

The RF MOSFET Line

RF Power Field-Effect Transistor

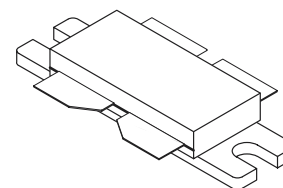
N-Channel Enhancement-Mode Lateral MOSFET

Designed for broadband commercial and industrial applications with frequencies from 470 to 860 MHz. The high gain and broadband performance of this device make it ideal for large-signal, common source amplifier applications in 32 volt digital television transmitter equipment.

- Typical Broadband DVBT OFDM Performance @ 470–860 MHz, 32 Volts, $I_{DQ} = 2.0$ A, 8K Mode, 64 QAM
Output Power — 45 Watts Avg.
Power Gain ≥ 16.7 dB
Efficiency $\geq 21\%$
ACPR ≤ -58 dBc
- Typical Broadband ATSC 8VSB Performance @ 470–860 MHz, 32 Volts, $I_{DQ} = 2.0$ A
Output Power — 80 Watts Avg.
Power Gain ≥ 16.5 dB
Efficiency $\geq 27.5\%$
IMD ≤ -31.3 dBc
- Internally Input and Output Matched for Ease of Use
- Integrated ESD Protection
- Capable of Handling 10:1 VSWR, @ 32 Vdc, 860 MHz, 45 Watts DVBT OFDM Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Available in Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel. R5 Suffix = 50 Units per 56 mm, 13 inch Reel.

MRF377
MRF377R3
MRF377R5

470 – 860 MHz, 240 W, 32 V
LATERAL N-CHANNEL
RF POWER MOSFET



CASE 375G-04, STYLE 1
NI-860C3

MAXIMUM RATINGS ⁽¹⁾

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	– 0.5, +15	Vdc
Drain Current – Continuous	I_D	17	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	486 2.78	W W/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	– 65 to +150	$^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.36	$^\circ\text{C/W}$

ESD PROTECTION CHARACTERISTICS

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)
Charge Device Model	7 (Minimum)

(1) Each side of device measured separately.

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

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

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Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS ⁽¹⁾

Drain–Source Breakdown Voltage (V _{GS} = 0 Vdc, I _D = 10 μA)	V _{(BR)DSS}	65	—	—	Vdc
Zero Gate Voltage Drain Current (V _{DS} = 32 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 ⁽¹⁾

Gate Threshold Voltage (V _{DS} = 10 Vdc, I _D = 200 μA)	V _{GS(th)}	—	2.8	—	Vdc
Gate Quiescent Voltage (V _{DS} = 32 Vdc, I _D = 225 mA)	V _{GS(Q)}	—	3.5	—	Vdc
Drain–Source On–Voltage (V _{GS} = 10 Vdc, I _D = 3 A)	V _{DS(on)}	—	0.27	—	Vdc

DYNAMIC CHARACTERISTICS ⁽¹⁾

Reverse Transfer Capacitance (V _{DS} = 28 Vdc, V _{GS} = 0, f = 1 MHz)	C _{rss}	—	3.2	—	pF
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FUNCTIONAL CHARACTERISTICS (In DVBT OFDM Single–Channel, Narrowband Fixture, 50 ohm system) ⁽²⁾

Common Source Power Gain (V _{DD} = 32 Vdc, P _{out} = 45 W Avg., I _{DQ} = 2 x 1000 mA, f = 860 MHz)	G _{ps}	16.5	18.2	—	dB
Drain Efficiency (V _{DD} = 32 Vdc, P _{out} = 45 W Avg., I _{DQ} = 2 x 1000 mA, f = 860 MHz)	η	21	22.9	—	%
Adjacent Channel Power Ratio (V _{DD} = 32 Vdc, P _{out} = 45 W Avg., I _{DQ} = 2 x 1000 mA, f = 860 MHz)	ACPR	—	–59.2	–57	dBc

TYPICAL CHARACTERISTICS (In DVBT OFDM Single–Channel, Broadband Fixture, 50 ohm system) ⁽²⁾

Common Source Power Gain (V _{DD} = 32 Vdc, P _{out} = 45 W Avg., I _{DQ} = 2 x 1000 mA) f = 470 MHz f = 560 MHz f = 660 MHz f = 760 MHz f = 860 MHz	G _{ps}	— — — — —	17.6 17.6 17.4 17.4 16.8	— — — — —	dB
Drain Efficiency (V _{DD} = 32 Vdc, P _{out} = 45 W Avg., I _{DQ} = 2 x 1000 mA) f = 470 MHz f = 560 MHz f = 660 MHz f = 760 MHz f = 860 MHz	η	— — — — —	23.5 25.8 23.0 22.7 21.3	— — — — —	%
Adjacent Channel Power Ratio (V _{DD} = 32 Vdc, P _{out} = 45 W Avg., I _{DQ} = 2 x 1000 mA) f = 470 MHz f = 560 MHz f = 660 MHz f = 760 MHz f = 860 MHz	ACPR	— — — — —	–59.3 –59.3 –58.7 –58.7 –58.1	— — — — —	dBc

(1) Each side of device measured separately.

