



RSD221N06

Nch 60V 22A Power MOSFET

Datasheet

V_{DSS}	60V
$R_{DS(on)}$ (Max.)	26m Ω
I_D	22A
P_D	20W

●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

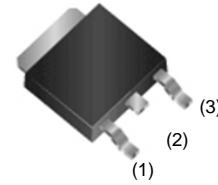
Switching Power Supply
Automotive Motor Drive
Automotive Solenoid Drive

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

Parameter	Symbol	Value	Unit	
Drain - Source voltage	V_{DSS}	60	V	
Continuous drain current	$T_c = 25^\circ\text{C}$	I_D^{*1}	± 22	A
	$T_c = 100^\circ\text{C}$	I_D^{*1}	± 11	A
Pulsed drain current	$I_{D,pulse}^{*2}$	± 44	A	
Gate - Source voltage	V_{GSS}	± 20	V	
Avalanche energy, single pulse	E_{AS}^{*3}	17.8	mJ	
Avalanche current	I_{AR}^{*3}	22	A	
Power dissipation	$T_c = 25^\circ\text{C}$	P_D	20	W
	$T_a = 25^\circ\text{C}^{*4}$	P_D	0.85	W
Junction temperature	T_j	150	$^\circ\text{C}$	
Range of storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$	

●Outline

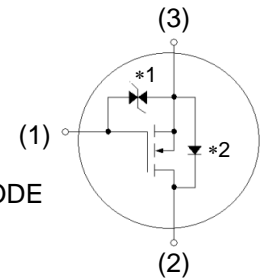
CPT3
(SC-63)
<SOT-428>



●Inner circuit

- (1) Gate
(2) Drain
(3) Source

*1 ESD PROTECTION DIODE
*2 BODY DIODE



●Packaging specifications

Type	Packaging	Taping
	Reel size (mm)	330
	Tape width (mm)	16
	Basic ordering unit (pcs)	2,500
	Taping code	TL
	Marking	221N06

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	R_{thJC}	-	-	6.25	°C/W
Thermal resistance, junction - ambient *4	R_{thJA}	-	-	147	°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	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	60	-	-	V
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 60V, V_{GS} = 0V$ $T_j = 25^\circ\text{C}$	-	-	1	μA
		$V_{DS} = 60V, V_{GS} = 0V$ $T_j = 125^\circ\text{C}$	-	-	100	
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	± 10	μA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	1.0	-	3.0	V
Static drain - source on - state resistance	$R_{DS(on)}$ *5	$V_{GS} = 10V, I_D = 22A$	-	18	26	$m\Omega$
		$V_{GS} = 4.5V, I_D = 22A$	-	21	30	
		$V_{GS} = 4.0V, I_D = 22A$	-	23	33	
		$V_{GS} = 10V, I_D = 22A$ $T_j = 125^\circ\text{C}$	-	32	45	
Forward transfer admittance	g_{fs}	$V_{DS} = 10V, I_D = 22A$	12	24	-	S

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	1500	-	pF
Output capacitance	C_{oss}	$V_{DS} = 10V$	-	320	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	140	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} \approx 30V, V_{GS} = 10V$	-	25	-	ns
Rise time	t_r^{*5}	$I_D = 11A$	-	45	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_L = 12\Omega$	-	75	-	
Fall time	t_f^{*5}	$R_G = 10\Omega$	-	65	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g^{*5}	$V_{DD} \approx 30V$	-	30	-	nC
Gate - Source charge	Q_{gs}^{*5}	$I_D = 22A$	-	4.5	-	
Gate - Drain charge	Q_{gd}^{*5}	$V_{GS} = 10V$	-	3.0	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 30V, I_D = 22A$	-	3.3	-	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}	$T_c = 25^\circ\text{C}$	-	-	16	A
Pulsed source current	I_{SM}^{*2}		-	-	44	A
Forward voltage	V_{SD}^{*5}	$V_{GS} = 0V, I_S = 22A$	-	-	1.2	V
Reverse recovery time	t_{rr}^{*5}	$I_S = 22A$	-	56	-	ns
Reverse recovery charge	Q_{rr}^{*5}	$di/dt = 100A/\mu\text{s}$	-	100	-	μC

*1 Limited only by maximum temperature allowed.

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

*3 $L \approx 50\mu\text{H}$, $V_{DD} = 30V$, $R_g = 10\Omega$, starting $T_j = 25^\circ\text{C}$

*4 Mounted on a epoxy PCB FR4 (20mm x 30mm x 0.8mm)

