To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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

April 1st, 2010
Renesas Electronics Corporation

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

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GaAs INTEGRATED CIRCUIT

Phase-out/Discontinued

μPG2054K

GaAs MMIC DBS 4 x 2 IF SWITCH MATRIX

FEATURES

- High isolation : ISL = 40 dB TYP. @ f = 0.95 to 2.15 GHz, V_{CONT} = +5.0 V/0 V
- Control voltage : $V_{CONT (H)}$ = +3.0 to +5.5 V (+5.0 V TYP.)
  : $V_{CONT (L)}$ = −0.5 to +0.5 V (0 V TYP.)
- Low insertion loss : L_{INS} = 6.0 dB TYP. @ f = 0.95 to 2.15 GHz, V_{CONT} = +5.0 V/0 V, Z_O = 50 Ω
- 20-pin 4 × 4 mm square micro lead package (20-pin plastic QFN (0.5 mm pitch))

APPLICATIONS

- Direct Broadcast Satellite (DBS)
- Switch Box
- 4 × 2 switch matrix to L, S band applications

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPG2054K-E3	μPG2054K-E3-A	20-pin plastic QFN (0.5 mm pitch) (Pb-Free) Note	G2054	• Embossed tape 12 mm wide • Pin 1 to 5 face the perforation side of the tape • Qty 3 kpcs/reel

Note With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPG2054K

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

Document No. PG10550EJ01V0DS (1st edition)
Date Published December 2004 CP(K)
Printed in Japan

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C, unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Supply Voltage	V_{DD}	−1.0 to +6.0	V
Control Voltage	$V_{CONT1\ to\ 4}$	−1.0 to +6.0	V
Total Power Dissipation	P_{tot}	2 Note	W
Input Power	P_{in}	+10	dBm
Operating Ambient Temperature	T_A	−40 to +85	°C
Storage Temperature	T_{stg}	−65 to +150	°C

Note Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB, T_A = +85°C

RECOMMENDED OPERATING CONDITIONS (T_A = +25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage Note	V_{DD}	+3.0	+5.0	+5.5	V
Control Voltage (H) Note	$V_{CONT\ (H)}$	+3.0	+5.0	+5.5	V
Control Voltage (L)	$V_{CONT\ (L)}$	−0.5	0	+0.5	V

Note $|V_{CONT\ (H)} - V_{CONT\ (L)}| \geq 3.0$ V, $|V_{DD} - V_{CONT\ (H)}| \leq 0.3$ V

ELECTRICAL CHARACTERISTICS

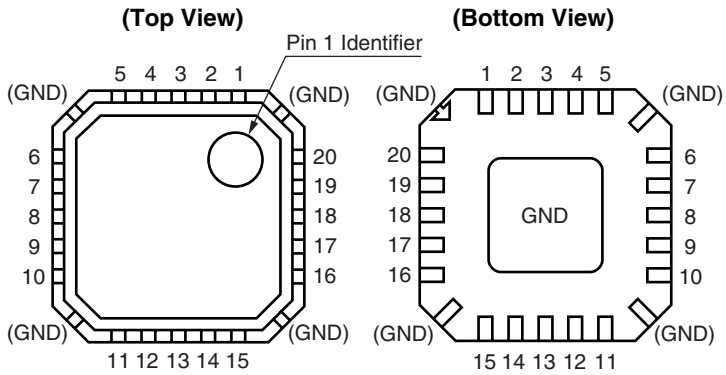
(T_A = +25°C, V_{DD} = +5.0 V, V_{CONT} = +5.0 V/0 V, P_{in} = 0 dBm, Z_O = 50 Ω, each port, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss	L_{INS}	f = 0.95 to 2.15 GHz	–	6.0	8.0	dB
Insertion Loss Flatness	ΔL_{INS}	$\lvert L_{INS\ (0.95\ GHz)} - L_{INS\ (2.15\ GHz)} \rvert$	–	0.5	1.5	dB
Isolation D/U-ratio Note 1	ISL	f = 0.95 to 2.15 GHz	35	40	–	dB
Output Return Loss	RL_{out}	f = 0.95 to 2.15 GHz	10	15	–	dB
Control Current Note 2	I_{CONT}	V_{CONT} = +5.0 V/0 V, non-RF	–	–	0.5	mA
Supply Current	I_{DD}	V_{CONT} = +5.0 V/0 V, non-RF	–	–	2.0	mA

Notes 1. Isolation D/U-ratio = |(Signal leakage (off-state)) − (Insertion loss (on-state))|

