

$V_{DSS}$	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

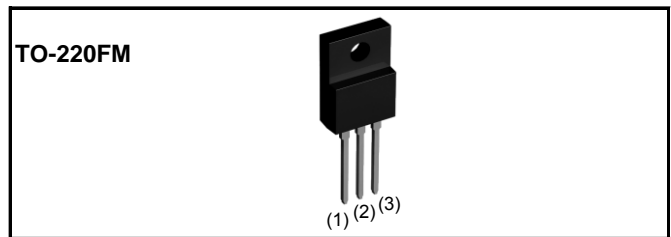
#### ●Application

Switching Power Supply  
 Automotive Motor Drive  
 Automotive Solenoid Drive

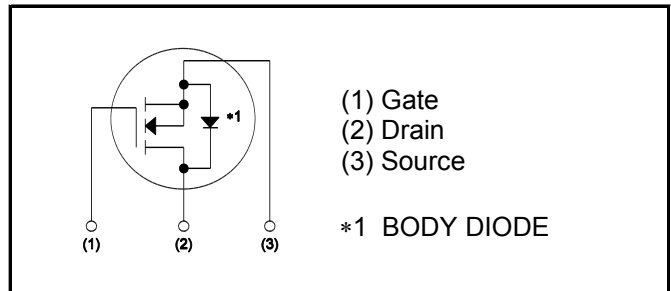
#### ●Absolute maximum ratings ( $T_a = 25^\circ\text{C}$ )

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	$I_{AS}^{*3}$	22.5	A
Power dissipation	$T_c = 25^\circ\text{C}$	$P_D$	40 W
	$T_a = 25^\circ\text{C}$	$P_D$	2.23 W
Junction temperature	$T_j$	150	°C
Range of storage temperature	$T_{stg}$	-55 to +150	°C

#### ●Outline



#### ●Inner circuit



#### ●Packaging specifications

Type	Packaging	Bulk
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	500
	Taping code	-
	Marking	RCX450N20

## ●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	$R_{thJC}$	-	-	3.12	°C/W
Thermal resistance, junction - ambient	$R_{thJA}$	-	-	56	°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	$\mu\text{A}$
		$V_{DS} = 200V, V_{GS} = 0V$ $T_j = 125^\circ\text{C}$	-	-	100	
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	3.0	-	5.0	V
Static drain - source on - state resistance	$R_{DS(on)}^{*4}$	$V_{GS} = 10V, I_D = 22.5A$	-	42	55	$m\Omega$
		$V_{GS} = 10V, I_D = 22.5A$ $T_j = 125^\circ\text{C}$	-	95	125	
Forward transfer admittance	$g_{fs}$	$V_{DS} = 10V, I_D = 22.5A$	17	34	-	S

**●Electrical characteristics (T<sub>a</sub> = 25°C)**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	4200	-	pF
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 25V	-	270	-	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	160	-	
Turn - on delay time	t <sub>d(on)</sub> <sup>*4</sup>	V <sub>DD</sub> ≈ 100V, V <sub>GS</sub> = 10V	-	52	-	ns
Rise time	t <sub>r</sub> <sup>*4</sup>	I <sub>D</sub> = 22.5A	-	210	-	
Turn - off delay time	t <sub>d(off)</sub> <sup>*4</sup>	R <sub>L</sub> = 4.4Ω	-	90	-	
Fall time	t <sub>f</sub> <sup>*4</sup>	R <sub>G</sub> = 10Ω	-	70	-	

**●Gate Charge characteristics (T<sub>a</sub> = 25°C)**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q <sub>g</sub> <sup>*4</sup>	V <sub>DD</sub> ≈ 100V	-	80	-	nC
Gate - Source charge	Q <sub>gs</sub> <sup>*4</sup>	I <sub>D</sub> = 45A	-	28	-	
Gate - Drain charge	Q <sub>gd</sub> <sup>*4</sup>	V <sub>GS</sub> = 10V	-	28	-	
Gate plateau voltage	V <sub>(plateau)</sub>	V <sub>DD</sub> ≈ 100V, I <sub>D</sub> = 45A	-	7.2	-	V

**●Body diode electrical characteristics (Source-Drain)(T<sub>a</sub> = 25°C)**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous source current	I <sub>S</sub> <sup>*1</sup>	T <sub>c</sub> = 25°C	-	-	45	A
Pulsed source current	I <sub>SM</sub> <sup>*2</sup>		-	-	180	A
Forward voltage	V <sub>SD</sub> <sup>*4</sup>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 45A	-	-	1.5	V
Reverse recovery time	t <sub>rr</sub> <sup>*4</sup>	I <sub>S</sub> = 22.5A	-	130	-	ns
Reverse recovery charge	Q <sub>rr</sub> <sup>*4</sup>	di/dt = 100A/μs	-	600	-	nC

\*1 Limited only by maximum temperature allowed.

