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SEMICONDUCTOR TECHNICAL DATA

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The RF MOSFET Line

RF Power Field Effect Transistors

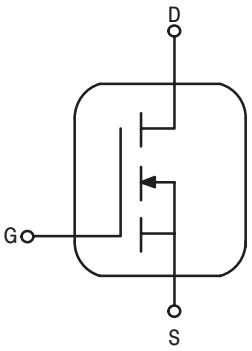
N–Channel Enhancement–Mode Lateral MOSFETs

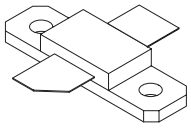
MRF373R1
MRF373SR1

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

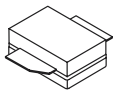
Designed for broadband commercial and industrial applications with frequencies from 470 – 860 MHz. The high gain and broadband performance of these devices make them ideal for large–signal, common source amplifier applications in 28 volt transmitter equipment.

- 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

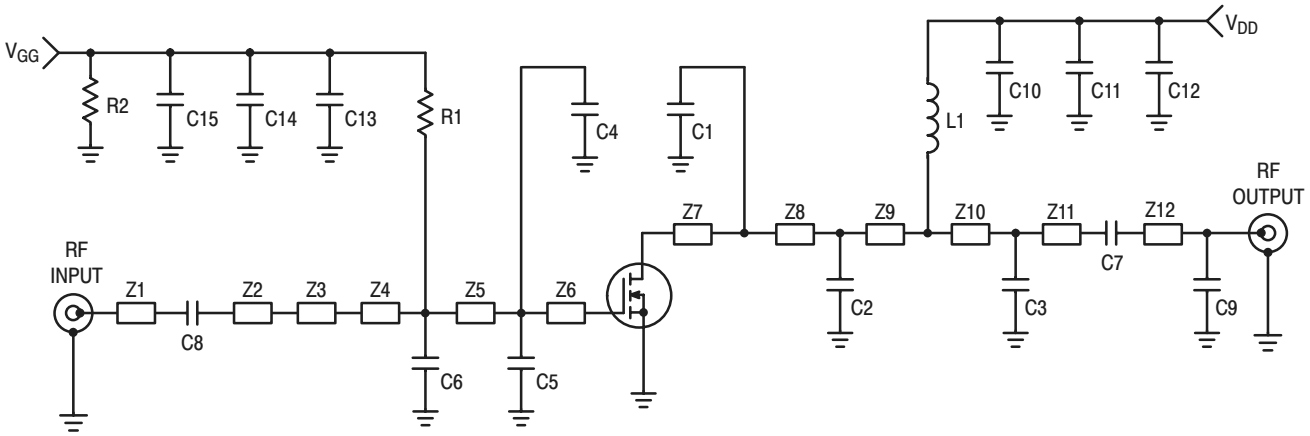
Characteristic		Symbol	Max	Unit
Thermal Resistance, Junction to Case	MRF373SR1	$R_{\theta JC}$	0.75	°C/W
Thermal Resistance, Junction to Case	MRF373R1	$R_{\theta JC}$	1	°C/W

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

REV 6

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D =1 μA)	$V_{(BR)DSS}$	65	–	–	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	–	–	1	μAdc
Gate–Source Leakage Current (V_{GS} = 20 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	–	–	1	μAdc
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 V, I_D = 200 μA)	$V_{GS(th)}$	2	3	4	Vdc
Gate Quiescent Voltage (V_{DS} = 28 V, I_D = 100 mA)	$V_{GS(Q)}$	3	4	5	Vdc
Drain–Source On–Voltage (V_{GS} = 10 V, I_D = 3 A)	$V_{DS(on)}$	–	0.6	0.8	Vdc
Forward Transconductance (V_{DS} = 10 V, I_D = 3 A)	g_{fs}	2.2	2.9	–	S
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 28 V, V_{GS} = 0, f = 1 MHz)	C_{iss}	–	79	–	pF
Output Capacitance (V_{DS} = 28 V, V_{GS} = 0, f = 1 MHz)	C_{oss}	–	46	–	pF
Reverse Transfer Capacitance (V_{DS} = 28 V, V_{GS} = 0, f = 1 MHz)	C_{rss}	–	4	–	pF
FUNCTIONAL CHARACTERISTICS, CW Operation					
Common Source Power Gain (V_{DD} = 28 V, P_{out} = 60 W, I_{DQ} = 200 mA, f = 860 MHz)	G_{ps}	13	14.7	–	dB
Drain Efficiency (V_{DD} = 28 V, P_{out} = 60 W, I_{DQ} = 200 mA, f = 860 MHz)	η	50	54	–	%
Load Mismatch (V_{DD} = 28 V, P_{out} = 60 W, I_{DQ} = 200 mA, f = 860 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 Vdc, P_{out} = 100 W PEP, I_{DQ} = 400 mA, f1 = 860.0 MHz, f2 = 866 MHz)	G_{ps}	–	11.2	–	dB
Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 100 W PEP, I_{DQ} = 400 mA, f1 = 860.0 MHz, f2 = 866 MHz)	η	–	40	–	%
Third Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 100 W PEP, I_{DQ} = 400 mA, f1 = 860.0 MHz, f2 = 866 MHz)	IMD	–	–30	–	dBc



