Freescale Semiconductor
Technical Data

Document Number: MMRF1317H
Rev. 0, 3/2016

RoHS

RF Power LDMOS Transistors

High Ruggedness N-Channel Enhancement-Mode Lateral MOSFETs

These 1300 W RF power transistors are designed for applications operating at frequencies between 1020 and 1100 MHz. These devices are suitable for use in defense and commercial pulse applications, such as IFF and secondary surveillance radars.

Typical Performance: In 1030, 1090 MHz reference circuit, V_{DD} = 50 Vdc, $I_{DQ(A+B)}$ = 100 mA

Frequency (MHz)	Signal Type	P_{out} (W)	G_{ps} (dB)	η_D (%)
1030 (1)	Pulse (128 μsec, 10% Duty Cycle)	1300 Peak	18.9	56.0
1090 (1)		1100 Peak	18.8	57.9

Typical Narrowband Performance: V_{DD} = 50 Vdc, $I_{DQ(A+B)}$ = 100 mA

Frequency (MHz)	Signal Type	P_{out} (W)	G_{ps} (dB)	η_D (%)
1030 (2)	Pulse (128 μsec, 10% Duty Cycle)	1300 Peak	18.2	58.1

Load Mismatch/Ruggedness

Frequency (MHz)	Signal Type	VSWR	Pin (W)	Test Voltage	Result
1030 (2)	Pulse (128 μsec, 10% Duty Cycle)	> 10:1 at all Phase Angles	40 (3 dB Overdrive)	50	No Device Degradation

1. Measured in 1030, 1090 MHz reference circuit.
2. Measured in 1030 MHz narrowband test circuit.

Features

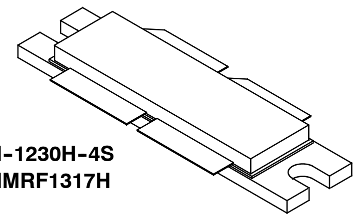
- Internally input and output matched for broadband operation and ease of use
- Device can be used single-ended, push-pull, or in a quadrature configuration
- High ruggedness, handles > 10:1 VSWR
- Integrated ESD protection with greater negative voltage range for improved Class C operation and gate voltage pulsing
- Characterized with series equivalent large-signal impedance parameters

Applications

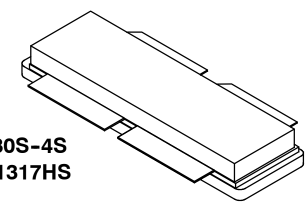
- Ground-based secondary surveillance radars
- IFF transponders

MMRF1317H
MMRF1317HS

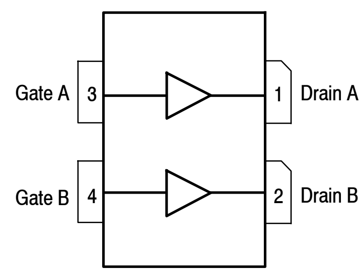
1030–1090 MHz, 1300 W PEAK, 50 V RF POWER LDMOS TRANSISTORS



NI-1230H-4S
MMRF1317H



NI-1230S-4S
MMRF1317HS



(Top View)

Note: The backside of the package is the source terminal for the transistor.

Figure 1. Pin Connections

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	–0.5, +105	Vdc
Gate-Source Voltage	V_{GS}	–6.0, +10	Vdc
Storage Temperature Range	T_{stg}	–65 to +150	°C
Case Operating Temperature Range	T_C	–55 to +150	°C
Operating Junction Temperature Range (1)	T_J	–55 to +225	°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	869 4.35	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2)	Unit
Thermal Impedance, Junction to Case Pulse: Case Temperature 70°C, 1300 W Peak, 128 μsec Pulse Width, 10% Duty Cycle, 50 Vdc, $I_{DQ(A+B)}$ = 100 mA, 1030 MHz	$Z_{\theta JC}$	0.019	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	2, passes 2500 V
Machine Model (per EIA/JESD22-A115)	B, passes 250 V
Charge Device Model (per JESD22-C101)	IV, passes 2000 V

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

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics (3)					
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
Drain-Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 10 μAdc)	$V_{(BR)DSS}$	105	—	—	Vdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 50 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 105 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
On Characteristics					
Gate Threshold Voltage (3) (V_{DS} = 10 Vdc, I_D = 520 μAdc)	$V_{GS(th)}$	1.3	1.7	2.3	Vdc
Gate Quiescent Voltage (4) (V_{DD} = 50 Vdc, $I_{D(A+B)}$ = 100 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	1.5	2.0	2.5	Vdc
Drain-Source On-Voltage (3) (V_{GS} = 10 Vdc, I_D = 2.6 Adc)	$V_{DS(on)}$	0.1	0.3	0.5	Vdc
Dynamic Characteristics (3)					
Reverse Transfer Capacitance (V_{DS} = 50 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	2.43	—	pF

1. Continuous use at maximum temperature will affect MTTF.
2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.nxp.com/RF and search for AN1955.
3. Each side of device measured separately.
4. Measurement made with device in push-pull configuration.

