

μPD5750T7D

SiGe BiCMOS Integrated Circuit Wide Band LNA IC with Through Function

R09DS0009EJ0100

Rev.1.00

Feb 24, 2011

DESCRIPTION

The μPD5750T7D is a low noise wideband amplifier IC mainly designed for the portable digital TV application. This IC exhibits low noise figure and high power gain characteristics. The μPD5750T7D has an LNA pass-through function (bypass function) to prevent the degradation of the received signal quality at the strong electric field, and achieve the high reception sensitivity and low power consumption.

The package is a 6-pin WLBGA (Wafer Level Ball Grid Array) (T7D) suitable for surface mount.

This IC is manufactured using our latest SiGe BiCMOS process that shows superior high frequency characteristics.

FEATURES

- Low voltage operation : $V_{CC} = 1.8 \text{ V TYP.}$
- Low mode control voltage : $V_{\text{cont (H)}} = 1.0 \text{ V to } V_{CC}, V_{\text{cont (L)}} = 0 \text{ to } 0.4 \text{ V}$
- Low current consumption : $I_{CC} = 3.1 \text{ mA TYP. @ } V_{CC} = 1.8 \text{ V (LNA-mode)}$
: $I_{CC} = 1 \mu\text{A MAX. @ } V_{CC} = 1.8 \text{ V (Bypass-mode)}$
- Low noise : $NF = 1.5 \text{ dB TYP. @ } V_{CC} = 1.8 \text{ V, } f = 470 \text{ MHz}$
(LNA-mode) : $NF = 1.4 \text{ dB TYP. @ } V_{CC} = 1.8 \text{ V, } f = 770 \text{ MHz}$
- High gain : $G_p = 13.5 \text{ dB TYP. @ } V_{CC} = 1.8 \text{ V, } f = 470 \text{ MHz}$
(LNA-mode) : $G_p = 12.5 \text{ dB TYP. @ } V_{CC} = 1.8 \text{ V, } f = 770 \text{ MHz}$
- Low insertion loss : $L_{\text{ins}} = 1.2 \text{ dB TYP. @ } V_{CC} = 1.8 \text{ V, } f = 470 \text{ MHz}$
(Bypass-mode) : $L_{\text{ins}} = 1.4 \text{ dB TYP. @ } V_{CC} = 1.8 \text{ V, } f = 770 \text{ MHz}$
- High-density surface mounting : 6-pin WLBGA ($0.73 \times 0.48 \times 0.26 \text{ mm}$)
- Included protection circuit for ESD

APPLICATIONS

- Low noise amplifier for the portable and mobile digital TV system, etc.

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPD5750T7D-E4A	μPD5750T7D-E4A-A	6-pin WLBGA (T7D) (Pb-Free)	A	• Embossed tape 8 mm wide • Pin A3, B3 face the perforation side of the tape • Qty 10 kpcs/reel

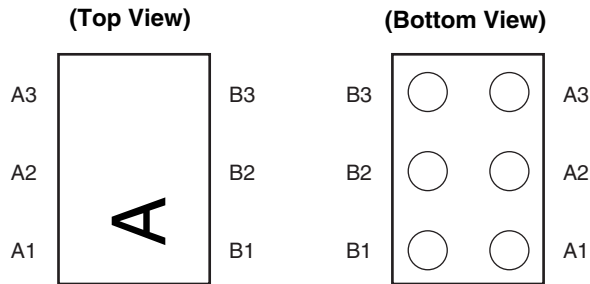
Remark To order evaluation samples, please contact your nearby sales office.

Part number for sample order: μPD5750T7D

CAUTION

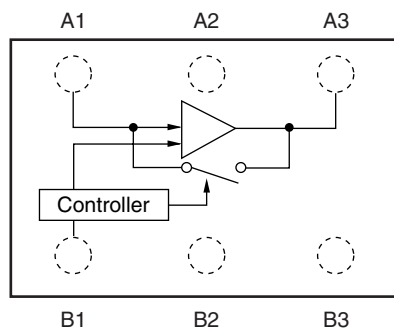
Observe precautions when handling because these devices are sensitive to electrostatic discharge.

PIN CONNECTIONS AND MARKING



Pin No	Pin Name
A1	INPUT
A2	GND1
A3	OUTPUT
B1	V_{cont}
B2	GND2
B3	V_{CC}

INTERNAL BLOCK DIAGRAM



TRUTH TABLE

V_{cont}	Gain	Mode
H	High	LNA-mode
L	Low	Bypass-mode

Remark "H" = V_{cont} (H), "L" = V_{cont} (L)

ABSOLUTE MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Supply Voltage	V_{CC}	3.6	V
Mode Control Voltage	V_{cont}	3.6	V
Operating Ambient Temperature	T_A	-40 to +85	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to +150	$^\circ\text{C}$
Input Power	P_{in}	+30	dBm

RECOMMENDED OPERATING RANGE ($T_A = +25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	1.6	1.8	2.0	V
Mode Control Voltage (H)	V_{cont} (H)	1.0	—	V_{CC}	V
Mode Control Voltage (L)	V_{cont} (L)	0	—	0.4	V
Operating Frequency	f	50	—	1 800	MHz
Operating Ambient Temperature	T_A	-40	—	+85	$^\circ\text{C}$
Input Power (LNA-mode)	P_{in}	—	—	+7	dBm
Input Power (Bypass-mode)	P_{in}	—	—	+15	dBm

ELECTRICAL CHARACTERISTICS 1 (DC Characteristics)**($T_A = +25^\circ\text{C}$, $V_{CC} = 1.8\text{ V}$, unless otherwise specified)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	I_{CC1}	$V_{cont} = 1.8\text{ V}$, No Signal (LNA-mode)	1.6	3.1	4.5	mA
Circuit Current 2	I_{CC2}	$V_{cont} = 0\text{ V}$, No Signal (Bypass-mode)	–	–	1	μA
Mode Control Current 1	I_{cont1}	$V_{cont} = 1.8\text{ V}$, No Signal (LNA-mode)	–	20	30	μA
Mode Control Current 2	I_{cont2}	$V_{cont} = 0\text{ V}$, No Signal (Bypass-mode)	–	–	1	μA

ELECTRICAL CHARACTERISTICS 2 (LNA-mode)**($T_A = +25^\circ\text{C}$, $V_{CC} = V_{cont} = 1.8\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain 1	G_{P1}	$f = 470\text{ MHz}$, $P_{in} = -30\text{ dBm}$, excluded PCB and connector losses Note 1	10.5	13.5	16.5	dB
Power Gain 2	G_{P2}	$f = 770\text{ MHz}$, $P_{in} = -30\text{ dBm}$, excluded PCB and connector losses Note 1	9.5	12.5	15.5	dB
Noise Figure 1	NF1	$f = 470\text{ MHz}$, excluded PCB and connector losses Note 2	–	1.5	2.0	dB
Noise Figure 2	NF2	$f = 770\text{ MHz}$, excluded PCB and connector losses Note 2	–	1.4	2.0	dB
Output Return Loss 1	RL_{out1}	$f = 470\text{ MHz}$, $P_{in} = -30\text{ dBm}$	6.5	8.5	–	dB
Output Return Loss 2	RL_{out2}	$f = 770\text{ MHz}$, $P_{in} = -30\text{ dBm}$	6.0	8.0	–	dB
Input 3rd Order Intercept Point 1	IIP_{31}	$f_1 = 470\text{ MHz}$, $f_2 = 471\text{ MHz}$, $P_{in} = -30\text{ dBm}$	–15	–11	–	dBm
Input 3rd Order Intercept Point 2	IIP_{32}	$f_1 = 770\text{ MHz}$, $f_2 = 771\text{ MHz}$, $P_{in} = -30\text{ dBm}$	–12	–8	–	dBm

