DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUITS
μPC2745TB, μPC2746TB

3 V, SUPER MINIMOLD SILICON MMIC WIDEBAND AMPLIFIER FOR MOBILE COMMUNICATIONS

DESCRIPTION

The μPC2745TB and μPC2746TB are silicon monolithic integrated circuits designed as buffer amplifier for mobile communications. These ICs are packaged in super minimold package which is smaller than conventional minimold.

The μPC2745TB and μPC2746TB have each compatible pin connections and performance to μPC2745T/μPC2746T of conventional minimold version. So, in the case of reducing your system size, μPC2745TB/μPC2746TB are suitable to replace from μPC2745T/μPC2746T.

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
- Supply voltage : Recommended V_{CC} = 2.7 to 3.3 V
  Circuit operation V_{CC} = 1.8 to 3.3 V
- Wideband response : f_u = 2.7 GHz TYP. @μPC2745TB
  f_u = 1.5 GHz TYP. @μPC2746TB
- High isolation : ISL = 38 dB TYP. @μPC2745TB
  ISL = 45 dB TYP. @μPC2746TB

APPLICATION

- 1.5 GHz to 2.5 GHz communication system (PHS, wireless LAN; etc.): μPC2745TB
- 800 MHz to 900 MHz cellular telephone (CT2, GSM, etc.) : μPC2746TB

ORDERING INFORMATION

PART NUMBER	PACKAGE	MARKING	SUPPLYING FORM	f_U
μPC2745TB-E3	6 pin super minimold	C1Q	Embossed tape 8 mm wide. 1, 2, 3 pins face to perforation side of the tape. Qty 3 kp/reel.	2.7 GHz TYP.
μPC2746TB-E3		C1R		1.5 GHz TYP.

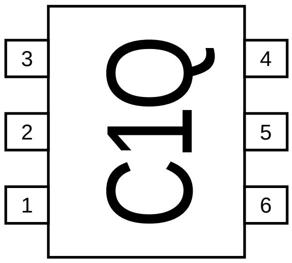
Remarks To order evaluation samples, please contact your local NEC sales office.
(Part number: μPC2745TB, μPC2746TB)

Caution: Electro-static sensitive devices

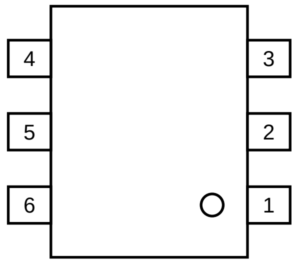
Document No. P11511EJ2V0DS00 (2nd edition)
Date Published April 1997 N

PIN CONNECTIONS

(Top View)



(Bottom View)



Marking is an example of μPC2745TB

Pin NO.	Pin name
1	INPUT
2	GND
3	GND
4	OUTPUT
5	GND
6	V_{CC}

PRODUCT LINE-UP OF μPC2745, μPC2746 (T_A = +25 °C, V_{CC} = 3.0 V, Z_L = Z_S = 50 Ω)

PART NO.	f_u (GHz)	$P_{O(sat)}$ (dBm)	G_P (dB)	NF (dB)	I_{CC} (mA)	PACKAGE	MARKING
μPC2745T	2.7	−1	12	6.0	7.5	6 pin minimold	C1Q
μPC2745TB						6 pin super minimold	
μPC2746T	1.5	0	19	4.0	7.5	6 pin minimold	C1R
μPC2746TB						6 pin super minimold	

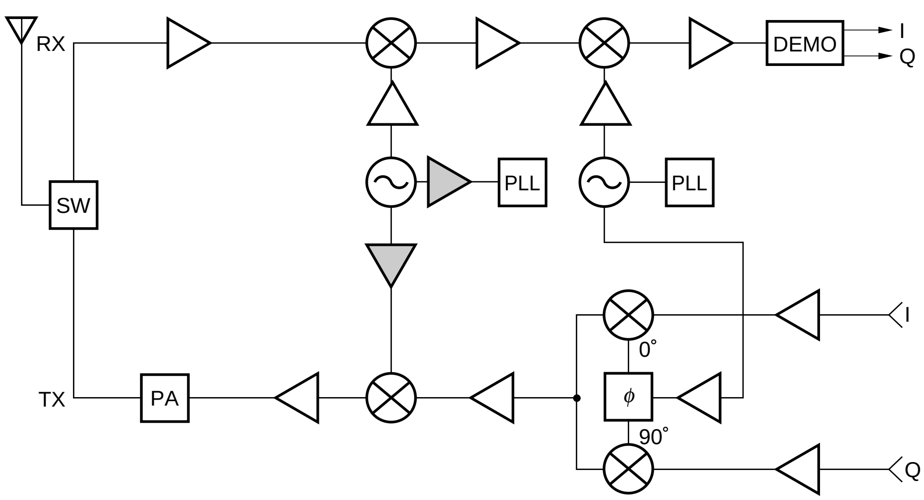
Remarks Typical performance. Please refer to ELECTRICAL CHARACTERISTICS in detail.

Notice The package size distinguish between minimold and super minimold.

SYSTEM APPLICATION EXAMPLE

Digital Cellular System Block Diagram

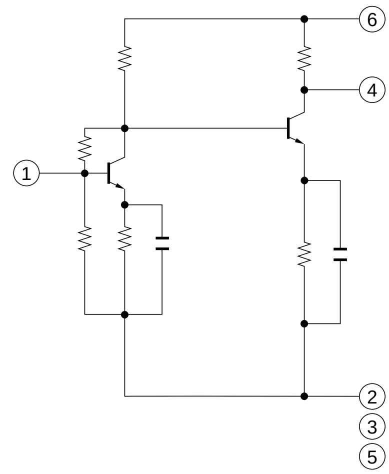
Digital Cellular System Block Diagram



▷: μPC2745TB, μPC2746TB applicable

To know the associated products, please refer to each latest data sheet.

