

WIDE BAND SP4T SWITCH

DESCRIPTION

The μ PD5731T6M is a CMOS MMIC SP4T switch which was developed for mobile communications, wireless communications and another RF switching applications.

<R> This device can operate frequency from 0.01 to 2.0 GHz, having the low insertion loss and high isolation.

This device is housed in a 12-pin plastic TSQFN (Thin Small Quad Flat Non-leaded) (T6M) package. And this package is able to high-density surface mounting.

FEATURES

- Supply voltage : $V_{DD} = 1.5$ to 3.6 V (2.8 V TYP.)
- Switch control voltage : $V_{cont(H)} = 1.5$ to 3.6 V (2.8 V TYP.)
: $V_{cont(L)} = -0.2$ to $+0.4$ V (0 V TYP.)
- Low insertion loss : $L_{ins1} = 0.7$ dB TYP. @ $f = 0.01$ to 0.05 GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
: $L_{ins2} = 1.0$ dB TYP. @ $f = 0.05$ to 1.0 GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
: $L_{ins3} = 1.4$ dB TYP. @ $f = 1.0$ to 2.0 GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
- High isolation : $ISL1 = 60$ dB TYP. @ $f = 0.01$ to 0.05 GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
: $ISL2 = 35$ dB TYP. @ $f = 0.05$ to 1.0 GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
: $ISL3 = 26$ dB TYP. @ $f = 1.0$ to 2.0 GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
- Handling power : $P_{in(1\text{ dB})} = +20$ dBm TYP. @ $f = 1.0$ GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
: $P_{in(0.1\text{ dB})} = +17$ dBm TYP. @ $f = 1.0$ GHz, $V_{DD} = 2.8$ V, $V_{cont(H)} = 2.8$ V, $V_{cont(L)} = 0$ V
- High-density surface mounting : 12-pin plastic TSQFN (T6M) package ($2.0 \times 2.0 \times 0.37$ mm)

APPLICATIONS

- Mobile communications
- Wireless communications
- Another RF switching applications

ORDERING INFORMATION

| Part Number | Order Number | Package | Marking | Supplying Form |
|--------------------|----------------------|--------------------------------------|---------|--|
| μ PD5731T6M-E2 | μ PD5731T6M-E2-A | 12-pin plastic TSQFN (T6M) (Pb-Free) | 5731 | <ul style="list-style-type: none"> • Embossed tape 8 mm wide • Pin 10, 11, 12 face the perforation side of the tape • Qty 3 kpcs/reel |

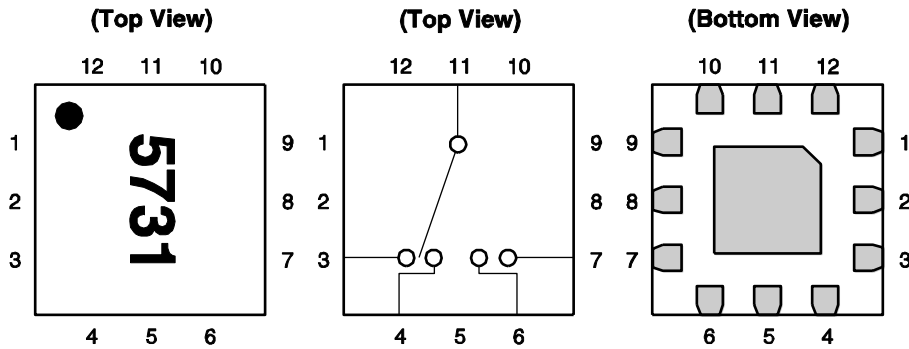
Remark To order evaluation samples, contact your nearby sales office.

