

## N-CHANNEL MOS FIELD EFFECT TRANSISTOR FOR SWITCHING

### DESCRIPTION

The  $\mu$  PA2503, which has a heat spreader, is N-channel MOS Field Effect Transistor designed for power management applications of notebook computers.

### FEATURES

- $\mu$  PA2503 has a thin surface mount package with a heat spreader. The land size is same as 8-pin TSSOP.
- Low on-state resistance  
 $R_{DS(on)1} = 9.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10.0 \text{ V, } I_D = 8.0 \text{ A)}$   
 $R_{DS(on)2} = 15.1 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 8.0 \text{ A)}$
- Low  $C_{iss}$ : 1200 pF TYP. ( $V_{DS} = 10.0 \text{ V, } V_{GS} = 0 \text{ V}$ )

### ORDERING INFORMATION

PART NUMBER	PACKAGE
$\mu$ PA2503TM	8PIN HWSOP

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

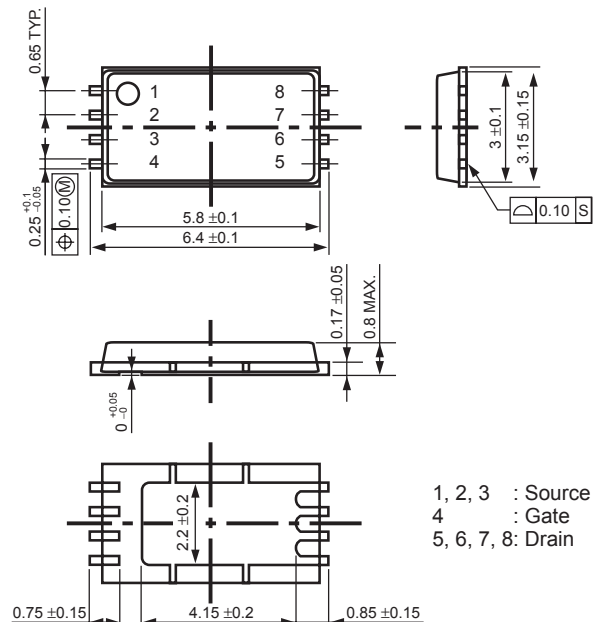
Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	30.0	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20.0$	V
Drain Current (DC) <sup>Note1</sup>	$I_{D(DC)}$	$\pm 16.0$	A
Drain Current (pulse) <sup>Note2</sup>	$I_{D(pulse)}$	$\pm 64.0$	A
Total Power Dissipation <sup>Note1</sup>	$P_T$	2.7	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	$-55 \text{ to } +150$	$^\circ\text{C}$
Single Avalanche Current <sup>Note3</sup>	$I_{AS}$	16.0	A
Single Avalanche Energy <sup>Note3</sup>	$E_{AS}$	25.6	mJ

- Notes**
1. Mounted on FR-4 board of  $25 \text{ cm}^2 \times 1.6 \text{ mm}$ ,  $PW \leq 10 \text{ sec}$
  2.  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$
  3. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 30 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20.0 \rightarrow 0 \text{ V}$

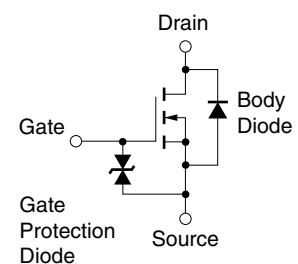
**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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### PACKAGE DRAWING (Unit: mm)



