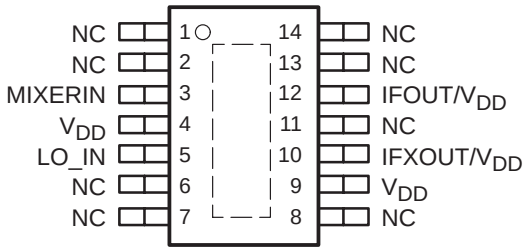
- **Downconverter for 1.9-GHz CDMA Applications**
- **0.5-Micron GaAs MESFET Technology**
- **Operates from 2.7-V to 3.3-V Supply**
- **High Third-Order Intercept Point Mixer**
- **On-Chip Buffer Amplifier to Minimize Mixer Drive Requirements**
- **14-Pin Plastic Surface-Mount TSSOP PowerPAD™ (PWP)**

PWP PACKAGE
(TOP VIEW)



NC – No internal connection

description

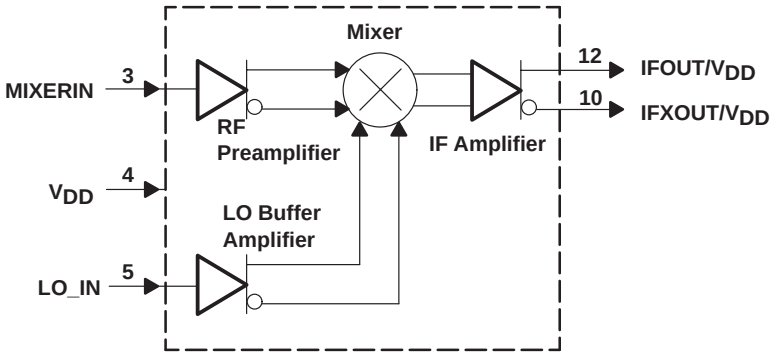
The TRF4000 personal communications system (PCS) RF downconverter is a gallium arsenide (GaAs) integrated circuit housed in a 14-pin plastic surface-mount, thin-shrink small outline package (TSSOP). It is suitable for 1.9-GHz code-division multiple-access (CDMA) applications and is composed of a local oscillator (LO) buffer amplifier, an RF preamplifier, a mixer, and a differential IF amplifier.

These devices have no 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 gates.

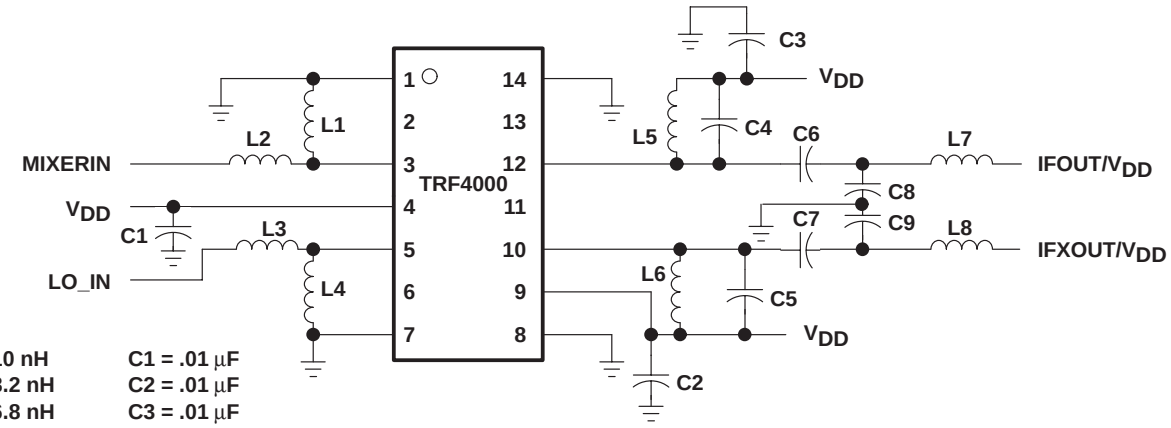
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PowerPAD is a trademark of Texas Instruments Incorporated.

functional block diagram



application circuit



L1 = 10 nH	C1 = .01 μF
L2 = 8.2 nH	C2 = .01 μF
L3 = 6.8 nH	C3 = .01 μF
L4 = 6.8 nH	C4 = 5 pF
L5 = 150 nH	C5 = 5 pF
L6 = 150 nH	C6 = 100 pF
L7 = 150 nH	C7 = 100 pF
L8 = 150 nH	C8 = 1.5 pF
	C9 = 1.5 pF