C1	4.7 pF, B Case Chip Capacitor, ATC
C2	15 pF, B Case Chip Capacitor, ATC
C3	6.8 pF, B Case Chip Capacitor, ATC
C4, C5, C6	10 pF, B Case Chip Capacitor, ATC
C7, C8	47 pF, B Case Chip Capacitor, ATC
C9	0.2 pF, B Case Chip Capacitor, ATC
C10, C13	300 pF, B Case Chip Capacitor, ATC, Side Mounted
C11	2) 2.2 μF, 50 V, Kemet P/N C1825C225
C12	22 μF, 50 V, Kemet P/N T491D226K50AS
C14	2) 1.0 μF, 50 V, Kemet P/N C1825C105
C15	10 μF, 35 V, Kemet P/N T491D106K35AS
L1	22 nH, Coilcraft P/N B07T
R1	1.2 kΩ, Vishay Dale Chip Resistor (1206)
R2	12 kΩ, 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, ε_r = 2.55
Heatsink	Motorola P/N 95–11LDMOSKPS–1 LDMOS μ250 3″ x 5″ Bedstead
Insert	Motorola P/N 95–11LDMOSKPS–2 Insert for LDMOS μ250 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 1. Single–Ended Narrowband Test Circuit Schematic (MRF373R1)

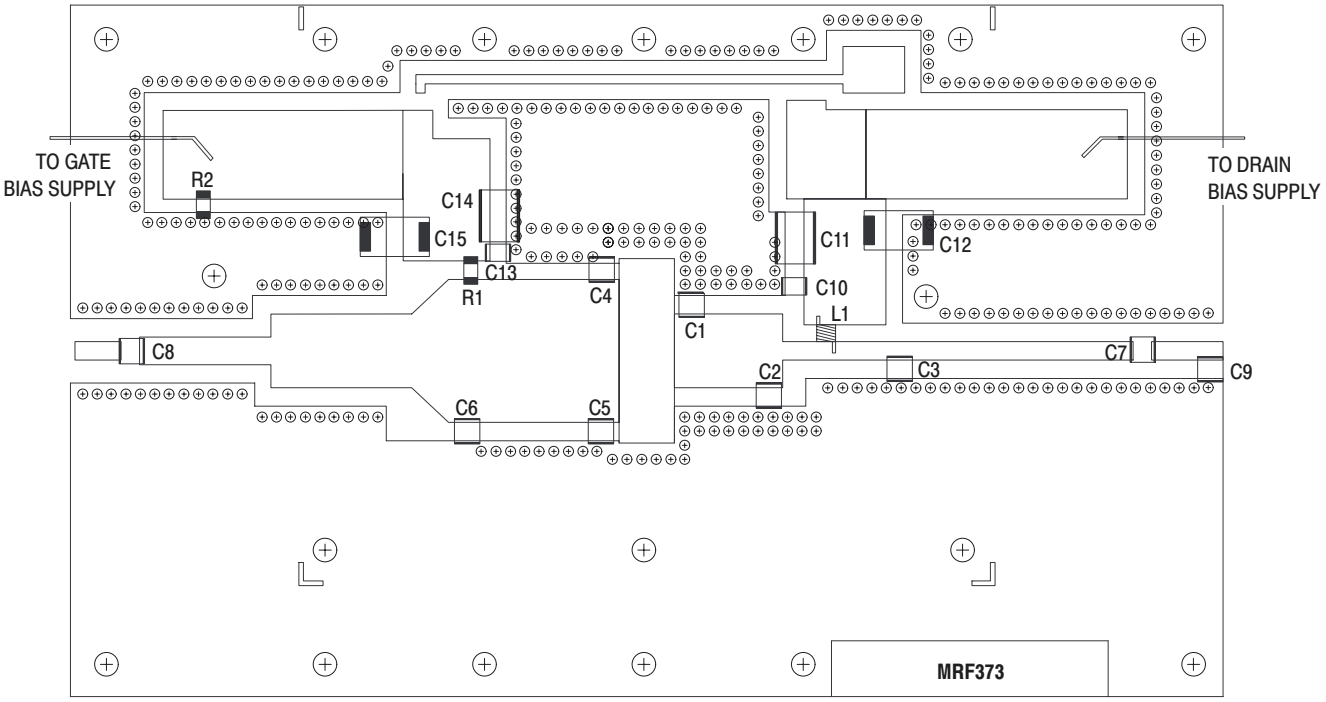


Figure 2. Single–Ended Narrowband Test Circuit Layout (Suitable for Use with MRF373R1)