### EQUIVALENT CIRCUIT

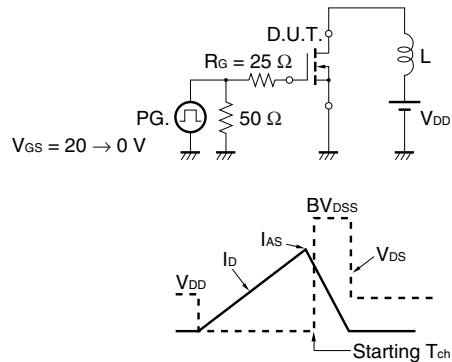


# ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

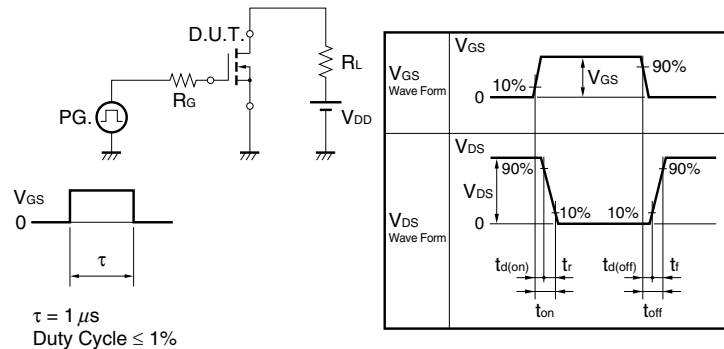
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 30.0 V, V <sub>GS</sub> = 0 V			1.0	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±18.0 V, V <sub>DS</sub> = 0 V			±10.0	μA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10.0 V, I <sub>D</sub> = 1.0 mA	1.5		2.5	V
Forward Transfer Admittance <b>Note</b>	y <sub>fs</sub>	V <sub>DS</sub> = 10.0 V, I <sub>D</sub> = 8.0 A	5			S
Drain to Source On-state Resistance <b>Note</b>	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10.0 V, I <sub>D</sub> = 8.0 A		7.5	9.5	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 8.0 A		11.0	15.1	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10.0 V		1200		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		320		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1.0 MHz		190		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15.0 V, I <sub>D</sub> = 8.0 A		12		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10.0 V		17		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		52		ns
Fall Time	t <sub>f</sub>			15		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 15.0 V		15		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 5.0 V		4		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 16.0 A		7		nC
Body Diode Forward Voltage <b>Note</b>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 16.0 A, V <sub>GS</sub> = 0 V		0.84		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 16.0 A, V <sub>GS</sub> = 0 V		28		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		18		nC

