NEC

# MOS FIELD EFFECT TRANSISTOR

# μPA650TT

## P-CHANNEL MOS FIELD EFFECT TRANSISTOR FOR SWITCHING

### DESCRIPTION

The μPA650TT 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 switch of portable machine and so on.

### FEATURES

- 1.8 V drive available
- Low on-state resistance
  $R_{DS(on)1}$ = 50 mΩ MAX. ($V_{GS}$ = –4.5 V, $I_D$ = –2.5 A)
  $R_{DS(on)2}$ = 68 mΩ MAX. ($V_{GS}$ = –2.5 V, $I_D$ = –2.5 A)
  $R_{DS(on)3}$ = 114 mΩ MAX. ($V_{GS}$ = –1.8 V, $I_D$ = –1.5 A)

### ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|---|---|
| μPA650TT | 6pinWSOF (1620) |

Marking: WD

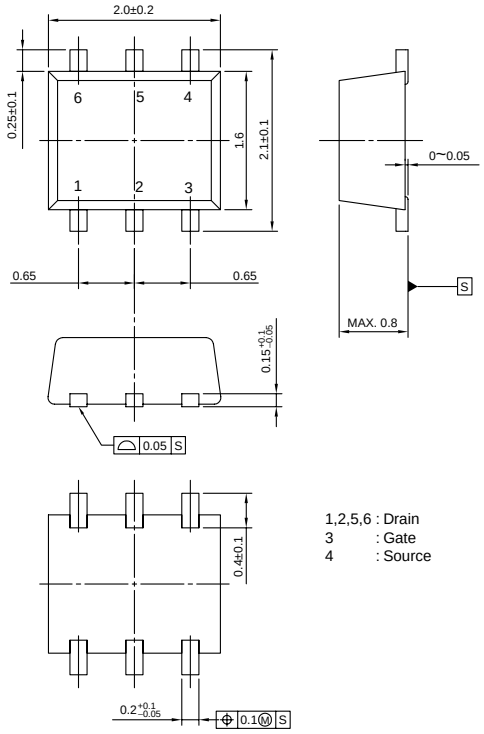
### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C)

| | | | |
|---|---|---|---|
| Drain to Source Voltage ($V_{GS}$ = 0 V) | $V_{DSS}$ | –12 | V |
| Gate to Source Voltage ($V_{DS}$ = 0 V) | $V_{GSS}$ | ∓8.0 | V |
| Drain Current (DC) ($T_A$ = 25°C) | $I_{D(DC)}$ | ∓5.0 | A |
| Drain Current (pulse) **Note1** | $I_{D(pulse)}$ | ∓20 | A |
| Total Power Dissipation ($T_A$ = 25°C) | $P_{T1}$ | 0.2 | W |
| Total Power Dissipation ($T_A$ = 25°C) **Note2** | $P_{T2}$ | 1.4 | W |
| Channel Temperature | $T_{ch}$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | –55 to +150 | °C |

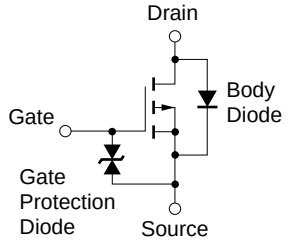
**Notes 1.** PW ≤ 10 μs, Duty Cycle ≤ 1%

**2.** Mounted on FR-4 board, t ≤ 5 sec.

### PACKAGE DRAWING (Unit: mm)




### EQUIVALENT CIRCUIT




**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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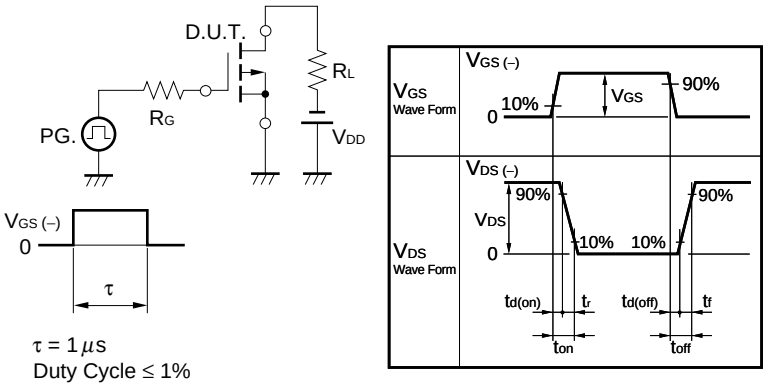
## ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C)

