

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 FET WITH SCHOTTKY BARRIER DIODE

# $\mu$ PA507TE

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

### DESCRIPTION

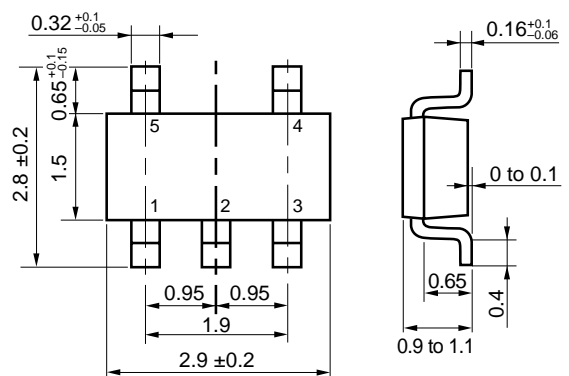
The  $\mu$ PA507TE is a switching device, which can be driven directly by a 1.8 V power source.

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.

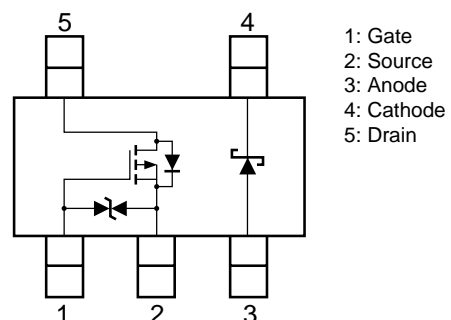
### FEATURES

- 1.8 V drive available (MOS FET)
- Low on-state resistance (MOS FET)
  - $R_{DS(on)1} = 68 \text{ m}\Omega$  TYP. ( $V_{GS} = -4.5 \text{ V}$ ,  $I_D = -1.0 \text{ A}$ )
  - $R_{DS(on)2} = 84 \text{ m}\Omega$  TYP. ( $V_{GS} = -2.5 \text{ V}$ ,  $I_D = -1.0 \text{ A}$ )
  - $R_{DS(on)3} = 109 \text{ m}\Omega$  TYP. ( $V_{GS} = -1.8 \text{ V}$ ,  $I_D = -1.0 \text{ A}$ )
- Low forward voltage (Schottky barrier diode)
  - $V_F = 0.35 \text{ V}$  TYP. ( $I_F = 1.0 \text{ A}$ )

### PACKAGE DRAWING (Unit: mm)



### PIN CONNECTION (Top View)



### <R> ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
$\mu$ PA507TE-T1-A <sup>Note</sup>	Sn-Bi	8 mm Embossed Taping 3000 p/reel	SC-95_5pin (Mini Mold Thin Type)
$\mu$ PA507TE-T2-A <sup>Note</sup>			
$\mu$ PA507TE-T1-AT <sup>Note</sup>	Pure Sn	8 mm Embossed Taping 3000 p/reel	SC-95_5pin (Mini Mold Thin Type)
$\mu$ PA507TE-T2-AT <sup>Note</sup>			

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

**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.

$V_{ESD} \pm 100 \text{ V}$  TYP. ( $C = 200 \text{ pF}$ ,  $R = 0 \Omega$ , Single pulse)

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**MOS FET ABSOLUTE MAXIMUM RATINGS (TA = 25°C)**

Drain to Source Voltage (VGS = 0 V)	V <sub>DSS</sub>	-20	V
Gate to Source Voltage (VDS = 0 V)	V <sub>GSS</sub>	±8	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 (TA = 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 (TA = 25°C)**

