

# MOS FET WITH SCHOTTKY BARRIER DIODE

# $\mu$ PA508TE

## N-CHANNEL MOS FET WITH SCHOTTKY BARRIER DIODE FOR SWITCHING

### DESCRIPTION

The  $\mu$  PA508TE is a switching device, which can be driven directly by a 2.5 V power source.

This device incorporates a MOS FET, which features a low on-state resistance and excellent switching characteristics, and a low forward voltage Schottky barrier diode, and is suitable for applications such as DC/DC converter of portable machine and so on.

### FEATURES

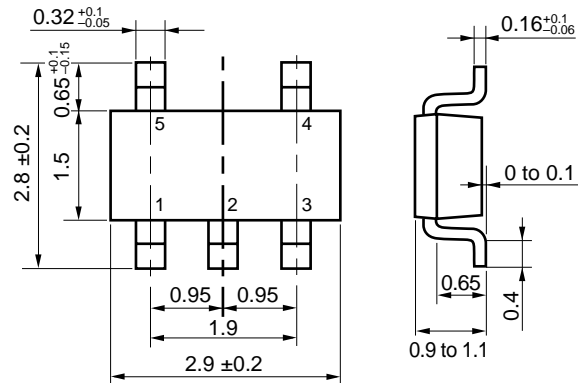
- 2.5 V drive available (MOS FET)
- Low on-state resistance (MOS FET)
  - $R_{DS(on)1} = 40 \text{ m}\Omega$  TYP. ( $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 1.0 \text{ A}$ )
  - $R_{DS(on)2} = 42 \text{ m}\Omega$  TYP. ( $V_{GS} = 4.0 \text{ V}$ ,  $I_D = 1.0 \text{ A}$ )
  - $R_{DS(on)3} = 59 \text{ m}\Omega$  TYP. ( $V_{GS} = 2.5 \text{ V}$ ,  $I_D = 1.0 \text{ A}$ )
- Low forward voltage (Schottky barrier diode)
  - $V_F = 0.35 \text{ V}$  TYP. ( $I_F = 1.0 \text{ A}$ )

### ORDERING INFORMATION

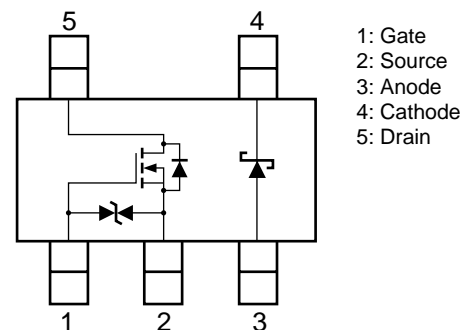
PART NUMBER	PACKAGE
$\mu$ PA508TE	SC-95_5p (Mini Mold Thin Type)

Marking: ZB

### PACKAGE DRAWING (Unit: mm)



### ★ PIN CONNECTION (Top View)



**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.

**Caution** This product is electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge.

$V_{ESD} \pm 150 \text{ V}$  TYP. ( $C = 200 \text{ pF}$ ,  $R = 0 \Omega$ , Single pulse)

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**MOS FET ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)**

Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	20	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±12	V
Drain Current (DC)	I <sub>D(DC)</sub>	±2	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±8	A
Total Power Dissipation <sup>Note2</sup>	P <sub>T</sub>	0.57	W
Channel Temperature	T <sub>ch</sub>	150	°C

**Notes 1.** PW ≤ 10 μs, Duty Cycle ≤ 1%

**2.** Mounted on FR-4 board of 2500 mm<sup>2</sup> x 1.6 mm, t ≤ 5 sec.

**SCHOTTKY BARRIER DIODE ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)**

Repetitive Peak Reverse Voltage	V <sub>RRM</sub>	30	V
Average Forward Current <sup>Note1</sup>	I <sub>F(AV)</sub>	1	A
Surge Current <sup>Note2</sup>	I <sub>FSM</sub>	10	A
Junction Temperature	T <sub>j</sub>	+125	°C
Storage Temperature	T <sub>stg</sub>	-55 to +125	°C

