

## DC-DC CONVERTER APPLICATION HIGH VOLTAGE SWITCHING APPLICATIONS

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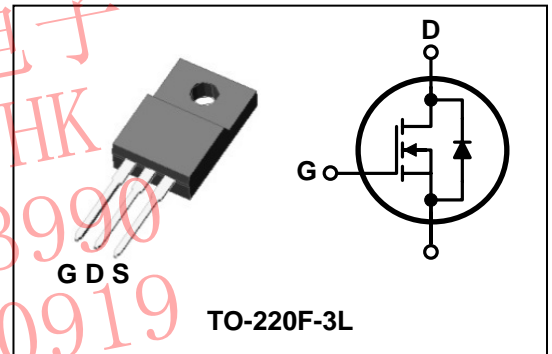
### Features

- High Voltage:  $BV_{DSS}=200V(\text{Min.})$
- Low  $C_{RSS}$  :  $C_{RSS}=55pF(\text{Typ.})$
- Low gate charge :  $Q_g=22nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=0.17\Omega(\text{Max.})$

### Ordering Information

Type No.	Marking	Package Code	
SMK1820F	SMK1820	TO-220F-3L	TO-220F-3L

### PIN Connection



### Absolute maximum ratings ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	200	V
Gate-source voltage	$V_{GSS}$	$\pm 30$	V
Drain current (DC) *	$I_D$	( $T_C=25^\circ\text{C}$ )	18
		( $T_C=100^\circ\text{C}$ )	9.1
Drain current (Pulsed) *	$I_{DM}$	72	A
Drain power dissipation	$P_D$	35	W
Avalanche current (Single) ②	$I_{AS}$	18	A
Single pulsed avalanche energy ②	$E_{AS}$	453	mJ
Avalanche current (Repetitive) ①	$I_{AR}$	18	A
Repetitive avalanche energy ①	$E_{AR}$	13.9	mJ
Junction temperature	$T_J$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55~150	

\* Limited by maximum junction temperature

Characteristic	Symbol	Typ.	Max	Unit
Thermal resistance	Junction-case	-	3.57	$^\circ\text{C}/\text{W}$
	Junction-ambient	-	62.5	

**Electrical Characteristics** ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	$BV_{DSS}$	$I_D=250\mu\text{A}, V_{GS}=0$	200	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu\text{A}, V_{DS}=V_{GS}$	2.0	-	4.0	V
Drain-source cut-off current	$I_{DSS}$	$V_{DS}=200\text{V}, V_{GS}=0\text{V}$	-	-	1	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{DS}=0\text{V}, V_{GS}=\pm 30\text{V}$	-	-	$\pm 100$	nA
Drain-source on-resistance ④	$R_{DS(on)}$	$V_{GS}=10\text{V}, I_D=9.0\text{A}$	-	0.14	0.17	$\Omega$
Forward transfer conductance ④	$g_{fs}$	$V_{DS}=10\text{V}, I_D=9.0\text{A}$	-	10.5	-	S
Input capacitance	$C_{iss}$	$V_{GS}=0\text{V}, V_{DS}=25\text{V},$ $f=1\text{MHz}$	-	942	1240	pF
Output capacitance	$C_{oss}$		-	227	310	
Reverse transfer capacitance	$C_{rss}$		-	55	71	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=125\text{V}, I_D=18\text{A}$ $R_G=25\Omega$	-	15	-	ns
Rise time	$t_r$		-	130	-	
Turn-off delay time	$t_{d(off)}$		-	135	-	
Fall time	$t_f$		-	105	-	
Total gate charge	$Q_g$	$V_{DS}=160\text{V}, V_{GS}=10\text{V}$ $I_D=18\text{A}$	-	22	28	nC
Gate-source charge	$Q_{gs}$		-	6.6	-	
Gate-drain charge	$Q_{gd}$		-	7.2	-	

