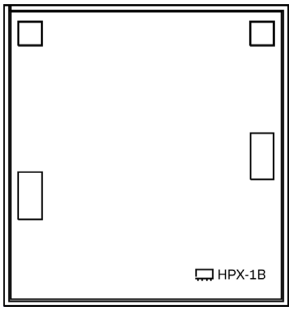
LOW CURRENT, LOW NOISE

Monolithic Amplifier Die TSY-173LN-D+

50Ω 13.5 to 17 GHz



THE BIG DEAL

- Positive Gain Slope
- Shutdown Feature
- Excellent Noise Figure, 1.2dB Typ.
- Built-In ESD Protection Circuits (Class 1C)
- Low Current Operation, 13.2mA

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

SEE ORDERING INFORMATION ON THE LAST PAGE

APPLICATIONS

- Point to Point ODU System
- Fixed Satellite
- Radio Location
- Mobile

PRODUCT OVERVIEW

The TSY-173LN-D+ is a GaAs E-PHEMT based low noise MMIC Amplifier Die with shutdown feature that comes with a unique combination of low noise (1.2dB Typ.) and Low Current (13.2mA Typ.) It is suitable for receiver application. This design operates on a single supply of 3V and is well-matched to 50Ω.

KEY FEATURES

Feature	Advantages
Low Noise, 1.2dB Typical from 13.5-17GHz	It is a good candidate to be used as the first stage amplifier of the receiver. It provides signal amplification and contributes to the low noise figure of the overall receiver system.
Positive Gain Slope Vs. Frequency • +0.6dB/GHz from 13.5 GHz to 15 GHz • +0.4dB/GHz from 15 GHz to 17 GHz	Useful for compensating for the negative gain slope nature of most wideband microwave components and reducing the need for equalization.
Shutdown Feature	Allow users to turn on and off the amplifier with pulsed signals while keeping the power supply at constant voltage.
Integrated DC Blocks and Bias-Tee	DC Blocks and Bias-Tee have already embedded into the die design. It waives extra effort from the customers to do the external Component design.
Unpackaged Die	Enables user to integrate it directly into hybrids

REV. OR
ECO-011904
TSY-173LN-D+
MCLNY
220214

Monolithic Amplifier Die TSY-173LN-D+

ELECTRICAL SPECIFICATIONS[1] AT 25°C, 50Ω, UNLESS NOTED OTHERWISE

Parameter	Condition(GHz)	Amplifier - ON			Amplifier- OFF	Units
		Min	Typ	Max	Typ	
Frequency Range		13.5		17	13.5-17	GHz
Noise Figure	13.5		1.2		---	dB
	14		1.2		---	
	15		1.1		---	
	16		1.2		---	
	17		1.2		---	
Gain	13.5		15.6		-14.8	dB
	14		16		-14.7	
	15		16.5		-15.1	
	16		16.8		-15.6	
	17		16.7		-16.7	
Input Return Loss	13.5		16.4		2.6	dB
	14		18.9		2.7	
	15		18.8		3.1	
	16		15.4		3.3	
	17		16.6		3.2	
Output Return Loss	13.5		11.7		8.8	dB
	14		14.9		8.0	
	15		21.4		6.0	
	16		20.3		5.9	
	17		16		5.2	
P1dB (AMP-ON)	13.5		9.3		---	dBm
	14		9.4		---	
	15		8.7		---	
	16		8.4		---	
	17		6.6		---	
Output IP3 (Pout = -10dBm/Tone)	13.5		22.4		---	dBm
	14		22.9		---	
	15		24.2		---	
	16		21.9		---	
	17		21		---	
Device Operating Voltage (VDD)		2.75	3	3.25	3	V
Device Operating Current(IDD)			13.2	19	0.00012	mA
Control Voltage (VC)		2.25	2.5	2.75	0	V
Control Current(IC)			0.56		0	mA
DC Current (IDD) Variation Vs. Temperature[2]			11.54		---	uA/°C
DC Current (IDD) Variation Vs. Voltage[3]			0.014		---	mA/mV
Thermal Resistance			106.7		---	°C/W

