

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# MOS FIELD EFFECT TRANSISTOR

# $\mu$ PA2211T1M

## P-CHANNEL MOS FET FOR SWITCHING

### DESCRIPTION

The  $\mu$ PA2211T1M is P-channel MOS Field Effect Transistor designed for power management applications of portable equipments, such as load switch.

### FEATURES

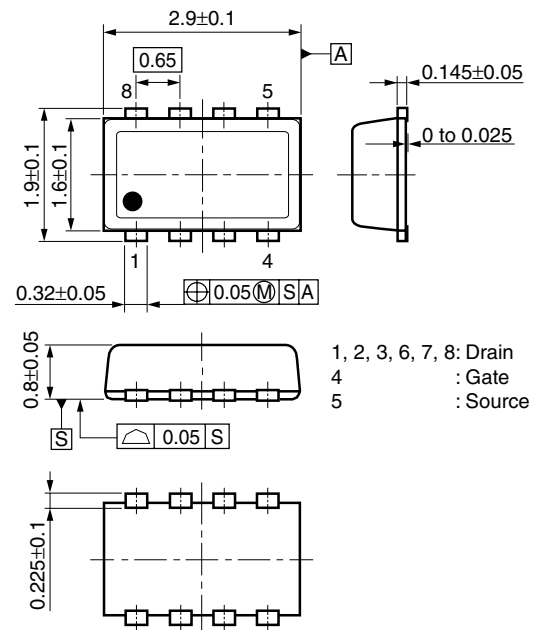
- Low on-state resistance  
 $R_{DS(on)1} = 25 \text{ m}\Omega \text{ MAX. (} V_{GS} = -4.5 \text{ V, } I_D = -7.5 \text{ A)}$   
 $R_{DS(on)2} = 34 \text{ m}\Omega \text{ MAX. (} V_{GS} = -2.5 \text{ V, } I_D = -3.8 \text{ A)}$   
 $R_{DS(on)3} = 66 \text{ m}\Omega \text{ MAX. (} V_{GS} = -1.8 \text{ V, } I_D = -3.8 \text{ A)}$
- Built-in gate protection diode
- $-1.8 \text{ V}$  Gate drive available

### ORDERING INFORMATION

PART NUMBER	PACKING	PACKAGE
$\mu$ PA2211T1M-T1-AT <sup>Note</sup>	8 mm embossed taping	8-pin VSOF (1629)
$\mu$ PA2211T1M-T2-AT <sup>Note</sup>	3000 p/reel	0.011 g TYP.

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

### PACKAGE DRAWING (Unit: mm)



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, All terminals are connected.)

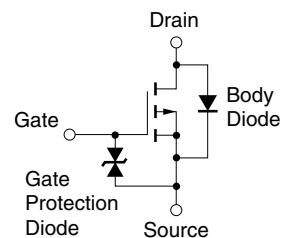
Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	-12	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±8	V
Drain Current (DC)	I <sub>D(DC)</sub>	±7.5	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±30	A
Total Power Dissipation <sup>Note2</sup>	P <sub>T1</sub>	1.1	W
Total Power Dissipation (PW = 5 sec) <sup>Note2</sup>	P <sub>T2</sub>	2.5	W
Channel Temperature	T <sub>ch</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

- Notes 1.** PW ≤ 10 μs, Duty Cycle ≤ 1%  
**2.** Mounted on glass epoxy board of 25.4 mm x 25.4 mm x 0.8 mm

