

To our customers,

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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MOS FET WITH SCHOTTKY BARRIER DIODE μ PA507TE

P-CHANNEL MOS FET WITH SCHOTTKY BARRIER DIODE FOR SWITCHING

DESCRIPTION

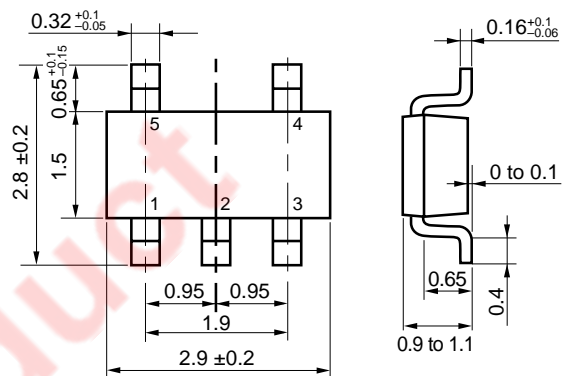
The μ PA507TE is a switching device, which can be driven directly by a 1.8 V power source.

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.

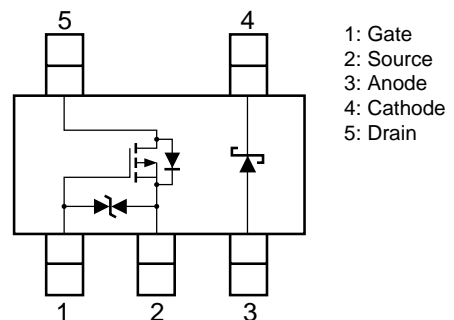
FEATURES

- 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 |
|-------------------------------------|--------------|----------------------------------|----------------------------------|
| μ PA507TE-T1-A ^{Note} | Sn-Bi | 8 mm Embossed Taping 3000 p/reel | SC-95_5pin (Mini Mold Thin Type) |
| μ PA507TE-T2-A ^{Note} | | | |
| μ PA507TE-T1-AT ^{Note} | Pure Sn | 8 mm Embossed Taping 3000 p/reel | SC-95_5pin (Mini Mold Thin Type) |
| μ PA507TE-T2-AT ^{Note} | | | |

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 _{DSS} | -20 | V |
| Gate to Source Voltage (VDS = 0 V) | V _{GSS} | ±8 | V |
| Drain Current (DC) | I _{D(DC)} | ±2 | A |
| Drain Current (pulse) ^{Note1} | I _{D(pulse)} | ±8 | A |
| Total Power Dissipation ^{Note2} | P _T | 0.57 | W |
| Channel Temperature | T _{ch} | 150 | °C |

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. Mounted on FR-4 board of 2500 mm² x 1.6 mm, t ≤ 5 sec.

SCHOTTKY BARRIER DIODE ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

| | | | |
|--|--------------------|-------------|----|
| Repetitive Peak Reverse Voltage | V _{RRM} | 30 | V |
| Average Forward Current ^{Note1} | I _{F(AV)} | 1 | A |
| Surge Current ^{Note2} | I _{FSM} | 10 | A |
| Junction Temperature | T _J | +125 | °C |
| Storage Temperature | T _{stg} | -55 to +125 | °C |

Notes 1. Mounted on FR-4 board of 2500 mm² x 1.6 mm, t ≤ 5 sec

2. 50 Hz sine wave, 1 cycle

EOL Product

MOS FET ELECTRICAL CHARACTERISTICS (TA = 25°C)

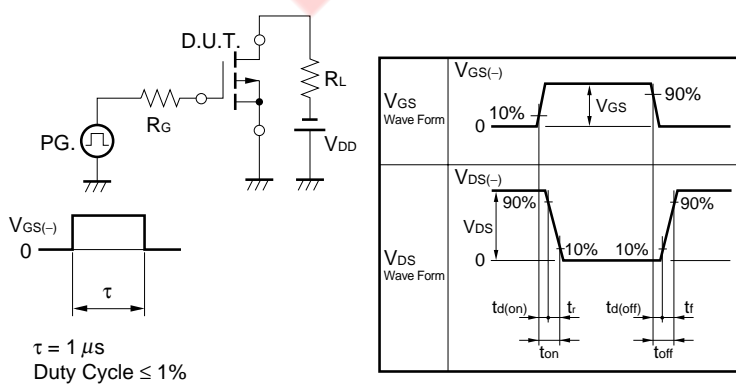
| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------|--|-------|-------|-------|------|
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$ | | | -1 | μA |
| Gate Leakage Current | I_{GSS} | $V_{GS} = \mp 8\text{ V}, V_{DS} = 0\text{ V}$ | | | ±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 ^{Note} | $ y_{fs} $ | $V_{DS} = -10\text{ V}, I_D = -1.0\text{ A}$ | 2.0 | 4.3 | | S |
| Drain to Source On-state Resistance ^{Note} | $R_{DS(on)1}$ | $V_{GS} = -4.5\text{ V}, I_D = -1.0\text{ A}$ | | 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 ^{Note} | $V_{F(S-D)}$ | $I_F = 2.0\text{ A}, V_{GS} = 0\text{ V}$ | | 0.84 | | V |