Part number for sample order: μ PD5731T6M-A

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

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 | NC |
| 2 | GND |
| 3 | OUTPUT1 |
| 4 | OUTPUT2 |
| 5 | GND |
| 6 | OUTPUT3 |
| 7 | OUTPUT4 |
| 8 | GND |
| 9 | V _{cont1} |
| 10 | V _{cont2} |
| 11 | INPUT |
| 12 | V _{DD} |

TRUTH TABLE

| ON-state | V _{cont1} | V _{cont2} |
|---------------|--------------------|--------------------|
| INPUT-OUTPUT1 | Low | Low |
| INPUT-OUTPUT2 | Low | High |
| INPUT-OUTPUT3 | High | Low |
| INPUT-OUTPUT4 | High | High |

Remark High: +2.8 V, Low: 0 V

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

| Parameter | Symbol | Ratings | Unit |
|-------------------------------|--|--------------|------|
| Supply Voltage | V _{DD} | -0.5 to +4.6 | V |
| Switch Control Voltage | V _{cont} | -0.5 to +4.6 | V |
| Voltage Difference | V _{cont (H)} - V _{DD} | +0.5 | V |
| Input Power | P _{in} | +23 | dBm |
| Operating Ambient Temperature | T _A | -45 to +85 | °C |
| Storage Temperature | T _{stg} | -55 to +150 | °C |

RECOMMENDED OPERATING RANGE (T_A = +25°C, unless otherwise specified)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|----------------------------|-----------------------|------|------|------|------|
| Supply Voltage | V _{DD} | +1.5 | +2.8 | +3.6 | V |
| Switch Control Voltage (H) | V _{cont (H)} | +1.5 | +2.8 | +3.6 | V |
| Switch Control Voltage (L) | V _{cont (L)} | -0.2 | 0 | +0.4 | V |

Remark V_{DD} - 0.4 V ≤ V_{cont (H)} ≤ V_{DD} + 0.2 V

ELECTRICAL CHARACTERISTICS

($T_A = +25^\circ\text{C}$, $V_{DD} = 2.8\text{ V}$, $V_{\text{cont(H)}} = 2.8\text{ V}$, $V_{\text{cont(L)}} = 0\text{ V}$, $P_{\text{in}} = 0\text{ dBm}$, DC cut capacitors = 10 000 pF, unless otherwise specified)

| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|--|--------------------------------|--|------|------|------|------|
| Insertion Loss 1 | L_{ins1} | $f = 0.01\text{ to }0.05\text{ GHz}$ | – | 0.7 | 1.1 | dB |
| Insertion Loss 2 | L_{ins2} | $f = 0.05\text{ to }1.0\text{ GHz}$ | – | 1.0 | 1.4 | dB |
| <R> Insertion Loss 3 | L_{ins3} | $f = 1.0\text{ to }2.0\text{ GHz}$ | – | 1.4 | 1.8 | dB |
| Isolation 1 | $ISL1$ | $f = 0.01\text{ to }0.05\text{ GHz}$ | 50 | 60 | – | dB |
| Isolation 2 | $ISL2$ | $f = 0.05\text{ to }1.0\text{ GHz}$ | 31 | 35 | – | dB |
| Isolation 3 | $ISL3$ | $f = 1.0\text{ to }2.0\text{ GHz}$ | 23 | 26 | – | dB |
| <R> Input Return Loss 1 | RL_{in1} | $f = 0.01\text{ to }1.0\text{ GHz}$ | 12 | 15 | – | dB |
| <R> Input Return Loss 2 | RL_{in2} | $f = 1.0\text{ to }2.0\text{ GHz}$ | 10 | 12 | – | dB |
| <R> Output Return Loss 1 | RL_{out1} | $f = 0.01\text{ to }1.0\text{ GHz}$ | 12 | 16 | – | dB |
| <R> Output Return Loss 2 | RL_{out2} | $f = 1.0\text{ to }2.0\text{ GHz}$ | 10 | 14 | – | dB |
| 0.1 dB Loss Compression Input Power ^{Note 1} | $P_{\text{in}(0.1\text{ dB})}$ | $f = 1.0\text{ GHz}$ | +13 | +17 | – | dBm |
| 1 dB Loss Compression Input Power ^{Note 2} | $P_{\text{in}(1\text{ dB})}$ | $f = 1.0\text{ GHz}$ | – | +20 | – | dBm |
| Supply Current | I_{DD} | $V_{DD} = V_{\text{cont}} = 2.8\text{ V}$, RF off | – | 0.01 | 1.0 | μA |
| Switch Control Current | I_{cont} | $V_{DD} = V_{\text{cont}} = 2.8\text{ V}$, RF off | – | 0.01 | 1.0 | μA |
| Switch Control Speed | t_{sw} | $f = 1.0\text{ GHz}$ | – | 30 | 100 | ns |

