DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUITS

μPC2711TB, μPC2712TB

5 V, SUPER MINIMOLD SILICON MMIC WIDEBAND AMPLIFIER

DESCRIPTION

The μPC2711TB and μPC2712TB are silicon monolithic integrated circuits designed as buffer amplifier for DBS tuners. These ICs are packaged in super minimold package which is smaller than conventional minimold.

The μPC2711TB and μPC2712TB have each compatible pin connections and performance to μPC2711T/μPC2712T of conventional minimold version. So, in the case of reducing your system size, μPC2711TB/μPC2712TB are suitable to replace from μPC2711T/μPC2712T.

These ICs are manufactured using NEC's 20 GHz f_T NESAT™III silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials can protect chip surface from external pollution and prevent corrosion/migration. Thus, these IC have excellent performance, uniformity and reliability.

FEATURES

- High-density surface mounting : 6-pin super minimold package (2.0 × 1.25 × 0.9 mm)
- Supply voltage : V_{CC} = 4.5 to 5.5 V
- Wideband response : f_u = 2.9 GHz TYP. @μPC2711TB
  f_u = 2.6 GHz TYP. @μPC2712TB
- Power gain variation : G_P = 13 dB TYP. @μPC2711TB
  G_P = 20 dB TYP. @μPC2712TB

APPLICATIONS

- Local buffer in DBS tuners, etc. : μPC2711TB
- RF stage buffer in DBS tuners, etc. : μPC2712TB

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
μPC2711TB-E3	6-pin super minimold	C1G	Embossed tape 8 mm wide. 1, 2, 3 pins face the perforation side of the tape. Qty 3 kpcs/reel.
μPC2712TB-E3		C1H	

Remark To order evaluation samples, please contact your local NEC sales office (Part number for sample order: μPC2711TB, μPC2712TB).

Caution Electro-static sensitive devices

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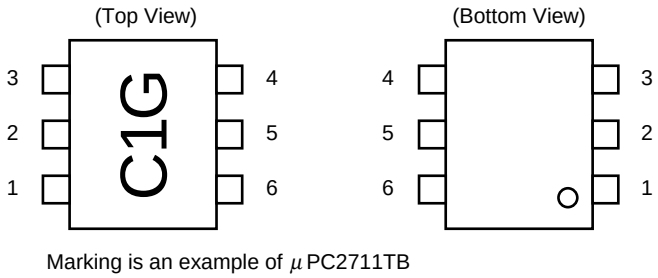
The mark ★ shows major revised points.

PIN CONNECTIONS



Marking is an example of μPC2711TB

Pin No.	Pin Name
1	INPUT
2	GND
3	GND
4	OUTPUT
5	GND
6	V_{CC}

★ PRODUCT LINE-UP OF 5V-BIAS SILICON MMIC WIDEBAND AMPLIFIERS (T_A = +25°C, V_{CC} = 5.0 V, Z_S = Z_L = 50 Ω)

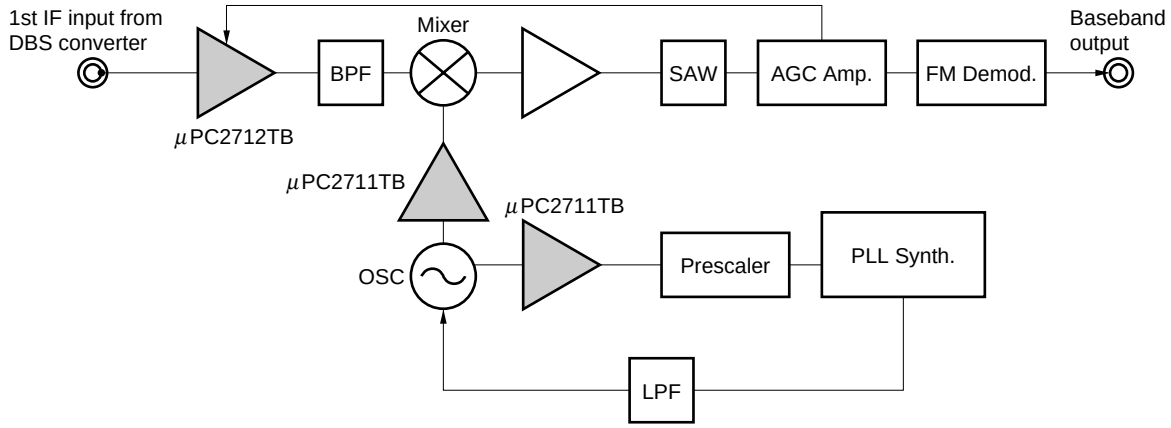
Part No.	f_u (GHz)	$P_{O(sat)}$ (dBm)	G_P (dB)	NF (dB)	I_{CC} (mA)	Package	Marking
μPC2711T	2.9	+1	13	5.0	12	6-pin minimold	C1G
μPC2711TB						6-pin super minimold	
μPC2712T	2.6	+3	20	4.5	12	6-pin minimold	C1H
μPC2712TB						6-pin super minimold	
μPC2713T	1.2	+7.0	29	3.2 @f = 0.5 GHz	12	6-pin minimold	C1J
μPC2791TB	1.9	+4.0	12	5.5 @f = 0.5 GHz	17	6-pin super minimold	C2S
μPC2792TB	1.2	+5.0	20	3.5 @f = 0.5 GHz	19		C2T
μPC3215TB	2.9	+3.5	20.5	2.3 @f = 1.5 GHz	14		C3H

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

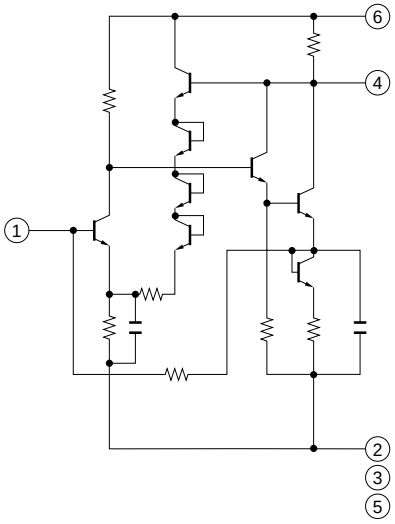
Caution The package size distinguish between minimold and super minimold.

SYSTEM APPLICATION EXAMPLE

RF unit block of DBS tuners



PIN EXPLANATIONS

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V)[Note]	Function and Applications	Internal Equivalent Circuit
1	INPUT	—	1.00 0.97	Signal input pin. A internal matching circuit, configured with resistors, enables 50 Ω connection over a wide band. A multi-feedback circuit is designed to cancel the deviations of h_{FE} and resistance. This pin must be coupled to signal source with capacitor for DC cut.	
4	OUTPUT	—	4.40 4.12	Signal output pin. A internal matching circuit, configured with resistors, enables 50 Ω connection over a wide band. This pin must be coupled to next stage with capacitor for DC cut.	
6	V_{CC}	4.5 to 5.5	—	Power supply pin. This pin should be externally equipped with 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 decrease impedance difference.	