Note Pulsed: $PW \leq 350\ \mu s$, Duty Cycle $\leq 2\%$

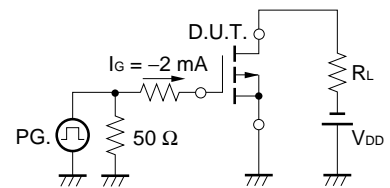
SCHOTTKY BARRIER DIODE ELECTRICAL CHARACTERISTICS (TA = 25°C)

| 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 |

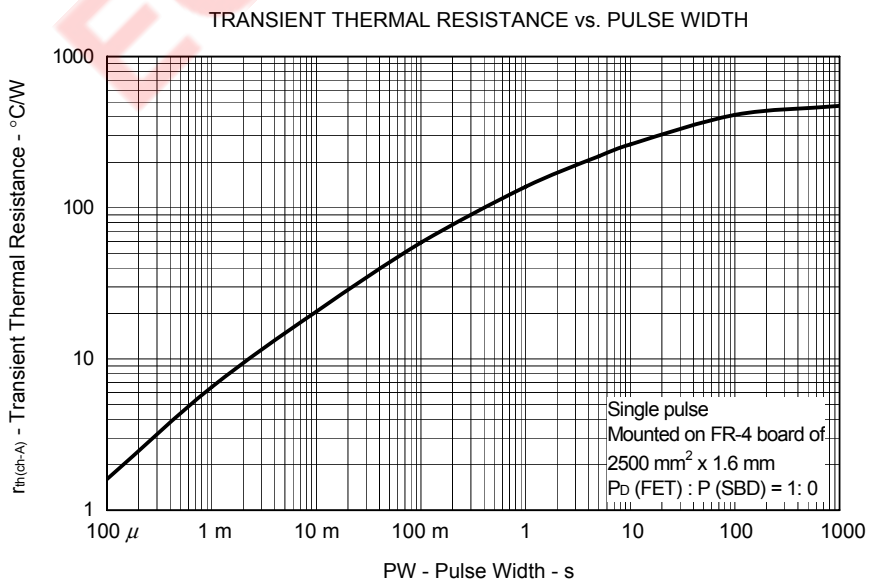
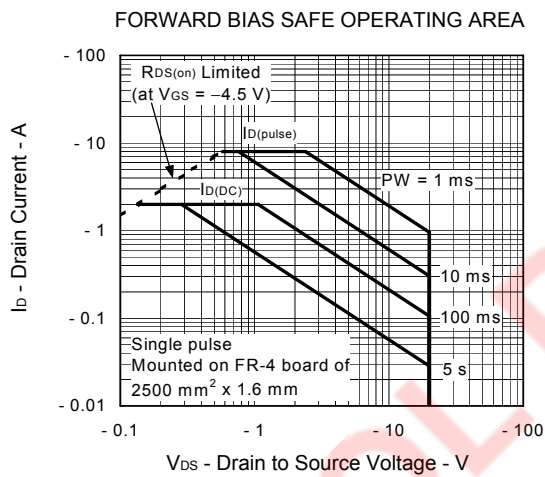
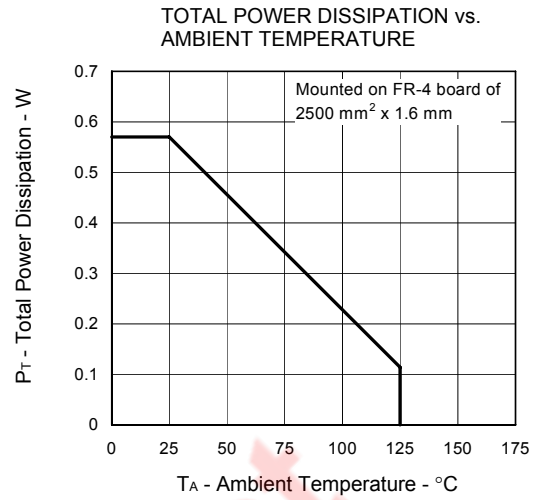
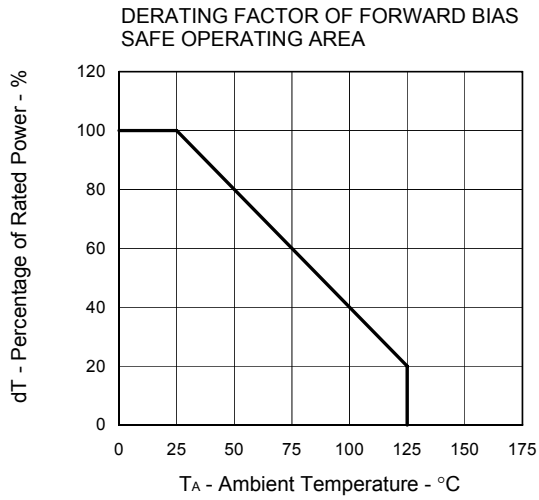
TEST CIRCUIT 1 SWITCHING TIME



