

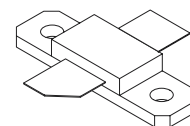
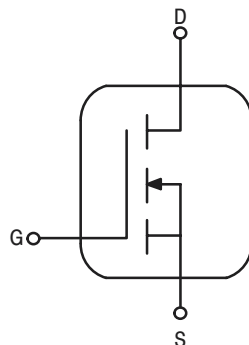
The RF MOSFET Line
RF Power Field Effect Transistors
N-Channel Enhancement-Mode Lateral MOSFETs

MRF373R1
MRF373SR1

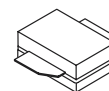
Designed for broadband commercial and industrial applications with frequencies from 470 – 860 MHz. The high gain and broadband performance of these devices make them ideal for large-signal, common source amplifier applications in 28 volt transmitter equipment.

470 – 860 MHz, 60 W, 28 V
LATERAL N-CHANNEL
BROADBAND
RF POWER MOSFETS

- Guaranteed CW Performance at 860 MHz, 28 Volts, Narrowband Fixture
Output Power – 60 Watts
Power Gain – 13 dB
Efficiency – 50%
- Typical Performance at 860 MHz, 28 Volts, Broadband Push-Pull Fixture
Output Power – 100 Watts (PEP)
Power Gain – 11.2 dB
Efficiency – 40%
IMD – -30 dBc
- Excellent Thermal Stability
- 100% Tested for Load Mismatch Stress at All Phase Angles with 5:1 VSWR @ 28 Vdc, 860 MHz, 60 Watts CW
- In Tape and Reel. R1 = 500 units per 32 mm, 13 inch Reel.



CASE 360B-05, STYLE 1
NI-360
MRF373R1



CASE 360C-05, STYLE 1
NI-360S
MRF373SR1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V _{DSS}	65	Vdc
Gate-Source Voltage	V _{GS}	±20	Vdc
Drain Current – Continuous	I _D	7	Adc
Total Device Dissipation @ T _C = 25°C Derate above 25°C	MRF373SR1 P _D	173 1.33	W 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	MRF373SR1 R _{θJC}	0.75	°C/W
Thermal Resistance, Junction to Case	MRF373R1 R _{θJC}	1	°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
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OFF CHARACTERISTICS

Drain–Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 1\ \mu\text{A}$)	$V_{(BR)DSS}$	65	–	–	Vdc
Zero Gate Voltage Drain Current ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	–	–	1	μAdc
Gate–Source Leakage Current ($V_{GS} = 20\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$)	I_{GSS}	–	–	1	μAdc

ON CHARACTERISTICS

Gate Threshold Voltage ($V_{DS} = 10\text{ V}$, $I_D = 200\ \mu\text{A}$)	$V_{GS(th)}$	2	3	4	Vdc
Gate Quiescent Voltage ($V_{DS} = 28\text{ V}$, $I_D = 100\text{ mA}$)	$V_{GS(Q)}$	3	4	5	Vdc
Drain–Source On–Voltage ($V_{GS} = 10\text{ V}$, $I_D = 3\text{ A}$)	$V_{DS(on)}$	–	0.6	0.8	Vdc
Forward Transconductance ($V_{DS} = 10\text{ V}$, $I_D = 3\text{ A}$)	g_{fs}	2.2	2.9	–	S

DYNAMIC CHARACTERISTICS

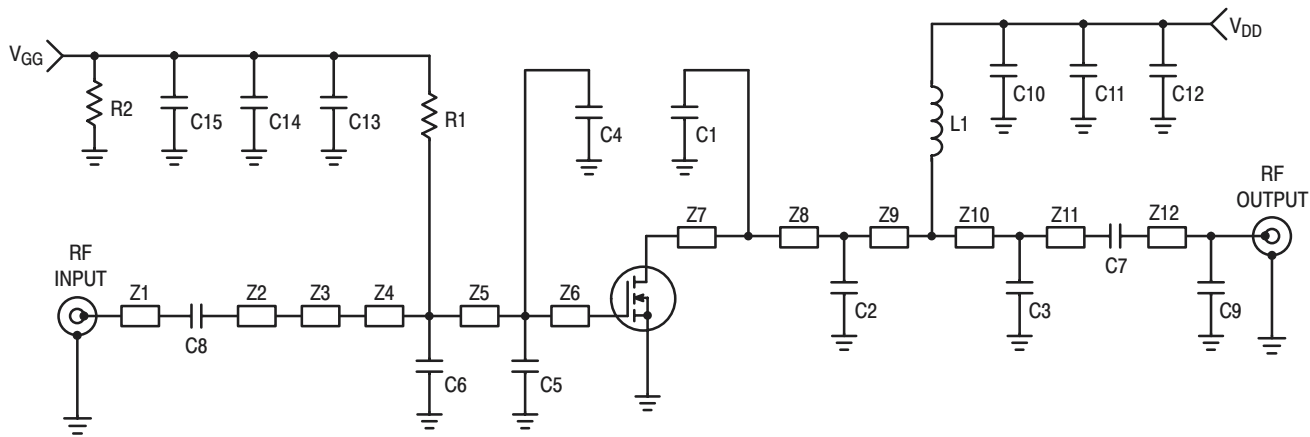
Input Capacitance ($V_{DS} = 28\text{ V}$, $V_{GS} = 0$, $f = 1\text{ MHz}$)	C_{iss}	–	79	–	pF
Output Capacitance ($V_{DS} = 28\text{ V}$, $V_{GS} = 0$, $f = 1\text{ MHz}$)	C_{oss}	–	46	–	pF
Reverse Transfer Capacitance ($V_{DS} = 28\text{ V}$, $V_{GS} = 0$, $f = 1\text{ MHz}$)	C_{rss}	–	4	–	pF

