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MOTOROLA

MRFIC0930

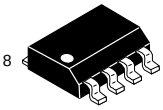
900 MHz GaAs Low Noise Amplifier with Gain Control

Designed primarily for use in 900 MHz wireless communication systems such as GSM, AMPS, and Industrial, Scientific, and Medical (ISM) band applications. The MRFIC0930 is a two–stage low noise amplifier with an integrated step attenuator and is packaged in a low–cost SO–8 package. The MRFIC0930DM is packaged in the smaller Micro–8 package. The attenuator is controlled by a V_{gain} Pin. The LNA can be turned off during transmit mode to save current by using the Rx Enable Pin. The amplifier can be matched to optimize gain or noise figure with simple off–chip input matching.

- Usable Frequency Range = 800 to 1000 MHz
- 19 dB Typ Gain
- Gain Attenuation = 18 dB (Typ)
- 1.7 dB Typ Noise Figure
- Simple Off–chip Matching for Maximum Gain/Noise Figure Flexibility
- High Reverse Isolation = 41 dB (Typ)
- Low Power Consumption = 24 mW (Typ)
- Single Bias Supply = 2.7 to 4.5 V
- Low Standby Current = 20 μA (Typ)
- Low Cost Surface Mount Plastic Package

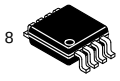
900 MHz GaAs LOW NOISE AMPLIFIER WITH GAIN CONTROL

SEMICONDUCTOR TECHNICAL DATA



(Scale 2:1)

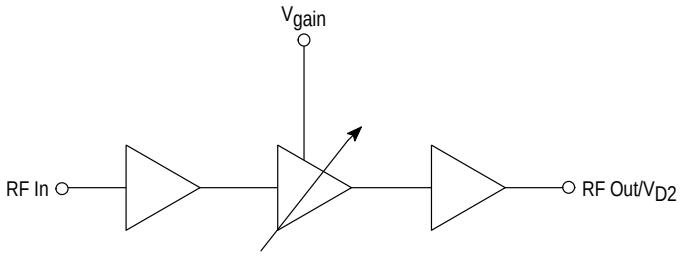
PLASTIC PACKAGE
CASE 751
(SO–8, Tape & Reel Only)



(Scale 2:1)

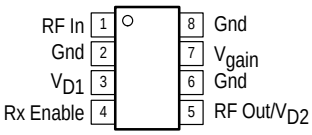
DM SUFFIX
PLASTIC PACKAGE
CASE 846A
(Micro–8, Tape & Reel Only)

Simplified Block Diagram



This device contains 12 active transistors.

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

Device	Operating Temp Range	Package
MRFIC0930R2	T_A = –30 to 70°C	SO–8* Tape & Reel
MRFIC0930DMR2		Micro–8** Tape & Reel

*2,500 Units per 16 mm, 13 inch reel.
**2,500 Units per 12 mm, 13 inch reel.

Rev 2

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

Rating	Symbol	Value	Unit
Supply Voltage	V_{D1}, V_{D2}	5.5	Vdc
RF Input Power	P_{RF}	3	dBm
Gain Control Voltage	V_{gain}	5.5	Vdc
Enable Voltage	RX Enable	5.5	Vdc
Storage Temperature Range	T_{stg}	–65 to 150	°C
Operating Ambient Temperature	T_A	–30 to 70	°C

NOTES: 1. Meets Human Body Model (HBM) ≤750 V and Machine Model (MM) ≤100 V.
2. ESD data available upon request.

RECOMMENDED OPERATING RANGES

Parameter	Symbol	Min	Typ	Max	Unit
RF Frequency	f_{RF}	800	–	1000	MHz
Supply Voltage	V_{D1}, V_{D2}	2.7	–	4.5	Vdc
V_{gain}, High Gain	V_{gain}	–	3.0	–	Vdc
V_{gain}, Low Gain	V_{gain}	–	0	–	Vdc
Rx Enable Voltage, On	Rx Enable	2.7	–	V_{D1}, V_{D2}	Vdc
Rx Enable Voltage, Off	Rx Enable	0	–	0.2	Vdc