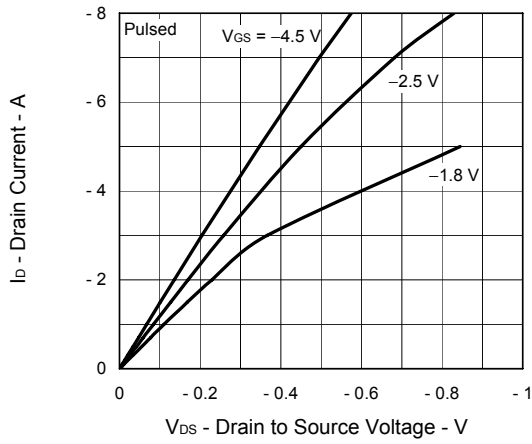
TEST CIRCUIT 2 GATE CHARGE



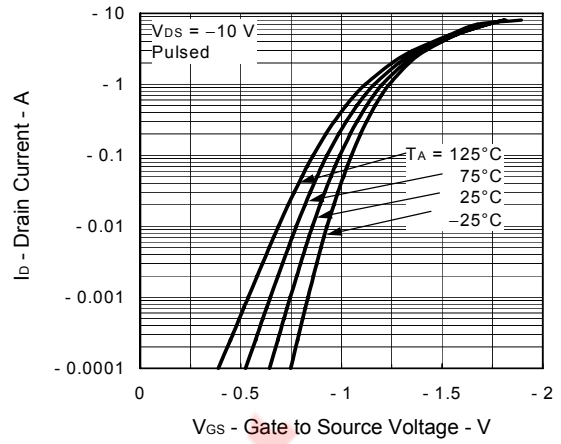
MOS FET TYPICAL CHARACTERISTICS (T_A = 25°C)



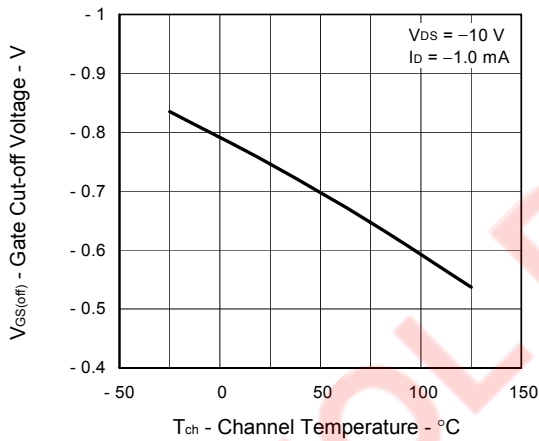
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