2. Per 1 control pin

PIN CONNECTIONS



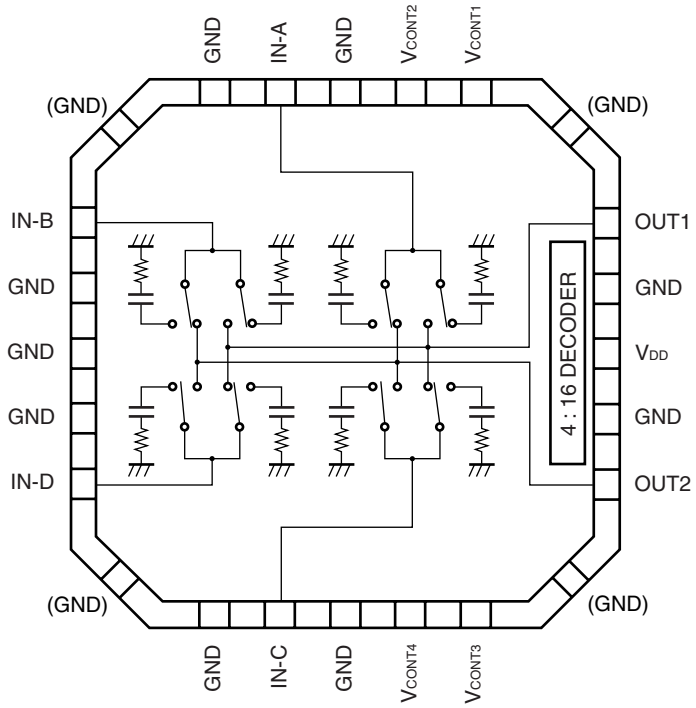
Pin No.	Pin Name	Pin No.	Pin Name
1	V_{CONT1}	11	GND
2	V_{CONT2}	12	IN-C
3	GND	13	GND
4	IN-A	14	V_{CONT4}
5	GND	15	V_{CONT3}
6	IN-B	16	OUT2
7	GND	17	GND
8	GND	18	V_{DD}
9	GND	19	GND
10	IN-D	20	OUT1

TRUTH TABLE

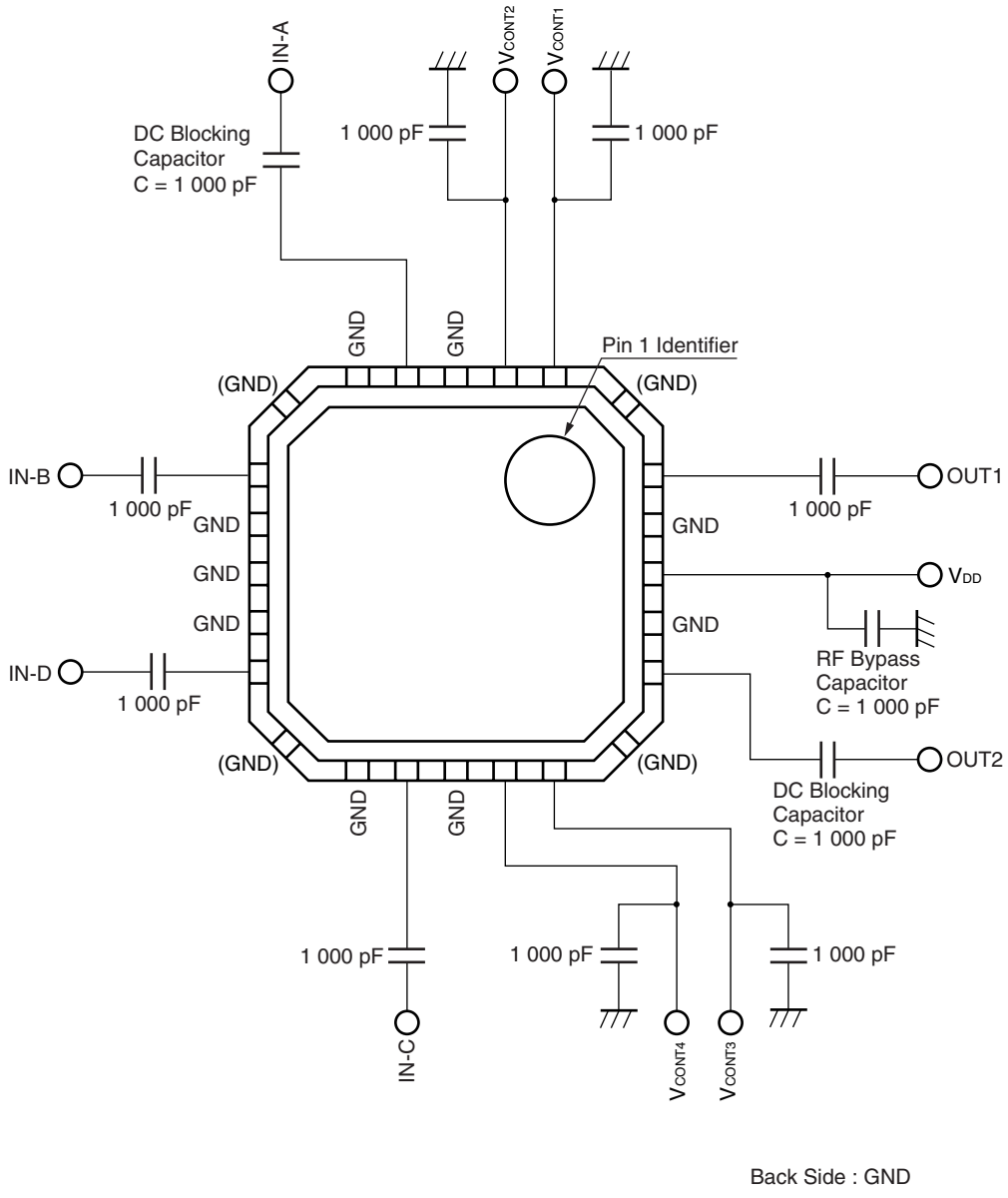
State	ON CHANNEL		CONTROL PINS			
	OUT1	OUT2	V_{CONT1}	V_{CONT2}	V_{CONT3}	V_{CONT4}
1	IN-A	IN-A	Low	Low	Low	Low
2		IN-B	Low	Low	Low	High
3		IN-C	Low	Low	High	Low
4		IN-D	Low	Low	High	High
5	IN-B	IN-A	Low	High	Low	Low
6		IN-B	Low	High	Low	High
7		IN-C	Low	High	High	Low
8		IN-D	Low	High	High	High
9	IN-C	IN-A	High	Low	Low	Low
10		IN-B	High	Low	Low	High
11		IN-C	High	Low	High	Low
12		IN-D	High	Low	High	High
13	IN-D	IN-A	High	High	Low	Low
14		IN-B	High	High	Low	High
15		IN-C	High	High	High	Low
16		IN-D	High	High	High	High