Notes: 1. Input-output PCB and connector losses : 0.20 dB (at 470 MHz), 0.27 dB (at 770 MHz)

2. Input PCB and connector losses : 0.10 dB (at 470 MHz), 0.14 dB (at 770 MHz)

ELECTRICAL CHARACTERISTICS 3 (Bypass-mode)**($T_A = +25^\circ\text{C}$, $V_{CC} = 1.8\text{ V}$, $V_{cont} = 0\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	L_{ins1}	$f = 470\text{ MHz}$, $P_{in} = -10\text{ dBm}$, excluded PCB and connector losses Note	–	1.2	2.0	dB
Insertion Loss 2	L_{ins2}	$f = 770\text{ MHz}$, $P_{in} = -10\text{ dBm}$, excluded PCB and connector losses Note	–	1.4	2.0	dB
Input Return Loss 1	RL_{in1}	$f = 470\text{ MHz}$, $P_{in} = -10\text{ dBm}$	10	17	–	dB
Input Return Loss 2	RL_{in2}	$f = 770\text{ MHz}$, $P_{in} = -10\text{ dBm}$	10	14	–	dB
Output Return Loss 1	RL_{out1}	$f = 470\text{ MHz}$, $P_{in} = -10\text{ dBm}$	10	17	–	dB
Output Return Loss 2	RL_{out2}	$f = 770\text{ MHz}$, $P_{in} = -10\text{ dBm}$	10	14	–	dB
Input 3rd Order Intercept Point	IIP_3	$f_1 = 770\text{ MHz}$, $f_2 = 771\text{ MHz}$, $P_{in} = -2.5\text{ dBm}$	+25	+32	–	dBm

Note: Input-output PCB and connector losses : 0.20 dB (at 470 MHz), 0.27 dB (at 770 MHz)

STANDARD CHARACTERISTICS FOR REFERENCE 1 (LNA-mode)

($T_A = +25^{\circ}\text{C}$, $V_{CC} = V_{cont} = 1.8\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Isolation 1	ISL1	$f = 470\text{ MHz}$, $P_{in} = -30\text{ dBm}$	-30	dB
Isolation 2	ISL2	$f = 770\text{ MHz}$, $P_{in} = -30\text{ dBm}$	-25	dB
Input Return Loss 1	RL_{in1}	$f = 470\text{ MHz}$, $P_{in} = -30\text{ dBm}$	1.7	dB
Input Return Loss 2	RL_{in2}	$f = 770\text{ MHz}$, $P_{in} = -30\text{ dBm}$	2.5	dB
Input Impedance 1	Z_{in1}	$f = 470\text{ MHz}$, $P_{in} = -30\text{ dBm}$ Note	$0.50 - j\ 2.01$	Ω
Input Impedance 2	Z_{in2}	$f = 770\text{ MHz}$, $P_{in} = -30\text{ dBm}$ Note	$0.36 - j\ 1.21$	Ω
Gain 1 dB Compression Output Power 1	$P_{O(1\text{ dB})1}$	$f = 470\text{ MHz}$	-12	dBm
Gain 1 dB Compression Output Power 2	$P_{O(1\text{ dB})2}$	$f = 770\text{ MHz}$	-12	dBm

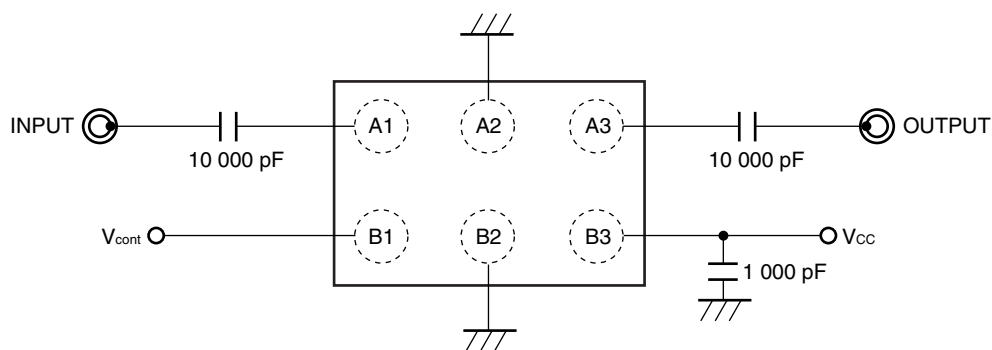
Note: Calibration reference plane : Device edge side

STANDARD CHARACTERISTICS FOR REFERENCE 2 (Bypass-mode)

($T_A = +25^{\circ}\text{C}$, $V_{CC} = 1.8\text{ V}$, $V_{cont} = 0\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Gain 1 dB Compression Output Power	$P_{O(1\text{ dB})}$	$f = 770\text{ MHz}$	+6	dBm

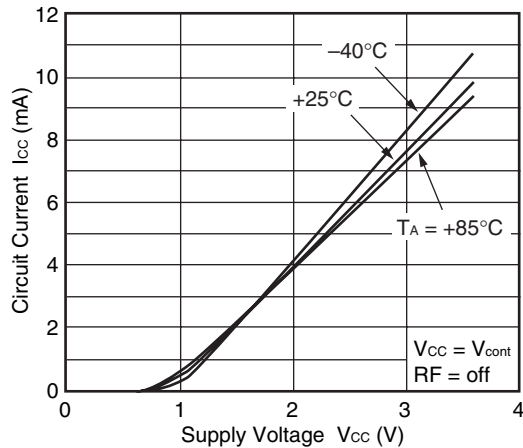
TEST CIRCUIT



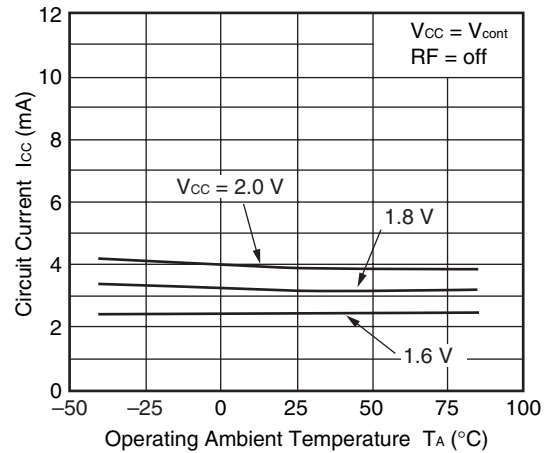
TYPICAL CHARACTERISTICS 1 (DC Characteristics)

($T_A = +25^\circ\text{C}$, unless otherwise specified)

