



BIPOLAR ANALOG INTEGRATED CIRCUITS

UPC2711TB, UPC2712TB

5 V, SUPER MINIMOLD SILICON MMIC WIDEBAND AMPLIFIER

FEATURES

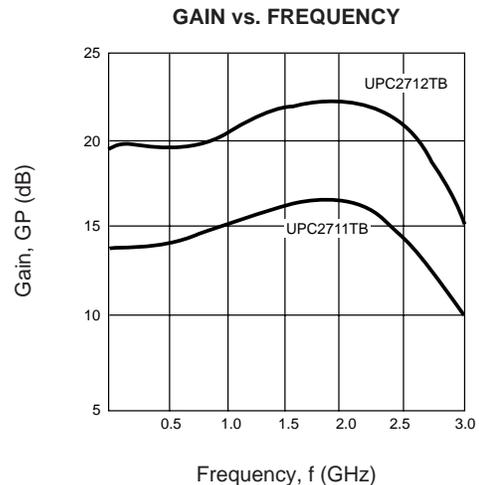
- **HIGH DENSITY SURFACE MOUNTING:**
6 pin super minimold or SOT-363 package
- **SUPPLY VOLTAGE:** $V_{CC} = 4.5$ to 5.5 V
- **WIDEBAND RESPONSE:**
UPC2711TB: $f_u = 2.9$ GHz TYP
UPC2712TB: $f_u = 2.6$ GHz TYP
- **POWER GAIN:**
UPC2711TB: $G_P = 13$ dB TYP
UPC2712TB: $G_P = 20$ dB TYP

DESCRIPTION

NEC's UPC2711TB and UPC2712TB are Silicon MMIC Wideband Amplifiers manufactured using NEC's 20 GHz f_T NESAT™ III silicon bipolar process. These devices are designed for use as buffer amps in DBS tuners. The UPC2711/12TB are pin compatible and have comparable performance as the larger UPC2711/12T, so they are suitable for use as a replacement to help reduce system size. These IC's are housed in a 6 pin super minimold or SOT-363 package.

NEC's stringent quality assurance and test procedure ensure the highest reliability and performance.

TYPICAL PERFORMANCE CURVES



ELECTRICAL CHARACTERISTICS ($T_A = +25$ °C, $V_{CC} = 5.0$ V, $Z_L = Z_s = 50$ W)

| PART NUMBER PACKAGE OUTLINE | | | UPC2711TB S06 | | | UPC2712TB S06 | | |
|--------------------------------|----------------------------------------------------------------------------------------------|-------|------------------|-----------|------|------------------|-----------|------|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX | MIN | TYP | MAX |
| I_{CC} | Circuit Current (no signal) | mA | 9 | 12 | 15 | 9 | 12 | 15 |
| G_P | Power Gain, $f = 1$ GHz | dB | 11 | 13 | 16.5 | 18 | 20 | 23.5 |
| f_u | Upper Limit Operating Frequency (The gain at f_u is 3 dB down from the gain at 100 MHz) | GHz | 2.7 | 2.9 | | 2.2 | 2.6 | |
| ΔG_P | Gain Flatness, $f = 0.1$ GHz to 2.5 GHz | dB | | ± 0.8 | | | ± 0.8 | |
| $P_{O(SAT)}$ | Maximum Output Level, $f = 1$ GHz, $P_{IN} = 0$ dBm | dBm | -2 | +1 | | 0 | +3 | |
| NF | Noise Figure, $f = 1$ GHz | dB | | 5 | 6.5 | | 4.5 | 6 |
| RL_{IN} | Input Return Loss, $f = 1$ GHz | dB | 20 | 25 | | 9 | 12 | |
| RL_{OUT} | Output Return Loss, $f = 1$ GHz | dB | 9 | 12 | | 10 | 13 | |
| ISOL | Isolation, $f = 1$ GHz | dB | 25 | 30 | | 28 | 33 | |

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

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|--------------------------------------|-------|-------------|
| V _{CC} | Supply Voltage | V | 6 |
| P _{IN} | Input Power | dBm | +10 |
| P _T | Total Power Dissipation ² | mW | 200 |
| T _{OP} | Operating Temperature | °C | -45 to +85 |
| T _{STG} | 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 double sided copper clad 50 x 50 x 1.6 mm epoxy glass PWB (T_A = +85°C).