(continued)

Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests [1] (In Freescale Test Fixture, 50 ohm system) V_{DD} = 50 Vdc, $I_{DQ(A+B)}$ = 100 mA, P_{out} = 1300 W Peak (130 W Avg.), f = 1030 MHz, 128 μsec Pulse Width, 10% Duty Cycle					
Power Gain	G_{ps}	17.4	18.2	19.1	dB
Drain Efficiency	η_D	55.0	58.1	—	%
Input Return Loss	IRL	—	–12	–9	dB

Load Mismatch/Ruggedness (In Freescale Test Fixture, 50 ohm system) $I_{DQ(A+B)}$ = 100 mA

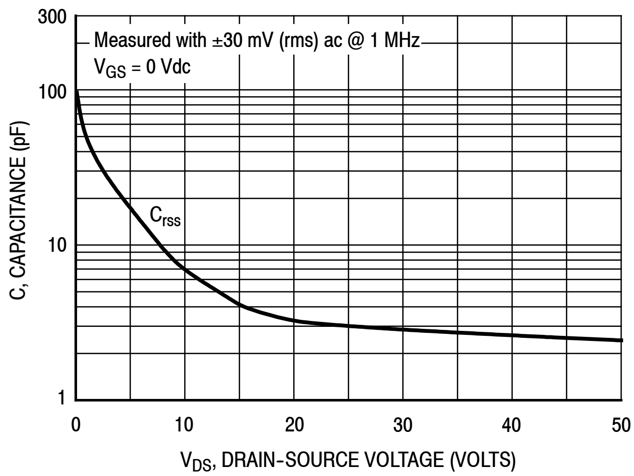
Frequency (MHz)	Signal Type	VSWR	P_{in} (W)	Test Voltage, V_{DD}	Result
1030	Pulse (128 μsec, 10% Duty Cycle)	> 10:1 at all Phase Angles	40 (3 dB Overdrive)	50	No Device Degradation

Table 5. Ordering Information

Device	Tape and Reel Information	Package
MMRF1317HR5	R5 Suffix = 50 Units, 56 mm Tape Width, 13-inch Reel	NI-1230H-4S, Eared
MMRF1317HSR5		NI-1230S-4S, Earless

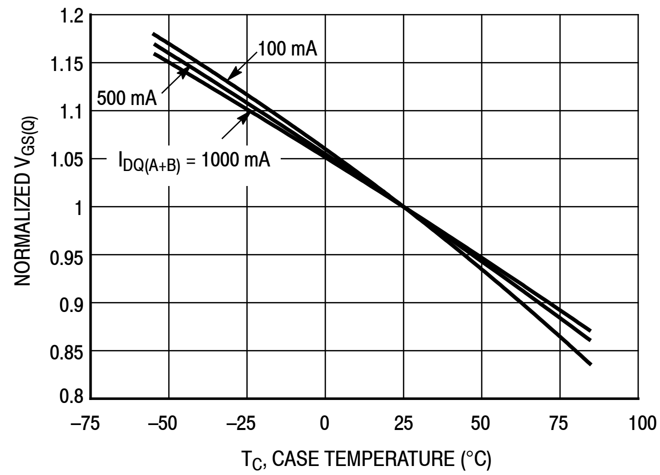
1. Measurement made with device in push-pull configuration.

TYPICAL CHARACTERISTICS



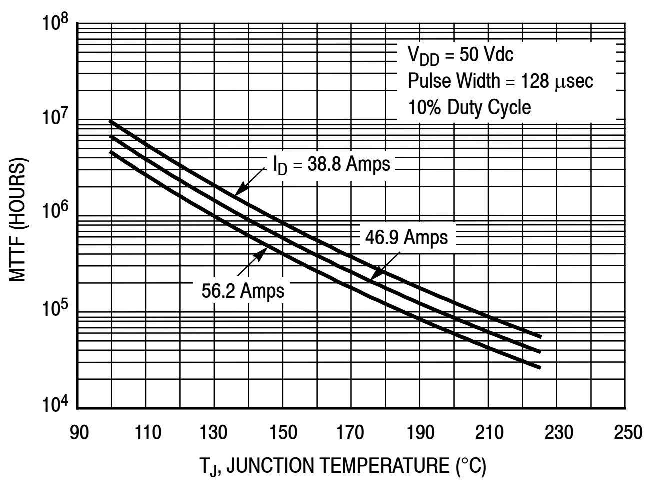
Note: Each side of device measured separately.

Figure 2. Capacitance versus Drain-Source Voltage



I_{DQ} (mA)	Slope (mV/°C)
100	–2.46
500	–2.21
1000	–2.07

Figure 3. Normalized V_{GS} versus Quiescent Current and Case Temperature



Note: MTTF value represents the total cumulative operating time under indicated test conditions.

