NEC

BIPOLAR DIGITAL INTEGRATED CIRCUITS
μPB1502GR, 1502GR(1)

1.7 GHz/ 2.0 GHz LOW-POWER TWO-MODULUS PRESCALER DIVIDED-BY-64/65, 128/129

FEATURES

- High toggle frequency – 2.0 GHz: μPB1502GR(1), 1.7 GHz: μPB1502GR
- Low power consumption – 6.7 mA TYP. at 3 V
- Operating supply voltage – 2.7 V to 3.3 V
- High input sensitivity – 130 to 220 mV_{P-P}: μPB1502GR(1), 100 to 320 mV_{P-P}: μPB1502GR (@50 Ω)
- Equipped with power-save function: 5 μA (standard) on power-save mode.
- Packaged in 8 pins plastic SOP suitable for surface mounting.

DESCRIPTION

μPB1502GR and μPB1502GR(1) are two-modulus prescaler divided by 64/65 or 128/129. This device is designed for mobile communication applications for example 0.8-1.9 GHz cellular and cordless telephones. The ICs operate on low power and therefore are suitable for hand-held, battery-operated systems.

These products are manufactured using NEC's 20 GHz f_T NESAT™ III silicon bipolar process. This process uses silicon nitride passivation film and gold metallization wirings. These materials can protect the chips from external pollution and prevent corrosion and migration. Thus, these products have excellent performance, uniformity and reliability.

ORDER INFORMATION

ORDER NUMBER	PACKAGE	SUPPLYING FORM	f_{in} MAX.
μPB1502GR–E1	8 pin plastic SOP	Embossed tape 12 mm wide. QTY 2.5 k/reel	1.7 GHz
μPB1502GR(1)–E1	(225 mil)	Pin1 is in tape pull-out direction.	2.0 GHz

Remarks To order evaluation samples, please contact your local NEC sales office. (Order number: μPB1502GR, μPB1502GR(1))

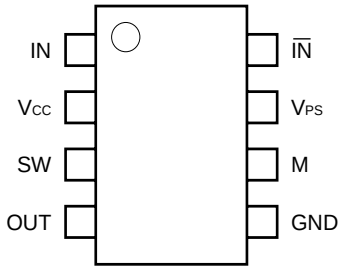
Caution electro-static sensitive devices

Document No. P10871EJ3V0DS00 (3rd edition)
Date Published October 1999 N CP(K)
Printed in Japan

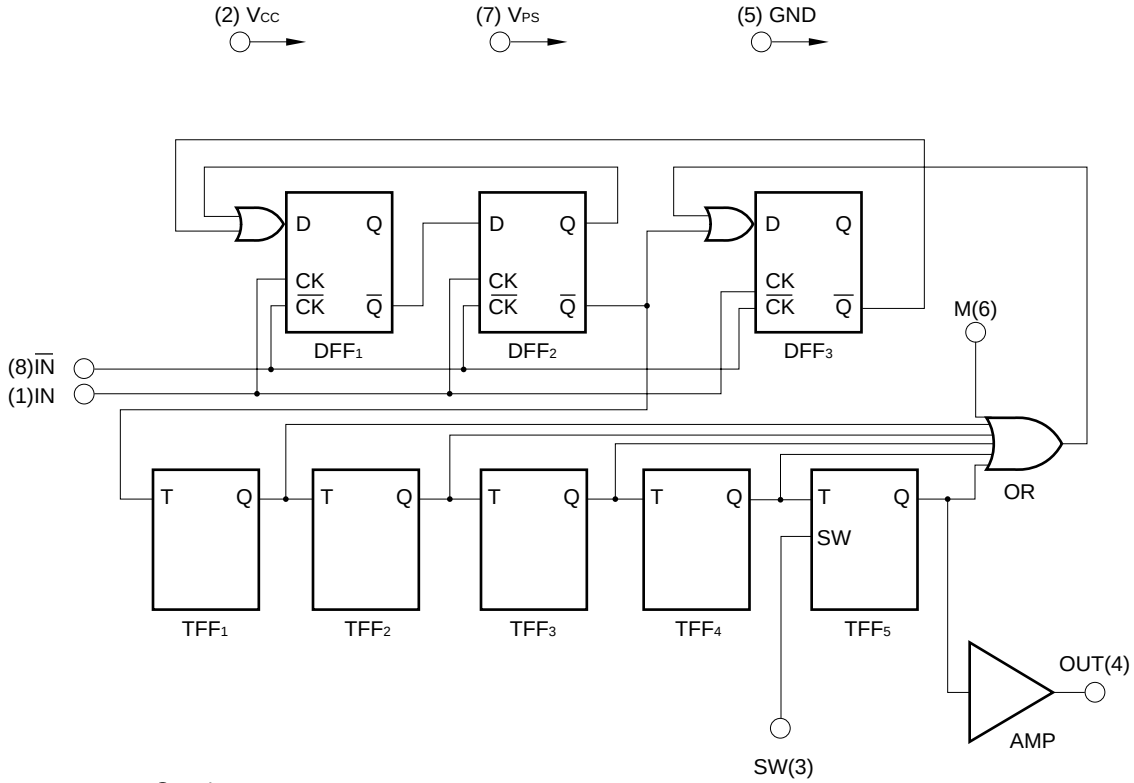
The mark ★ shows major revised points.