RECOMMENDED OPERATING CONDITIONS

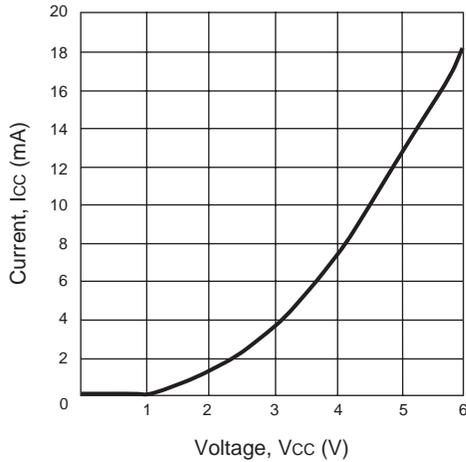
| SYMBOL | PARAMETER | UNITS | MIN | TYP | MAX |
|-----------------|-----------------------|-------|-----|-----|-----|
| V _{CC} | Supply Voltage | V | 4.5 | 5.0 | 5.5 |
| T _{OP} | Operating Temperature | °C | -40 | +25 | +85 |

PIN DESCRIPTION

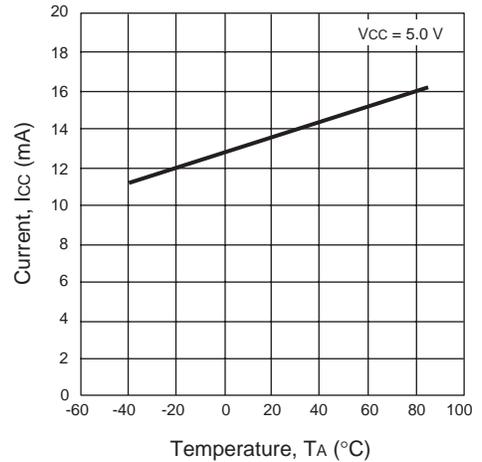
| Pin No. | Pin Name | Applied Voltage (V) | Description | Internal Equivalent Circuit |
|-------------|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1 | Input | | Signal input pin. An internal matching circuit, configured with resistors, enables 50 Ω connection over a wide bandwidth. A multi-feedback circuit is designed to cancel the deviations of h _{FE} and resistance. This pin must be coupled to the signal source with a blocking capacitor. | |
| 4 | Output | | Signal output pin. An internal matching circuit, configured with resistors, enables 50 Ω connection over a wide bandwidth. This pin must be coupled to the output load with a blocking capacitor. | |
| 6 | V _{CC} | 4.5 to 5.5 | Power supply pin. This pin should be externally equipped with a bypass capacitor to minimize ground impedance. | |
| 2 3 5 | GND | 0 | Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. All the ground pins must be connected together with wide ground pattern to minimize impedance difference. | |

TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$)

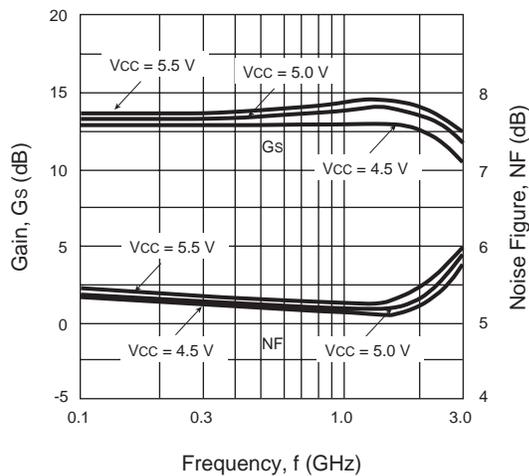
**UPC2711TB
CURRENT vs. VOLTAGE**



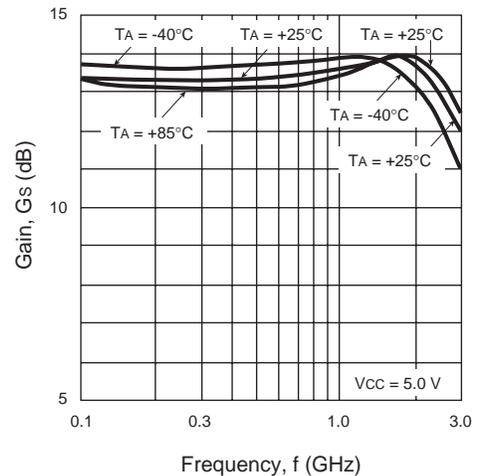
**UPC2711TB
CURRENT vs. TEMPERATURE**



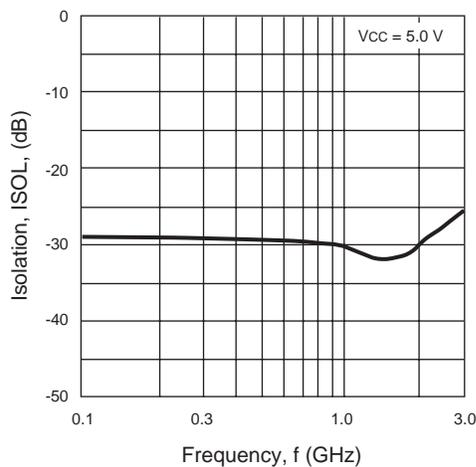
**UPC2711TB
GAIN AND NOISE FIGURE vs.
FREQUENCY AND VOLTAGE**