FUNCTIONAL CHARACTERISTICS, CW Operation

Common Source Power Gain ($V_{DD} = 28\text{ V}$, $P_{out} = 60\text{ W}$, $I_{DQ} = 200\text{ mA}$, $f = 860\text{ MHz}$)	G_{ps}	13	14.7	–	dB
Drain Efficiency ($V_{DD} = 28\text{ V}$, $P_{out} = 60\text{ W}$, $I_{DQ} = 200\text{ mA}$, $f = 860\text{ MHz}$)	η	50	54	–	%
Load Mismatch ($V_{DD} = 28\text{ V}$, $P_{out} = 60\text{ W}$, $I_{DQ} = 200\text{ mA}$, $f = 860\text{ MHz}$, Load VSWR at 5:1 at All Phase Angles)	ψ	No Degradation in Output Power			

TYPICAL CHARACTERISTICS, 2 Tone Operation, Push Pull Configuration (MRF373SR1), Broadband Fixture

Common Source Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 100\text{ W PEP}$, $I_{DQ} = 400\text{ mA}$, $f_1 = 860.0\text{ MHz}$, $f_2 = 866\text{ MHz}$)	G_{ps}	–	11.2	–	dB
Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 100\text{ W PEP}$, $I_{DQ} = 400\text{ mA}$, $f_1 = 860.0\text{ MHz}$, $f_2 = 866\text{ MHz}$)	η	–	40	–	%
Third Order Intermodulation Distortion ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 100\text{ W PEP}$, $I_{DQ} = 400\text{ mA}$, $f_1 = 860.0\text{ MHz}$, $f_2 = 866\text{ MHz}$)	IMD	–	–30	–	dBc



- | | | | |
|------------|---|---------------------|---|
| C1 | 4.7 pF, B Case Chip Capacitor, ATC | Connectors | N-Type (female), M/A Com P/N 3052-1648-10 |
| C2 | 15 pF, B Case Chip Capacitor, ATC | PCB | MRF373 Printed Circuit Board Rev 01, CuClad 250 (GX-0300-55), height 30 mils, $\epsilon_r = 2.55$ |
| C3 | 6.8 pF, B Case Chip Capacitor, ATC | Heatsink | Motorola P/N 95-11LDMOSKPS-1 |
| C4, C5, C6 | 10 pF, B Case Chip Capacitor, ATC | LDMOS | μ 250 3" x 5" Bedstead |
| C7, C8 | 47 pF, B Case Chip Capacitor, ATC | Insert | Motorola P/N 95-11LDMOSKPS-2 |
| C9 | 0.2 pF, B Case Chip Capacitor, ATC | Insert for LDMOS | μ 250 3" x 5" Bedstead |
| C10, C13 | 300 pF, B Case Chip Capacitor, ATC, Side Mounted | End Plates | 2) Motorola P/N 93-3MB-9, End Plate for Type-N Connector |
| C11 | 2) 2.2 μ F, 50 V, Kemet P/N C1825C225 | Banana Jack and Nut | |
| C12 | 22 μ F, 50 V, Kemet P/N T491D226K50AS | | |
| C14 | 2) 1.0 μ F, 50 V, Kemet P/N C1825C105 | | |
| C15 | 10 μ F, 35 V, Kemet P/N T491D106K35AS | | |
| L1 | 22 nH, Coilcraft P/N B07T | Brass Banana Jack | |
| R1 | 1.2 k Ω , Vishay Dale Chip Resistor (1206) | | |
| R2 | 12 k Ω , Vishay Dale Chip Resistor (1206) | | |

Figure 1. Single-Ended Narrowband Test Circuit Schematic (MRF373R1)

