μPA2373T1P

Dual (Drain common), N-channel MOSFET

24V, 6A, 23.0mΩ

R07DS0674EJ0101
Rev.1.01
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 mΩ MAX. (V_{GS} = 4.5 V, I_S = 3.0 A)
  - — $R_{SS(on)2}$ = 24.0 mΩ MAX. (V_{GS} = 4.0 V, I_S = 3.0 A)
  - — $R_{SS(on)3}$ = 25.0 mΩ MAX. (V_{GS} = 3.8 V, I_S = 3.0 A)
  - — $R_{SS(on)4}$ = 30.0 mΩ MAX. (V_{GS} = 3.1 V, I_S = 3.0 A)
  - — $R_{SS(on)4}$ = 39.0 mΩ MAX. (V_{GS} = 2.5 V, I_S = 3.0 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°C)

Item	Symbol	Ratings	Unit
Source to Source Voltage (V_{GS} = 0 V)	V_{SSS}	24.0	V
Gate to Source Voltage (V_{DS} = 0 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	°C
Storage Temperature	T_{stg}	–55 to +150	°C

Note: *1. Mounted on ceramic board of 50 cm^2 ×1.0 mmt
*2. PW ≤ 10 μs, Duty Cycle ≤ 1%

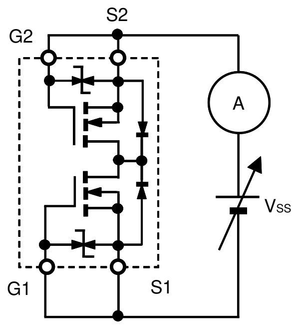
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

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

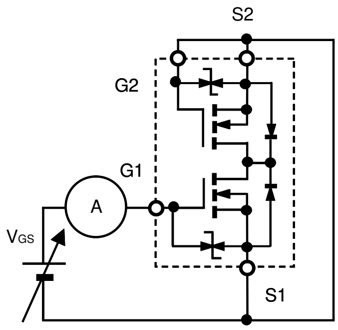
Both the FET1 and the FET2 are measured. Test circuits are example of measuring the FET1 side.

TEST CIRCUIT 1 I_{SSS}



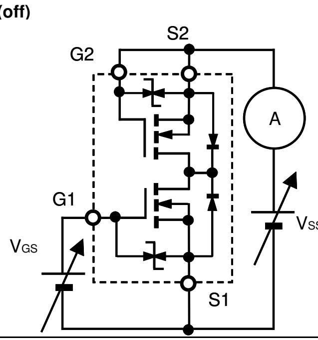
TEST CIRCUIT 2 I_{GSS}

When FET1 is measured, between GATE and SOURCE of FET2 are shorted.



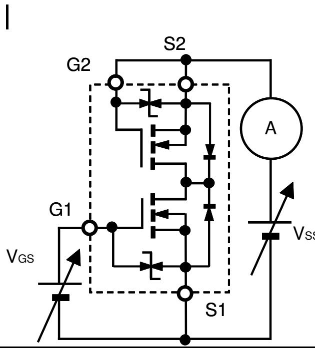
TEST CIRCUIT 3 $V_{GS(off)}$

When FET1 is measured, between GATE and SOURCE of FET2 are shorted.