Note Pin voltage is measured at V_{CC} = 5.0 V, Above: μPC2711TB, Below: μPC2712TB

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	6	V
Total Circuit Current	I_{CC}	T_A = +25°C	30	mA
★ Power Dissipation	P_D	Mounted on double sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB (T_A = +85°C)	270	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C
Input Power	P_{in}	T_A = +25°C	+10	dBm

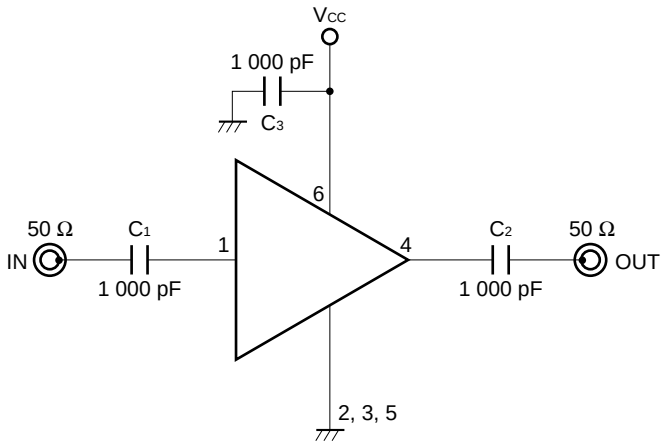
RECOMMENDED OPERATING RANGE

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

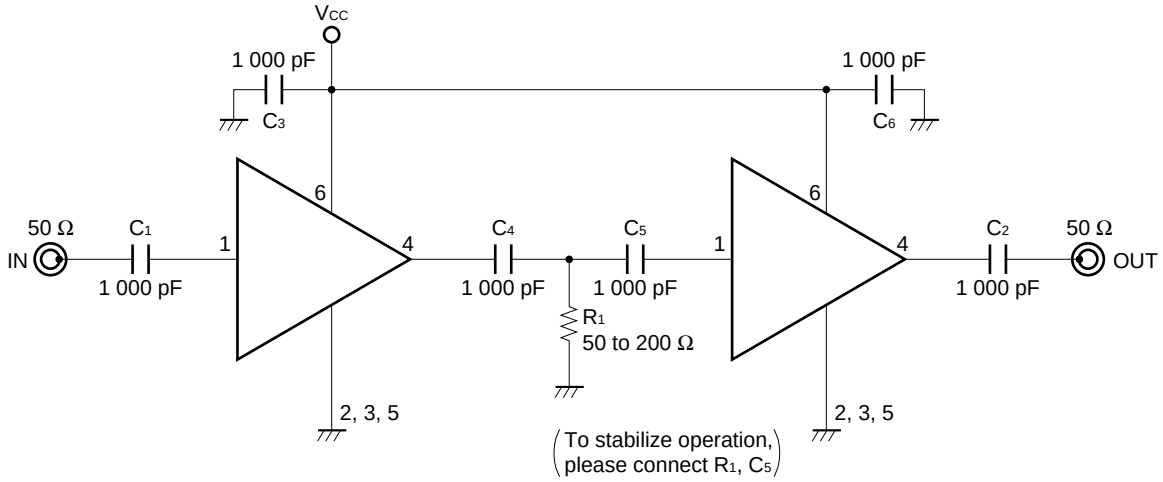
ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = 5.0 V, Z_S = Z_L = 50 Ω)

Parameter	Symbol	Test Conditions	μPC2711TB			μPC2712TB			Unit
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Circuit Current	I_{CC}	No signal	9	12	15	9	12	15	mA
Power Gain	G_P	f = 1 GHz	11	13	16.5	18	20	23.5	dB
Saturated Output Power	$P_{O(sat)}$	f = 1 GHz, P_{in} = 0 dBm	–2	+1	—	0	+3	—	dBm
Noise Figure	NF	f = 1 GHz	—	5	6.5	—	4.5	6	dB
Upper Limit Operating Frequency	f_u	3 dB down below from gain at f = 0.1 GHz	2.7	2.9	—	2.2	2.6	—	GHz
Isolation	ISL	f = 1 GHz	25	30	—	28	33	—	dB
Input Return Loss	RL_{in}	f = 1 GHz	20	25	—	9	12	—	dB
Output Return Loss	RL_{out}	f = 1 GHz	9	12	—	10	13	—	dB
★ Gain Flatness	ΔG_P	f = 0.1 to 2.5 GHz @μPC2711TB f = 0.1 to 2.0 GHz @μPC2712TB	—	±0.8	—	—	±0.8	—	dB

TEST CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT



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

CAPACITORS FOR V_{CC}, INPUT AND OUTPUT PINS

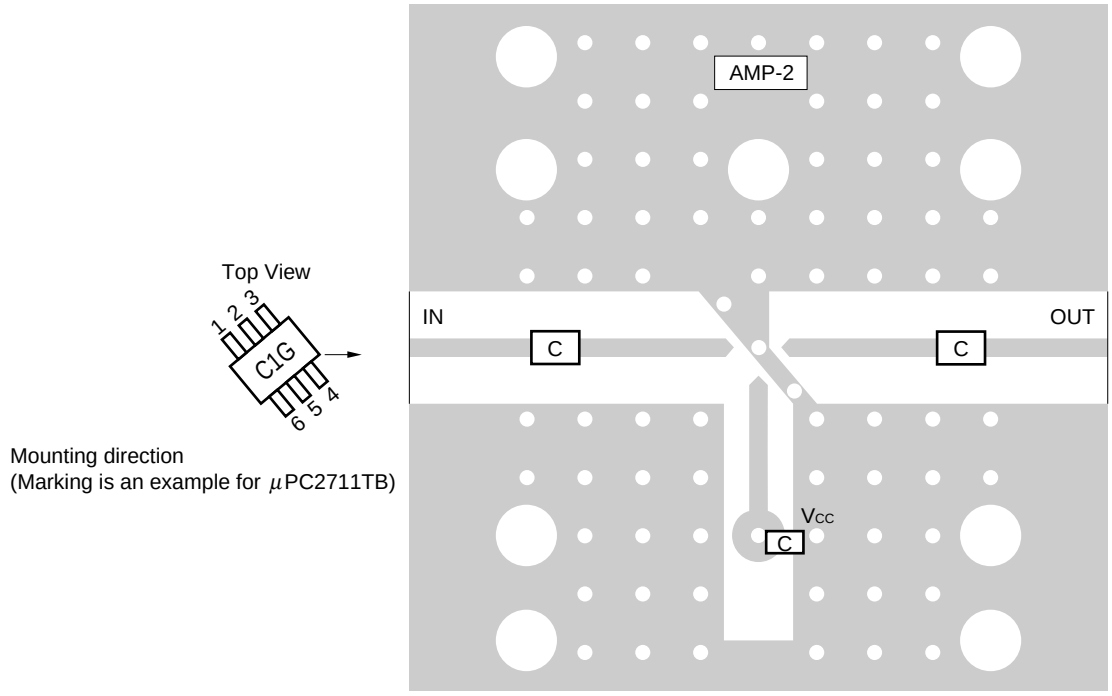
1 000 pF capacitors are recommendable as bypass capacitor for V_{CC} pin and coupling capacitors for input/output pins.