\*2 P<sub>w</sub> ≤ 10μs, Duty cycle ≤ 1%

\*3 L ≈ 500μH, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, starting T<sub>j</sub> = 25°C

\*4 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

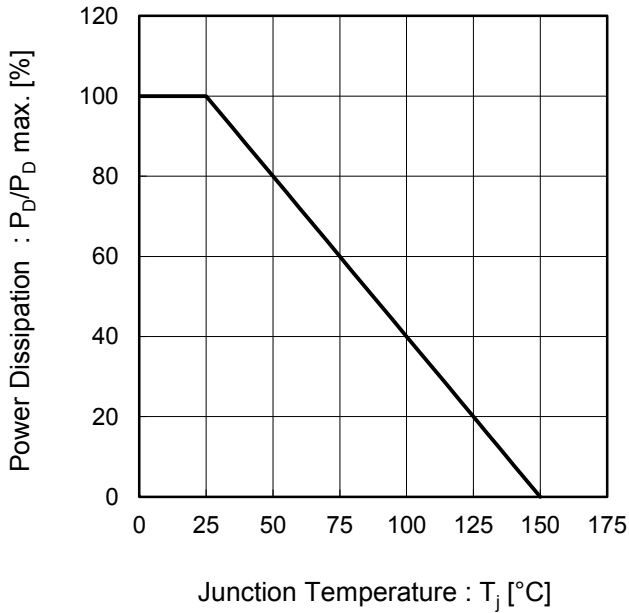


Fig.2 Maximum Safe Operating Area

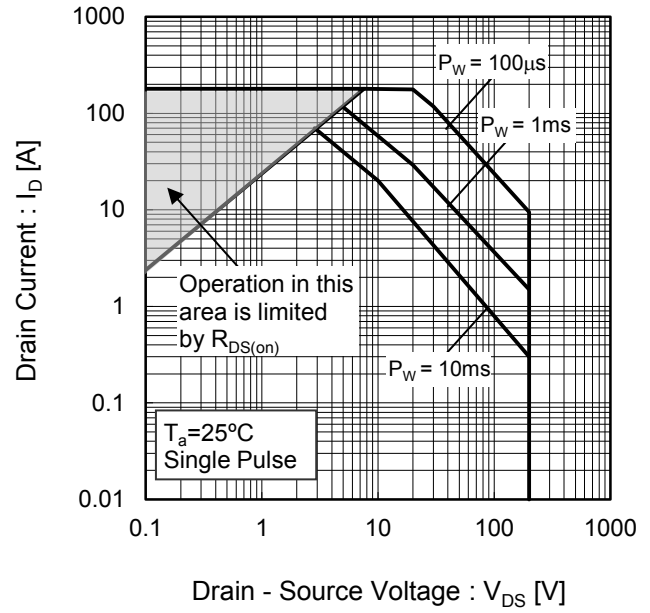
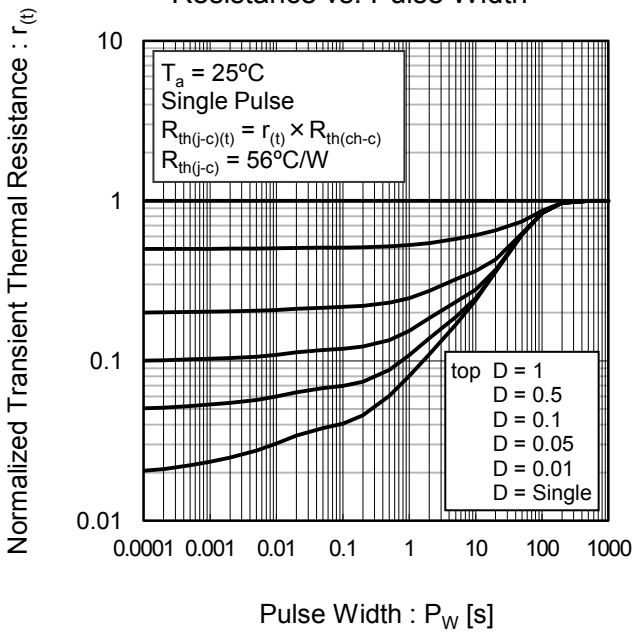


