

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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P-CHANNEL MOS FET WITH SCHOTTKY BARRIER DIODE  
 FOR SWITCHING

DESCRIPTION

The  $\mu$  PA1980 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 leakage Schottky barrier diode, and is suitable for applications such as DC/DC converter of portable machine and so on.

FEATURES

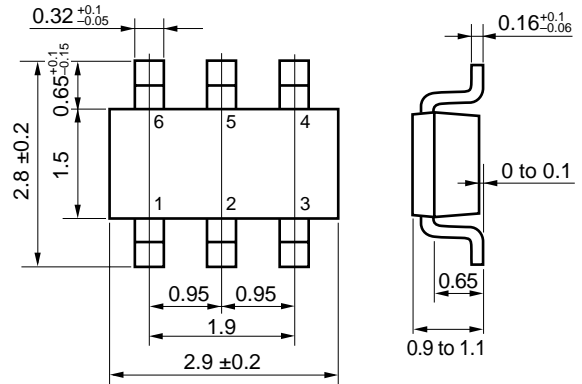
- 1.8 V drive available (MOS FET)
- Low on-state resistance (MOS FET)  
 $R_{DS(on)1} = 135 \text{ m}\Omega \text{ MAX. (} V_{GS} = -4.5 \text{ V, } I_D = -1.0 \text{ A)}$   
 $R_{DS(on)2} = 183 \text{ m}\Omega \text{ MAX. (} V_{GS} = -2.5 \text{ V, } I_D = -1.0 \text{ A)}$   
 $R_{DS(on)3} = 284 \text{ m}\Omega \text{ MAX. (} V_{GS} = -1.8 \text{ V, } I_D = -0.5 \text{ A)}$
- Low reverse current (Schottky barrier diode)  
 $I_R = 20 \text{ }\mu\text{A MAX. (} V_R = 40 \text{ V)}$

ORDERING INFORMATION

PART NUMBER	PACKAGE
$\mu$ PA1980TE	SC-95 (Mini Mold Thin Type)

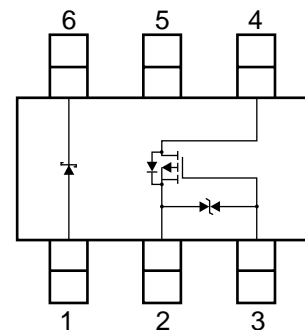
Marking: TW

PACKAGE DRAWING (Unit: mm)



- 1: Anode      4: Drain  
 2: Source    5: N/C  
 3: Gate       6: Cathode

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.

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

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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>	-20.0	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±8.0	V
Drain Current (DC)	I <sub>D(DC)</sub>	±2.0	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±8.0	A
Total Power Dissipation <sup>Note2</sup>	P <sub>T</sub>	0.57	W
Channel Temperature	T <sub>ch</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +125	°C

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

2. Mounted on FR-4 board of 5000 mm<sup>2</sup> x 1.1 mm, t ≤ 5 sec.

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

Repetitive Peak Reverse Voltage	V <sub>RRM</sub>	40	V
Average Forward Current <sup>Note3</sup>	I <sub>F(AV)</sub>	0.5	A
Surge Current <sup>Note4</sup>	I <sub>FSM</sub>	5.5	A
Junction Temperature	T <sub>j</sub>	+125	°C
Storage Temperature	T <sub>stg</sub>	-55 to +125	°C

