



## TRF37C73 1-6000MHz 射频 (RF) 增益块

### 1 特性

- 1MHz-6000MHz
- 增益: 17dB
- 噪声值: 3.5dB
- 输出 P1dB: 2000MHz 时为 16.5dBm
- 输出 IP3: 2000MHz 时为 28.5dBm
- 节电模式
- 单电源: 3.3V
- 温度范围内的稳定性能
- 无条件稳定
- 强健的静电放电 (ESD) 防护: > 1kV 人体模型 (HBM); > 1kV 充电器件模型 (CDM)

### 2 应用范围

- 通用 RF 增益块
- 消费类产品
- 工业用
- 公用事业计量仪表
- 低成本无线电产品
- 蜂窝基站
- 无线基础设施
- RF 回程
- 雷达
- 电子对抗
- 软件定义的无线电
- 测试和测量
- 点对点/多点微波
- 软件定义的无线电
- RF 中继器
- 分布式天线系统
- 本振 (LO) 和 PA 驱动器放大器
- 无线数据, 卫星, 直播卫星 (DBS), 有线电视 (CATV)
- 中频 (IF) 放大器

### 3 说明

TRF37C73 采用具有节电引脚的 2.00mm x 2.00mm 超薄小外形尺寸无引线 (WSN) 封装, 这使得这款器件非常适合于空间占用和低功率模式十分关键的应用。

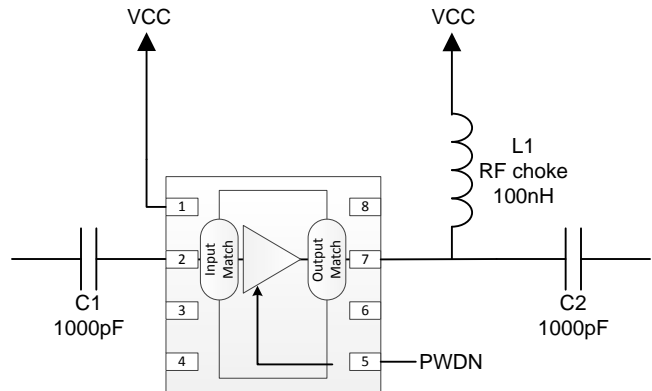
TRF37C73 的设计目的是易于使用。为了实现最大灵活性, 这个产品系列使用常见的 3.3V 电源, 并且流耗为 55mA。此外, 这一系列在设计时使用了有源偏置电路, 此电路在过程、温度和电压变化范围内提供一个稳定且可预计的偏置电流。为了实现增益和线性预算, 此器件被设计成提供一个平坦增益响应, 以及频率达到 6000MHz 时的出色 OIP3 输出。针对空间受限应用, 这一系列与 50Ω 内部匹配, 这样简化了使用, 并且最大限度地减小了所需的印刷电路板 (PCB) 面积。

器件信息<sup>(1)</sup>

产品型号	封装	封装尺寸 (标称值)
TRF37C73	WSN (32)	2.00mm x 2.00mm

(1) 要了解所有可用封装, 请见数据表末尾的可订购产品附录。

简化电路原理图



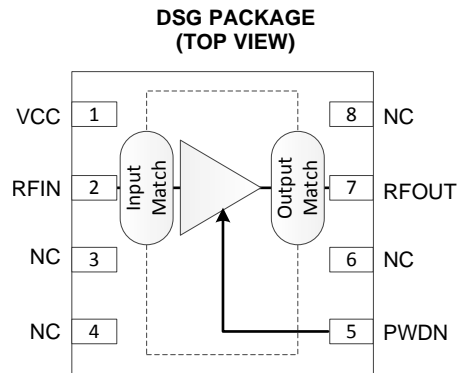
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## 4 修订历史记录

日期	修订版本	注释
2014 年 5 月	*	最初发布。

## 5 Pin Configuration and Functions



### Pin Functions

PIN		DESCRIPTION
NAME	NO.	
VCC	1	DC Bias.
RFIN	2	RF input. Connect to an RF source through a DC-blocking capacitor. Internally matched to 50 $\Omega$ .
NC	3, 4, 6, 8	No electrical connection. Connect pad to GND for board level reliability integrity.
PWDN	5	When high the device is in power down state. When LOW or NC the device is in active state. Internal pulldown resistor to GND.
RFOUT	7	RF Output and DC Bias ( $V_{CC}$ ). Connect to DC supply through an RF choke inductor. Connect to output load through a DC-blocking capacitor. Internally matched to 50 $\Omega$ .
GND	PowerPAD™	RF and DC GND. Connect to PCB ground plane.

