



1.8 – 1.9 GHz GaAs Low Noise Amplifier with Gain Control

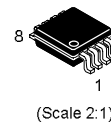
Designed primarily for use in 1.8 to 1.9 GHz wireless Personal Communication Systems (PCS) such as DCS1800, PCS1900, PHS, and DECT. The MRFIC1830 is a two-stage low noise amplifier with an integrated step attenuator and is packaged in a low-cost Micro-8 package. The attenuator is controlled by a CMOS 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

MRFIC1830

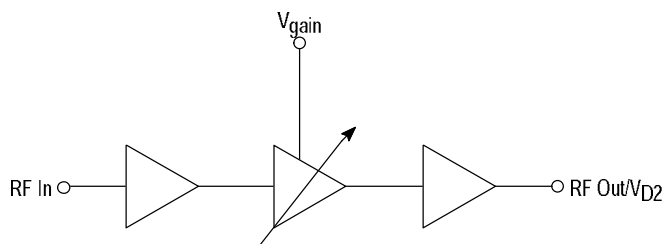
DCS/PCS GaAs LOW NOISE AMPLIFIER WITH GAIN CONTROL

SEMICONDUCTOR TECHNICAL DATA



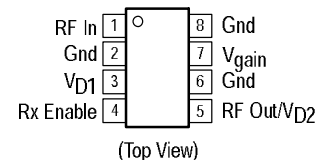
DM SUFFIX
PLASTIC PACKAGE
CASE 846A
(Micro-8, Tape & Reel Only)

Simplified Block Diagram



This device contains 12 active transistors.

PIN CONNECTIONS



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.

MRFIC1830

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 |

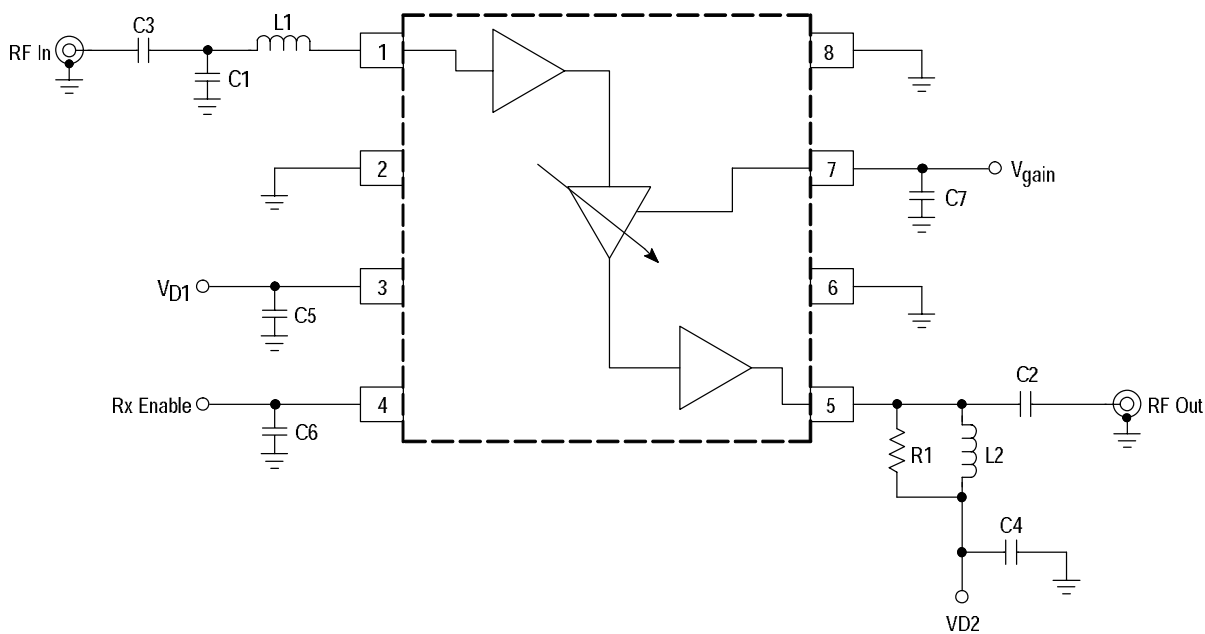
ELECTRICAL CHARACTERISTICS (V_{D1}, V_{D2} = 2.8 V, T_A = 25°C, RF = 1840 MHz (1960 MHz for PCS), RF In = –30 dBm, Rx Enable = 2.8 V, V_{gain} = 2.8 V, unless otherwise noted. Tested in circuit shown in Figure 1.)

| 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.