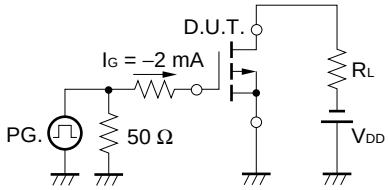
| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = –12 V, $V_{GS}$ = 0 V | | | –10 | μA |
| Gate Leakage Current | $I_{GSS}$ | $V_{GS}$ = ∓8.0 V, $V_{DS}$ = 0 V | | | ∓10 | μA |
| Gate Cut-off Voltage | $V_{GS(off)}$ | $V_{DS}$ = –10 V, $I_D$ = –1.0 mA | –0.45 | | –1.5 | V |
| Forward Transfer Admittance | $\|y_{fs}\|$ | $V_{DS}$ = –10 V, $I_D$ = –2.5 A | 4.0 | | | S |
| Drain to Source On-state Resistance | $R_{DS(on)1}$ | $V_{GS}$ = –4.5 V, $I_D$ = –2.5 A | | 40 | 50 | mΩ |
| | $R_{DS(on)2}$ | $V_{GS}$ = –2.5 V, $I_D$ = –2.5 A | | 51 | 68 | mΩ |
| | $R_{DS(on)3}$ | $V_{GS}$ = –1.8 V, $I_D$ = –1.5 A | | 68 | 114 | mΩ |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = –10 V | | 610 | | pF |
| Output Capacitance | $C_{oss}$ | $V_{GS}$ = 0 V | | 150 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | f = 1.0 MHz | | 100 | | pF |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$ = –6.0 V, $I_D$ = –2.5 A | | 50 | | ns |
| Rise Time | $t_r$ | $V_{GS}$ = –4.0 V | | 200 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | $R_G$ = 10 Ω | | 400 | | ns |
| Fall Time | $t_f$ | | | 315 | | ns |
| Total Gate Charge | $Q_G$ | $V_{DD}$ = –10 V | | 5.5 | | nC |
| Gate to Source Charge | $Q_{GS}$ | $V_{GS}$ = –4.0 V | | 1.5 | | nC |
| Gate to Drain Charge | $Q_{GD}$ | $I_D$ = –5.0 A | | 1.6 | | nC |
| Body Diode Forward Voltage | $V_{F(S-D)}$ | $I_F$ = 5.0 A, $V_{GS}$ = 0 V | | 0.89 | | V |

