

$V_{DSS}$	500V
$R_{DS(on)}$ (Max.)	1.5 $\Omega$
$I_D$	5A
$P_D$	40W

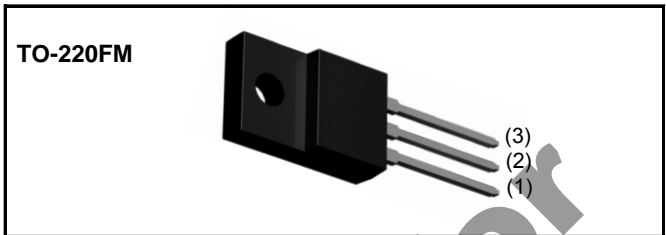
#### ●Features

- 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

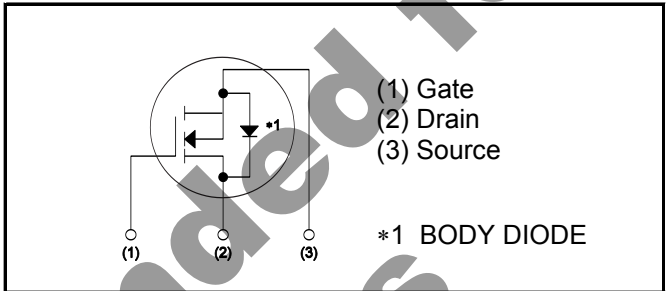
#### ●Application

Switching Power Supply

#### ●Outline



#### ●Inner circuit



#### ●Packaging specifications

Type	Packaging	Bulk
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	500
	Taping code	-
	Marking	ZDX050N50

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

Parameter	Symbol	Value	Unit
Drain - Source voltage	$V_{DSS}$	500	V
Continuous drain current	$I_D$ *1	$\pm 5$	A
Pulsed drain current	$I_{D,pulse}$ *2	$\pm 15$	A
Gate - Source voltage	$V_{GSS}$	$\pm 30$	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	$\mu\text{A}$
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	2.5	-	4.4	V
Static drain - source on - state resistance	$R_{DS(on)}^{*3}$	$V_{GS} = 10V, I_D = 2.5A$	-	1.2	1.5	$\Omega$

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	$g_{fs}^{*3}$	$V_{DS} = 10\text{V}, I_D = 2.5\text{A}$	1	4	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{V}$	-	600	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 25\text{V}$	-	62	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	5	-	
Turn - on delay time	$t_{d(on)}^{*3}$	$V_{DD} \approx 250\text{V}, V_{GS} = 10\text{V}$	-	20	-	ns
Rise time	$t_r^{*3}$	$I_D = 2.5\text{A}$	-	12	-	
Turn - off delay time	$t_{d(off)}^{*3}$	$R_L = 10\Omega$	-	38	-	
Fall time	$t_f^{*3}$	$R_G = 10\Omega$	-	22	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_g^{*3}$	$V_{DD} \approx 250\text{V}$	-	14	-	nC
Gate - Source charge	$Q_{gs}^{*3}$	$I_D = 5\text{A}$	-	6	-	
Gate - Drain charge	$Q_{gd}^{*3}$	$V_{GS} = 10\text{V}$	-	4	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 250\text{V}, I_D = 5\text{A}$	-	6	-	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	$I_S^{*1}$	$T_c = 25^\circ\text{C}$	-	-	5	A
Inverse diode direct current, pulsed	$I_{SM}^{*2}$		-	-	15	A
Forward voltage	$V_{SD}^{*3}$	$V_{GS} = 0\text{V}, I_S = 5\text{A}$	-	-	1.5	V

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●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

