

$V_{DSS}$	60V
$R_{DS(on)}$ (Max.)	26mΩ
$I_D$	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

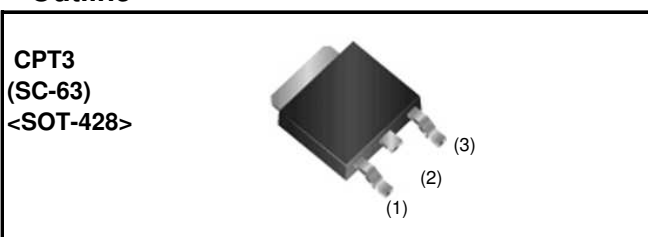
#### ●Application

Switching Power Supply  
 Automotive Motor Drive  
 Automotive Solenoid Drive

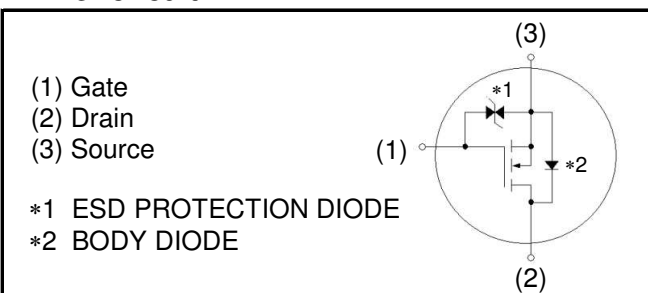
#### ●Absolute maximum ratings( $T_a = 25^\circ\text{C}$ )

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	°C
Range of storage temperature		$T_{stg}$	-55 to +150	°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	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	$\mu\text{A}$
		$V_{DS} = 60V, V_{GS} = 0V$ $T_j = 125^\circ\text{C}$	-	-	100	
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 10$	$\mu\text{A}$
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	$C_{iss}$	$V_{GS} = 0\text{V}$	-	1500	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 10\text{V}$	-	320	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	140	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} \approx 30\text{V}, V_{GS} = 10\text{V}$	-	25	-	ns
Rise time	$t_r^{*5}$	$I_D = 11\text{A}$	-	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	$Q_g^{*5}$	$V_{DD} \approx 30\text{V}$	-	30	-	nC
Gate - Source charge	$Q_{gs}^{*5}$	$I_D = 22\text{A}$	-	4.5	-	
Gate - Drain charge	$Q_{gd}^{*5}$	$V_{GS} = 10\text{V}$	-	3.0	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 30\text{V}, I_D = 22\text{A}$	-	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	$V_{SD}^{*5}$	$V_{GS} = 0\text{V}, I_S = 22\text{A}$	-	-	1.2	V
Reverse recovery time	$t_{rr}^{*5}$	$I_S = 22\text{A}$	-	56	-	ns
Reverse recovery charge	$Q_{rr}^{*5}$	$di/dt = 100\text{A}/\mu\text{s}$	-	100	-	$\mu\text{C}$

\*1 Limited only by maximum temperature allowed.