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

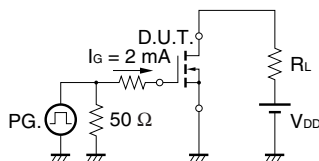
## TEST CIRCUIT 1 AVALANCHE CAPABILITY



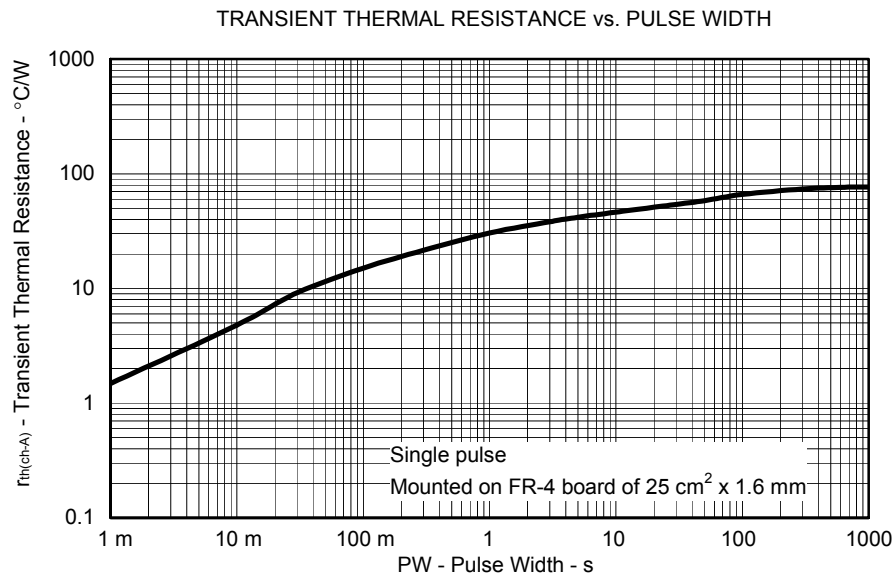
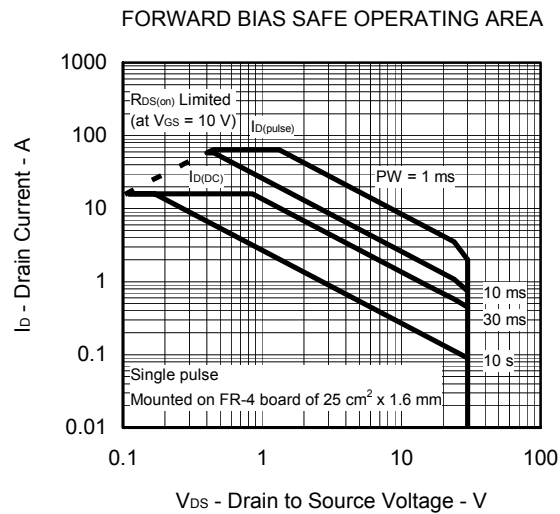
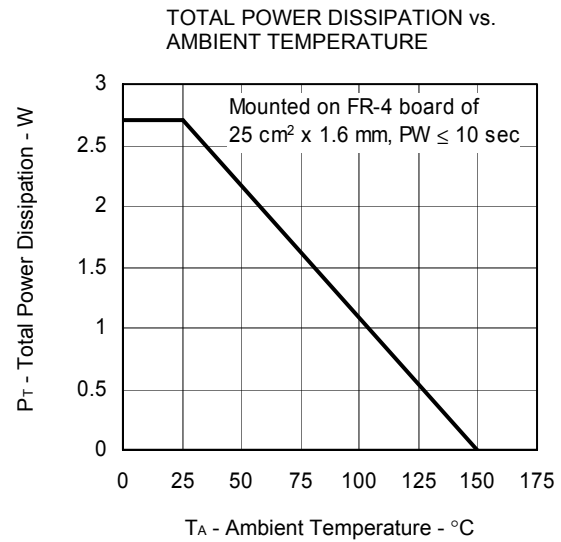
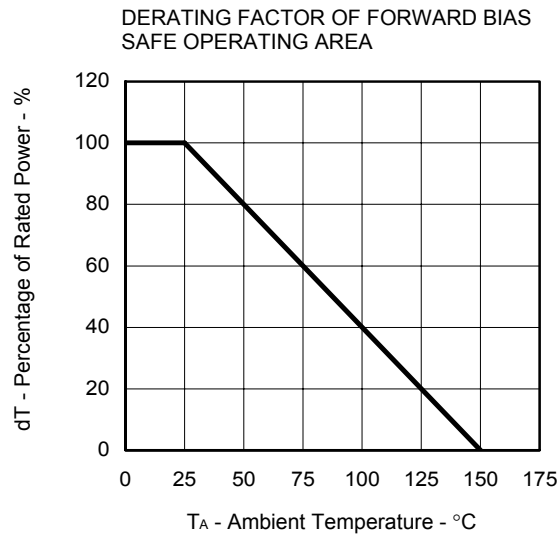
## TEST CIRCUIT 2 SWITCHING TIME



