

**N-CHANNEL MOS FIELD EFFECT TRANSISTOR  
FOR SWITCHING**

**DESCRIPTION**

The  $\mu$ PA1970 is a switching device which can be driven directly by a 2.5 V power source.

The device features a low on-state resistance and excellent switching characteristics, and is suitable for applications such as power switch of portable machine and so on.

**FEATURES**

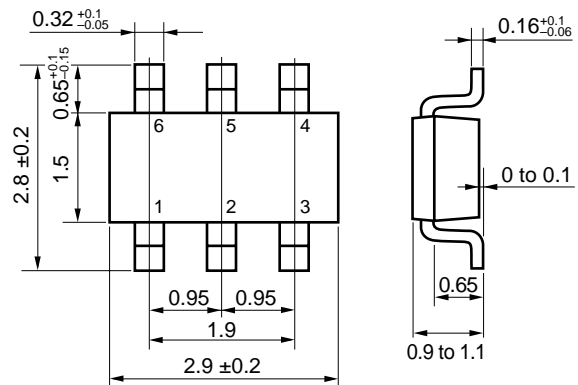
- 2.5 V drive available
- Low on-state resistance  
 $R_{DS(on)1} = 69 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 1.0 \text{ A)}$   
 $R_{DS(on)2} = 72 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.0 \text{ V, } I_D = 1.0 \text{ A)}$   
 $R_{DS(on)3} = 107 \text{ m}\Omega \text{ MAX. (} V_{GS} = 2.5 \text{ V, } I_D = 1.0 \text{ A)}$

**ORDERING INFORMATION**

PART NUMBER	PACKAGE
$\mu$ PA1970TE <sup>Note</sup>	SC-95 (Mini Mold Thin Type)

**Note** Marking: TT

**PACKAGE DRAWING (Unit: mm)**

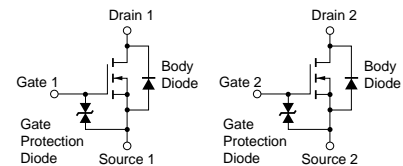


- |    |          |    |          |
|----|----------|----|----------|
| 6: | Drain 1  | 4: | Drain 2  |
| 1: | Gate 1   | 3: | Gate 2   |
| 5: | Source 1 | 2: | Source 2 |

**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) (T <sub>A</sub> = 25°C)	I <sub>D(DC)</sub>	±2.2	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±8.8	A
Total Power Dissipation (2 units) (T <sub>A</sub> = 25°C) <sup>Note2</sup>	P <sub>T1</sub>	1.15	W
Total Power Dissipation (1 unit) (T <sub>A</sub> = 25°C) <sup>Note2</sup>	P <sub>T2</sub>	0.57	W
Channel Temperature	T <sub>ch</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

**EQUIVALENT CIRCUITS**



- Notes**
1.  $PW \leq 10 \mu s$ , Duty Cycle  $\leq 1\%$
  2. Mounted on FR-4 board of  $5000 \text{ mm}^2 \times 1.1 \text{ mm}$ ,  $t \leq 5 \text{ sec}$ .

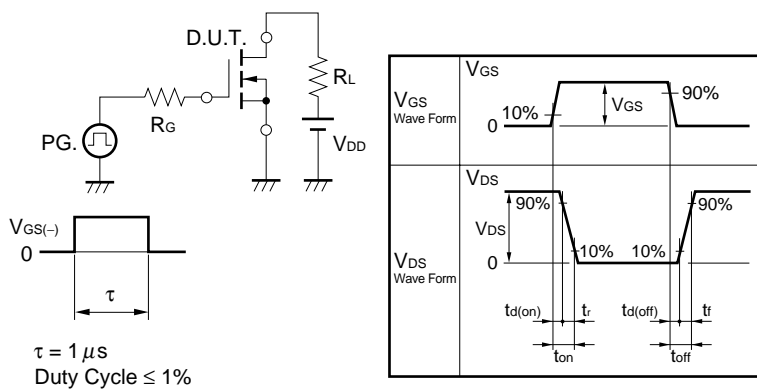
**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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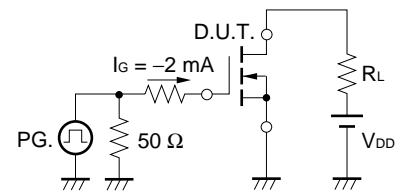
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V			10	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	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.0 mA	0.5	0.97	1.5	V
Forward Transfer Admittance	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	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 1.0 A		55	69	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 1.0 A		57	72	mΩ
	R <sub>DS(on)3</sub>	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 1.0 A		80	107	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		160		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		60		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		17		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 4.0 V		90		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		100		ns
Fall Time	t <sub>f</sub>			120		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 16 V		2.3		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 4.0 V		0.5		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 2.2 A		1.1		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 2.2 A, V <sub>GS</sub> = 0 V		0.85		V

