

V_{DSS}	500V
$R_{DS(on)}$ (Max.)	0.52Ω
I_D	-13A
P_D	40W

●Features

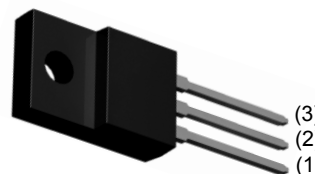
- 1) Low on-resistance.
- 2) Fast switching speed.
- 3) Gate-source voltage (V_{GSS}) guaranteed to be $\pm 30V$.
- 4) Drive circuits can be simple.
- 5) Parallel use is easy.
- 6) Pb-free lead plating ; RoHS compliant

●Application

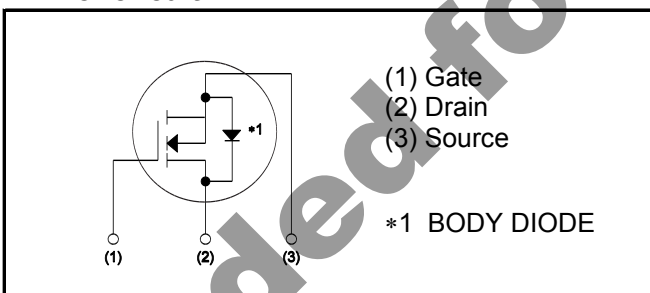
Switching Power Supply

●Outline

TO-220FM



●Inner circuit



●Packaging specifications

Type	Packaging	Bulk
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	500
	Taping code	-
	Marking	ZDX130N50

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

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	500	V
Continuous drain current $T_c = 25^\circ C$	I_D^{*1}	± 13	A
Pulsed drain current	$I_{D,pulse}^{*2}$	± 39	A
Gate - Source voltage	V_{GSS}	± 30	V
Power dissipation ($T_c = 25^\circ C$)	P_D	40	W
Junction temperature	T_j	150	$^\circ C$
Range of storage temperature	T_{stg}	-55 to +150	$^\circ C$

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - ambient	R_{thJA}	-	-	3.125	°C/W

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	500	-	-	V
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 500V, V_{GS} = 0V$	-	-	100	μA
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	± 100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	2.5	-	4.5	V
Static drain - source on - state resistance	$R_{DS(on)}^{*3}$	$V_{GS} = 10V, I_D = 6.5A$	-	0.4	0.52	Ω

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs}^{*3}	$V_{DS} = 10\text{V}, I_D = 6\text{A}$	2.0	8.5	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$	-	2180	-	pF
Output capacitance	C_{oss}	$V_{DS} = 25\text{V}$	-	200	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	60	-	
Turn - on delay time	$t_{d(on)}^{*3}$	$V_{DD} \approx 250\text{V}, V_{GS} = 10\text{V}$	-	30	-	ns
Rise time	t_r^{*3}	$I_D = 5\text{A}$	-	25	-	
Turn - off delay time	$t_{d(off)}^{*3}$	$R_L = 50\Omega$	-	43	-	
Fall time	t_f^{*3}	$R_G = 10\Omega$	-	15	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g^{*3}	$V_{DD} \approx 250\text{V}$	-	40	-	nC
Gate - Source charge	Q_{gs}^{*3}	$I_D = 5\text{A}$	-	11.5	-	
Gate - Drain charge	Q_{gd}^{*3}	$V_{GS} = 10\text{V}$	-	12.5	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 250\text{V}, I_D = 5\text{A}$	-	5.5	-	V

*1 Limited only by maximum temperature allowed.

