NEC

GaAs INTEGRATED CIRCUIT

μPG154TB

L-BAND SPDT SWITCH

DESCRIPTION

The μPG154TB is an L-band SPDT (Single Pole Double Throw) GaAs FET switch which was developed for digital cellular or cordless telephone application. The device can operate from 100 MHz to 2.5 GHz, having the low insertion loss. It housed in an original 6-pin super minimold package that is smaller than usual 6-pin minimold easy to install and contributes to miniaturizing the system.

FEATURES

- Low Insertion Loss : L_{INS} = 0.65 dB TYP. @V_{CONT} = +3.0 V/0 V, V_{DD} = +3.0 V, C_X = 2.0 pF, f = 2 GHz
- High Power Switching: $P_{in\ (1\ dB)}$ = +30 dBm TYP. @V_{CONT} = +3.0 V/0 V, V_{DD} = +3.0 V, C_X = 2.0 pF, f = 2 GHz
- Small 6-pin super minimold package (Size: 2.0 × 1.25 × 0.9 mm)

APPLICATIONS

- L, S-band digital cellular or cordless telephone
- PCS, WLAN and WLL applications

ORDERING INFORMATION

Part Number	Marking	Package	Supplying Form
μPG154TB-E3	G1K	6-pin super minimold	Embossed tape 8 mm wide. Pin 1, 2, 3 face to tape perforation side. Qty 3 kp/reel.

Remark To order evaluation samples, please contact your local NEC sales office. (Part number for sample order: μPG154TB)

Caution The IC must be handled with care to prevent static discharge because its circuit is composed of GaAs MES FET.

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The mark ★ shows major revised points.

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings	Unit
Control Voltage 1, 2	$V_{CONT1, 2}$	–6.0 to +6.0[Note]	V
Supply Voltage	V_{DD}	5.0	V
Input Power	P_{in}	+31	dBm
Total Power Dissipation	P_{tot}	0.15	W
Operating Temperature	T_A	–45 to +85	°C
Storage Temperature	T_{stg}	–55 to +150	°C

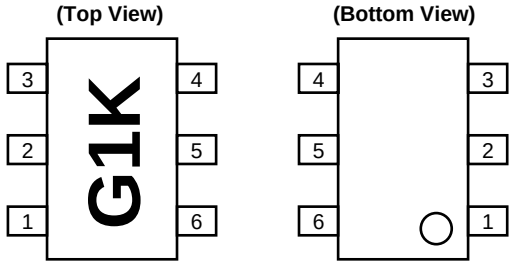
Note Condition $2.5 \leq | V_{CONT1} - V_{CONT2} | \leq 6.0$ V

Remarks 1. Mounted on a 50 × 50 × 1.6 mm double copper clad epoxy glass PWB, T_A = +85°C

2. Operation in excess of any one of these parameters may result in permanent damage.

PIN CONNECTIONS

Pin No.	Connection	Pin No.	Connection
1	OUT1	4	V_{CONT2}
2	V_{DD}	5	IN
3	OUT2	6	V_{CONT1}



RECOMMENDED OPERATING CONDITIONS (T_A = +25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Control Voltage (Low)	V_{CONT}	–0.2	0	+0.2	V
Control Voltage (High)	V_{CONT}	+2.5	+3.0	+5.3	V
Supply Voltage	V_{DD}	+2.5	$V_{CONT(H)}$	$V_{CONT(H)}$ + 0.3	V

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, T_A = +25°C, V_{CONT1} = 3 V, V_{CONT2} = 0 V or V_{CONT1} = 0 V, V_{CONT2} = 3 V, Z_O = 50 Ω, V_{DD} = 3.0 V, Off chip DC blocking capacitors value; 51 pF)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss	L_{INS}	f = 100 M to 1.0 GHz, C_X = 12.0 pF	–	0.30	0.65	dB
		f = 2.0 GHz, C_X = 2.0 pF	–	0.65	0.90	
Isolation	ISL	f = 1.0 GHz, C_X = 12.0 pF	20	24	–	dB
		f = 1.5 GHz, C_X = 4.5 pF	–	22	–	
		f = 2.0 GHz, C_X = 2.0 pF	18	21	–	
Input Return Loss	RL_{in}	f = 100 M to 2.0 GHz, C_X = 2.0 pF	11	15	–	dB
Output Return Loss	RL_{out}	f = 100 M to 2.0 GHz, C_X = 2.0 pF	11	15	–	dB
Input Power at 0.1 dB Compression Point[Note]	$P_{in\ (0.1\ dB)}$	f = 2.0 GHz, C_X = 2.0 pF	–	26.5	–	dBm
Input Power at 1 dB Compression Point[Note]	$P_{in\ (1\ dB)}$	f = 2.0 GHz, C_X = 2.0 pF	27	30	–	dBm
Switching Speed	t_{sw}		–	30	–	ns
Control Current	I_{CONT}	V_{CONT} = 3 V/0 V	–	2	10	μA

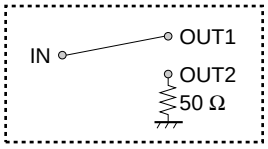
Note $P_{in\ (1\ dB)}$ and $P_{in\ (0.1\ dB)}$ are measured the input power level when the insertion loss increase more 1 dB or 0.1 dB than that of linear range. All other characteristics are measured in linear range.

