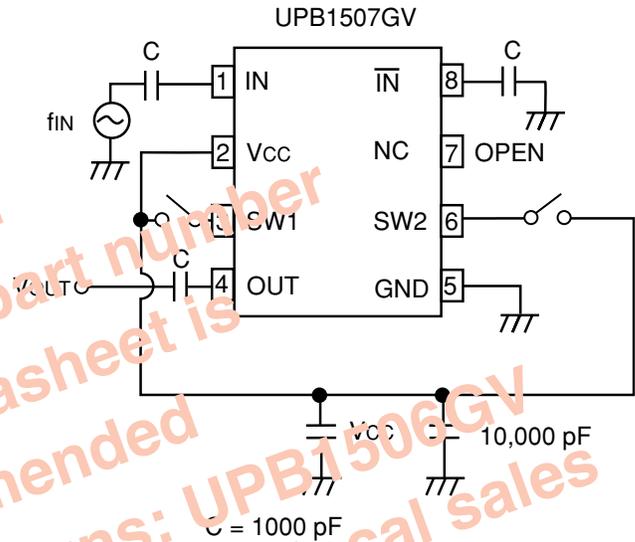


## FEATURES

- HIGH FREQUENCY OPERATION TO 3 GHz
- SELECTABLE DIVIDE RATIO: ÷64, ÷128, ÷256
- LOW CURRENT CONSUMPTION: 19 mA at 5 V
- SMALL PACKAGE: 8 pin SSOP
- AVAILABLE IN TAPE AND REEL

## TEST CIRCUIT



## DESCRIPTION

NEC's UPB1506GV and UPB1507GV are Silicon MMIC digital prescalers manufactured with the NESAT™ IV silicon bipolar process. They feature high frequency response to 3 GHz, selectable divide-by-64, 128, or 256 modes, and operate on a 5 volt supply while drawing only 19 mA. The devices are housed in a small 8 pin SSOP package that contributes to system miniaturization. These devices are designed for use in a PLL synthesizer for DBS and CATV settop and WLAN applications.

PLEASE NOTE:  
The following part number  
recommended is UPB1506GV  
for New Designs:  
Please contact your local sales  
office for details:

## ELECTRICAL CHARACTERISTICS (TA = -40 to +85°C, Vcc = 4.5 to 5.5 V, Zs = 50Ω)

PART NUMBER PACKAGE OUTLINE			UPB1506GV, UPB1507GV S08		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
Icc	Circuit Current	mA	12.5	19	26.5
f <sub>IN(U)</sub>	Upper Limit Operating Frequency, P <sub>IN</sub> = -15 to +6 dBm	GHz		3.0	
f <sub>IN(L)1</sub>	Lower Limit Operating Frequency, P <sub>IN</sub> = -10 to +6 dBm	GHz			0.5
f <sub>IN(L)2</sub>	Lower Limit Operating Frequency, P <sub>IN</sub> = -15 to +6 dBm	GHz			1.0
P <sub>IN1</sub>	Input Power, f <sub>IN</sub> = 1.0 to 3.0 GHz	dBm	-15		+6
P <sub>IN2</sub>	Input Power, f <sub>IN</sub> = 0.5 to 1.0 GHz	dBm	-10		+6
V <sub>OUT</sub>	Output Voltage, C <sub>L</sub> = 0.8 pF	V <sub>P-P</sub>	1.2	1.6	
V <sub>IN(H)</sub>	Division Ratio Control Input High	V		V <sub>cc</sub>	
V <sub>IN(L)</sub>	Division Ratio Control Input Low	V		OPEN or GND	

# UPB1506GV, UPB1507GV

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup> (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage	V	-0.5 to 6.0
V <sub>IN</sub>	Input Voltage	V	-0.5 to V <sub>CC</sub> + 0.5
P <sub>IN</sub>	Input Power	dBm	+10
P <sub>D</sub>	Power Dissipation <sup>2</sup>	mW	250
T <sub>OP</sub>	Operating Temperature	°C	-45 to +85
T <sub>STG</sub>	Storage Temperature	°C	-55 to +150

### Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a double-sided copper clad 50x50x1.6 mm epoxy glass PWB (T<sub>A</sub> = +85°C).

## RECOMMENDED OPERATING CONDITIONS

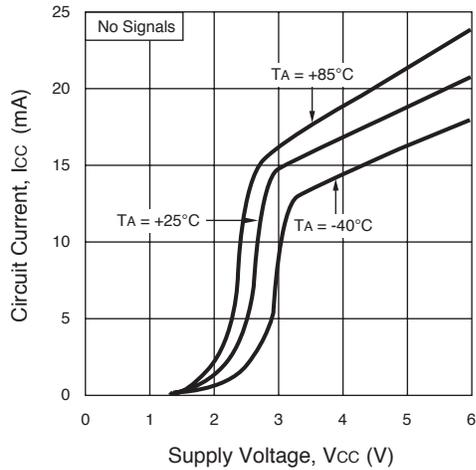
SYMBOL	PARAMETER	UNITS	MIN	TYP	MAX
V <sub>CC</sub>	Supply Voltage	V	4.5	5.0	5.5
T <sub>OP</sub>	Operating Temperature	°C	-40	+25	+85