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

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

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

\*5 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

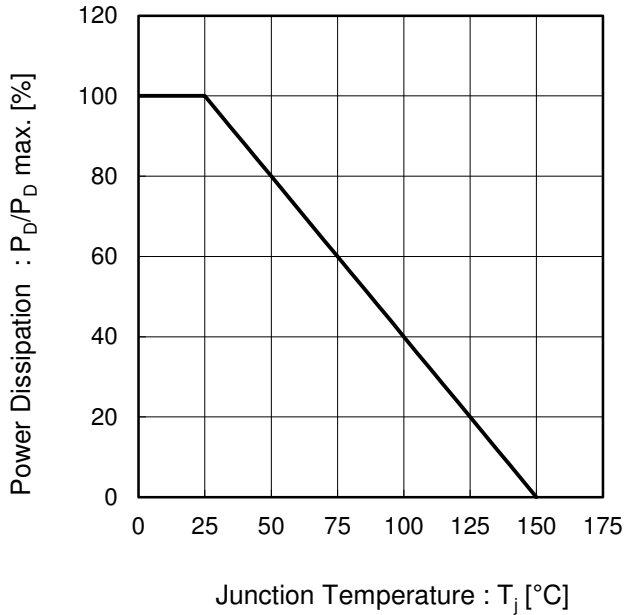


Fig.2 Maximum Safe Operating Area

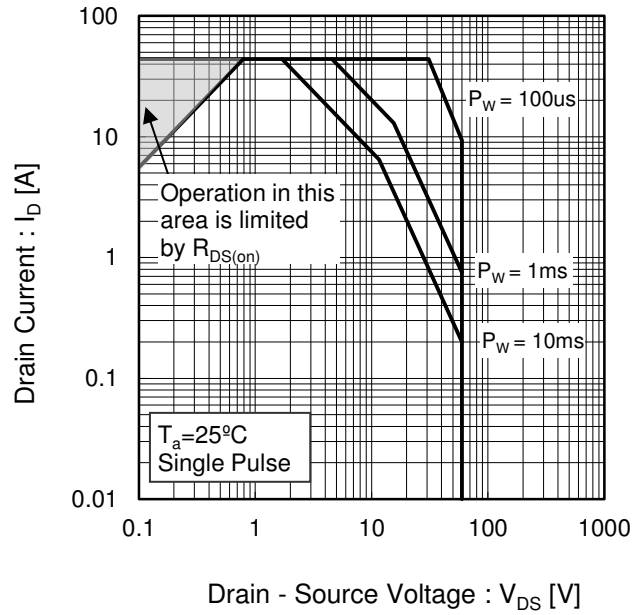
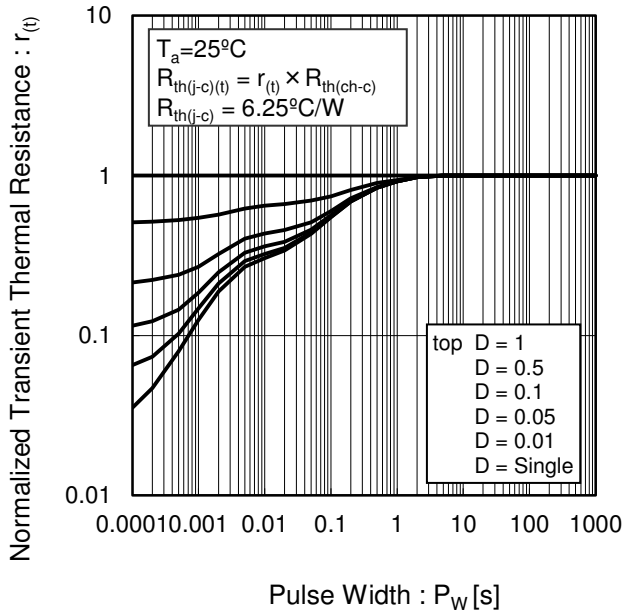


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

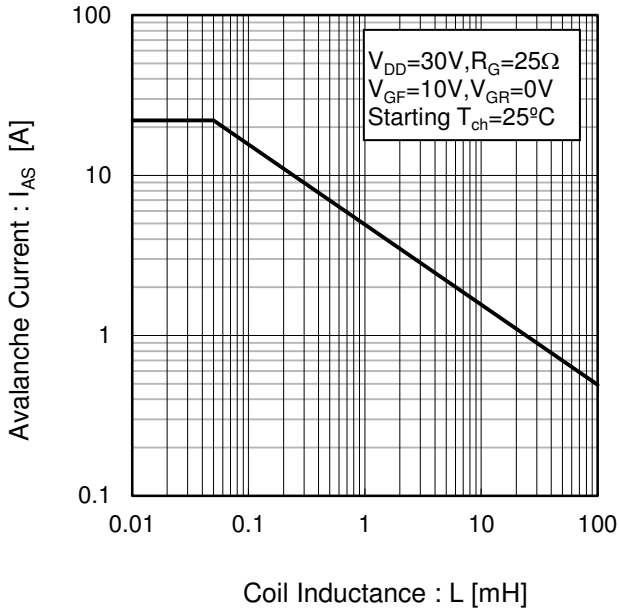


Fig.5 Avalanche Energy Derating Curve vs Junction Temperature

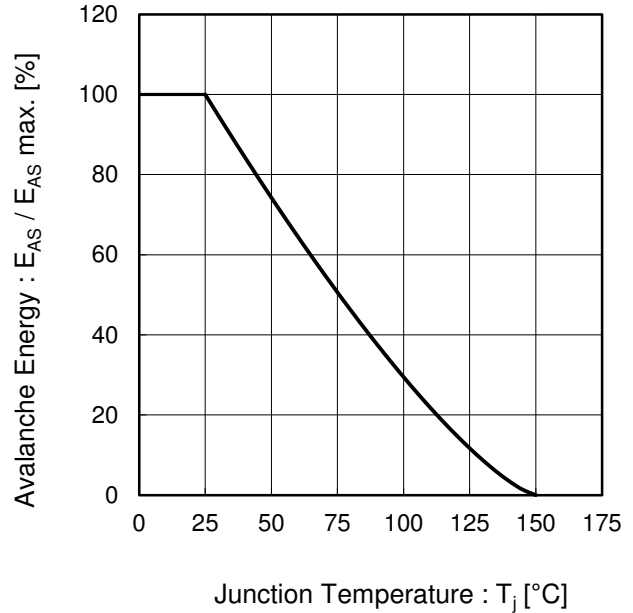


Fig.6 Typical Output Characteristics(I)