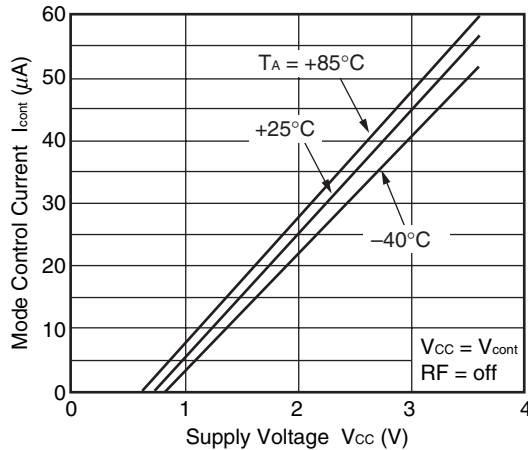
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



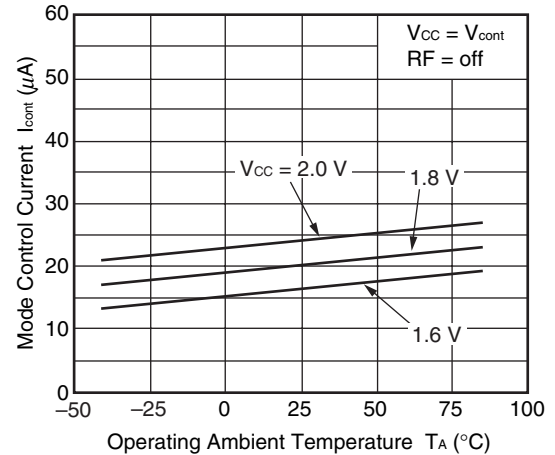
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



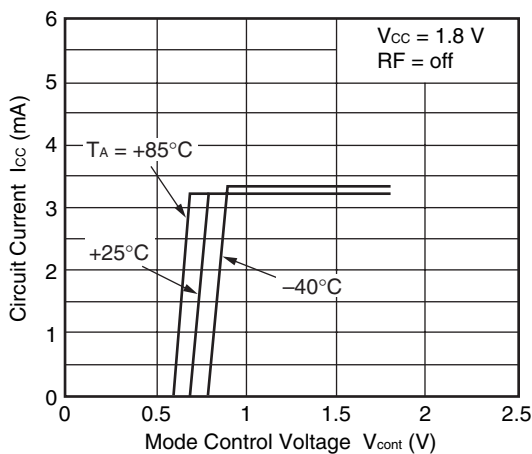
MODE CONTROL CURRENT vs. SUPPLY VOLTAGE



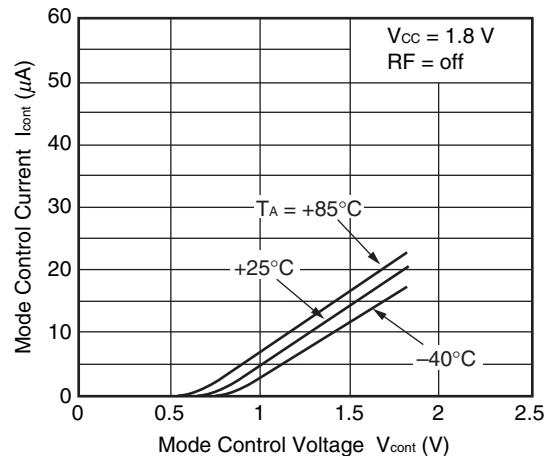
MODE CONTROL CURRENT vs. OPERATING AMBIENT TEMPERATURE



CIRCUIT CURRENT vs. MODE CONTROL VOLTAGE

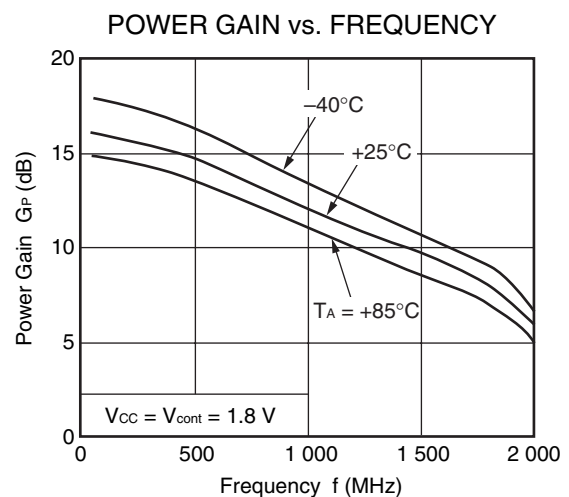
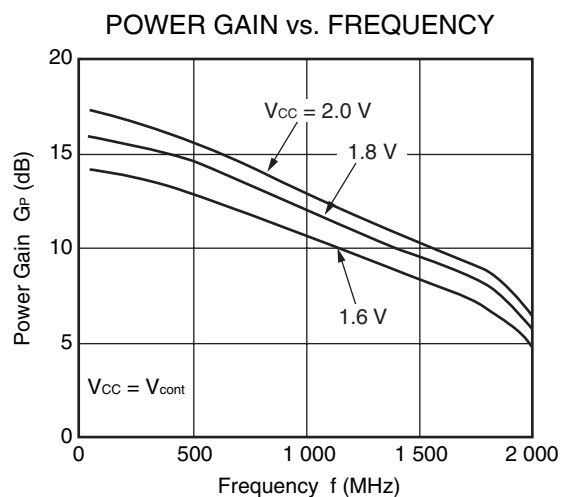
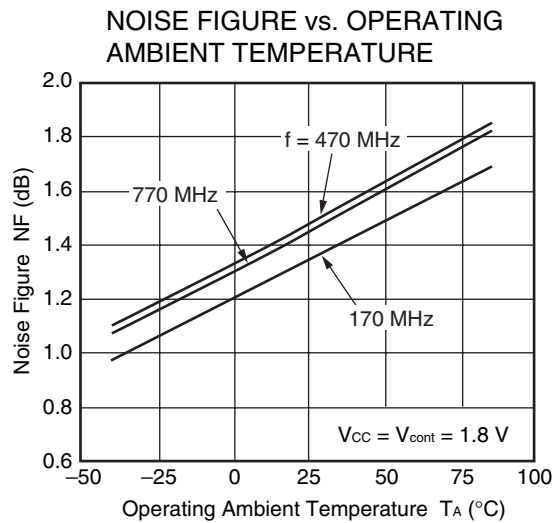
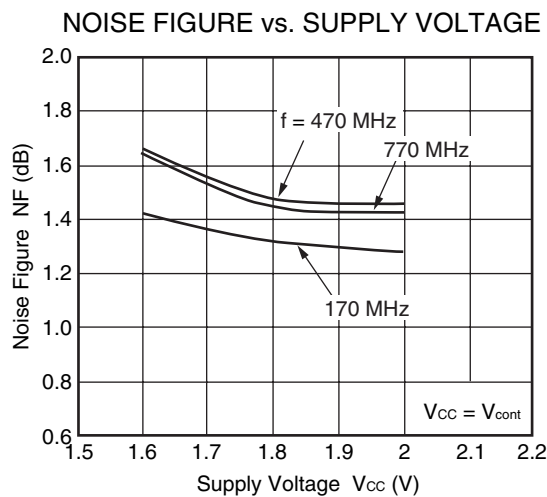
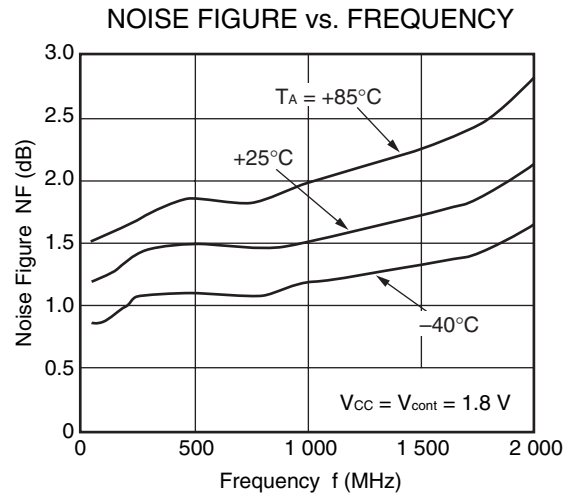
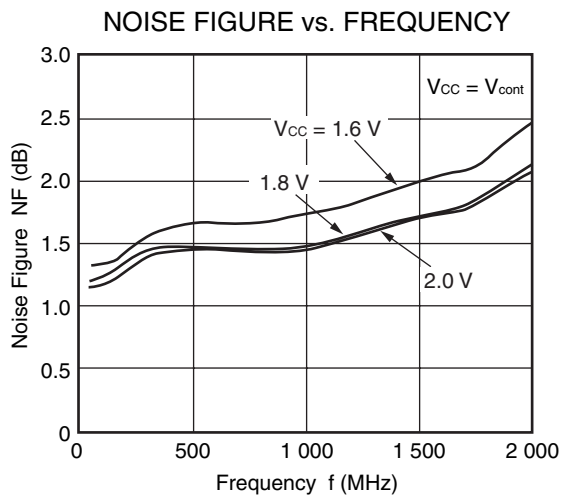