## PIN DESCRIPTIONS

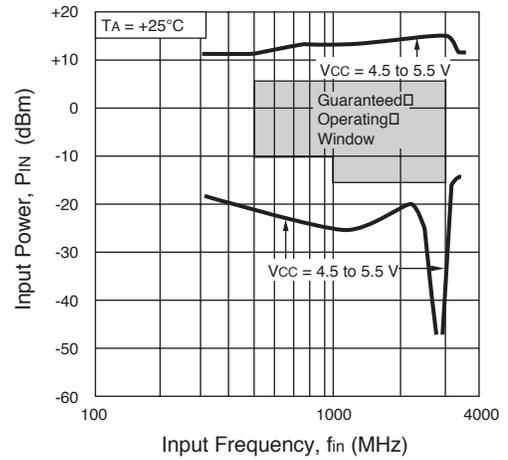
Pin No.		Pin Name	Applied Voltage (V)	Pin Voltage (V)	Description															
UPB1506GV	UPB1507GV																			
2	1	IN	–	2.9	Signal input pin. This pin should be coupled to the source with a capacitor (eg 1000 pF).															
3	8	$\overline{\text{IN}}$	–	2.9	Signal input bypass pin. This pin must be equipped with a bypass capacitor (eg 1000 pF) to ground.															
4	5	GND	0	–	Ground pin. Ground pattern on the board should be formed as wide as possible to minimize ground impedance.															
1	3	SW1	H/L	–	Divided ratio input pin. The ratio can be controlled by the following input data to these pins. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th colspan="2"></th> <th colspan="2">SW2</th> </tr> <tr> <th colspan="2"></th> <th>H</th> <th>L</th> </tr> </thead> <tbody> <tr> <th rowspan="2">SW1</th> <th>H</th> <td>+64</td> <td>+128</td> </tr> <tr> <th>L</th> <td>+128</td> <td>+256</td> </tr> </tbody> </table>			SW2				H	L	SW1	H	+64	+128	L	+128	+256
		SW2																		
		H	L																	
SW1	H	+64	+128																	
	L	+128	+256																	
6	6	SW2			These pins should be equipped with a bypass capacitor (e.g. 1000 pF) to ground.															
8	2	V <sub>CC</sub>	4.5 to 5.5	–	Power supply pin. This pin must be equipped with bypass capacitor (eg 1000 pF) to ground.															
7	4	OUT	–	2.6 to 4.7	Divided frequency output pin. This pin is designed as an emitter follower output. This pin can be connected to CMOS input due to 1.2 V <sub>p-p</sub> MIN output.															
5	7	NC	–	–	No connection. This pin must be opened.															

**TYPICAL PERFORMANCE CURVES** (TA = +25°C unless otherwise noted)

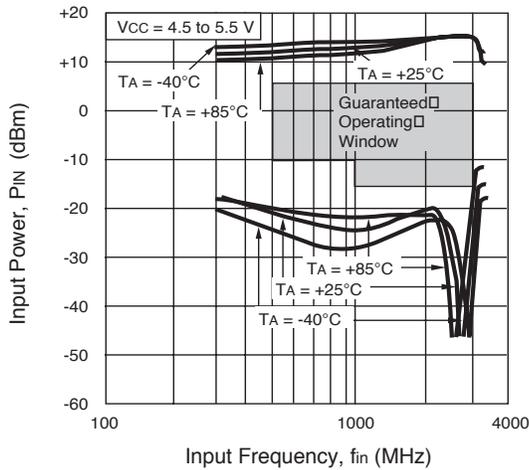
**CURRENT vs. VOLTAGE and TEMPERATURE**



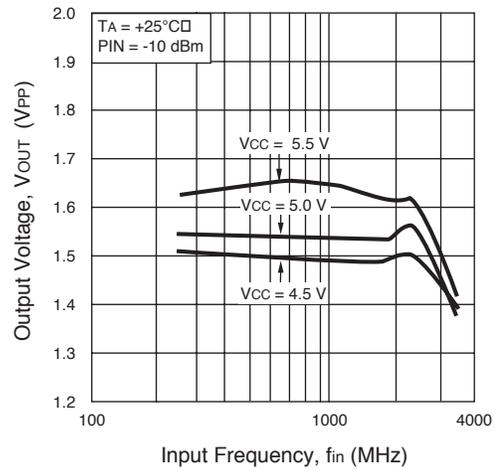
**INPUT POWER vs. INPUT FREQUENCY and VOLTAGE**



