

V_{DSS}	200V
$R_{DS(on)}$ (Max.)	55mΩ
I_D	45A
P_D	40W

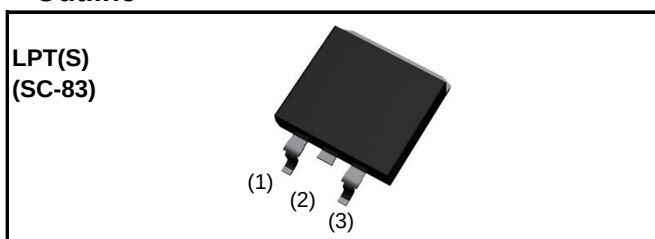
●Features

- 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

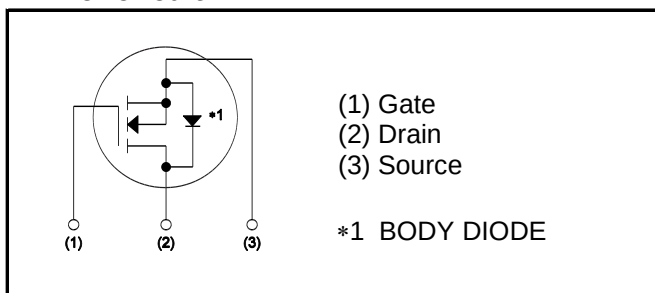
●Application

Switching Power Supply
Automotive Motor Drive
Automotive Solenoid Drive

●Outline



●Inner circuit



●Packaging specifications

Type	Packaging	Taping
	Reel size (mm)	330
	Tape width (mm)	24
	Basic ordering unit (pcs)	1,000
	Taping code	TL
	Marking	RCJ450N20

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

Parameter		Symbol	Value	Unit
Drain - Source voltage		V_{DSS}	200	V
Continuous drain current	$T_c = 25^\circ\text{C}$	I_D^{*1}	±45	A
	$T_c = 100^\circ\text{C}$	I_D^{*1}	±24.4	A
Pulsed drain current		$I_{D,pulse}^{*2}$	±180	A
Gate - Source voltage		V_{GSS}	±30	V
Avalanche energy, single pulse		E_{AS}^{*3}	160	mJ
Avalanche current		I_{AR}^{*3}	22.5	A
Power dissipation	$T_c = 25^\circ\text{C}$	P_D	40	W
	$T_a = 25^\circ\text{C}^{*4}$	P_D	1.56	W
Junction temperature		T_j	150	°C
Range of storage temperature		T_{stg}	-55 to +150	°C

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	-	3.13	°C/W
Thermal resistance, junction - ambient ^{*4}	R_{thJA}	-	-	80	°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	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1.0mA$	200	-	-	V
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 200V, V_{GS} = 0V$ $T_j = 25^\circ\text{C}$	-	-	1.0	μA
		$V_{DS} = 200V, V_{GS} = 0V$ $T_j = 125^\circ\text{C}$	-	-	100	
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	± 100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	3.0	-	5.0	V
Static drain - source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS} = 10V, I_D = 22.5A$	-	42	55	$m\Omega$
		$V_{GS} = 10V, I_D = 22.5A$ $T_j = 125^\circ\text{C}$	-	95	125	
Forward transfer admittance	g_{fs}	$V_{DS} = 10V, I_D = 22.5A$	10	20	-	S

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	4200	-	pF
Output capacitance	C_{oss}	$V_{DS} = 25V$	-	270	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	160	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} \approx 100V, V_{GS} = 10V$	-	52	-	ns
Rise time	t_r^{*5}	$I_D = 22.5A$	-	210	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_L = 4.4\Omega$	-	90	-	
Fall time	t_f^{*5}	$R_G = 10\Omega$	-	70	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g^{*5}	$V_{DD} \approx 100V$	-	80	-	nC
Gate - Source charge	Q_{gs}^{*5}	$I_D = 45A$	-	28	-	
Gate - Drain charge	Q_{gd}^{*5}	$V_{GS} = 10V$	-	28	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 100V, I_D = 45A$	-	7.2	-	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}	$T_c = 25^\circ\text{C}$	-	-	45	A
Pulsed source current	I_{SM}^{*2}		-	-	104	A
Forward voltage	V_{SD}^{*5}	$V_{GS} = 0V, I_S = 26A$	-	-	1.5	V
Reverse recovery time	t_{rr}^{*5}	$I_S = 22.5A$	-	130	-	ns
Reverse recovery charge	Q_{rr}^{*5}	$di/dt = 100A/\mu s$	-	600	-	nC

*1 Limited only by maximum temperature allowed.