NOTES: A. All ports matched to 50 Ω

B. Backside must be connected to ground.

Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
MIXERIN	3	I	Mixer input
LO_IN	5	I	Local oscillator input
IFOUT/V_{DD}	12	I/O	Intermediate frequency in-phase output (+) and connection to V_{DD}
IFXOUT/V_{DD}	10	I/O	Intermediate frequency quadrature output (–) and connection to V_{DD}
NC	1, 2, 6, 7, 8, 11, 13, 14		No internal connection
V_{DD}	4, 9	I	Supply Voltage

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

Supply voltage range, V_{DD} . . . . . 2.7 V to 5 V
Input power, MIXERIN . . . . . 0 dBm
LO_IN . . . . . 5 dBm
Continuous power dissipation at or below T_A = 25°C . . . . . 150 mW
Operating free-air temperature range, T_A . . . . . –30°C to 80°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.

recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, V_{DD}	2.7	3.3	V
Operating free-air temperature, T_A	–30	80	°C

electrical characteristics over recommended operating free-air temperature range, V_{DD} = 2.7 V, f_{IF} = 185 MHz

mixer

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Input frequency range (MIXERIN)		1930		1990	MHz
Local oscillator frequency range (LO_IN)		2115		2175	MHz
Intermediate frequency (IFOUT, IFXOUT)			185		MHz
Gain		10.5	12	13.5	dB
Noise figure			9.7	10.7	dB
Input VSWR (MIXERIN) (see Note 1)	50 Ω			1.5:1	
Differential output impedance (IFOUT, IFXOUT)	20 mA required to achieve mixer current		330		Ω
Input 1-dB gain compression point (MIXERIN)		–11			dBm
Input third-order intercept point (MIXERIN)	f_{LO} = 2145 MHz, f_{RF} = 1960 MHz	–2.1	0.5		dBm
Input power (LO_IN)		–12.5	–10.5	–8.5	dBm
Input VSWR (LO_IN) (see Note 1)				1.7:1	

† Typical values are at T_A = 25°C.
NOTE 1: VSWR = Voltage standing wave ratio

current consumption over recommended operating free-air temperature range and V_{DD} = 2.7 V

	MIN	TYP†	MAX	UNIT
Total current consumption		30	35	mA

† Typical values are at T_A = 25°C.

