

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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# MOS FIELD EFFECT TRANSISTOR

# $\mu$ PA2592T1H

## N- AND P-CHANNEL MOSFET FOR SWITCHING

### DESCRIPTION

The  $\mu$ PA2592T1H is N- and P-channel MOSFETs designed for DC/DC converters and power management applications of portable equipments.

N- and P-channel MOSFETs are assembled in one package, to contribute minimize the equipments.

### FEATURES

- 2.5 V drive available
- Low on-state resistance

N-channel  $R_{DS(on)1} = 50 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 2 \text{ A}$ )

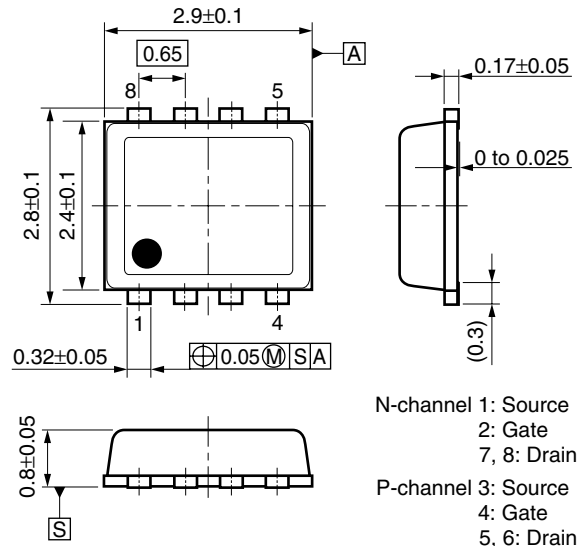
$R_{DS(on)2} = 65 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = 2.5 \text{ V}$ ,  $I_D = 2 \text{ A}$ )

P-channel  $R_{DS(on)1} = 80 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = -4.5 \text{ V}$ ,  $I_D = -2 \text{ A}$ )

$R_{DS(on)2} = 140 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = -2.5 \text{ V}$ ,  $I_D = -1 \text{ A}$ )

- Built-in gate protection diode
- Small and surface mount package (8-pin VSOFF (2429))

### PACKAGE DRAWING (Unit: mm)



### ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
$\mu$ PA2592T1H-T1-AT <small>Note</small>	Pure Sn	8 mm embossed taping	8-pin VSOFF (2429)
$\mu$ PA2592T1H-T2-AT <small>Note</small>		3000 p/reel	

**Note** Pb-free (This product does not contain Pb in the external electrode and other parts.)

**Marking: 2592**

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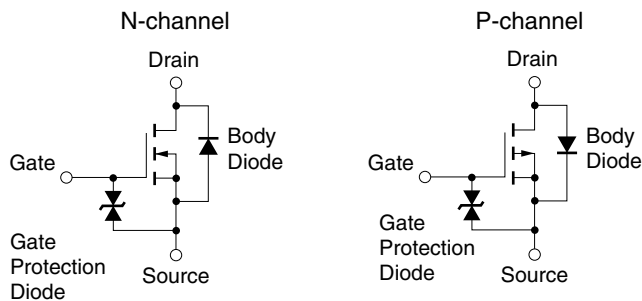
**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)**

PARAMETER	SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	20	-20	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±12	∓12	V
Drain Current (DC)	I <sub>D(DC)</sub>	±4.0	∓3.0	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±16	∓12	A
Total Power Dissipation (1 unit, 5 s) <sup>Note2</sup>	P <sub>T1</sub>	1.5		W
Total Power Dissipation (2 units, 5 s) <sup>Note2</sup>	P <sub>T2</sub>	1.24		W
Channel Temperature	T <sub>ch</sub>	150		°C
Storage Temperature	T <sub>stg</sub>	-55 to +150		°C

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

2. Mounted on FR-4 board of 25.4 mm x 25.4 mm x 0.8 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.

**Caution** This product is electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge.

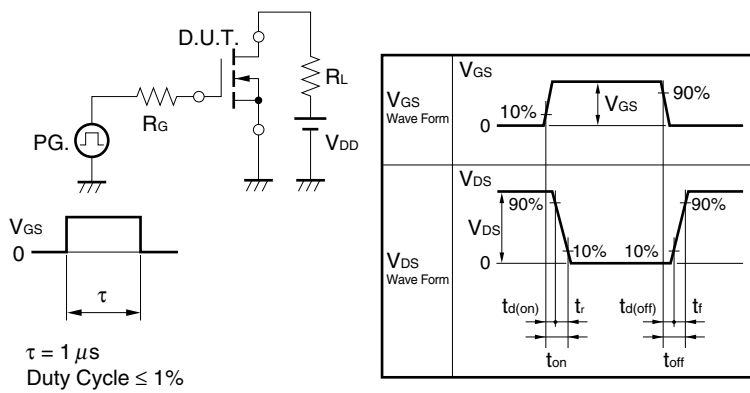
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

