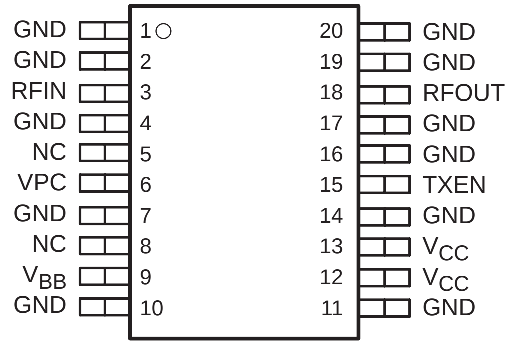
- **Operates from 4.8-V Power Supply for 900-MHz Applications**
- **Unconditionally Stable**
- **Wide UHF Frequency Range: 800 MHz to 1000 MHz**
- **24.5 dBm Typical Output Power**
- **Linear Ramp Control**
- **Transmit Enable/Disable Control**
- **Advanced BiCMOS Processing Technology for Low-Power Consumption, High Efficiency, and Highly Linear Operation**
- **Minimum of External Components Required for Operation**
- **Thermally Enhanced Surface-Mount Package for Extremely Small Circuit Footprint**

PWP PACKAGE
(TOP VIEW)



NC − No internal connection

description

The TRF8011 RF transmit driver amplifier is for use in 800 to 1000 MHz wireless communication systems. It consists of a two-stage amplifier and a linear ramp controller for burst control in TDMA (time-division multiple access) applications. Very few external components are required for operation. The input is dc-blocked and requires no external matching. The output requires external matching suitable for the application frequency.

The device is enabled when the TXEN input is held high. A power control signal applied to the VPC input can ramp the RF output power up or down to meet ramp and spurious emission specifications in TDMA systems. The power control signal causes a linear change in output power as the voltage applied to VPC varies between 0 V and 3 V. With the RF input power applied to RFIN at 5 dBm and TXEN high, adjusting VPC from 0 V to 3 V increases the output power from a typical value of −50 dBm to 24.5 dBm at 900 MHz. Forward isolation with the input power applied to RFIN at 5 dBm, VPC = 0 V, and TXEN high is typically greater than 50 dB.

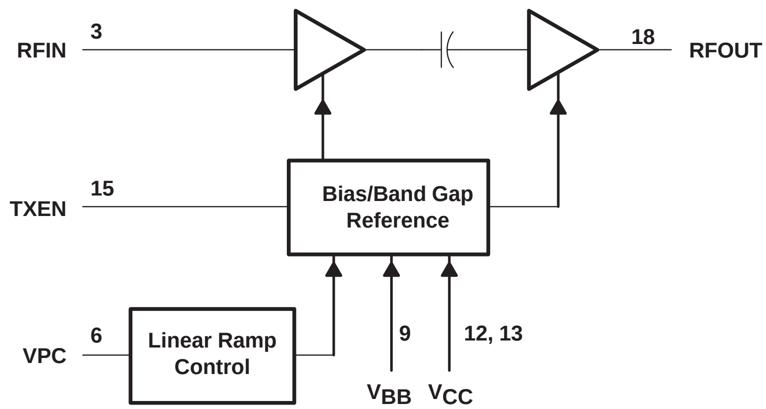
The TRF8011 is available in a thermally enhanced, surface-mount, 20-pin PowerPAD™ (PWP) thin-shrink small outline package (TSSOP) and is characterized for operation from −40°C to 85°C. The PWP package has a solderable pad that can improve the package thermal performance by bonding the pad to an external thermal plane. The pad also acts as a low-inductance electrical path to ground and must be electrically connected to the PCB ground plane as a continuation of the regular package terminals that are designated GND.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PowerPAD is a trademark of Texas Instruments.

