Freescale Semiconductor
Technical Data

Document Number: MRFE6P3300H
Rev. 0, 5/2007

RoHS

RF Power Field Effect Transistor

N-Channel Enhancement-Mode Lateral MOSFET

Designed for broadband commercial and industrial applications with frequencies from 470 to 860 MHz. The high gain and broadband performance of this device make it ideal for large-signal, common-source amplifier applications in 32 volt analog or digital television transmitter equipment.

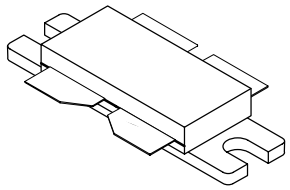
- Typical Narrowband Two-Tone Performance @ 860 MHz: V_{DD} = 32 Volts, I_{DQ} = 1600 mA, P_{out} = 270 Watts PEP
  Power Gain — 20.4 dB
  Drain Efficiency — 44.8%
  IMD — -28.8 dBc
- Capable of Handling 10:1 VSWR, @ 32 Vdc, 860 MHz, 3 dB Overdrive, Designed for Enhanced Ruggedness

Features

- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched for Ease of Use
- Designed for Push-Pull Operation Only
- Qualified Up to a Maximum of 32 V_{DD} Operation
- Integrated ESD Protection
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.
  R5 Suffix = 50 Units per 56 mm, 13 inch Reel.

MRFE6P3300HR3
MRFE6P3300HR5

860 MHz, 300 W, 32 V
LATERAL N-CHANNEL
RF POWER MOSFET



CASE 375G-04, STYLE 1
NI-860C3

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +66	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +12	Vdc
Storage Temperature Range	T_{stg}	-65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature (1,2)	T_J	225	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$		°C/W
Case Temperature 80°C, 300 W CW		0.23	
Case Temperature 82°C, 220 W CW		0.24	
Case Temperature 79°C, 100 W CW		0.27	
Case Temperature 81°C, 60 W CW		0.27	

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at http://www.freescale.com/rf. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.

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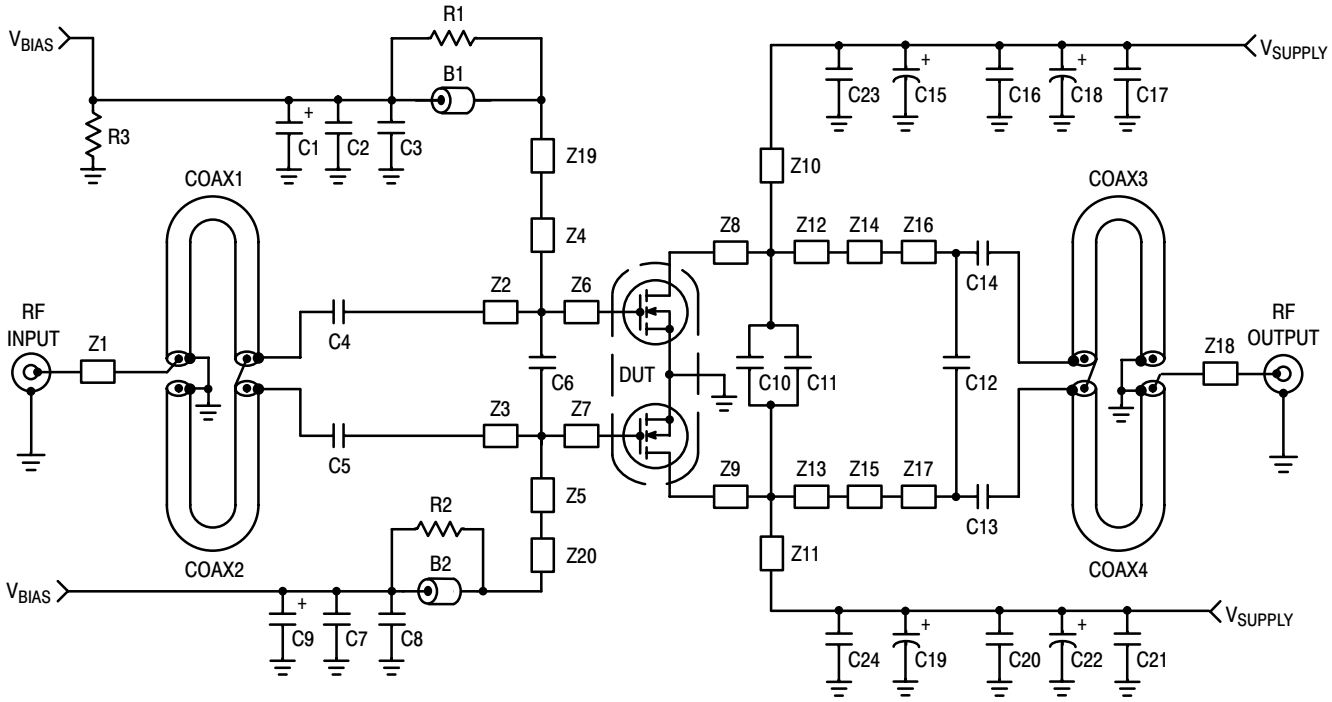
Table 3. ESD Protection Characteristics

