

# μPG2417T6M

## GaAs Integrated Circuit SP6T Switch for NFC Application

R09DS0010EJ0100

Rev.1.00

Dec 24, 2010

### DESCRIPTION

The μPG2417T6M is a GaAs MMIC for SP6T (Single Pole Six Throw) switch for NFC (Near Field Communication) application.

This device is housed in a 12-pin plastic TSQFN (Thin Small Quad Flat Non-leaded) (T6M) package and is suitable for high-density surface mounting.

### FEATURES

- 1, 2, 4, 8 pF capacitors on RF path are built in PKG.
- Switch control voltage :  $V_{\text{cont (H)}} = 2.85 \text{ V TYP.}$   
:  $V_{\text{cont (L)}} = 0 \text{ V TYP.}$
- Low insertion loss :  $L_{\text{ins}} = 0.5 \text{ dB TYP. @ } f = 13.56 \text{ MHz}$
- High isolation :  $\text{ISL} = 50 \text{ dB TYP. @ } f = 13.56 \text{ MHz}$
- Handling power :  $P_{\text{in (0.1 dB)}} = +32.0 \text{ dBm TYP. @ } f = 13.56 \text{ MHz}$
- High-density surface mounting : 12-pin plastic TSQFN (T6M) package (2.0 × 2.0 × 0.37 mm)

### APPLICATIONS

- NFC Application (FeliCa™ etc.)

### ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPG2417T6M-E2	μPG2417T6M-E2-A	12-pin plastic TSQFN (T6M) (Pb-Free)	2417	<ul style="list-style-type: none"> <li>• Embossed tape 8 mm wide</li> <li>• Pin 10, 11, 12 face the perforation side of the tape</li> <li>• Qty 3 kpcs/reel</li> </ul>

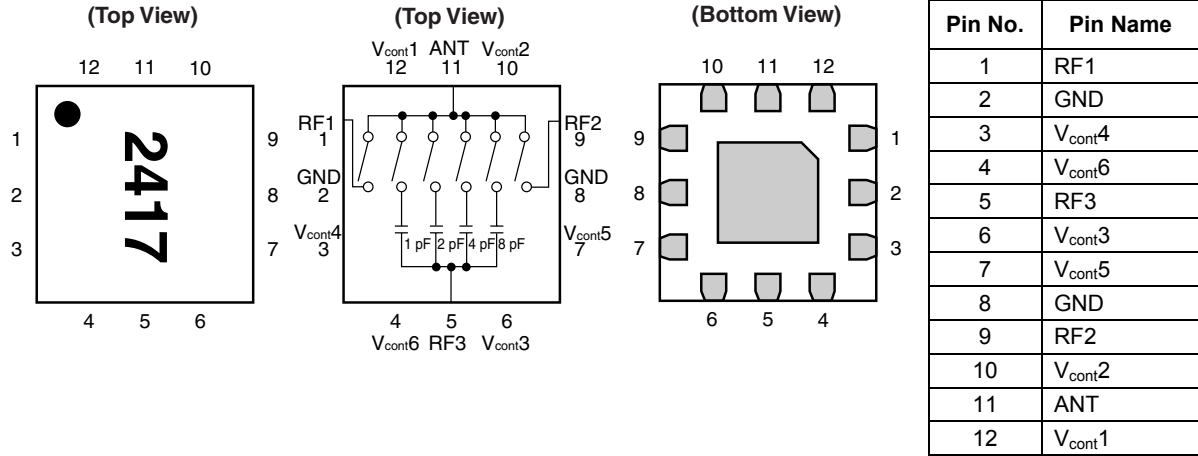
**Remark** To order evaluation samples, please contact your nearby sales office.

Part number for sample order: μPG2417T6M

### CAUTION

Although this device is designed to be as robust as possible, ESD (Electrostatic Discharge) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions must be employed at all times.

**PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM**



**SW TRUTH TABLE**

RF Path								
ANT-RF3 (Capacitor)	ANT-RF1	ANT-RF2	V <sub>cont1</sub>	V <sub>cont2</sub>	V <sub>cont3</sub>	V <sub>cont4</sub>	V <sub>cont5</sub>	V <sub>cont6</sub>
OFF	OFF	ON	L	H	L	L	L	L
	ON	OFF	H	L	L	L	L	L
	ON	ON	H	H	L	L	L	L
1 pF	OFF	OFF	L	L	H	L	L	L
	OFF	ON	L	H	H	L	L	L
	ON	OFF	H	L	H	L	L	L
2 pF	ON	ON	H	H	H	L	L	L
	OFF	OFF	L	L	L	H	L	L
	OFF	ON	L	H	L	H	L	L
3 pF	ON	OFF	H	L	L	H	L	L
	ON	ON	H	H	L	H	L	L
	OFF	OFF	L	L	H	H	L	L
4 pF	OFF	ON	L	H	H	L	L	L
	ON	OFF	H	L	L	L	H	L
	ON	ON	H	H	L	L	H	L
5 pF	OFF	OFF	L	L	H	L	H	L
	OFF	ON	L	H	H	L	H	L
	ON	OFF	H	L	H	L	H	L
6 pF	ON	ON	H	H	H	L	H	L
	OFF	OFF	L	L	L	H	H	L
	OFF	ON	L	H	L	H	H	L
7 pF	ON	OFF	H	L	L	H	H	L
	ON	ON	H	H	H	H	H	L
	OFF	OFF	L	L	L	L	L	H
8 pF	OFF	ON	L	H	L	L	L	H
	ON	OFF	H	L	L	L	L	H
	ON	ON	H	H	L	L	L	H
9 pF	OFF	OFF	L	L	H	L	L	H
	OFF	ON	L	H	H	L	L	H
	ON	OFF	H	L	H	L	L	H
10 pF	ON	ON	H	H	H	L	L	H
	OFF	OFF	L	L	L	H	L	H
	OFF	ON	L	H	L	H	L	H
11 pF	ON	OFF	H	L	L	H	L	H
	ON	ON	H	H	H	H	L	H
	OFF	OFF	L	L	H	H	L	H
12 pF	OFF	ON	L	H	L	L	H	H
	ON	OFF	H	L	L	L	H	H
	ON	ON	H	H	L	L	H	H
13 pF	OFF	OFF	L	L	H	L	H	H
	OFF	ON	L	H	H	L	H	H
	ON	OFF	H	L	H	L	H	H
14 pF	ON	ON	H	H	H	L	H	H
	OFF	OFF	L	L	L	H	H	H
	ON	OFF	H	L	L	H	H	H
15 pF	ON	ON	H	H	L	H	H	H
	OFF	OFF	L	L	H	H	H	H
	OFF	ON	L	H	H	H	H	H

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C, unless otherwise specified)**

Parameter	Symbol	Ratings	Unit
Switch Control Voltage	V <sub>cont</sub>	-6.0 to +6.0 <sup>Note</sup>	V
Input Power (ON Port)	P <sub>in</sub>	+35.0	dBm
Operating Ambient Temperature	T <sub>A</sub>	-45 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

Note:  $|V_{cont(H)} - V_{cont(L)}| \leq 6.0\text{ V}$

**RECOMMENDED OPERATING RANGE (T<sub>A</sub> = +25°C, unless otherwise specified)**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Switch Control Voltage (H)	V <sub>cont(H)</sub>	+2.4	+2.85	+3.4	V
Switch Control Voltage (L)	V <sub>cont(L)</sub>	-0.2	0	+0.2	V
Control Voltage Difference	ΔV <sub>cont(H)</sub> , ΔV <sub>cont(L)</sub> <b>Note</b>	-0.1	0	+0.1	V

Note: ΔV<sub>CONT(H)</sub> is a difference between the maximum and the minimum control voltage among V<sub>CONT1(H)</sub>, V<sub>CONT2(H)</sub>, V<sub>CONT3(H)</sub>, V<sub>CONT4(H)</sub>, V<sub>CONT5(H)</sub> and V<sub>CONT6(H)</sub>.  
 ΔV<sub>CONT(L)</sub> is a difference between the maximum and the minimum control voltage among V<sub>CONT1(L)</sub>, V<sub>CONT2(L)</sub>, V<sub>CONT3(L)</sub>, V<sub>CONT4(L)</sub>, V<sub>CONT5(L)</sub> and V<sub>CONT6(L)</sub>.