MRFIC1830

Figure 1. 1.9 GHz Test Circuit



DCS (1.8 – 1.88 GHz)

C1 = Not Used

 $C2 = 1.5 \text{ pF}$
$$C_3, C_4, C_5, C_6, C_7 = 1.0 \text{ k}\mu\text{F}$$
 $L1 = 5.6 \text{ nH}$ $L2 = 2.2 \text{ nH}$
$$R1 = 390 \, \Omega$$

PCS (1.93 – 1.99 GHz)

 $C1 = 1.0 \text{ pF}$ $C2 = 1.3 \text{ pF}$
$$C3, C4, C5, C6, C7 = 1.0 \text{ k}\mu\text{F}$$
 $L1 = 5.6 \text{ nH}$
$$L2 = 2.2 \text{ nH}$$
$$R1 = 390 \, \Omega$$

Figure 2. Reverse Isolation versus Frequency

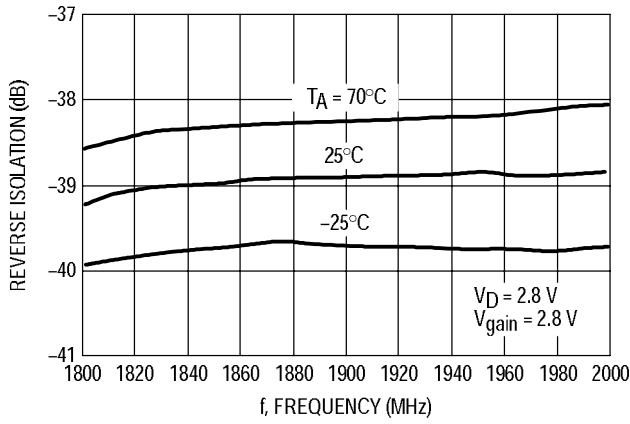


Figure 3. Reverse Isolation versus Frequency

