

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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N-CHANNEL MOS FIELD EFFECT TRANSISTOR  
 FOR SWITCHING

DESCRIPTION

The  $\mu$ PA1870B is a switching device which can be driven directly by a 2.5 V power source.

The  $\mu$ PA1870B 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  
 $R_{DS(on)1} = 16.0 \text{ m}\Omega \text{ TYP. (} V_{GS} = 4.5 \text{ V, } I_D = 3.0 \text{ A)}$   
 $R_{DS(on)2} = 16.5 \text{ m}\Omega \text{ TYP. (} V_{GS} = 4.0 \text{ V, } I_D = 3.0 \text{ A)}$   
 $R_{DS(on)3} = 20.0 \text{ m}\Omega \text{ TYP. (} V_{GS} = 2.5 \text{ V, } I_D = 3.0 \text{ A)}$
- Built-in G-S protection diode against ESD

ORDERING INFORMATION

PART NUMBER	PACKAGE
$\mu$ PA1870BGR-9JG	Power TSSOP8

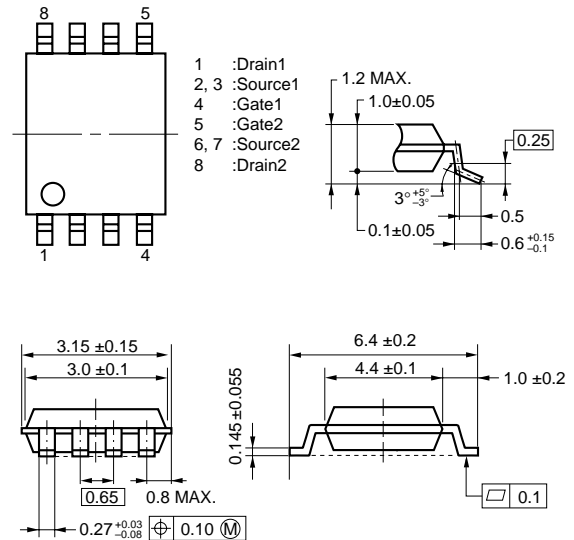
ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	20.0	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 12.0$	V
Drain Current (DC) <sup>Note 1</sup>	$I_{D(DC)}$	$\pm 6.0$	A
Drain Current (pulse) <sup>Note 2</sup>	$I_{D(pulse)}$	$\pm 80.0$	A
Total Power Dissipation <sup>Note 1</sup>	$P_T$	2.0	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

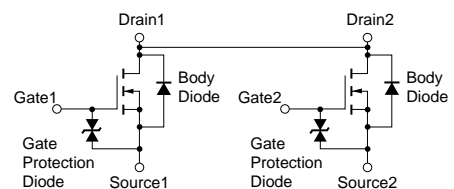
- Notes 1.** Mounted on ceramic substrate of  $50 \text{ cm}^2 \times 1.1 \text{ mm}$   
**2.**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

**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.

PACKAGE DRAWING (Unit: mm)



EQUIVALENT CIRCUIT



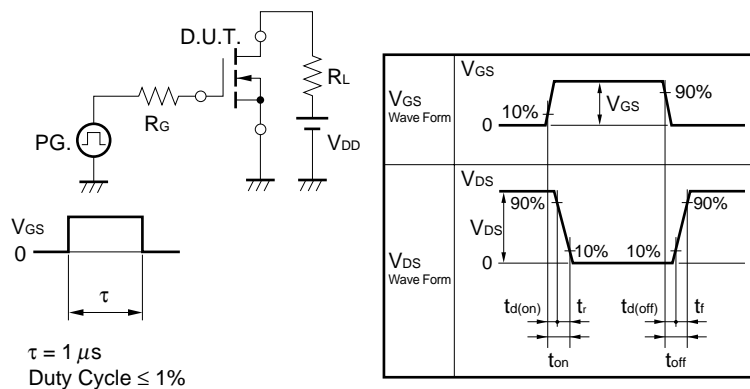
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**ELECTRICAL CHARACTERISTICS (TA = 25°C)**