**Notes 3.** Mounted on FR-4 board of 5000 mm<sup>2</sup> x 1.1 mm

4. 50 Hz sine wave, 1 cycle

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

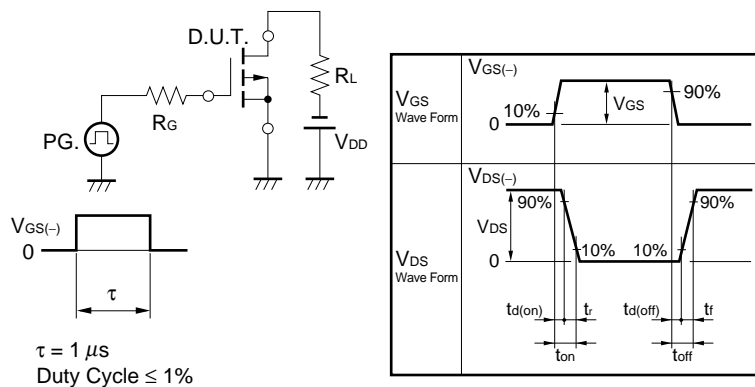
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -20.0 V, V <sub>GS</sub> = 0 V			-10	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±8.0 V, V <sub>DS</sub> = 0 V			±10	μA
Gate Cut-off Voltage <sup>Note</sup>	V <sub>GS(off)</sub>	V <sub>DS</sub> = -10.0 V, I <sub>D</sub> = -1.0 mA	-0.45	-0.75	-1.50	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = -10.0 V, I <sub>D</sub> = -1.0 A	1.0	4.1		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		116	135	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -1.0 A		142	183	mΩ
	R <sub>DS(on)3</sub>	V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -0.5 A		170	284	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -10.0 V		272		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		60		pF
Reverse Transfer Capacitance	C <sub>riss</sub>	f = 1.0 MHz		30		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -10.0 V, I <sub>D</sub> = -1.0 A		9		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = -4.0 V		5		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		33		ns
Fall Time	t <sub>f</sub>			9		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = -16.0 V		2.3		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		0.6		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 2.0 A, V <sub>GS</sub> = 0 V		0.90		V

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

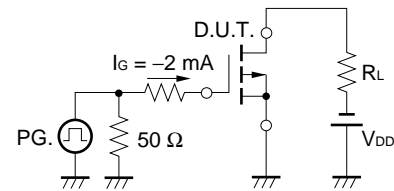
**SCHOTTKY BARRIER DIODE ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 0.5 A		0.44	0.51	V
Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 40.0 V		3	20	μA

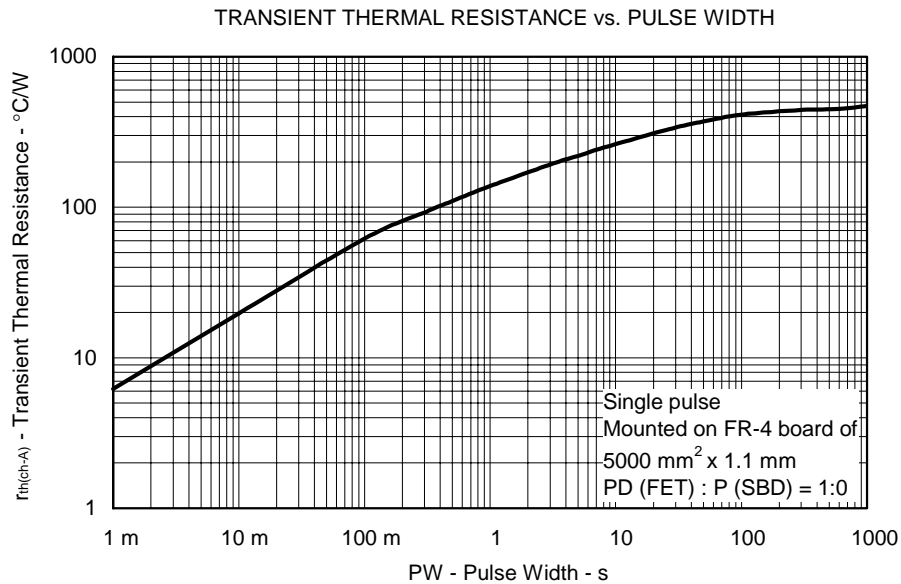
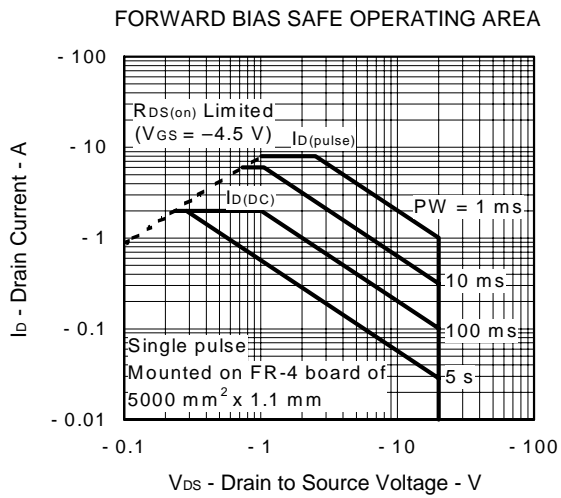
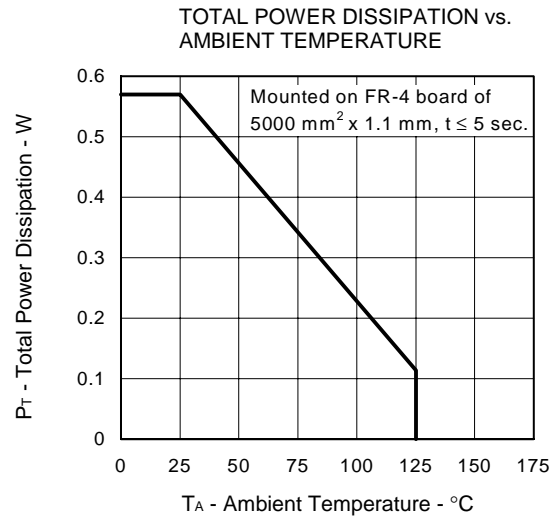
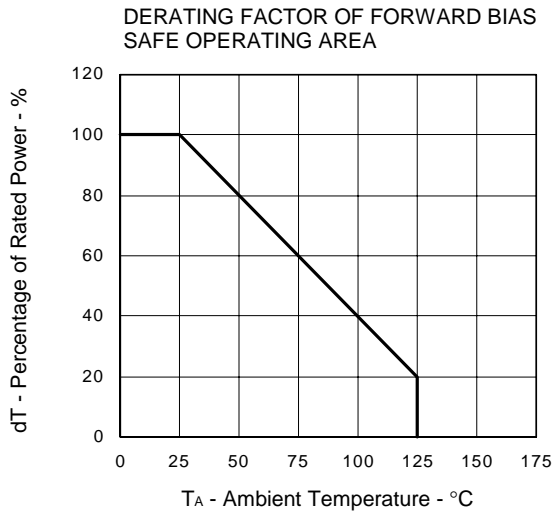
**TEST CIRCUIT 1 SWITCHING TIME**



