

BIPOLAR ANALOG INTEGRATED CIRCUIT UPC3227TB

5 V, SILICON GERMANIUM MMIC WIDEBAND AMPLIFIER

DESCRIPTION

The μ PC3227TB is a silicon germanium (SiGe) monolithic integrated circuit designed as IF amplifier for DBS tuners. This IC is manufactured using our 50 GHz f_{max} UHS2 (<u>U</u>Itra <u>High Speed</u> Process) SiGe bipolar process.

FEATURES

٠	Low current	: Icc = 4.8 mA TYP. @ Vcc = 5.0 V	
٠	Output power	: Po (sat) = -1.0 dBm TYP. @ f = 1.0 GH	z
		: Po $(sat) = -3.5 \text{ dBm TYP}$. @ f = 2.2 GH	z
٠	High linearity	: Po (1dB) = -6.5 dBm TYP. @ f = 1.0 GF	lz
		: Po (1dB) = -8.0 dBm TYP. @ f = 2.2 GH	lz
٠	Power gain	: G _P = 22.0 dB TYP. @ f = 1.0 GHz	
		: G _P = 22.0 dB TYP. @ f = 2.2 GHz	
٠	Noise Figure	: NF = 4.7 dB TYP. @ f = 1.0 GHz	
		: NF = 4.6 dB TYP. @ f = 2.2 GHz	
•	Supply voltage	: Vcc = 4.5 to 5.5 V	
•	Port impedance	: input/output 50 Ω	

APPLICATIONS

• IF amplifiers in LNB for DBS converters etc.

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μΡC3227TB-E3	μΡC3227TB-E3-A	6-pin super minimold (Pb-Free) ^{Note}	C3P	Embossed tape 8 mm wide. 1, 2, 3 pins face the perforation side of the tape. Qty 3 kpcs/reel.

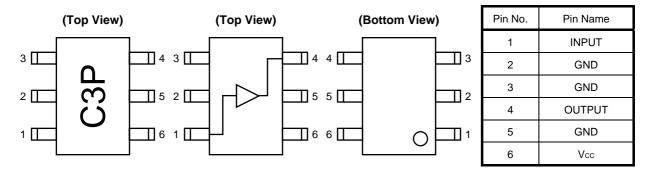
Note With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

RemarkTo order evaluation samples, please contact your nearby sales office.Part number for sample order: μ PC3227TB

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



PRODUCT LINE-UP OF 5 V-BIAS SILICON MMIC WIDEBAND AMPLIFIER (TA = +25°C, f = 1 GHz, Vcc = 5.0 V, Zs = ZL = 50 Ω)

Part No.	fu (GHz)	Po _(sat) (dBm)	G⊦ (dB)	NF (dB)	lcc (mA)	Package	Marking
μPC2711TB	2.9	+1.0	13	5.0	12	6-pin super minimold	C1G
μPC2712TB	2.6	+3.0	20	4.5	12		C1H
μPC3215TB ^{Note}	2.9	+3.5	20.5	2.3	14		СЗН
μPC3224TB	3.2	+4.0	21.5	4.3	9.0		СЗК
μPC3227TB	3.2	-1.0	22	4.7	4.8		C3P

Note μ PC3215TB is f = 1.5 GHz

Remark Typical performance. Please refer to ELECTRICAL CHARACTERISTICS in detail.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	Vcc	T _A = +25°C	6.0	V
Total Circuit Current	Icc	T _A = +25°C	15	mA
Power Dissipation	PD	T _A = +85°C Note	270	mW
Operating Ambient Temperature	TA		-40 to +85	°C
Storage Temperature	Tstg		-55 to +150	°C
Input Power	Pin	T _A = +25°C	+10	dBm

Note $% 10^{-1}$ Mounted on double-sided copper-clad 50 \times 50 \times 1.6 mm epoxy glass PWB $^{-1}$

