



# PRELIMINARY PRODUCT INFORMATION

## GaAs INTEGRATED CIRCUIT uPG2158T5K

### L,S-BAND SPDT SWITCH

#### DESCRIPTION

The uPG2158T5K is a GaAs MMIC for L,S-band SPDT (Single Pole Double Throw) which were designed for mobile phone and the another L,S-band applications.

This device can operate frequency from 0.05GHz to 3.0GHz, having the low insertion loss and high isolation.

This device is housed in a 6-pin TSON(Thin Small Out-line Non-Leaded) package. And this package is able to high-density surface mounting.

#### FEATURES

- Switch Control Voltage :  $V_{cont(H)} = 1.8$  to  $5.3V$  (2.7V TYP.)  
:  $V_{cont(L)} = -0.2$  to  $0.2V$  (0V TYP.)
- Low Insertion Loss :  $L_{ins1} = 0.40dB$  TYP. @  $f = 0.05$  to  $0.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins2} = 0.40dB$  TYP. @  $f = 0.5$  to  $1.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins3} = 0.45dB$  TYP. @  $f = 1.0$  to  $2.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins4} = 0.47dB$  TYP. @  $f = 2.0$  to  $2.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins5} = 0.53dB$  TYP. @  $f = 2.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$
- High Isolation :  $ISL1 = 27dB$  TYP. @  $f = 0.05$  to  $0.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL2 = 27dB$  TYP. @  $f = 0.5$  to  $1.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL3 = 19dB$  TYP. @  $f = 1.0$  to  $2.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL4 = 17dB$  TYP. @  $f = 2.0$  to  $2.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL5 = 17dB$  TYP. @  $f = 2.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$
- Handling Power :  $P_{in(1dB)} = +30.5.0dBm$  TYP. @  $f = 0.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $P_{in(0.1dB)} = +29.0dBm$  TYP. @  $f = 0.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$
- High-density surface mounting : 6-pin TSON package ( $1.0 \times 1.0 \times 0.4$  mm)

#### APPLICATION

- L,S-band digital cellular or cordless telephone
- W-LAN, WLL and Bluetooth™ etc.

#### ORDERING INFORMATION

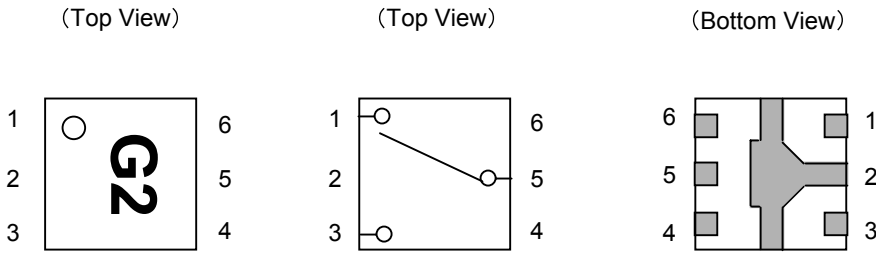
Part Number	Package	Marking	Supplying Form
uPG2158T5K-E2-A	6-pin TSON(1010)	G2	TBD

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order : uPG2158T5K

#### Caution Electro-static sensitive devices

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

**PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM**



Pin No.	Pin Name
1	OUTPUT1
2	GND
3	OUTPUT2
4	V <sub>cont2</sub>
5	INPUT
6	V <sub>cont1</sub>

**SW TRUTH TABLE**

V <sub>cont1</sub>	V <sub>cont2</sub>	INPUT-OUTPUT1	INPUT-OUTPUT2
Low	High	OFF	ON
High	Low	ON	OFF

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

Parameter	Symbol	Ratings	Unit
Switch Control Voltage	V <sub>cont</sub>	+6.0 <sup>Note</sup>	V
Input Power	P <sub>in</sub>	+31	dBm
Operating Ambient Temperature	T <sub>A</sub>	-45 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

**Note** | V<sub>cont1</sub> - V<sub>cont2</sub> | ≤ 6.0V

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

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Switch Control Voltage (H)	V <sub>cont</sub> (H)	1.8	2.7	5.3	V
Switch Control Voltage (L)	V <sub>cont</sub> (L)	-0.2	0	0.2	V

**ELECTRICAL CHARACTERISTICS**

(  $T_A = +25^{\circ}\text{C}$ ,  $V_{\text{cont(H)}} = 2.7\text{V}$ ,  $V_{\text{cont(L)}} = 0\text{V}$ , DC cut capacitors = 56pF, Unless otherwise specified )