PIN ASSIGNMENT

(Top View)



INTERNAL BLOCK DIAGRAM



○ : pin
( ) : pin No.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT	CONDITION
Supply voltage	V_{CC}	–0.5 to +6	V	T_A = +25 °C
Input voltage	V_{IN}	–0.5 to V_{CC} +0.5	V	T_A = +25 °C
Total power dissipation	P_D	250	mW	Mounted on double sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB (T_A = +85 °C)
Operating temperature	T_{opt}	–40 to +85	°C	
Storage temperature	T_{stg}	–65 to +150	°C	

RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage	V_{CC}	2.7	3.0	3.3	V
Operating temperature	T_{opt}	–40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (T_A = –40 to +85 °C, V_{CC} = 2.7 to 3.3 V)

PARAMETER	SYMBOL	μPB1502GR			μPB1502GR(1)			UNIT	CONDITION
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Response frequency	f_{in}	0.5		1.7	0.5		2.0	GHz	P_{in} = –10 dBm
Circuit current	I_{CC}	3.2	6.7	11.0	3.2	6.7	11.0	mA	V_{PS}H level, No input signal
Input power sensitivity 1	P_{in1}	–11	—	0	–11	—	0	dBm	f_{in} = 0.5 to 0.8 GHz
Input power sensitivity 2	P_{in2}	–15	—	0	–15	—	0	dBm	f_{in} = 0.8 to 1.5 GHz
Input power sensitivity 3	P_{in3}	–15	—	–6	–15	—	–1	dBm	f_{in} = 1.5 to 1.7 GHz
Input power sensitivity 4	P_{in4}	—	—	—	–14	—	–9	dBm	f_{in} = 1.7 to 2.0 GHz
Modulus control input high (M)	V_{IH1}	2.5	—	—	2.5	—	—	V	
Modulus control input low (M)	V_{IL1}	—	—	0.8	—	—	0.8	V	
Divide ratio control input high (SW)	V_{IH2}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V	
Divide ratio control input low (SW)	V_{IL2}	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	V	
Output voltage swing	V_{OUT}	0.8	—	—	0.8	—	—	V_{P-P}	C_L = 8 pF
Modulus set up time	t_{set}	—	11	—	—	11	—	ns	f_{in}MAX.
Power-save input high	V_{PS}H	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V	
Power-save input low	V_{in}L	—	—	0.8	—	—	0.8	V	*
Circuit current on power-save mode	I_{PS}	—	5	20	—	5	20	μA	V_{PS}L level *

* Standard reference value on power-save mode.