(2) Measured in push–pull configuration.

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(2) Measured in push–pull configuration.

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Table 1. 845–875 MHz Narrowband Test Circuit Component Designations and Values

Part	Description	Value, P/N or DWG	Manufacturer
B1, B2	Ferrite Beads, Surface Mount, 11 Ω (0805)	2508051107Y0	Fair-Rite
Balun 1, Balun 2	0.8–1GHz Xinger Balun	3A412	Anaran
C1	33 pF Chip Capacitor (0805)	08055J330JBT	AVX / Kyocera
C2	2.7 pF Chip Capacitor (0603)	06035J2R7BBT	AVX / Kyocera
C3	12 pF Chip Capacitor (0805)	08051J120GBT	AVX / Kyocera
C4, C5	6.8 pF Chip Capacitors (0805)	08051J6R8BBT	AVX / Kyocera
C6	2.7 pF Chip Capacitor (0805)	0805J2R7BBT	AVX / Kyocera
C7, C8, C9, C10	3.3 pF Chip Capacitors (0805)	08051J3R3BBT	AVX / Kyocera
C11, C12	2.2 μ F, 50 V Chip Capacitors	C1825C225J5RAC3810	Kemet
C13, C14, C15, C16	0.01 μ F, 100 V Chip Capacitors	C1825C103J1GAC	Kemet
C17, C18	0.56 μ F, 50 V Chip Capacitors	C1825C564J5RAC	Kemet
C19, C20	10 μ F, 50 V Tantalum Chip Capacitors	522Z050/100MTRE	Tecate
C21, C22, C23, C24	47 μ F, 16 V Tantalum Chip Capacitors	TPSD476K016R0150	AVX / Kyocera
C25, C26	470 μ F, 63 V Electrolytic Capacitors	NACZF471M63V (18x22)	Nippon
L1	12 nH Inductor (0603)	0603HC-12NXJB	CoilCraft
L2	7.15 nH Inductor	1606-7	CoilCraft
L3, L4	10 nH Inductor (0603)	0603HC-10NXJB	CoilCraft
R1, R2	24 Ω , 1/8 W, 5% Chip Resistors (1206)		
WB1, WB2, WB3, WB4	Brass Wear Shims		
PCB	Arlon 30 mil, $\epsilon_r = 2.56$	DS1152	DS Electronics