**Notes 1.** Mounted on FR-4 board of 2500 mm<sup>2</sup> x 1.6 mm, t ≤ 5 sec

**2.** 50 Hz sine wave, 1 cycle

**MOS FET ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

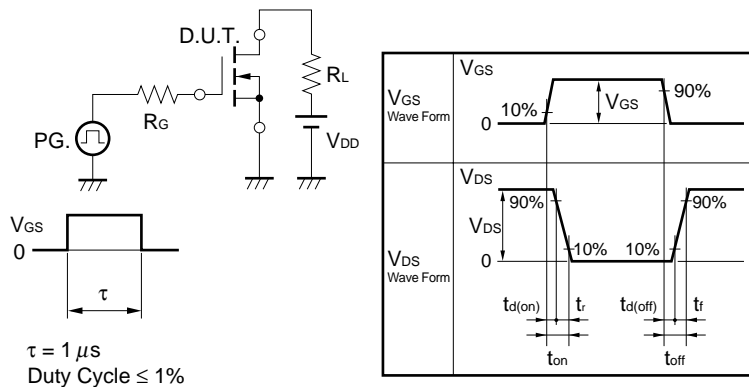
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V			1	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±12 V, V <sub>DS</sub> = 0 V			±10	μA
Gate Cut-off Voltage <sup>Note</sup>	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.0 mA	0.5	1.0	1.5	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.0 A	1.0	3.3		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> = 1.0 A		40	51	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 1.0 A		42	57	mΩ
	R <sub>DS(on)3</sub>	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 1.0 A		59	90	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		170		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		80		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1.0 MHz		40		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, I <sub>D</sub> = 1.0 A		9		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 4.0 V		9		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		15		ns
Fall Time	t <sub>f</sub>			4		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 16 V		2.7		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 4.0 V		0.6		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 2.0 A		1.0		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 2.0 A, V <sub>GS</sub> = 0 V		0.81		V

**Note** Pulsed: PW ≤ 350 μs, Duty Cycle ≤ 2%

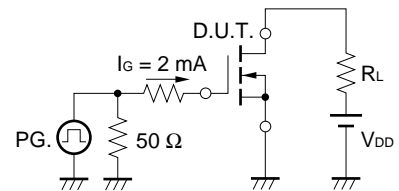
**SCHOTTKY BARRIER DIODE ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 1.0 A		0.35	0.38	V
Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 10 V			200	μA
Terminal Capacitance	C <sub>T</sub>	f = 1.0 MHz, V <sub>R</sub> = 10 V		36		pF

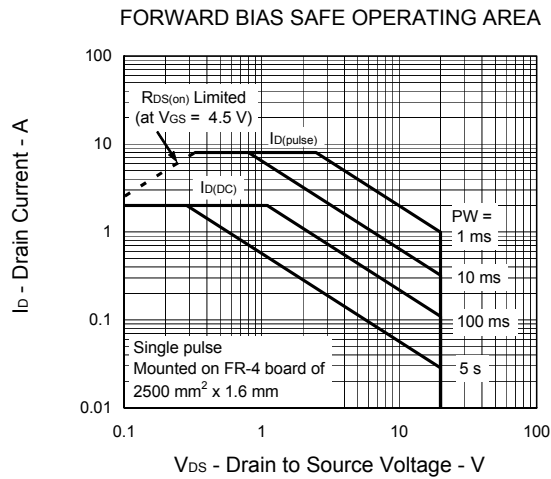
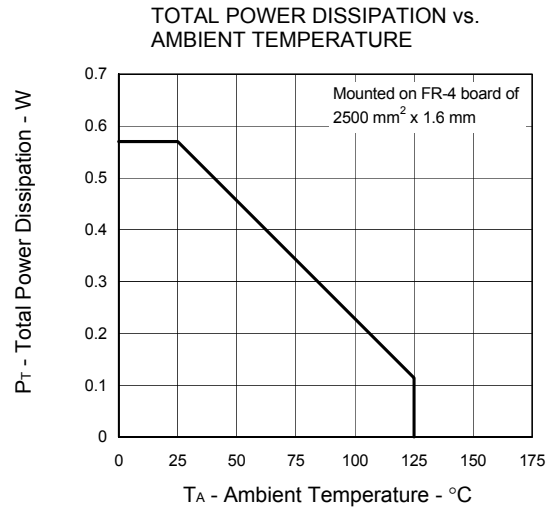
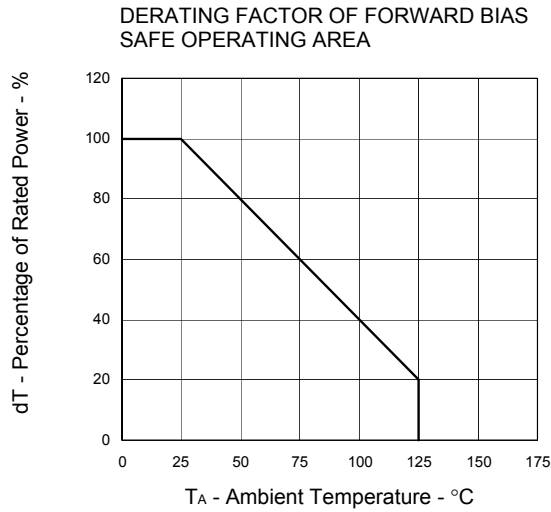
**TEST CIRCUIT 1 SWITCHING TIME**