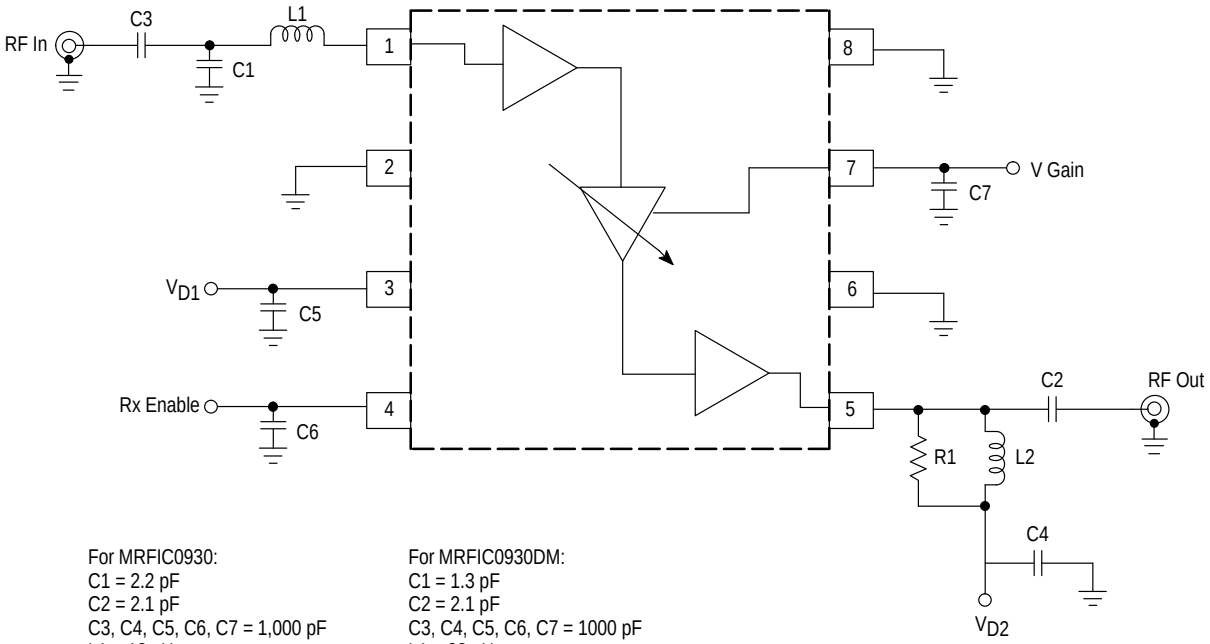
NOTE: To bias, apply V_{D1} and V_{D2} before Rx Enable.

ELECTRICAL CHARACTERISTICS (V_{D1}, V_{D2} = 2.8 V, T_A = 25°C, RF = 940 MHz, Rx Enable = 2.8 V, V Gain = 2.8 V, RF In = –30 dBm, unless otherwise noted. Tested in Circuit Shown in Figure 1.)

Characteristic	Symbol	Min	Typ	Max	Unit
RF Gain MRFIC0930 MRFIC0930DM	S_{21}	 17 17.5	 19 19	 21 21.5	dB
RF Gain (V_{gain} = 0 V)	S_{21}	–	0.8	4.0	dB
SSB Noise Figure [Note]	NF	–	1.7	3.0	dB
SSB Noise Figure (V_{gain} = 0 V) [Note]	NF	–	10.4	–	dB
RF Input 3rd Order Intercept Point [Note]	IIP3	–12	–9.0	–	dBm
RF Input 3rd Order Intercept Point (V_{gain} = 0 V) [Note]	IIP3	–7.0	–5.7	–	dBm
Input 1.0 dB Gain Compression [Note]	P_{1dB}	–21.5	–20.8	–	dBm
Input 1.0 dB Gain Compression (V_{gain} = 0 V) [Note]	P_{1dB}	–16	–11	–	dBm
Reverse Isolation (S_{12})	S_{12}	–	41	–	dB
Input Return Loss	S_{11}	–	15	–	dB
Input Return Loss (V_{gain} = 0 V)	S_{11}	–	15	–	dB
Output Return Loss	S_{22}	–	15	–	dB
Output Return Loss (V_{gain} = 0 V)	S_{22}	–	12	–	dB
Supply Current Rx Mode	I_D	–	8.5	12	mA
Supply Current Standby Mode (Rx Enable = 0 V)	I_D	–	20	200	μA

NOTE: Guaranteed by design.