Cautions

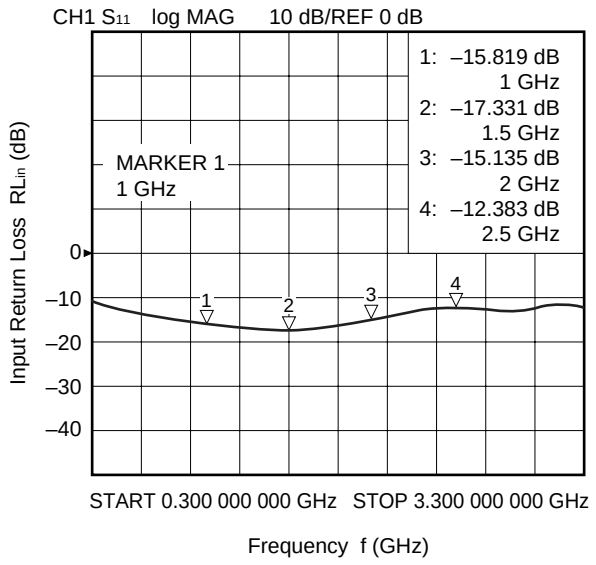
1. **The value of trap capacitor to improve the isolation performance should be chosen to accommodate the operating frequency, band width, switching speed and the condition with actual board of your system. The distance between IC's No.2 pin and trap capacitor C_X should be placed as shorter as possible to avoid parasitic parameters.**
2. **When the μPG154TB is used, it is necessary to use DC blocking capacitors for No.1 (OUT1), No.3 (OUT2) and No.5 (IN). The value of DC blocking capacitors should be chosen to accommodate the operating frequency, band width, switching speed and the condition with actual board of your system. The range of recommended DC blocking capacitor value is less than 100 pF.**

★ TYPICAL CHARACTERISTICS (Cx = 12 pF)

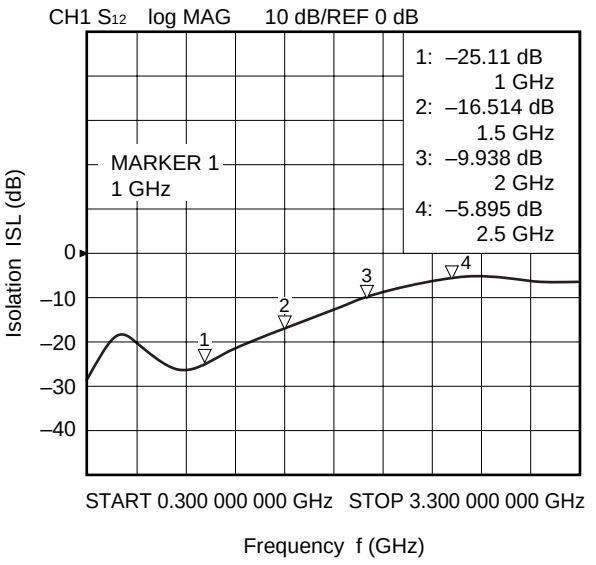
TEST CONDITIONS: V_{CONT} = 3 V/0 V, V_{DD} = 3.0 V, P_{in} = 0 dBm, T_A = +25°C, using evaluation board.



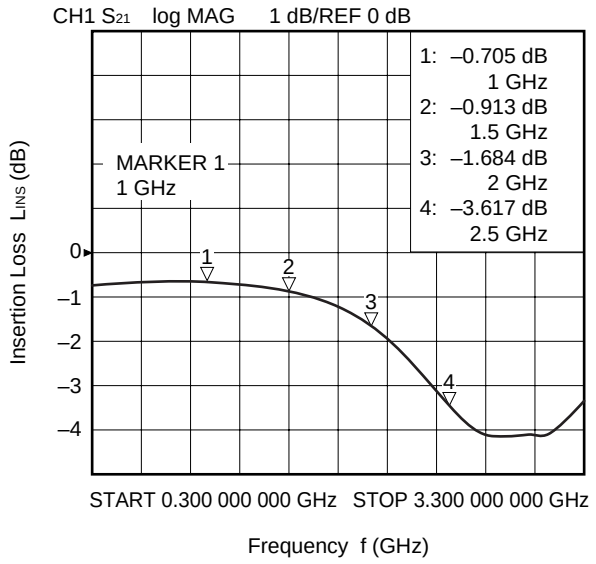
IN-OUT1 INPUT RETURN LOSS vs. FREQUENCY



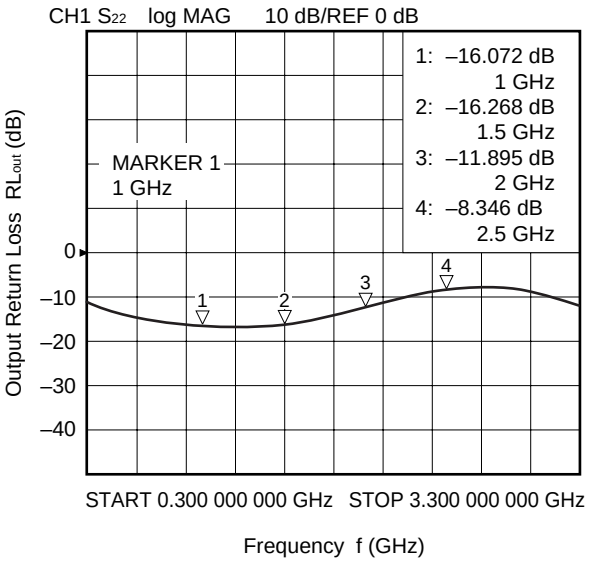
IN-OUT1 ISOLATION vs. FREQUENCY



IN-OUT1 INSERTION LOSS vs. FREQUENCY



IN-OUT1 OUTPUT RETURN LOSS vs. FREQUENCY



Caution This data is including loss of the test fixture.