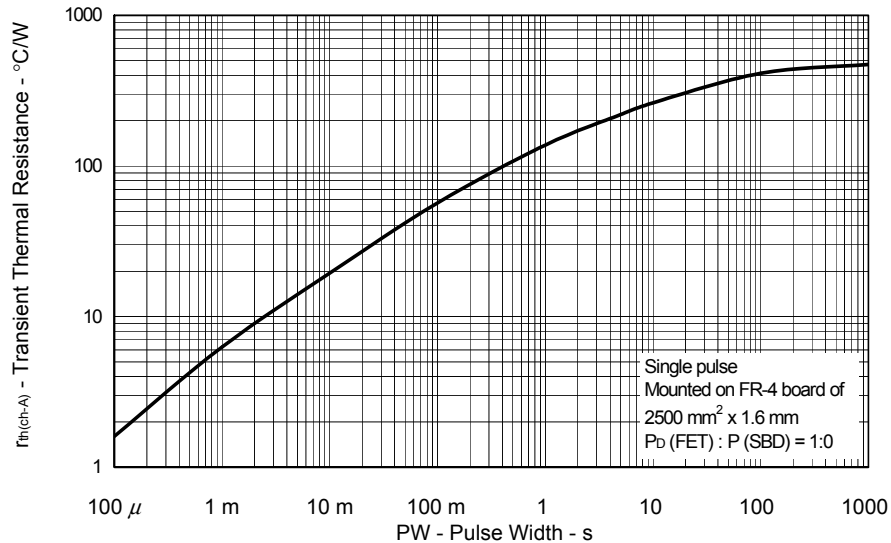
**TEST CIRCUIT 2 GATE CHARGE**



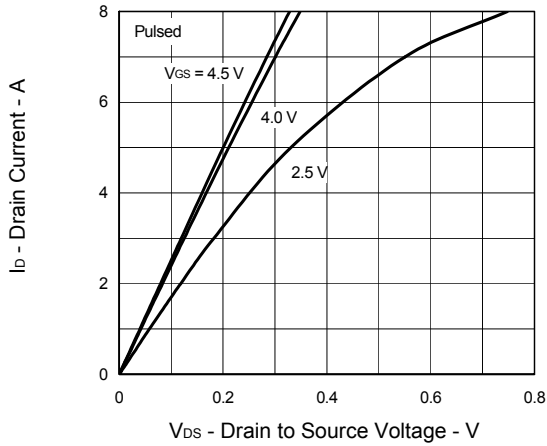
MOS FET TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