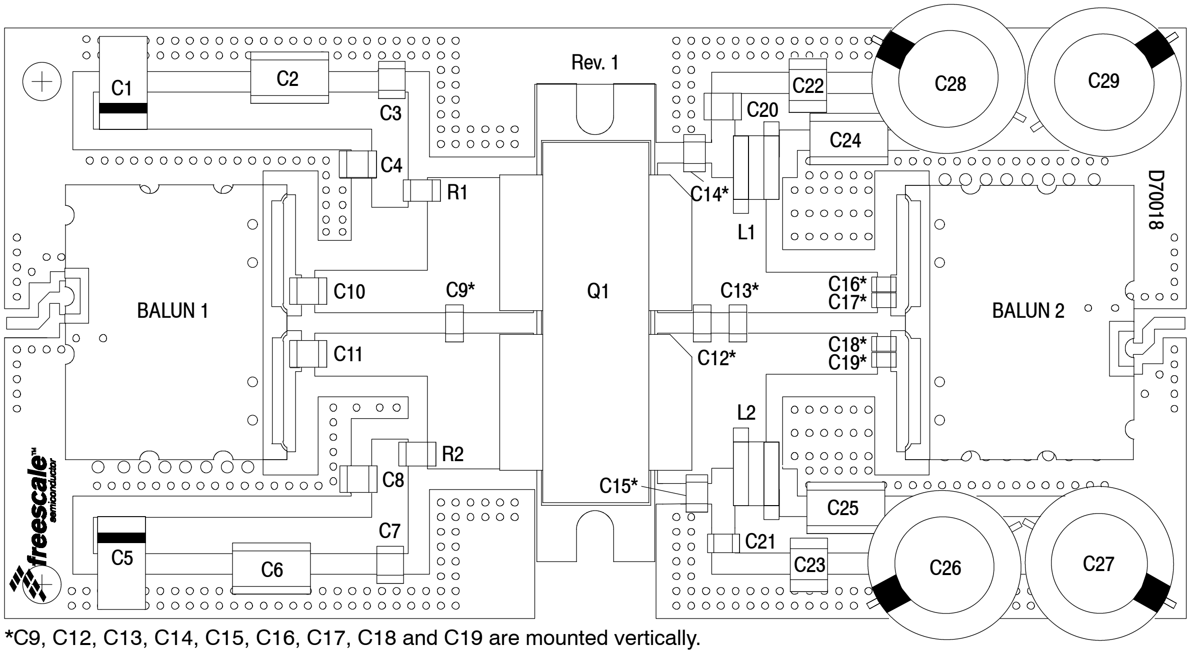
Figure 4. MTTF versus Junction Temperature — Pulse

1030, 1090 MHz REFERENCE CIRCUIT — 2.0″ × 4.0″ (5.1 cm × 10.2 cm)

Table 6. 1030, 1090 MHz Performance (In Freescale Reference Circuit, 50 ohm system)
V_{DD} = 50 Vdc, $I_{DQ(A+B)}$ = 100 mA

Frequency (MHz)	Signal Type	G_{ps} (dB)	η_D (%)	P_{out} (W)
1030	Pulse (128 μsec, 10% Duty Cycle)	18.9	56.0	1300 Peak
1090		18.8	57.9	1100 Peak

1030, 1090 MHz REFERENCE CIRCUIT — 2.0″ × 4.0″ (5.1 cm × 10.2 cm)



*C9, C12, C13, C14, C15, C16, C17, C18 and C19 are mounted vertically.

Figure 5. MMRF1317HR5 Reference Circuit Component Layout — 1030, 1090 MHz

Table 7. MMRF1317H(HS) Reference Circuit Component Designations and Values — 1030, 1090 MHz

Part	Description	Part Number	Manufacturer
Balun 1, 2	800–1000 MHz, 4-to-1 PCB Balun Transformers	3A412S	Anaren
C1, C5	22 μF, 35 V Tantalum Capacitors	T491X226K035AT	Kemet
C2, C6	2.2 μF Chip Capacitors	C1825C225J5RACTU	Kemet
C3, C7	0.22 μF Chip Capacitors	C1210C224K1RACTU	Kemet
C4, C8, C10, C11, C16, C17, C18, C19, C20, C21	36 pF Chip Capacitors	ATC100B360JT500XT	ATC
C9	5.1 pF Chip Capacitor	ATC800B5R1BT500XT	ATC
C12	6.2 pF Chip Capacitor	ATC800B6R2BT500XT	ATC
C13	1.6 pF Chip Capacitor	ATC800B1R5BT500XT	ATC
C14, C15	6.8 pF Chip Capacitors	ATC800B6R8BT500XT	ATC
C22, C23	0.47 μF Chip Capacitors	HMK432B7474KM-T	Taiyo Yuden
C24, C25	0.022 μF Chip Capacitors	C1825C223K1GACTU	Kemet
C26, C27, C28, C29	470 μF, 63 V Electrolytic Capacitors	MCGPR63V477M13X26-RH	Multicomp
L1, L2	27.4 nH, 3 Turn, #20 AWG ID = 0.125″ Inductors, Hand Wound	8050	Belden
Q1	RF Power LDMOS Transistor	MMRF1317HR5	Freescale
R1, R2	1 kΩ, 1/4 W Chip Resistors	CRCW12061K00FKEA	Vishay
PCB	Rogers RO3010 0.050″, ε_r = 11.2	D70018	MTL