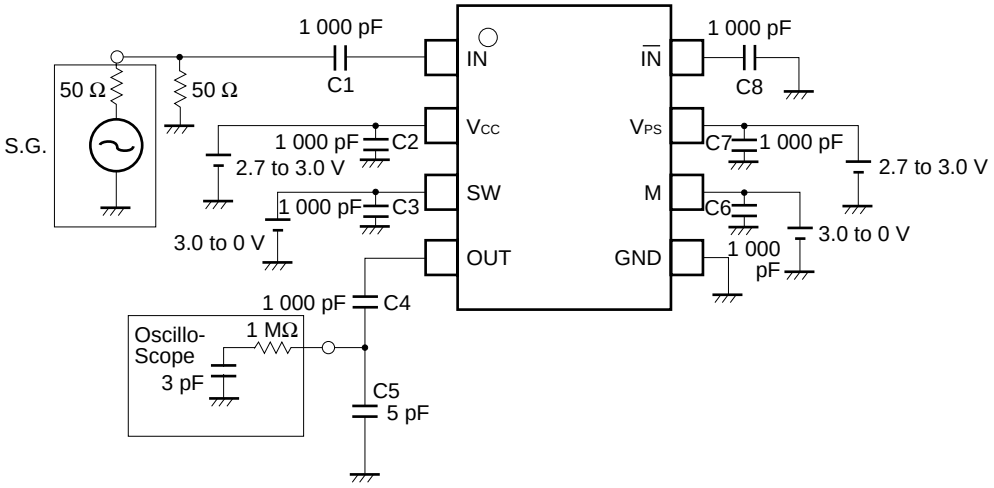
PIN DESCRIPTIONS

Pin No.	Symbol	Assignment	Functions and Explanation
1	IN	Frequency input pin	Input frequency from an external VCO output. Must be coupled with capacitor (e.g. 1 000 pF) for DC cut.
2	V_{CC}	Power supply pin	Supply voltage 3.0 ± 0.3 V for operation. Must be connected bypass capacitor (e.g. 1 000 pF) to minimize ground impedance.
3	SW	Divided ratio control input pin	Divided ratio and modulus control can be governed by following input data to these pins.
6	M	Modulus control input pin	
4	OUT	Divided frequency output pin	This frequency output can be interfaced to CMOS PLL. Must be coupled with capacitor (e.g. 1 000 pF) for DC cut.
5	GND	Ground pin	Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. (Track length should be kept as short as possible).
7	V_{PS}	Power-save function pin	ON/OFF-operation control can be governed by following input data to this pin.
8	$\overline{IN}$	Frequency-input bypass pin	Must be connected bypass capacitor (e.g. 1 000 pF) to minimize ground impedance.