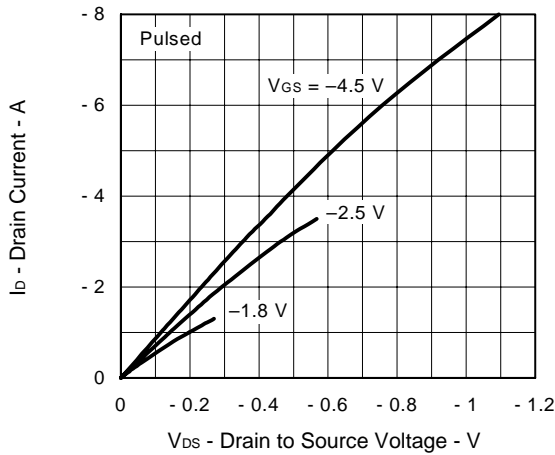
**TEST CIRCUIT 2 GATE CHARGE**



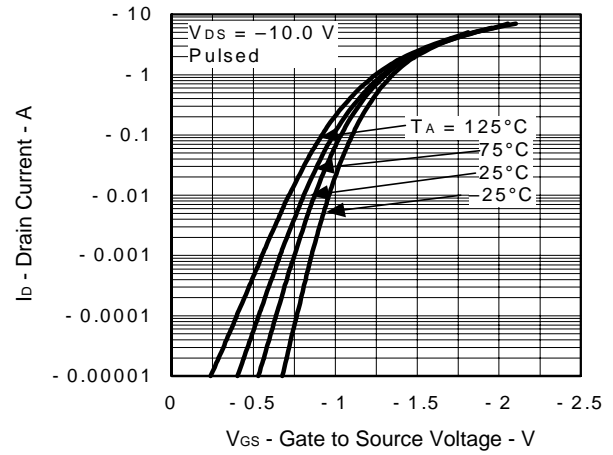
MOS FET TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



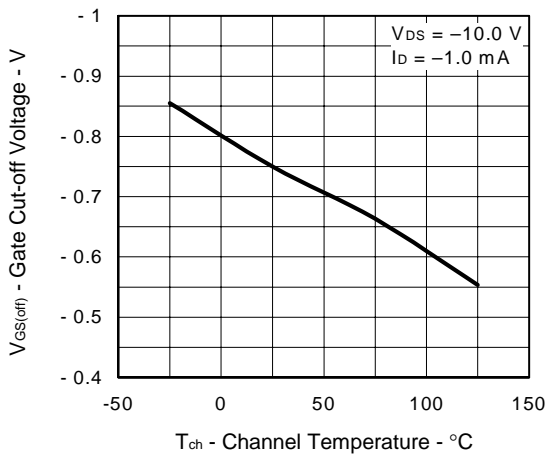
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