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

*3 Pulsed

●Body diode electrical characteristics (Source-Drain)($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S^{*1}	$T_c = 25^\circ\text{C}$	-	-	13	A
Inverse diode direct current, pulsed	I_{SM}^{*2}		-	-	39	A
Forward voltage	V_{SD}^{*3}	$V_{GS} = 0\text{V}, I_S = 13\text{A}$	-	-	1.7	V

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

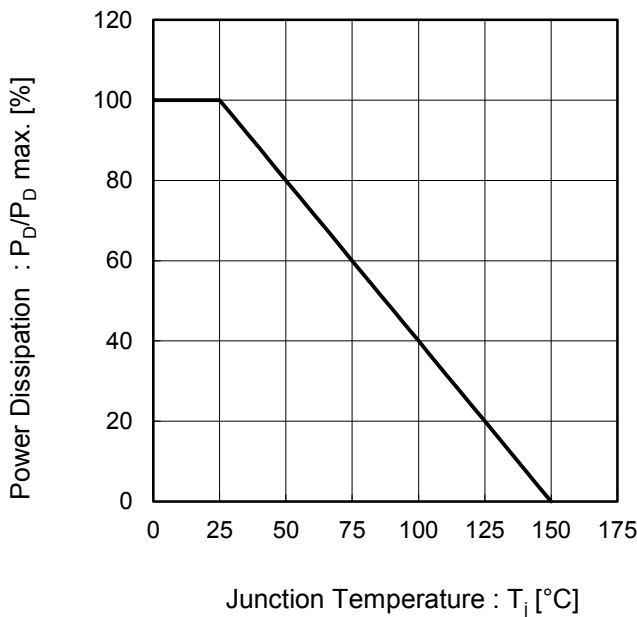


Fig.2 Maximum Safe Operating Area

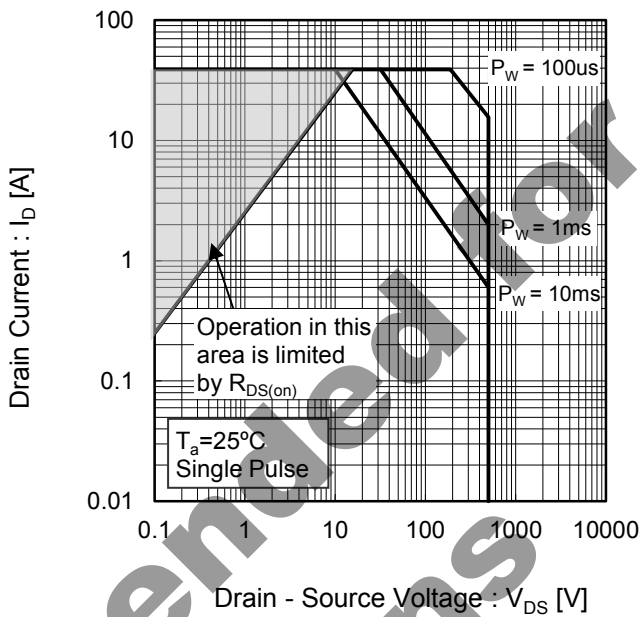
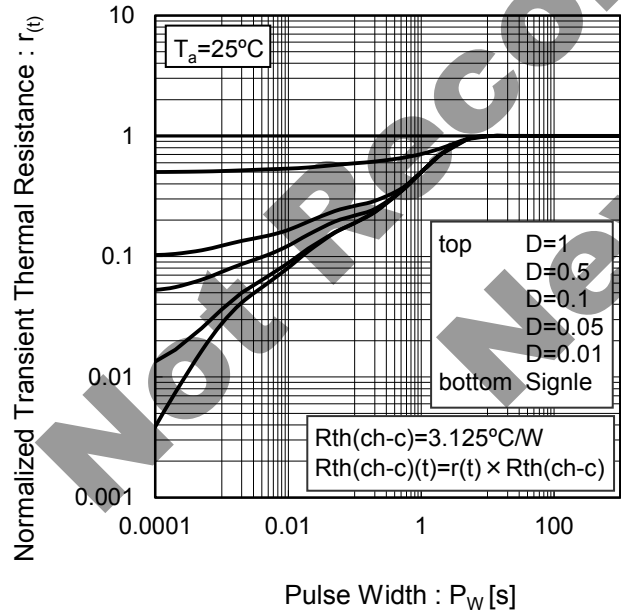