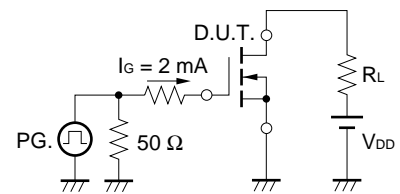
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20.0 V, V <sub>GS</sub> = 0 V			1.0	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±12.0 V, V <sub>DS</sub> = 0 V			±10.0	μA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10.0 V, I <sub>D</sub> = 1.0 mA	0.5	1.0	1.5	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = 10.0 V, I <sub>D</sub> = 3.0 A	5			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> = 3.0 A	12.0	16.0	20.0	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 3.0 A	13.0	16.5	21.0	mΩ
	R <sub>DS(on)3</sub>	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 3.0 A	15.0	20.0	27.0	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10.0 V		720		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		166		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1.0 MHz		125		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10.0 V, I <sub>D</sub> = 3.0 A		48		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 4.0 V		245		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		315		ns
Fall Time	t <sub>f</sub>			305		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 16.0 V		8.0		nC
Gate to Source Charge	Q <sub>GS</sub>	I <sub>D</sub> = 6.0 A		1.7		nC
Gate to Drain Charge	Q <sub>GD</sub>	V <sub>GS</sub> = 4.0 V		3.5		nC
Body Diode Forward Voltage <sup>Note</sup>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 6.0 A, V <sub>GS</sub> = 0 V		0.8		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 6.0 A, V <sub>GS</sub> = 0 V		295		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 50 A/μs		450		nC

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

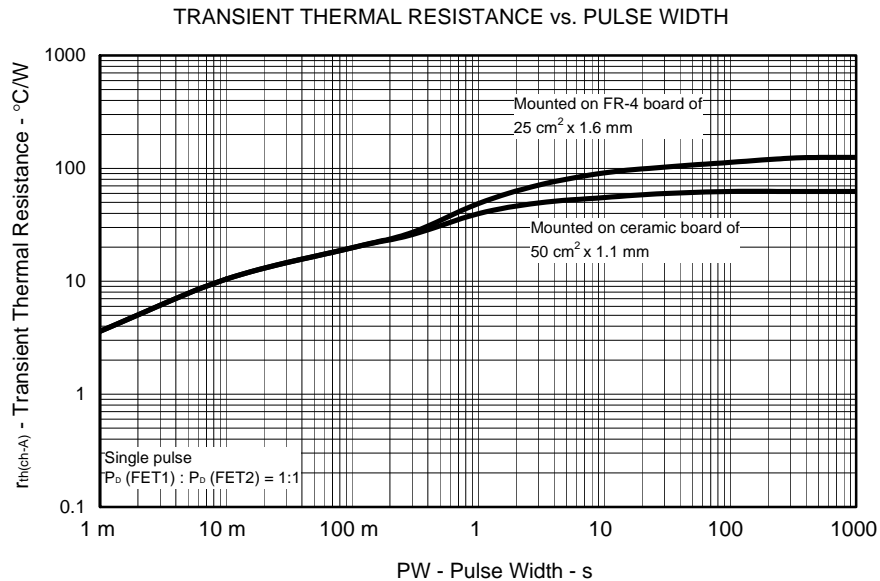
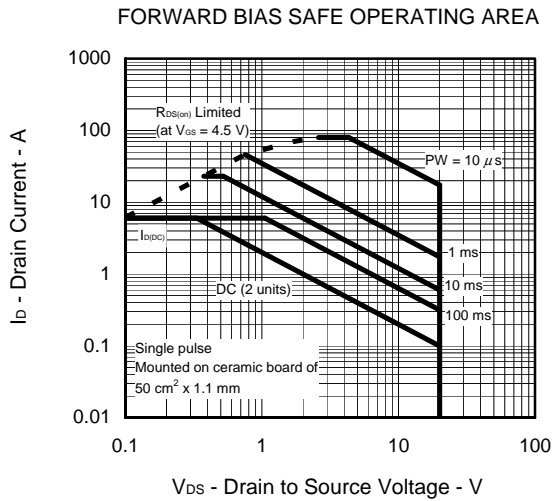
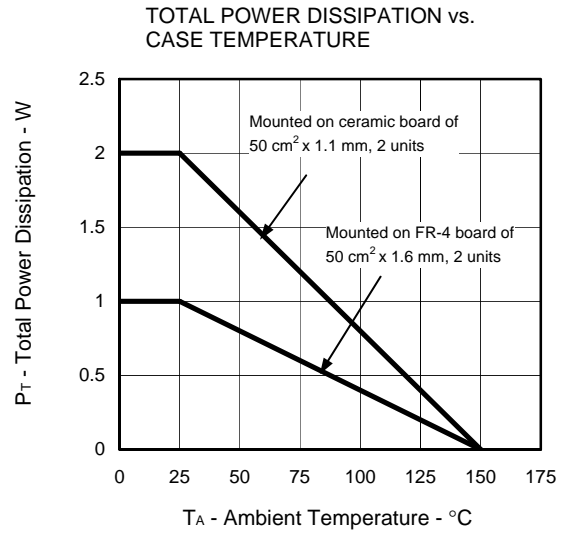
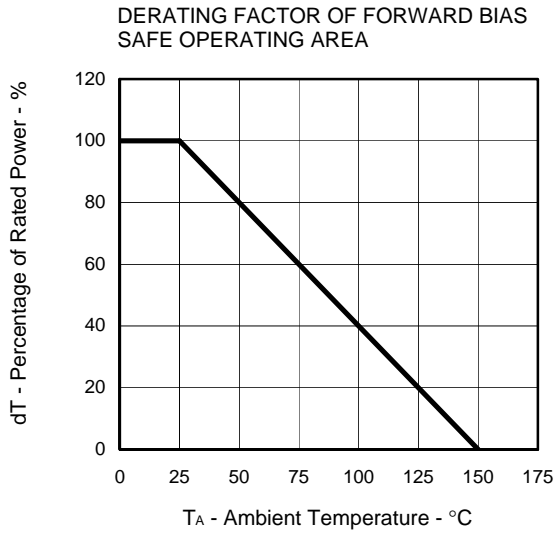
**TEST CIRCUIT 1 SWITCHING TIME**



