

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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Not recommended  
for new design

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# SiGe BiCMOS INTEGRATED CIRCUIT

## $\mu$ PD5740T6N

### LOW NOISE WIDEBAND AMPLIFIER IC WITH THROUGH FUNCTION

#### DESCRIPTION

The  $\mu$ PD5740T6N is a low noise wideband amplifier IC mainly designed for the portable digital TV application. This IC has achieved low noise figure and the wideband operation. The  $\mu$ PD5740T6N 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 plastic TSON (Thin Small Out-line Non-leaded) (T6N) suitable for surface mount.

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

#### FEATURES

- Low voltage operation :  $V_{CC} = 2.3$  to  $3.3$  V (2.8 V TYP.)
- Low mode control voltage :  $V_{cont(H)} = 1.0$  V to  $V_{CC}$ ,  $V_{cont(L)} = 0$  to  $0.5$  V
- Low current consumption :  $I_{CC1} = 5.0$  mA TYP. @  $V_{CC} = 2.8$  V (LNA-mode)  
:  $I_{CC2} = 1$   $\mu$ A MAX. @  $V_{CC} = 2.8$  V (Bypass-mode)
- Low noise (LNA-mode) :  $NF1 = 1.5$  dB TYP. @  $V_{CC} = 2.8$  V,  $f = 470$  MHz  
:  $NF2 = 1.5$  dB TYP. @  $V_{CC} = 2.8$  V,  $f = 770$  MHz
- High gain (LNA-mode) :  $GP1 = 15.0$  dB TYP. @  $V_{CC} = 2.8$  V,  $f = 470$  MHz  
:  $GP2 = 13.5$  dB TYP. @  $V_{CC} = 2.8$  V,  $f = 770$  MHz
- Low insertion loss (Bypass-mode) :  $L_{ins1} = 1.1$  dB TYP. @  $V_{CC} = 2.8$  V,  $f = 470$  MHz  
:  $L_{ins2} = 1.3$  dB TYP. @  $V_{CC} = 2.8$  V,  $f = 770$  MHz
- High-density surface mounting : 6-pin plastic TSON (T6N) package ( $1.5 \times 1.5 \times 0.37$  mm)
- Included protection circuits for ESD

#### APPLICATION

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

#### ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
$\mu$ PD5740T6N-E2	$\mu$ PD5740T6N-E2-A	6-pin plastic TSON (T6N) (Pb-Free)	C3U	<ul style="list-style-type: none"> <li>• 8 mm wide embossed taping</li> <li>• Pin 1, 6 face the perforation side of the tape</li> <li>• Qty 3 kpcs/reel</li> </ul>

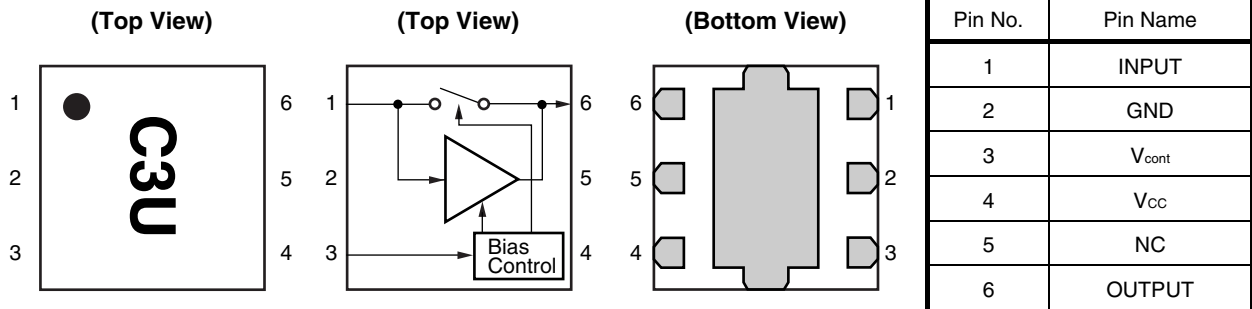
**Remark** To order evaluation samples, please contact your nearby sales office.

Part number for sample order:  $\mu$ PD5740T6N

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

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PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



Remark Exposed pad : GND

TRUTH TABLE

V <sub>cont</sub>	Gain	Mode
H	High	LNA-mode
L	Low	Bypass-mode

Remark "H" = V<sub>cont</sub> (H), "L" = V<sub>cont</sub> (L)

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V <sub>cc</sub>	T <sub>A</sub> = +25°C	3.6	V
Mode Control Voltage	V <sub>cont</sub>	T <sub>A</sub> = +25°C	3.6	V
Total Power Dissipation	P <sub>tot</sub>		150	mW
Operating Ambient Temperature	T <sub>A</sub>		-40 to +85	°C
Storage Temperature	T <sub>stg</sub>		-55 to +150	°C
Input Power	P <sub>in</sub>		+33	dBm

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sub>cc</sub>	2.3	2.8	3.3	V
Mode Control Voltage (H)	V <sub>cont</sub> (H)	1.0	-	V <sub>cc</sub>	V
Mode Control Voltage (L)	V <sub>cont</sub> (L)	0	-	0.5	V
Operating Frequency	f	50	-	1 800	MHz
Operating Ambient Temperature	T <sub>A</sub>	-40	+25	+85	°C
Input Power (LNA-mode)	P <sub>in</sub>	-	-	+7	dBm
Input Power (Bypass-mode)	P <sub>in</sub>	-	-	+15	dBm

**ELECTRICAL CHARACTERISTICS 1 (DC Characteristics)**

(T<sub>A</sub> = +25°C, V<sub>CC</sub> = 2.8 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	I <sub>cc1</sub>	V <sub>cont</sub> = 2.8 V, No Signal (LNA-mode)	3.8	5.0	6.5	mA
Circuit Current 2	I <sub>cc2</sub>	V <sub>cont</sub> = 0 V, No Signal (Bypass-mode)	–	–	1	μA
Mode Control Current 1	I <sub>cont1</sub>	V <sub>cont</sub> = 2.8 V, No Signal (LNA-mode)	–	40	100	μA
Mode Control Current 2	I <sub>cont2</sub>	V <sub>cont</sub> = 0 V, No Signal (Bypass-mode)	–	–	1	μA

**ELECTRICAL CHARACTERISTICS 2 (LNA-mode)**

(T<sub>A</sub> = +25°C, V<sub>CC</sub> = V<sub>cont</sub> = 2.8 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain 1	G <sub>P1</sub>	f = 470 MHz, P <sub>in</sub> = –30 dBm	13.0	15.0	17.0	dB
Power Gain 2	G <sub>P2</sub>	f = 770 MHz, P <sub>in</sub> = –30 dBm	11.5	13.5	15.5	dB
Noise Figure 1	NF1	f = 470 MHz, excluded PCB and connector losses <b>Note</b>	–	1.5	2.0	dB
Noise Figure 2	NF2	f = 770 MHz, excluded PCB and connector losses <b>Note</b>	–	1.5	2.0	dB
Input Return Loss 1	RL <sub>in1</sub>	f = 470 MHz, P <sub>in</sub> = –30 dBm	7	12	–	dB
Input Return Loss 2	RL <sub>in2</sub>	f = 770 MHz, P <sub>in</sub> = –30 dBm	7	10	–	dB
Output Return Loss 1	RL <sub>out1</sub>	f = 470 MHz, P <sub>in</sub> = –30 dBm	7	14	–	dB
Output Return Loss 2	RL <sub>out1</sub>	f = 770 MHz, P <sub>in</sub> = –30 dBm	7	11	–	dB
Input 3rd Order Intercept Point 1	IIP <sub>31</sub>	f <sub>1</sub> = 470 MHz, f <sub>2</sub> = 471 MHz, P <sub>in</sub> = –30 dBm	–4.0	–1.0	–	dBm
Input 3rd Order Intercept Point 2	IIP <sub>32</sub>	f <sub>1</sub> = 770 MHz, f <sub>2</sub> = 771 MHz, P <sub>in</sub> = –30 dBm	–1.0	+2.0	–	dBm

**Note** Input PCB and connector losses: 0.05 dB (at 470 MHz), 0.08 dB (at 770 MHz)

**ELECTRICAL CHARACTERISTICS 3 (Bypass-mode)**  
 (T<sub>A</sub> = +25°C, V<sub>CC</sub> = 2.8 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	L <sub>ins1</sub>	f = 470 MHz, P <sub>in</sub> = -10 dBm, excluded PCB and connector losses <b>Note</b>	-	1.1	2	dB
Insertion Loss 2	L <sub>ins2</sub>	f = 770 MHz, P <sub>in</sub> = -10 dBm, excluded PCB and connector losses <b>Note</b>	-	1.3	2	dB
Input Return Loss 1	RL <sub>in1</sub>	f = 470 MHz, P <sub>in</sub> = -10 dBm	10	20	-	dB
Input Return Loss 2	RL <sub>in2</sub>	f = 770 MHz, P <sub>in</sub> = -10 dBm	10	17	-	dB
Output Return Loss 1	RL <sub>out1</sub>	f = 470 MHz, P <sub>in</sub> = -10 dBm	10	20	-	dB
Output Return Loss 2	RL <sub>out1</sub>	f = 770 MHz, P <sub>in</sub> = -10 dBm	10	17	-	dB
Input 3rd Order Intercept Point	IIP <sub>3</sub>	f1 = 770 MHz, f2 = 771 MHz, P <sub>in</sub> = -2.5 dBm	+20	+30	-	dBm

**Note** Input-output PCB and connector losses: 0.10 dB (at 470 MHz), 0.16 dB (at 770 MHz)

Not recommended for new design

**STANDARD CHARACTERISTICS FOR REFERENCE 1 (LNA-mode)**

(T<sub>A</sub> = +25°C, V<sub>CC</sub> = V<sub>cont</sub> = 2.8 V, unless otherwise specified)