		M	
		H	L
SW	H	1/64	1/65
	L	1/128	1/129

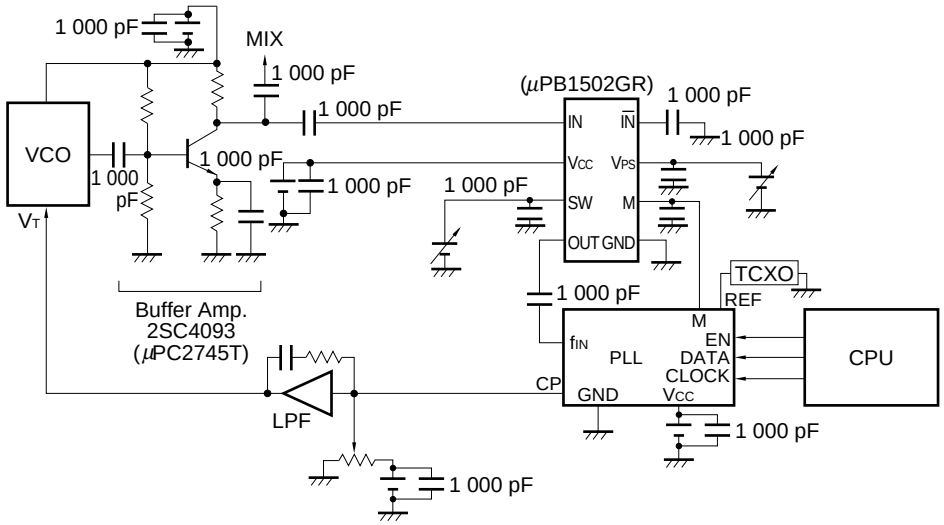
		Operation
V_{PS}	H	ON
	L	OFF

TEST CIRCUIT



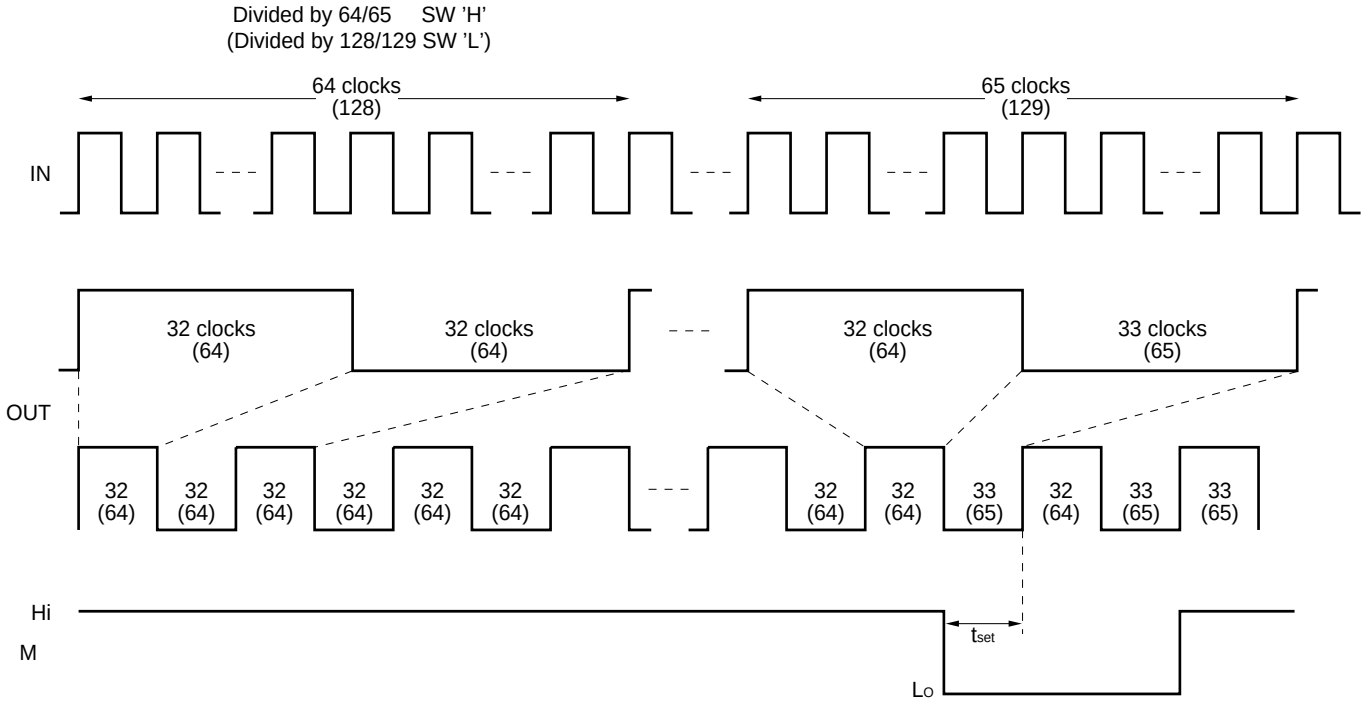
		M	
		H	L
SW	H	1/64	1/65
	L	1/128	1/129

APPLICATION CIRCUIT FOR REFERENCE



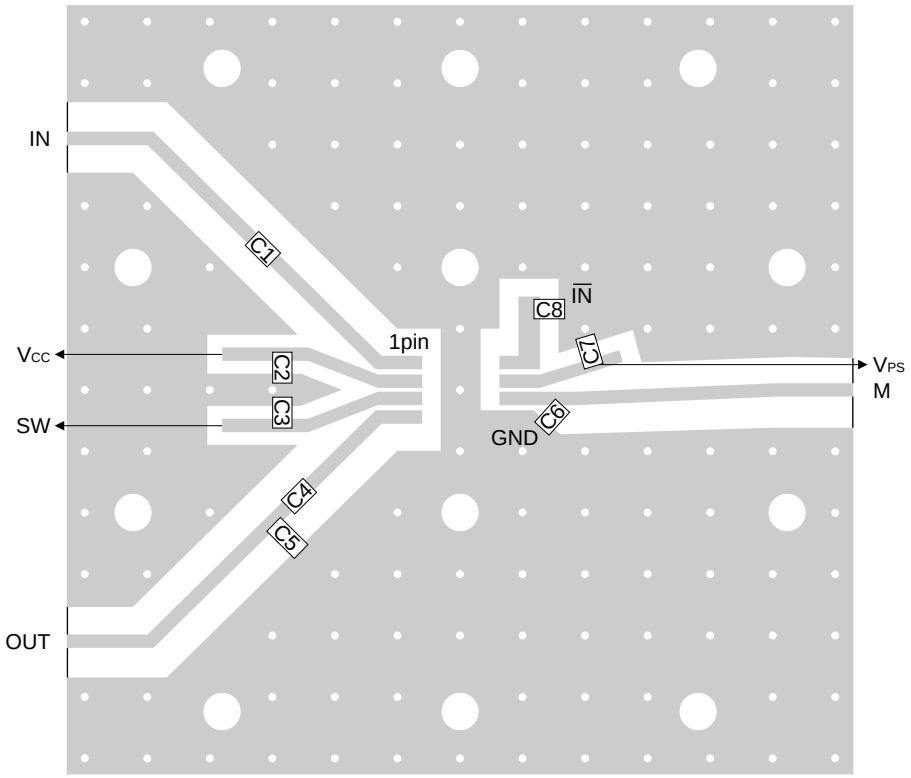
The application circuits and their parameters are for references only and are not intended for use in actual design-in's.
To know the real application circuits, please refer to PLL synthesizer LSI's documentations (e.g.μPD3160GS).