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

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

To get flat gain from 100 MHz up, 1 000 pF capacitors are assembled on the test circuit. [Actually, 1 000 pF capacitors give flat gain at least 10 MHz. In the case of under 10 MHz operation, increase the value of coupling capacitor such as 2 200 pF. Because the coupling capacitors are determined by the equation of $C = 1/(2 \pi fZs)$.]

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

	Value
C	1 000 pF

Notes

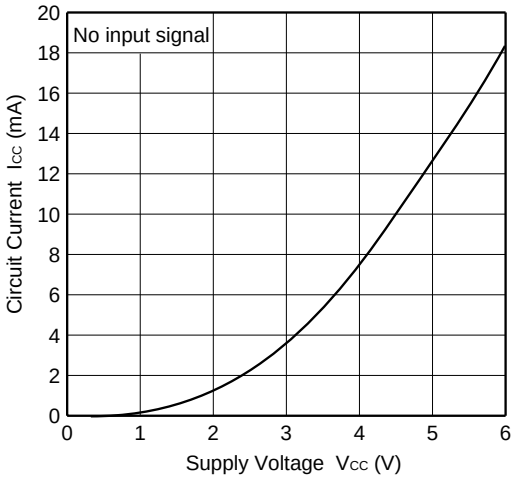
1. 30 × 30 × 0.4 mm double sided copper clad polyimide board.
2. Back side: GND pattern
3. Solder plated on pattern
4. ○◯: Through holes

For more information on the use of this IC, refer to the following application note: **USAGE AND APPLICATIONS OF 6-PIN MINI-MOLD, 6-PIN SUPER MINI-MOLD SILICON HIGH-FREQUENCY WIDEBAND AMPLIFIER MMIC** (P11976E).

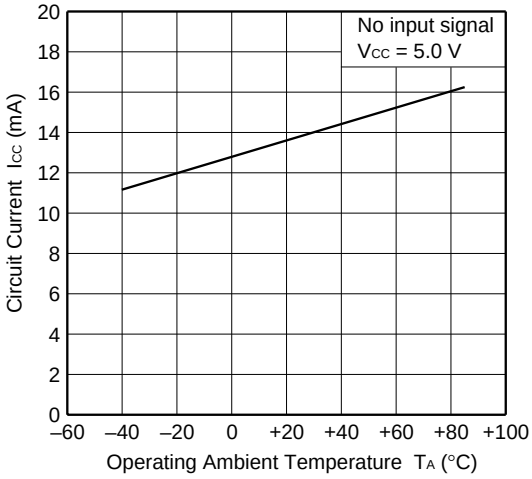
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

— μPC2711TB —

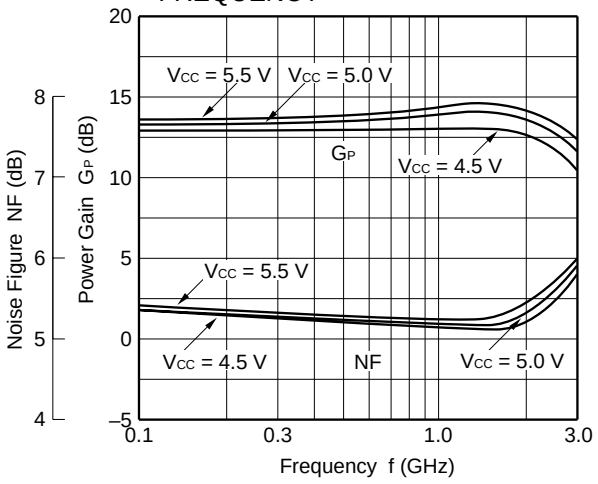
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



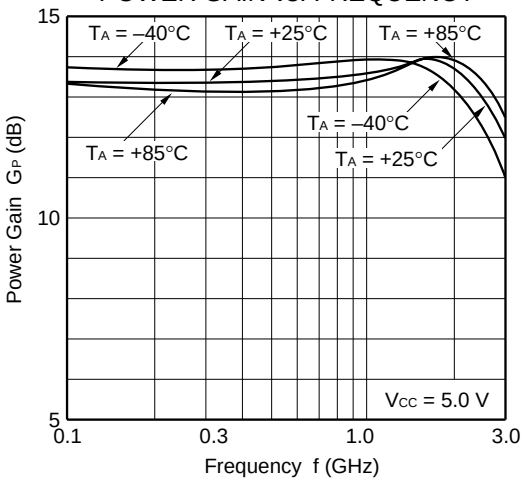
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