MODE CONTROL CURRENT vs. MODE CONTROL VOLTAGE

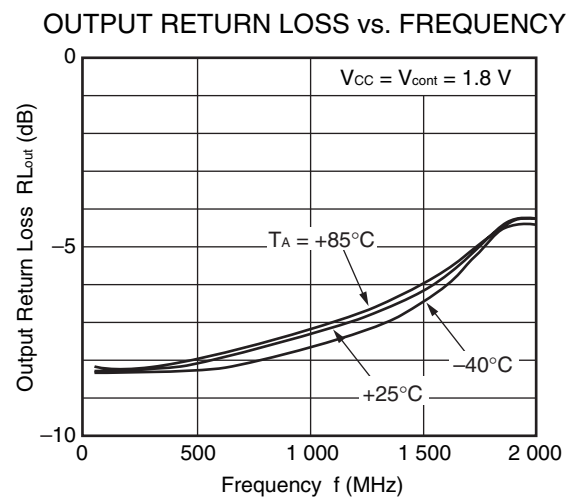
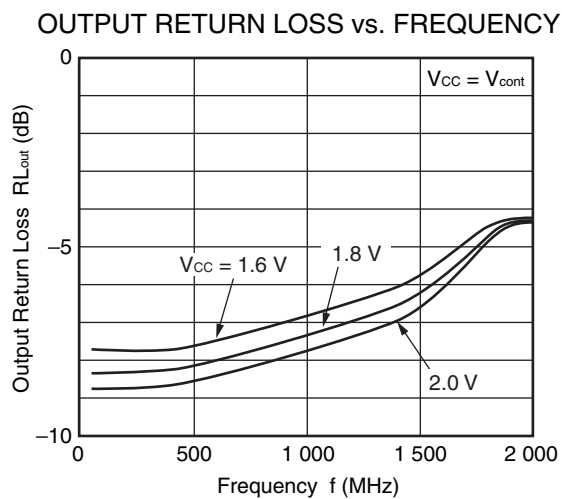
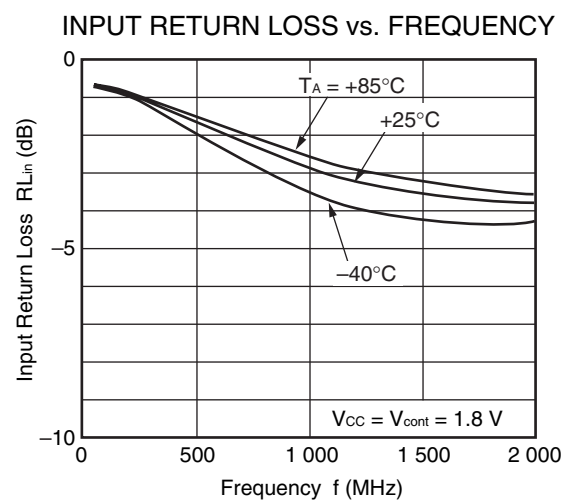
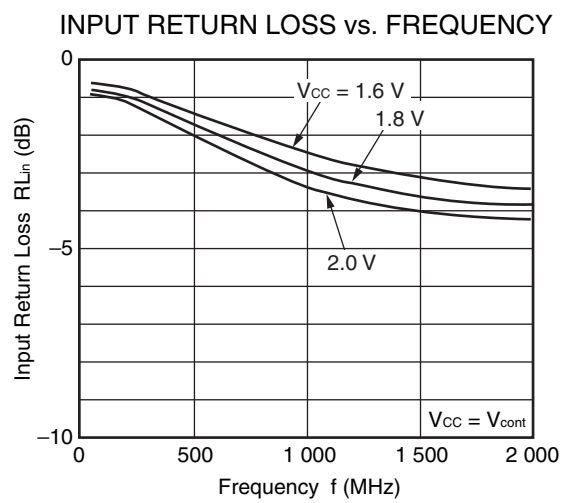
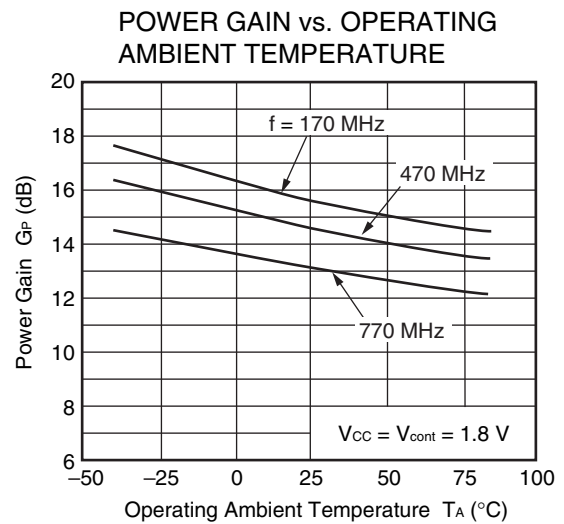
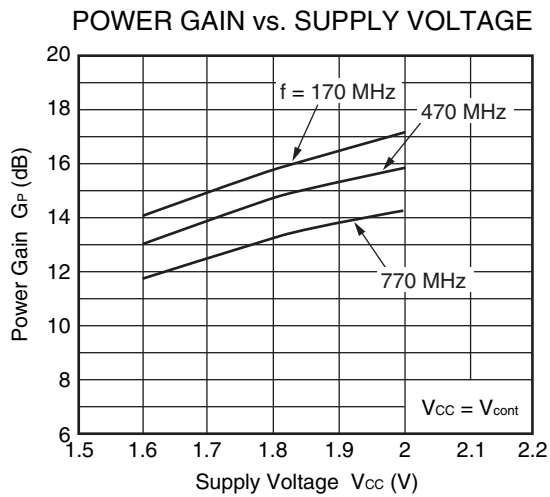


Remark The graphs indicate nominal characteristics.

