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MOTOROLA

MRFIC1856

Advance Information

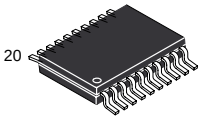
Dual-Band/Dual-Mode pHEMT GaAs IPA

The MRFIC1856 is designed for dual–band subscriber equipment applications at 3.6 V in the cellular (800 MHz) and PCS (1900 MHz) bands. The device incorporates two pHEMT GaAs amplifier chains in one package, allowing the most flexibility and highest performance while reducing board space. Target applications include dual–band/dual–mode handsets for TDMA/AMPS and PCS TDMA cellular phones.

- Designed to Operate in Frequency Ranges of:
  824 to 849 MHz TDMA/AMPS
  1850 to 1910 MHz PCS TDMA
- 3.6 V Operation
- 30 dBm Output Power PCS TDMA
- 31 dBm Output Power TDMA Cellular
- 31 dBm Output Power AMPS

DUAL–BAND/DUAL–MODE GaAs INTEGRATED POWER AMPLIFIER

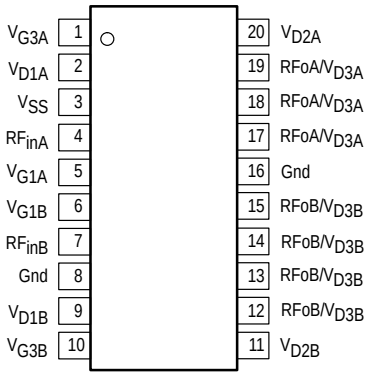
SEMICONDUCTOR TECHNICAL DATA



(Scale 2:1)

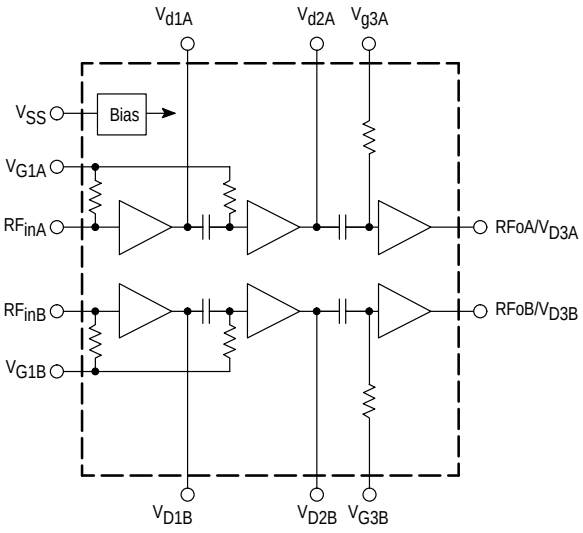
PLASTIC PACKAGE
CASE 948M
(TSSOP–20EP, Tape & Reel Only)

PIN CONNECTIONS



(Top View)

Simplified Block Diagram



This device contains 8 active transistors.

ORDERING INFORMATION

Device	Operating Temp Range	Package
MRFIC1856R2	T_C = –35 to 85°C	TSSOP–20EP

Rev 1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_D	4.8	Vdc
RF Input Power	P_{in}	15	dBm
Gate Voltage	V_g	–6 to –0.3	Vdc
Storage Temperature Range	T_{stg}	–65 to 150	°C
Operating Case Temperature	T_C	–35 to 85	°C
Thermal Resistance, Junction to Case	$R_{\theta JC}$	15	°C/W

NOTES: 1. Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics tables.
2. ESD (electrostatic discharge) immunity meets Human Body Model (HBM) ≤100 V and Machine Model (MM) <50 V. Additional ESD data available upon request.

RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Limit	Unit
Frequency Range – TDMA/AMPS	f_{RF}	824 to 849	MHz
Frequency Range – PCS TDMA	f_{RF}	1850 to 1910	MHz
Supply Voltage Range	$V_{D1,2,3A}$, $V_{D1,2,3B}$	3.0 to 4.8	Vdc
Negative Supply Voltage	V_G	–4.5 to –2.5	Vdc

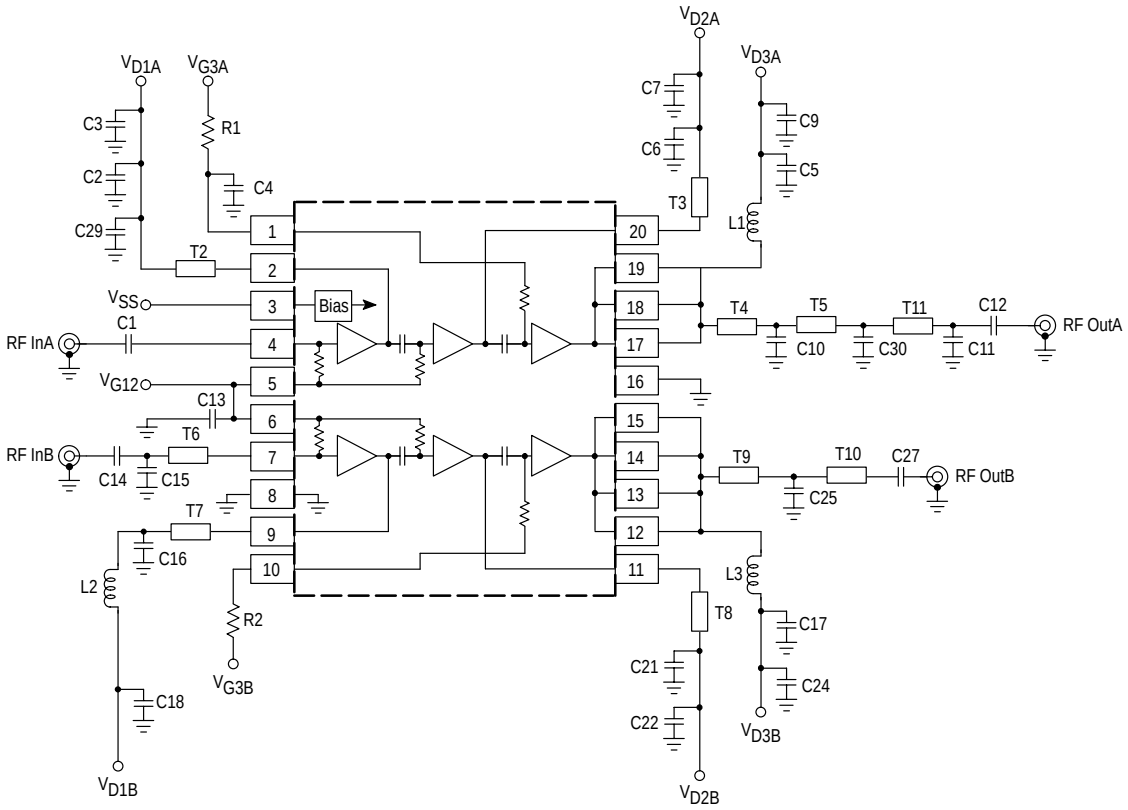
ELECTRICAL CHARACTERISTICS ($V_{D1,2,3A}$ = 3.6 V, T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
TDMA CELLULAR PERFORMANCE (P_{out} = 31 dBm, f = 840 MHz)					
Quiescent Supply Current	I_{DQ}	–	–	300	mA
Negative Supply Current	I_{SS}	–	–	3.0	mA
Efficiency	PAE	40	45	–	%
Gain	G_P	29	–	–	
Adj Channel Power (±30 kHz)	ACP	–	–	–29	dBc
Alt Channel Power (±60 kHz)	ALT	–	–	–48	dBc
Rx Band Noise (30 kHz BW)	–	–	–92	–	dBm
Harmonic Output Power $2f_0$ $3f_0$	–	 – –	 – –	 –34 –40	dBc
Spurious Output, 10:1 VSWR, all angles on output		–	–	–60	dBc
AMPS PERFORMANCE (P_{out} = 31 dBm, f = 840 MHz)					
Quiescent Supply Current	I_{DQ}	–	–	300	mA
Negative Supply Current	I_{SS}	–	–	3.0	mA
Efficiency (P_{out} = 31 dBm)	PAE	–	48	–	%
Gain	G_P	30	–	–	
Harmonic Output Power $2f_0$ $3f_0$	–	 – –	 – –	 –34 –40	dBc
Rx Band Noise (30 kHz BW)	–	–	–92	–	dBm
Spurious Output, 10:1 VSWR, all angles on output	–	–	–	–60	dBc
PCS TDMA PERFORMANCE (P_{out} = 30 dBm, f = 1.88 GHz)					
Quiescent Supply Current	–	–	-	300	mA
Negative Supply Current	–	–	–	3.0	mA
Efficiency	–	30	35	–	%
Gain	–	28	–	–	