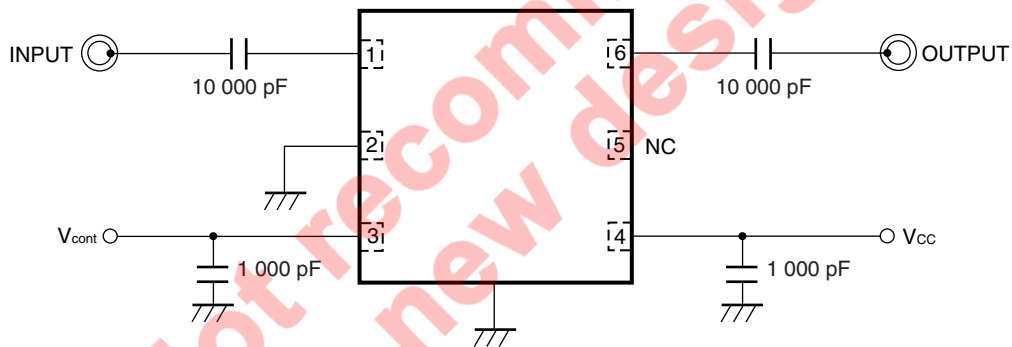
Parameter	Symbol	Test Conditions	Reference	Unit
Isolation 1	ISL1	f = 470 MHz, P <sub>in</sub> = -30 dBm	20	dB
Isolation 2	ISL2	f = 770 MHz, P <sub>in</sub> = -30 dBm	20	dB
Gain 1 dB Compression Output Power 1	P <sub>O(1 dB) 1</sub>	f = 470 MHz	-5.5	dBm
Gain 1 dB Compression Output Power 2	P <sub>O(1 dB) 2</sub>	f = 770 MHz	-5.0	dBm

**STANDARD CHARACTERISTICS FOR REFERENCE 2 (Bypass-mode)**

(T<sub>A</sub> = +25°C, V<sub>CC</sub> = 2.8 V, V<sub>cont</sub> = 0 V, unless otherwise specified)

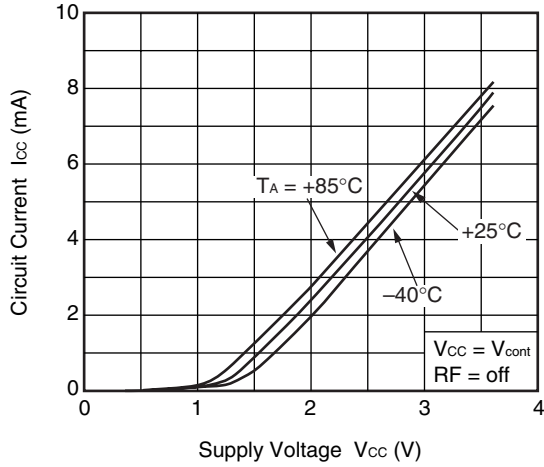
Parameter	Symbol	Test Conditions	Reference	Unit
Gain 1 dB Compression Output Power	P <sub>O(1 dB)</sub>	f = 770 MHz	+8	dBm

**TEST CIRCUIT**

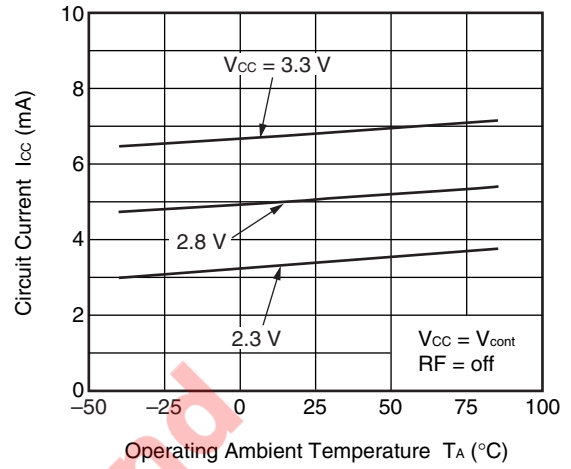


TYPICAL CHARACTERISTICS 1 (DC Characteristics) (T<sub>A</sub> = +25°C, unless otherwise specified)

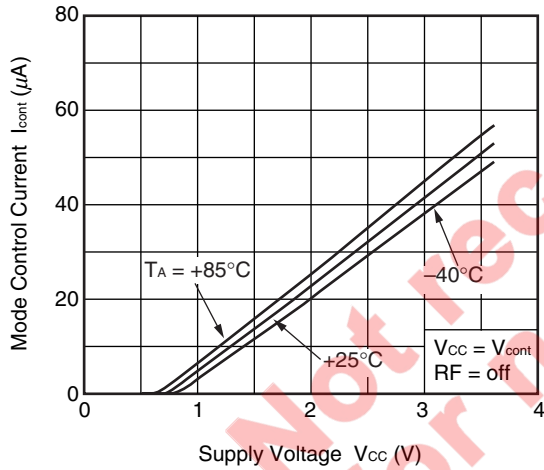
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



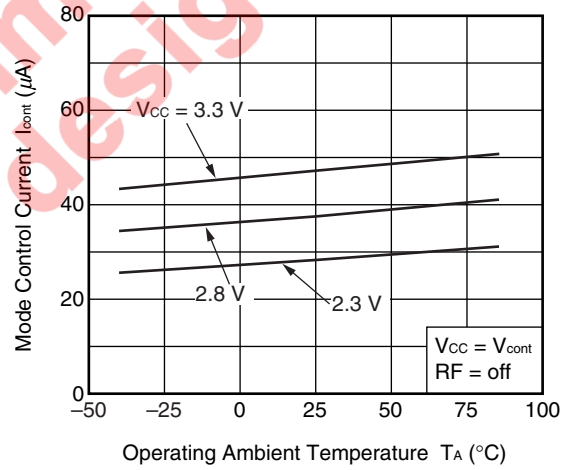
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



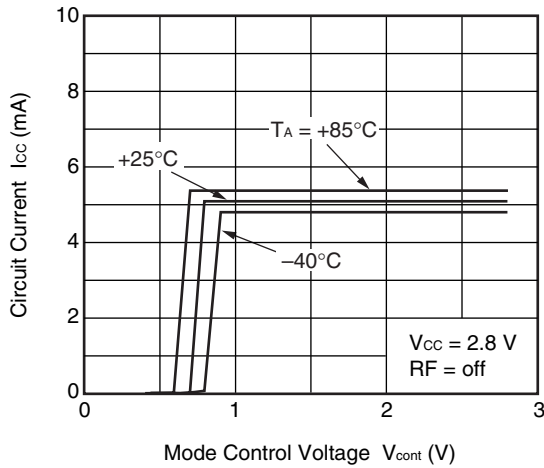
MODE CONTROL CURRENT vs. SUPPLY VOLTAGE



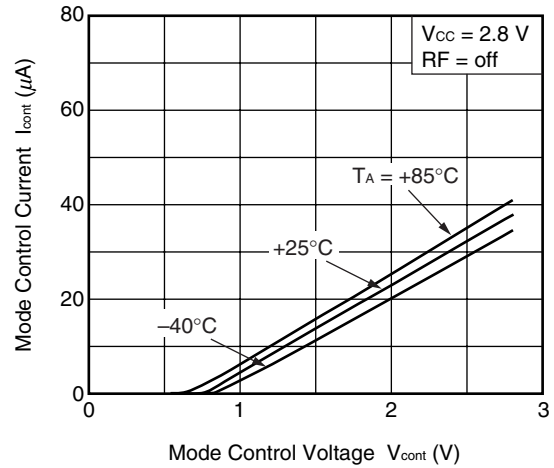
MODE CONTROL CURRENT vs. OPERATING AMBIENT TEMPERATURE