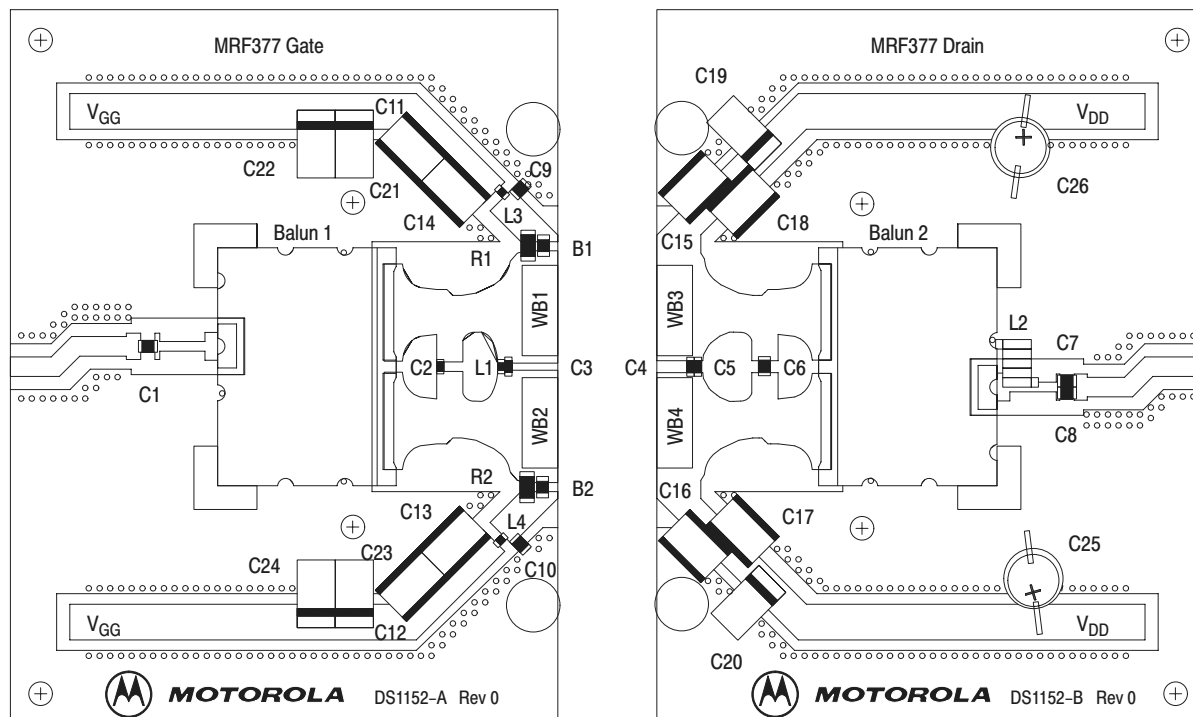


Figure 1. 845–875 MHz Narrowband Test Circuit Component Layout

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TYPICAL NARROWBAND CHARACTERISTICS

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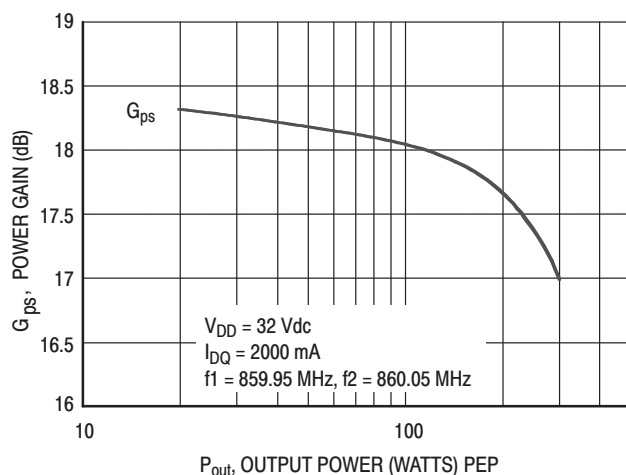