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

Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics (1)					
Zero Gate Voltage Drain Leakage Current (4) (V_{DS} = 66 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (4) (V_{DS} = 32 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics (1)					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 350 μAdc)	$V_{GS(th)}$	1	2.2	3	Vdc
Gate Quiescent Voltage (3) (V_{DD} = 32 Vdc, I_D = 1600 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	2	2.8	4	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 2.4 Adc)	$V_{DS(on)}$	—	0.22	0.3	Vdc
Dynamic Characteristics (1,2)					
Reverse Transfer Capacitance (4) (V_{DS} = 32 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	1.22	—	pF
Output Capacitance (4) (V_{DS} = 32 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	217	—	pF
Input Capacitance (1) (V_{DS} = 32 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{iss}	—	106	—	pF
Functional Tests (3) (In Freescale Narrowband Test Fixture, 50 ohm system) V_{DD} = 32 Vdc, I_{DQ} = 1600 mA, P_{out} = 270 W PEP, f1 = 857 MHz, f2 = 863 MHz					
Power Gain	G_{ps}	19	20.4	23	dB
Drain Efficiency	η_D	41	44.8	—	%
Intermodulation Distortion	IMD	—	-28.8	-27	dBc
Input Return Loss	IRL	—	-18.4	-9	dB

1. Each side of the device measured separately.
2. Part internally matched both on input and output.
3. Measurement made with device in push-pull configuration.
4. Drains are tied together internally as this is a total device value.



Z1, Z18	0.401″ x 0.081″ Microstrip	Z12, Z13	0.225″ x 0.507″ Microstrip
Z2, Z3	0.563″ x 0.101″ Microstrip	Z14, Z15	0.440″ x 0.435″ Microstrip
Z4, Z5	1.013″ x 0.058″ Microstrip	Z16, Z17	0.123″ x 0.215″ Microstrip
Z6, Z7	0.416″ x 0.727″ Microstrip	Z19, Z20	0.165″ x 0.339″ Microstrip
Z8, Z9	0.191″ x 0.507″ Microstrip	PCB	Arlon GX-0300-55-22, 0.030″, ε_r = 2.5
Z10, Z11	1.054″ x 0.150″ Microstrip		

Figure 1. 820-900 MHz Narrowband Test Circuit Schematic

Table 5. 820-900 MHz Narrowband Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
B1, B2	Ferrite Beads, Short	2743019447	Fair-Rite
C1, C9	1.0 μF, 50 V Tantulum Chip Capacitors	T491C105K050AT	Kemet
C2, C7, C17, C21	0.1 μF, 50 V Chip Capacitors	CDR33BX104AKYS	Kemet
C3, C8, C16, C20	1000 pF Chip Capacitors	ATC100B102JT50XT	ATC
C4, C5, C13, C14	100 pF Chip Capacitors	ATC100B101JT500XT	ATC
C6, C12	8.2 pF Chip Capacitors	ATC100B8R2JT500XT	ATC
C10	9.1 pF Chip Capacitor	ATC100B9R1BT500XT	ATC
C11	1.8 pF Chip Capacitor	ATC100B1R8BT500XT	ATC
C15, C19	47 μF, 50 V Electrolytic Capacitors	EMVY500ADA470MF80G	Nippon
C18, C22	470 μF, 63 V Electrolytic Capacitors	ESME630ELL471MK255	United Chemi-Con
C23, C24	22 pF Chip Capacitors	ATC100B220FT500XT	ATC
Coax1, 2, 3, 4	50 Ω, Semi Rigid Coax, 2.06″ Long	UT-141A-TP	Micro-Coax
R1, R2	10 Ω, 1/4 W Chip Resistors	CRCW120610R0FKTA	Vishay
R3	1 kΩ, 1/4 W Chip Resistor	CRCW12061001FKTA	Vishay

