

μPA2373T1P

Dual (Drain common), N-channel MOSFET

R07DS0674EJ0101

Rev.1.01

24V, 6A, 23.0mΩ

Aug 19, 2013

DESCRIPTION

The μPA2373T1P is a switching device, which can be driven directly by a 2.5 V power source.

The μPA2373T1P features a low on-state resistance and excellent switching characteristics, and is suitable for applications such as power switch of portable machine and so on. Best suite for single cell LiB application.

FEATURES

- 2.5 V drive available
- Low on-state resistance
 - $R_{SS(on)1} = 23.0 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 4.5 \text{ V}$, $I_S = 3.0 \text{ A}$)
 - $R_{SS(on)2} = 24.0 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 4.0 \text{ V}$, $I_S = 3.0 \text{ A}$)
 - $R_{SS(on)3} = 25.0 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 3.8 \text{ V}$, $I_S = 3.0 \text{ A}$)
 - $R_{SS(on)4} = 30.0 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 3.1 \text{ V}$, $I_S = 3.0 \text{ A}$)
 - $R_{SS(on)4} = 39.0 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 2.5 \text{ V}$, $I_S = 3.0 \text{ A}$)
- Built-in G-S protection diode against ESD

ORDERING INFORMATION

Part No.	Lead Plating	Packing	Package
μPA2373T1P-E4-A*1	Ni/Au	Reel 5000 p/reel	4-pin EFLIP-LGA

Note: *1. Pb-free (This product does not contain Pb in the external electrode and other parts.)

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

Item	Symbol	Ratings	Unit
Source to Source Voltage ($V_{GS} = 0 \text{ V}$)	V_{SSS}	24.0	V
Gate to Source Voltage ($V_{DS} = 0 \text{ V}$)	V_{GSS}	± 12.0	V
Source Current (DC) *1	$I_{S(DC)}$	± 6.0	A
Source Current (pulse) *2	$I_{S(pulse)}$	± 60	A
Total Power Dissipation (2 units) *1	P_{T1}	1.3	W
Channel Temperature	T_{ch}	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

Note: *1. Mounted on ceramic board of $50 \text{ cm}^2 \times 1.0 \text{ mmt}$

*2. $PW \leq 10 \mu\text{s}$, Duty Cycle $\leq 1\%$

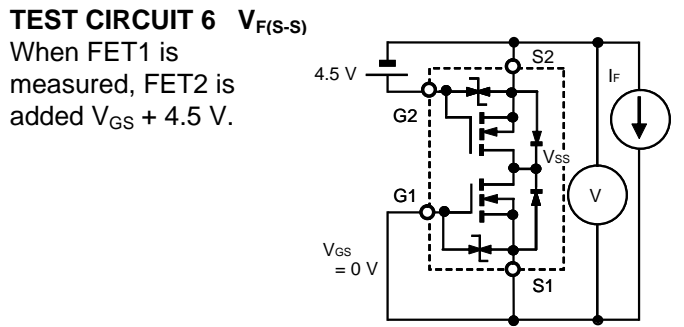
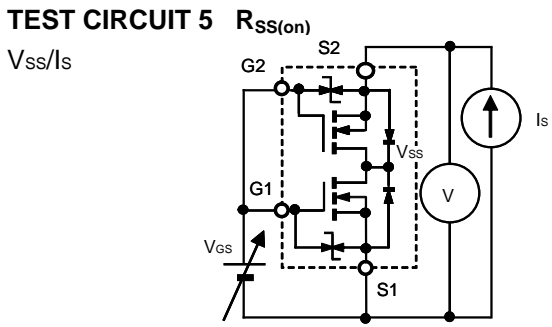
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