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

*3 $L \approx 500\mu H$, $V_{DD} = 50V$, $R_g = 25\Omega$, starting $T_j = 25^\circ\text{C}$

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

*5 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

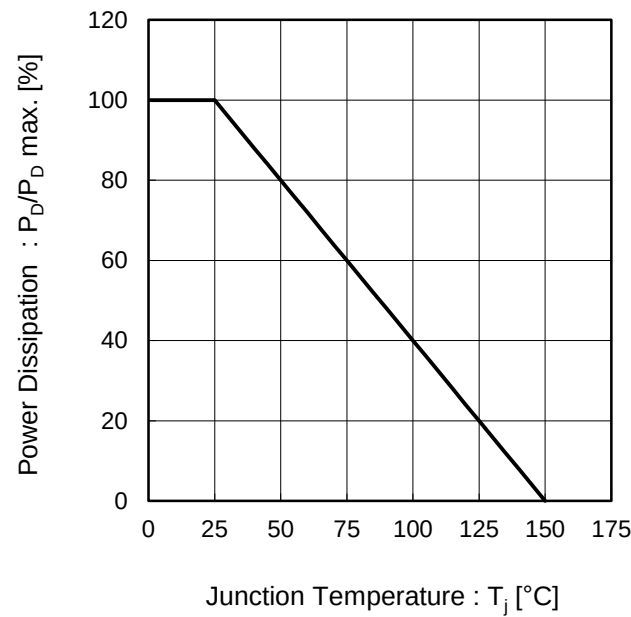


Fig.2 Maximum Safe Operating Area

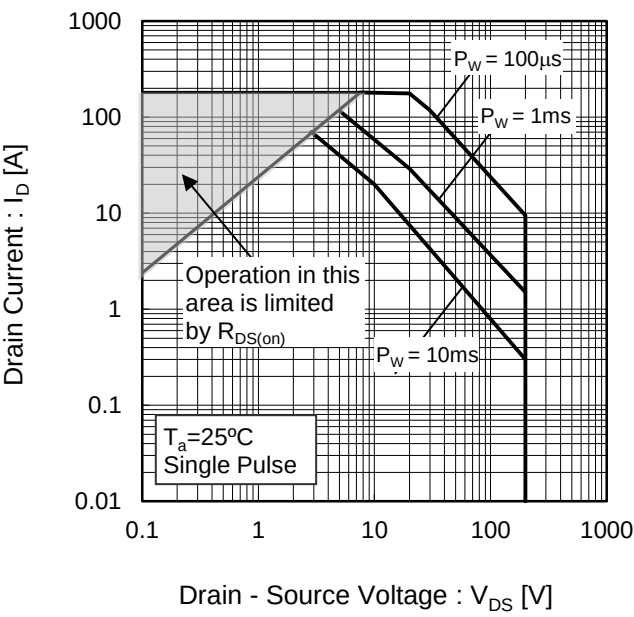
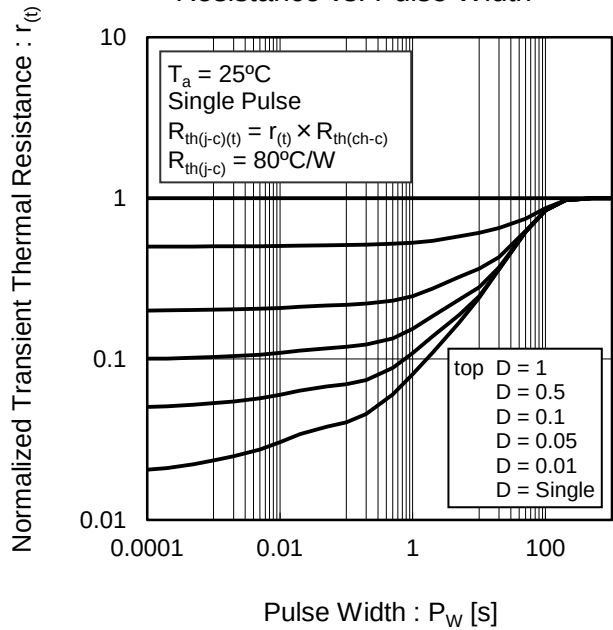


