CEL

BIPOLAR DIGITAL INTEGRATED CIRCUIT

μPB1513TU

13 GHz INPUT DIVIDE BY 4 PRESCALER IC FOR SATELLITE COMMUNICATIONS

DESCRIPTION

The μPB1513TU is a silicon germanium (SiGe) monolithic integrated circuit designed as a divide by 4 prescaler IC for satellite communications and point-to-point/multi-point radios.

The package is 8-pin lead-less minimold suitable for surface mount.

This IC is manufactured using our 50 GHz f_{max} UHS2 (Ultra High Speed Process) SiGe bipolar process.

FEATURES

- Operating frequency : f_{in} = 5 to 13 GHz
- Low current consumption : I_{CC} = 48 mA @ V_{CC} = 5.0 V
- High-density surface mounting : 8-pin lead-less minimold
- Supply voltage : V_{CC} = 4.5 to 5.5 V
- Division ratio : 4

APPLICATIONS

- Point-to-point/Multi-point radios
- VSAT radios

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPB1513TU-E2	μPB1513TU-E2-A	8-pin lead-less minimold (Pb-Free) Note	1513	• 8 mm wide embossed taping • Pin 5, 6, 7, 8 indicates pull-out direction of tape • Qty 5 kpcs/reel

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

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPB1513TU

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.

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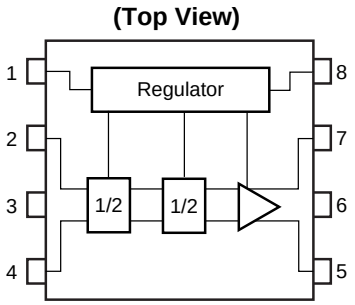
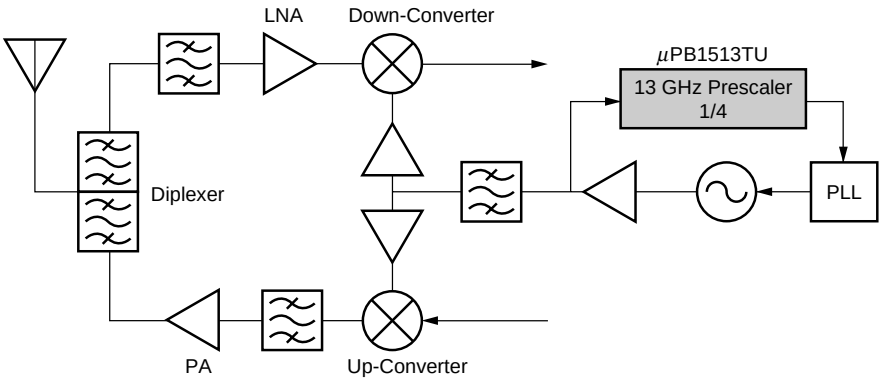
The mark ★ shows major revised points.

INTERNAL BLOCK DIAGRAM AND PIN CONNECTIONS



Pin No.	Pin Name
1	$V_{CC}1$
2	IN
3	GND
4	$\overline{IN}$
5	$\overline{OUT}$
6	GND
7	OUT
8	$V_{CC}2$

SYSTEM APPLICATION EXAMPLE



PIN EXPLANATION

Pin No.	Pin Name	Applied Voltage (V)	Function and Applications
1	$V_{CC}1$	5	Power supply pin. This pin must be equipped with bypass capacitor (example : 100 pF and 10 nF) to minimize ground impedance.
2	IN	–	Signal input pin. This pin should be coupled to signal source with capasitor (example : 100 pF) for DC cut.
3	GND	0	Ground pin. Ground pattern on the board should be formed as widely as possible to minimize ground impedance.
4	$\overline{IN}$	–	Signal input bypass pin. This pin must be equipped with bypass capacitor (example : 100 pF) to minimize ground impedance.
5	$\overline{OUT}$	–	Divided frequency output pin. This pin shoud be coupled to load device with capasitor (example : 100 pF) for DC cut.
6	GND	0	Ground pin. Ground pattern on the board should be formed as widely as possible to minimize ground impedance.
7	OUT	–	Divided frequency output pin. This pin should be coupled to load device with capasitor (example : 100 pF) for DC cut.
8	$V_{CC}2$	5	Power supply pin. This pin must be equipped with bypass capacitor (example : 100 pF and 10 nF) to minimize ground impedance.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	6	V
Total Power Dissipation	P_D	T_A = +85°C **Note**	867	mW
Thermal Resistance (junction to ground paddle)	$R_{th(j-c)}$	T_A = +85°C **Note**	75	°C/W
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C

Note Mounted on 33 × 21 × 0.4 mm polyimide PCB, with copper patterning on both sides.