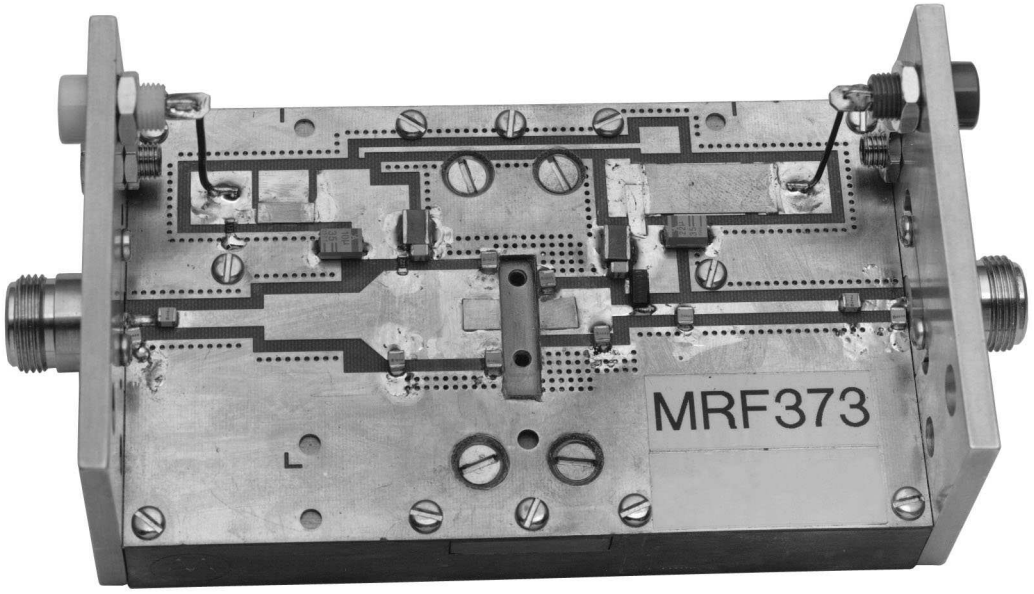
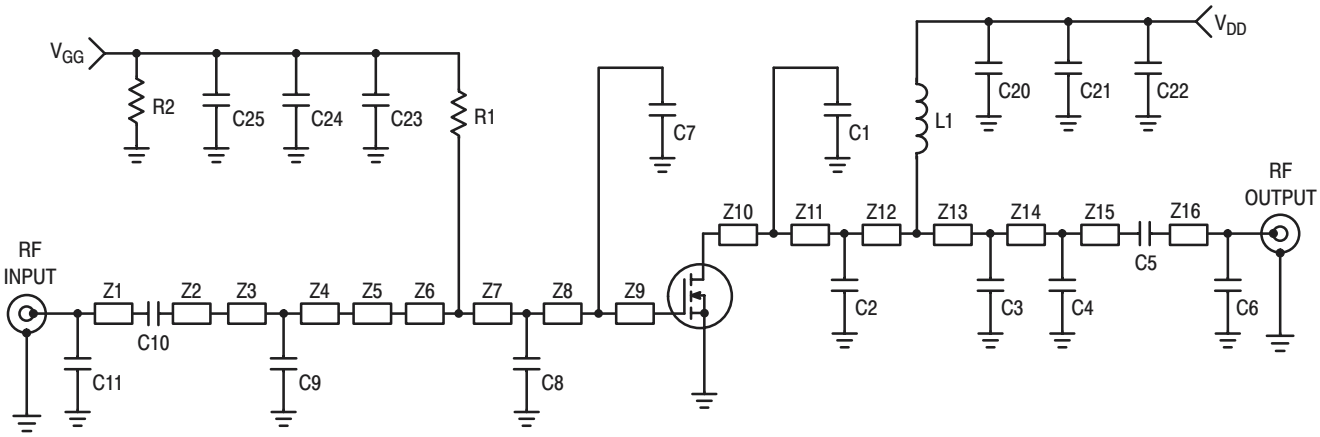