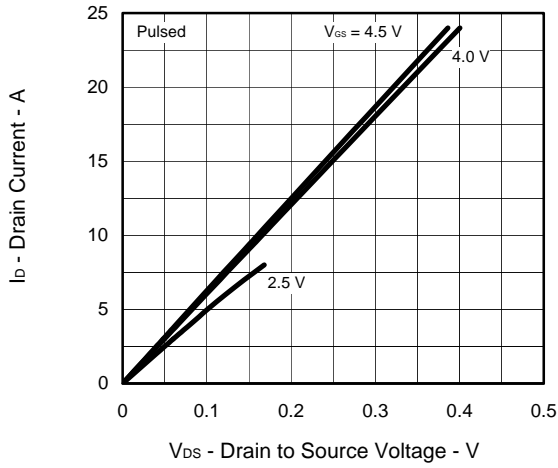
**TEST CIRCUIT 2 GATE CHARGE**



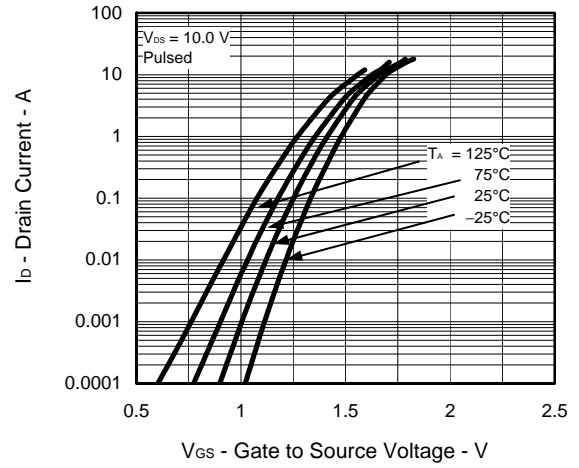
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



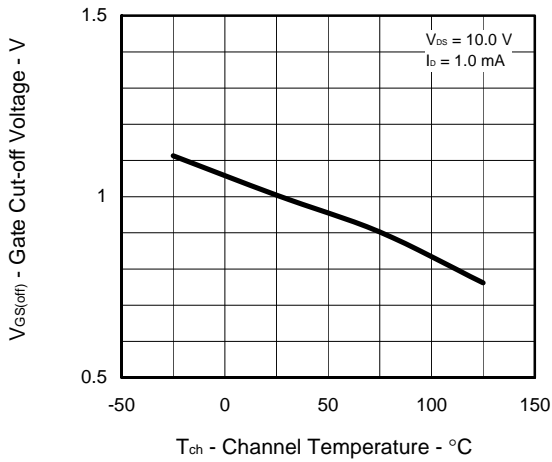
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