TYPICAL CHARACTERISTICS — 1030, 1090 MHz REFERENCE CIRCUIT

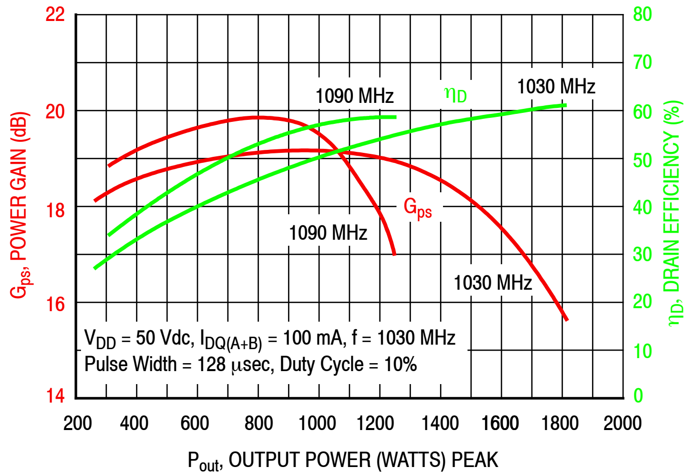
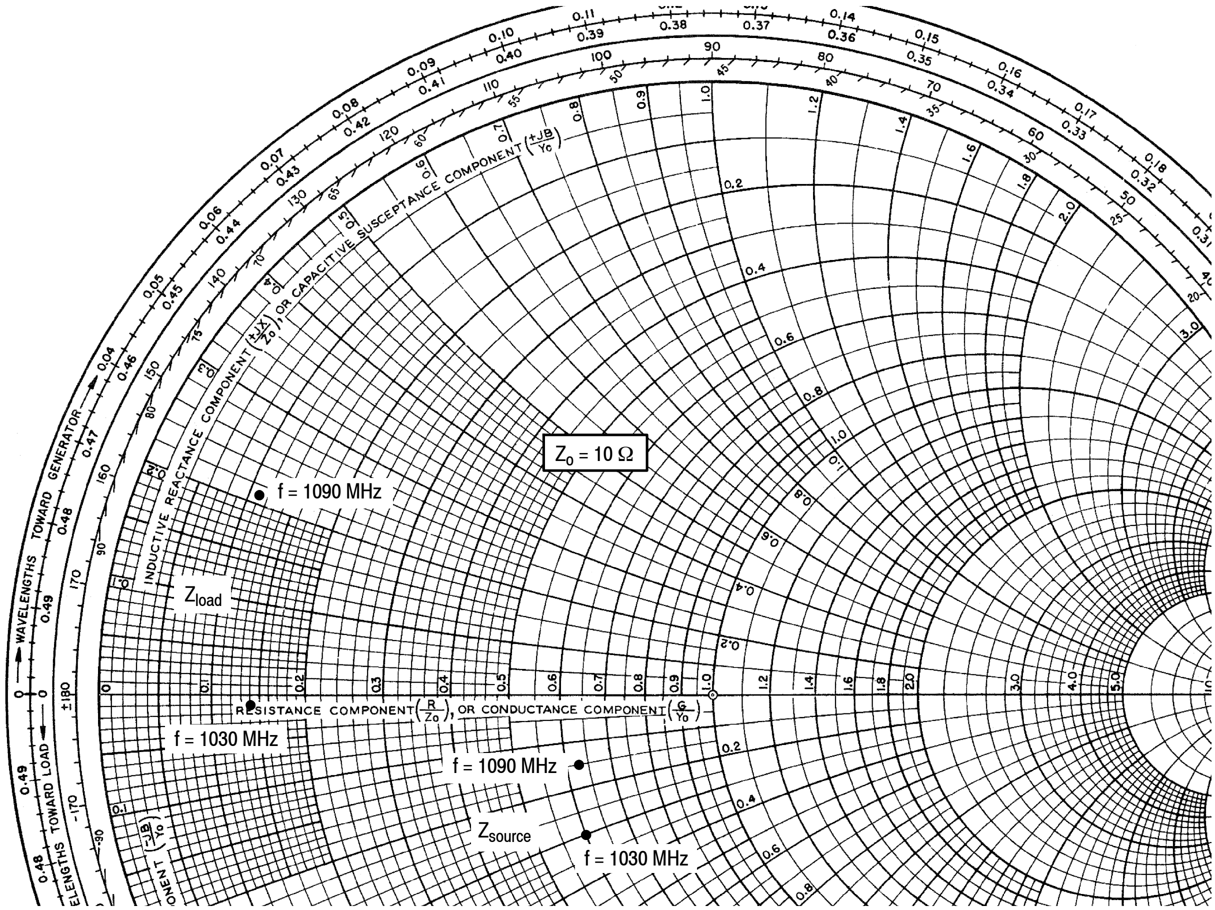


Figure 6. Power Gain and Drain Efficiency versus Output Power

1030, 1090 MHz REFERENCE CIRCUIT



f MHz	Z_{source} Ω	Z_{load} Ω
1030	6.03 – j2.97	1.41 – j0.13
1090	6.30 – j1.54	1.08 + j2.08

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.

