

$V_{DSS}$	100V
$R_{DS(on)}$ (Max.)	27m $\Omega$
$I_D$	40A
$P_D$	50W

### ●Features

- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Drive circuits can be simple.
- 4) Parallel use is easy.
- 5) Pb-free lead plating ; RoHS compliant
- 6) 100% Avalanche tested

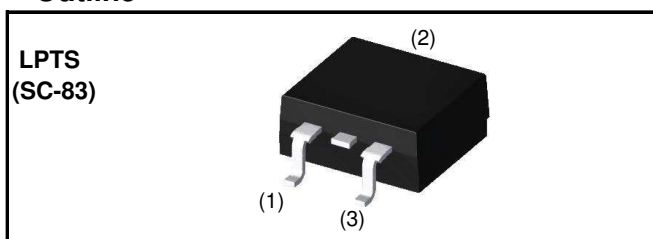
### ●Application

Switching Power Supply  
Automotive Motor Drive  
Automotive Solenoid Drive

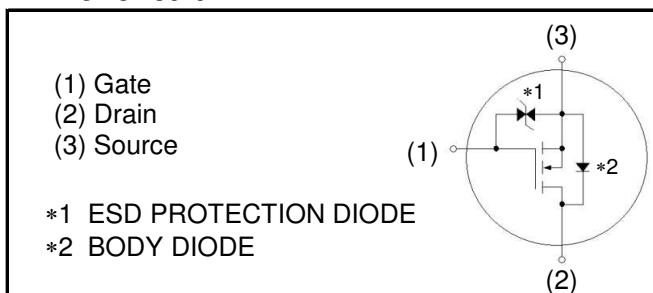
### ●Absolute maximum ratings( $T_a = 25^\circ\text{C}$ )

Parameter		Symbol	Value	Unit
Drain - Source voltage		$V_{DSS}$	100	V
Continuous drain current	$T_c = 25^\circ\text{C}$	$I_D^{*1}$	$\pm 40$	A
	$T_c = 100^\circ\text{C}$	$I_D^{*1}$	$\pm 22$	A
Pulsed drain current		$I_{D,pulse}^{*2}$	$\pm 80$	A
Gate - Source voltage		$V_{GSS}$	$\pm 20$	V
Avalanche energy, single pulse		$E_{AS}^{*3}$	14.6	mJ
Avalanche current		$I_{AR}^{*3}$	10	A
Power dissipation	$T_c = 25^\circ\text{C}$	$P_D$	50	W
	$T_a = 25^\circ\text{C}^{*4}$	$P_D$	1.35	W
Junction temperature		$T_j$	150	$^\circ\text{C}$
Range of storage temperature		$T_{stg}$	-55 to +150	$^\circ\text{C}$

### ●Outline



### ●Inner circuit



### ●Packaging specifications

Type	Packaging	Taping
	Reel size (mm)	330
	Tape width (mm)	16
	Basic ordering unit (pcs)	2,500
	Taping code	TL
	Marking	RSJ400N10

### ●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	$R_{thJC}$	-	-	2.5	°C/W
Thermal resistance, junction - ambient *4	$R_{thJA}$	-	-	92.6	°C/W
Soldering temperature, wavesoldering for 10s	$T_{sold}$	-	-	265	°C

### ●Electrical characteristics( $T_a = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	100	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 100V, V_{GS} = 0V$ $T_j = 25^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 100V, V_{GS} = 0V$ $T_j = 125^\circ\text{C}$	-	-	100	
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 10$	$\mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	1.0	-	2.5	V
Static drain - source on - state resistance	$R_{DS(on)}$ *5	$V_{GS} = 10V, I_D = 40A$	-	19	27	$m\Omega$
		$V_{GS} = 4.0V, I_D = 40A$	-	21	30	
		$V_{GS} = 10V, I_D = 40A$ $T_j = 125^\circ\text{C}$	-	42	60	
Forward transfer admittance	$g_{fs}$	$V_{DS} = 10V, I_D = 40A$	23	56	-	S

**●Electrical characteristics**( $T_a = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	$C_{iss}$	$V_{GS} = 0V$	-	3600	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 25V$	-	270	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	180	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} \approx 50V, V_{GS} = 10V$	-	25	-	ns
Rise time	$t_r^{*5}$	$I_D = 20A$	-	80	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_L = 12\Omega$	-	205	-	
Fall time	$t_f^{*5}$	$R_G = 10\Omega$	-	250	-	

**●Gate Charge characteristics**( $T_a = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_g^{*5}$	$V_{DD} \approx 50V$	-	90	-	nC
Gate - Source charge	$Q_{gs}^{*5}$	$I_D = 40A$	-	12	-	
Gate - Drain charge	$Q_{gd}^{*5}$	$V_{GS} = 10V$	-	18	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 50V, I_D = 40A$	-	3.1	-	V

**●Body diode electrical characteristics (Source-Drain)**( $T_a = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous source current	$I_S^{*1}$	$T_c = 25^\circ\text{C}$	-	-	40	A
Pulsed source current	$I_{SM}^{*2}$		-	-	80	A
Forward voltage	$V_{SD}^{*5}$	$V_{GS} = 0V, I_S = 40A$	-	-	1.5	V
Reverse recovery time	$t_{rr}^{*5}$	$I_S = 40A$	-	66	-	ns
Reverse recovery charge	$Q_{rr}^{*5}$	$di/dt = 100A/\mu\text{s}$	-	100	-	$\mu\text{C}$

\*1 Limited only by maximum temperature allowed.