*5 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

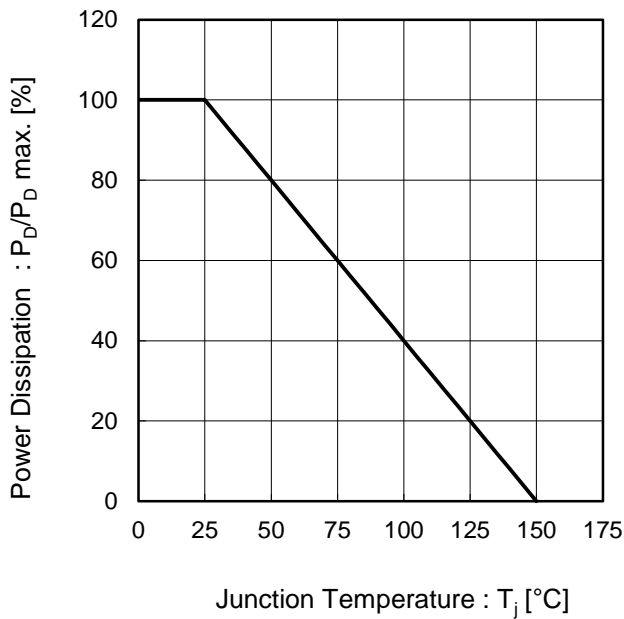


Fig.2 Maximum Safe Operating Area

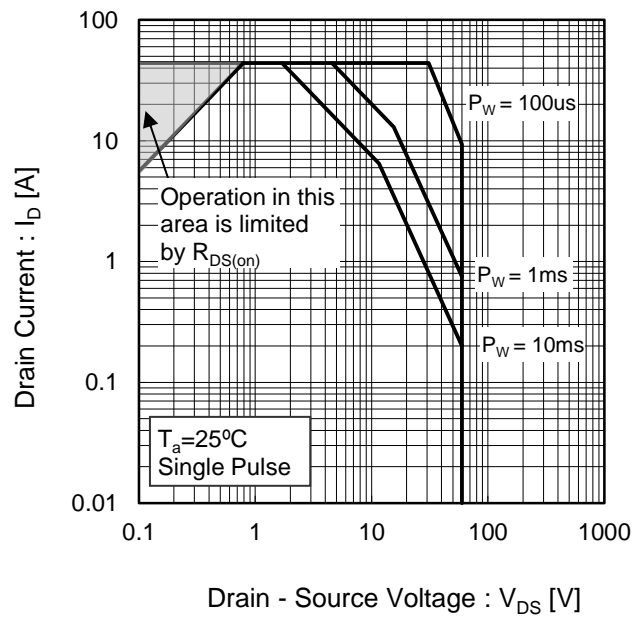
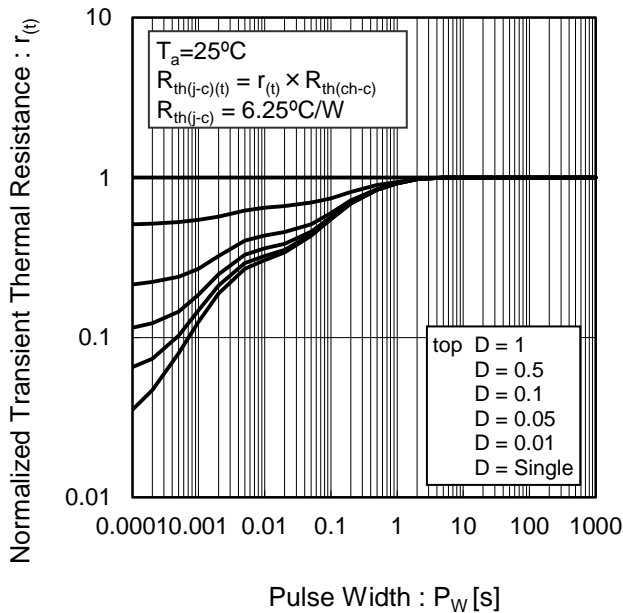


