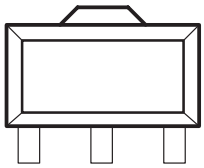
- **Wide Operating Frequency Range up to 1000 MHz**
- **High Output Power:**
  - **Typical Value of 32 dBm at 4.8 V and 900 MHz**
  - **Typical Value of 29 dBm at 3.6 V and 900 MHz**
- **High Gain:**
  - **Typical Value of 9 dB at 4.8 V and 900 MHz at 32-dBm Output Power**
- **High Power-Added Efficiency (PAE):**
  - **Typical Value of 50% at 32-dBm Output Power**
- **Low Cost**
- **Extremely Rugged:**
  - **Sustains 20:1 Load Mismatch**
- **Suitable for Various Wireless Applications**
- **Low Leakage Current <1 μA**
- **SOT-89 Plastic Power Package**
- **1000 V Human Body Model ESD Protection on Gate and Drain**

PK PACKAGE
(TOP VIEW)



description

The TRF7003 power amplifier is a silicon, metal-oxide semiconductor, field-effect transistor (MOSFET) manufactured using the Texas Instruments RFMOS™ process. It is housed in a SOT-89 (PK) plastic power package. The TRF7003, suitable for a variety of wireless applications, has been characterized for global systems for mobile communications (GSM) power amplifier applications. The TRF7003, a rugged, low-cost device, operates from a single-polarity positive power supply and has low leakage current. Typical power output at 900 MHz is 32 dBm, with an associated power gain of 9 dB and 50-percent power-added efficiency (PAE).

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.

RFMOS is a trademark of Texas Instruments Incorporated.

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

Drain-source voltage, V_{DS} . . . . . 15 V
Gate-source voltage, V_{GS} . . . . . 7 V
Continuous drain current, I_D . . . . . 2 A
Junction temperature, $T_{J\ max}$ . . . . . 150°C
Thermal resistance, junction to case, $R_{\theta JC}$ (See Note 1) . . . . . 10°C/W
Total device power dissipation at T_C = 25°C . . . . . 12.5 W
Derate above 25°C . . . . . 100 mW/°C
Operating free-air temperature range,T_A . . . . . –40°C to 85°C
Storage temperature range, T_{stg} . . . . . –65°C to 100°C
ESD protection, gate and drain, human body model . . . . . 1000 V

† 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.

NOTE 1: With infinite heatsink and no air flow

electrical characteristics over operating free-air temperature range (unless otherwise noted)

dc characteristics

PARAMETER		TEST CONDITIONS‡		LIMITS			UNITS
				MIN	TYP	MAX	
I_D	Saturated drain current	V_{DS} = 4.8 V,	V_{GS} = 1.7 V		0.7		A
g_m	Transconductance	V_{DS} = 4.8 V,	V_{GS} = 1.7 V		1000		mS
$V_{(TO)}$	Threshold voltage	V_{DS} = 100mV,	I_{DS} = 1.5 mA		1.0		V
$V(BR)_{sd}$	Source-drain breakdown voltage	Ids = 40 μA, Source is grounded	V_{GS} = 0 V		16		V
	Leakage current	V_{DS} = 4.8 V	V_{GS} = 0 V		<1		μA

‡ T_A = 25°C

RF characteristics, V_{DS} = 4.8 V, V_{GS} = 1.7 V

PARAMETER		TEST CONDITIONS§		LIMITS			UNITS
				MIN	TYP	MAX	
	Output power	Frequency = 900 MHz,	P_I = 23 dBm	31	32		dBm
	Power gain	Frequency = 900 MHz,	P_I = 23 dBm		9		dB
η_{add}	Power added efficiency	Frequency = 900 MHz,	P_I = 23 dBm	45%	50%		
	Ruggedness test	Frequency = 900 MHz, Load VSWR = 20:1,	P_I = 23 dBm, All phase angles		¶		

§ T_A = 25°C, fixed matching circuit
¶ No degradation in output power after test.