\*2  $P_w \leq 10\mu\text{s}$ , Duty cycle  $\leq 1\%$

\*3  $L \approx 200\mu\text{H}$ ,  $V_{DD} = 50V$ ,  $R_g = 10\Omega$ , starting  $T_j = 25^\circ\text{C}$

\*4 Mounted on a epoxy PCB FR4 (27mm × 25mm × 0.8mm)

\*5 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

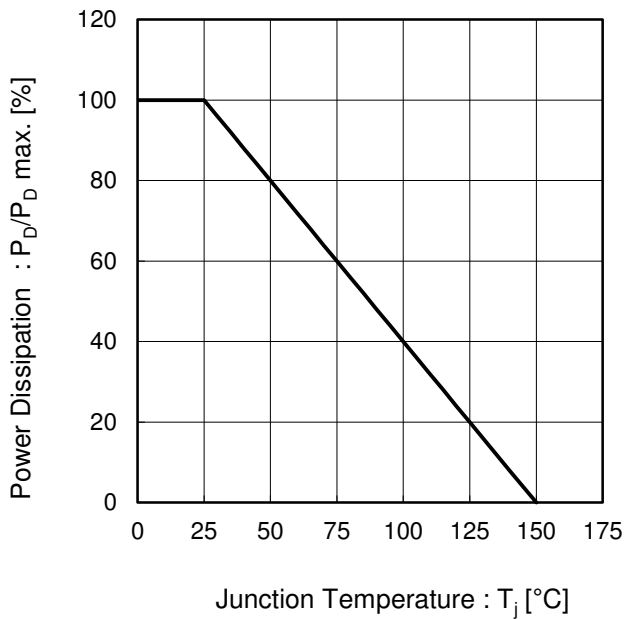


Fig.2 Maximum Safe Operating Area

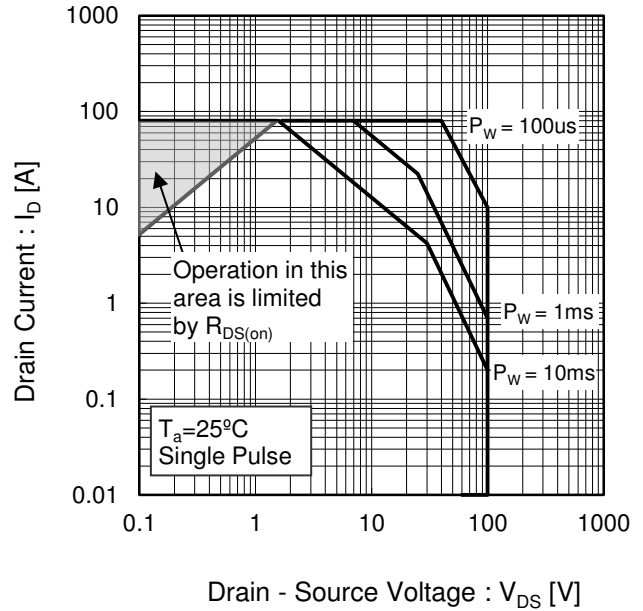
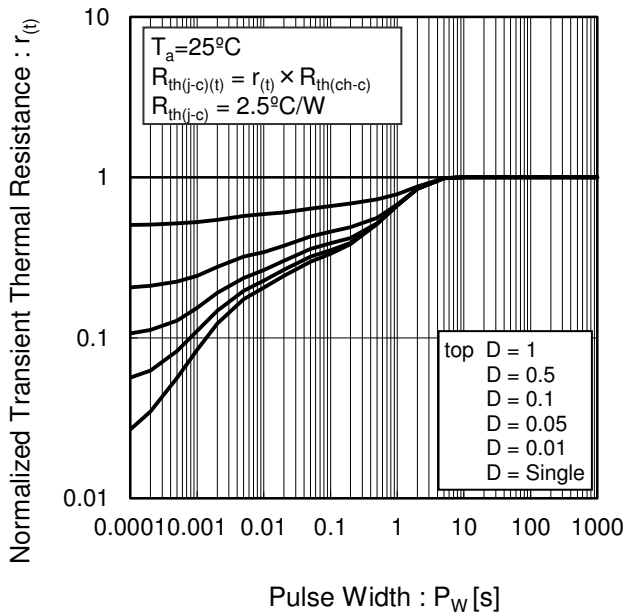