APPLICATION INFORMATION

NOISE FIGURE
vs
SUPPLY VOLTAGE

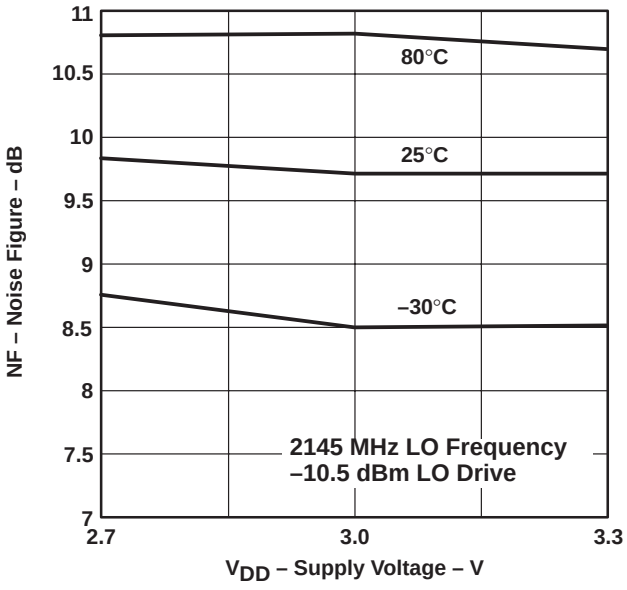


Figure 1

NOISE FIGURE
vs
LO FREQUENCY

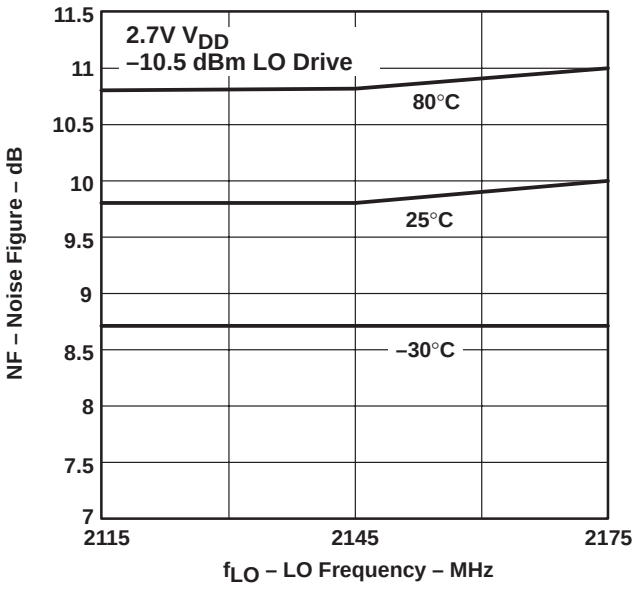


Figure 2

NOISE FIGURE
vs
LO DRIVE LEVEL

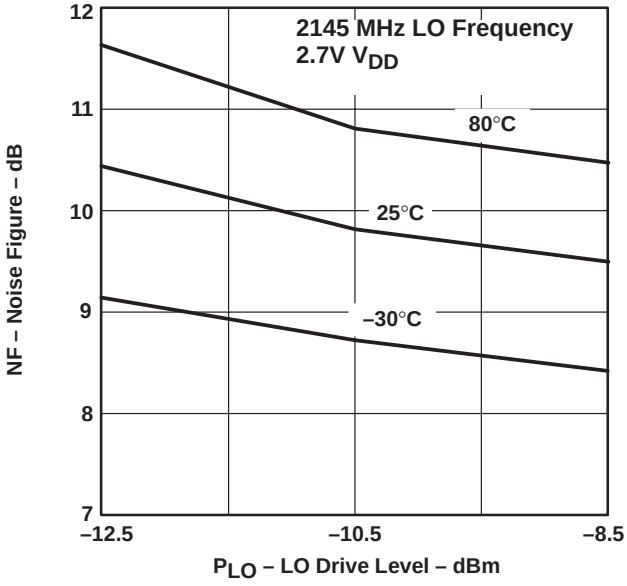


Figure 3

GAIN
vs
SUPPLY VOLTAGE

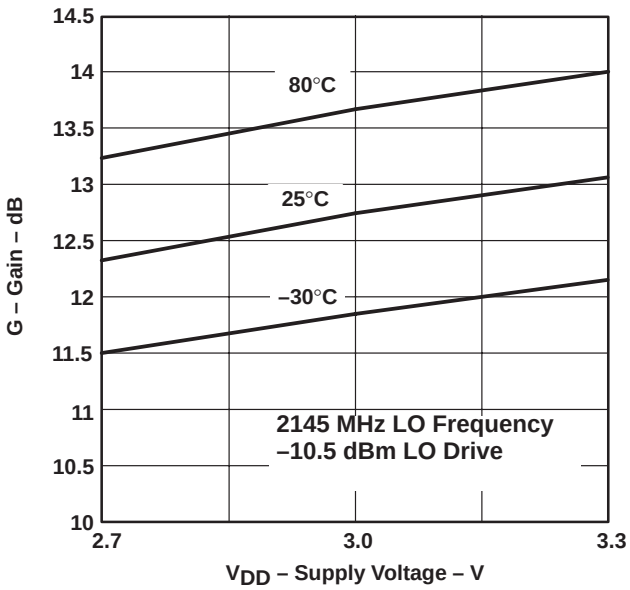


Figure 4

APPLICATION INFORMATION

GAIN vs LO FREQUENCY

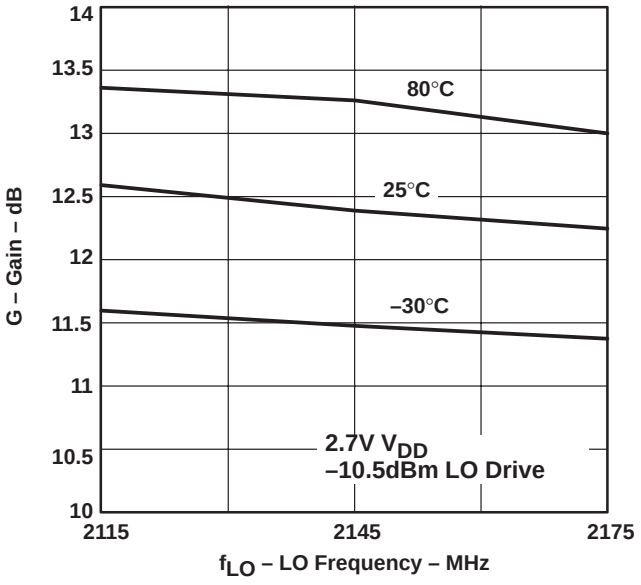


Figure 5

GAIN vs LO DRIVE LEVEL