Figure 3. MRF373R1 Narrowband Test Fixture Photo



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 μF, 100 V, Vishay P/N VJ3640Y225KXBAT
C24	2) 1.0 μF, 50 V, Kemet P/N C1825C105
C22	22 μF, 35 V, Kemet P/N T491D226K35AS
C25	10 μF, 35 V, Kemet P/N T491D106K35AS
L1	22 nH, Coilcraft P/N B07T
R1	1.2 kΩ, Vishay Dale Chip Resistor (1206)
R2	12 kΩ, 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, ε_r = 2.55 (new PCB's available from CMR)
Heatsink	Motorola P/N 95–11LDMOSKPS–1 LDMOS μ250 3″ x 5″ Bedstead
Insert	Motorola P/N 95–11LDMOSKPS–2S Insert for LDMOS μ250S 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)

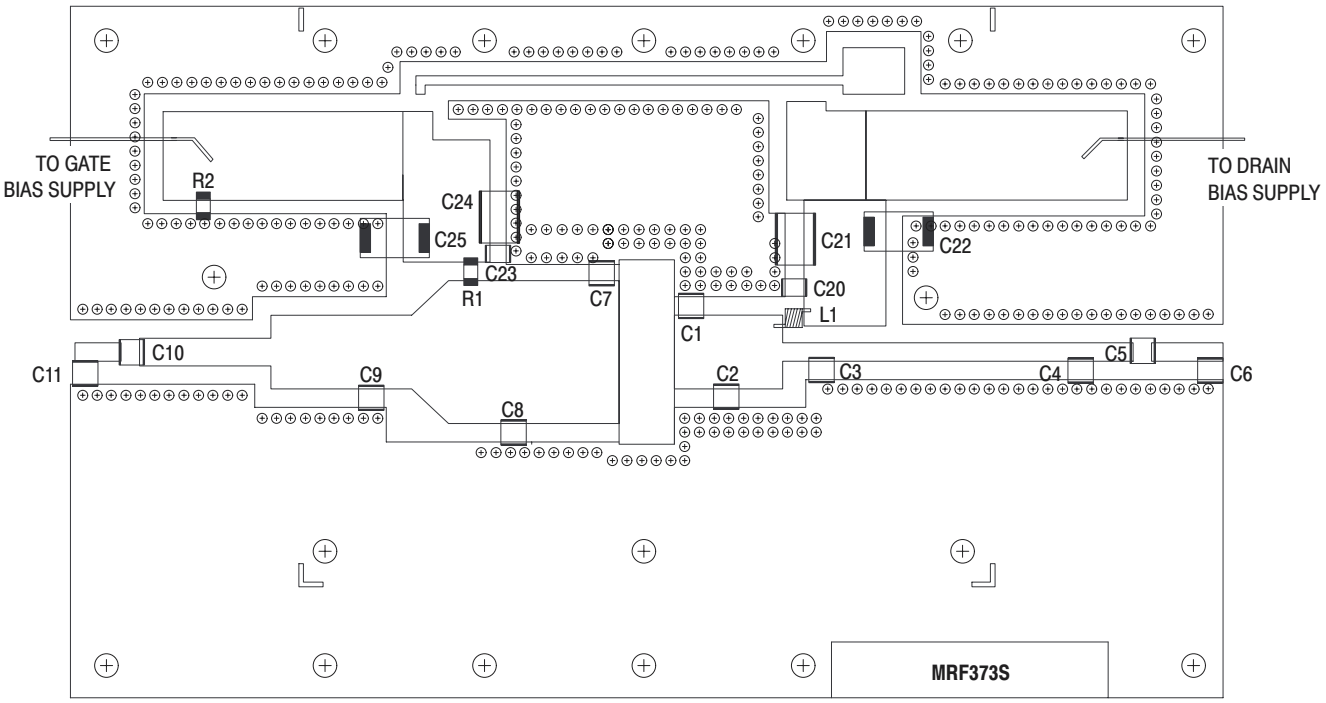


Figure 5. Single–Ended Narrowband Test Circuit Layout (Suitable for Use with MRF373SR1)

