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MOTOROLA

MRFIC1830

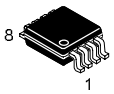
1.8 – 1.9 GHz GaAs Low Noise Amplifier with Gain Control

Designed primarily for use in 1.8 to 1.9 GHz wireless Personal Communication Systems (PCS) such as DCS1800, PCS1900, PHS, and DECT. The MRFIC1830 is a two–stage low noise amplifier with an integrated step attenuator and is packaged in a low–cost Micro–8 package. The attenuator is controlled by a CMOS compatible V_{gain} pin. The LNA can be turned off during transmit mode to save current by using the CMOS compatible Receive Enable pin. The amplifier can be matched to optimize gain or noise figure with simple off–chip input matching.

- Usable Frequency Range = 1800 to 2000 MHz
- 19 dB Typ Gain at 1.8 GHz and 17.5 dB at 1.9 GHz
- Gain Attenuation = 19.5 dB (Typ)
- 2.1 dB Typ Noise Figure for DCS and 2.3 dB for PCS
- Simple Off–chip Matching for Maximum Gain/Noise Figure Flexibility
- High Reverse Isolation = 38 dB (Typ)
- Low Power Consumption = 30 mW (Typ)
- Single Bias Supply = 2.7 to 4.5 V
- Low Standby Current = 20 μA (Typ)
- Low Cost Surface Mount Plastic Package
- Device Marking = M1830

DCS/PCS GaAs LOW NOISE AMPLIFIER WITH GAIN CONTROL

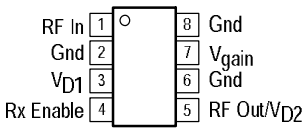
SEMICONDUCTOR TECHNICAL DATA



(Scale 2:1)

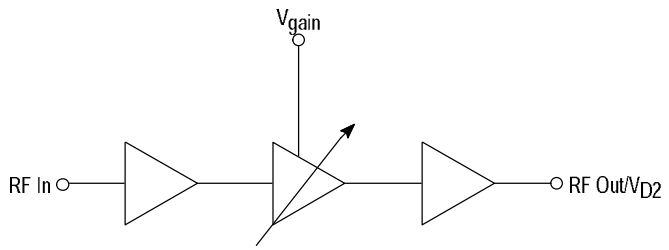
DM SUFFIX
PLASTIC PACKAGE
CASE 846A
(Micro–8, Tape & Reel Only)

PIN CONNECTIONS



(Top View)

Simplified Block Diagram



This device contains 12 active transistors.

ORDERING INFORMATION

Device	Operating Temp Range	Package
MRFIC1830DMR2	T_A = –30 to 70°C	Micro–8 Tape & Reel*

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

Rev 1

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

Rating	Symbol	Limit	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	– 20 to 70	°C

NOTES: 1. Meets Human Body Model (HBM) ≤250 V and Machine Model ≤50 V.
2. ESD data available upon request.