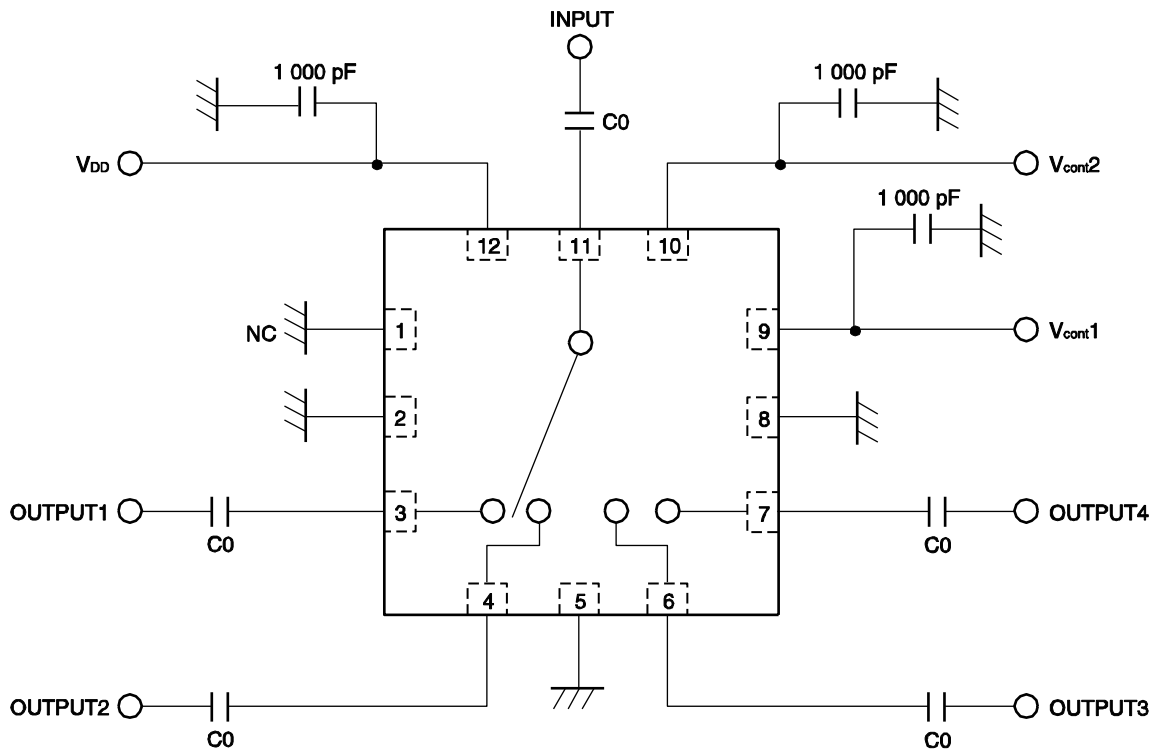
Notes 1. $P_{\text{in}(0.1\text{ dB})}$ is measured the input power level when the insertion loss increases more 0.1 dB than that of linear range.

2. $P_{\text{in}(1\text{ dB})}$ is measured the input power level when the insertion loss increases more 1 dB than that of linear range.

Caution This device is used it is necessary to use DC cut capacitors.

The value of DC cut capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system.