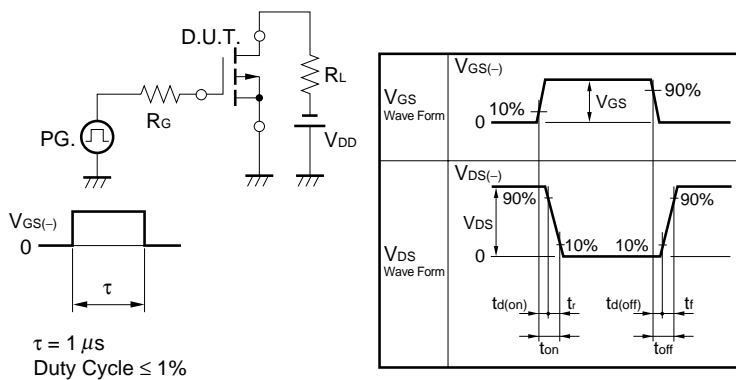
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \mp 8\text{ V}, V_{DS} = 0\text{ V}$			±10	μA
Gate Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = -10\text{ V}, I_D = -1.0\text{ mA}$	-0.45	-0.75	-1.50	V
Forward Transfer Admittance <sup>Note</sup>	$ y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -1.0\text{ A}$	2.0	4.3		S
Drain to Source On-state Resistance <sup>Note</sup>	$R_{DS(on)1}$	$V_{GS} = -4.5\text{ V}, I_D = -1.0\text{ A}$		68	85	mΩ
	$R_{DS(on)2}$	$V_{GS} = -2.5\text{ V}, I_D = -1.0\text{ A}$		84	120	mΩ
	$R_{DS(on)3}$	$V_{GS} = -1.8\text{ V}, I_D = -1.0\text{ A}$		109	180	mΩ
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V},$		380		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V},$		85		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1.0\text{ MHz}$		45		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, I_D = -1.0\text{ A},$		10		ns
Rise Time	$t_r$	$V_{GS} = -4.0\text{ V},$		5		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 10\ \Omega$		47		ns
Fall Time	$t_f$			28		ns
Total Gate Charge	$Q_G$	$V_{DD} = -16\text{ V},$		4.7		nC
Gate to Source Charge	$Q_{GS}$	$V_{GS} = -4.0\text{ V},$		0.9		nC
Gate to Drain Charge	$Q_{GD}$	$I_D = -2.0\text{ A}$		1.5		nC
Body Diode Forward Voltage <sup>Note</sup>	$V_{F(S-D)}$	$I_F = 2.0\text{ A}, V_{GS} = 0\text{ V}$		0.84		V

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

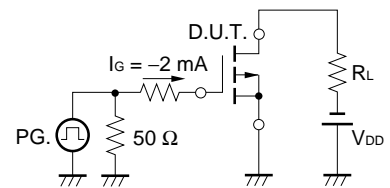
**SCHOTTKY BARRIER DIODE ELECTRICAL CHARACTERISTICS (TA = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward Voltage	$V_F$	$I_F = 1.0\text{ A}$		0.35	0.38	V
Reverse Current	$I_R$	$V_R = 10\text{ V}$			200	μA
Terminal Capacitance	$C_T$	$f = 1.0\text{ MHz}, V_R = 10\text{ V}$		36		pF