Remark High : +5 Vdc, Low : 0 Vdc.

FUNCTIONAL DIAGRAM



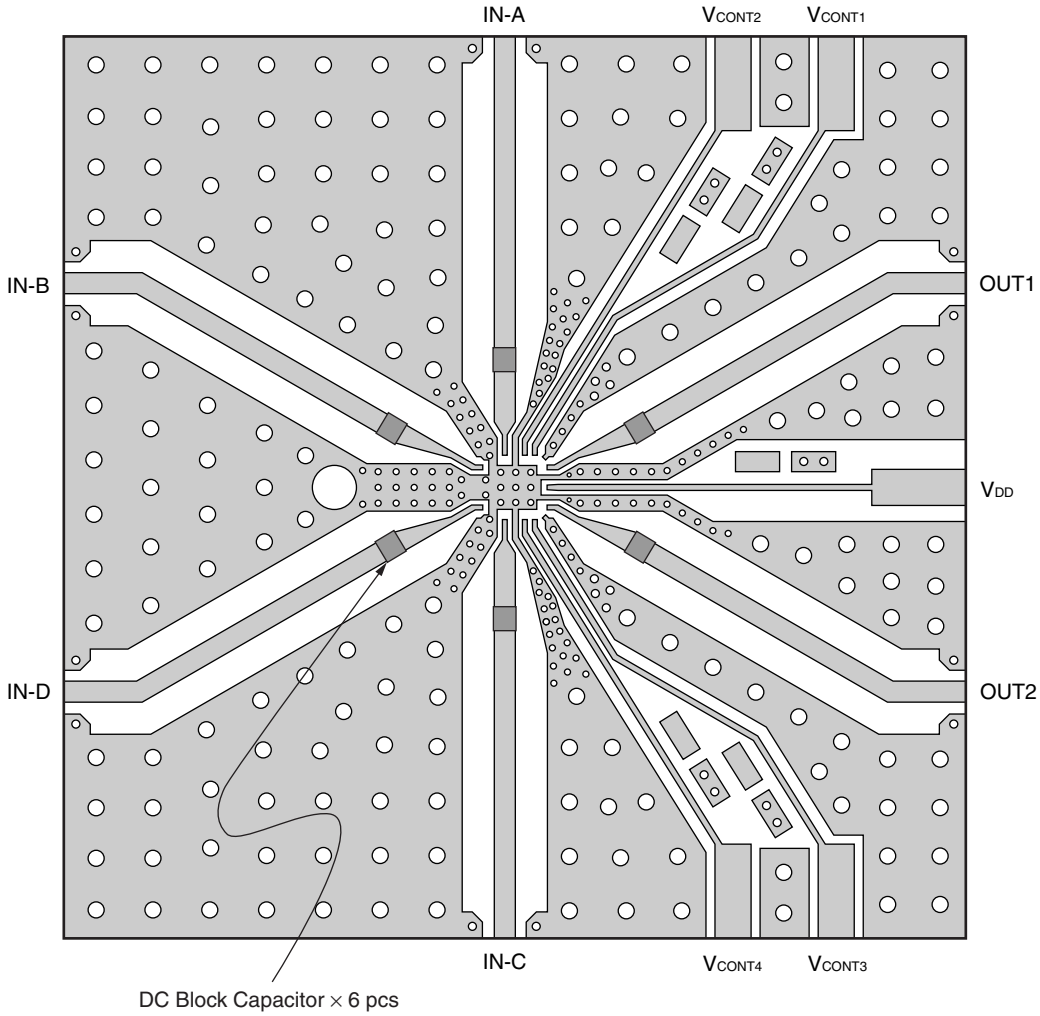
EVALUATION CIRCUIT (V_{DD} = +5.0 V, V_{CONT} = +5.0 V/0 V, Z_O = 50 Ω)