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

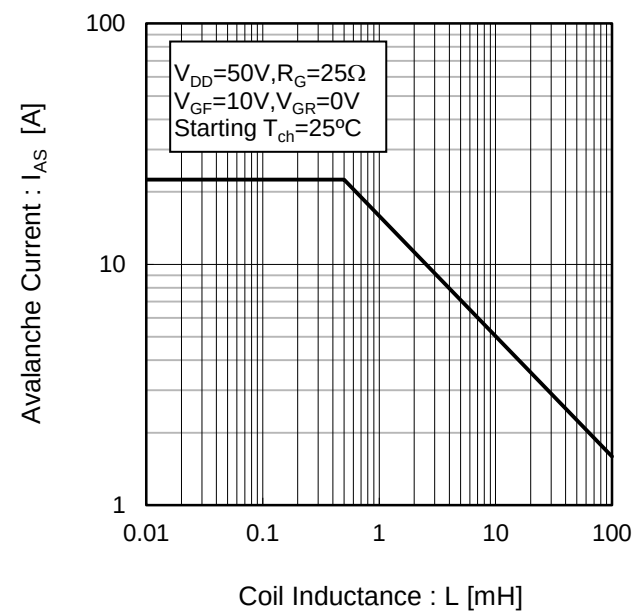


Fig.5 Avalanche Energy Derating Curve vs Junction Temperature

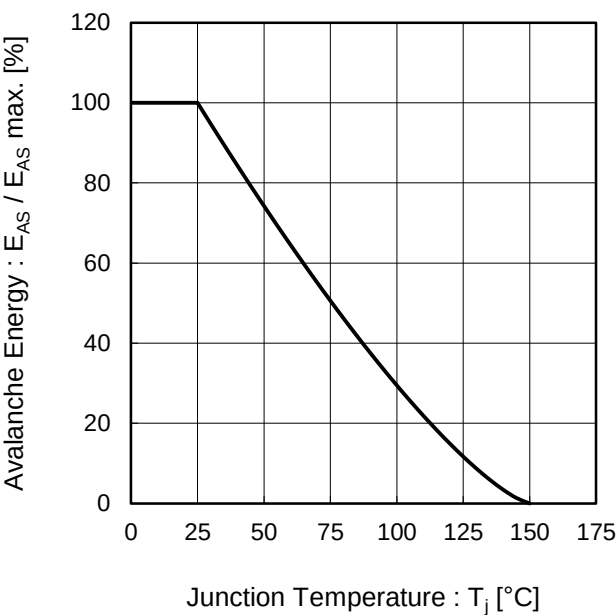


Fig.6 Typical Output Characteristics(I)

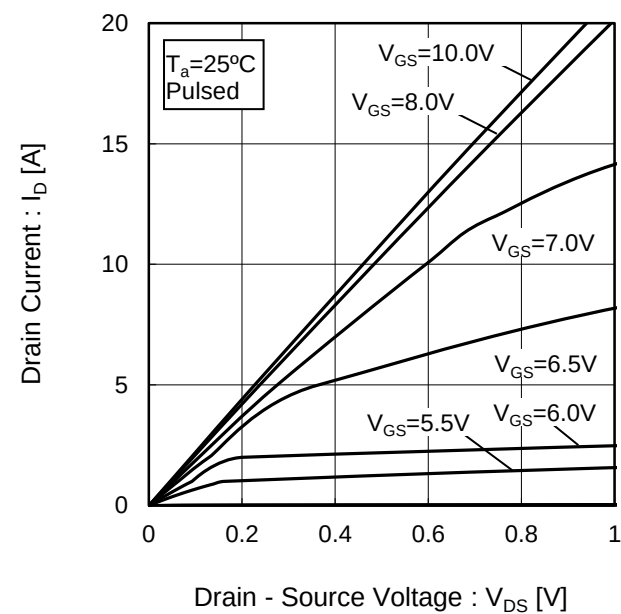
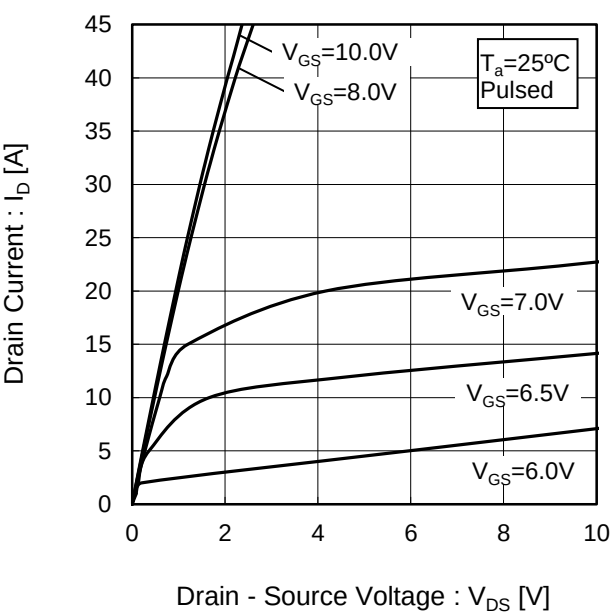


Fig.7 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Breakdown Voltage vs. Junction Temperature