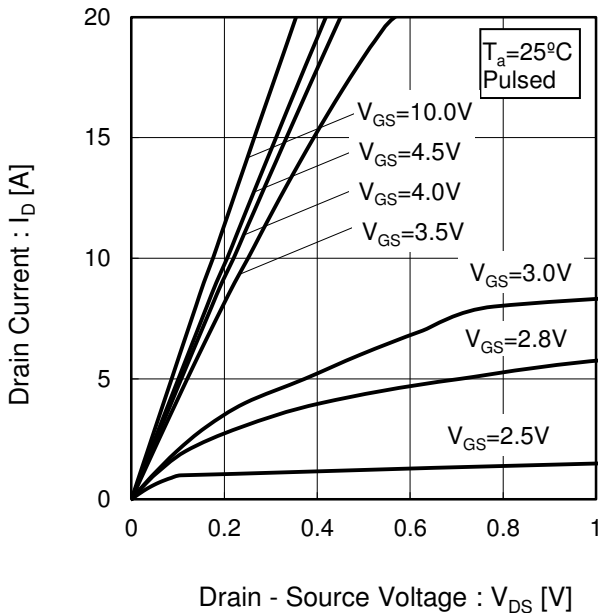
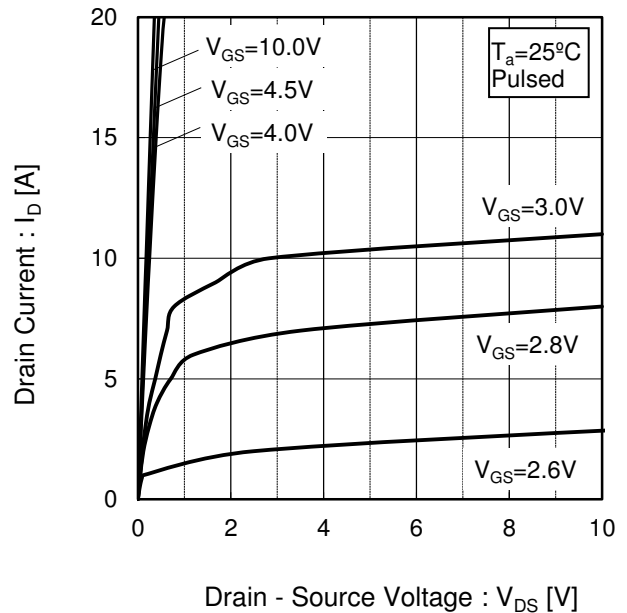


Fig.7 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Breakdown Voltage vs. Junction Temperature