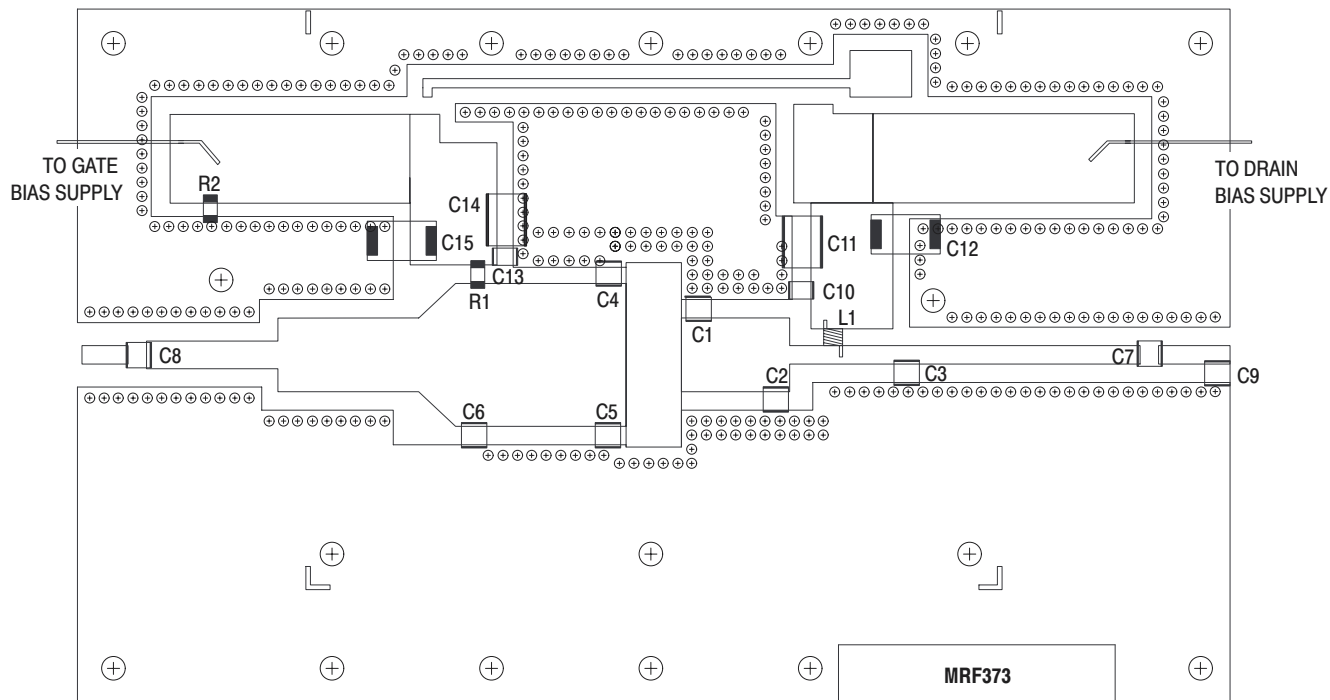


Figure 2. Single-Ended Narrowband Test Circuit Layout (Suitable for Use with MRF373R1)

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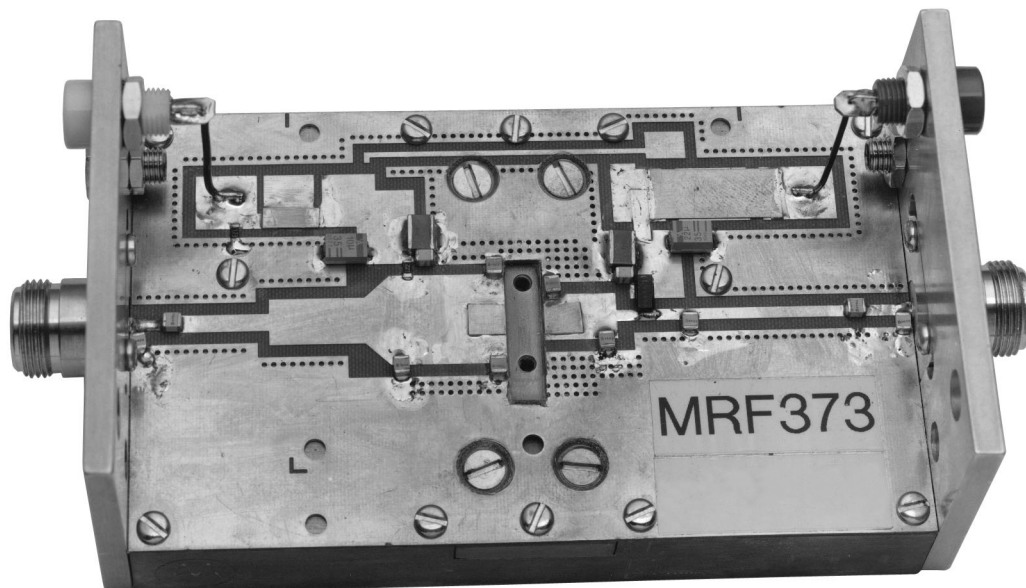
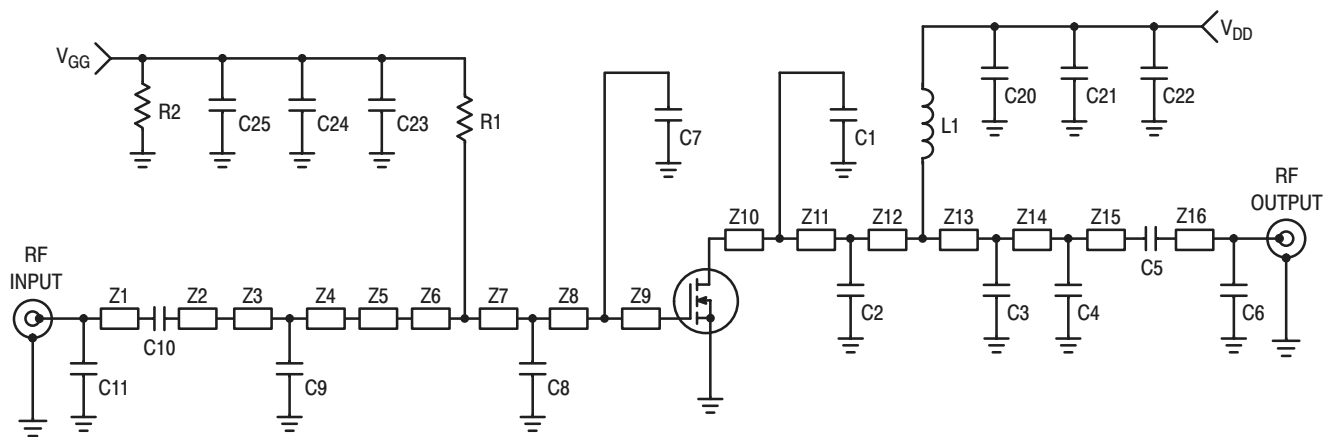