Characteristics	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Zero Gate Voltage Source Current	I _{SSS}			1	μA	V _{SS} = 24 V, V _{GS} = 0 V, TEST CIRCUIT 1
Gate Leakage Current	I _{GSS}			±10	μA	V _{GS} = ±12 V, V _{SS} = 0 V, TEST CIRCUIT 2
Gate to Source Cut-off Voltage	V _{GS(off)}	0.5	0.9	1.5	V	V _{SS} = 10 V, I _S = 1.0 mA, TEST CIRCUIT 3
Forward Transfer Admittance *1	y _{fs}	3.5			S	V _{SS} = 5 V, I _S = 1.5 A, TEST CIRCUIT 4
Source to Source On-state Resistance *1	R _{SS(on)1}	14	19	23	mΩ	V _{GS} = 4.5 V, I _S = 3.0 A, TEST CIRCUIT 5
	R _{SS(on)2}	14.4	20	24	mΩ	V _{GS} = 4.0 V, I _S = 3.0 A, TEST CIRCUIT 5
	R _{SS(on)3}	14.6	20.5	25	mΩ	V _{GS} = 3.8 V, I _S = 3.0 A, TEST CIRCUIT 5
	R _{SS(on)4}	16	23	30	mΩ	V _{GS} = 3.1 V, I _S = 3.0 A, TEST CIRCUIT 5
	R _{SS(on)5}	19	27	39	mΩ	V _{GS} = 2.5 V, I _S = 3.0 A, TEST CIRCUIT 5
Input Capacitance	C _{iSS}		1230		pF	V _{SS} = 10 V,
Output Capacitance	C _{oSS}		370		pF	V _{GS} = 0 V,
Reverse Transfer Capacitance	C _{rSS}		282		pF	f = 1.0 MHz, TEST CIRCUIT 7
Turn-on Delay Time	t _{d(on)}		6.2		μs	V _{DD} = 20 V, I _S = 6.0 A,
Rise Time	t _r		36		μs	V _{GS} = 4.0 V,
Turn-off Delay Time	t _{d(off)}		37		μs	R _G = 6.0 Ω,
Fall Time	t _f		61		μs	TEST CIRCUIT 8
Total Gate Charge	Q _G		22		nC	V _{DD} = 19.2 V, V _{G1S1} = 4.0 V, I _S = 6.0 A, TEST CIRCUIT 9
Body Diode Forward Voltage *1	V _{F(S-S)}		0.9		V	I _F = 6.0 A, V _{GS} = 0 V, TEST CIRCUIT 6

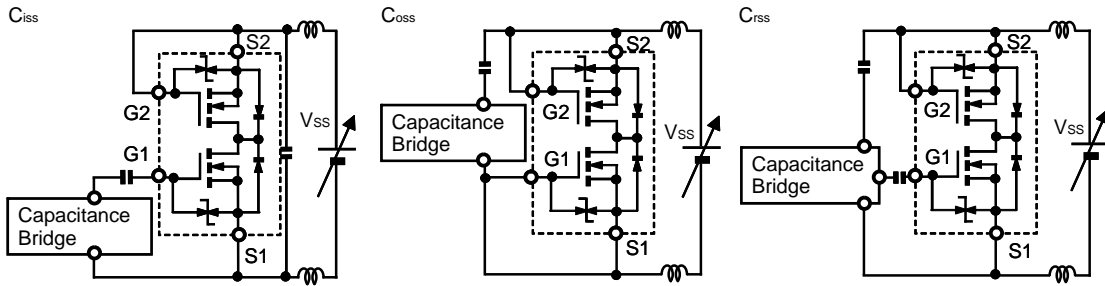
Note: *1. Pulsed test

Both the FET1 and the FET2 are measured. Test circuits are example of measuring the FET1 side.

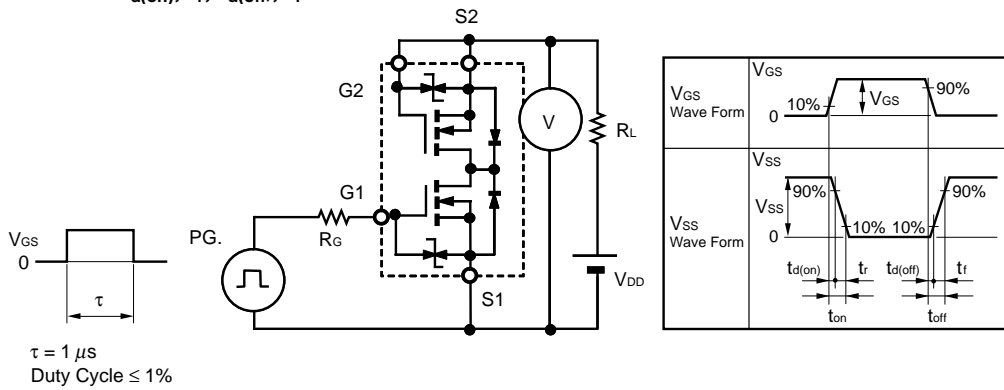
<p>TEST CIRCUIT 1 I_{SSS}</p>	<p>TEST CIRCUIT 2 I_{GSS}</p> <p>When FET1 is measured, between GATE and SOURCE of FET2 are shorted.</p>
<p>TEST CIRCUIT 3 V_{GS(off)}</p> <p>When FET1 is measured, between GATE and SOURCE of FET2 are shorted.</p>	<p>TEST CIRCUIT 4 y_{fs} </p> <p>ΔI_S/ΔV_{GS}</p>