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

	MIN	MAX	UNIT
Supply Input voltage	−0.3	3.6	V
Input Power		10	dBm
Operating virtual junction temperature range	−40	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### 6.2 Handling Ratings

			MIN	MAX	UNIT
T <sub>STG</sub>	Storage temperature range		−65	150	°C
V <sub>ESD</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>	−1	1	kV
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup>	−1	1	kV

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

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

	MIN	NOM	MAX	UNIT
Supply Voltage, V <sub>CC</sub>	3	3.3	3.45	V
Operating junction temperature, T <sub>J</sub>	−40		125	°C

### 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		DSG	UNIT
		8 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	79.3	°C/W
R <sub>θJctop</sub>	Junction-to-case (top) thermal resistance	110	
R <sub>θJB</sub>	Junction-to-board thermal resistance	49	
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	6	
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	49.4	
R <sub>θJcbot</sub>	Junction-to-case (bottom) thermal resistance	19.2	

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 6.5 Electrical Characteristics

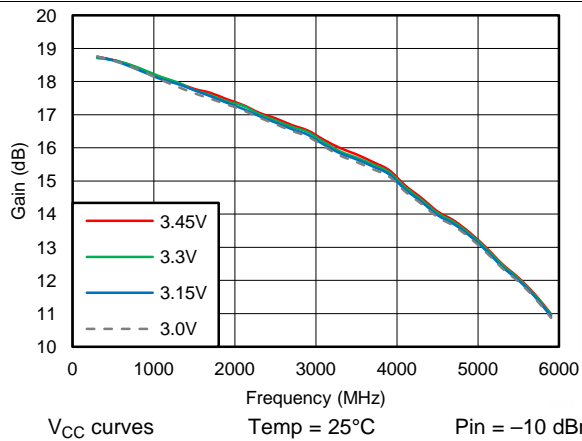
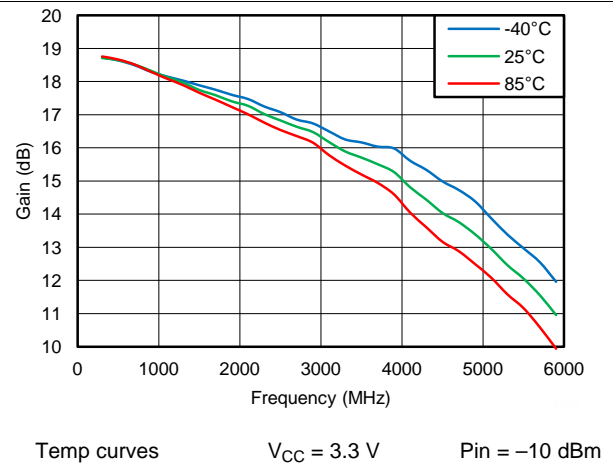
