

μPA2375T1P

N-CHANNEL MOSFET FOR SWITCHING

R07DS0573EJ0100

Rev.1.00

Dec 05, 2011

DESCRIPTION

The μPA2375T1P is a switching device, which can be driven directly by a 2.5 V power source.

The μPA2375T1P features a low on-state resistance and excellent switching characteristics, and is suitable for single cell LiB application.

FEATURES

- 2.5 V drive available
- Ultra low on-state resistance
 - $R_{SS(on)1} = 11.4 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_S = 5 \text{ A)}$
 - $R_{SS(on)2} = 12.4 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.0 \text{ V, } I_S = 5 \text{ A)}$
 - $R_{SS(on)3} = 13.0 \text{ m}\Omega \text{ MAX. (} V_{GS} = 3.8 \text{ V, } I_S = 5 \text{ A)}$
 - $R_{SS(on)4} = 17.0 \text{ m}\Omega \text{ MAX. (} V_{GS} = 3.1 \text{ V, } I_S = 5 \text{ A)}$
 - $R_{SS(on)5} = 23.0 \text{ m}\Omega \text{ MAX. (} V_{GS} = 2.5 \text{ V, } I_S = 5 \text{ A)}$
- Built-in G-S protection diode against ESD

ORDERING INFORMATION

Part No.	Lead Plating	Packing	Package
μPA2375T1P-E1-A *1	Ni/Au	Reel 5000 p/reel	6-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)}	±10	A
Source Current (pulse) *2	I _{S(pulse)}	±100	A
Total Power Dissipation (2 units) *1	P _{T1}	1.75	W
Channel Temperature	T _{ch}	150	°C
Storage Temperature	T _{stg}	-55 to +150	°C

Note: *1. Mounted on ceramic board (50 cm² × 1.0 mm)

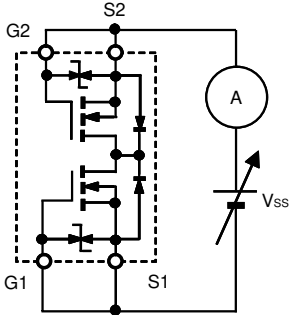
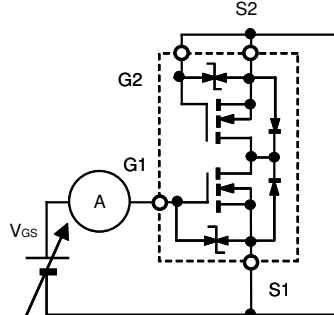
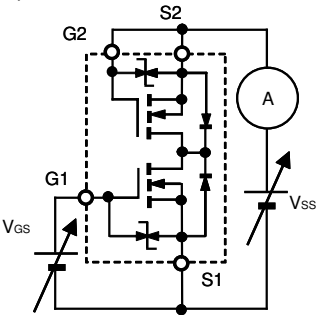
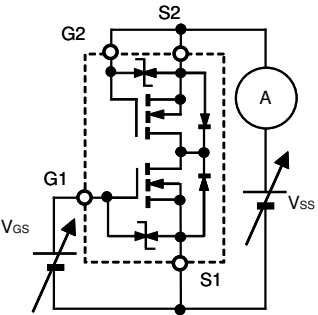
*2. PW ≤ 10 μs, Duty Cycle ≤ 1%

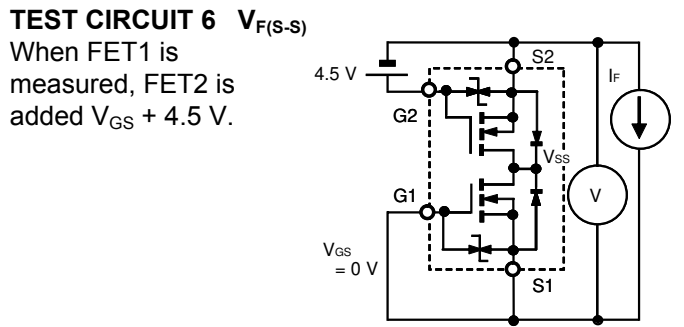
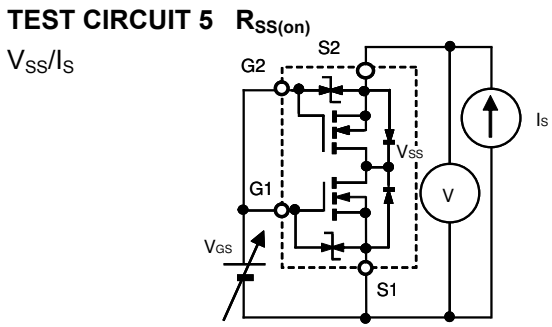
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