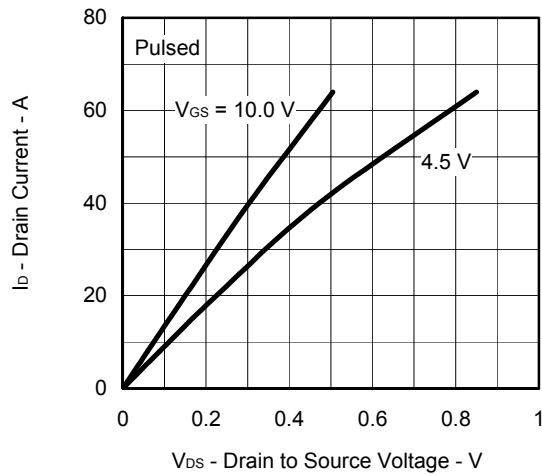
## TEST CIRCUIT 3 GATE CHARGE



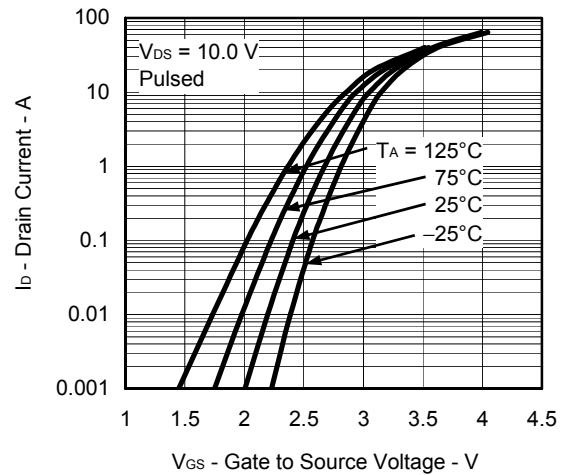
TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



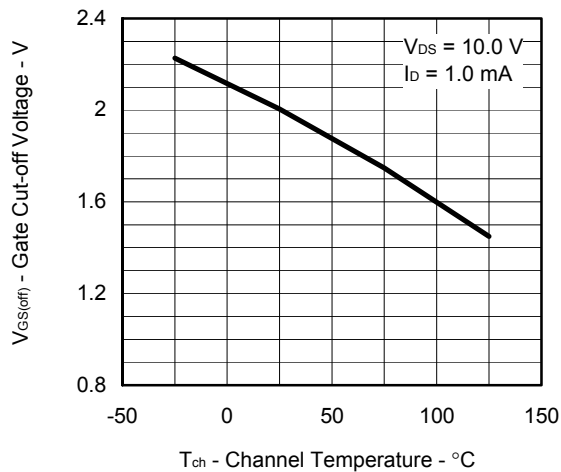
DRAIN CURRENT vs.  
DRAIN TO SOURCE VOLTAGE



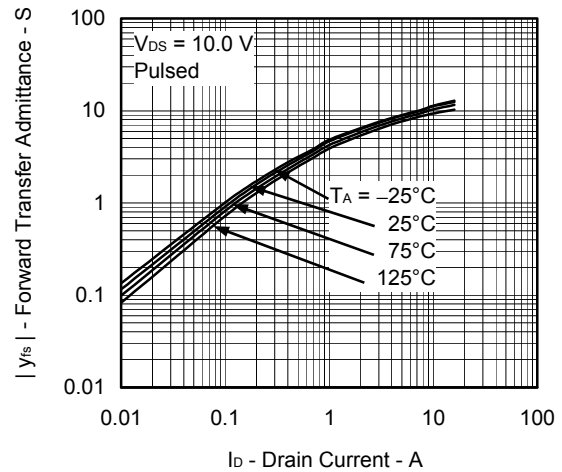
FORWARD TRANSFER CHARACTERISTICS



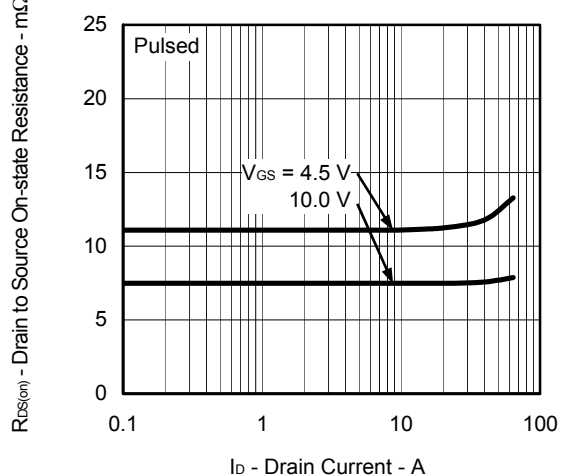
GATE CUT-OFF VOLTAGE vs.  
CHANNEL TEMPERATURE