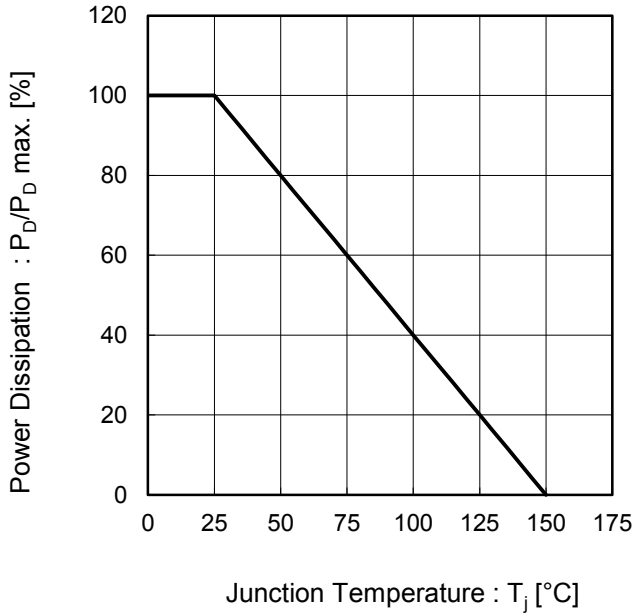


Fig.2 Maximum Safe Operating Area

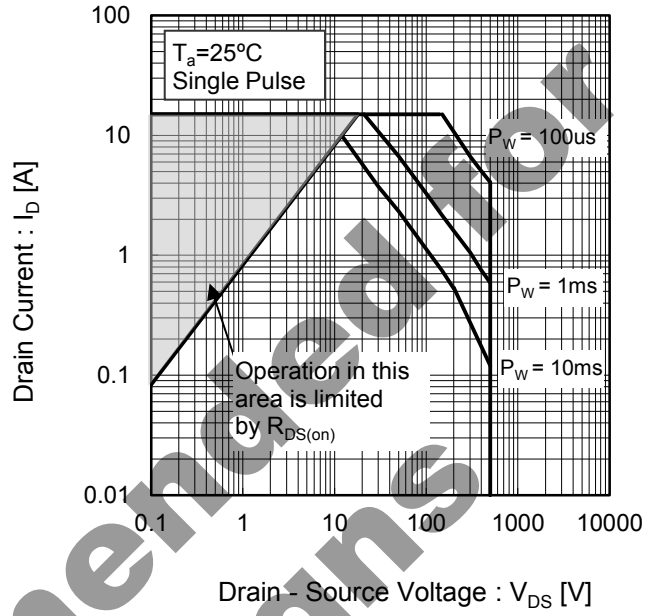
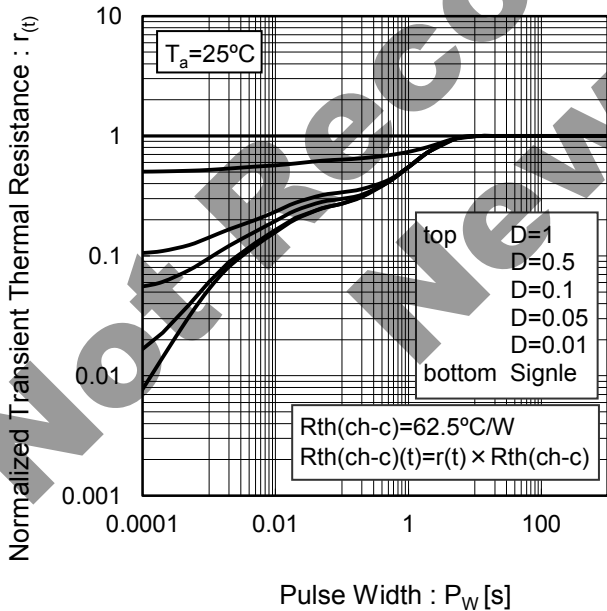


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

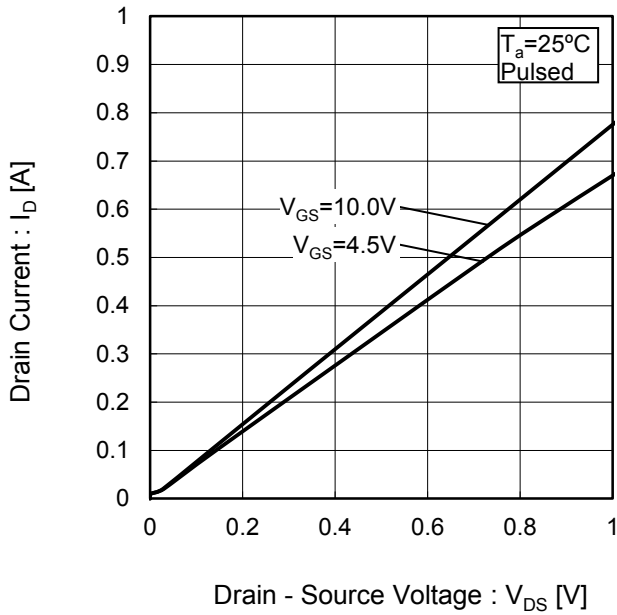


Fig.5 Typical Output Characteristics(II)