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

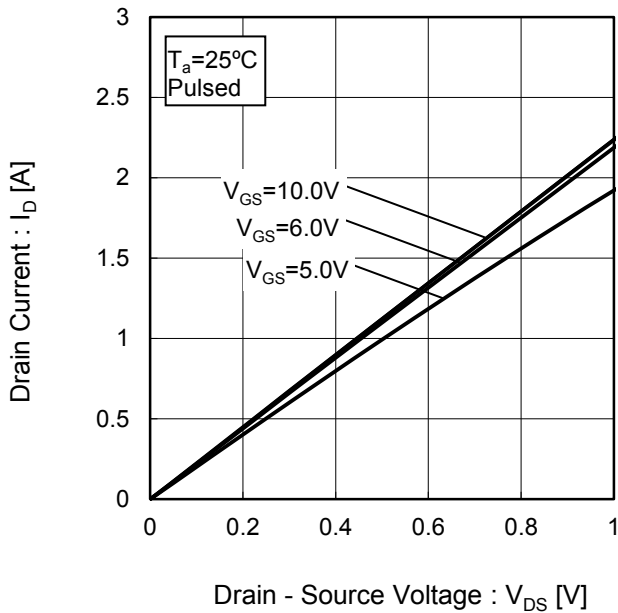


Fig.5 Typical Output Characteristics(II)