CIRCUIT CURRENT vs. MODE CONTROL VOLTAGE



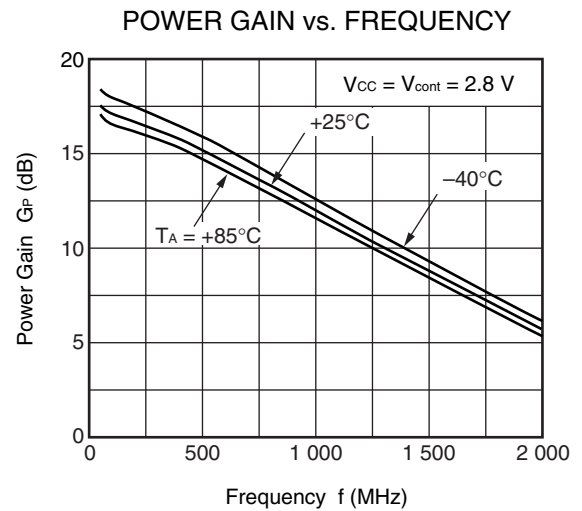
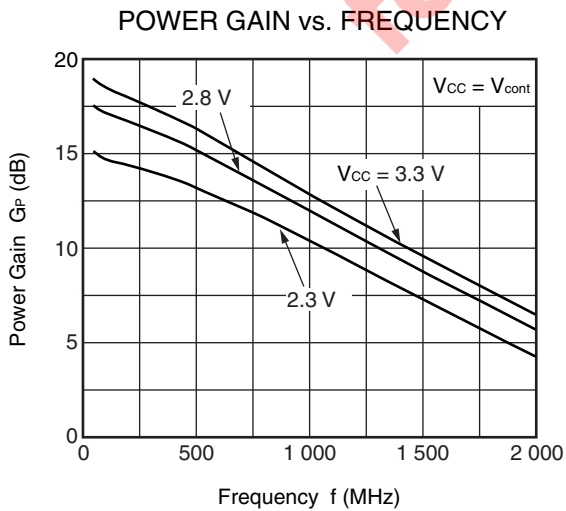
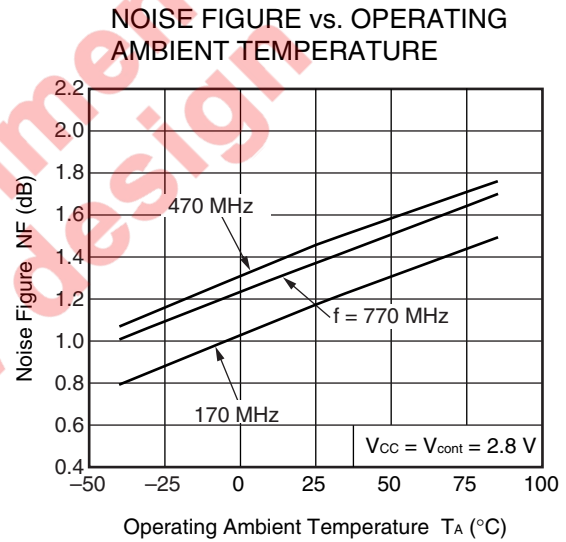
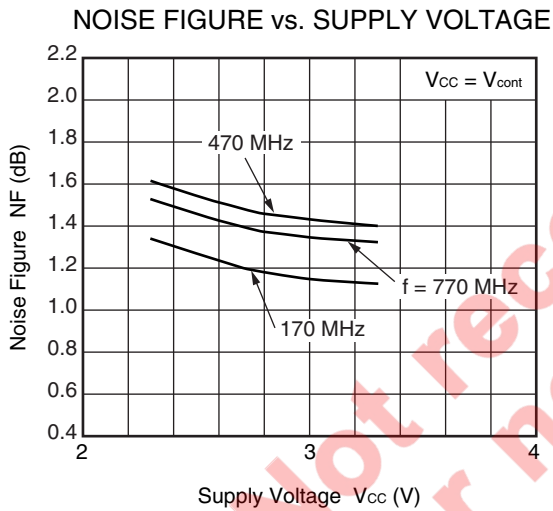
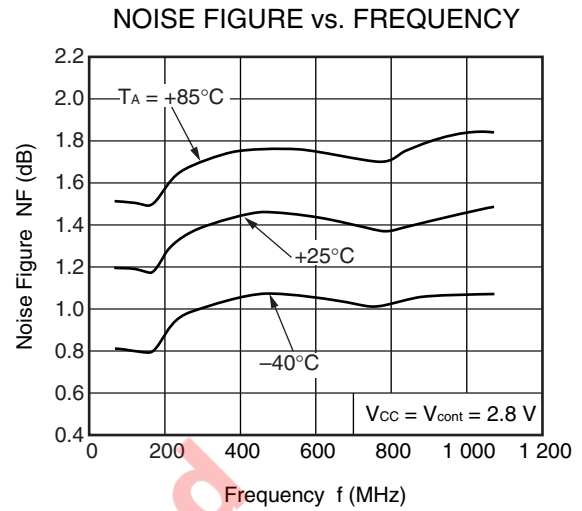
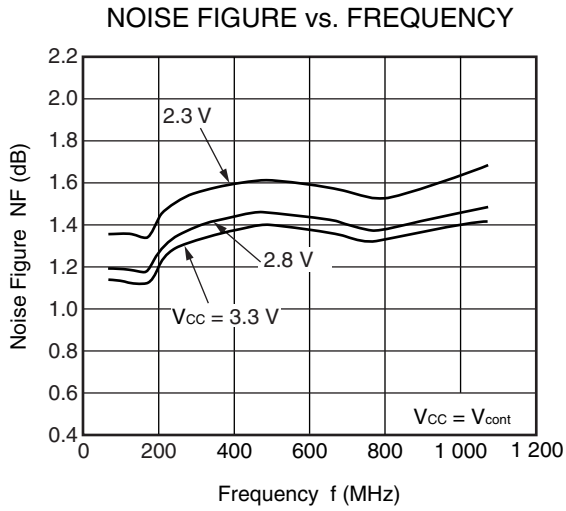
MODE CONTROL CURRENT vs. MODE CONTROL VOLTAGE



**Remark** The graphs indicate nominal characteristics.

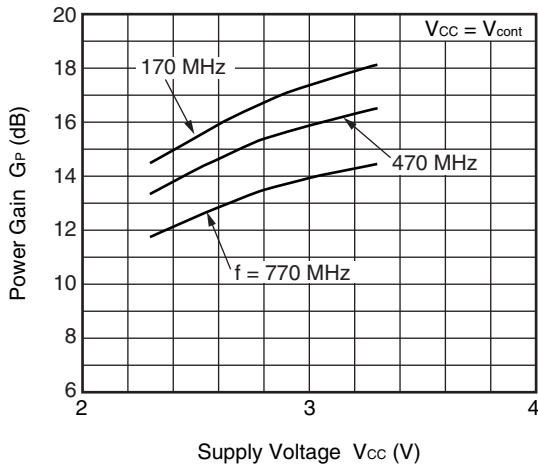


TYPICAL CHARACTERISTICS 2 (LNA-mode) (T<sub>A</sub> = +25°C, unless otherwise specified)

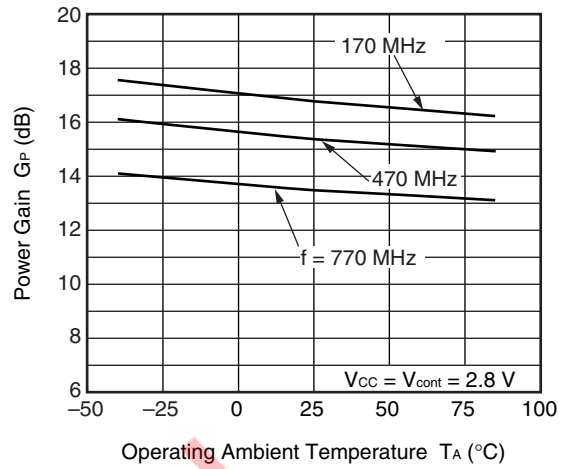


**Remark** The graphs indicate nominal characteristics.

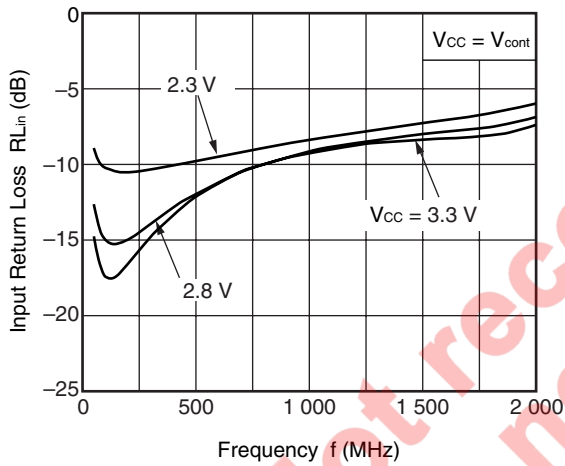
POWER GAIN vs. SUPPLY VOLTAGE



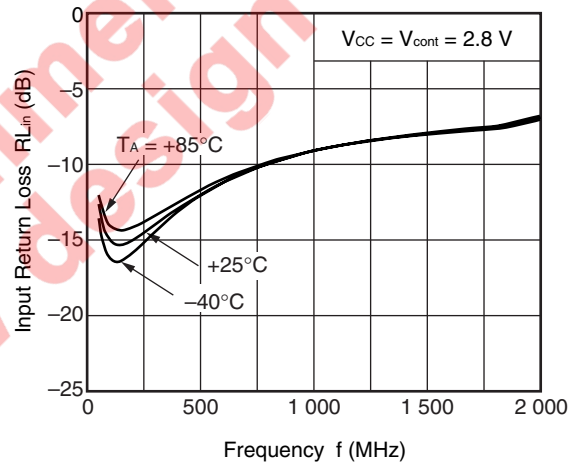
POWER GAIN vs. OPERATING AMBIENT TEMPERATURE