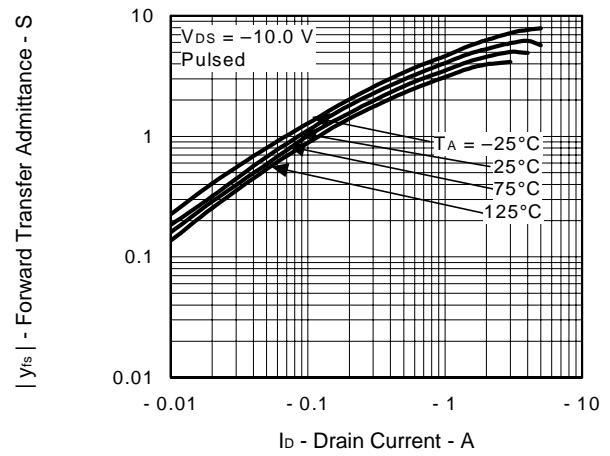
FORWARD TRANSFER CHARACTERISTICS



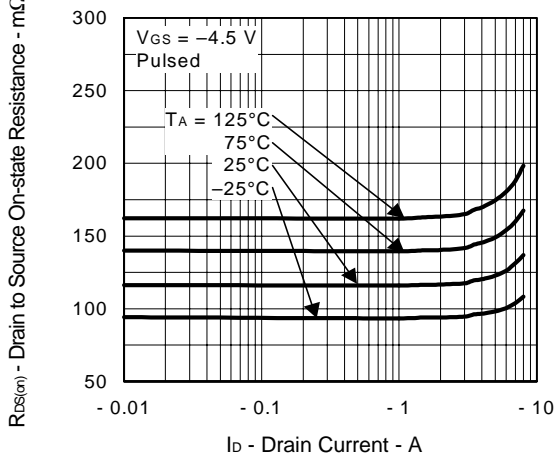
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



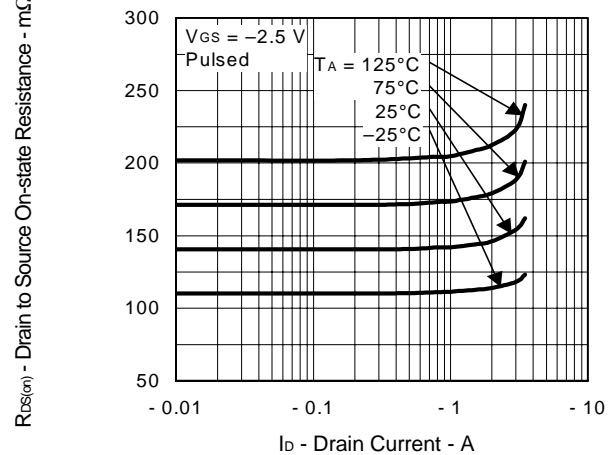
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