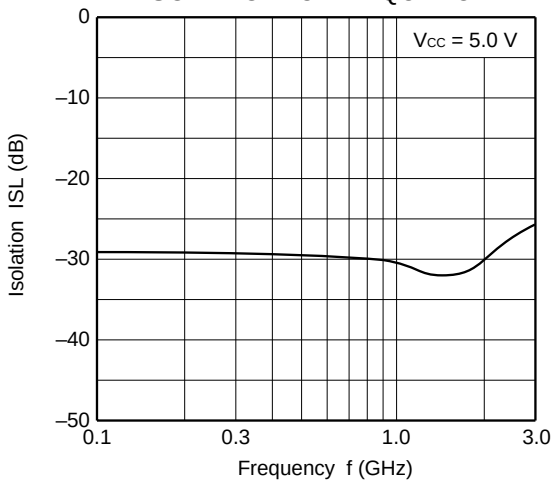
NOISE FIGURE, POWER GAIN vs. FREQUENCY



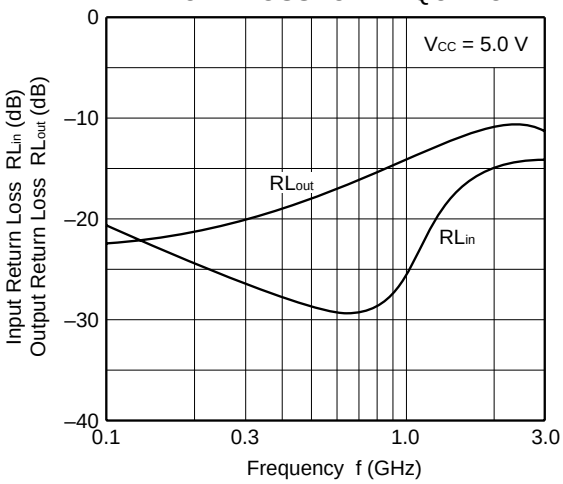
POWER GAIN vs. FREQUENCY



ISOLATION vs. FREQUENCY

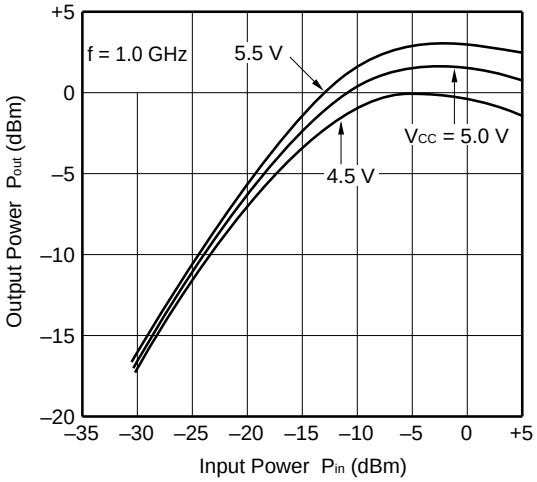


INPUT RETURN LOSS, OUTPUT RETURN LOSS vs. FREQUENCY

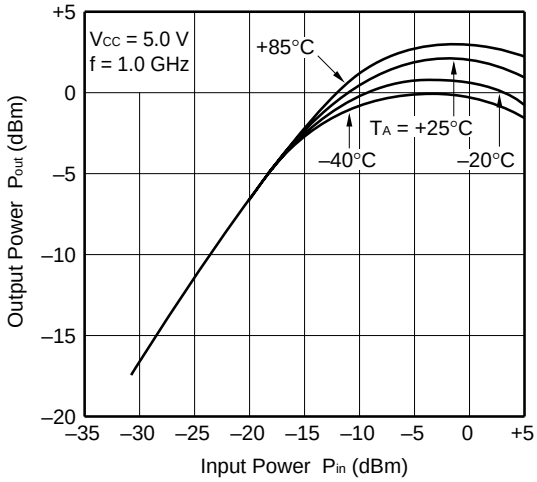


— μPC2711TB —

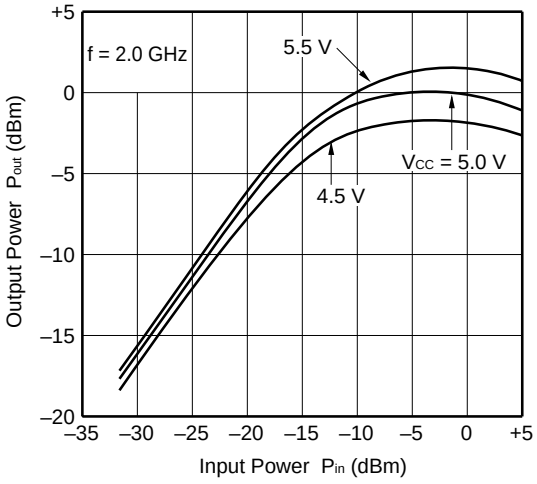
OUTPUT POWER vs. INPUT POWER



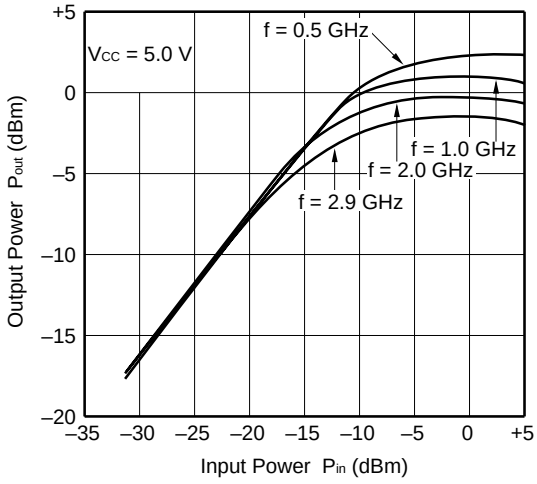
OUTPUT POWER vs. INPUT POWER



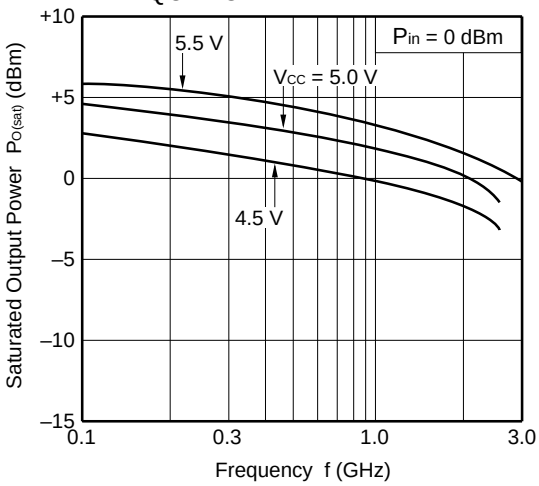
OUTPUT POWER vs. INPUT POWER



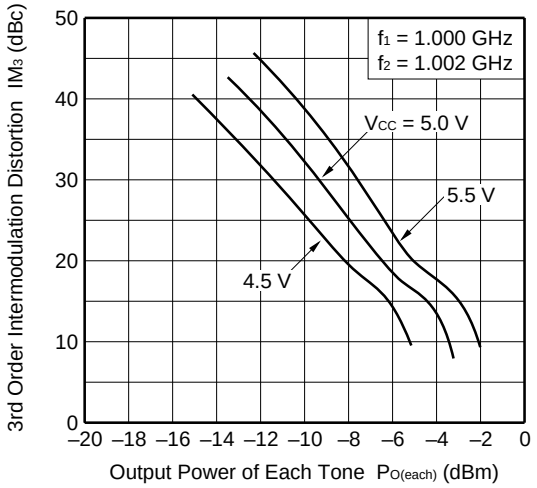
OUTPUT POWER vs. INPUT POWER



SATURATED OUTPUT POWER vs. FREQUENCY



3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE

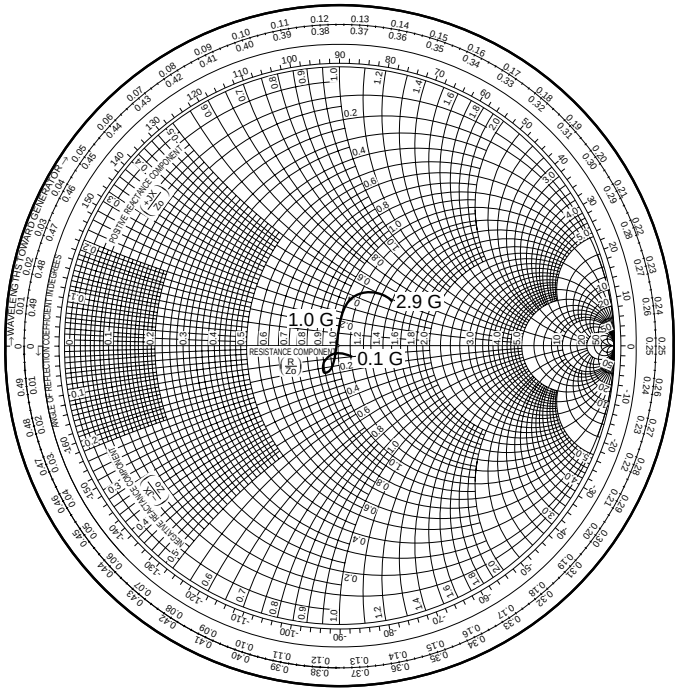


Remark The graphs indicate nominal characteristics.

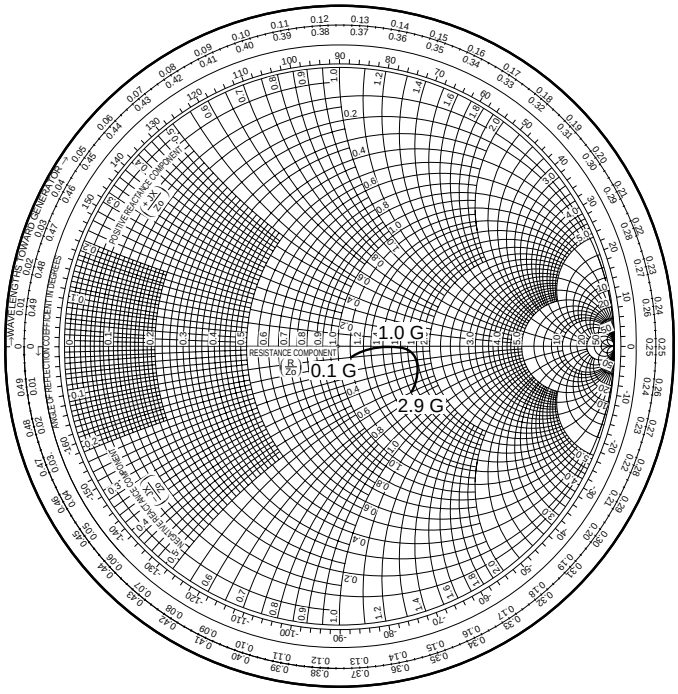
S-PARAMETERS (T_A = +25°C, V_{CC} = 5.0 V)

— μPC2711TB —

S_{11}-FREQUENCY



S_{22}-FREQUENCY



TYPICAL S-PARAMETER VALUES (T_A = +25°C)

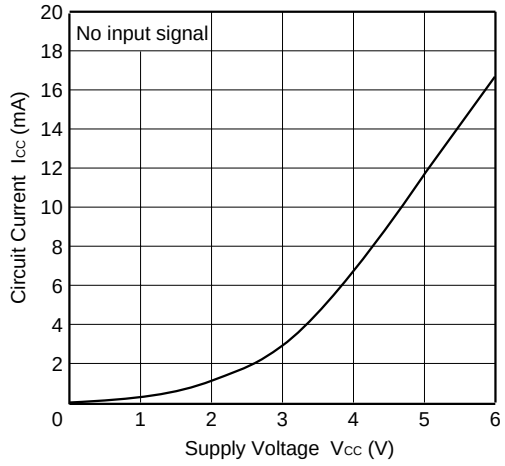
μPC2711TB
V_{CC} = 5.0 V, I_{CC} = 13.8 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
100.0000	0.085	–22.4	4.447	–14.9	0.035	–12.7	0.113	–3.1	3.18
200.0000	0.086	–25.0	4.468	–30.1	0.035	–23.0	0.119	1.2	3.21
300.0000	0.098	–29.2	4.491	–44.9	0.034	–32.1	0.136	1.6	3.23
400.0000	0.081	–29.4	4.510	–60.3	0.033	–42.5	0.142	6.5	3.34
500.0000	0.066	–33.9	4.540	–74.9	0.033	–50.1	0.156	10.1	3.32
600.0000	0.041	–54.5	4.572	–90.2	0.033	–59.6	0.161	12.7	3.34