PIN EXPLANATION

Pin NO.	Pin Name	Applied voltage V	Pin voltage V[Note]	Function and applications	Internal equivalent circuit
1	INPUT	—	0.87 0.82	Signal input pin. A internal matching circuit, configured with resistors, enables 50 Ω connection over a wide band. this pin must be coupled to signal source with capacitor for DC cut.	
4	OUTPUT	—	1.95 2.54	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}	2.7 to 3.3	—	Power supply pin. This pin should be externally equipped with bypass capacity 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} = 3.0 V. Above: μPC2745TB, Below: μPC2746TB

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	CONDITION	RATINGS	UNIT
Supply voltage	V_{CC}	T_A = +25 °C	4.0	V
Circuit current	I_{CC}	T_A = +25 °C	16	mA
Input power level	P_{in}	T_A = +25 °C	0	dBm
Total power dissipation	P_D	Mounted on double sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB (T_A = +85 °C)	200	mW
Operating ambient temperature	T_A		−40 to +85	°C
Storage temperature	T_{STG}		−55 to +150	°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTICE
Supply voltage	V_{CC}	2.7	3.0	3.3	V	
Operating ambient temperature	T_A	−40	+25	+85	°C	

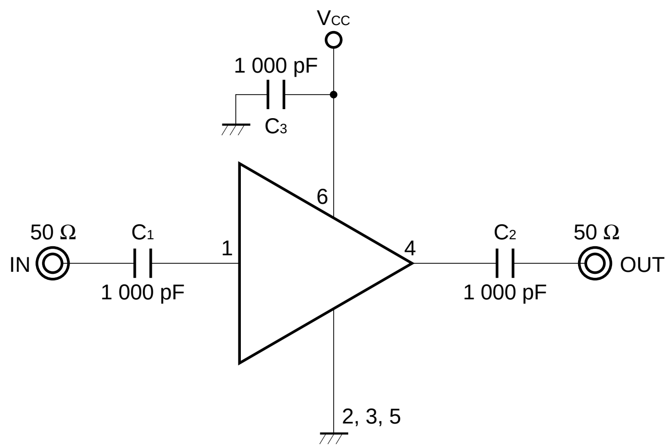
ELECTRICAL CHARACTERISTICS (T_A = + 25 °C, V_{CC} = 3.0 V, $Z_L = Z_S$ = 50 Ω)

PARAMETER	SYMBOL	TEST CONDITION	μPC2745TB			μPC2746TB			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Circuit current	I_{CC}	No signals	5.0	7.5	10.0	5.0	7.5	10.0	mA
Power Gain	G_P	f = 0.5 GHz	9.0	12	14	16	19	21	dB
Noise figure	NF	f = 0.5 GHz	—	6	7.5	—	4.0	5.5	dB
Upper limit operating frequency	f_u	3 dB down below from gain at f = 100 MHz	2.3	2.7	—	1.1	1.5	—	GHz
Isolation	ISL	f = 0.5 GHz	33	38	—	40	45	—	dB
Input return loss	RL_{in}	f = 0.5 GHz	8	11	—	10	13	—	dB
Output return loss	RL_{out}	f = 0.5 GHz	2.5	5.5	—	5.5	8.5	—	dB
Maximum output level	$P_{O(sat)}$	f = 0.5 GHz, Pin = −6 dBm	−4	−1	—	−3	0	—	dBm

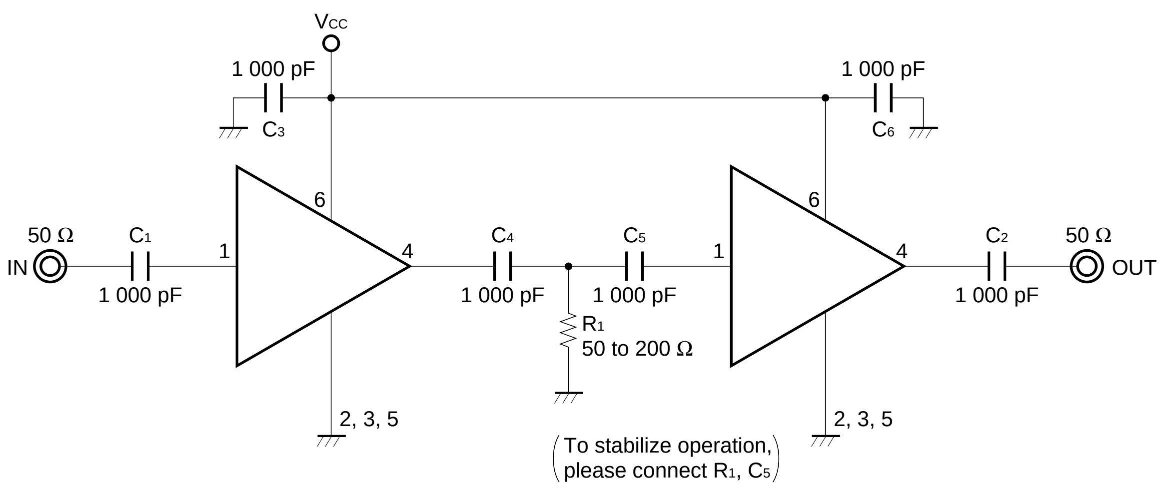
STANDARD CHARACTERISTICS FOR REFERENCE (T_A = +25 °C, V_{CC} = 3.0 V, Z_L = Z_S = 50 Ω)

PARAMETER	SYMBOL	TEST CONDITION	μPC2745TB	μPC2745B	UNIT
Circuit current	I_{CC}	V_{CC} = 1.8 V, No signals	4.5	4.5	mA
Power Gain	G_P	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 3.0 V, f = 2 GHz V_{CC} = 1.8 V, f = 500 MHz	12 11 7	18.5 — 14	dB
Noise figure	NF	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 3.0 V, f = 2 GHz V_{CC} = 1.8 V, f = 500 MHz	5.5 5.7 8.0	4.2 — 5.0	dB
Upper limit operating frequency	f_u	V_{CC} = 1.8 V, 3 dB down below from gain at f = 100 MHz	1.8	1.1	GHz
Isolation	ISL	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 3.0 V, f = 2 GHz V_{CC} = 1.8 V, f = 500 MHz	33 30 35	38 — 37	dB
Input return loss	RL_{in}	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 3.0 V, f = 2 GHz V_{CC} = 1.8 V, f = 500 MHz	13 14 6.5	10 — 10	dB
Output return loss	RL_{out}	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 3.0 V, f = 2 GHz V_{CC} = 1.8 V, f = 500 MHz	6.5 8.5 6.0	8.5 — 9.5	dB
Maximum output level	$P_{O(sat)}$	V_{CC} = 3.0 V, f = 1 GHz, Pin = −6 dBm V_{CC} = 3.0 V, f = 2 GHz, Pin = −6 dBm V_{CC} = 1.8 V, f = 500 MHz, Pin = −10 dBm	−2.5 −3.5 −11	−1 — −8	dBm
3rd order intermodulation distortion	IM_3	V_{CC} = 3.0 V, Pout = −20 dBm, f1 = 500 MHz, f2 = 502 MHz V_{CC} = 3.0 V, Pout = −20 dBm, f1 = 1 000 MHz, f2 = 1 002 MHz V_{CC} = 1.8 V, Pout = −20 dBm, f1 = 500 MHz, f2 = 502 MHz	−54 −50 −31	−51 — −37	dBc

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-in's.