Back Side : GND

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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



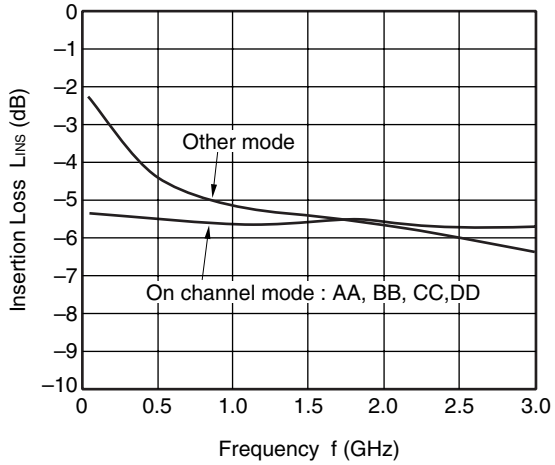
Notes

1. Size : 45 × 45 mm
2. Material : RO4003 (Rogers), t = 0.51 mm, εr = 3.38
3. ○ : Through holes

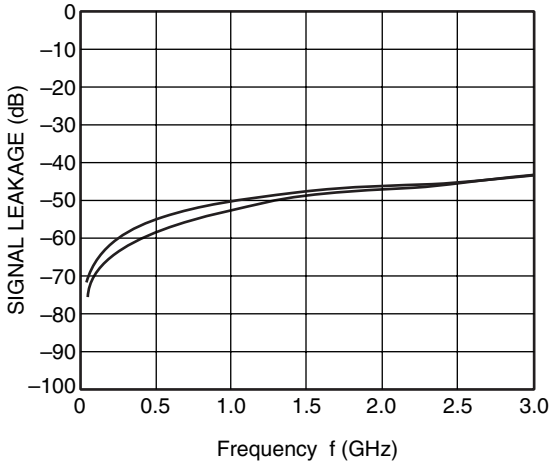
TYPICAL CHARACTERISTICS

(T_A = +25°C, V_{DD} = +5.0 V, V_{CONT} = +5.0 V/0 V, P_{in} = 0 dBm, Z_O = 50 Ω, unless otherwise specified)