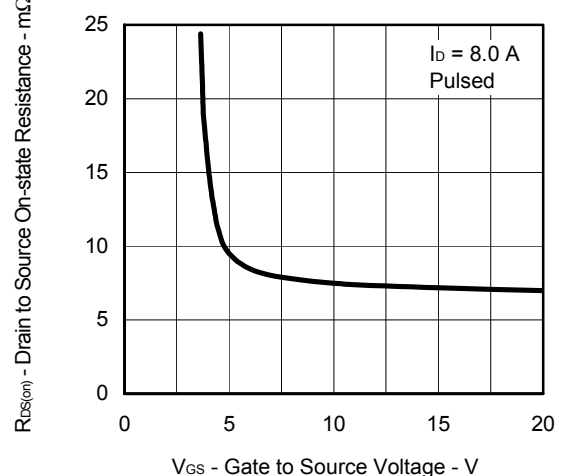
FORWARD TRANSFER ADMITTANCE vs.  
DRAIN CURRENT



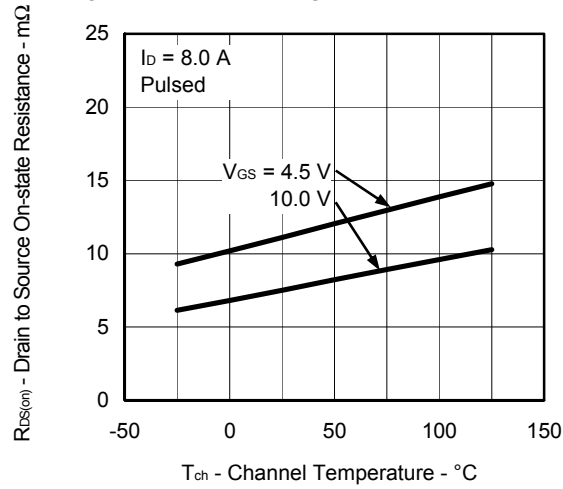
DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
DRAIN CURRENT



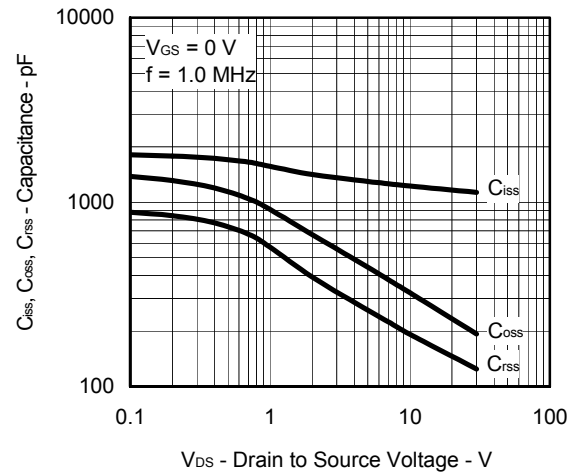
DRAIN TO SOURCE ON-STATE RESISTANCE vs.  
GATE TO SOURCE VOLTAGE



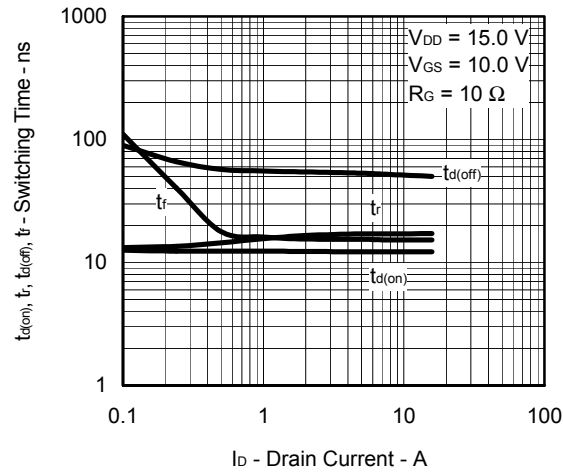
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