TIMING DIAGRAM



t_{set} = The minimum time required between 'Modulus Control' going low and next output rising edge, in order to ensure a P+1 modulus change.

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



Component List

No.	Value
$C_{1 \text{ to } 4}$	1 000 pF
C_5	8 pF
$C_{6 \text{ to } 8}$	1 000 pF

Note

(1) 50 × 50 × 0.4 mm double copper clad polyimide board.

(2) Back side: GND pattern

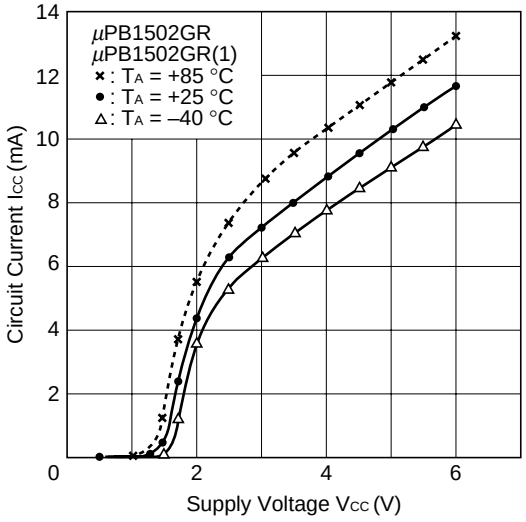
(3) Solder plated on pattern

(4) ∘ ◯: Through holes

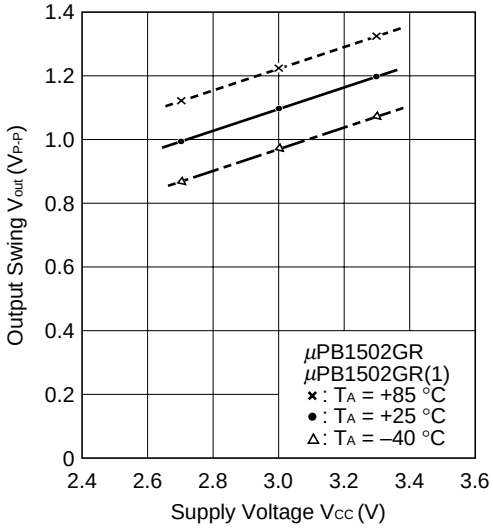
TYPICAL CHARACTERISTICS (T_A = +25 °C)