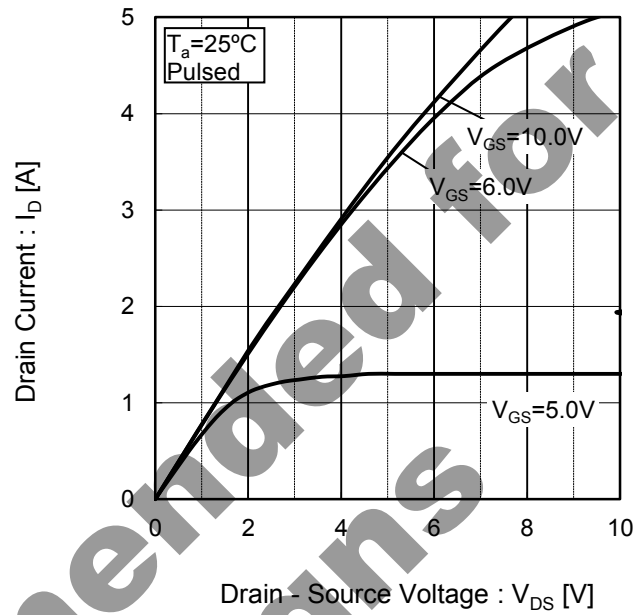


Fig.6 Breakdown Voltage vs. Channel Temperature

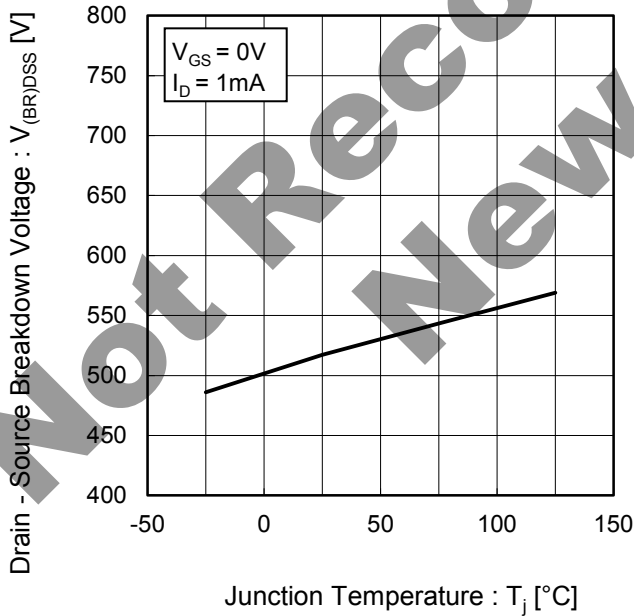
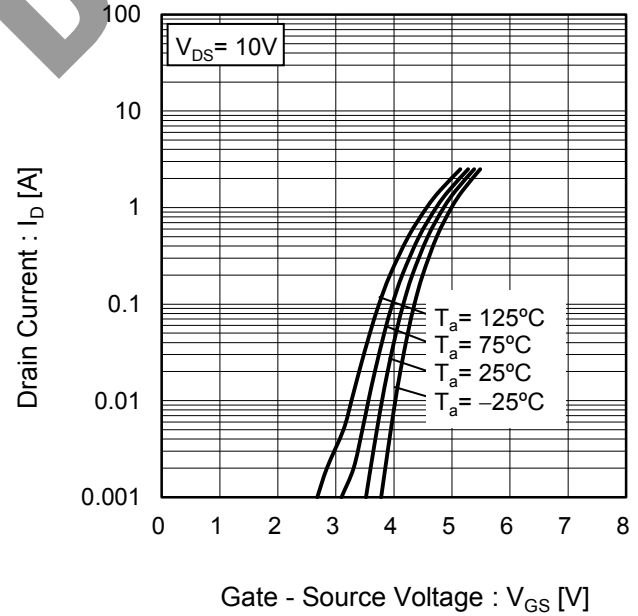