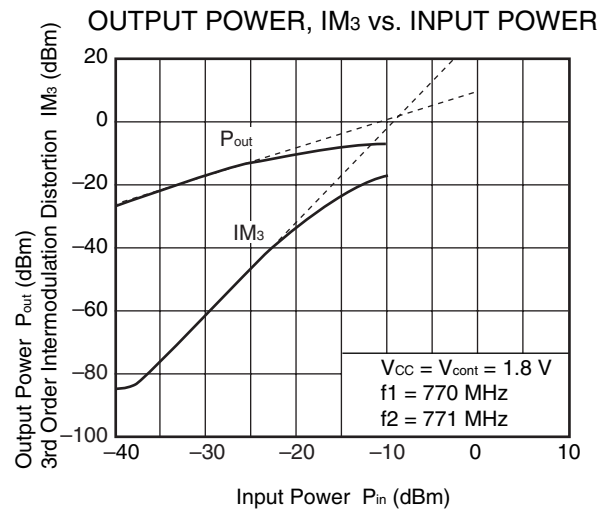
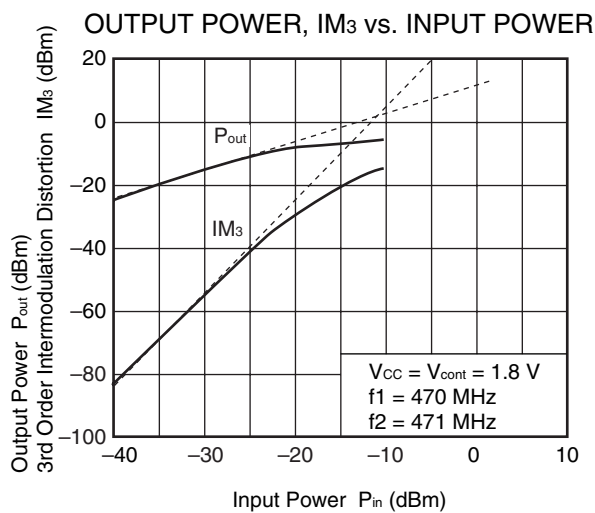
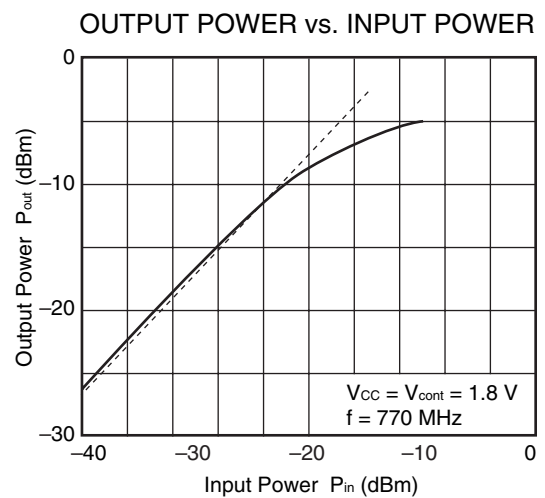
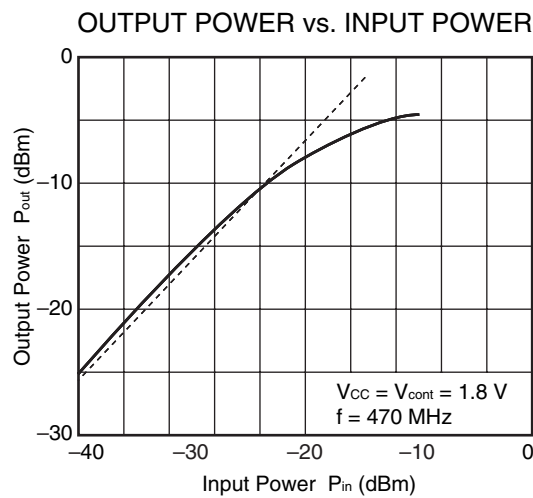
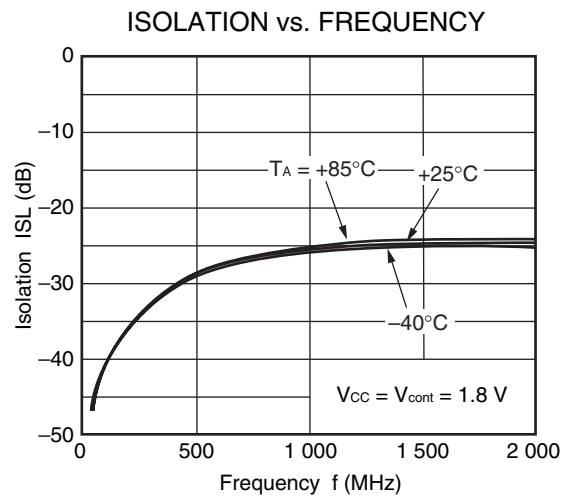
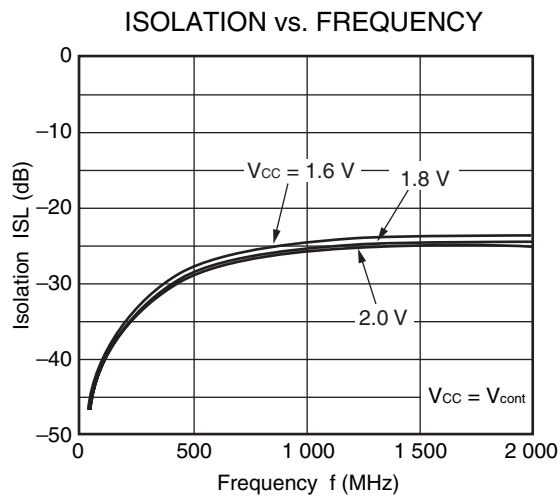
TYPICAL CHARACTERISTICS 2 (LNA-mode) ($T_A = +25^\circ\text{C}$, unless otherwise specified)



Remark The graphs indicate nominal characteristics.