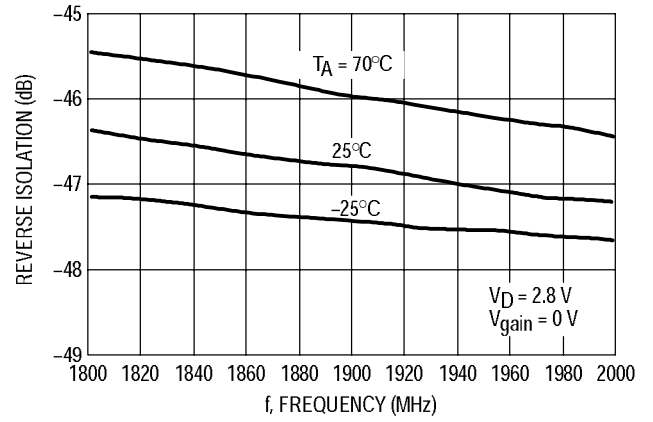


Figure 4. Gain versus Frequency

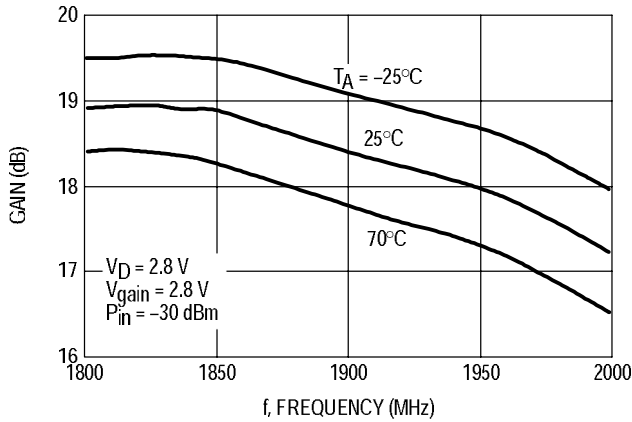


Figure 5. Gain Attenuation versus Frequency

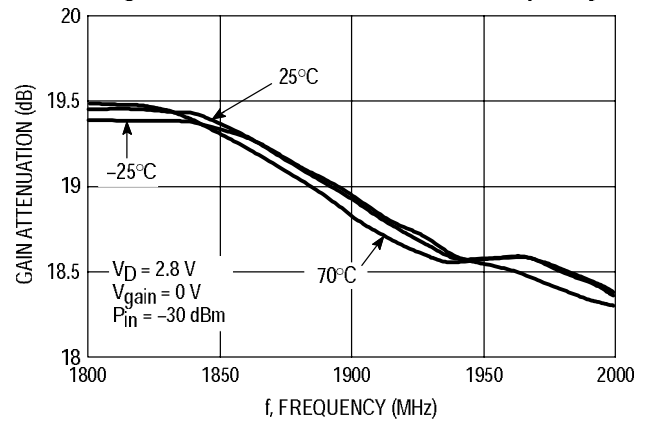


Figure 6. Gain versus Frequency

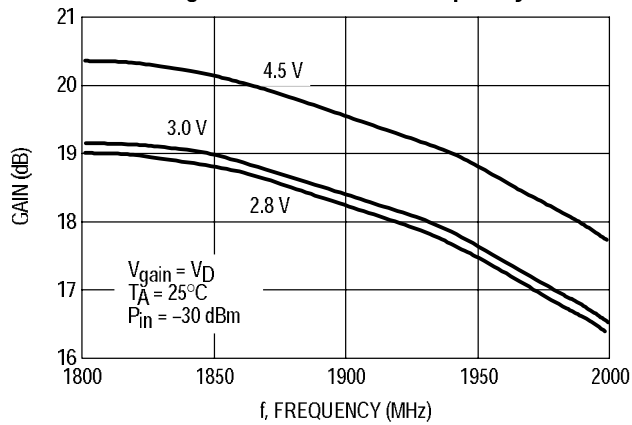


Figure 7. Gain Attenuation versus Frequency

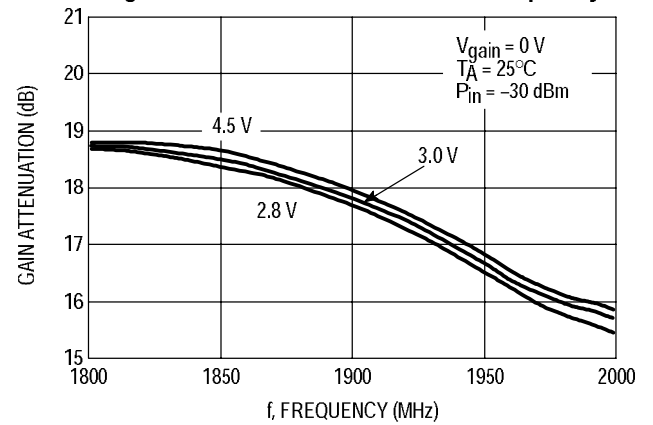


Figure 8. Input Power versus Output Power

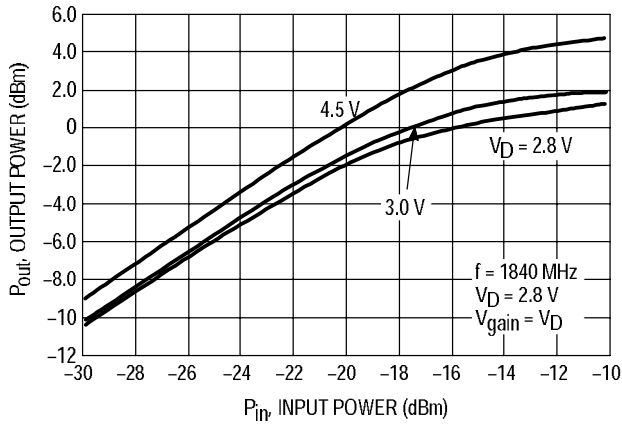


Figure 9. Input Power versus Output Power

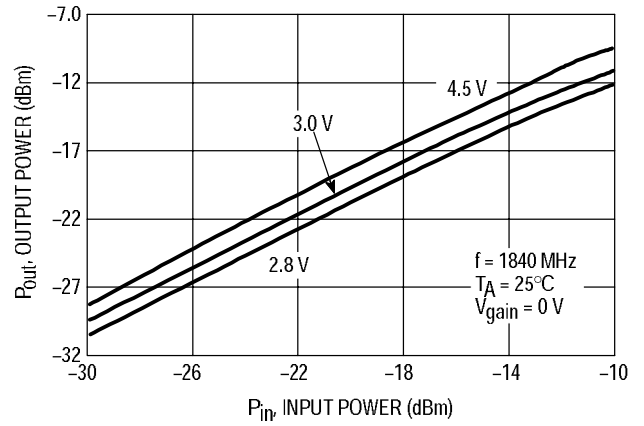


Figure 10. Input Power versus Output Power

