

P-CHANNEL MOS FIELD EFFECT TRANSISTOR  
FOR SWITCHING

## DESCRIPTION

The  $\mu$ PA1816 is a switching device which can be driven directly by a 1.8 V power source.

This device features a low on-state resistance and excellent switching characteristics, and is suitable for applications such as power management of notebook computers and so on.

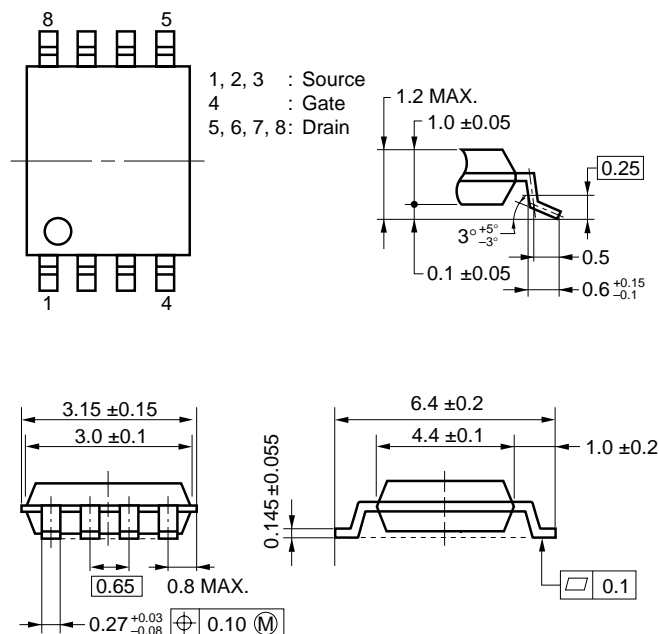
## FEATURES

- 1.8 V drive available
- Low on-state resistance
  - $R_{DS(on)1} = 15 \text{ m}\Omega \text{ MAX. (} V_{GS} = -4.5 \text{ V, } I_D = -4.5 \text{ A)}$
  - $R_{DS(on)2} = 16 \text{ m}\Omega \text{ MAX. (} V_{GS} = -4.0 \text{ V, } I_D = -4.5 \text{ A)}$
  - $R_{DS(on)3} = 22.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = -2.5 \text{ V, } I_D = -4.5 \text{ A)}$
  - $R_{DS(on)4} = 41.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = -1.8 \text{ V, } I_D = -2.5 \text{ A)}$
- Built-in G-S protection diode against ESD

## ORDERING INFORMATION

PART NUMBER	PACKAGE
$\mu$ PA1816GR-9JG	Power TSSOP8

## PACKAGE DRAWING (Unit: mm)

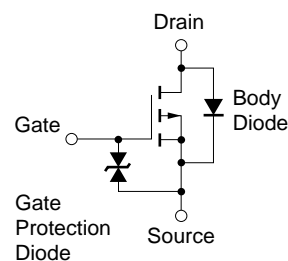
ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DS}$	-12	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GS}$	$\mp 8.0$	V
Drain Current (DC) ( $T_A = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\mp 9.0$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\mp 36$	A
Total Power Dissipation <sup>Note2</sup>	$P_T$	2.0	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

- Notes 1.**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$   
**2.** Mounted on ceramic substrate of  $5000 \text{ mm}^2 \times 1.1 \text{ mm}$