700.0000	0.053	–104.3	4.624	–105.3	0.032	–69.3	0.161	8.8	3.33
800.0000	0.070	–119.7	4.664	–120.7	0.031	–78.4	0.176	6.2	3.36
900.0000	0.098	–121.9	4.729	–136.1	0.032	–86.6	0.192	1.9	3.27
1000.0000	0.101	–112.5	4.781	–152.0	0.031	–94.9	0.228	0.1	3.29
1100.0000	0.090	–108.5	4.843	–167.9	0.031	–103.9	0.256	–0.6	3.15
1200.0000	0.060	–95.6	4.945	175.8	0.029	–111.0	0.290	–1.1	3.24
1300.0000	0.019	–79.2	4.999	159.5	0.029	–120.2	0.308	–0.3	3.16
1400.0000	0.023	54.8	5.062	143.0	0.028	–128.9	0.322	–1.4	3.18
1500.0000	0.062	80.7	5.114	126.4	0.029	–133.1	0.327	–2.2	3.08
1600.0000	0.087	80.4	5.142	109.5	0.029	–140.9	0.333	–4.8	3.07
1700.0000	0.113	78.7	5.160	92.7	0.029	–146.2	0.344	–7.0	3.02
1800.0000	0.126	72.0	5.146	75.4	0.030	–151.4	0.356	–9.7	2.88
1900.0000	0.154	63.5	5.123	58.0	0.032	–159.7	0.371	–11.1	2.70
2000.0000	0.178	59.0	5.113	41.3	0.035	–168.3	0.378	–12.0	2.51
2100.0000	0.212	54.2	5.063	24.0	0.036	–175.7	0.383	–12.8	2.39
2200.0000	0.232	55.2	5.006	6.9	0.038	175.2	0.378	–13.6	2.27
2300.0000	0.246	53.8	4.954	–10.4	0.041	165.2	0.367	–16.1	2.13
2400.0000	0.248	53.6	4.865	–27.7	0.045	155.3	0.359	–18.0	1.99
2500.0000	0.240	49.2	4.783	–45.0	0.048	143.6	0.356	–21.1	1.88
2600.0000	0.238	43.7	4.664	–62.3	0.049	131.2	0.359	–23.6	1.85
2700.0000	0.240	36.2	4.529	–79.6	0.052	119.8	0.366	–26.2	1.76
2800.0000	0.262	31.7	4.384	–96.6	0.054	108.7	0.374	–28.6	1.72
2900.0000	0.285	28.8	4.255	–113.1	0.056	95.5	0.372	–31.1	1.68
3000.0000	0.316	29.7	4.117	–129.6	0.057	83.6	0.361	–35.0	1.69