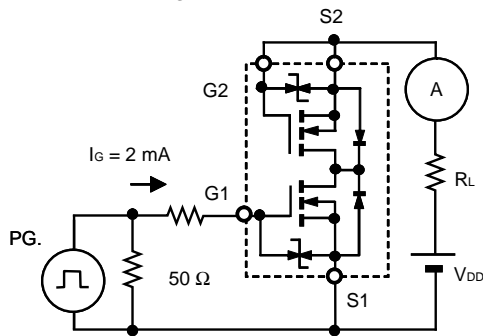
TEST CIRCUIT 7



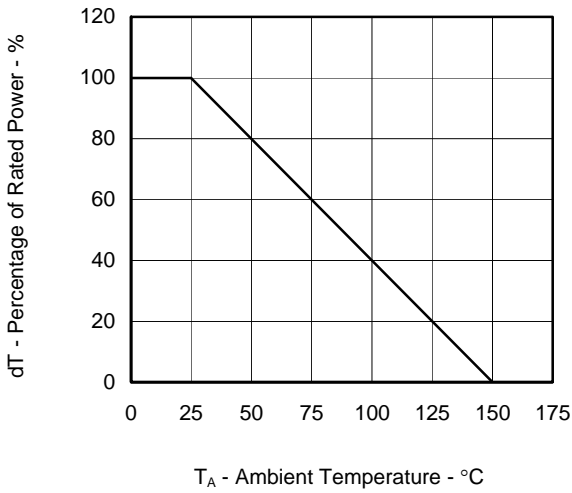
TEST CIRCUIT 8 $t_{d(on)}$, t_r , $t_{d(off)}$, t_f



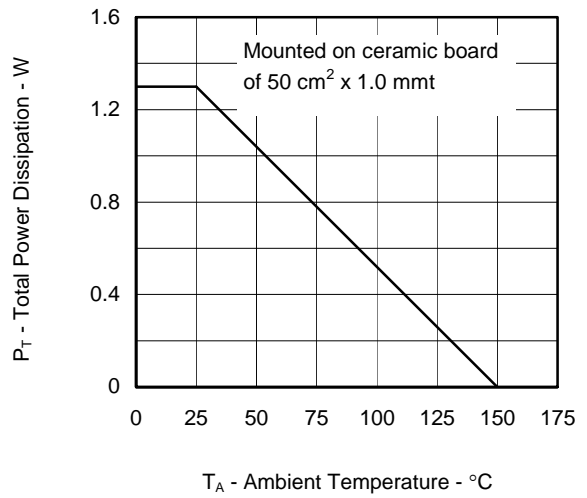
TEST CIRCUIT 9 Q_G



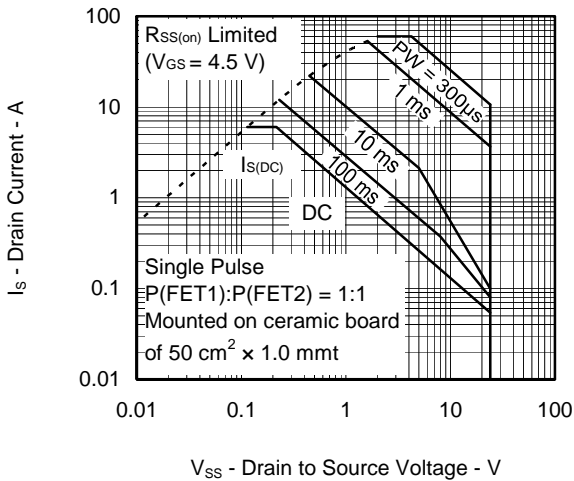
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



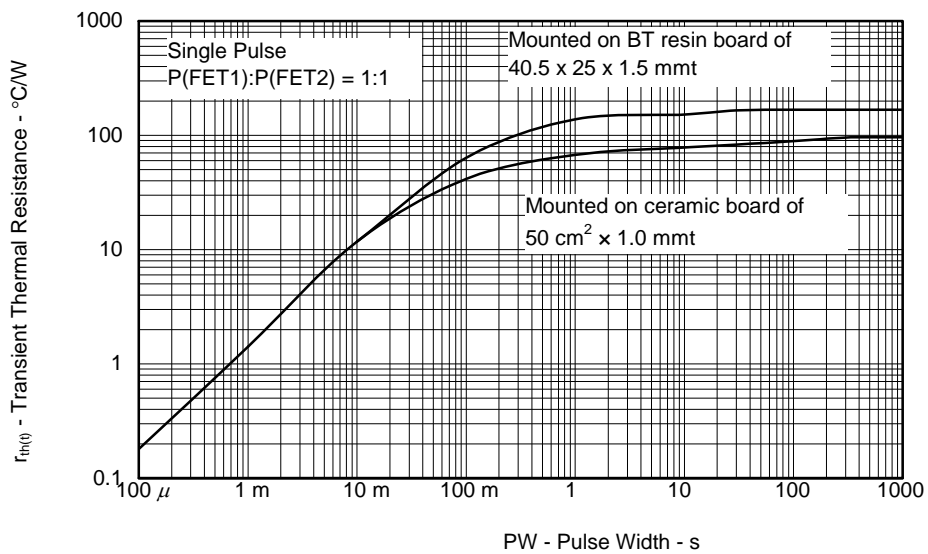
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