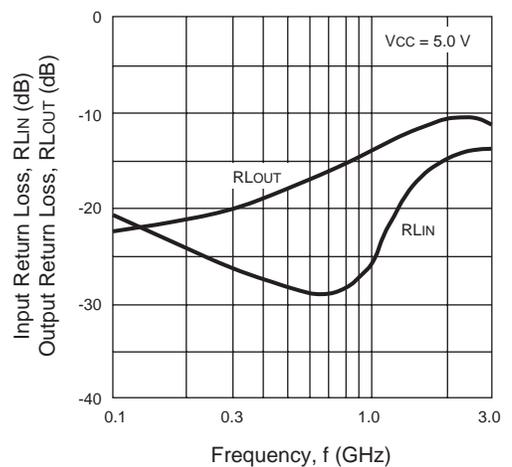
**UPC2711TB
GAIN vs. FREQUENCY AND
TEMPERATURE**



**UPC2711TB
ISOLATION vs. FREQUENCY**

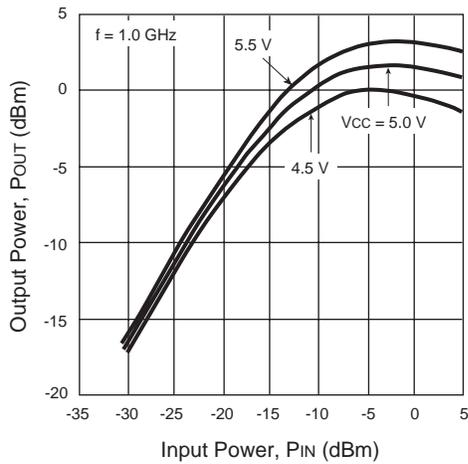


**UPC2711TB
INPUT RETURN LOSS AND
OUTPUT RETURN LOSS vs. FREQUENCY**

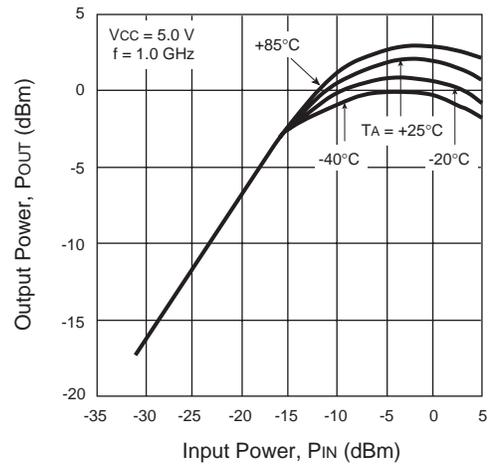


TYPICAL PERFORMANCE CURVES (TA = 25°C)

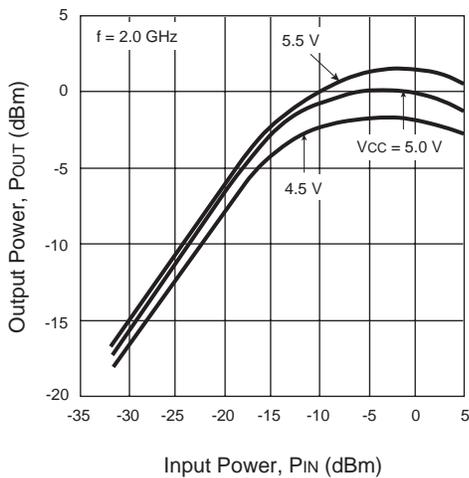
UPC2711TB
OUTPUT POWER vs.
INPUT POWER VOLTAGE



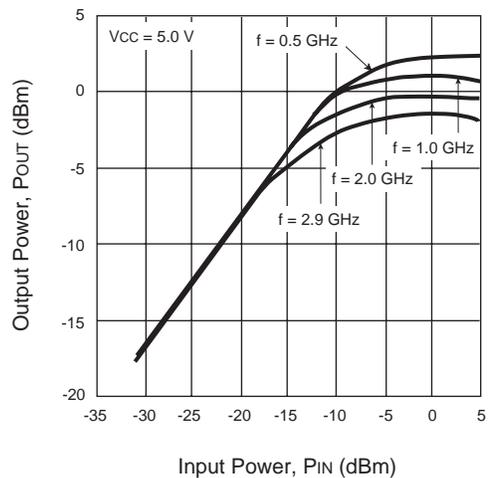
UPC2711TB
OUTPUT POWER vs.
INPUT POWER AND TEMPERATURE



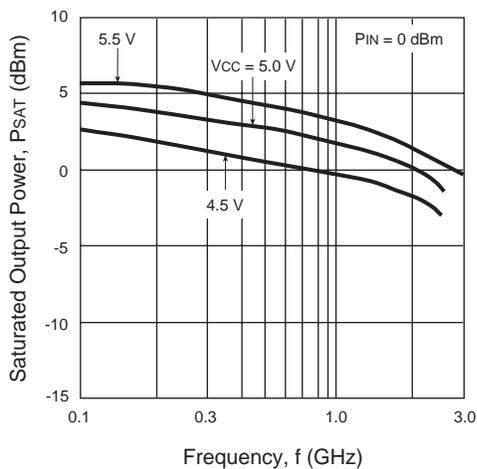
UPC2711TB
OUTPUT POWER vs.
INPUT POWER AND VOLTAGE