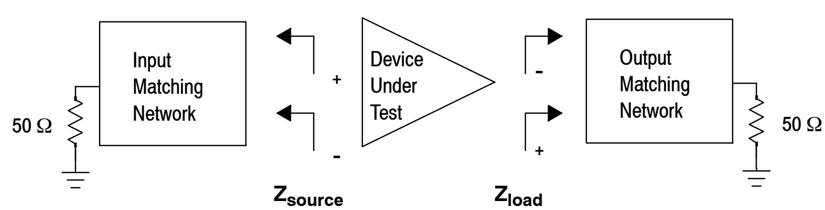


Figure 7. Series Equivalent Source and Load Impedance — 1030, 1090 MHz

1030 MHz NARROWBAND PRODUCTION TEST FIXTURE — 6.0″ × 4.0″ (15.2 cm × 10.2 cm)

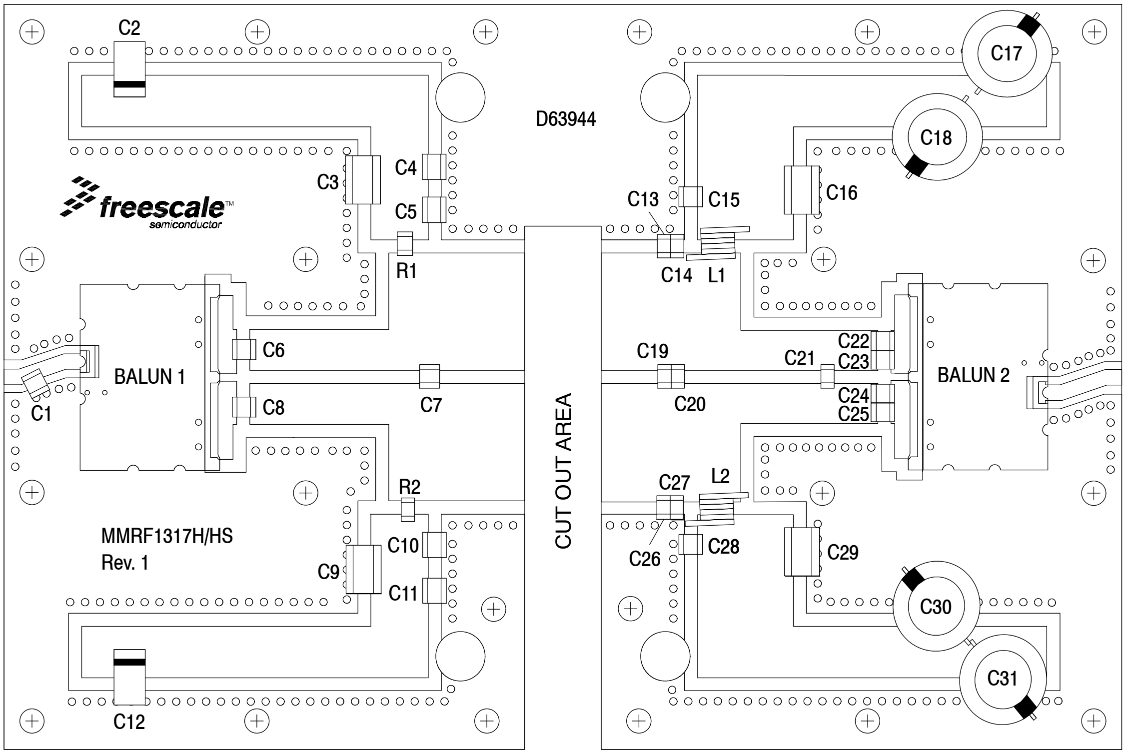


Figure 8. MMRF1317H(HS) Narrowband Test Circuit Component Layout — 1030 MHz

Table 8. MMRF1317H(HS) Narrowband Test Circuit Component Designations and Values — 1030 MHz

Part	Description	Part Number	Manufacturer
Balun 1, 2	800–1000 MHz, 4-to-1 PCB Balun Transformers	3A412S	Anaren
C1	1.0 pF Chip Capacitor	ATC100B1R0JT500XT	ATC
C2, C12	22 μF Tantalum Capacitors	T491X226K035AT	Kemet
C3, C9	2.2 μF Chip Capacitors	C1825C225J5RACTU	Kemet
C4, C11	0.1 μF Chip Capacitors	CDR33BX104AKWS	AVX
C5, C6, C8, C10, C15, C22, C23, C24, C25, C28	36 pF Chip Capacitors	ATC100B360JT500XT	ATC
C7	6.2 pF Chip Capacitor	ATC100B6R2JT500XT	ATC
C13, C19, C26	5.1 pF Chip Capacitors	ATC100B5R1JT500XT	ATC
C14, C27	2.0 pF Chip Capacitors	ATC800B2R0BT500XT	ATC
C16, C29	0.22 μF Chip Capacitors	C1825C224K1RACTU	Kemet
C17, C18, C30, C31	470 μF, 63 V Electrolytic Capacitors	MCGPR63V477M13X26-RH	Multicomp
C20	3.0 pF Chip Capacitor	ATC100B3R0JT500XT	ATC
C21	2.2 pF Chip Capacitor	ATC100B2R2JT500XT	ATC
L1, L2	12 nH Inductors	GA3094ALB	Coilcraft
R1, R2	100 Ω, 1/2 W Chip Resistors	CRCW2010100RFKFA	Vishay
PCB	Arlon AD255A, 0.030″, ε_r = 2.55	D63944	MTL