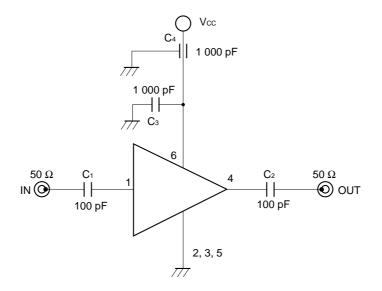
RECOMMENDED OPERATING RANGE

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Supply Voltage	Vcc		4.5	5.0	5.5	V
Operating Ambient Temperature	TA		-40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (T_A = +25 °C, V_{CC} = 5.0 V, Z_S = Z_L = 50 Ω)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	lcc	No input signal	4.0	4.8	6.0	mA
Power Gain 1	G⊦1	$f = 0.1 \text{ GHz}, P_{in} = -40 \text{ dBm}$	20.5	22.5	24.5	dB
Power Gain 2	G₽2	f = 1.0 GHz, P _{in} = -40 dBm	19.5	22.0	24.5	
Power Gain 3	G⊦3	f = 1.8 GHz, P _{in} = -40 dBm	19.0	22.0	25.0	
Power Gain 4	G₽4	f = 2.2 GHz, P _{in} = -40 dBm	19.0	22.0	25.0	
Power Gain 5	G⊳5	f = 2.6 GHz, P _{in} = -40 dBm	19.0	22.0	25.0	
Power Gain 6	G⊧6	f = 3.0 GHz, P _{in} = -40 dBm	18.0	21.0	24.5	
Saturated Output Power 1	Po (sat) 1	f = 1.0 GHz, P _{in} = -12 dBm	-3.5	-1.0	-	dBm
Saturated Output Power 2	Po (sat) 2	f = 2.2 GHz, P _{in} = -12 dBm	-6.0	-3.5	-	
Gain 1 dB Compression Output Power 1	Po (1 dB) 1	f = 1.0 GHz	-9.0	-6.5	-	dBm
Gain 1 dB Compression Output Power 2	Po (1 dB) 2	f = 2.2 GHz	-11.0	-8.0	-	
Noise Figure 1	NF1	f = 1.0 GHz	-	4.7	5.5	dB
Noise Figure 2	NF2	f = 2.2 GHz	-	4.6	5.5	
Isolation 1	ISL1	f = 1.0 GHz, P _{in} = -40 dBm	35	40	-	dB
Isolation 2	ISL2	f = 2.2 GHz, P _{in} = -40 dBm	35	43	-	
Input Return Loss 1	RLin1	f = 1.0 GHz, P _{in} = -40 dBm	7.5	10.5	-	dB
Input Return Loss 2	RLin2	f = 2.2 GHz, P _{in} = -40 dBm	7.5	10.5	-	
Output Return Loss 1	RL _{out} 1	f = 1.0 GHz, P _{in} = -40 dBm	10.0	13.5	-	dB
Output Return Loss 2	RLout2	f = 2.2 GHz, P _{in} = -40 dBm	7.5	9.5	-	
Input 3rd Order Distortion Intercept Point 1	IIP31	f1 = 1 000 MHz, f2 = 1 001 MHz, P _{in} = -40 dBm	-	-18.0	-	dBm
Input 3rd Order Distortion Intercept Point 2	IIP32	f1 = 2 200 MHz, f2 = 2 201 MHz, $P_{in} = -40 \text{ dBm}$	-	-20.5	_	
Output 3rd Order Distortion Intercept Point 1	OIP ₃ 1	f1 = 1 000 MHz, f2 = 1 001 MHz, P _{in} = -40 dBm	-	+4.0	-	dBm
Output 3rd Order Distortion Intercept Point 2	OIP ₃ 2	f1 = 2 200 MHz, f2 = 2 201 MHz, $P_{in} = -40 \text{ dBm}$	-	+1.5	-	
2nd Order Intermodulation Distortion	IM2	f1 = 1 000 MHz, f2 = 1 001 MHz, P _{in} = -40 dBm	_	30.5	-	dBc
K factor 1	K1	f = 1.0 GHz	-	3.8	-	-
K factor 2	K2	f = 2.2 GHz	-	3.9	_	_

TEST CIRCUIT



The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

COMPONENTS OF TEST CIRCUIT FOR MEASURING ELECTRICAL CHARACTERISTICS

	Туре	Value
C1, C2	Chip Capacitor	100 pF
C3	Chip Capacitor	1 000 pF
C4	Feed-through Capacitor	1 000 pF

CAPACITORS FOR Vcc AND INPUT PINS

Bypass capacitor for Vcc pin is intended to minimize Vcc pin's ground impedance. Therefore, stable bias can be supplied against Vcc fluctuation.

Coupling capacitors for input/output pins are intended to minimize RF serial impedance and cut DC.

○ AMP-2 ○ 0 0 \bigcirc 0 \bigcirc 0 Q OUT IN C1 C2 0 \bigcirc C3 \bigcirc \bigcirc

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



	Value
C1, C2	100 pF
C3, C4	1 000 pF

Notes

0

 \bigcirc

0

1. $30 \times 30 \times 0.4$ mm double sided copper clad polyimide board.