**TEST CIRCUIT 1 SWITCHING TIME**



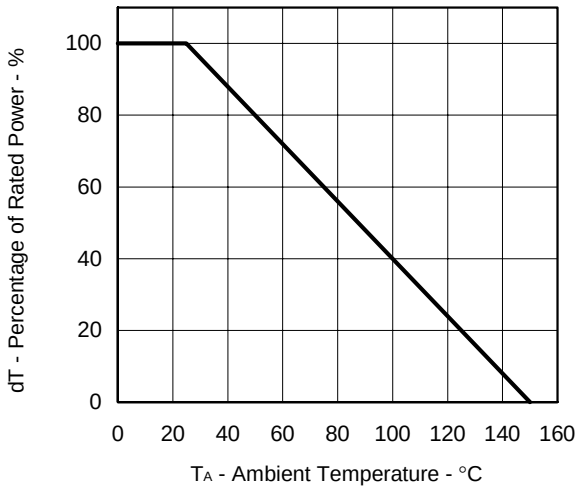

τ = 1 μs
Duty Cycle ≤ 1%

**TEST CIRCUIT 2 GATE CHARGE**

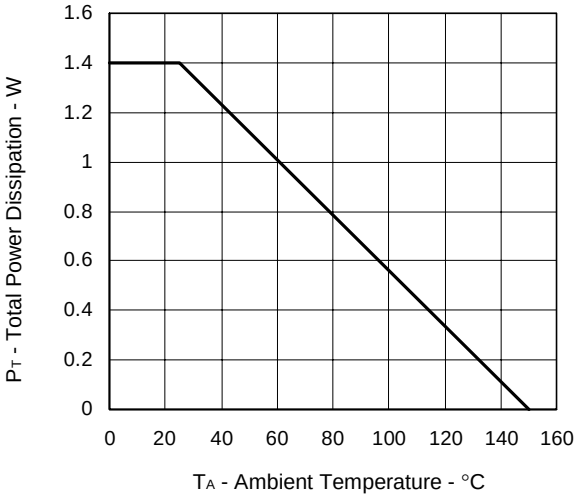


## TYPICAL CHARACTERISTICS ($T_A$ = 25°C)

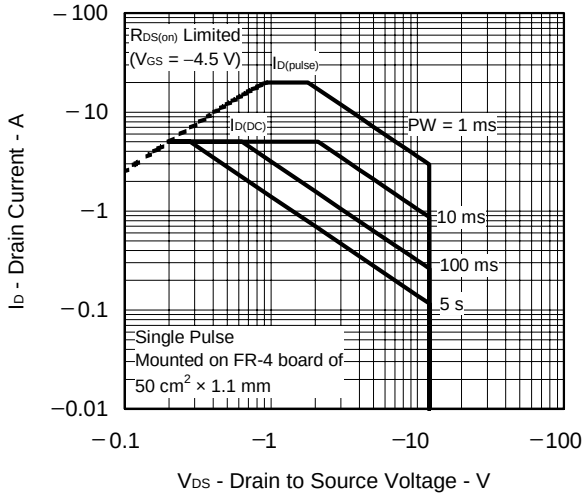
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