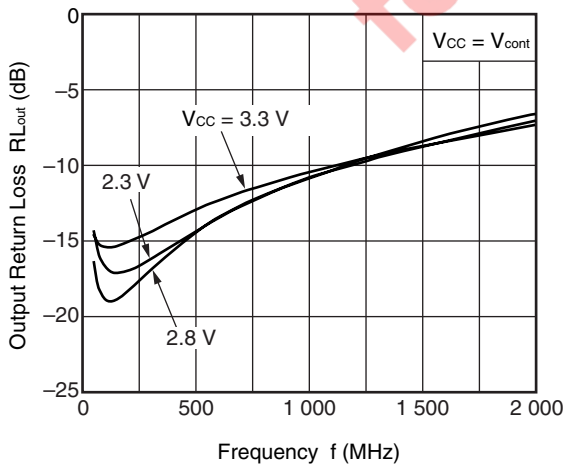
INPUT RETURN LOSS vs. FREQUENCY



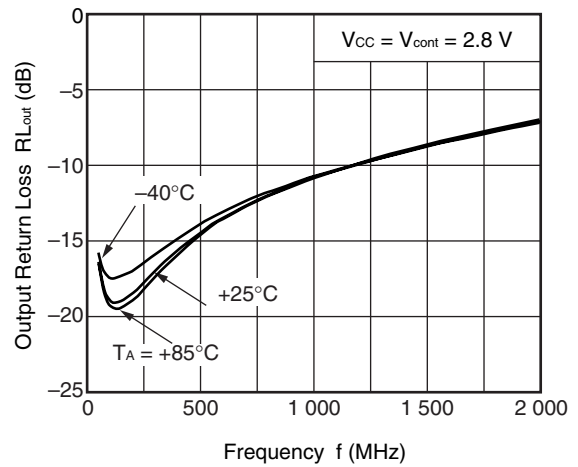
INPUT RETURN LOSS vs. FREQUENCY



OUTPUT RETURN LOSS vs. FREQUENCY

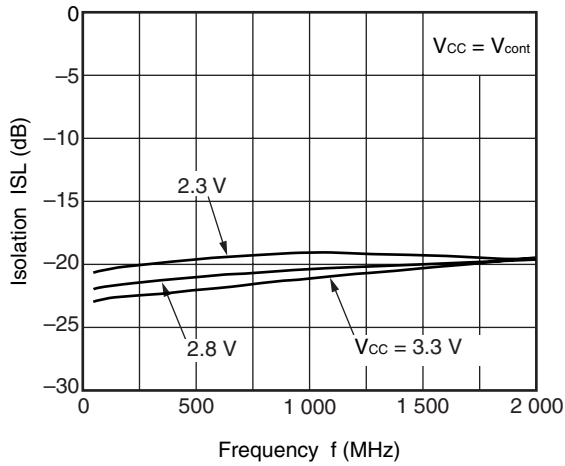


OUTPUT RETURN LOSS vs. FREQUENCY

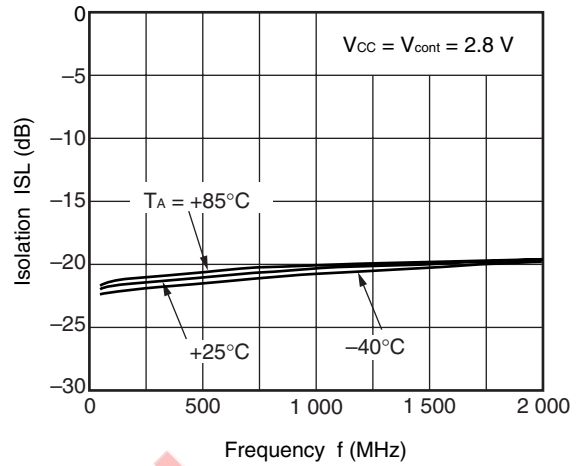


**Remark** The graphs indicate nominal characteristics.

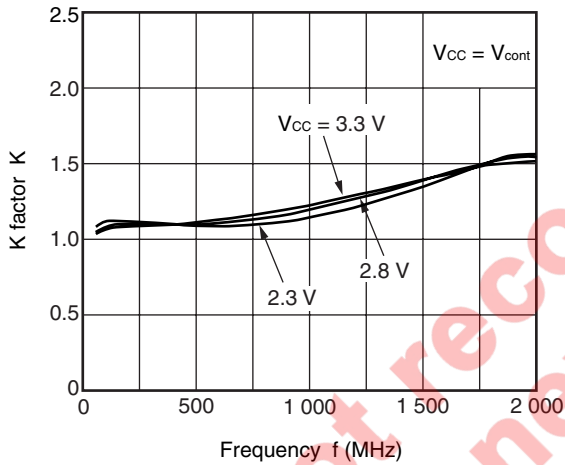
ISOLATION vs. FREQUENCY



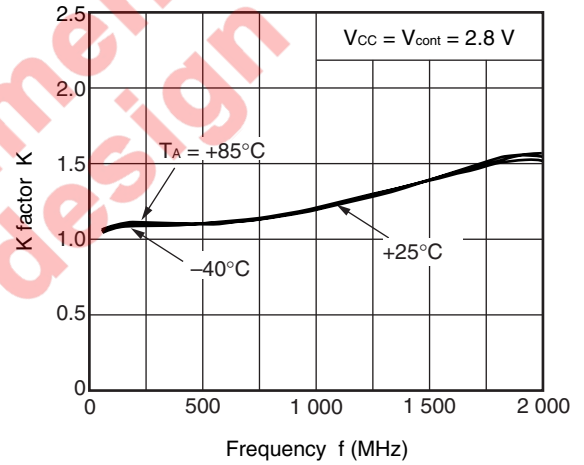
ISOLATION vs. FREQUENCY



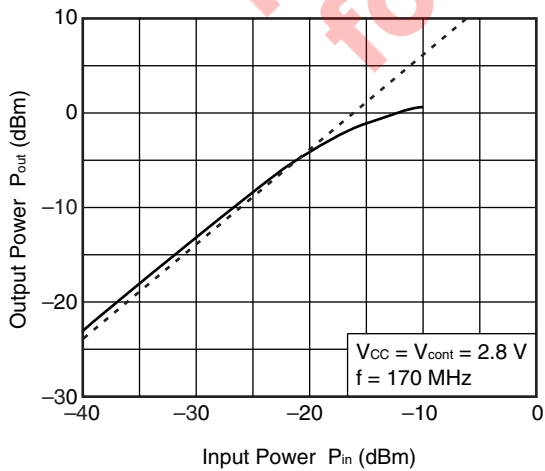
K FACTOR vs. FREQUENCY



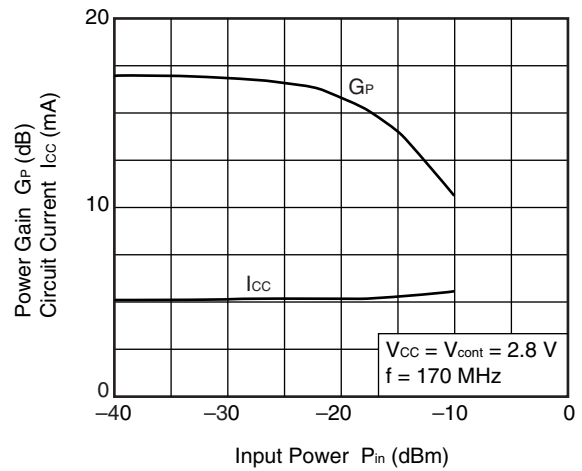
K FACTOR vs. FREQUENCY



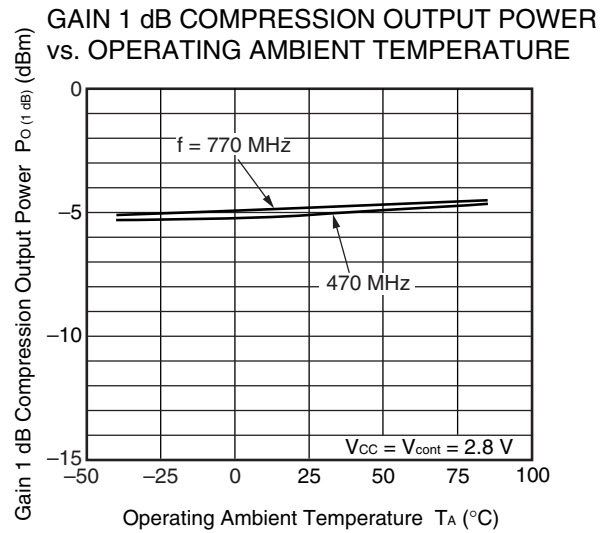
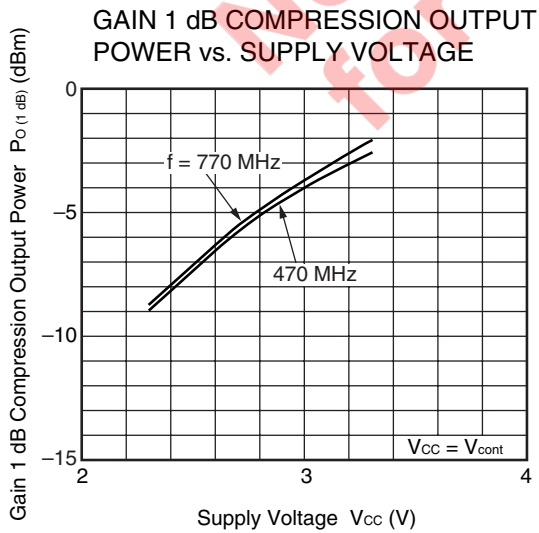
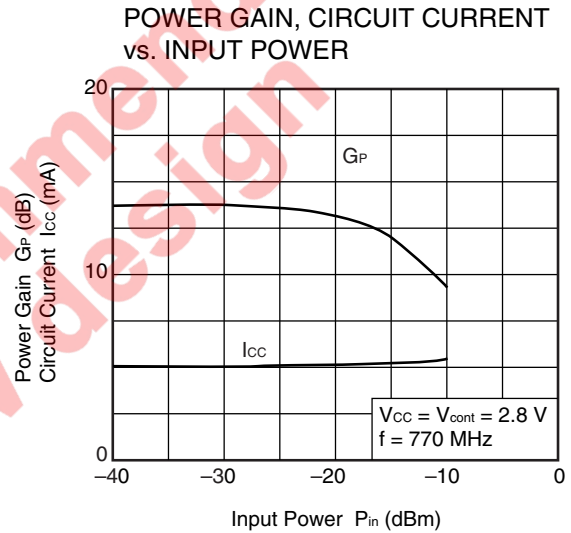
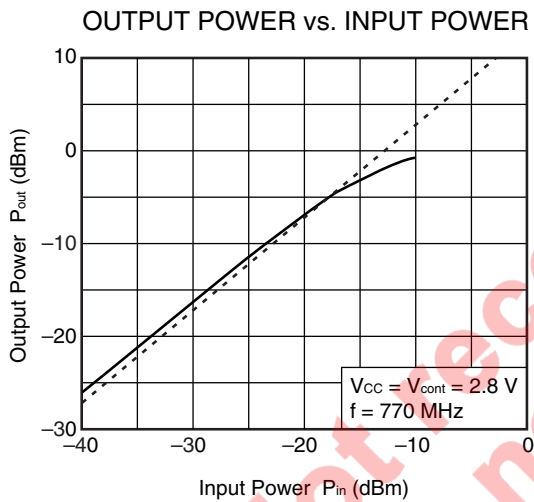
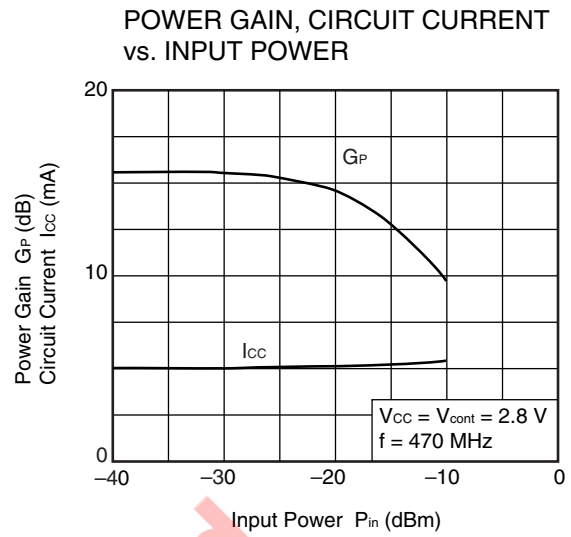
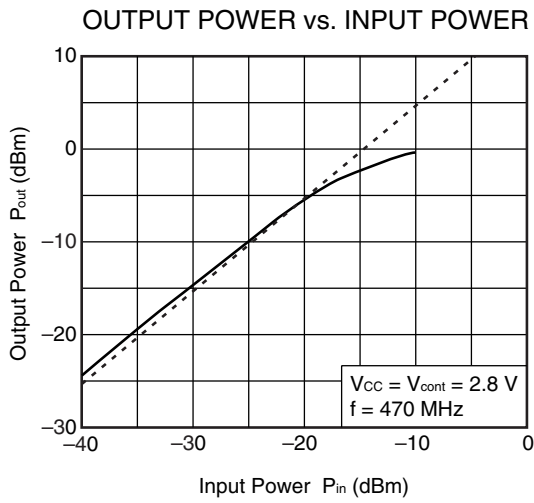
OUTPUT POWER vs. INPUT POWER



