WIDEBAND

Low Noise Bypass Amplifier TSS-53LNB+

50Ω 0.5 to 5 GHz

THE BIG DEAL

- Wideband: 0.5 to 5 GHz
- Built-In Bypass Switching
- Low Noise Figure, 1.4 dB Typ. at 2.0 GHz
- High Gain, 21.7 dB Typ. at 2 GHz
- Ultra Flat Gain, 0.7 dB From 0.7 to 2.1 GHz
- P1dB, +21 dBm Typ. at 1.0 GHz
- Minimal Matching Components



Generic photo used for illustration purposes only

CASE STYLE: DQ1225

+RoHS Compliant
The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

APPLICATIONS

- Wireless Base Station Systems
- Test and Measurement Systems
- Multi-Band Receivers

PRODUCT OVERVIEW

TSS-53LNB+ (RoHS compliant) is an advanced ultra-flat gain Low Noise wideband amplifier fabricated using E-pHEMT technology offering extremely high dynamic range over a broad frequency range. It has integrated switches enabling users to bypass the amplifier during high signal conditions. In addition, the TSS-53LNB+ has good input and output return loss over a broad frequency range without the need for external matching components. It is enclosed in a 12-lead 3x3 mm MCLP package for good thermal performance.

KEY FEATURES

Feature	Advantages
Ultra-Wideband, 500 MHz to 5 GHz	Ideal for a wide range of receiver applications including military, commercial wireless, and instrumentation.
Very Flat Gain	Ideal for broadband or multi-band applications. Just one, cost-efficient model required for broadband frequency usage.
Minimal External Matching Components Required; 15 dB Return Loss Typ.	Minimizes the need for external matching networks, simplifying circuit designs, and enabling the amplifier to operate over multiple bands in a single application circuit.
High IP3, +48.4 dBm Typ. at 1 GHz (Bypass Mode)	Provides enhanced linearity over broad frequency range under high signal conditions.
Internal Bypass Switch Feature	Unique design handles low to high signal levels with minimal noise distortion.
Built-In DC Blocking Cap at RF-Out Port & Separate Pads for RF-Out & V_{DD}	Simplifies biasing by eliminating the need for a Bias-Tee at output.
Compact Size, 3x3x0.9 mm	Saves space in dense system layouts. Low inductance, repeatable transitions, and excellent thermal contact.

REV. C
ECO-026573
TSS-53LNB+
MCL NY
250814

ELECTRICAL SPECIFICATIONS[1] AT +25°C, Zo = 50Ω AND V_{DD} = +5 V, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Amplifier-ON			Amplifier-Bypass	Units
		Min.	Typ.	Max.	Typ.	
Frequency Range		0.5		5.0		GHz
Noise Figure	0.5		1.3		0.7	dB
	1.0		1.2		0.9	
	2.0		1.4		0.9	
	3.0		1.4		1.0	
	4.0		1.6		1.4	
	5.0		1.7		1.1	
Gain	0.5	19.5	22.8	23.9	-0.7	dB
	1.0		22.7		-0.7	
	2.0		21.7		-0.9	
	3.0		20.5		-1.0	
	4.0		19.5		-0.9	
	5.0		18.7		-1.0	
Gain Flatness	0.7-2.1		±0.7		±0.14	dB
Input Return Loss	0.5	10.5	16.0		25.8	dB
	1.0		15.1		18.5	
	2.0		14.5		12.3	
	3.0		13.1		11.1	
	4.0		14.5		14.5	
	5.0		16.9		16.9	
Output Return Loss	0.5		11.8		22.8	dB
	1.0		12.5		17.1	
	2.0		17.0		12.6	
	3.0		14.1		11.7	
	4.0		10.7		14.0	
	5.0		10.0		11.9	
Output Power @ 1 dB Compression AMP-ON[2] Input Power @ 1 dB Compression AMP-Bypass[2]	0.5		+21.1			dBm
	1.0		+21.0			
	2.0		+20.6			
	3.0		+20.1			
	4.0		+20.2			
	5.0		+19.2			
Output IP3 (P_{OUT} = 0 dBm/Tone)	0.5		+35.1			dBm
	1.0		+34.5			
	2.0		+33.9			
	3.0		+32.7			
	4.0		+33.4			
	5.0		+30.9			
Device Operating Voltage (V_{DD})		+4.8	+5.0	+5.2	+4.8 V to +5 V (+5 V)	V
Device Operating Current (I_D)			82	105	2	mA
Enable Voltage (V_E)			+5.0		0	V
Enable Control Current (I_E)			2.0		0	mA
DC Current (I_D) Variation vs. Temperature[3]			-19			µA/°C
DC Current (I_D) Variation vs. Voltage			0.008			mA/mV
Thermal Resistance, Junction-to-Ground Lead			60			°C/W