O Vcc

0

 \bigcirc

C4

 \bigcirc

0

2. Back side: GND pattern

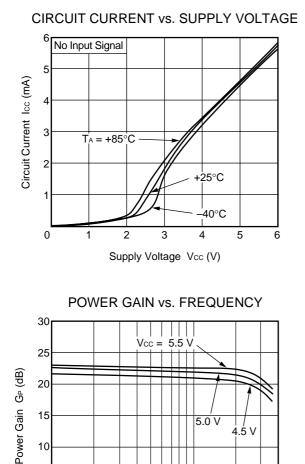
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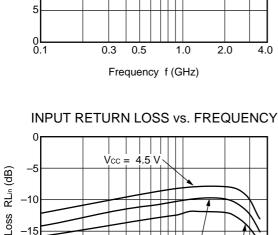
0

 \bigcirc

- 3. Solder plated on pattern
- 4. oO: Through holes

TYPICAL CHARACTERISTICS (TA = +25°C, V_{cc} = 5.0 V, Z_s = Z_L = 50 Ω , unless otherwise specified)



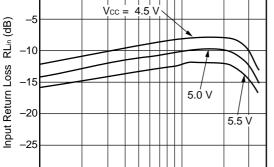


10

_30L 0.1

5.0 V

4.5 V



0.5

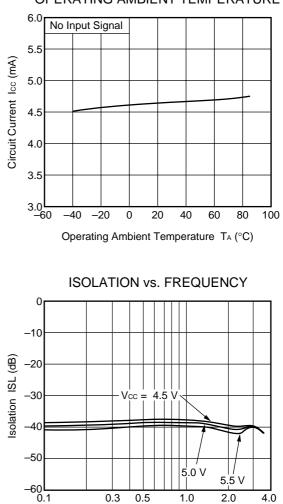
0.3

Frequency f (GHz) Remark The graphs indicate nominal characteristics.

1.0

2.0

4.0



CIRCUIT CURRENT vs. **OPERATING AMBIENT TEMPERATURE**

OUTPUT RETURN LOSS vs. FREQUENCY

Frequency f (GHz)

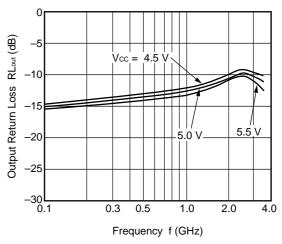
1.0

2.0

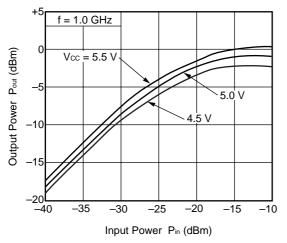
4.0

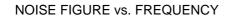
0.3

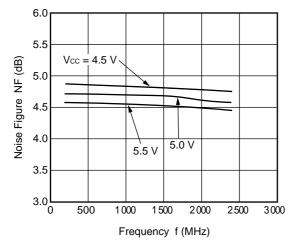
0.5



OUTPUT POWER vs. INPUT POWER

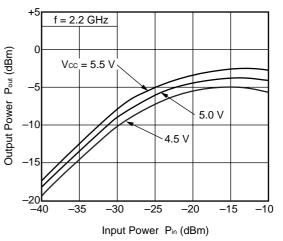




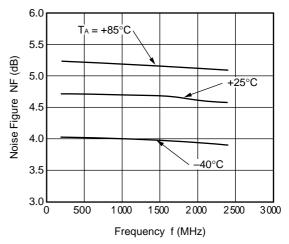


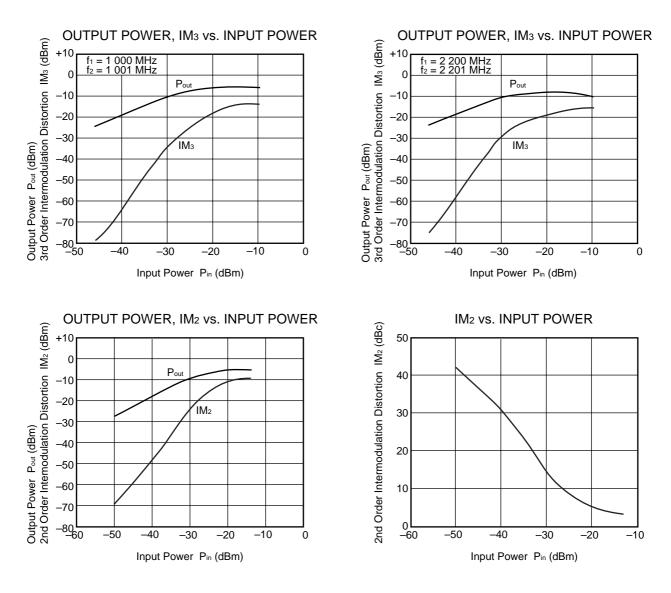
Remark The graphs indicate nominal characteristics.