**N-channel MOSFET**

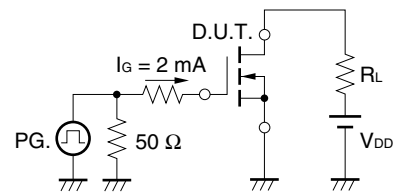
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V			1	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±12 V, V <sub>DS</sub> = 0 V			±10	μA
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	0.5		1.5	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2 A	2			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> = 2 A		29	50	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 2 A		41	65	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V,		455		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V,		75		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1.0 MHz		47		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, I <sub>D</sub> = 2 A, V <sub>GS</sub> = 4.5 V, R <sub>G</sub> = 6 Ω		8		ns
Rise Time	t <sub>r</sub>			8		ns
Turn-off Delay Time	t <sub>d(off)</sub>			20		ns
Fall Time	t <sub>f</sub>			6		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 16 V, V <sub>GS</sub> = 4.5 V,		5.4		nC
Gate to Source Charge	Q <sub>GS</sub>	I <sub>D</sub> = 4 A		0.9		nC
Gate to Drain Charge	Q <sub>GD</sub>			1.6		nC
Body Diode Forward Voltage <sup>Note</sup>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 4 A, V <sub>GS</sub> = 0 V		0.85		V

**Note** Pulsed

**TEST CIRCUIT 1 SWITCHING TIME**



**TEST CIRCUIT 2 GATE CHARGE**

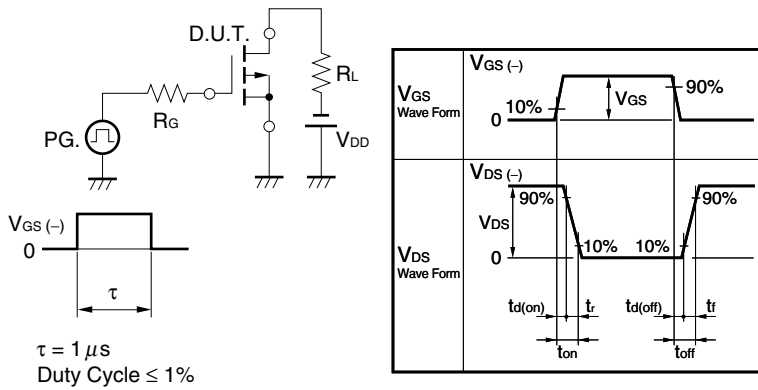


**P-channel MOSFET**

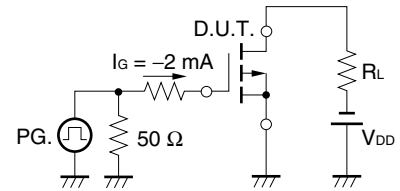
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 12\text{ V}, V_{DS} = 0\text{ V}$			±10	μA
Gate to Source Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$	-0.5		-1.5	V
Forward Transfer Admittance <sup>Note</sup>	$ y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -1.5\text{ A}$	2			S
Drain to Source On-state Resistance <sup>Note</sup>	$R_{DS(on)1}$	$V_{GS} = -4.5\text{ V}, I_D = -2\text{ A}$		55	80	mΩ
	$R_{DS(on)2}$	$V_{GS} = -2.5\text{ V}, I_D = -1\text{ A}$		80	140	mΩ
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V},$		445		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V},$		96		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1.0\text{ MHz}$		82		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, I_D = -1.5\text{ A},$		12		ns
Rise Time	$t_r$	$V_{GS} = -4.5\text{ V},$		5		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 6\ \Omega$		36		ns
Fall Time	$t_f$			20		ns
Total Gate Charge	$Q_G$	$V_{DD} = -16\text{ V}, V_{GS} = -4.5\text{ V},$		5.7		nC
Gate to Source Charge	$Q_{GS}$	$I_D = -3\text{ A}$		1.2		nC
Gate to Drain Charge	$Q_{GD}$			2.2		nC
Body Diode Forward Voltage <sup>Note</sup>	$V_{F(S-D)}$	$I_F = -3\text{ A}, V_{GS} = 0\text{ V}$		0.88		V