★ TYPICAL CHARACTERISTICS (Cx = 4.5 pF)

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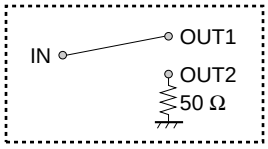
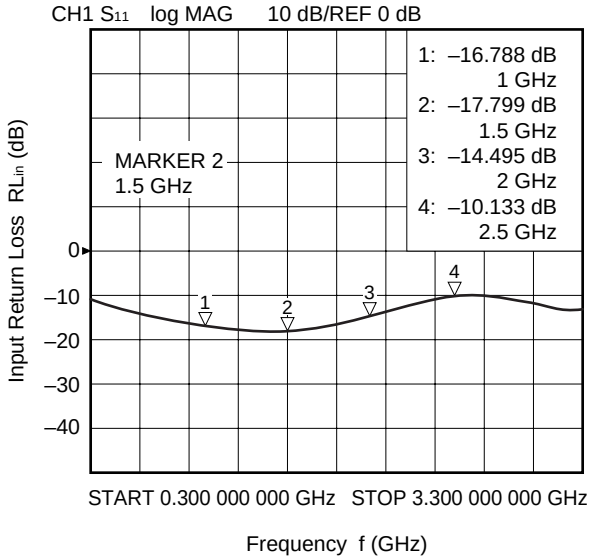
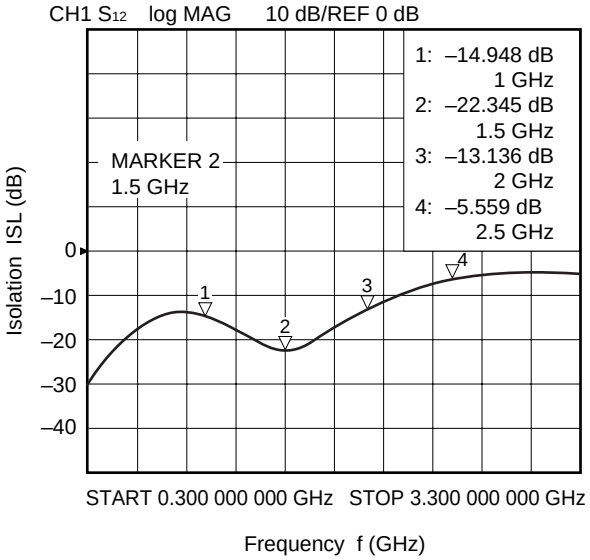


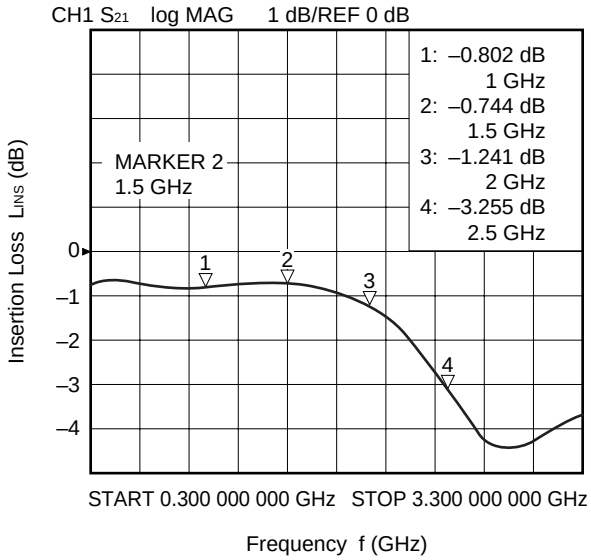
IN-OUT1 INPUT RETURN LOSS vs. FREQUENCY



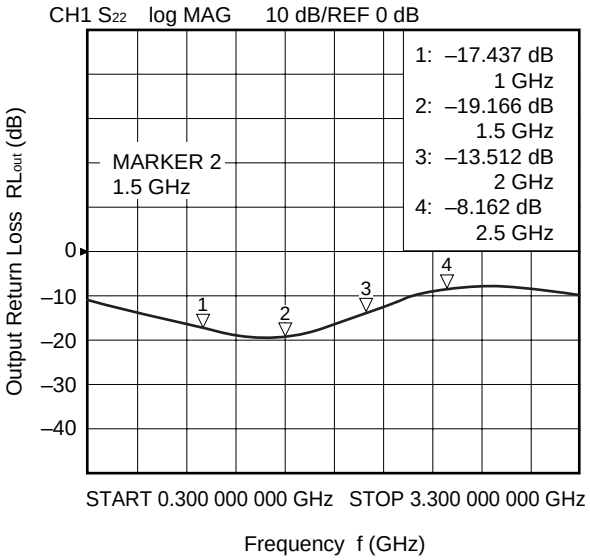
IN-OUT1 ISOLATION vs. FREQUENCY



IN-OUT1 INSERTION LOSS vs. FREQUENCY



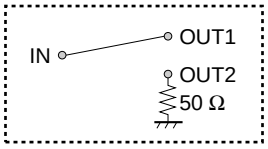
IN-OUT1 OUTPUT RETURN LOSS vs. FREQUENCY