ELECTRICAL CHARACTERISTICS (continued) ($V_{D1,2,3A}$ = 3.6 V, T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
PCS TDMA PERFORMANCE (continued) (P_{out} = 30 dBm, f = 1.88 GHz)					
Adj Channel Power (±30 kHz)	–	–	–	–29	dBc
Alt Channel Power (±60 kHz)	–	–	–	–48	dBc
Rx Band Noise (30 kHz BW)	–	–	–94	–	dBm
Harmonic Output Power	–				dBc
$2f_o$		–	–	–40	
$3f_o$		–	–	–40	
Spurious Output, 10:1 VSWR, all angles on output	–	–	–	–60	dBc

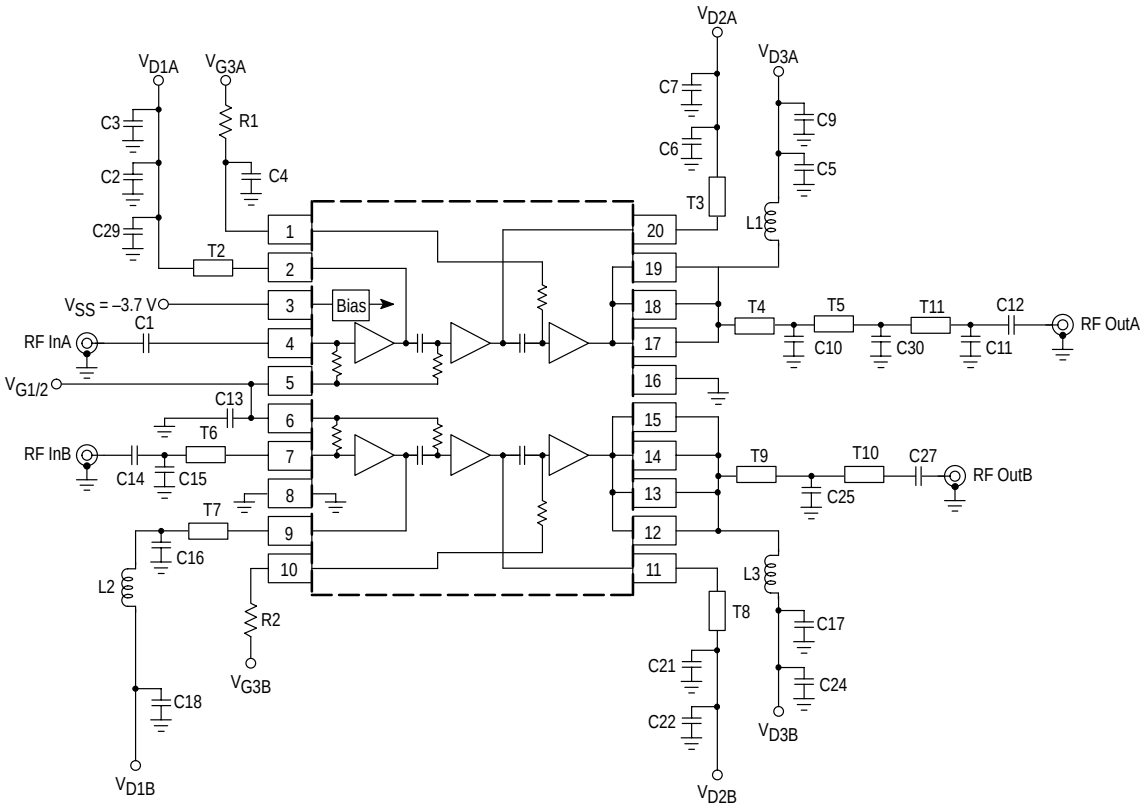
Figure 1. 3.6 V Applications Circuit



C1,C2,C5,C12,C17,	100 pF	C16	6.2 pF	T2	50 Ω, Microstrip, L = 128 mils
C28	3.9 nF	C25	4.7 pF	T3	50 Ω, Microstrip, L = 50 mils
C3,C4,C6,C13,C21	1000 pF	C27	10 pF	T4	50 Ω, Microstrip, L = 60 mils
C7,C18	10 µF	C29	3.9 pF	T5	90 Ω, Microstrip, L = 88 mils
C9,C22,C24	20 µF			T6	90 Ω, Microstrip, L = 600 mils
C10	12 pF	L1,L2,L3	15 nH	T7	63 Ω, Microstrip, L = 133 mils