Fig.7 Typical Transfer Characteristics



●Electrical characteristic curves

Fig.8 Gate Threshold Voltage vs. Channel Temperature

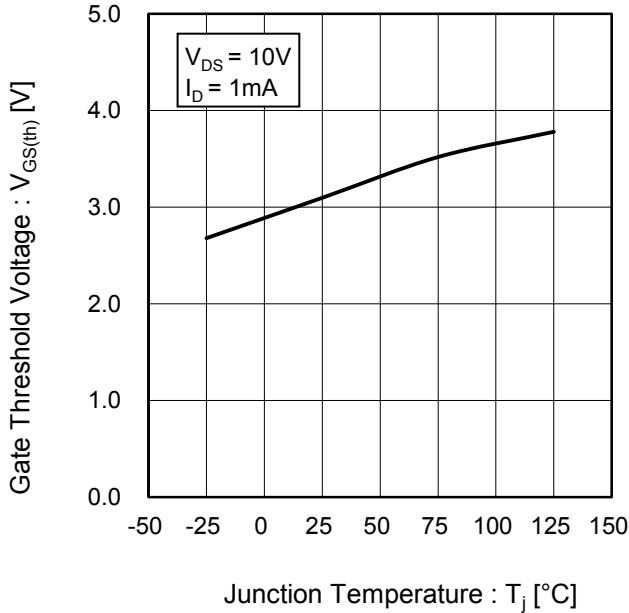


Fig.9 Transconductance vs. Drain Current

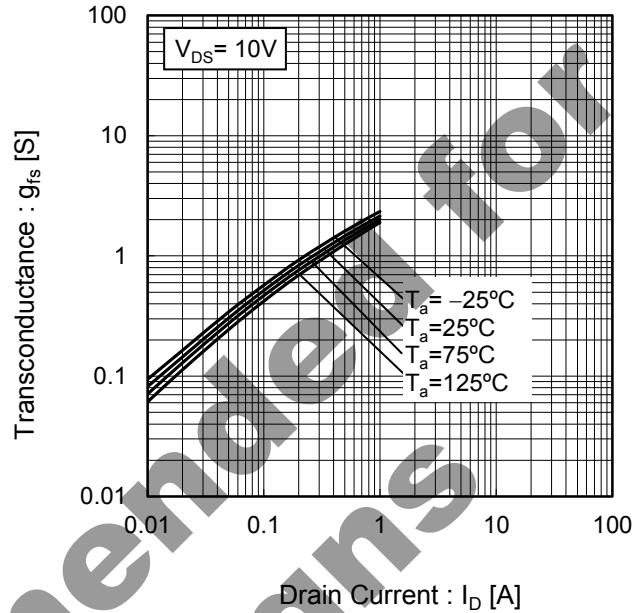
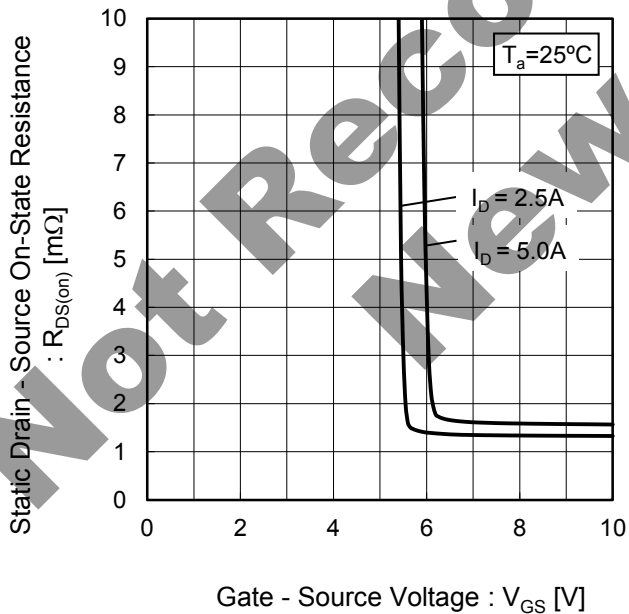