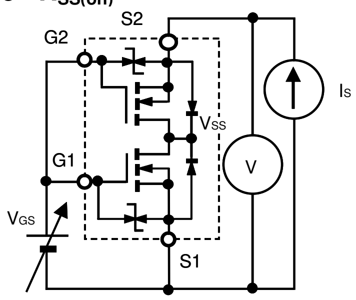
TEST CIRCUIT 4 $| y_{fs} |$

$\Delta I_S / \Delta V_{GS}$



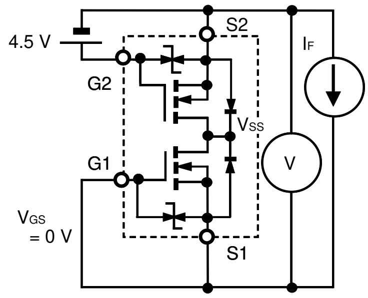
TEST CIRCUIT 5 $R_{SS(on)}$

V_{SS}/I_S

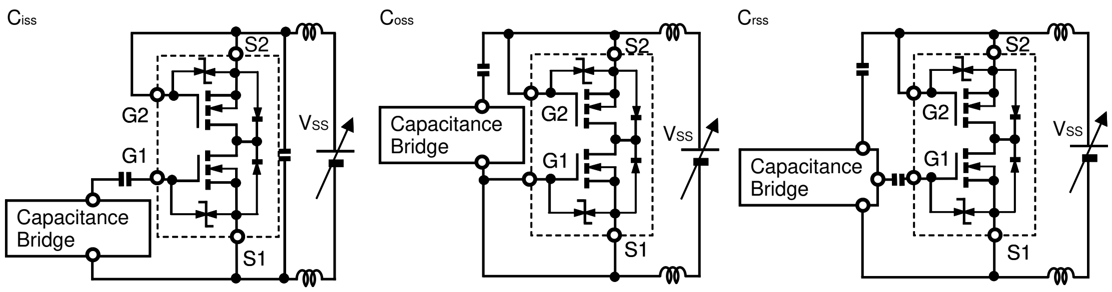


TEST CIRCUIT 6 $V_{F(S-S)}$

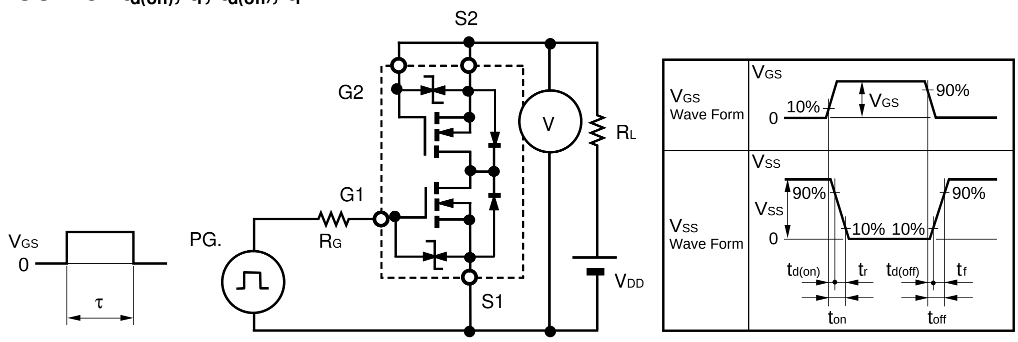
When FET1 is measured, FET2 is added V_{GS} + 4.5 V.



TEST CIRCUIT 7



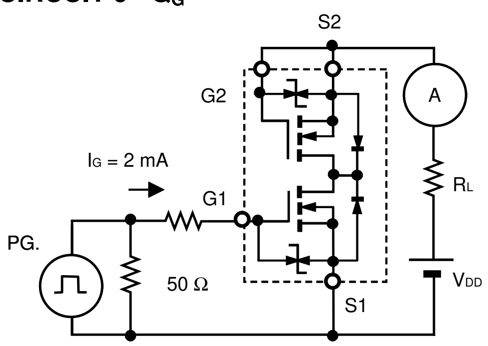
TEST CIRCUIT 8 $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