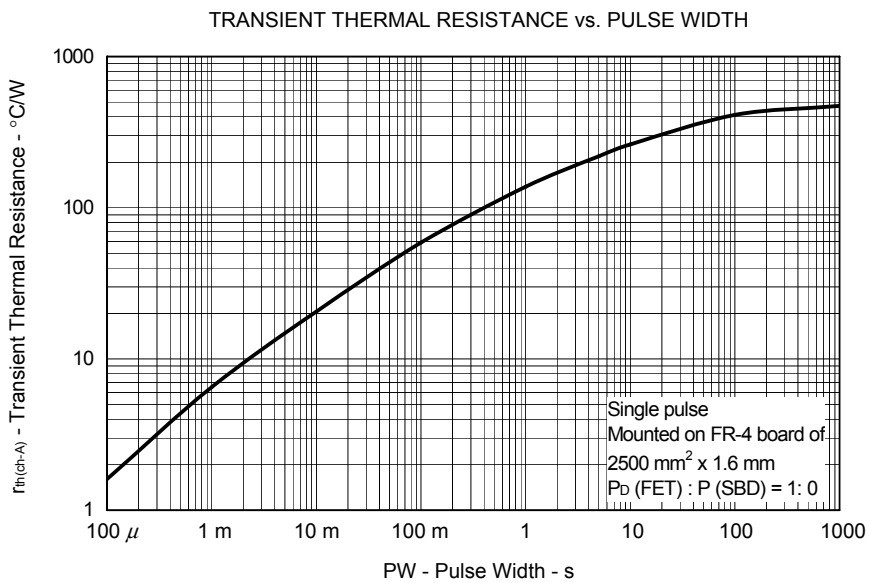
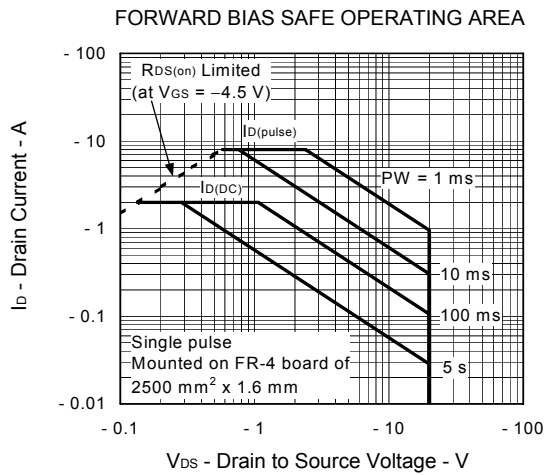
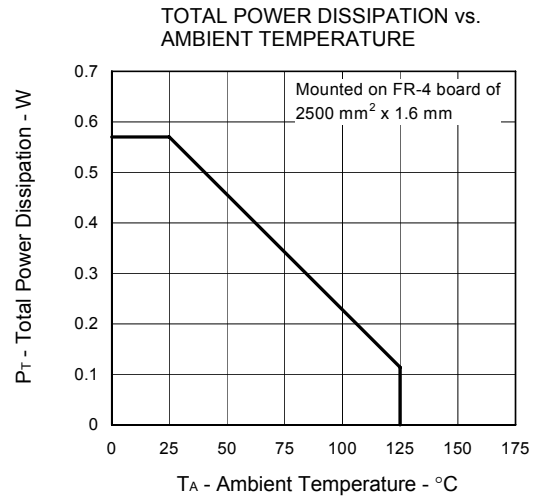
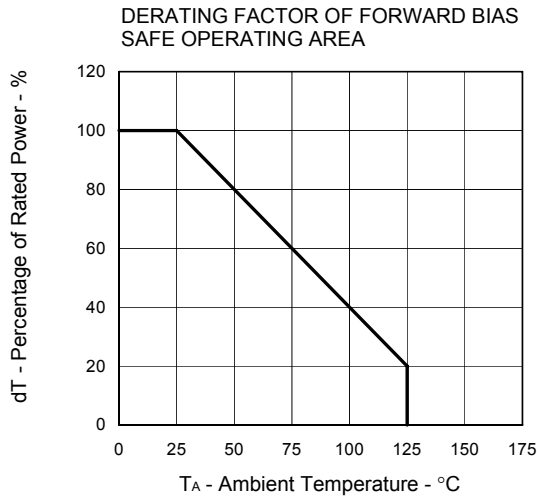
**TEST CIRCUIT 1 SWITCHING TIME**