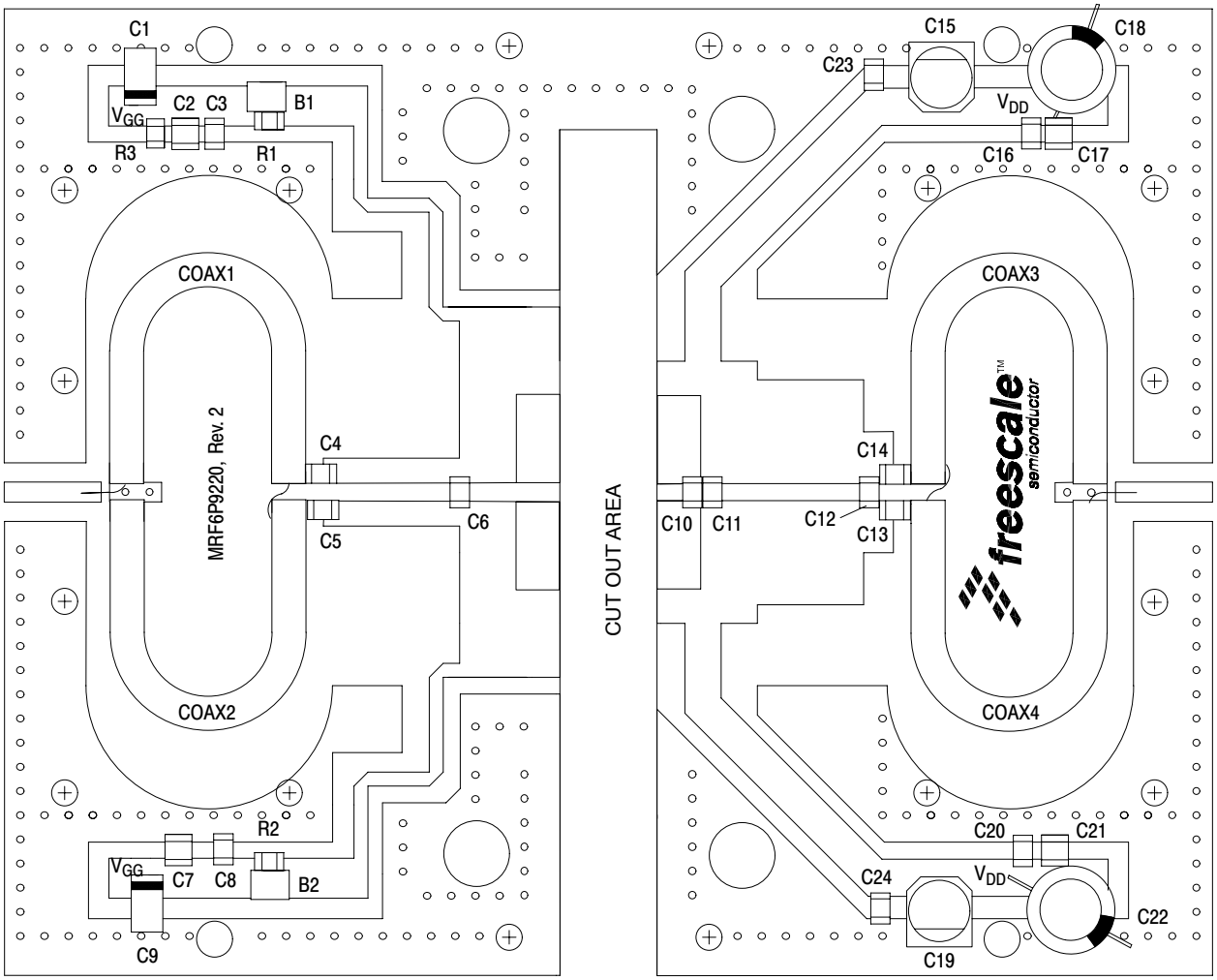


Figure 2. 820-900 MHz Narrowband Test Circuit Component Layout

TYPICAL NARROWBAND CHARACTERISTICS

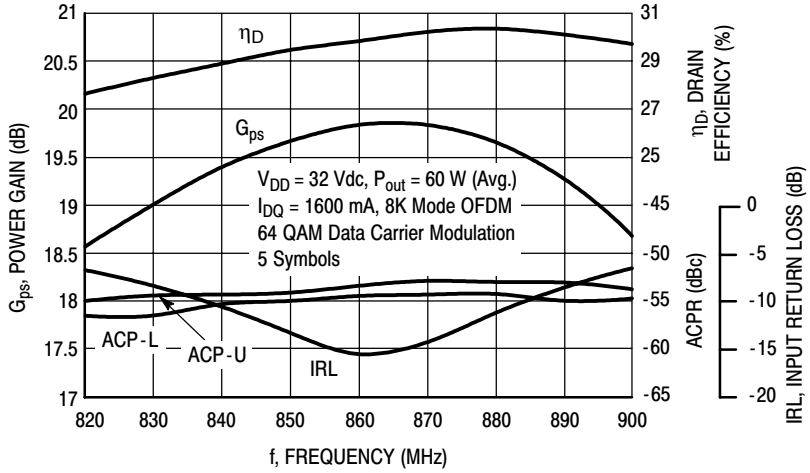


Figure 3. Single-Carrier OFDM Broadband Performance @ 60 Watts Avg.

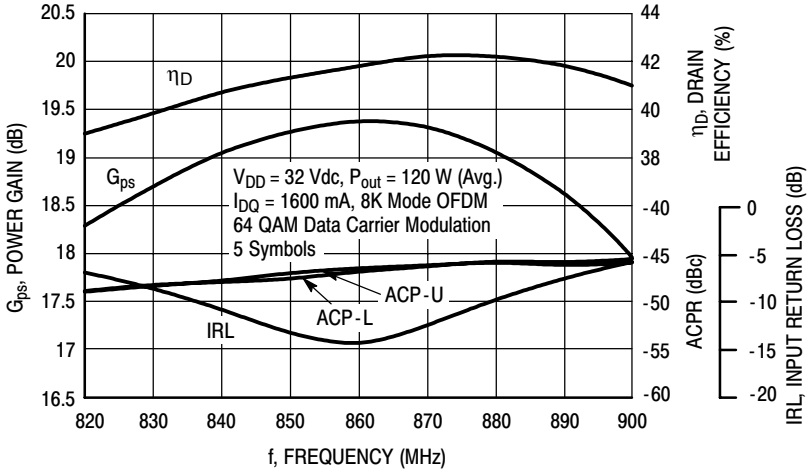


Figure 4. Single-Carrier OFDM Broadband Performance @ 120 Watts Avg.