**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.

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### EQUIVALENT CIRCUIT

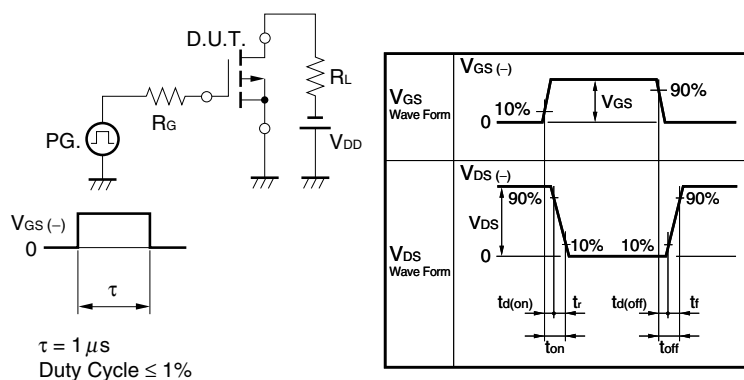


**ELECTRICAL CHARACTERISTICS (TA = 25°C, All terminals are connected.)**

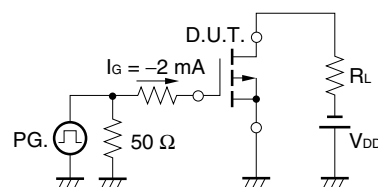
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -12 V, V <sub>GS</sub> = 0 V			-10	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±8 V, V <sub>DS</sub> = 0 V			±10	μA
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1 mA	-0.45		-1.5	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -3.8 A	5			S
Drain to Source On-state Resistance <sup>Note</sup>	R <sub>DS(on)1</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -7.5 A		21	25	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -3.8 A		25	34	mΩ
	R <sub>DS(on)3</sub>	V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -3.8 A		34	66	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -10 V,		1350		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V,		255		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		215		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -10 V, I <sub>D</sub> = -3.8 A,		10.7		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = -4.0 V,		16.7		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		101.0		ns
Fall Time	t <sub>f</sub>			76.4		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = -9.6 V,		14.9		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = -4.5 V,		2.8		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = -7.5 A		4.0		nC
Body Diode Forward Voltage <sup>Note</sup>	V <sub>F(S-D)</sub>	I <sub>F</sub> = -7.5 A, V <sub>GS</sub> = 0 V		0.88	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = -7.5 A, V <sub>GS</sub> = 0 V,		60		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = -47 A/μs		19		nC

**Note** Pulsed

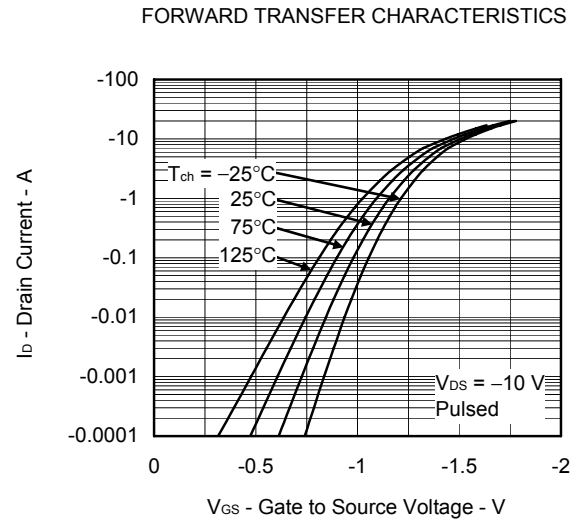
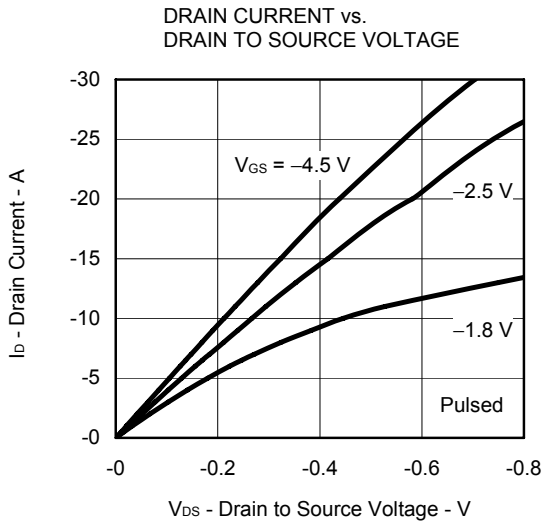
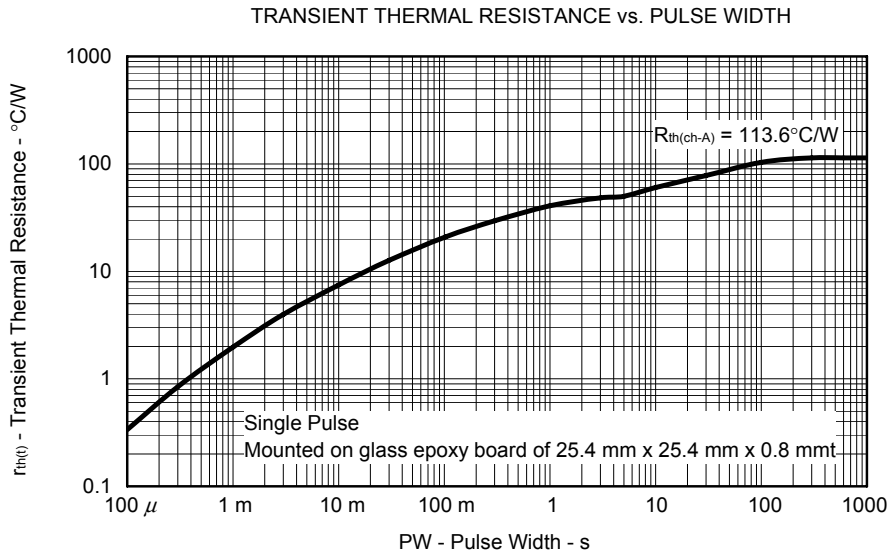
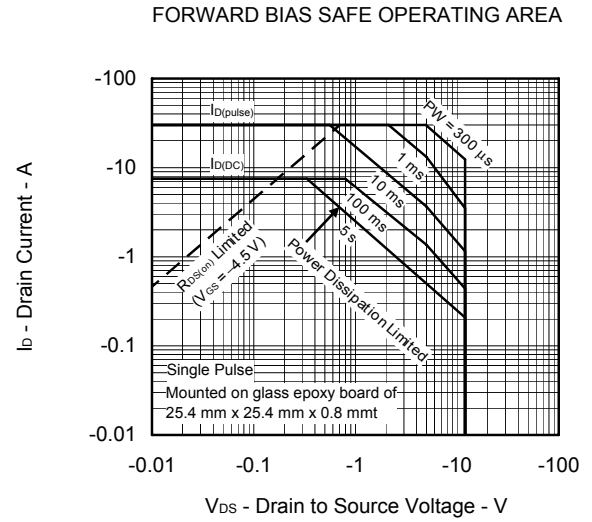
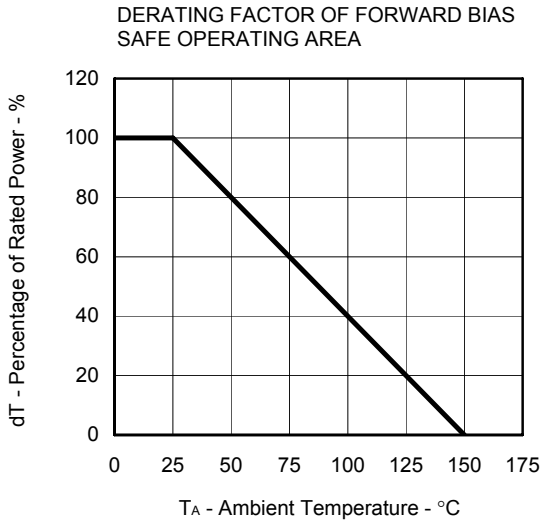
**TEST CIRCUIT 1 SWITCHING TIME**