Capacitors for V_{CC}, input and output pins

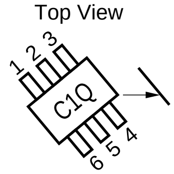
1 000 pF capacitors are recommendable as bypass capacitor for V_{CC} pin and coupling capacitors for input/output pins.

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.

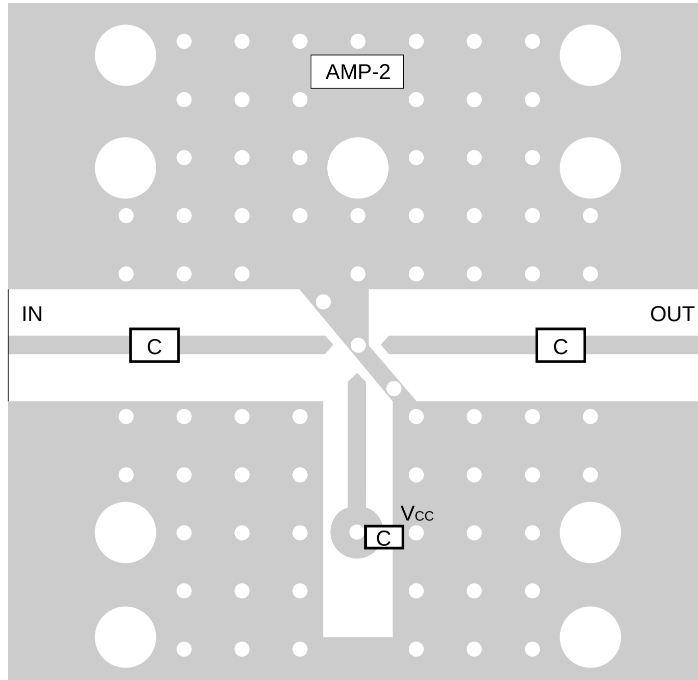
Coupling capacitors for input/output pins are intended to minimize RF serial impedance and cut DC.

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



Mounting direction
(Marking is an example for μPC2745TB)



Component List

	Value
C	1 000 pF

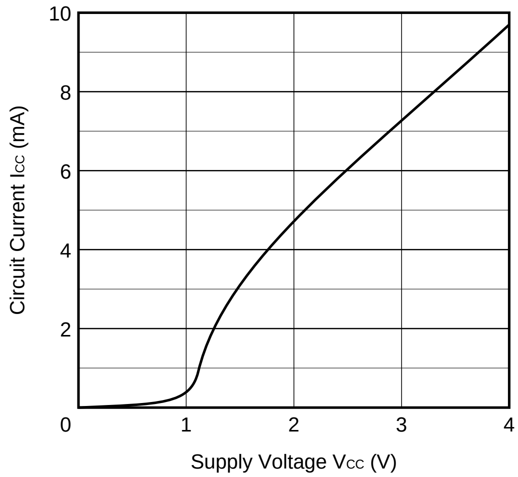
Notes

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

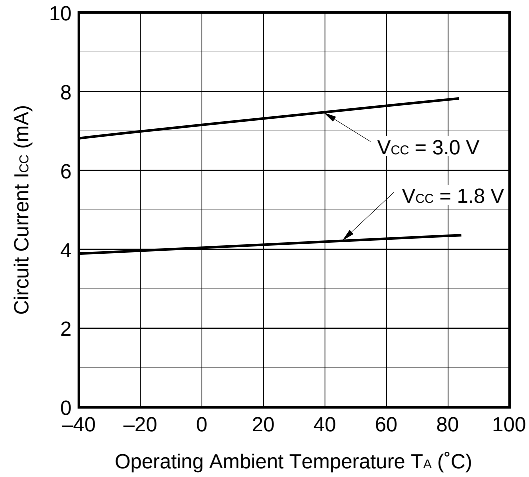
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25 °C)

— μPC2745TB —

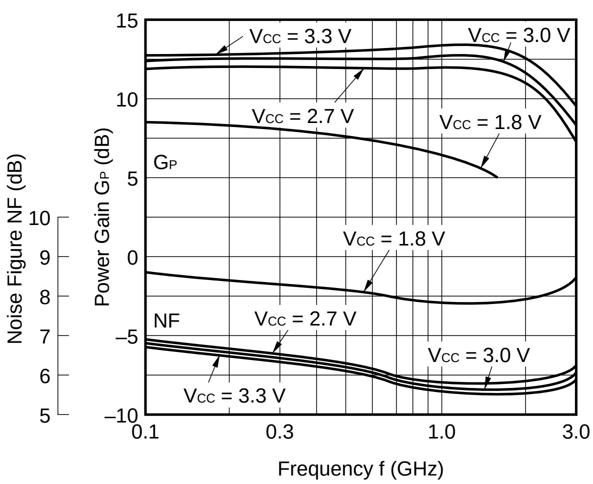
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



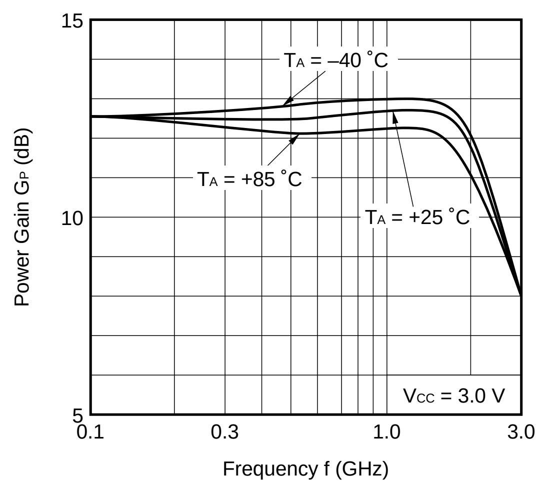
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