Figure 1. 900 MHz Test Circuit



For MRFIC0930:
C1 = 2.2 pF
C2 = 2.1 pF
C3, C4, C5, C6, C7 = 1,000 pF
L1 = 18 nH
L2 = 10 nH
R1 = 220 Ω

For MRFIC0930DM:
C1 = 1.3 pF
C2 = 2.1 pF
C3, C4, C5, C6, C7 = 1000 pF
L1 = 22 nH
L2 = 8.2 nH
R1 = 180 Ω

TYPICAL CHARACTERISTICS

(For SO–8 Packaged MRFIC0930)

Figure 2. Reverse Isolation versus Frequency

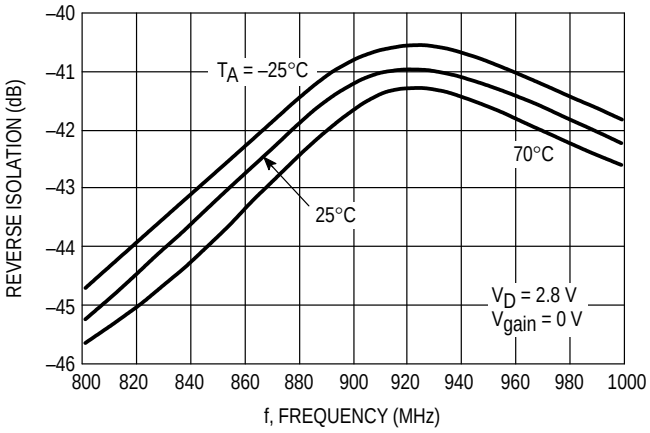


Figure 3. Reverse Isolation versus Frequency