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

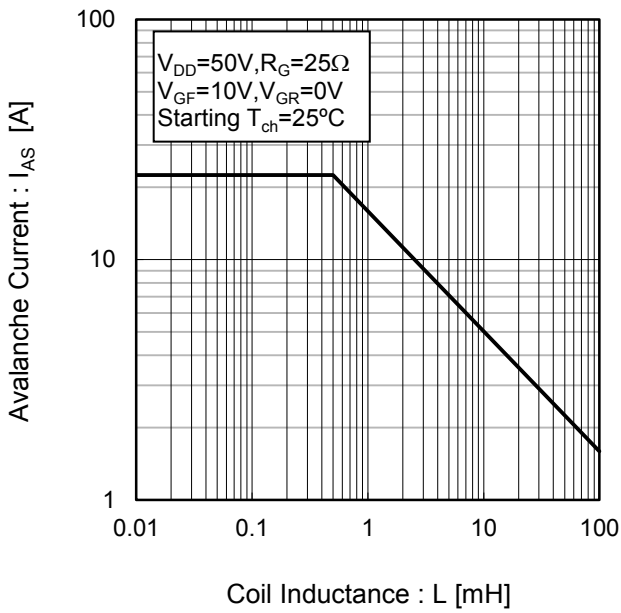


Fig.5 Avalanche Energy Derating Curve vs Junction Temperature

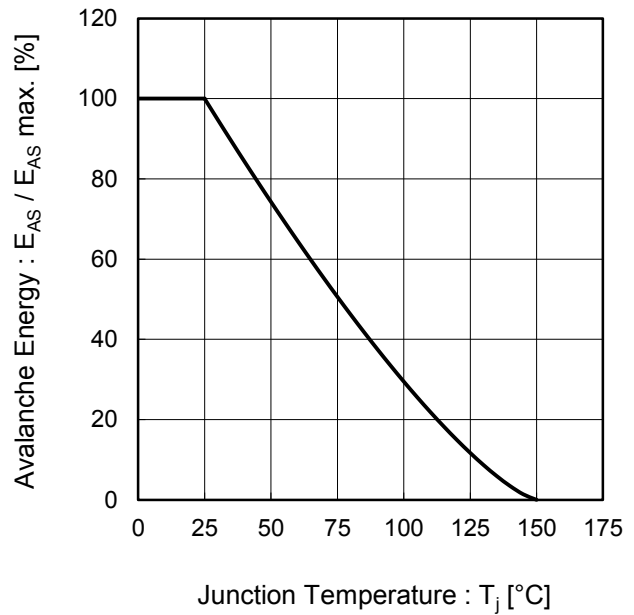


Fig.6 Typical Output Characteristics(I)

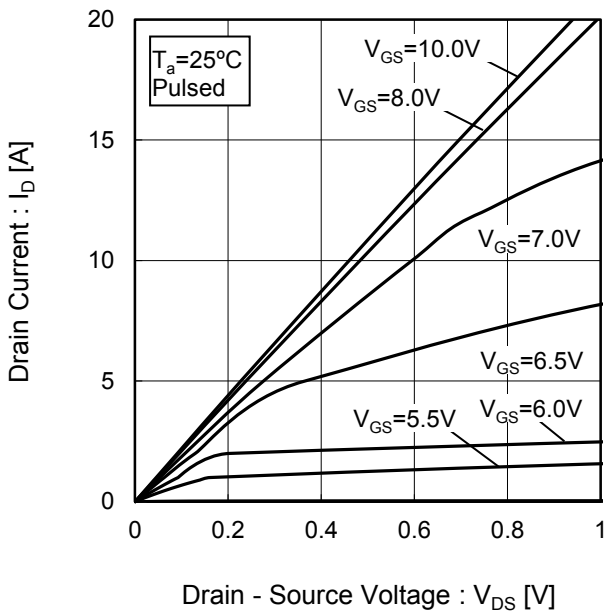
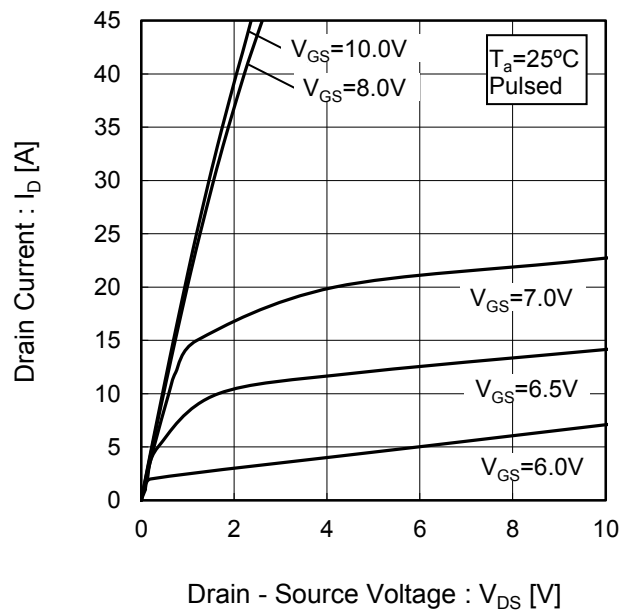


Fig.7 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Breakdown Voltage vs. Junction Temperature