— μPB1502GR, μPB1502GR(1) in common —

CIRCUIT CURRENT vs. SUPPLY VOLTAGE

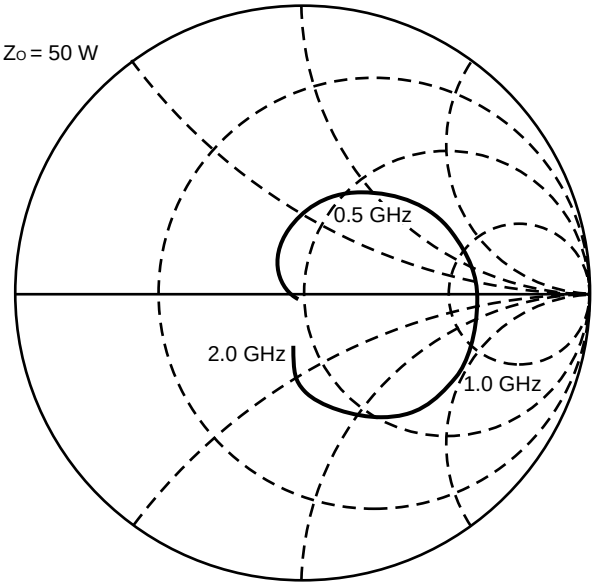


OUTPUT VOLTAGE SWING vs. SUPPLY VOLTAGE



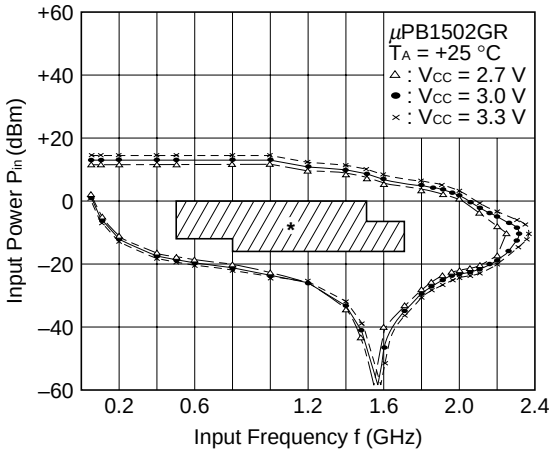
S_{11} vs. f

V_{CC} = 3.0 V, I_{CC} = 6.7 mA, Z_O = 50 Ω



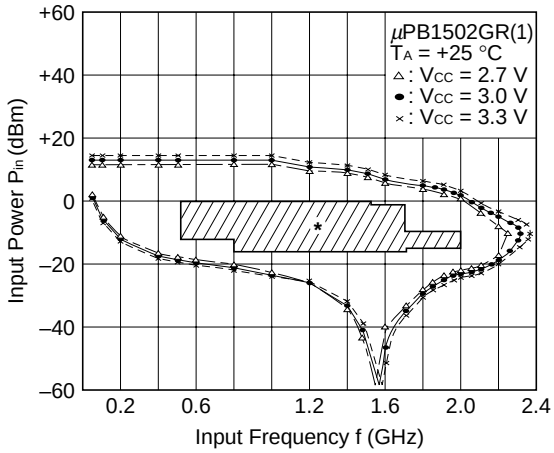
— μPB1502GR — <Left line>

INPUT POWER vs. FREQUENCY

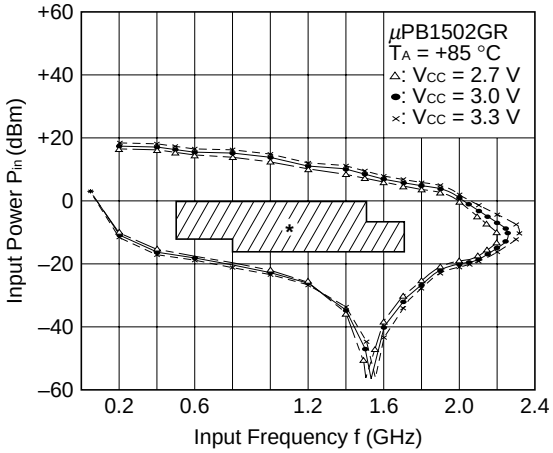


— μPB1502GR(1) — <Right line>

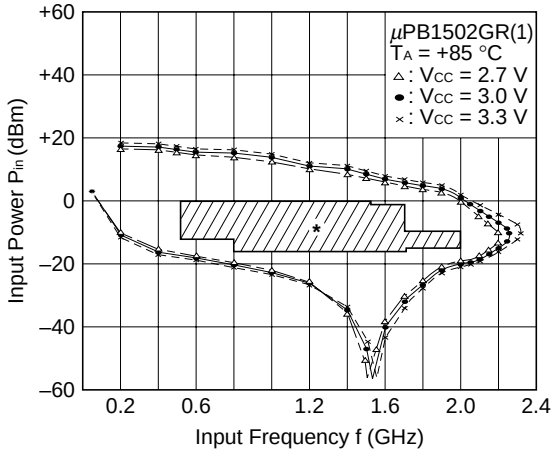
INPUT POWER vs. FREQUENCY



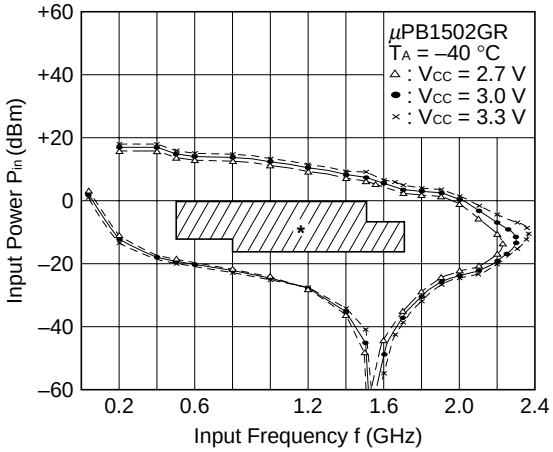
INPUT POWER vs. FREQUENCY



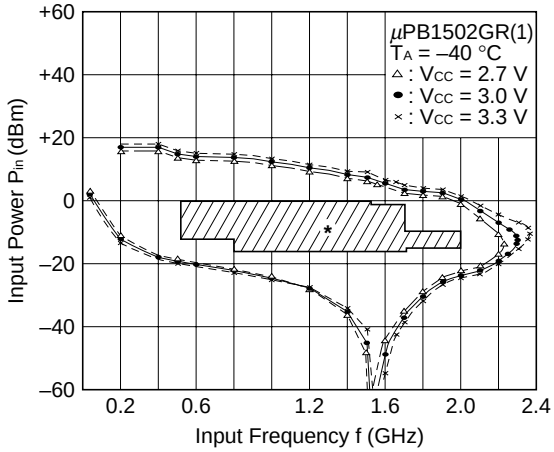
INPUT POWER vs. FREQUENCY



INPUT POWER vs. FREQUENCY



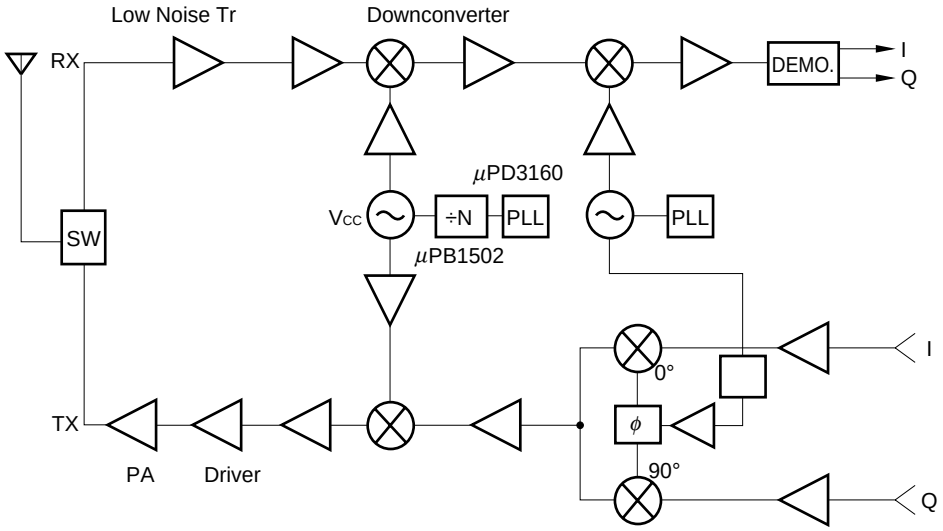
INPUT POWER vs. FREQUENCY



* Guaranteed Operating Window

TYPICAL SYSTEM APPLICATION

Digital Cellular System Block Diagram

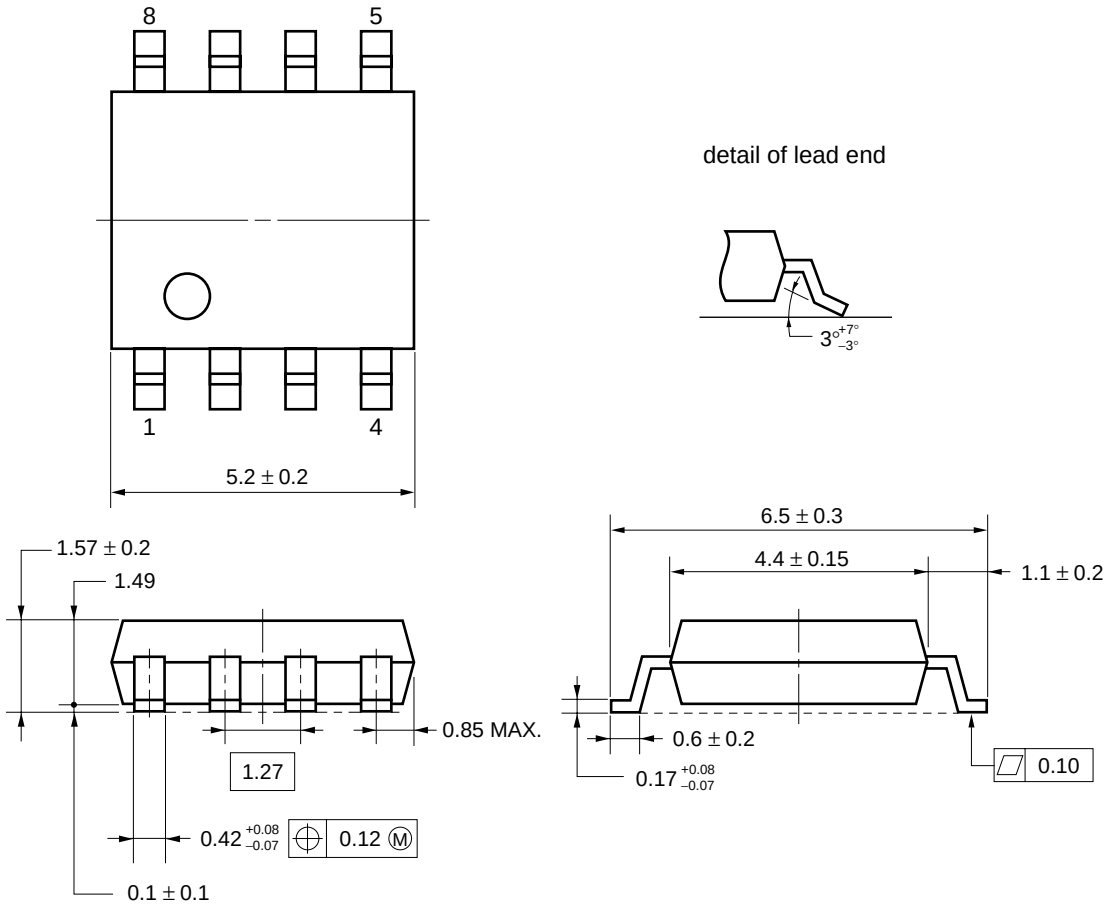


Other applicable systems

1.9 GHz digital cordless telephone, hand-held radio.