RECOMMENDED OPERATING RANGE

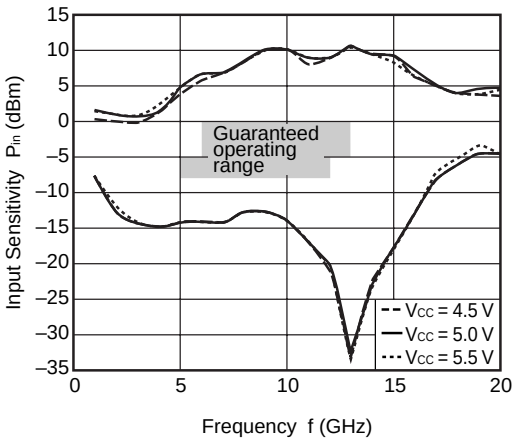
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
Operating Ambient Temperature	T_A	–40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 4.5 to 5.5 V, T_A = –40 to +85°C, Z_S = Z_L = 50 Ω)

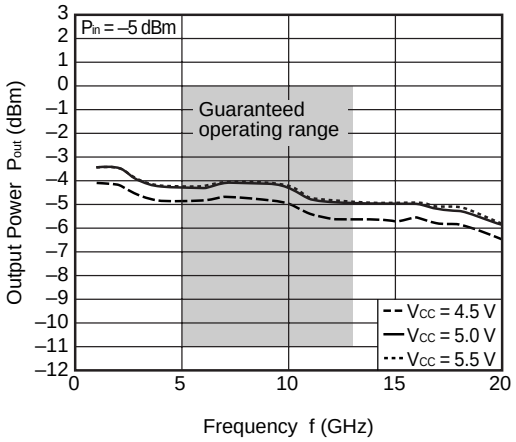
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No Signals	–	48	75	mA
Input Sensitivity	$P_{in}1$	f_{in} = 5 to 6 GHz	–8	–	–5	dBm
	$P_{in}2$	f_{in} = 6 to 12 GHz	–8	–	0	dBm
	$P_{in}3$	f_{in} = 12 to 13 GHz	–5	–	0	dBm
Output Power	P_{out}	f_{in} = 5 to 13 GHz, single ended, P_{in} = –5 dBm	–11	–4	2	dBm

TYPICAL CHARACTERISTICS (T_A = +25°C, unless otherwise specified)