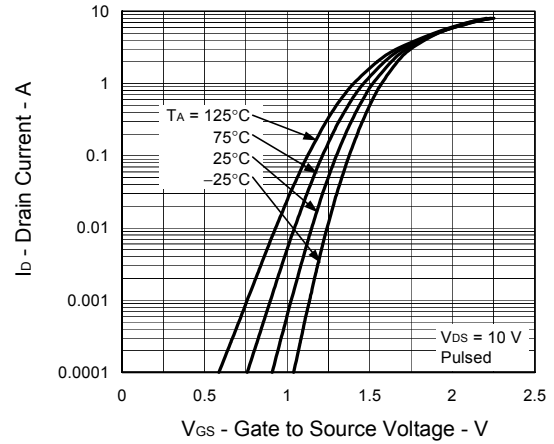
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



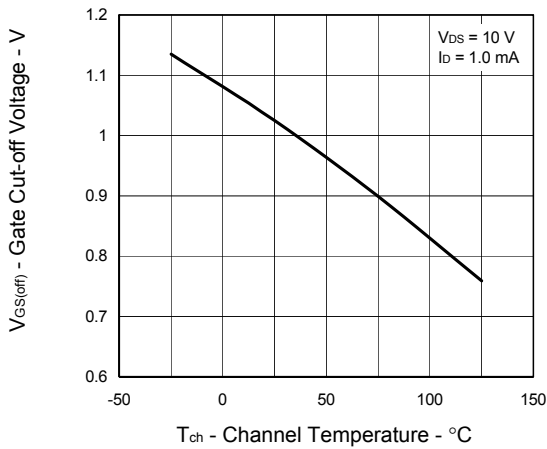
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



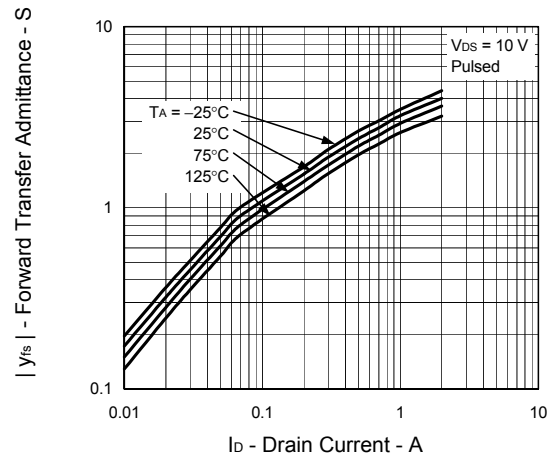
FORWARD TRANSFER CHARACTERISTICS



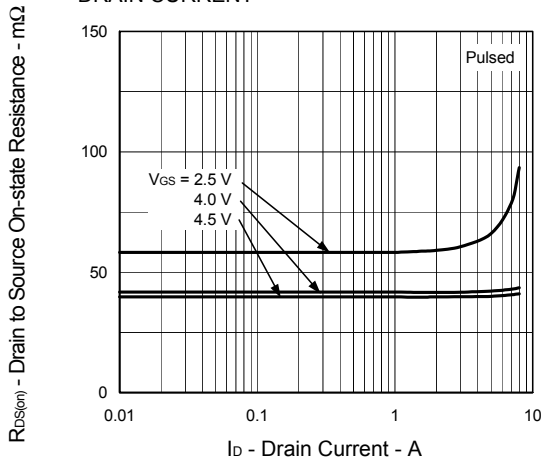
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



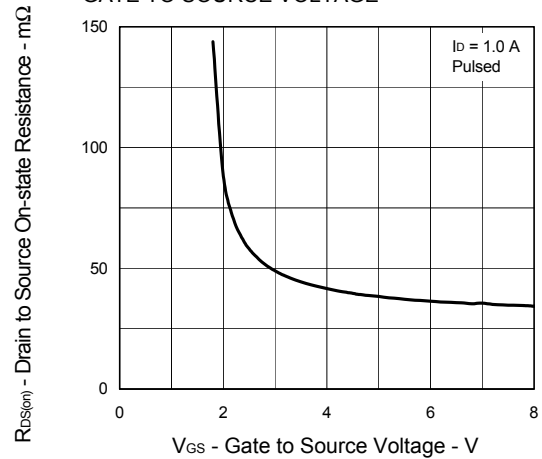
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