functional block diagram



Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
GND	1,2,4,7,10,11,14, 16,17,19,20		Analog ground for all internal circuits. All signals are referenced to the ground terminals.
NC	5, 8		No connection. It is recommended that all NC terminals be connected to ground.
RFIN	3	I	RF input. RFIN accepts signals between 800 MHz and 1000 MHz.
RFOUT	18	O	RF output. RFOUT is an open-collector output and requires a decoupled connection to V_{CC} for operation.
TXEN	15	I	Transmit enable input (digital). When TXEN is high, the output device is enabled.
V_{BB}	9		Control section supply voltage
V_{CC}	12, 13		First stage bias
VPC	6	I	Voltage power control. VPC is a signal between 0 V and 3 V that adjusts the output power from a typical value of −50 dBm to 25.5 dBm.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} (see Note 1) . . . . −0.6 V to 5.6 V
Input voltage range at TXEN, VPC . . . . −0.6 V to 5.6 V
Input power at RFIN . . . . 10 dBm
Thermal resistance, junction to case, $R_{\theta JC}$ (see Note 2) . . . . 3.5°C/W
Thermal resistance, junction to ambient, $R_{\theta JA}$ (see Note 3) . . . . 32°C/W
Continuous total power dissipation at T_A = 25°C . . . . 3.9 W
Operating junction temperature, T_J . . . . 110°C
Junction temperature T_J max . . . . 150°C
Operating free-air temperature range, T_A . . . . −40°C to 85°C
Storage temperature range, T_{stg} . . . . −65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. Voltage values are with respect to GND.
2. No air flow and with infinite heatsink
3. With the thermal pad of the device soldered to a 1-ounce copper (Cu) ground plane of an FR4 board with no air flow

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage: V_{CC} (see Note 1)	3		5	V
High-level input voltage at TXEN, V_{IH}	V_{CC} − 0.8			V
Low-level input voltage at TXEN, V_{IL}			0.8	V
Operating free-air temperature, T_A	−40		85	°C

NOTE: 1. Voltage values are with respect to GND.

electrical characteristics over full range of operating conditions

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
I_{CC} Supply current from V_{CC}	Operating at maximum power out	TXEN high, VPC = 3 V	190	200	250	mA
	Operating at minimum power out	TXEN high, VPC = 0 V		10		mA
	Power down	TXEN low, VPC = 0 V			0.05	mA

† Typical values are at T_A = 25°C

V_{CC} = 4.8 V, TXEN high, VPC = 3 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Operating frequency range			870		925	MHz
Output power		P_I = 5 dBm	23.5	24.5	25.5	dBm
		P_I = 5 dBm, VPC = 0 V		−50		dBm
Gain (small signal)		P_I = −20 dBm		29		dB
Power added efficiency (PAE)		P_I = 5 dBm		31		%
Input return loss (internally matched)		P_I = −20 dBm		12		dB
Harmonics	$2f_0$	P_I = 5 dBm		−20		dBc
	$3f_0$	P_I = 5 dBm		−35		dBc
Noise power in 30 kHz bandwidth	10 MHz above f_0	P_I = 5 dBm		−92		dBm
	20 MHz above f_0	P_I = 5 dBm		−93		dBm

stability

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Stability	Output VSWR‡ < 6:1 all phases, V_{CC} < 5.6 V, P_I = 5 dBm, Output power 25 dBm, Output frequency band : 200 MHz − 1200 MHz		§		

‡ VSWR = voltage standing wave ratio
§ No parasitic oscillations (all spurious < −70 dBc)

switching characteristics

V_{CC} = 4.8 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{on}	Switching time, RF output OFF to ON	TXEN = high, VPC stepped from 0 V to 3 V		1		µs
t_{off}	Switching time, RF output ON to OFF	TXEN = high, VPC stepped from 3 V to 0 V		2		µs

APPLICATION INFORMATION

A typical application example for GSM cellular telephone systems is shown in Figure 1.

In all cases, a capacitor must be connected from the positive power supply to ground, as close as possible to the IC terminals for power supply bypassing. A dc-blocking capacitor is also required on the RF output. A list of components and their functions is given in Table 1.