**Note** Pulsed

**TEST CIRCUIT 1 SWITCHING TIME**

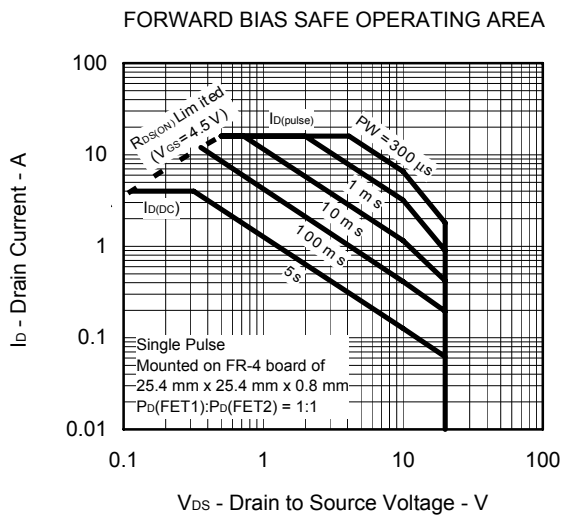
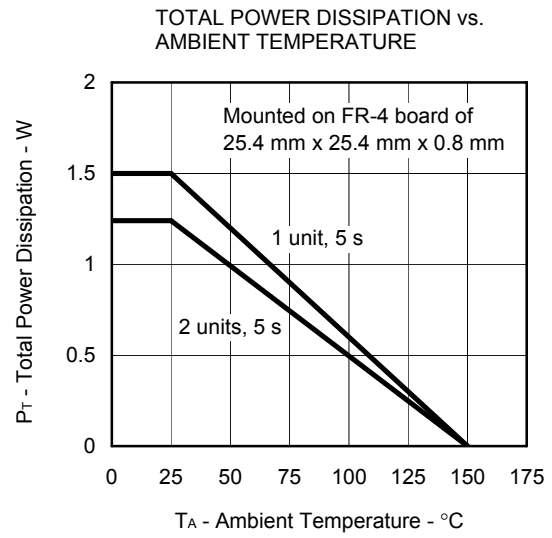
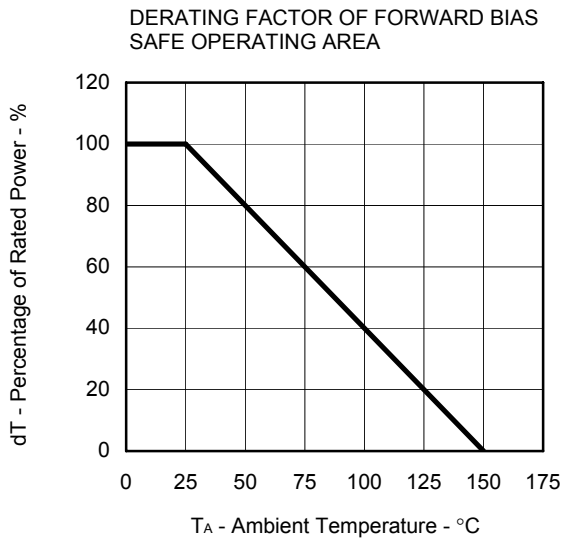