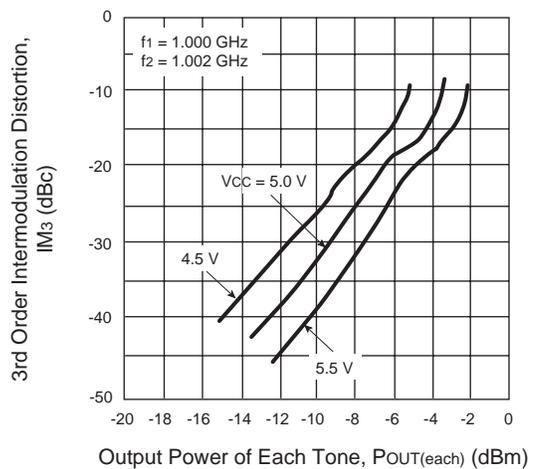
UPC2711TB
OUTPUT POWER vs.
INPUT POWER AND FREQUENCY



UPC2711TB
SATURATED OUTPUT POWER vs.
FREQUENCY AND VOLTAGE

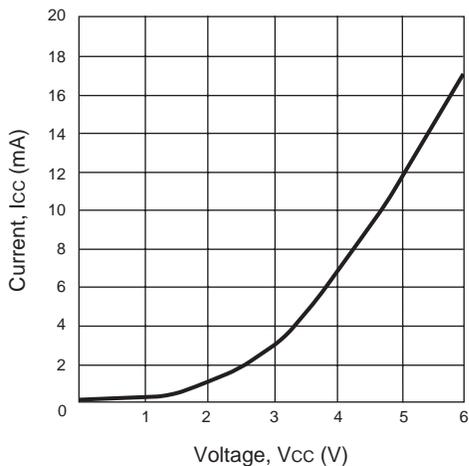


UPC2711TB
3RD ORDER INTERMODULATION
DISTORTION vs. OUTPUT POWER
AND VOLTAGE

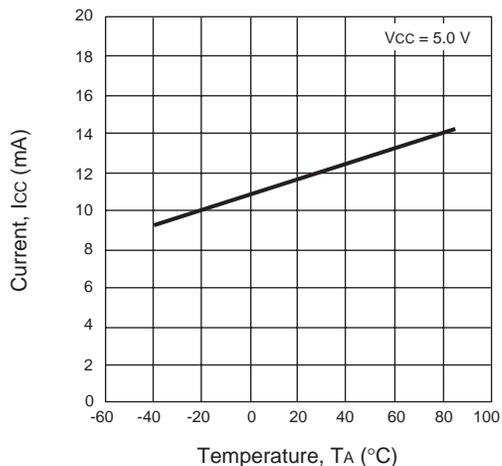


TYPICAL PERFORMANCE CURVES (TA = 25°C)

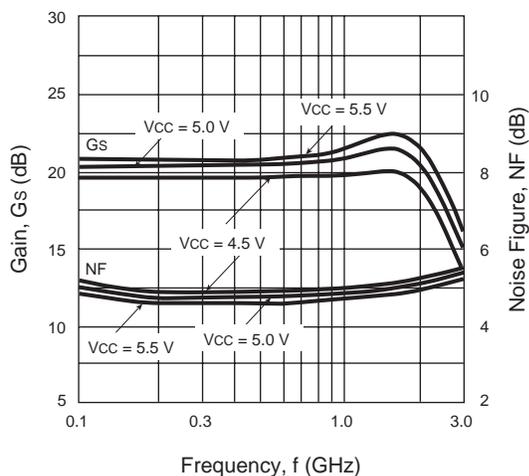
UPC2712TB
CURRENT vs. VOLTAGE



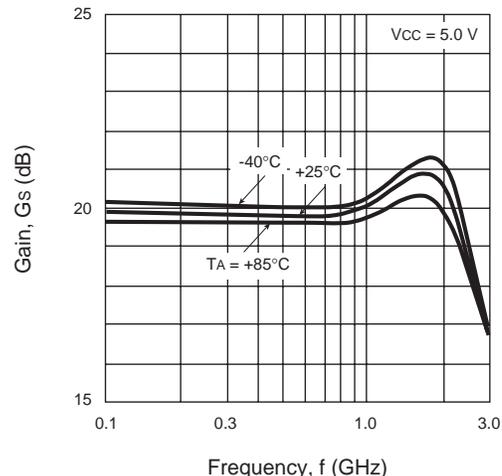
UPC2712TB
CURRENT vs. TEMPERATURE



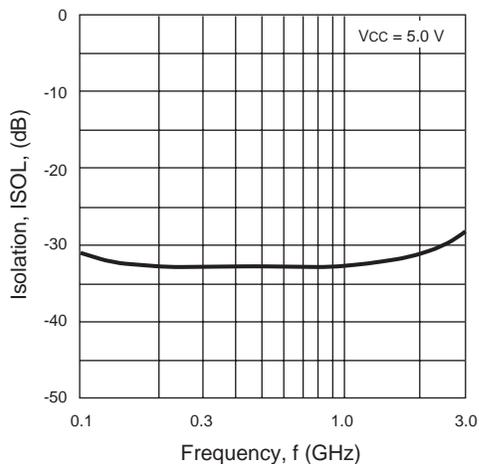
UPC2712TB
GAIN AND NOISE FIGURE vs.
FREQUENCY AND VOLTAGE