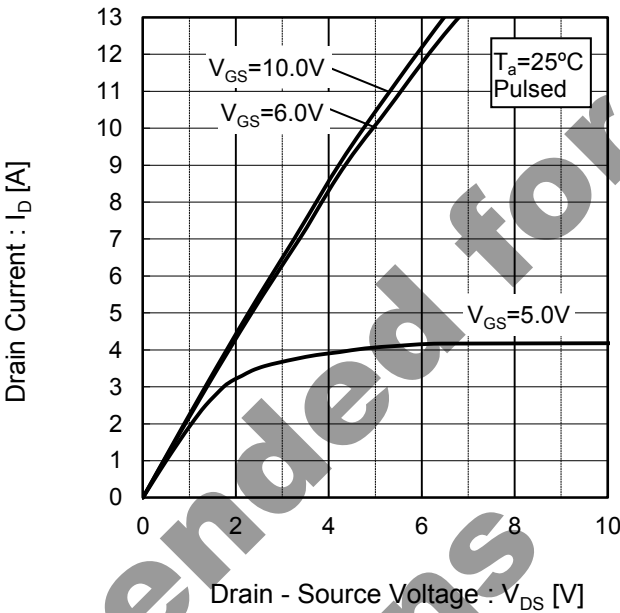


Fig.6 Breakdown Voltage vs. Channel Temperature

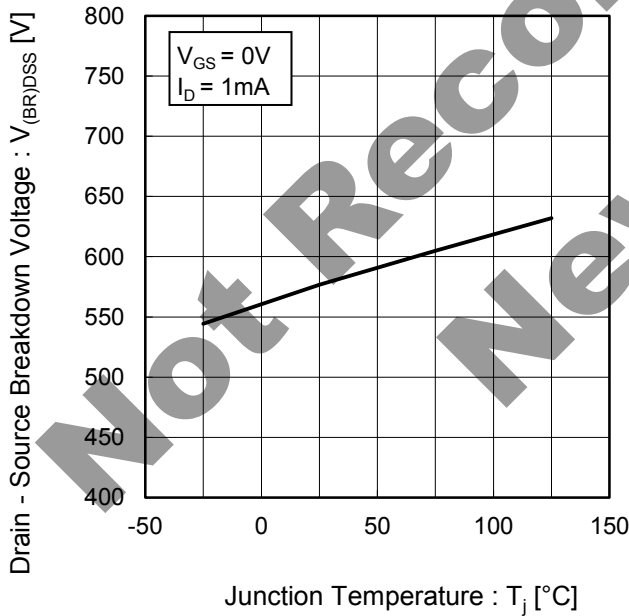
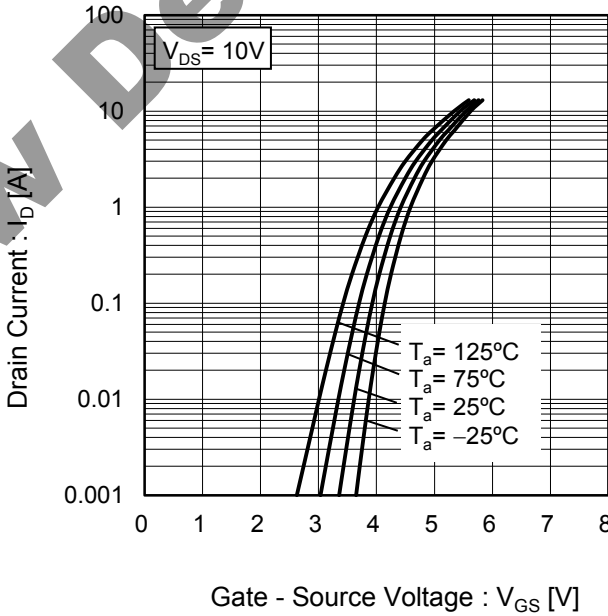


Fig.7 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.8 Gate Threshold Voltage vs. Channel Temperature