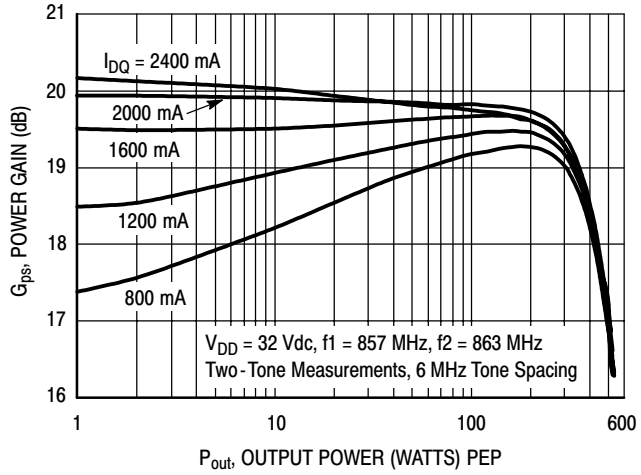


Figure 5. Two-Tone Power Gain versus Output Power

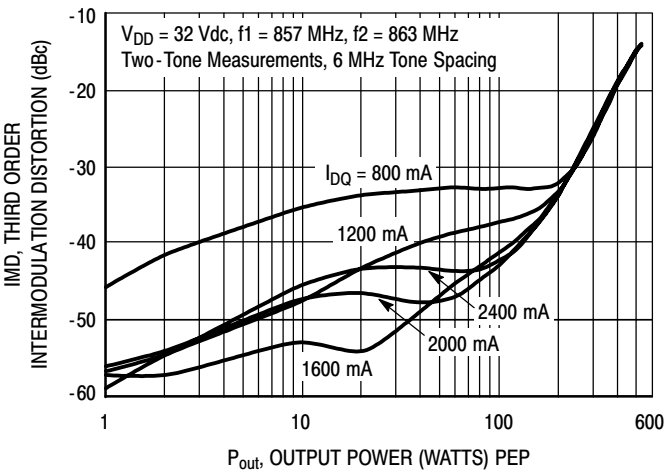


Figure 6. Third Order Intermodulation Distortion versus Output Power

TYPICAL NARROWBAND CHARACTERISTICS

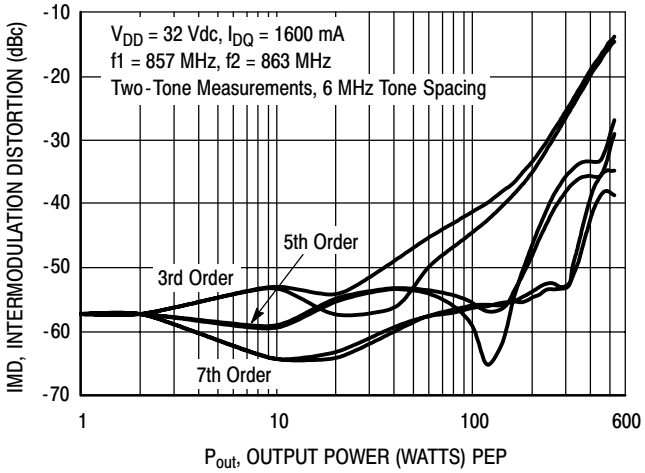


Figure 7. Intermodulation Distortion Products versus Output Power

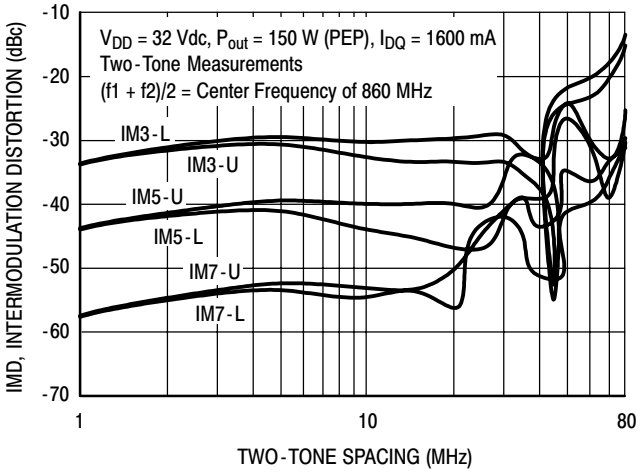


Figure 8. Intermodulation Distortion Products versus Tone Spacing

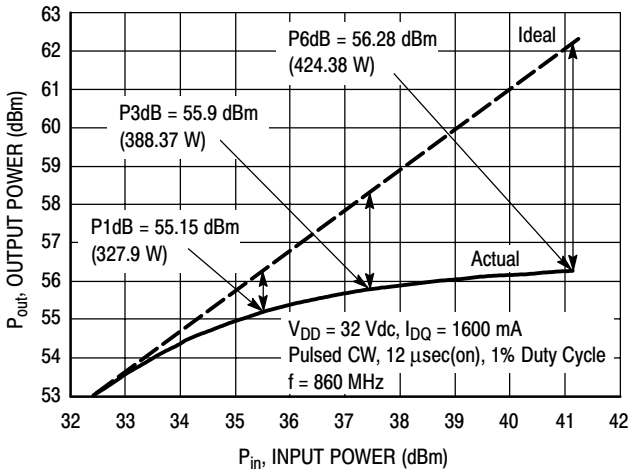


Figure 9. Pulsed CW Output Power versus Input Power