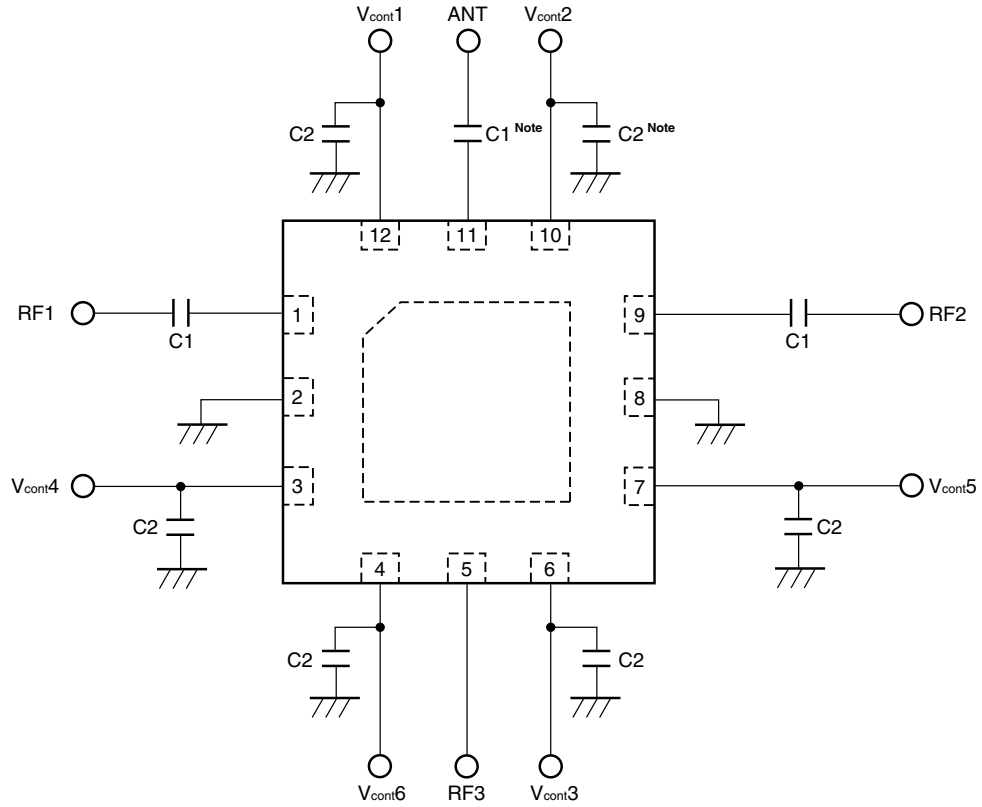
**ELECTRICAL CHARACTERISTICS**

( $T_A = -45$  to  $+85^\circ\text{C}$ ,  $f = 13.56$  MHz,  $V_{\text{cont (H)}} = +2.4$  to  $+3.4\text{V}$ ,  $V_{\text{cont (L)}} = -0.2$  to  $+0.2$  V,  $Z_O = 50 \Omega$ , DC blocking capacitors = 10 000 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss	L <sub>ins1</sub>	ANT-RF1, V <sub>cont1</sub> = H, P <sub>in</sub> = +20 dBm	–	0.5	0.9	dB
	L <sub>ins2</sub>	ANT-RF2, V <sub>cont2</sub> = H, P <sub>in</sub> = +20 dBm	–	0.5	0.9	dB
	L <sub>ins3</sub>	ANT-RF3, V <sub>cont3</sub> = H, P <sub>in</sub> = +20 dBm	36.0	38.0	40.0	dB
	L <sub>ins4</sub>	ANT-RF3, V <sub>cont4</sub> = H, P <sub>in</sub> = +20 dBm	31.5	33.5	35.5	dB
	L <sub>ins5</sub>	ANT-RF3, V <sub>cont5</sub> = H, P <sub>in</sub> = +20 dBm	26.0	28.0	30.0	dB
	L <sub>ins6</sub>	ANT-RF3, V <sub>cont6</sub> = H, P <sub>in</sub> = +20 dBm	20.5	22.5	24.5	dB
Isolation	ISL1	ANT-RF1, V <sub>cont2</sub> = H, P <sub>in</sub> = +20 dBm	32.0	50.0	–	dB