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}	7.0			S	V _{SS} = 5 V, I _S = 5 A, TEST CIRCUIT 4
Source to Source On-state Resistance *1	R _{SS(on)1}	6.5	9.0	11.4	mΩ	V _{GS} = 4.5 V, I _S = 5 A, TEST CIRCUIT 5
	R _{SS(on)2}	6.5	9.6	12.4	mΩ	V _{GS} = 4.0 V, I _S = 5 A, TEST CIRCUIT 5
	R _{SS(on)3}	6.5	9.8	13.0	mΩ	V _{GS} = 3.8 V, I _S = 5 A, TEST CIRCUIT 5
	R _{SS(on)4}	7.0	11.5	17.0	mΩ	V _{GS} = 3.1 V, I _S = 5 A, TEST CIRCUIT 5
	R _{SS(on)5}	9.0	15.0	23.0	mΩ	V _{GS} = 2.5 V, I _S = 5 A, TEST CIRCUIT 5
Input Capacitance	C _{iSS}		2250		pF	V _{SS} = 10 V,
Output Capacitance	C _{oss}		670		pF	V _{GS} = 0 V,
Reverse Transfer Capacitance	C _{rSS}		510		pF	f = 1.0 MHz, TEST CIRCUIT 7
Turn-on Delay Time	t _{d(on)}		6.6		μs	V _{DD} = 20 V, I _S = 10 A,
Rise Time	t _r		44		μs	V _{GS} = 4.0 V,
Turn-off Delay Time	t _{d(off)}		72		μs	R _G = 6.0 Ω,
Fall Time	t _f		133		μs	TEST CIRCUIT 8
Total Gate Charge	Q _G		40		nC	V _{DD} = 19.2 V, V _{G1S1} = 4.0 V, I _S = 3 A, TEST CIRCUIT 9
Body Diode Forward Voltage *1	V _{F(S-S)}		0.9		V	I _F = 10 A, V _{GS} = 0 V, TEST CIRCUIT 6

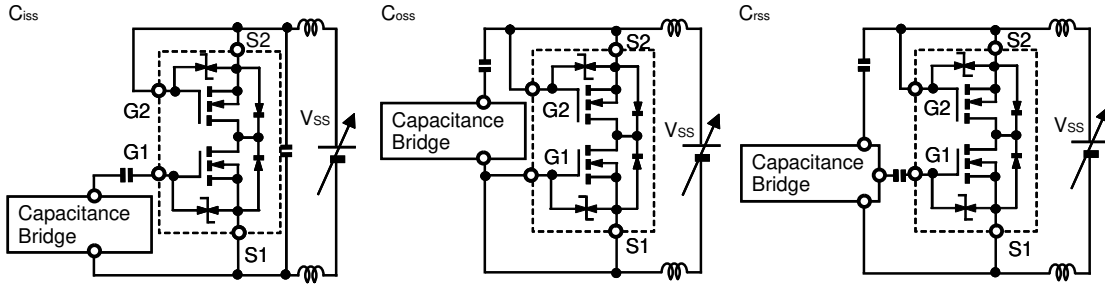
Note: *1. Pulsed test

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

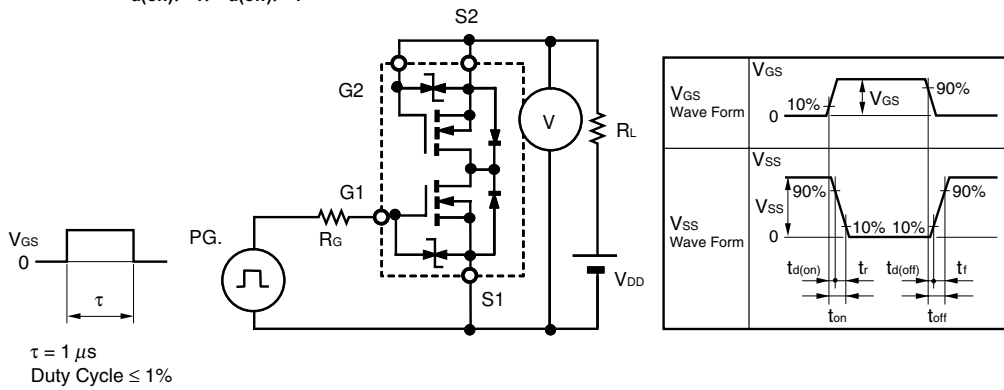
<p>TEST CIRCUIT 1 I_{SSS}</p> 	<p>TEST CIRCUIT 2 I_{GSS}</p> <p>When FET1 is measured, between GATE and SOURCE of FET2 are shorted.</p> 
<p>TEST CIRCUIT 3 V_{GS(off)}</p> <p>When FET1 is measured, between GATE and SOURCE of FET2 are shorted.</p> 	<p>TEST CIRCUIT 4 y_{fs} </p> <p>ΔI_S/ΔV_{GS}</p> 