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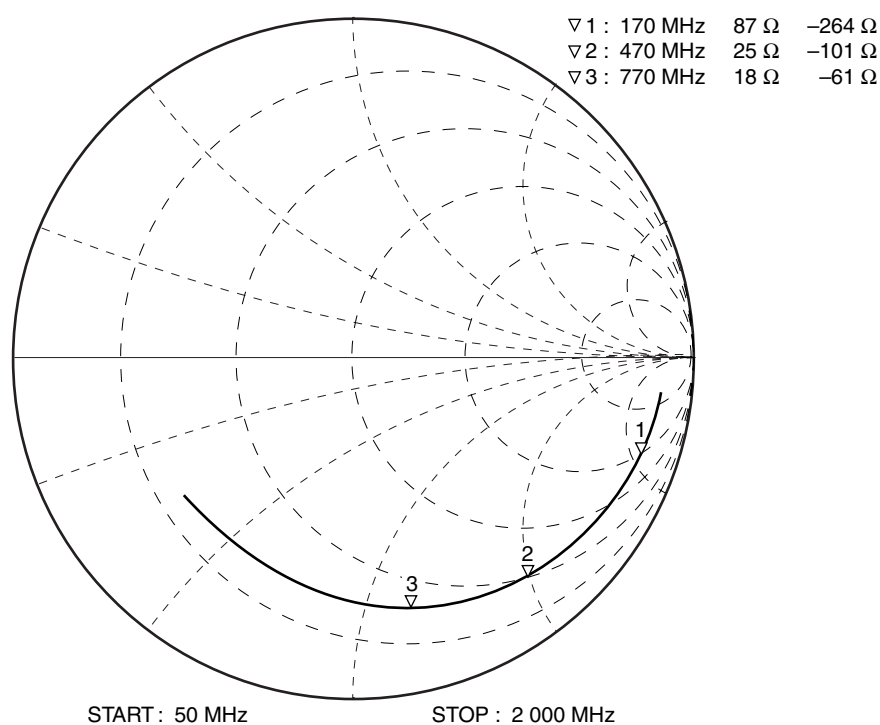


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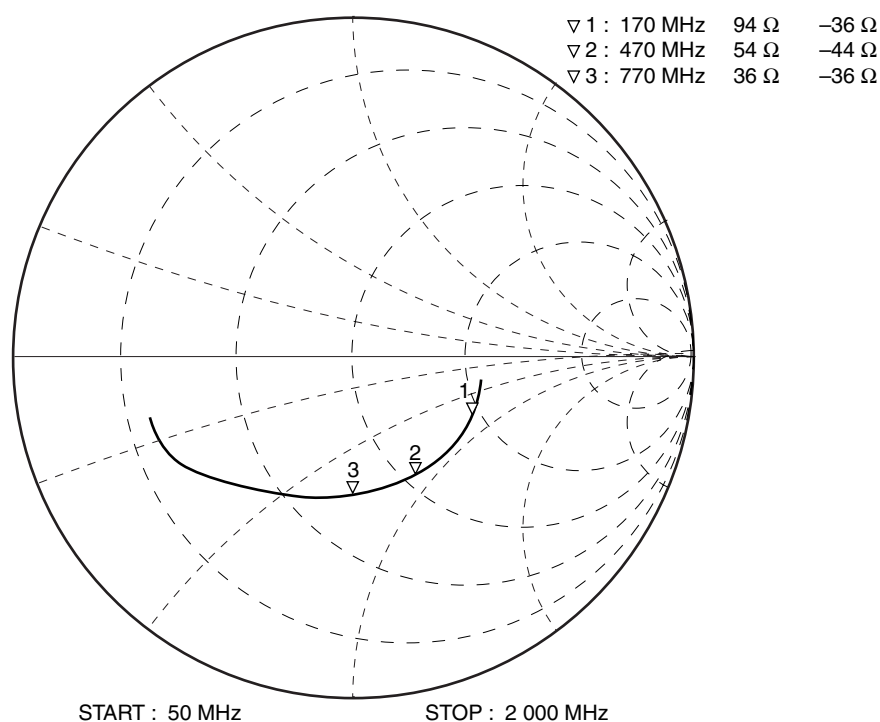
S-PARAMETERS 1 (LNA-mode)

($T_A = +25^\circ\text{C}$, $V_{CC} = V_{cont} = 1.8\text{ V}$, Calibration reference plane: Device edge side)

S_{11} -FREQUENCY

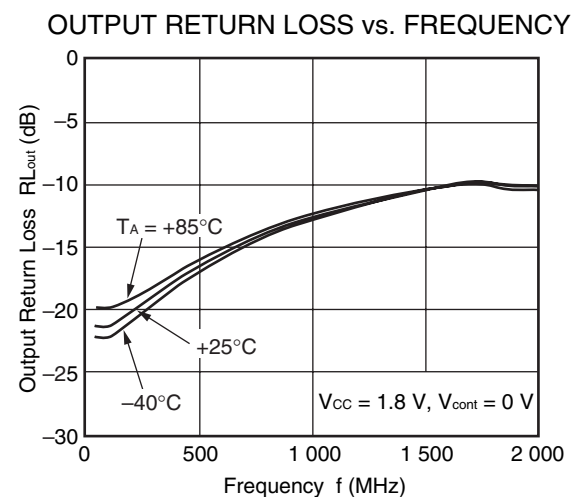
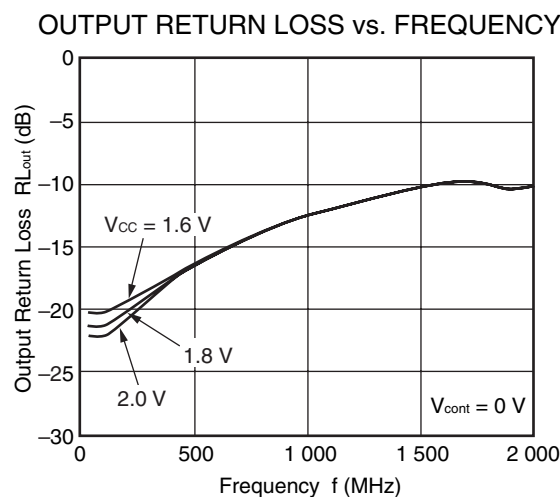
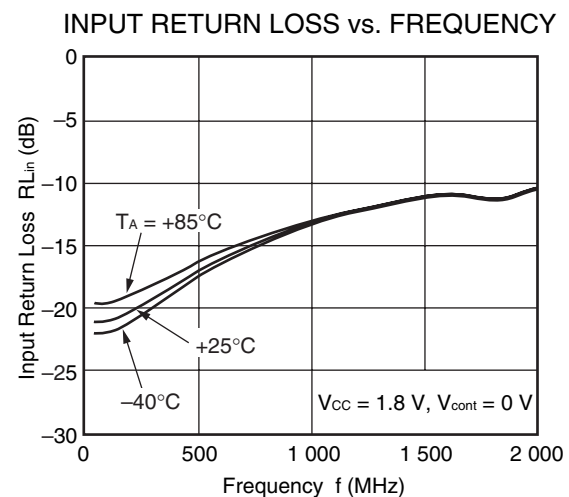
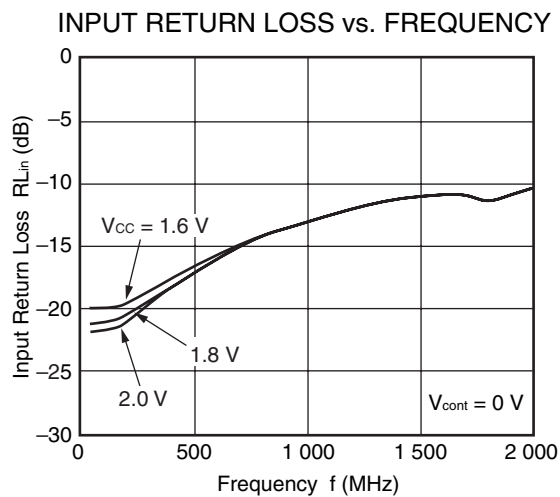
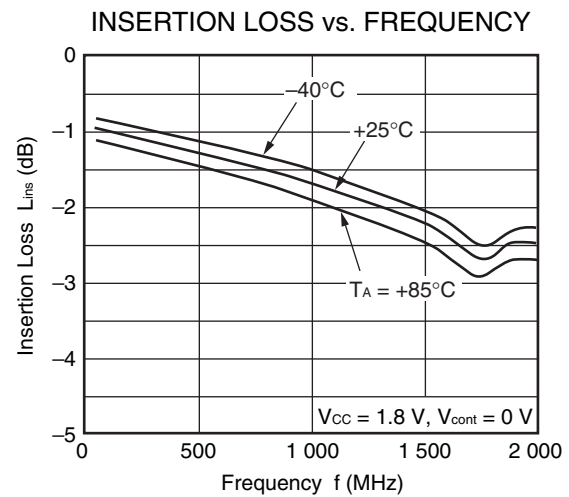
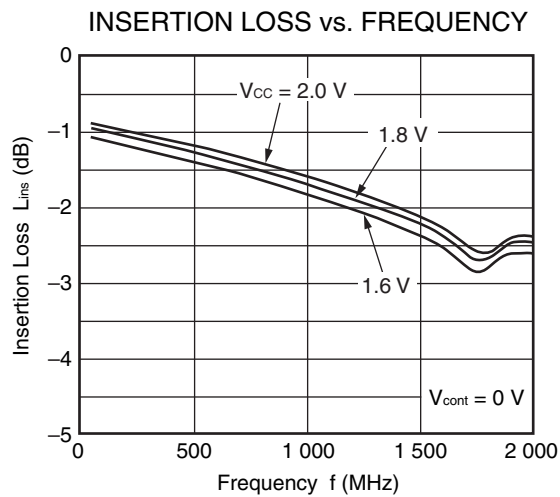