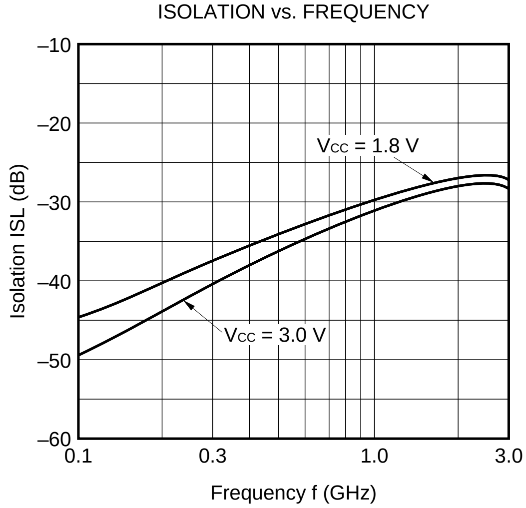
NOISE FIGURE, POWER GAIN vs. FREQUENCY



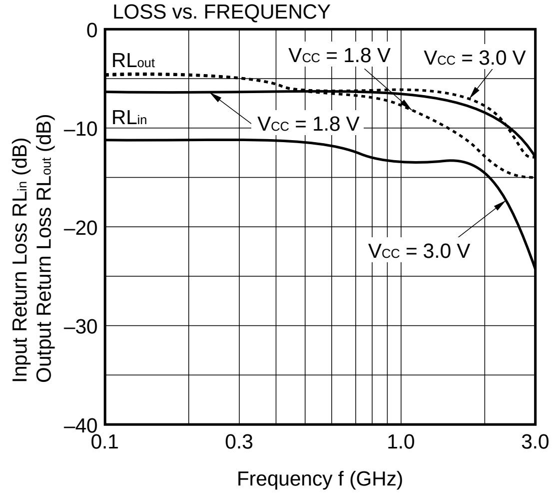
POWER GAIN vs. FREQUENCY



ISOLATION vs. FREQUENCY

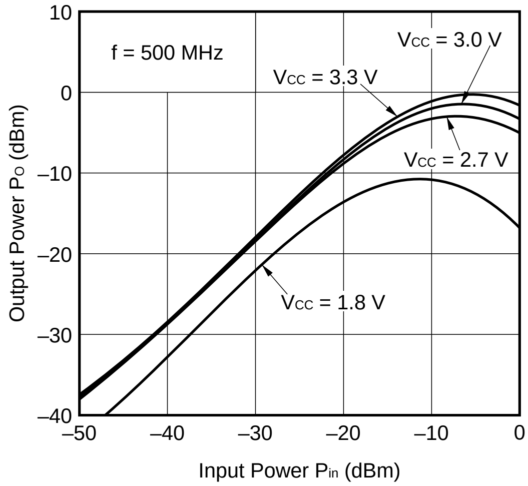


INPUT RETURN LOSS, OUTPUT RETURN LOSS vs. FREQUENCY

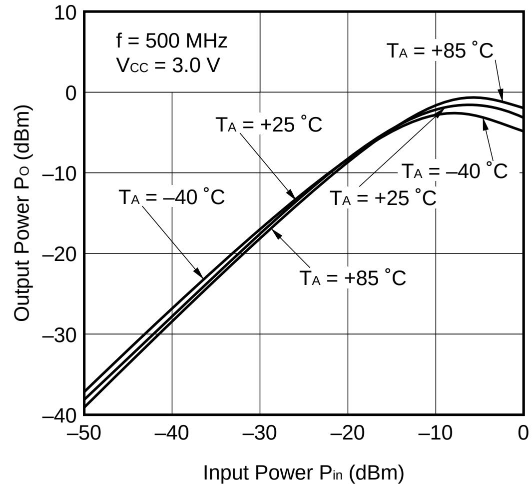


— μPC2745TB —

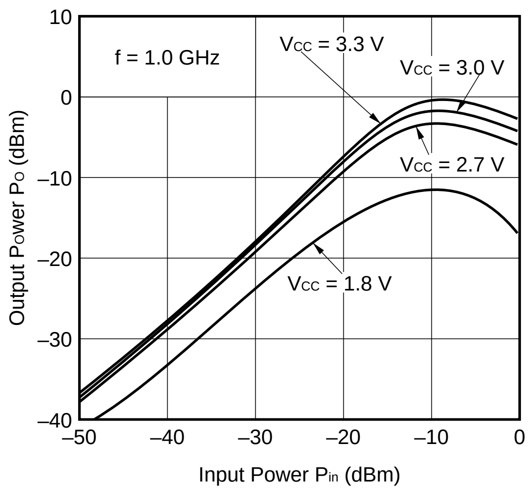
OUTPUT POWER vs. INPUT POWER



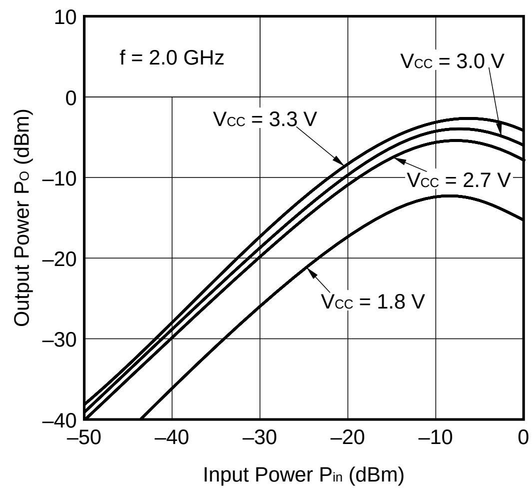
OUTPUT POWER vs. INPUT POWER



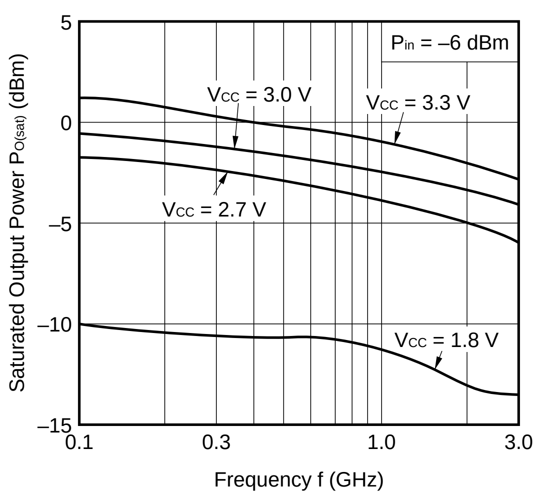