EVALUATION CIRCUIT

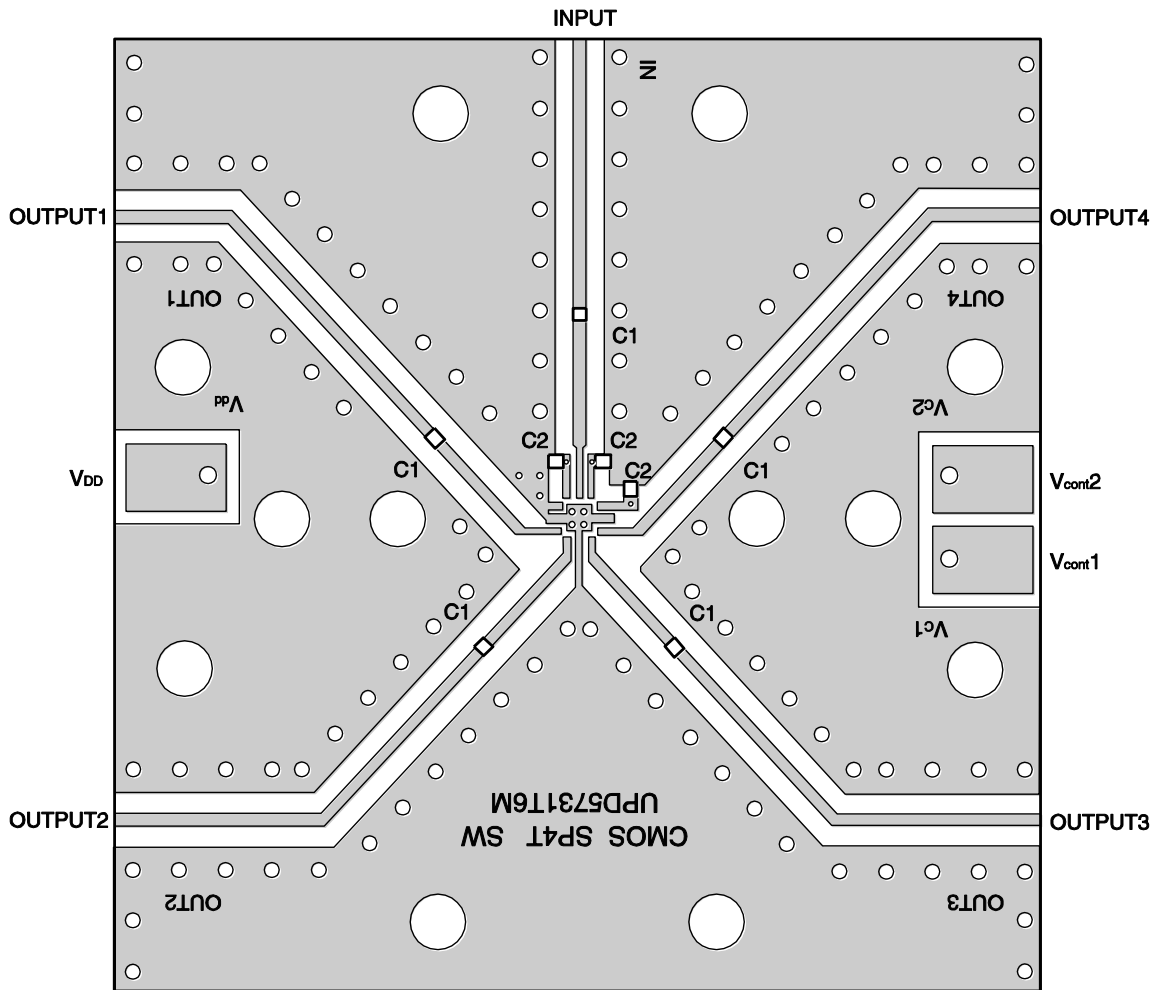


Remark C0 = 10 000 pF

Caution This IC has pull down resistance between RF line and GND, which fixes electric potential of RF line to 0 V, then the IC cannot be used for DC switching.