1. Measured on Mini-Circuits Characterization Test Board. Die is packaged in 2x2 mm 6L MCLP and soldered on TB-TSY-173LN+ (See Figure 1)
2. Current Variation vs. Temperature = (Current at 85°C - Current at -45 °C) / 130 °C
3. Current Variation vs. Voltage = (Current(mA) at 3.25V – Current (mA) at 2.75V)/((3.25V-2.75V)*1000mA/mV)

Monolithic Amplifier Die TSY-173LN-D+

MAXIMUM RATINGS[4]

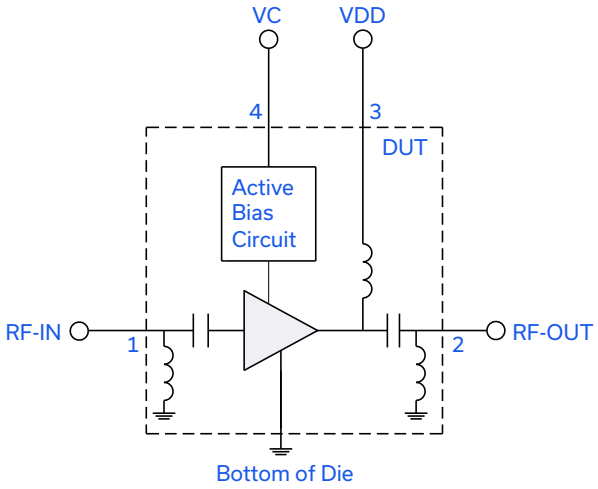
Parameter	Ratings
Operating temperature (ground lead)	-40°C to 85°C
Storage temperature	-65°C to 150°C
Junction Temperature	130°C
Total power dissipation	0.42W
Input power (CW)	+22 dBm
DC voltage at VC	3V
DC voltage at VDD	8V

4. Permanent damage may occur if any of those limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.

TRUTH TABLE + SWITCHING TIME SPECIFICATION

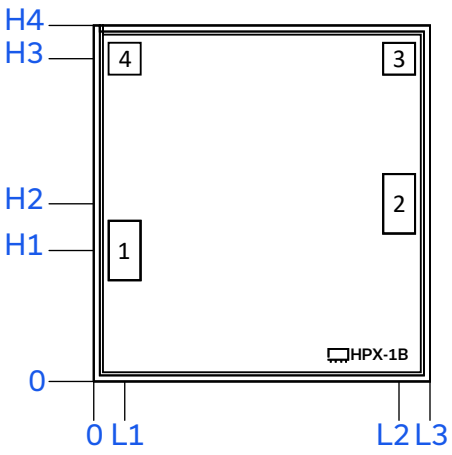
Truth Table		VC Min.	VC Typ.	VC Max.	Units
Amplifier- ON		2.25	2.5	2.75	V
Amplifier -OFF			0	0.2	V
Switching Time Parameter		**Min.**	**Typ.**	**Max.**	**Units**
Amplifier ON to OFF	OFF Time (50% Control to 10% RF)		13.7		ns
	FALL Time (90% RF to 10% RF)		8.8		ns
Amplifier OFF to ON	ON Time (50% Control to 90% RF)		52.4		ns
	RISE Time (10% RF to 90% RF)		38.8		ns
Control Voltage Leakage (Rising Edge)			0.64		mV
Control Voltage Leakage (Falling Edge)			1.45		mV

SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Pad Number	Description
1	RF-IN
2	RF-OUT
3	VDD
4	VC