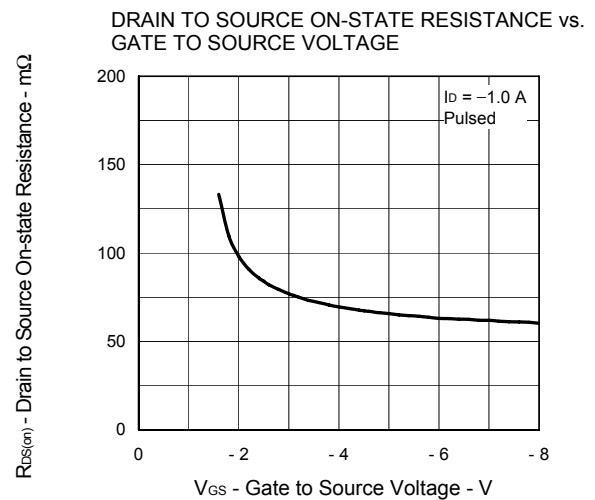
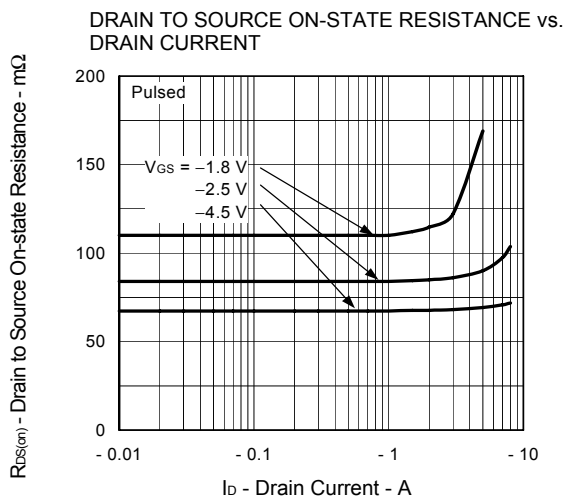
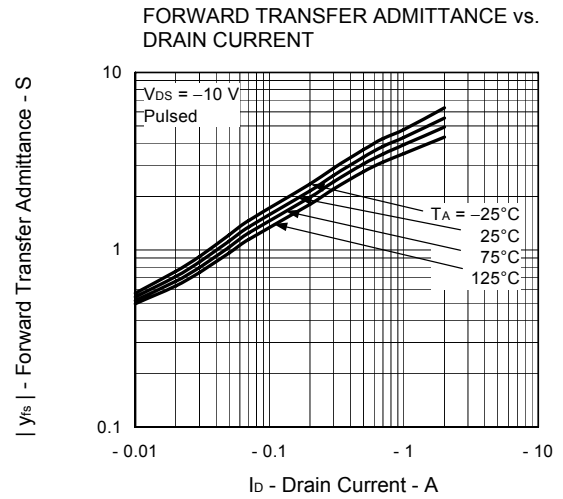
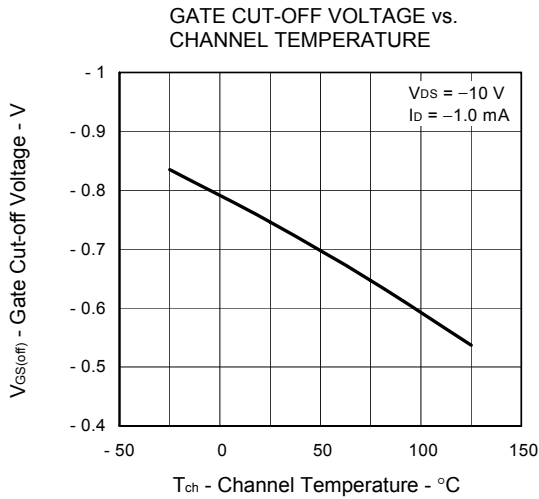
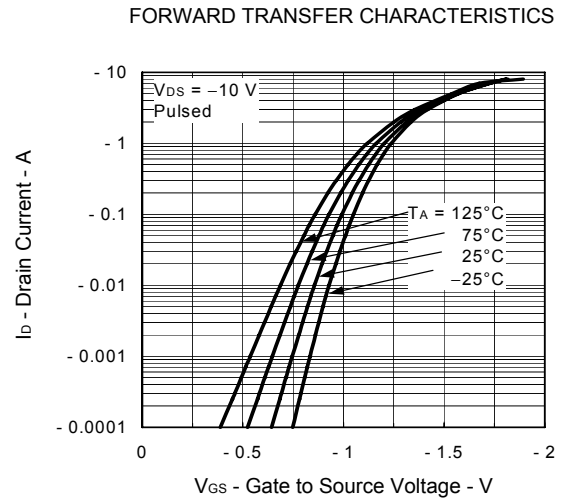
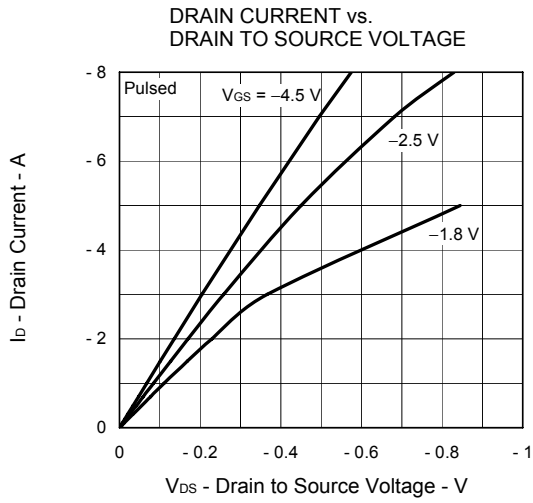