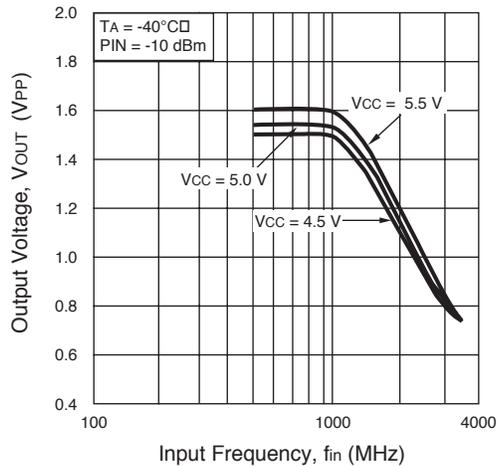
**INPUT POWER vs. INPUT FREQUENCY and TEMPERATURE**



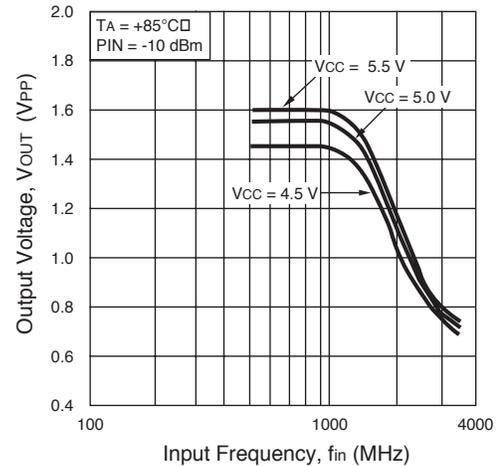
**OUTPUT VOLTAGE vs. INPUT FREQUENCY and VOLTAGE**



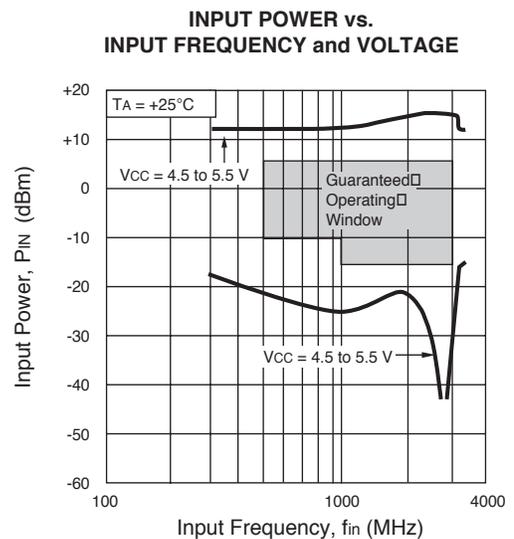
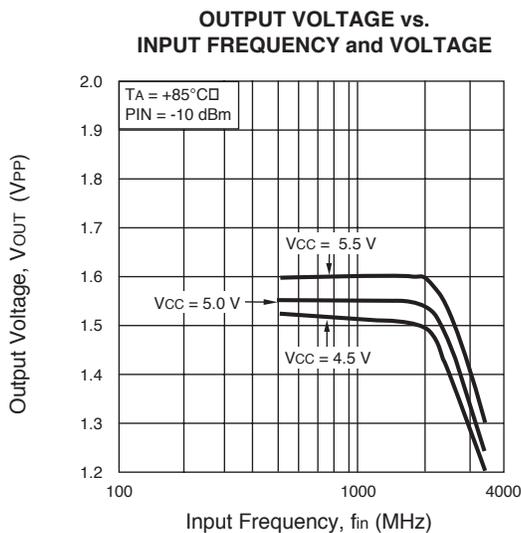
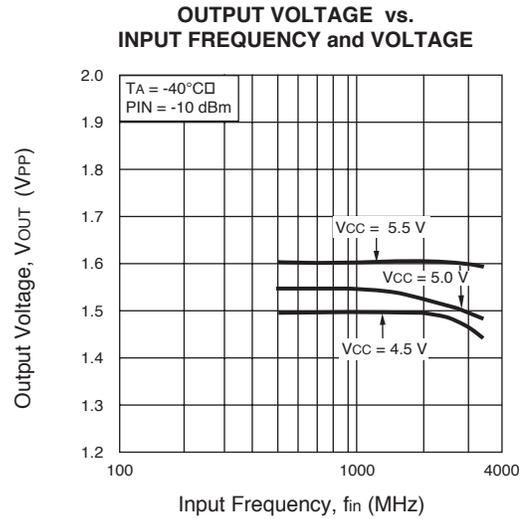
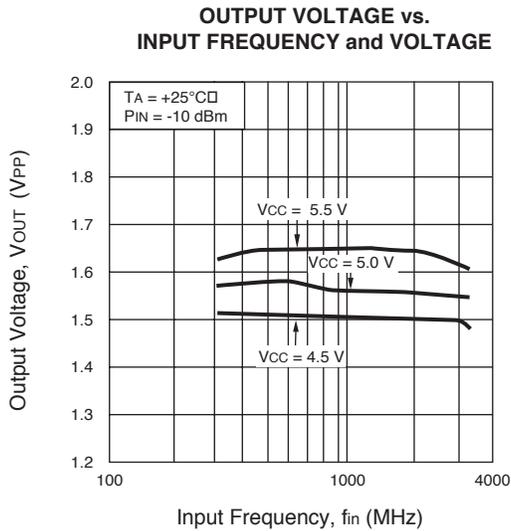
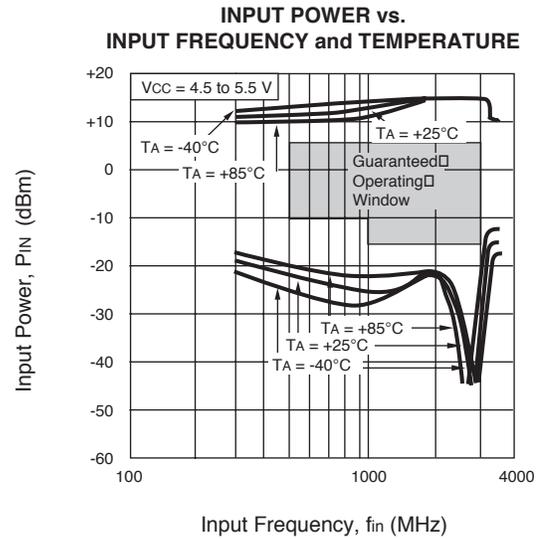
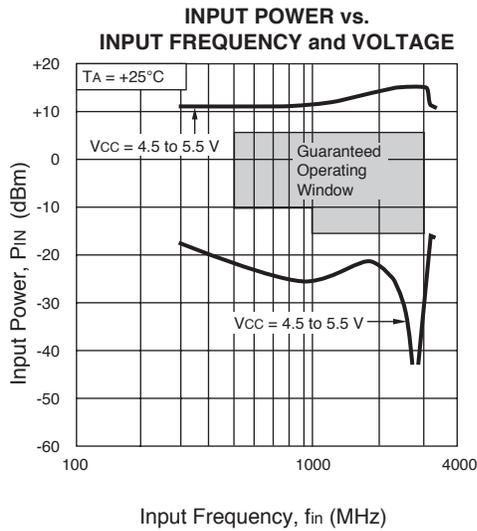
**OUTPUT VOLTAGE vs. INPUT FREQUENCY and VOLTAGE**