**Source-Drain Diode Ratings and Characteristics** ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)

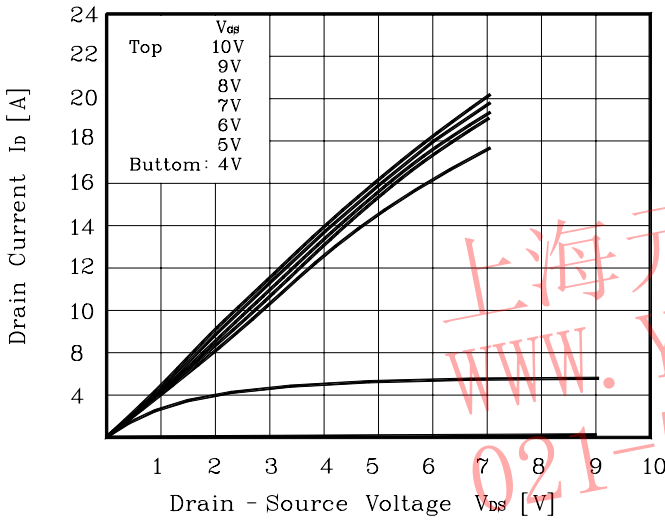
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Source current	$I_S$	Integral reverse diode in the MOSFET	-	-	18	A
Source current(Plused) ①	$I_{SM}$		-	-	72	
Forward voltage ④	$V_{SD}$	$V_{GS}=0\text{V}, I_S=18\text{A}$	-	-	1.4	V
Reverse recovery time	$t_{rr}$	$I_S=18\text{A}, V_{GS}=0,$ $di_s/dt=100\text{A/us}$	-	208	-	ns
Reverse recovery charge	$Q_{rr}$		-	1.63	-	$\mu\text{C}$

Note ;

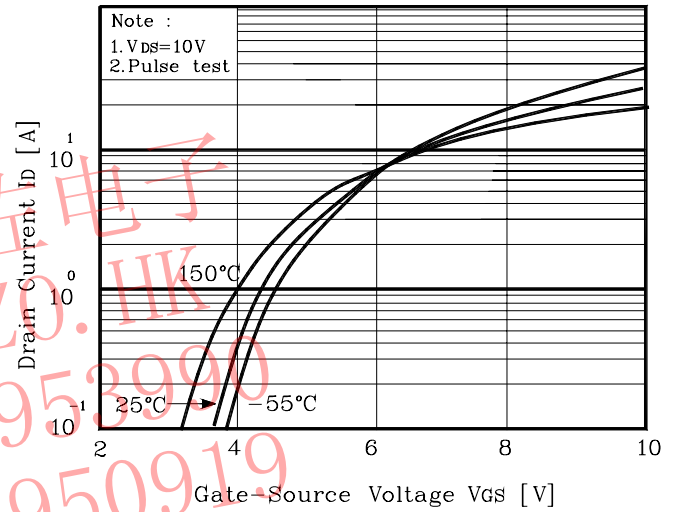
- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=2.1\text{mH}, I_{AS}=18\text{A}, V_{DD}=50\text{V}, R_G=27\Omega$
- ③ Pulse Test : Pulse Width < 300us, Duty cycle  $\leq 2\%$
- ④ Essentially independent of operating temperature