Figure 3. MRF373R1 Narrowband Test Fixture Photo



- C1, C2 18 pF, B Case Chip Capacitor, ATC
- C3 12 pF, B Case Chip Capacitor, ATC
- C4, C11 0.8 pF, B Case Chip Capacitor, ATC
- C5, C10 68 pF, B Case Chip Capacitor, ATC
- C6 0.3 pF, B Case Chip Capacitor, ATC
- C7 15 pF, B Case Chip Capacitor, ATC
- C8 10 pF, B Case Chip Capacitor, ATC
- C9 1.8 pF, B Case Chip Capacitor, ATC
- C20, C23 300 pF, B Case Chip Capacitor, ATC, Side Mounted
- C21 2) 2.2 μ F, 100 V, Vishay P/N VJ3640Y225KXBAT
- C24 2) 1.0 μ F, 50 V, Kemet P/N C1825C105
- C22 22 μ F, 35 V, Kemet P/N T491D226K35AS
- C25 10 μ F, 35 V, Kemet P/N T491D106K35AS
- L1 22 nH, Coilcraft P/N B07T
- R1 1.2 k Ω , Vishay Dale Chip Resistor (1206)
- R2 12 k Ω , Vishay Dale Chip Resistor (1206)

- Connectors N-Type (female), M/A Com P/N 3052-1648-10
- PCB MRF373 Printed Circuit Board Rev 01, CuClad 250 (GX-0300-55), height 30 mils, $\epsilon_r = 2.55$ (new PCB's available from CMR)
- Heatsink Motorola P/N 95-11LDMOSKPS-1 LDMOS μ 250 3" x 5" Bedstead
- Insert Motorola P/N 95-11LDMOSKPS-2S Insert for LDMOS μ 250S 3" x 5" Bedstead
- End Plates 2) Motorola P/N 93-3MB-9, End Plate for Type-N Connector
- Banana Jack and Nut 2) Johnson P/N 108-0904-001
- Brass Banana Jack 2) H.H. Smith P/N SM-101

Figure 4. Single-Ended Narrowband Test Circuit Schematic (MRF373SR1)

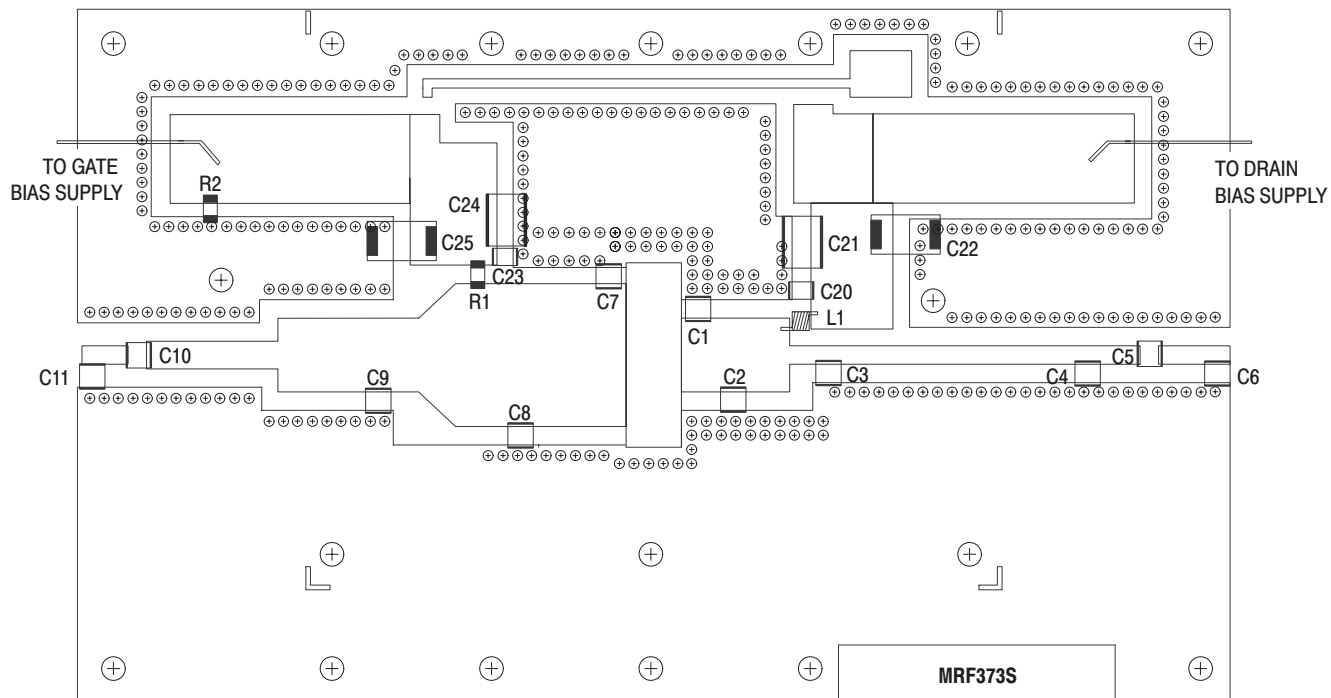


Figure 5. Single-Ended Narrowband Test Circuit Layout (Suitable for Use with MRF373SR1)