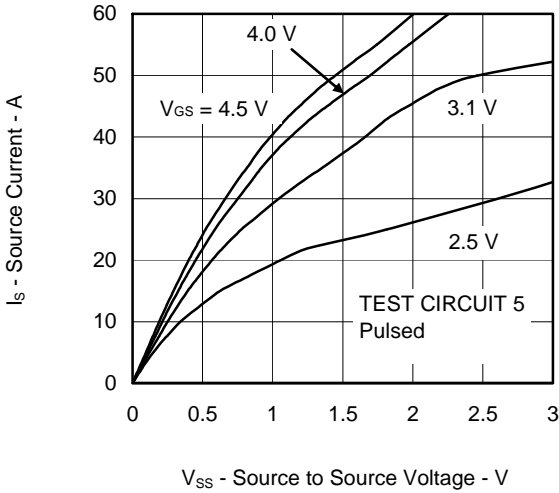
FORWARD BIAS SAFE OPERATING AREA



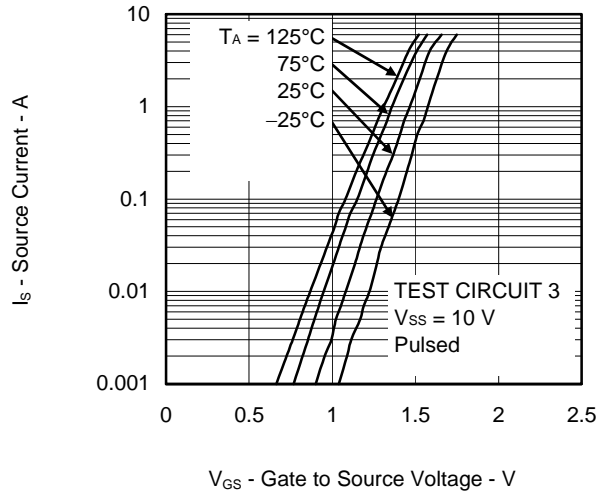
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



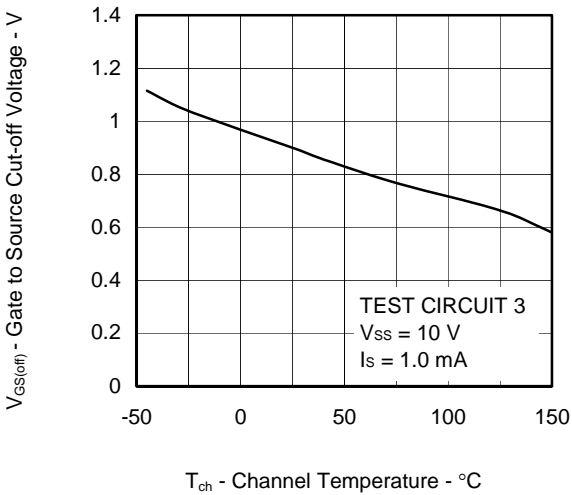
SOURCE CURRENT vs. SOURCE TO SOURCE VOLTAGE



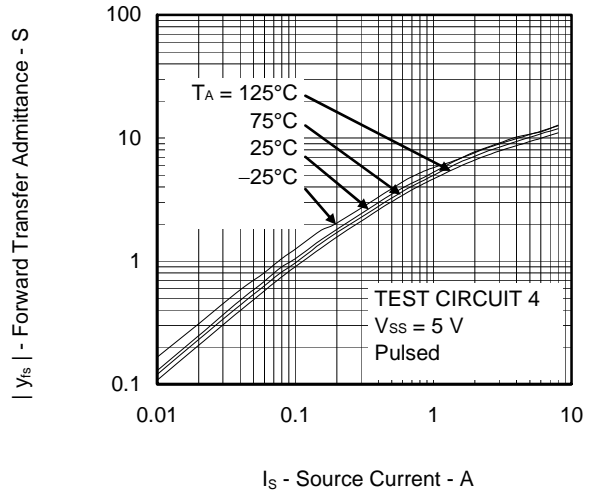
FORWARD TRANSFER CHARACTERISTICS



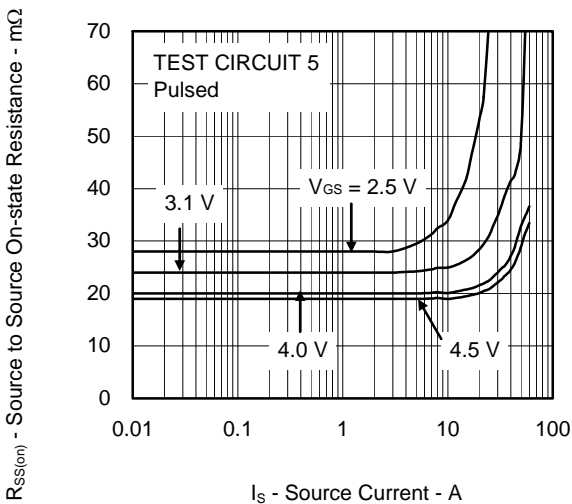
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