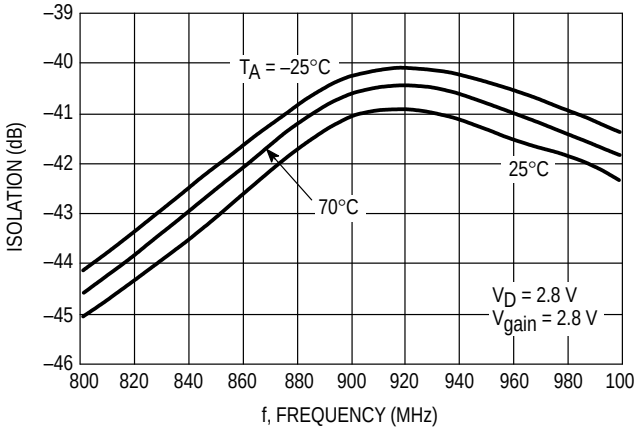


Figure 4. Gain versus Frequency

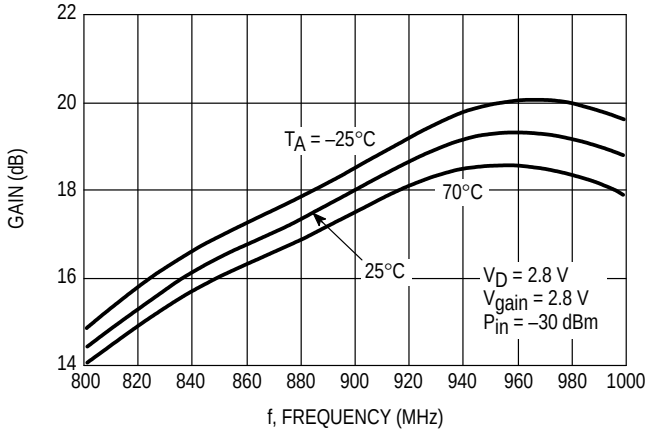


Figure 5. Gain Attenuation versus Frequency

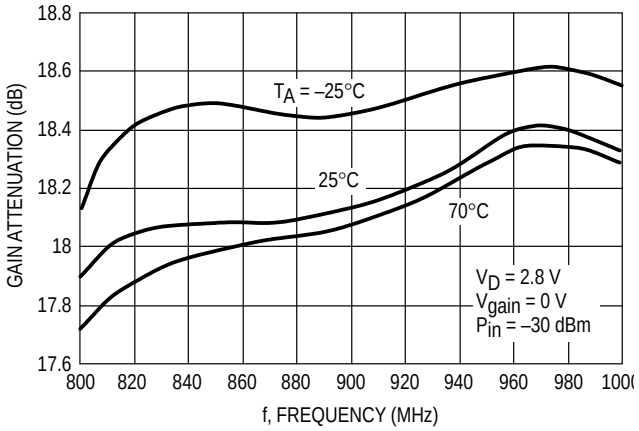


Figure 6. Gain versus Frequency

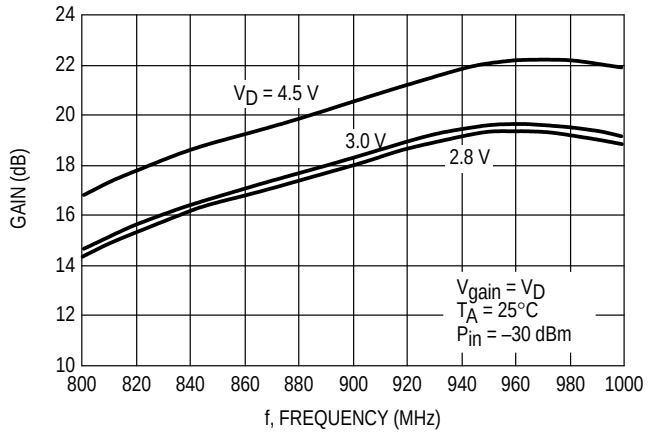
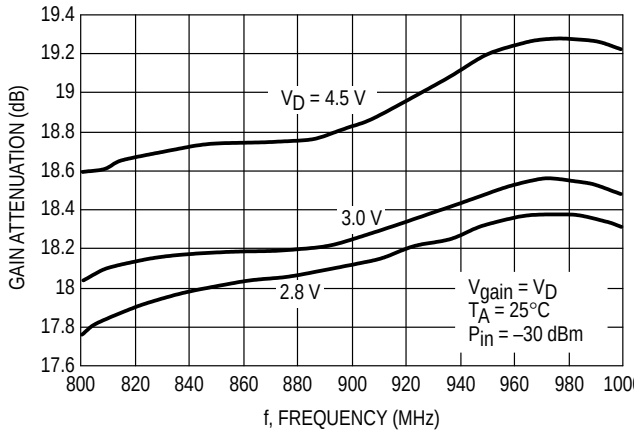


Figure 7. Gain Attenuation versus Frequency



TYPICAL CHARACTERISTICS

(For SO–8 Packaged MRFIC0930)