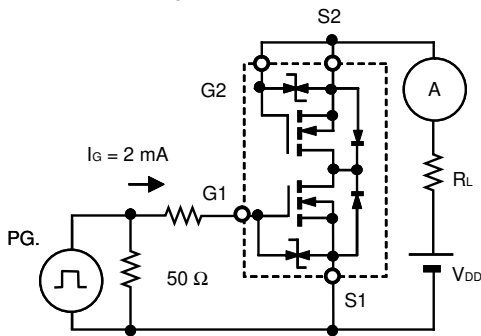
TEST CIRCUIT 7



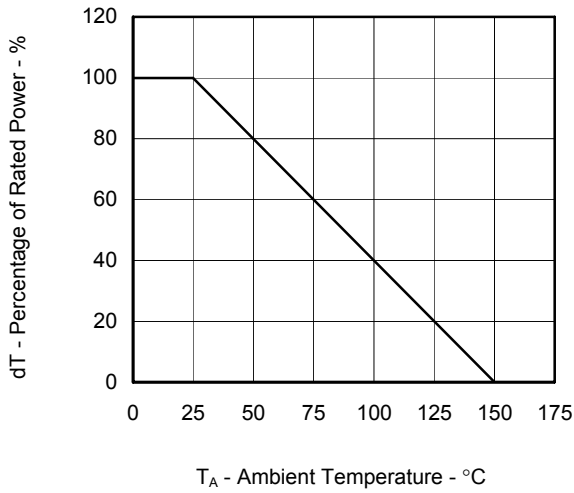
TEST CIRCUIT 8 $t_{d(on)}$, t_r , $t_{d(off)}$, t_f



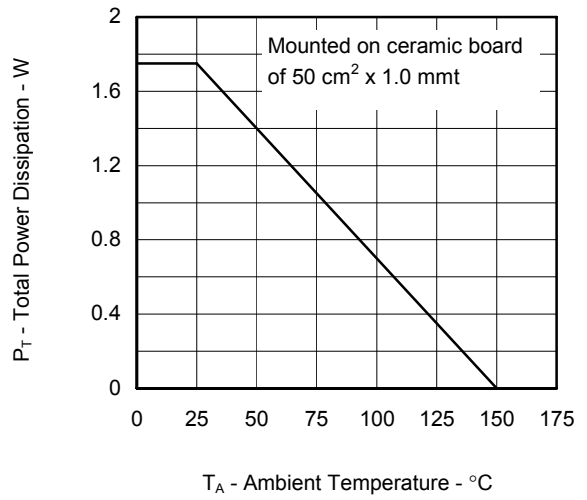
TEST CIRCUIT 9 Q_G



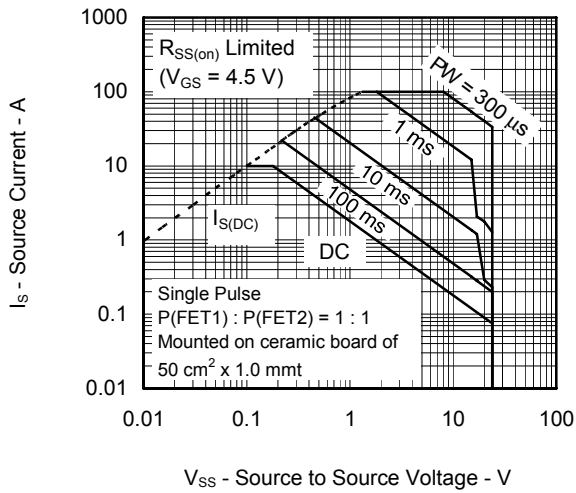
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