OUTPUT POWER vs. INPUT POWER



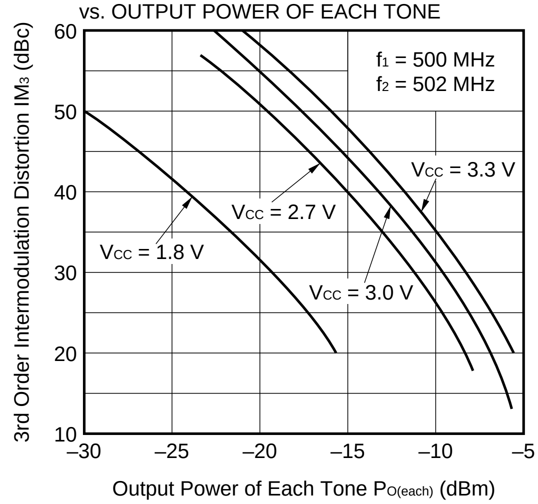
OUTPUT POWER vs. INPUT POWER



SATURATED OUTPUT POWER vs. FREQUENCY



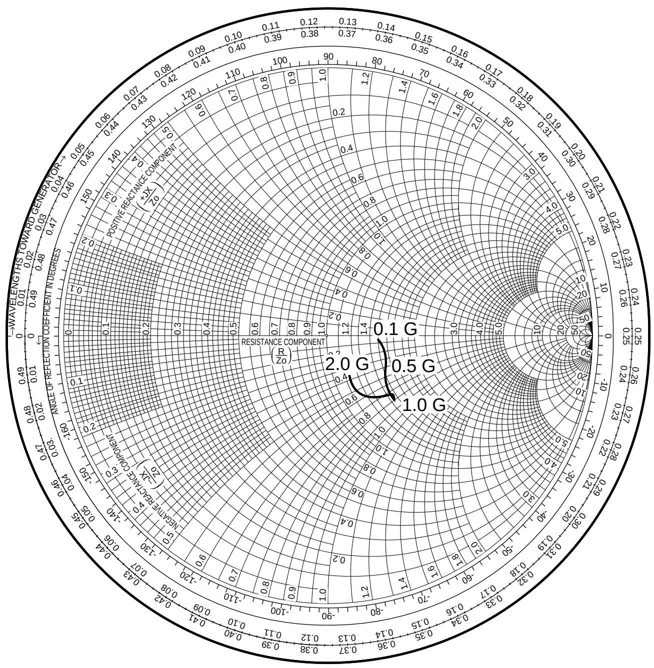
3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE



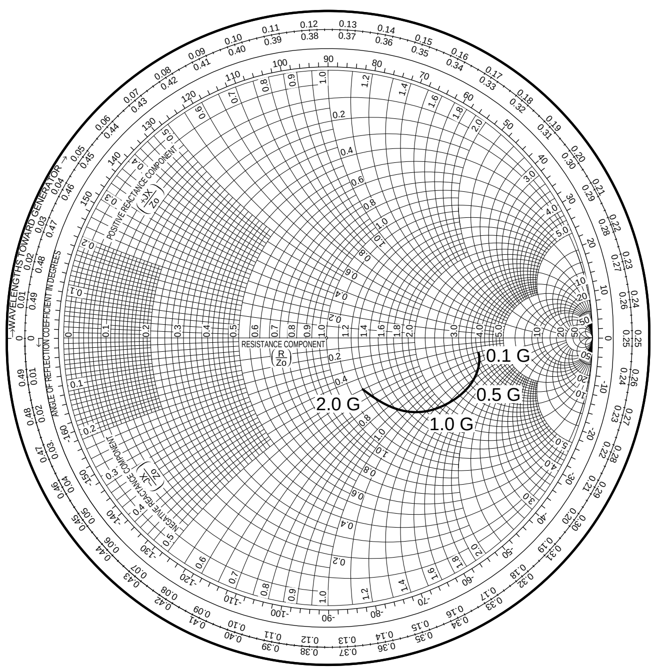
S Parameter (Vcc = 3.0 V)

— μPC2745TB —

S11-FREQUENCY



S22-FREQUENCY



Typical S Parameter Values (T_A = +25 °C)

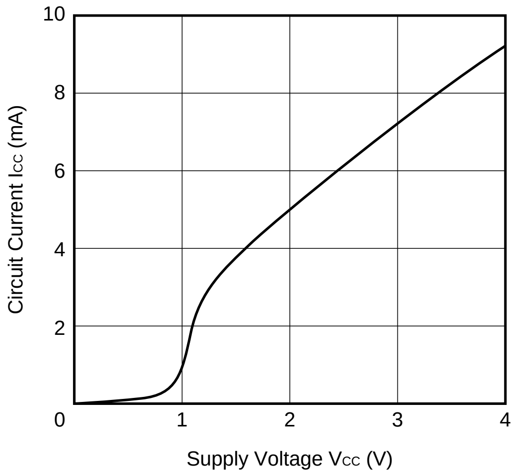
μPC2745TB
V_{CC} = 3.0 V, I_{CC} = 8.4 mA