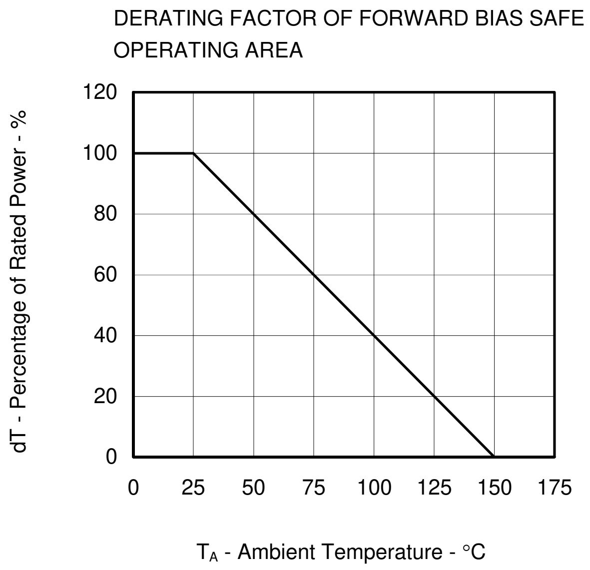


τ = 1 μs

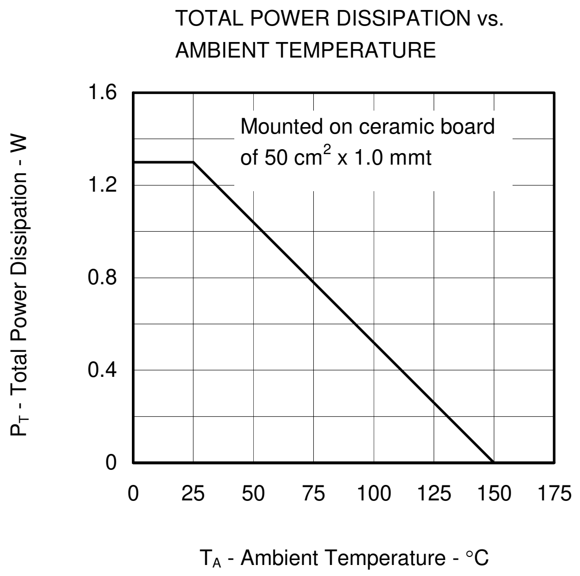
Duty Cycle ≤ 1%

TEST CIRCUIT 9 Q_G

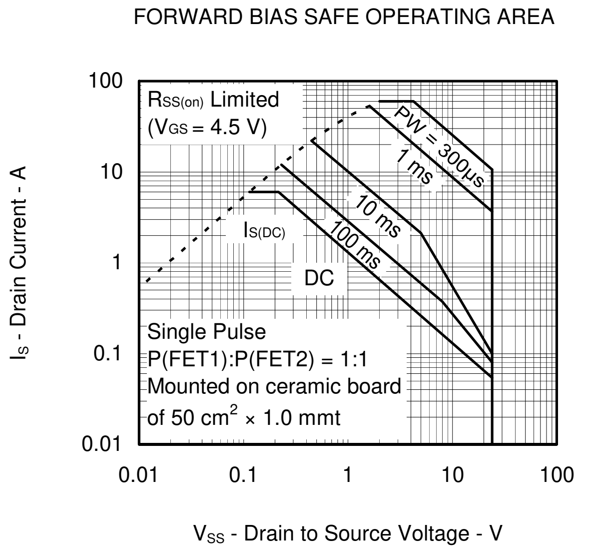




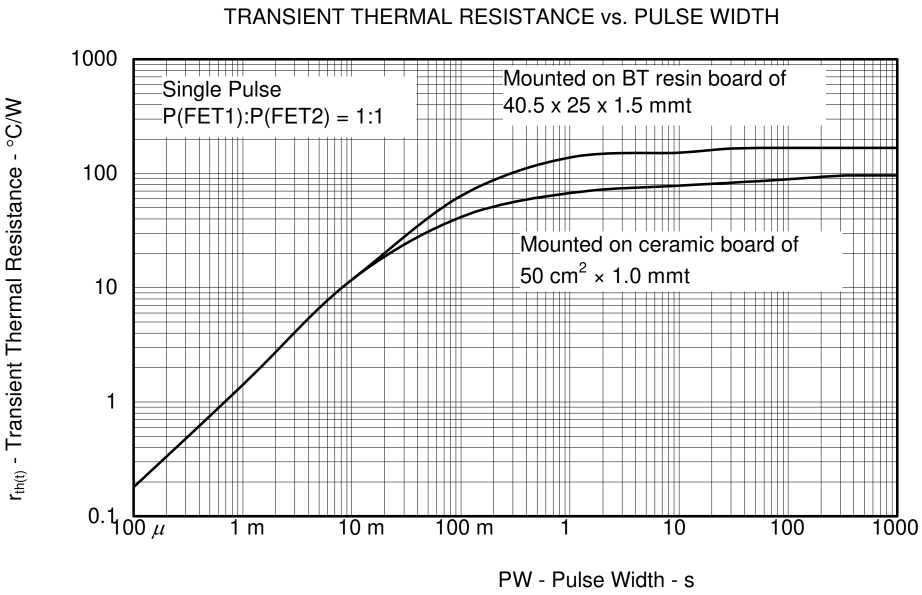
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA
dT - Percentage of Rated Power - %
120
100
80
60
40
20
0
0
25
50
75
100
125
150
175
T_A - Ambient Temperature - °C



TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE
P_T - Total Power Dissipation - W
Mounted on ceramic board of 50 cm^2 x 1.0 mmt
1.6
1.2
0.8
0.4
0
0
25
50
75
100
125
150
175
T_A - Ambient Temperature - °C

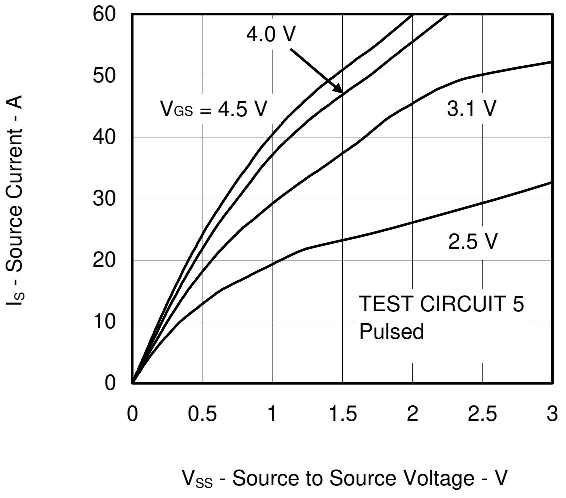


FORWARD BIAS SAFE OPERATING AREA
I_S - Drain Current - A
$R_{SS(on)}$ Limited
(V_{GS} = 4.5 V)
PW = 300μs
1 ms
10 ms
100 ms
$I_{S(DC)}$
DC
Single Pulse
P(FET1):P(FET2) = 1:1
Mounted on ceramic board
of 50 cm^2 × 1.0 mmt
100
10
1
0.1
0.01
0.01
0.1
1
10
100
V_{SS} - Drain to Source Voltage - V

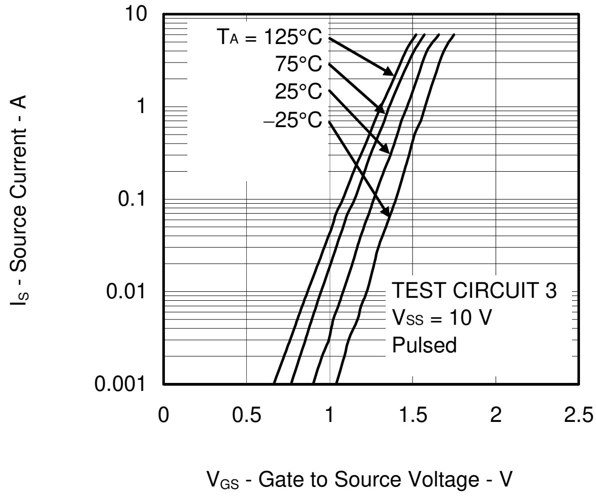


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH
$r_{th(t)}$ - Transient Thermal Resistance - °C/W
Single Pulse
P(FET1):P(FET2) = 1:1
Mounted on BT resin board of
40.5 x 25 x 1.5 mmt
Mounted on ceramic board of
50 cm^2 × 1.0 mmt
1000
100
10
1
0.1
100 μ
1 m
10 m
100 m
1
10
100
1000
PW - Pulse Width - s