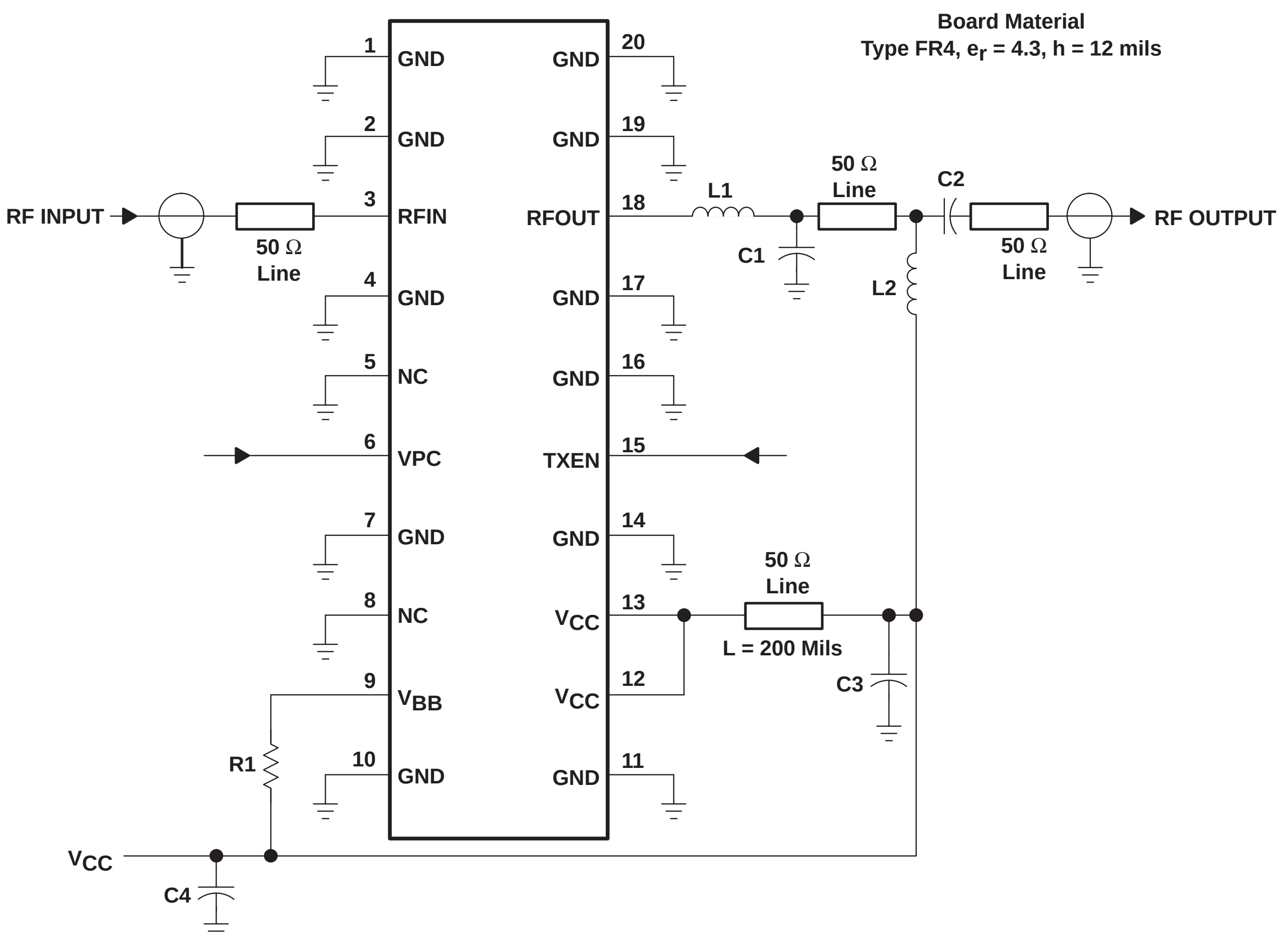


Figure 1. Typical GSM Cellular Telephone Application

Table 1. External Component Selection

COMPONENT DESIGNATION	TYPICAL VALUE	FUNCTION
C1	4 pF	Output impedance matching capacitor
C2	100 pF	DC-blocking capacitor for RF output
C3	1000 pF	Matching capacitor
C4	1 μF	Power supply decoupling capacitor
L1	3.3 nH	Output impedance matching inductor
L2	100 nH	DC bias/RF choke
R1	80 Ω	Bias supply resistor

