Freescale Semiconductor
Technical Data

Document Number: MRF9085
Rev. 11, 5/2006

RoHS

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Designed for broadband commercial and industrial applications with frequencies from 865 to 895 MHz. The high gain and broadband performance of these devices make them ideal for large-signal, common-source amplifier applications in 26 volt base station equipment.

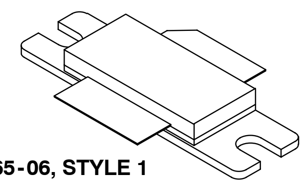
- Typical CDMA Performance @ 880 MHz, 26 Volts, I_{DQ} = 700 mA
  IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13
  - Output Power — 20 Watts
  - Power Gain — 17.9 dB
  - Efficiency — 28%
  - Adjacent Channel Power —
    - 750 kHz: -45.0 dBc @ 30 kHz BW
    - 1.98 MHz: -60.0 dBc @ 30 kHz BW
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 880 MHz, 90 Watts CW Output Power

Features

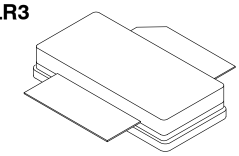
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40μ″ Nominal.
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

MRF9085LR3
MRF9085LSR3

880 MHz, 90 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465-06, STYLE 1
NI-780
MRF9085LR3



CASE 465A-06, STYLE 1
NI-780S
MRF9085LSR3

ARCHIVE INFORMATION

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	250 1.43	W W/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.7	°C/W

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Table 3. ESD Protection Characteristics

Test Conditions		Class
Human Body Model		1 (Minimum)
Machine Model	MRF9085LR3 MRF9085LSR3	M2 (Minimum) M1 (Minimum)

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

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 26 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					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 300 μAdc)	$V_{GS(th)}$	2.0	—	4.0	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 700 mAdc)	$V_{GS(Q)}$	—	3.7	—	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 2 Adc)	$V_{DS(on)}$	—	0.19	0.4	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 6 Adc)	g_{fs}	—	8.0	—	S
Dynamic Characteristics (1)					
Output Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	73	—	pF
Reverse Transfer Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	2.9	—	pF

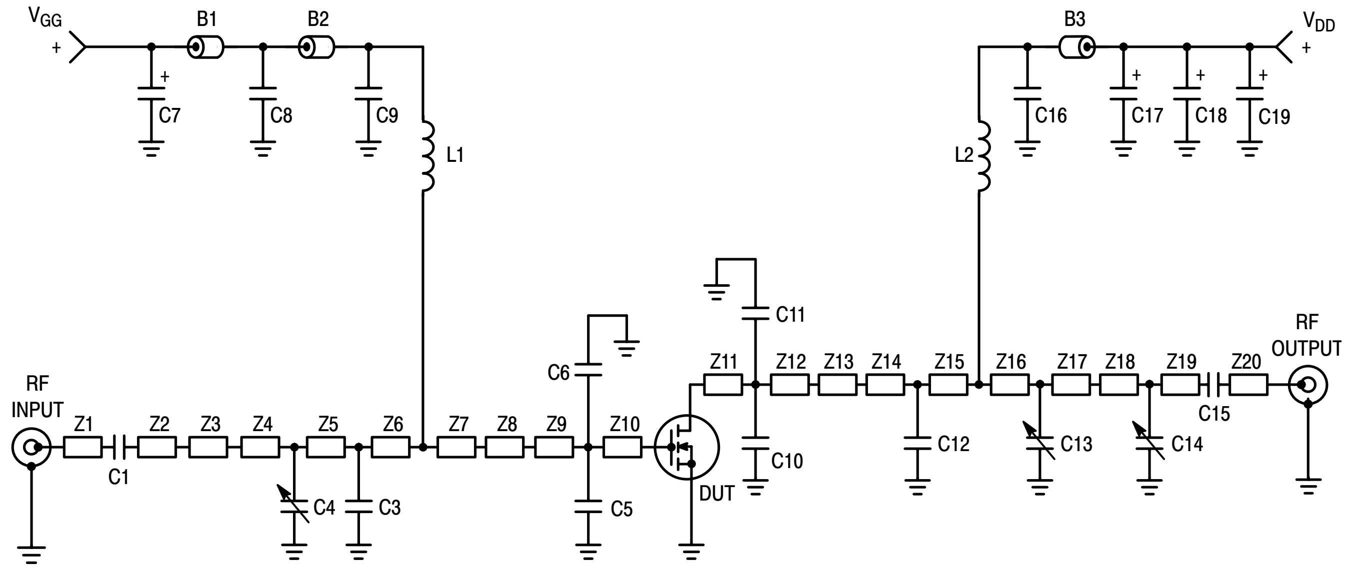
1. Part is internally input matched.