TYPICAL CHARACTERISTICS

OUTPUT POWER vs INPUT POWER

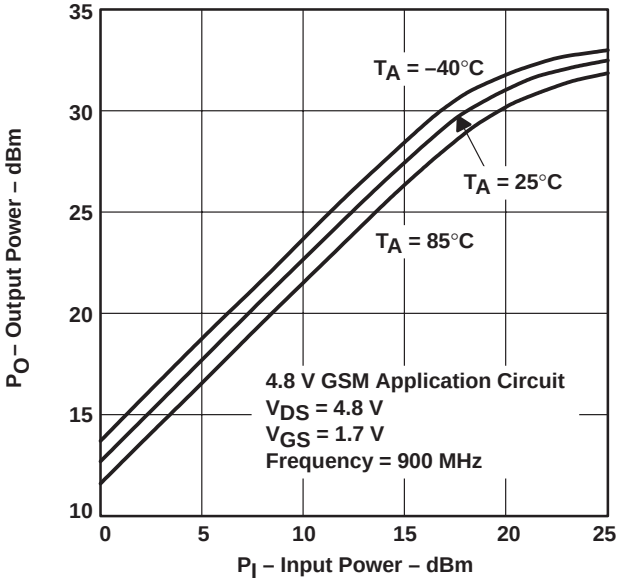


Figure 1

OUTPUT POWER vs FREQUENCY

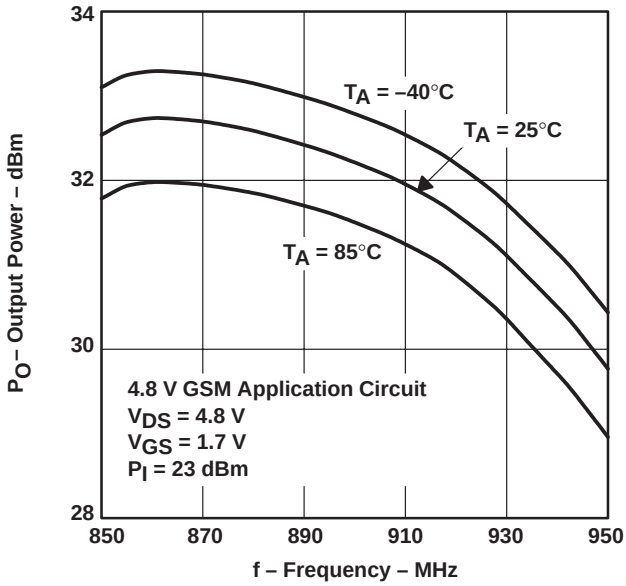


Figure 2

OUTPUT POWER vs DRAIN VOLTAGE

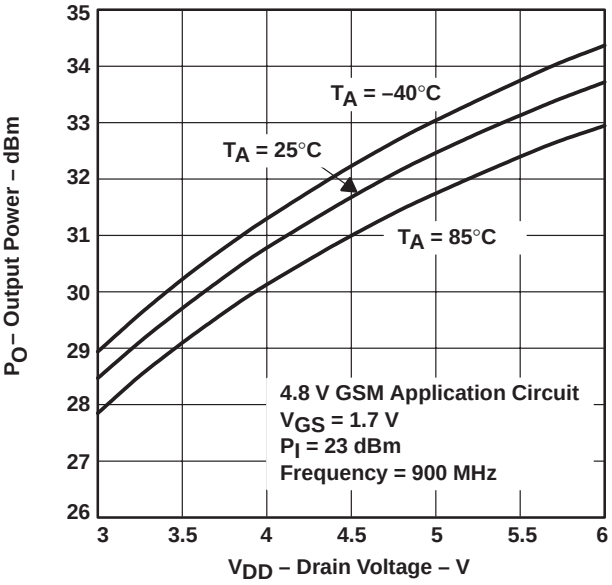


Figure 3

OUTPUT POWER vs GATE VOLTAGE (MAX POWER ADDED EFFICIENCY TUNING)