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

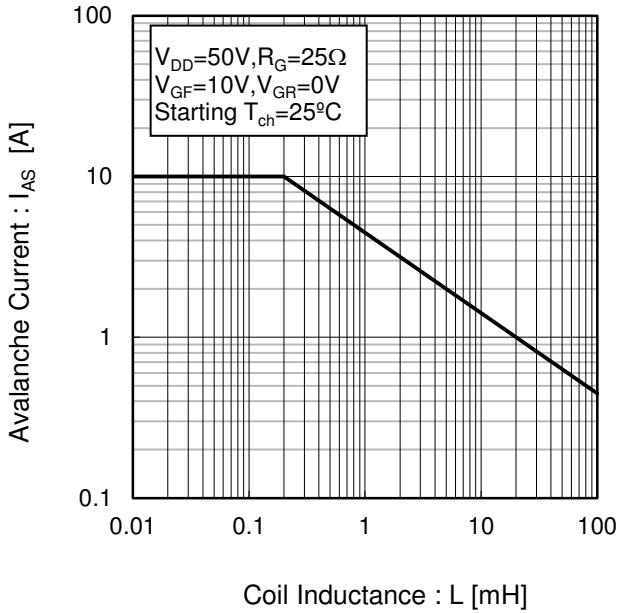


Fig.5 Avalanche Energy Derating Curve vs Junction Temperature

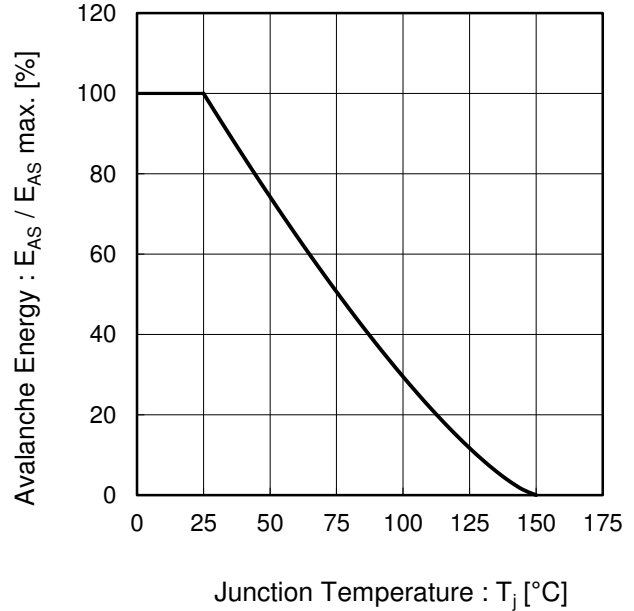


Fig.6 Typical Output Characteristics(I)

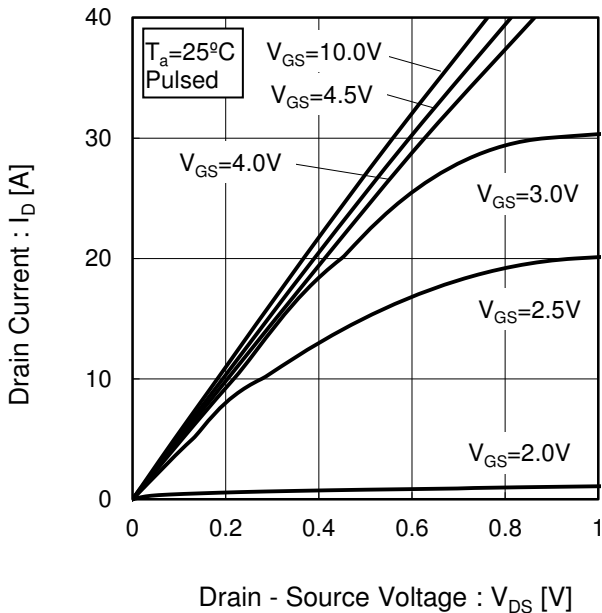
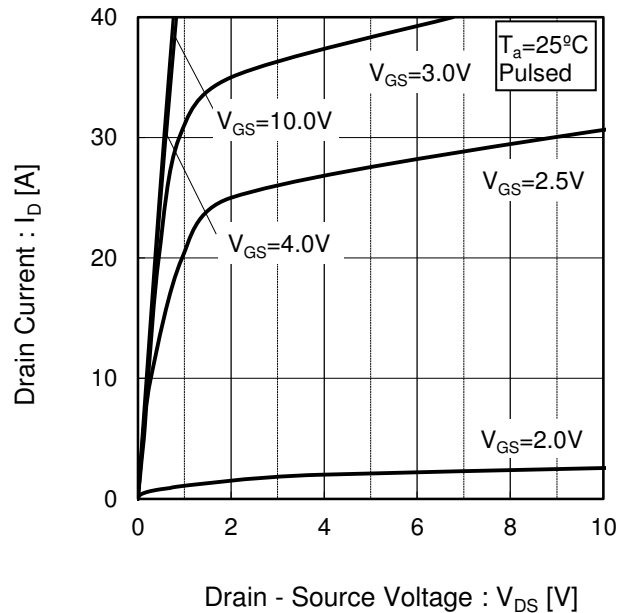


Fig.7 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Breakdown Voltage vs. Junction Temperature