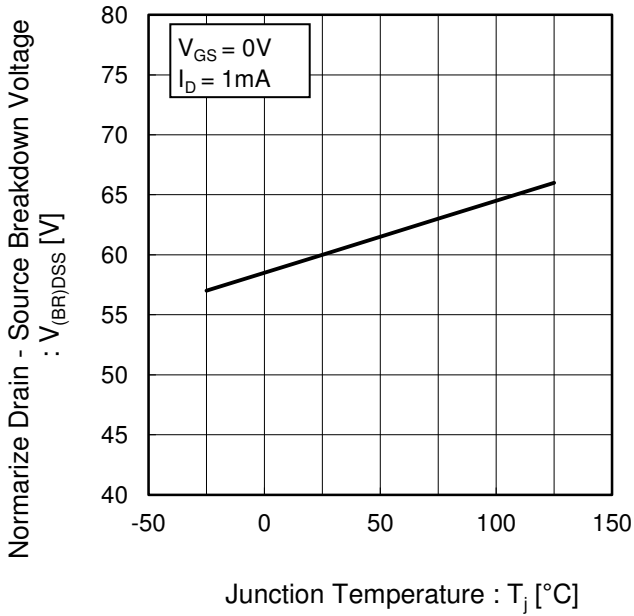


Fig.9 Typical Transfer Characteristics

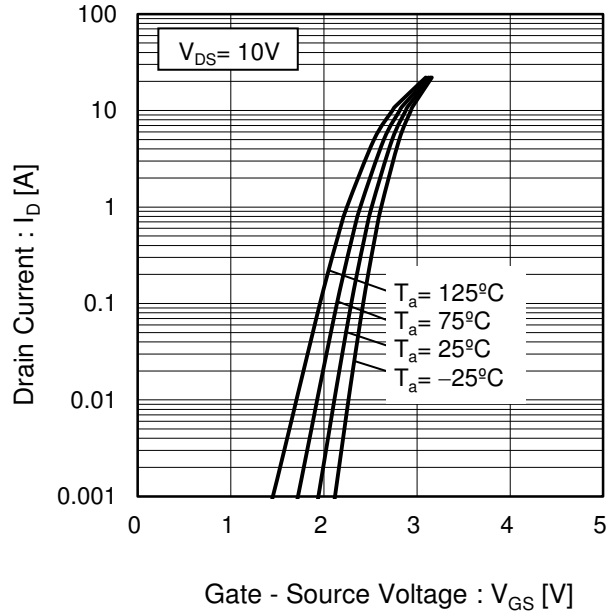


Fig.10 Gate Threshold Voltage vs. Junction Temperature

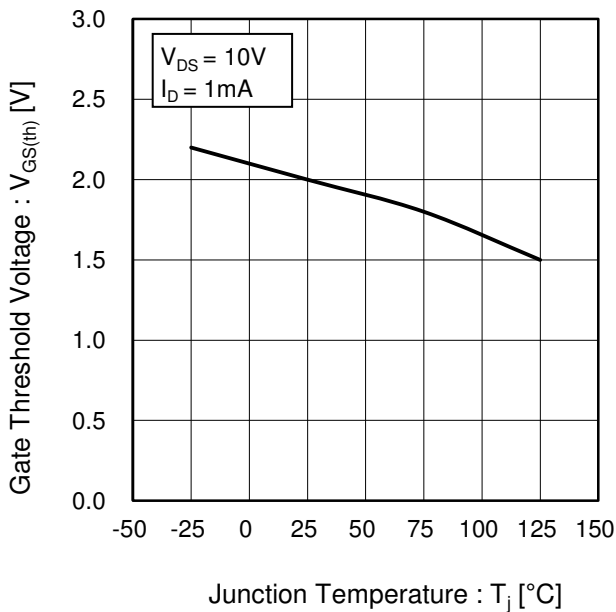
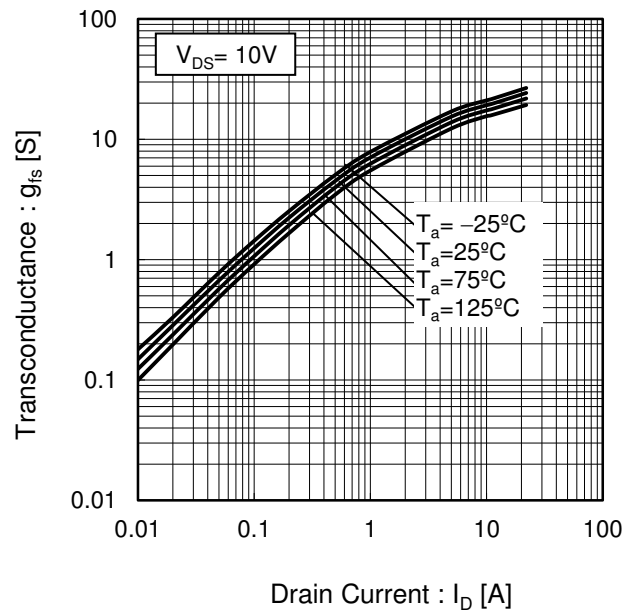


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

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

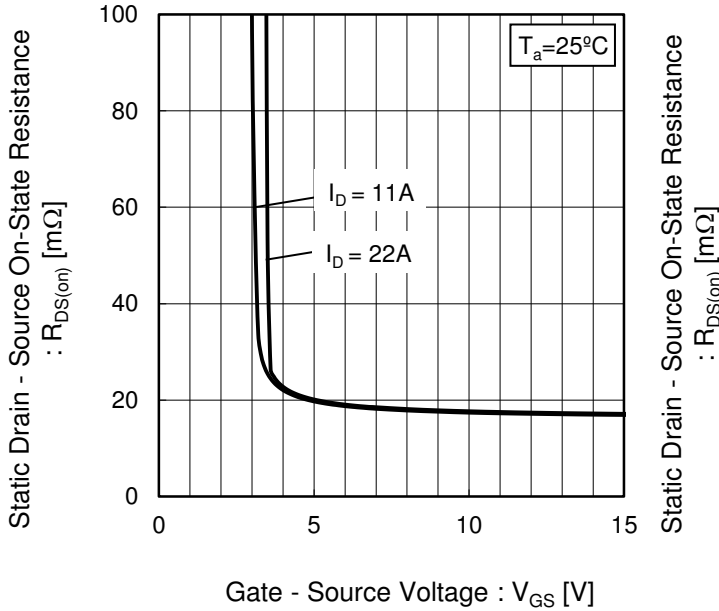


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(I)