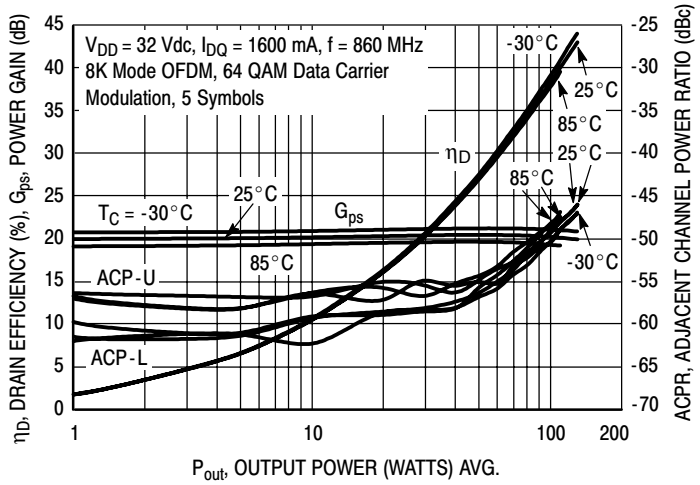


Figure 10. Single-Carrier DVBT OFDM ACPR, Power Gain and Drain Efficiency versus Output Power

TYPICAL NARROWBAND CHARACTERISTICS

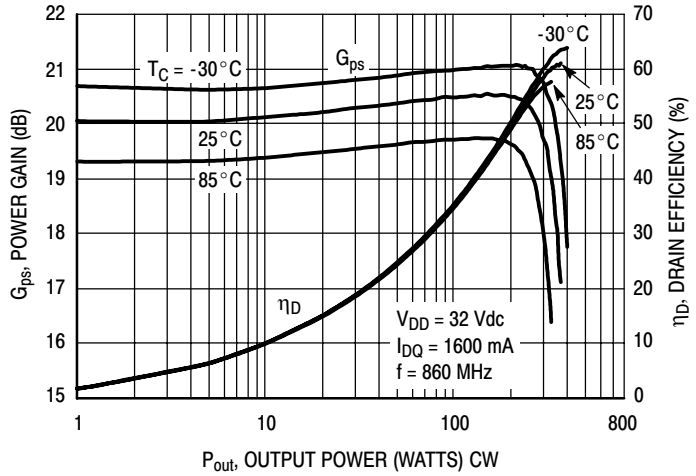


Figure 11. Power Gain and Drain Efficiency versus CW Output Power

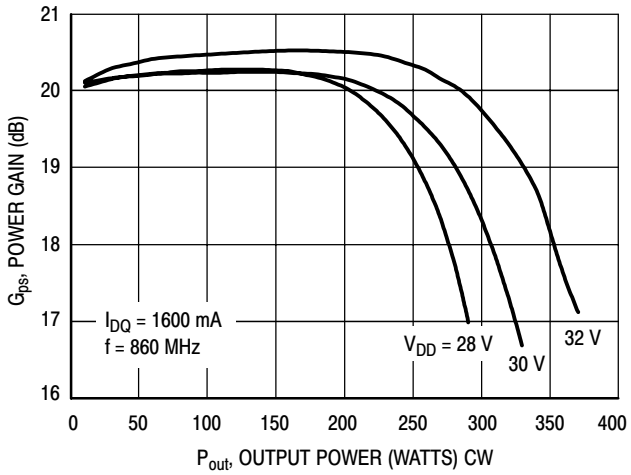
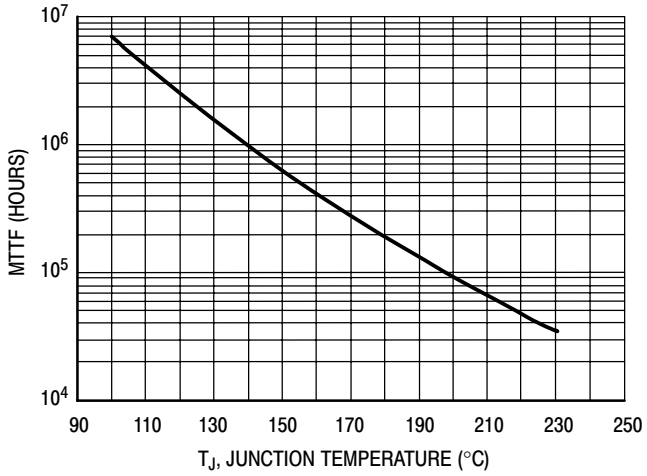


Figure 12. Power Gain versus Output Power



This above graph displays calculated MTTF in hours when the device is operated at V_{DD} = 32 Vdc, P_{out} = 270 W PEP, and η_D = 44.8%.