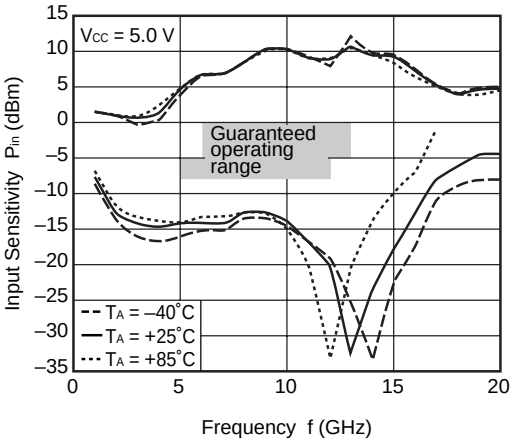
INPUT SENSITIVITY vs. FREQUENCY



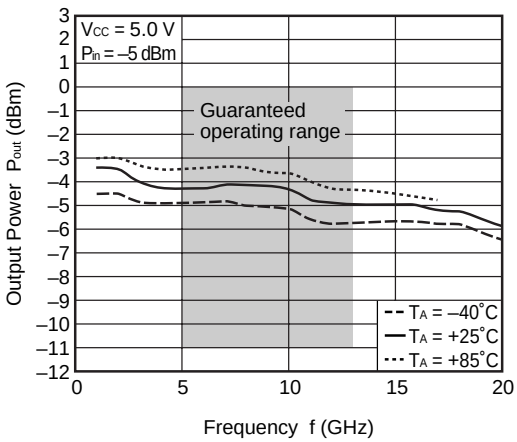
OUTPUT POWER vs. FREQUENCY



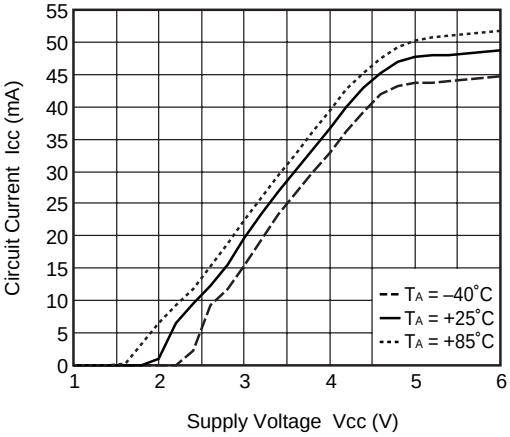
INPUT SENSITIVITY vs. FREQUENCY



OUTPUT POWER vs. FREQUENCY



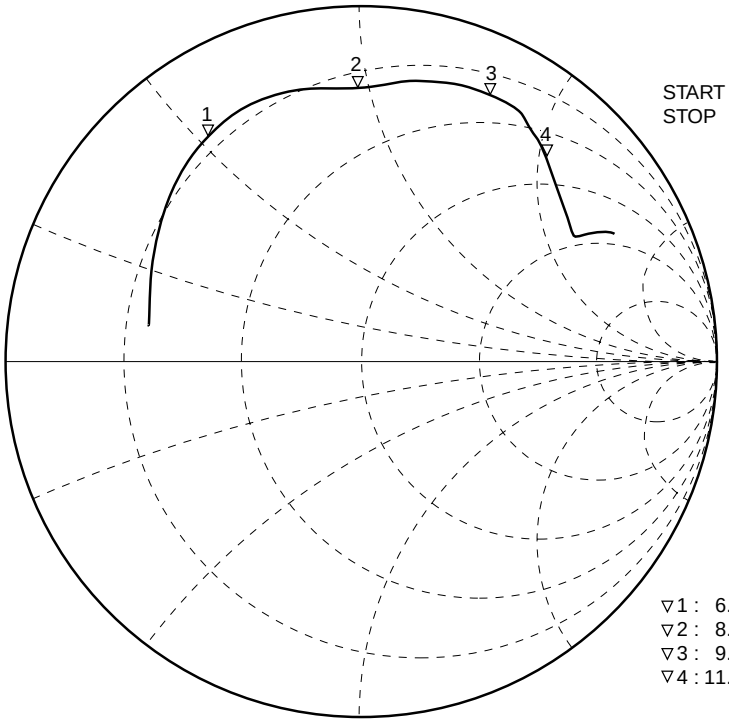
★ CURCUIT CURRENT vs. SUPPLY VOLTAGE



Remark The graphs indicate nominal characteristics.

★ S-PARAMETERS (T_A = +25°C, V_{CC} = 5.0 V)