Figure 8. Input Power versus Output Power

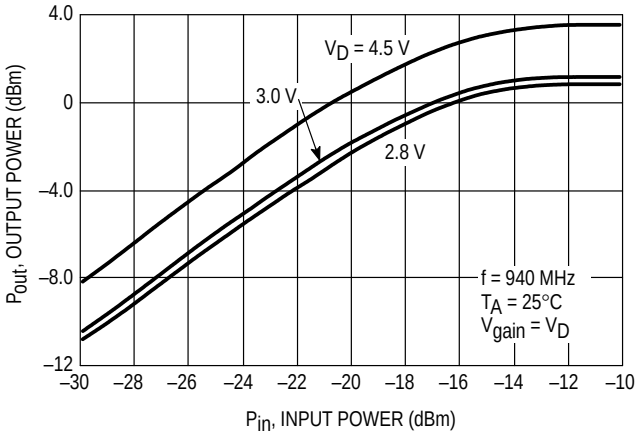


Figure 9. Input Power versus Output Power

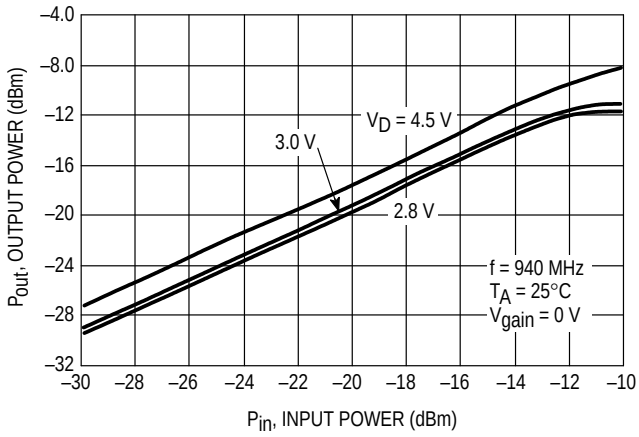


Figure 10. Input Power versus Output Power

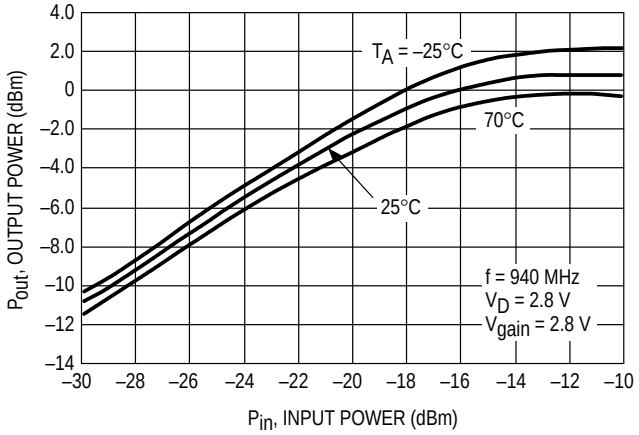


Figure 11. Input Power versus Output Power

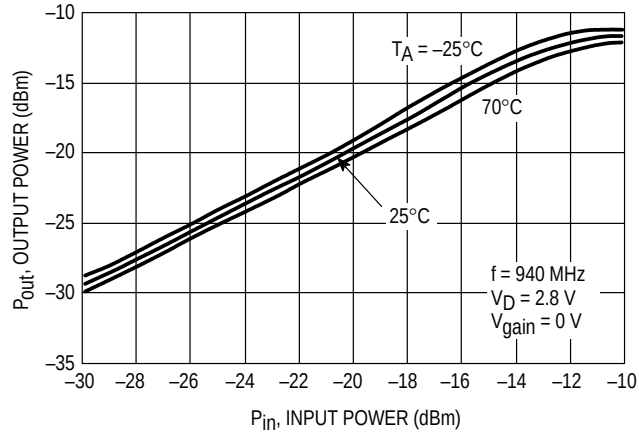


Figure 12. Noise Figure versus Frequency

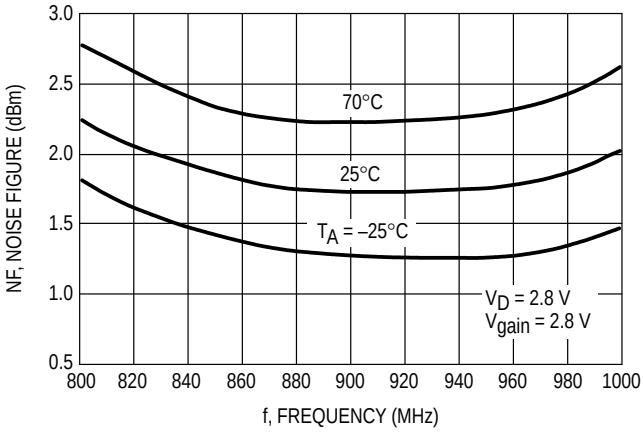
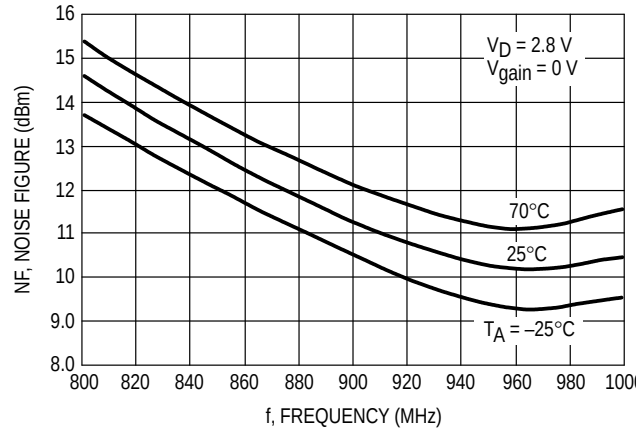


Figure 13. Noise Figure versus Frequency



TYPICAL CHARACTERISTICS

(For Micro–8 Packaged MRFIC0930DM)