Fig.10 Static Drain - Source On - State Resistance vs. Gate Source Voltage



●Electrical characteristic curves

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

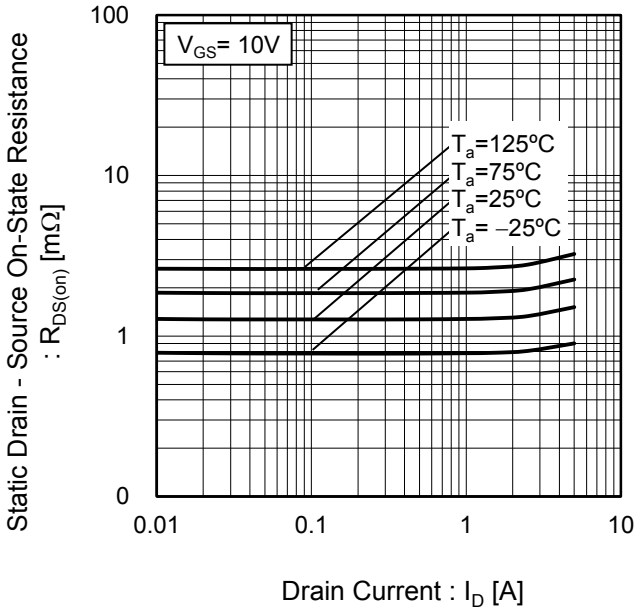
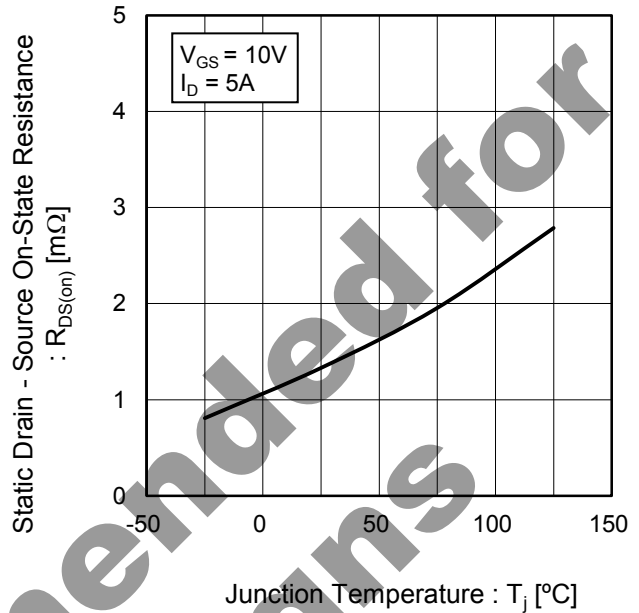


Fig.12 Static Drain - Source On - State Resistance vs. Junction Temperature



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●Electrical characteristic curves