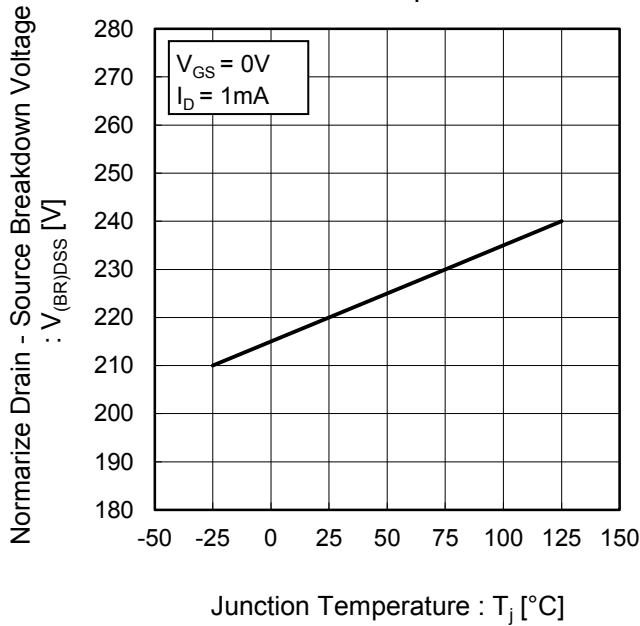


Fig.9 Typical Transfer Characteristics

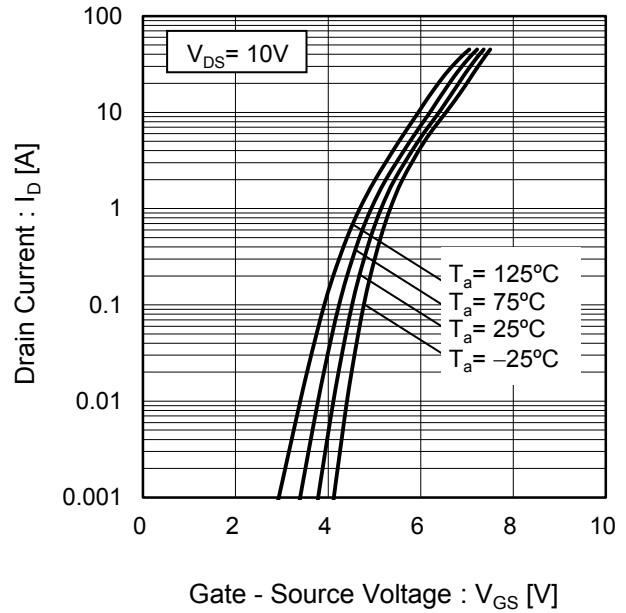


Fig.10 Gate Threshold Voltage vs. Junction Temperature

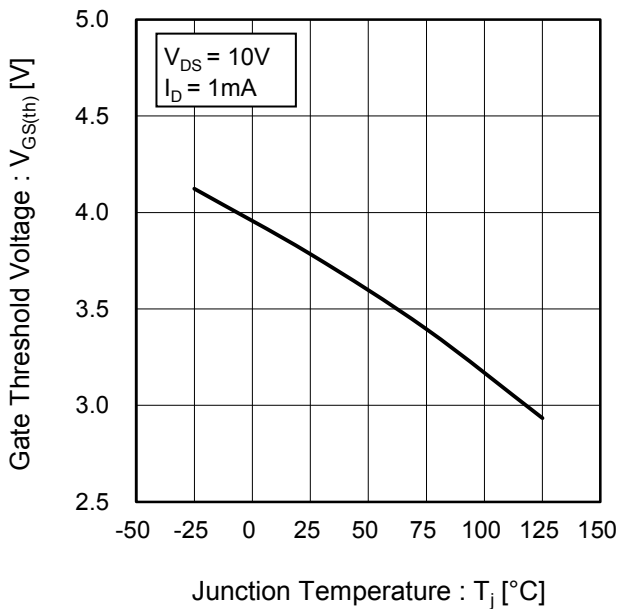
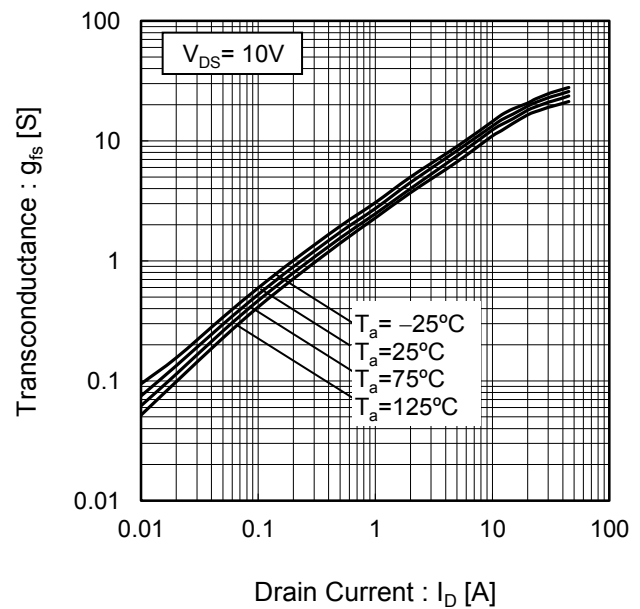


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

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

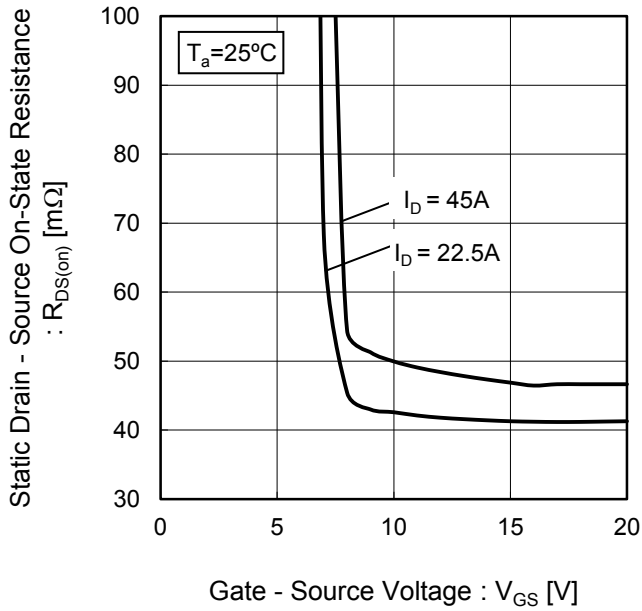


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(I)