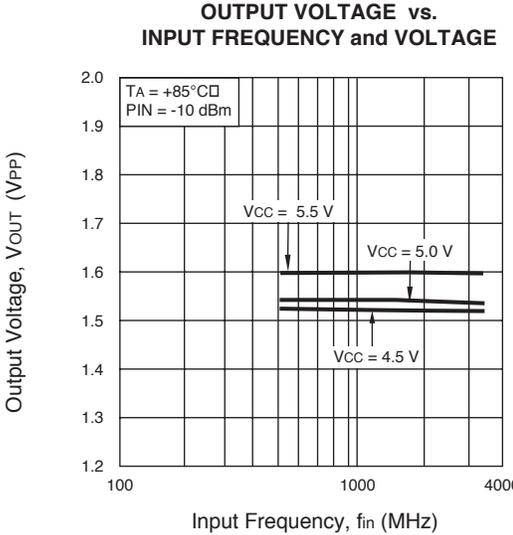
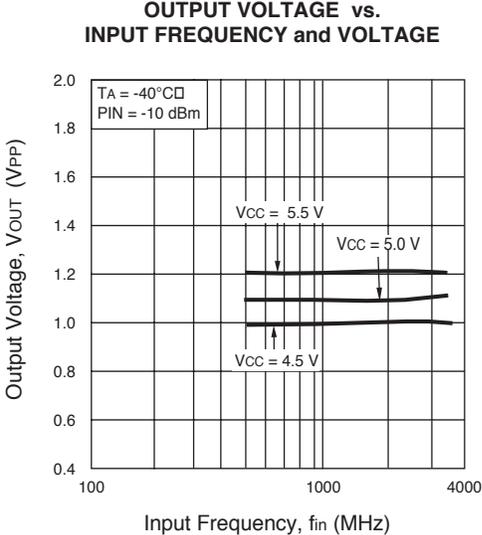
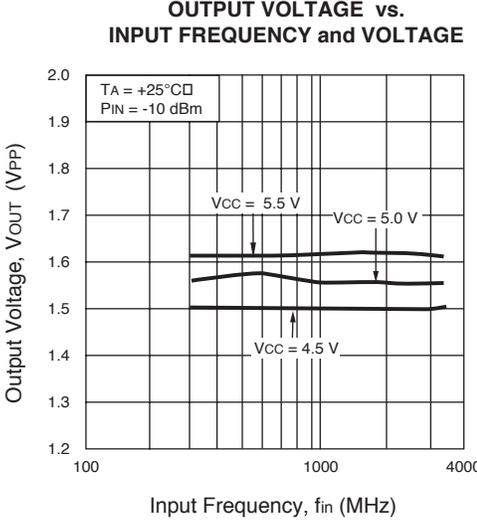
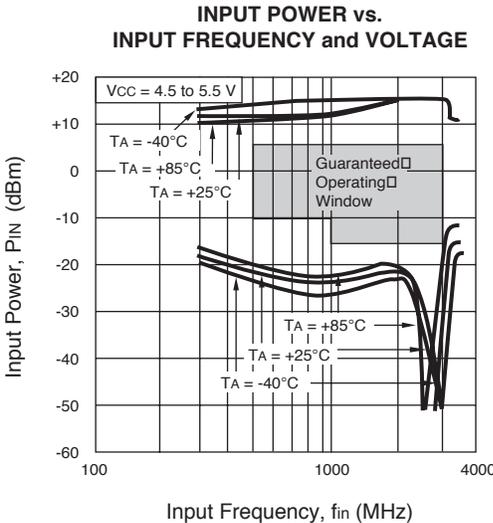
**OUTPUT VOLTAGE vs. INPUT FREQUENCY and VOLTAGE**