FREQUENCY	S11		S21		S12		S22		K
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.0000	.318	−3.9	4.055	−17.2	.003	62.9	.593	−6.6	20.94
200.0000	.325	−5.9	4.030	−35.5	.006	54.2	.584	−12.1	11.68
300.0000	.346	−7.2	3.985	−52.5	.009	42.0	.579	−16.5	8.29
400.0000	.341	−8.9	3.916	−70.7	.012	29.4	.562	−20.6	6.26
500.0000	.339	−10.8	3.842	−87.3	.013	11.8	.546	−23.0	6.29
600.0000	.326	−13.9	3.775	−104.7	.015	1.6	.527	−26.2	5.50
700.0000	.311	−20.8	3.668	−121.5	.017	−11.9	.515	−29.9	5.46
800.0000	.312	−25.8	3.594	−138.1	.018	−24.2	.511	−32.4	5.36
900.0000	.325	−31.9	3.525	−154.2	.020	−38.4	.512	−34.8	4.91
1000.0000	.356	−32.8	3.497	−170.3	.019	−45.9	.523	−35.8	4.93
1100.0000	.382	−32.7	3.503	173.7	.020	−54.3	.525	−36.3	4.56
1200.0000	.416	−31.2	3.542	156.7	.022	−70.5	.530	−36.8	4.14
1300.0000	.416	−30.9	3.569	139.1	.023	−78.4	.518	−37.5	3.92
1400.0000	.415	−30.8	3.520	121.4	.025	−88.4	.509	−38.8	3.53
1500.0000	.393	−30.3	3.501	103.7	.025	−102.9	.492	−40.5	3.68
1600.0000	.386	−31.3	3.429	86.8	.025	−114.1	.481	−42.5	3.78
1700.0000	.373	−30.5	3.355	69.7	.026	−125.7	.474	−43.8	3.68
1800.0000	.369	−31.6	3.303	52.7	.028	−130.3	.468	−44.8	3.50
1900.0000	.366	−29.6	3.229	35.8	.028	−142.5	.457	−44.8	3.63
2000.0000	.353	−30.0	3.179	18.8	.030	−152.4	.440	−45.0	3.62
2100.0000	.344	−28.6	3.081	1.5	.031	−164.9	.416	−45.0	3.85
2200.0000	.313	−29.5	2.999	−15.4	.031	−177.1	.389	−45.4	4.23
2300.0000	.293	−31.6	2.911	−32.5	.033	171.1	.365	−46.4	4.23
2400.0000	.267	−35.1	2.802	−49.4	.034	160.8	.346	−47.4	4.40
2500.0000	.262	−39.9	2.695	−66.0	.036	148.3	.331	−48.2	4.45
2600.0000	.253	−40.3	2.598	−82.3	.036	134.8	.321	−48.3	4.54
2700.0000	.253	−40.9	2.496	−98.6	.034	121.4	.311	−47.6	5.08
2800.0000	.248	−35.5	2.400	−114.6	.036	106.5	.299	−46.7	5.01
2900.0000	.237	−30.2	2.306	−130.2	.032	92.8	.279	−46.3	5.88
3000.0000	.230	−20.6	2.209	−146.4	.031	83.6	.254	−46.2	6.49

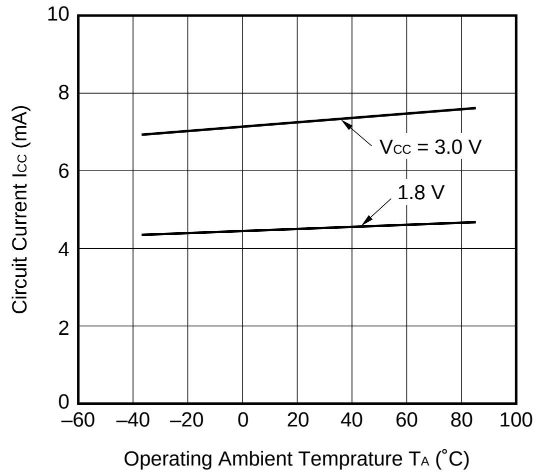
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25 °C)

— μPC2746TB —

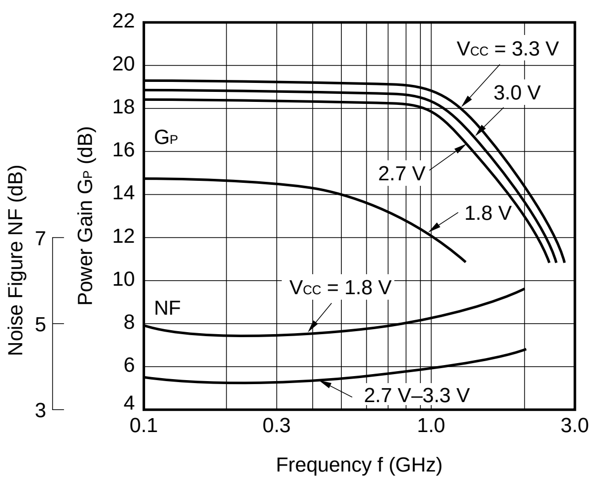
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



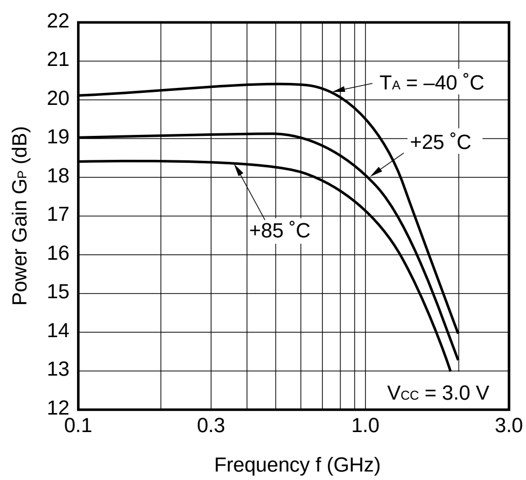
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



