

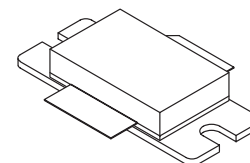
The RF MOSFET Line
RF Power Field Effect Transistors
N-Channel Enhancement-Mode Lateral MOSFETs

Designed for class AB PCN and PCS base station applications from 1.9 to 2.0 GHz. Suitable for CDMA, TDMA, GSM, and multicarrier amplifier applications.

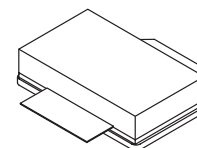
- Typical CDMA Performance: 1990 MHz, 26 Volts
IS-97 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13
Output Power — 9 Watts
Power Gain — 10 dB
Adjacent Channel Power —
885 kHz: -47 dBc @ 30 kHz BW
1.25 MHz: -55 dBc @ 12.5 kHz BW
2.25 MHz: -55 dBc @ 1 MHz BW
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection: Class 2 Human Body Model, Class M3 Machine Model
- Ease of Design for Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1.93 GHz, 90 Watts (CW) Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters

MRF19090
MRF19090S

90 W, 1990 MHz
LATERAL N-CHANNEL
BROADBAND
RF POWER MOSFETs



CASE 465B-02, STYLE 1
(MRF19090)



CASE 465C-01, STYLE 1
(MRF19090S)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	+15, -0.5	Vdc
Total Device Dissipation @ $T_C > = 25^\circ\text{C}$ Derate above 25°C	P_D	270 1.54	Watts W/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

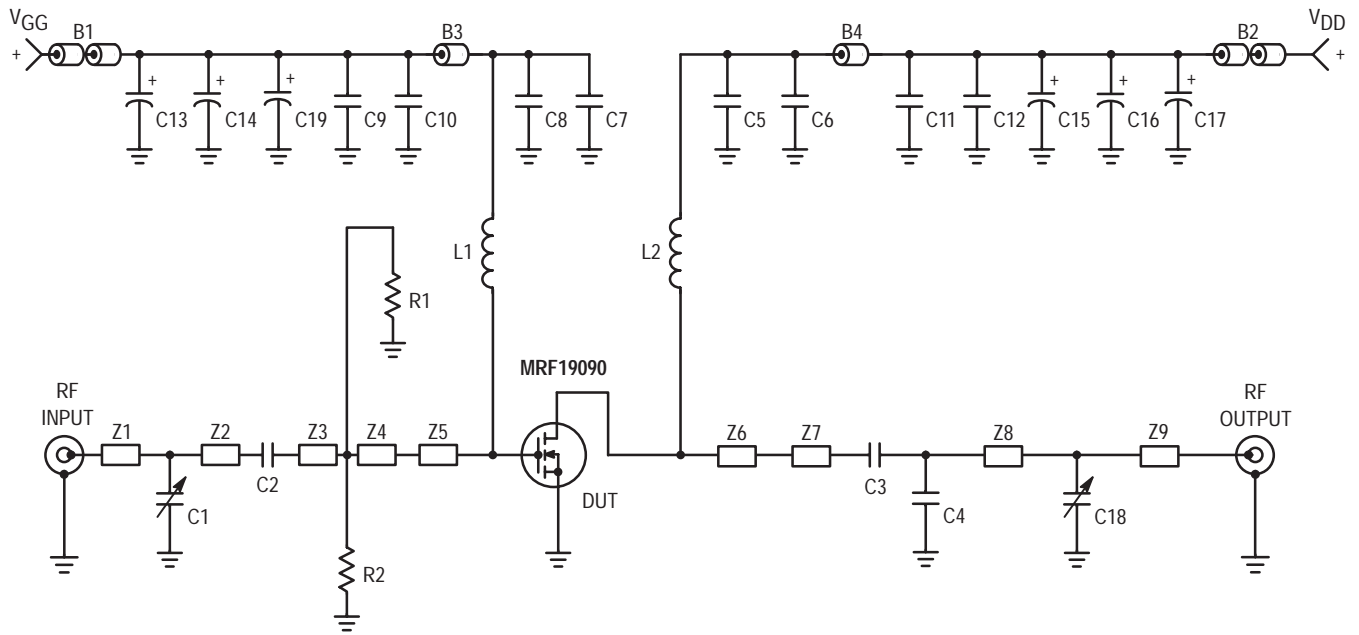
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.65	°C/W