TYPICAL CHARACTERISTICS — 1030 MHz
PRODUCTION TEST FIXTURE

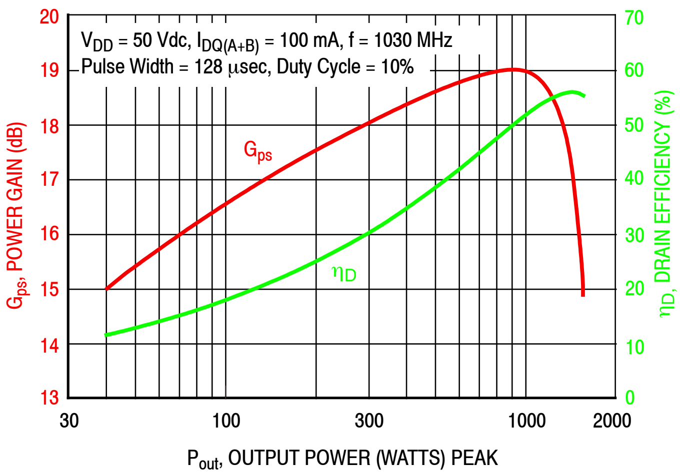


Figure 9. Power Gain and Drain Efficiency versus Output Power

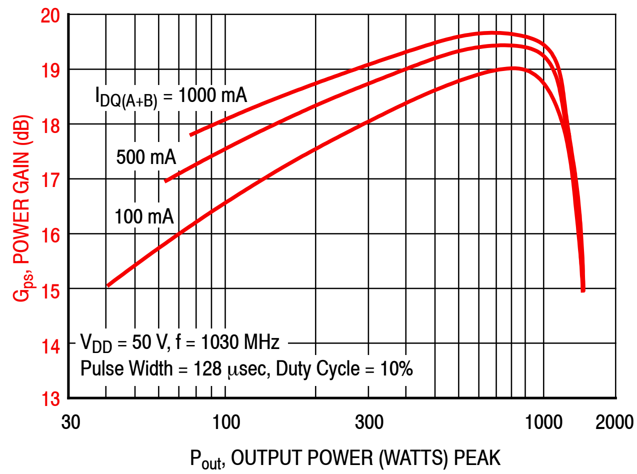


Figure 10. Power Gain versus Output Power and Quiescent Drain Current

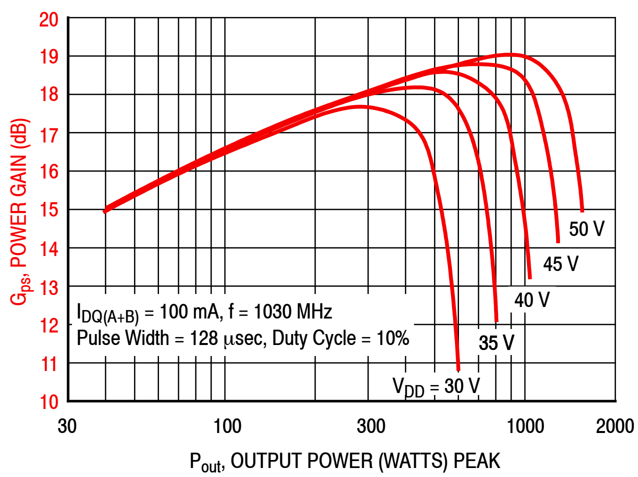
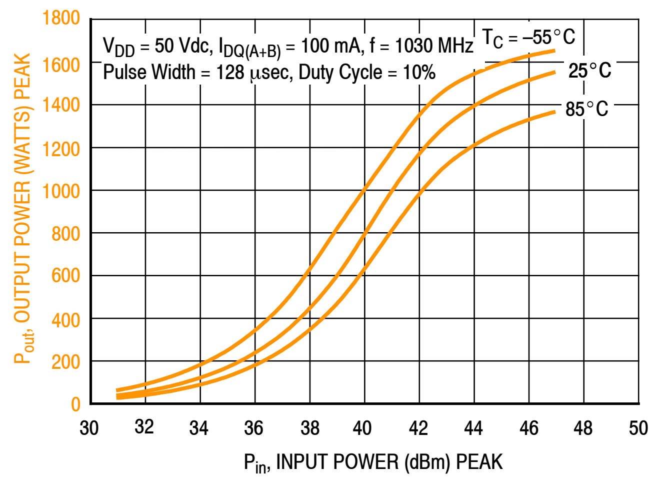


Figure 11. Power Gain versus Output Power and Drain Voltage



f (MHz)	P1dB (W)	P3dB (W)
1030	1322	1498

Figure 12. Output Power versus Input Power

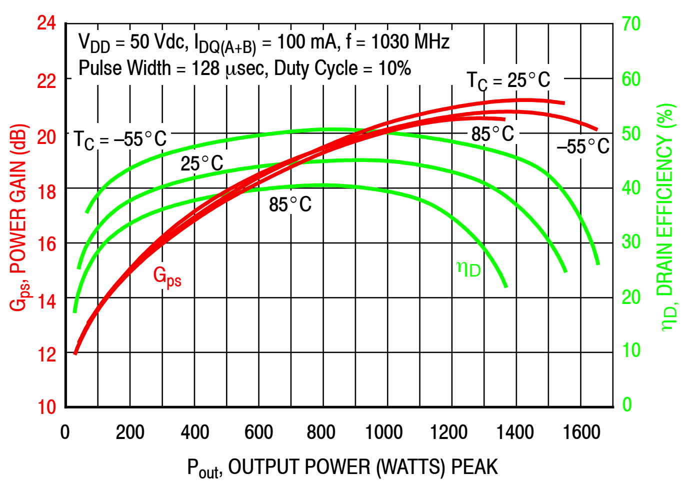


Figure 13. Power Gain and Drain Efficiency versus Output Power

1030 MHz NARROWBAND PRODUCTION TEST FIXTURE

f MHz	Z_{source} Ω	Z_{load} Ω
1030	3.74 – j1.63	2.29 – j0.19

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.