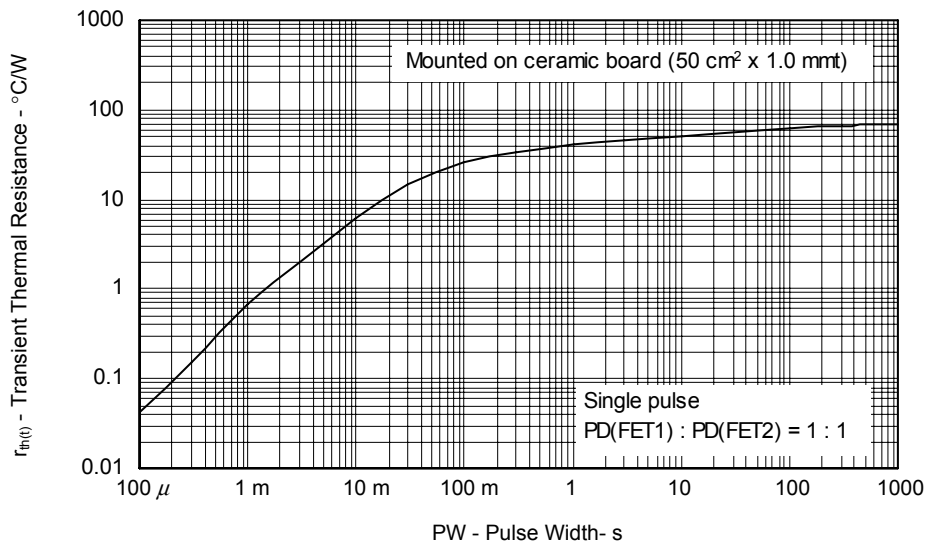
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



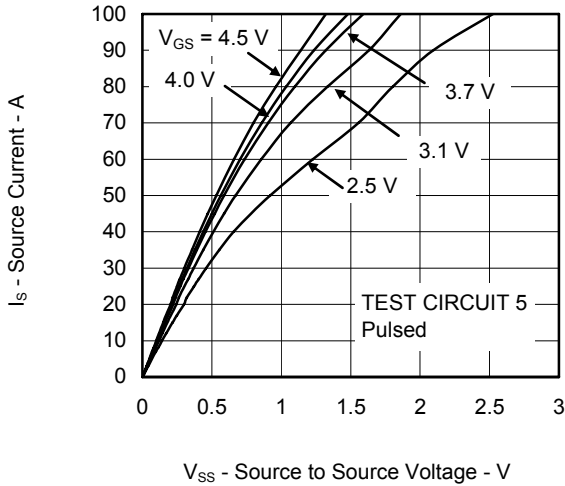
FORWARD BIAS SAFE OPERATING AREA



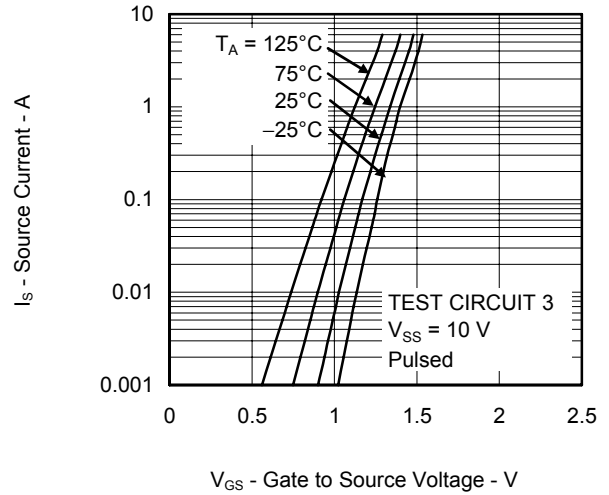
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



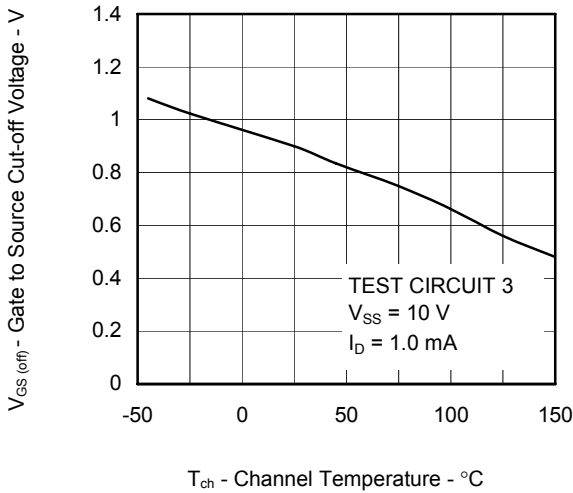
SOURCE CURRENT vs. SOURCE TO SOURCE VOLTAGE