S_{22} -FREQUENCY



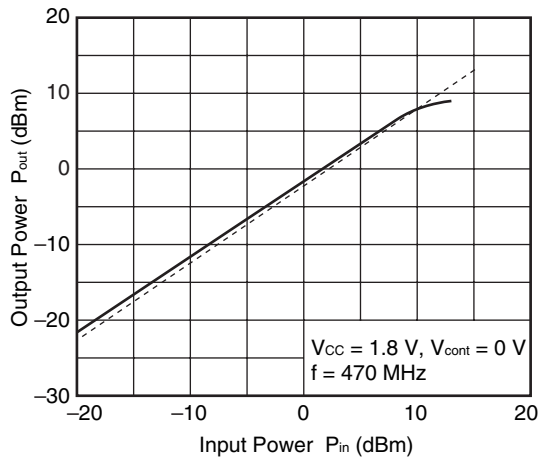
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS 3 (Bypass-mode)
($T_A = +25^\circ\text{C}$, unless otherwise specified)

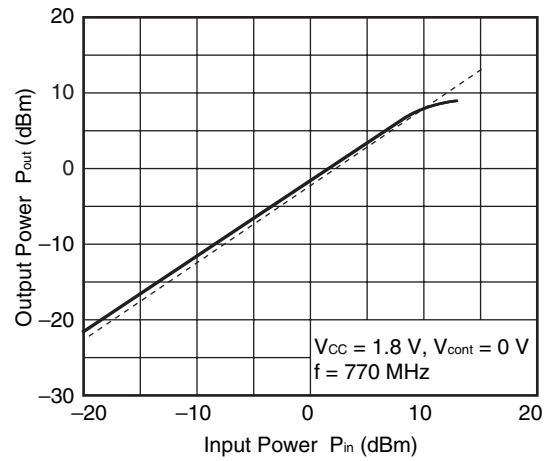


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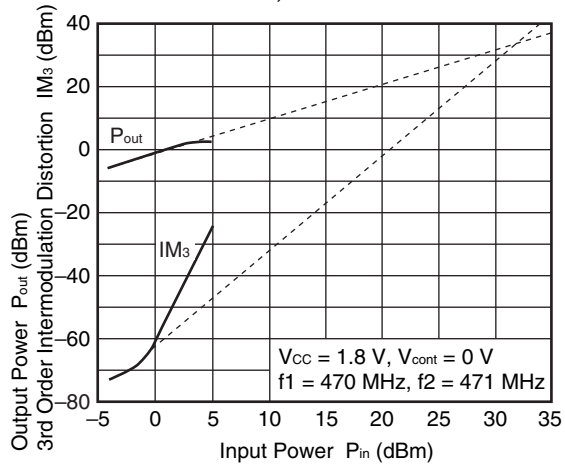
OUTPUT POWER vs. INPUT POWER



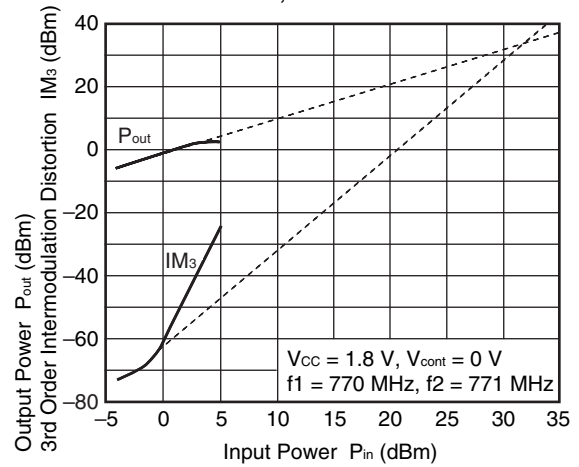
OUTPUT POWER vs. INPUT POWER



OUTPUT POWER, IM_3 vs. INPUT POWER



OUTPUT POWER, IM_3 vs. INPUT POWER

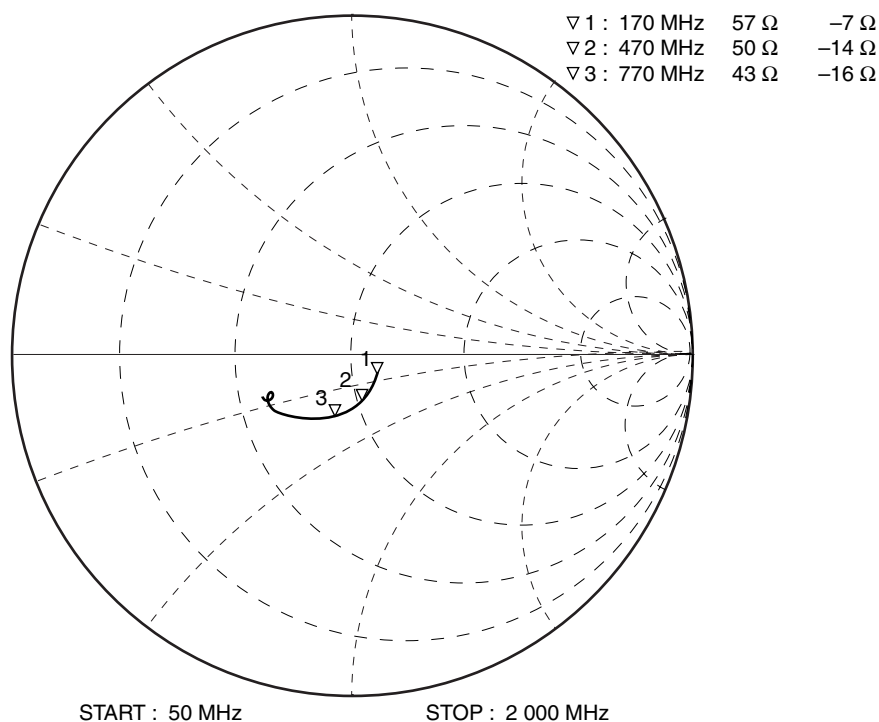


Remark The graphs indicate nominal characteristics.