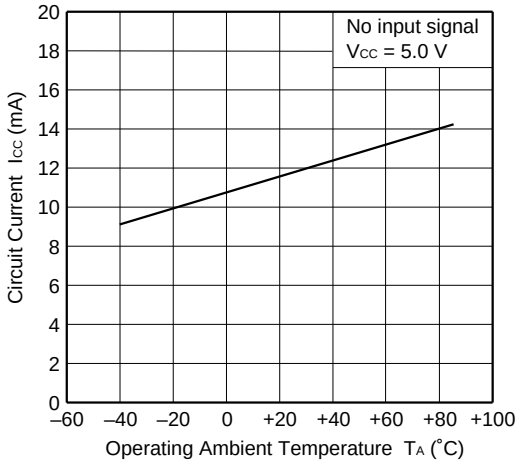
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

— μPC2712TB —

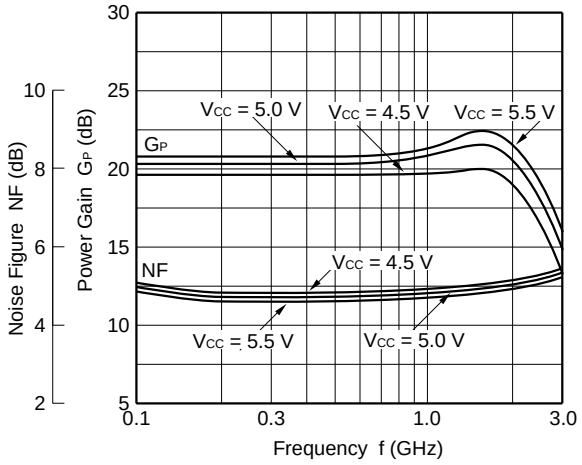
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



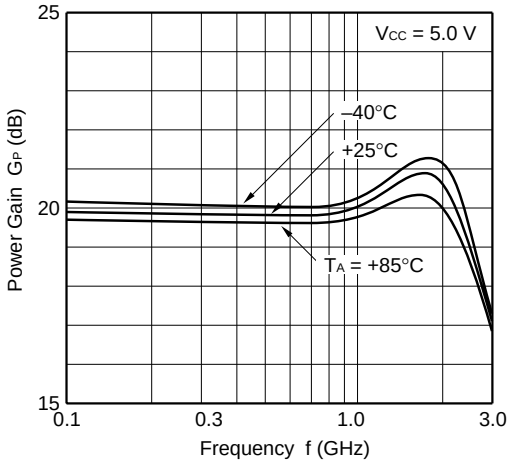
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