Fig.13 Typical Capacitance vs. Drain - Source Voltage

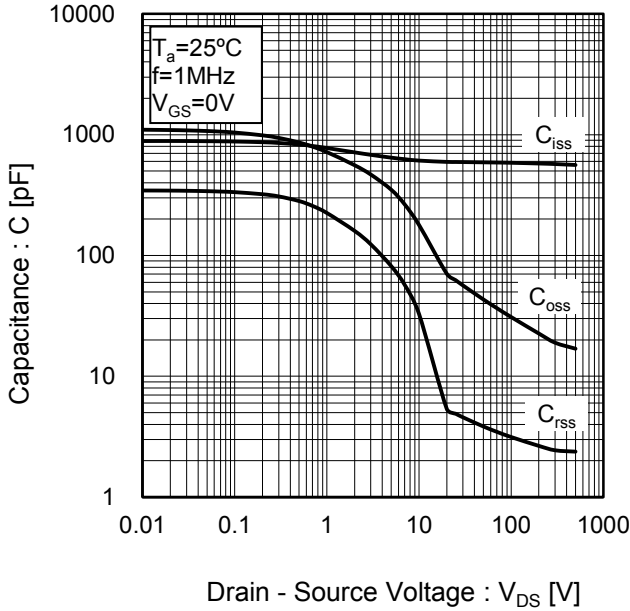


Fig.14 Switching Characteristics

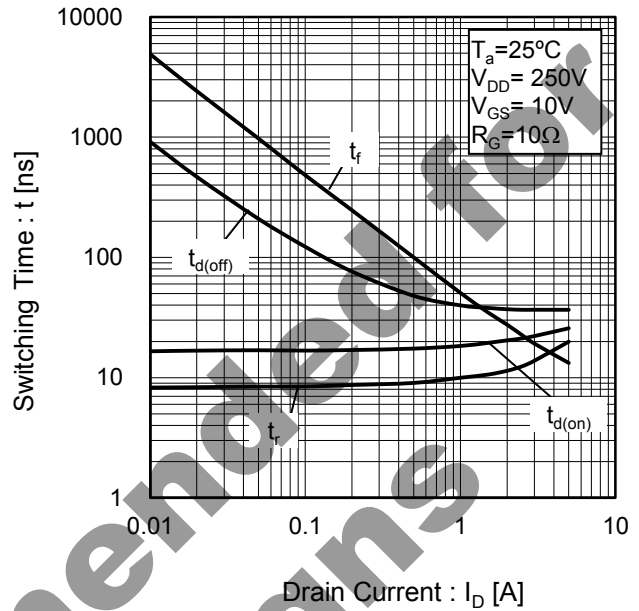


Fig.15 Dynamic Input Characteristics

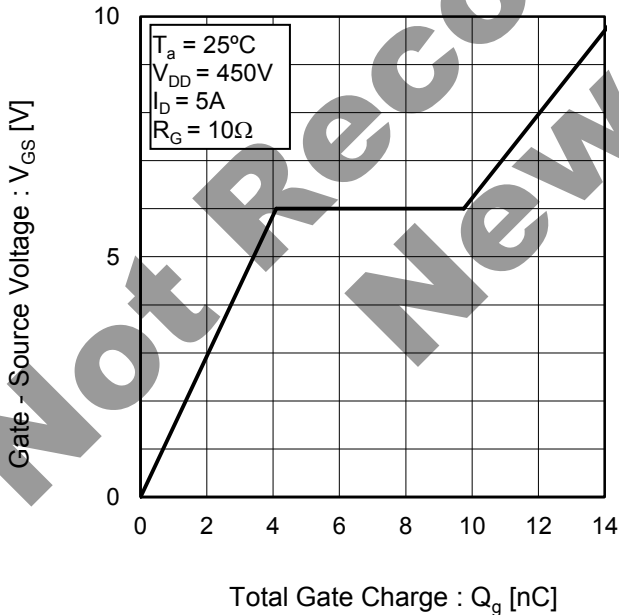
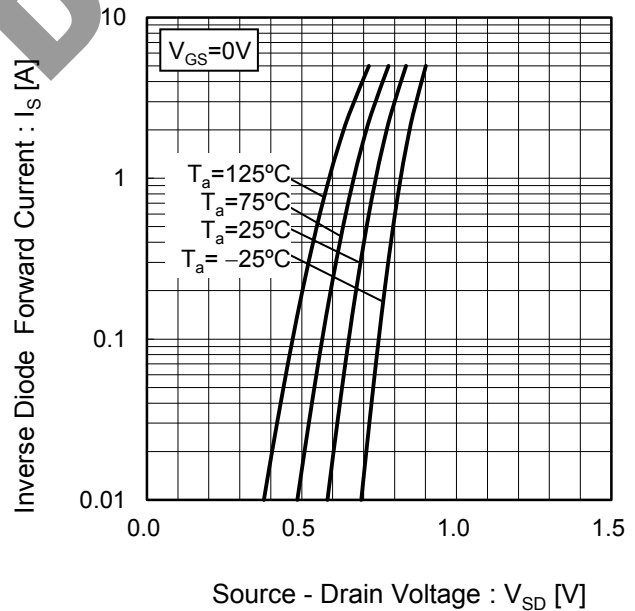