**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.

## EQUIVALENT CIRCUIT

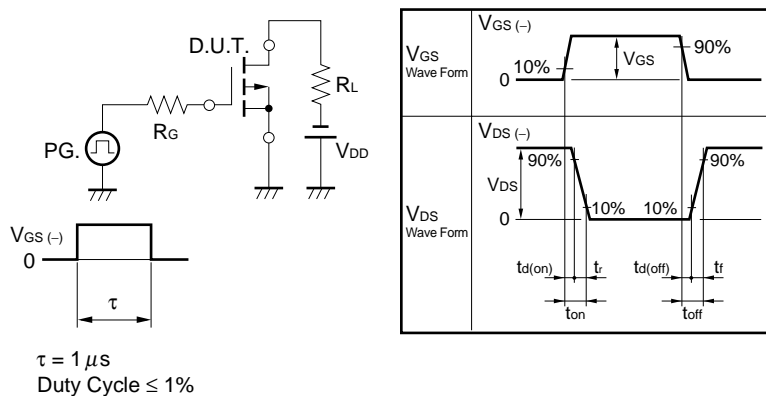


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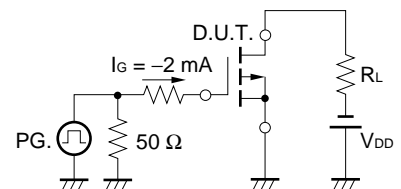
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -12 V, V <sub>GS</sub> = 0 V			-1.0	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	V <sub>GS(off)</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1.0 mA	-0.45	-0.75	-1.5	V
Forward Transfer Admittance	y <sub>fs</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -4.5 A	11	22		S
Drain to Source On-state Resistance	R <sub>DS(on)1</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -4.5 A		12.0	15	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = -4.0 V, I <sub>D</sub> = -4.5 A		12.5	16	mΩ
	R <sub>DS(on)3</sub>	V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -4.5 A		16.2	22.5	mΩ
	R <sub>DS(on)4</sub>	V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -2.5 A		23.7	41.5	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -10 V		1570		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		400		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1.0 MHz		240		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -10 V, I <sub>D</sub> = -4.5 A		16		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = -4.0 V		132		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		223		ns
Fall Time	t <sub>f</sub>			295		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = -10 V		15		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = -4.0 V		3.0		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = -9.0 A		4.5		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 9.0 A, V <sub>GS</sub> = 0 V		0.82		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 9.0 A, V <sub>GS</sub> = 0 V		490		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		580		nC