**TEST CIRCUIT 2 GATE CHARGE**

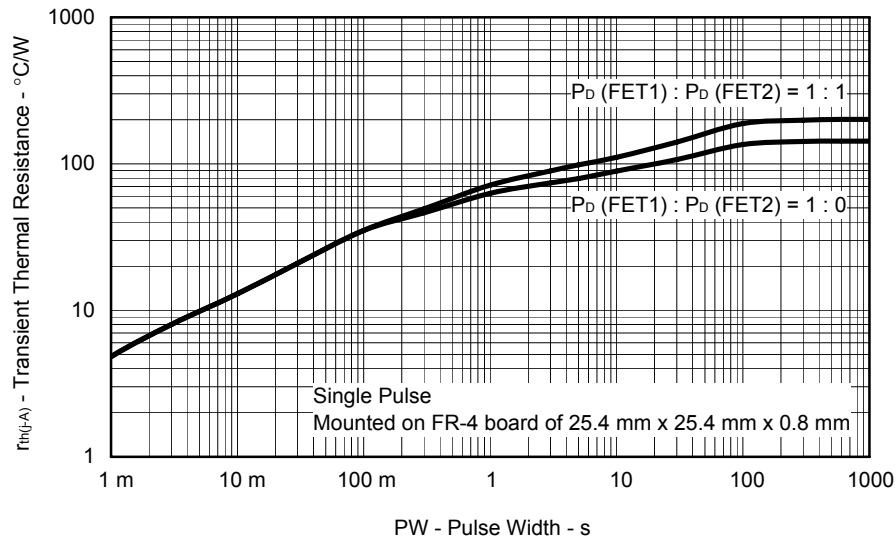


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

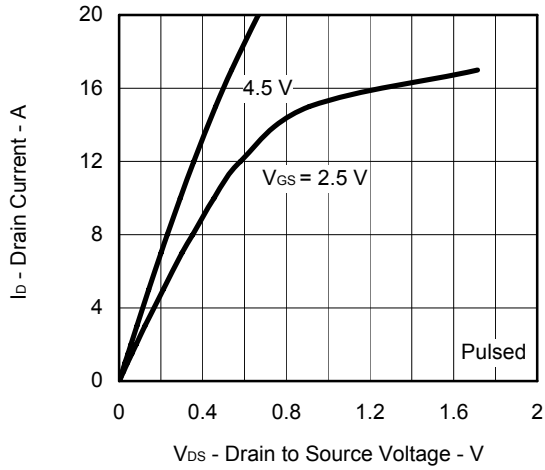
(1) N-channel MOSFET



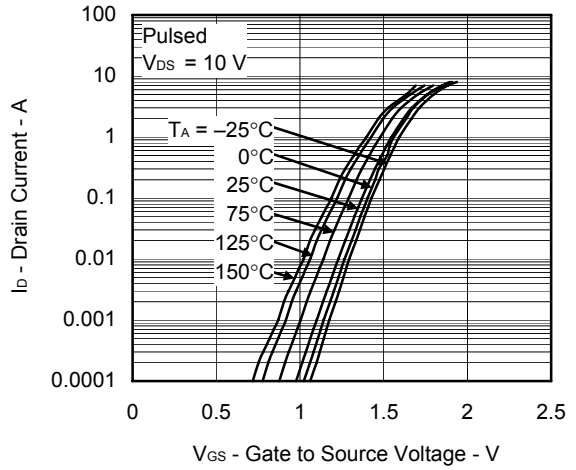
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



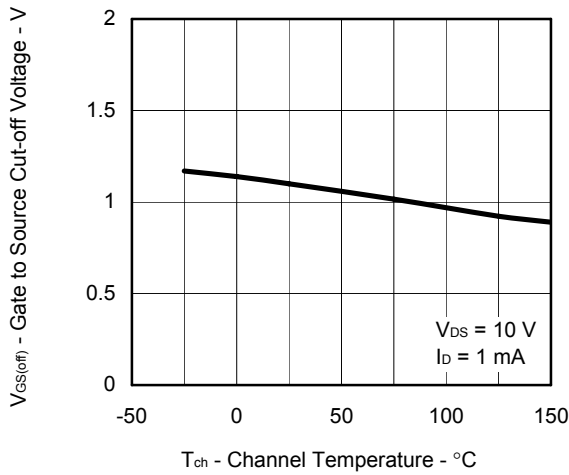
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



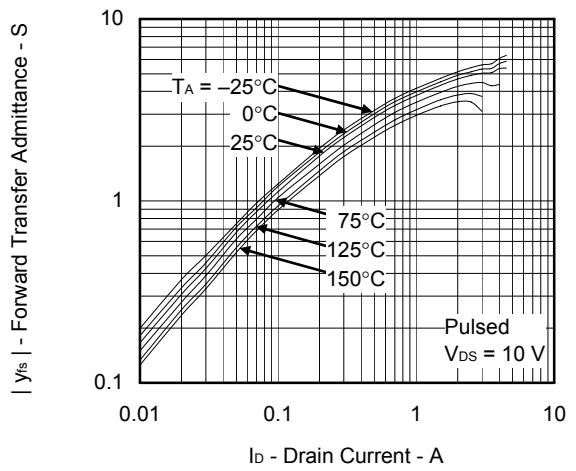
FORWARD TRANSFER CHARACTERISTICS



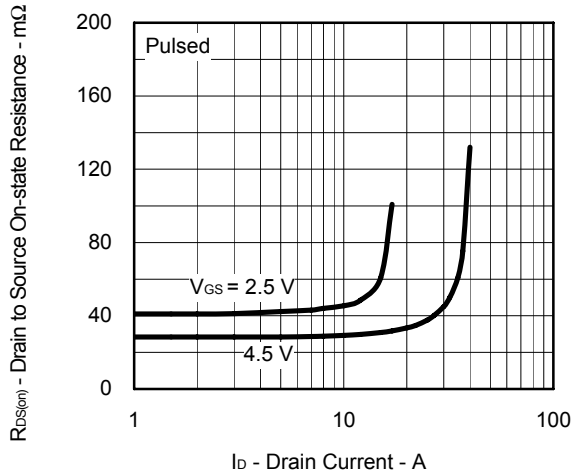
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