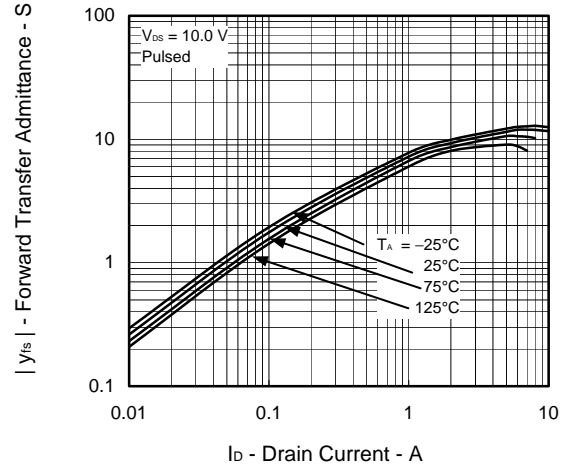
FORWARD TRANSFER CHARACTERISTICS



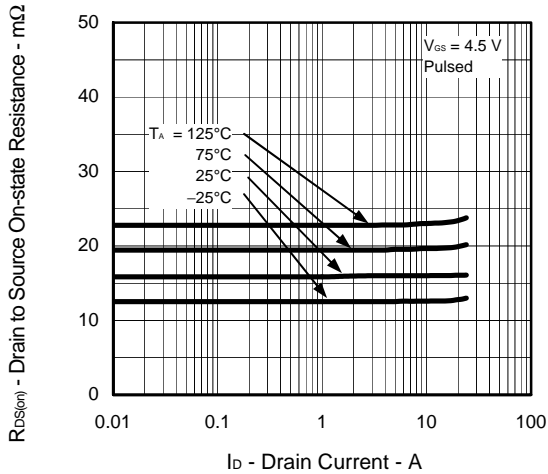
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



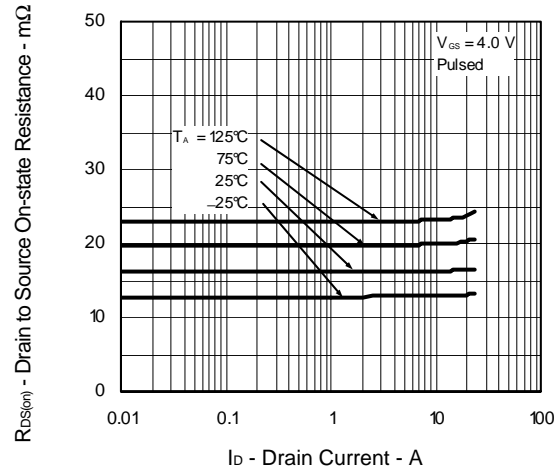
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



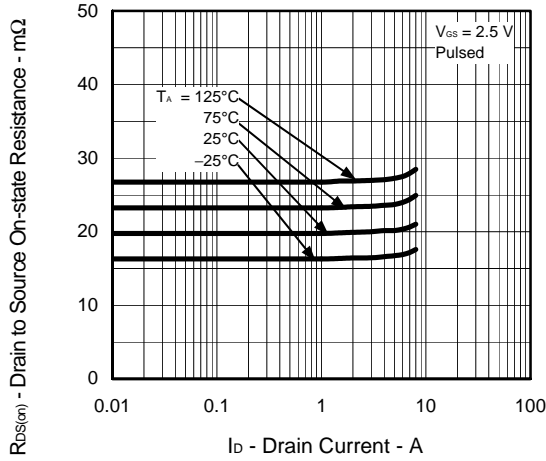
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



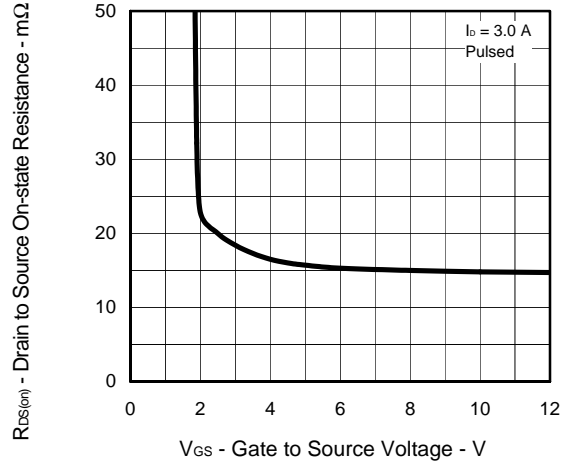
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