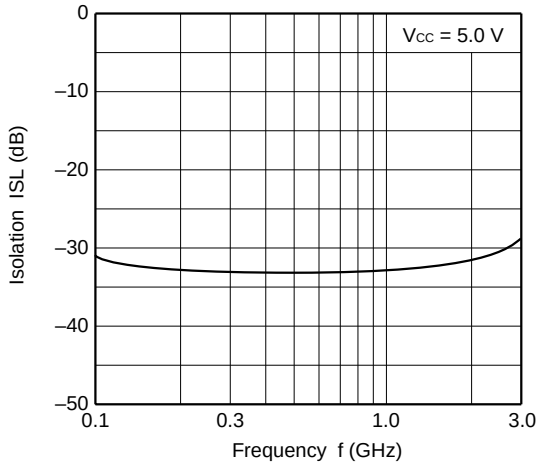
NOISE FIGURE, POWER GAIN vs. FREQUENCY



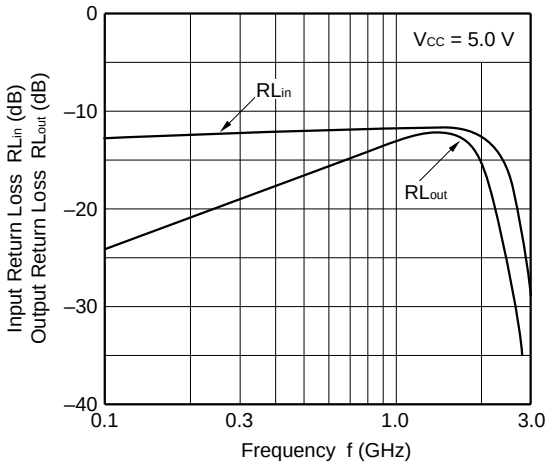
POWER GAIN vs. FREQUENCY



ISOLATION vs. FREQUENCY

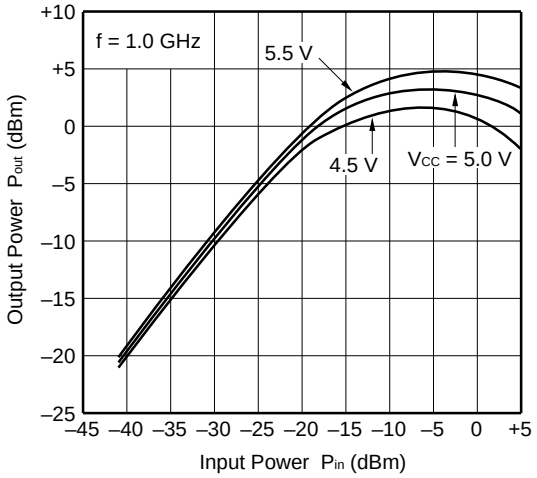


INPUT RETURN LOSS, OUTPUT RETURN LOSS vs. FREQUENCY

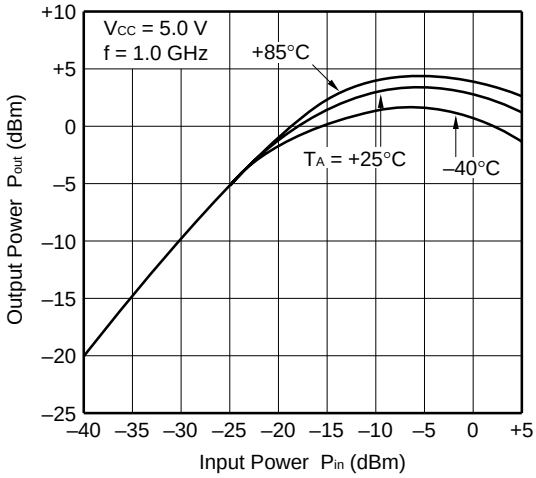


— μPC2712TB —

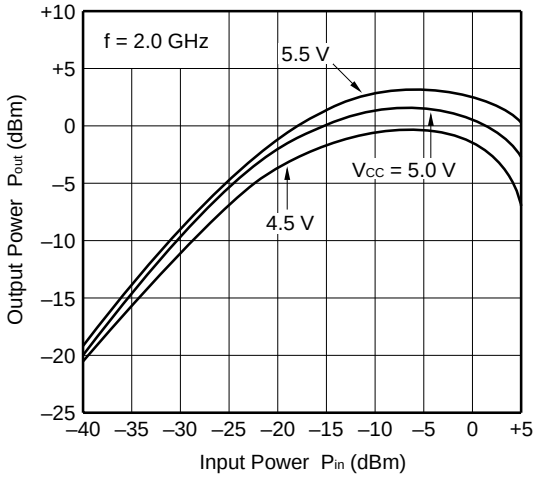
OUTPUT POWER vs. INPUT POWER



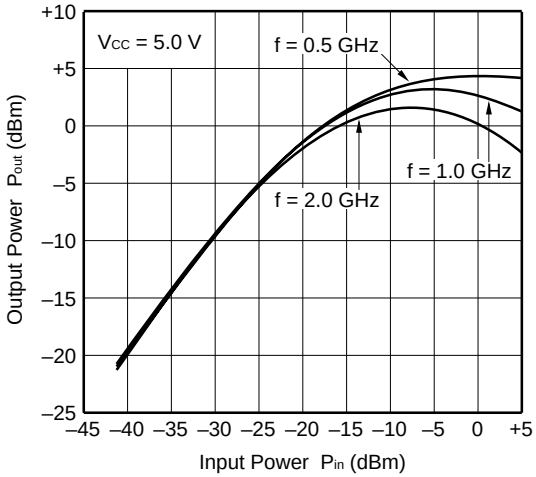
OUTPUT POWER vs. INPUT POWER



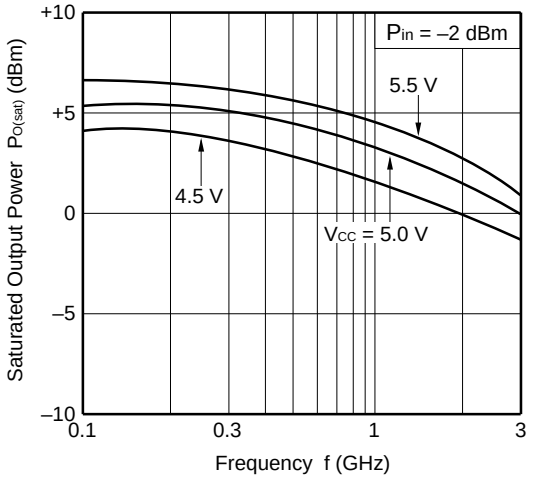
OUTPUT POWER vs. INPUT POWER



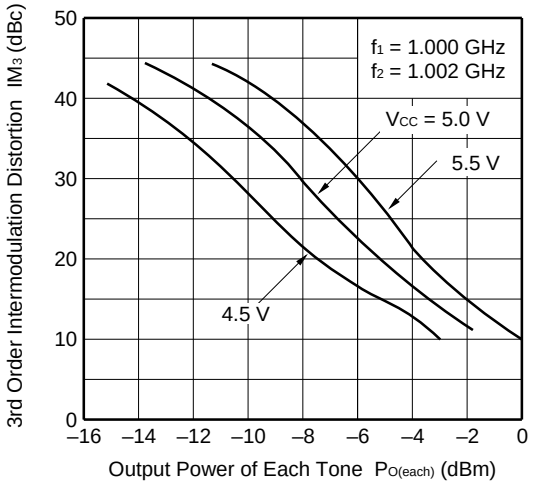
OUTPUT POWER vs. INPUT POWER



SATURATED OUTPUT POWER vs. FREQUENCY



3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE

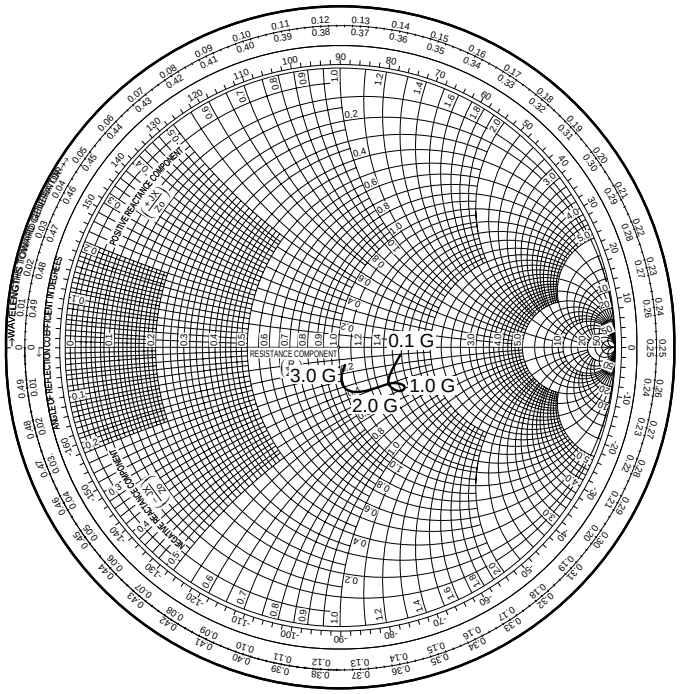


Remark The graphs indicate nominal characteristics.