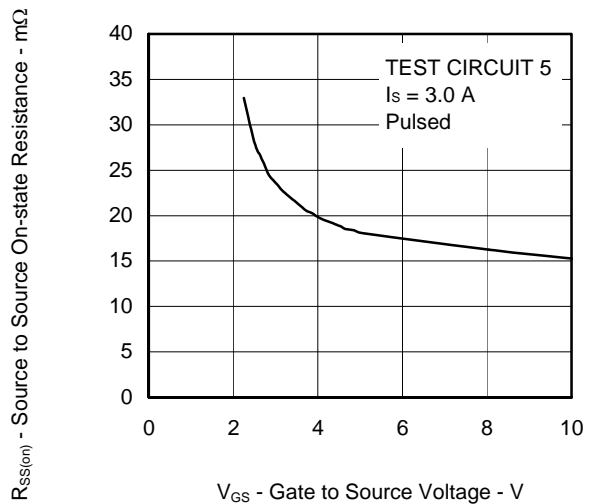
FORWARD TRANSFER ADMITTANCE vs. SOURCE CURRENT



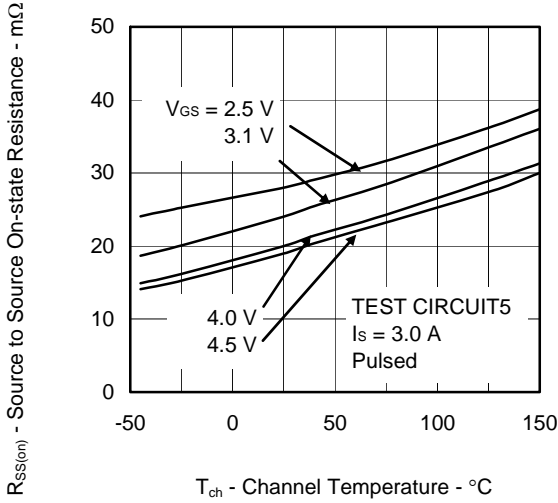
SOURCE TO SOURCE ON-STATE RESISTANCE vs. SOURCE CURRENT



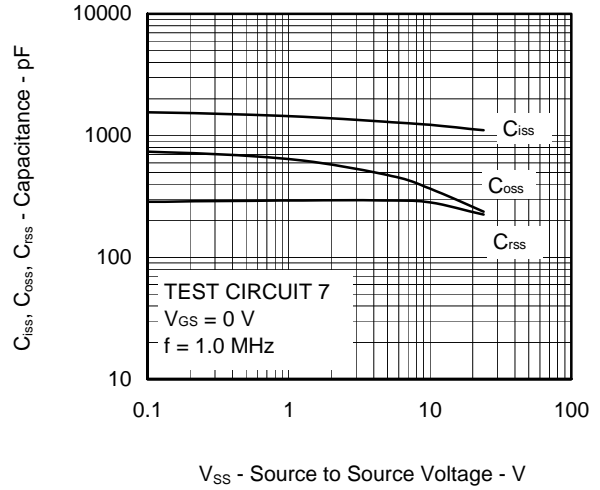
SOURCE TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



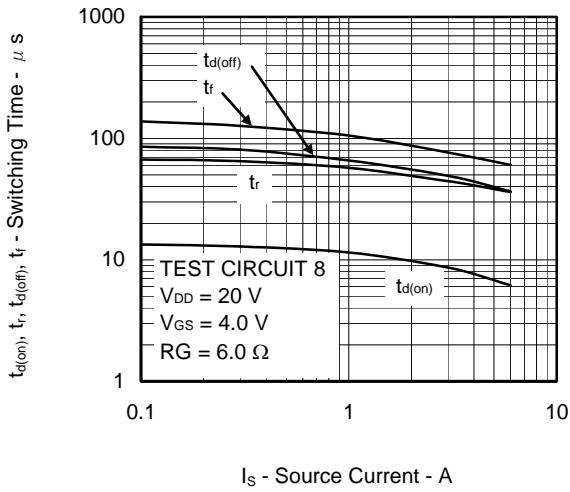
SOURCE TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