1. Measured on Mini-Circuits Characterization test board TB-779+. See Characterization Test Circuit (Fig. 1).
2. Current increases at P1dB.
3. (Current at +85°C - Current at -45°C)/130

ABSOLUTE MAXIMUM RATINGS[4]

Parameter		Ratings
Operating Temperature (Ground Lead)		-45°C to +85°C
Storage Temperature		-65°C to +150°C
Total Power Dissipation		0.7 W
Input Power	Amplifier-ON	+8 dBm (continuous), +19 dBm (5 min max.)
	Amplifier Bypass	+16 dBm (continuous), +29 dBm (5 min max.)
DC Voltage V_{DD}[5]		+7.0 V
DC Voltage Enable[6]		+7.0 V
Max. Voltage on Pad 8		+15 V

4. Permanent damage may occur if any of these limits are exceeded.
Electrical maximum ratings are not intended for continuous normal operation.
5. Measured by keeping V_E = +5 V.
6. Measured by keeping V_{DD} = +5 V.

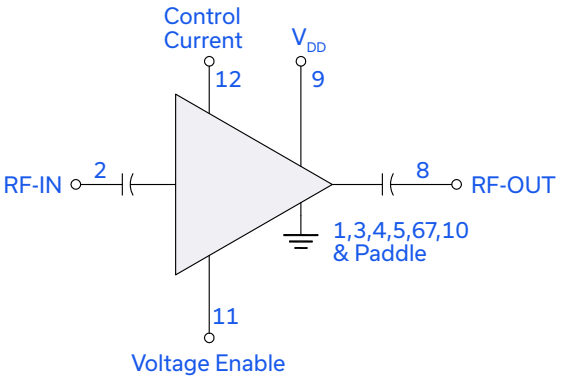
ENABLE VOLTAGE (V_E) FIG. 1

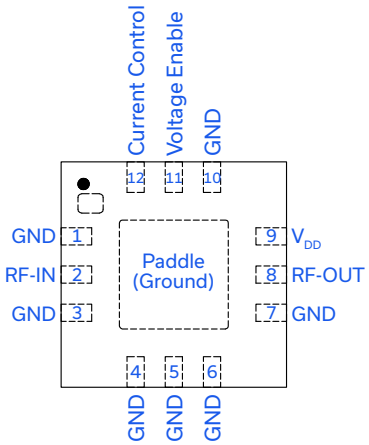
	Min.	Typ.	Max.	Units
Amplifier-ON	+4.5	+5.0	+5.5	V
Amplifier-Bypass	0		+0.5	V

SWITCHING SPECIFICATIONS (RISE/FALL TIME)

Parameter		Min.	Typ.	Max.	Units
Amplifier ON to Bypass	OFF TIME (50% Control to 10% RF)		50		ns
	FALL TIME (90 to 10% RF)		12		
Amplifier Bypass to ON	ON TIME (50% Control to 90% RF)		740		ns
	RISE TIME (10% to 90% RF)		240		
Control Voltage Leakage			65		mV

SIMPLIFIED SCHEMATIC AND BONDING PAD DESCRIPTION





Function	Pad Number	Description (See Figure 2)
RF-IN	2	RF-Input pad. Connect to Ground Via L1. Add a DC blocking cap in series of appropriate value if required.
RF-OUT	8	RF-Output pad. No external DC blocking cap required.
Current Control	12	Control Current pad, voltage level on this pad sets the I_{DD}. Connect to pad 11 via 3.92 kΩ resistor.
Voltage Enable	11	Voltage Enable pad. Voltage level on this pad determines if Amplifier is ON or bypassed.
V_{DD}	9	Supply Voltage pad. Connect to V_{DD} via L2.
Ground	1,3,4,5,6,7,10 Paddle	Connect to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.