**TEST CIRCUIT 2 GATE CHARGE**

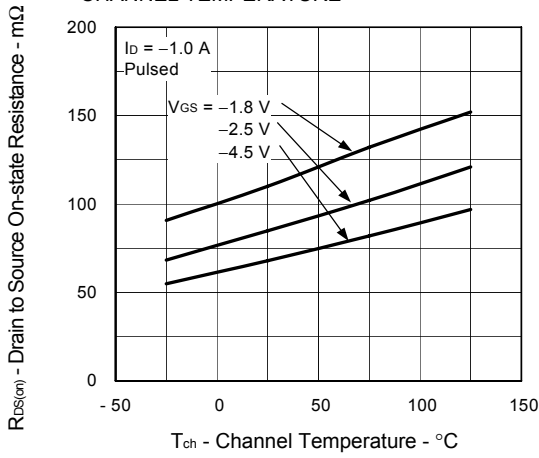


MOS FET TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

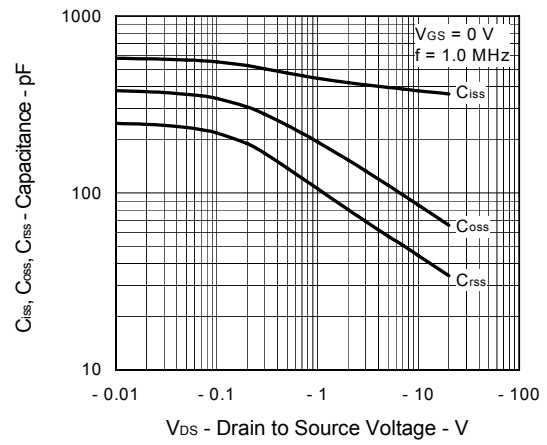




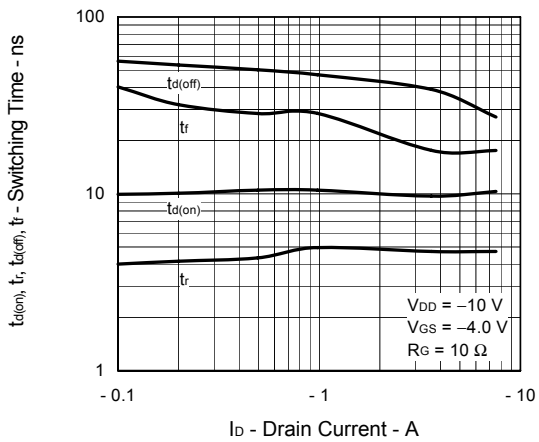
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



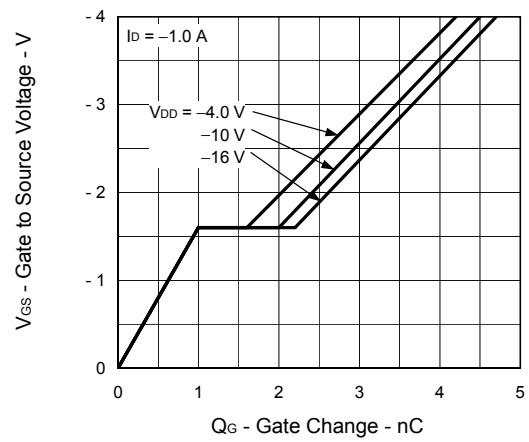
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