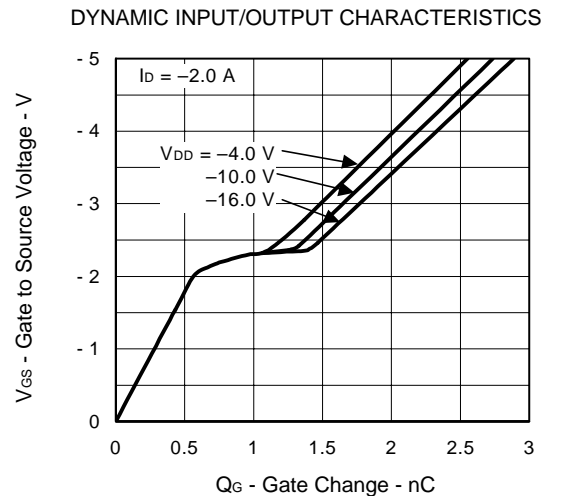
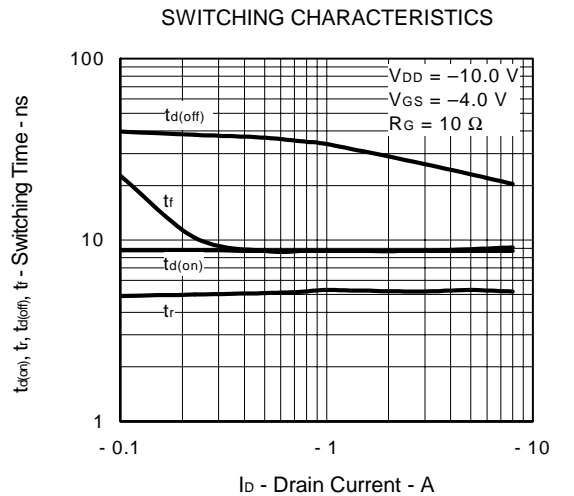
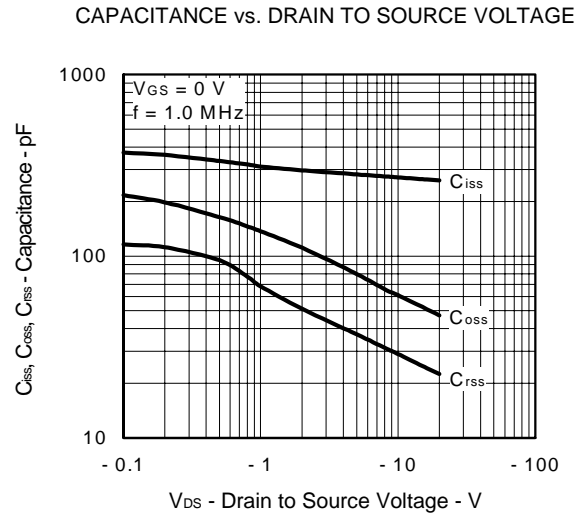
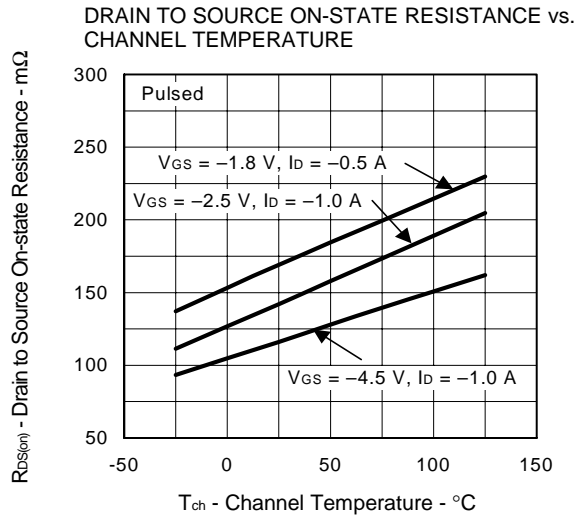
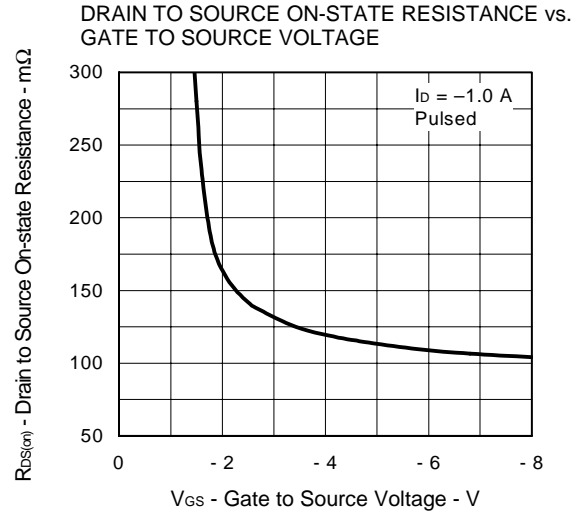
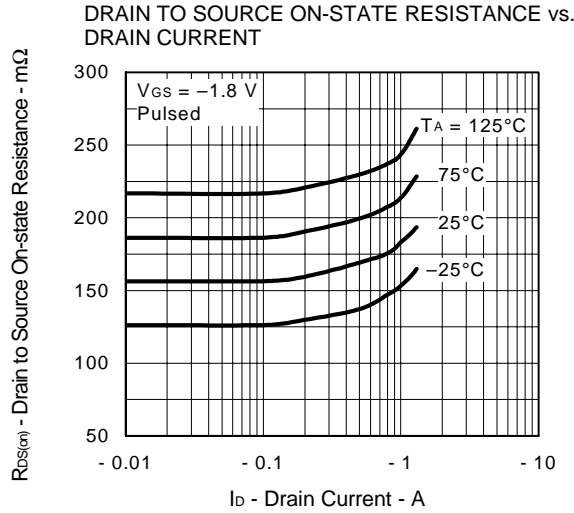