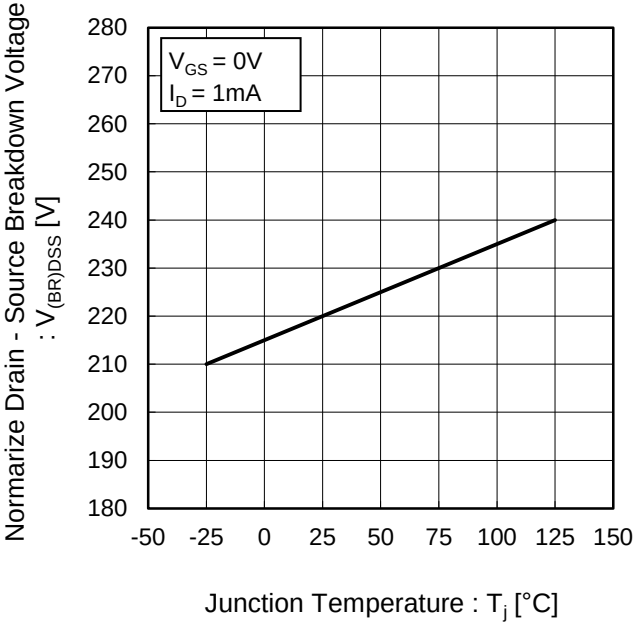


Fig.9 Typical Transfer Characteristics

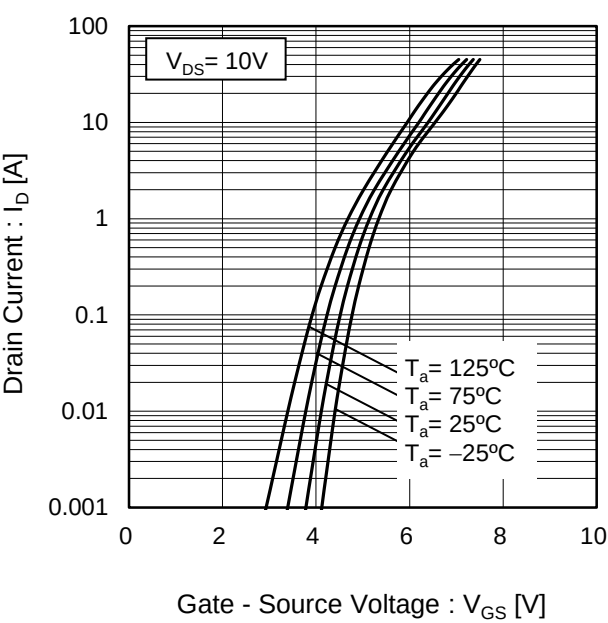


Fig.10 Gate Threshold Voltage vs. Junction Temperature

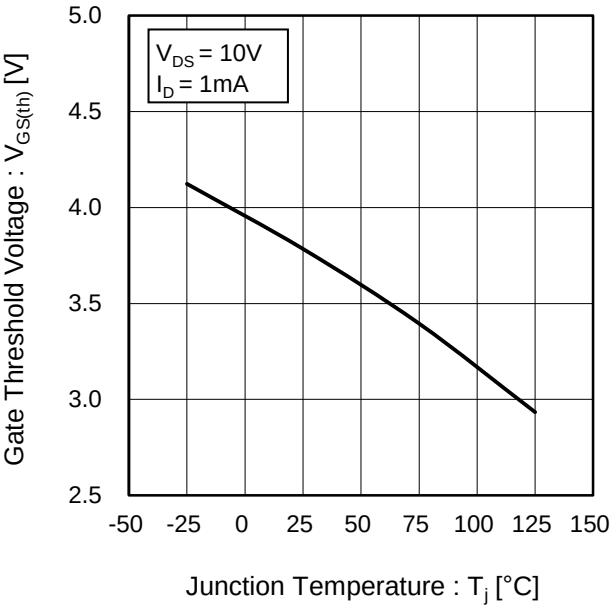
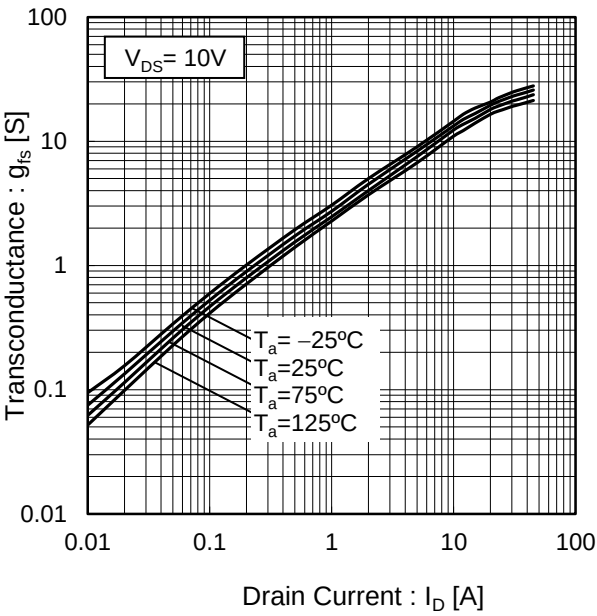