Figure 2. Two-Tone Power Gain versus Output Power

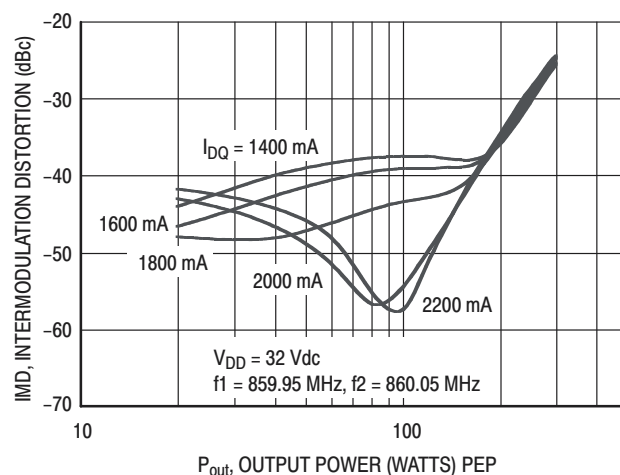


Figure 3. Third Order Intermodulation Distortion versus Output Power

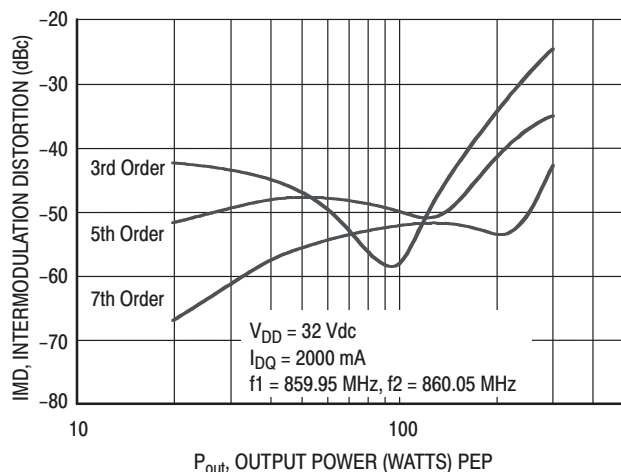


Figure 4. Intermodulation Distortion Products versus Output Power

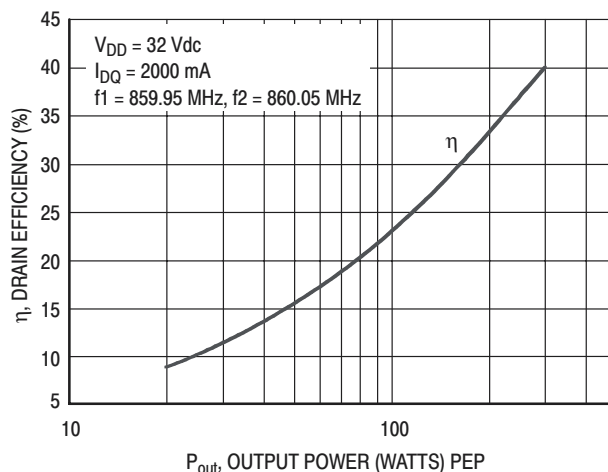


Figure 5. Two-Tone Drain Efficiency versus Output Power

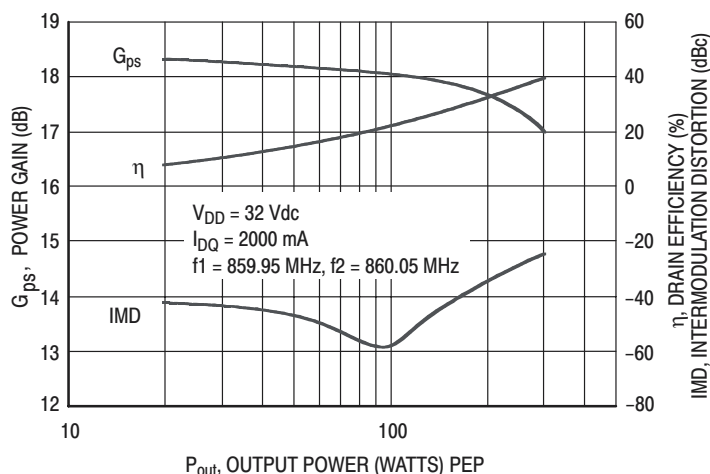
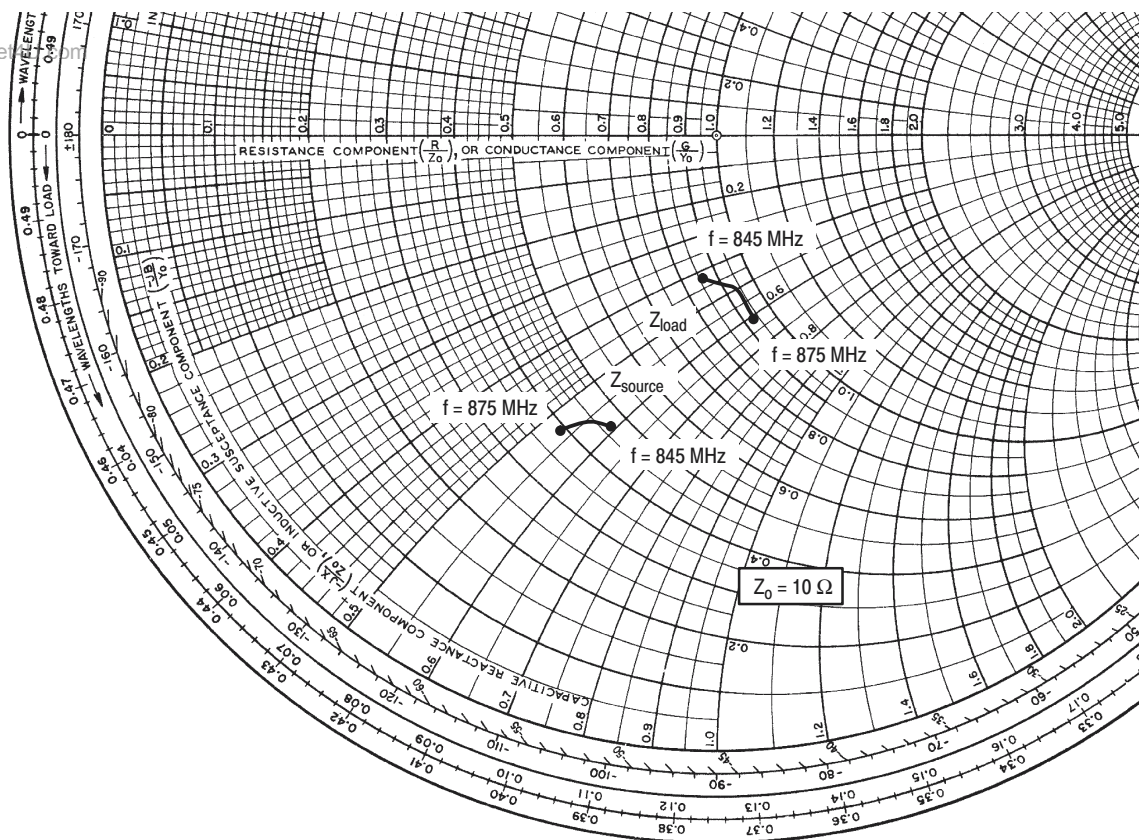


Figure 6. Power Gain, Efficiency and IMD versus Output Power



$V_{DD} = 32 \text{ V}$, $I_{DQ} = 2 \times 1000 \text{ mA}$, $P_{out} = 45 \text{ W Avg.}$, DVB-T OFDM

f MHz	Z_{source} Ω	Z_{load} Ω
845	$4.66 - j5.90$	$8.59 - j4.22$
860	$4.38 - j5.64$	$9.36 - j4.95$
875	$3.93 - j5.33$	$9.39 - j6.06$

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.