RECOMMENDED OPERATING CONDITIONS

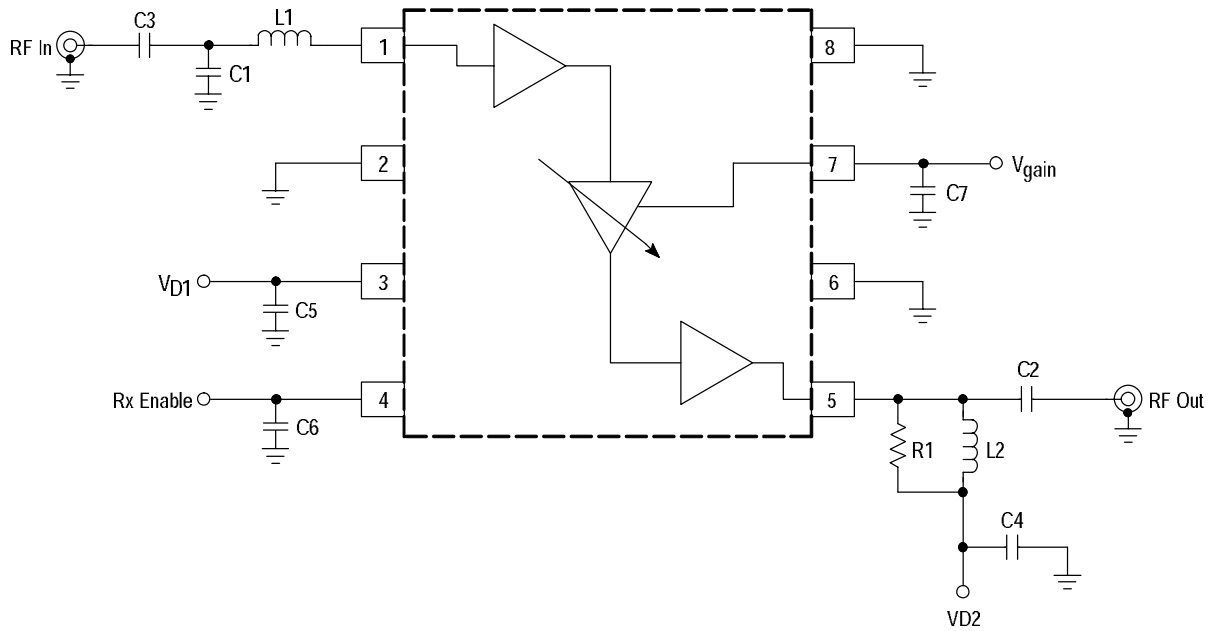
Parameter	Symbol	Min	Typ	Max	Unit
RF Frequency (DCS) DCS PCS	f_{RF}	 1.8 1.93	 – –	 1.88 1.99	GHz
Supply Voltage	V_{D1}, V_{D2}	2.7	–	4.5	Vdc
V Gain, High Gain	V_{gain}	–	3.0	–	Vdc
V Gain, Low Gain	V_{gain}	–	0	–	Vdc
Rx Enable Voltage, On	Rx Enable	2.7	–	V_{D1}, V_{D2}	Vdc
Rx Enable Voltage, Off	Rx Enable	0	–	0.2	Vdc

ELECTRICAL CHARACTERISTICS ($V_{D1, D2}$ = 2.8 V, T_A = 25°C, RF = 1840 MHz (1960 MHz for PCS), RF In = –30 dBm, Rx Enable = 2.8 V, V_{gain} = 2.8 V, unless otherwise noted. Tested in circuit shown in Figure 1.)

Characteristic	Symbol	Min	Typ	Max	Unit
RF Gain DCS PCS	–	 17 –	 19 17.5	 21 –	dB
RF Gain (V_{gain} = 0 V) (DCS and PCS)	–	–	–0.5	2.5	dB
SSB Noise Figure (DCS) [Note] DCS PCS	–	 – –	 2.1 2.3	 3.0 –	dB
SSB Noise Figure (V_{gain} = 0 V) (DCS and PCS) [Note]	–	–	9.5	20	dB
RF Input 3rd Order Intercept Point [Note] DCS and PCS V_{gain} = 0 V (DCS and PCS)	–	 –12 –7.0	 –9.0 –1.0	 – –	dBm
Input 1.0 dB Gain Compression [Note] DCS and PCS V_{gain} =0 V (DCS and PCS)	–	 –21.5 –16	 –20 –13	 – –	dBm
Reverse Isolation (S_{12}) V_{gain} = 3.0 V V_{gain} = 0 V	–	 – –	 38 47	 – –	dB
Input Return Loss V_{gain} = 3.0 V V_{gain} = 0 V	–	 – –	 15 12	 – –	dB
Output Return Loss V_{gain} = 3.0 V V_{gain} = 0 V	–	 – –	 12 12	 – –	dB
Supply Current Rx Mode	–	–	9.0	12	mA
Supply Current Standby Mode (Rx Enable = 0 V)	–	–	20	200	μA

NOTE: Guaranteed by design.