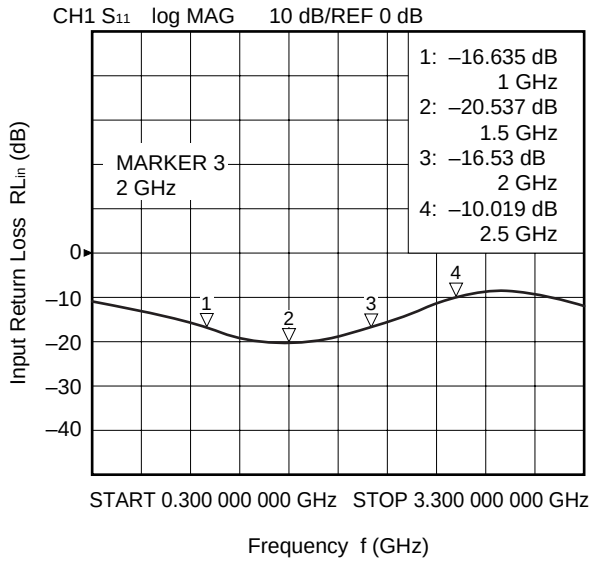
Caution This data is including loss of the test fixture.

★ TYPICAL CHARACTERISTICS (Cx = 2 pF)

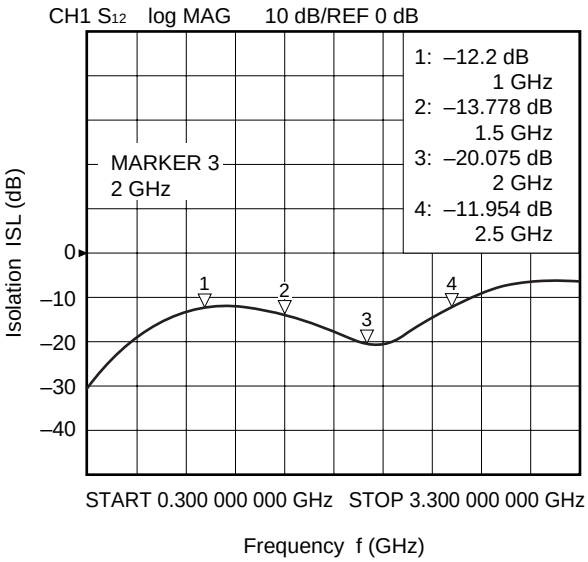
TEST CONDITIONS: V_{CONT} = 3 V/0 V, V_{DD} = 3.0 V, P_{in} = 0 dBm, T_A = +25°C, using evaluation board.



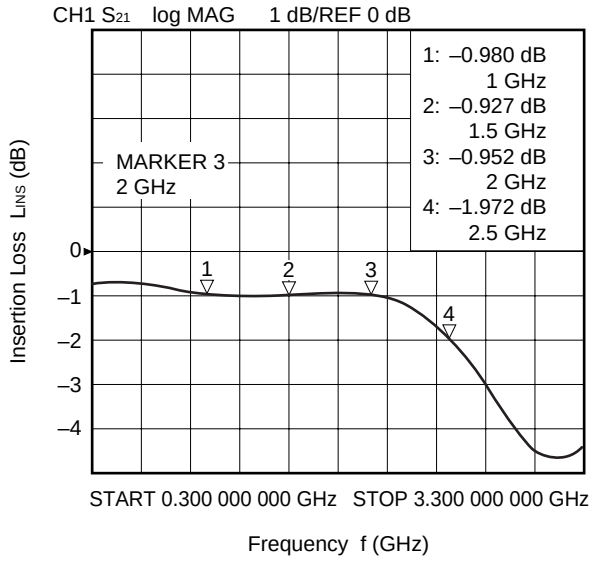
IN-OUT1 INPUT RETURN LOSS vs. FREQUENCY



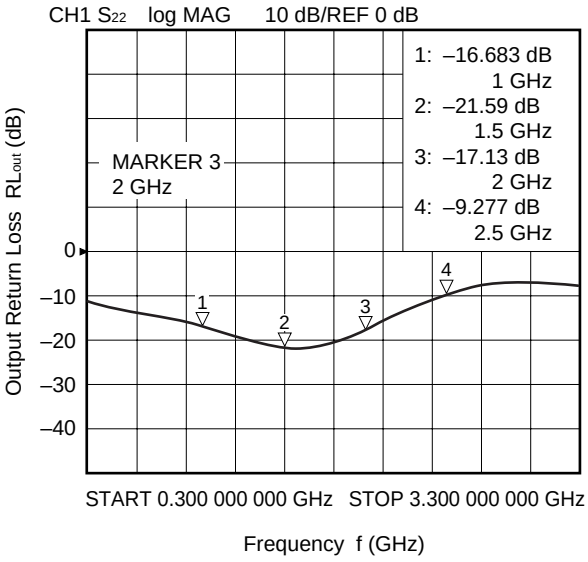
IN-OUT1 ISOLATION vs. FREQUENCY



IN-OUT1 INSERTION LOSS vs. FREQUENCY



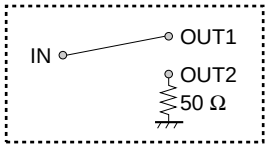
IN-OUT1 OUTPUT RETURN LOSS vs. FREQUENCY