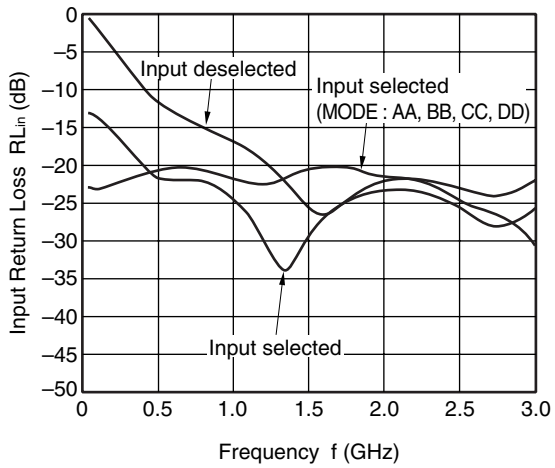
INSERTION LOSS vs. FREQUENCY



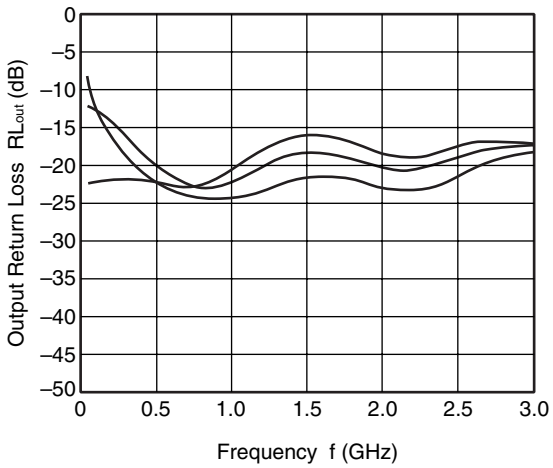
SIGNAL LEAKAGE vs. FREQUENCY



INPUT RETURN LOSS vs. FREQUENCY

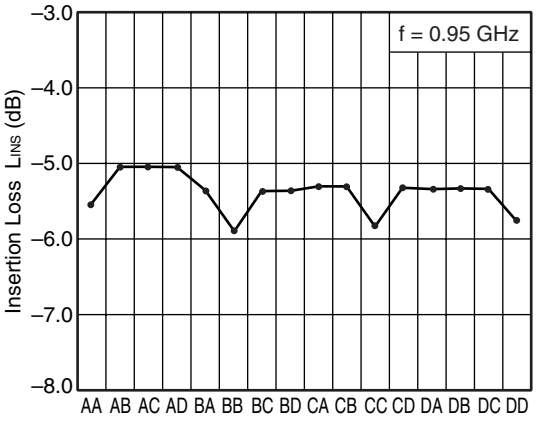


OUTPUT RETURN LOSS vs. FREQUENCY

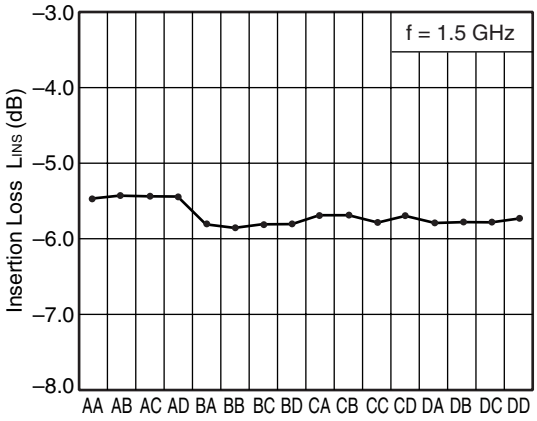


Remark The graphs indicate nominal characteristics.