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

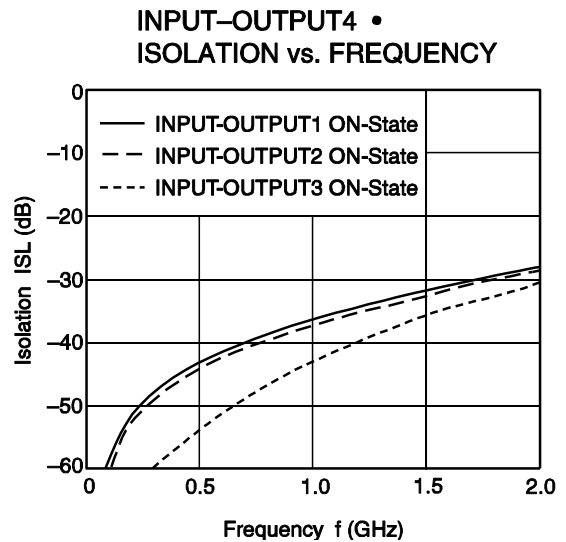
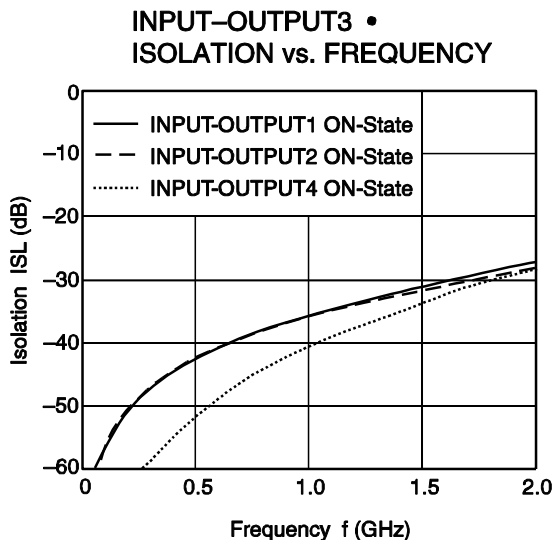
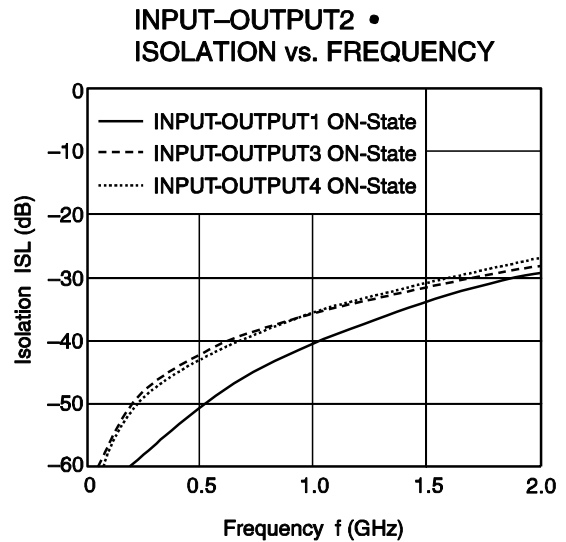
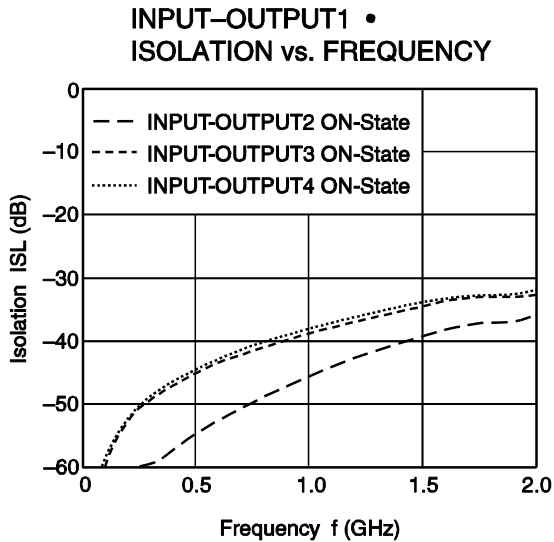
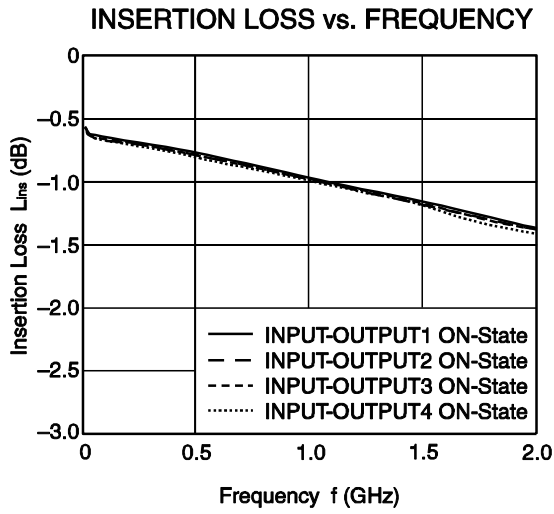
<R> ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