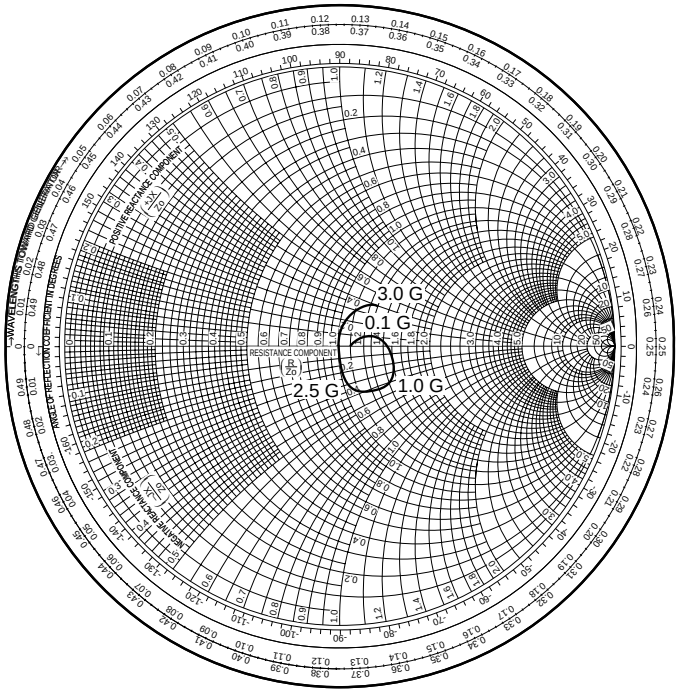
S-PARAMETERS (T_A = +25°C, V_{CC} = 5.0 V)

— μPC2712TB —

S_{11}-FREQUENCY



S_{22}-FREQUENCY



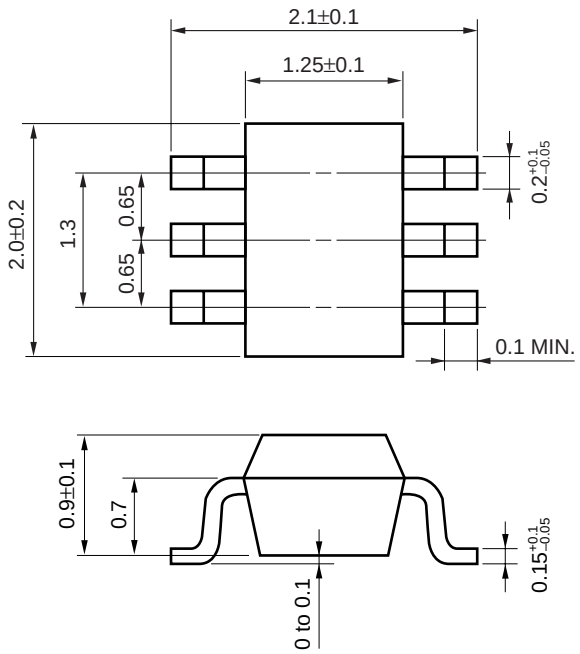
TYPICAL S-PARAMETER VALUES (T_A = +25°C)

μPC2712TB
V_{CC} = 5.0 V, I_{CC} = 13.9 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
100.0000	0.303	–8.1	8.864	–16.7	0.023	–11.4	0.043	2.3	2.32
200.0000	0.291	–10.1	8.827	–33.5	0.023	–19.2	0.055	11.5	2.35
300.0000	0.295	–11.8	8.936	–49.5	0.022	–25.5	0.078	8.5	2.38
400.0000	0.276	–11.3	9.044	–67.6	0.023	–34.6	0.095	13.4	2.33
500.0000	0.265	–11.0	9.051	–82.2	0.023	–42.8	0.112	13.6	2.37
600.0000	0.243	–12.3	9.096	–98.8	0.023	–50.0	0.120	11.1	2.35
700.0000	0.222	–20.3	9.089	–115.2	0.023	–59.8	0.120	1.7	2.37
800.0000	0.219	–25.4	9.080	–131.5	0.023	–66.2	0.136	–6.0	2.38
900.0000	0.230	–33.9	9.096	–147.6	0.023	–73.0	0.155	–14.4	2.39
1000.0000	0.267	–35.5	9.044	–164.2	0.024	–82.9	0.189	–17.5	2.26
1100.0000	0.290	–35.5	9.197	179.5	0.024	–89.5	0.212	–19.9	2.12
1200.0000	0.316	–33.2	9.421	162.4	0.024	–98.4	0.240	–21.4	2.02
1300.0000	0.317	–30.6	9.524	144.9	0.024	–107.0	0.245	–23.2	1.94
1400.0000	0.314	–29.4	9.512	126.6	0.026	–115.7	0.248	–27.1	1.82
1500.0000	0.296	–28.1	9.574	109.1	0.026	–122.3	0.236	–31.8	1.78
1600.0000	0.290	–29.4	9.598	91.1	0.027	–133.2	0.231	–38.0	1.74
1700.0000	0.278	–31.1	9.480	72.9	0.028	–139.4	0.221	–43.8	1.72
1800.0000	0.282	–34.9	9.372	54.3	0.029	–148.1	0.215	–49.8	1.69
1900.0000	0.284	–35.5	9.193	35.6	0.030	–157.6	0.199	–53.0	1.70
2000.0000	0.280	–36.6	9.198	18.4	0.031	–167.4	0.170	–55.3	1.69
2100.0000	0.273	–36.0	9.011	0.1	0.033	–175.1	0.134	–56.2	1.68
2200.0000	0.244	–38.2	8.784	–17.9	0.033	176.5	0.090	–55.2	1.74
2300.0000	0.222	–40.0	8.717	–35.1	0.034	164.8	0.050	–53.7	1.74
2400.0000	0.189	–45.7	8.388	–52.9	0.036	154.8	0.025	1.8	1.75
2500.0000	0.177	–52.9	8.217	–70.1	0.037	143.5	0.039	33.4	1.74
2600.0000	0.164	–57.4	7.890	–87.4	0.039	133.3	0.071	39.3	1.72
2700.0000	0.158	–59.6	7.597	–104.6	0.041	123.8	0.099	34.3	1.70
2800.0000	0.143	–53.9	7.313	–121.4	0.041	114.0	0.131	26.0	1.72
2900.0000	0.128	–44.3	7.078	–138.4	0.043	101.4	0.149	22.8	1.70
3000.0000	0.111	–22.2	6.806	–154.9	0.046	90.2	0.157	19.4	1.70

★ 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 wide as possible to minimize ground impedance (to prevent undesired oscillation). All the ground pins must be connected together with wide ground pattern to decrease impedance difference.

(3) The bypass capacitor should be attached to V_{CC} line.

(4) The DC cut capacitor must be each attached to input and output 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.

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared Reflow	Package peak temperature: 235°C or below Time: 30 seconds or less (at 210°C) Count: 3, Exposure limit[Note]: None	IR35-00-3
VPS	Package peak temperature: 215°C or below Time: 40 seconds or less (at 200°C) Count: 3, Exposure limit[Note]: None	VP15-00-3
Wave Soldering	Soldering bath temperature: 260°C or below Time: 10 seconds or less Count: 1, Exposure limit[Note]: None	WS60-00-1
Partial Heating	Pin temperature: 300°C Time: 3 seconds or less (per side of device) Exposure limit[Note]: None	–

Note After opening the dry pack, keep it in a place below 25°C and 65% RH for the allowable storage period.

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

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

[MEMO]

[MEMO]

[MEMO]

ATTENTION

OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

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  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
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