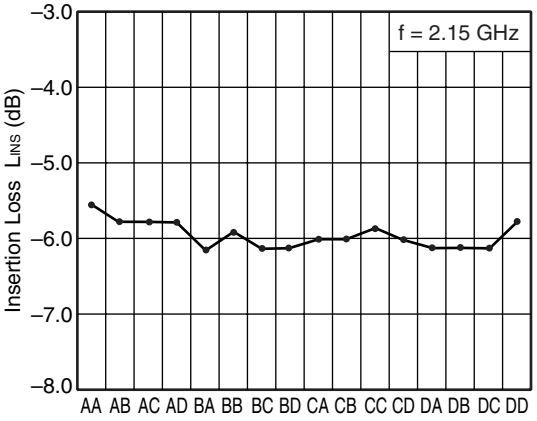
INSERTION LOSS
vs. ON CHANNEL MODE



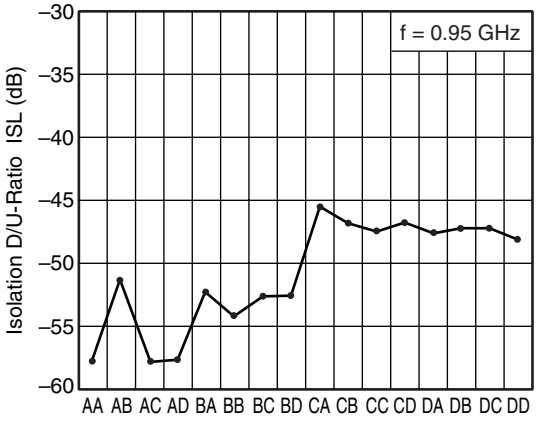
INSERTION LOSS
vs. ON CHANNEL MODE



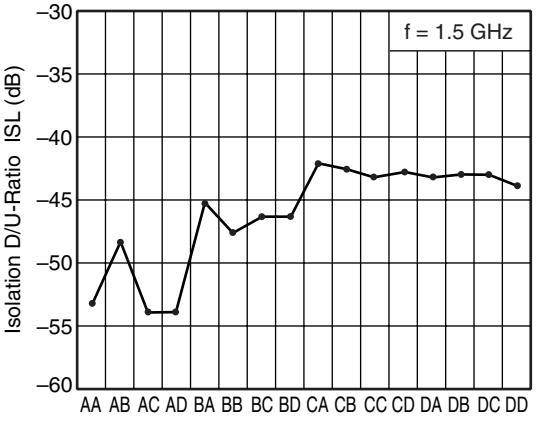
INSERTION LOSS
vs. ON CHANNEL MODE



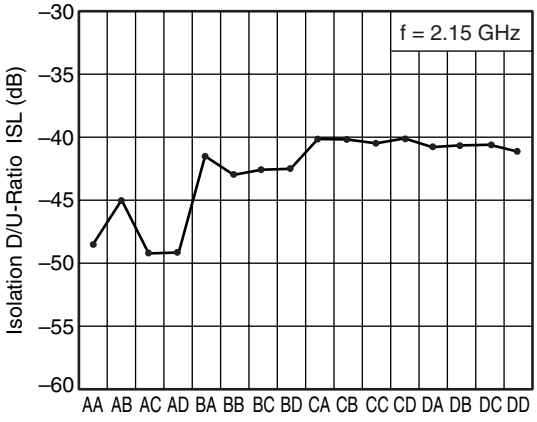
ISOLATION D/U-RATIO
vs. ON CHANNEL MODE



ISOLATION D/U-RATIO
vs. ON CHANNEL MODE

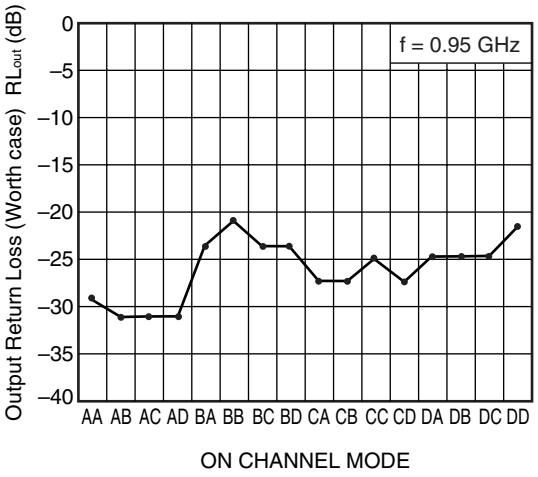


ISOLATION D/U-RATIO
vs. ON CHANNEL MODE

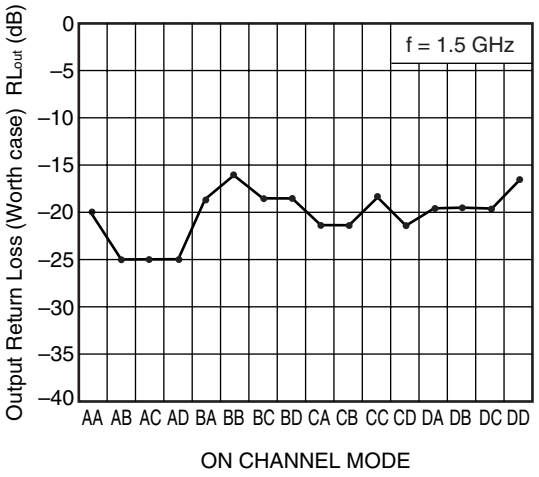


Remark The graphs indicate nominal characteristics.

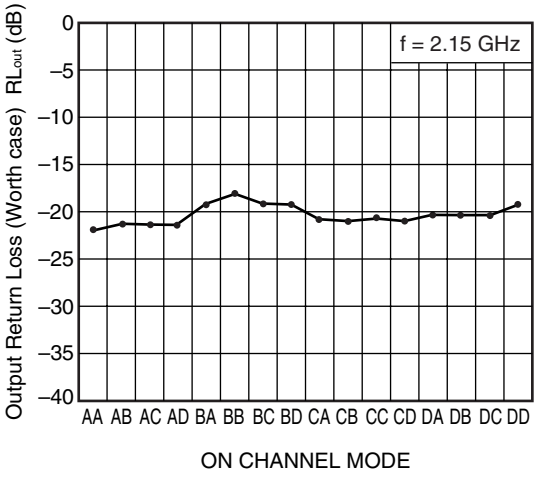
OUTPUT RETURN LOSS (WORSE CASE) vs. ON CHANNEL MODE