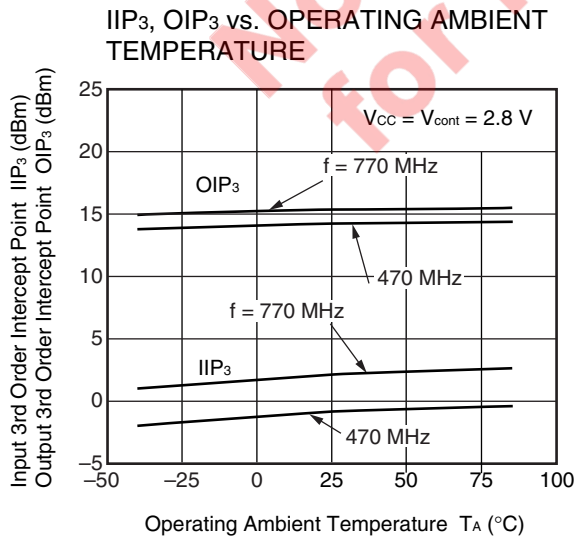
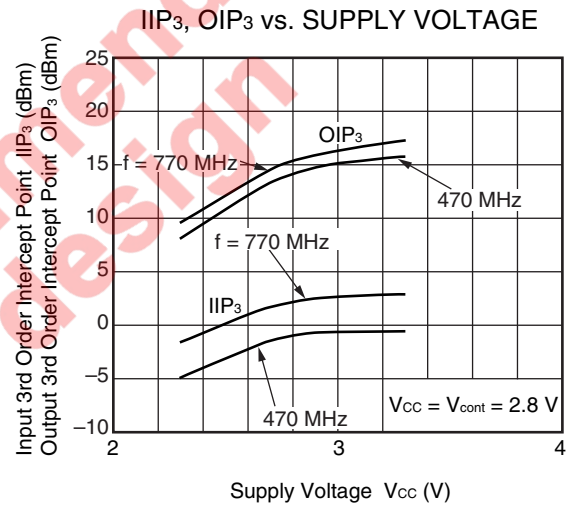
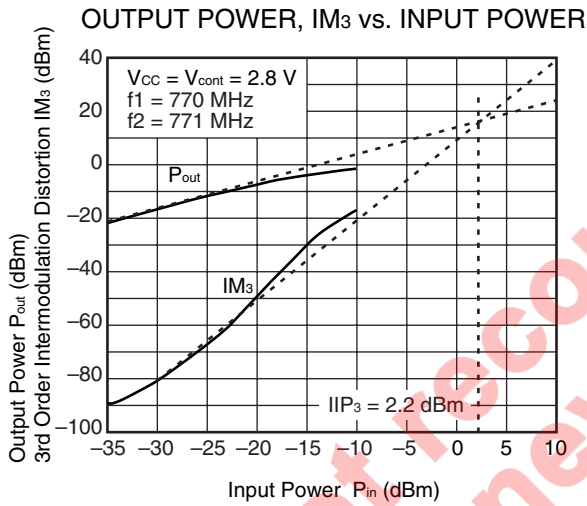
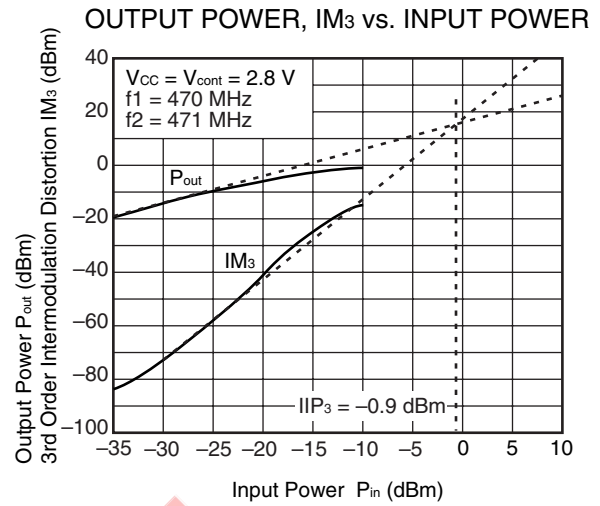
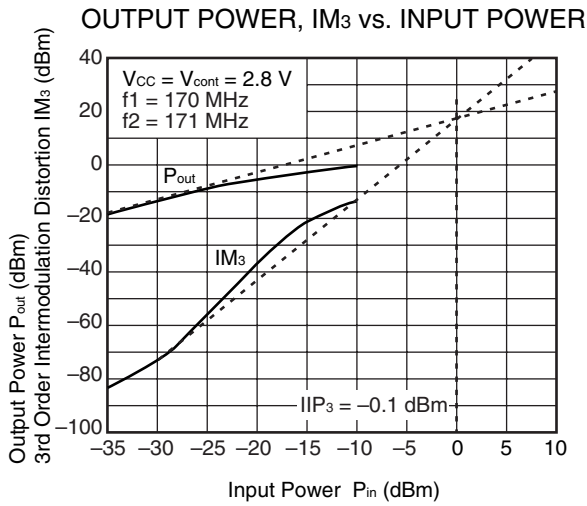
POWER GAIN, CIRCUIT CURRENT vs. INPUT POWER



**Remark** The graphs indicate nominal characteristics.



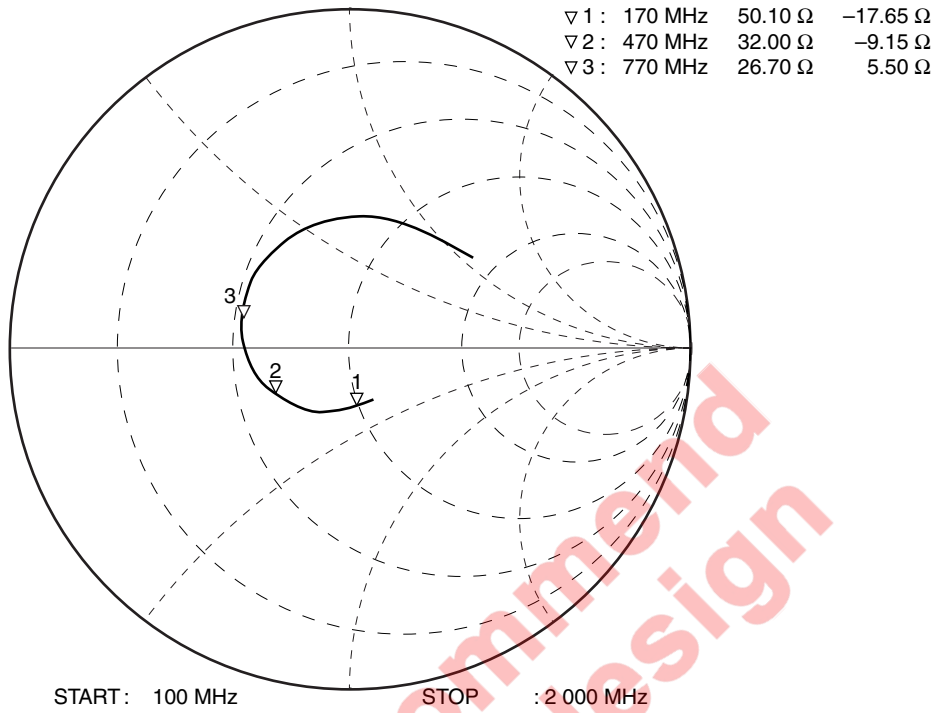
**Remark** The graphs indicate nominal characteristics.