Figure 14. Reverse Isolation versus Frequency

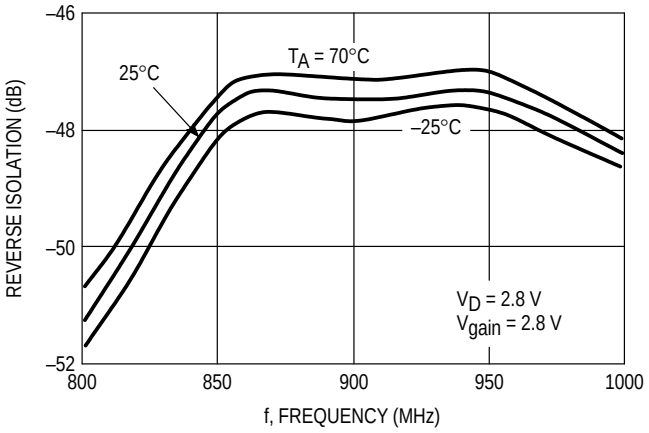


Figure 15. Reverse Isolation versus Frequency

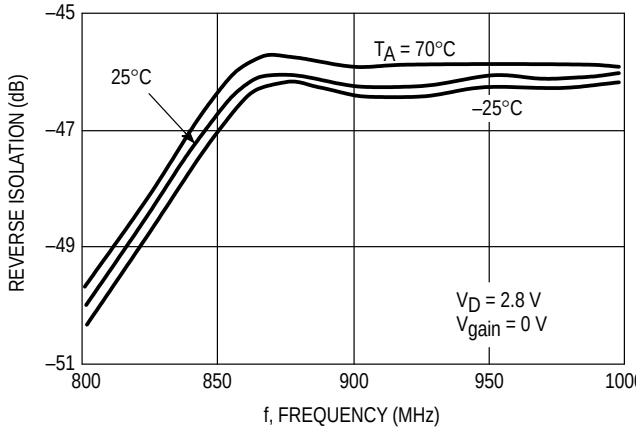


Figure 16. Gain versus Frequency

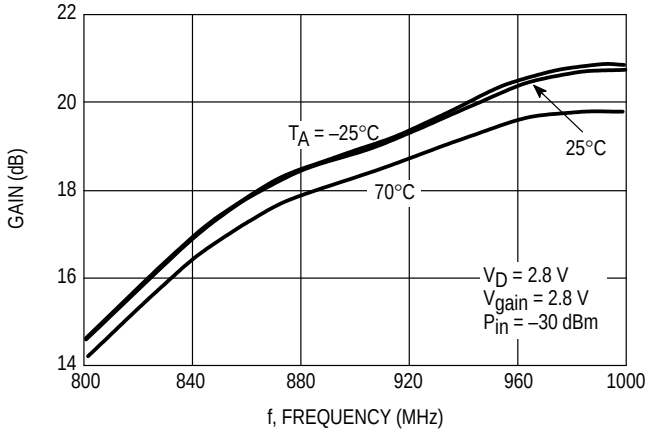


Figure 17. Gain Attenuation versus Frequency

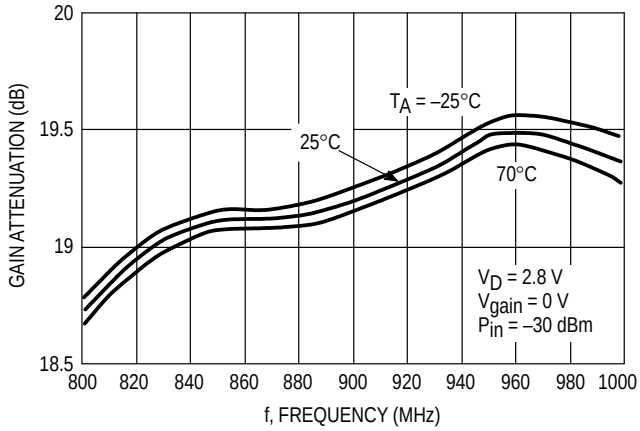


Figure 18. Gain versus Frequency

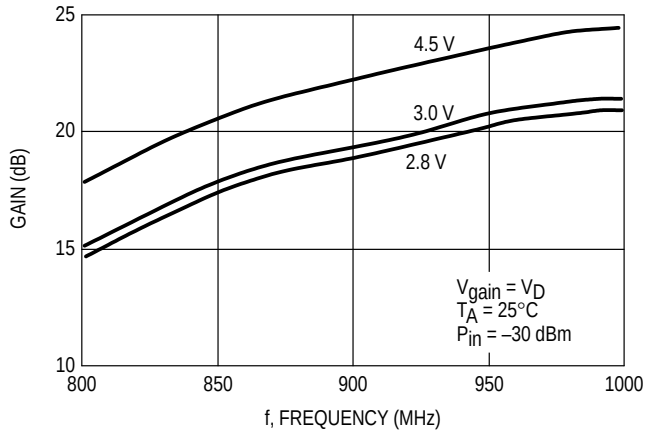
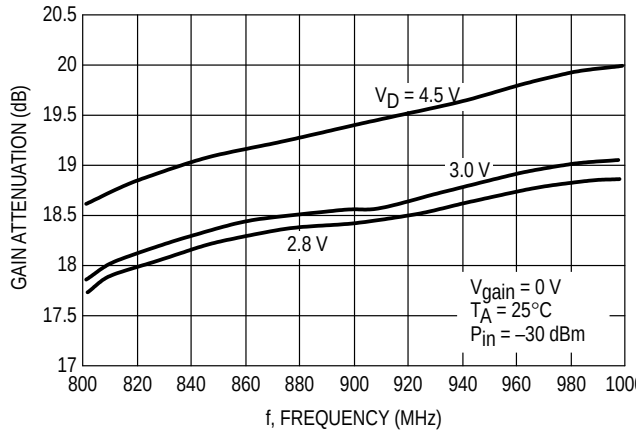