**TEST CIRCUIT 1 SWITCHING TIME**

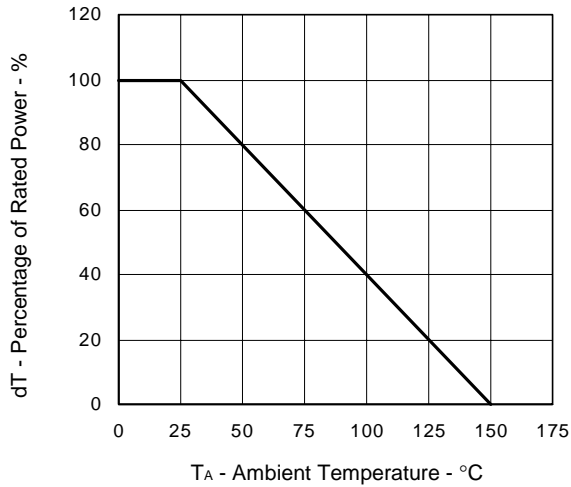


**TEST CIRCUIT 2 GATE CHARGE**

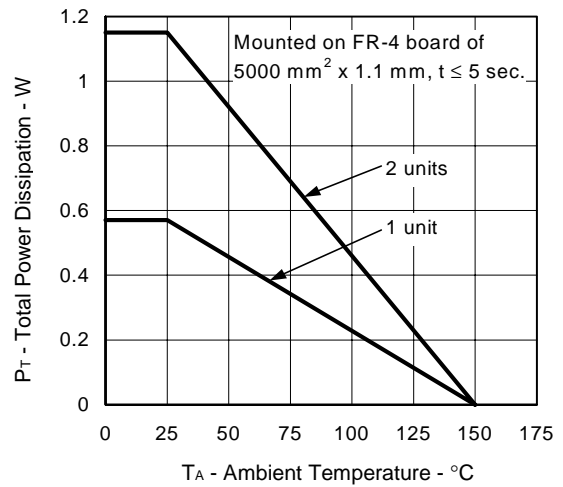


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

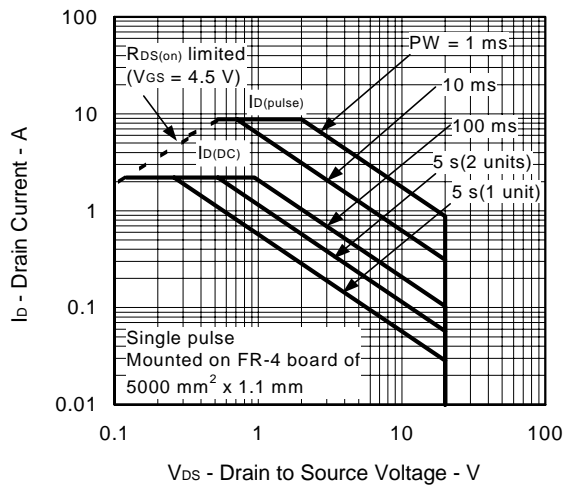
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



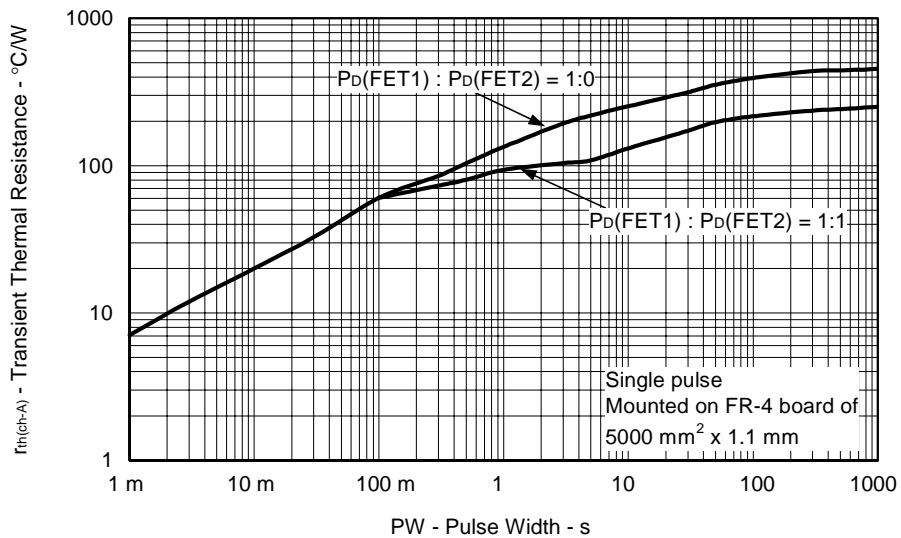
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