TYPICAL PERFORMANCE CURVES (TA = +25°C unless otherwise noted)



TYPICAL PERFORMANCE CURVES (TA = +25°C unless otherwise noted)



**TYPICAL SCATTERING PARAMETERS** (TA = 25°C)

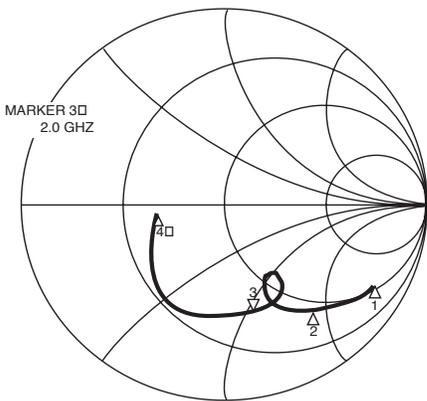
**UPB1506GV**

**S11 vs. INPUT FREQUENCY**  
Vcc = 5.0 V

S11 Z  
REF 1.0 Units  
3 200.0 mUnits/  
▽ 33.881 Ω -52.875 Ω  
hp

C

D



START 0.500000000 GHz  
STOP 3.000000000 GHz

△ 1□ : 0.5 GHz  
△ 2□ : 1.0 GHz  
△ 3□ : 2.0 GHz  
△ 4□ : 3.0 GHz

FREQUENCY	S11	
	GHz	MAG
0.5	0.868	-26.6
0.6	0.828	-32.6
0.7	0.794	-37.4
0.8	0.761	-41.9
0.9	0.721	-46.5
1.0	0.706	-49.3
1.1	0.662	-54.0
1.2	0.629	-57.2
1.3	0.595	60.2
1.4	0.554	-62.9
1.5	0.516	-64.8
1.6	0.440	-61.9
1.7	0.428	51.0
1.8	0.543	-61.5
1.9	0.555	-68.4
2.0	0.560	-74.7
2.1	0.558	-79.5
2.2	0.564	-84.9
2.3	0.570	-90.9
2.4	0.574	-98.3
2.5	0.574	-107.9
2.6	0.564	-118.3
2.7	0.530	-131.4
2.8	0.476	-144.6
2.9	0.411	-159.1
3.0	0.331	-175.8

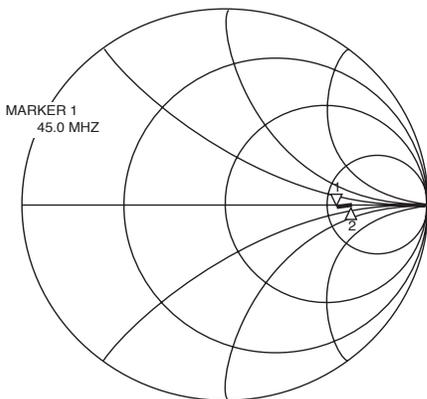
**UPB1506GV**

**S22 vs. OUTPUT FREQUENCY**  
Divide by 64 mode, Vcc = 5.0 V

S22 Z  
REF 1.0 Units  
1 200.0 mUnits/  
▽ 171.22 Ω -04.438 Ω  
hp

C

D



START 0.045000000 GHz  
STOP 0.100000000 GHz

△ 1□ : 45 MHz  
△ 2□ : 100 MHz

FREQUENCY	S22	
	MHz	MAG
45.0	0.542	-1.4
50.0	0.602	-0.3
55.0	0.616	0.0
60.0	0.605	1.1
65.0	0.609	0.7
70.0	0.616	0.3
75.0	0.620	0.1
80.0	0.622	0.0
85.0	0.619	0.6
90.0	0.610	0.9
95.0	0.626	-0.7
100.0	0.623	-1.7