<R> USING THE EVALUATION BOARD

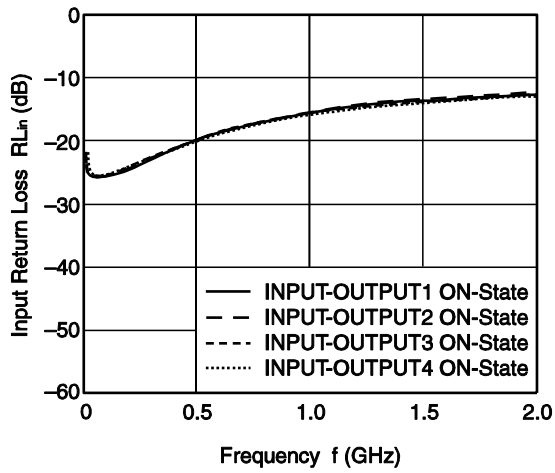
| Symbol | Values |
|--------|-----------|
| C2 | 1 000 pF |
| C1 | 10 000 pF |

<R> **TYPICAL CHARACTERISTICS**
 ($T_A = +25^\circ\text{C}$, $V_{DD} = 2.8\text{ V}$, $V_{cont(H)} = 2.8\text{ V}$, $V_{cont(L)} = 0\text{ V}$, $P_{in} = 0\text{ dBm}$, DC cut capacitors = 10 000 pF, unless otherwise specified)

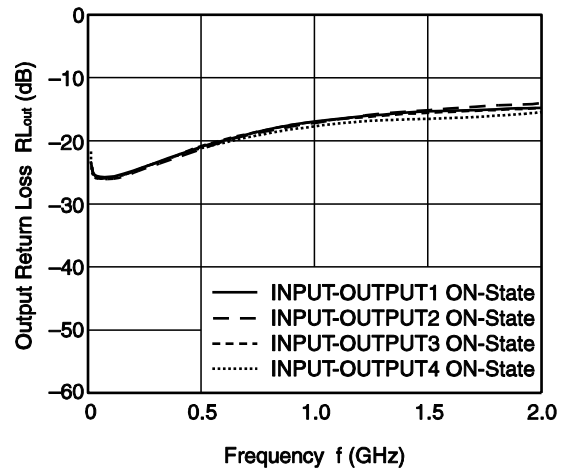


Remark The graphs indicate nominal characteristics.