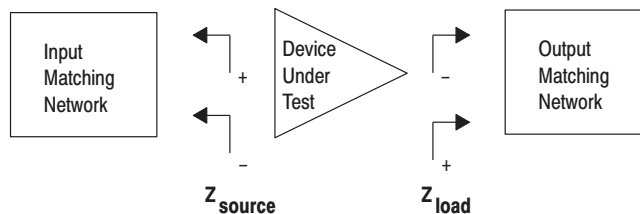
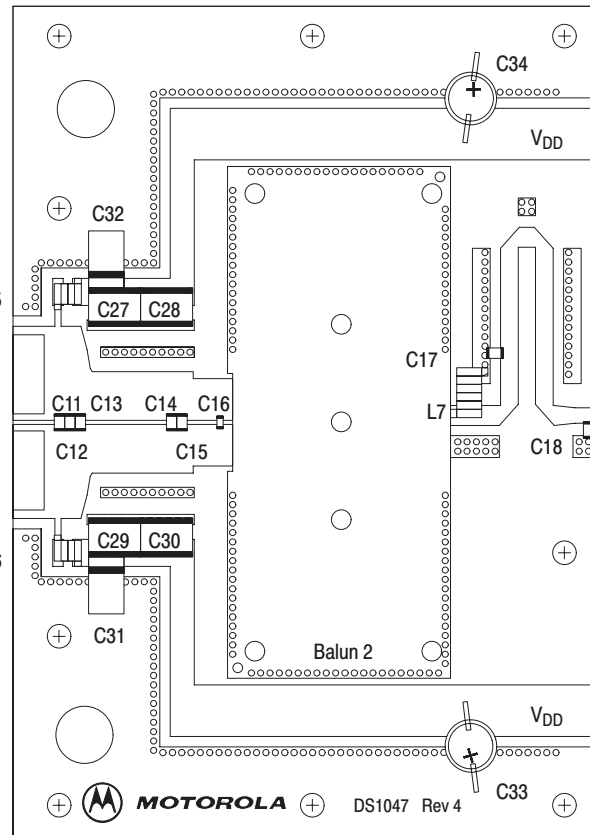
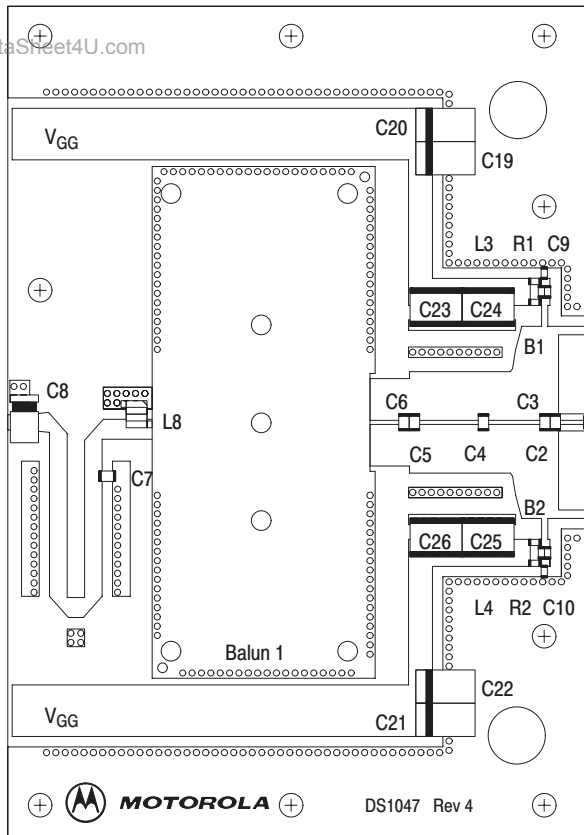


Figure 7. 845–875 MHz Narrowband Series Equivalent Input and Output Impedance

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Multilayer Balun Mounting Detail