NOTE - **CAUTION** - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 100\ \mu\text{A}$)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0$)	I_{DSS}	—	—	10	μAdc
Gate–Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0$)	I_{GSS}	—	—	1	μAdc
ON CHARACTERISTICS					
Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 3\text{ Adc}$)	g_{fs}	—	7.2	—	S
Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 300\ \mu\text{Adc}$)	$V_{GS(th)}$	2.0	—	4.0	Vdc
Gate Quiescent Voltage ($V_{DS} = 26\text{ Vdc}$, $I_D = 750\text{ mAdc}$)	$V_{GS(Q)}$	2.5	3.8	4.5	Vdc
Drain–Source On–Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 1\text{ Adc}$)	$V_{DS(on)}$	—	0.10	—	Vdc
DYNAMIC CHARACTERISTICS					
Reverse Transfer Capacitance (1) ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$)	C_{rss}	—	4.2	—	pF
FUNCTIONAL TESTS (In Motorola Test Fixture)					
Two–Tone Common–Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	G_{ps}	10	11.5	—	dB
Two–Tone Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	η	33	35	—	%
3rd Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	IMD	—	–30	–28	dBc
Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	IRL	—	–12	—	dB
P_{out} , 1 dB Compression Point ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W CW}$, $f = 1990\text{ MHz}$)	P1dB	—	90	—	W
Output Mismatch Stress ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 90\text{ W CW}$, $I_{DQ} = 750\text{ mA}$, $f = 1930\text{ MHz}$, VSWR = 10:1, All Phase Angles at Frequency of Tests)	Ψ	No Degradation In Output Power Before and After Test			

(1) Part is internally matched both on input and output.



B1 – B4	2 Ferrite Beads, Round, Ferroxcube 56–590–65–3B	L1, L2	8 Turns, #26 AWG, 0.085" OD, 0.330" Long, Copper Wire
B2 – B3	Ferrite Bead, Surface Mount Ferrite Bead, Ferroxcube	R1, R2	270 Ω , 1/4 W Chip Resistor, Garrett Instruments RM73B2B271JT
C1, C18	0.4 – 2.5 pF, Gigatrim Variable Capacitors, Johanson 27285	Z1	ZO = 50 Ohms
C2, C5, C8	10 pF, ATC RF Chip Capacitors, Case "B", 100B100CCA500X	Z2	ZO = 50 Ohms, Lambda = 0.123
C3	12 pF, ATC RF Chip Capacitors, Case "B", 100B120CCA500X	Z3	ZO = 15.24 Ohms, Lambda = 0.0762
C4	0.3 pF, ATC RF Chip Capacitors, Case "B", 100B0R3CCA500X	Z4	ZO = 10.11 Ohms, Lambda = 0.0392
C6, C7	120 pF, ATC RF Chip Capacitors, Case "B", 100B12R1CCA500X	Z5	ZO = 6.34 Ohms, Lambda = 0.0711
C9, C12	0.1 μ F, Chip Capacitor, CDR33BX104AKWS, KEMET	Z6	ZO = 5.02 Ohms, Lambda = 0.0476
C10, C11	1000 pF, ATC RF Chip Capacitors, Case "B", 100B102JCA50X	Z7	ZO = 5.54 Ohms, Lambda = 0.0972
C13, C17	22 μ F, 35 V Tantalum Surface Mount Electrolytic Chip Capacitor, T491X226K035AS4394, KEMET	Z8	ZO = 50.0 Ohms, Lambda = 0.194
C14, C16	10 μ F, 35 V Tantalum Surface Mount Electrolytic Chip Capacitor, T495X106K035AS4394, KEMET	Z9	ZO = 50.0 Ohms
C15, C19	1 μ F, 35 V Tantalum Surface Mount Electrolytic Chip Capacitor, T495X105K035AS4394, KEMET	Raw PCB Material	0.030" Glass Teflon [®] , $\epsilon_r = 2.55$, 2 oz Copper, 3" x 5" Dimensions