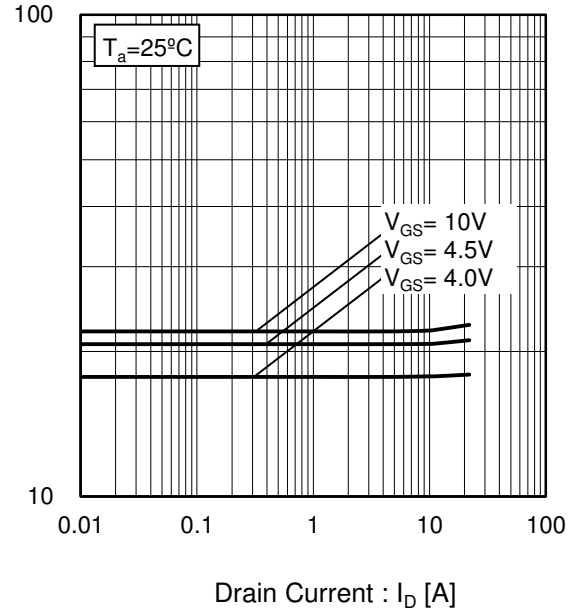
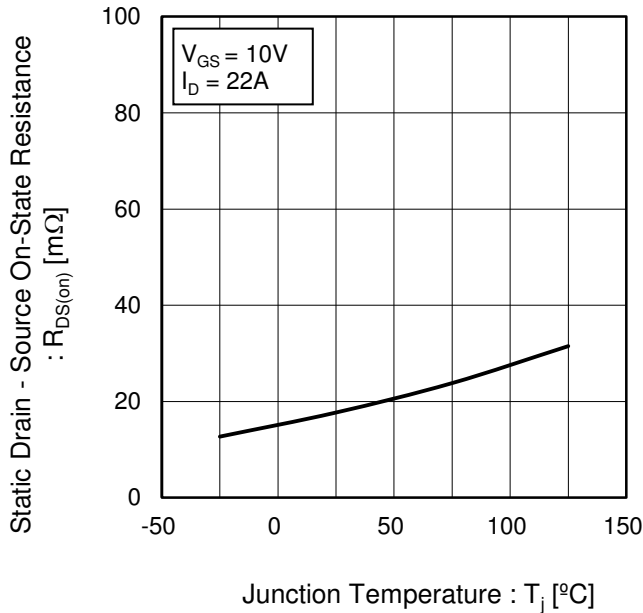


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

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

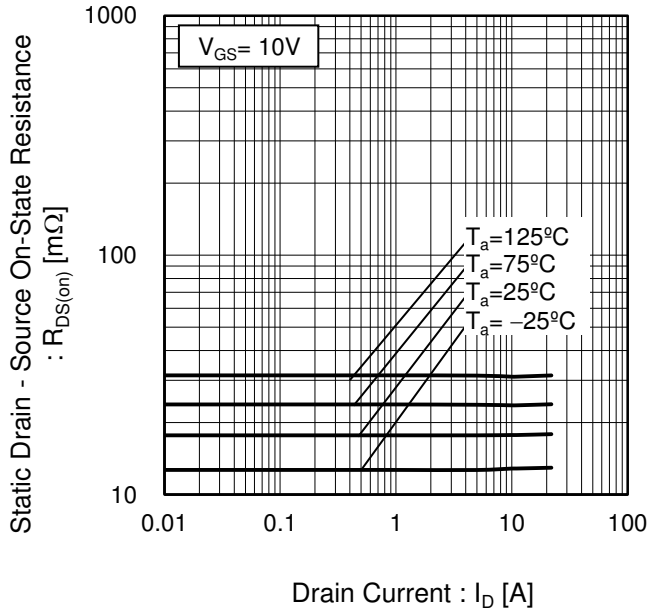


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)

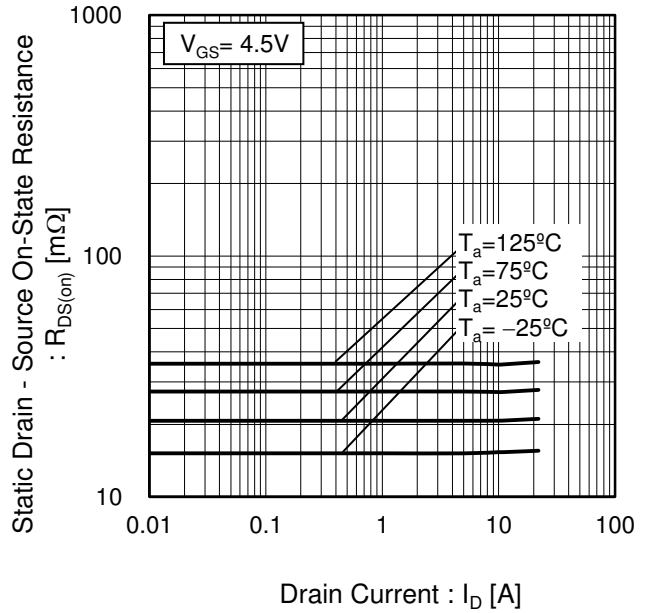


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current(IV)