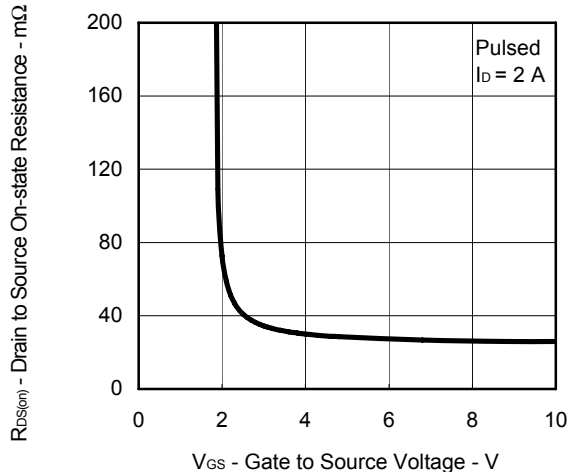
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

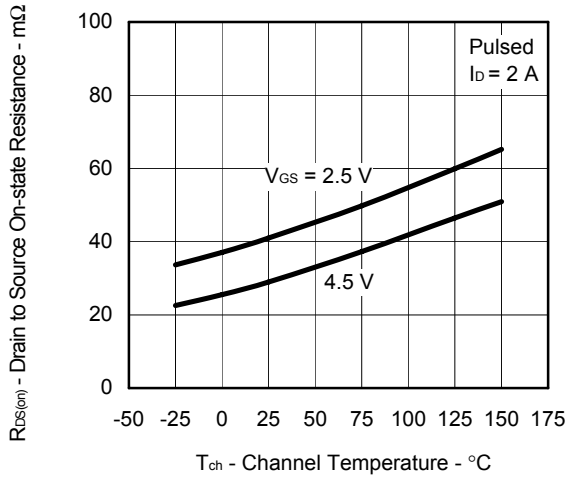


DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

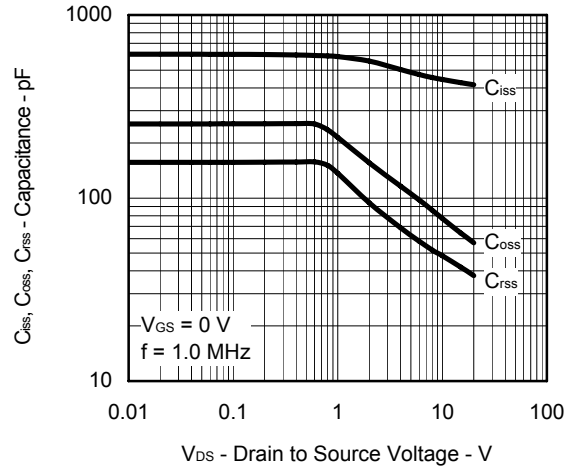




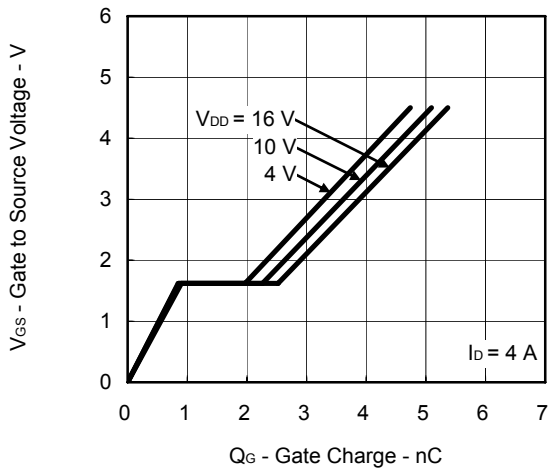
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



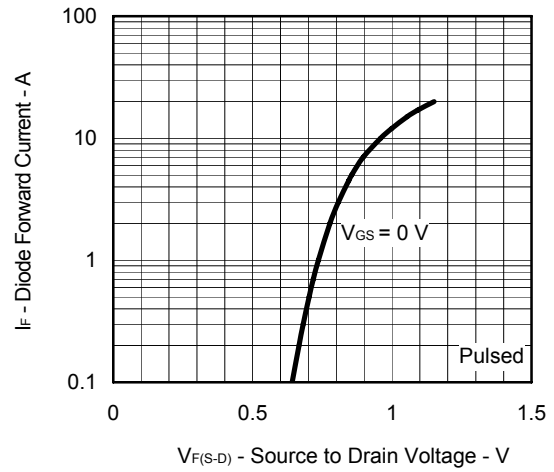
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