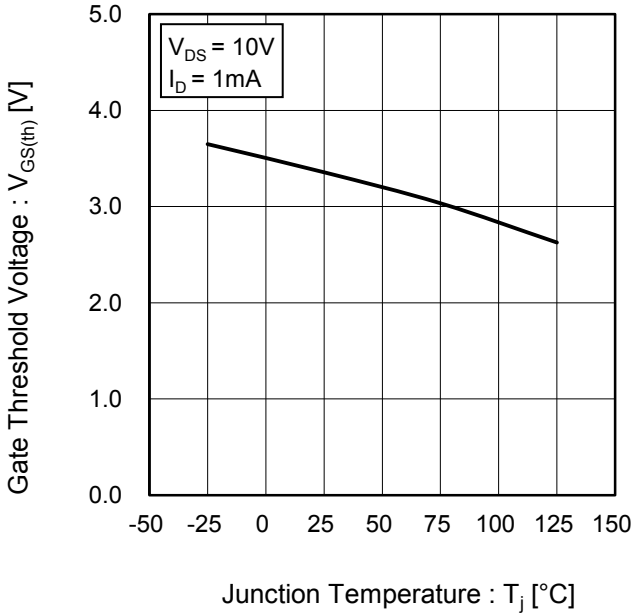


Fig.9 Transconductance vs. Drain Current

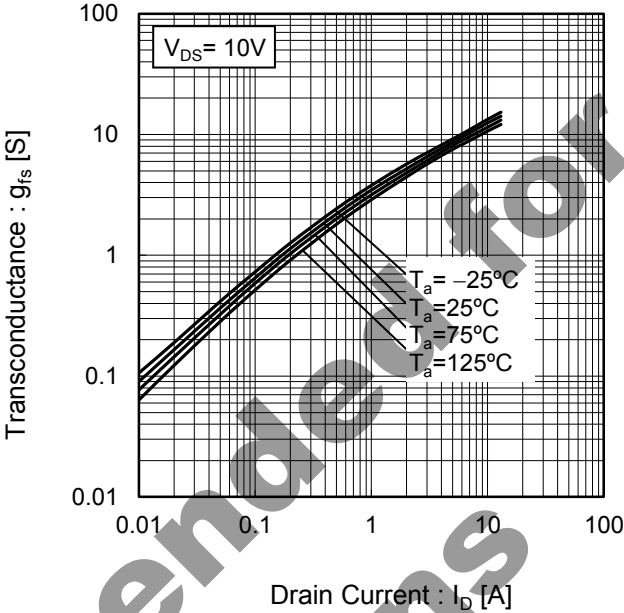
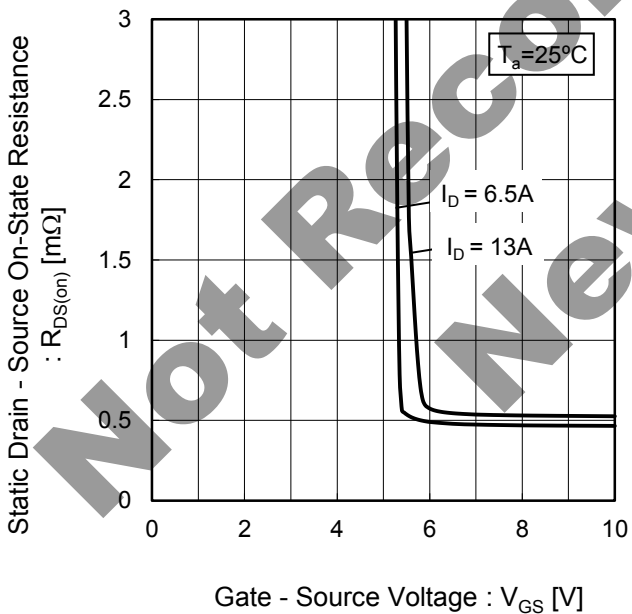


Fig.10 Static Drain - Source On - State Resistance vs. Gate Source Voltage