(continued)

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

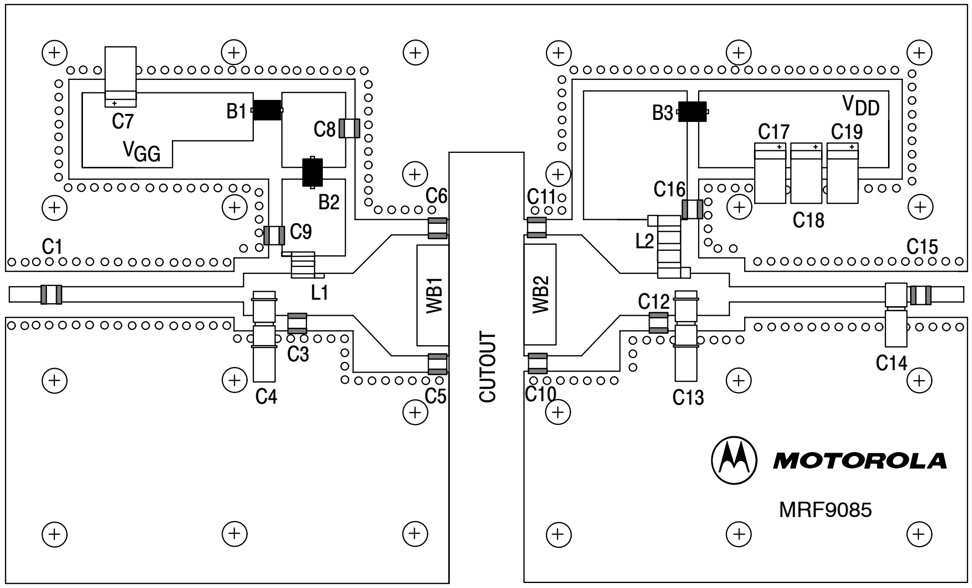
Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (In Freescale Test Fixture, 50 ohm system)					
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	G_{ps}	17	17.9	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	η	36	40	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	IMD	—	-31	-28	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	IRL	—	-21	-9	dB
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	G_{ps}	—	17.9	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	η	—	40.0	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	IMD	—	-31	—	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 90 W PEP, I_{DQ} = 700 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	IRL	—	-16	—	dB
Power Output, 1 dB Compression Point, CW (V_{DD} = 26 Vdc, I_{DQ} = 700 mA, f1 = 880.0 MHz)	P_{1dB}	—	105	—	W
Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 90 W CW, I_{DQ} = 700 mA, f1 = 880.0 MHz)	G_{ps}	—	17.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 90 W CW, I_{DQ} = 700 mA, f1 = 880.0 MHz)	η	—	51	—	%
Power Output, 1 dB Compression Point, CW (1) (V_{DD} = 26 Vdc, I_{DQ} = 700 mA, f1 = 960 MHz)	P_{1dB}	—	105	—	W