S_{11}–FREQUENCY

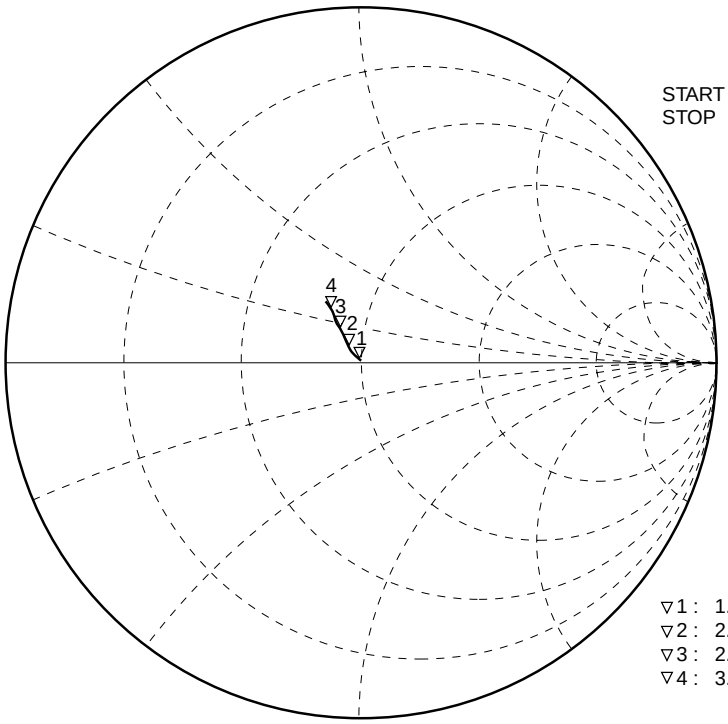


START : 5.0 GHz
STOP : 13.0 GHz

▽1 : 6.5 GHz
▽2 : 8.0 GHz
▽3 : 9.5 GHz
▽4 : 11.0 GHz

FREQUENCY GHz	S_{11} MAG	ANG
5.0	0.603	170.5
6.0	0.705	139.7
7.0	0.782	112.0
8.0	0.766	90.6
9.0	0.820	71.2
10.0	0.832	57.9
11.0	0.768	46.3
12.0	0.698	32.2
13.0	0.798	26.6