C11	5.1 pF			T8	50 Ω, Microstrip, L = 133 mils
C14	22 pF	R1	50 Ω	T9	50 Ω, Microstrip, L = 10 mils
C15,C30	1.3 pF	R2	100 Ω	T10	50 Ω, Microstrip, L = 330 mils
				T11	50 Ω, Microstrip, L = 145 mils

NOTE: C29 added for 2nd harm trap.

Figure 2. 4.8 V Applications Circuit



C1,C2,C5,C12,C17, C28	100 pF 3.9 nF	C16 C25	6.8 pF 4.3 pF	T2 T3	50 Ω, Microstrip, L = 128 mils 50 Ω, Microstrip, L = 50 mils
C3,C4,C6,C13,C21	1000 pF	C27	10 pF	T4	50 Ω, Microstrip, L = 60 mils
C7,C18	10 µF	C29	3.9 pF	T5	90 Ω, Microstrip, L = 88 mils
C9,C22,C24	20 µF			T6	90 Ω, Microstrip, L = 600 mils
C10	12 pF	L1,L2,L3	15 nH	T7	63 Ω, Microstrip, L = 133 mils
C11	5.1 pF			T8	50 Ω, Microstrip, L = 133 mils
C14	22 pF	R1	50 Ω	T9	50 Ω, Microstrip, L = 10 mils
C15,C30	1.3 pF	R2	100 Ω	T10	50 Ω, Microstrip, L = 330 mils
				T11	50 Ω, Microstrip, L = 145 mils