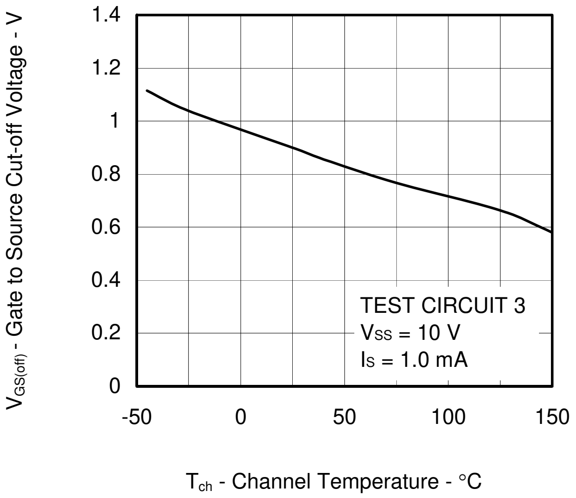
SOURCE CURRENT vs.
SOURCE TO SOURCE VOLTAGE



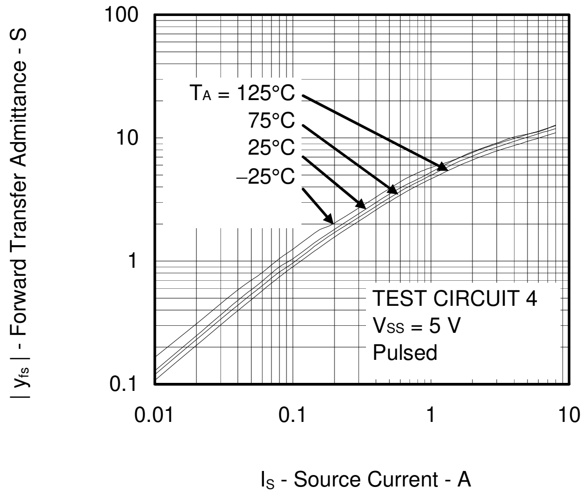
FORWARD TRANSFER CHARACTERISTICS



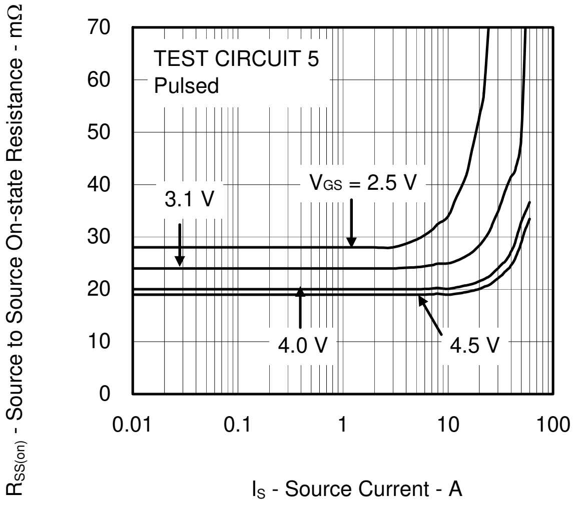
GATE TO SOURCE CUT-OFF VOLTAGE
vs. CHANNEL TEMPERATURE



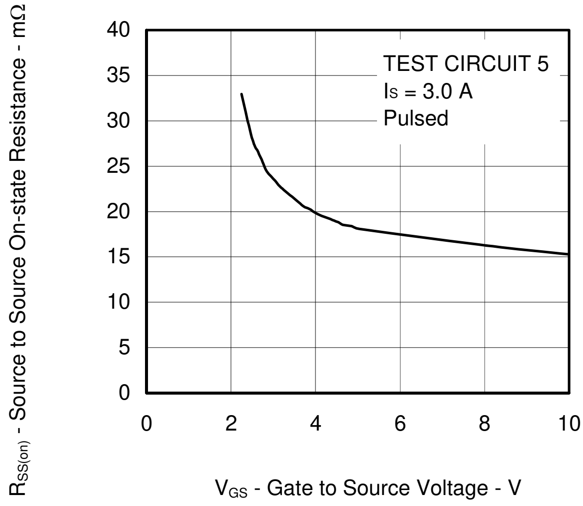
FORWARD TRANSFER ADMITTANCE vs.
SOURCE CURRENT