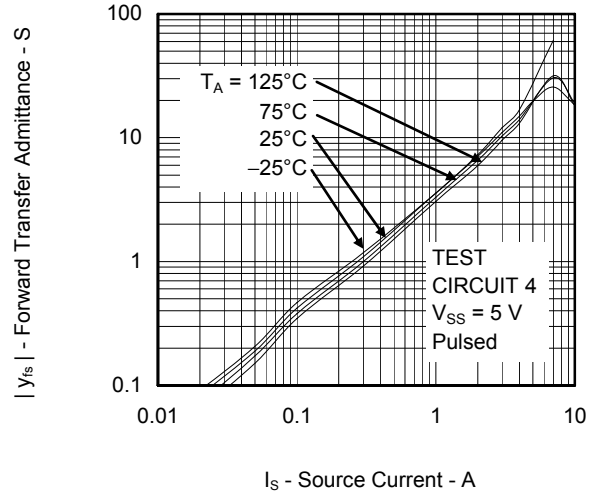
FORWARD TRANSFER CHARACTERISTICS



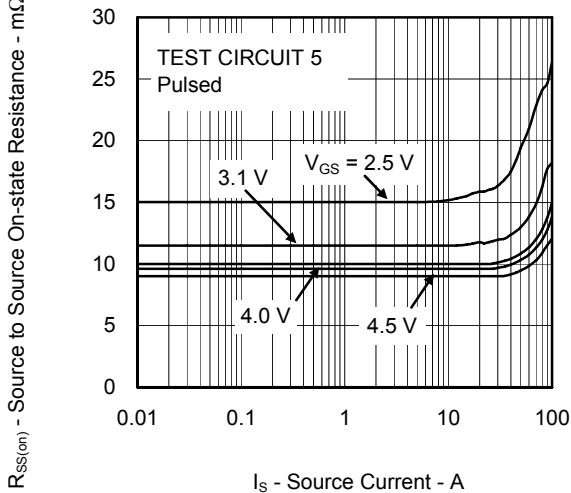
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



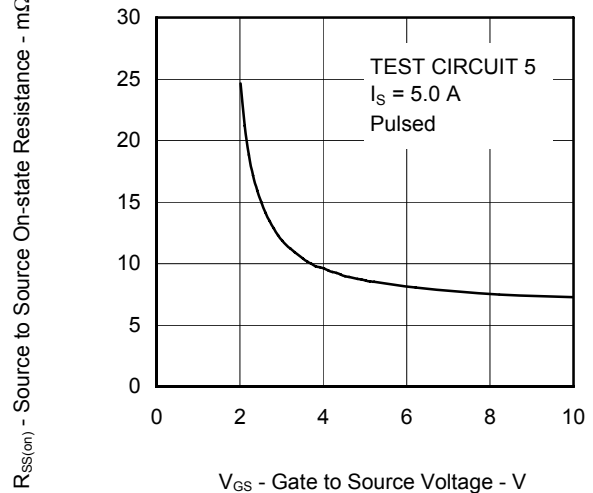
FORWARD TRANSFER ADMITTANCE vs. SOURCE CURRENT



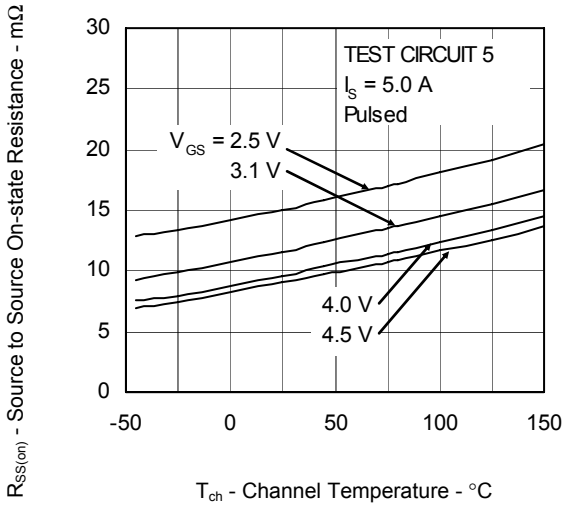
SOURCE TO SOURCE ON-STATE RESISTANCE vs. SOURCE CURRENT