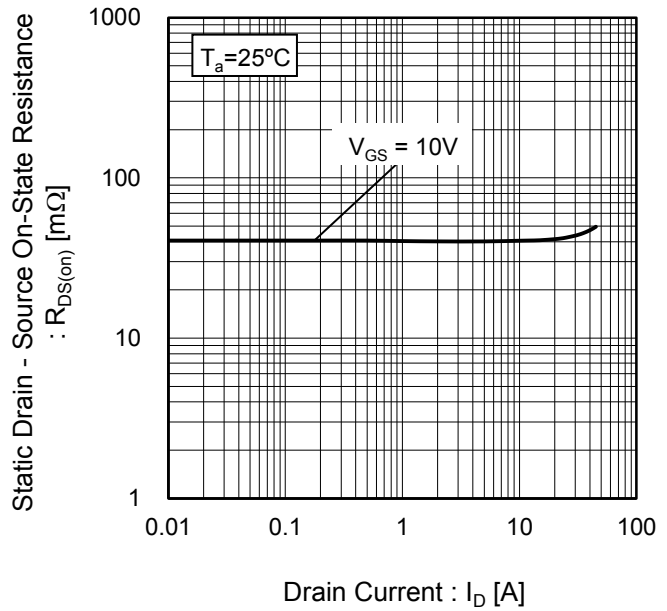
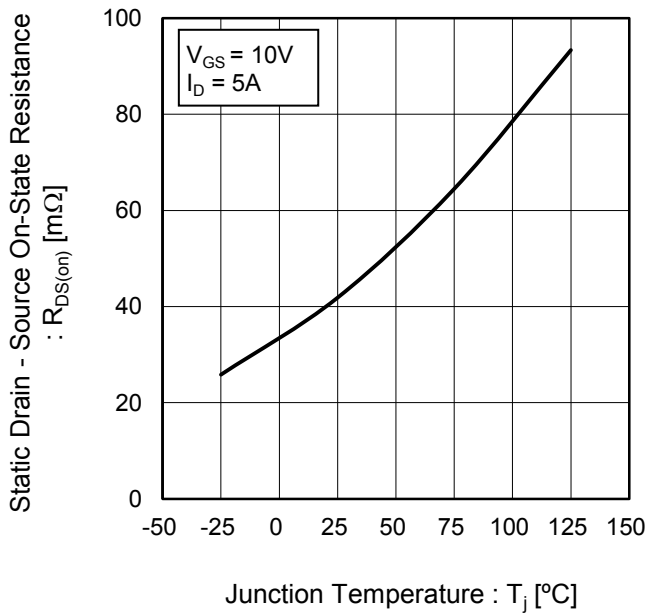


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

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

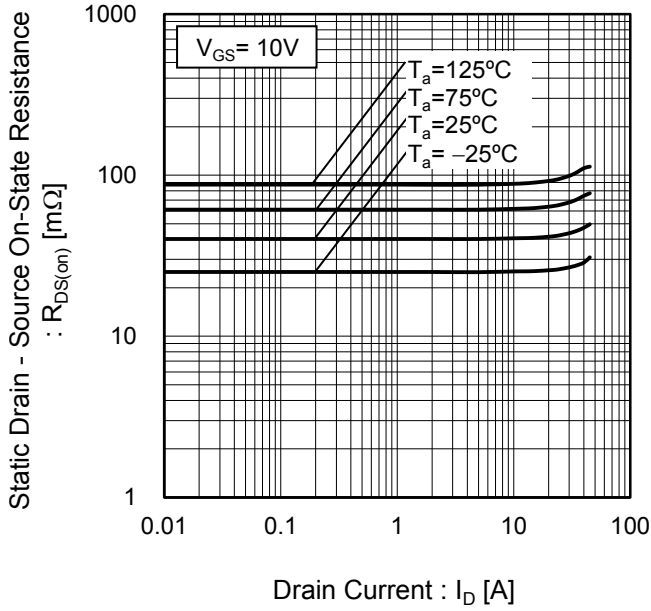
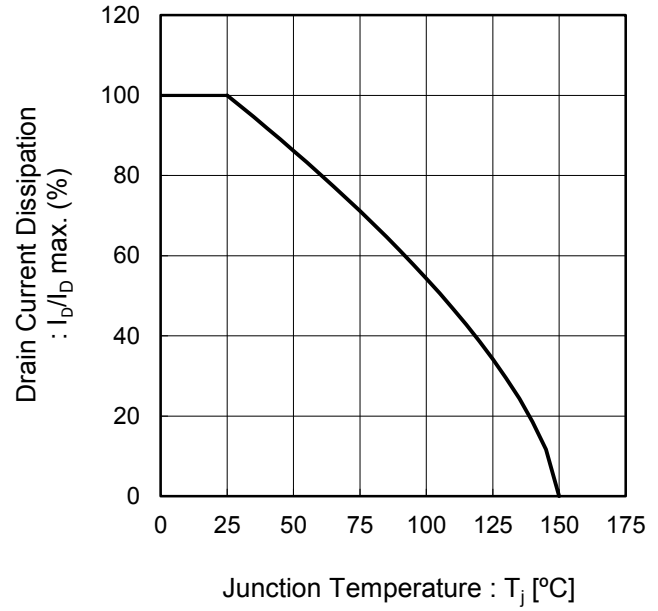