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

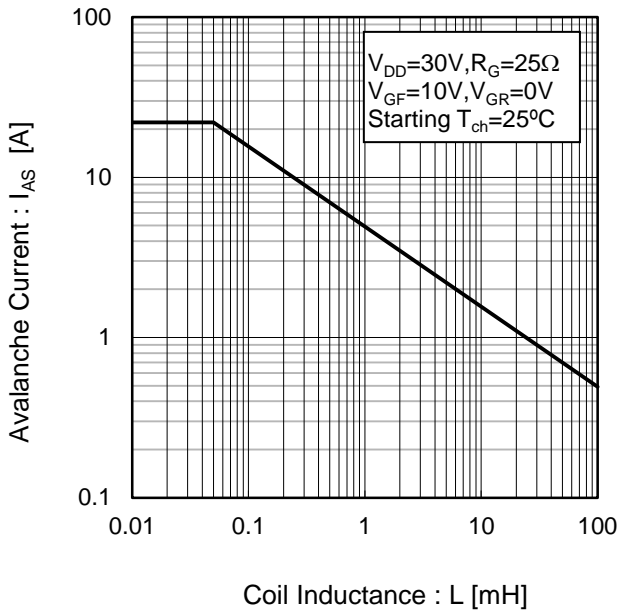


Fig.5 Avalanche Energy Derating Curve vs Junction Temperature

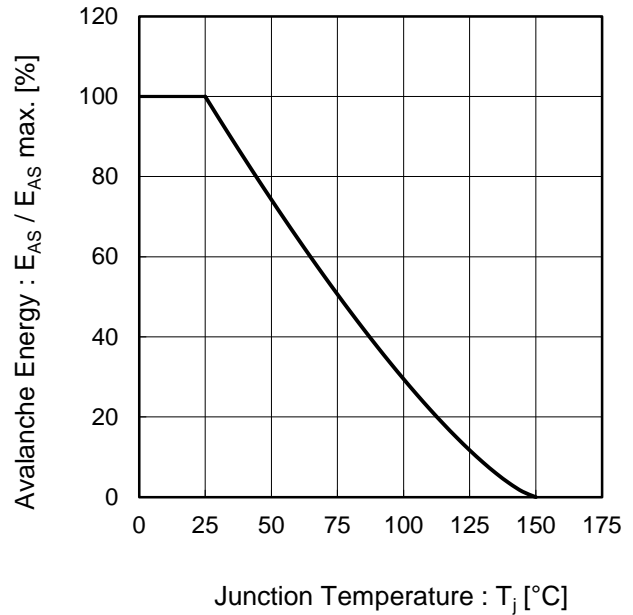


Fig.6 Typical Output Characteristics(I)

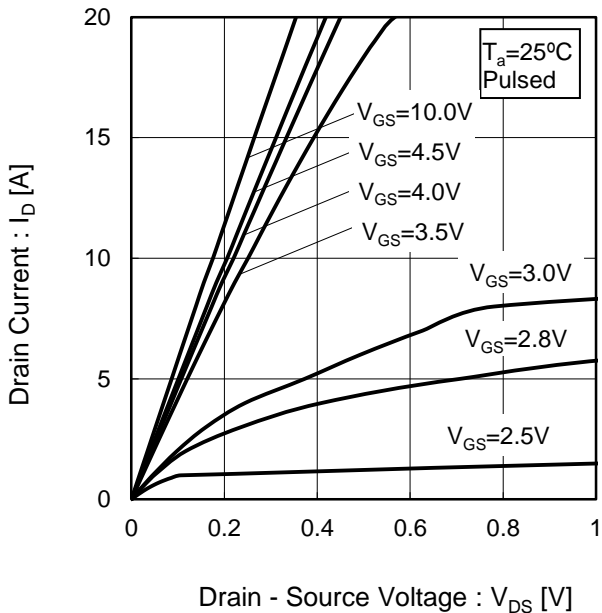
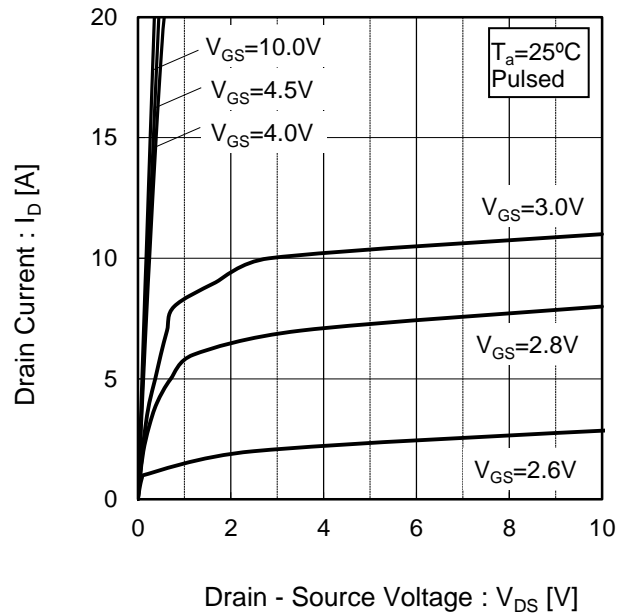


Fig.7 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Breakdown Voltage vs. Junction Temperature