**Electrical Characteristic Curves**

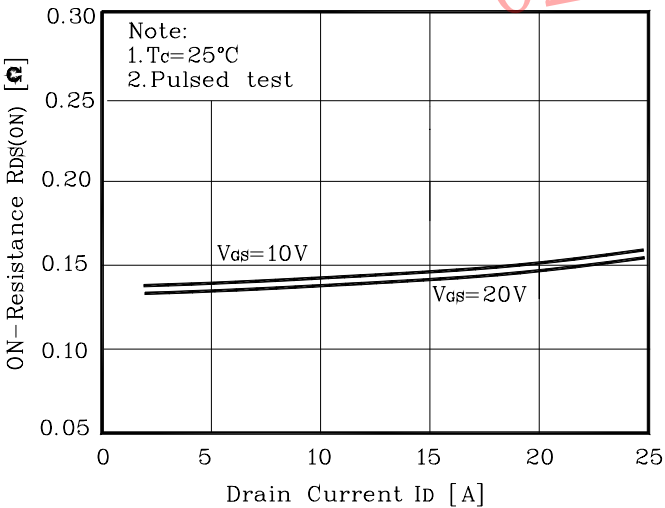
**Fig. 1  $I_D - V_{DS}$**



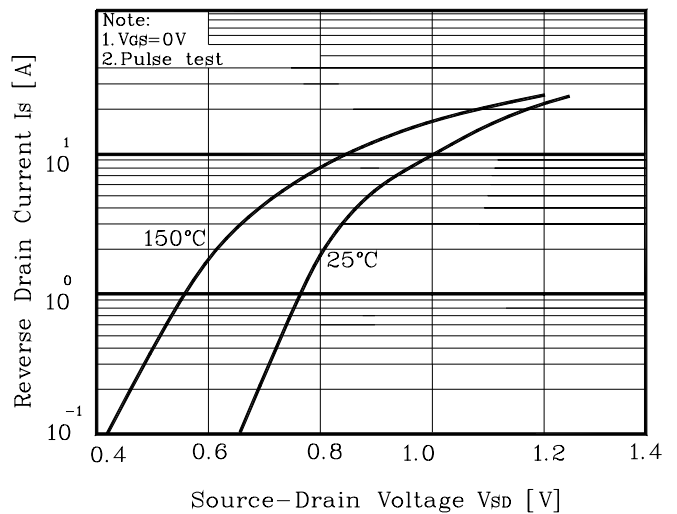
**Fig. 2  $I_D - V_{GS}$**



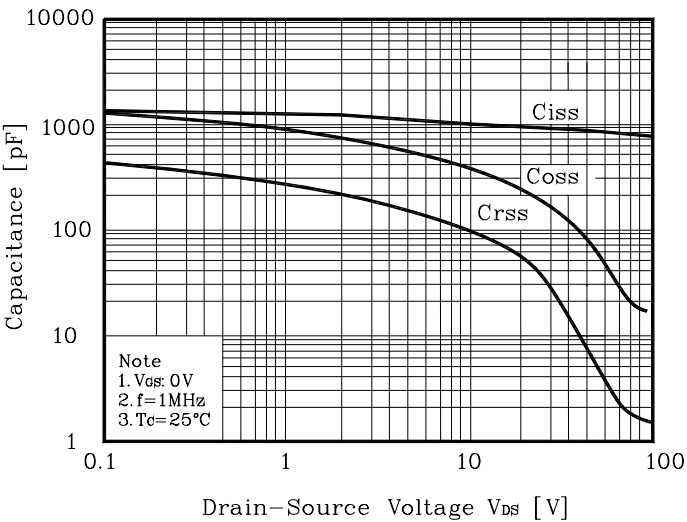