Figure 19. Gain Attenuation versus Frequency



TYPICAL CHARACTERISTICS

(For Micro–8 Packaged MRFIC0930DM)

Figure 20. Input Power versus Output Power

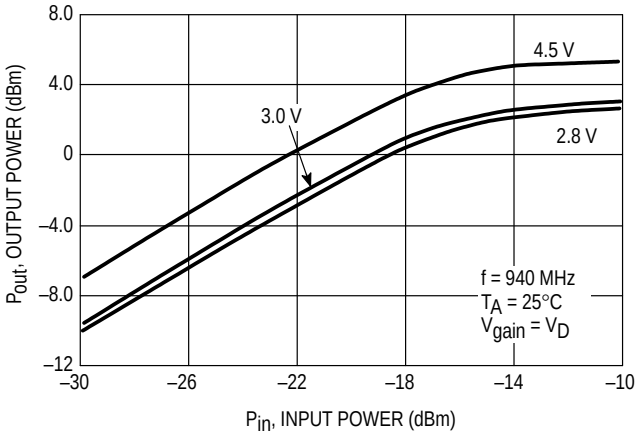


Figure 21. Input Power versus Output Power

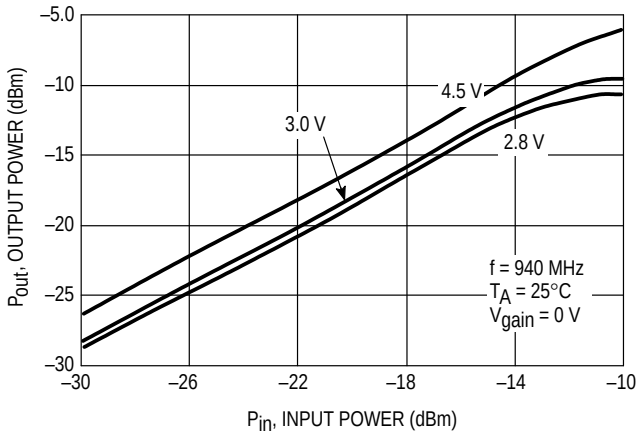


Figure 22. Input Power versus Output Power

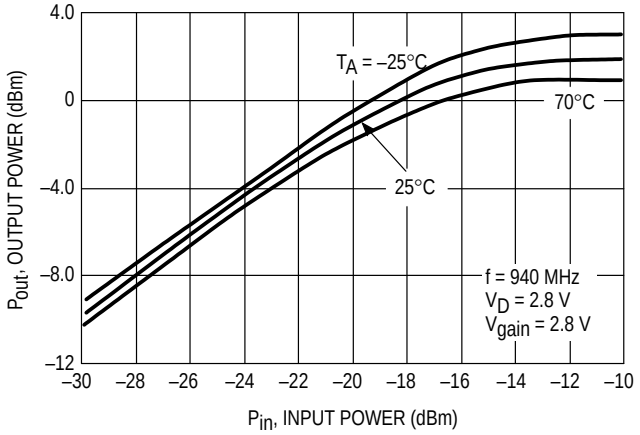


Figure 23. Input Power versus Output Power

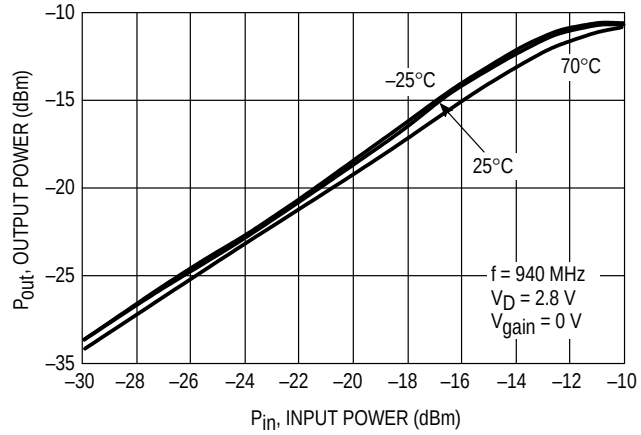


Figure 24. Noise Figure versus Frequency

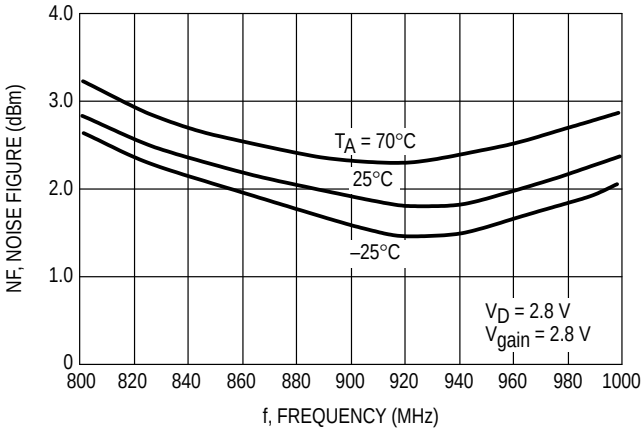
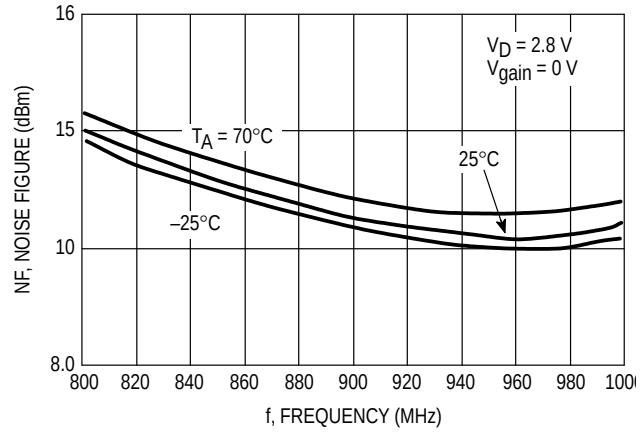