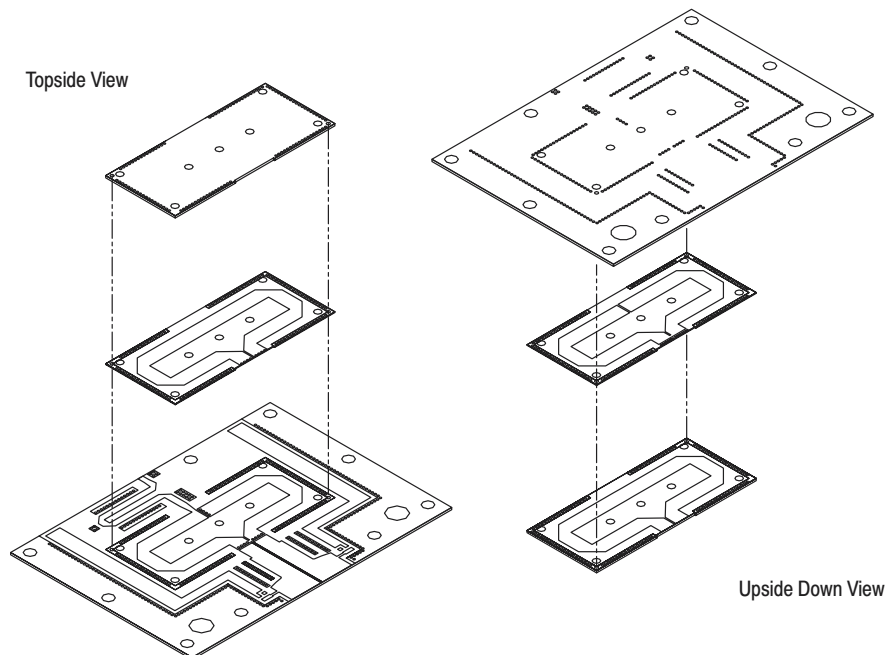


Figure 8. 470–860 MHz Broadband Test Circuit Component Layout



TYPICAL ATSC 8VSB BROADBAND CHARACTERISTICS

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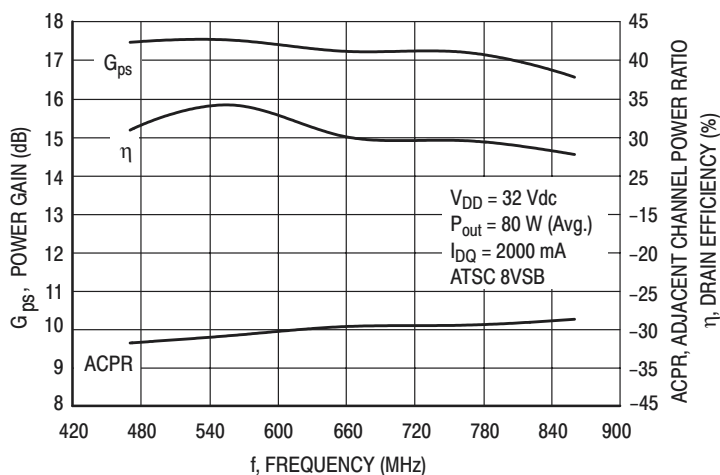


Figure 14. Single-Channel ATSC 8VSB Broadband Performance

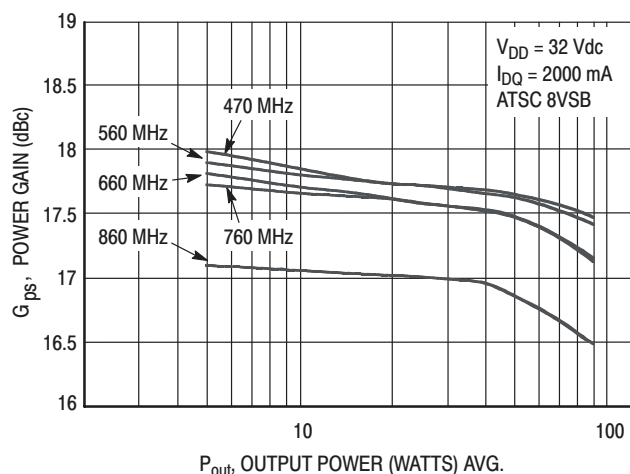


Figure 15. Single-Channel ATSC 8VSB Broadband Performance Power Gain versus Output Power

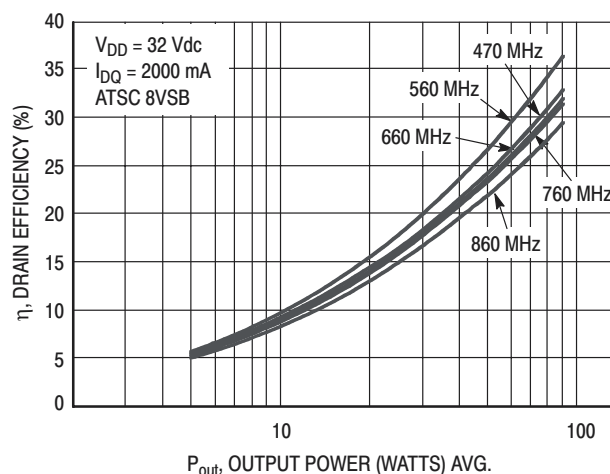


Figure 16. Single-Channel ATSC 8VSB Broadband Performance Drain Efficiency versus Output Power