Fig.16 Drain Current Derating Curve





●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

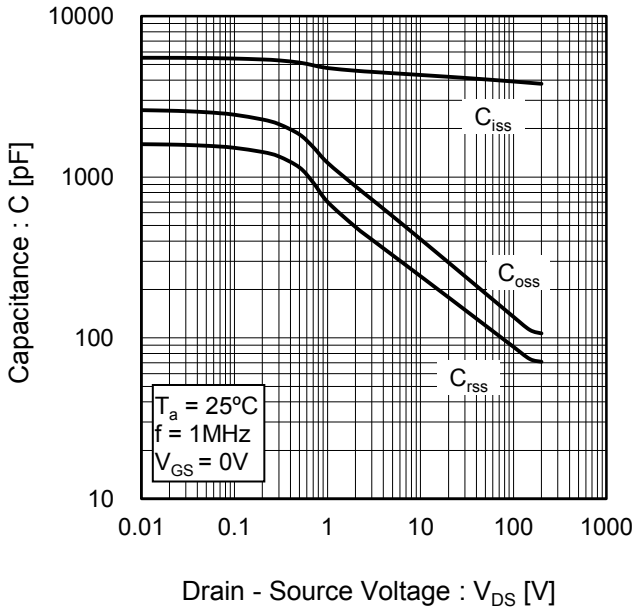


Fig.18 Switching Characteristics

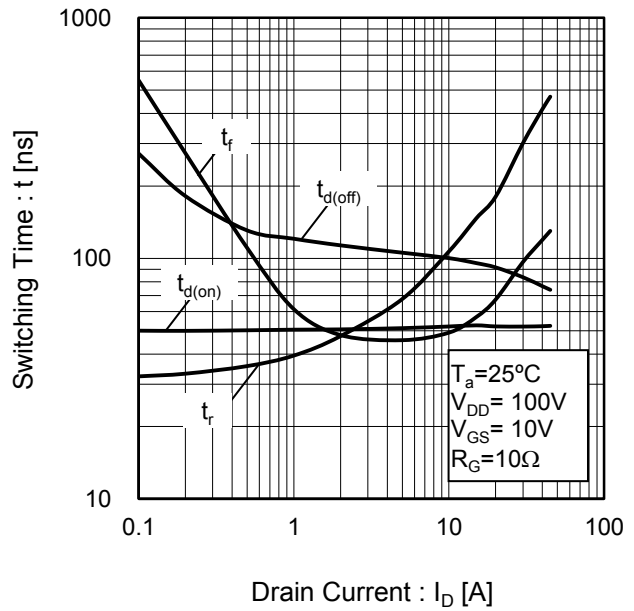
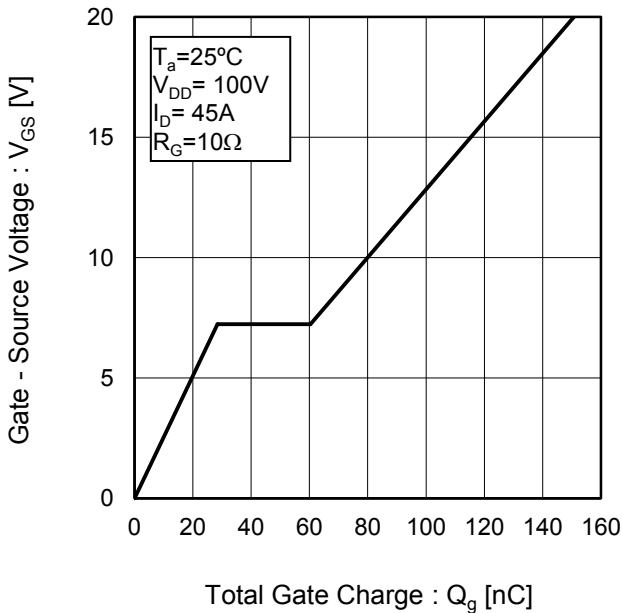


Fig.19 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.20 Source Current vs. Source - Drain Voltage