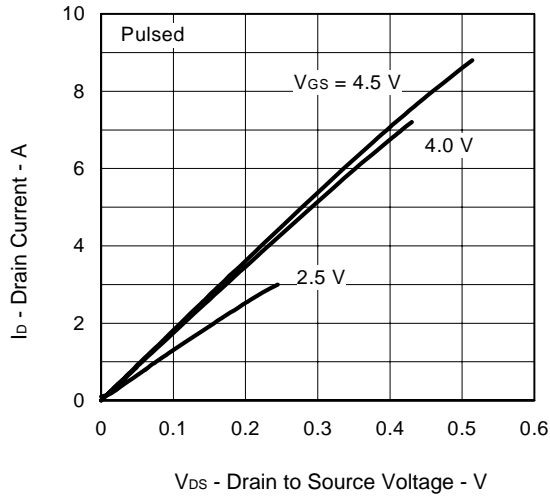
FORWARD BIAS SAFE OPERATING AREA



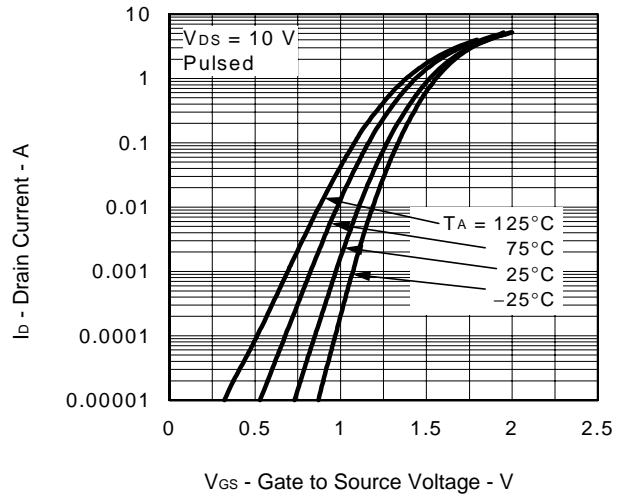
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



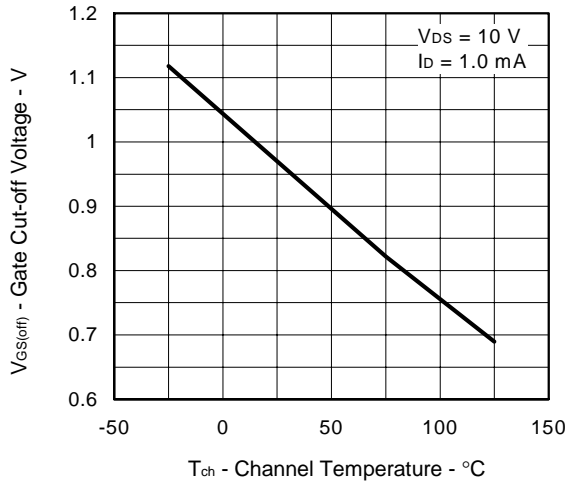
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