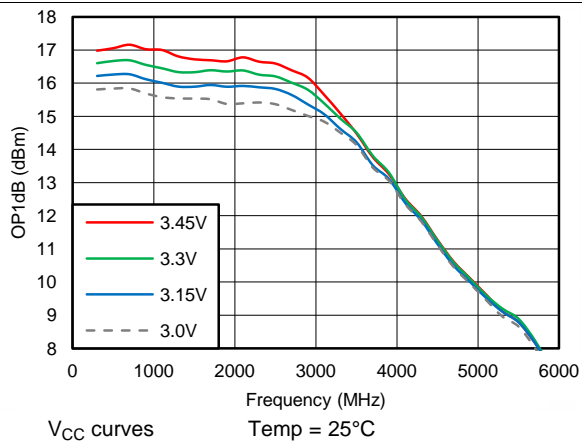
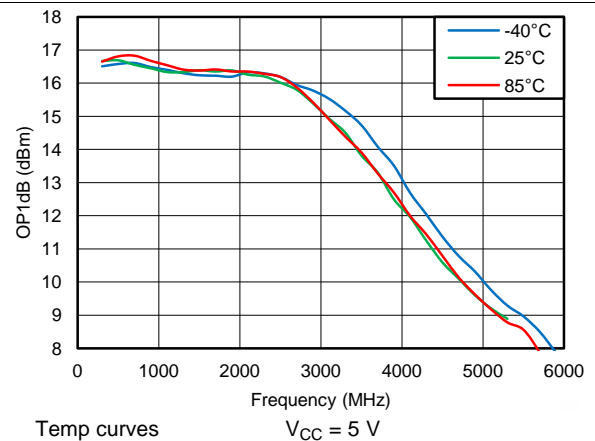
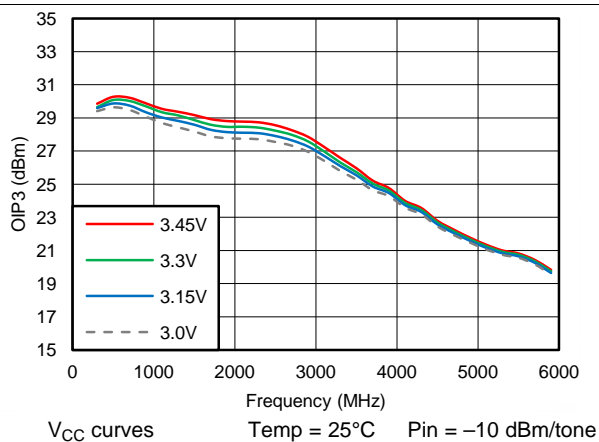
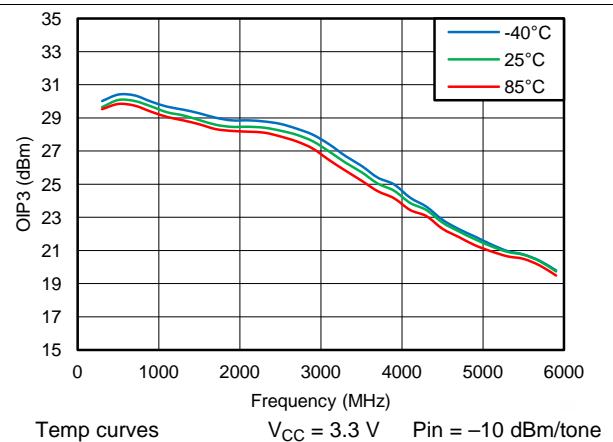
$V_{CC} = 3V3$ ,  $T_A = 25^{\circ}C$ ,  $PWDN = Low$ ,  $L_{OUT} = 100\text{ nH}$ ,  $C1 = C2 = 1000\text{ pF}$ ,  $Z_S = Z_L = 50\text{ }\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DC PARAMETERS</b>						
$I_{CC}$	Total supply current			55	65	mA
	Power down current	$PWDN = High$		125		$\mu A$
$P_{diss}$	Power dissipation			0.182		W
<b>RF FREQUENCY RANGE</b>						
	Frequency range		1		6000	MHz
G	Small signal gain	$f_{RF} = 400\text{ MHz}$		18.5		dB
		$f_{RF} = 2000\text{ MHz}$		17.5		dB
		$f_{RF} = 3000\text{ MHz}$		16.5		dB
		$f_{RF} = 4000\text{ MHz}$		15		dB
		$f_{RF} = 5000\text{ MHz}$		13		dB
		$f_{RF} = 6000\text{ MHz}$		11		dB
OP1dB	Output 1dB compression point	At 2000 MHz		16.5		dBm
OIP3	Output 3rd order intercept point	At 2000 MHz, 2-tone 10 MHz apart		28.5		dBm
NF	Noise figure	At 2000 MHz		3.5		dB
$R_{(LI)}$	Input return loss	At 2000 MHz		19		dB
$R_{(LO)}$	Output return loss	At 2000 MHz		13		dB
<b>PWDN PIN</b>						
$V_{IH}$	High level input level		2			V
$V_{IL}$	Low level input level				0.8	V
$I_{IH}$	High level input current			30		$\mu A$
$I_{IL}$	Low level input current			1		$\mu A$