PACKAGE DIMENSIONS

★ **8 PIN PLASTIC SOP (225 mil) (UNIT: mm)**



NOTE Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

NOTE ON CORRECT USE

(1) Observe precautions for handling because of electro-static sensitive devices.
(2) Form a ground pattern as wide as possible to minimize ground impedance (to prevent abnormal operation).
(3) Keep the wiring length of the ground pins as short as possible.
(4) Connect a bypass capacitor (e.g. 1 000 pF) to the V_{CC} pin.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered in the following recommended conditions. Other soldering methods and conditions than the recommended conditions are to be consulted with our sales representatives.

μPB1502GR, 1502GR(1)

Soldering method	Soldering conditions	Recommended condition symbol
Infrared ray reflow	Package peak temperature: 235 °C, Hour: within 30 s. (more than 210 °C), Time: 3 times, Limited days: no.*	IR35–00-3
VPS	Package peak temperature: 215 °C, Hour: within 40 s. (more than 200 °C), Time: 3 times, Limited days: no.*	VP15–00-3
Wave soldering	Soldering tub temperature: less than 260 °C, Hour: within 10 s. Time: 1 time, Limited days: no.	WS60–00-1
Pin part heating	Pin area temperature: less than 300 °C, Hour: within 3 s./pin Limited days: no.*	

***:** It is the storage days after opening a dry pack, the storage conditions are 25 °C, less than 65 % RH.

Note 1. The combined use of soldering method is to be avoided (However, except the pin area heating method).

For details of recommended soldering conditions for surface mounting, refer to information document SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).

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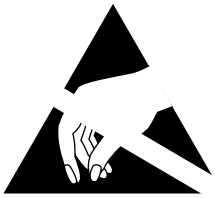

ATTENTION

OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

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