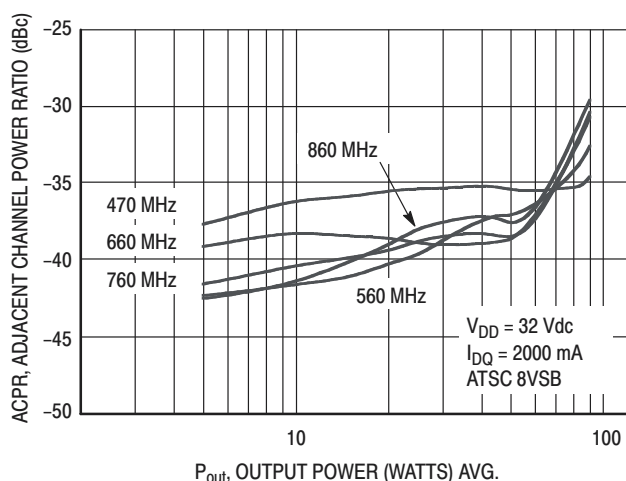


Figure 17. Single-Channel ATSC 8VSB Broadband Performance Adjacent Channel Power Ratio versus Output Power

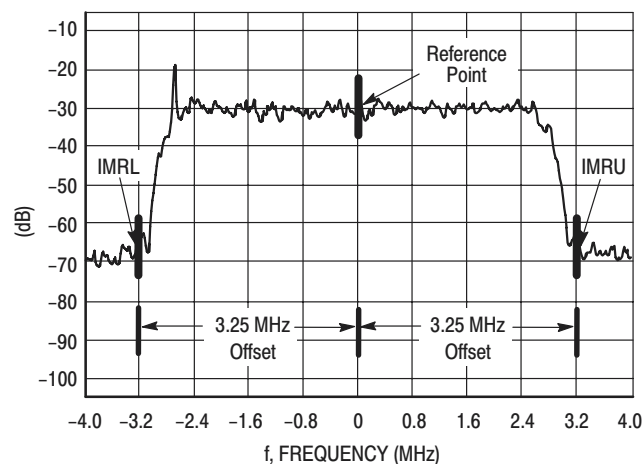
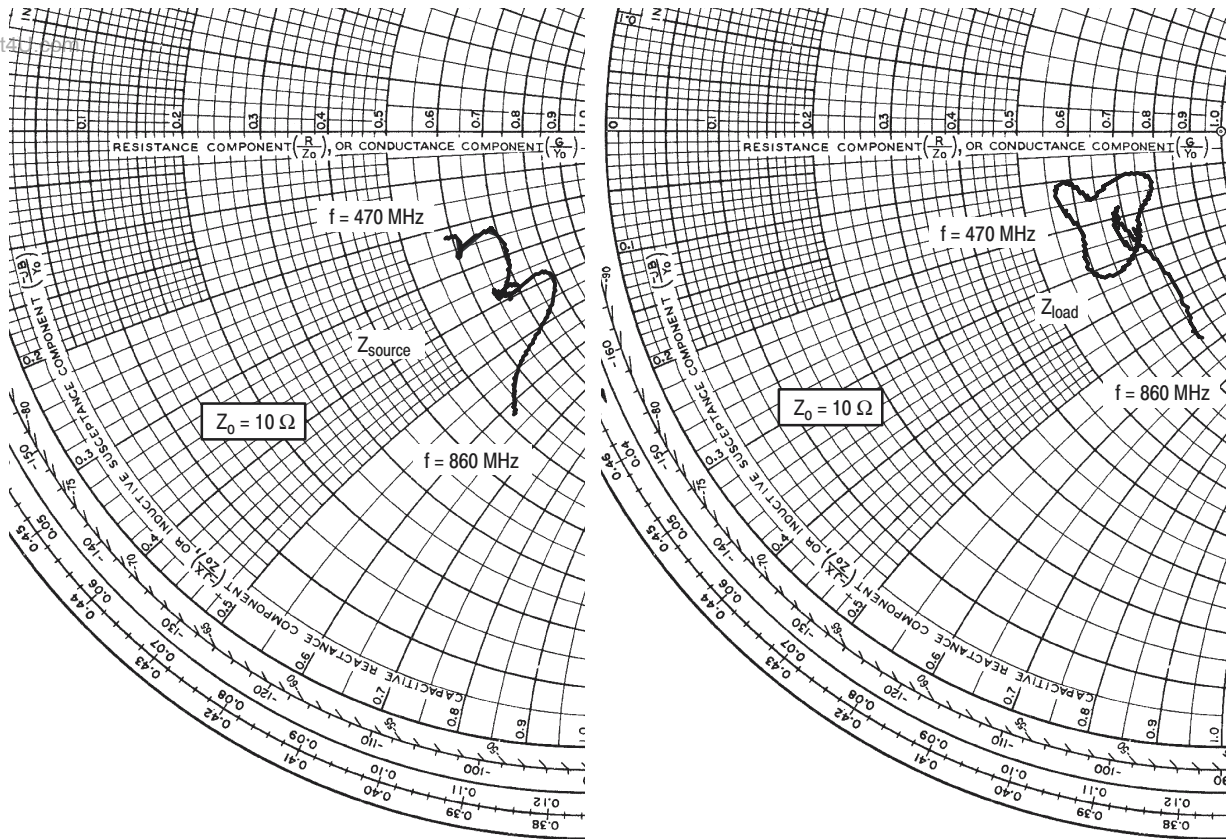