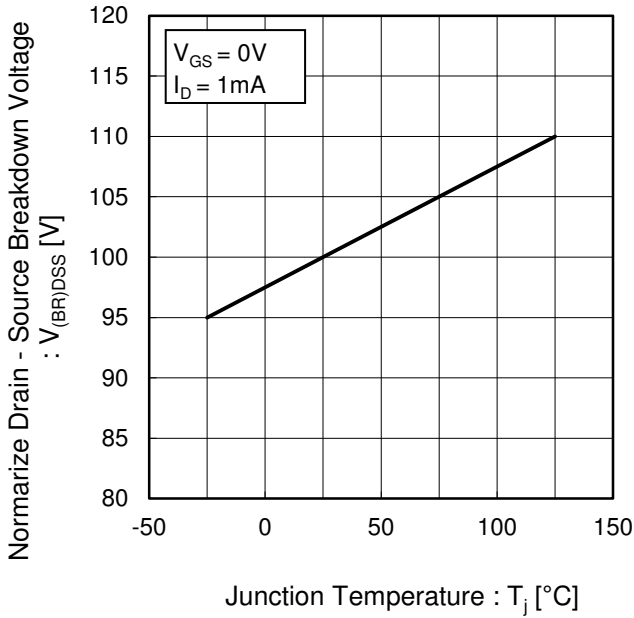


Fig.9 Typical Transfer Characteristics

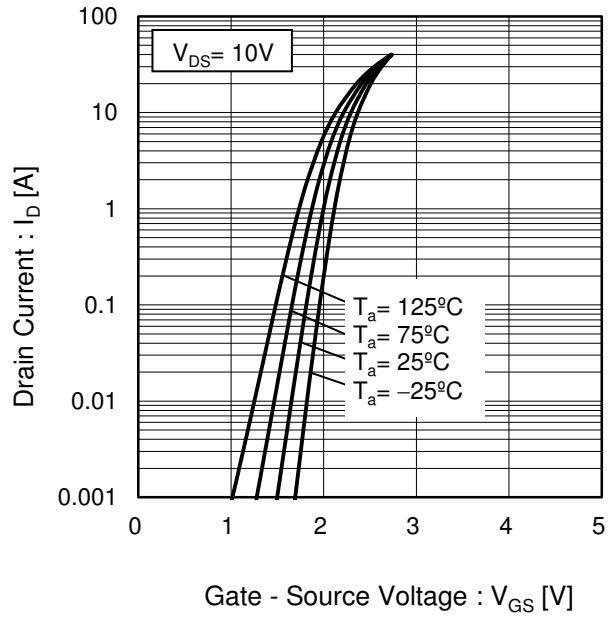


Fig.10 Gate Threshold Voltage vs. Junction Temperature

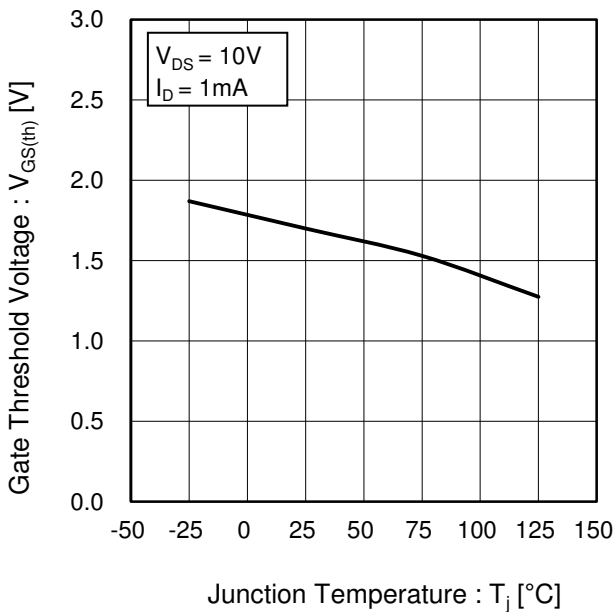
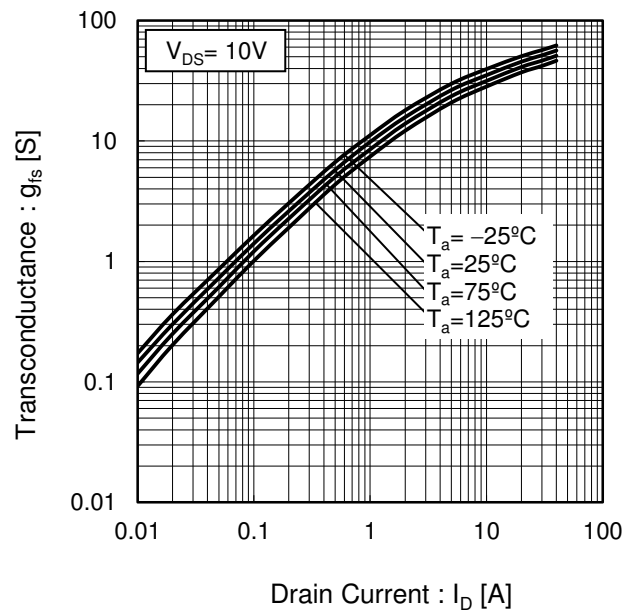


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

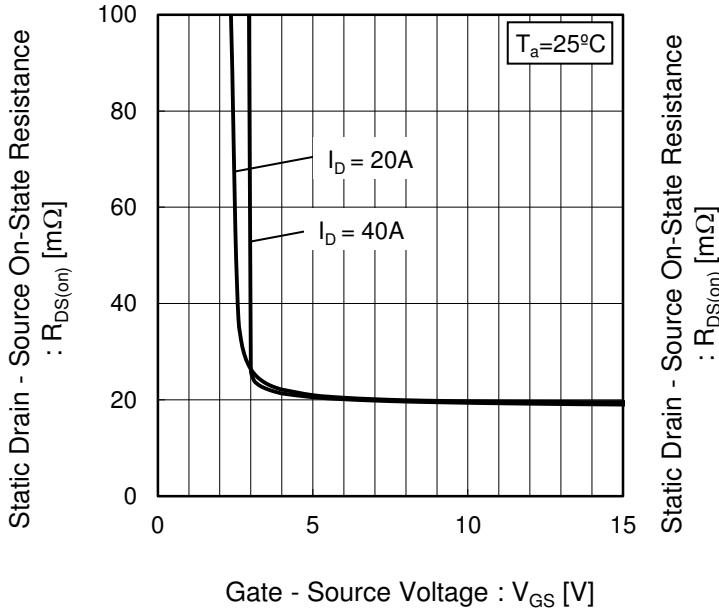


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(I)

