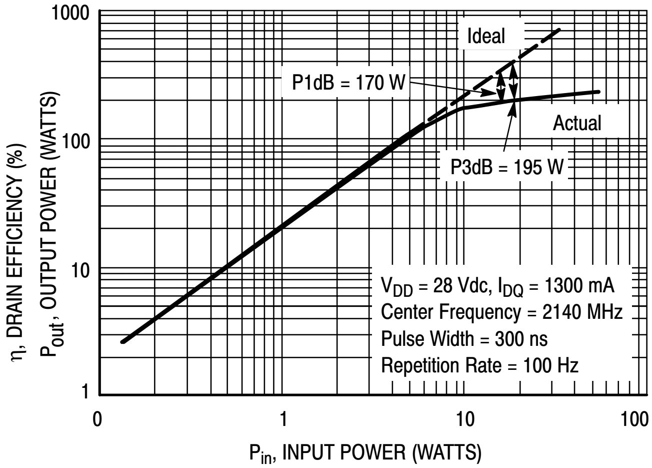


Figure 17. Pulse CW Output Power versus Input Power

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
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