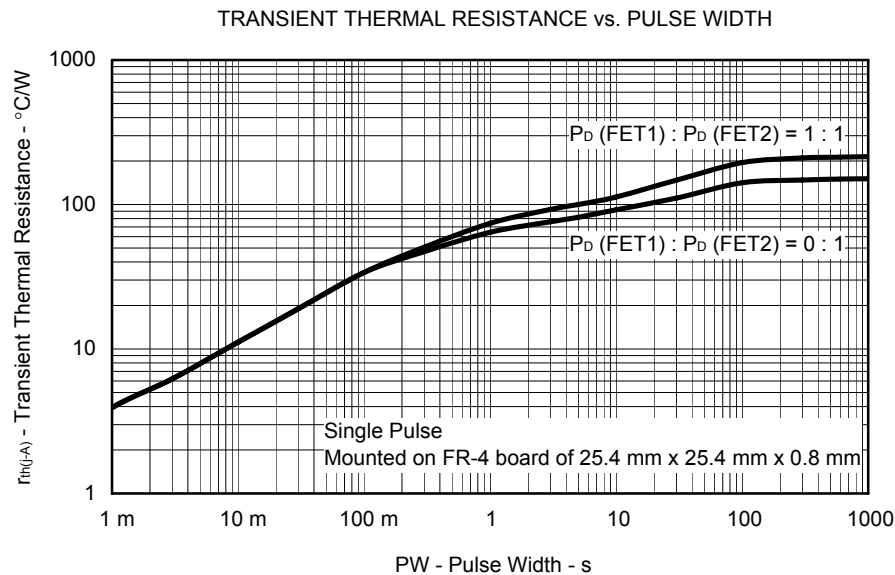
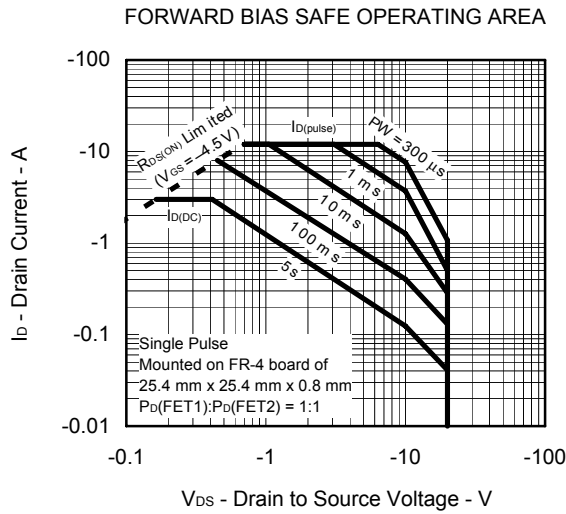
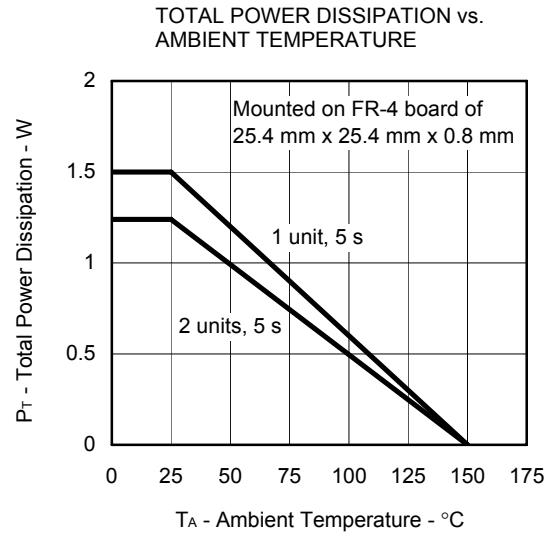
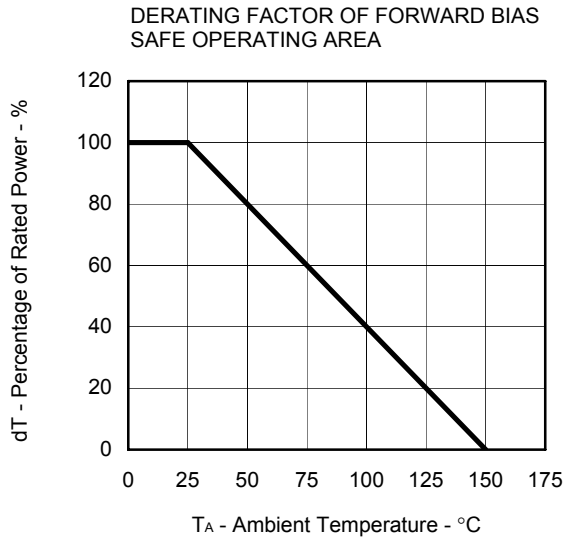
DYNAMIC INPUT CHARACTERISTICS