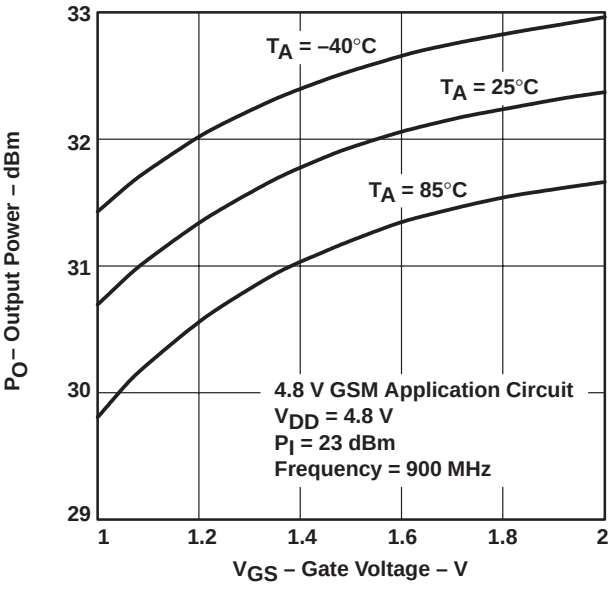


Figure 4

TYPICAL CHARACTERISTICS

POWER ADDED EFFICIENCY vs INPUT POWER

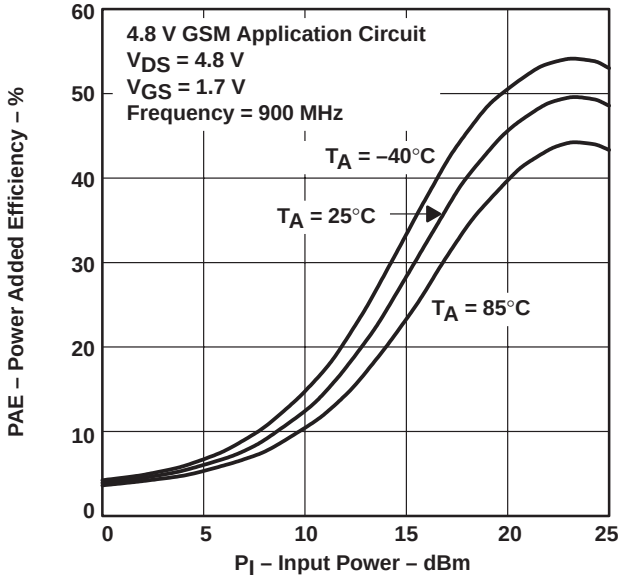


Figure 5

POWER ADDED EFFICIENCY vs FREQUENCY

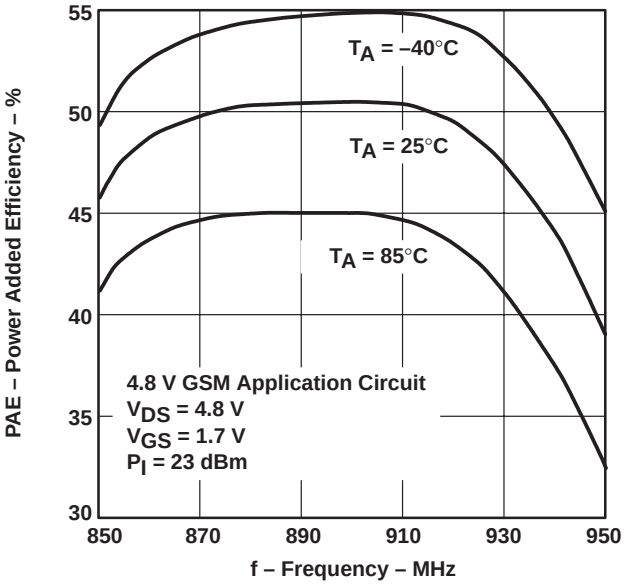


Figure 6

POWER ADDED EFFICIENCY vs DRAIN VOLTAGE

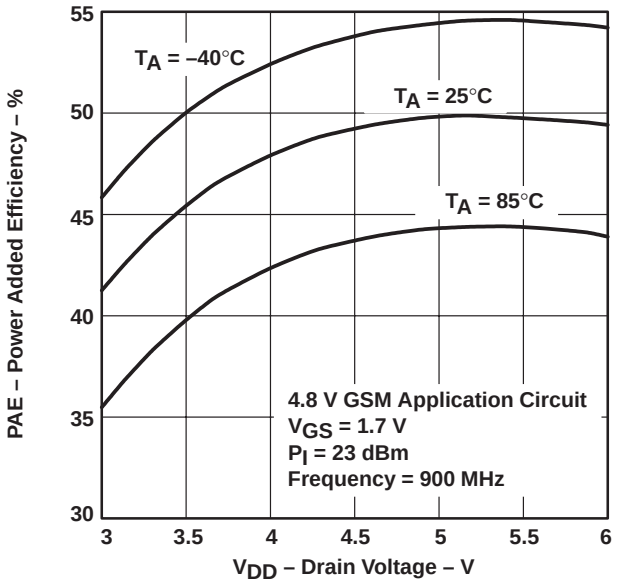


Figure 7

POWER GAIN vs INPUT POWER

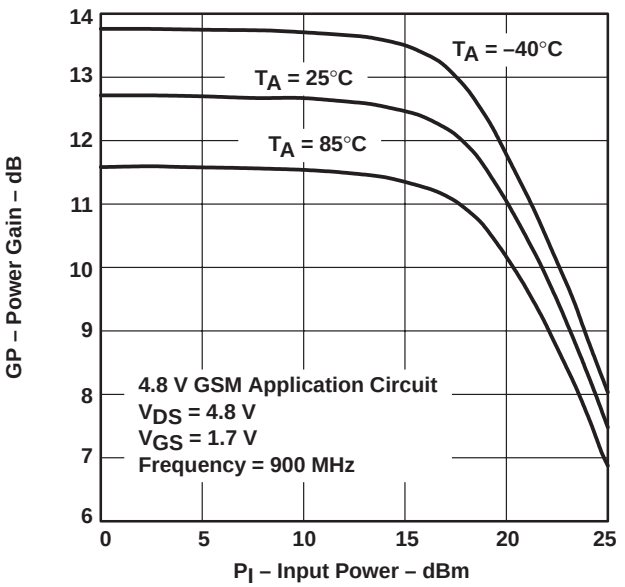


Figure 8

TYPICAL CHARACTERISTICS

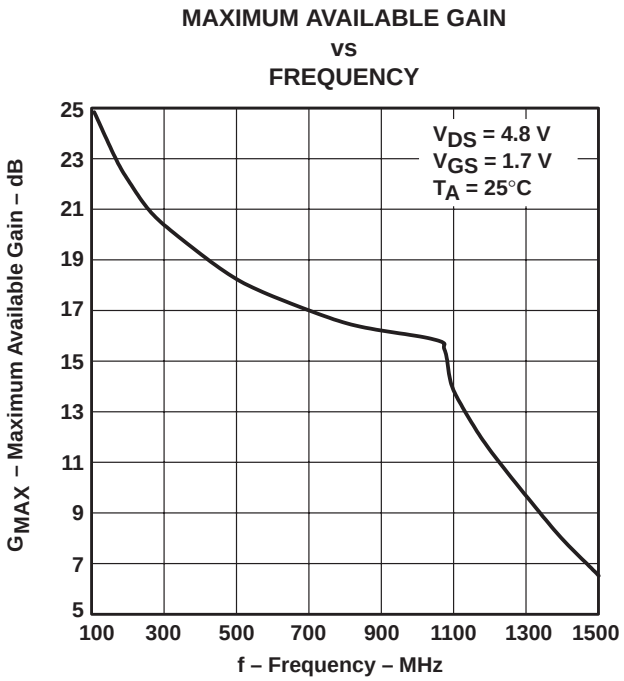


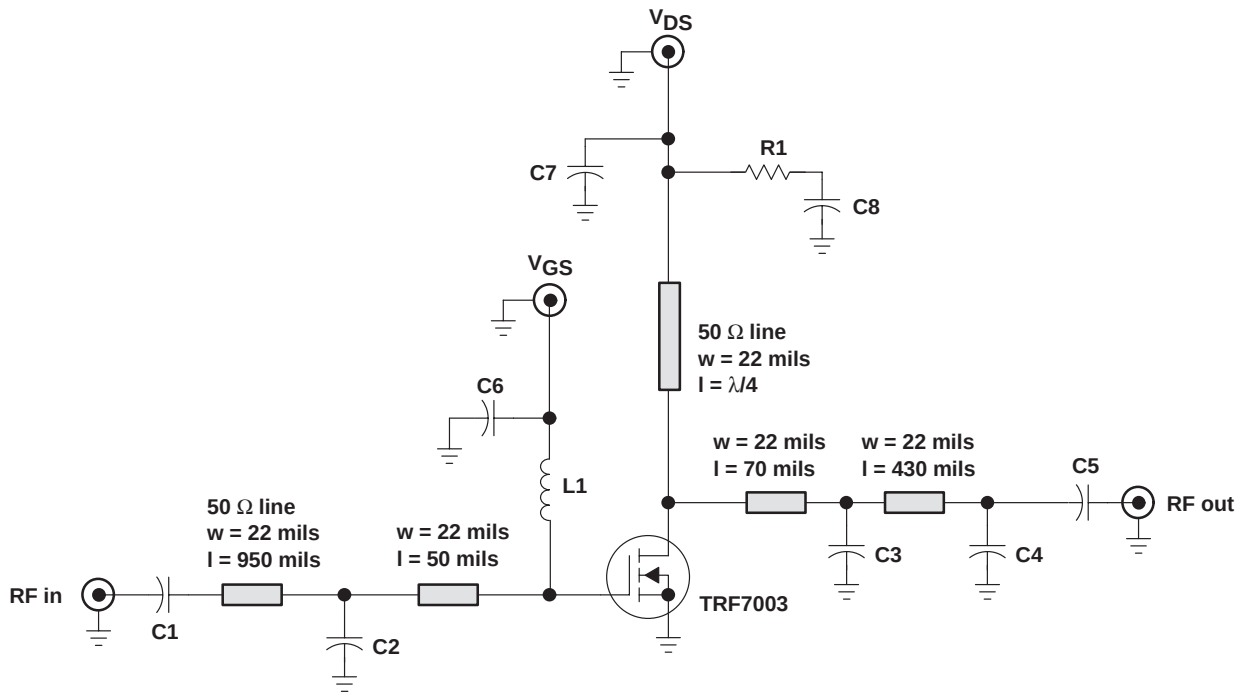
Figure 9

Table 1 lists the small signal scattering parameters of the TRF7003.