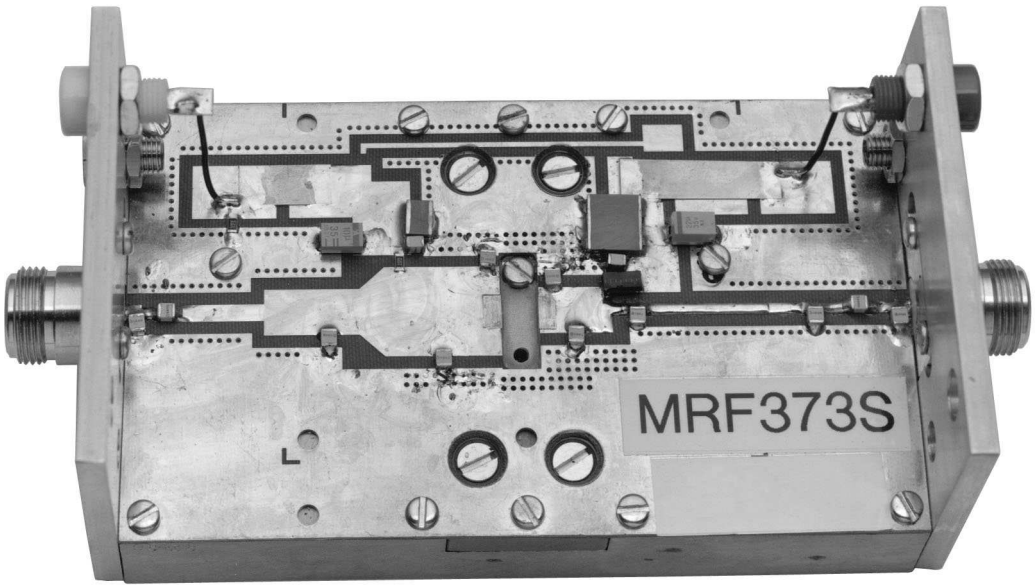


Figure 6. MRF373SR1 Narrowband Test Circuit Photo

TYPICAL CHARACTERISTICS FOR MRF373R1 IN SINGLE–ENDED FIXTURE

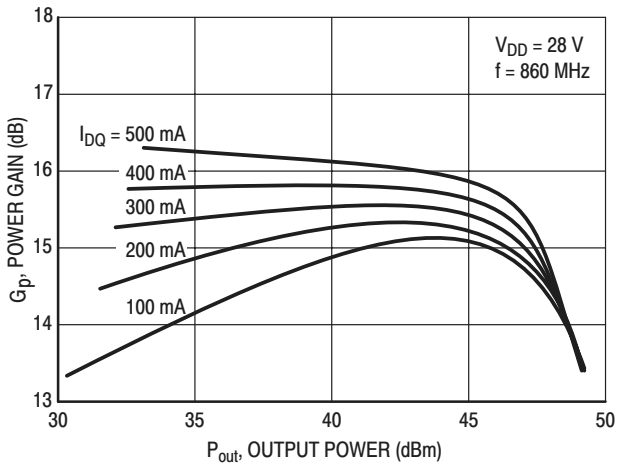


Figure 7. Power Gain versus Output Power

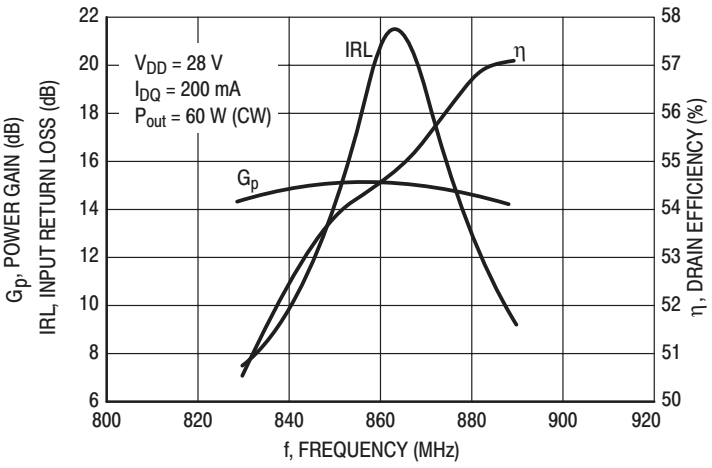


Figure 8. Performance in Narrowband Circuit

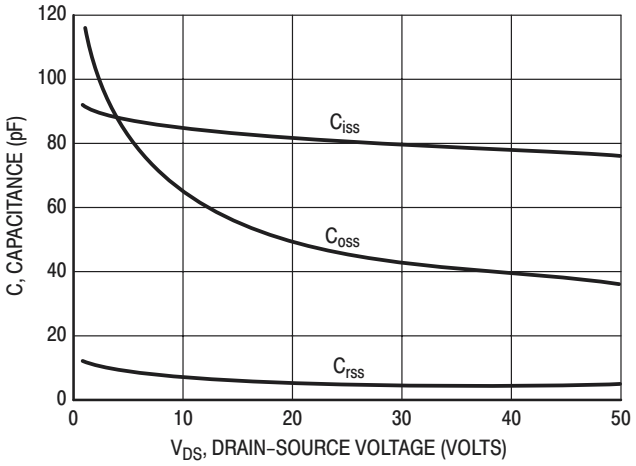
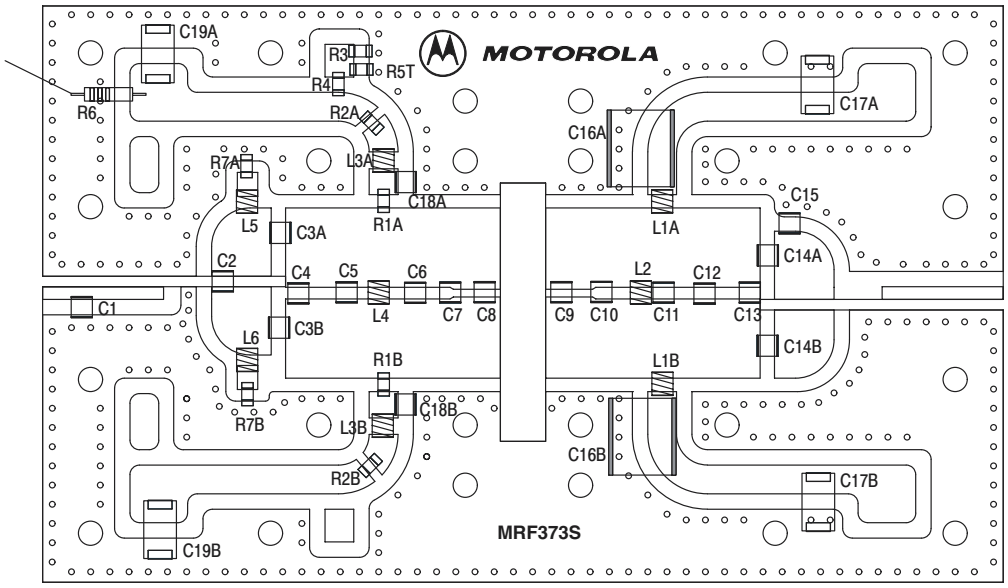


Figure 9. Capacitance versus Voltage

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

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	∠ 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