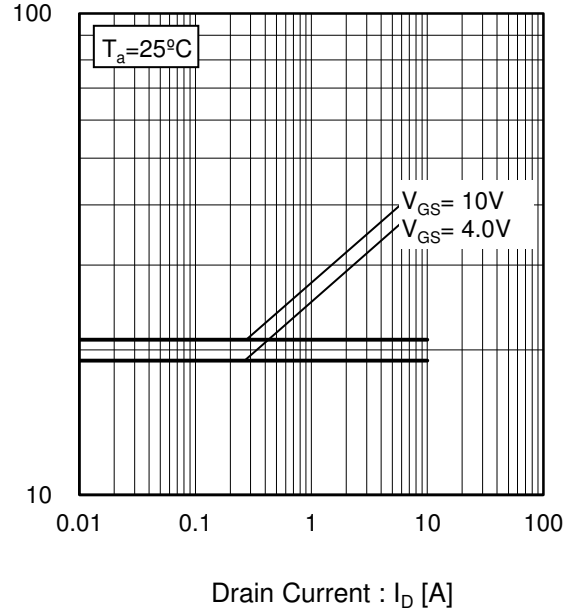
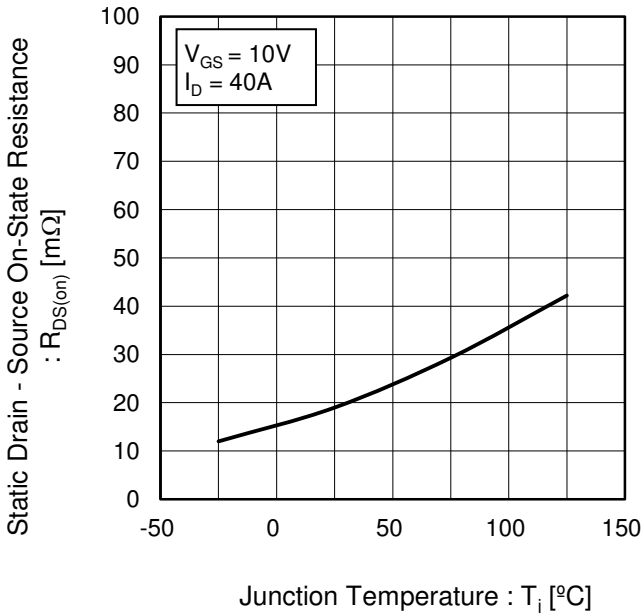


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

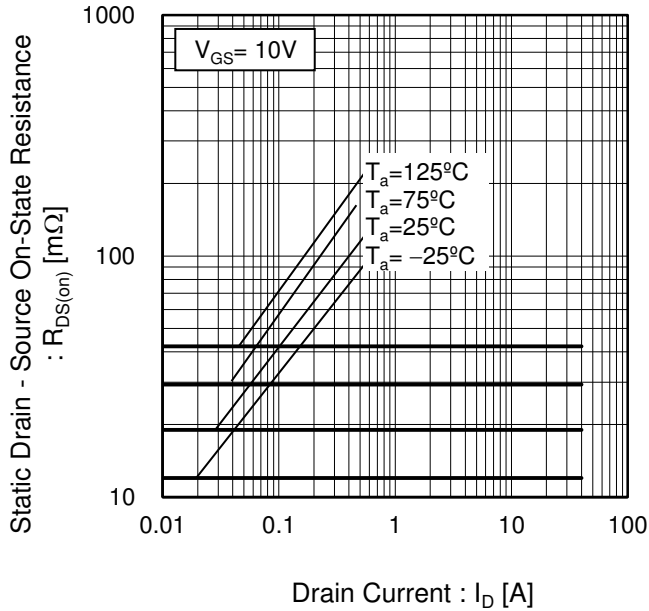


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)

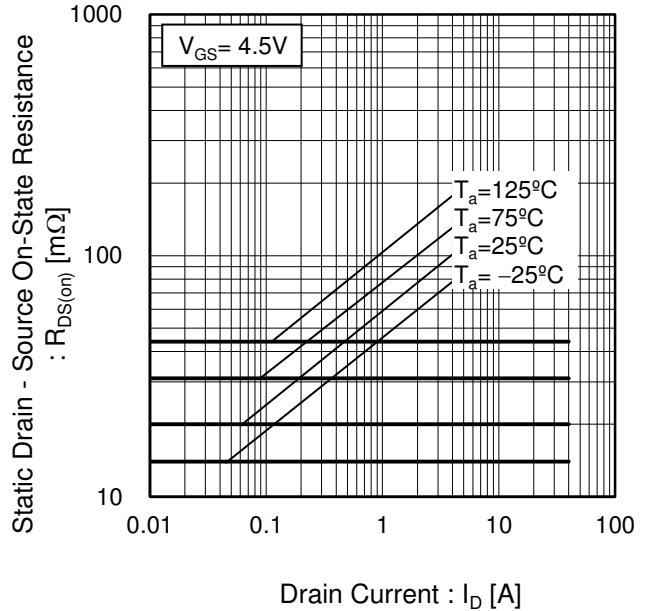


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)