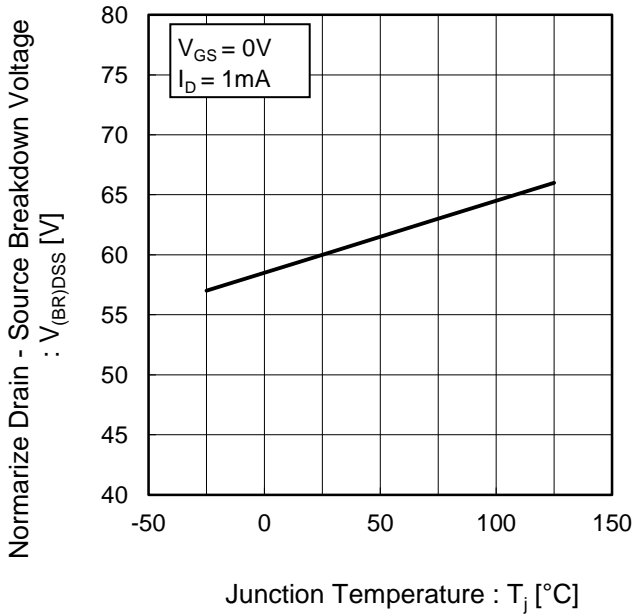


Fig.9 Typical Transfer Characteristics

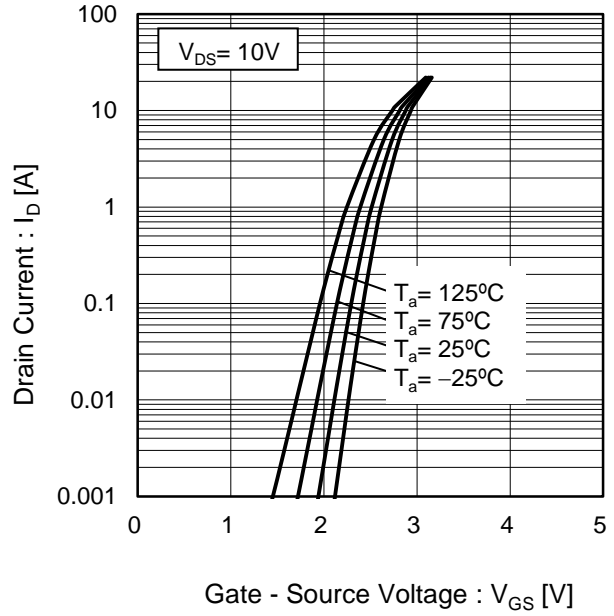


Fig.10 Gate Threshold Voltage vs. Junction Temperature

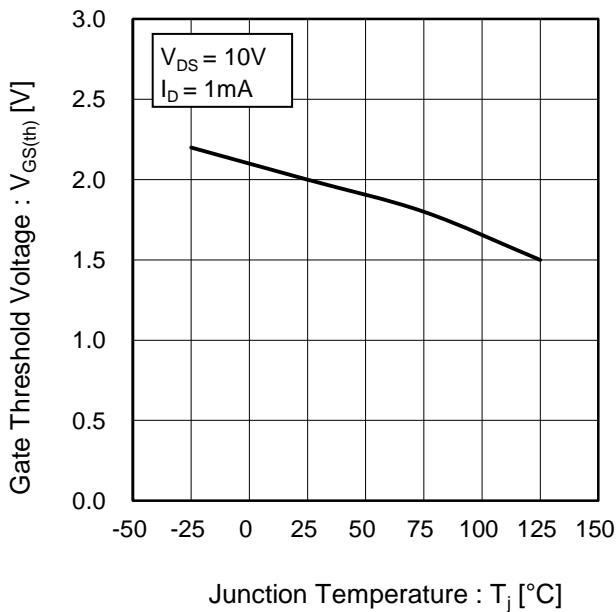
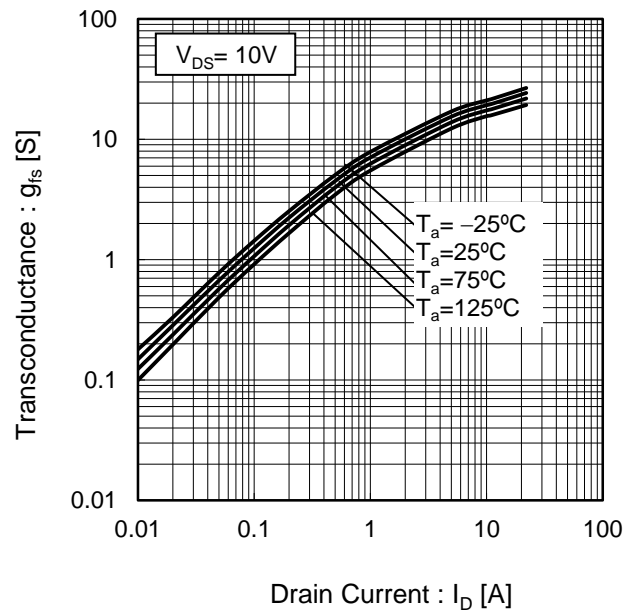


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

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

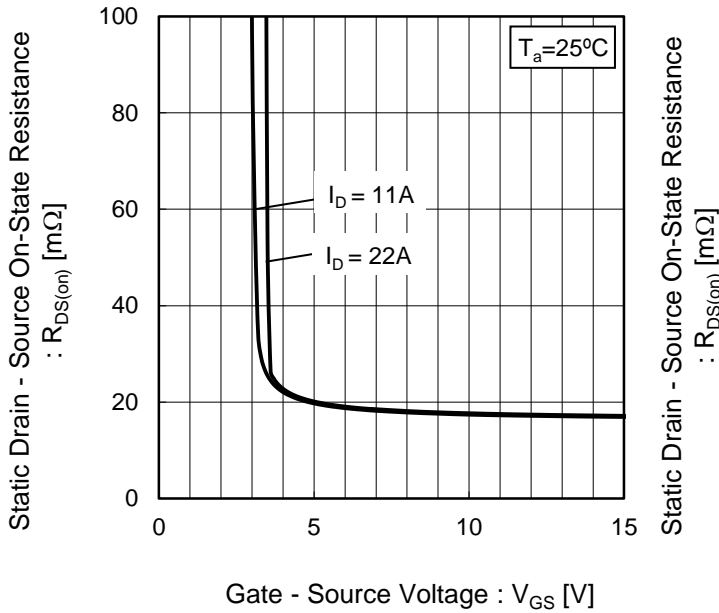


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(I)