●Electrical characteristic curves

Fig.11 Static Drain - Source On - State Resistance vs. Drain Current(II)

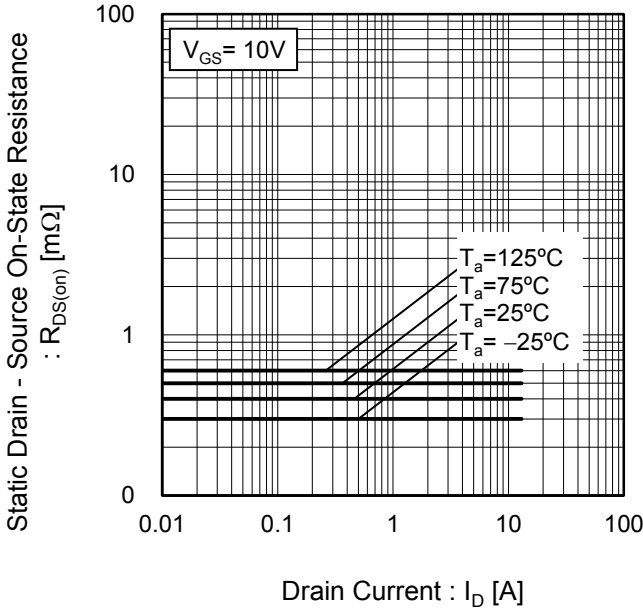
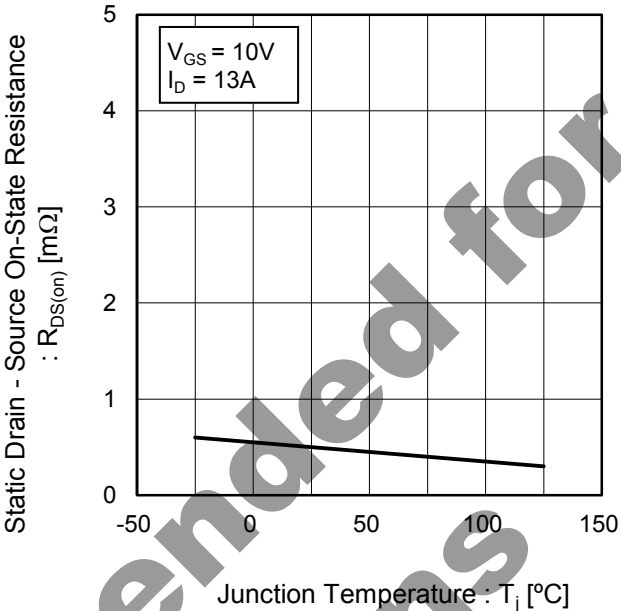


Fig.12 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves

Fig.13 Typical Capacitance vs. Drain - Source Voltage

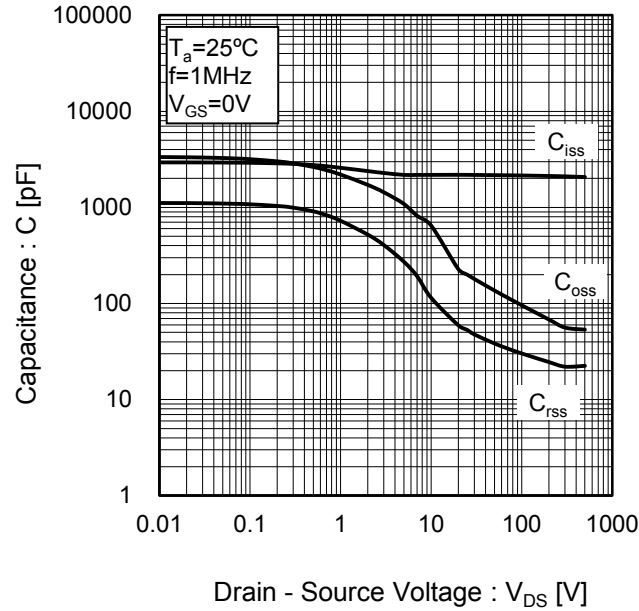


Fig.14 Switching Characteristics

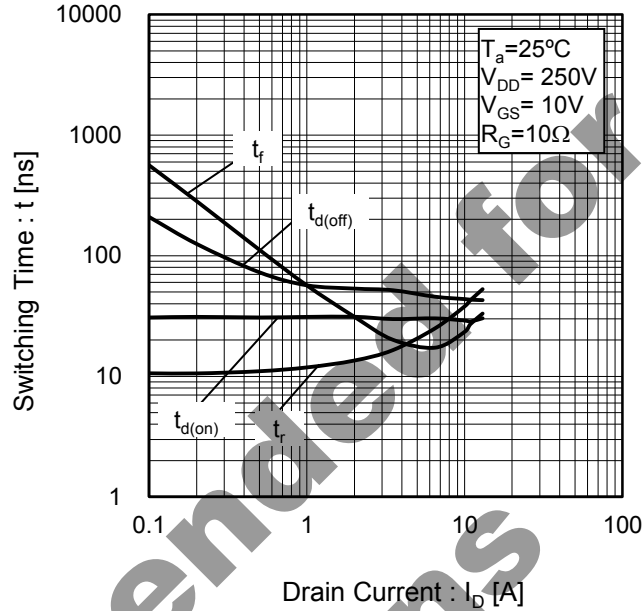


Fig.15 Dynamic Input Characteristics

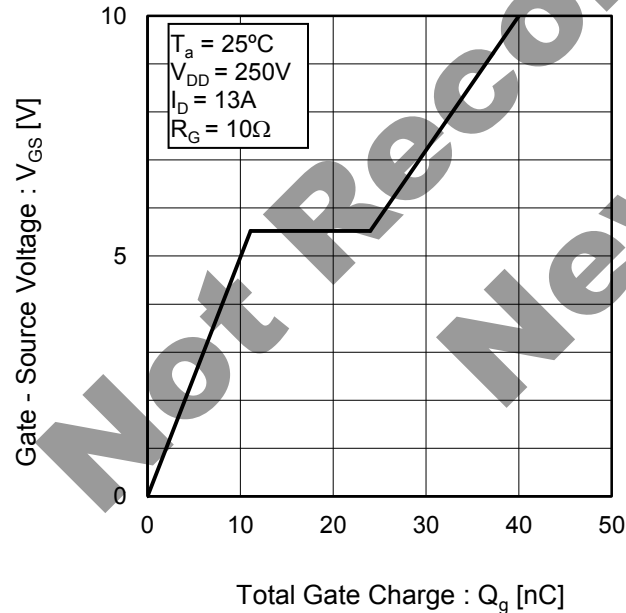
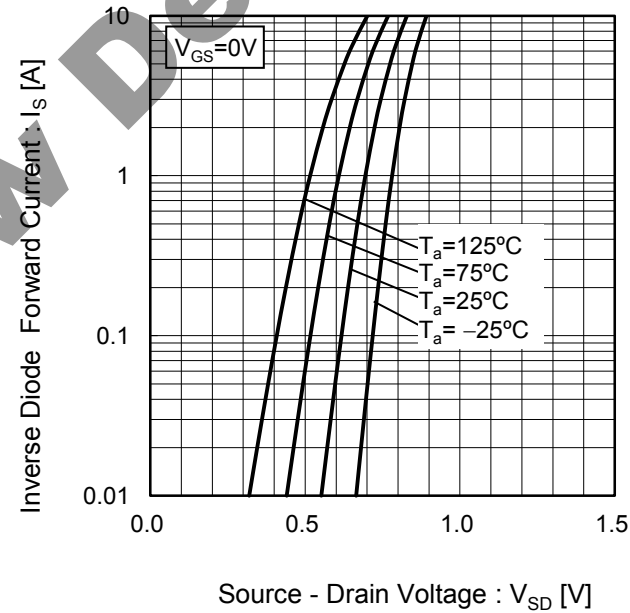


Fig.16 Inverse Diode Forward Current vs. Source - Drain Voltage



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

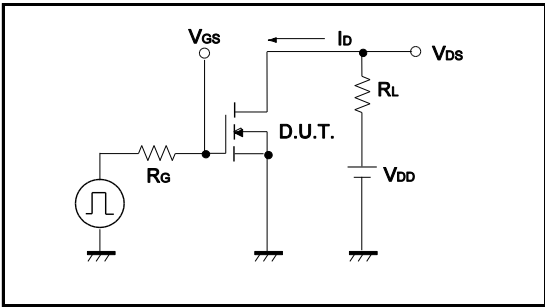


Fig.1-2 Switching Waveforms

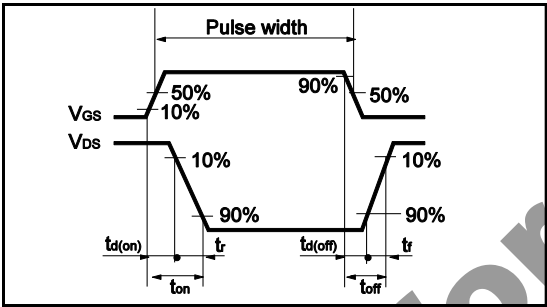


Fig.2-1 Gate Charge Measurement Circuit

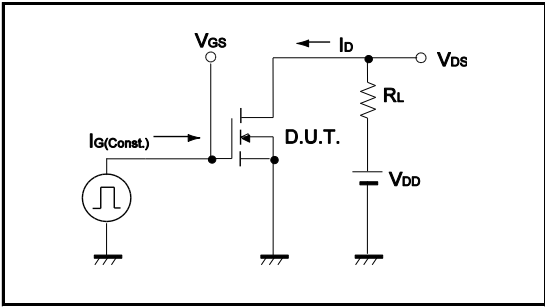
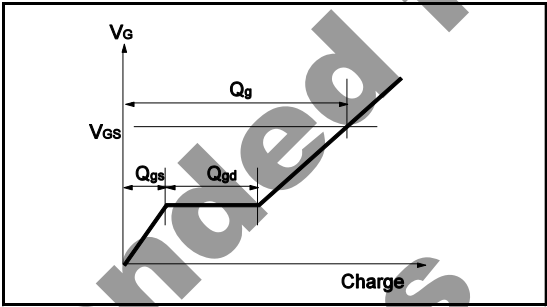
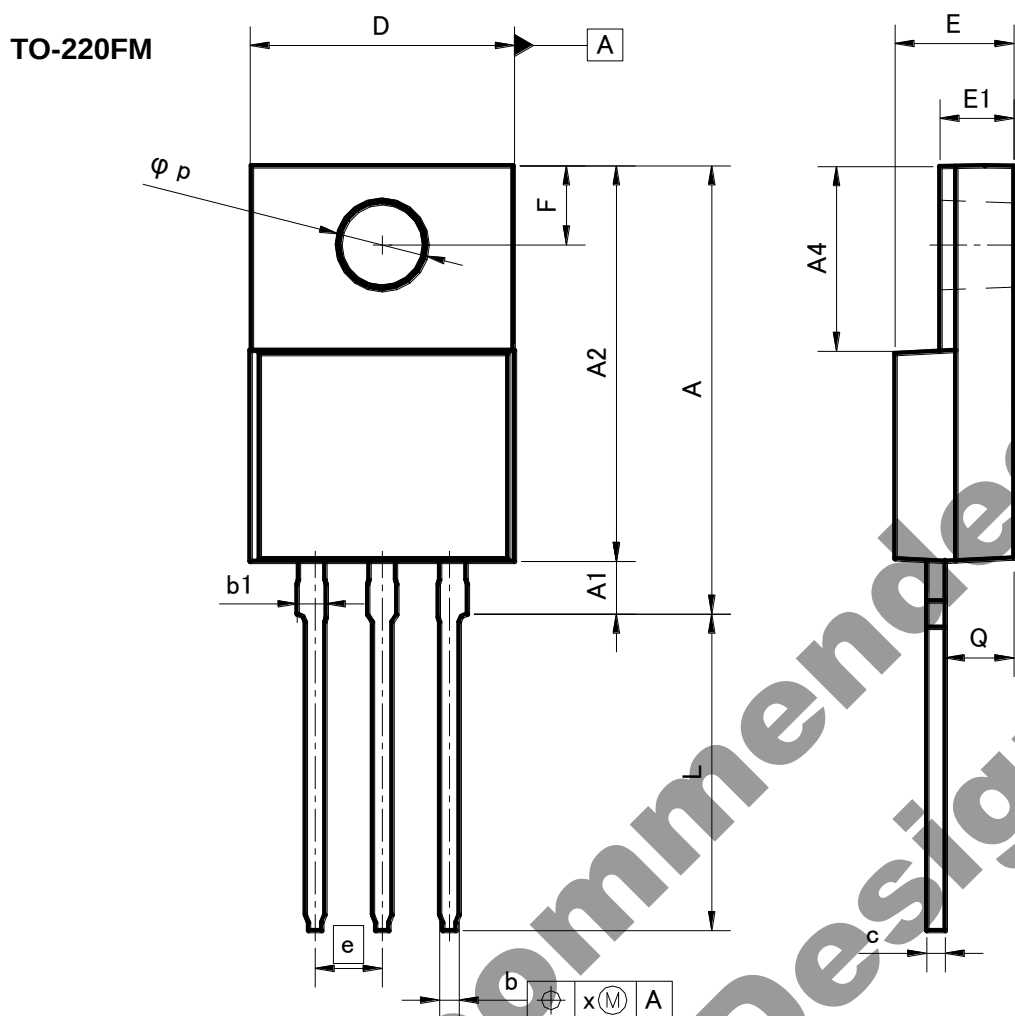


Fig.2-2 Gate Charge Waveform



●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

Notes

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