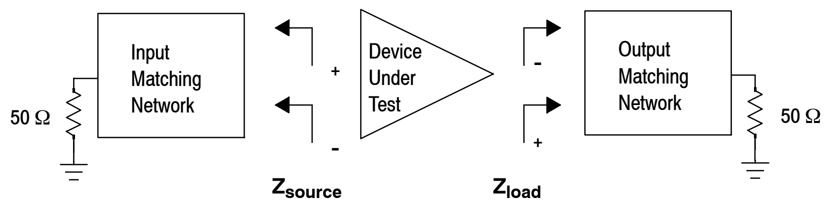
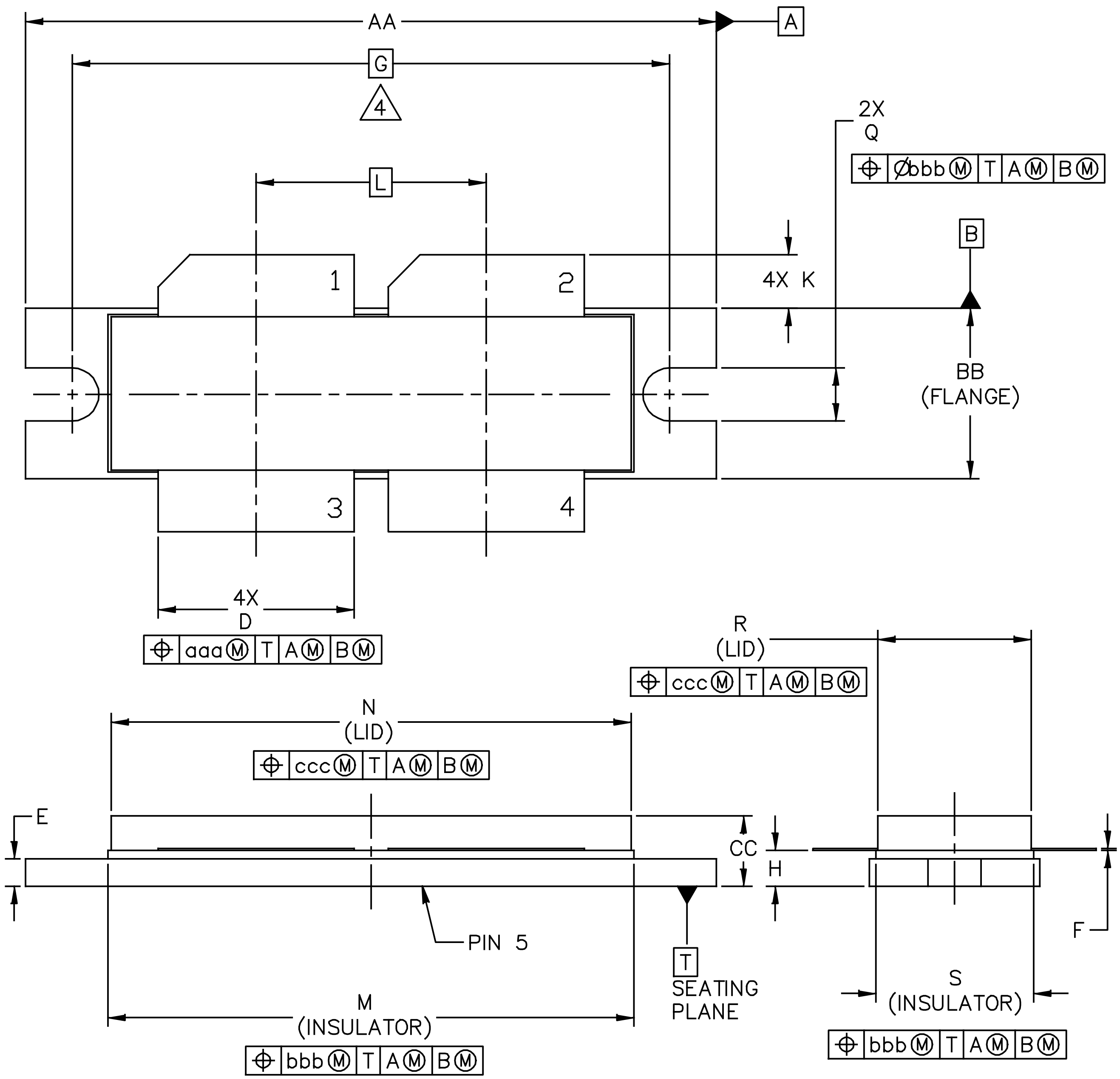


Figure 14. Series Equivalent Source and Load Impedance — 1030 MHz

PACKAGE DIMENSIONS



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	STANDARD: NON–JEDEC	
	28 FEB 2013	

NOTES:

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.

2. CONTROLLING DIMENSION: INCH

3. DIMENSION H IS MEASURED .030 INCH (0.762 MM) AWAY FROM PACKAGE BODY.

4. RECOMMENDED BOLT CENTER DIMENSION OF 1.52 INCH (38.61 MM) BASED ON M3 SCREW.

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
AA	1.615	1.625	41.02	41.28	N	1.218	1.242	30.94	31.55
BB	.395	.405	10.03	10.29	Q	.120	.130	3.05	3.30
CC	.170	.190	4.32	4.83	R	.355	.365	9.02	9.27
D	.455	.465	11.56	11.81	S	.365	.375	9.27	9.53
E	.062	.066	1.57	1.68					
F	.004	.007	0.10	0.18					
G	1.400 BSC		35.56 BSC		aaa	.013		0.33	
H	.082	.090	2.08	2.29	bbb	.010		0.25	
K	.117	.137	2.97	3.48	ccc	.020		0.51	
L	.540 BSC		13.72 BSC						
M	1.219	1.241	30.96	31.52					