Figure 1. 1.9 GHz Test Circuit



DCS (1.8 – 1.88 GHz)
C1 = Not Used
C2 = 1.5 pF
C3, C4, C5, C6, C7 = 1.0 kpF
L1 = 5.6 nH
L2 = 2.2 nH
R1 = 390 Ω

PCS (1.93 – 1.99 GHz)
C1 = 1.0 pF
C2 = 1.3 pF
C3, C4, C5, C6, C7 = 1.0 kpF
L1 = 5.6 nH
L2 = 2.2 nH
R1 = 390 Ω

Figure 2. Reverse Isolation versus Frequency

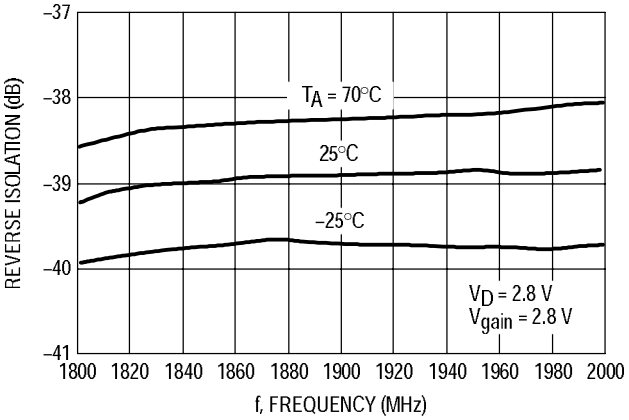


Figure 3. Reverse Isolation versus Frequency

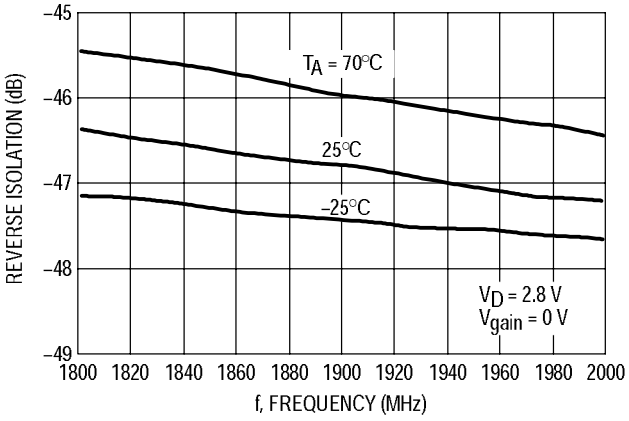


Figure 4. Gain versus Frequency