S_{22}–FREQUENCY

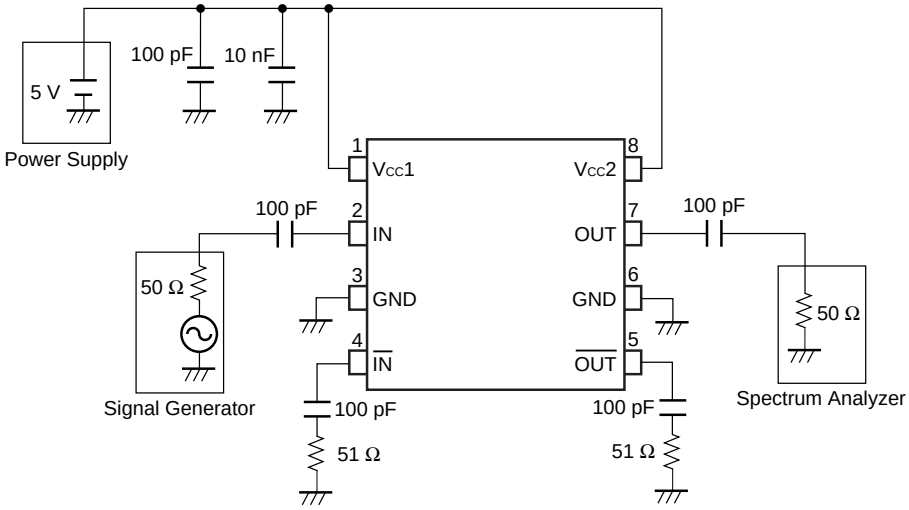


START : 1.25 GHz
STOP : 3.25 GHz

▽1 : 1.5 GHz
▽2 : 2.0 GHz
▽3 : 2.5 GHz
▽4 : 3.0 GHz

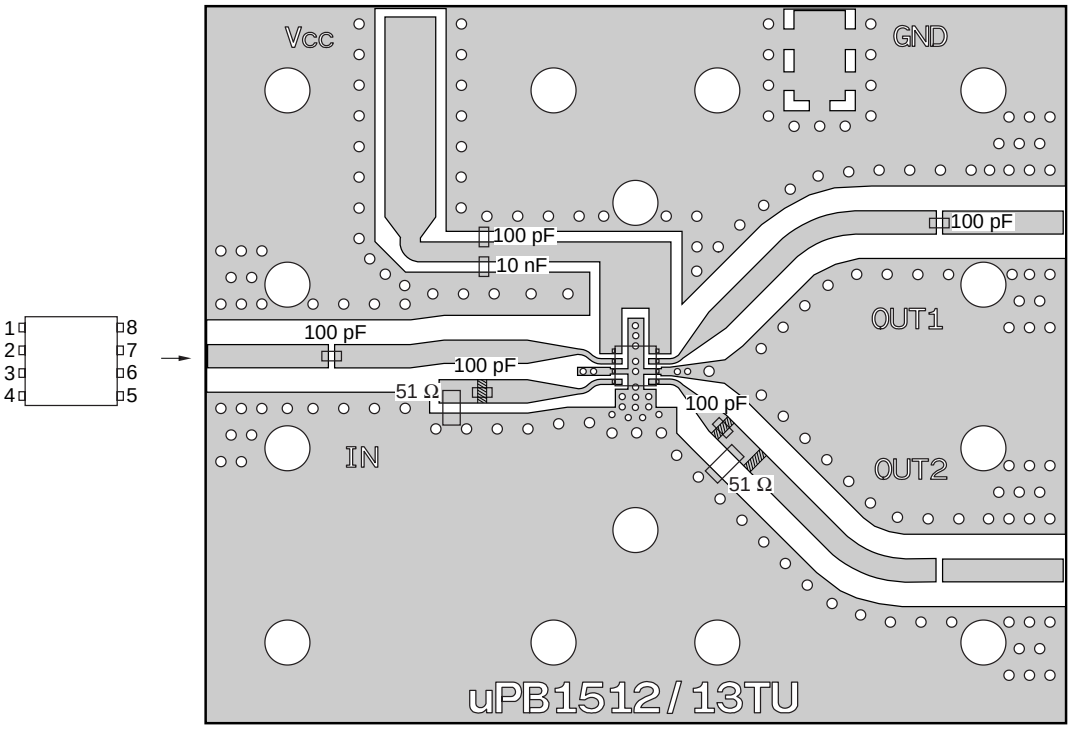
FREQUENCY GHz	S_{22} MAG	ANG
1.25	0.002	90.3
1.4	0.011	133.3
1.6	0.024	132.3
1.8	0.038	130.2
2.0	0.054	127.3
2.2	0.073	126.8
2.4	0.092	124.5
2.6	0.117	122.6
2.8	0.137	121.9
3.0	0.164	120.3
3.2	0.186	120.3
3.25	0.196	121.0

MEASUREMENT CIRCUIT



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

ILLUSTRATION OF THE MEASUREMENT CIRCUIT ASSEMBLED ON EVALUATION BOARD



Remarks 1. 33 × 21 × 0.4 mm double-sided copper-clad polyimide PCB

2. Back side: GND pattern

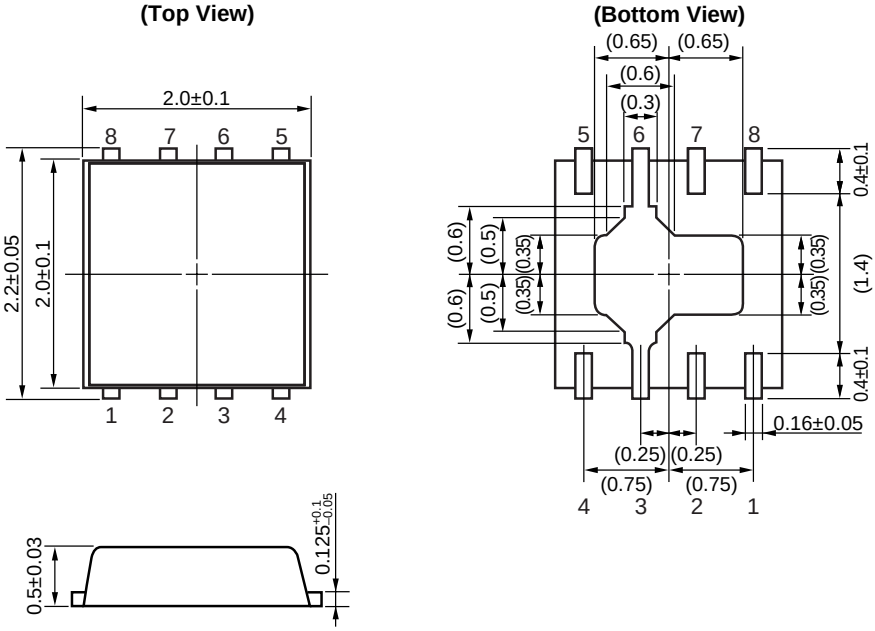
3. Solder plated on pattern

4. ▨ represents cutout

5. ○: Through holes

PACKAGE DIMENSIONS

8-PIN LEAD-LESS 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).
(3) Keep the track length of the ground terminals as short as possible.
(4) Bypass capacitance must be attached to V_{CC} line.
(5) Exposed heatsink at bottom on package must be soldered to PCB RF/DC ground.

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).

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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	-AZ
		Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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