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

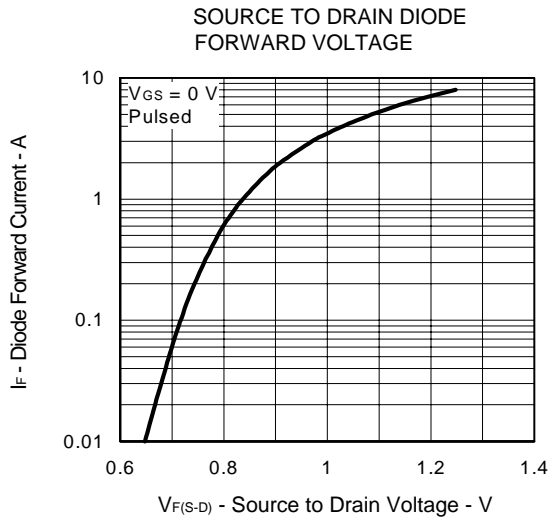


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

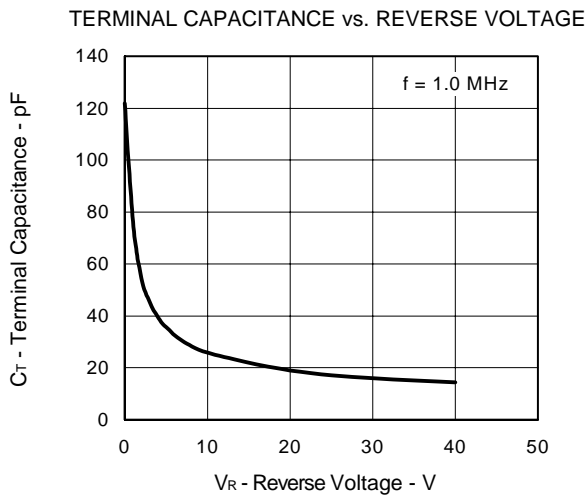
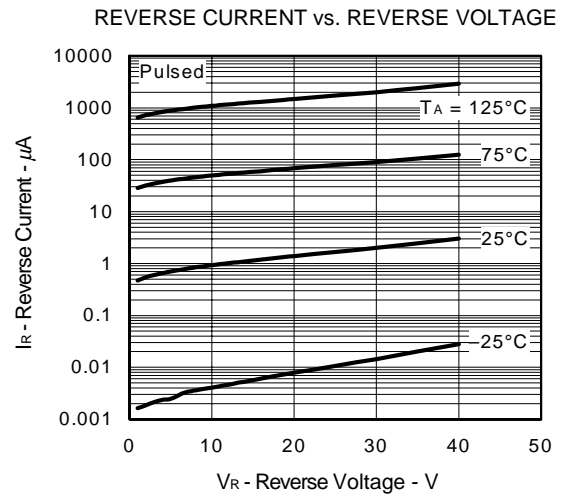
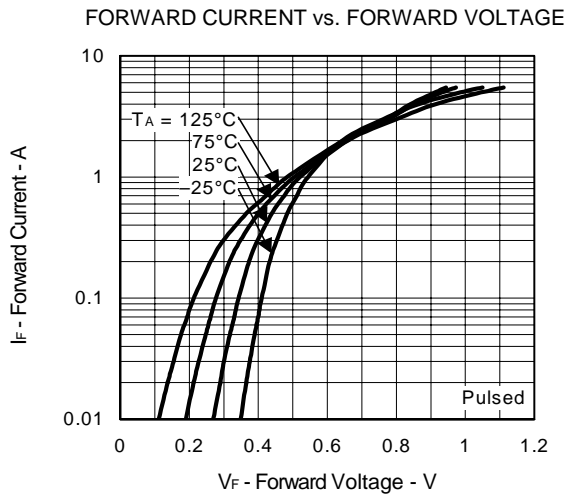








**SCHOTTKY BARRIER DIODE TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )**



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