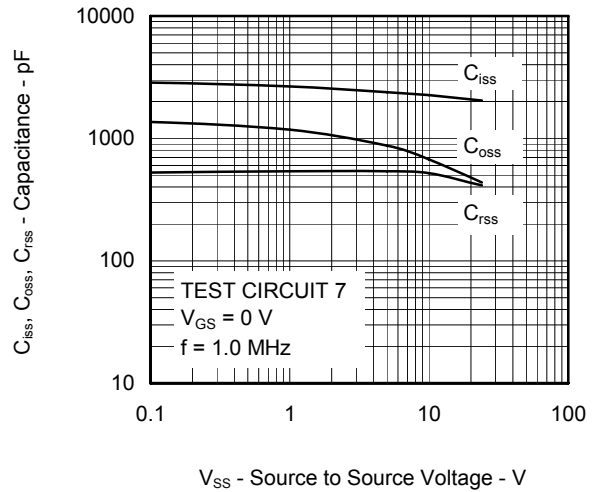
SOURCE TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



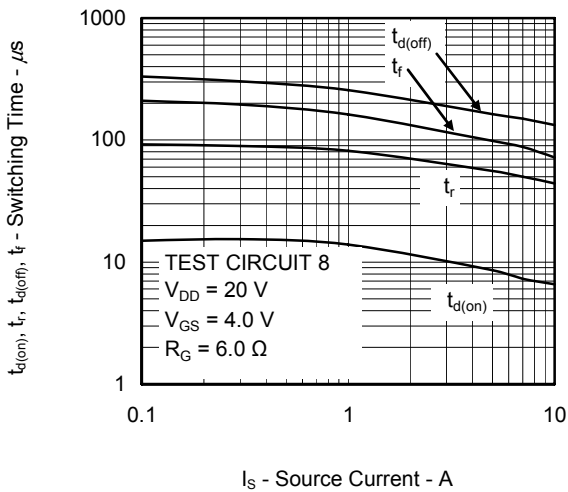
SOURCE TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



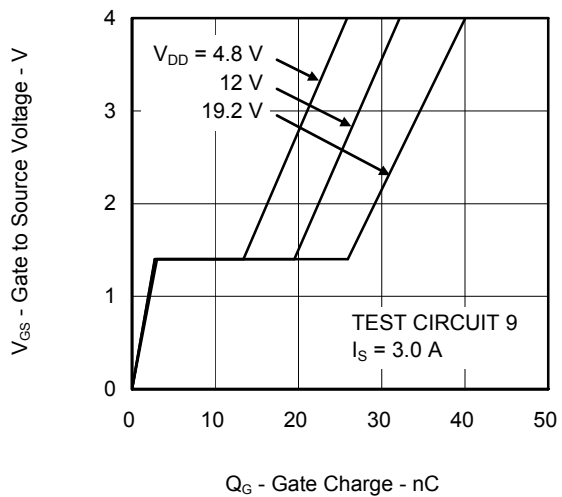
CAPACITANCE vs. SOURCE TO SOURCE VOLTAGE



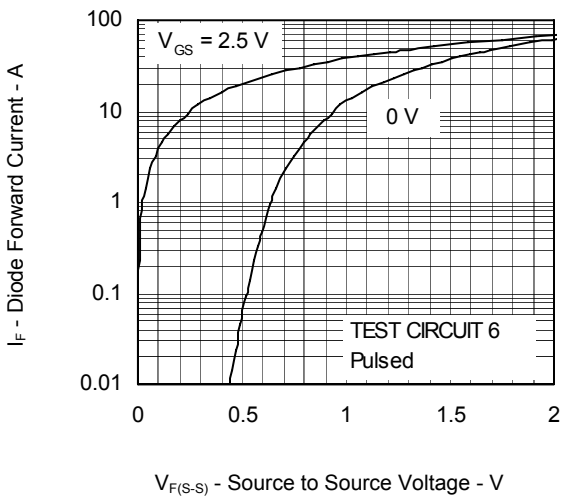
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