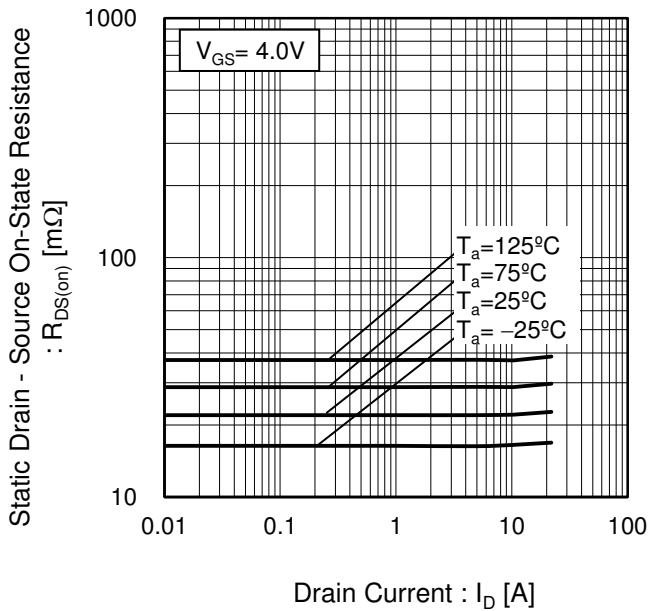
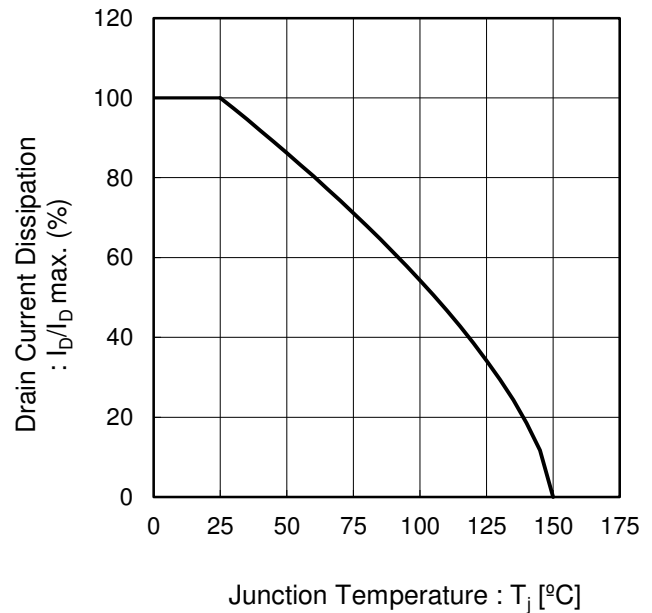