**TYPICAL SCATTERING PARAMETERS** ( $T_A = 25^\circ\text{C}$ )

**UPB1506GV**

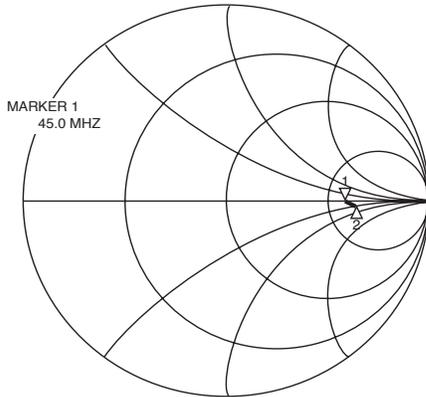
**S<sub>22</sub> vs. OUTPUT FREQUENCY**  
Divide by 128 mode, V<sub>cc</sub> = 5.0 V

S<sub>22</sub> Z  
REF 1.0 Units  
1 200.0 mUnits/  
▽ 192.34 Ω 03.109 Ω

hp

C

D



START 0.045000000 GHz  
STOP 0.100000000 GHz

Δ<sub>10</sub>: 45 MHz  
Δ<sub>20</sub>: 100 MHz

FREQUENCY	S <sub>22</sub>	
	MHz	MAG
45.0	0.590	-0.4
50.0	0.604	-1.0
55.0	0.610	-1.1
60.0	0.607	-0.8
65.0	0.548	-5.9
70.0	0.630	-0.0
75.0	0.615	-1.0
80.0	0.618	-1.4
85.0	0.617	-1.2
90.0	0.616	-2.2
95.0	0.623	-2.4
100.0	0.624	-2.3

**UPB1506GV**

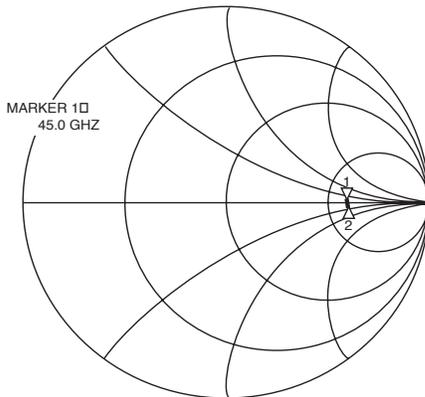
**S<sub>22</sub> vs. OUTPUT FREQUENCY**  
Divide by 256 mode, V<sub>cc</sub> = 5.0 V

S<sub>22</sub> Z  
REF 1.0 Units  
1 200.0 mUnits/  
▽ 199.25 Ω -05.992 Ω

hp

C

D



START 0.045000000 GHz  
STOP 0.100000000 GHz

Δ<sub>10</sub>: 45 MHz  
Δ<sub>20</sub>: 100 MHz

FREQUENCY	S <sub>22</sub>	
	MHz	MAG
45.0	0.601	-0.9
50.0	0.609	-1.6
55.0	0.611	-1.5
60.0	0.620	-1.4
65.0	0.607	-2.1
70.0	0.615	-1.9
75.0	0.613	-3.2
80.0	0.611	-2.8
85.0	0.607	-2.5
90.0	0.605	-2.4
95.0	0.610	-3.0
100.0	0.608	-2.8

# UPB1506GV, UPB1507GV

## TYPICAL SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)

### UPB1507GV

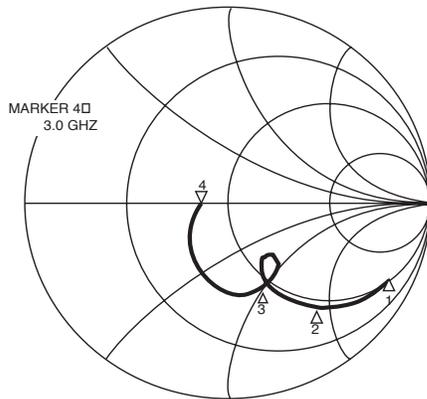
**S<sub>11</sub> vs. INPUT FREQUENCY**  
V<sub>CC</sub> = 5.0 V

S<sub>11</sub> Z  
REF 1.0 Units  
4 200.0 mUnits/  
▽ 38.111 Ω 0.9707 Ω

hp

C

D



START 0.500000000 GHz  
STOP 3.000000000 GHz

FREQUENCY	S <sub>11</sub>	
	MAG	ANG
0.5	0.857	-27.5
0.6	0.849	-32.0
0.7	0.800	-38.9
0.8	0.764	-43.8
0.9	0.725	-49.0
1.0	0.665	-50.9
1.1	0.619	-55.3
1.2	0.573	-59.3
1.3	0.531	-61.3
1.4	0.484	-62.8
1.5	0.439	-63.0
1.6	0.377	-59.1
1.7	0.340	-54.1
1.8	0.377	-54.7
1.9	0.441	-59.5
2.0	0.464	-67.2
2.1	0.443	-67.4
2.2	0.466	-74.5
2.3	0.465	-81.3
2.4	0.454	-89.4
2.5	0.433	-99.2
2.6	0.383	-109.6
2.7	0.350	-114.0
2.8	0.332	-124.2
2.9	0.271	-141.2
3.0	0.185	-163.6