Vertical Balun Mounting Detail

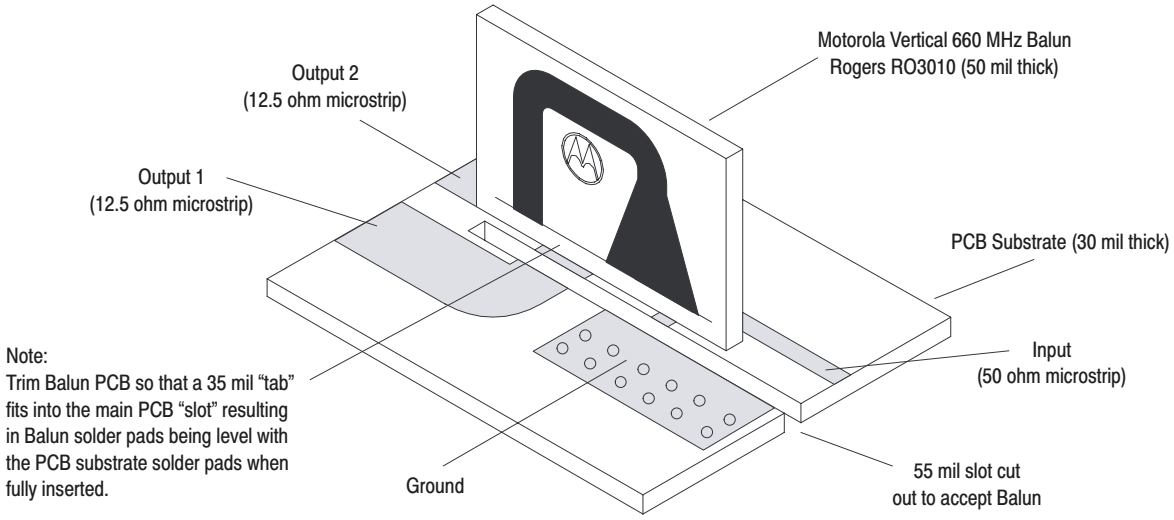


Figure 10. MRF373SR1 Broadband Push–Pull Component Layout

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 μF, 100 V, Vitramon P/N VJ3640Y335KXBAT
C17A, B, C19A, B	22 μF, 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 kΩ, 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, $\varepsilon_r = 3.48$
Balun A, B	Vertical 660 MHz Broadband Balun, Printed Circuit Board Rev 01, Rogers RO3010, Height 50 mils, $\varepsilon_r = 10.2$