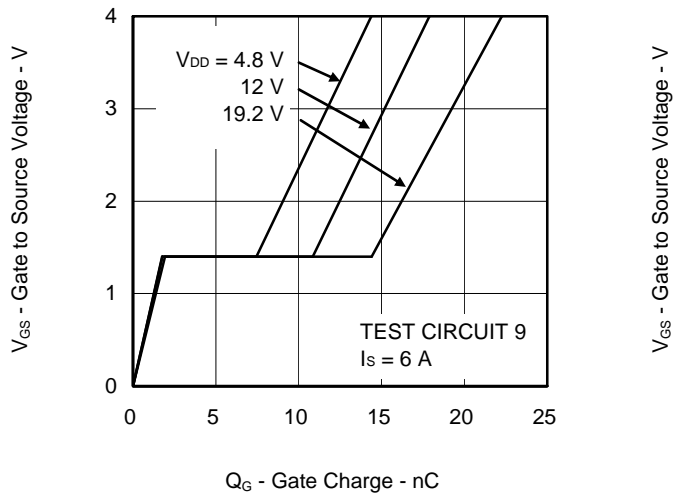
CAPACITANCE vs. SOURCE TO SOURCE VOLTAGE



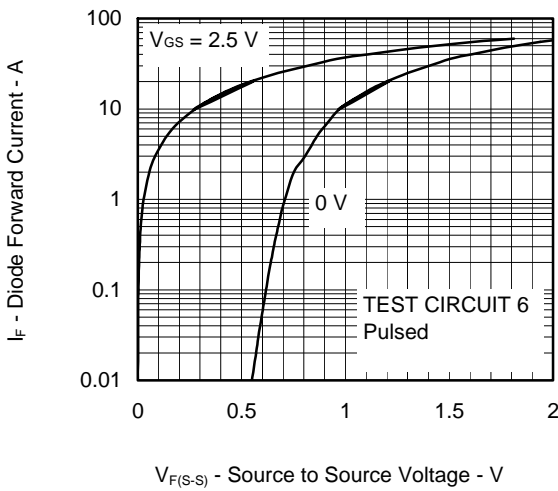
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