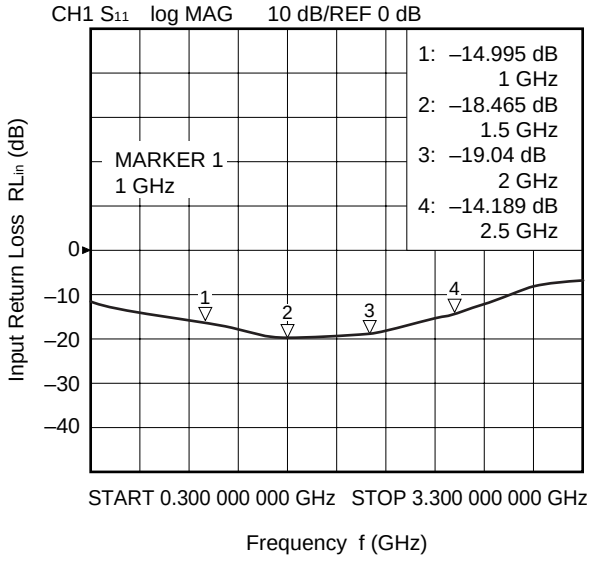
Caution This data is including loss of the test fixture.

★ TYPICAL CHARACTERISTICS (Cx = 13 pF)

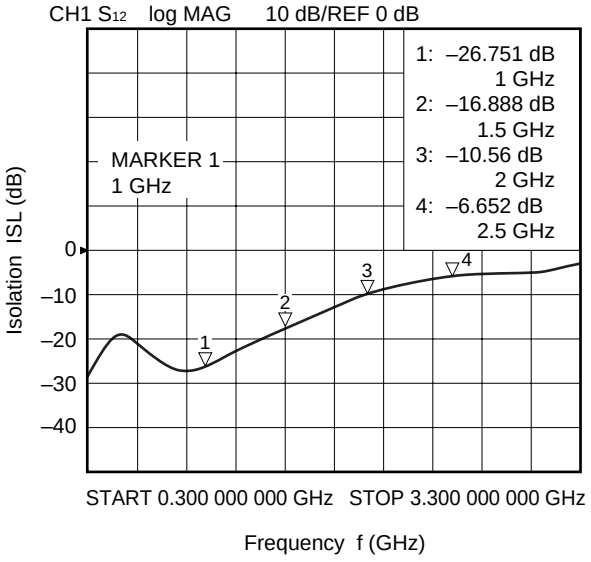
TEST CONDITIONS: V_{CONT} = 3 V/0 V, V_{DD} = 3.0 V, P_{in} = 0 dBm, T_A = +25°C, using board for customer.



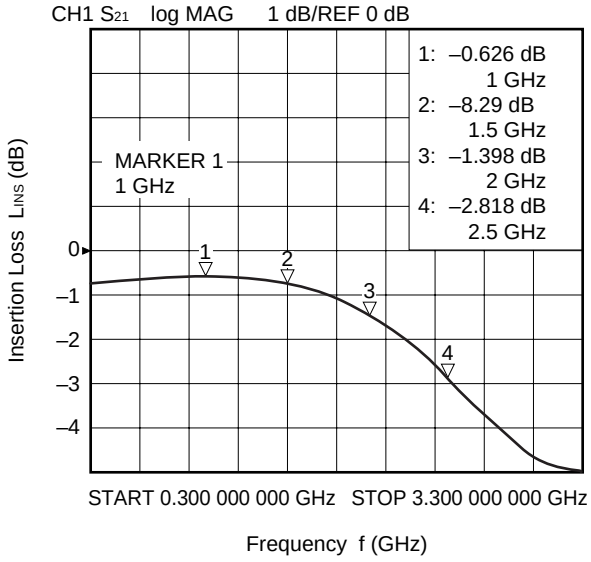
IN-OUT1 INPUT RETURN LOSS vs. FREQUENCY



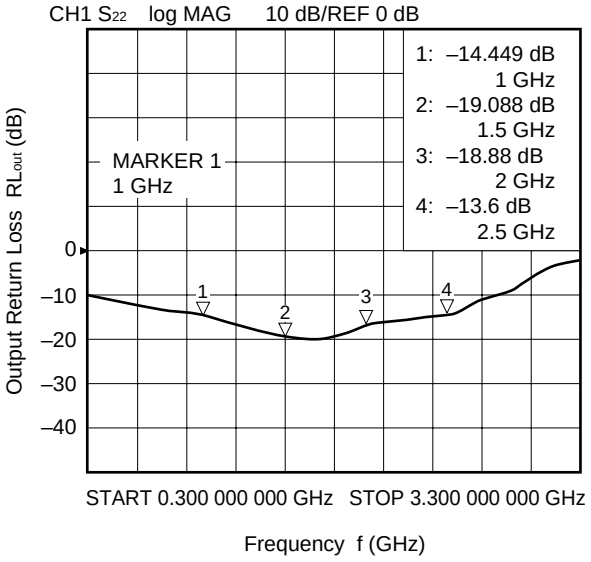
IN-OUT1 ISOLATION vs. FREQUENCY



IN-OUT1 INSERTION LOSS vs. FREQUENCY



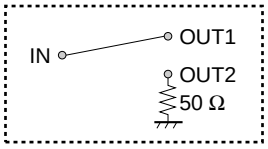
IN-OUT1 OUTPUT RETURN LOSS vs. FREQUENCY