MTTF calculator available at http:/www.freescale.com/rf. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product.

Figure 13. MTTF versus Junction Temperature

DIGITAL TEST SIGNALS

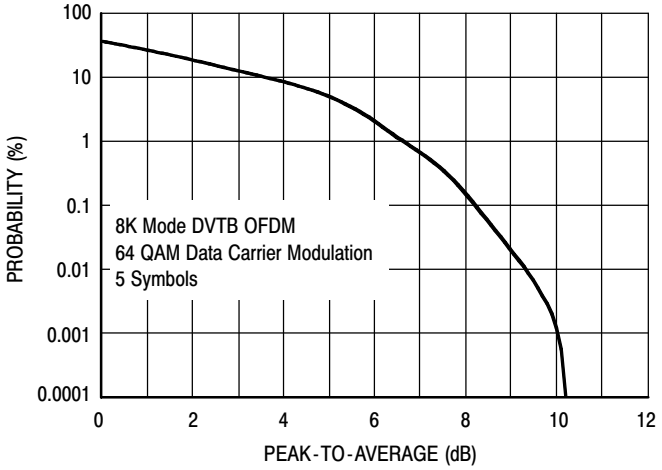


Figure 14. Single-Carrier DVTB OFDM

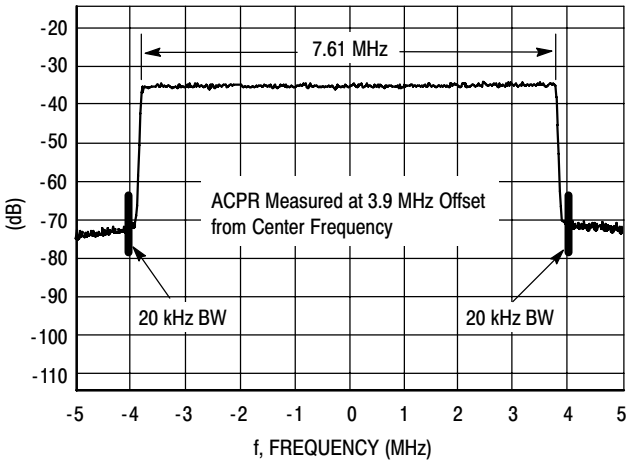
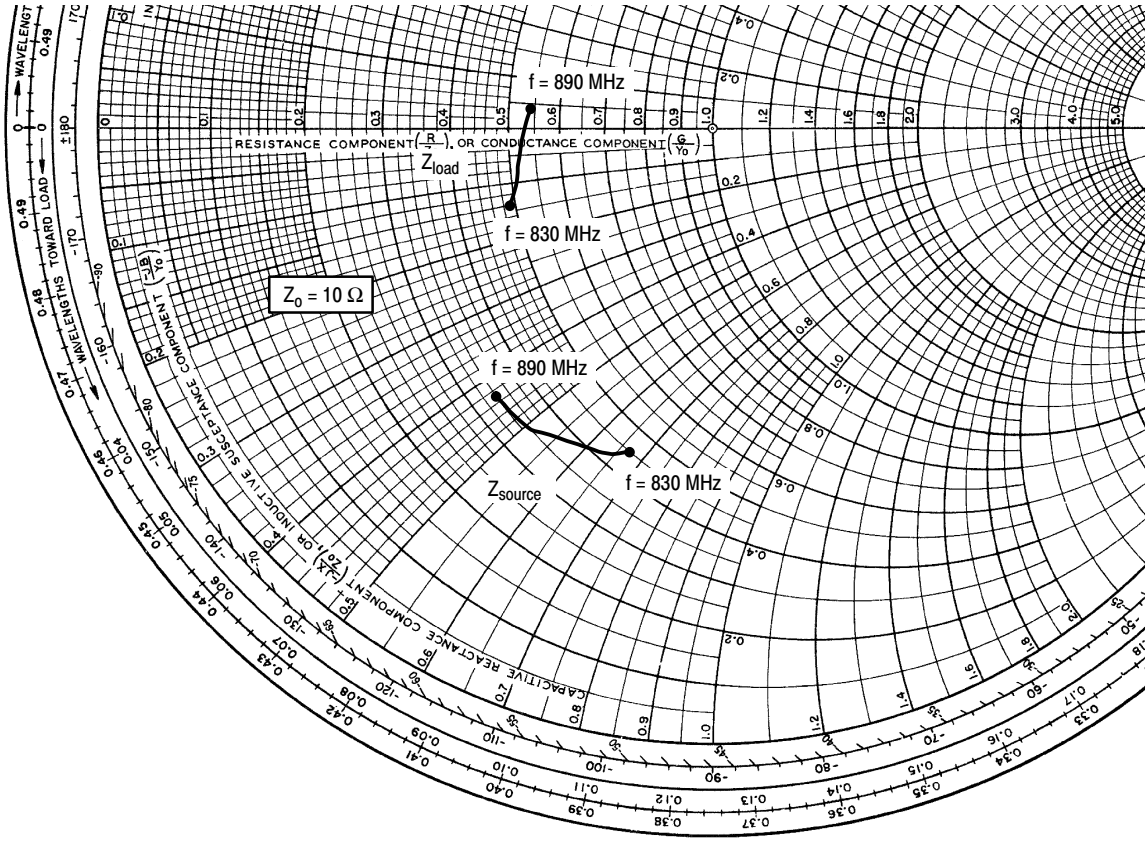