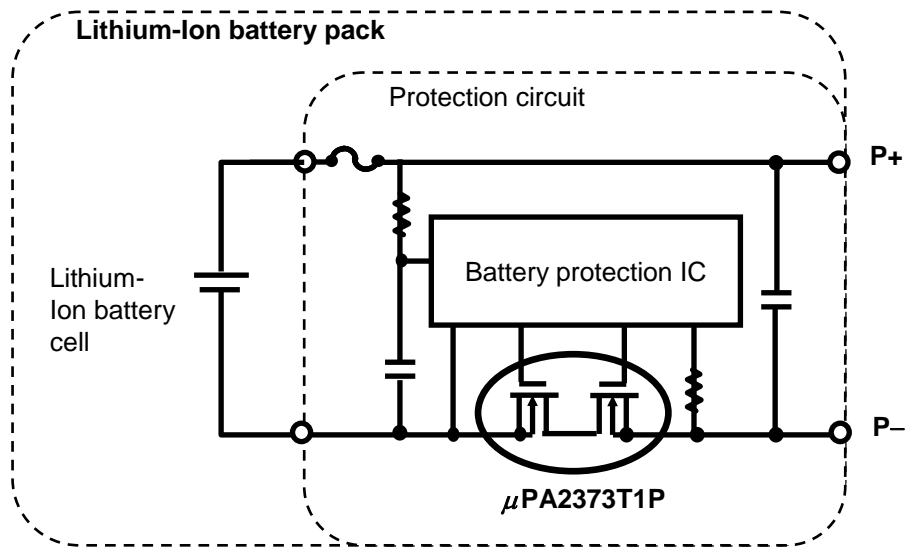


SOURCE TO SOURCE DIODE FORWARD VOLTAGE



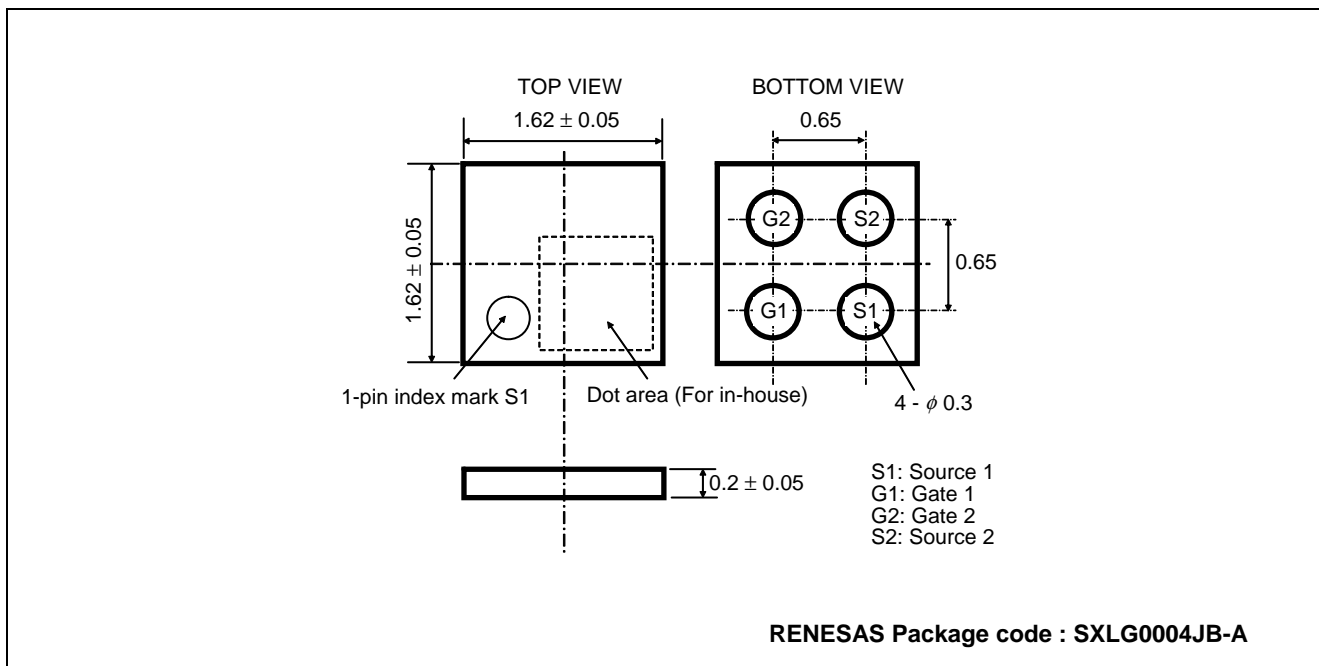
Example of application circuit

LI-ion battery (1 cell) protection circuit

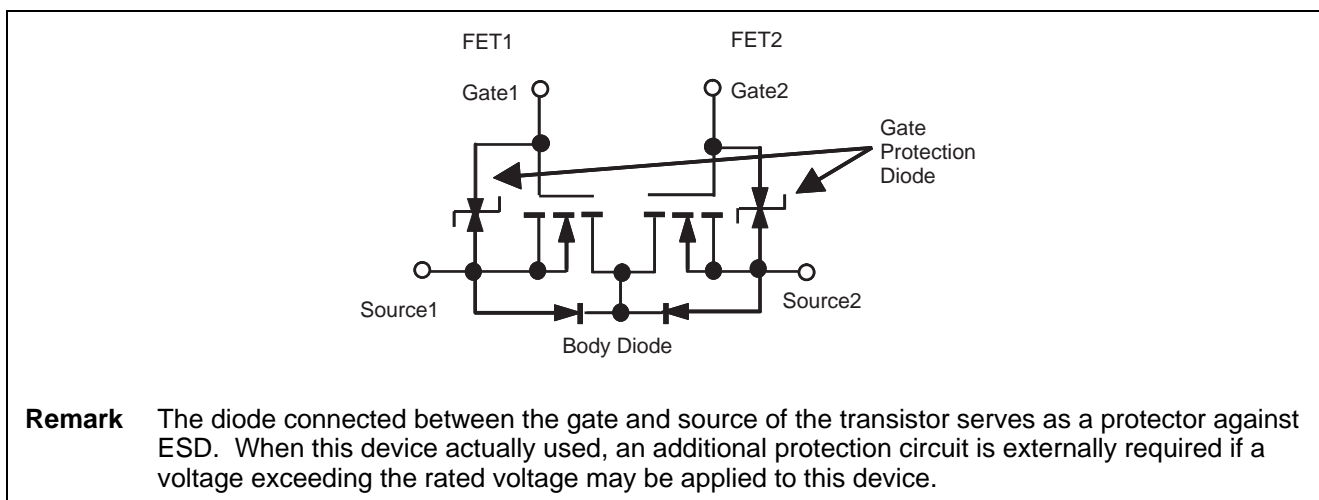


PACKAGE DRAWINGS (UNIT: mm)

4-pin EFLIP-LGA



Equivalent Circuit



USAGE CAUTIONS

When you use this device, in order to prevent a customer's hazard and damage, use it with understanding the following contents. If used exceeding recommended conditions, there is a possibility of causing the device and characteristic degradation.