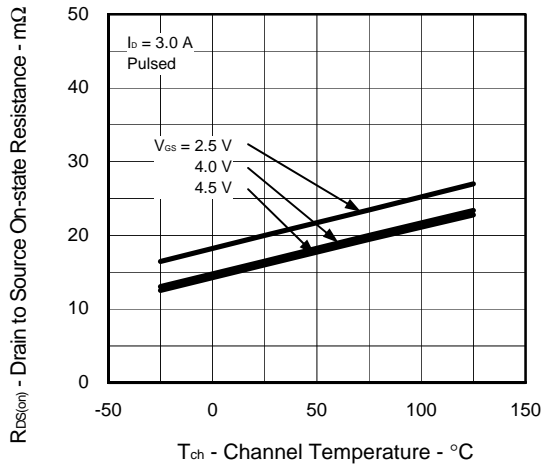
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



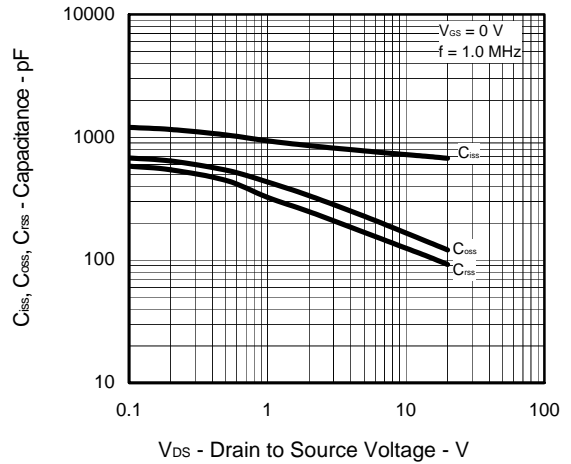
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



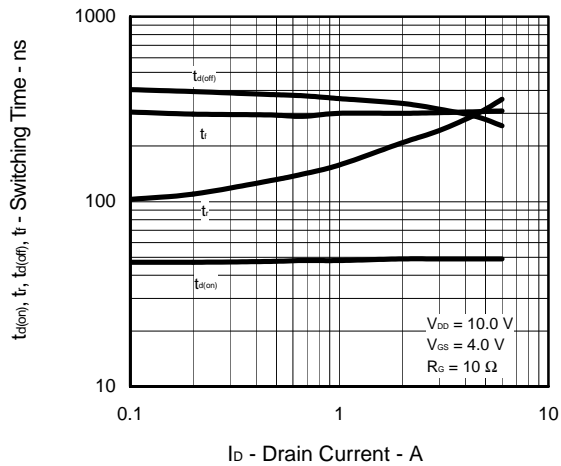
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



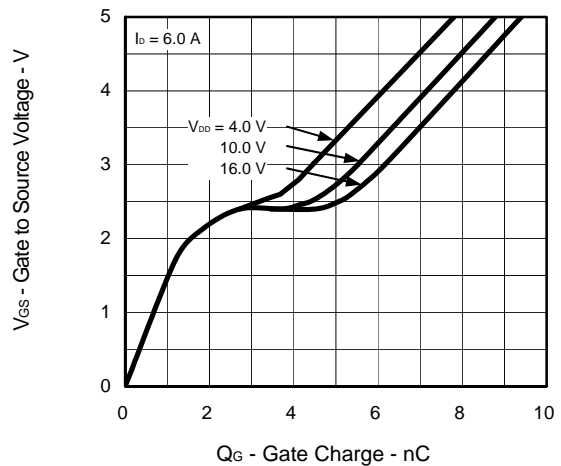
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

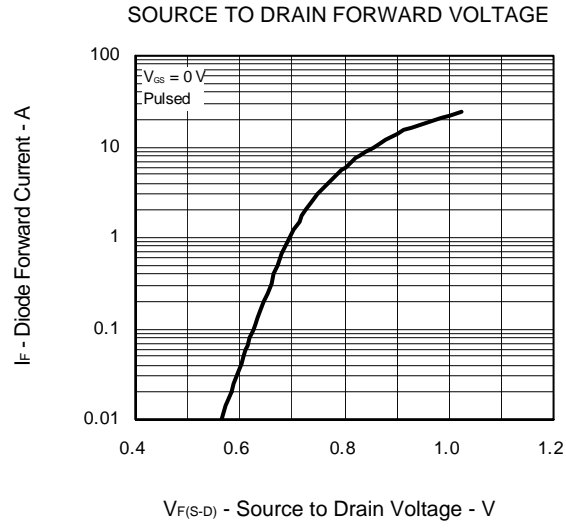


SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS







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