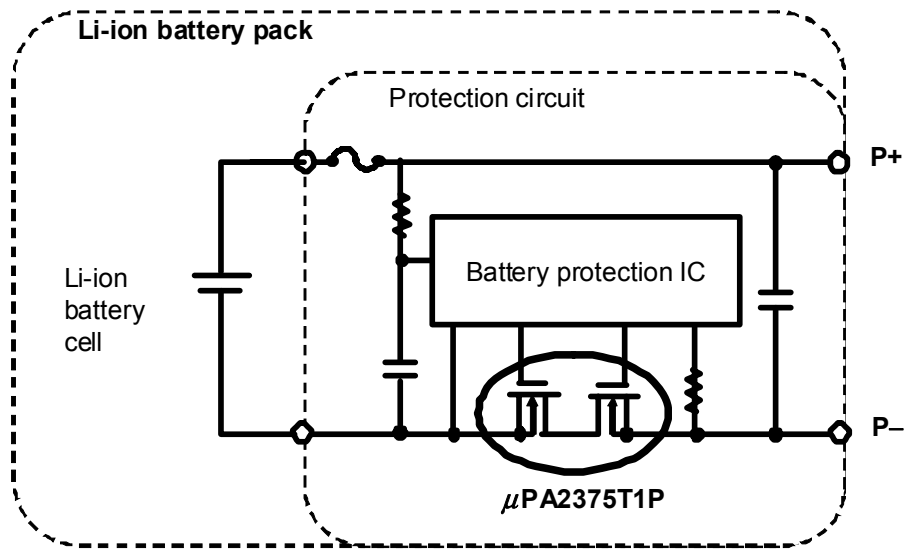


SOURCE TO SOURCE DIODE FORWARD VOLTAGE



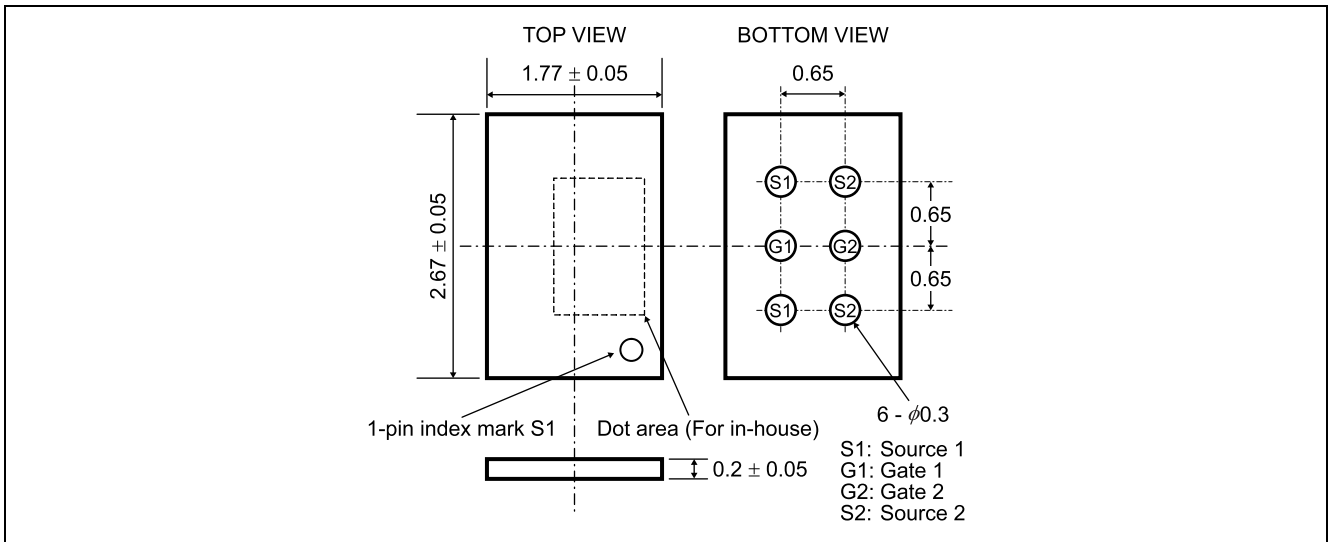
Example of application circuit

Li-ion battery (1 cell) protection circuit

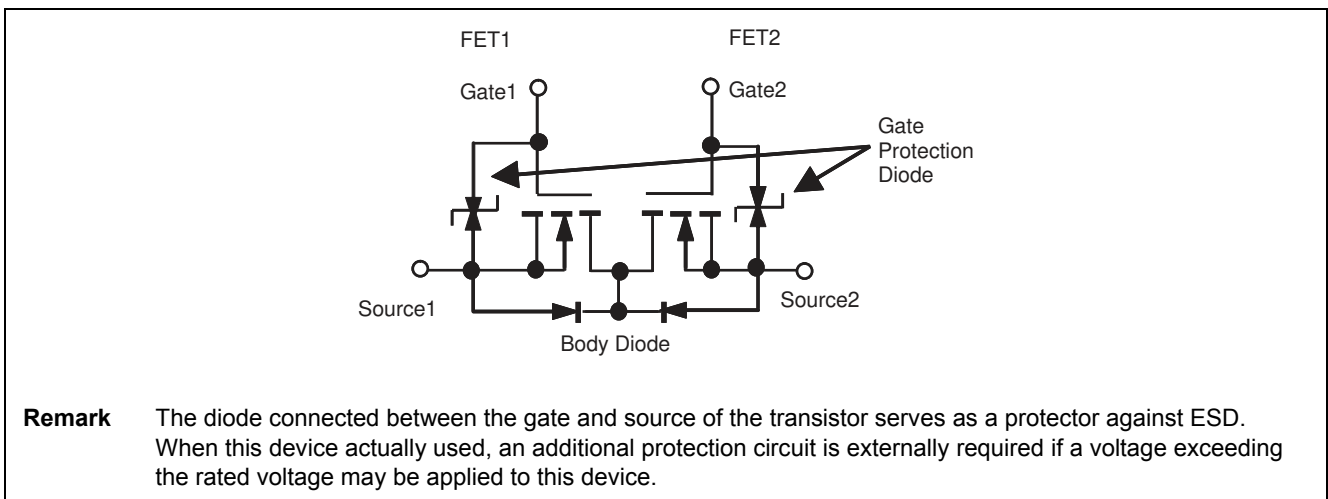


PACKAGE DRAWINGS (UNIT: mm)

6-pin EFLIP-LGA



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