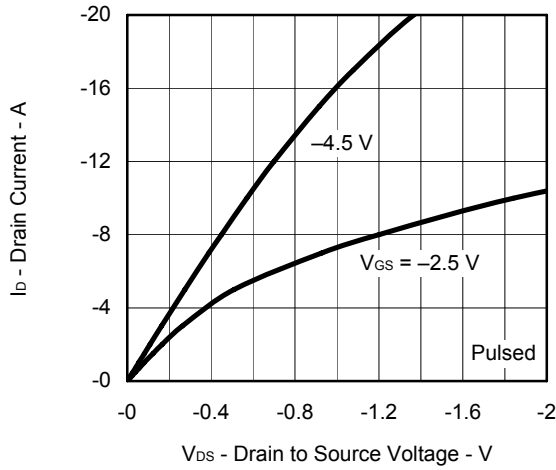
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



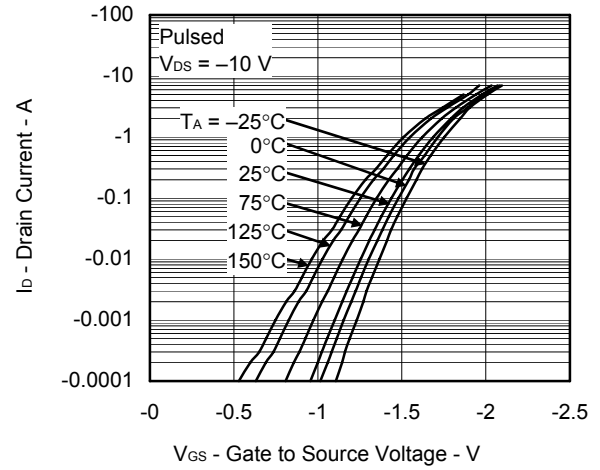
(2) P-channel MOSFET



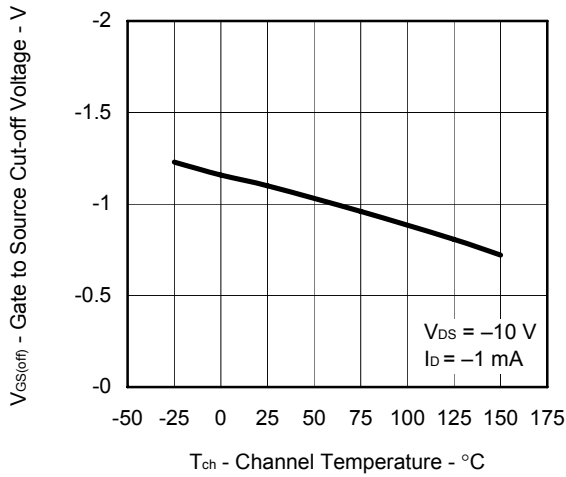
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



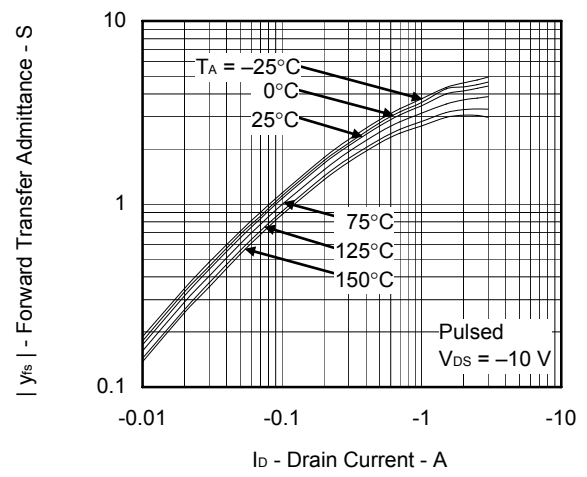
FORWARD TRANSFER CHARACTERISTICS



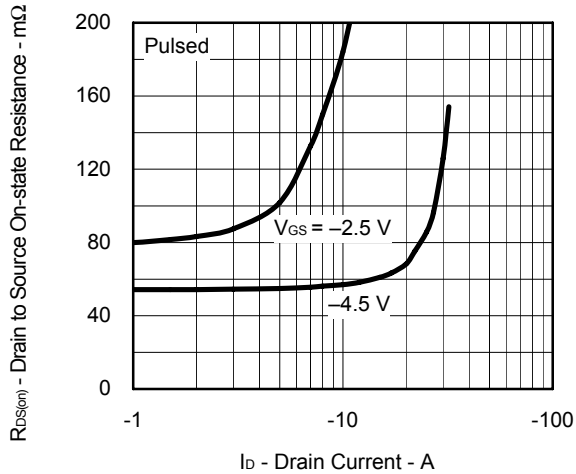
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