TDMA PERFORMANCE

Figure 3. Gain versus Frequency

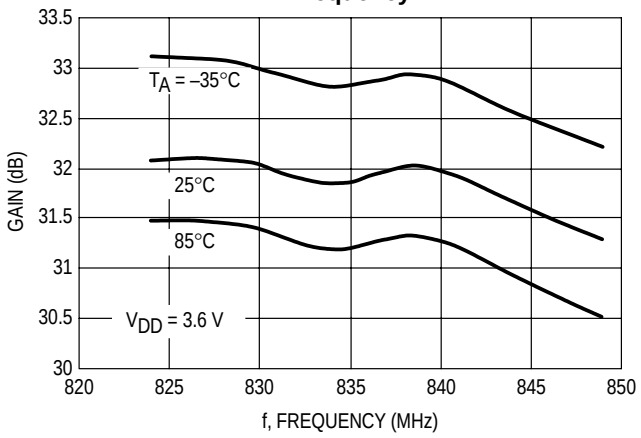


Figure 4. Gain versus Frequency

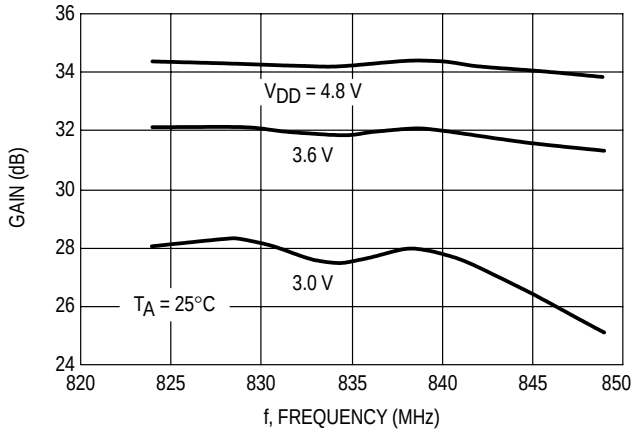


Figure 5. Output Power versus Input Power

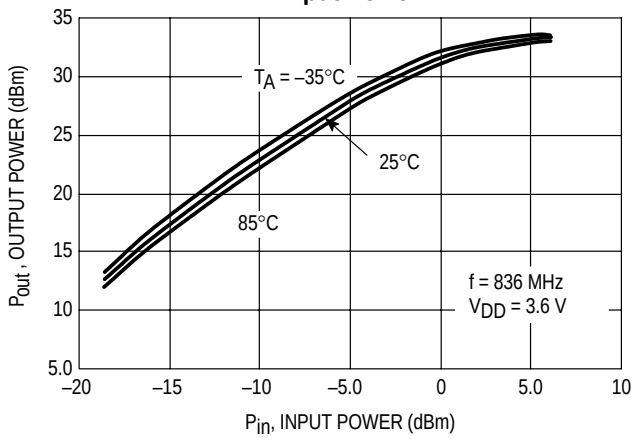


Figure 6. Output Power versus Input Power

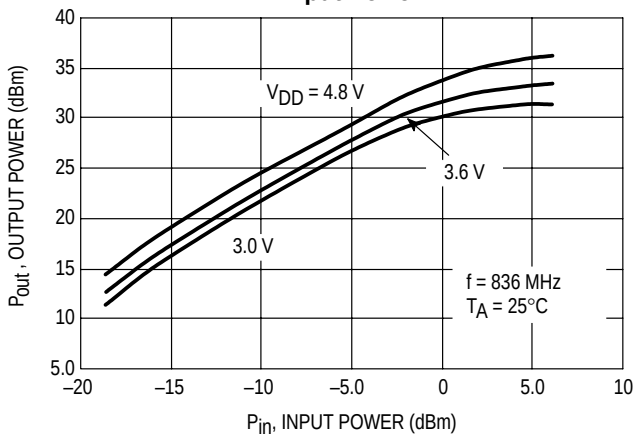


Figure 7. Adjacent Channel Power versus Output Power

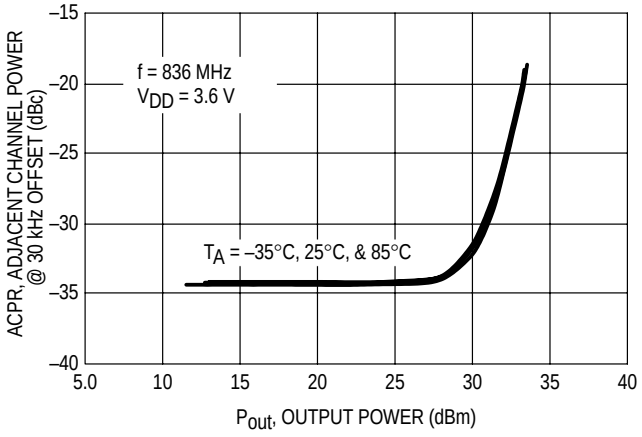
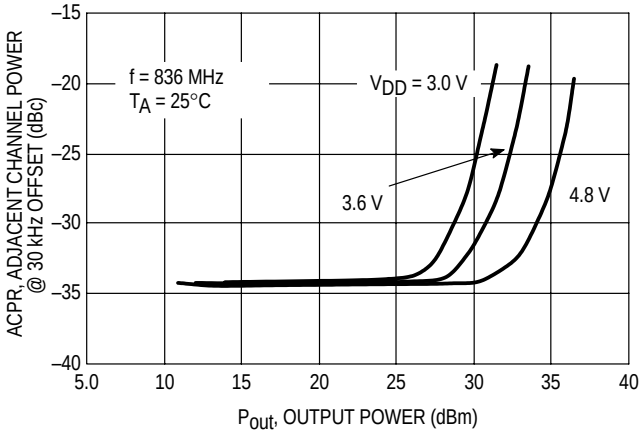