1. These values are derived from a 960 MHz optimized test fixture. Values are not applicable to Figures 1 and 2.



B1, B2, B3	Short Ferrite Beads, Surface Mount
C1, C9, C15, C16	47 pF Chip Capacitors, ATC
C3	5.6 pF Chip Capacitor, ATC
C4, C13	0.8 - 8.0 Variable Capacitors, Gigatrim
C5, C6, C12	8.2 pF Chip Capacitors, ATC
C7, C17, C18, C19	10 μF, 35 V Tantalum Surface Mount Capacitors, Kemet
C8	20 K pF Chip Capacitor, ATC
C10, C11	16 pF Chip Capacitors, ATC
C14	0.6 - 4.5 Variable Capacitor, Gigatrim
L1	7.15 nH Inductor, Coilcraft
L2	17.5 nH Inductor, Coilcraft
N1, N2	N-Type Panel Mount, Stripline, M/A-Com
WB1, WB2	5 Mil BeCu Shim (0.225 x 0.525)
Z1	0.219″ x 0.080″ Microstrip
Z2	0.150″ x 0.080″ Microstrip
Z3	0.851″ x 0.080″ Microstrip
Z4	0.125″ x 0.220″ Microstrip
Z5	0.123″ x 0.220″ Microstrip
Z6	0.076″ x 0.220″ Microstrip
Z7	0.261″ x 0.220″ Microstrip
Z8	0.220″ x 0.630″ x 0.200″ Taper
Z9	0.240″ x 0.630″ Microstrip
Z10	0.060″ x 0.630″ Microstrip
Z11	0.067″ x 0.630″ Microstrip
Z12	0.233″ x 0.630″ Microstrip
Z13	0.630″ x 0.220″ x 0.200″ Taper
Z14	0.200″ x 0.220″ Microstrip
Z15	0.055″ x 0.220″ Microstrip
Z16	0.088″ x 0.220″ Microstrip
Z17	0.226″ x 0.220″ Microstrip
Z18	0.868″ x 0.080″ Microstrip
Z19	0.129″ x 0.080″ Microstrip
Z20	0.223″ x 0.080″ Microstrip
PCB	Arlon GX-0300-55-22, 30 mils $\varepsilon_r = 2.55$

Figure 1. 865-895 MHz Broadband Test Circuit Schematic



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 2. 865-895 MHz Broadband Test Circuit Component Layout