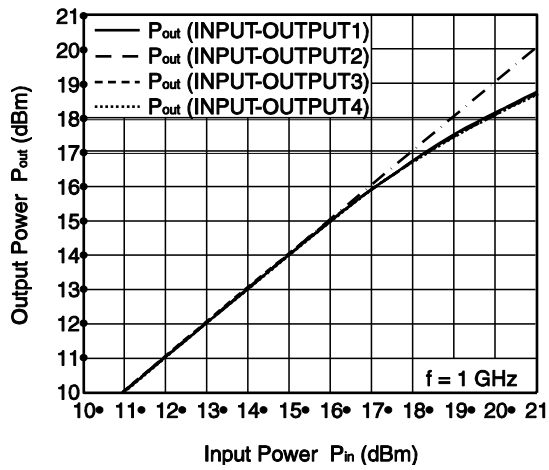
INPUT RETURN LOSS vs. FREQUENCY



OUTPUT RETURN LOSS vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER

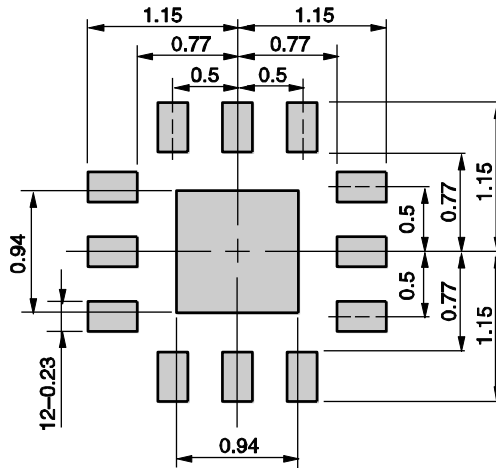


Remark The graphs indicate nominal characteristics.

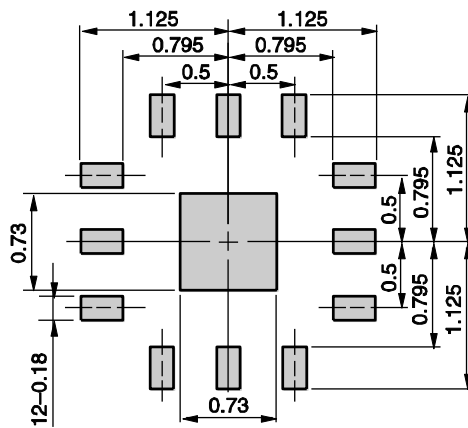
MOUNTING PAD AND SOLDER MASK LAYOUT DIMENSIONS

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

MOUNTING PAD



SOLDER MASK

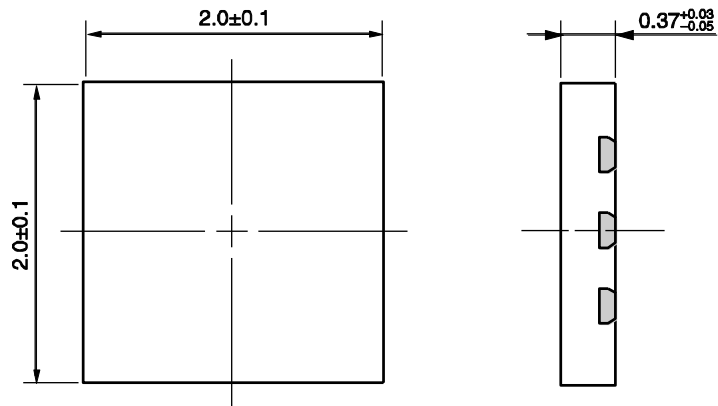


Solder thickness : 0.1 mm

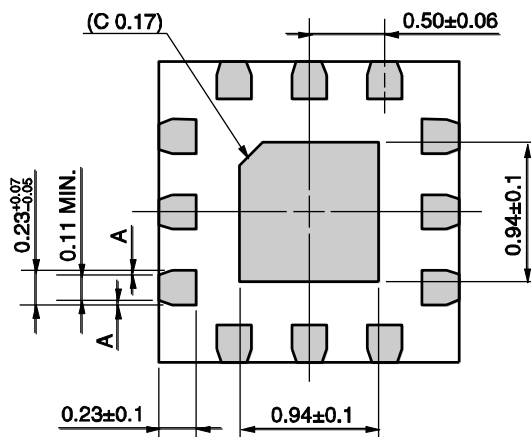
Remark The mounting pad and solder mask layouts in this document are for reference only.

PACKAGE DIMENSIONS

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



(Bottom View)



Remark $A > 0$

(): Reference value

<R> **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).

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JONHON

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