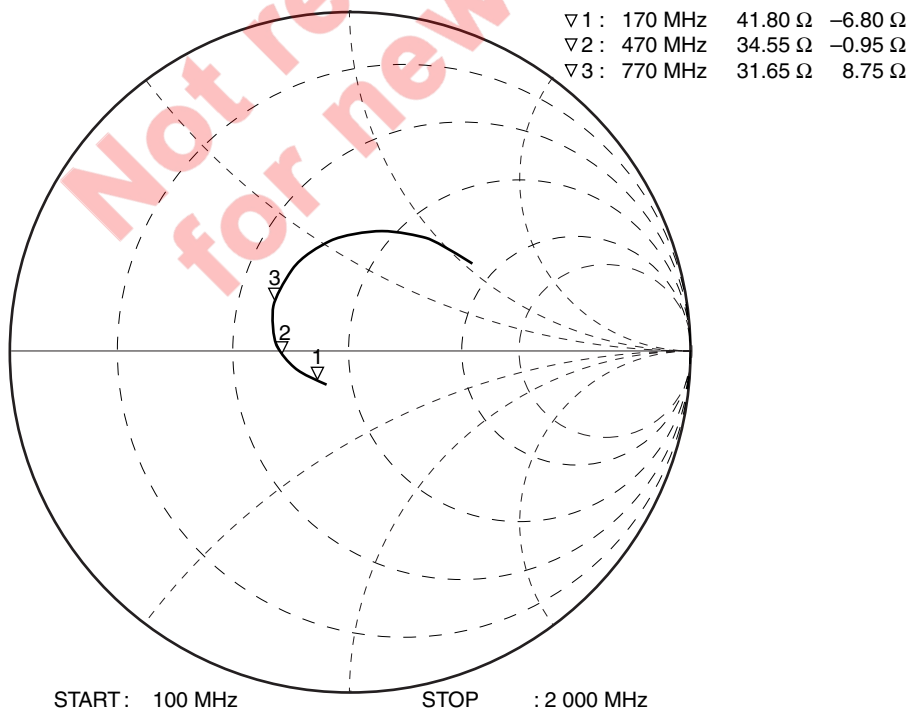
**Remark** The graphs indicate nominal characteristics.

S-PARAMETERS 1 (LNA-mode) (T<sub>A</sub> = +25°C, V<sub>CC</sub> = V<sub>cont</sub> = 2.8 V, monitored at connector on board)

S<sub>11</sub>-FREQUENCY

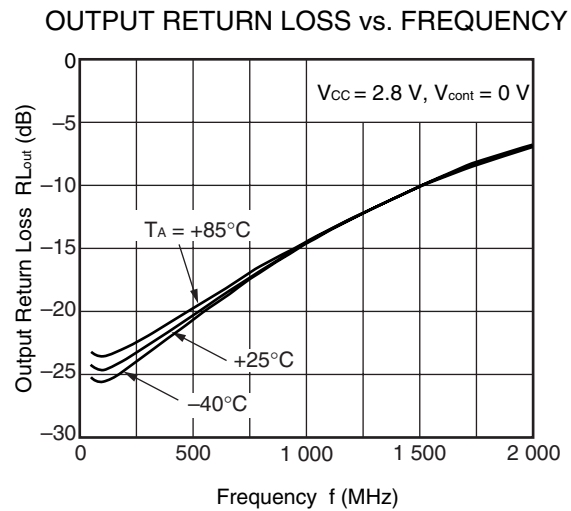
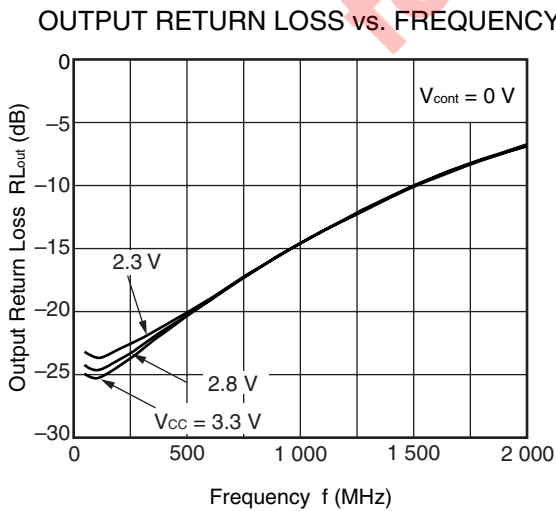
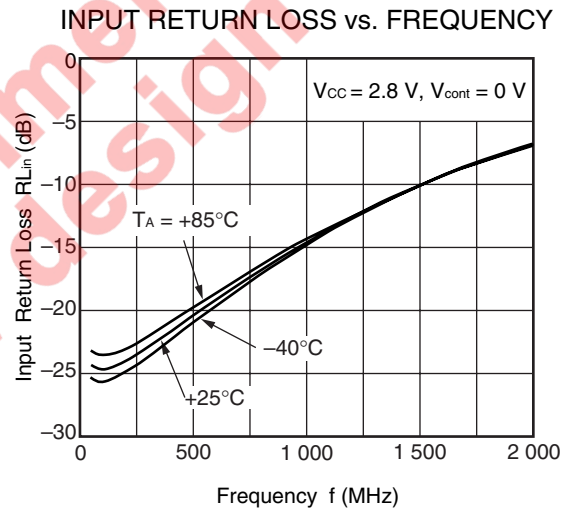
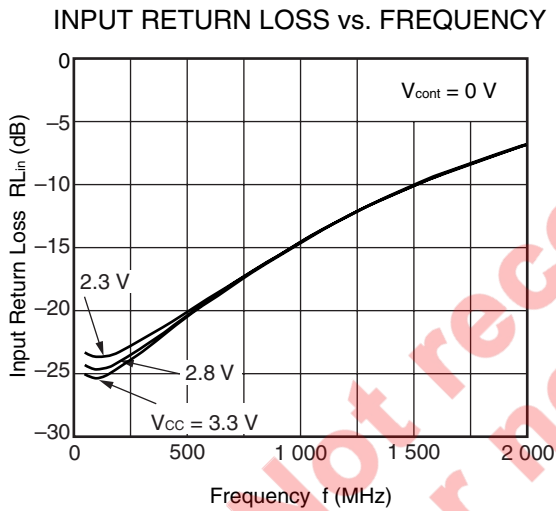
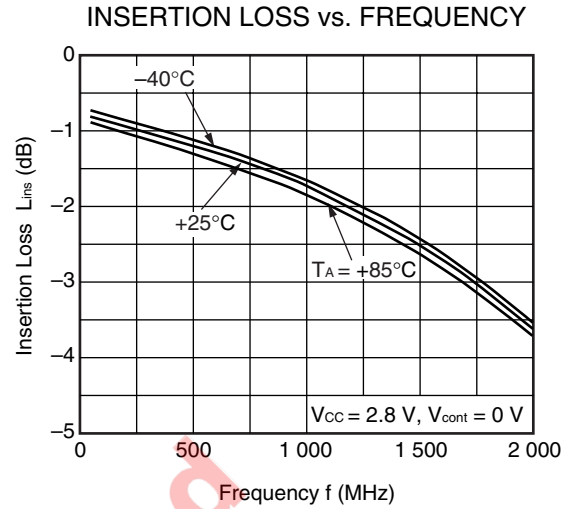
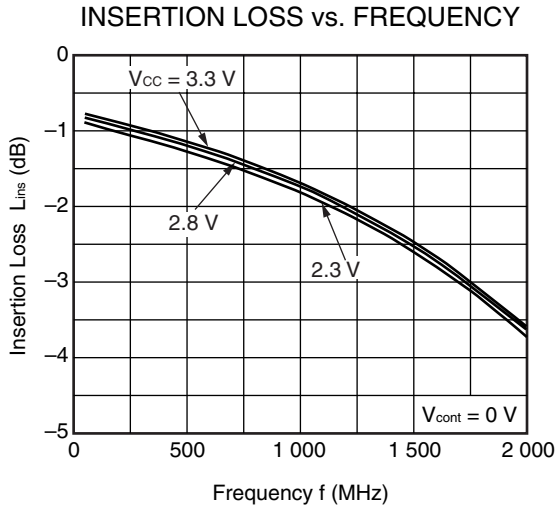


S<sub>22</sub>-FREQUENCY



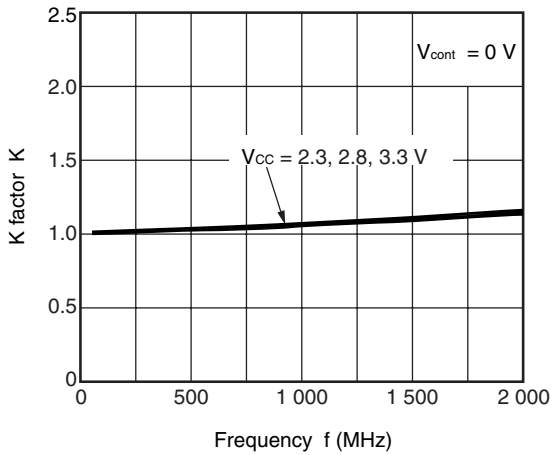
**Remark** The graphs indicate nominal characteristics.