TYPICAL CHARACTERISTICS

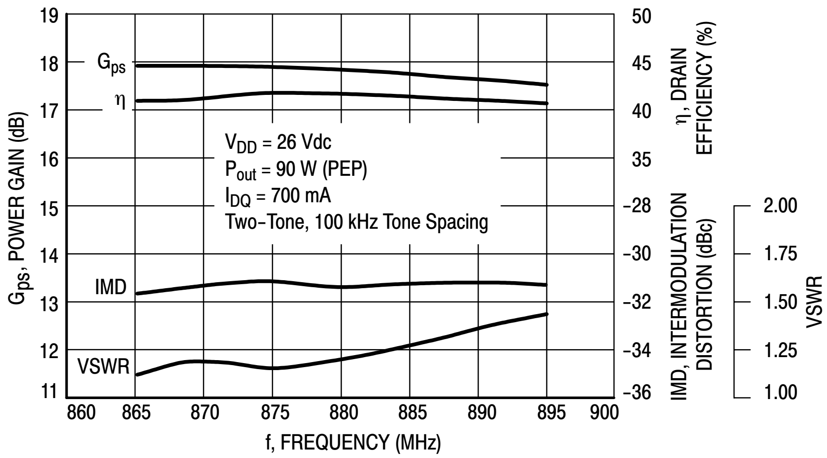


Figure 3. Class AB Broadband Circuit Performance

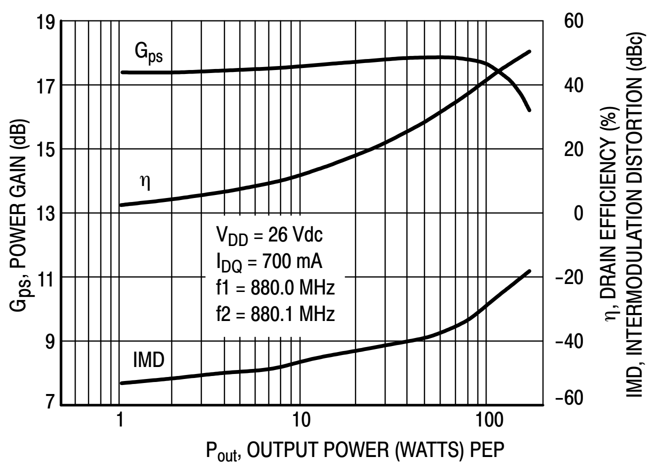


Figure 4. Power Gain, Efficiency, IMD versus Output Power

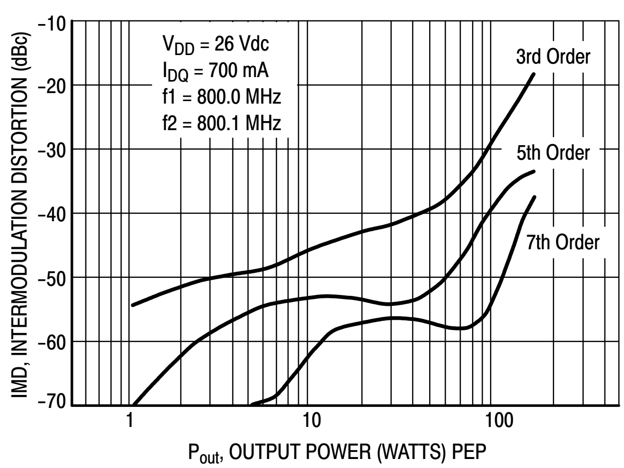


Figure 5. Intermodulation Distortion Products versus Output Power

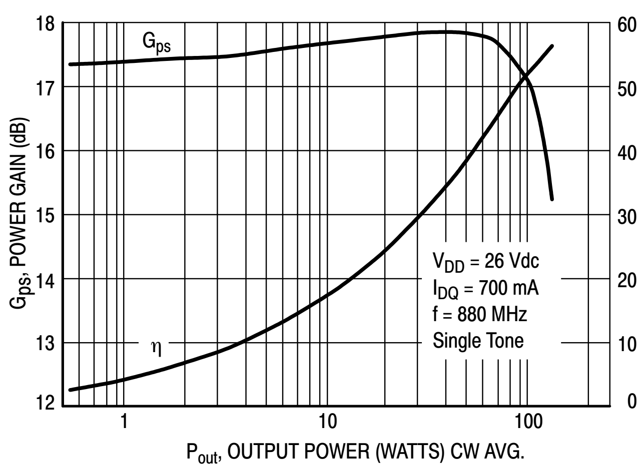


Figure 6. Power Gain, Efficiency versus Output Power

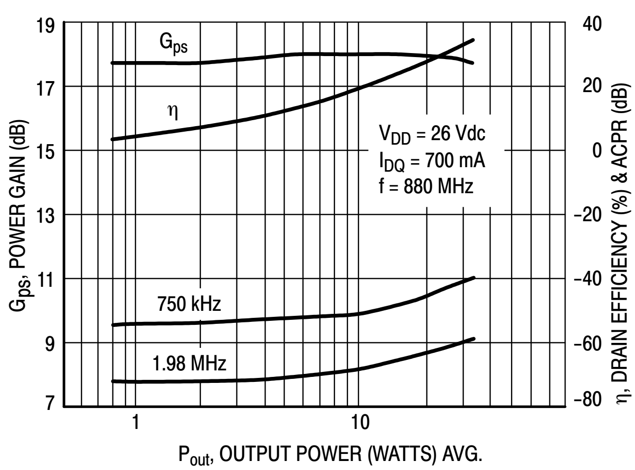