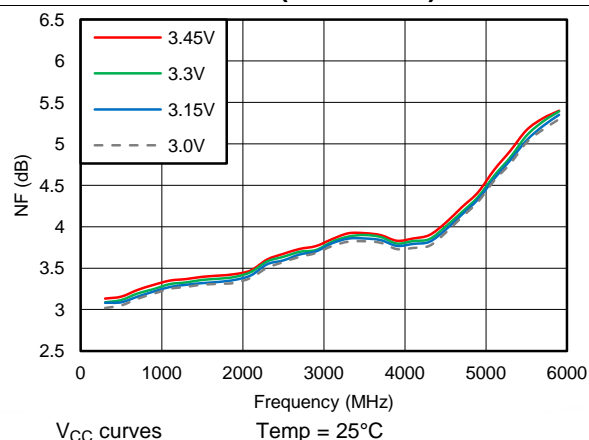
## 6.6 Timing Requirements

			MIN	TYP	MAX	UNIT
<b>PWDN PIN</b>						
$t_{ON}$	Turn-on Time	50% TTL to 90% $P_{OUT}$		0.6		$\mu s$
$t_{OFF}$	Turn-off Time	50% TTL to 10% $P_{OUT}$		1.4		$\mu s$

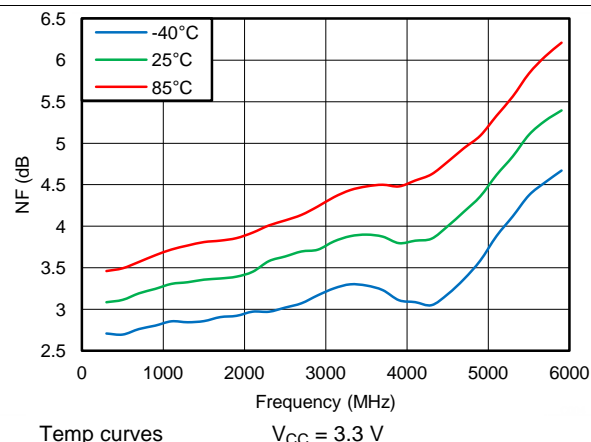
## 6.7 Typical Characteristics


**Figure 1. Gain vs Frequency**

**Figure 2. Gain vs Frequency**

**Figure 3. OP1dB vs Frequency**

**Figure 4. OP1dB vs Frequency**

**Figure 5. OIP3 vs Frequency**

**Figure 6. OIP3 vs Frequency**

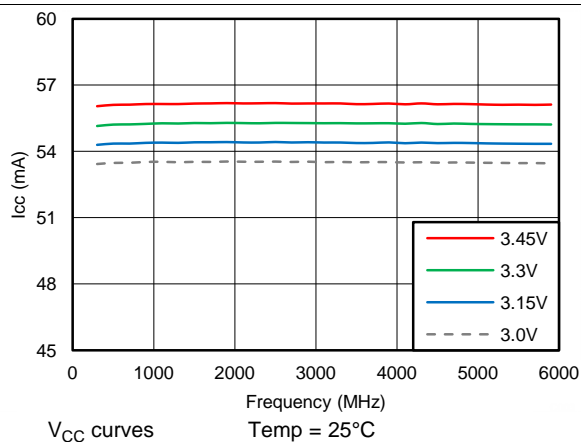
## Typical Characteristics (continued)