TYPICAL TWO–TONE BROADBAND CHARACTERISTICS

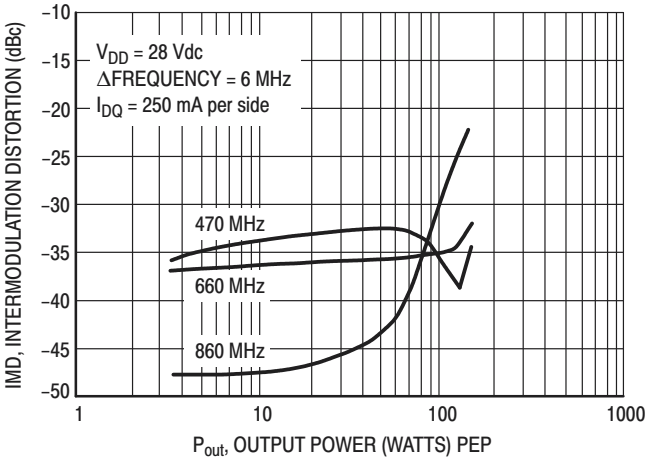


Figure 11. Intermodulation Distortion versus Output Power (MRF373S Broadband Push–Pull Fixture)

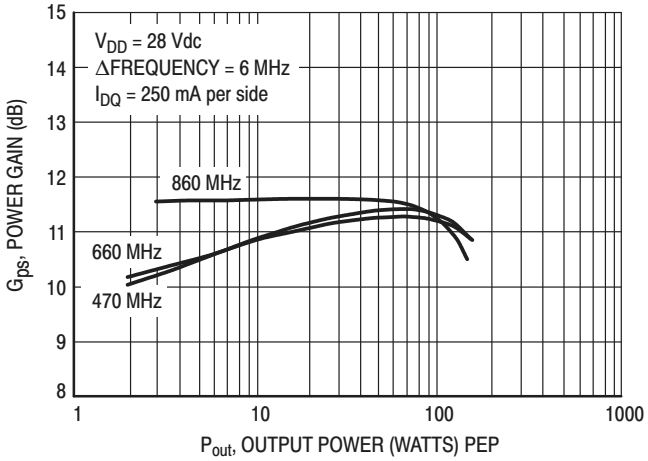


Figure 12. Broadband Power Gain versus Output Power (MRF373S Broadband Push–Pull Fixture)

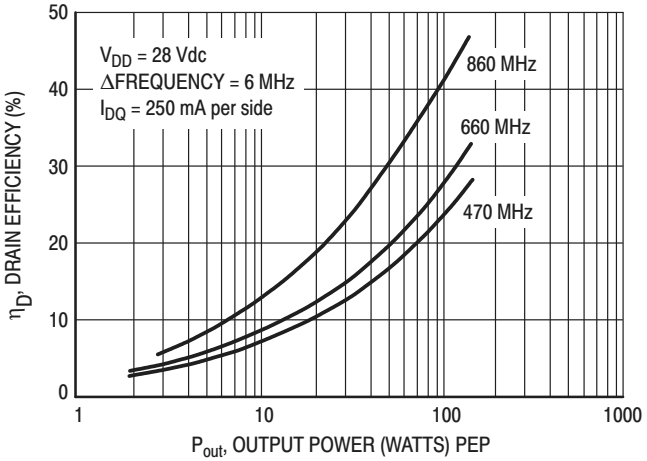
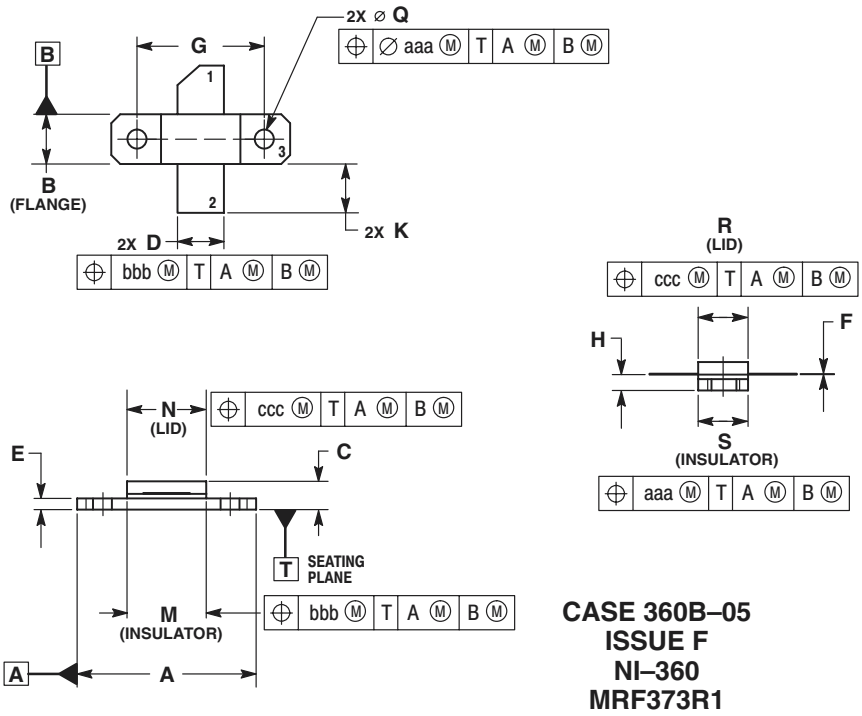