Figure 7. Power Gain, Efficiency, ACPR versus Output Power

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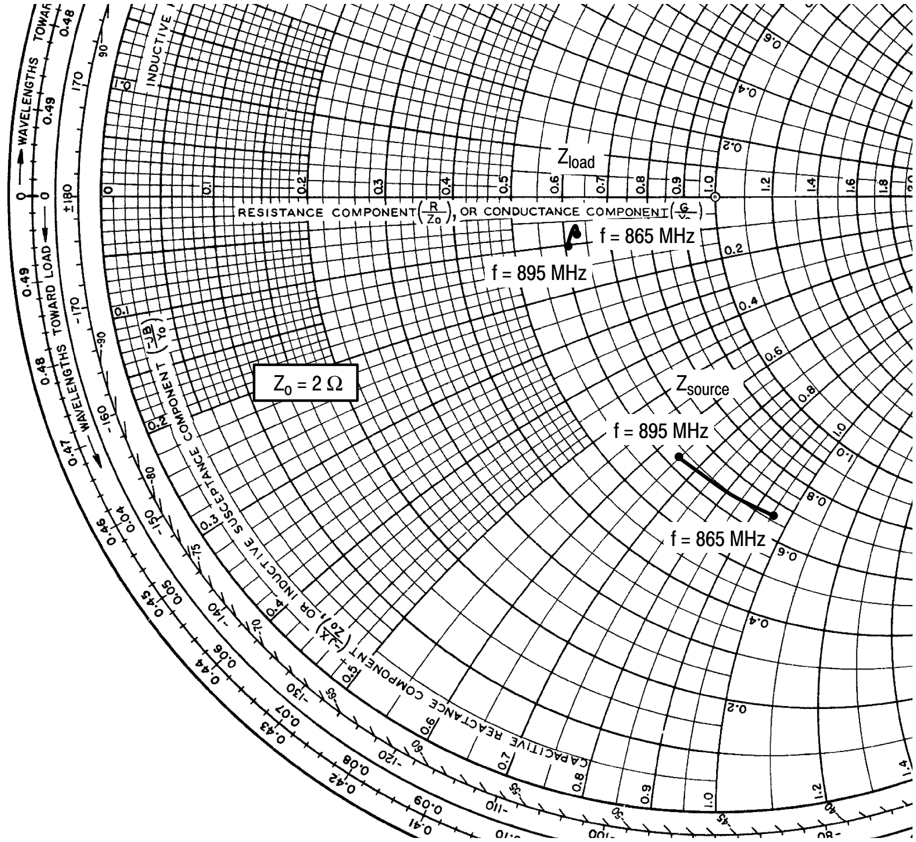

V_{DD} = 26 V, I_{DQ} = 700 mA, P_{out} = 90 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
865	1.35 - j1.92	1.26 - j0.15
880	1.33 - j1.66	1.26 - j0.10
895	1.28 - j1.30	1.21 - j0.20

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

Note: Z_{load} was chosen based on tradeoffs between gain, output power, drain efficiency and intermodulation distortion.