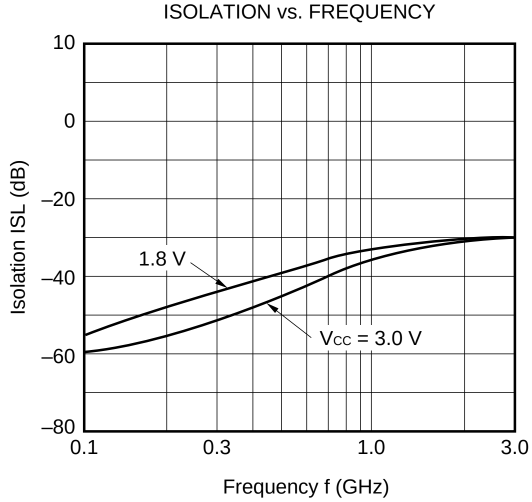
NOISE FIGURE, POWER GAIN vs. FREQUENCY



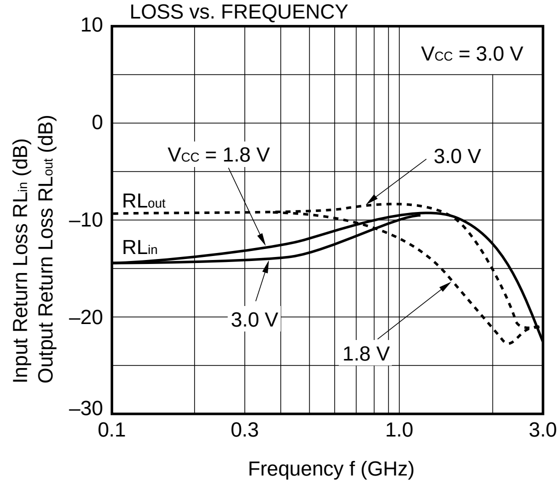
POWER GAIN vs. FREQUENCY



ISOLATION vs. FREQUENCY

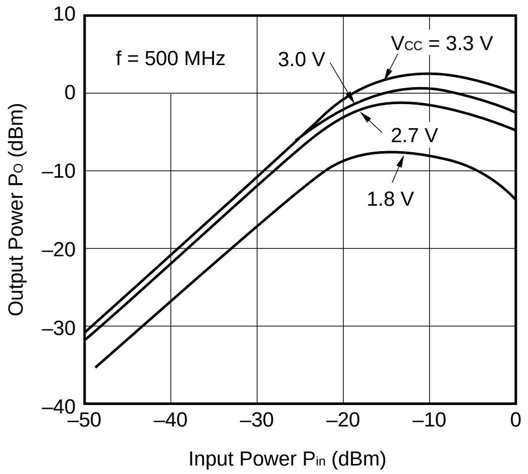


INPUT RETURN LOSS, OUTPUT RETURN LOSS vs. FREQUENCY

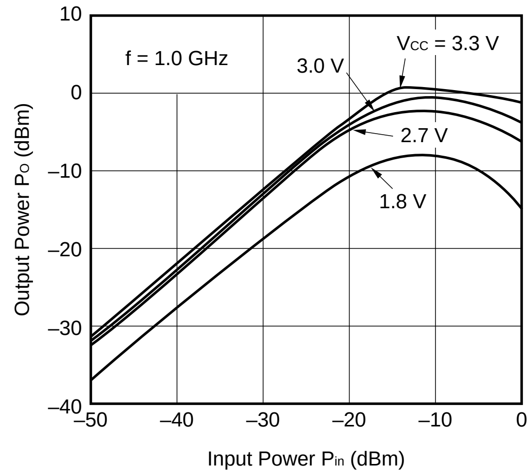


— μPC2746TB —

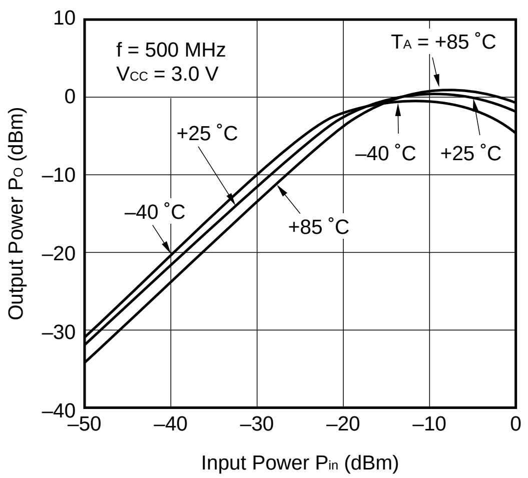
OUTPUT POWER vs. INPUT POWER



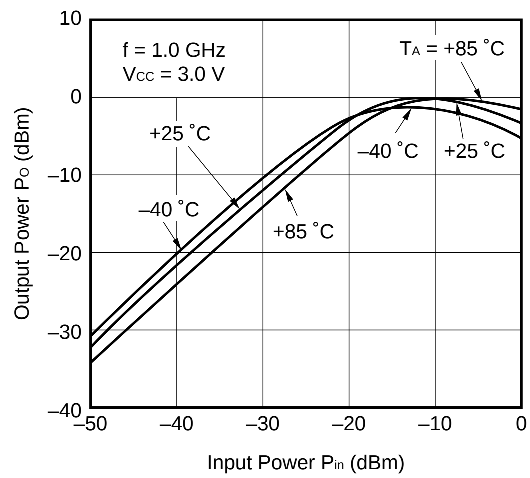
OUTPUT POWER vs. INPUT POWER



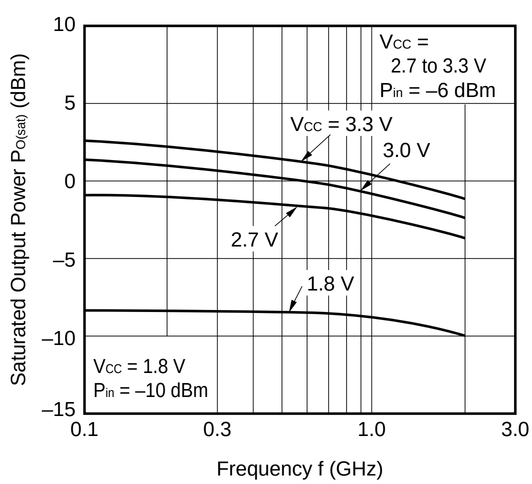
OUTPUT POWER vs. INPUT POWER



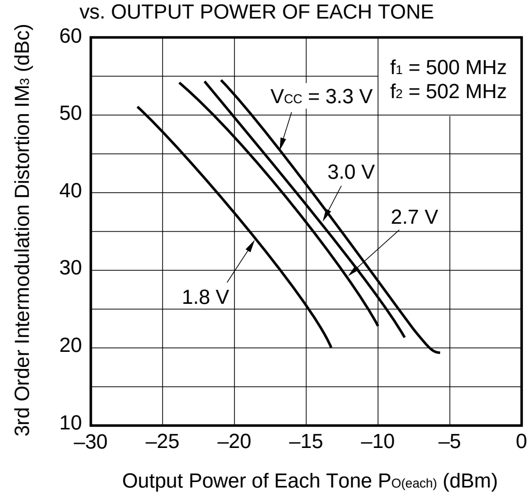
OUTPUT POWER vs. INPUT POWER



SATURATED OUTPUT POWER vs. FREQUENCY



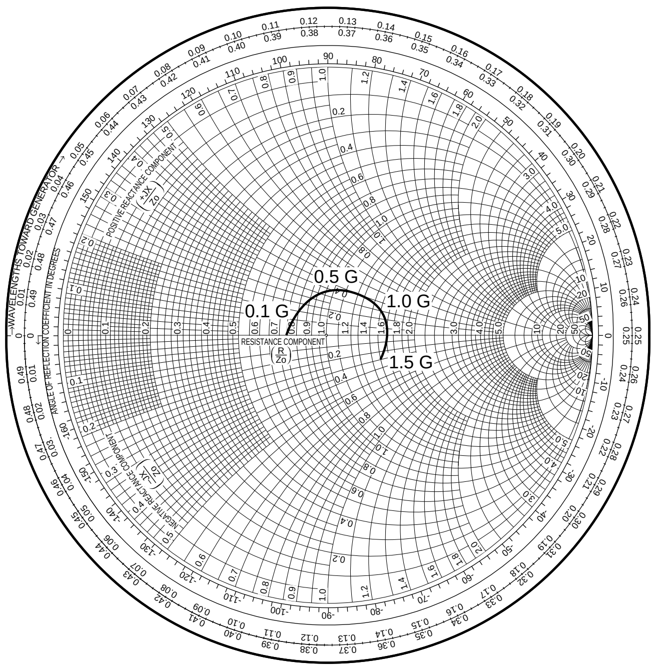
3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE



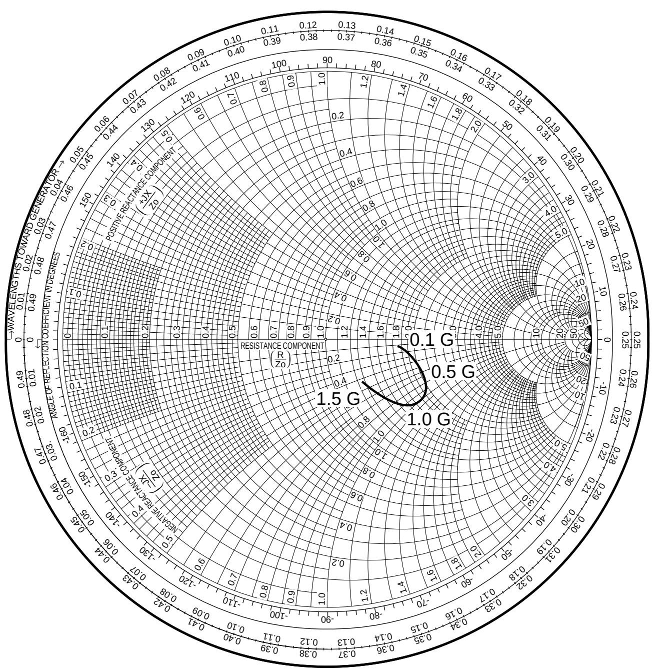
S Parameter (VCC = 3.0 V)

— μPC2746TB —

S11-FREQUENCY



S22-FREQUENCY



Typical S Parameter Values (T_A = +25 °C)

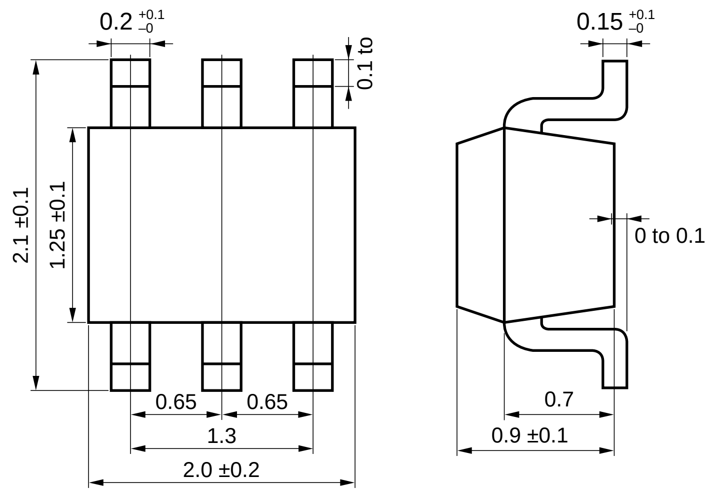
μPC2746TB

V_{CC} = 3.0 V, I_{CC} = 7.7 mA

FREQUENCY	S11		S21		S12		S22		K
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.0000	.146	165.0	6.443	−19.4	.001	77.0	.403	−5.3	108.63
200.0000	.130	141.7	6.594	−38.7	.003	51.8	.406	−8.6	20.56
300.0000	.117	117.9	6.623	−58.1	.004	47.7	.418	−11.0	16.33
400.0000	.128	100.8	6.522	−77.5	.005	51.1	.417	−14.0	12.34