Figure 8. Adjacent Channel Power versus Output Power



TDMA PERFORMANCE

Figure 9. Alternate Channel Power versus Output Power

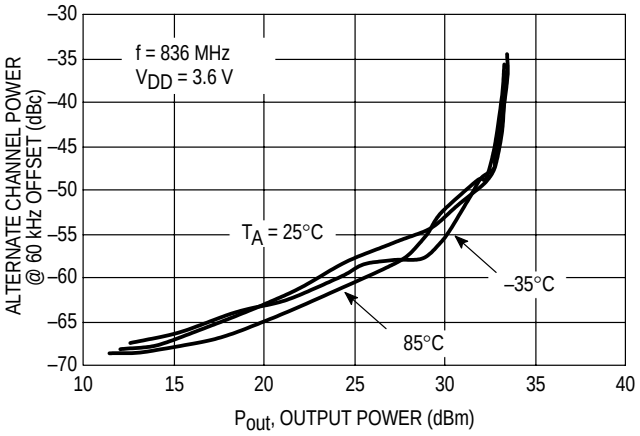


Figure 10. Alternate Channel Power versus Output Power

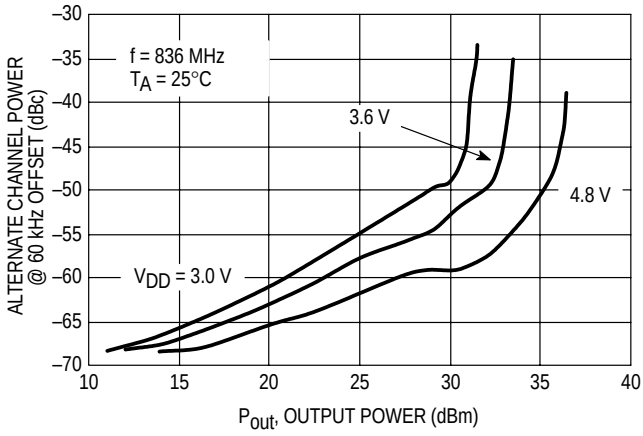


Figure 11. Gain versus Frequency

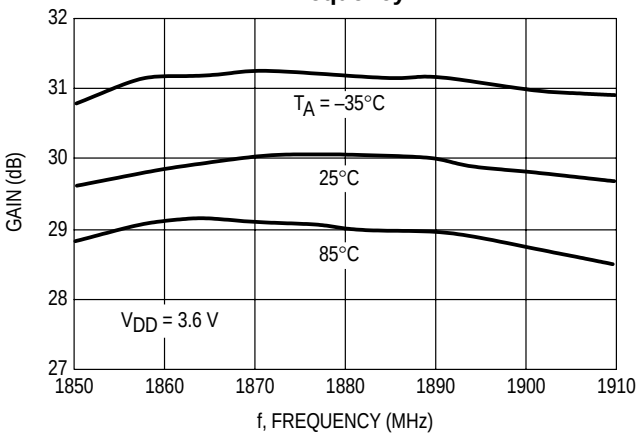


Figure 12. Gain versus Frequency

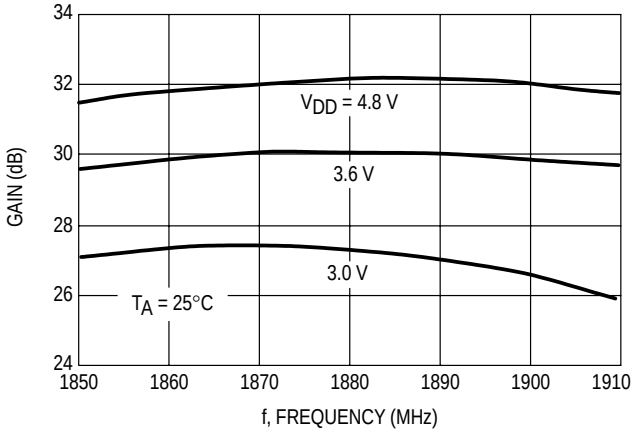


Figure 13. Output Power versus Input Power

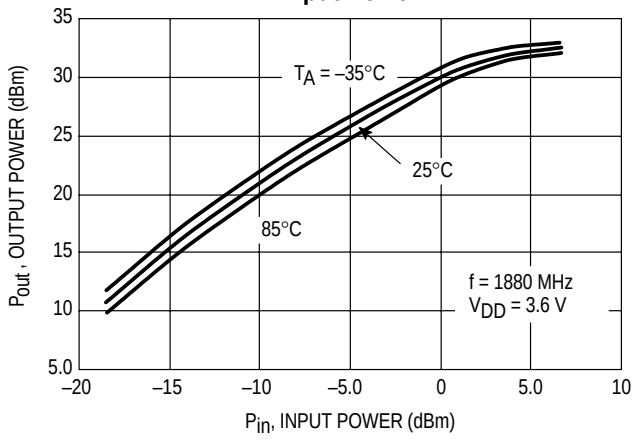
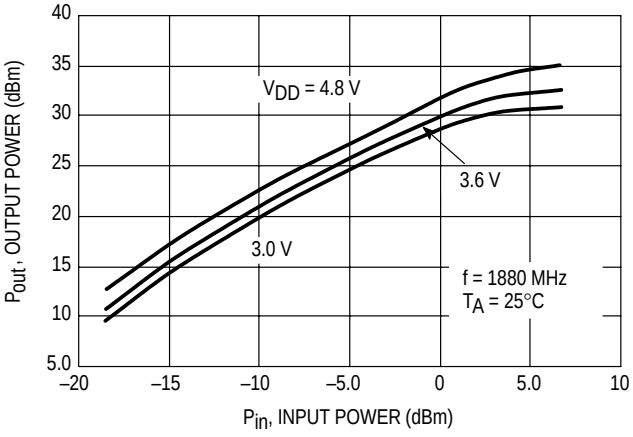