Figure 1. MRF19090 Test Circuit Schematic

TYPICAL CHARACTERISTICS

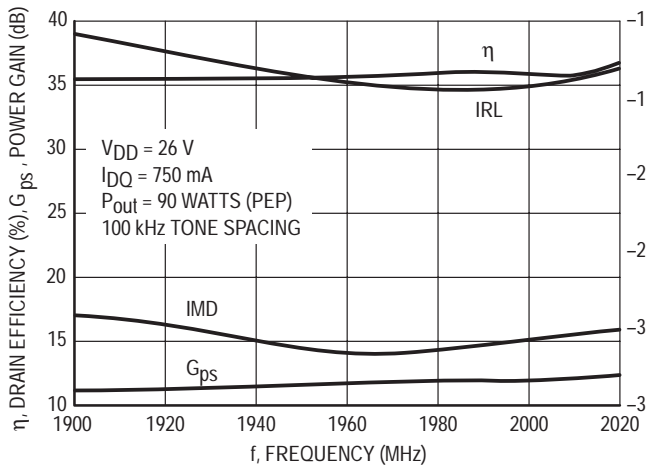


Figure 2. Class AB Performance versus Frequency

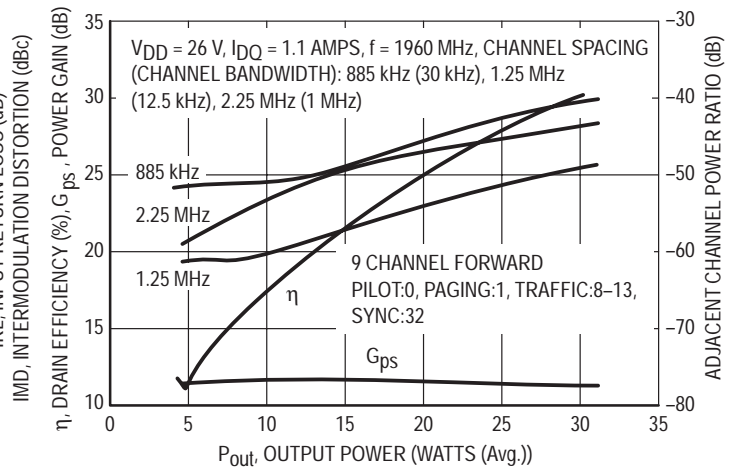


Figure 3. CDMA Performance ACPR, Gain and Drain Efficiency versus Output Power

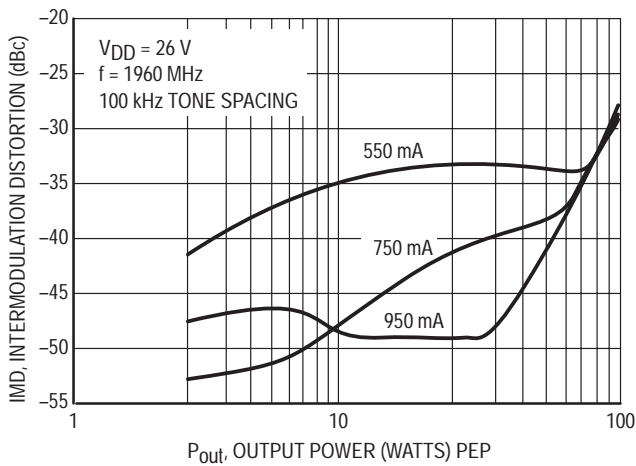


Figure 4. Third Order Intermodulation Distortion versus Output Power

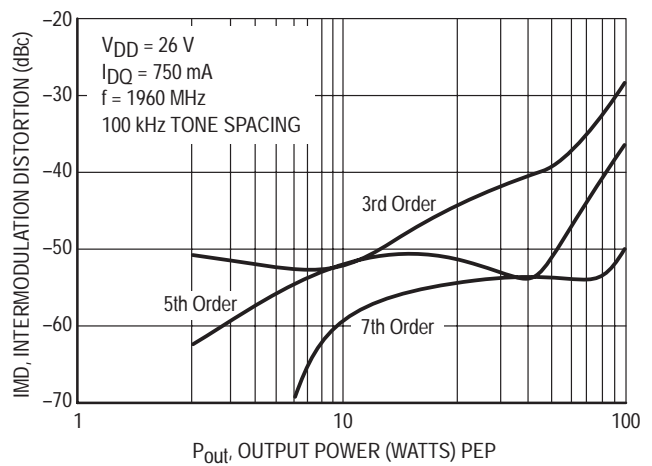


Figure 5. Intermodulation Products versus Output Power

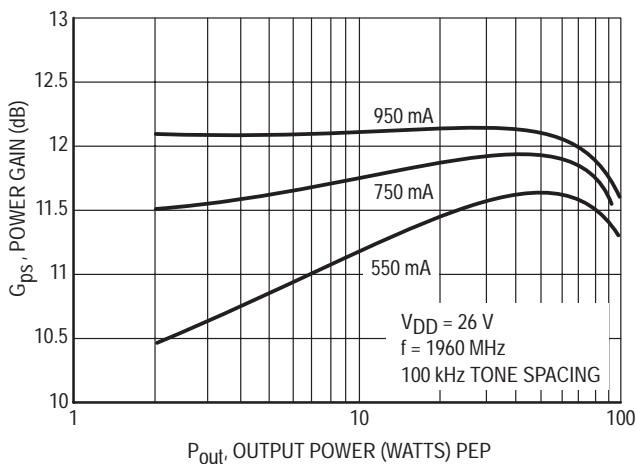