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

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

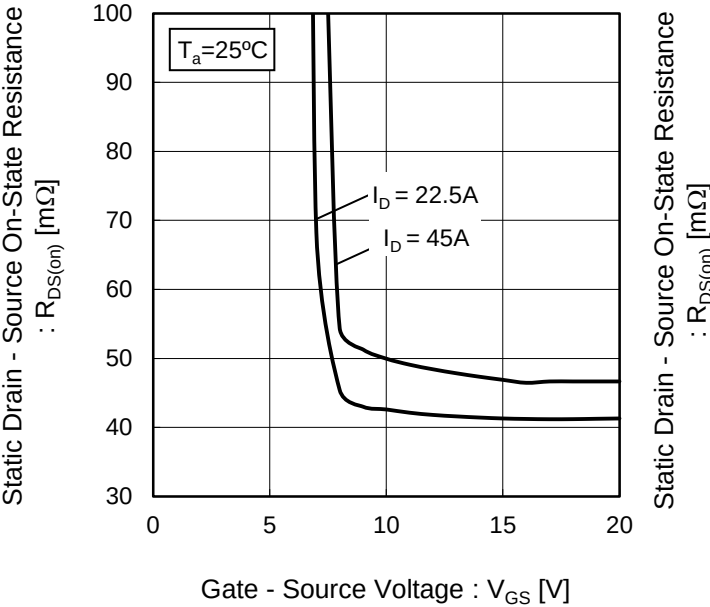


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(I)

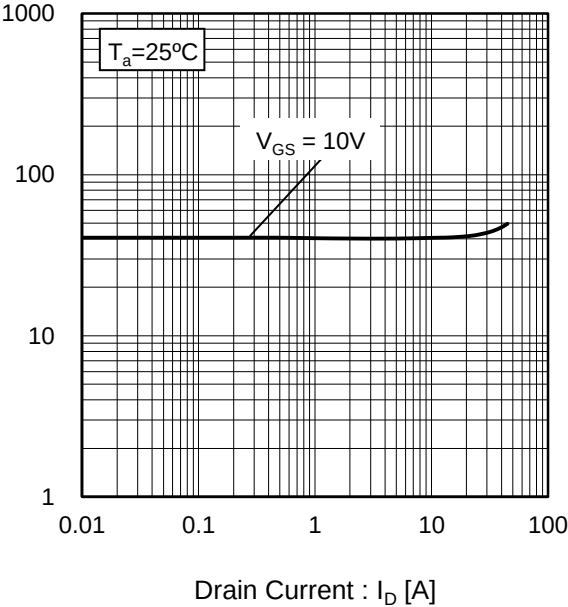
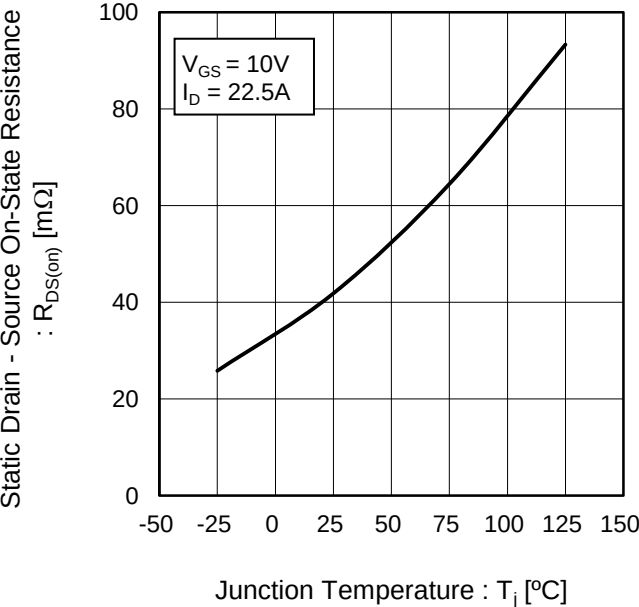