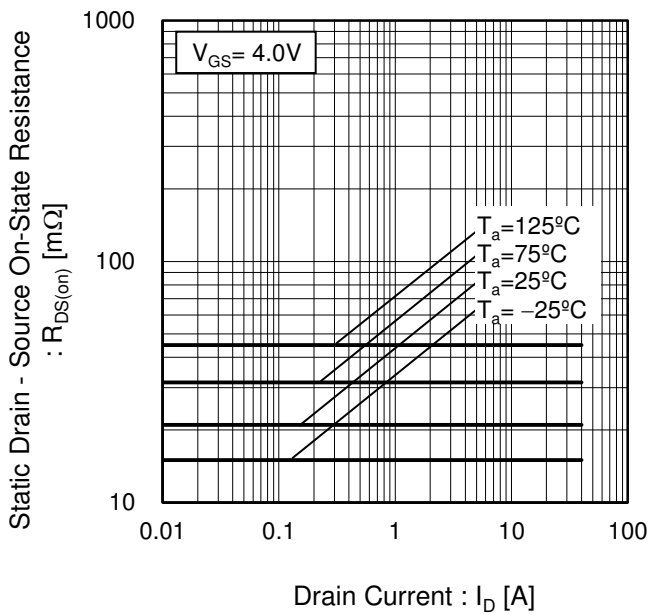
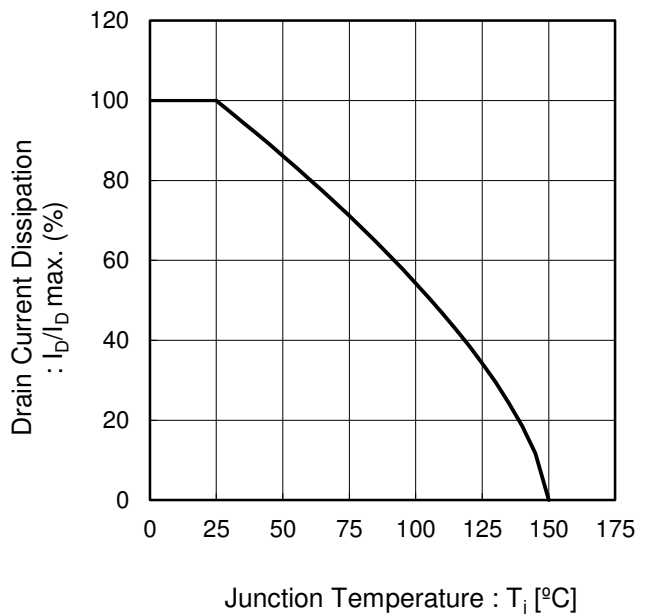