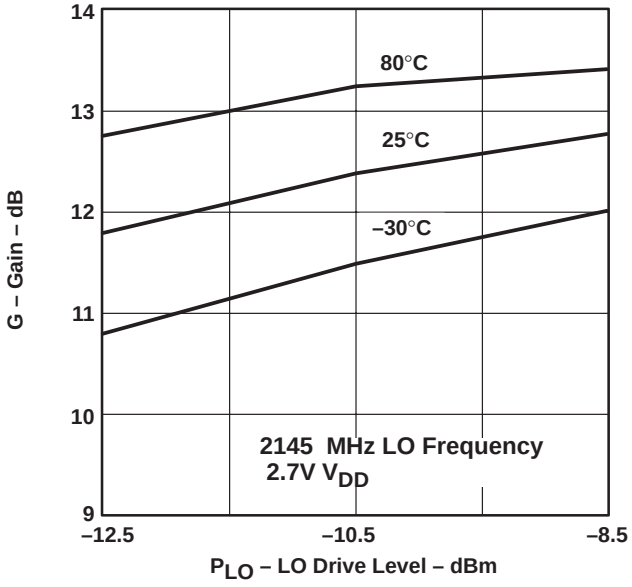
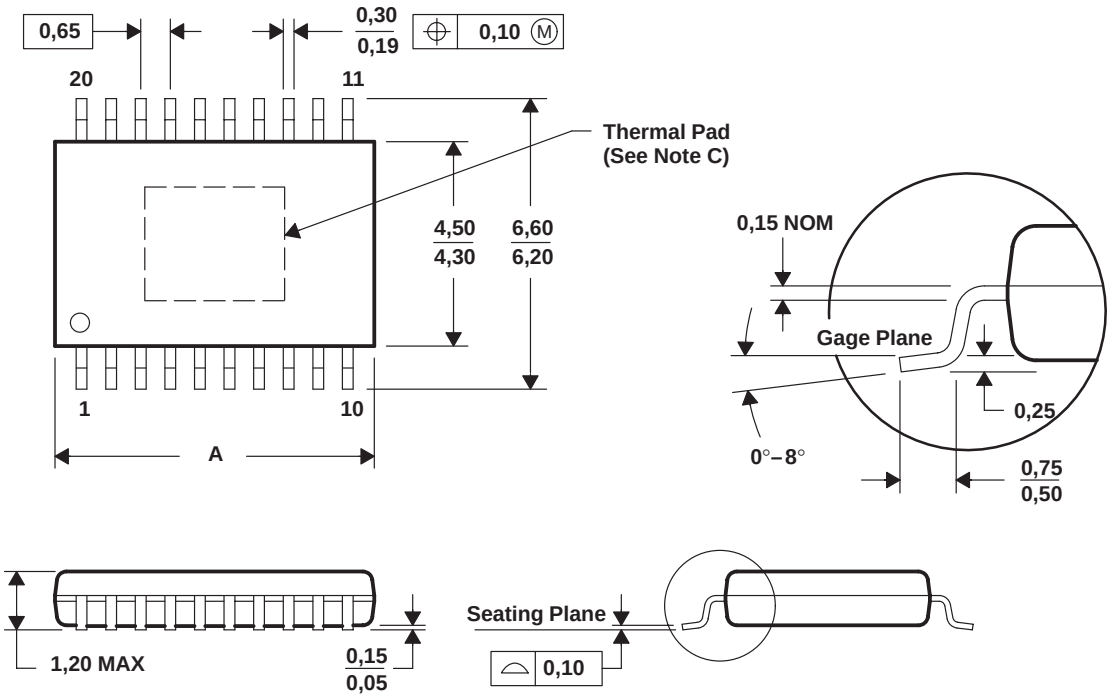


Figure 6

MECHANICAL DATA

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

20-PIN SHOWN



DIM \ PINS **	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 possibly selected leads. The maximum pad size on the printed circuit board should be equal to the package body size – 2,0mm.

PowerPAD is a trademark of Texas Instruments Incorporated.

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.