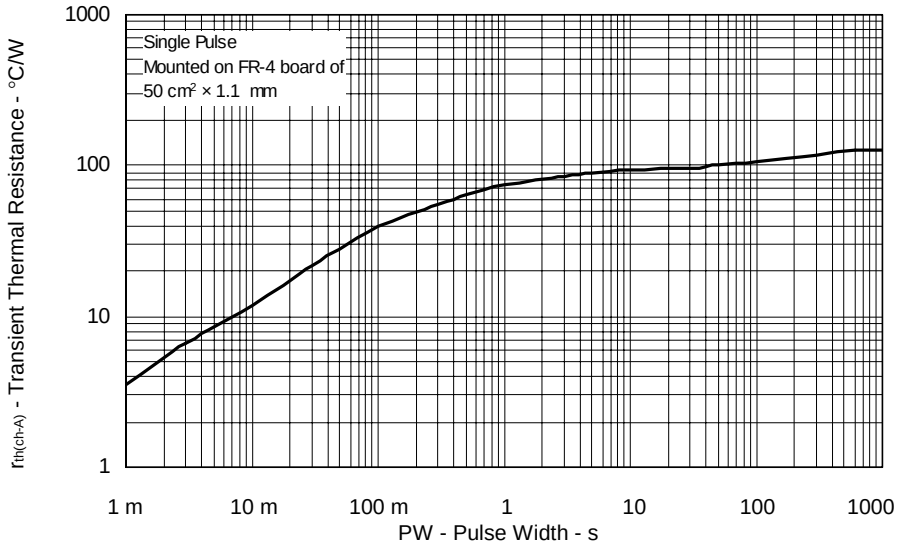

TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



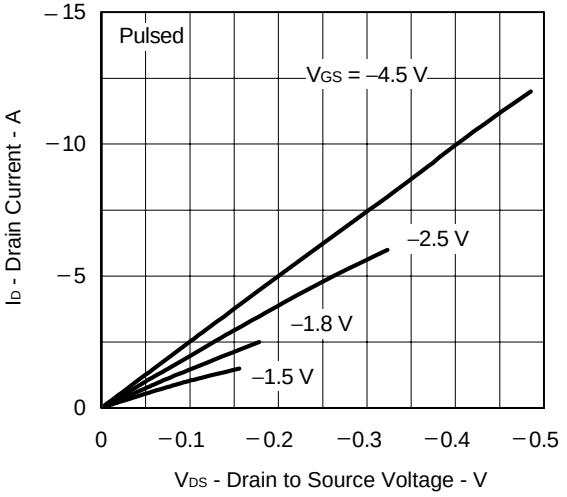

FORWARD BIAS SAFE OPERATING AREA



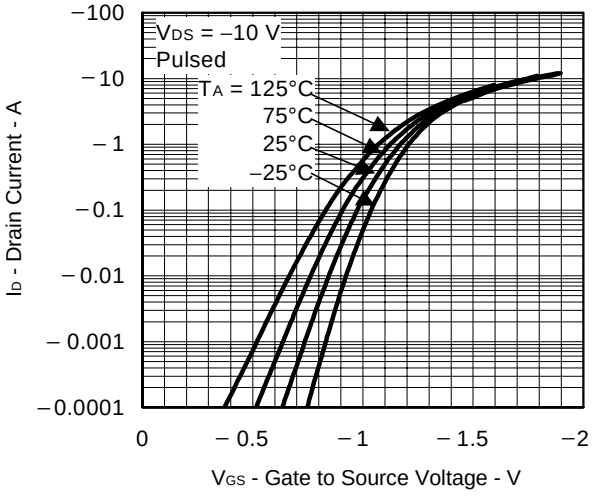

TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



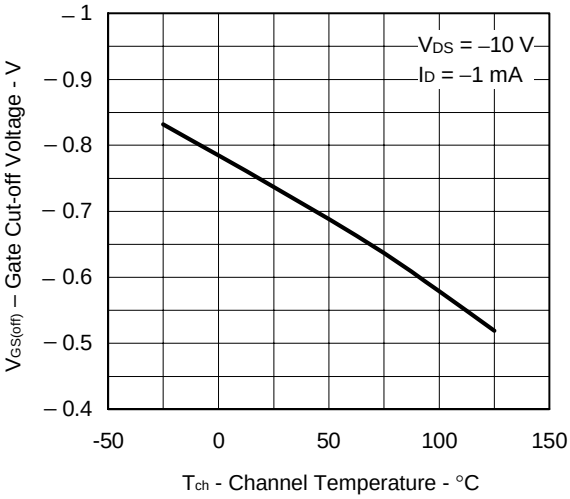
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