Fig.18 Drain Current Derating Curve





●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

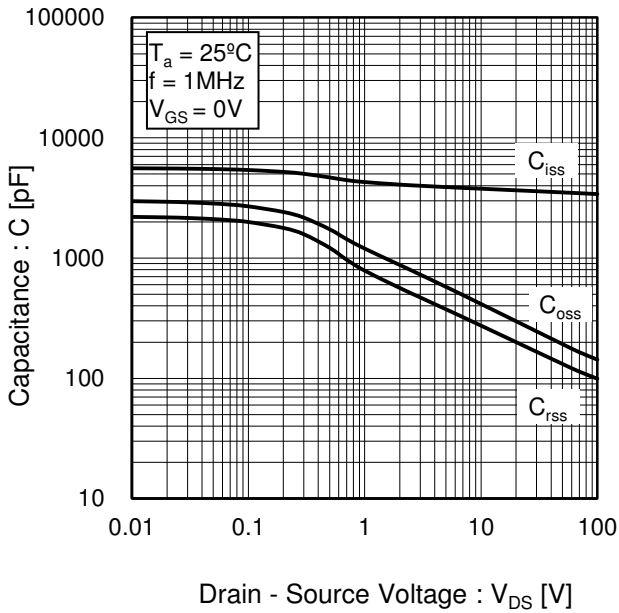


Fig.20 Switching Characteristics

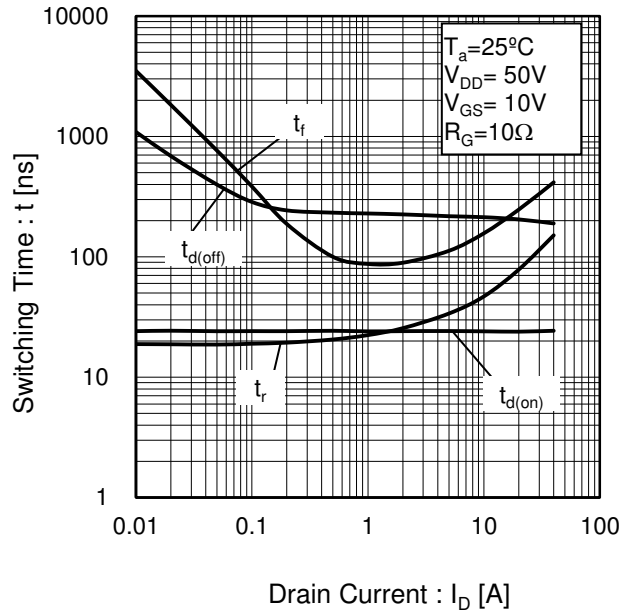


Fig.21 Dynamic Input Characteristics

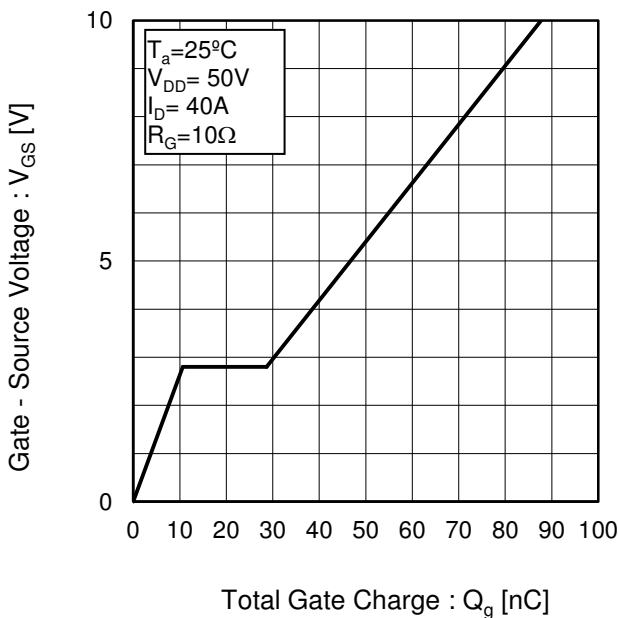
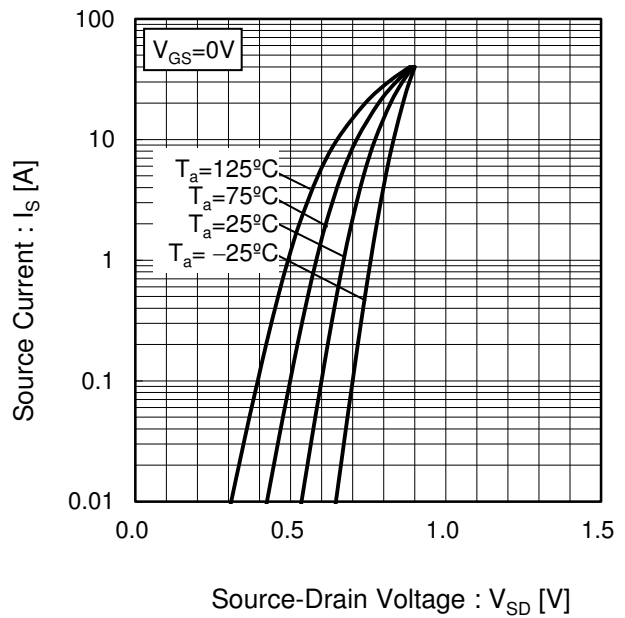
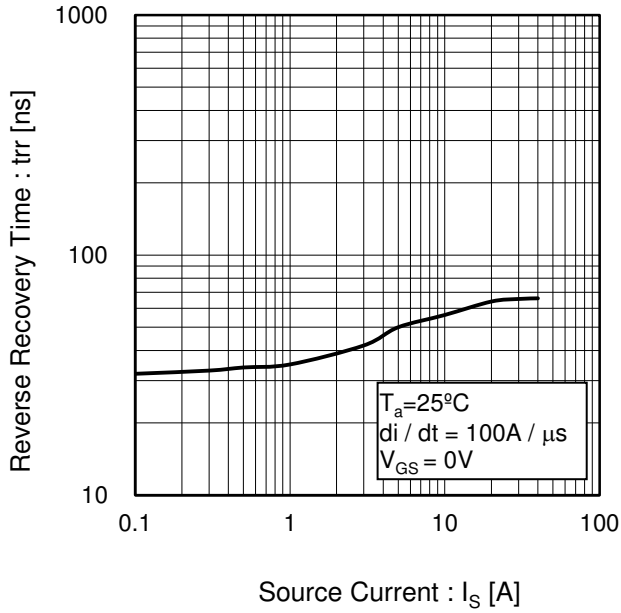


Fig.22 Source Current vs. Source - Drain Voltage



●Electrical characteristic curves

Fig23 Reverse Recovery Time vs.Source Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