1. This device is very thin device and should be handled with caution for mechanical stress. The distortion applied to the device should become below 2000×10^{-6} . If the distortion exceeds 2000×10^{-6} , the characteristic of a device may be degraded and it may result in failure.
2. Please do not damage the device when you handle it. The use of metallic tweezers has the possibility of giving the wound. Mounting with the nozzle with clean point is recommended.
3. When you mount the device on a substrate, carry out within our recommended soldering conditions of infrared reflow. If mounted exceeding the conditions, the characteristic of a device may be degraded and it may result failure.
4. When you wash the device mounted the board, carry out within our recommended conditions. If washed exceeding the conditions, the characteristic of a device may be degraded and it may result in failure.
5. When you use ultrasonic wave to substrate after the device mounting, prevent from touching a resonance directly. If it touches, the characteristic of a device may be degraded and it may result in failure.
6. Only the epoxy resin of the semiconductor grade is recommended as coating material.
7. Please refer to Figure 2 as an example of the Mounting Pad. Optimize the land pattern in consideration of density, appearance of solder fillets, common difference, etc in an actual design.
8. The marking side of this device is an internal electrode. Please neither contact with terminals of other parts nor take out the electrode.

Figure 1 Recommended soldering conditions of INFRARED REFLOW

Maximum temperature (Package's surface temperature)	: 260°C or below
Time at maximum temperature	: 10 s or less
Time of temperature higher than 220°C	: 60 s or less
Preheating time at 160 to 180°C	: 60 to 120 s
Maximum number of reflow processes	: 3 times
Maximum chlorine content of rosin flux (Mass percentage)	: 0.2% or less

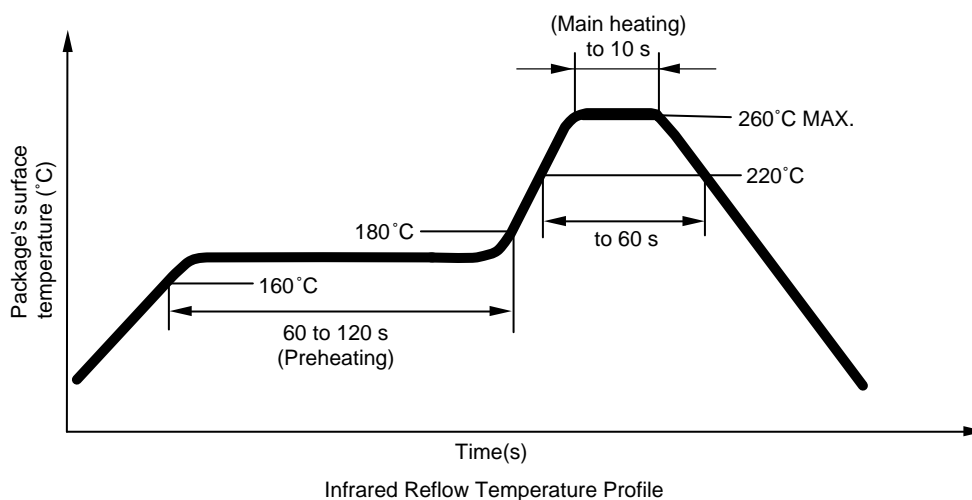


Figure 2 The example of the Mounting Pad (Unit : mm)

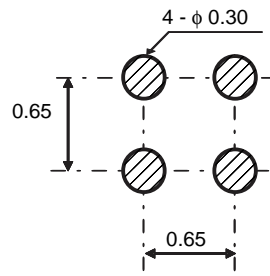
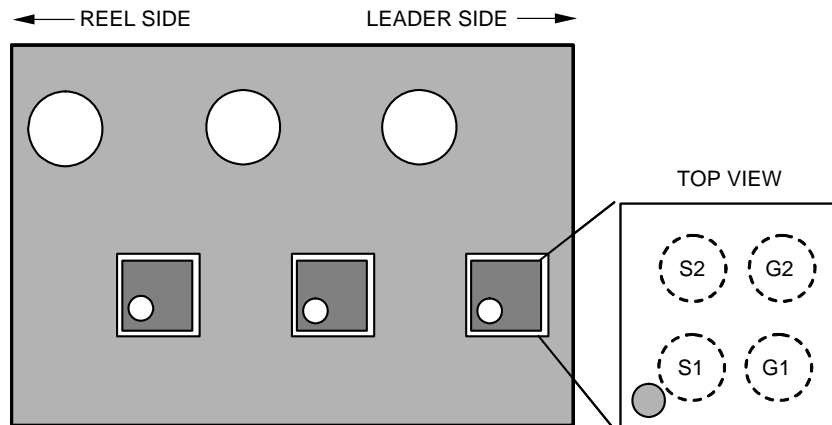


Figure 3 The unit orientation



Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
 2. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
 3. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
 4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
 5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.
 6. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
 7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.
 8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
 9. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
 10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
 11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.
- (Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

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: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, 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: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

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: +60-3-7955-3390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Laved' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141