**TEST CIRCUIT 1 SWITCHING TIME**

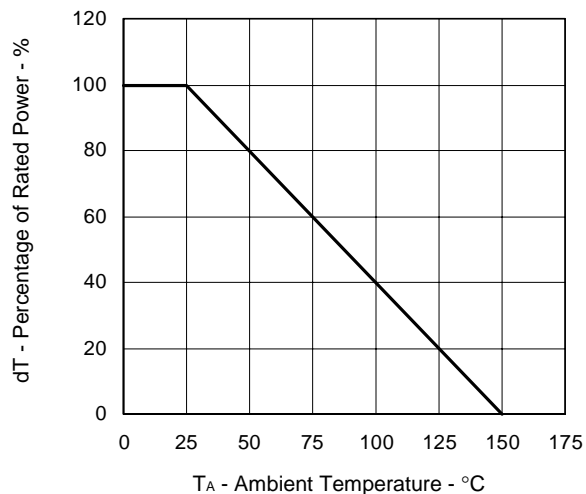


**TEST CIRCUIT 2 GATE CHARGE**

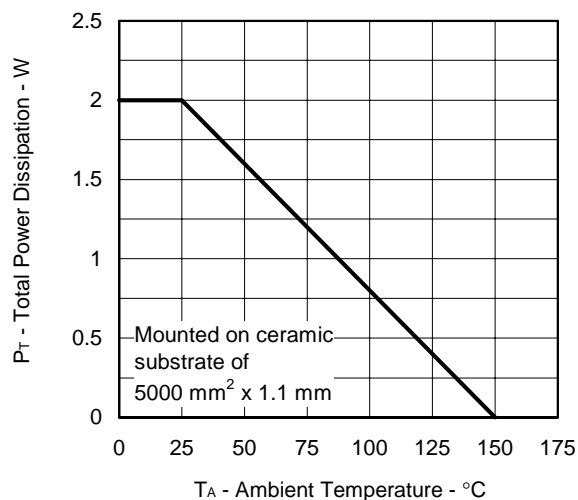


TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

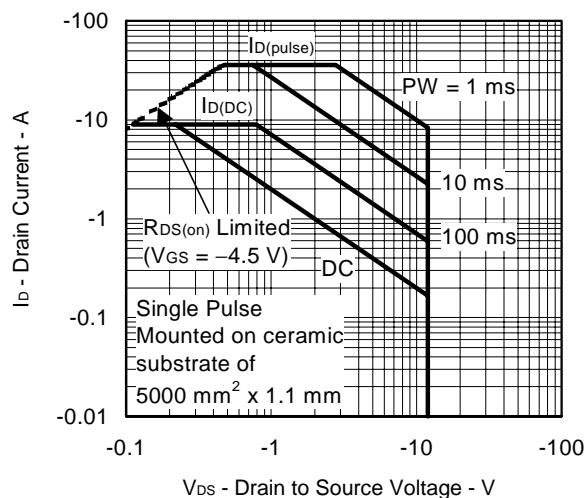
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



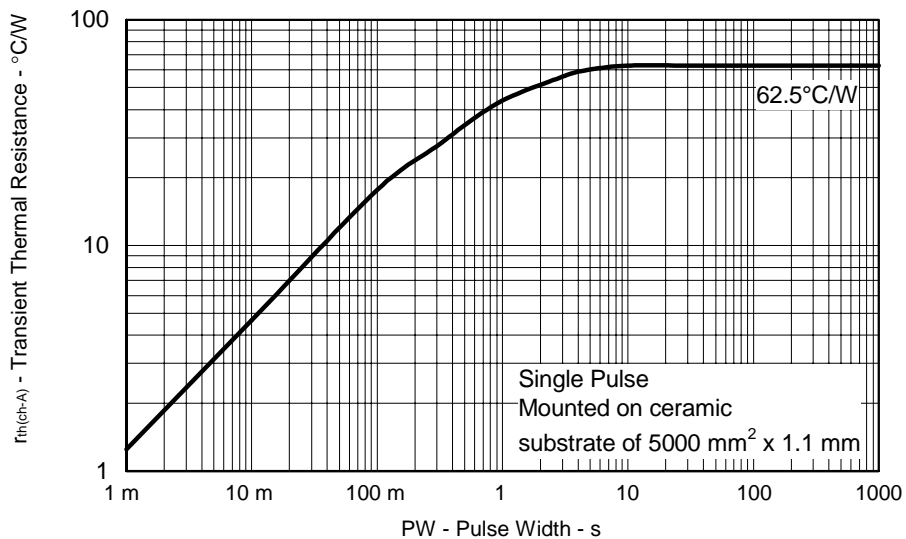
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



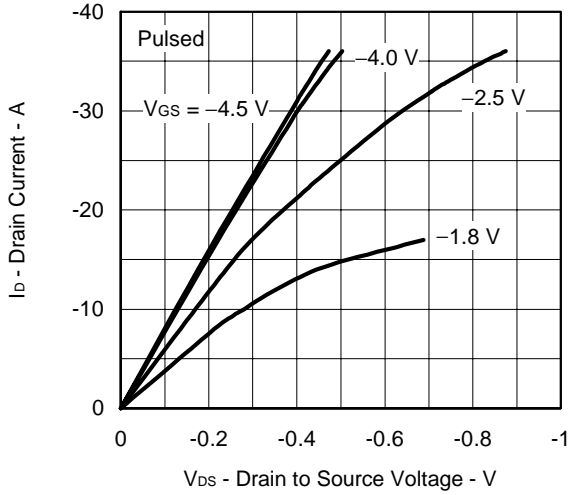
FORWARD BIAS SAFE OPERATING AREA



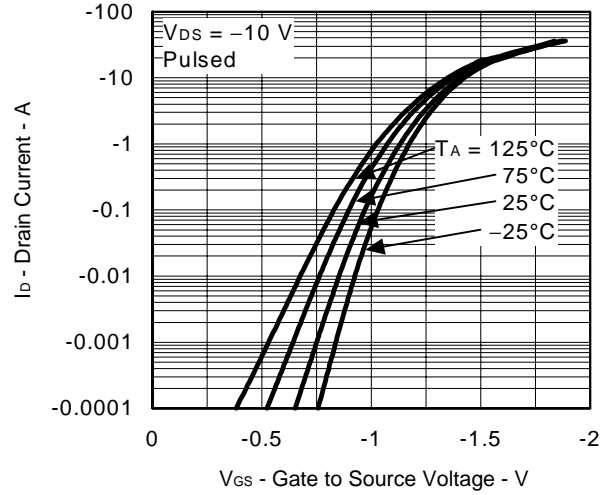
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