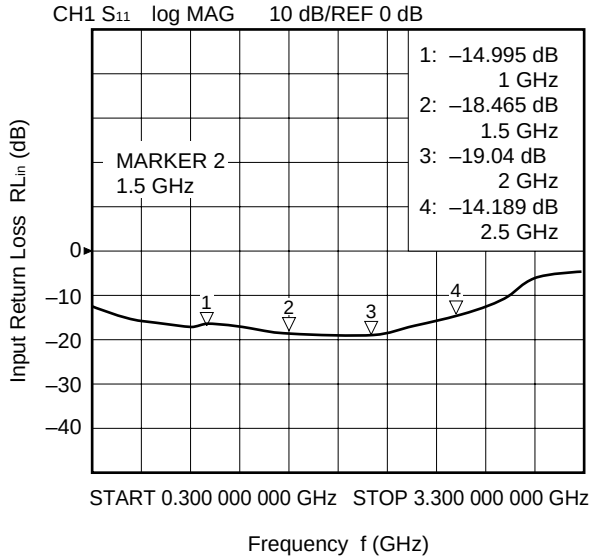
Caution This data is including loss of the test fixture.

★ TYPICAL CHARACTERISTICS (Cx = 5.5 pF)

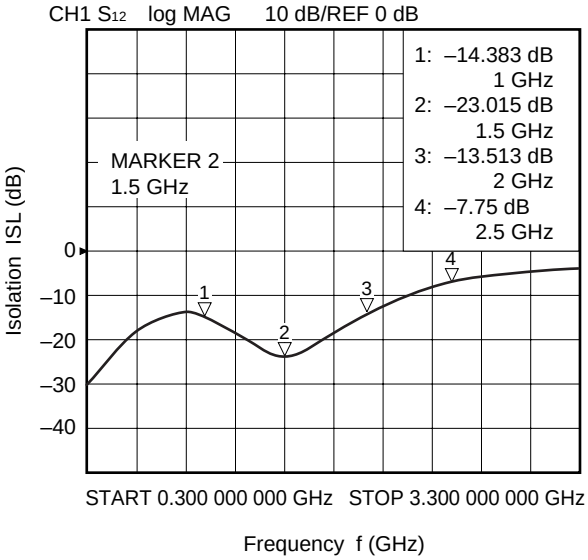
TEST CONDITIONS: V_{CONT} = 3 V/0 V, V_{DD} = 3.0 V, P_{in} = 0 dBm, T_A = +25°C, using board for customer.



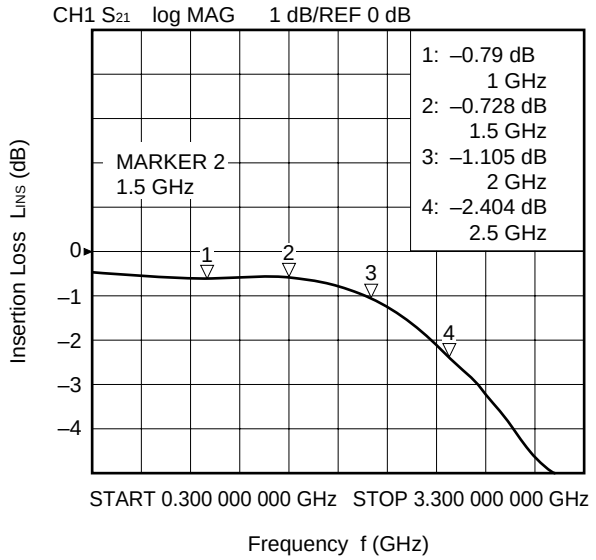
IN-OUT1 INPUT RETURN LOSS vs. FREQUENCY



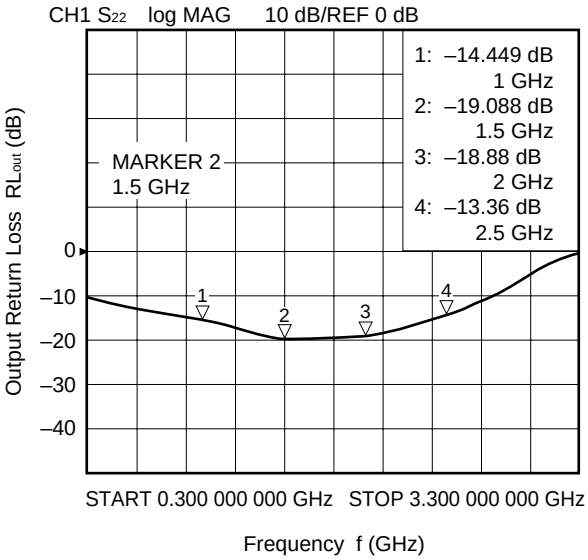
IN-OUT1 ISOLATION vs. FREQUENCY



IN-OUT1 INSERTION LOSS vs. FREQUENCY



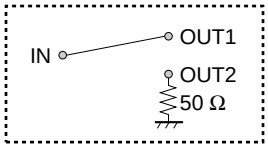
IN-OUT1 OUTPUT RETURN LOSS vs. FREQUENCY



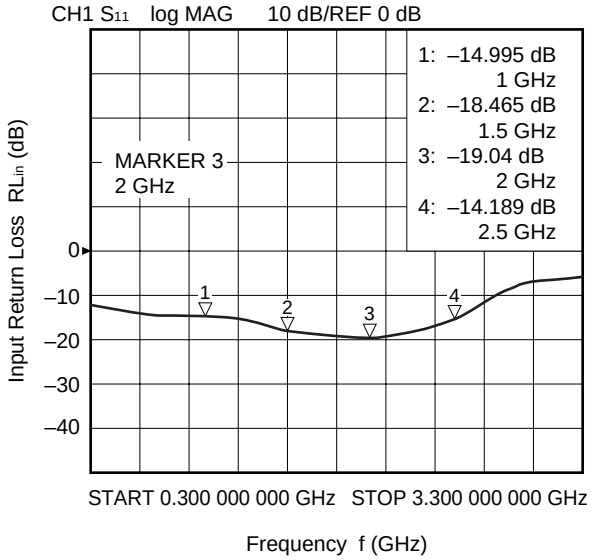
Caution This data is including loss of the test fixture.