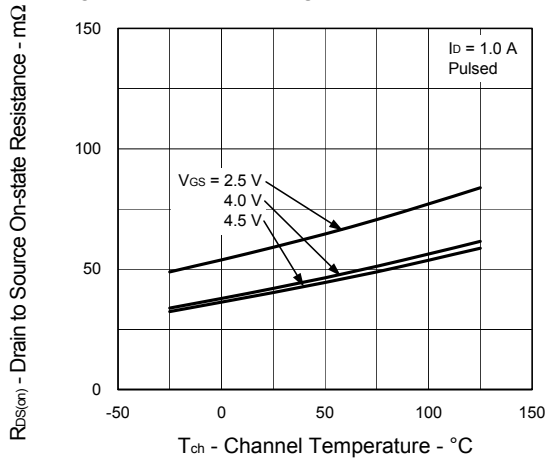
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



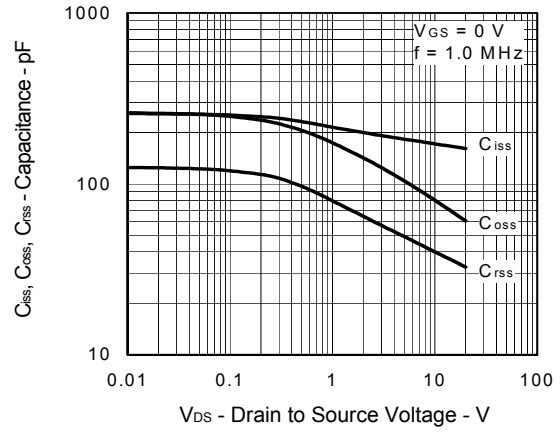
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



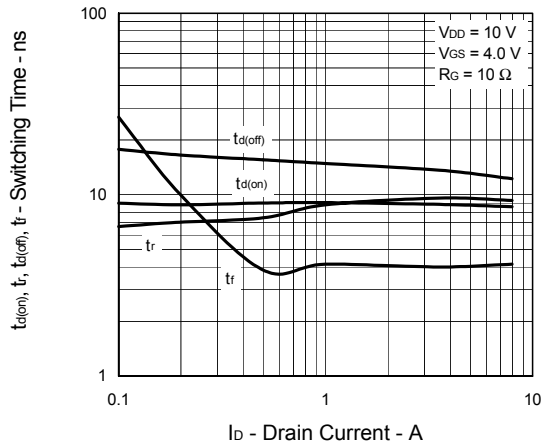
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



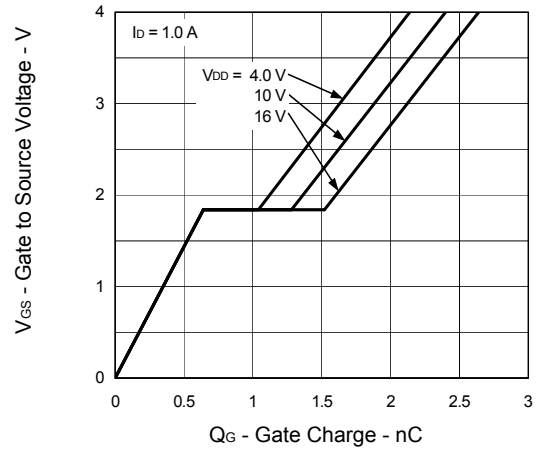
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



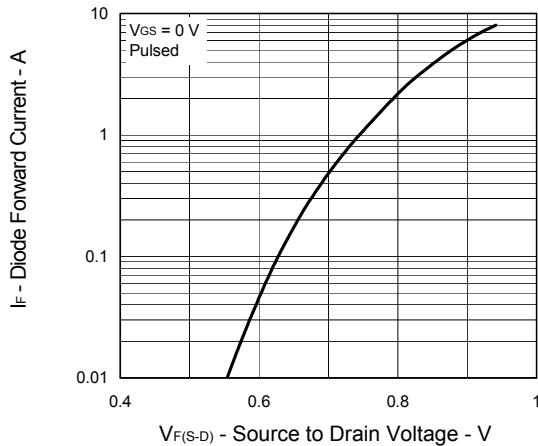
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



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