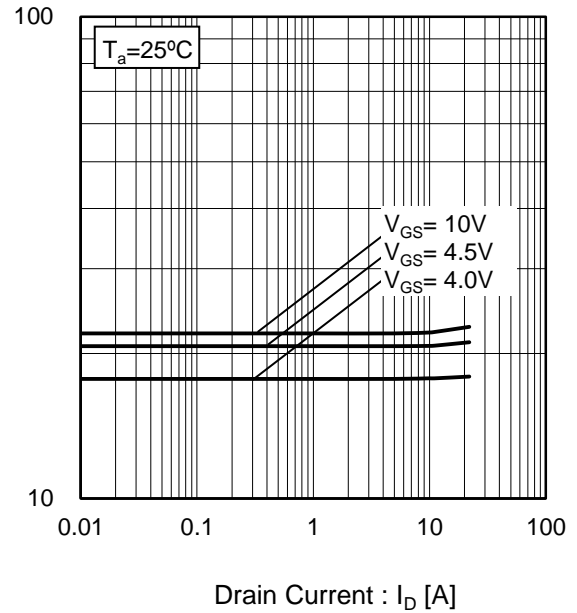
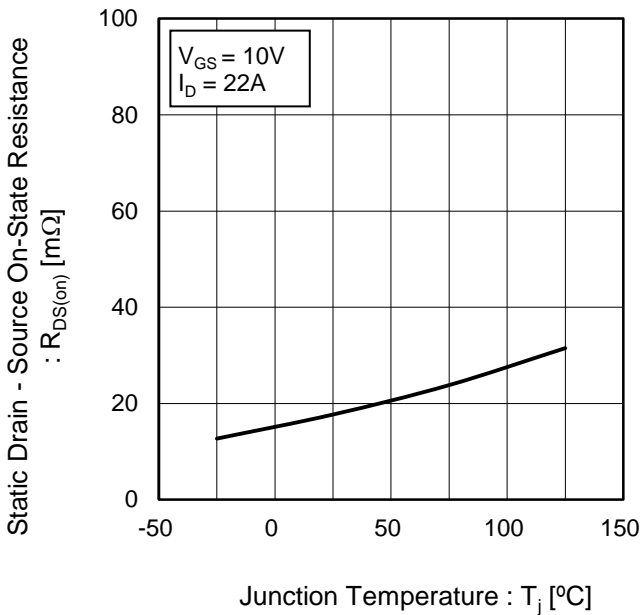


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

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

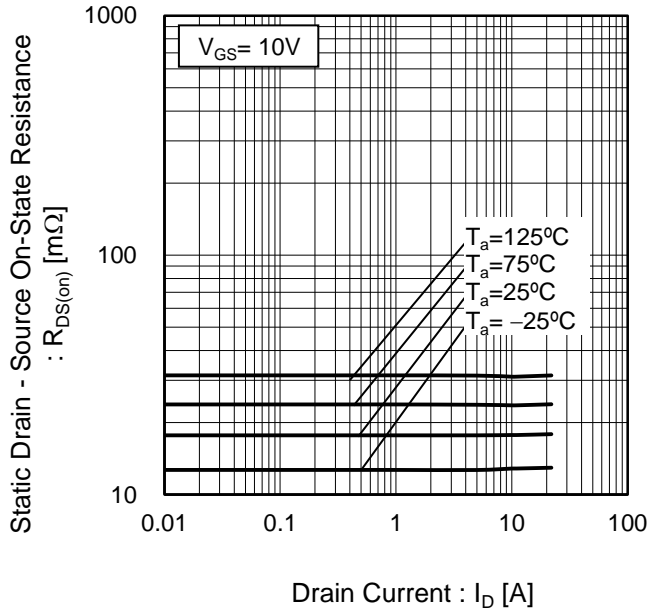


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)

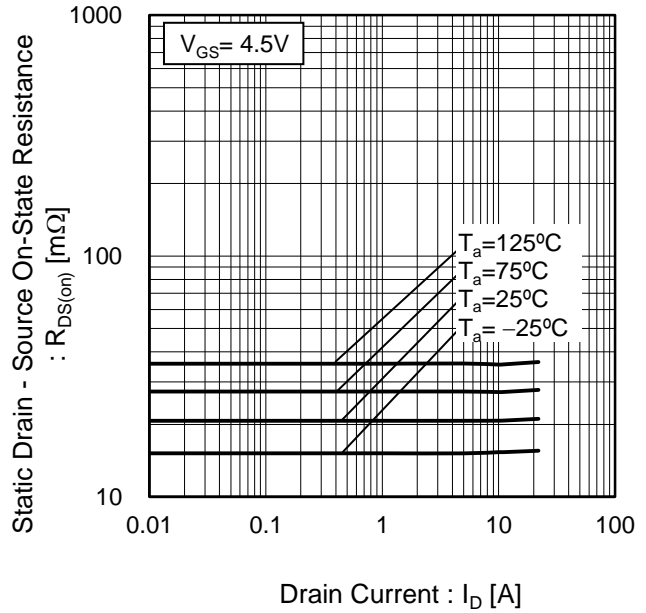


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)