CHARACTERIZATION TEST CIRCUIT

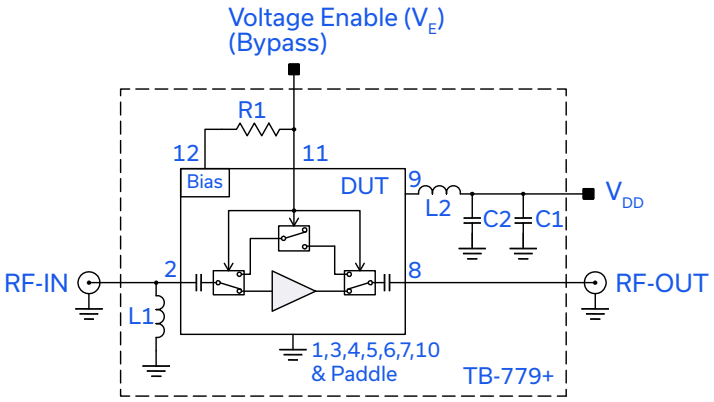


Fig 1. Block diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-780+) Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:
1. Gain and Return Loss: P_{IN} = -25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.
3. Switching Time: P_{IN} = -25 dBm at 500 MHz. Venable = +4.5, +5.0, +5.5 V at 10 kHz.
   V_D = +4.75, +5.0 and +5.5 V.

Component	Size	Value	Units
L1	0402	47	nH
L2	0402	56	nH
C1	0402	0.1	µF
C2	0402	10	pF
R1	0402	3.92	KΩ

RECOMMENDED APPLICATION CIRCUIT

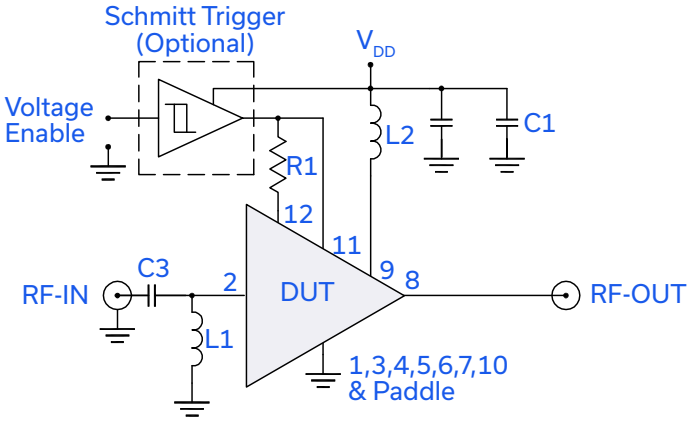


Fig 2. Recommended Application Circuit.

Component	Size	Value	Units
L1	0402	47	nH
L2	0402	56	nH
R1	0402	3.92	kΩ
C1	0402	0.1	µF
C2	0402	10	pF
C3	0402	1000	pF
Schmitt Trigger	SN74LVC2G17DCKR Texas Instruments		

PRODUCT MARKING



Marking may contain other features or characters for internal lot control.

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. CLICK HERE

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DQ1225 Plastic package, exposed paddle, Terminal Finish: Matte Tin
Tape & Reel **Standard Quantities Available on Reel**	F66 7" Reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-421
Evaluation Board	TB-779+
Environmental Ratings	ENV12

ESD RATING

Human Body Model (HBM): Class 1A (250 V to <500 V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (pass 50 V) in accordance with ANSI/ESD STM5.2-1999

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

NOTES

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/terms/viewterm.html