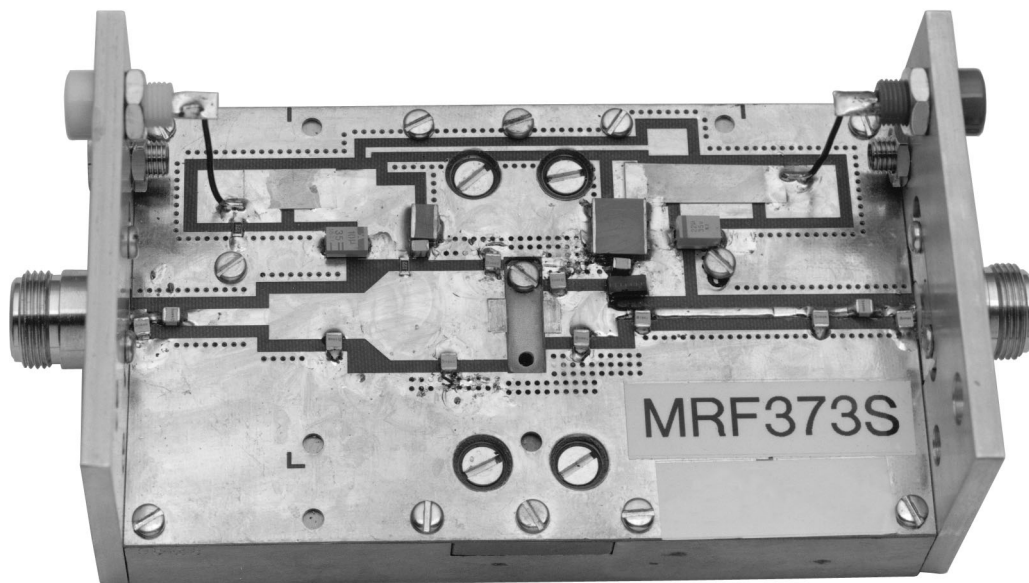


Figure 6. MRF373SR1 Narrowband Test Circuit Photo

TYPICAL CHARACTERISTICS FOR MRF373R1 IN SINGLE-ENDED FIXTURE

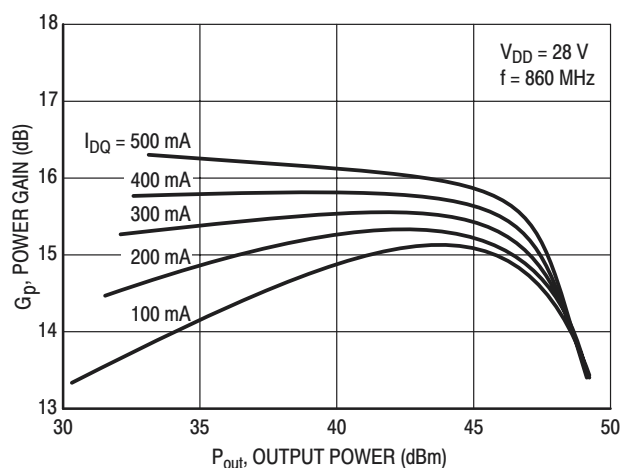


Figure 7. Power Gain versus Output Power

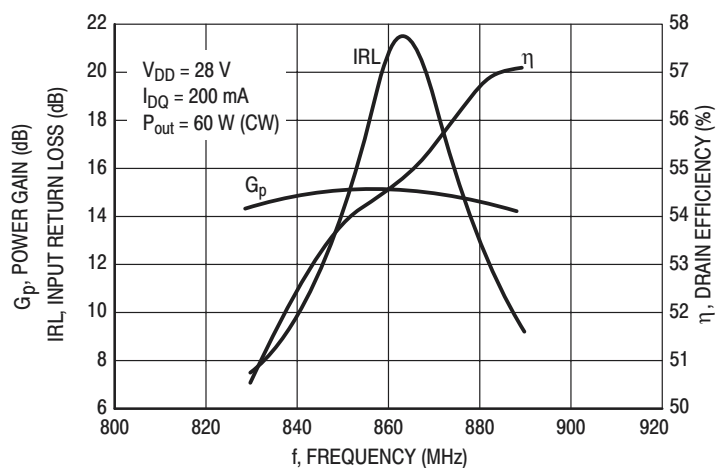


Figure 8. Performance in Narrowband Circuit

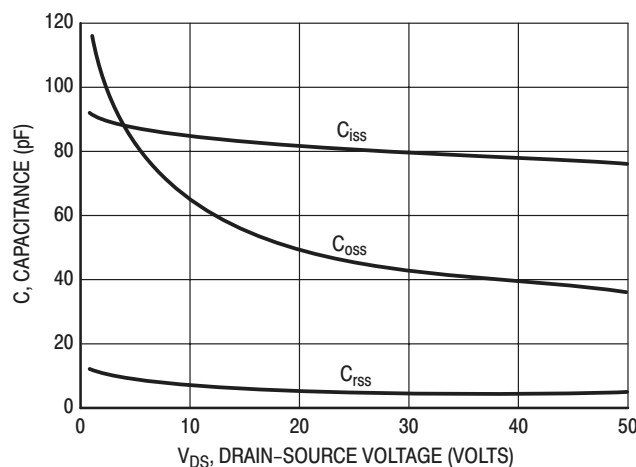
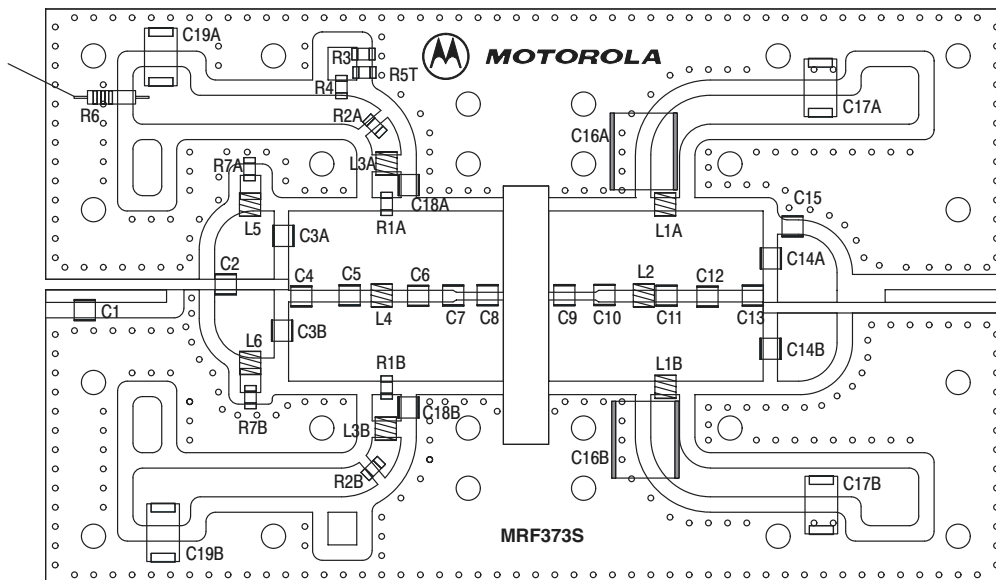