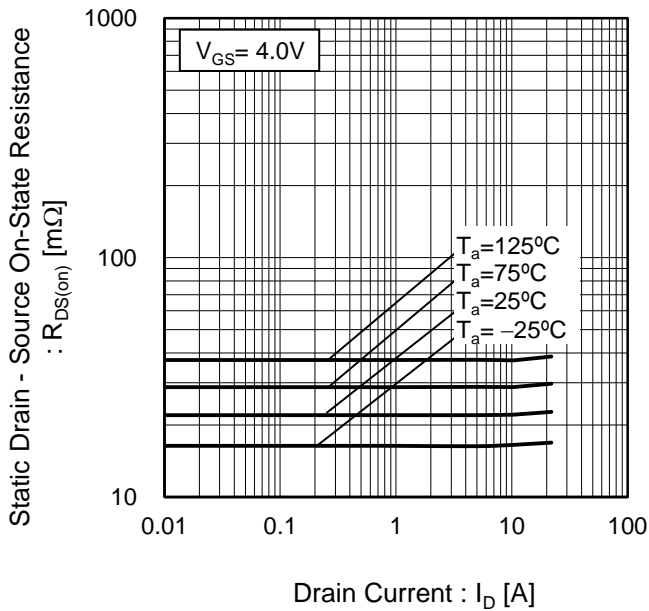
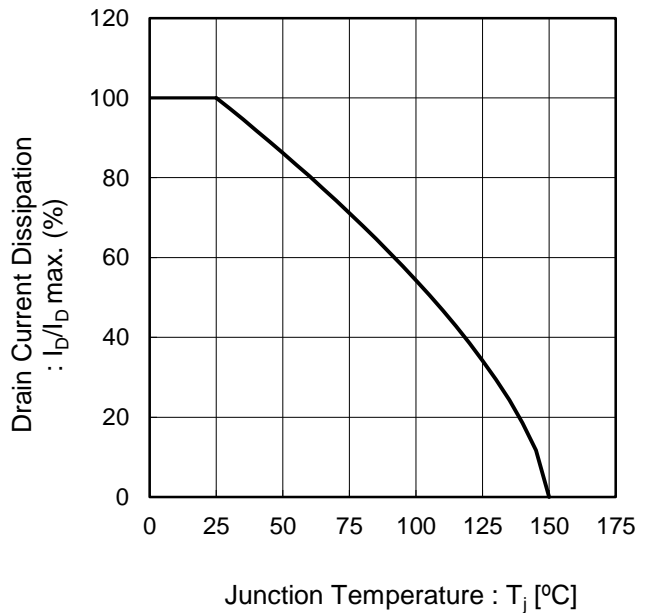