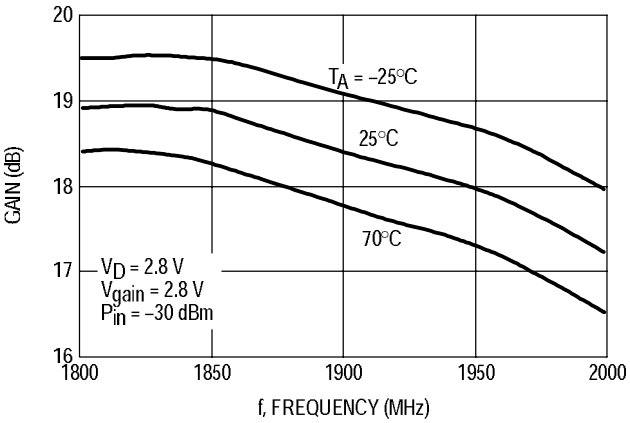


Figure 5. Gain Attenuation versus Frequency

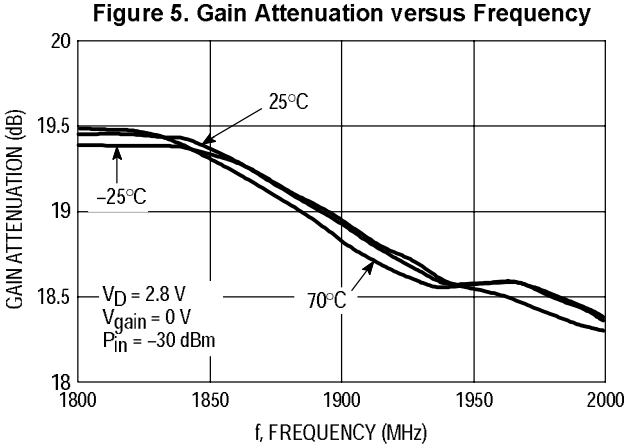


Figure 6. Gain versus Frequency

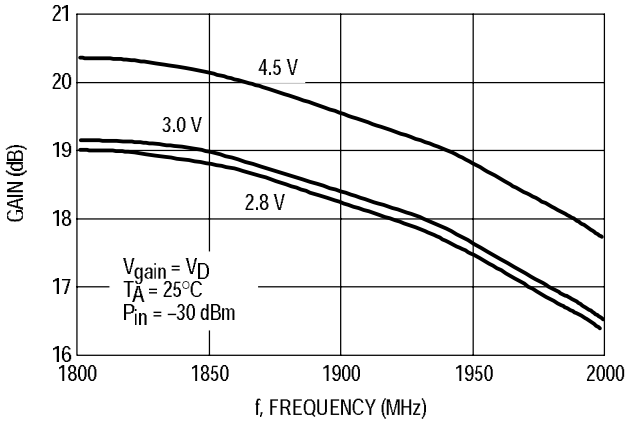


Figure 7. Gain Attenuation versus Frequency

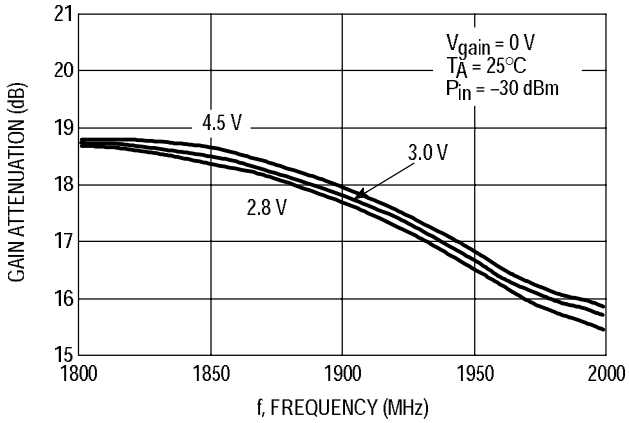


Figure 8. Input Power versus Output Power

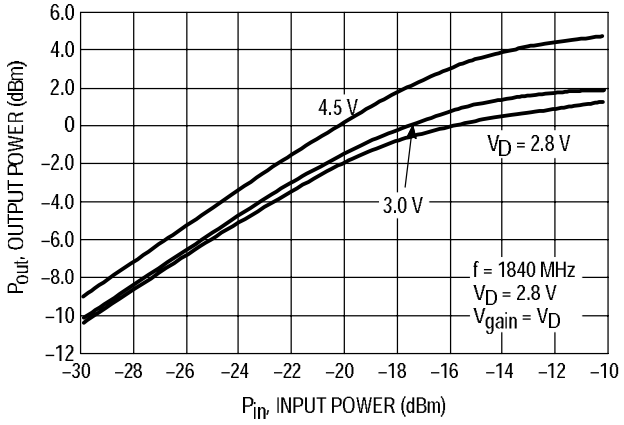


Figure 9. Input Power versus Output Power

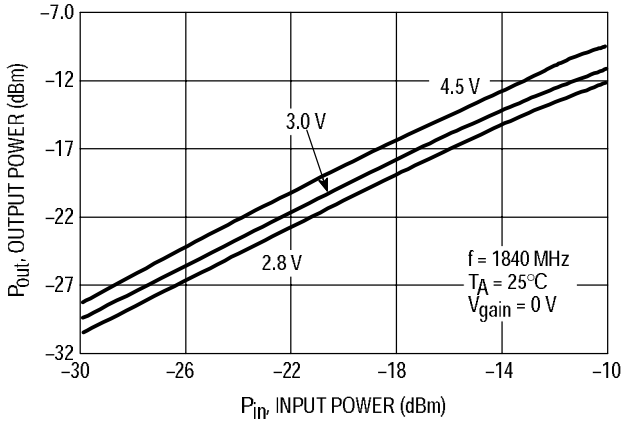


Figure 10. Input Power versus Output Power