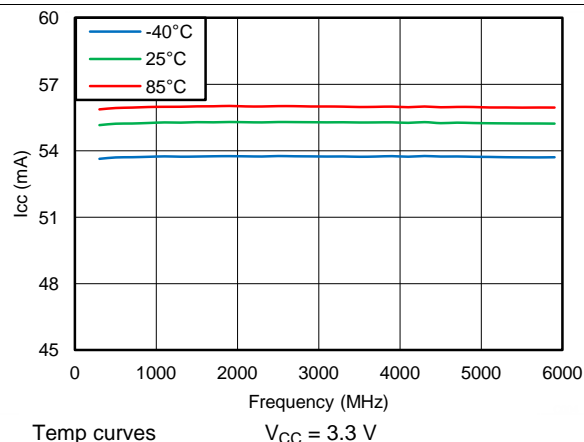
**Figure 7. NF vs Frequency**



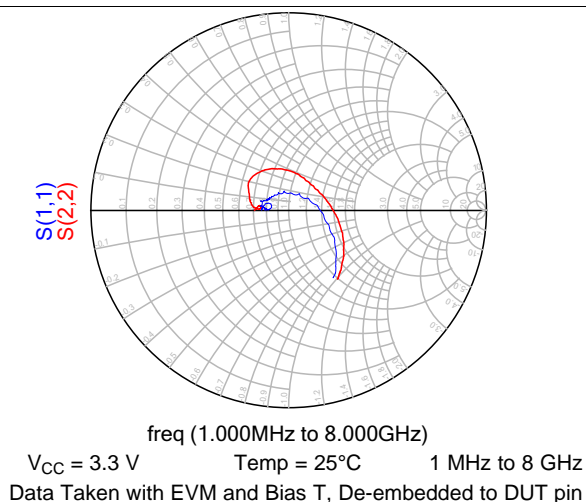
**Figure 8. NF vs Frequency**



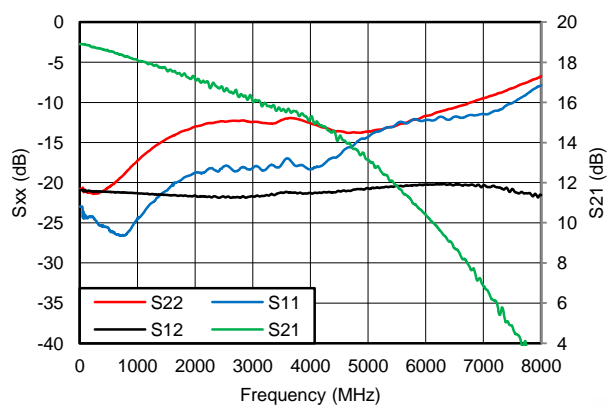
**Figure 9. ICC vs Frequency**



**Figure 10. ICC vs Frequency**



**Figure 11. Smith Chart – S11, S22**



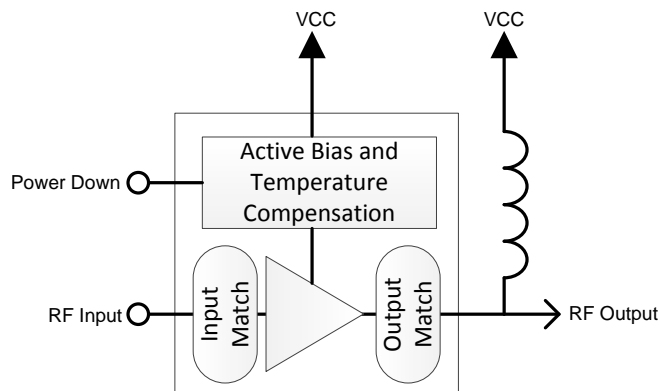
**Figure 12. S22, S11, S12, S21**

## 7 Detailed Description

### 7.1 Overview

The device is a 3.3 V general purpose RF gain block. It is a SiGe Darlington amplifier with integrated 50  $\Omega$  input and output matching. The device contains an active bias circuit to maintain performance over a wide temperature and voltage range. The included power down function allows the amplifier to shut down saving power when the amplifier is not needed. Fast shut down and start up enable the amplifier to be used in a host of time division duplex applications.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

The TRF37C73 is a fixed gain RF amplifier. It is internally matched to 50  $\Omega$  on both the input and output. It is a fully cascable general purpose amplifier. The included active bias circuitry ensures the amplifier performance is optimized over the full operating temperature and voltage ranges.

### 7.4 Device Functional Modes

#### 7.4.1 Power Down

The TRF37C73 PWDN pin can be left unconnected for normal operation or a logic-high for disable mode operation. For applications that use the power down mode, normal 5 V TLL levels are supported.