	ISL2	ANT-RF2, V <sub>cont1</sub> = H, P <sub>in</sub> = +20 dBm	32.0	50.0	–	dB
Capacitance Value	Cap 1	ANT-RF3, V <sub>cont3</sub> = H	–	1.0	–	pF
	Cap 2	ANT-RF3, V <sub>cont4</sub> = H	–	2.0	–	pF
	Cap 3	ANT-RF3, V <sub>cont5</sub> = H	–	4.0	–	pF
	Cap 4	ANT-RF3, V <sub>cont6</sub> = H	–	8.0	–	pF
0.1 dB Loss Compression Input Power <sup>Note</sup>	P <sub>in (0.1 dB)</sub>	ANT-RF1/RF2	28.0	32.0	–	dBm
Switch Control Current	I <sub>cont</sub>	No RF input	–	2	30	μA
Switch Control Speed	t <sub>sw</sub>	50% CTL to 90/10% RF	–	1	5	μs

Note: P<sub>in (0.1 dB)</sub> is the measured input power level when the insertion loss increases 0.1 dB more than that of the linear range.

## EVALUATION CIRCUIT

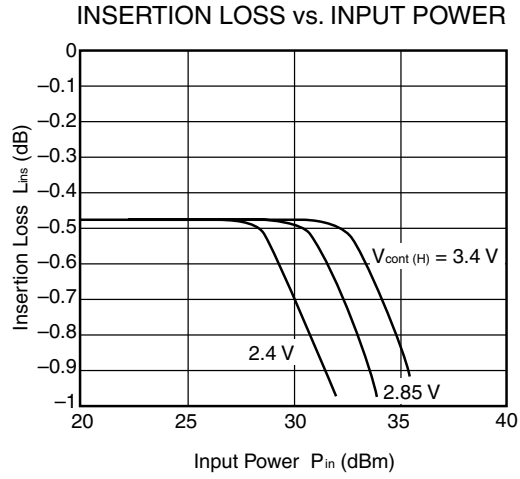


Note: C1: 10 000 pF  
C2: 10 000 pF

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

**TYPICAL CHARACTERISTICS**

( $T_A = +25^\circ\text{C}$ ,  $f = 13.56\text{ MHz}$ ,  $V_{\text{cont (H)}} = +2.4\text{ to }+3.4\text{ V}$ ,  $V_{\text{cont (L)}} = 0\text{ V}$ ,  $Z_O = 50\ \Omega$ , DC blocking capacitors = 10 000 pF)