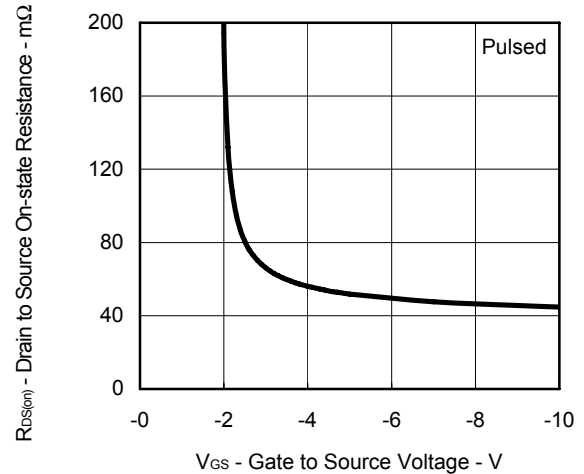
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



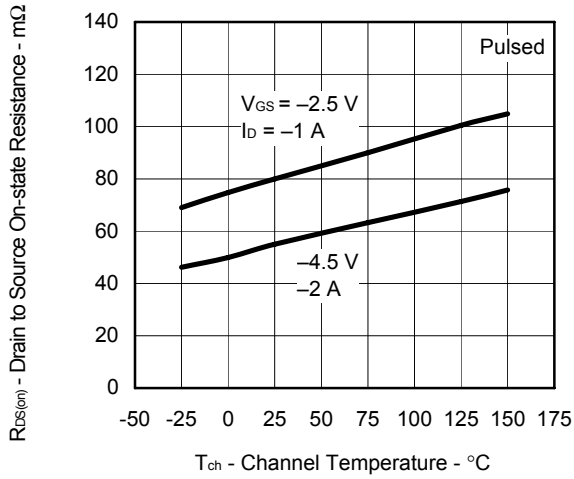
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



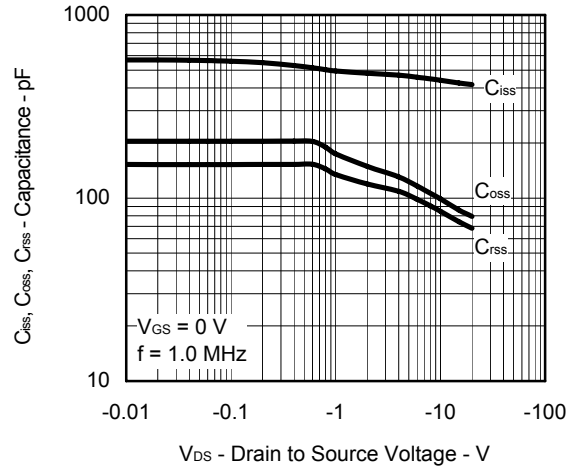
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



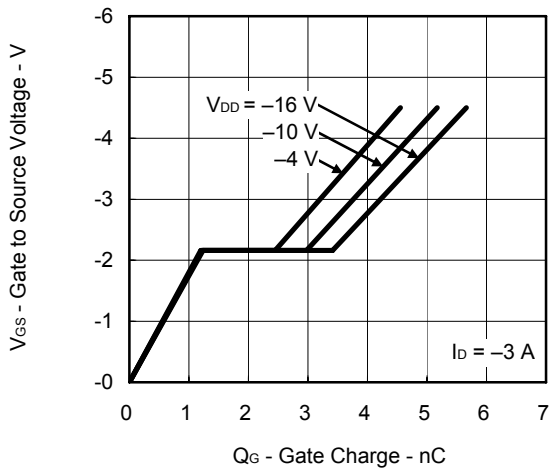
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



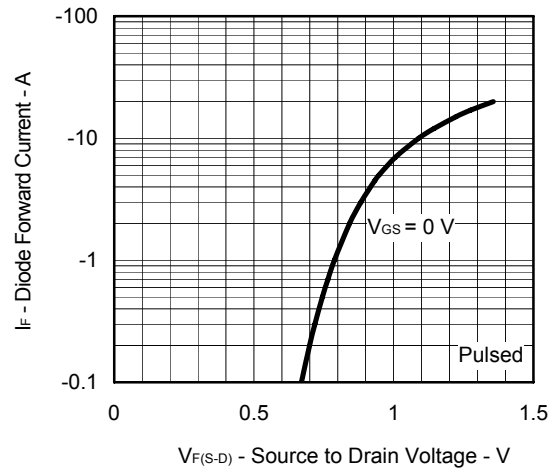
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



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