Figure 9. Capacitance versus Voltage

Table 1. Common Source S-Parameters ($V_{DS} = 28\text{ V}$, $I_D = 2.0\text{ A}$)

f MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠φ	S ₂₁	∠φ	S ₁₂	∠φ	S ₂₂	∠φ
400	0.921	182	2.23	52	0.009	39	0.824	184
450	0.922	181	1.95	49	0.009	53	0.832	184
500	0.924	180	1.70	46	0.010	64	0.841	184
550	0.926	179	1.49	42	0.011	72	0.851	183
600	0.929	178	1.31	38	0.013	78	0.860	183
650	0.932	177	1.16	35	0.015	81	0.870	182
700	0.936	176	1.03	31	0.017	82	0.881	182
750	0.940	176	0.93	28	0.019	82	0.892	181
800	0.945	175	0.84	26	0.021	82	0.904	180
850	0.951	174	0.78	24	0.023	80	0.917	180
900	0.957	173	0.72	24	0.025	78	0.929	179

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Vertical Balun Mounting Detail

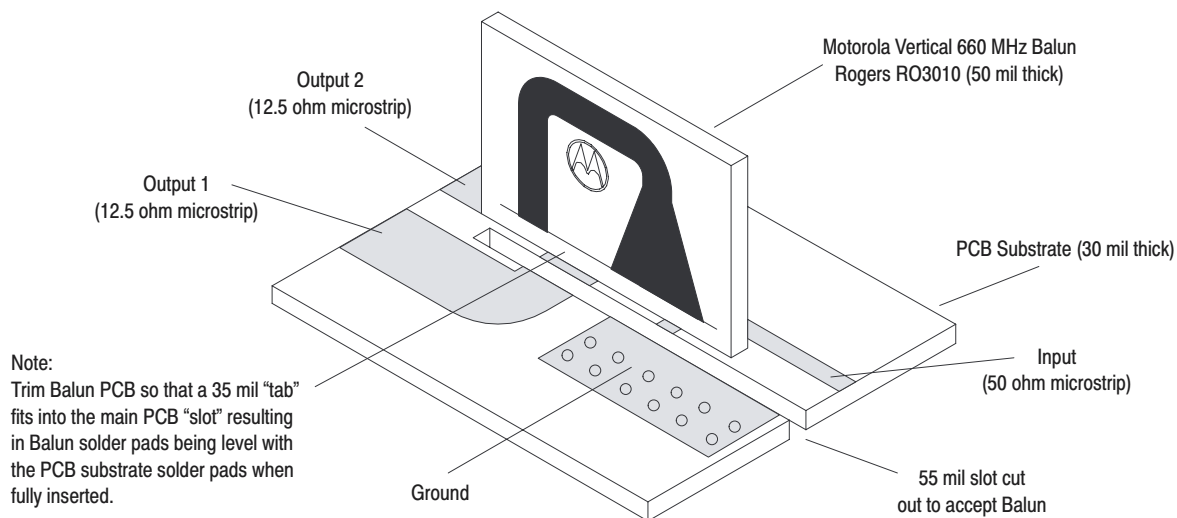


Figure 10. MRF373SR1 Broadband Push-Pull Component Layout

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Table 2. MRF373SR1 Broadband Push–Pull Application Parts List

Designation	Description
C1	1.0 pF, AVX, P12101J1R0BBT
C2, C4, C10	10 pF, AVX, P12101J100GBT
C3A, B	120 pF, 300 V, AVX, AQ149M121JAJBE
C5, C6, C9	12 pF, AVX, P12101J120GBT
C7, C8	18 pF, AVX, P12101J180GBT
C11	6.8 pF, AVX, P12101J6R8BBT
C12	4.7 pF, AVX, P12101J4R7BBT
C13, C18A, B	3.3 pF, AVX, P12101J3R3BBT
C14A, B	100 pF, 500 V, AVX, AQ147M101JAJBE
C15	2.7 pF, AVX, P12101J2R7BBT
C16A, B	3.3 μ F, 100 V, Vitramon P/N VJ3640Y335KXBAT
C17A, B, C19A, B	22 μ F, 35 V, Kemet P/N T491D226K35AS
L1A, B, L3A, B, L4, L5	8.0 nH, Coilcraft P/N A03T
L2, L6	12.5 nH, Coilcraft P/N A04T
R1A, B	22 Ω , Vishay Dale Chip Resistor, 1/4 W (1206)
R2A, B	10 Ω , Vishay Dale Chip Resistor, 1/4 W (1206)
R3	390 Ω , Vishay Dale Chip Resistor (1206)
R4	2.4 k Ω , Vishay Dale Chip Resistor (1206)
R5T	470 Ω Thermistor, KOA SPEER MOT P/N 0680149M01
PCB	MRF373 PP Printed Circuit Board Rev 2C, Rogers RO4350, Height 30 mils, $\epsilon_r = 3.48$
Balun A, B	Vertical 660 MHz Broadband Balun, Printed Circuit Board Rev 01, Rogers RO3010, Height 50 mils, $\epsilon_r = 10.2$