### UPB1507GV

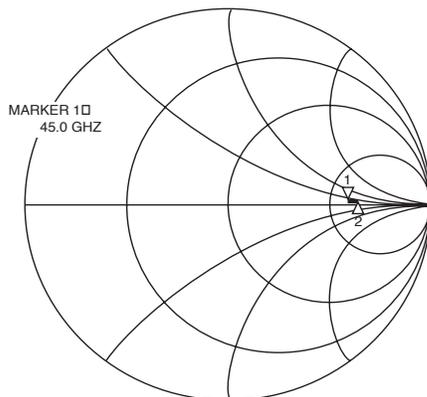
**S<sub>22</sub> vs. OUTPUT FREQUENCY**  
Divide by 64 mode, V<sub>CC</sub> = 5.0 V

S<sub>22</sub> Z  
REF 1.0 Units  
1 200.0 mUnits/  
▽ 185.13 Ω 17.789 Ω

hp

C

D



START 0.045000000 GHz  
STOP 0.100000000 GHz

FREQUENCY	S <sub>22</sub>	
	MAG	ANG
45.0	0.580	3.4
50.0	0.572	2.5
55.0	0.574	3.0
60.0	0.574	2.7
65.0	0.584	3.0
70.0	0.587	2.6
75.0	0.592	2.4
80.0	0.587	2.6
85.0	0.589	2.9
90.0	0.591	2.9
95.0	0.573	1.7
100.0	0.604	2.9

**TYPICAL SCATTERING PARAMETERS** ( $T_A = 25^\circ\text{C}$ )

**UPB1507GV**

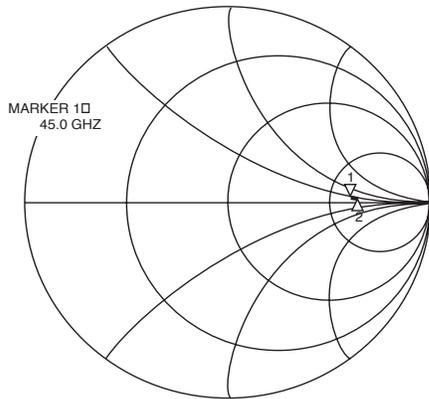
**S22 vs. OUTPUT FREQUENCY**  
Divide by 128 mode,  $V_{CC} = 5.0\text{ V}$

S22 Z  
REF 1.0 Units  
1 200.0 mUnits/  
▽ 185.02 Ω 18.953 Ω

hp

C

D



START 0.045000000 GHz  
STOP 0.100000000 GHz

**FREQUENCY** **S22**

MHz	MAG	ANG
45.0	0.578	3.2
50.0	0.571	2.8
55.0	0.572	3.3
60.0	0.576	3.0
65.0	0.584	3.1
70.0	0.587	2.8
75.0	0.589	2.4
80.0	0.589	2.8
85.0	0.588	3.0
90.0	0.593	2.8
95.0	0.598	3.0
100.0	0.602	2.9

△<sub>10</sub> : 45 MHz  
△<sub>20</sub> : 100 MHz

**UPB1507GV**

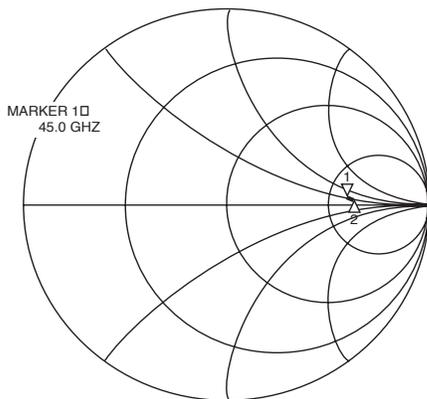
**S22 vs. OUTPUT FREQUENCY**  
Divide by 256 mode,  $V_{CC} = 5.0\text{ V}$