Figure 15. 8K Mode DVBT OFDM Spectrum



V_{DD} = 32 Vdc, I_{DQ} = 1600 mA, P_{out} = 270 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
830	4.52 - j6.73	4.89 - j1.35
845	4.22 - j6.38	5.06 - j1.01
860	3.89 - j5.81	5.18 - j0.58
875	3.54 - j5.10	5.27 - j0.11
890	3.39 - j4.32	5.36 + j0.43

Z_{source} = Test circuit impedance as measured from gate to gate, balanced configuration.

Z_{load} = Test circuit impedance as measured from drain to drain, balanced configuration.

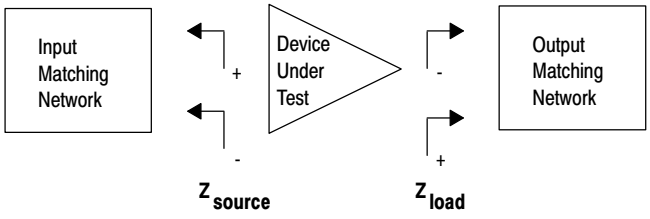
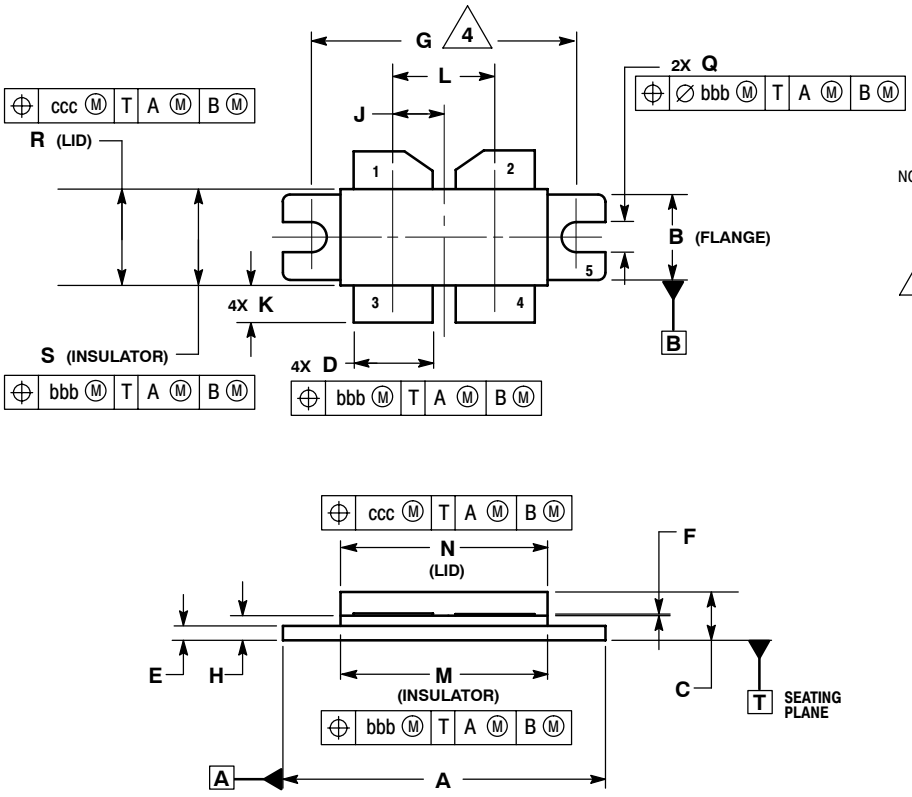


Figure 16. 820-900 MHz Narrowband Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS



NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DIMENSION H TO BE MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. RECOMMENDED BOLT CENTER DIMENSION OF 1.140 (28.96) BASED ON 3M SCREW.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.180	0.224	4.57	5.69
D	0.325	0.335	8.26	8.51
E	0.060	0.070	1.52	1.78
F	0.004	0.006	0.10	0.15
G	1.100 BSC		27.94 BSC	
H	0.097	0.107	2.46	2.72
J	0.2125 BSC		5.397 BSC	
K	0.135	0.165	3.43	4.19
L	0.425 BSC		10.8 BSC	
M	0.852	0.868	21.64	22.05
N	0.851	0.869	21.62	22.07
Q	0.118	0.138	3.00	3.30
R	0.395	0.405	10.03	10.29
S	0.394	0.406	10.01	10.31
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. GATE
5. SOURCE

CASE 375G-04
ISSUE G
NI-860C3

PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	May 2007	• Initial Release of Data Sheet