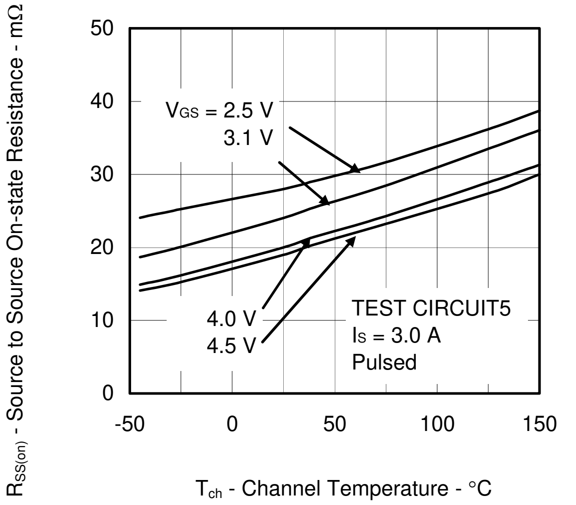
SOURCE TO SOURCE ON-STATE RESISTANCE
vs. SOURCE CURRENT



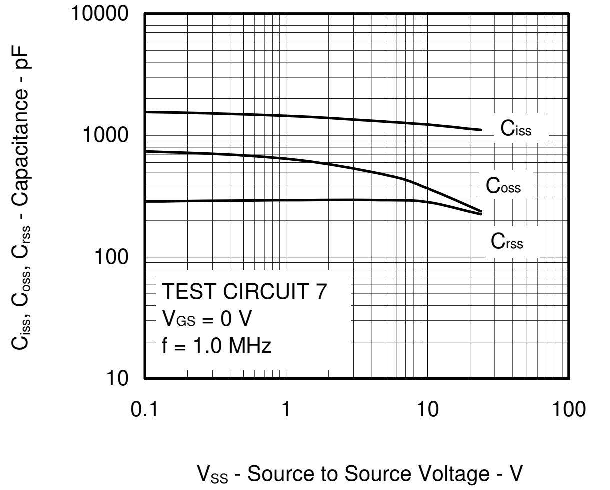
SOURCE TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



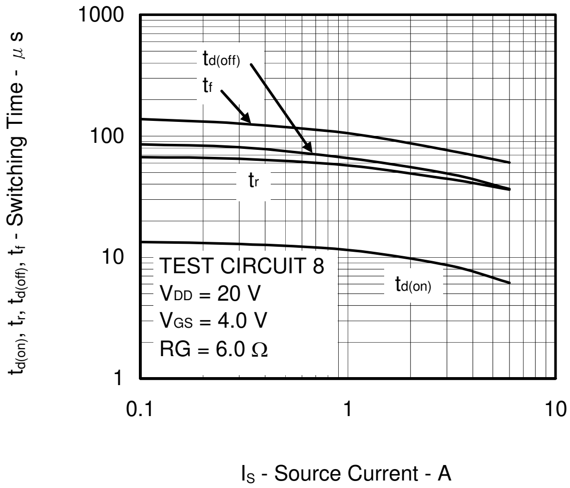
SOURCE TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



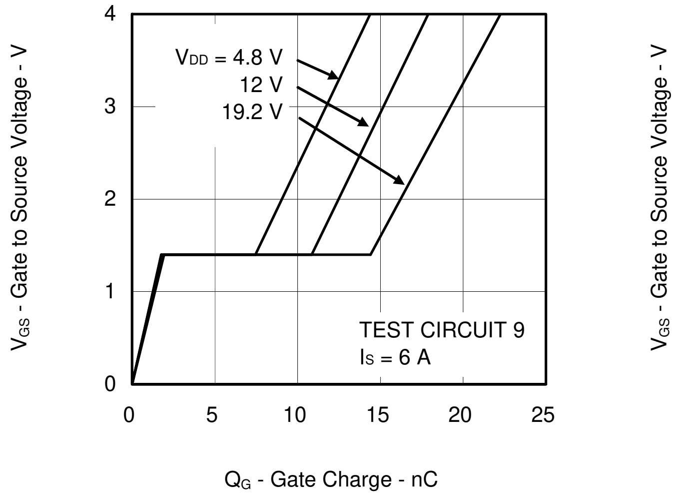
CAPACITANCE vs. SOURCE TO SOURCE VOLTAGE