Fig.18 Drain Current Derating Curve



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

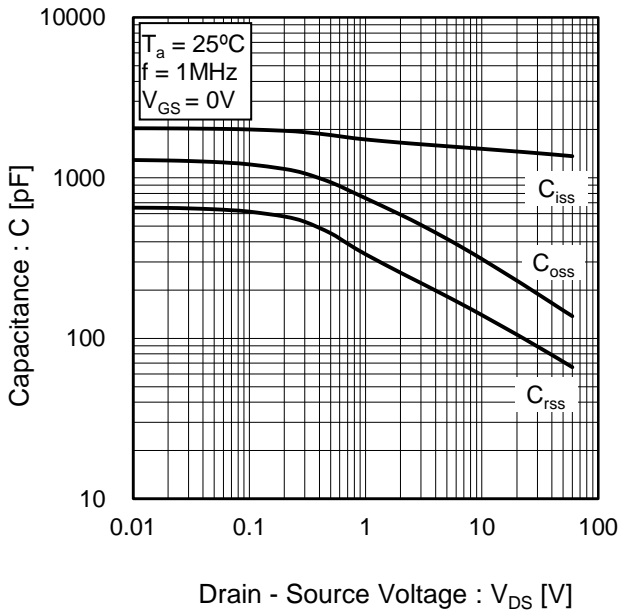


Fig.20 Switching Characteristics

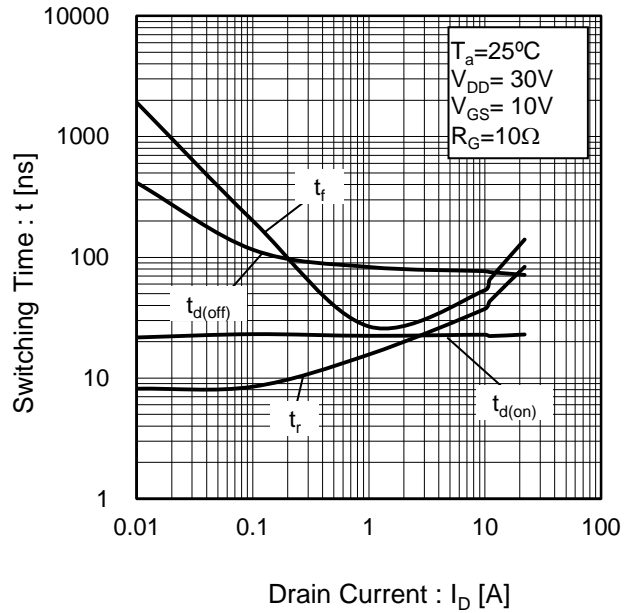


Fig.21 Dynamic Input Characteristics

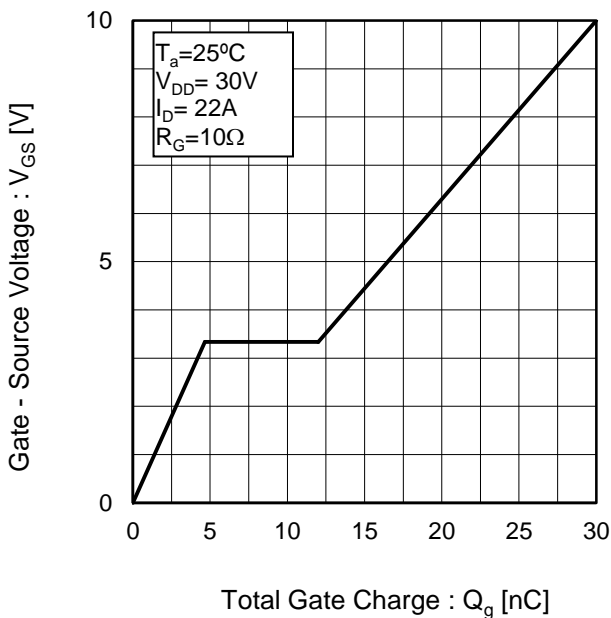
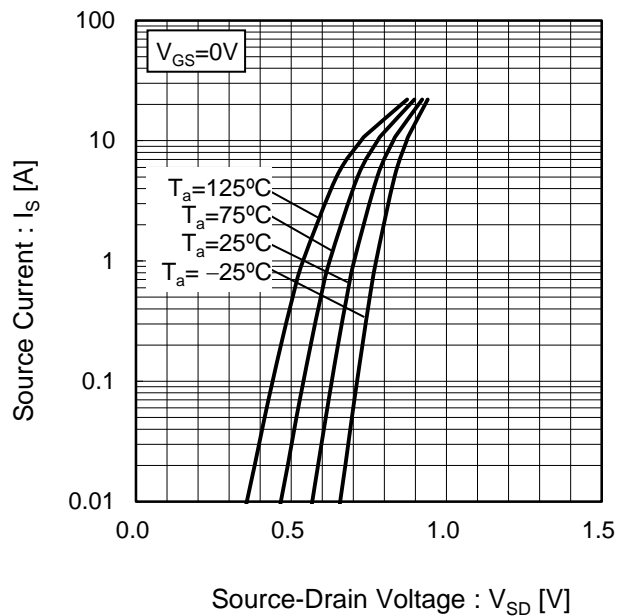
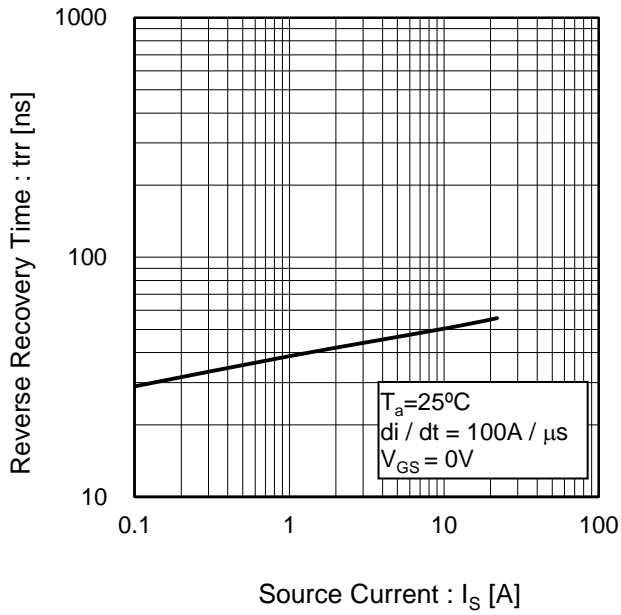