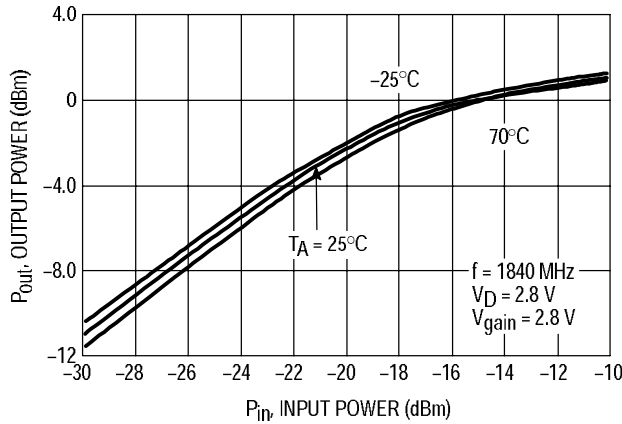


Figure 11. Input Power versus Output Power

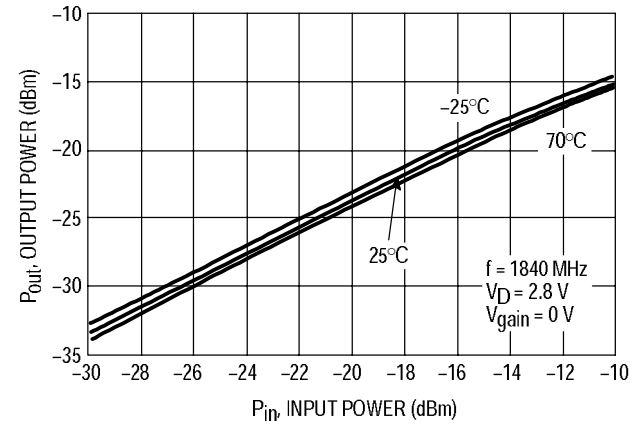


Figure 12. Noise Figure versus Frequency

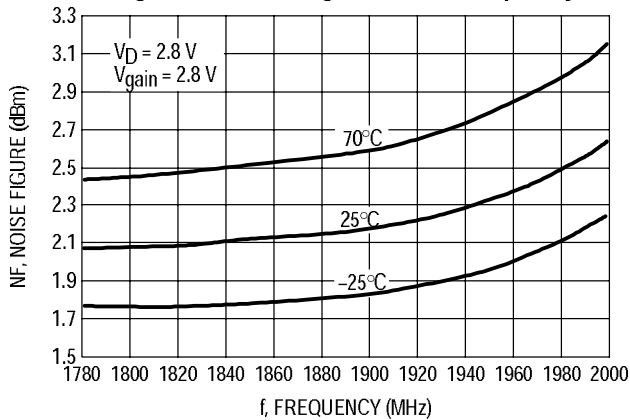
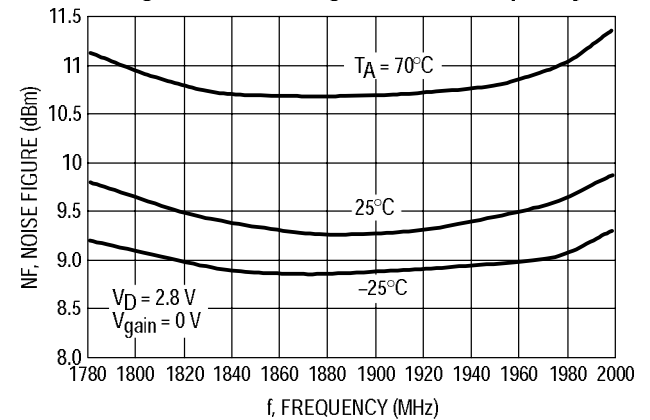


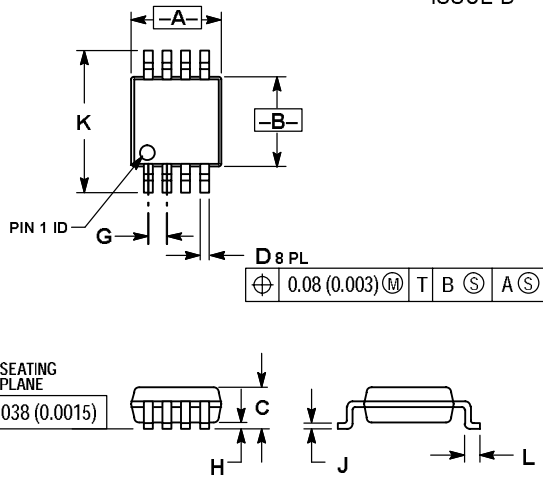
Figure 13. Noise Figure versus Frequency



MRFIC1830

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.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | 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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