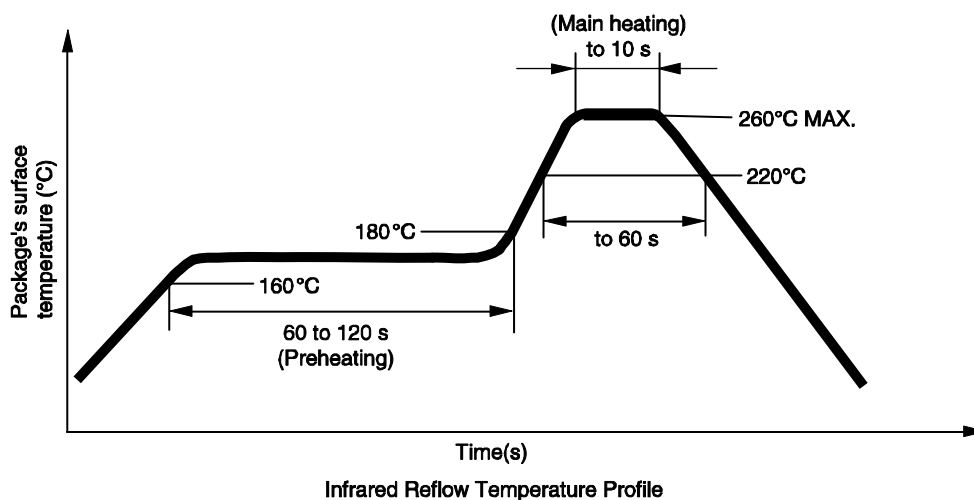


Figure 2 The example of the Mounting Pad (Unit : mm)

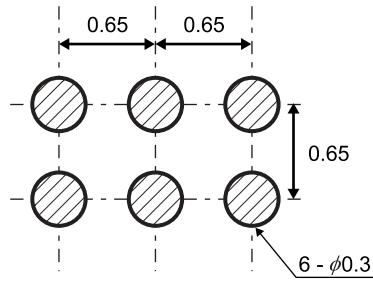
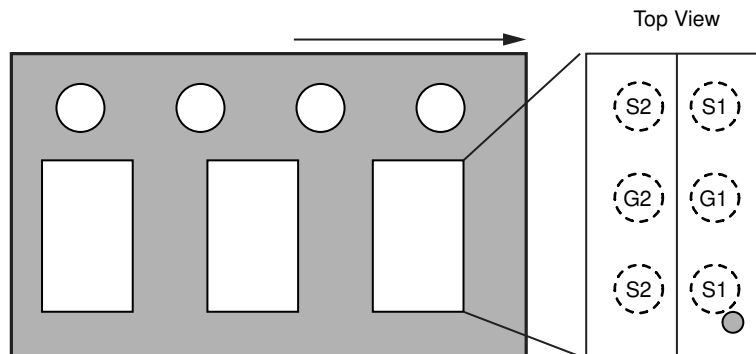


Figure 3 The unit orientation



Revision History	μPA2375T1P Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Dec 05, 2011	–	First Edition Issued

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