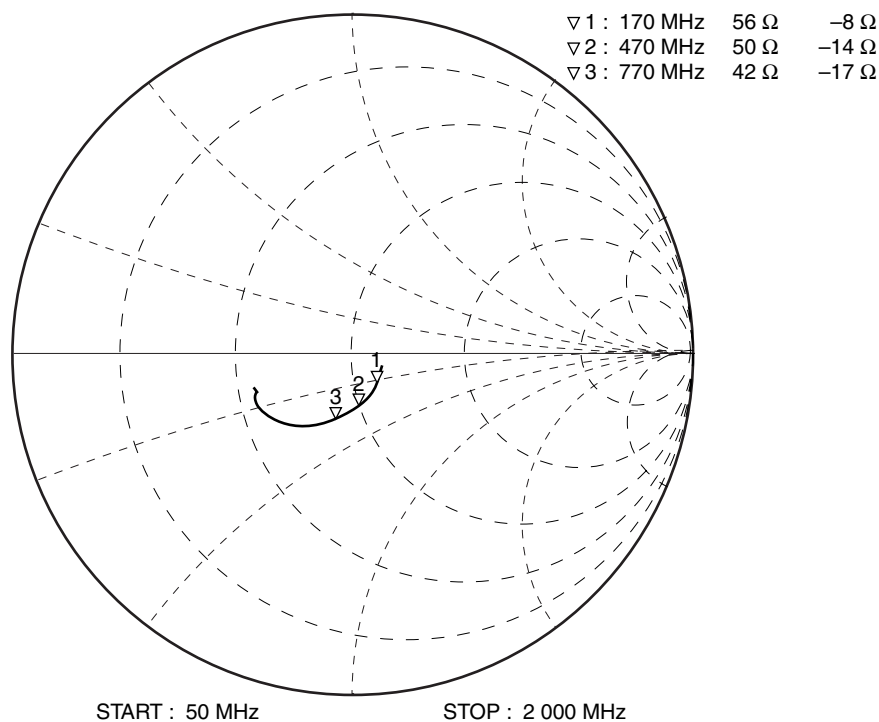
S-PARAMETERS 2 (Bypass-mode)

($T_A = +25^\circ\text{C}$, $V_{CC} = 1.8\text{ V}$, $V_{cont} = 0\text{ V}$, Calibration reference plane: Device edge side)

S_{11} -FREQUENCY



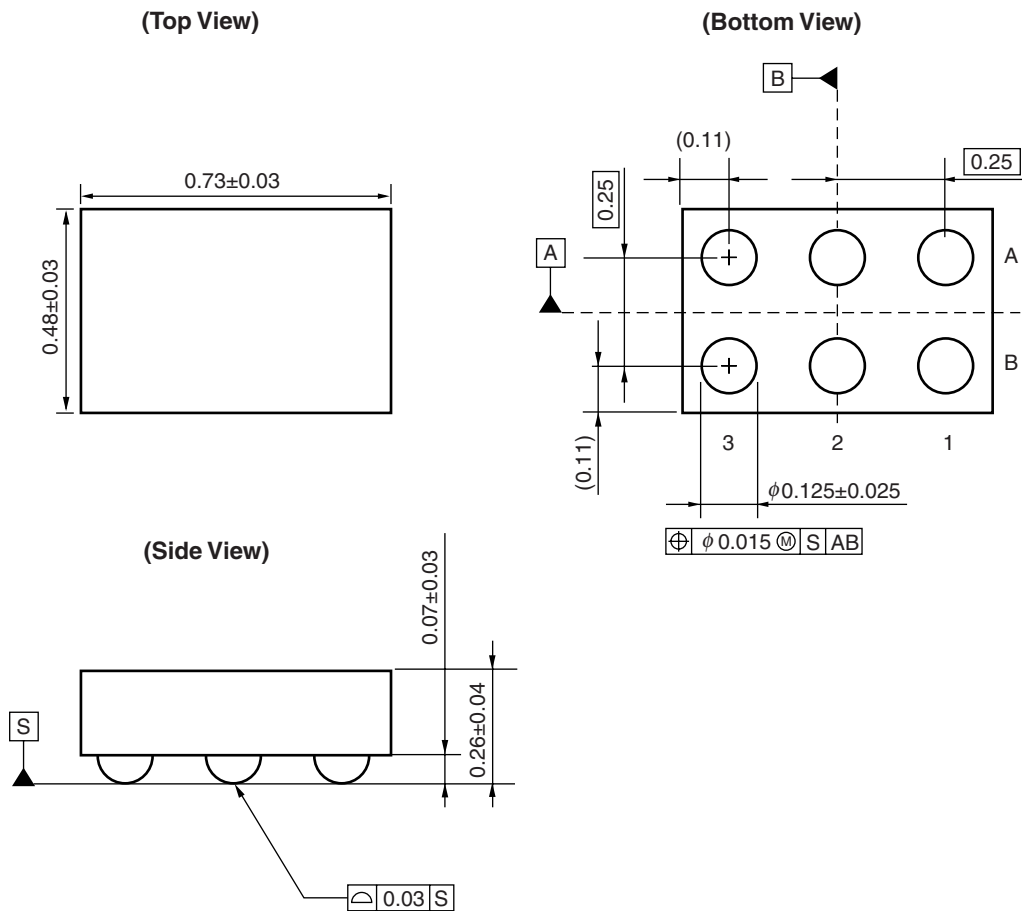
S_{22} -FREQUENCY



Remark The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

6-PIN WLBGA (T7D) (UNIT: mm)



Remark (): Reference value

NOTES ON CORRECT USE

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).
All the ground terminals must be connected together with wide ground pattern to decrease impedance difference.
- (3) The bypass capacitor should be attached to V_{CC} line.
- (4) Do not supply DC voltage to INPUT pin.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions	Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) : 260°C or below Time at peak temperature : 10 seconds or less Time at temperature of 220°C or higher : 60 seconds or less Preheating time at 120 to 180°C : 120±30 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	IR260

CAUTION

Do not use different soldering methods together.

Revision History	μPD5750T7D Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Feb 24, 2011	—	First edition issued

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Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
7F, No. 363 Fu Shing North Road Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Laved' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141