Fig.16 Inverse Diode Forward Current vs. Source - Drain Voltage



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

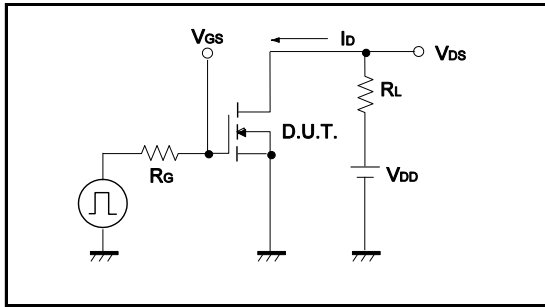


Fig.1-2 Switching Waveforms

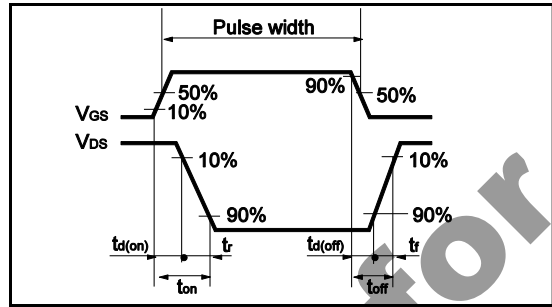


Fig.2-1 Gate Charge Measurement Circuit

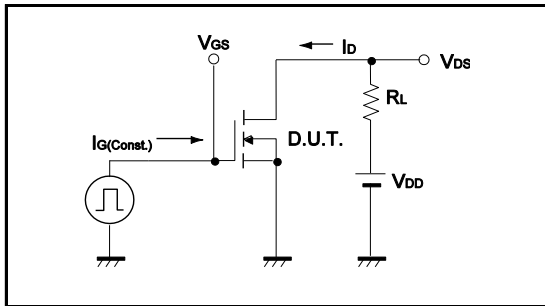
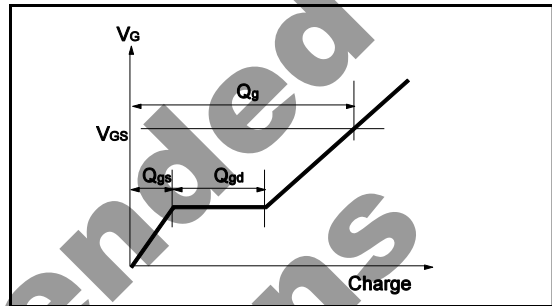


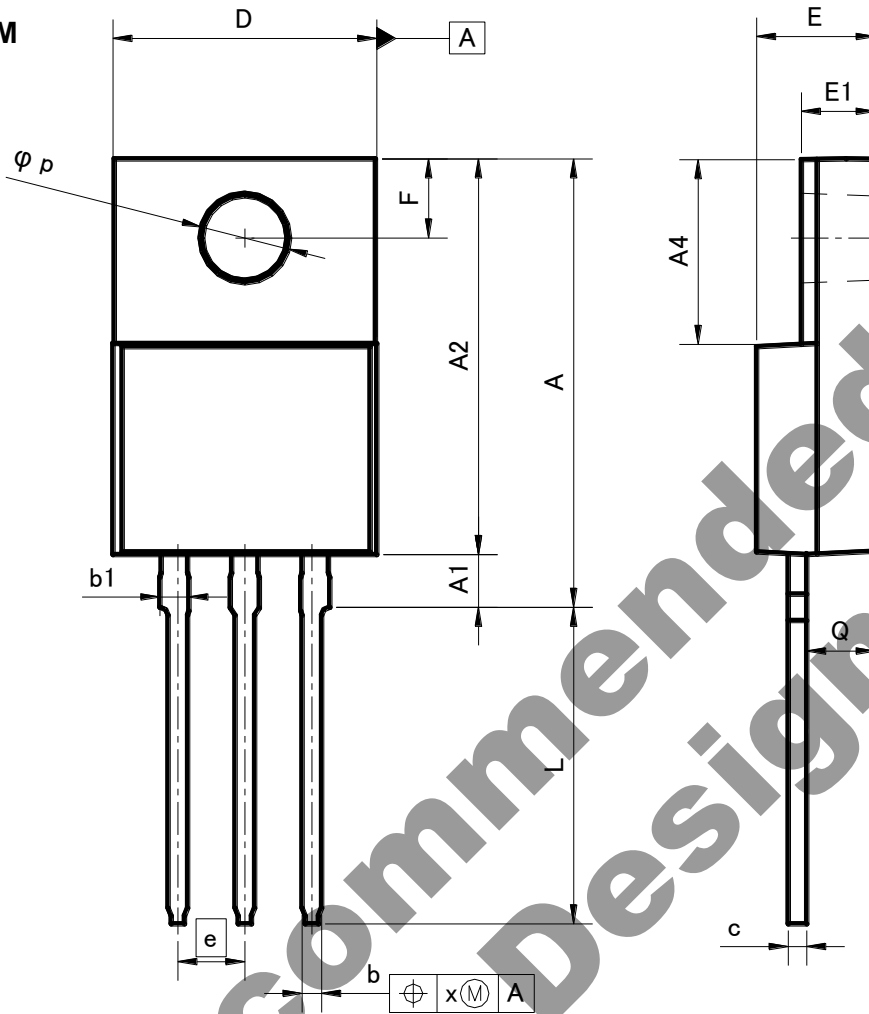
Fig.2-2 Gate Charge Waveform



Not Recommended for New Designs

●Dimensions (Unit : mm)

TO-220FM



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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