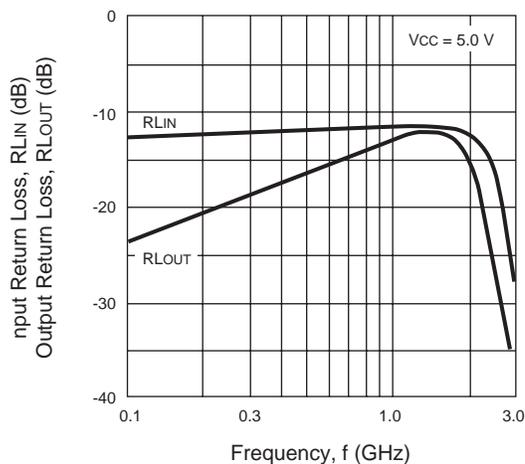
UPC2712TB
GAIN vs.
FREQUENCY AND TEMPERATURE



UPC2712TB
ISOLATION vs. FREQUENCY

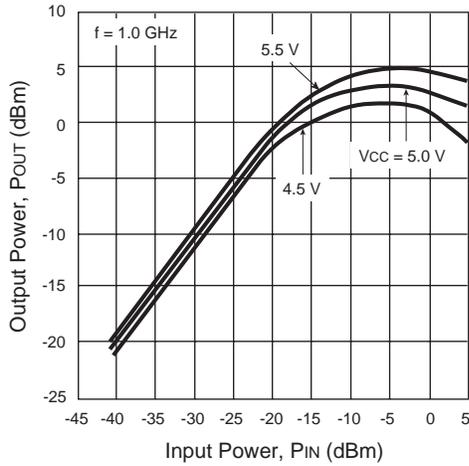


UPC2712TB
INPUT RETURN LOSS AND OUTPUT
RETURN LOSS vs. FREQUENCY

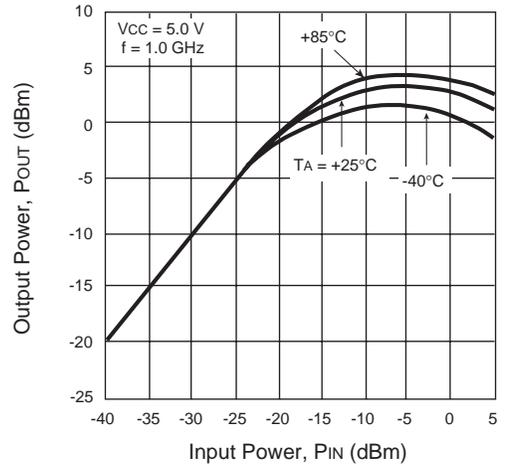


TYPICAL PERFORMANCE CURVES (TA = 25°C)

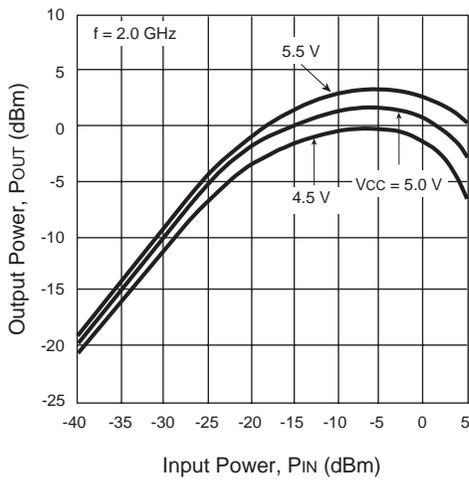
UPC2712TB
OUTPUT POWER vs.
INPUT POWER VOLTAGE



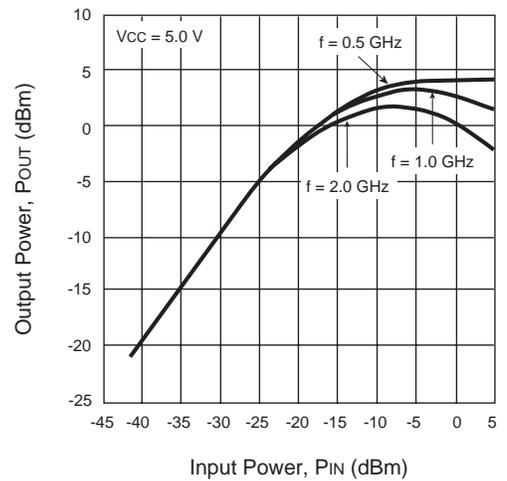
UPC2712TB
OUTPUT POWER vs.
INPUT POWER AND TEMPERATURE