BONDING PAD POSITION



Dimension in µm

L1	L2	L3	H1	H2	H3	H4
78.0	772	850	331.0	449.0	816	900

Thickness	Die size	Pad size 1 & 2	Pad size 3 & 4
100	850 x 900	69 x 139	69 x 69

CHARACTERIZATION, APPLICATION CIRCUIT

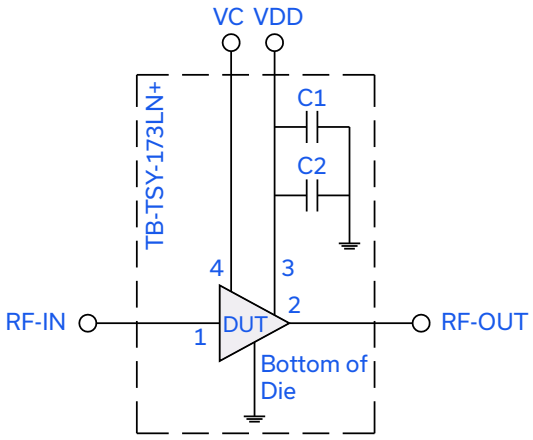
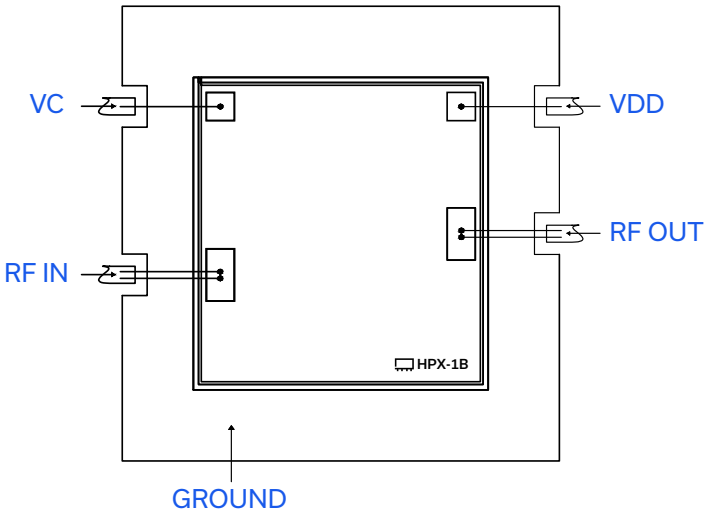


Fig 1. Application and Characterization Circuit
Note: This block diagram is used for application and characterization. (The die is packaged in 2x2mm 6L MCLP and soldered on TB-TSY-173LN+)
Gain, Return Loss, Output Power at 1dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:
1. Gain and Return Loss: Pin = -25dBm
2. Output IP3 (OIP3): Two Tones, spaced 1MHz apart, -10dBm/Tone at Output.
3. Switching Time: RF Signal: Pin = -10dBm, fRF =15GHz , VDD = 3V, VC = Pulse Signal at 100Hz with VHIGH = 2.5V and VLOW= 0V & 50% Duty Cycle.

Component	Size	Value	Part Number	Manufacturer
C1	0402	0.1uF	GRM155R71C104KA88D	Murata
C2	0402	100pF	GRM1555C1H101JA01D	Murata

ASSEMBLY DRAWING



ASSEMBLY PROCEDURE

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC PHEMT amplifier dice are susceptible to electrostatic and mechanical damage. Dice are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation.
3. Die Handling and Attachment
   Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition.
5. Wire Bonding
   Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

Monolithic Amplifier Die TSY-173LN-D+

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set with and without port extension(.zip file)
Case Style	Die
Die Ordering and packaging information	Quantity, Package — Model No. Small, Gel - Pak: 5,10,50,100 KGD* — TSY-173LN-DG+ Medium†, Partial wafer: KGD*<1722 — TSY-173LN-DP+ Full Wafer — TSY-173LN-DF+ †Available upon request contact sales representative Refer to AN-60-067
Die Marking	HPX-1B
Environmental Ratings	ENV80

*Known Good Die ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, it does provide a higher degree of confidence that die are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

ESD RATING**

Human Body Model (HBM): Class 1C (1000V) in accordance with ANSI/ESD STM 5.1-2001
**ESD was measured in a 2x2 mm 6L MCLP

NOTES

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