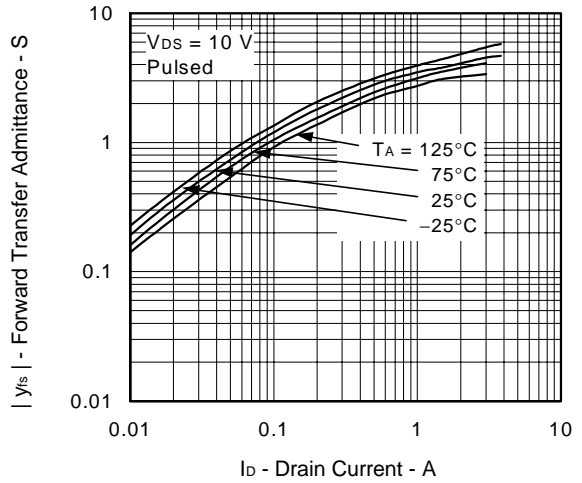
FORWARD TRANSFER CHARACTERISTICS



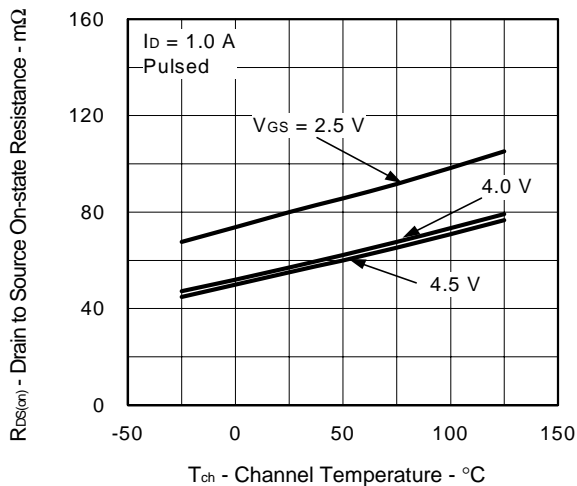
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



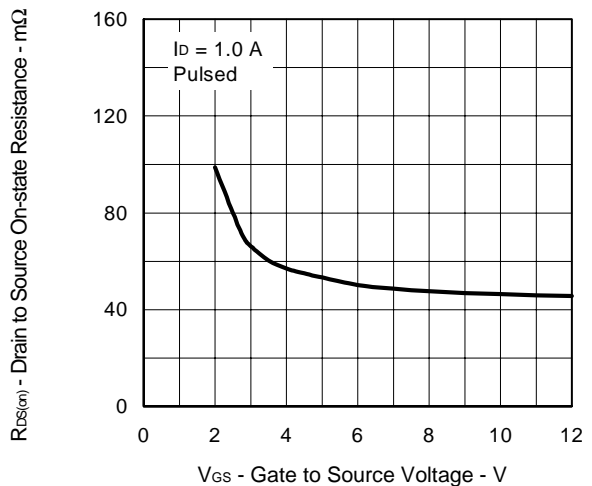
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



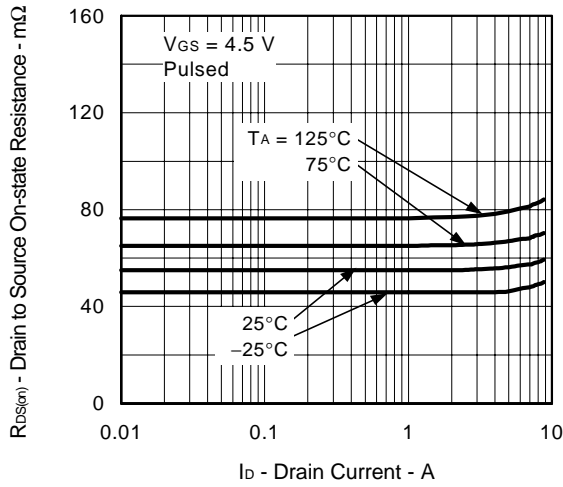
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



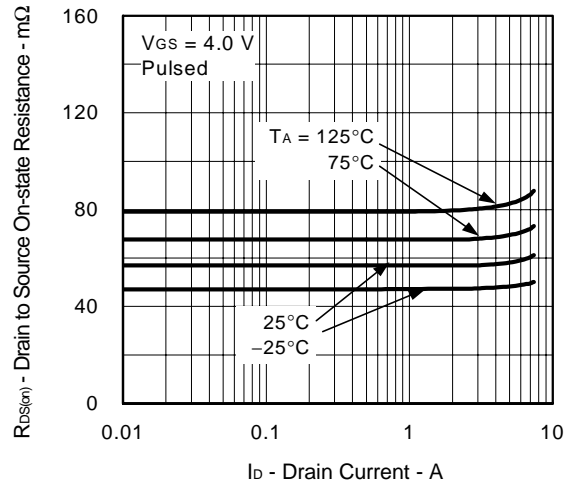
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