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss1	Lins1	f = 0.05 to 0.5GHz <sup>Note1</sup>	-	0.40	0.45	dB
Insertion Loss2	Lins2	f = 0.5 to 1.0GHz	-	0.40	0.45	dB
Insertion Loss3	Lins3	f = 1.0 to 2.0GHz	-	0.45	0.50	dB
Insertion Loss4	Lins4	f = 2.0 to 2.5GHz	-	0.47	0.55	dB
Insertion Loss5	Lins5	f = 2.5 to 3.0GHz	-	0.53	0.60	dB
Isolation1	ISL1	f = 0.05 to 0.5GHz <sup>Note1</sup>	23	27	-	dB
Isolation2	ISL2	f = 0.5 to 1.0GHz	23	27	-	dB
Isolation3	ISL3	f = 1.0 to 2.0GHz	16	19	-	dB
Isolation4	ISL4	f = 2.0 to 2.5GHz	14	17	-	dB
Isolation5	ISL5	f = 2.5 to 3.0GHz	14	17	-	dB
Input Return Loss1	RL <sub>in1</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Input Return Loss2	RL <sub>in2</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
Output Return Loss1	RL <sub>out1</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Output Return Loss2	RL <sub>out2</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
0.1dB Loss Compression Input Power <sup>Note2</sup>	P <sub>in (0.1dB)</sub>	f = 2.0GHz/2.5GHz	+26.0	+29.0	-	dBm
		f = 0.5 TO 3.0GHz	-	+29.0	-	dBm
1dB Loss Compression Input Power <sup>Note3</sup>	P <sub>in (1dB)</sub>	f = 0.5 to 3.0GHz	-	+30.5	-	dBm
2nd Harmonics	2f <sub>0</sub>	f = 2.0GHz/2.5GHz, P <sub>in</sub> =+20dBm	65	75	-	dBc
3rd Harmonics	3f <sub>0</sub>	f = 2.0GHz/2.5GHz, P <sub>in</sub> =+20dBm	65	75	-	dBc
Input Intercept Point	IIP <sub>3</sub>	f = 0.5 to 3.0GHz, 2tone 5MHz spacing	-	+60	-	dBm
Switch Control Current	I <sub>cont</sub>		-	0.2	20	uA
Switch Control Speed	t <sub>sw</sub>	50% CTL to 90/10%	-	50	500	ns

**Note1.** DC cut capacitors = 1000pF 0.05 to 0.5GHz

**Note2.** P<sub>in (0.1dB)</sub> is measured the input power level when the insertion loss increases more 0.1dB than that of linear range.

**Note3.** P<sub>in (1dB)</sub> is measured the input power level when the insertion loss increases more 1dB than that of linear range.

**ELECTRICAL CHARACTERISTICS**

(  $T_A = +25^{\circ}\text{C}$ ,  $V_{\text{cont(H)}} = 1.8\text{V}$ ,  $V_{\text{cont(L)}} = 0\text{V}$ , DC cut capacitors = 56pF, Unless otherwise specified )

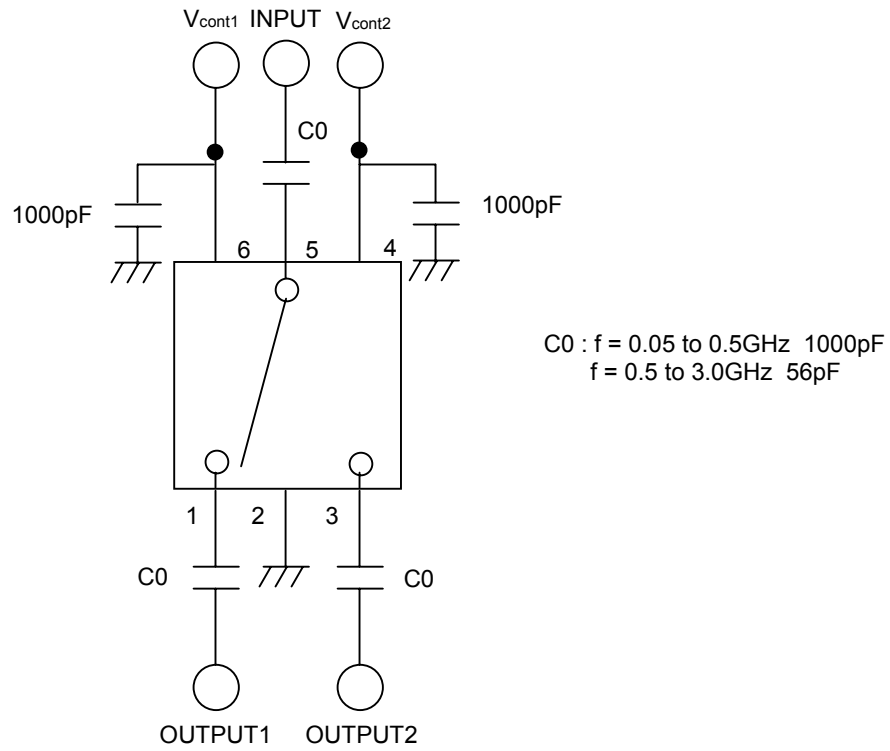
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss6	Lins6	f = 0.05 to 0.5GHz <sup>Note1</sup>	-	0.40	0.46	dB
Insertion Loss7	Lins7	f = 0.5 to 1.0GHz	-	0.40	0.47	dB
Insertion Loss8	Lins8	f = 1.0 to 2.0GHz	-	0.46	0.52	dB
Insertion Loss9	Lins9	f = 2.0 to 2.5GHz	-	0.48	0.57	dB
Insertion Loss10	Lins10	f = 2.5 to 3.0GHz	-	0.54	0.62	dB
Isolation6	ISL6	f = 0.05 to 0.5GHz <sup>Note1</sup>	23	27	-	dB
Isolation7	ISL7	f = 0.5 to 1.0GHz	23	27	-	dB
Isolation8	ISL8	f = 1.0 to 2.0GHz	16	19	-	dB
Isolation9	ISL9	f = 2.0 to 2.5GHz	14	17	-	dB
Isolation10	ISL10	f = 2.5 to 3.0GHz	14	17	-	dB
Input Return Loss1	RL <sub>in1</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Input Return Loss2	RL <sub>in2</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
Output Return Loss1	RL <sub>out1</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Output Return Loss2	RL <sub>out2</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
0.1dB Loss Compression Input Power <sup>Note2</sup>	P <sub>in (0.1dB)</sub>	f = 2.0GHz/2.5GHz	+19.0	+22.0	-	dBm
		f = 0.5 TO 3.0GHz	-	+22.0	-	dBm
1dB Loss Compression Input Power <sup>Note3</sup>	P <sub>in (1dB)</sub>	f = 0.5 to 3.0GHz	-	+25.0	-	dBm
Switch Control Current	I <sub>cont</sub>		-	0.2	20	uA
Switch Control Speed	t <sub>sw</sub>	50% CTL to 90/10%	-	50	500	ns