TYPICAL TWO-TONE BROADBAND CHARACTERISTICS

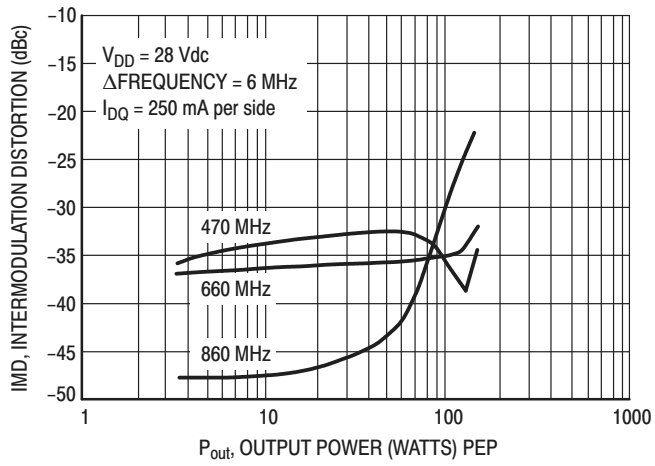


Figure 11. Intermodulation Distortion versus Output Power (MRF373S Broadband Push-Pull Fixture)

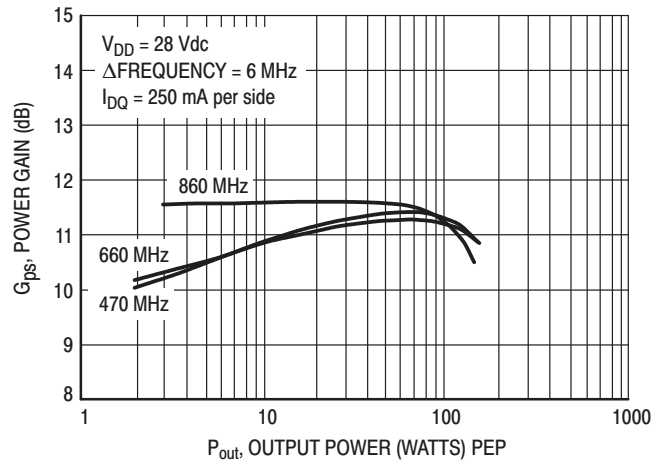


Figure 12. Broadband Power Gain versus Output Power (MRF373S Broadband Push-Pull Fixture)