**Fig. 3  $R_{DS(on)} - I_D$**



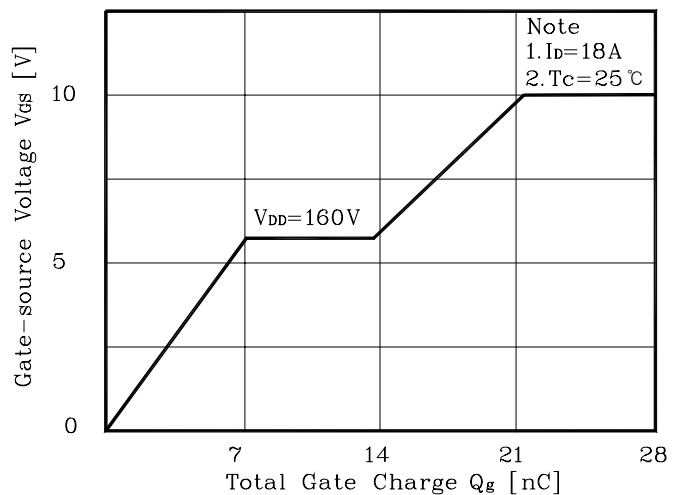
**Fig. 4  $I_S - V_{SD}$**



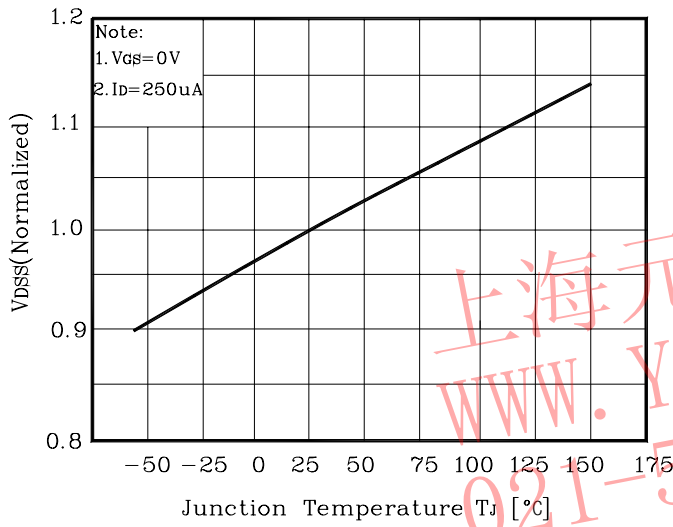
**Fig. 5 Capacitance -  $V_{DS}$**



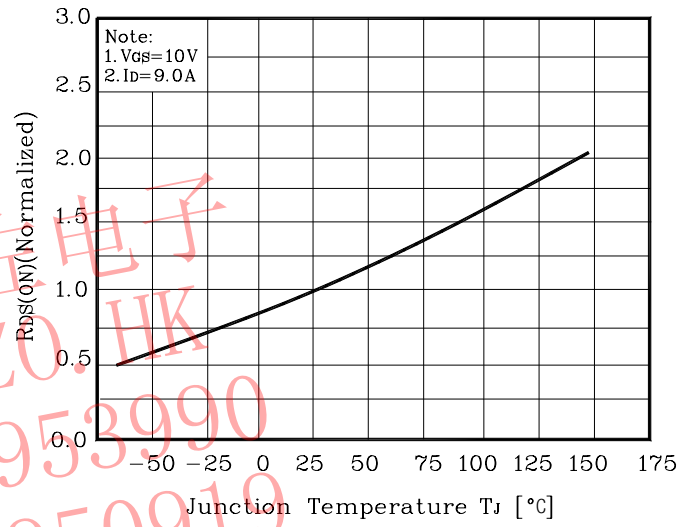