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

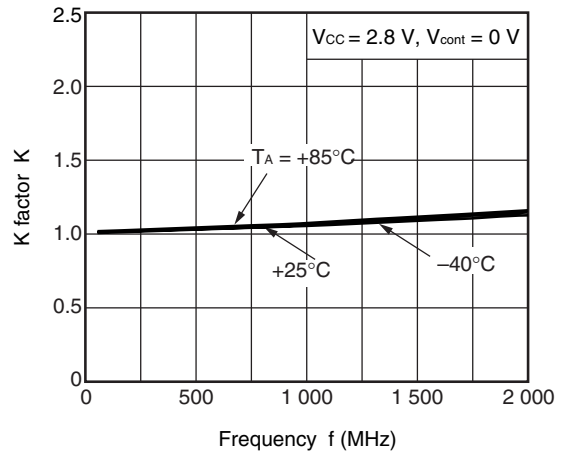


**Remark** The graphs indicate nominal characteristics.

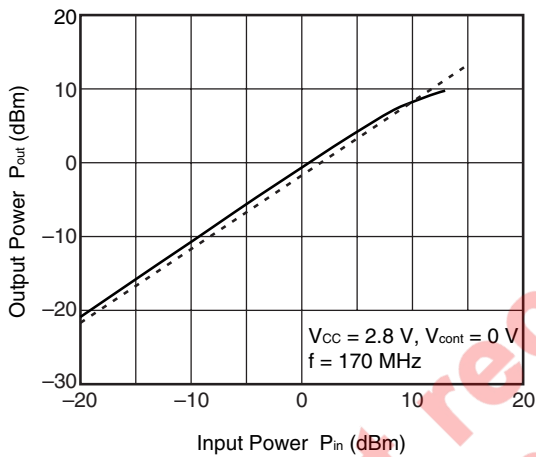
K FACTOR vs. FREQUENCY



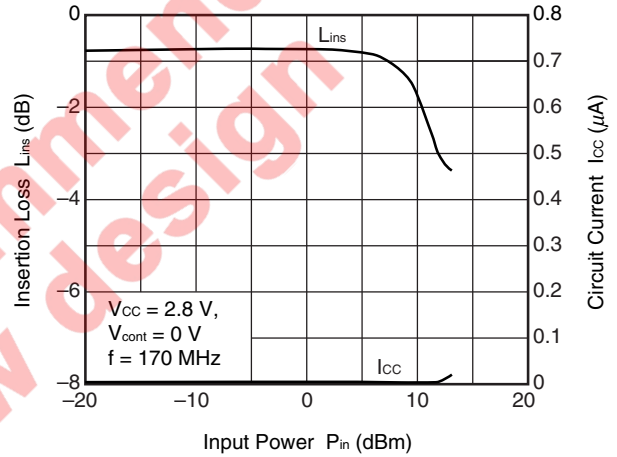
K FACTOR vs. FREQUENCY



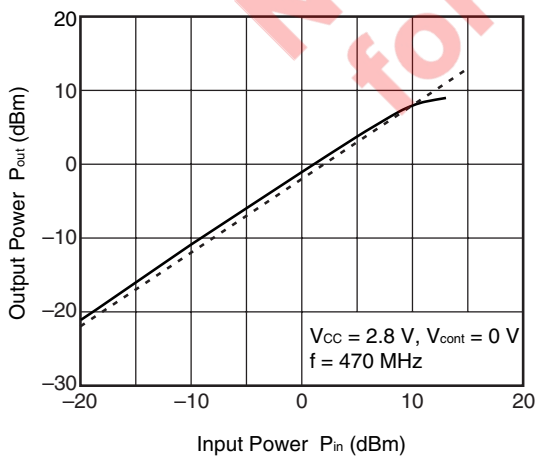
OUTPUT POWER vs. INPUT POWER



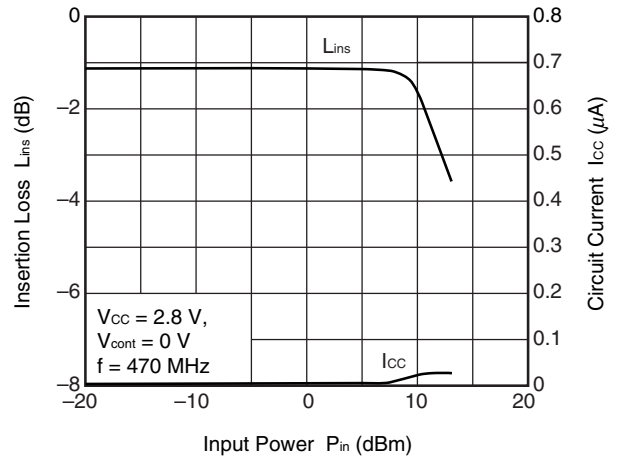
INSERTION LOSS, CIRCUIT CURRENT vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER

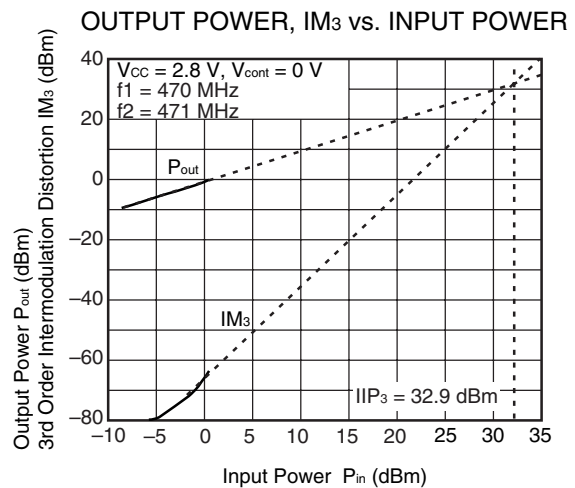
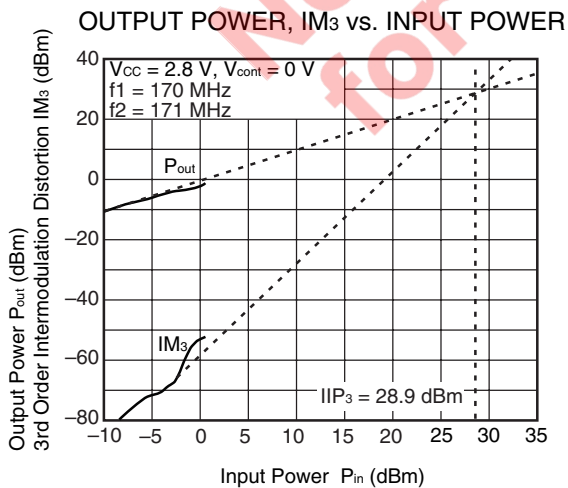
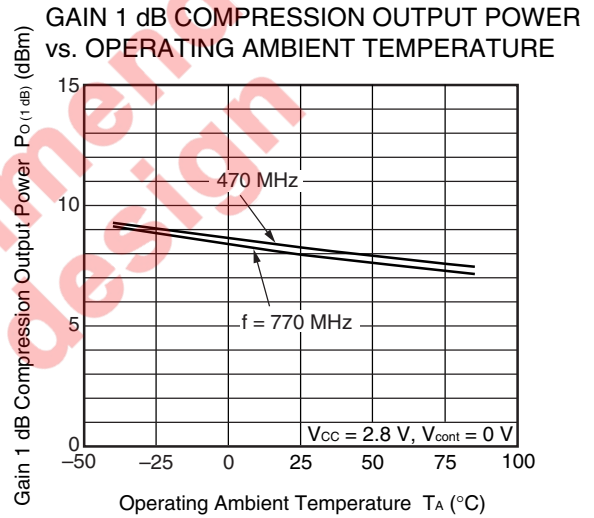
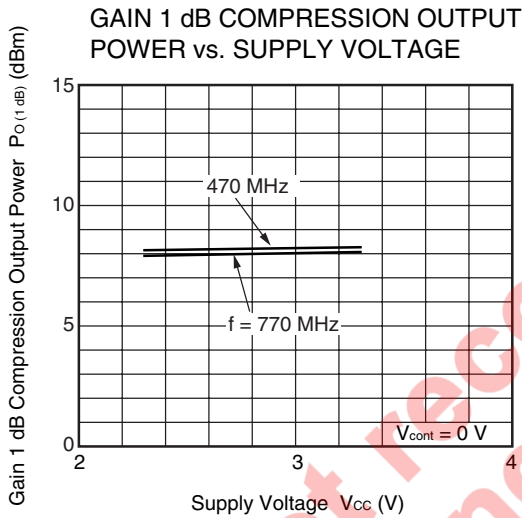
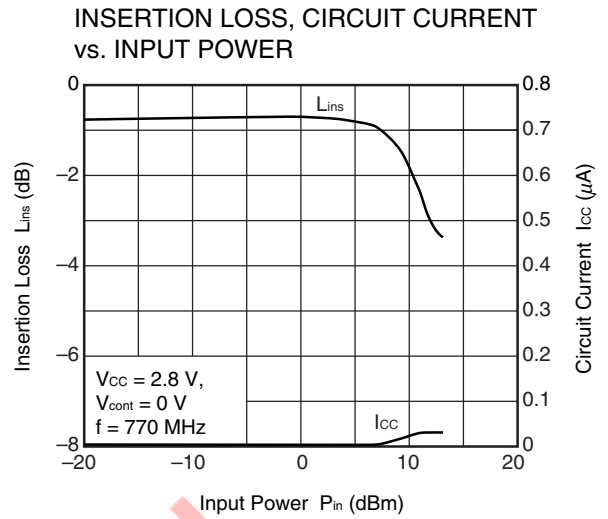
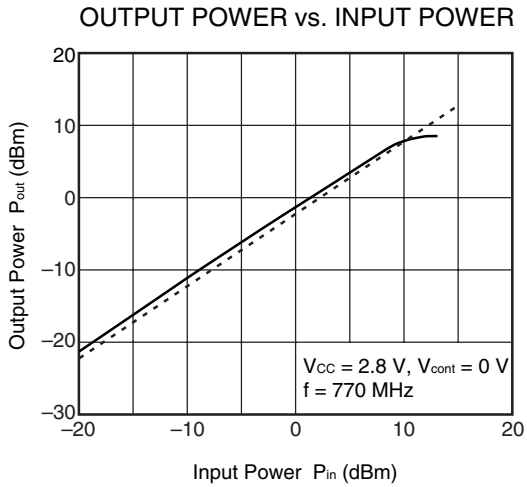