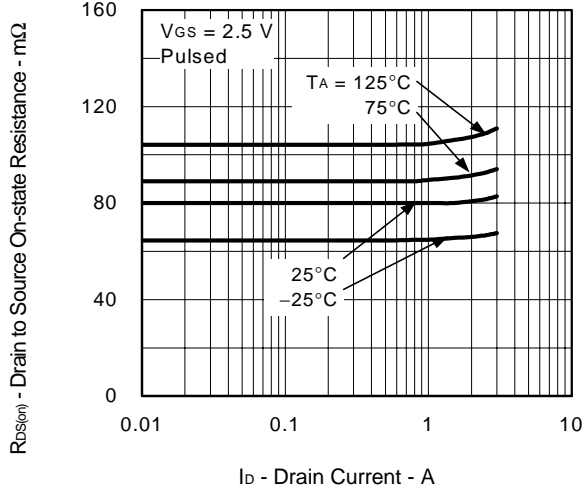
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



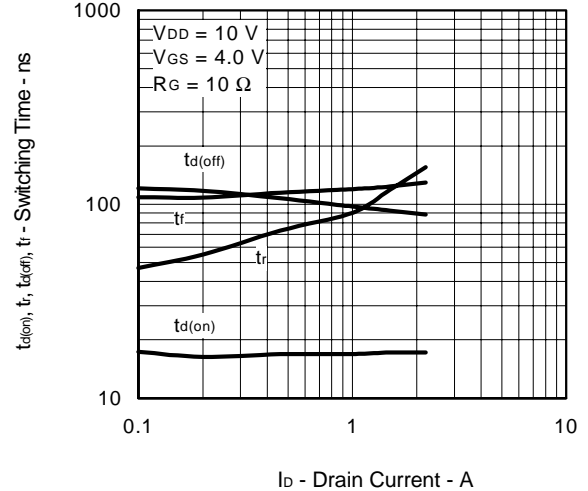
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



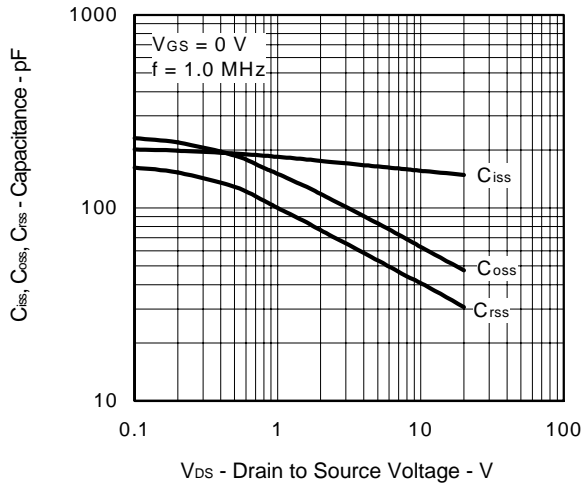
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



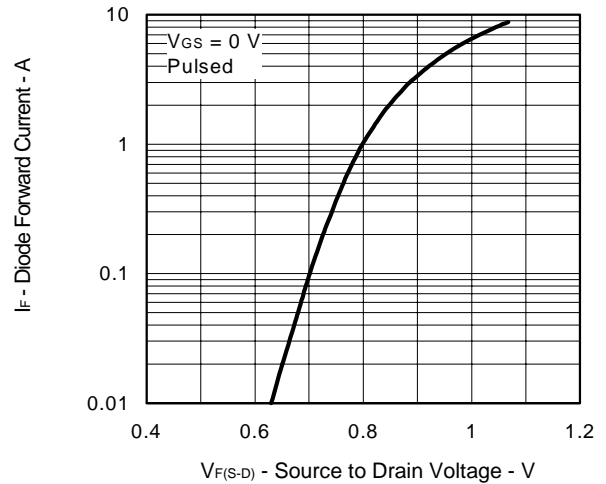
SWITCHING CHARACTERISTICS



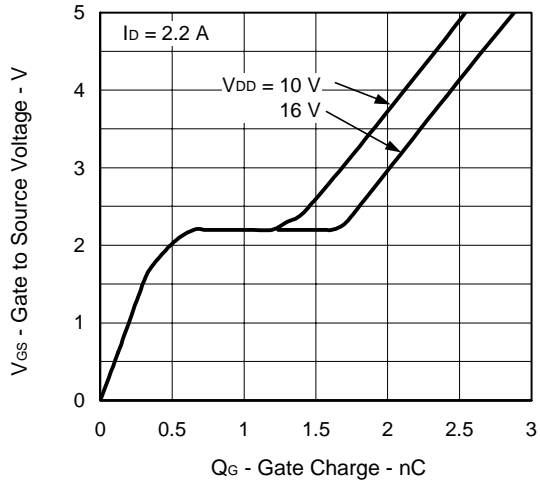
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



DYNAMIC INPUT/OUTPUT CHARACTERISTICS



[MEMO]

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