**Fig. 6  $V_{GS} - Q_g$**



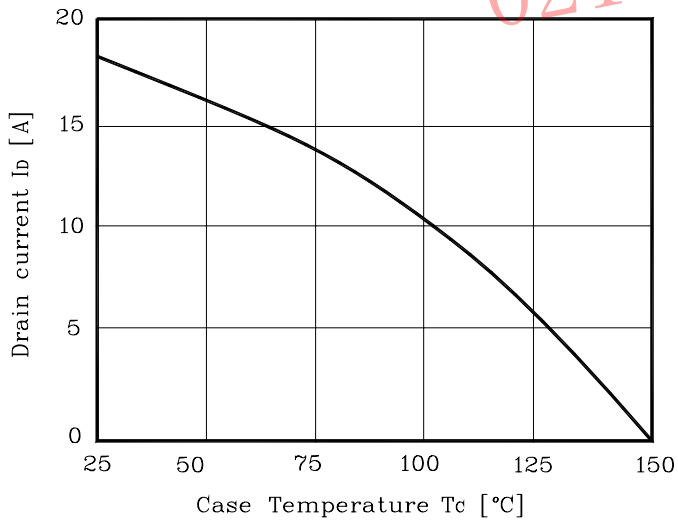
**Fig. 7  $V_{DSS} - T_J$**



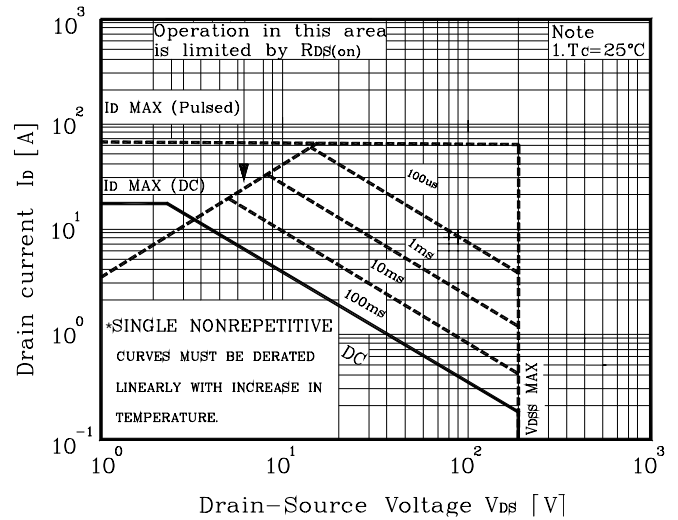
**Fig. 8  $R_{DS(on)} - T_J$**



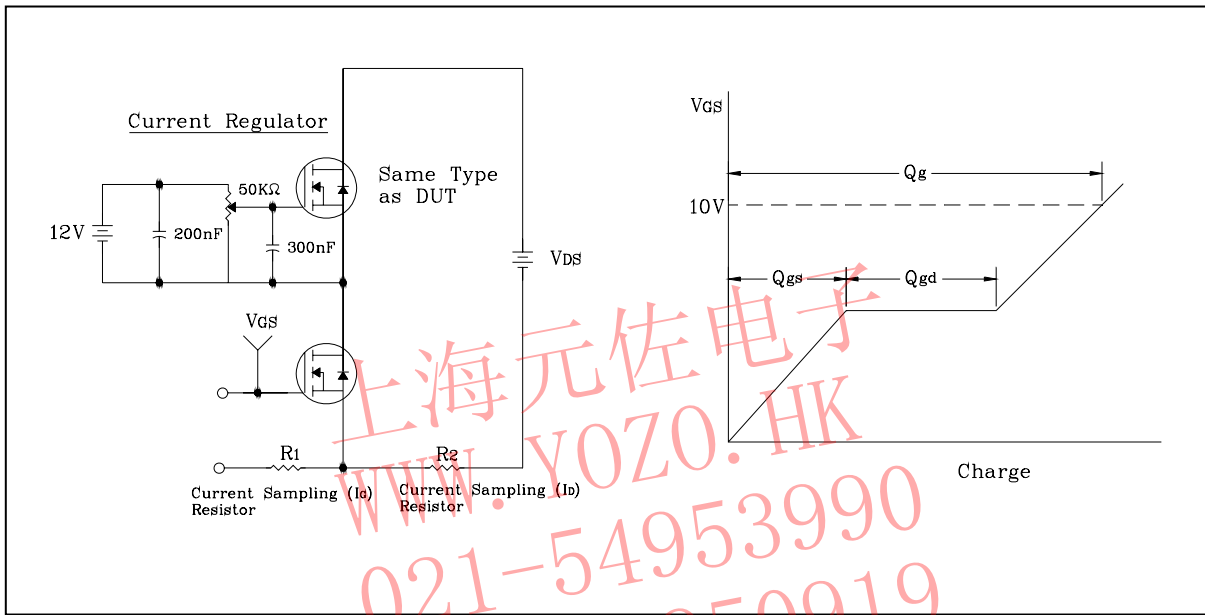
**Fig. 9  $I_D - T_C$**



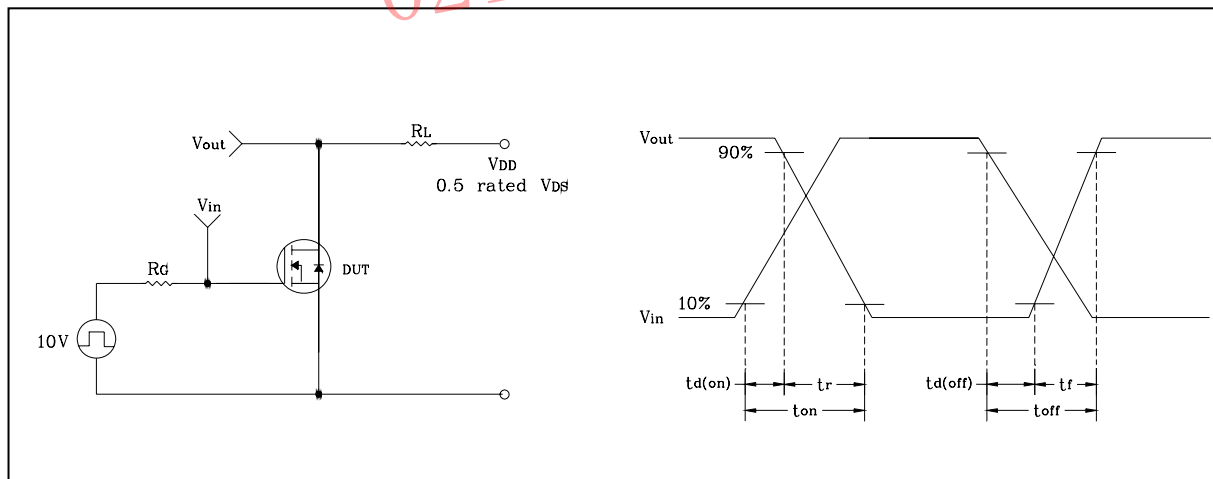