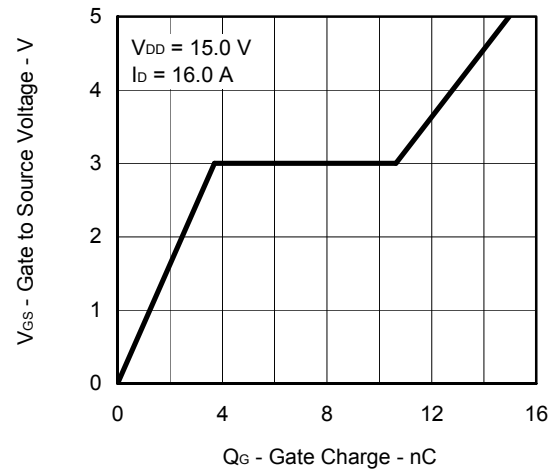
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



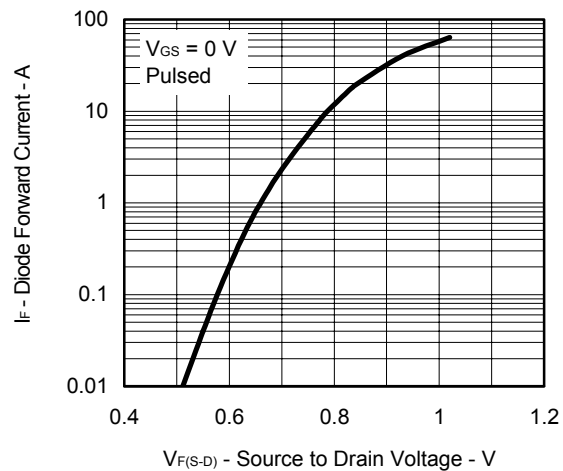
SWITCHING CHARACTERISTICS



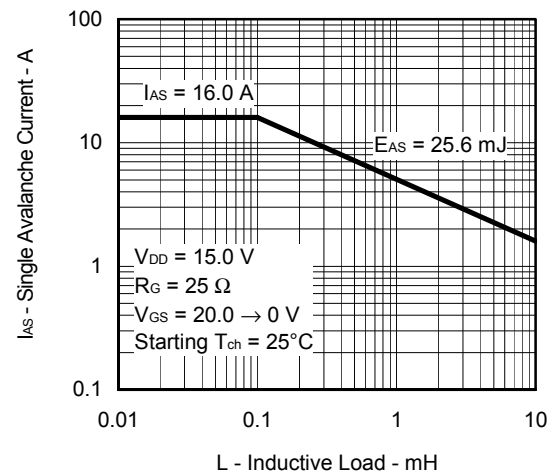
DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

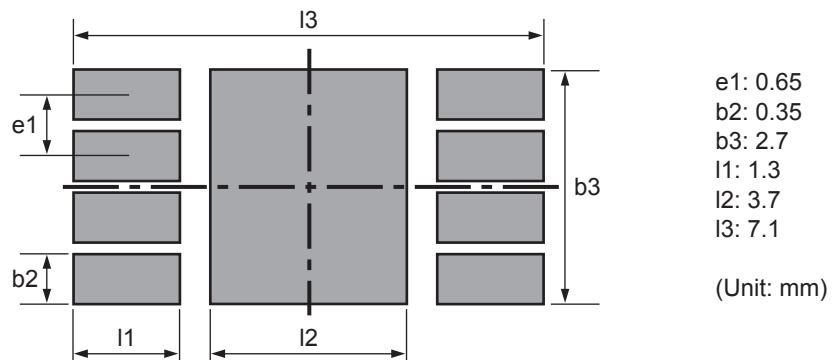


SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



## EXAMPLE OF THE LAND PATTERN

Please optimize the land pattern in consideration of density, appearance of solder fillets, common difference, etc in an actual design.



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