S22 Z  
REF 1.0 Units  
4 200.0 mUnits/  
▽ 186.76 Ω 17.82 Ω

hp

C

D



START 0.045000000 GHz  
STOP 0.100000000 GHz

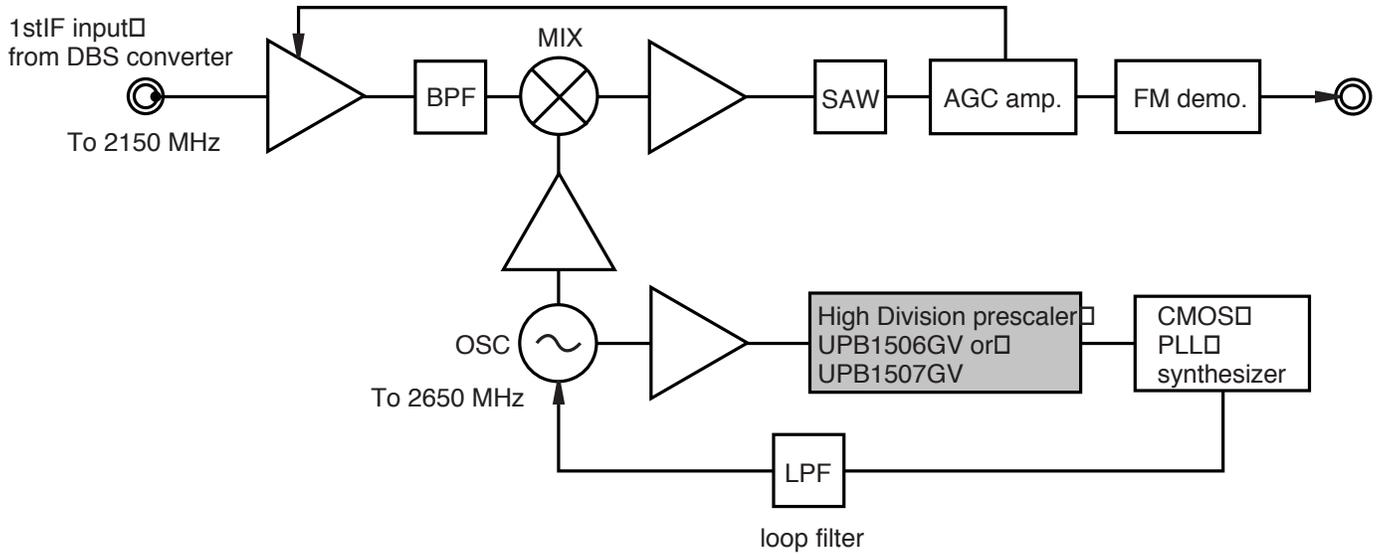
**FREQUENCY** **S22**

MHz	MAG	ANG
45.0	0.580	3.0
50.0	0.572	2.8
55.0	0.571	2.9
60.0	0.576	2.9
65.0	0.585	3.2
70.0	0.590	2.8
75.0	0.589	2.5
80.0	0.590	2.6
85.0	0.588	2.9
90.0	0.597	2.9
95.0	0.600	3.1
100.0	0.601	3.1

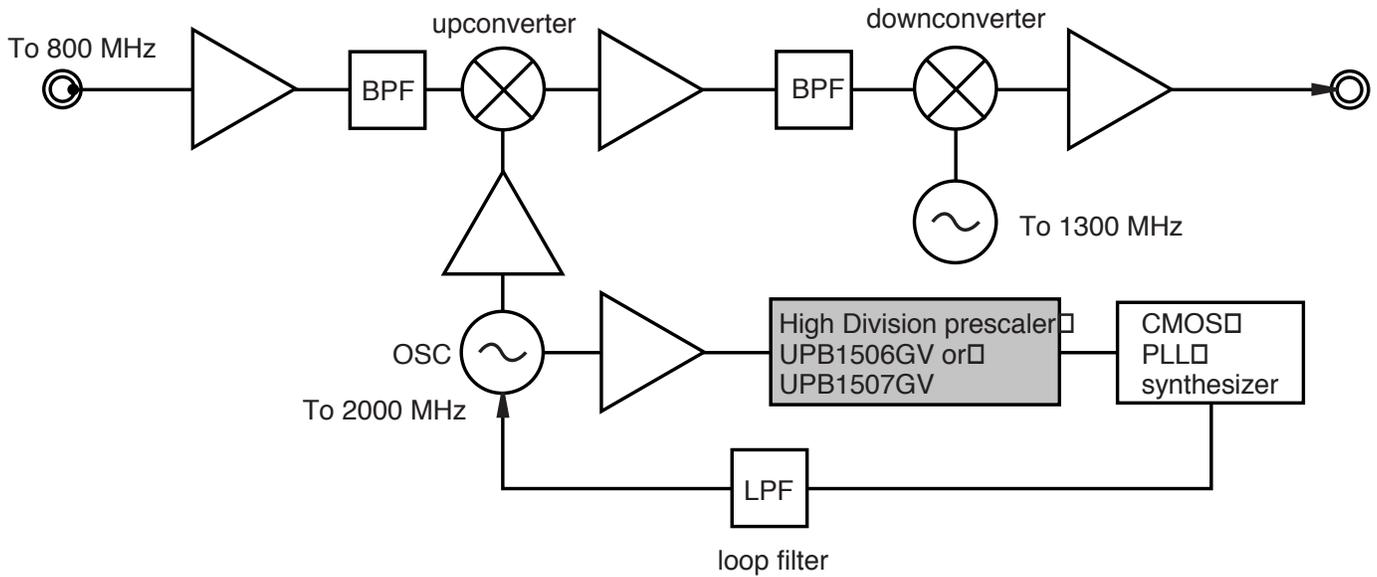
△<sub>10</sub> : 45 MHz  
△<sub>20</sub> : 100 MHz

**SYSTEM APPLICATION EXAMPLE**

**RF unit block of Analog DBS tuners**



**RF unit block of Analog CATV converter**





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	
		-A	-AZ
Lead (Pb)	< 1000 PPM	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	

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

Important Information and Disclaimer: Information provided by CEL on its website or in other communications concerning the substance content of its products represents knowledge and belief as of the date that it is provided. CEL bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. CEL has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. CEL and CEL suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.