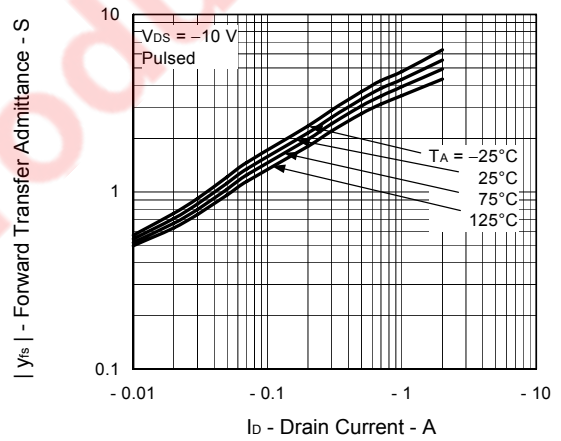
FORWARD TRANSFER CHARACTERISTICS



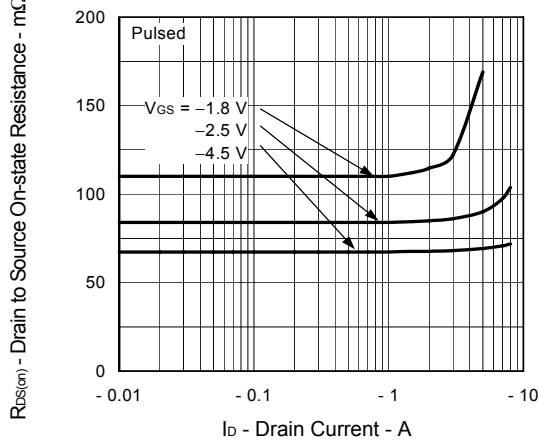
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



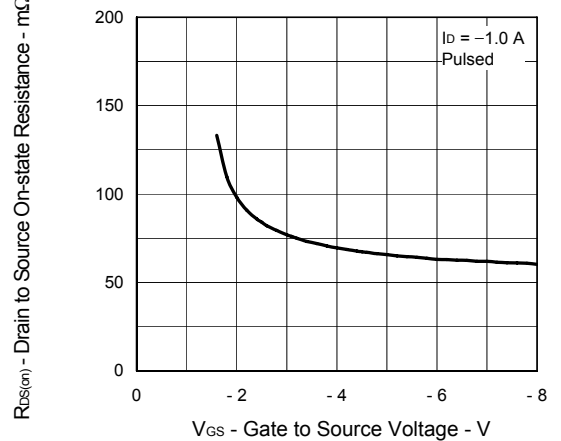
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



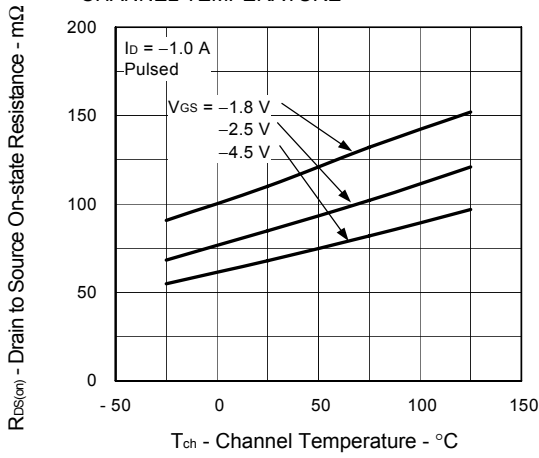
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



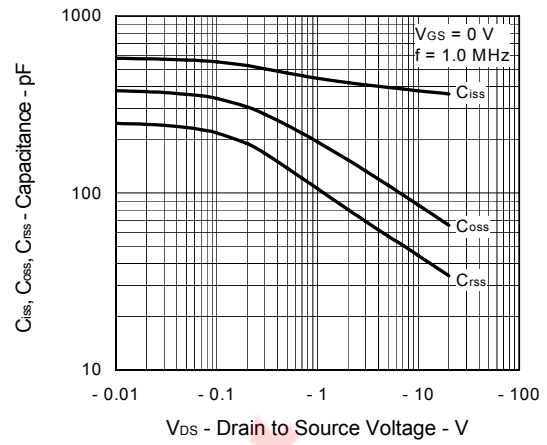
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



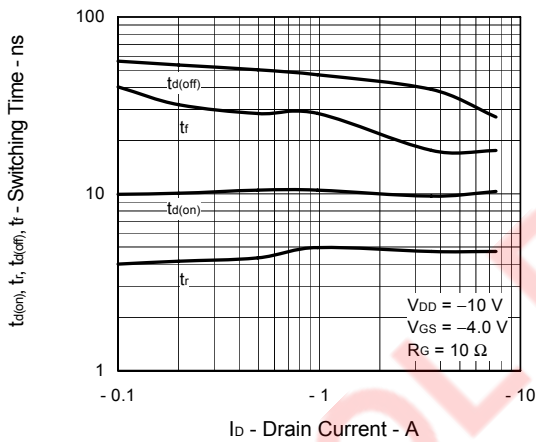
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