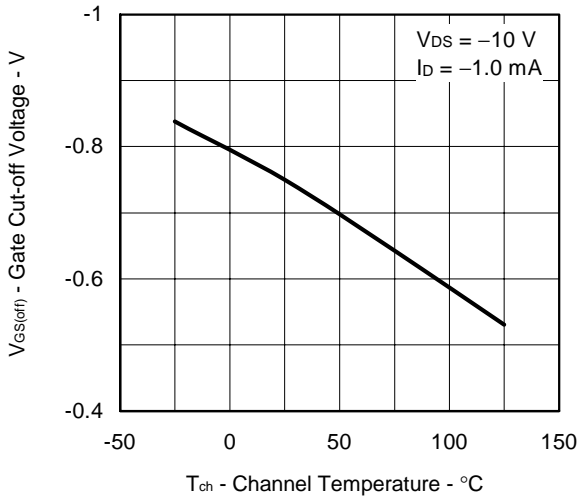
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



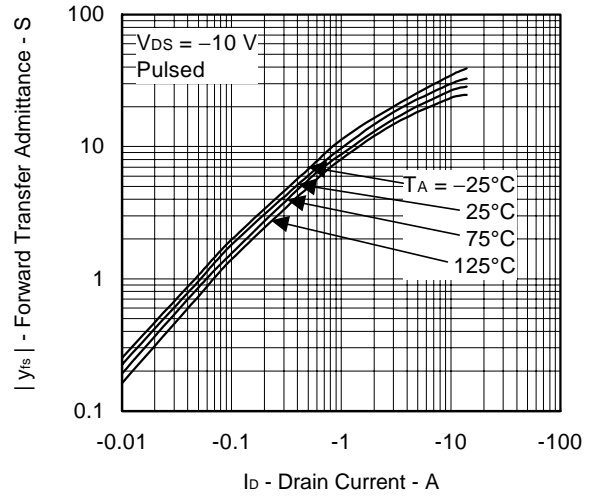
FORWARD TRANSFER CHARACTERISTICS



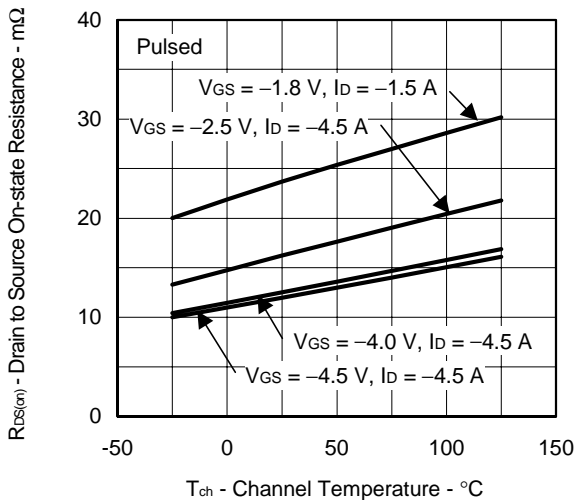
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



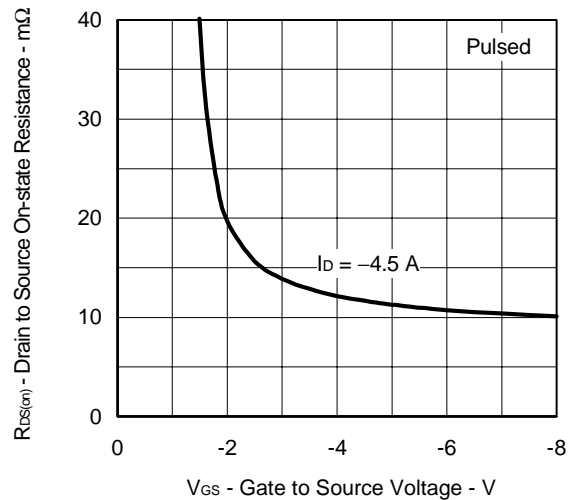
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