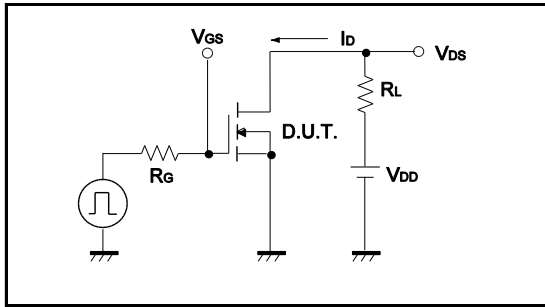


Fig.1-2 Switching Waveforms

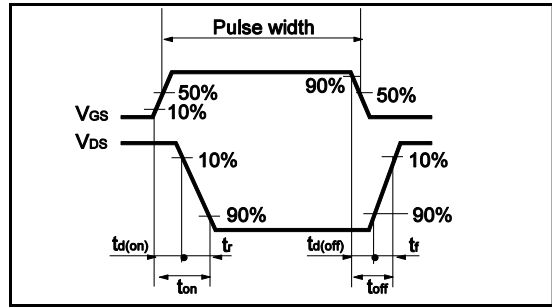


Fig.2-1 Gate Charge Measurement Circuit

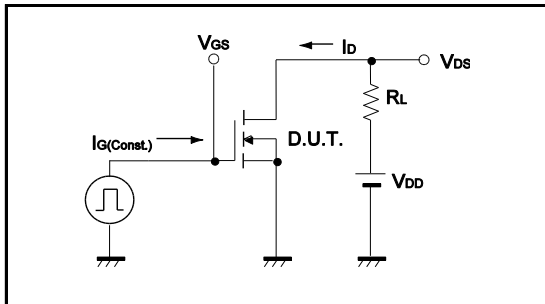


Fig.2-2 Gate Charge Waveform

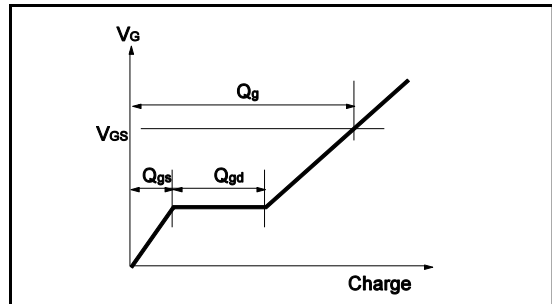


Fig.3-1 Avalanche Measurement Circuit

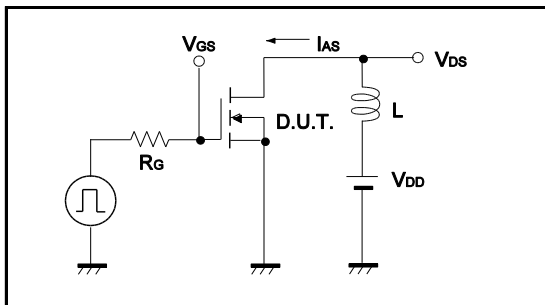
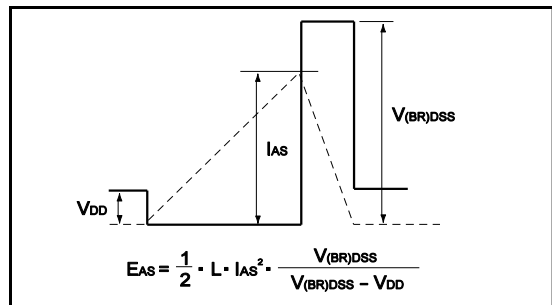
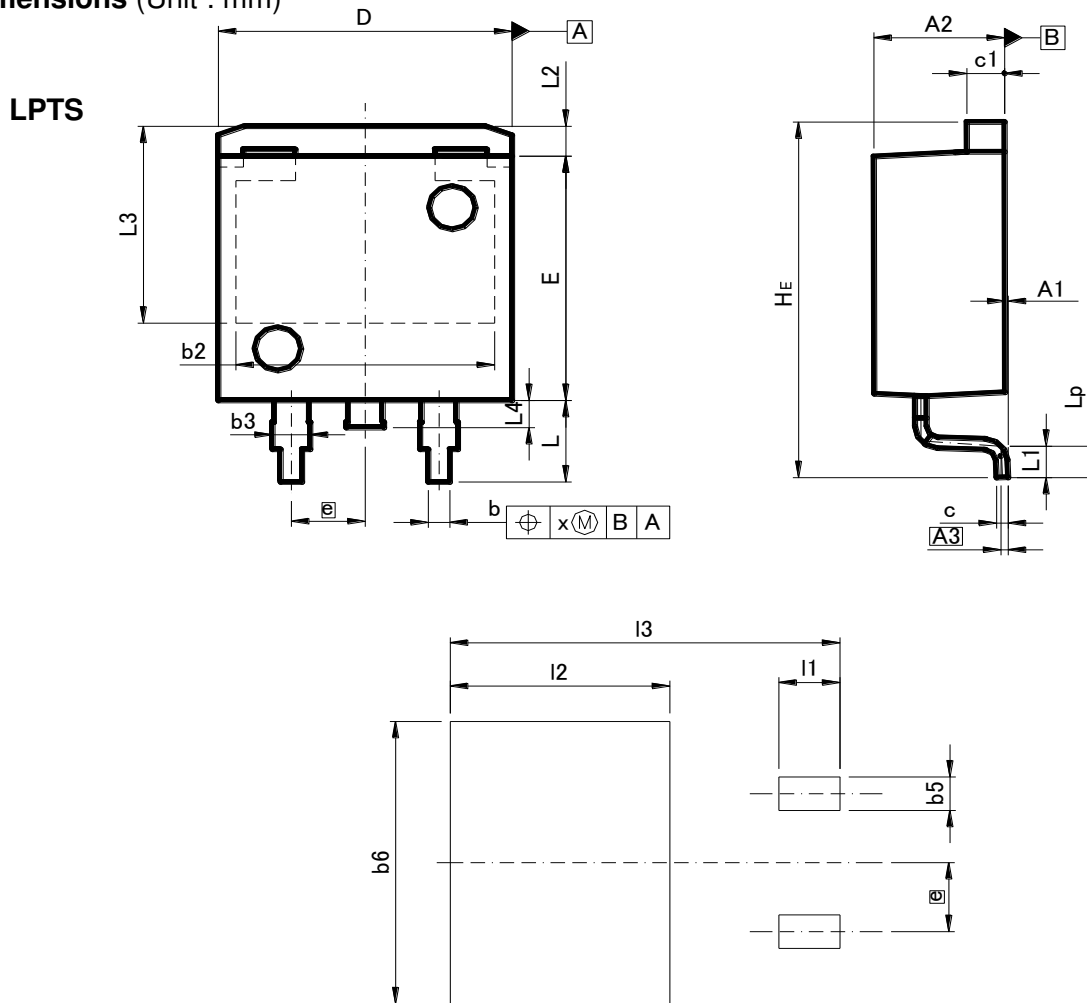


Fig.3-2 Avalanche Waveform



●Dimensions (Unit : mm)



**Pattern of terminal position areas**

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A1	0.00	0.30	0	0.012
A2	4.30	4.70	0.169	0.185
A3	0.25		0.01	
b	0.68	0.98	0.027	0.039
b2	8.90		0.35	
b3	1.14	1.44	0.045	0.057
c	0.30	0.60	0.012	0.024
c1	1.10	1.50	0.043	0.059
D	9.80	10.40	0.386	0.409
E	8.80	9.20	0.346	0.362
e	2.54		0.10	
HE	12.80	13.40	0.504	0.528
L	2.70	3.30	0.106	0.13
L1	0.90	1.50	0.035	0.059
L2	1.10		0.043	
L3	7.25		0.285	
L4	1.00		0.039	
Lp	0.90	1.50	0.035	0.059
x	-	0.25	-	0.01

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b5	-	1.23	-	0.049
b6	-	10.40	-	0.409
I1	-	2.10	-	0.083
I2	-	7.55	-	0.297
I3	-	13.40	-	0.528

Dimension in mm/inches

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