Table 1. Small Signal Scattering Parameters, V_{DS} = 4.8 V, V_{GS} = 1.7 V

FREQ MHz	S11 (MAG)	S11 (ANG)	S21 (MAG)	S21 (ANG)	S12 (MAG)	S12 (ANG)	S22 (MAG)	S22 (ANG)
100	0.87	–150.14	9.30	96.71	0.03	8.65	0.77	–166.79
200	0.87	–165.55	4.68	82.07	0.03	–4.19	0.79	–173.48
300	0.87	–171.34	3.06	71.95	0.03	–12.23	0.80	–175.44
400	0.88	–174.68	2.24	63.69	0.03	–18.69	0.82	–177.12
500	0.88	–177.12	1.74	56.64	0.03	–23.87	0.83	–178.14
600	0.89	179.25	1.40	49.46	0.02	–28.83	0.84	–179.71
700	0.89	178.67	1.15	43.07	0.02	–32.53	0.85	179.05
800	0.90	176.99	0.97	37.34	0.02	–36.07	0.86	177.34
900	0.91	175.01	0.83	32.10	0.02	–38.84	0.86	175.88
1000	0.91	173.15	0.71	26.71	0.02	–40.84	0.88	174.07
1100	0.91	171.29	0.62	21.52	0.02	–43.07	0.88	172
1200	0.91	169.46	0.55	16.99	0.02	–44.22	0.88	170.33
1300	0.91	167.47	0.48	12.40	0.01	–45.28	0.88	168.38
1400	0.91	165.25	0.43	7.64	0.01	–45	0.88	165.99
1500	0.90	163.33	0.39	3.76	0.01	–45	0.88	164.11

APPLICATION INFORMATION



Board Material Specifications:
Type FR4 ; ε_r = 4.3 ; h = 12 mils

Figure 10. Recommended Application Circuit for 4.8-V GSM

Table 2 lists the TRF7003 components for the recommended 4.8-V GSM application circuit.