Fig.18 Drain Current Derating Curve





●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

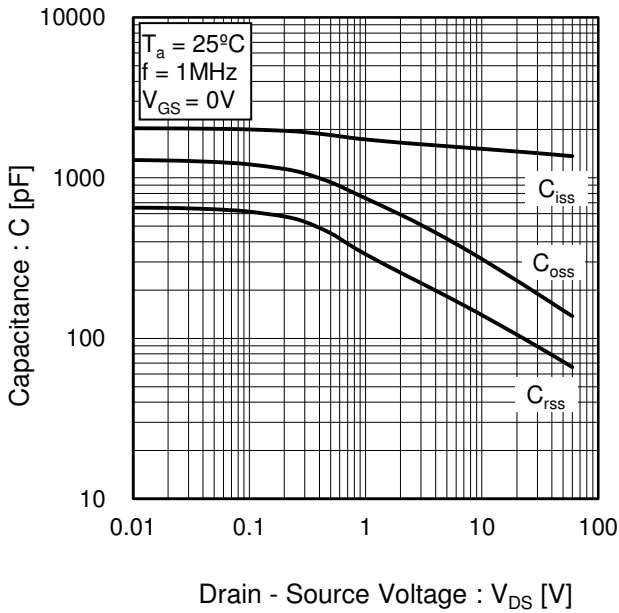


Fig.20 Switching Characteristics

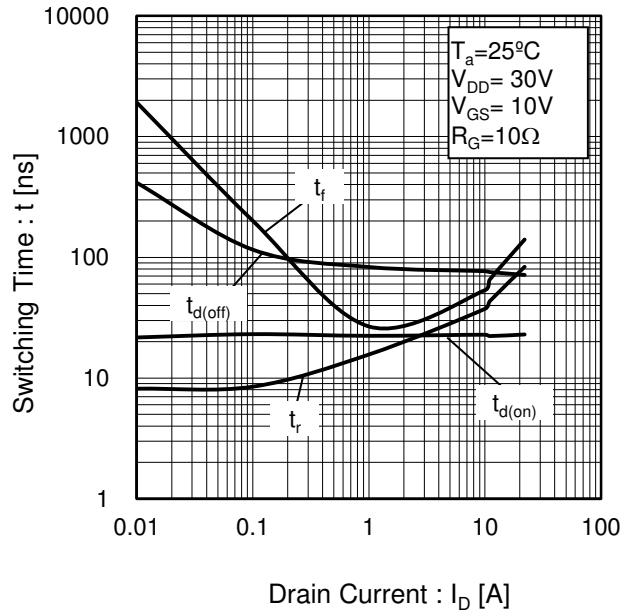


Fig.21 Dynamic Input Characteristics

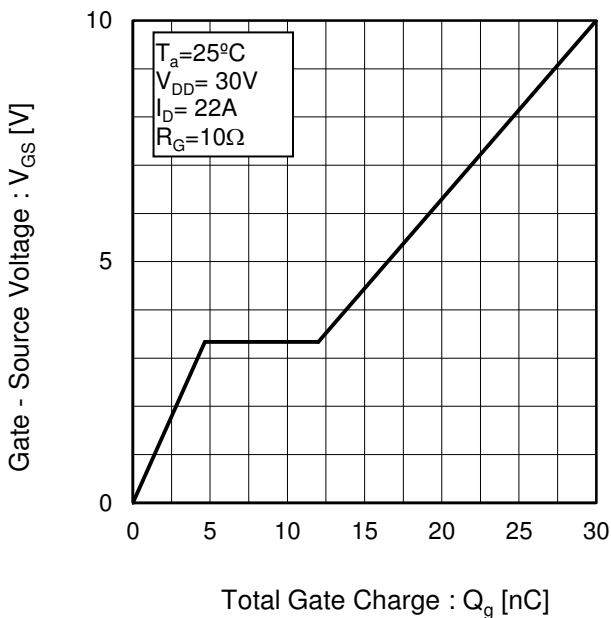
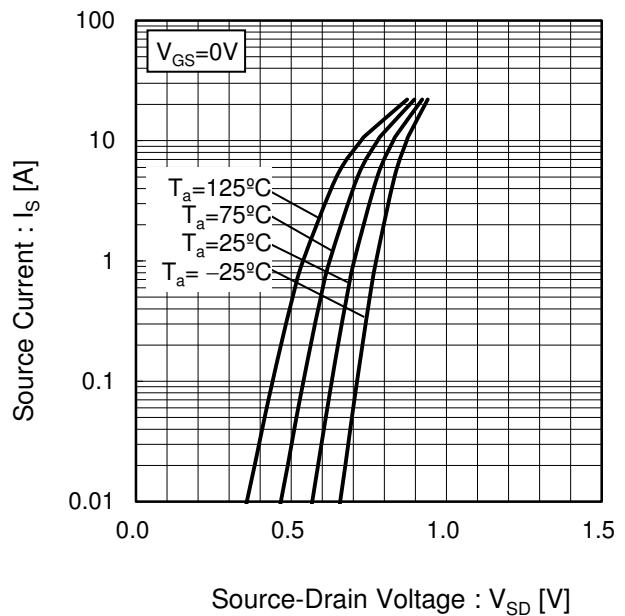
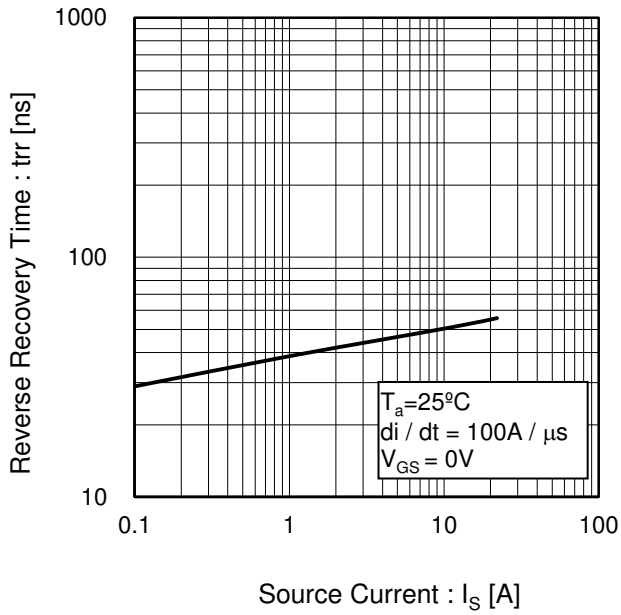


Fig.22 Source Current vs. Source - Drain Voltage



●Electrical characteristic curves

Fig23 Reverse Recovery Time vs.Source Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