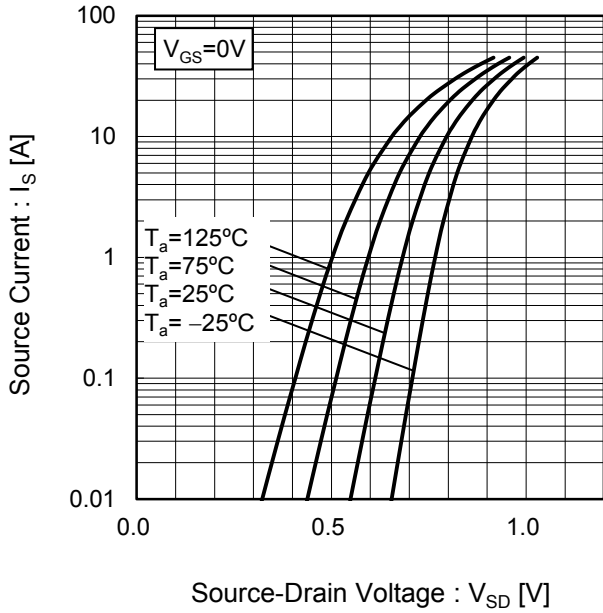
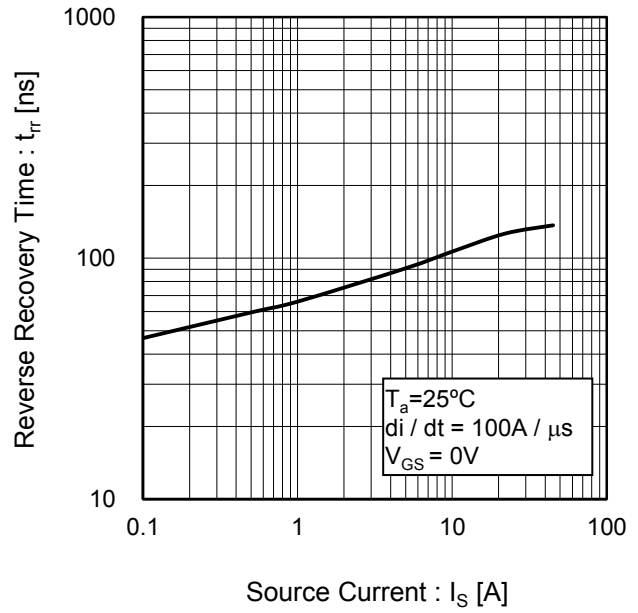


Fig.21 Reverse Recovery Time vs. Source Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