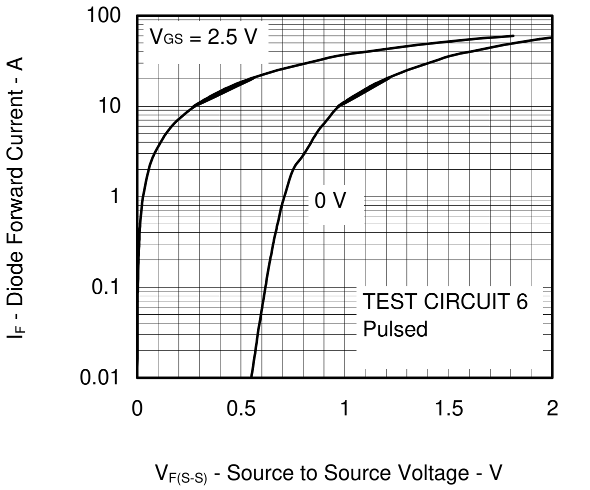
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

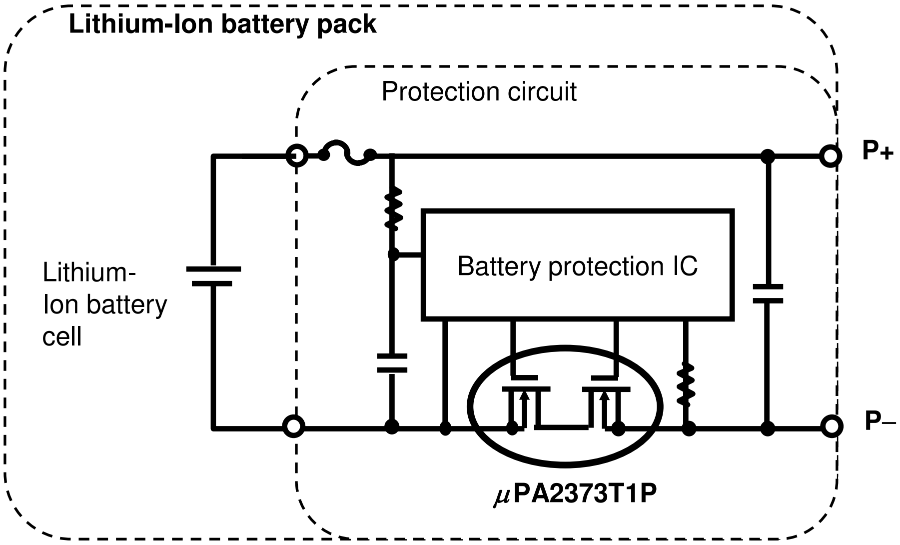


SOURCE TO SOURCE DIODE FORWARD VOLTAGE



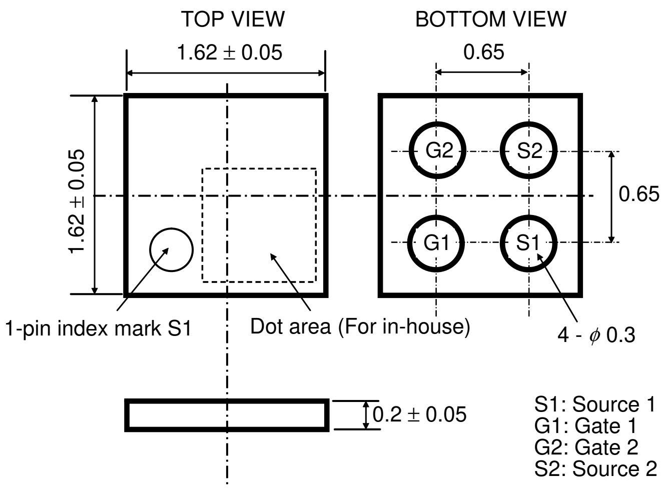
Example of application circuit

LI-ion battery (1 cell) protection circuit



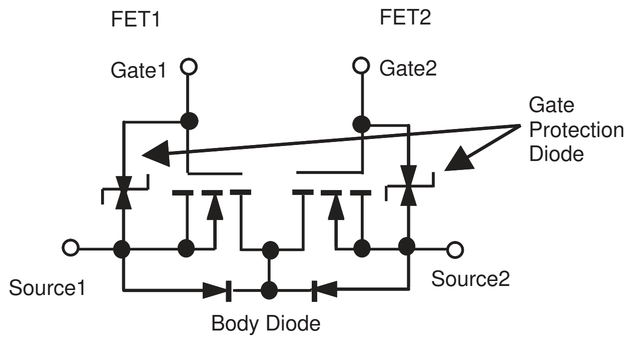
PACKAGE DRAWINGS (UNIT: mm)

4-pin EFLIP-LGA



RENESAS Package code : SXLG0004JB-A

Equivalent Circuit



Remark The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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.