OUTPUT POWER vs. INPUT POWER



NOISE FIGURE vs. FREQUENCY

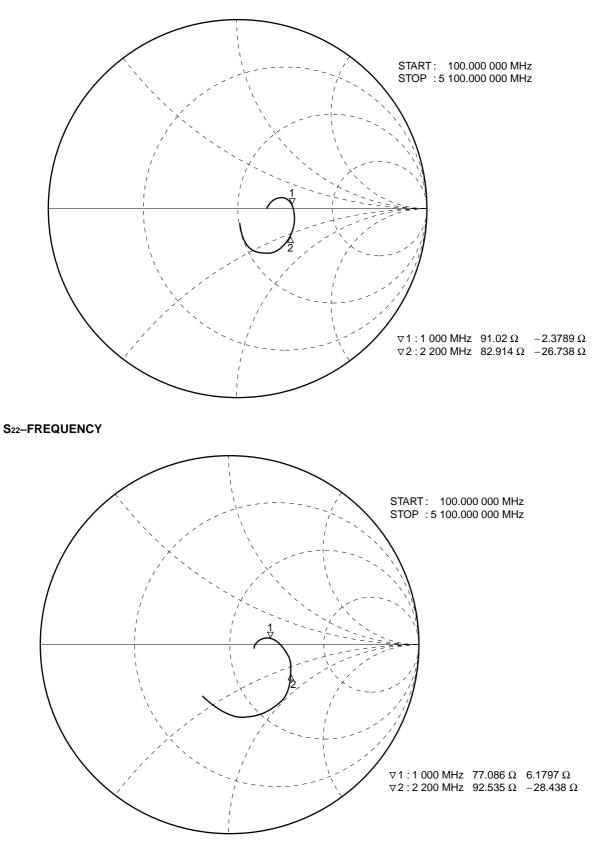




Remark The graphs indicate nominal characteristics.

S-PARAMETERS (TA = +25°C, Vcc = 5.0 V, Pin = -40 dBm)

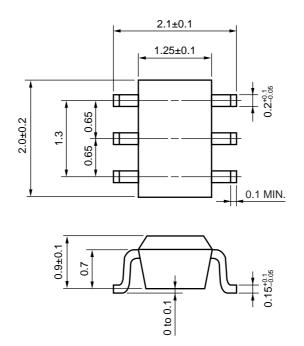
S11-FREQUENCY



Data Sheet PU10557EJ02V0DS

PACKAGE DIMENSIONS

6-PIN SUPER MINIMOLD (UNIT: mm)



NOTES ON CORRECT USE

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).
- All the ground terminals must be connected together with wide ground pattern to decrease impedance difference.
- (3) The bypass capacitor should be attached to the $\ensuremath{\mathsf{Vcc}}$ line.
- (4) The DC cut capacitor must be attached to input and output pin.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions	Condition Symbol	
Infrared Reflow	Peak temperature (package surface temperature) Time at peak temperature Time at temperature of 220°C or higher Preheating time at 120 to 180°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 60 seconds or less : 120±30 seconds : 3 times : 0.2%(Wt.) or below	IR260
Wave Soldering	Peak temperature (molten solder temperature) Time at peak temperature Preheating temperature (package surface temperature) Maximum number of flow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 120°C or below : 1 time : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (terminal temperature) Soldering time (per side of device) Maximum chlorine content of rosin flux (% mass)	: 350°C or below : 3 seconds or less : 0.2%(Wt.) or below	HS350

Caution Do not use different soldering methods together (except for partial heating).



Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices		
Lead (Pb)	< 1000 PPM	-A-AZNot Detected(*)		
Mercury	< 1000 PPM	Not Detected		
Cadmium	< 100 PPM	Not Detected		
Hexavalent Chromium	< 1000 PPM	Not Detected		
РВВ	< 1000 PPM	Not Detected		
PBDE	< 1000 PPM	Not De	etected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

In no event shall CEL's liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

See CEL Terms and Conditions for additional clarification of warranties and liability.

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