Figure 6. Power Gain versus Output Power

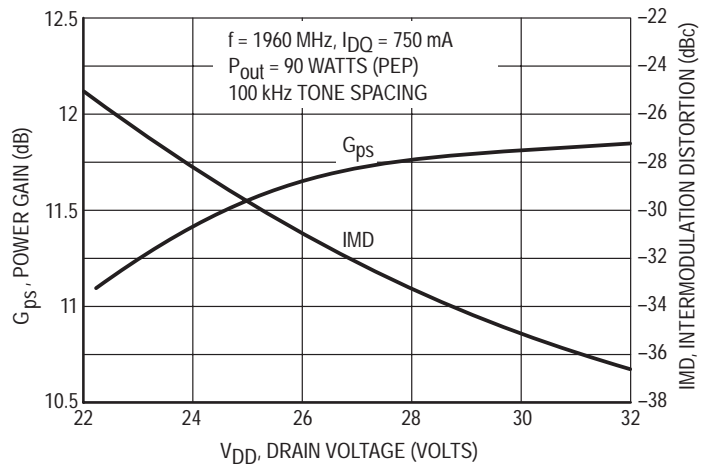
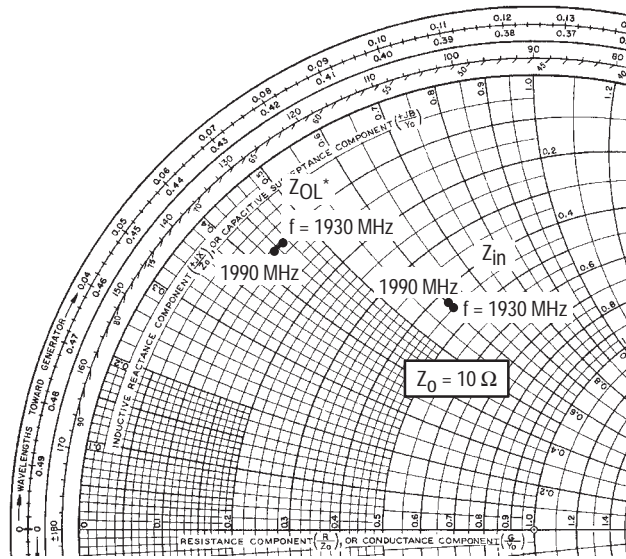


Figure 7. Third Order Intermodulation Distortion and Gain versus Supply Voltage



$V_{DD} = 26\text{ V}$, $I_{DQ} = 750\text{ mA}$, $P_{out} = 90\text{ Watts (PEP)}$

f MHz	Z_{in} Ω	Z_{OL}^* Ω
1930	$4.5 + j6.1$	$1.1 + j4.5$
1960	$4.4 + j6.0$	$1.1 + j4.4$
1990	$4.3 + j6.1$	$1.1 + j4.3$

Z_{in} = Complex conjugate of source impedance.

Z_{OL}^* = Complex conjugate of the optimum load.