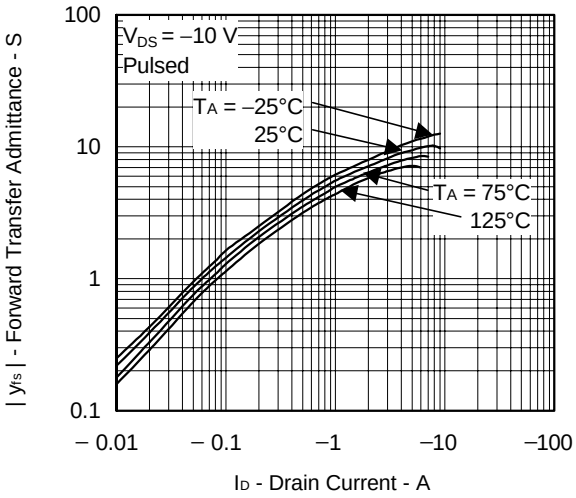

FORWARD TRANSFER CHARACTERISTICS



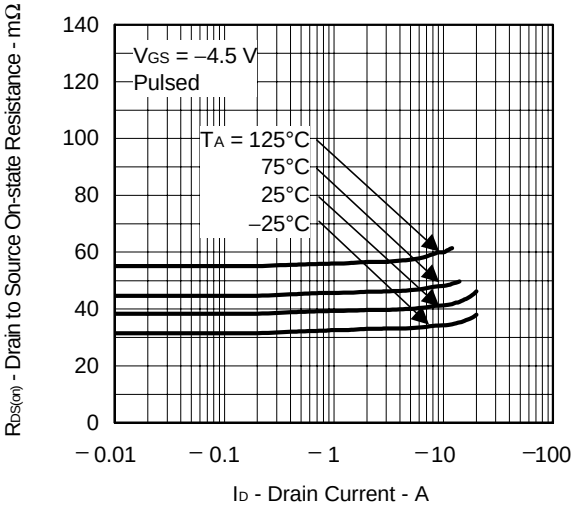

GATE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



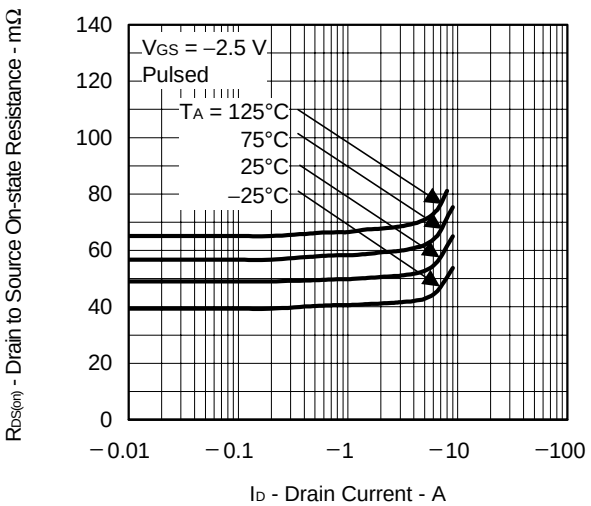

FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



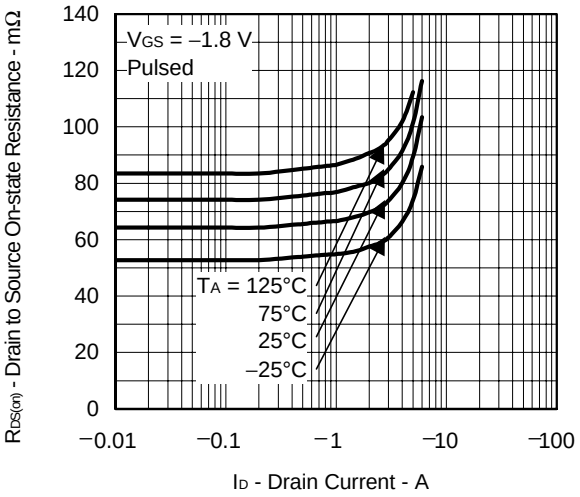

DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



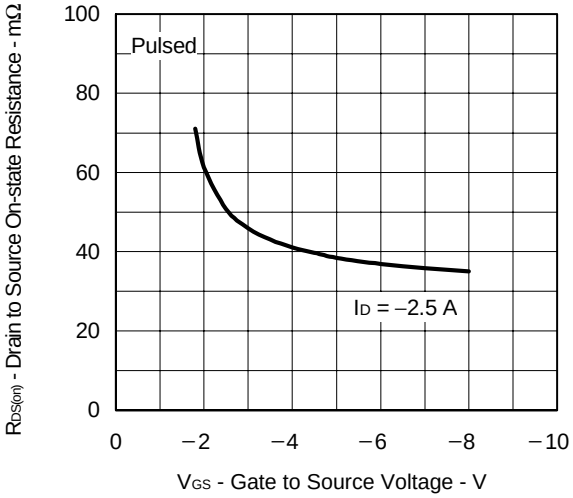

DRAIN TO SOURCE ON-STATE
RESISTANCE vs. DRAIN CURRENT



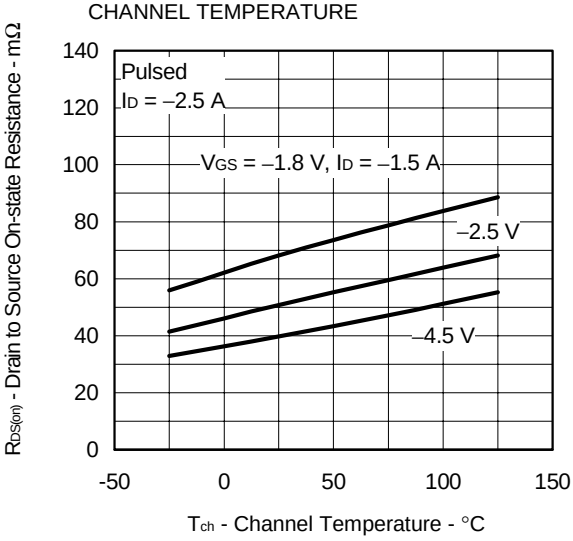
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