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射 频 和 天 线 设 计 培 训 课 程 推 荐

易迪拓培训(www.edatop.com)由数名来自于研发第一线的资深工程师发起成立，致力并专注于微波、射频、天线设计研发人才的培养；我们于 2006 年整合合并微波 EDA 网(www.mweda.com)，现已发展成为国内最大的微波射频和天线设计人才培养基地，成功推出多套微波射频以及天线设计经典培训课程和 ADS、HFSS 等专业软件使用培训课程，广受客户好评；并先后与人民邮电出版社、电子工业出版社合作出版了多本专业图书，帮助数万名工程师提升了专业技术能力。客户遍布中兴通讯、研通高频、埃威航电、国人通信等多家国内知名公司，以及台湾工业技术研究院、永业科技、全一电子等多家台湾地区企业。

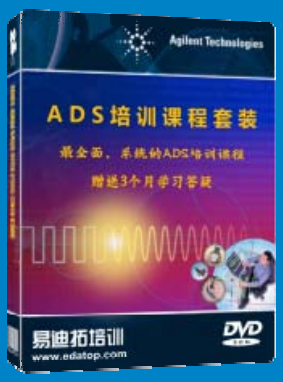
易迪拓培训课程列表：http://www.edatop.com/peixun/rfe/129.html

射频工程师养成培训课程套装

该套装精选了射频专业基础培训课程、射频仿真设计培训课程和射频电路测量培训课程三个类别共 30 门视频培训课程和 3 本图书教材；旨在引领学员全面学习一个射频工程师需要熟悉、理解和掌握的专业知识和研发设计能力。通过套装的学习，能够让学员完全达到和胜任一个合格的射频工程师的要求…

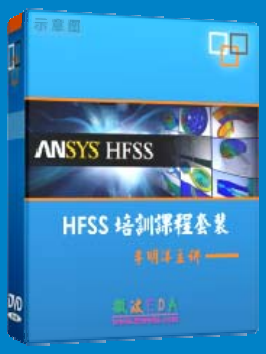
课程网址：http://www.edatop.com/peixun/rfe/110.html

ADS 学习培训课程套装



该套装是迄今国内最全面、最权威的 ADS 培训教程，共包含 10 门 ADS 学习培训课程。课程是由具有多年 ADS 使用经验的微波射频与通信系统设计领域资深专家讲解，并多结合设计实例，由浅入深、详细而又全面地讲解了 ADS 在微波射频电路设计、通信系统设计和电磁仿真设计方面的内容。能让您在最短的时间内学会使用 ADS，迅速提升个人技术能力，把 ADS 真正应用到实际研发工作中去，成为 ADS 设计专家...

课程网址： http://www.edatop.com/peixun/ads/13.html



HFSS 学习培训课程套装

该套课程套装包含了本站全部 HFSS 培训课程，是迄今国内最全面、最专业的 HFSS 培训教程套装，可以帮助您从零开始，全面深入学习 HFSS 的各项功能和在多个方面的工程应用。购买套装，更可超值赠送 3 个月免费学习答疑，随时解答您学习过程中遇到的棘手问题，让您的 HFSS 学习更加轻松顺畅…

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CST 学习培训课程套装

该培训套装由易迪拓培训联合微波 EDA 网共同推出，是最全面、系统、专业的 CST 微波工作室培训课程套装，所有课程都由经验丰富的专家授课，视频教学，可以帮助您从零开始，全面系统地学习 CST 微波工作的各项功能及其在微波射频、天线设计等领域的设计应用。且购买该套装，还可超值赠送 3 个月免费学习答疑…

课程网址：http://www.edatop.com/peixun/cst/24.html

HFSS 天线设计培训课程套装

套装包含 6 门视频课程和 1 本图书，课程从基础讲起，内容由浅入深，理论介绍和实际操作讲解相结合，全面系统的讲解了 HFSS 天线设计的全过程。是国内最全面、最专业的 HFSS 天线设计课程，可以帮助您快速学习掌握如何使用 HFSS 设计天线，让天线设计不再难…

课程网址：http://www.edatop.com/peixun/hfss/122.html

13.56MHz NFC/RFID 线圈天线设计培训课程套装

套装包含 4 门视频培训课程，培训将 13.56MHz 线圈天线设计原理和仿真设计实践相结合，全面系统地讲解了 13.56MHz 线圈天线的工作原理、设计方法、设计考量以及使用 HFSS 和 CST 仿真分析线圈天线的具体操作，同时还介绍了 13.56MHz 线圈天线匹配电路的设计和调试。通过该套课程的学习，可以帮助您快速学习掌握 13.56MHz 线圈天线及其匹配电路的原理、设计和调试…

详情浏览：http://www.edatop.com/peixun/antenna/116.html

我们的课程优势：

※ 成立于 2004 年，10 多年丰富的行业经验，

※ 一直致力并专注于微波射频和天线设计工程师的培养，更了解该行业对人才的要求

※ 经验丰富的一线资深工程师讲授，结合实际工程案例，直观、实用、易学

联系我们：

※ 易迪拓培训官网：http://www.edatop.com

※ 微波 EDA 网：http://www.mweda.com

※ 官方淘宝店：http://shop36920890.taobao.com