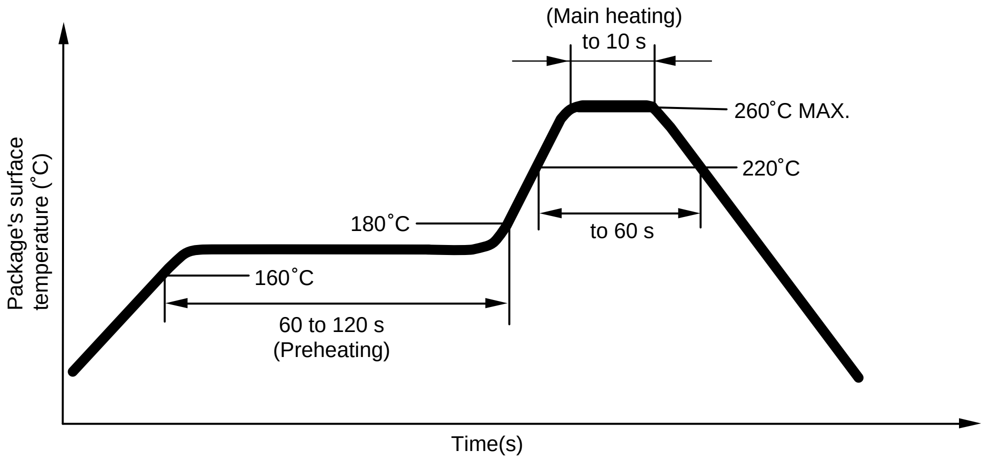
6. Only the epoxy resin of the semiconductor grade is recommended as coating material.

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



Infrared Reflow Temperature Profile

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

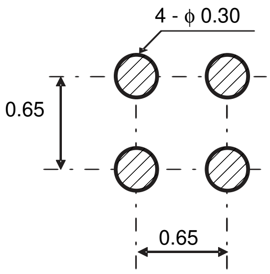
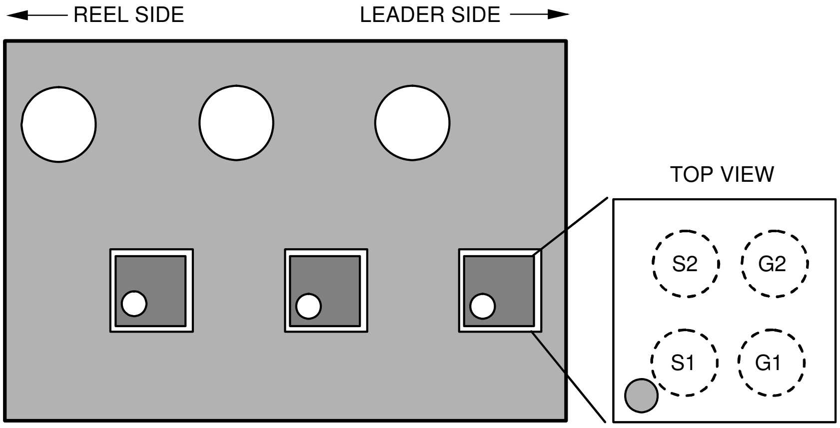


Figure 3 The unit orientation



SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

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