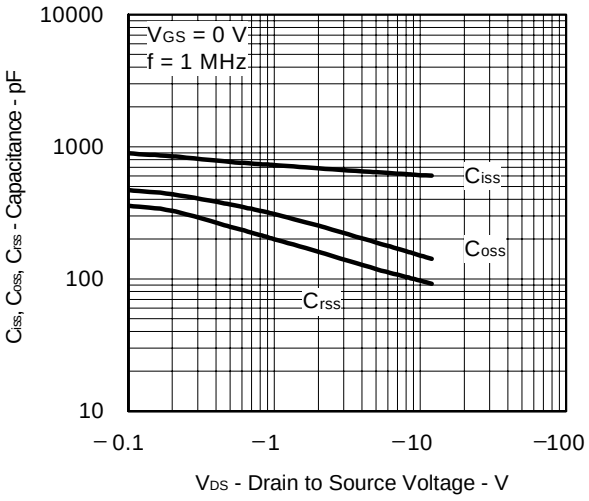

DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



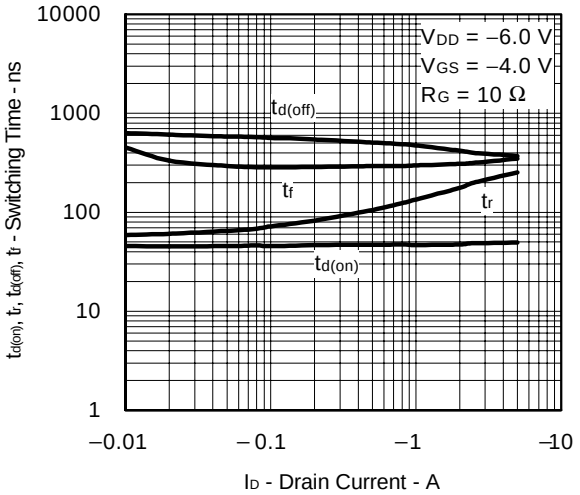

DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



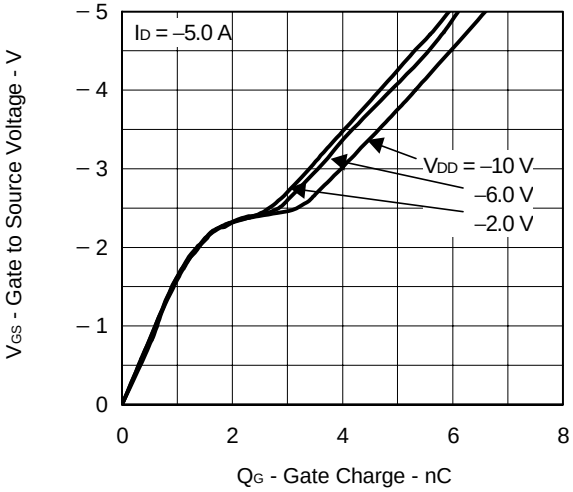

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



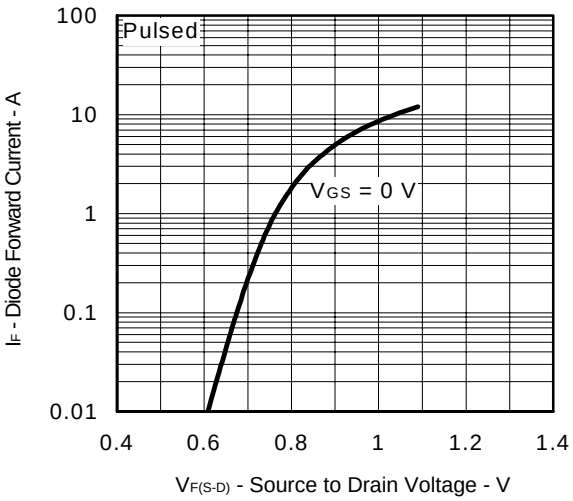

SWITCHING CHARACTERISTICS




DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE
FORWARD VOLTAGE



**[MEMO]**

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