Figure 13. Efficiency versus Output Power (MRF373S Broadband Push–Pull Fixture)

NOTES

PACKAGE DIMENSIONS

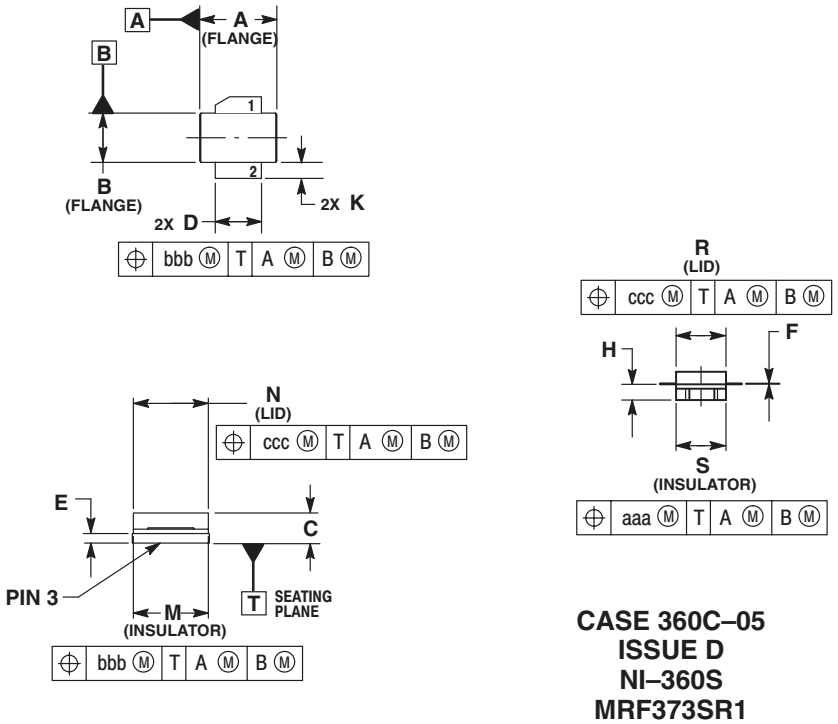


NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.795	0.805	20.19	20.45
B	0.225	0.235	5.72	5.97
C	0.125	0.175	3.18	4.45
D	0.210	0.220	5.33	5.59
E	0.055	0.065	1.40	1.65
F	0.004	0.006	0.10	0.15
G	0.562 BSC		14.28 BSC	
H	0.077	0.087	1.96	2.21
K	0.220	0.250	5.59	6.35
M	0.355	0.365	9.02	9.27
N	0.357	0.363	9.07	9.22
Q	0.125	0.135	3.18	3.43
R	0.227	0.233	5.77	5.92
S	0.225	0.235	5.72	5.97
aaa	0.005 REF		0.13 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

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

CASE 360B–05
ISSUE F
NI–360
MRF373R1



NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.375	0.385	9.53	9.78
B	0.225	0.235	5.72	5.97
C	0.105	0.155	2.67	3.94
D	0.210	0.220	5.33	5.59
E	0.035	0.045	0.89	1.14
F	0.004	0.006	0.10	0.15
H	0.057	0.067	1.45	1.70
K	0.085	0.115	2.16	2.92
M	0.355	0.365	9.02	9.27
N	0.357	0.363	9.07	9.22
R	0.227	0.23	5.77	5.92
S	0.225	0.235	5.72	5.97
aaa	0.005 REF		0.13 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

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

CASE 360C–05
ISSUE D
NI–360S
MRF373SR1

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