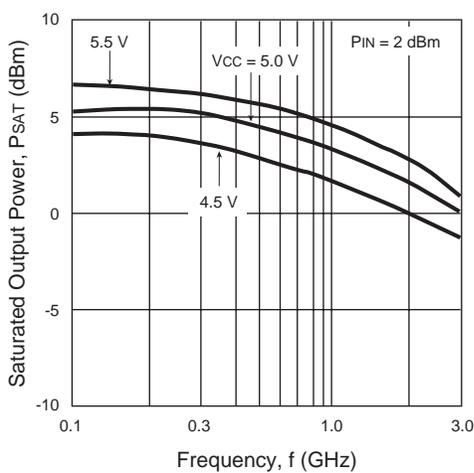
UPC2712TB
OUTPUT POWER vs.
INPUT POWER AND VOLTAGE



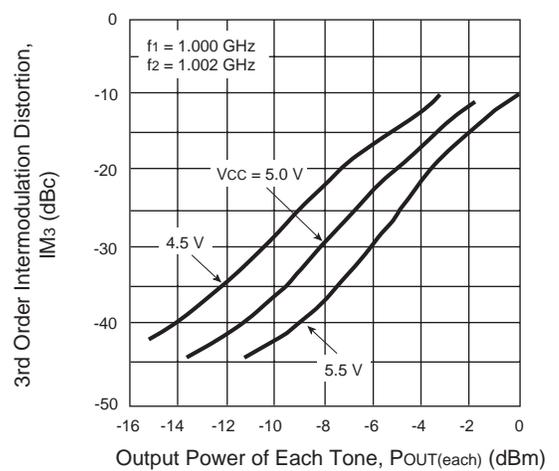
UPC2712TB
OUTPUT POWER vs.
INPUT POWER AND FREQUENCY



UPC2712TB
SATURATED OUTPUT POWER vs.
FREQUENCY AND VOLTAGE



UPC2712TB
3RD ORDER INTERMODULATION
DISTORTION vs. OUTPUT POWER
AND VOLTAGE



TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

UPC2711TB

V_{CC} = 5 V, I_{CC} = 13.8 mA

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K |
|--------------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|--------|------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | |
| 100.00 | 0.085 | -22.40 | 4.447 | -14.90 | 0.035 | -12.70 | 0.113 | -3.10 | 3.18 |
| 200.00 | 0.086 | -25.00 | 4.468 | -30.10 | 0.035 | -23.00 | 0.119 | 1.20 | 3.21 |
| 300.00 | 0.098 | -29.20 | 4.491 | -44.90 | 0.034 | -32.10 | 0.136 | 1.60 | 3.23 |
| 400.00 | 0.081 | -29.40 | 4.510 | -60.30 | 0.033 | -42.50 | 0.142 | 6.50 | 3.34 |
| 500.00 | 0.066 | -33.90 | 4.540 | -74.90 | 0.033 | -50.10 | 0.156 | 10.10 | 3.32 |
| 600.00 | 0.041 | -54.50 | 4.572 | -90.20 | 0.033 | -59.60 | 0.161 | 12.70 | 3.34 |
| 700.00 | 0.053 | -104.30 | 4.624 | -105.30 | 0.032 | -69.30 | 0.161 | 8.80 | 3.33 |
| 800.00 | 0.070 | -119.70 | 4.664 | -120.70 | 0.031 | -78.40 | 0.176 | 6.20 | 3.36 |
| 900.00 | 0.098 | -121.90 | 4.729 | -136.10 | 0.032 | -86.60 | 0.192 | 1.90 | 3.27 |
| 1000.00 | 0.101 | -112.50 | 4.781 | -152.00 | 0.031 | -94.90 | 0.228 | 0.10 | 3.29 |
| 1100.00 | 0.090 | -108.50 | 4.843 | -167.90 | 0.031 | -103.90 | 0.256 | -0.60 | 3.15 |
| 1200.00 | 0.060 | -95.60 | 4.945 | 175.80 | 0.029 | -111.00 | 0.290 | -1.10 | 3.24 |
| 1300.00 | 0.019 | -79.20 | 4.999 | 159.50 | 0.029 | -120.20 | 0.308 | -0.30 | 3.16 |
| 1400.00 | 0.023 | 54.80 | 5.062 | 143.00 | 0.028 | -128.90 | 0.322 | -1.40 | 3.18 |
| 1500.00 | 0.062 | 80.70 | 5.114 | 126.40 | 0.029 | -133.10 | 0.327 | -2.20 | 3.08 |
| 1600.00 | 0.087 | 80.40 | 5.142 | 109.50 | 0.029 | -140.90 | 0.333 | -4.80 | 3.07 |
| 1700.00 | 0.113 | 78.70 | 5.160 | 92.70 | 0.029 | -146.20 | 0.344 | -7.00 | 3.02 |
| 1800.00 | 0.126 | 72.00 | 5.146 | 75.40 | 0.030 | -151.40 | 0.356 | -9.70 | 2.88 |
| 1900.00 | 0.154 | 63.50 | 5.123 | 58.00 | 0.032 | -159.70 | 0.371 | -11.10 | 2.70 |
| 2000.00 | 0.178 | 59.00 | 5.113 | 41.30 | 0.035 | -168.30 | 0.378 | -12.00 | 2.51 |
| 2100.00 | 0.212 | 54.20 | 5.063 | 24.00 | 0.036 | -175.70 | 0.383 | -12.80 | 2.39 |
| 2200.00 | 0.232 | 55.20 | 5.006 | 6.90 | 0.038 | 175.20 | 0.378 | -13.60 | 2.27 |
| 2300.00 | 0.246 | 53.80 | 4.954 | -10.40 | 0.041 | 165.20 | 0.367 | -16.10 | 2.13 |
| 2400.00 | 0.248 | 53.60 | 4.865 | -27.70 | 0.045 | 155.30 | 0.359 | -18.00 | 1.99 |
| 2500.00 | 0.240 | 49.20 | 4.783 | -45.00 | 0.048 | 143.60 | 0.356 | -21.10 | 1.88 |
| 2600.00 | 0.238 | 43.70 | 4.664 | -62.30 | 0.049 | 131.20 | 0.359 | -23.60 | 1.85 |
| 2700.00 | 0.240 | 36.20 | 4.529 | -79.60 | 0.052 | 119.80 | 0.366 | -26.20 | 1.76 |
| 2800.00 | 0.262 | 31.70 | 4.384 | -96.60 | 0.054 | 108.70 | 0.374 | -28.60 | 1.72 |
| 2900.00 | 0.285 | 28.80 | 4.255 | -113.10 | 0.056 | 95.50 | 0.372 | -31.10 | 1.68 |
| 3000.00 | 0.316 | 29.70 | 4.117 | -129.60 | 0.057 | 83.60 | 0.361 | -35.00 | 1.69 |