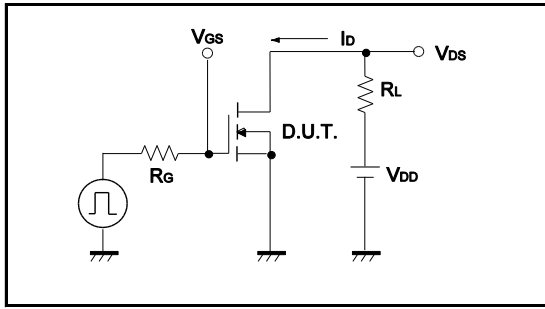


Fig.1-2 Switching Waveforms

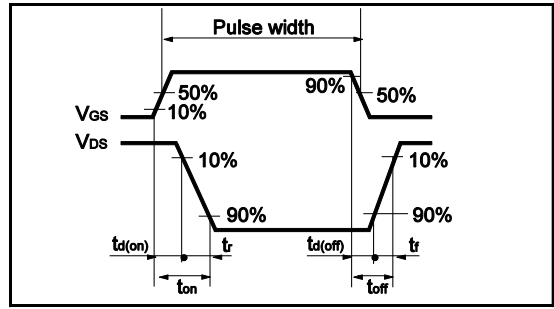


Fig.2-1 Gate Charge Measurement Circuit

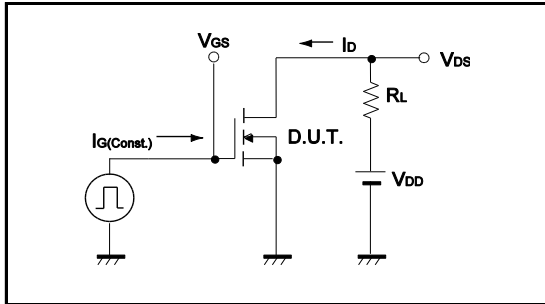


Fig.2-2 Gate Charge Waveform

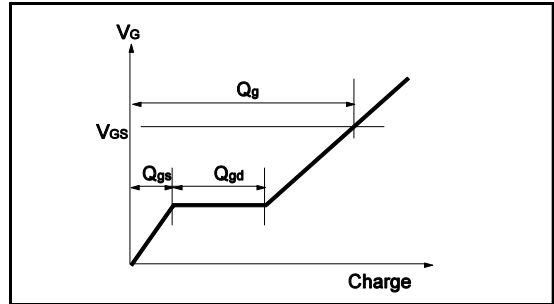


Fig.3-1 Avalanche Measurement Circuit

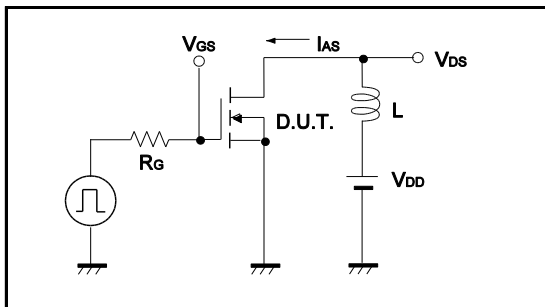
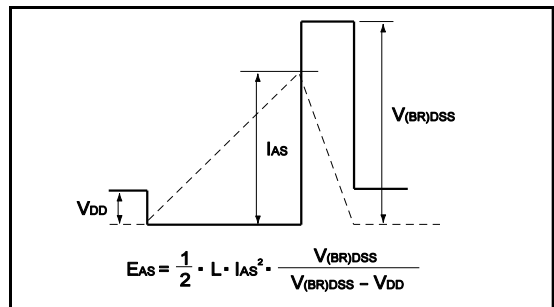
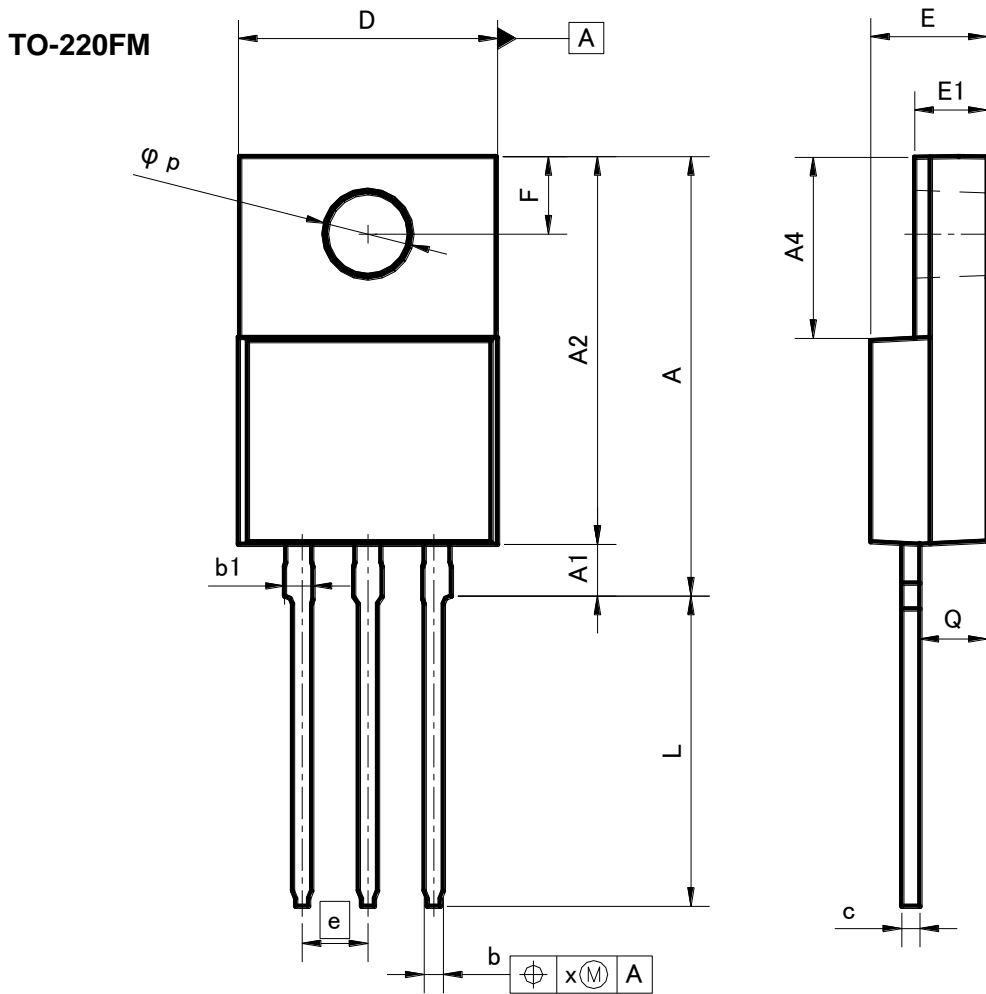


Fig.3-2 Avalanche Waveform



●Dimensions (Unit : mm)



DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	16.60	17.60	0.654	0.693
A1	1.80	2.20	0.071	0.087
A2	14.80	15.40	0.583	0.606
A4	6.80	7.20	0.268	0.283
b	0.70	0.85	0.028	0.033
b1	1.10	1.50	0.043	0.059
c	0.70	0.85	0.028	0.033
D	9.90	10.30	0.39	0.406
E	4.40	4.80	0.173	0.189
e	2.54		0.10	
E1	2.70	3.00	0.106	0.118
F	2.80	3.20	0.11	0.126
L	11.50	12.50	0.453	0.492
p	3.00	3.40	0.118	0.134
Q	2.10	3.10	0.083	0.122
x	-	0.381	-	0.015

Dimension in mm/inches

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