TYPICAL CHARACTERISTICS

**OUTPUT POWER
vs
INPUT POWER**

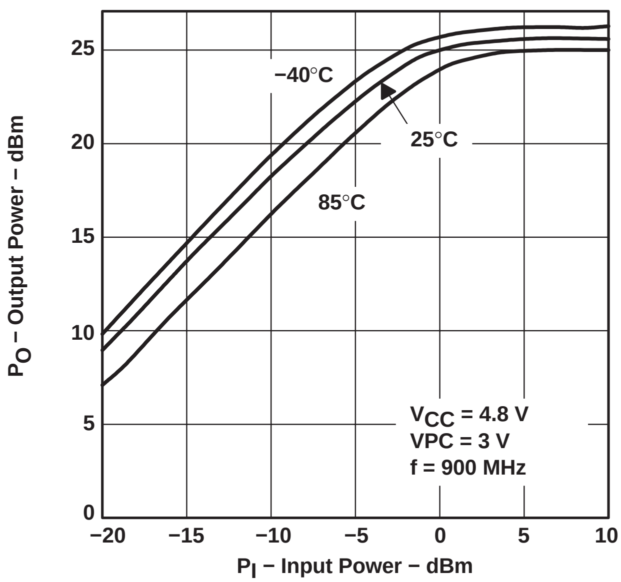


Figure 2

**POWER ADDED EFFICIENCY
vs
INPUT POWER**

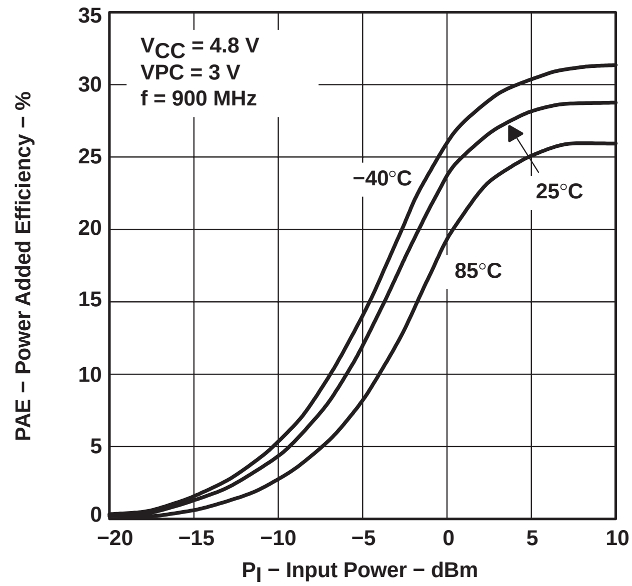


Figure 3

**OUTPUT POWER AND POWER
ADDED EFFICIENCY
vs
FREQUENCY**

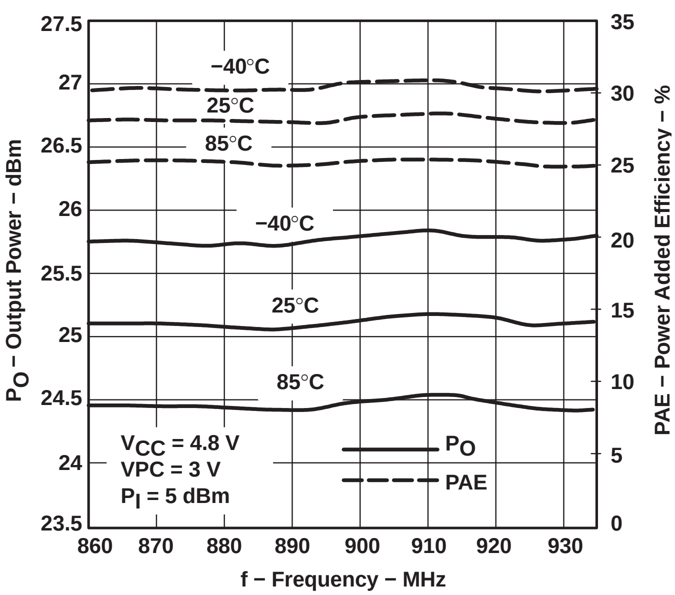


Figure 4

**OUTPUT POWER
vs
VPC GAIN CONTROL RANGE**

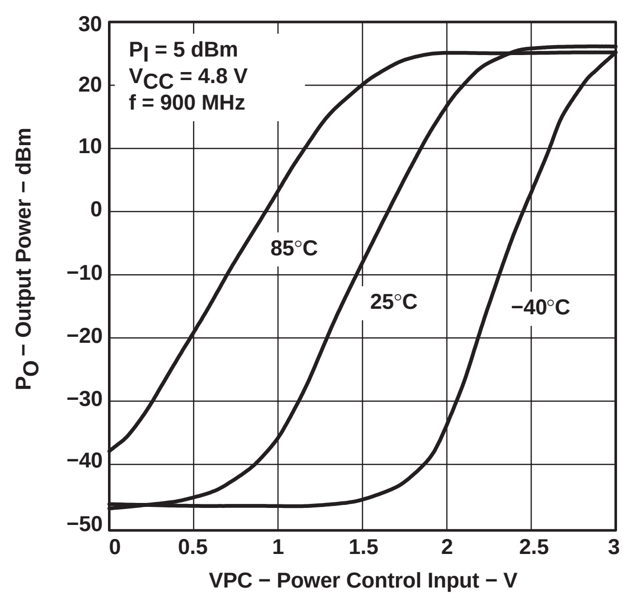


Figure 5

TYPICAL CHARACTERISTICS

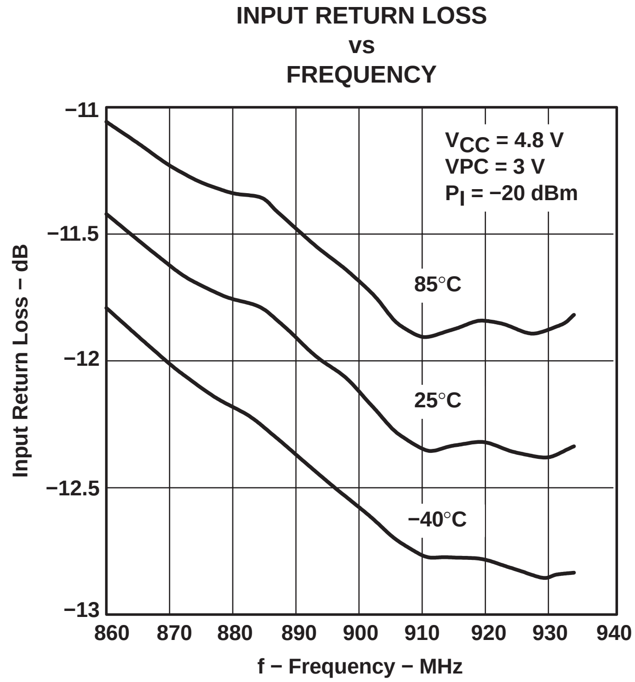
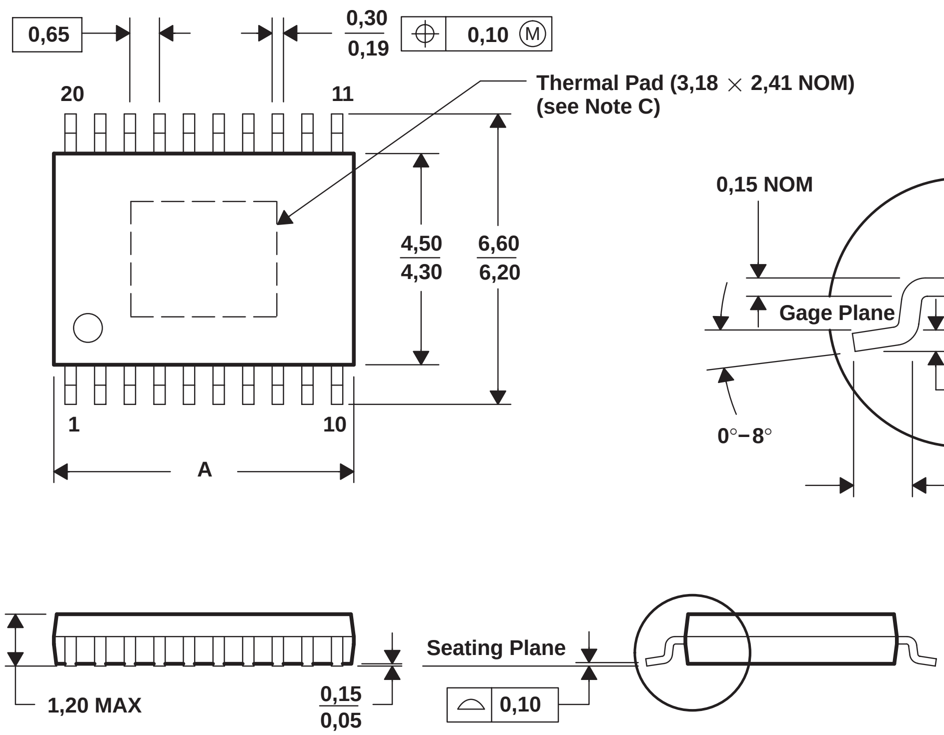


Figure 6

MECHANICAL DATA

PWP (R-PDSO-G)** **PowerPAD™ PLASTIC SMALL-OUTLINE PACKAGE**



PINS ** / DIM	14	16	20	24	28
A MAX	5,10	5,10	6,60	7,90	9,80
A MIN	4,90	4,90	6,40	7,70	9,60

4073225/E 03/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. The package thermal performance may be enhanced by bonding the thermal pad to an external thermal plane. This solderable pad is electrically and thermally connected to the backside of the die and leads 1, 10, 11, and 20.

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