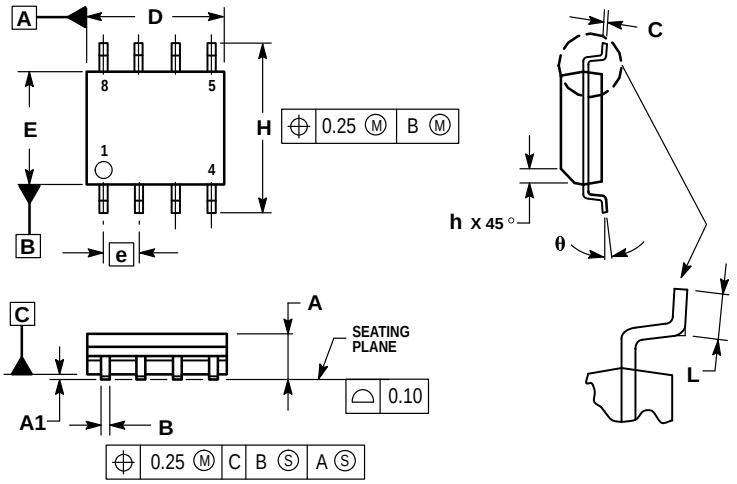


Figure 25. Noise Figure versus Frequency



OUTLINE DIMENSIONS

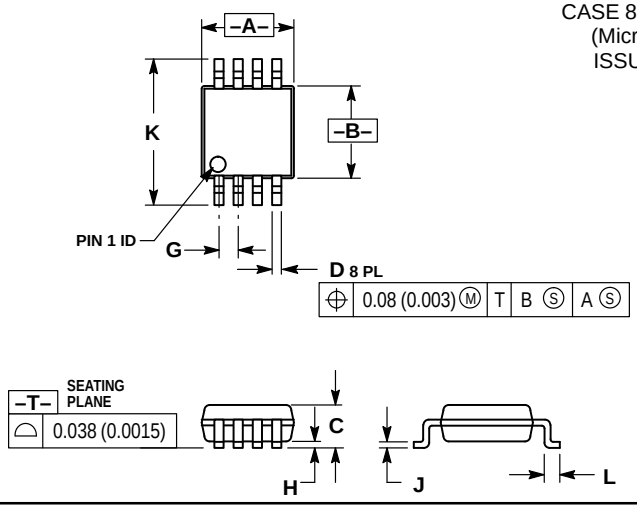
PLASTIC PACKAGE
CASE 751–06
(SO–8)
ISSUE T



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETER.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

PLASTIC PACKAGE
CASE 846A–02
(Micro–8)
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	—	1.10	—	0.043
D	0.25	0.40	0.010	0.016
G	0.65 BSC		0.026 BSC	
H	0.05	0.15	0.002	0.006
J	0.13	0.23	0.005	0.009
K	4.75	5.05	0.187	0.199
L	0.40	0.70	0.016	0.028

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