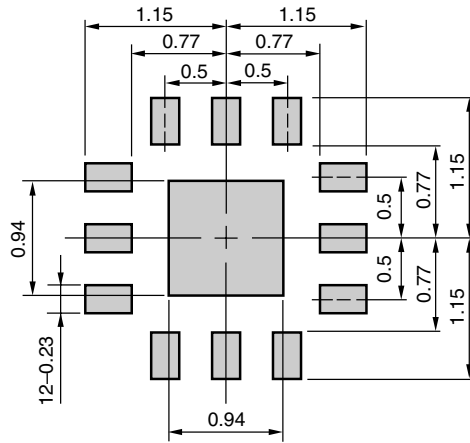


**Remark** The graph indicates nominal characteristics.

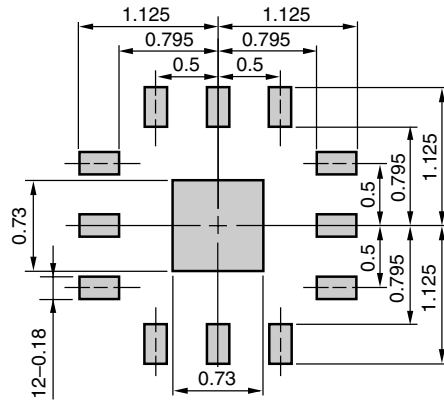
## MOUNTING PAD AND SOLDER MASK LAYOUT DIMENSIONS

12-PIN PLASTIC TSQFN (T6M) (UNIT: mm)

### MOUNTING PAD



### SOLDER MASK



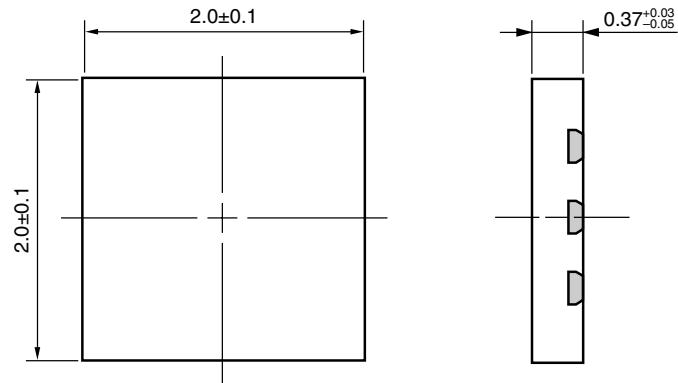
Solder thickness : 0.1 mm

**Remark** The mounting pad and solder mask layouts in this document are for reference only.

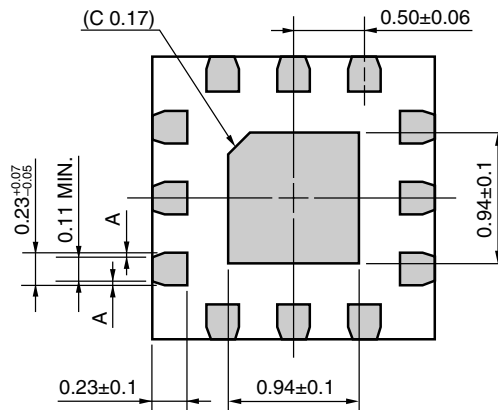


## PACKAGE DIMENSIONS

12-PIN PLASTIC TSQFN (T6M) (UNIT: mm)



(Bottom View)



**Remark**  $A > 0$

( ): Reference value

## 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).

<b>Caution</b>	GaAs Products	<p>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.</p> <ul style="list-style-type: none"><li>• 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.<ol style="list-style-type: none"><li>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.</li><li>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.</li></ol></li><li>• Do not burn, destroy, cut, crush, or chemically dissolve the product.</li><li>• Do not lick the product or in any way allow it to enter the mouth.</li></ul>
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<b>Revision History</b>	<b>μPG2417T6M Data Sheet</b>
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Rev.	Date	Description	
		Page	Summary
1.00	Dec 24, 2010	—	First edition issued

FeliCa is the contactless IC card technology developed by Sony Corporation.

FeliCa is a trademark of Sony Corporation.

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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: +49-211-6503-0, 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: +852-2886-0318, Fax: +852-2886-9022/9044

#### Renesas Electronics Taiwan Co., Ltd.

7F, No. 363 Fu Shing North Road Taipei, Taiwan, R.O.C.  
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 Laviel' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea  
Tel: +82-2-558-3737, Fax: +82-2-558-5141