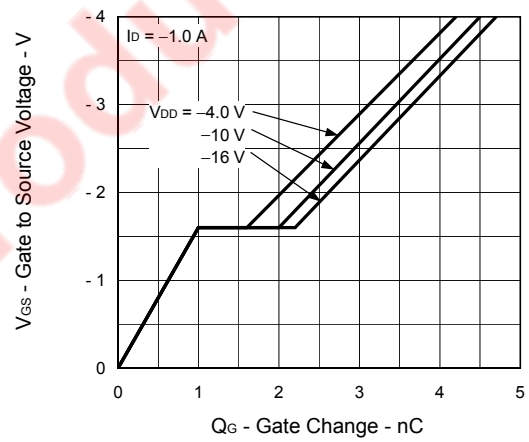
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



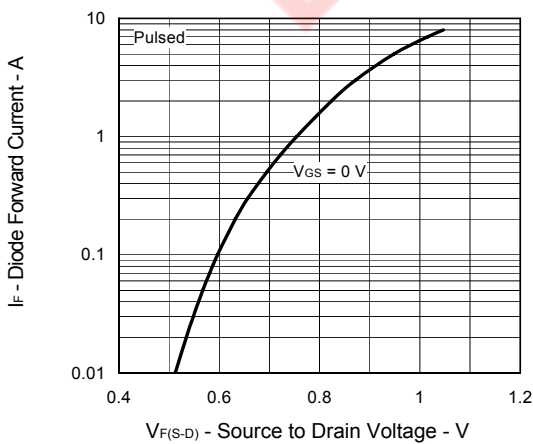
SWITCHING CHARACTERISTICS



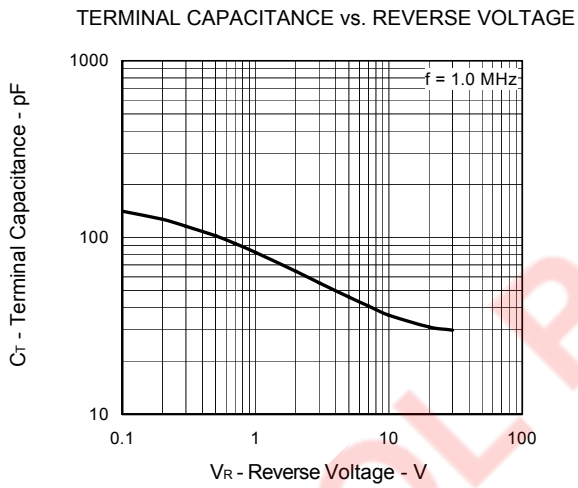
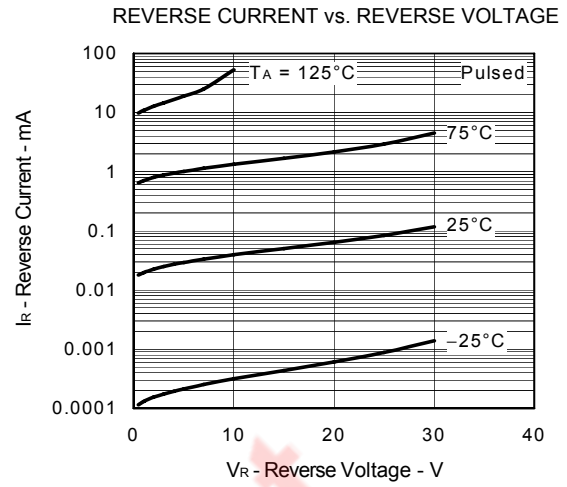
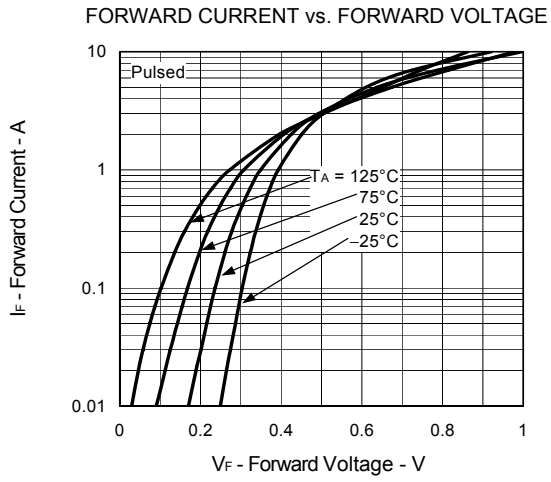
DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



SCHOTTKY BARRIER DIODE TYPICAL CHARACTERISTICS (T_A = 25°C)



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