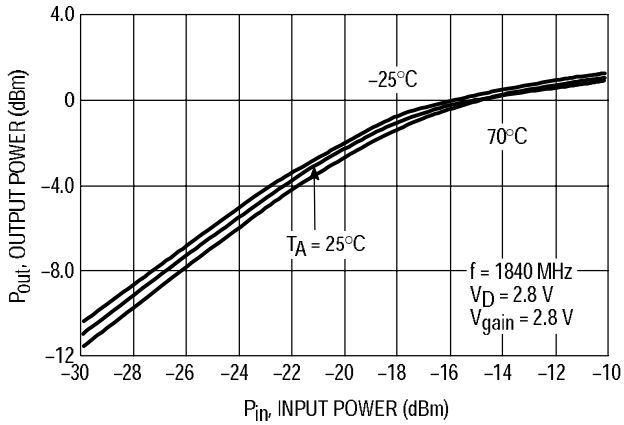


Figure 11. Input Power versus Output Power

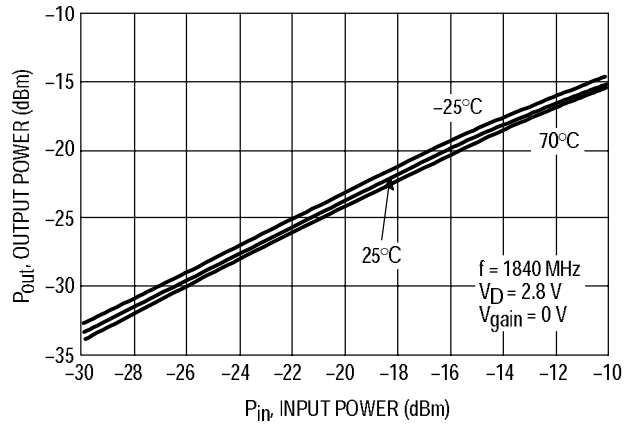


Figure 12. Noise Figure versus Frequency

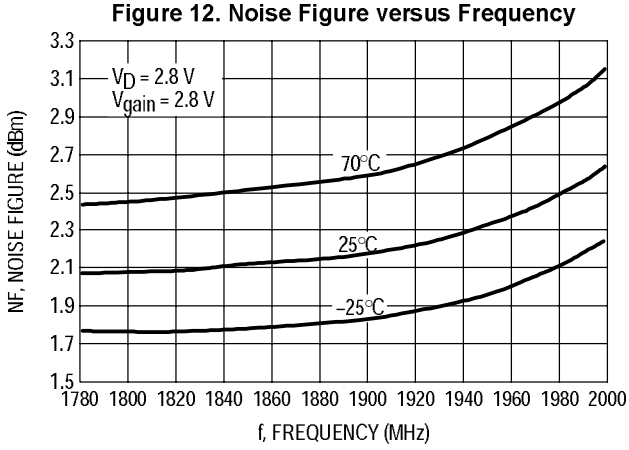
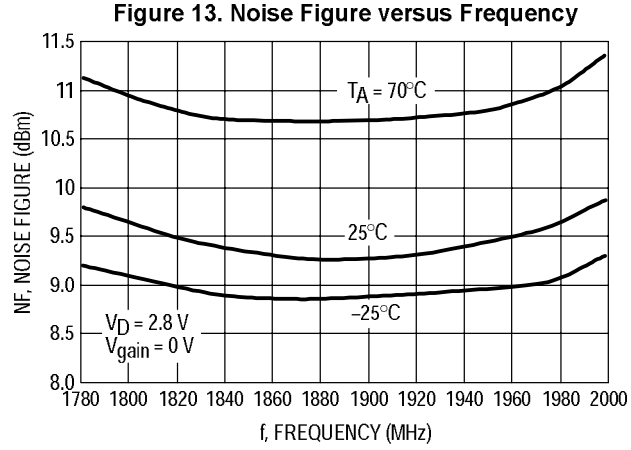
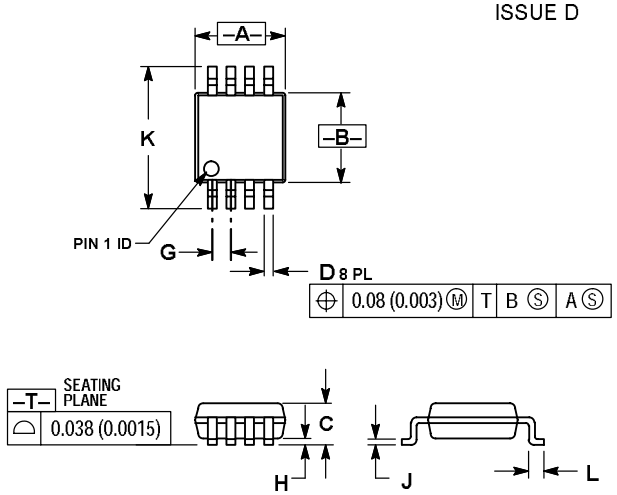


Figure 13. Noise Figure versus Frequency



OUTLINE DIMENSIONS

DM SUFFIX
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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