Fig.22 Source Current vs. Source - Drain Voltage



●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

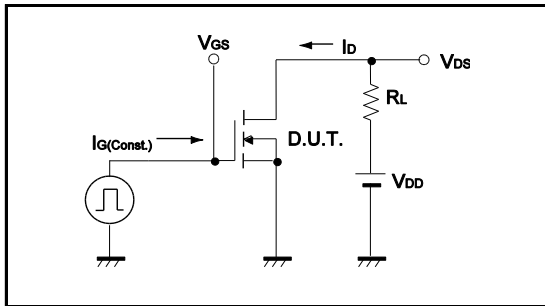


Fig.2-2 Gate Charge Waveform

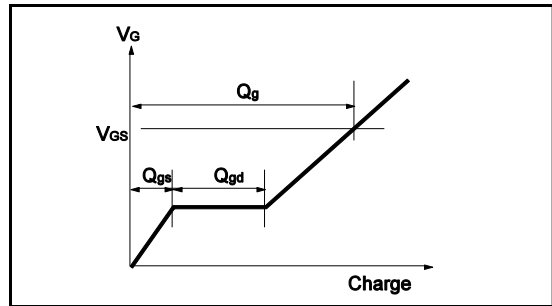
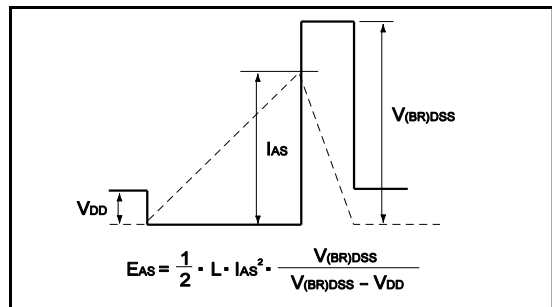


Fig.3-1 Avalanche Measurement Circuit

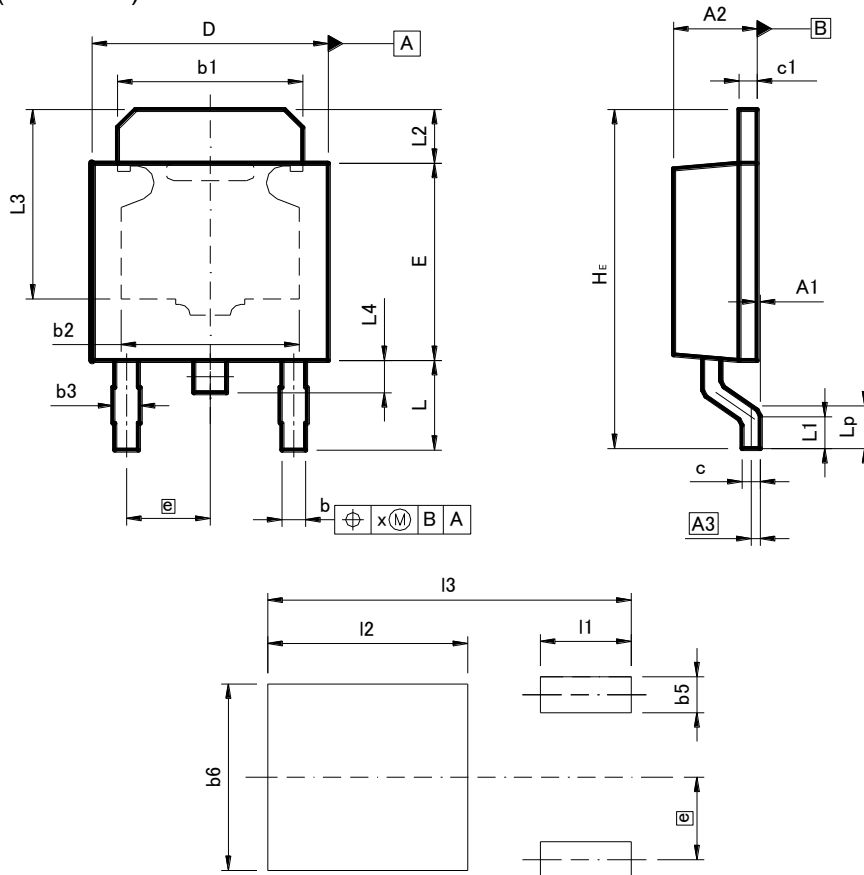


Fig.3-2 Avalanche Waveform



●Dimensions (Unit : mm)

CPT3



DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A1	0.00	0.15	0	0.006
A2	2.20	2.50	0.087	0.098
A3	0.25		0.01	
b	0.55	0.75	0.022	0.03
b1	5.00	5.30	0.197	0.209
b2	5.00		0.20	
b3	0.75		0.03	
c	0.40	0.60	0.016	0.024
c1	0.40	0.60	0.016	0.024
D	6.30	6.70	0.248	0.264
E	5.40	5.80	0.213	0.228
e	2.30		0.09	
HE	9.00	10.00	0.354	0.394
L	2.20	2.80	0.087	0.11
L1	0.80	1.40	0.031	0.055
L2	1.20	1.80	0.047	0.071
L3	5.30		0.209	
L4	0.90		0.035	
Lp	1.00	1.60	0.039	0.063
x	-	0.25	-	0.01

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b5	-	1.00	-	0.04
b6	-	5.20	-	0.205
I1	-	2.50	-	0.098
I2	-	5.50	-	0.217
I3	-	10.00	-	0.394

Dimension in mm/inches

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