Table 2. Component List

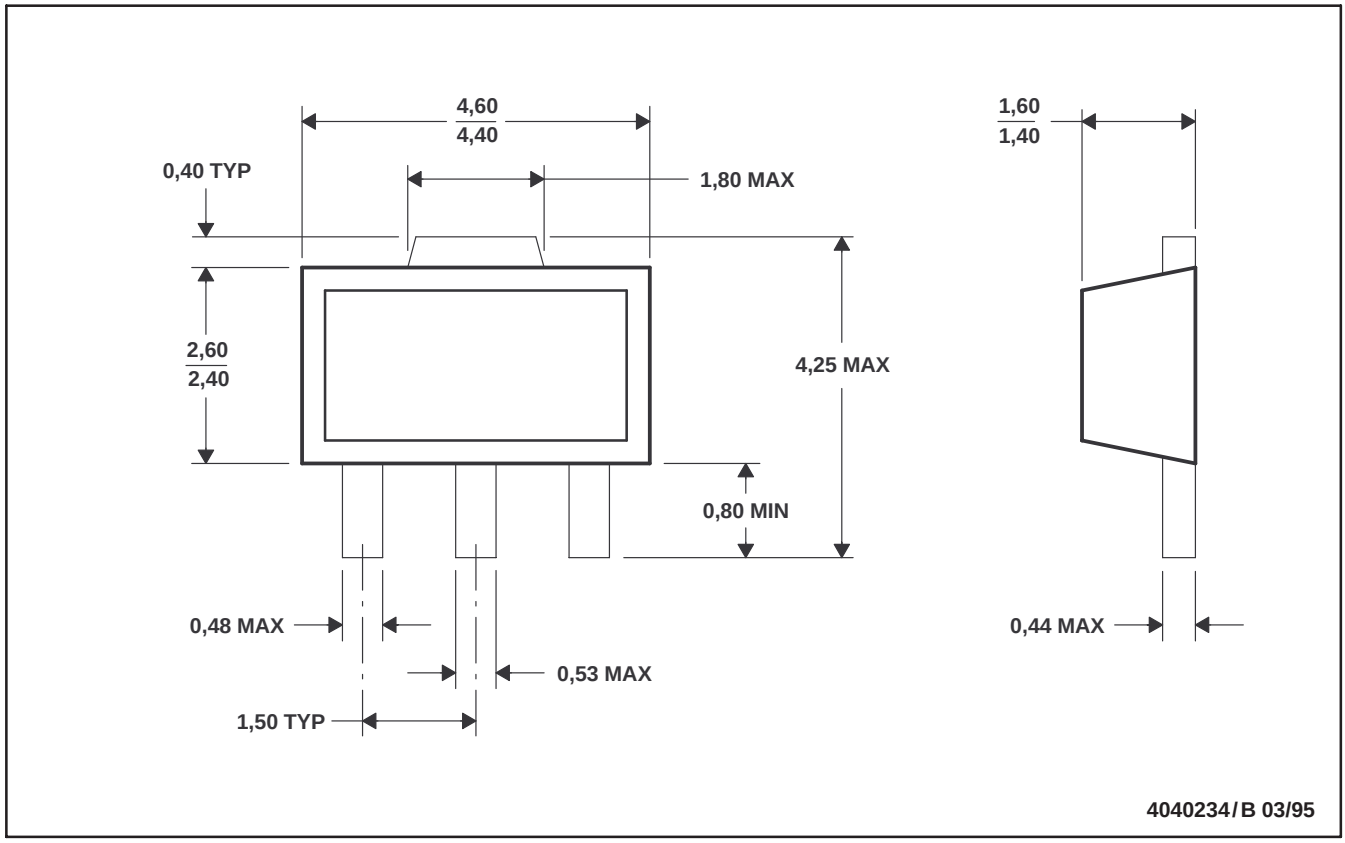
DESIGNATORS	DESCRIPTION	VALUE	MANUFACTURER†	MANUFACTURER P/N
C1	Capacitor	22 pF	ATC™	ATC100A220JP150X
C2	Capacitor	18 pF	ATC	ATC100A180JP150X
C3	Capacitor	16 pF	ATC	ATC100A160JP150X
C4	Capacitor	2.7 pF	ATC	ATC100A2R7CP150X
C5	Capacitor	100 pF	ATC	ATC100A101JP150X
C6	Capacitor	1 µF	MURATA	GRM220Y5V105Z010
C7	Capacitor	100 pF	ATC	ATC100A101JP150X
C8	Capacitor	1 µF	MURATA	GRM220Y5V105Z010
R1	Resistor	30 Ω	International Manufacturing Services	RCI–0402–30ROJ
L1	Inductor	15 nH	TOKO	LL2012–F15NK

† Or equivalent device

ATC is a trademark of American Technical Ceramics Corporation

MECHANICAL DATA

PK (R-PSSO-F3) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the tab.

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.