**Fig. 10 Safe Operating Area**



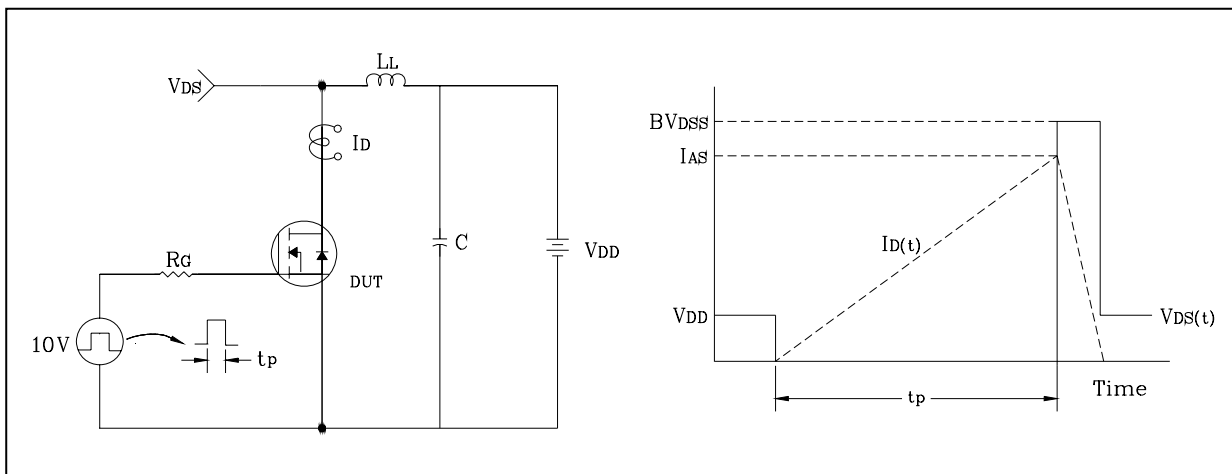
**Fig. 11 Gate Charge Test Circuit & Waveform**



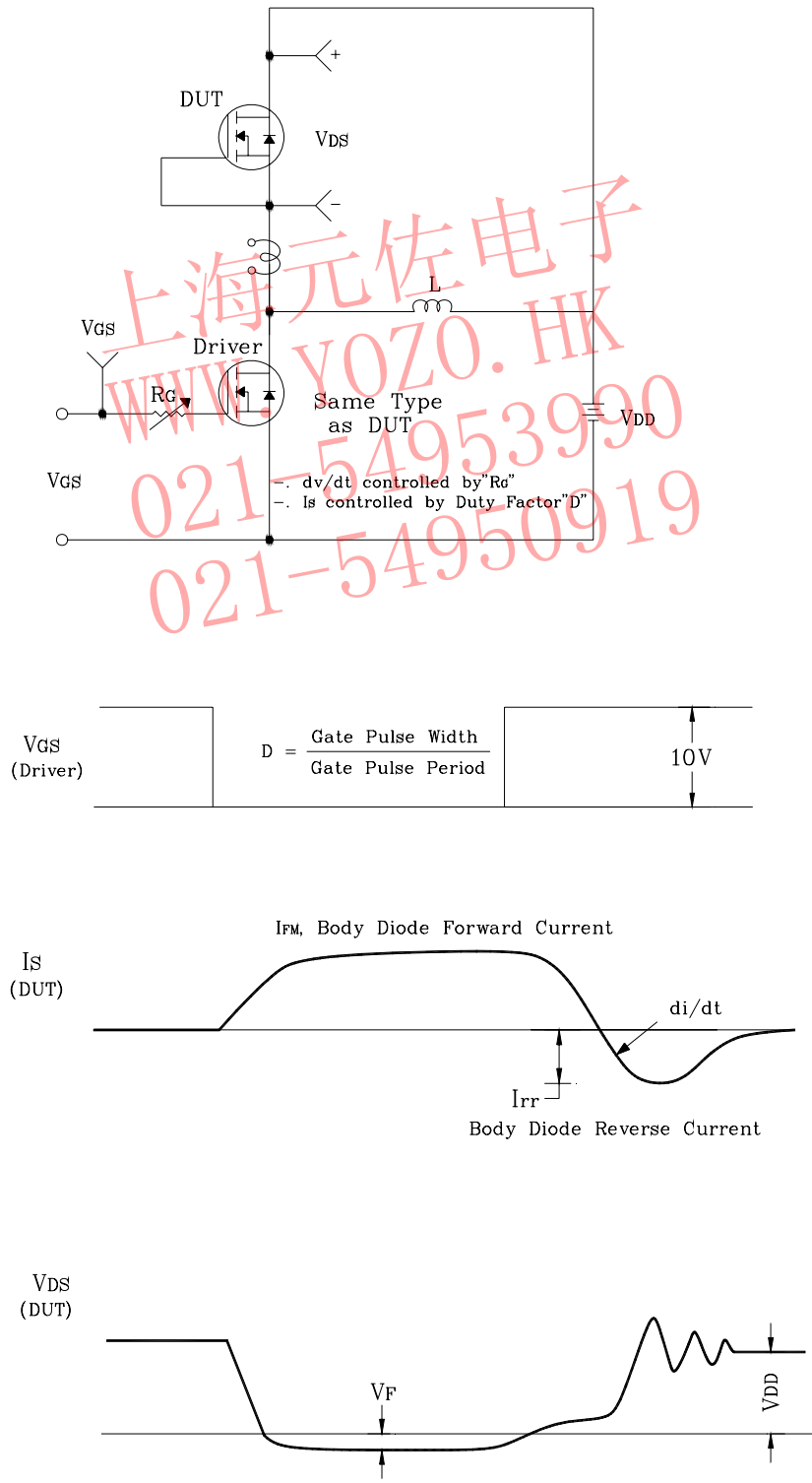
**Fig. 12 Resistive Switching Test Circuit & Waveform**