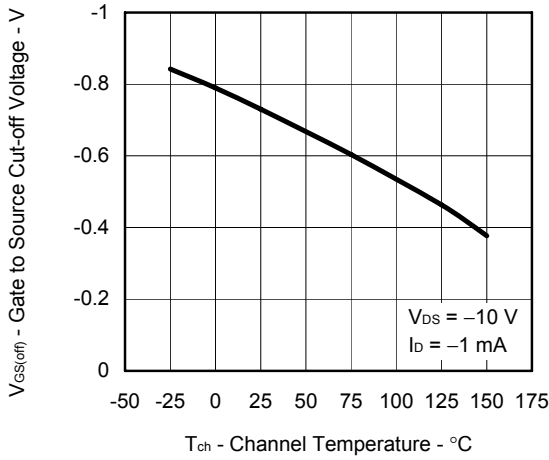
**TEST CIRCUIT 2 GATE CHARGE**



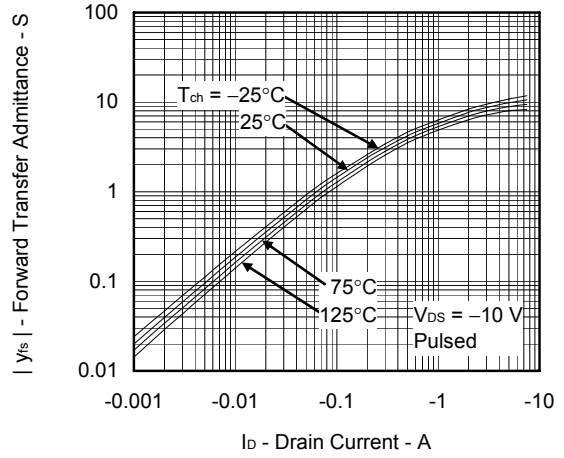
TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



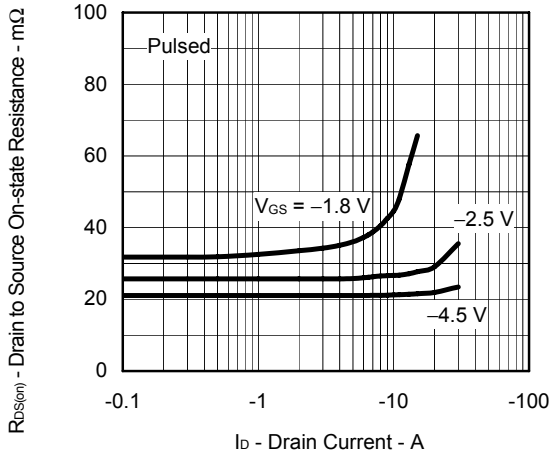
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