Figure 18. ATSC 8VSB Spectrum



Optimized for $V_{DD} = 32$ V, $I_{DQ} = 2 \times 1000$ mA, $P_{out} = 45$ W Avg., DVBT OFDM

f MHz	Z_{source} Ω	Z_{load} Ω
470	$5.79 - j2.40$	$6.21 - j1.69$
560	$6.63 - j2.63$	$5.66 - j1.12$
660	$6.57 - j4.03$	$6.76 - j1.00$
760	$6.67 - j4.55$	$6.57 - j1.91$
860	$5.34 - j6.28$	$7.37 - j5.45$

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.

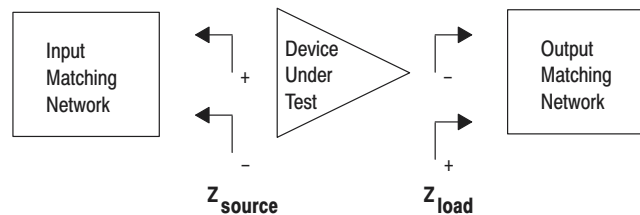
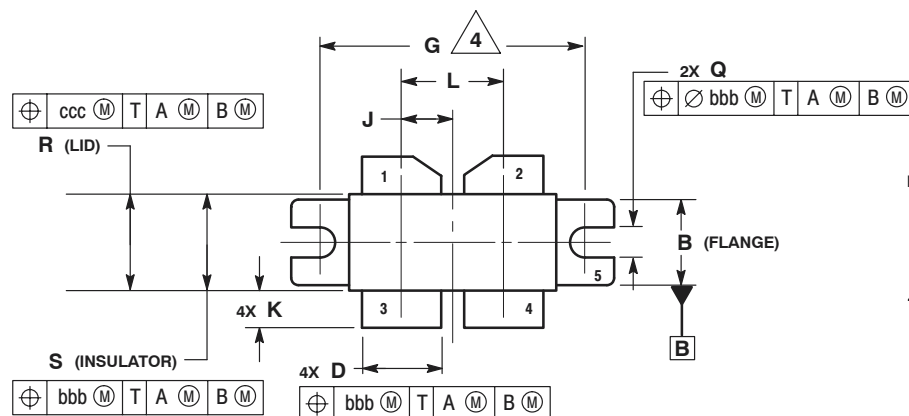


Figure 19. 470—860 MHz Broadband Series Equivalent Input and Output Impedance

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PACKAGE DIMENSIONS

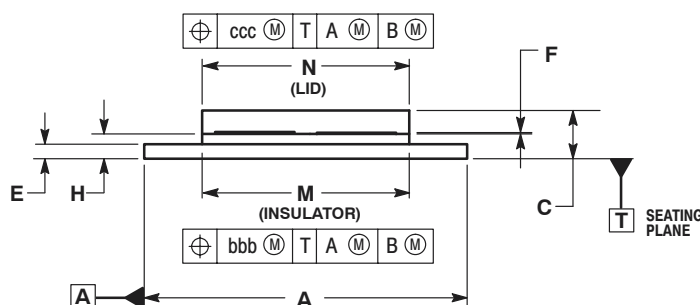
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- NOTES:
1. CONTROLLING DIMENSION: INCH.
 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
 3. DIMENSION H TO BE MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
 4. RECOMMENDED BOLT CENTER DIMENSION OF 1.140 (28.96) BASED ON 3M SCREW.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.180	0.224	4.57	5.69
D	0.325	0.335	8.26	8.51
E	0.060	0.070	1.52	1.78
F	0.004	0.006	0.10	0.15
G	1.100 BSC		27.94 BSC	
H	0.097	0.107	2.46	2.72
J	0.2125 BSC		5.397 BSC	
K	0.135	0.165	3.43	4.19
L	0.425 BSC		10.8 BSC	
M	0.852	0.868	21.64	22.05
N	0.851	0.869	21.62	22.07
Q	0.118	0.138	3.00	3.30
R	0.395	0.405	10.03	10.29
S	0.394	0.406	10.01	10.31
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

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



CASE 375G-04
 ISSUE E
 NI-860C3

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