500.0000	.139	90.8	6.613	−96.9	.008	33.1	.424	−16.2	8.14
600.0000	.145	83.1	6.481	−116.1	.009	21.7	.422	−19.4	7.22
700.0000	.135	77.0	6.424	−135.1	.010	14.7	.426	−23.8	6.52
800.0000	.131	67.4	6.353	−153.6	.011	−.4	.433	−27.7	5.63
900.0000	.119	49.3	6.234	−172.1	.014	−10.5	.442	−32.1	4.80
1000.0000	.142	30.4	6.137	169.6	.015	−24.2	.455	−34.7	4.44
1100.0000	.170	18.0	5.992	151.1	.016	−28.7	.455	−37.5	4.02
1200.0000	.219	10.6	5.972	133.3	.019	−48.0	.453	−39.7	3.49
1300.0000	.245	7.4	5.867	115.1	.019	−63.4	.433	−42.7	3.40
1400.0000	.268	3.1	5.679	97.0	.022	−72.2	.409	−45.5	3.16
1500.0000	.270	1.5	5.582	79.1	.021	−86.9	.375	−48.3	3.38
1600.0000	.268	−3.9	5.380	61.8	.022	−99.6	.349	−49.9	3.36
1700.0000	.258	−7.8	5.122	44.5	.024	−110.7	.318	−50.0	3.42
1800.0000	.251	−14.3	4.880	27.9	.024	−122.9	.294	−49.2	3.67
1900.0000	.249	−16.7	4.634	11.7	.025	−135.3	.268	−45.4	3.73
2000.0000	.240	−20.5	4.475	−4.4	.026	−146.0	.248	−40.5	3.91

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.

μPC2745TB, μPC2746TB

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 times, Limited days : no.*	WS60-00-1
Pin part heating	Pin area temperature : 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).

[MEMO]

[MEMO]

ATTENTION

OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES