V_{DSS}	650V
$R_{DS(on)}$ (Max.)	0.390Ω
I_D	11A
P_D	40W

Outline

TO-220FM
Front View

(1) (2) (3)
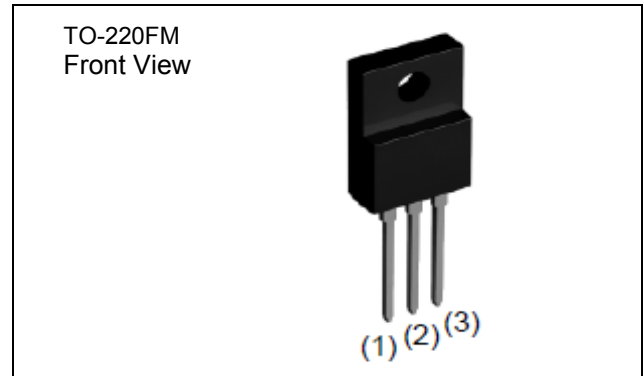
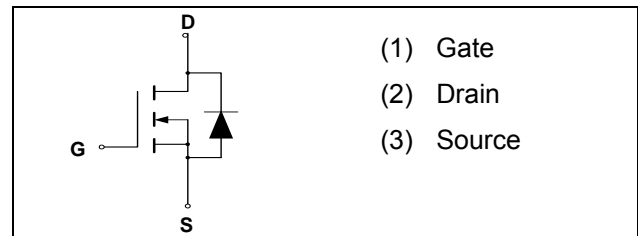## FEATURES

◆ Low on-resistance

◆ Fast switching speed

◆ Gate-source voltage (V_{GSS}) guaranteed to be ±20V

◆ Drive circuits can be simple

◆ Parallel use is easy

◆ Pb-free lead plating ; RoHs compliant

Inner circuit

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

Application

◆ Switching Power Supply

Packaging specificationa

Type	Packaging	Bulk
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	1000
	Taping code	-
	Marking	CMS6511

ORDERING INFORMATION

Part Number	Temperature Range	Package
CMS6511ENX	-55℃ to 150℃	TO-220FP

*Note :

E*Series

N*:N-ch Mosfet

X*TO-220FP

ABSOLUTE MAXIMUM RATINGS (Ta=25℃)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V_{DSS}	650	V
Continuous drain current	Tc=25℃	I_D [*1]	±11	A
	Tc=100℃	I_D [*1]	±5.9	A
Pulsed drain current		$I_{D, pulse}$ [*2]	±22	A
Gate-Source Voltage		V_{GSS}	±20	V
Avalanche energy, single pulse		E_{AS} [*3]	210	mJ
Avalanche energy, repetitive		E_{AR} [*3]	0.32	mJ
Avalanche current, repetitive		I_{AR}	1.8	A
Power Dissipation (Tc=25℃)		P_D	40	W
Junction temperature		T_J	150	℃
Range of storage temperature		T_{stg}	-55 to +150	℃
Reverse diode dv/dt		Dv/dt [*4]	15	V/ns
Drain-Source Voltage Slope	V_{DS}=480V ; Tj=25℃	Dv/dt	50	V/ns

THERMAL RESISTANCE

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Thermal resistance , junction-case	R_{thJC}	-	-	3.13	℃/W
Thermal resistance , junction-ambient	R_{thJA}	-	-	70	℃/W
Soldering temperature , wavesoldering for 10s	T_{sold}	-	-	265	℃

ELECTRICAL CHARACTERISTICS (Ta=25℃)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Drain-Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 1mA	650	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V				uA
		T_j = 25℃	-	0.1	100	
		T_j = 125℃	-	-	1000	
Gate-Source leakage current	I_{GSS}	V_{GS} = ±20V, V_{DS} = 0V	-	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	V_{DS} = 10V, I_D = 1mA	2	-	4	V
Static drain-source on-state resistance	$R_{DS(on)}$ [*5]	V_{GS} = 10V, I_D = 3.8A				Ω
		T_j = 25℃	-	0.34	0.39	
		T_j = 125℃	-	0.72	-	
Gate input resistance	R_G	F = 1MHz, open drain	-	7.7	-	Ω

ELECTRICAL CHARACTERISTICS (Ta=25℃)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Transconductance	G_{fs} [*5]	V_{DS} = 10V, I_D = 5.5A	3.0	6.0	-	S
Input capacitance	C_{iss}	V_{GS} = 0V V_{DS} = 25V F = 1MHZ	-	670	-	pF
Output capacitance	C_{oss}		-	570	-	
Reverse transfer capacitance	C_{rss}		-	70	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 480V	-	30	-	pF
Effective output capacitance, time related	$C_{o(tr)}$		-	136	-	
Turn-on delay time	$T_{d(on)}$ [*5]	$V_{DD}\sim$300V, V_{GS} = 10V I_D = 5.5A R_L = 54.9Ω R_G = 10Ω	-	25	-	ns
Rise time	T_r [*5]		-	40	-	
Turn-off delay time	$T_{d(off)}$ [*5]		-	90	-	
Fall time	T_f [*5]		-	35	-	

GATE CHARACTERISTICS (Ta=25℃)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD}\sim$300V, I_D = 11A	-	6.0	-	V
Total gate charge	Q_g [*5]	$V_{DD}\sim$300V I_D = 11A V_{GS} = 10V	-	32	-	nC
Gate-Source charge	Q_{gs} [*5]		-	5	-	
Gate Drain charge	Q_{gd} [*5]		-	17	-	

*1 : Limit only by maximum temperature allowed

*2 : Pw≦10us, Duty cycle≦1%

*3 : I_D = 1.8A, V_{DD} = 50V

*4 : Reference measurement circuits Fig.5-1

*5 : Pulsed

BODY DIODE ELECTRICAL CHARACTERISTICS (Source-Drain) (Ta=25℃)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S *1	Tc=25℃	-	-	11	A
Inverse diode direct current, pulsed	I_{SM} *2		-	-	22	A
Forward Voltage	V_{SD} *5	V_{GS} = 0V, I_S = 11A	-	-	1.5	V
Reverse recovery time	T_{rr} *5	I_S = 11A Di/dt = 100A/us	-	430	-	ns
Reverse recovery charge	Q_{rr} *5		-	4.5	-	uC
Peak reverse recovery current	I_{rrm} *5		-	22	-	A

TYPICAL TRANSIENT THERMAL CHARACTERISTICS

Symbol	Value	Unit
R_{th1}	0.261	K/W
R_{th2}	0.973	
R_{th3}	2.18	
C_{th1}	0.00167	Ws/K
C_{th2}	0.0192	
C_{th3}	0.460	

Application Circuit
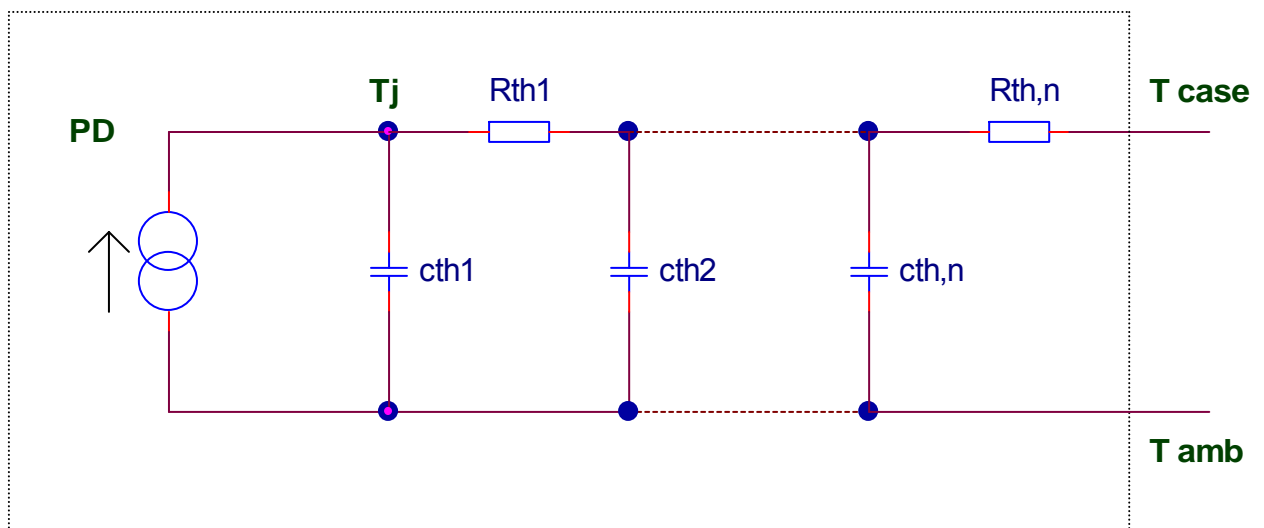
●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve
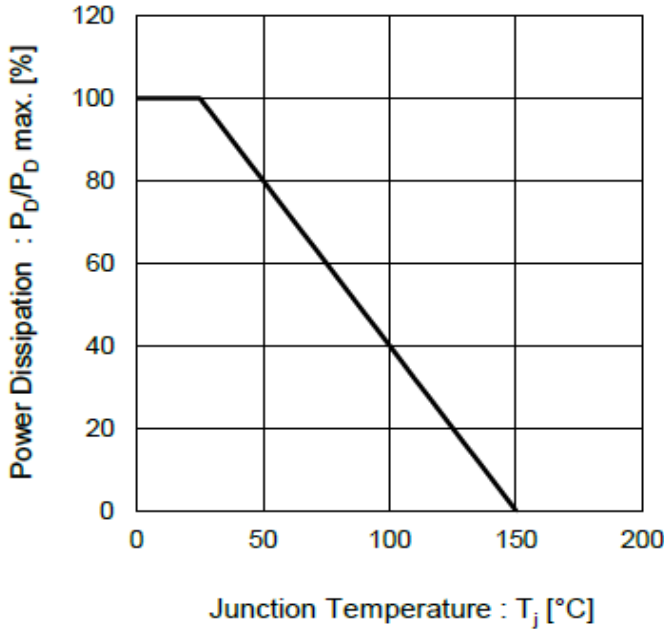
Fig.2 Maximum Safe Operating Area
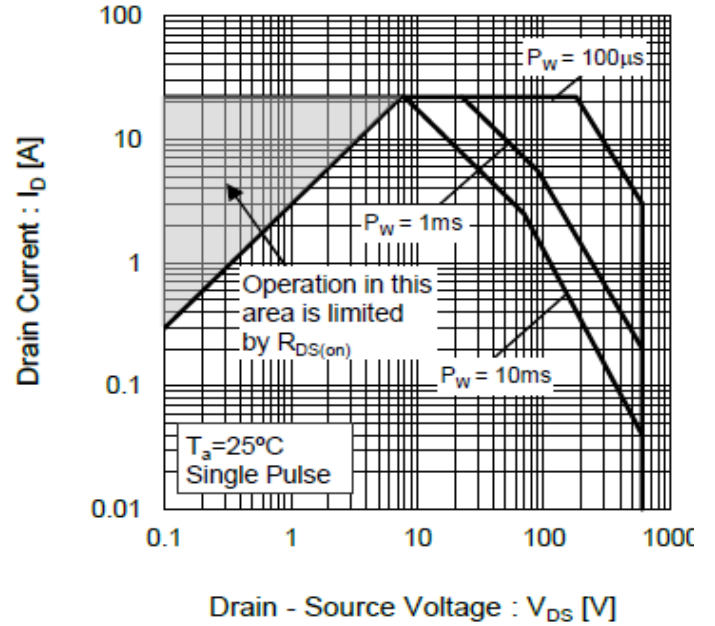
Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width
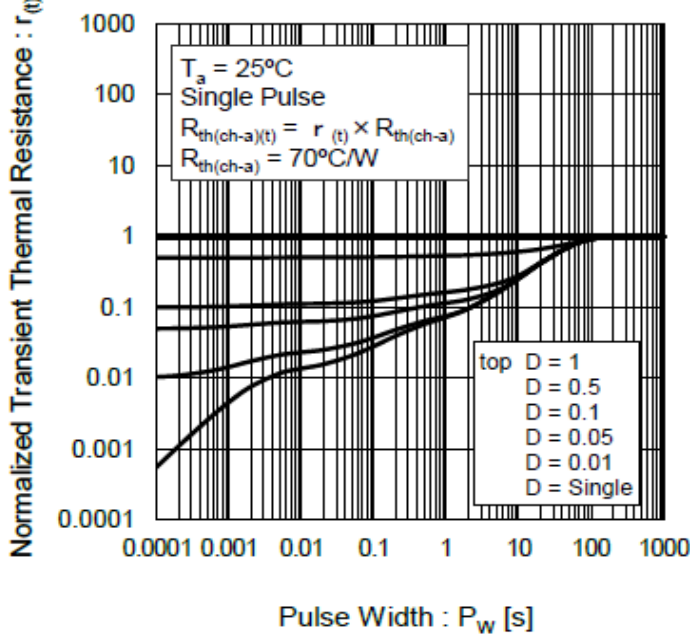
Fig.4 Avalanche Energy Derating Curve vs Junction Temperature
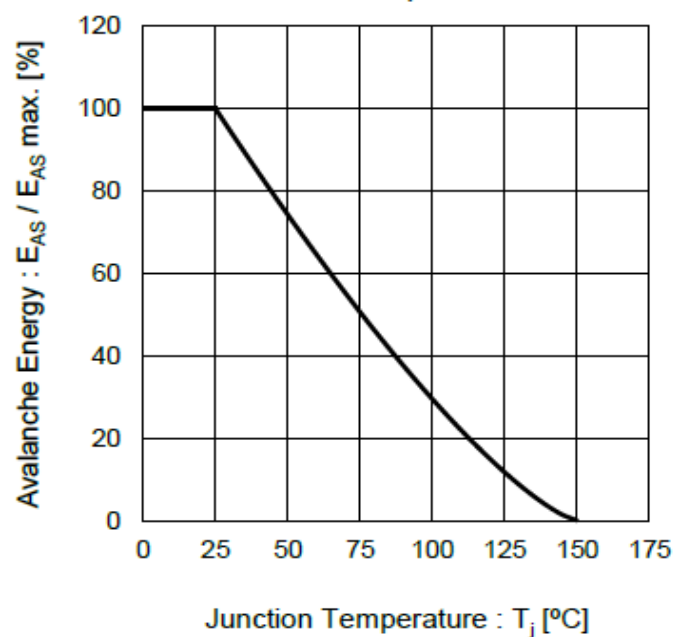
● **Electrical characteristic curves**

Fig.5 Typical Output Characteristics(I)
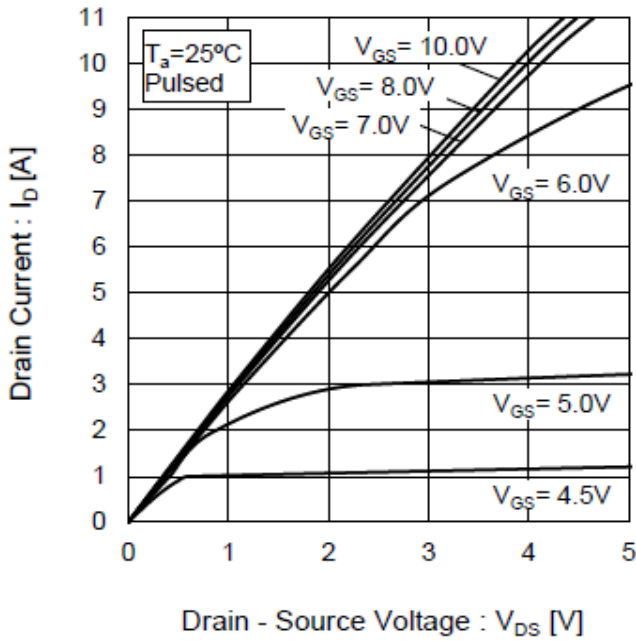
Fig.6 Typical Output Characteristics(II)
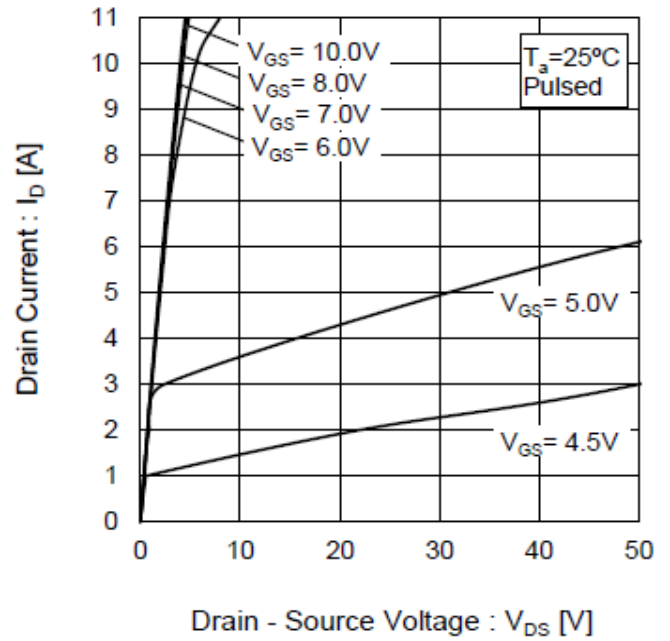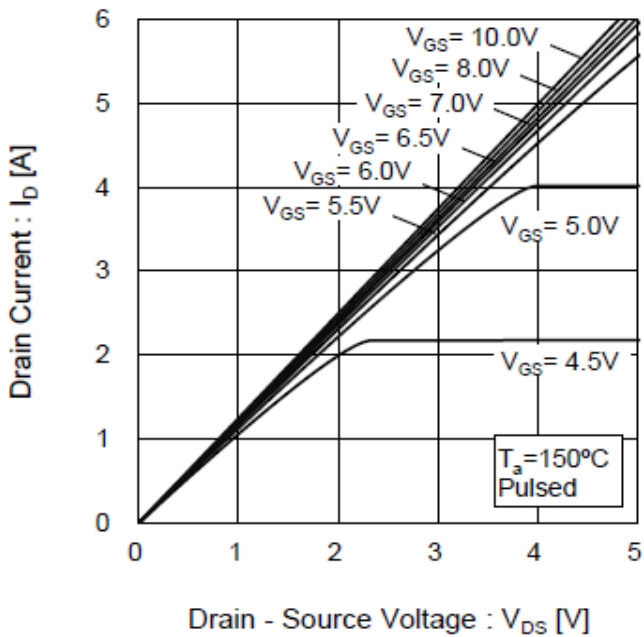
Fig.7 T_j = 150°C Typical Output Characteristics(I)

Fig.8 T_j = 150°C Typical Output Characteristics(II)
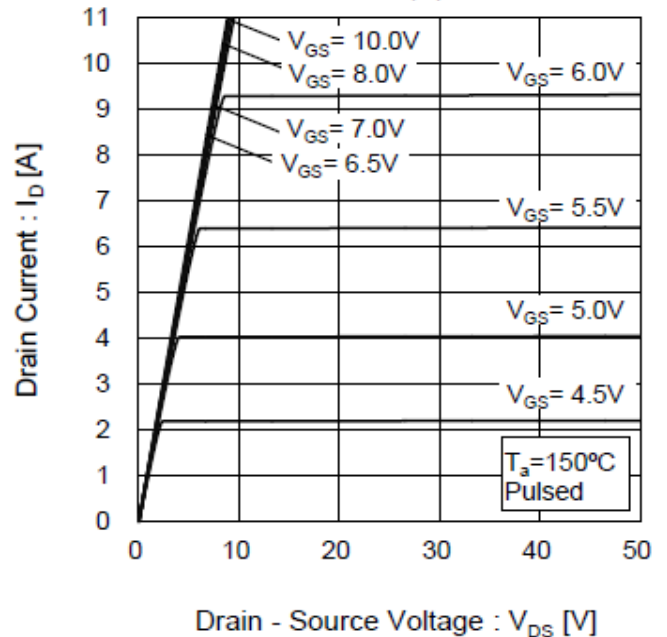
● Electrical characteristic curves

Fig.9 Breakdown Voltage vs. Junction Temperature
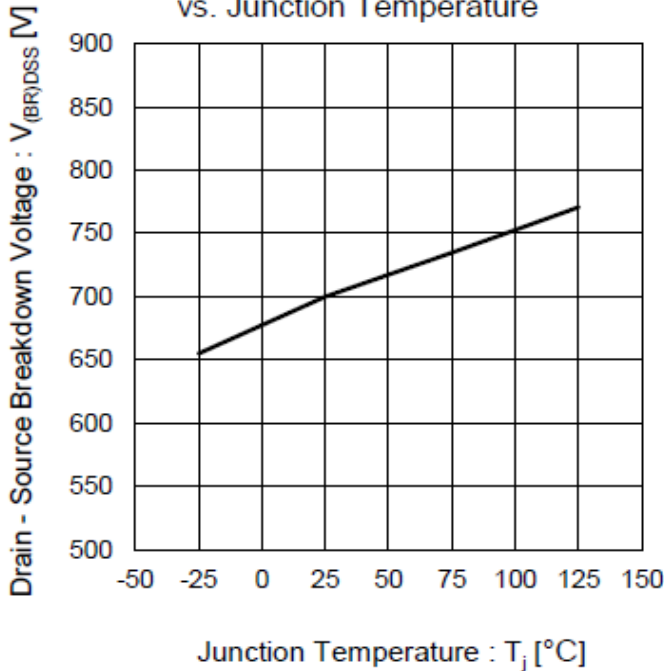
Fig.10 Typical Transfer Characteristics
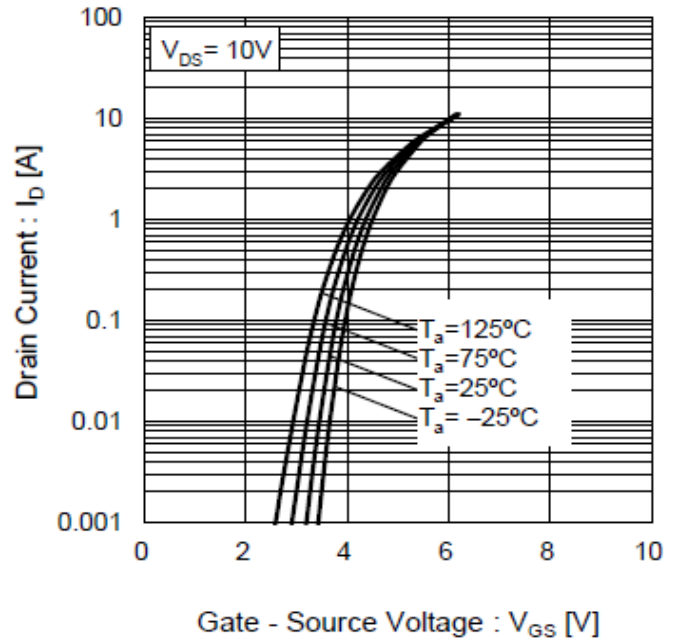
Fig.11 Gate Threshold Voltage vs. Junction Temperature
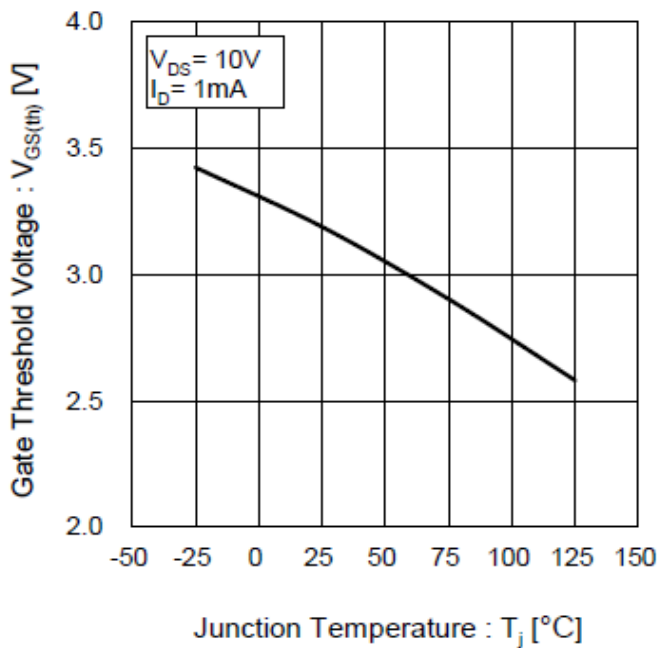
Fig.12 Transconductance vs. Drain Current
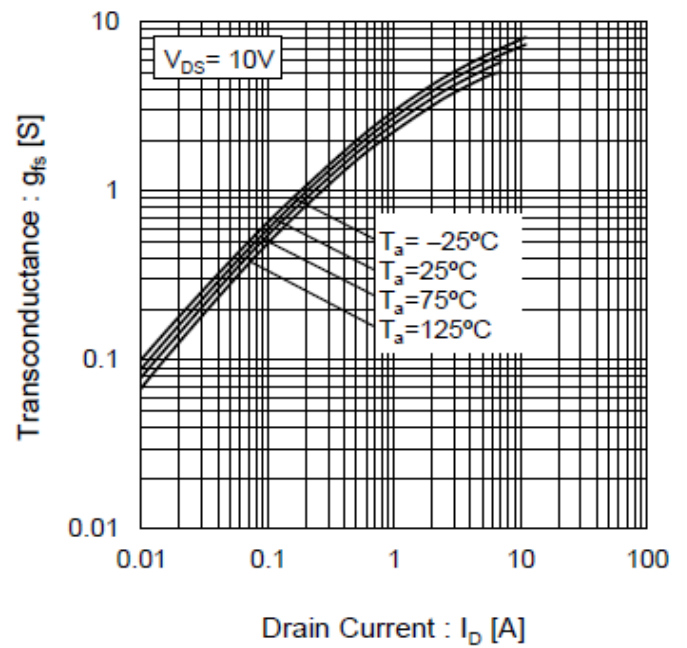
● **Electrical characteristic curves**

Fig.13 Static Drain - Source On - State Resistance vs. Gate Source Voltage
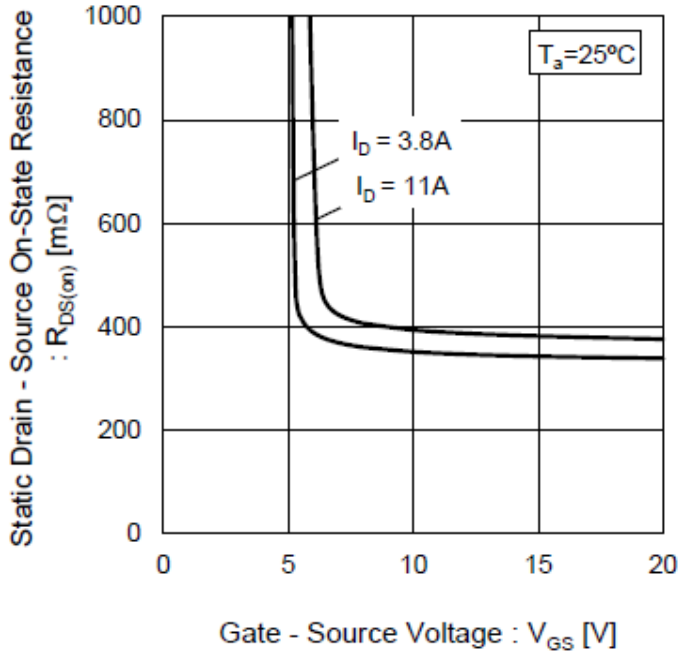
Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature
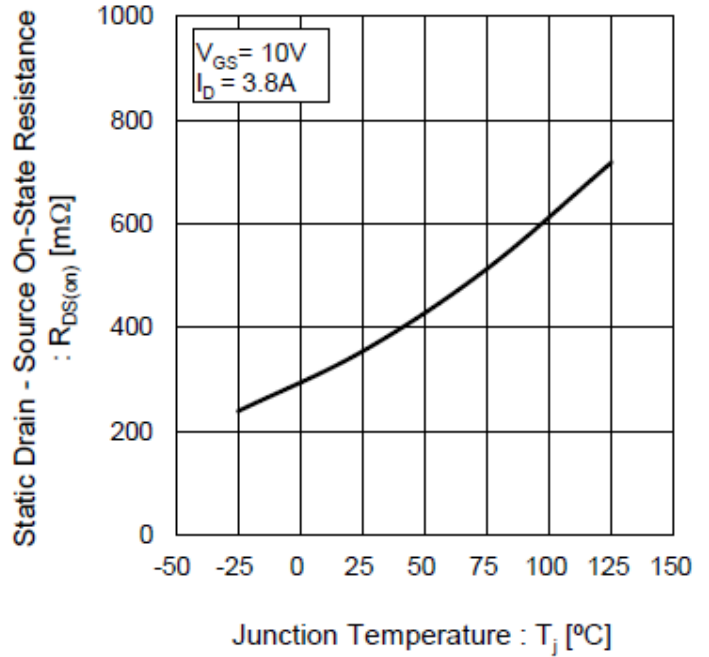

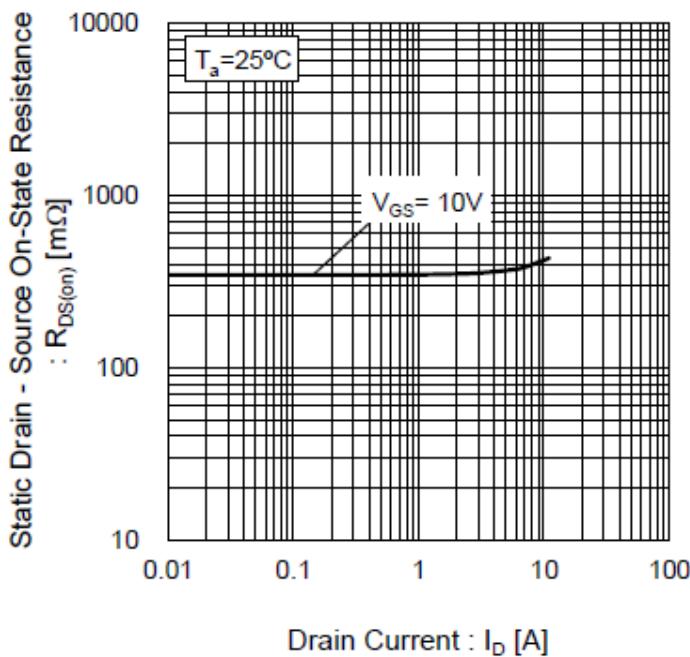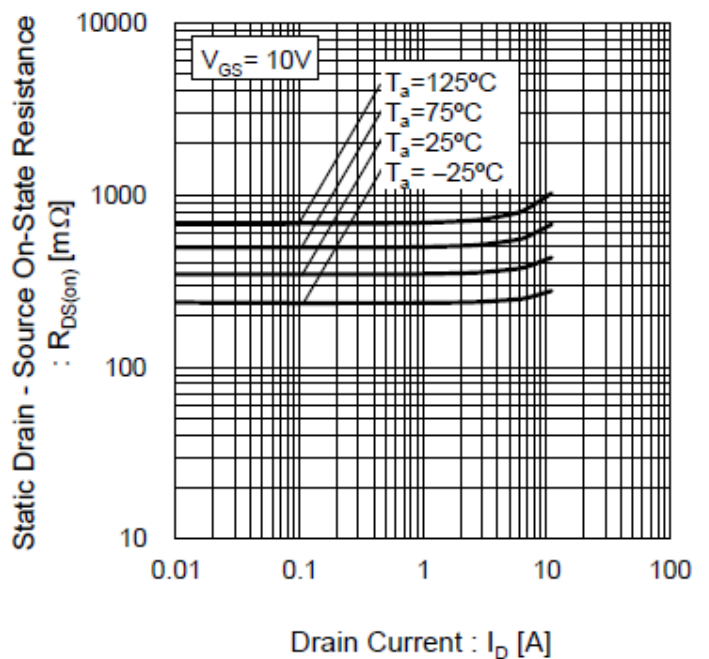Fig.15 Static Drain - Source On - State Resistance vs. Drain Current

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

●Electrical characteristic curves

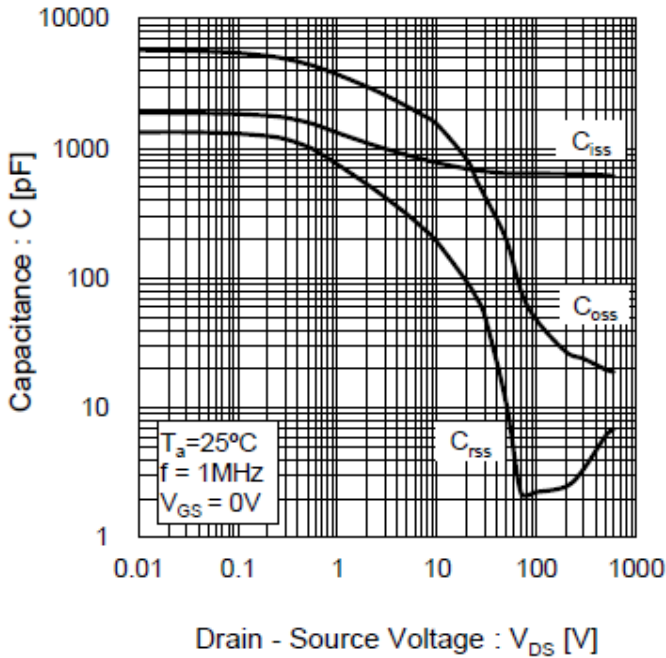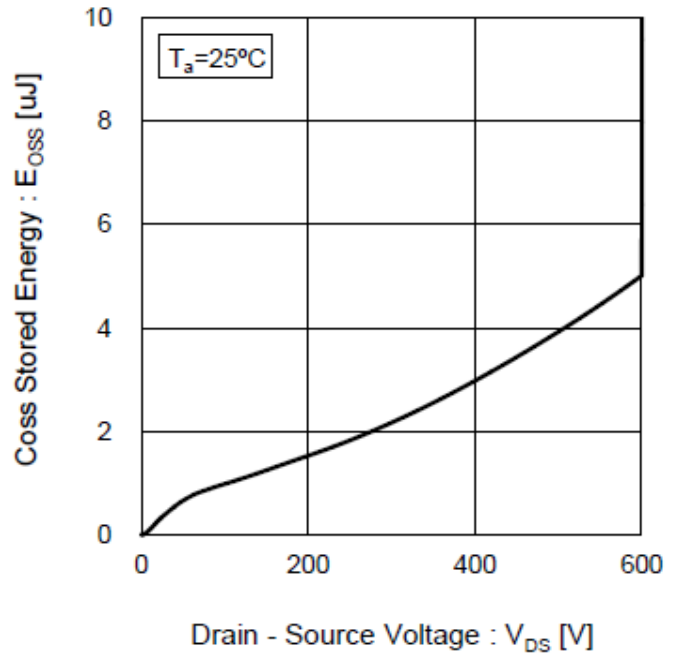Fig.17 Typical Capacitance vs. Drain - Source Voltage

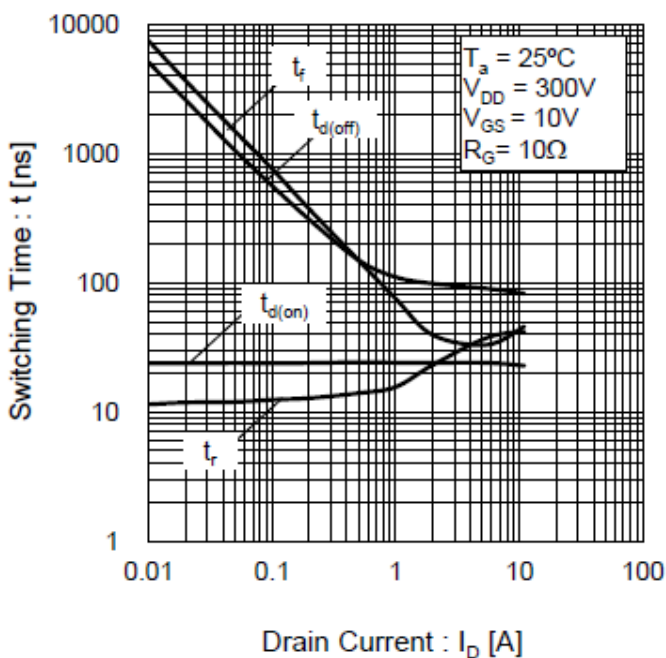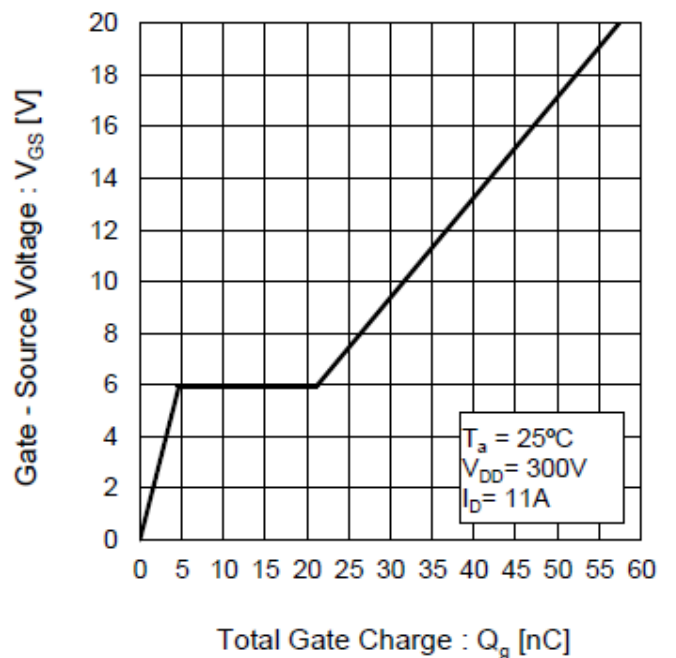Fig.18 Coss Stored Energy

Fig.19 Switching Characteristics

Fig.20 Dynamic Input Characteristics

●**Electrical characteristic curves**

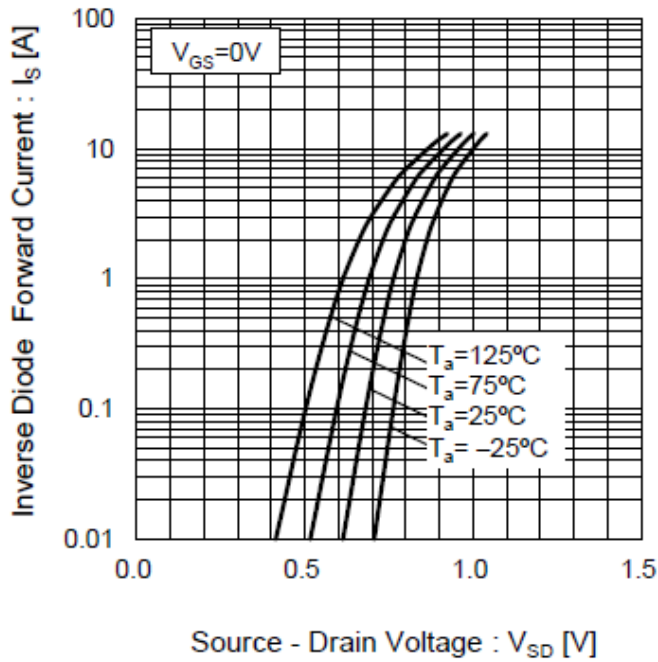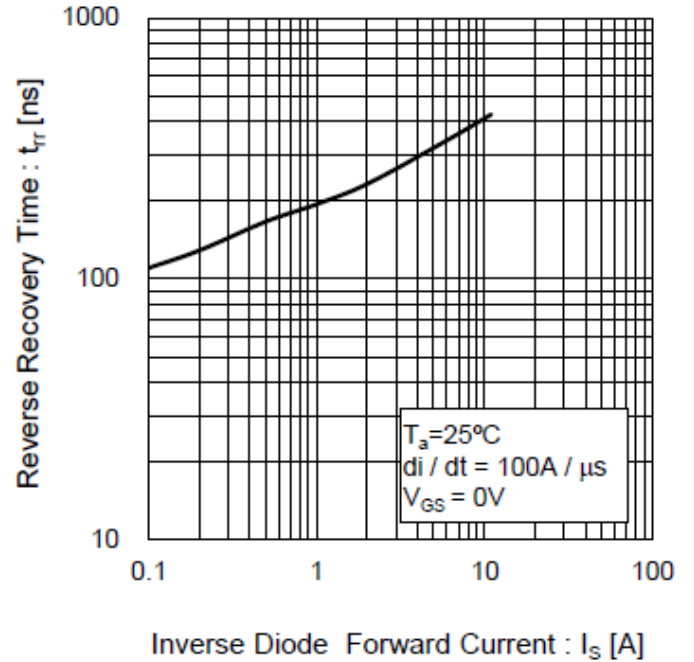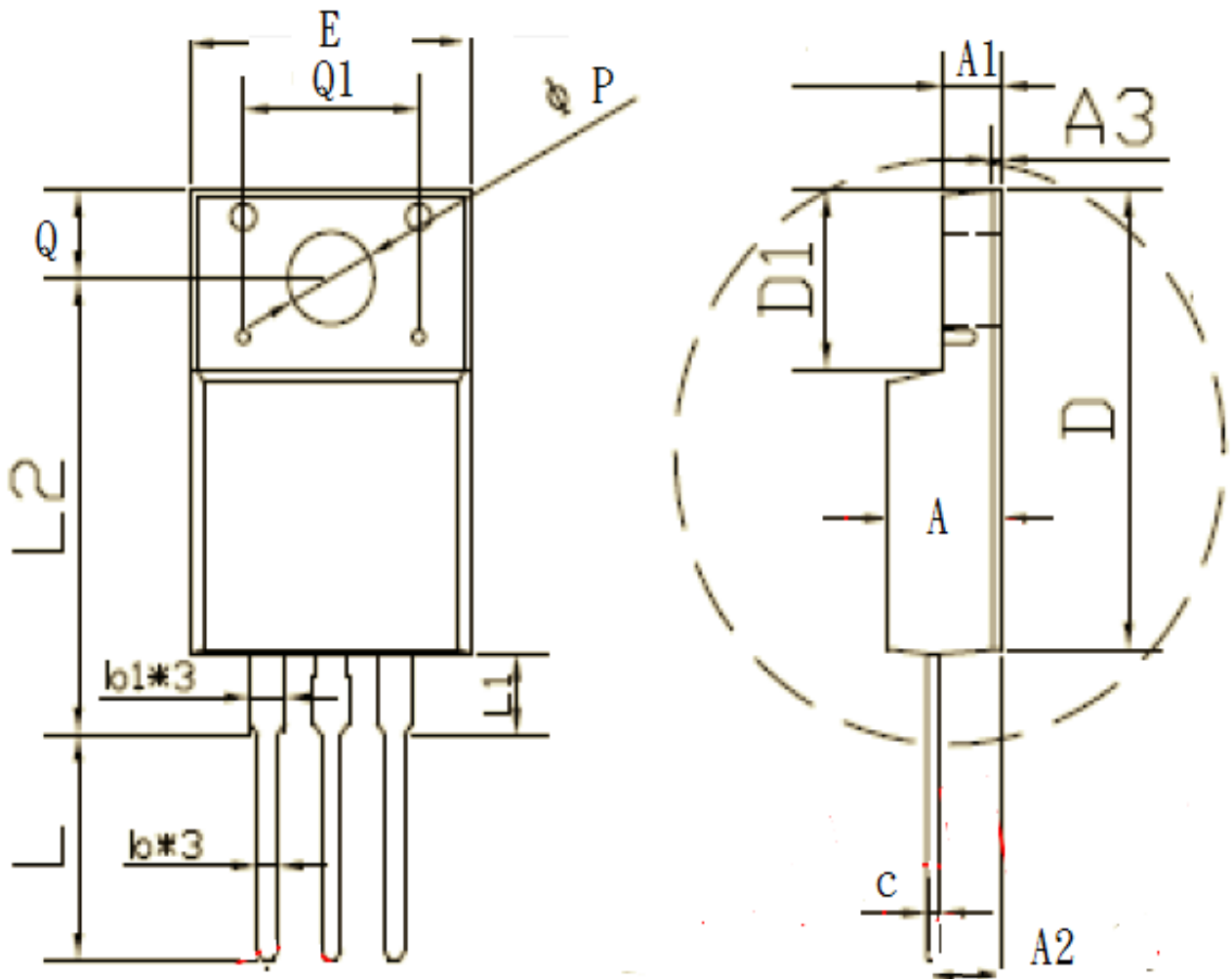Fig.21 Inverse Diode Forward Current vs. Source - Drain Voltage

Fig.22 Reverse Recovery Time vs.Inverse Diode Forward Current

Dimension	Millimeters		Dimension	Millimeters	
	Min.	Max.		Min.	Max.
A	4.68	4.73	E	9.95	10.22
A1	2.45	2.55	e	5.08 Ref	
A2	2.80	2.90	L	9.45	10.65
A3	0.60	0.75	L1	2.79	3.30
b	0.75	0.85	L2	15.60	16.00
b1	1.33	1.40	Q	3.20	3.40
c	0.45	0.55	Q1	6.90	7.10
D	15.8	16.0	P	3.5 Ref	
D1	6.67	6.77			

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