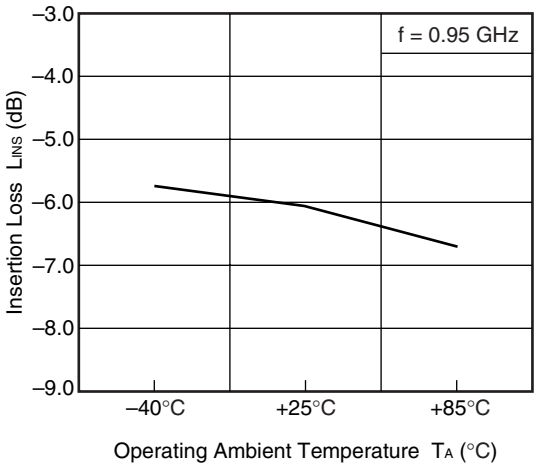
OUTPUT RETURN LOSS (WORSE CASE) vs. ON CHANNEL MODE



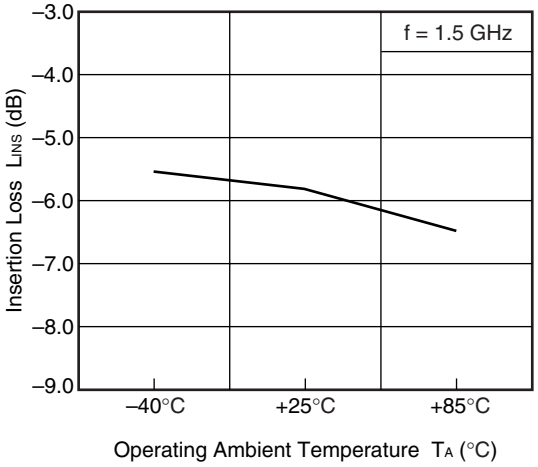
OUTPUT RETURN LOSS (WORSE CASE) vs. ON CHANNEL MODE



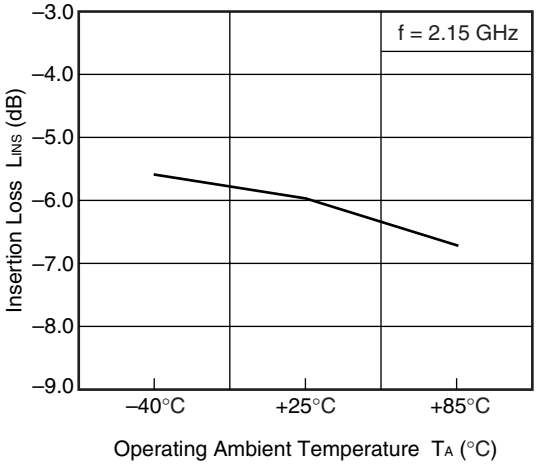
INSERTION LOSS vs. OPERATING AMBIENT TEMPERATURE



INSERTION LOSS vs. OPERATING AMBIENT TEMPERATURE

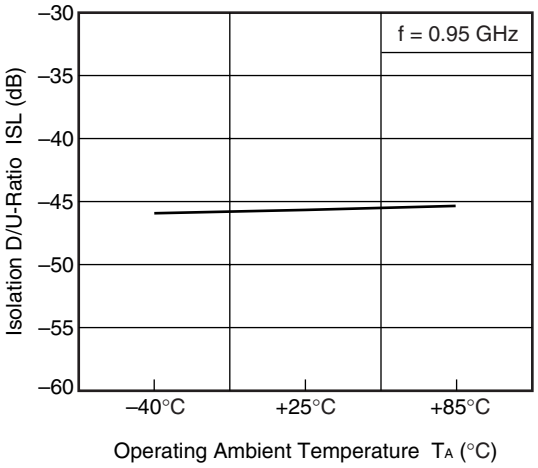


INSERTION LOSS vs. OPERATING AMBIENT TEMPERATURE

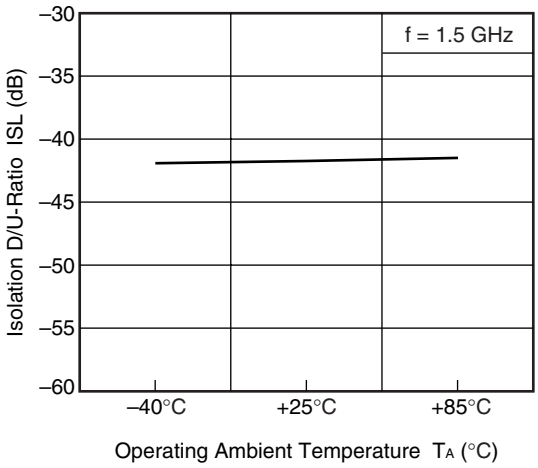


Remark The graphs indicate nominal characteristics.