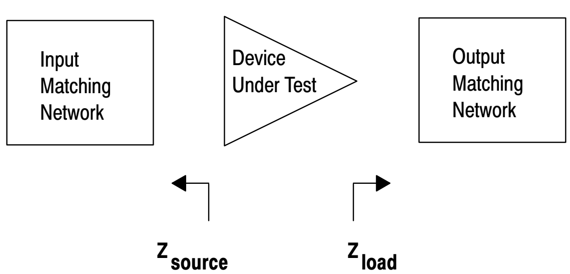

Figure 8. Series Equivalent Source and Load Impedance

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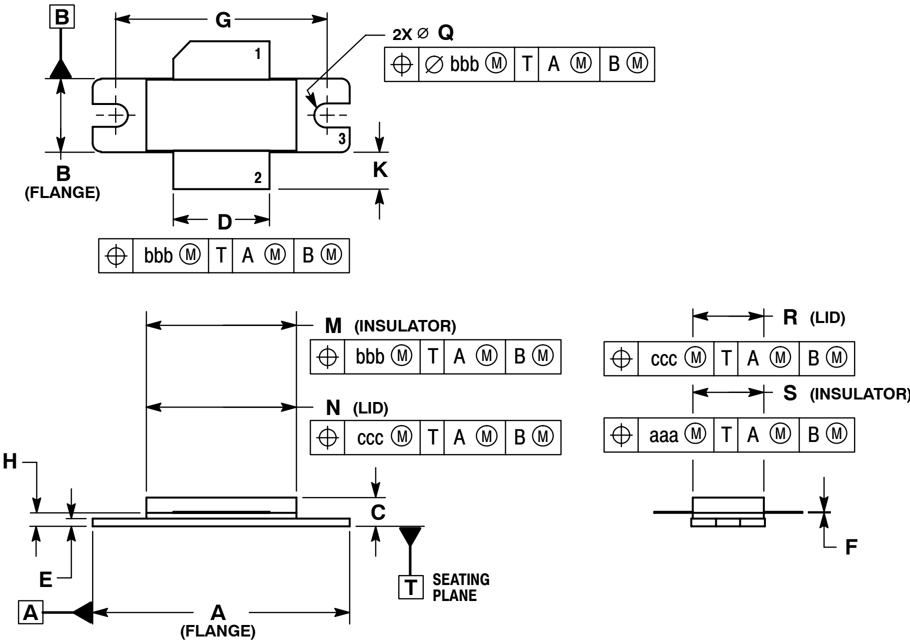
PACKAGE DIMENSIONS

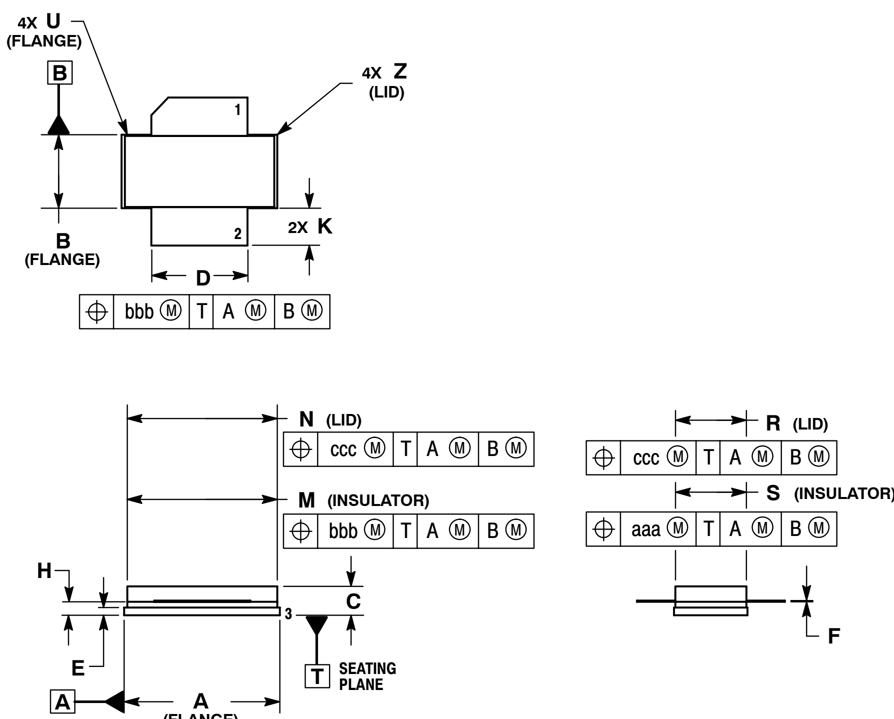


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
G	1.100 BSC		27.94 BSC	
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.66	19.96
N	0.772	0.788	19.60	20.00
Q	∅.118	∅.138	∅3.00	∅3.51
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
aaa	0.005 REF		0.127 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

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

CASE 465-06
ISSUE G
NI-780
MRF9085LR3



NOTES:
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3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.805	0.815	20.45	20.70
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.61	20.02
N	0.772	0.788	19.61	20.02
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
U	---	0.040	---	1.02
Z	---	0.030	---	0.76
aaa	0.005 REF		0.127 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

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

CASE 465A-06
ISSUE H
NI-780S
MRF9085LSR3

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