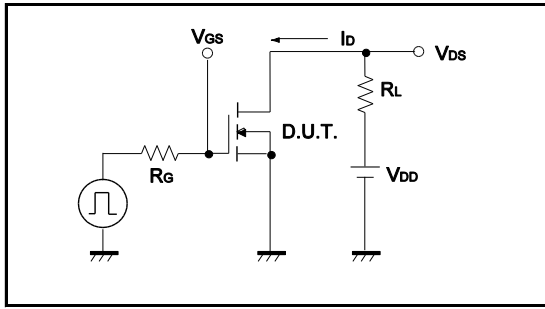


Fig.1-2 Switching Waveforms

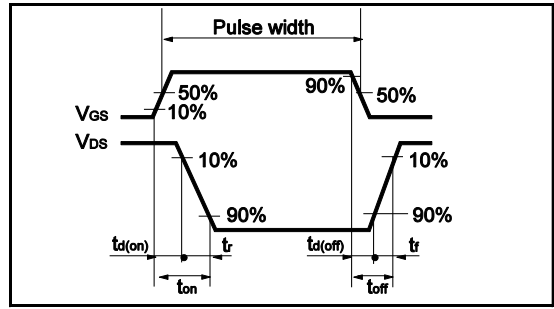


Fig.2-1 Gate Charge Measurement Circuit

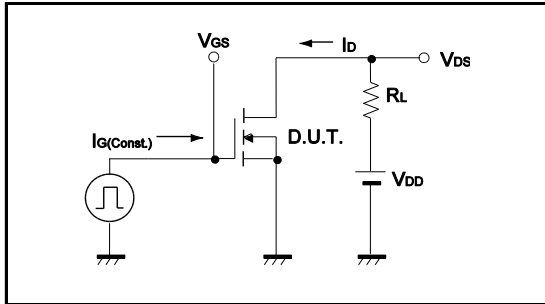


Fig.2-2 Gate Charge Waveform

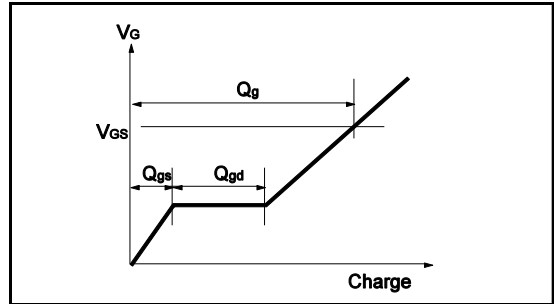


Fig.3-1 Avalanche Measurement Circuit

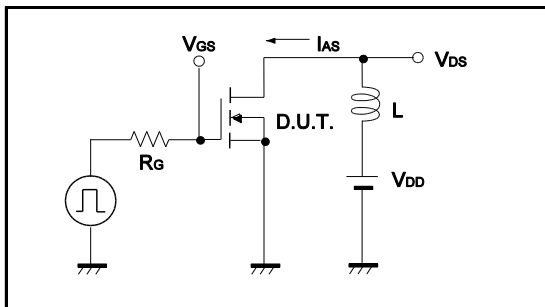
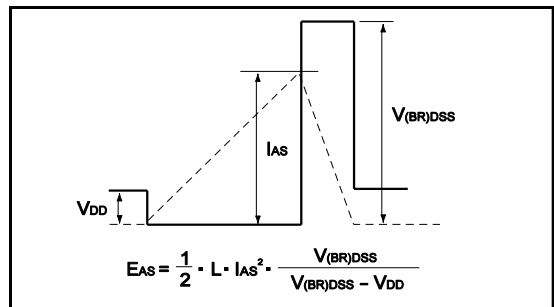
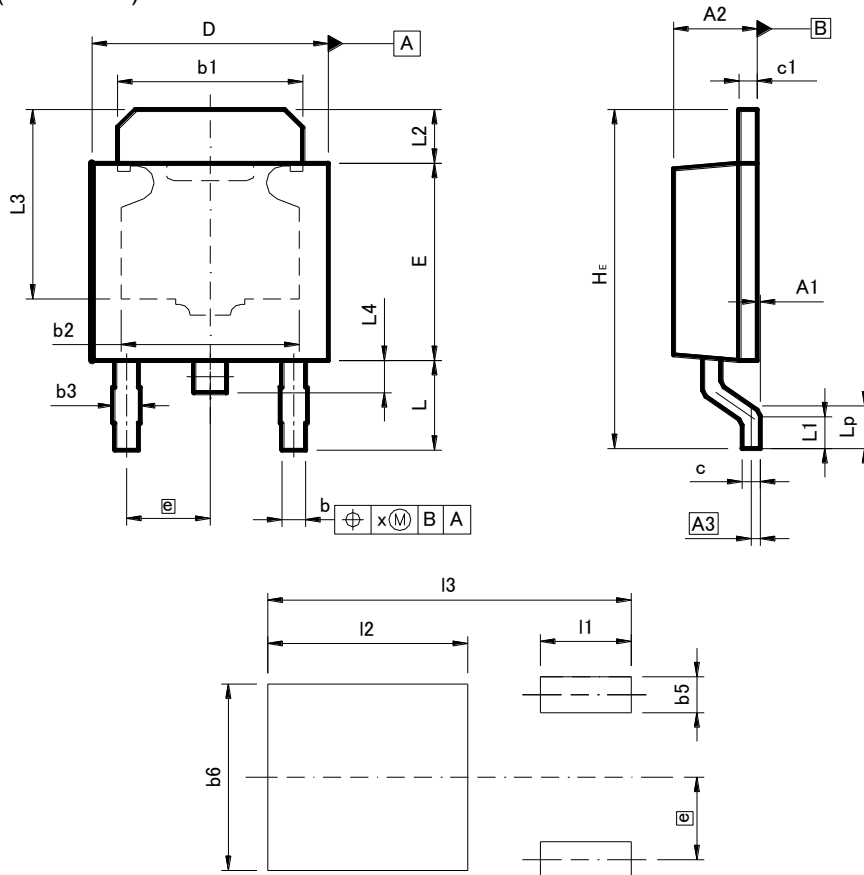


Fig.3-2 Avalanche Waveform



●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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