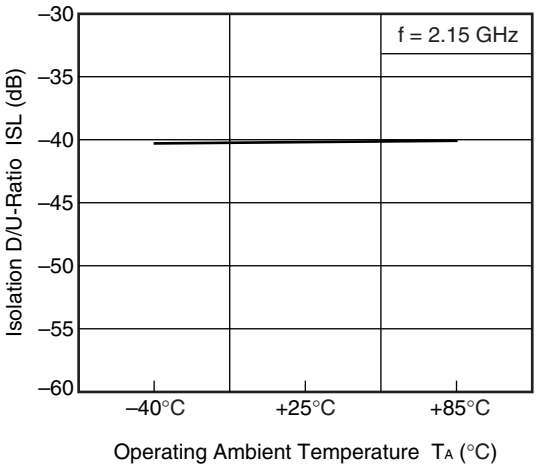
ISOLATION D/U-RATIO vs.
OPERATING AMBIENT TEMPERATURE



ISOLATION D/U-RATIO vs.
OPERATING AMBIENT TEMPERATURE



ISOLATION D/U-RATIO vs.
OPERATING AMBIENT TEMPERATURE

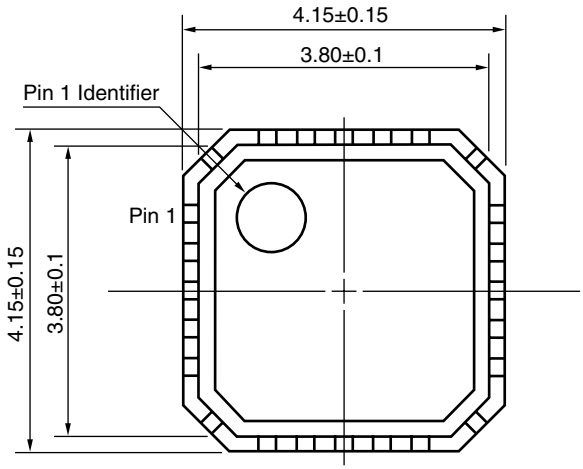


Remark The graphs indicate nominal characteristics.

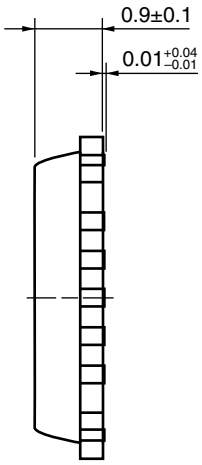
PACKAGE DIMENSIONS

20-PIN 4 × 4 mm SQUARE MICRO LEAD PACKAGE (20-PIN QFN (0.5 mm pitch)) (UNIT: mm)

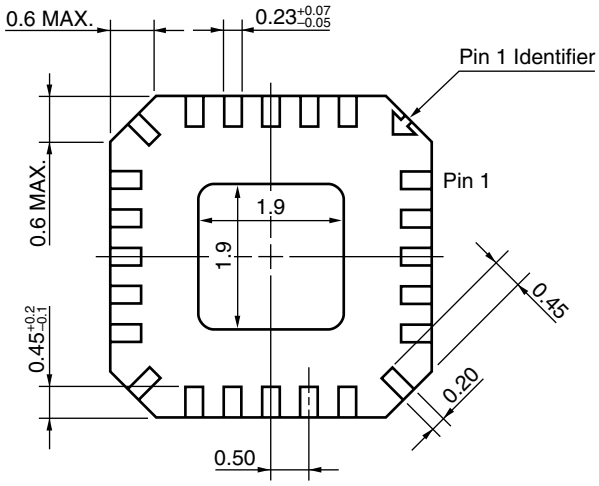
(Top View)



(Side View)



(Bottom View)



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Soldering Method	Soldering Conditions		Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) Time at peak temperature Time at temperature of 220°C or higher Preheating time at 120 to 180°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 60 seconds or less : 120±30 seconds : 3 times : 0.2%(Wt.) or below	IR260
Partial Heating	Peak temperature (terminal temperature) Soldering time (per side of device) Maximum chlorine content of rosin flux (% mass)	: 350°C or below : 3 seconds or less : 0.2%(Wt.) or below	HS350

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

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  (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4-0110

Caution GaAs Products	This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points. • Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below. 1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials. 2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal. • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or in any way allow it to enter the mouth.

▶**For further information, please contact**

NEC Compound Semiconductor Devices, Ltd. **http://www.ncsd.necel.com/**
E-mail: salesinfo@ml.ncsd.necel.com (sales and general)
techinfo@ml.ncsd.necel.com (technical)
Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579

NEC Compound Semiconductor Devices Hong Kong Limited
E-mail: ncsd-hk@elhk.nec.com.hk (sales, technical and general)
Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309
Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859
Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

NEC Electronics (Europe) GmbH **http://www.ee.nec.de/**
TEL: +49-211-6503-0 FAX: +49-211-6503-1327

California Eastern Laboratories, Inc. **http://www.cel.com/**
TEL: +1-408-988-3500 FAX: +1-408-988-0279

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