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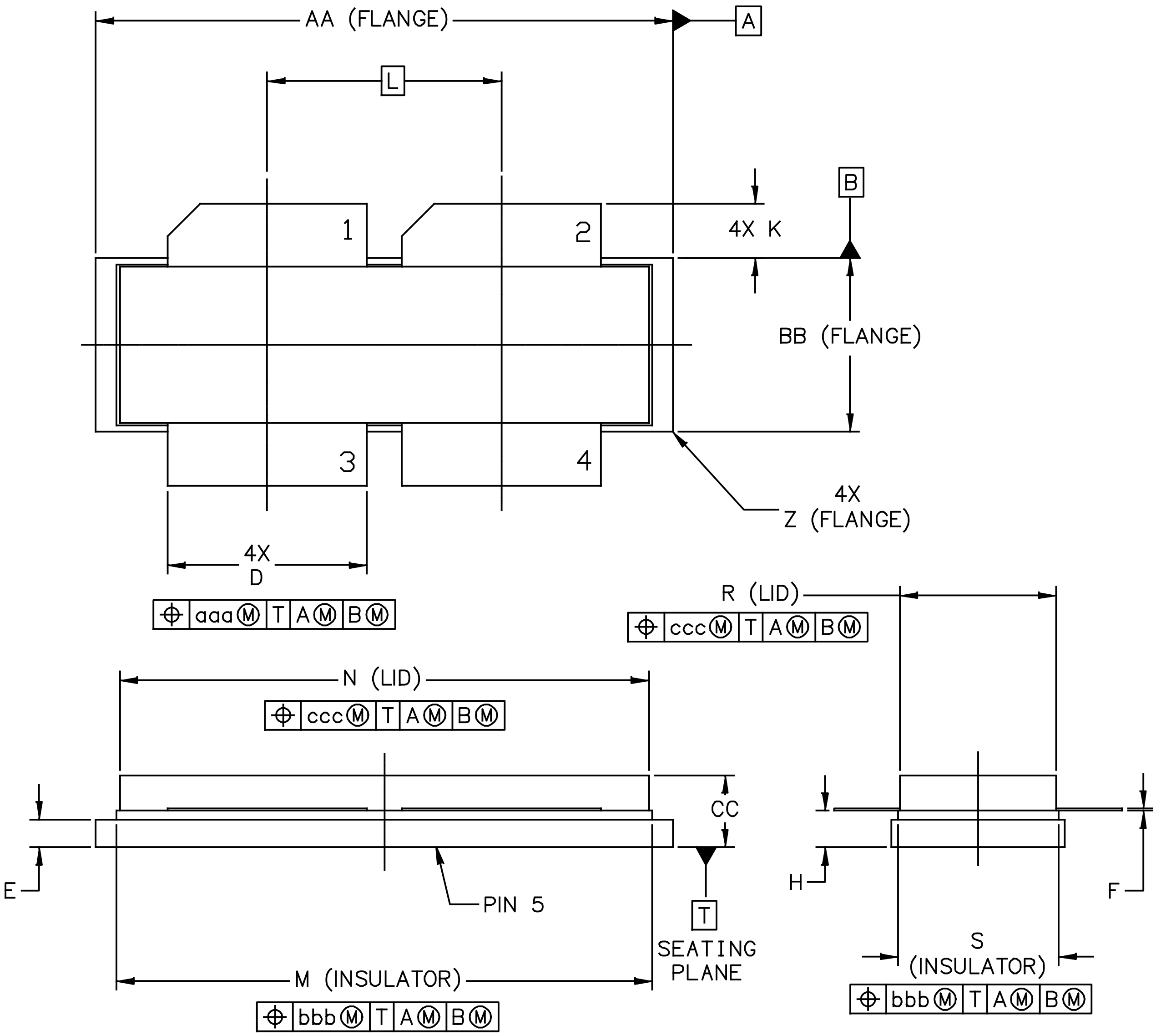
		28 FEB 2013



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	STANDARD: NON–JEDEC	
	SOT1829–1 19 FEB 2016	

NOTES:

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M−1994.

2. CONTROLLING DIMENSION: INCH

3. DIMENSION H IS MEASURED .030 INCH (0.762 MM) AWAY FROM PACKAGE BODY

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
AA	1.265	1.275	32.13	32.39	R	.355	.365	9.02	9.27
BB	.395	.405	10.03	10.29	S	.365	.375	9.27	9.53
CC	.170	.190	4.32	4.83	Z	R.000	R.040	R0.00	R1.02
D	.455	.465	11.56	11.81					
E	.062	.066	1.57	1.68	aaa	.013		0.33	
F	.004	.007	0.10	0.18	bbb	.010		0.25	
H	.082	.090	2.08	2.29	ccc	.020		0.51	
K	.117	.137	2.97	3.48					
L	.540 BSC		13.72 BSC						
M	1.219	1.241	30.96	31.52					
N	1.218	1.242	30.94	31.55					

	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: NI−1230−4S	DOCUMENT NO: 98ARB18247C	REV: H
	STANDARD: NON−JEDEC	
	SOT1829−1	19 FEB 2016

PRODUCT DOCUMENTATION

Refer to the following resources to aid your design process.

Application Notes

- AN1908: Solder Reflow Attach Method for High Power RF Devices in Air Cavity Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

To Download Resources Specific to a Given Part Number:

1. Go to http://www.nxp.com/RF
2. Search by part number
3. Click part number link
4. Choose the desired resource from the drop down menu

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Mar. 2016	• Initial Release of Data Sheet

How to Reach Us:

Home Page:
freescale.com

Web Support:
freescale.com/support

Document Number: MMRF1317H
Rev. 0, 3/2016

OCEAN CHIPS
Океан Электроники
Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения **«JONHON»**, а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов **«FORSTAR»**.

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