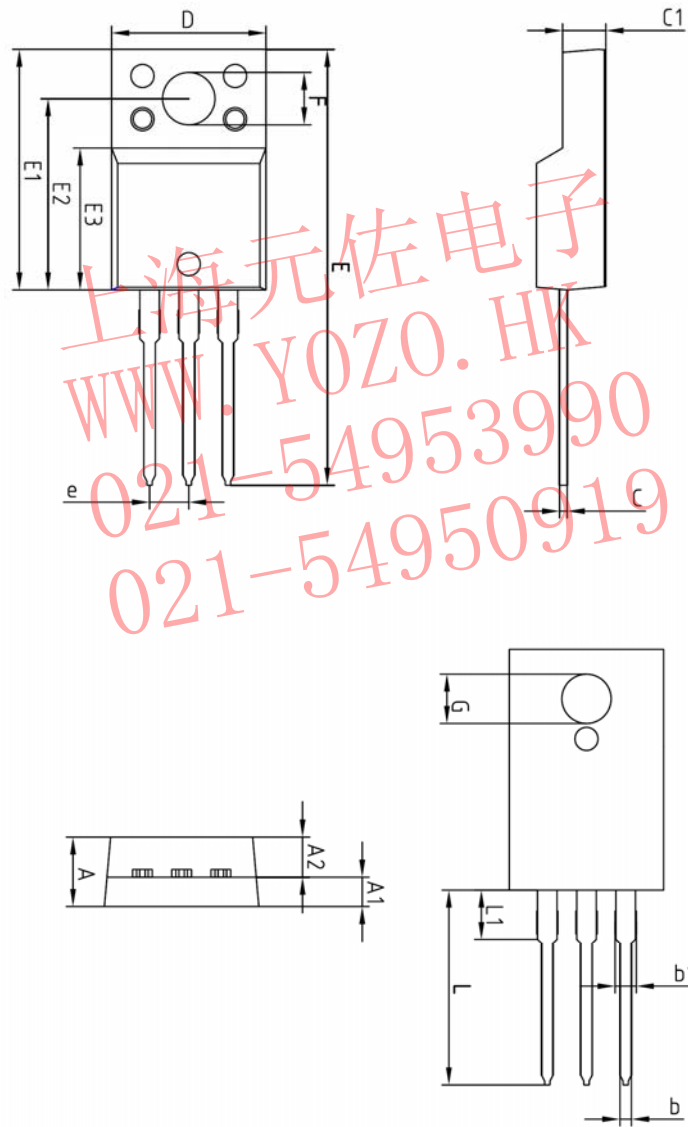
**Fig. 13 E<sub>AS</sub> Test Circuit & Waveform**



**Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform**



**Outline Dimension**



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	-	-	4.60	
A1	2.45	2.50	2.55	
A2	1.95	2.00	2.05	
b	0.65	0.75	0.85	
b1	1.07	1.27	1.47	
C	0.40	0.50	0.60	
C1	2.70	2.80	2.90	
D	9.90	10.00	10.10	
E	28.00	-	28.60	
E1	15.50	15.60	15.70	
E2	12.30	12.40	12.50	
E3	9.15	9.20	9.25	
F	3.30	3.40	3.50	
G	3.10	3.20	3.30	
e	2.54 BSC			
L	12.40	-	13.00	
L1	3.46 BSC			