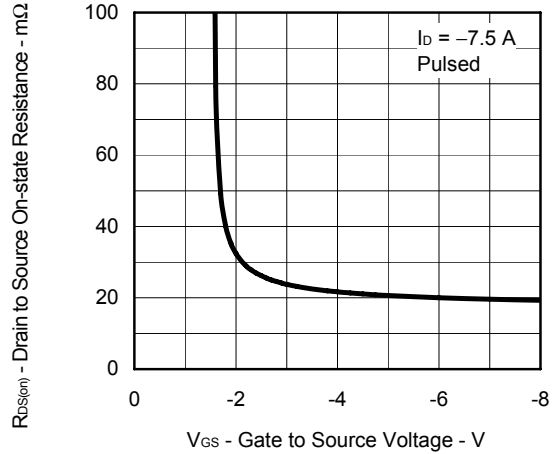
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



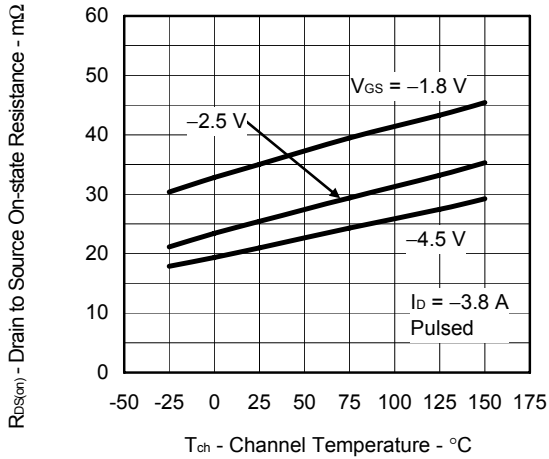
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



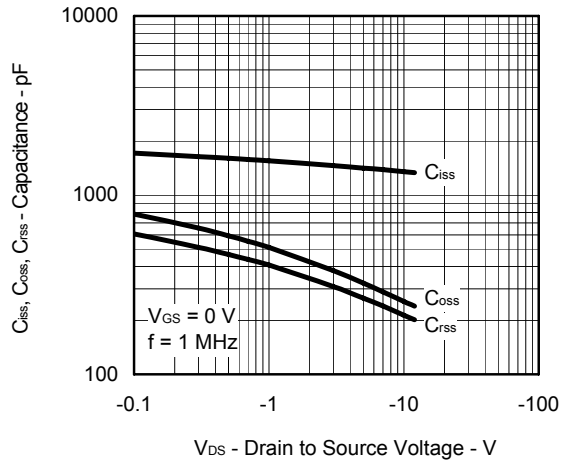
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



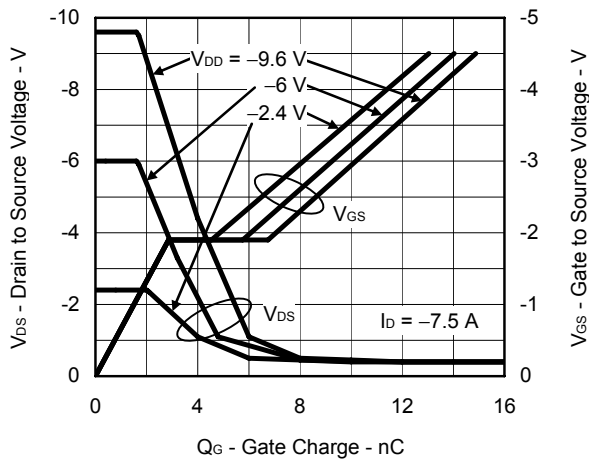
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



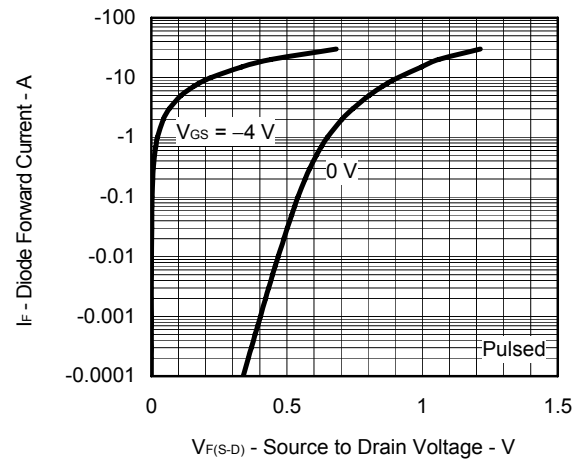
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



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