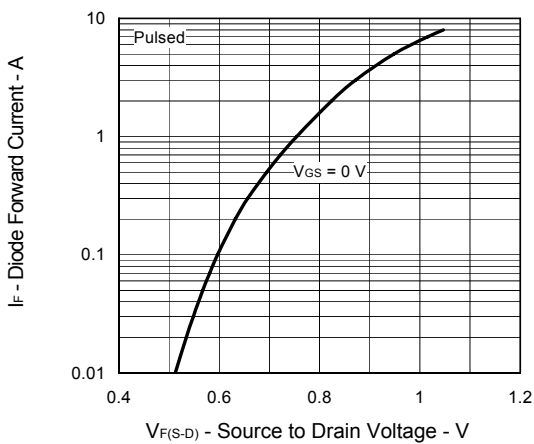
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

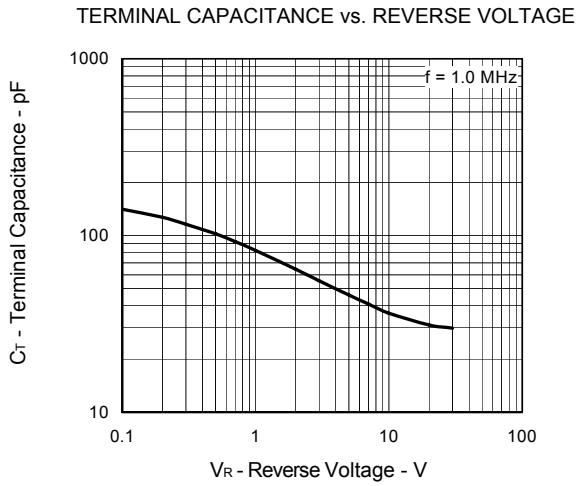
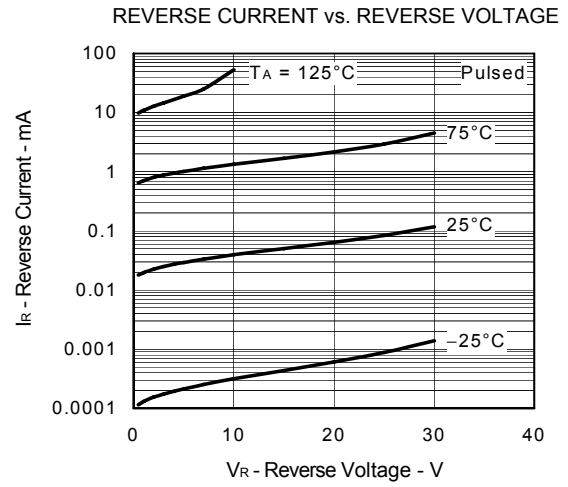
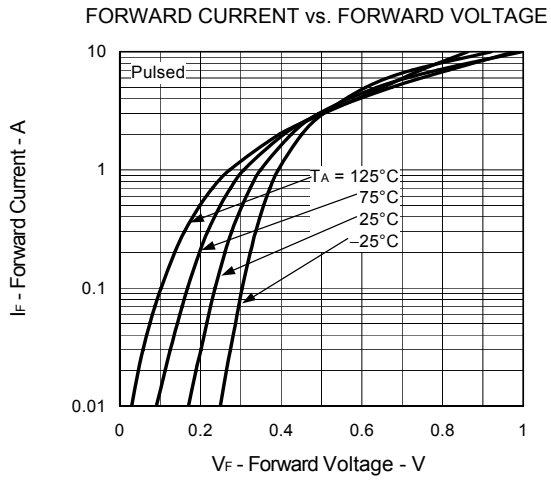


SOURCE TO DRAIN DIODE FORWARD VOLTAGE





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



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