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

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

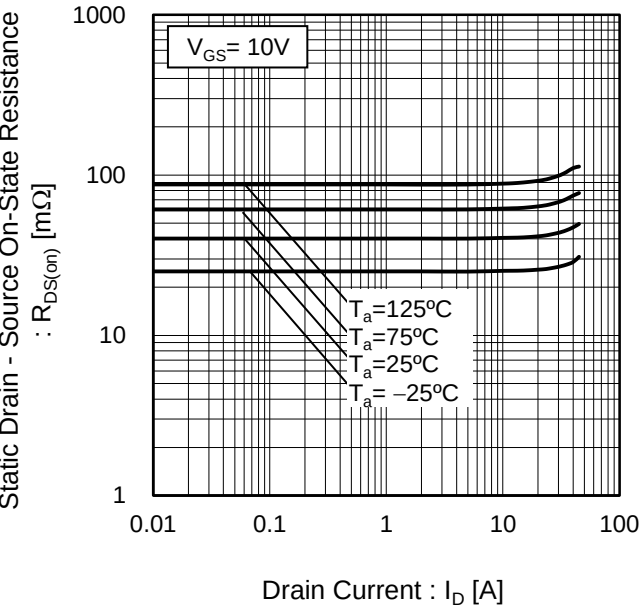
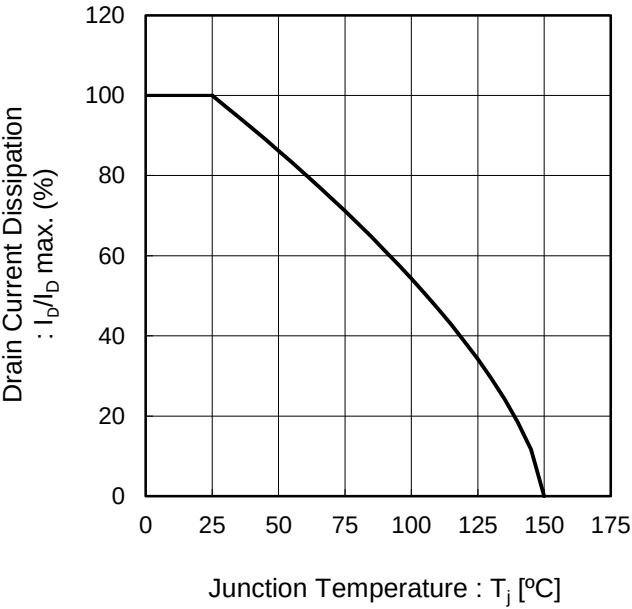


Fig.16 Drain Current Derating Curve



●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

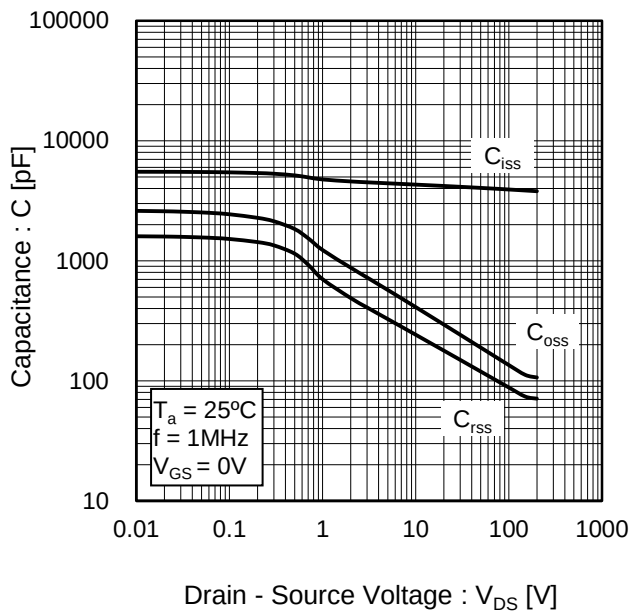


Fig.18 Switching Characteristics

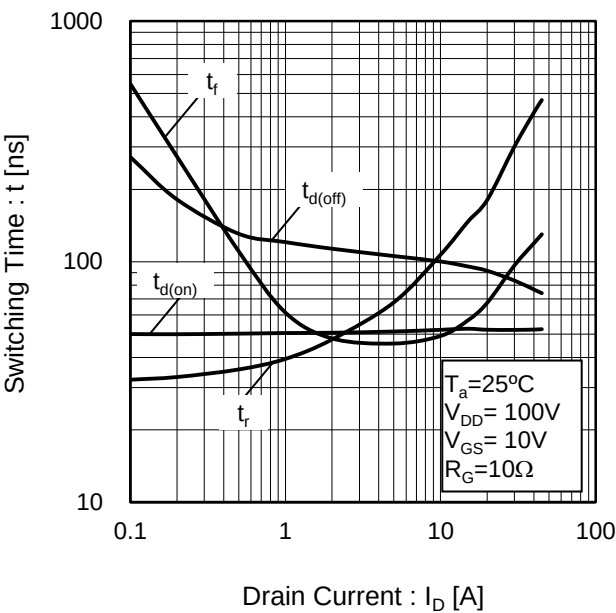
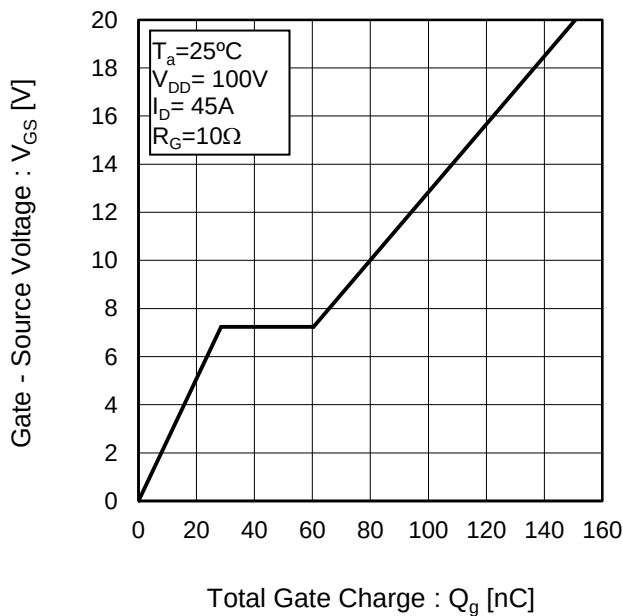