**Note1.** DC cut capacitors = 1000pF 0.05 to 0.5GHz

**Note2.** P<sub>in (0.1dB)</sub> is measured the input power level when the insertion loss increases more 0.1dB than that of linear range.

**Note3.** P<sub>in (1dB)</sub> is measured the input power level when the insertion loss increases more 1dB than that of linear range.

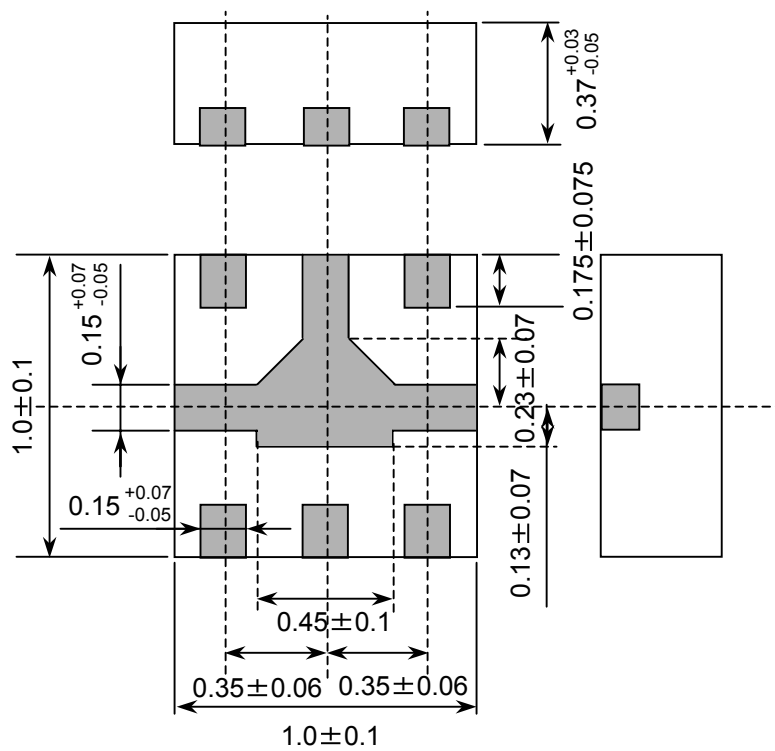
EVALUATION CIRCUIT



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

PACKAGE DIMENSIONS

6-PIN TSON (UNIT: mm)



**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
VPS	Peak temperature (package surface temperature) : 215°C or below Time at temperature of 200°C or higher : 25 to 40 seconds Preheating time at 120 to 150°C : 30 to 60 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2 % (Wt.) or below	VP215
Wave soldering	Peak temperature (molten solder temperature) : 260°C or below Time at peak temperature : 10 seconds or less Preheating temperature (package surface temperature) : 120°C or below Maximum number of reflow processes : 1 time Maximum chlorine content of rosin flux (% mass) : 0.2 % (Wt.) or below	WS260
Partial Heating	Peak temperature (pin 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) .**

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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