INSERTION LOSS, CIRCUIT CURRENT vs. INPUT POWER

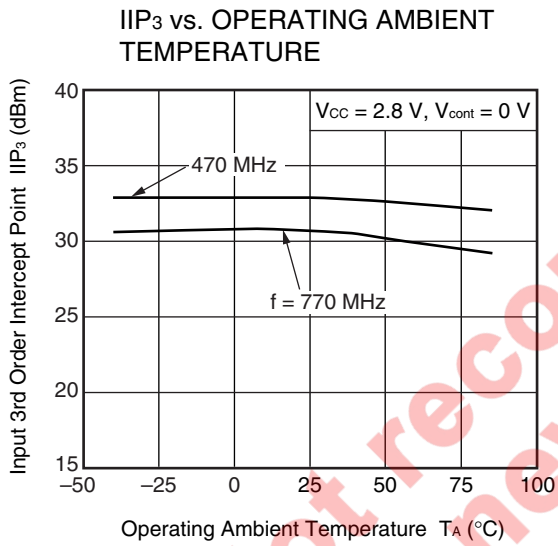
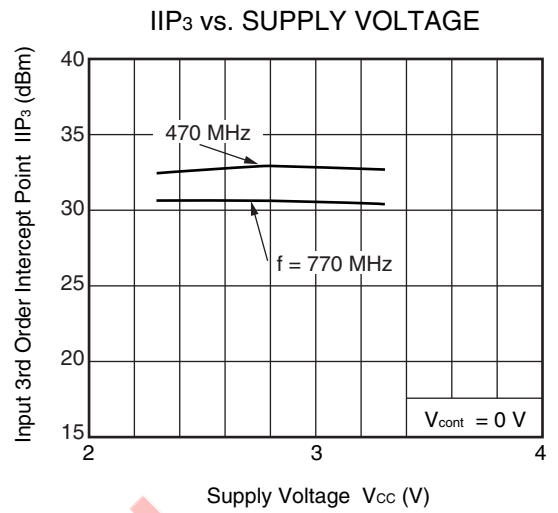
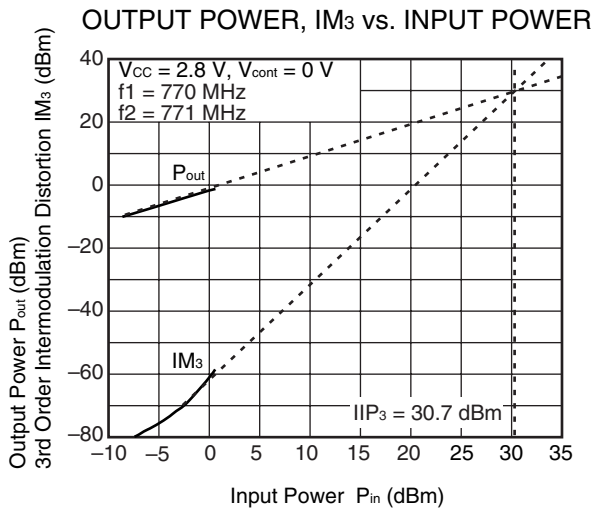


**Remark** The graphs indicate nominal characteristics.





**Remark** The graphs indicate nominal characteristics.



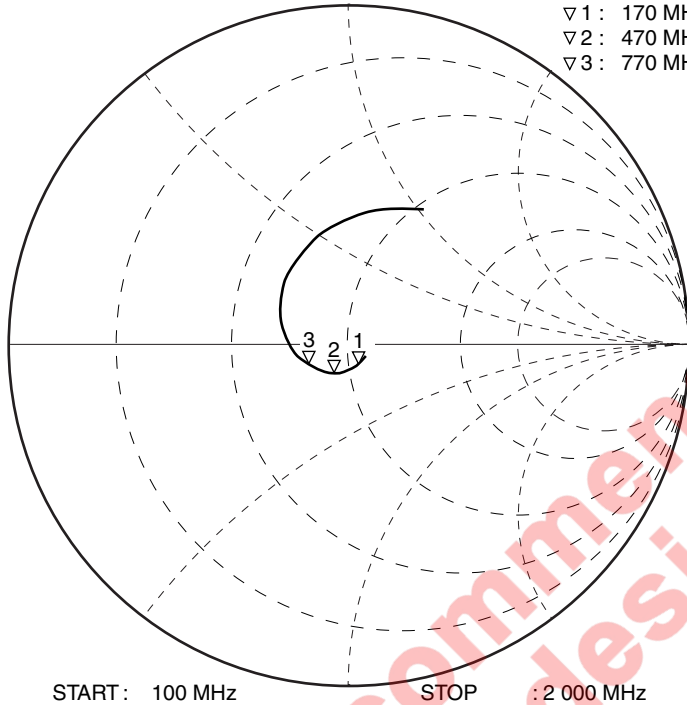
**Remark** The graphs indicate nominal characteristics.

**S-PARAMETERS 2 (Bypass-mode)**

(T<sub>A</sub> = +25°C, V<sub>CC</sub> = 2.8 V, V<sub>cont</sub> = 0 V, monitored at connector on board)

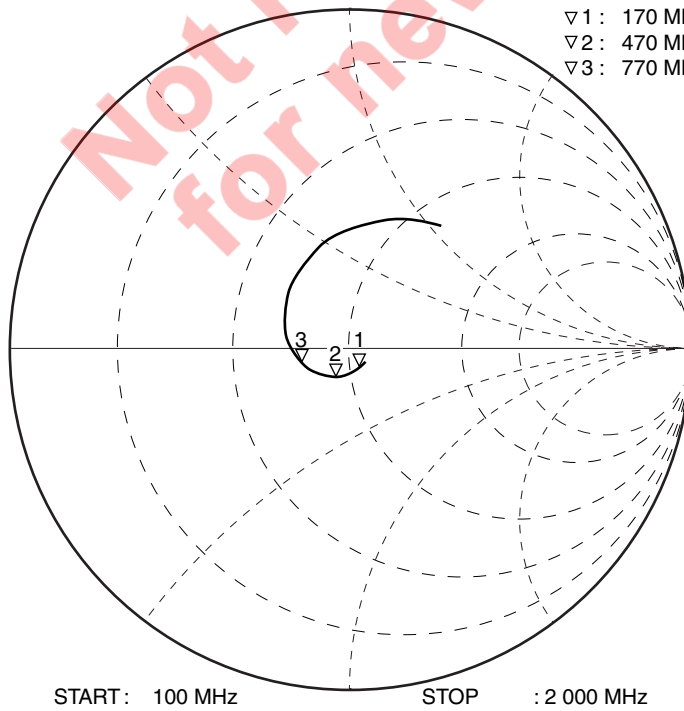
**S<sub>11</sub>-FREQUENCY**

▽1 : 170 MHz	53.50 Ω	-5.20 Ω
▽2 : 470 MHz	45.80 Ω	-7.65 Ω
▽3 : 770 MHz	26.70 Ω	-3.75 Ω



**S<sub>22</sub>-FREQUENCY**

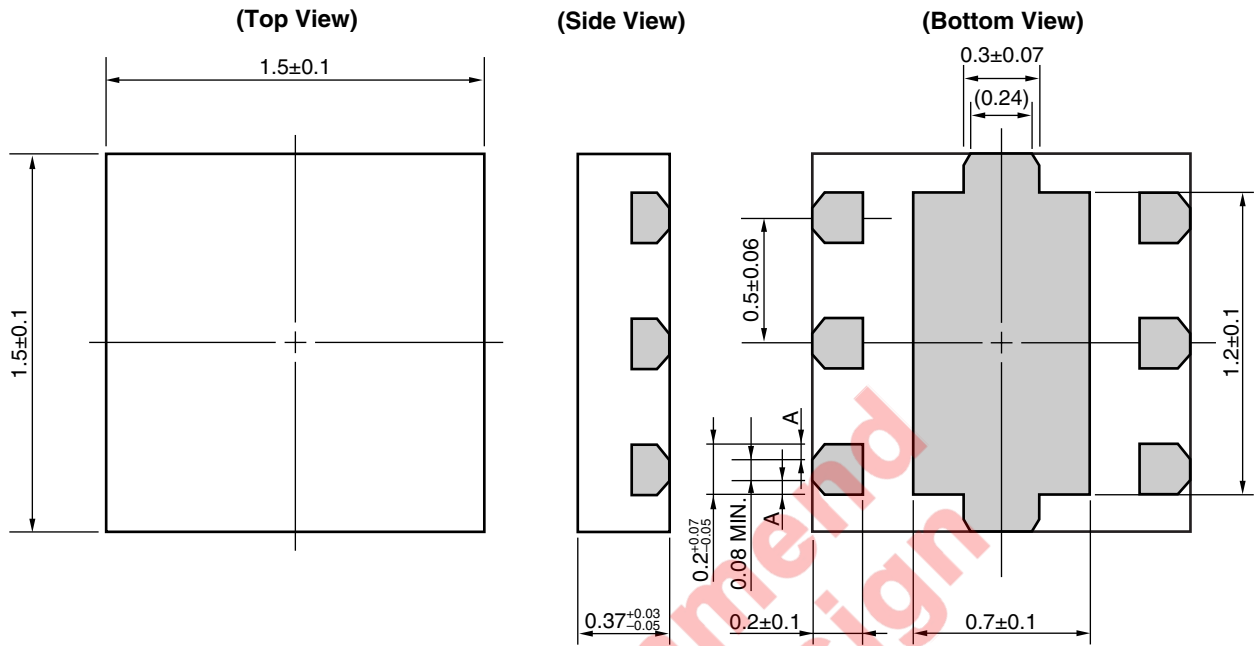
▽1 : 170 MHz	53.25 Ω	-5.50 Ω
▽2 : 470 MHz	34.55 Ω	-7.40 Ω
▽3 : 770 MHz	31.65 Ω	-2.70 Ω



**Remark** The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

6-PIN PLASTIC TSON (T6N) (UNIT: mm)



Remark A>0  
( ) : Reference value

Not recommended for new design

**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 Vcc line.
- (4) Do not supply DC voltage to INPUT pin.
- (5) Pin 5 (NC) should be connected to the ground pattern.

**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
Partial Heating	Peak temperature (terminal temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

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

Not recommended for new design

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"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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