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

Figure 8. Series Equivalent Input and Output Impedance

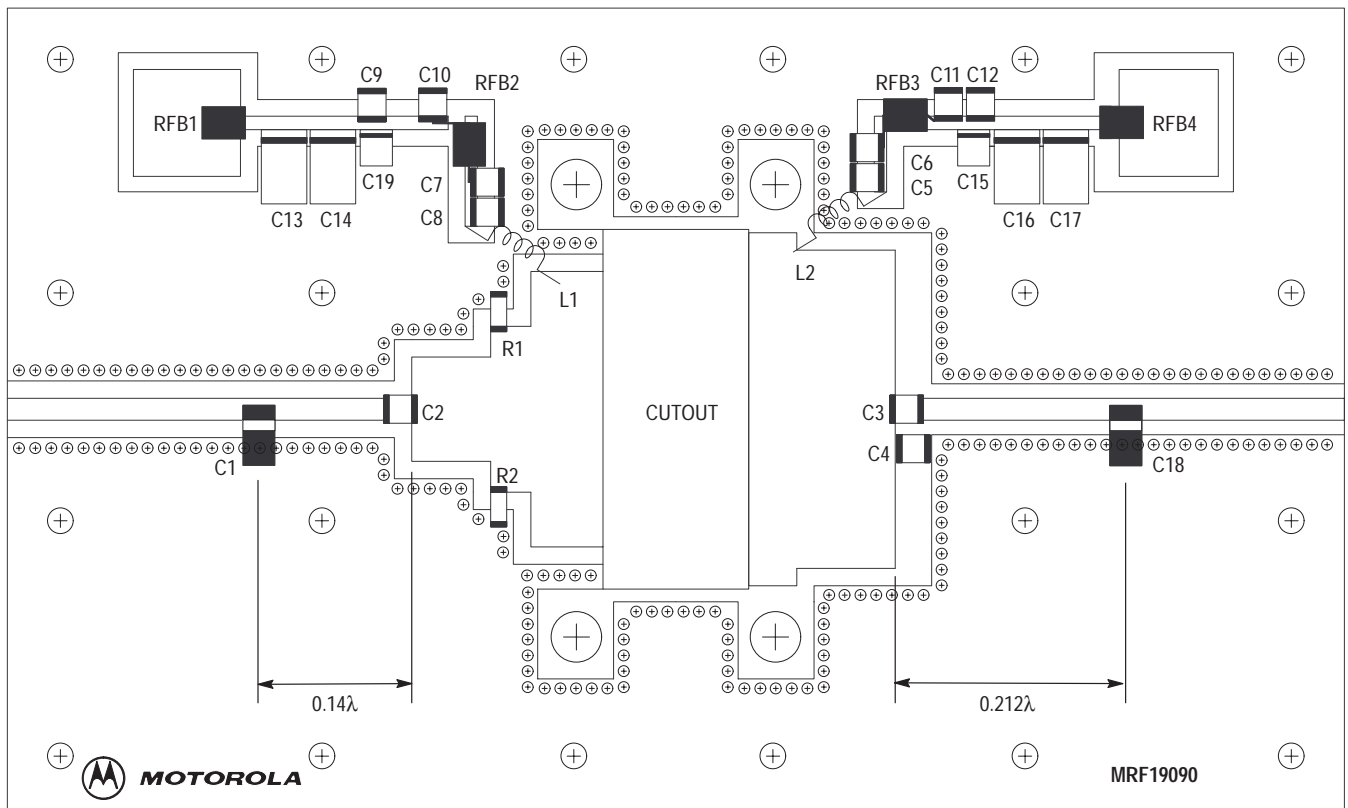


Figure 9. MRF19090 Populated PC Board Layout Diagram

PACKAGE DIMENSIONS

Q 2 PL

\oplus	\ominus	\varnothing 0.25 (0.010) (M)	T	A	(M)	B	(M)
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**CASE 465B-02
ISSUE A
(MRF19090)**

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION H IS MEASURED 0.030" AWAY FROM FLANGE.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.535	0.545	13.6	13.8
C	0.155	0.200	3.94	5.08
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
N	0.871	0.889	19.30	22.60
Q	0.118	0.138	3.00	3.51
R	0.515	0.525	13.10	13.30


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

**CASE 465C-01
ISSUE O
(MRF19090S)**

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION H IS MEASURED 0.030" AWAY FROM FLANGE.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.905	0.915	22.99	23.24
B	0.535	0.545	13.6	13.8
C	0.155	0.200	3.94	5.08
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
N	0.871	0.889	19.30	22.60
R	0.515	0.525	13.10	13.30

- STYLE 1:
PIN 1. DRAIN
2. GATE
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