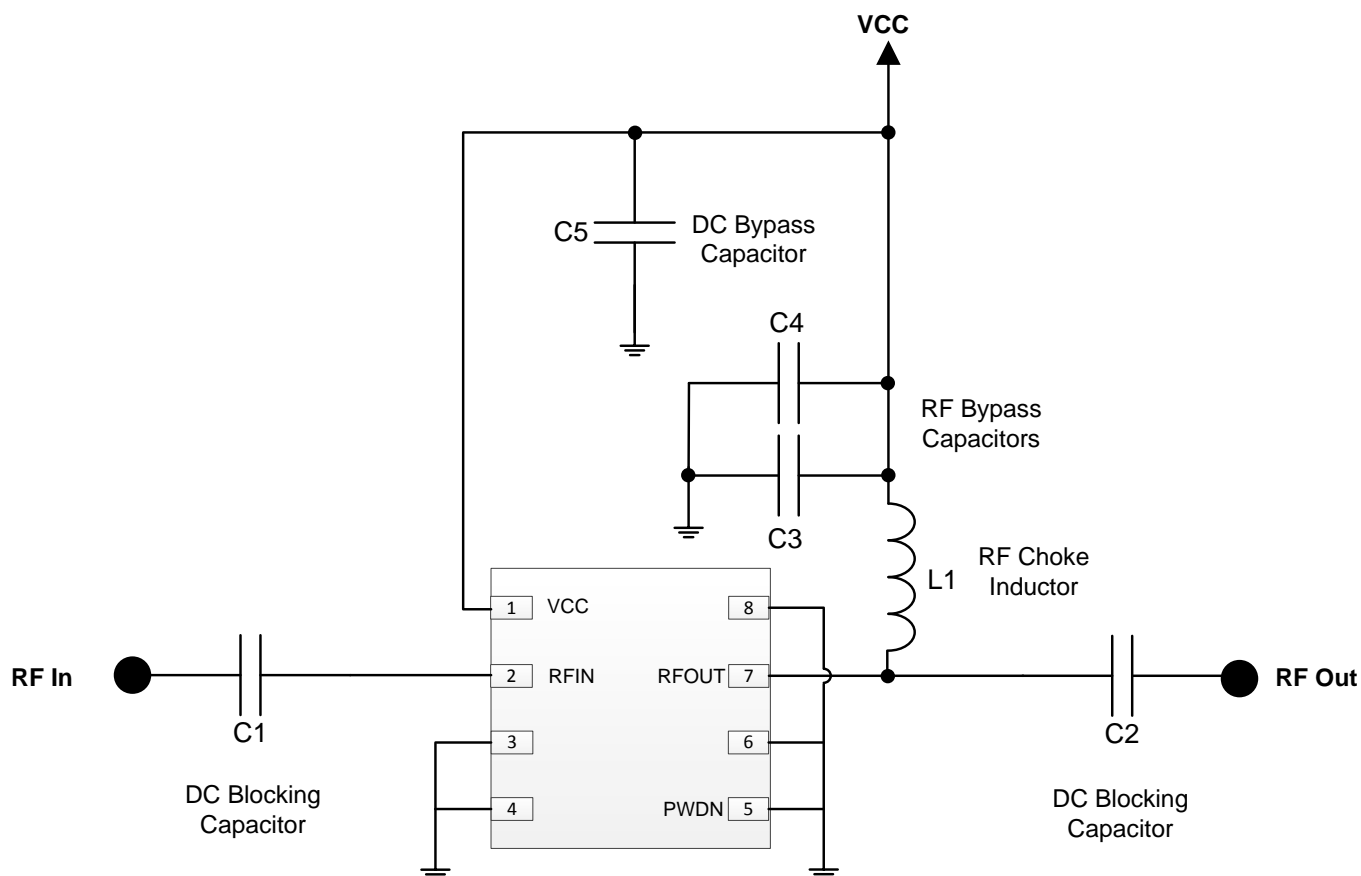
## 8 Applications and Implementation

### 8.1 Application Information

The TRF37C73 is a wideband, high performance, general purpose RF amplifier. To maximize its performance, good RF layout and grounding techniques should be employed.

### 8.2 Typical Application

The TRF37C73 device is typically placed in a system as illustrated in [Figure 13](#).



**Figure 13. Typical Application Schematic for TRF37C73**

#### 8.2.1 Design Requirements

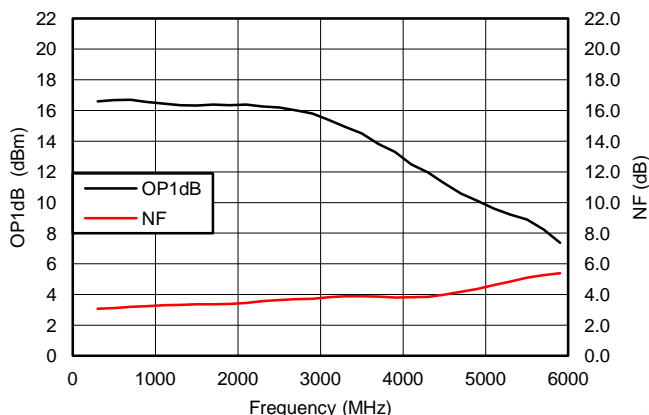
**Table 1. Design Parameters**

PARAMETERS	EXAMPLE VALUES
Input power range	< 3 dBm
Output power	< 18 dBm
Operating frequency range	1 — 6000 MHz

## 8.2.2 Detailed Design Procedure

The TRF37C73 is a simple to use internally matched and cascadable RF amplifier. Following the recommended RF layout with good quality RF components and local DC bypass capacitors will ensure optimal performance is achieved. TI provides various support materials including S-Parameter and ADS models to allow the design to be optimized to the user's particular performance needs.

## 8.2.3 Application Curve



**Figure 14. OP1dB and NF vs Frequency**

## 9 Power Supply Recommendations

All supplies may be generated from a common nominal 3.3 V source but should be isolated through decoupling capacitors placed close to the device. The typical application schematic in [Figure 13](#) is an excellent example. Select capacitors with self-resonant frequency near the application frequency. When multiple capacitors are used in parallel to create a broadband decoupling network, place the capacitor with the higher self-resonant frequency closer to the device. Expensive tantalum capacitors are not needed for optimal performance.