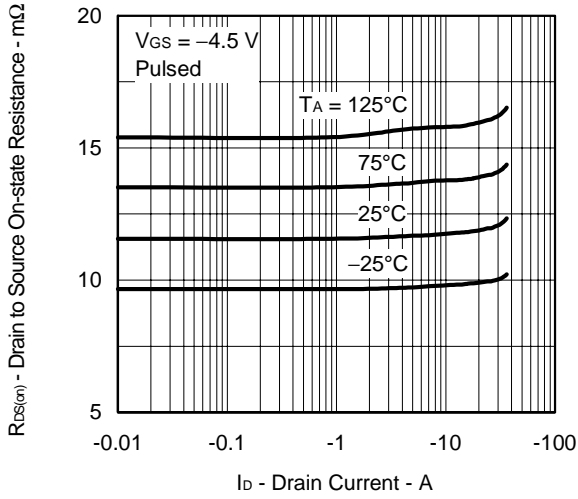
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



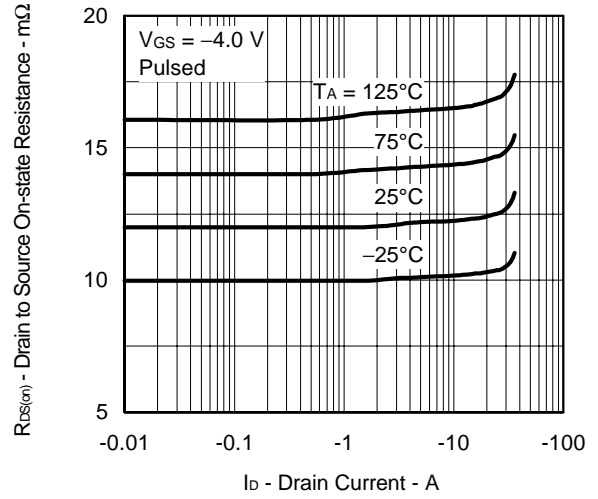
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



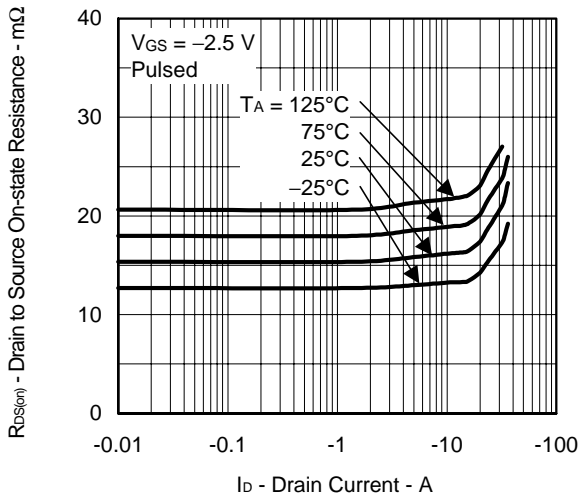
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



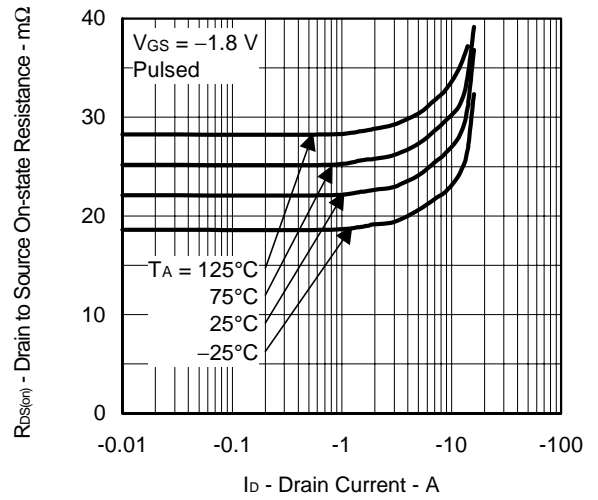
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