Fig.19 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.20 Source Current
vs. Source - Drain Voltage

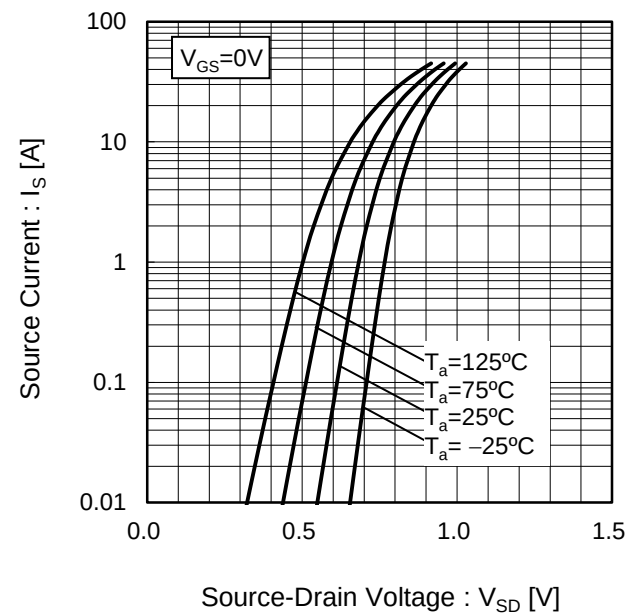
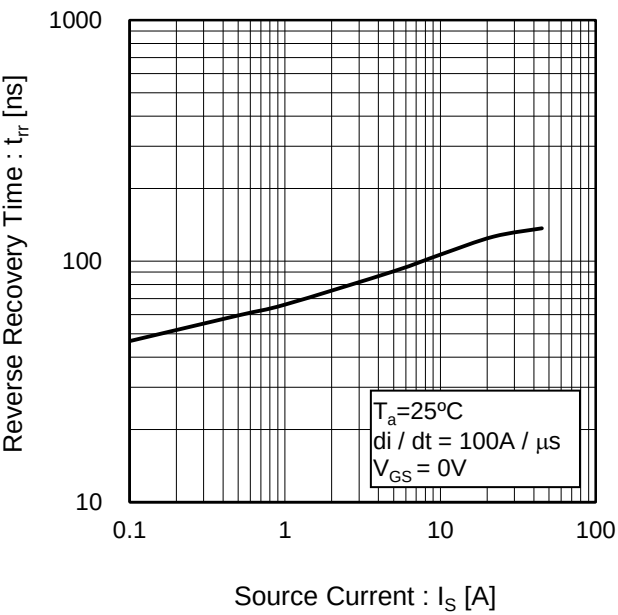


Fig21 Reverse Recovery Time
vs.Source Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