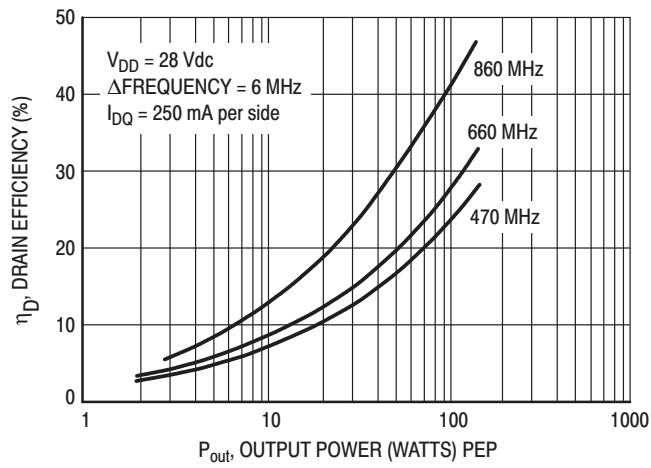


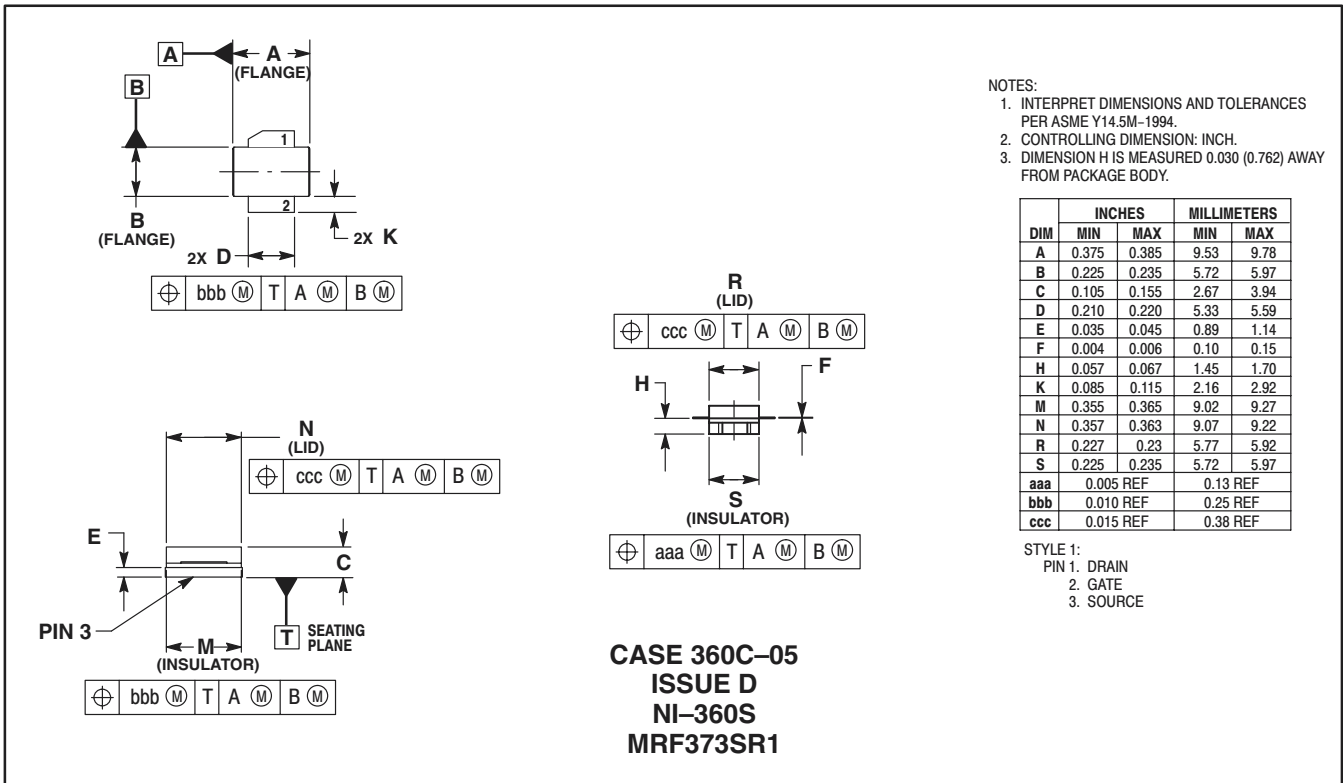
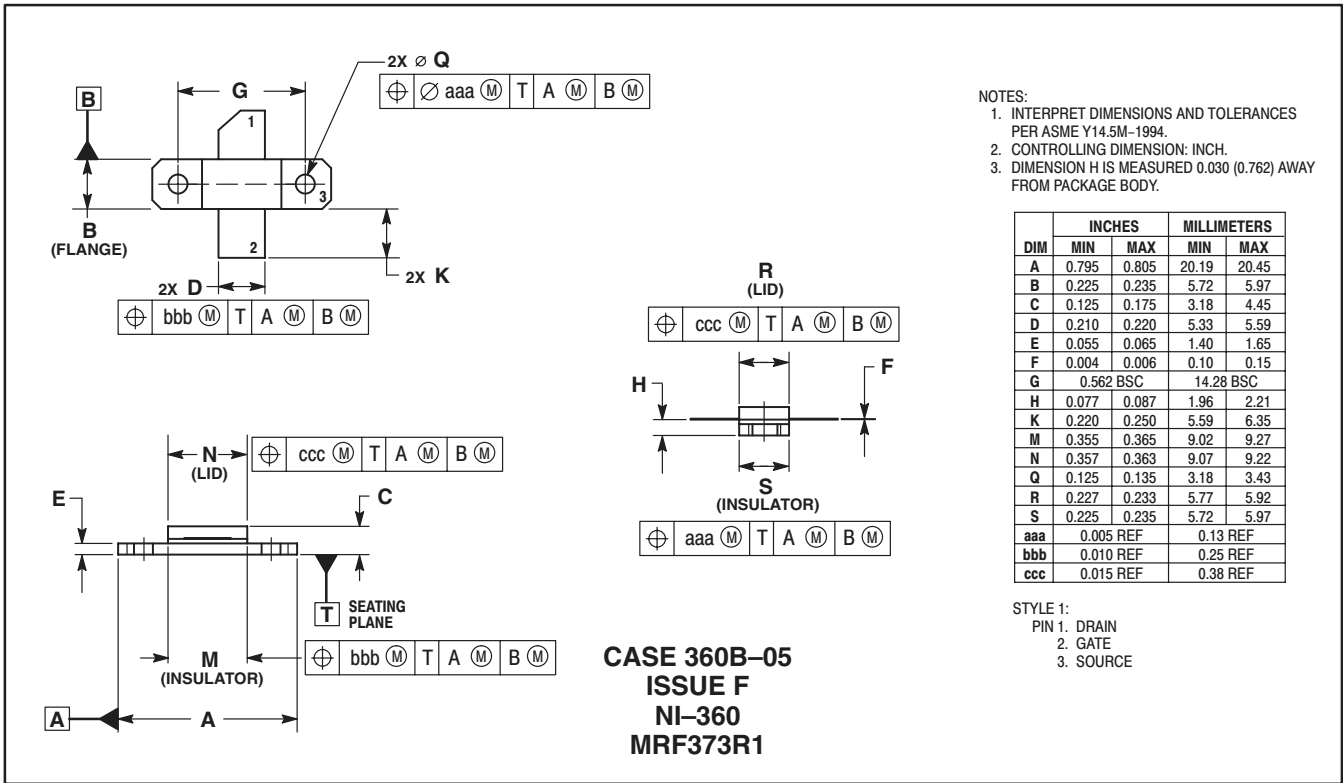
Figure 13. Efficiency versus Output Power (MRF373S Broadband Push-Pull Fixture)

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NOTES

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PACKAGE DIMENSIONS



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