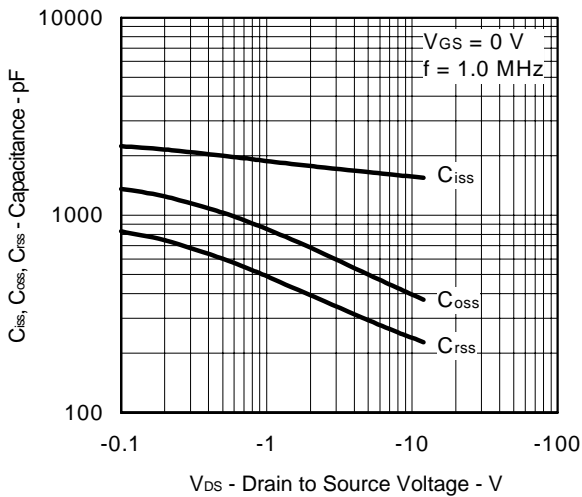
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



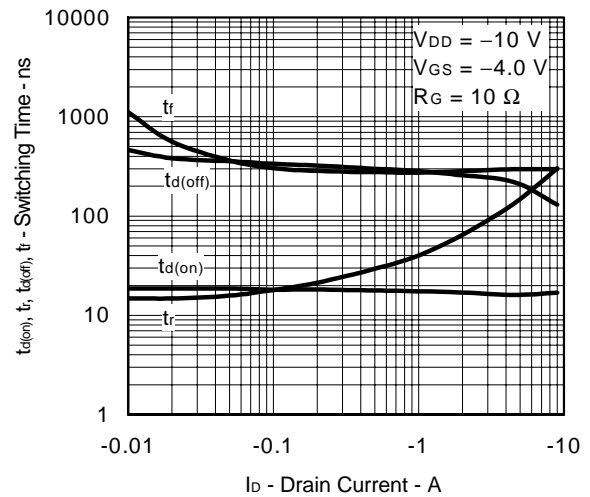
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



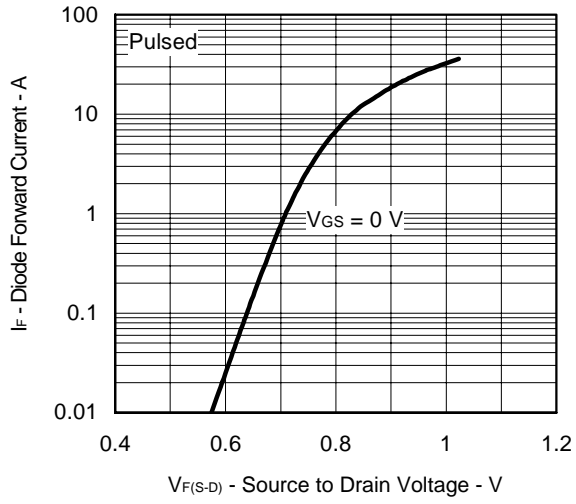
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



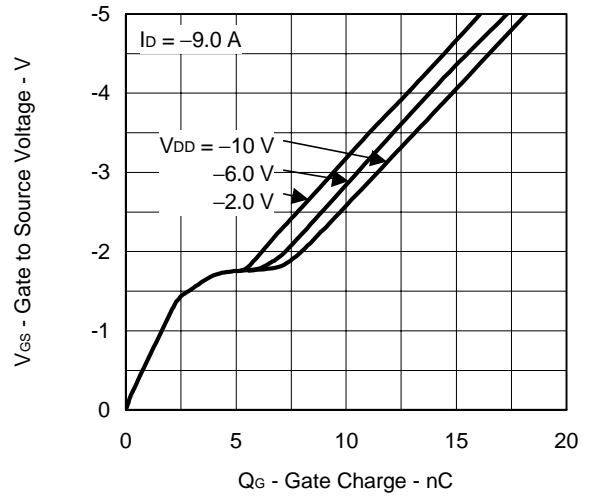
SWITCHING CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



DYNAMIC INPUT/OUTPUT CHARACTERISTICS



[MEMO]

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