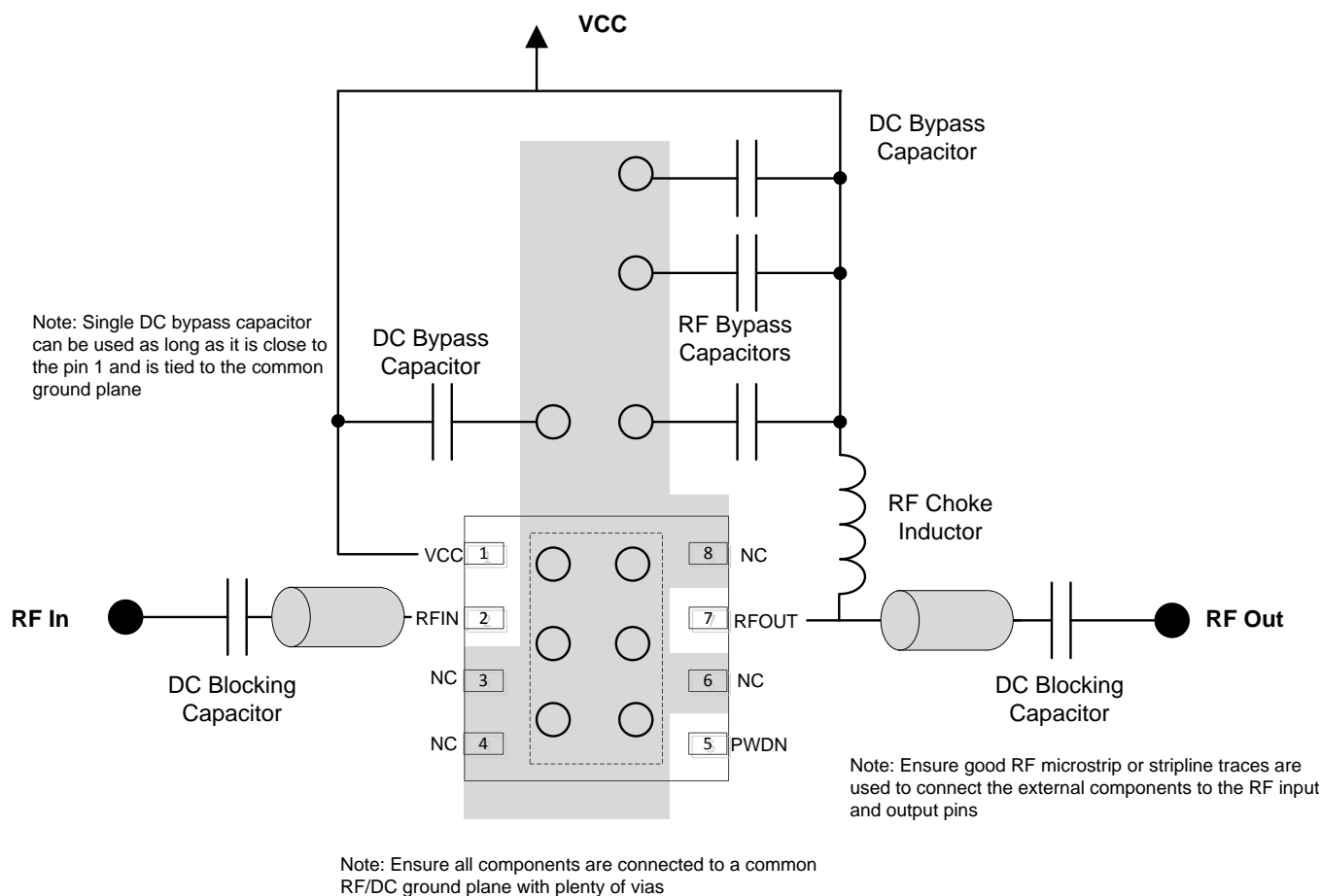
## 10 Layout

### 10.1 Layout Guidelines

Good layout practice helps to enable excellent linearity and isolation performance. An example of good layout is shown in Figure 15. In the example, only the top signal layer and its adjacent ground reference plane are shown.

- Excellent electrical connection from the PowerPAD™ to the board ground is essential. Use the recommended footprint, solder the pad to the board, and do not include solder mask under the pad.
- Connect pad ground to device terminal ground on the top board layer.
- Verify that the return DC and RF current path have a low impedance ground plane directly under the package and RF signal traces into and out of the amplifier.
- Ensure that ground planes on the top and any internal layers are well stitched with vias.
- Do not route RF signal lines over breaks in the reference ground plane.
- Avoid routing clocks and digital control lines near RF signal lines.
- Do not route RF or DC signal lines over noisy power planes. Ground is the best reference, although clean power planes can serve where necessary.
- Place supply decoupling close to the device.

### 10.2 Layout Example



**Figure 15. Layout**

## 11 器件和文档支持

### 11.1 Trademarks

PowerPAD is a trademark of Texas Instruments.

### 11.2 Electrostatic Discharge Caution



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.

### 11.3 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms and definitions.

## 12 机械封装和可订购信息

以下页中包括机械封装和可订购信息。 这些信息是针对指定器件可提供的最新数据。 这些数据会在无通知且不对本文档进行修订的情况下发生改变。 欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TRF37C73IDSGR</a>	Active	Production	WSO (DSG)   8	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	C73I
TRF37C73IDSGR.B	Active	Production	WSO (DSG)   8	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	C73I
<a href="#">TRF37C73IDSGT</a>	Active	Production	WSO (DSG)   8	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	C73I
TRF37C73IDSGT.B	Active	Production	WSO (DSG)   8	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	C73I
TRF37C73IDSGTG4	Active	Production	WSO (DSG)   8	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	C73I
TRF37C73IDSGTG4.B	Active	Production	WSO (DSG)   8	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	C73I