Figure 14. Output Power versus Input Power



TDMA PERFORMANCE

Figure 15. Adjacent Channel Power versus Output Power

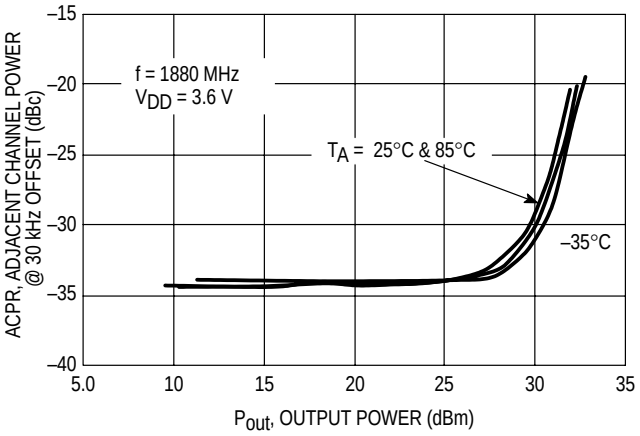


Figure 16. Adjacent Channel Power versus Output Power

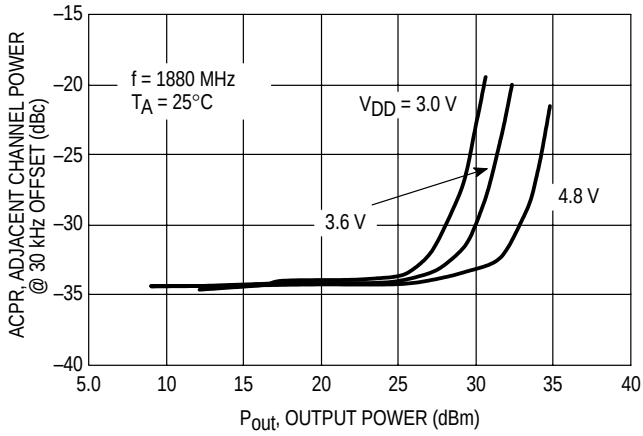


Figure 17. Alternate Channel Power versus Output Power

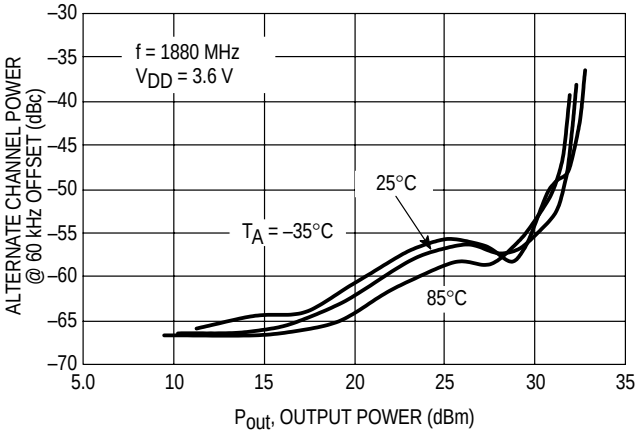
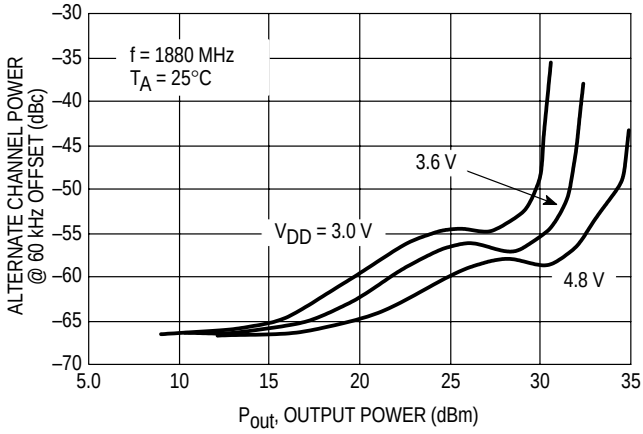
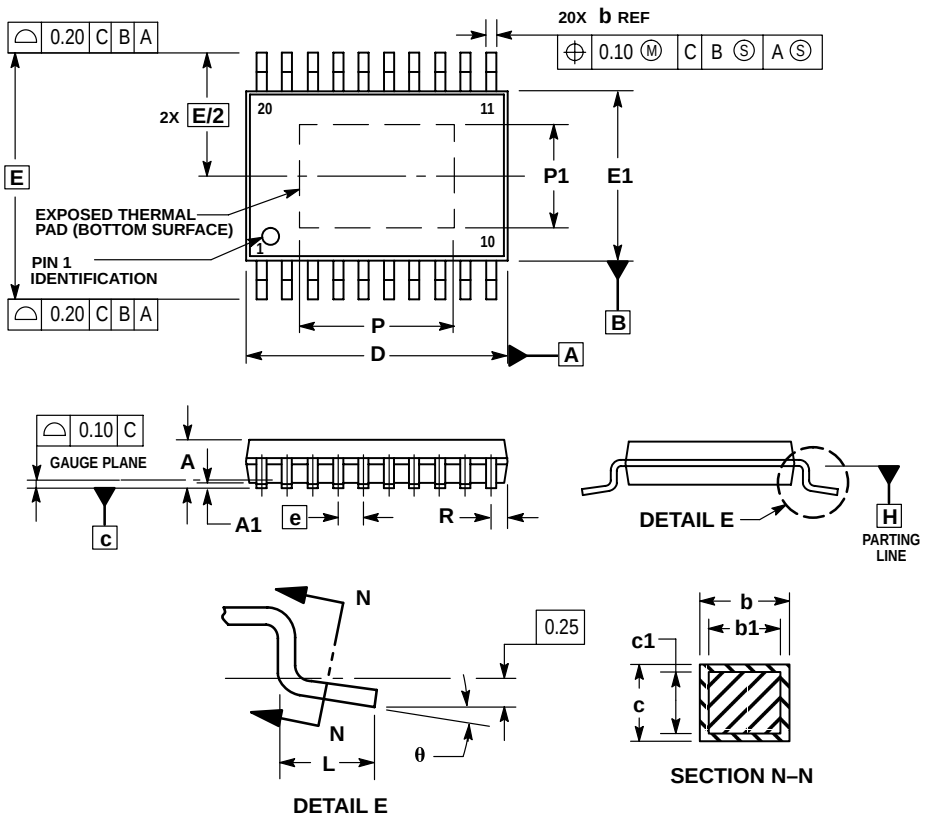


Figure 18. Alternate Channel Power versus Output Power



OUTLINE DIMENSIONS

PLASTIC PACKAGE
CASE 948M–01
(TSSOP–20EP)
ISSUE O



NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.
4. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSIONS D AND E1 ARE TO BE DETERMINED AT DATUM PLANE H.

	MILLIMETERS	
DIM	MIN	MAX
A	—	1.20
A1	0.00	0.10
b	0.19	0.30
b1	0.19	0.25
c	0.09	0.20
c1	0.09	0.16
D	6.40	6.60
E	6.40 BSC	
E1	4.30	4.50
e	0.65 BSC	
L	0.50	0.75
P	—	4.80
P1	—	3.00
R	0.27	0.37
θ	0°	8°

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