★ TYPICAL CHARACTERISTICS (Cx = 3 pF)

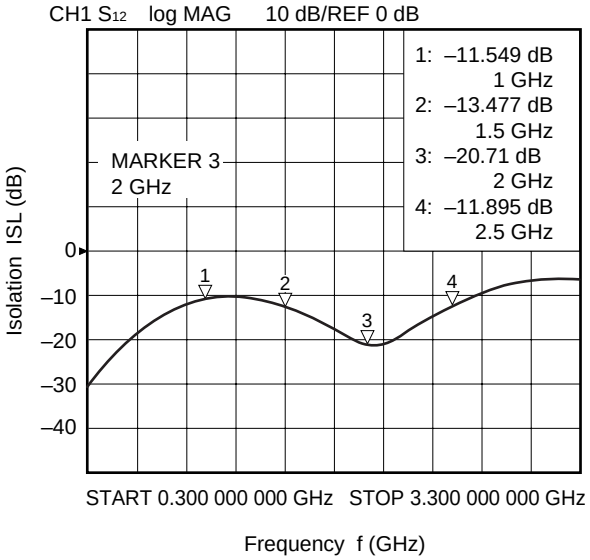
TEST CONDITIONS: V_{CONT} = 3 V/0 V, V_{DD} = 3.0 V, P_{in} = 0 dBm, T_A = +25°C, using board for customer.



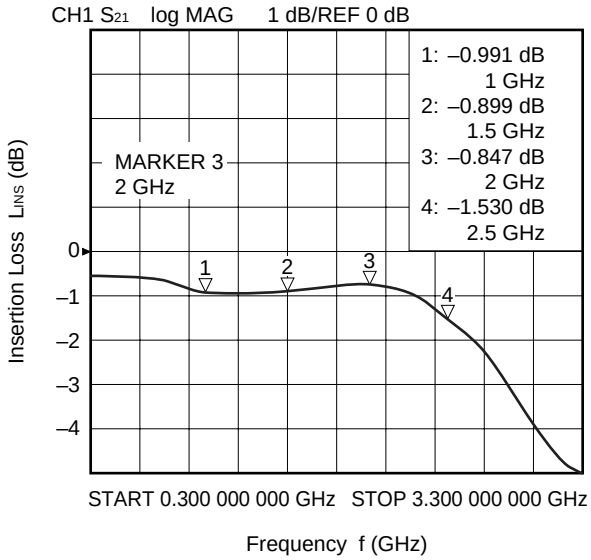
IN-OUT1 INPUT RETURN LOSS vs. FREQUENCY



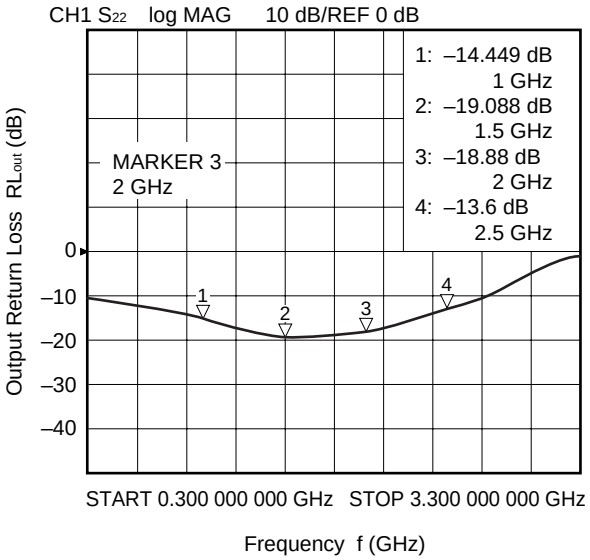
IN-OUT1 ISOLATION vs. FREQUENCY



IN-OUT1 INSERTION LOSS vs. FREQUENCY



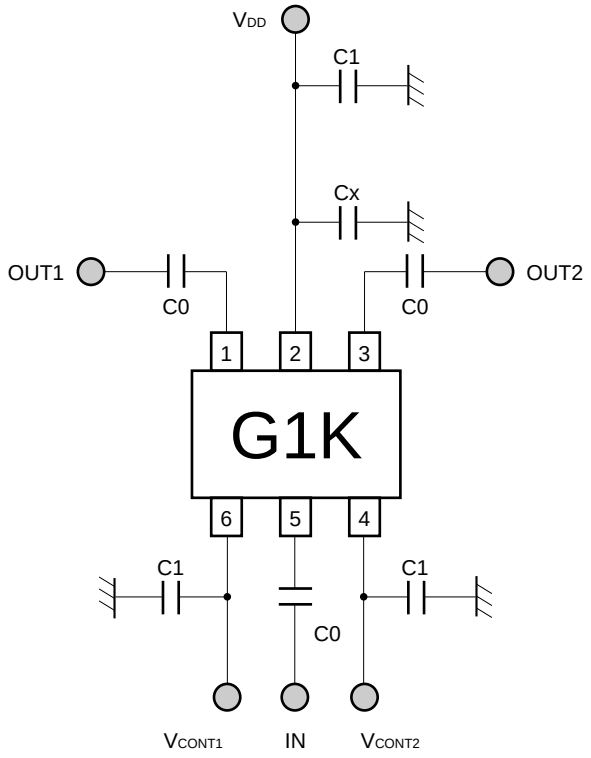
IN-OUT1 OUTPUT RETURN LOSS vs. FREQUENCY