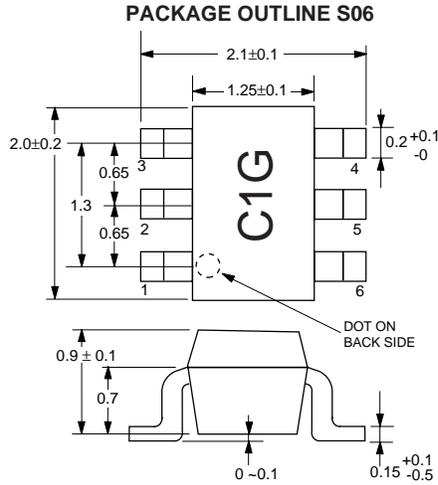
TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

UPC2712TB

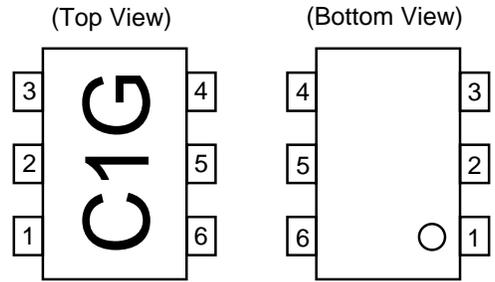
V_{CC} = 5 V, I_{CC} = 13.9 mA

| FREQUENCY (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K |
|--------------------|-----------------|--------|-----------------|---------|-----------------|---------|-----------------|--------|------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | |
| 100.00 | 0.303 | -8.10 | 8.864 | -16.70 | 0.023 | -11.40 | 0.043 | 2.30 | 2.32 |
| 200.00 | 0.291 | -10.10 | 8.827 | -33.50 | 0.023 | -19.20 | 0.055 | 11.50 | 2.35 |
| 300.00 | 0.295 | -11.80 | 8.936 | -49.50 | 0.022 | -25.50 | 0.078 | 8.50 | 2.38 |
| 400.00 | 0.276 | -11.30 | 9.044 | -67.60 | 0.023 | -34.60 | 0.095 | 13.40 | 2.33 |
| 500.00 | 0.265 | -11.00 | 9.051 | -82.20 | 0.023 | -42.80 | 0.112 | 13.60 | 2.37 |
| 600.00 | 0.243 | -12.30 | 9.096 | -98.80 | 0.023 | -50.00 | 0.120 | 11.10 | 2.35 |
| 700.00 | 0.222 | -20.30 | 9.089 | -115.20 | 0.023 | -59.80 | 0.120 | 1.70 | 2.37 |
| 800.00 | 0.219 | -25.40 | 9.080 | -131.50 | 0.023 | -66.20 | 0.136 | -6.00 | 2.38 |
| 900.00 | 0.230 | -33.90 | 9.096 | -147.60 | 0.023 | -73.00 | 0.155 | -14.40 | 2.39 |
| 1000.00 | 0.267 | -35.50 | 9.044 | -164.20 | 0.024 | -82.90 | 0.189 | -17.50 | 2.26 |
| 1100.00 | 0.290 | -35.50 | 9.197 | 179.50 | 0.024 | -89.50 | 0.212 | -19.90 | 2.12 |
| 1200.00 | 0.316 | -33.20 | 9.421 | 162.40 | 0.024 | -98.40 | 0.240 | -21.40 | 2.02 |
| 1300.00 | 0.317 | -30.60 | 9.524 | 144.90 | 0.024 | -107.00 | 0.245 | -23.20 | 1.94 |
| 1400.00 | 0.314 | -29.40 | 9.512 | 126.60 | 0.026 | -115.70 | 0.248 | -27.10 | 1.82 |
| 1500.00 | 0.296 | -28.10 | 9.574 | 109.10 | 0.026 | -122.30 | 0.236 | -31.80 | 1.78 |
| 1600.00 | 0.290 | -29.40 | 9.598 | 91.10 | 0.027 | -133.20 | 0.231 | -38.00 | 1.74 |
| 1700.00 | 0.278 | -31.10 | 9.480 | 72.90 | 0.028 | -139.40 | 0.221 | -43.80 | 1.72 |
| 1800.00 | 0.282 | -34.90 | 9.372 | 54.30 | 0.029 | -148.10 | 0.215 | -49.80 | 1.69 |