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## GENERIC PACKAGE VIEW

**DSG 8**

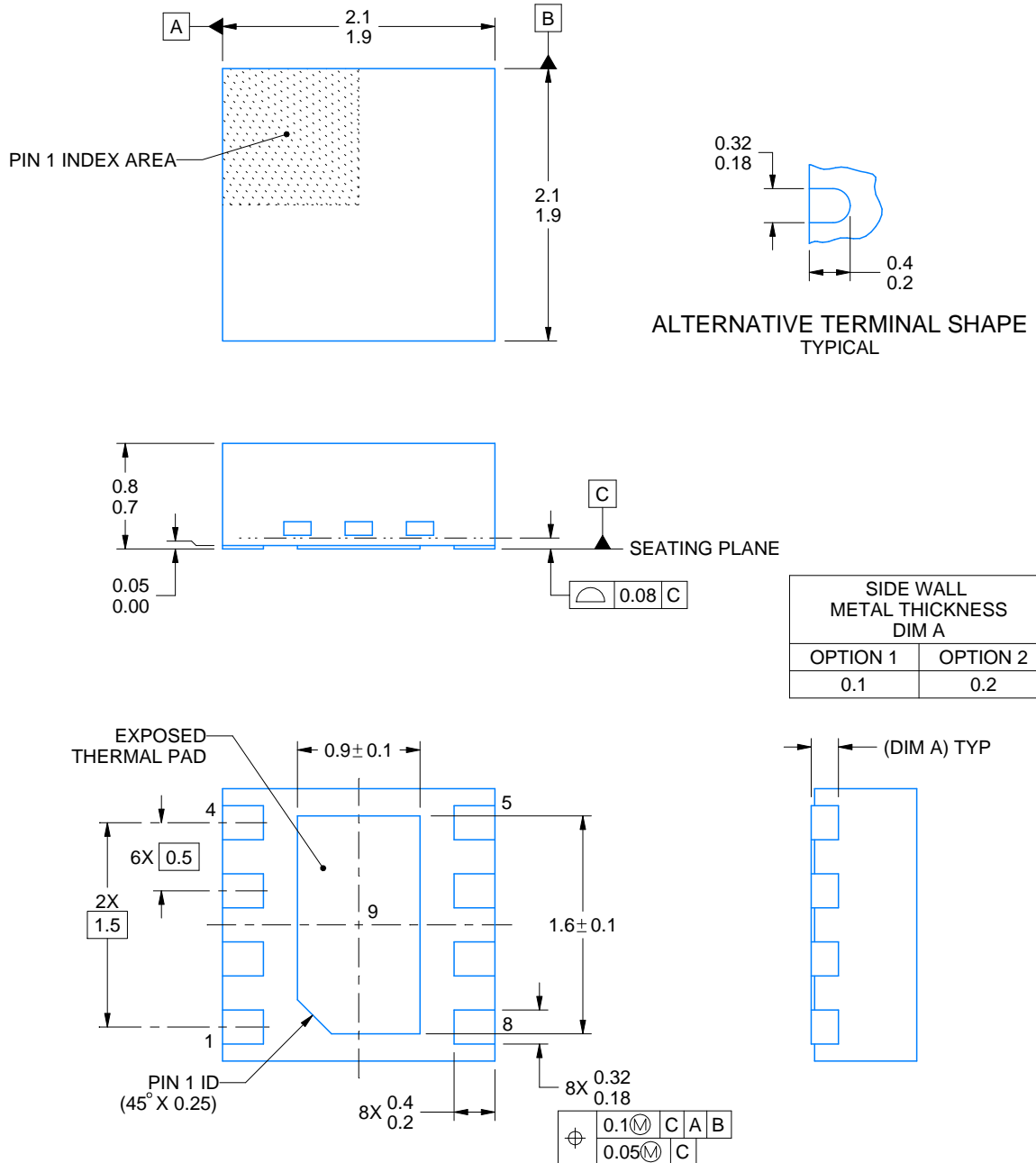
**WSON - 0.8 mm max height**

2 x 2, 0.5 mm pitch

PLASTIC SMALL OUTLINE - NO LEAD

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.





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**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.



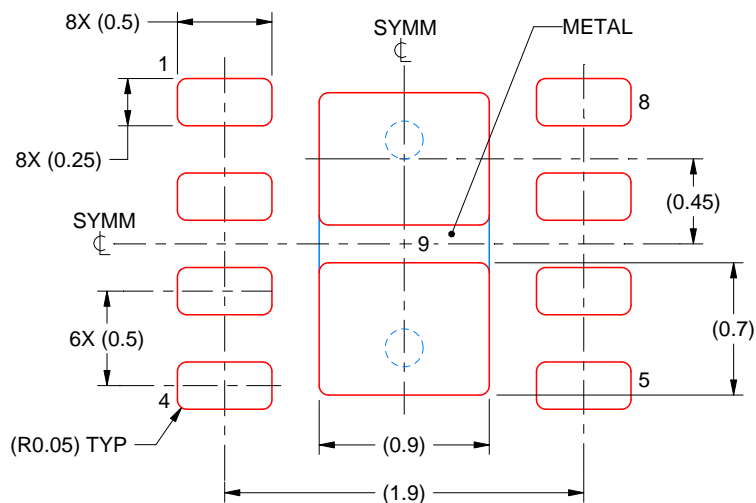


## EXAMPLE STENCIL DESIGN

DSG0008A

WSN - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 9:  
87% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE  
SCALE:25X

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NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

## 重要通知和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做任何明示或暗示的担保，包括但不限于对适销性、与某特定用途的适用性或不侵犯任何第三方知识产权的暗示担保。

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