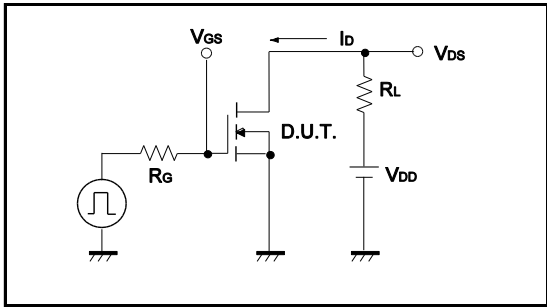


Fig.1-2 Switching Waveforms

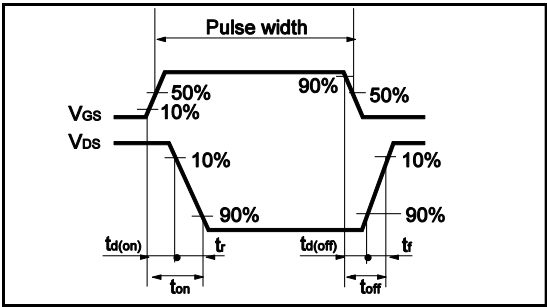


Fig.2-1 Gate Charge Measurement Circuit

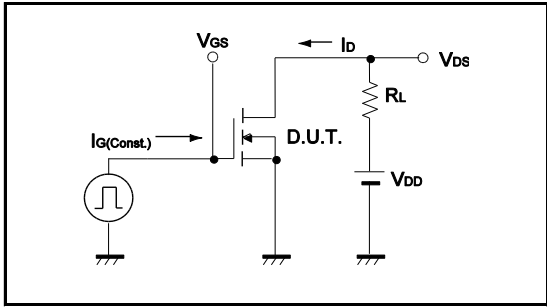


Fig.2-2 Gate Charge Waveform

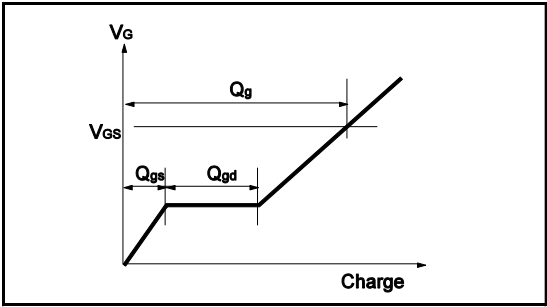


Fig.3-1 Avalanche Measurement Circuit

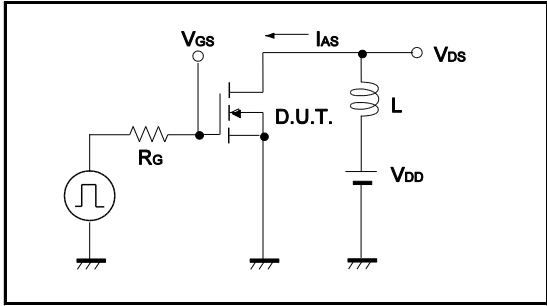
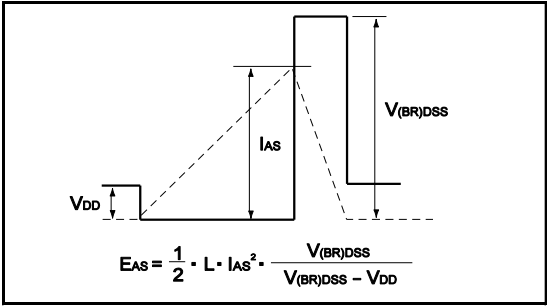
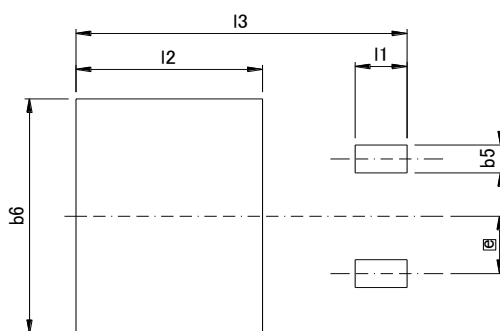
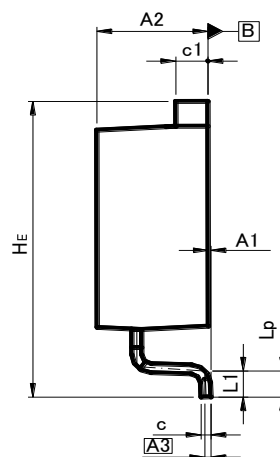
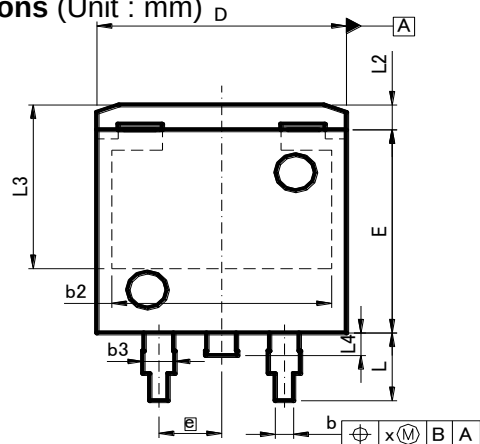


Fig.3-2 Avalanche Waveform



●Dimensions (Unit : mm) ϕ

LPTS



Pattern of terminal position areas
[Not a recommended pattern of soldering]

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A1	0.00	0.30	0.000	0.012
A2	4.30	4.70	0.169	0.185
A3	0.25		0.010	
b	0.68	0.98	0.027	0.039
b2	8.90		0.350	
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		0.100	
HE	12.80	13.40	0.504	0.528
L	2.70	3.30	0.106	0.130
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	-	0.010

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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