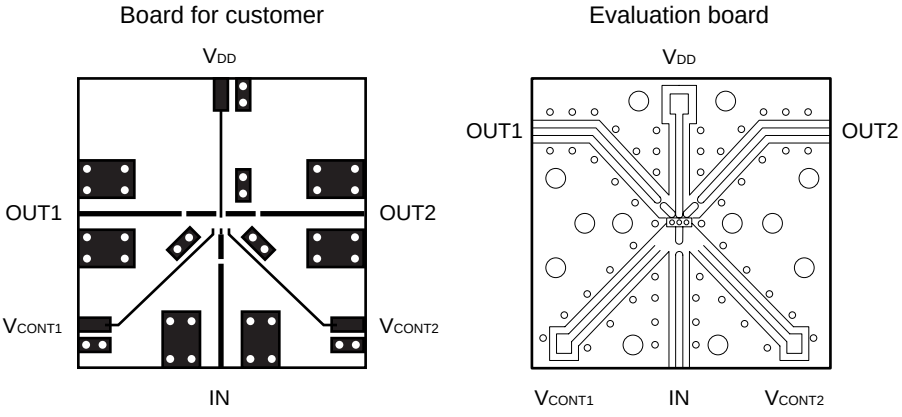
Caution This data is including loss of the test fixture.

TEST CIRCUIT

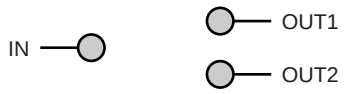
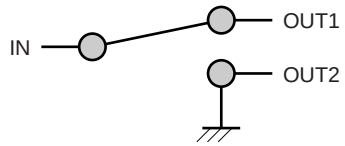
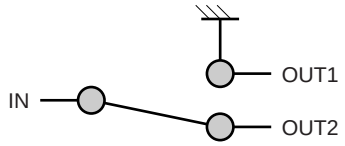
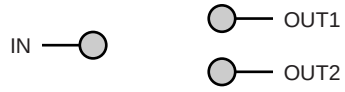
T_A = +25°C, V_{CONT1} = +3 V, V_{CONT2} = 0 V or V_{CONT1} = 0 V, V_{CONT2} = +3 V, V_{DD} = +3.0 V, f = 2 GHz, Z_O = 50 Ω
Off chip DC blocking capacitors value: C0 = 51 pF
C1 = 1 000 pF (Bypass: Select a suitable value for your application, especially concerning switching speed),
C_X = 2.0 pF (In case of 2 GHz), using NEC standard evaluation board



★ **EVALUATION BOARD**

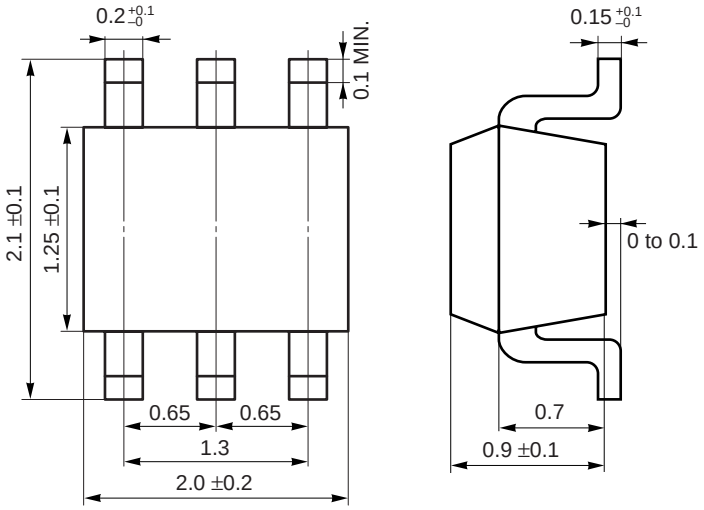


TRUTH TABLE OF SWITCHING BY CONDITION OF CONTROL VOLTAGE

		V_{CONT1}	
		$V_{CONT(H)}$	$V_{CONT(L)}$
V_{CONT2}	$V_{CONT(H)}$		
	$V_{CONT(L)}$		

PACKAGE DIMENTIONS

6 PIN SUPER MINIMOLD (Unit: mm)



RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions. For soldering method and conditions other than those recommended below, contact your NEC sales representative.

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: None[Note]	IR35-00-3
VPS	Package peak temperature: 215°C or below Time: 40 seconds or less (at 200°C) Count: 3, Exposure limit: None[Note]	VP15-00-3
Wave Soldering	Soldering bath temperature: 260°C or below Time: 10 seconds or less Count: 1, Exposure limit: None[Note]	WS60-00-1
Partial Heating	Pin temperature: 300°C Time: 3 seconds or less (per pin row) Exposure limit: None[Note]	–

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).

[MEMO]

[MEMO]

[MEMO]

Caution

The Great Care must be taken in dealing with the devices in this guide.
The reason is that the material of the devices is GaAs (Gallium Arsenide), which is designated as harmful substance according to the law concerned.
Keep the law concerned and so on, especially in case of removal.

M7 98.8