| 1900.00 | 0.284 | -35.50 | 9.193 | 35.60 | 0.030 | -157.60 | 0.199 | -53.00 | 1.70 |
| 2000.00 | 0.280 | -36.60 | 9.198 | 18.40 | 0.031 | -167.40 | 0.170 | -55.30 | 1.69 |
| 2100.00 | 0.273 | -36.00 | 9.011 | 0.10 | 0.033 | -175.10 | 0.134 | -56.20 | 1.68 |
| 2200.00 | 0.244 | -38.20 | 8.784 | -17.90 | 0.033 | 176.50 | 0.090 | -55.20 | 1.74 |
| 2300.00 | 0.222 | -40.00 | 8.717 | -35.10 | 0.034 | 164.80 | 0.050 | -53.70 | 1.74 |
| 2400.00 | 0.189 | -45.70 | 8.388 | -52.90 | 0.036 | 154.80 | 0.025 | 1.80 | 1.75 |
| 2500.00 | 0.177 | -52.90 | 8.217 | -70.10 | 0.037 | 143.50 | 0.039 | 33.40 | 1.74 |
| 2600.00 | 0.164 | -57.40 | 7.890 | -87.40 | 0.039 | 133.30 | 0.071 | 39.30 | 1.72 |
| 2700.00 | 0.158 | -59.60 | 7.597 | -104.60 | 0.041 | 123.80 | 0.099 | 34.30 | 1.70 |
| 2800.00 | 0.143 | -53.90 | 7.313 | -121.40 | 0.041 | 114.00 | 0.131 | 26.00 | 1.72 |
| 2900.00 | 0.128 | -44.30 | 7.078 | -138.40 | 0.043 | 101.40 | 0.149 | 22.80 | 1.70 |
| 3000.00 | 0.111 | -22.20 | 6.086 | -154.90 | 0.046 | 90.20 | 0.157 | 19.40 | 1.70 |

OUTLINE DIMENSIONS (Units in mm)



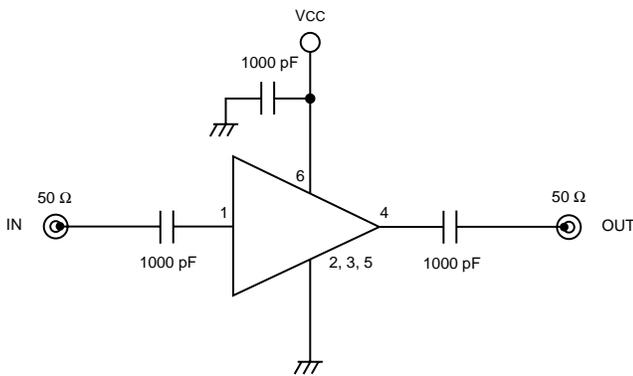
PIN CONNECTIONS



Marking is an example of UPC2711TB

- 1. Input 4. Output
- 2. GND 5. GND
- 3. GND 6. Vcc

TEST CIRCUIT



ORDERING INFORMATION (Solder Contains Lead)

| PART NUMBER | MARKING | QTY |
|--------------|---------|---------|
| UPC2711TB-E3 | C1G | 3K/reel |
| UPC2712TB-E3 | C1H | 3K/reel |

Note: Embossed tape, 8 mm wide. Pins 1, 2, and 3 face perforated side of tape.

ORDERING INFORMATION (Pb-Free)

| PART NUMBER | MARKING | QTY |
|----------------|---------|---------|
| UPC2711TB-E3-A | C1G | 3K/reel |
| UPC2712TB-E3-A | C1H | 3K/reel |

Note: Embossed tape, 8 mm wide. Pins 1, 2, and 3 face perforated side of tape.

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

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DATA SUBJECT TO CHANGE WITHOUT NOTICE

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.