

## SWITCHING REGULATOR APPLICATIONS

### Features

- High Voltage :  $BV_{DSS}=650V$ (Min.)
- Low  $C_{rss}$  :  $C_{rss}=16pF$ (Typ.)
- Low gate charge :  $Q_g=35nC$ (Typ.)
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=0.85\Omega$ (Max.)

### Ordering Information

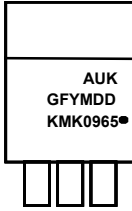
Type No.	Marking	Package Code
KMK0965F	KMK0965.	TO-220F-3L
KMK0965F (HF)	KMK0965.	TO-220F-3L

\* KMK0965F : Pb Free Product

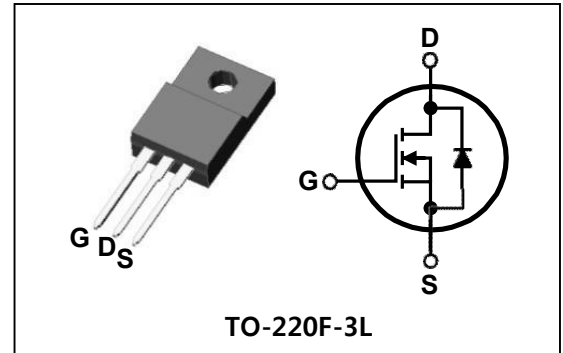
\* KMK0965F (HF) : Halogen Free Product

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### Marking Diagram

	Column 1 : Manufacturer
	Column 2 : Production Information e.g.) GFYMDD
	- . G : Option Code (H : Halogen Free)
	- . F : Factory Management Code
	- . YMDD : Date Code (Year, Month, Date)
	Column 3 : Device Code • Dalian

### PIN Connection



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

Characteristic	Symbol	Rating	Unit	
Drain-source voltage	$V_{DSS}$	650	V	
Gate-source voltage	$V_{GSS}$	$\pm 30$	V	
Drain current (DC) *	$I_D$	$T_C=25^{\circ}\text{C}$	9	A
		$T_C=100^{\circ}\text{C}$	5.5	A
Drain current (Pulsed) *	$I_{DM}$	36	A	
Power dissipation	$P_D$	40	W	
Avalanche current (Single) ②	$I_{AS}$	9	A	
Single pulsed avalanche energy ②	$E_{AS}$	250	mJ	
Avalanche current (Repetitive) ①	$I_{AR}$	9	A	
Repetitive avalanche energy ①	$E_{AR}$	11.6	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	$R_{th(J-C)}$	-	3.1	$^{\circ}\text{C/W}$
	Junction-ambient	$R_{th(J-A)}$	-	62.5	

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

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	$BV_{DSS}$	$I_D=250\mu A, V_{GS}=0V$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu A, V_{DS}=V_{GS}$	2.0	-	4.0	V
Drain-source cut-off current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$	-	-	1	$\mu A$
Gate leakage current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 30V$	-	-	$\pm 100$	nA
Drain-source on-resistance ④	$R_{DS(on)}$	$V_{GS}=10V, I_D=4.5A$	-	0.72	0.85	$\Omega$
Forward transfer conductance ④	$g_{fs}$	$V_{DS}=10V, I_D=4.5A$	-	11	-	S
Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=25V$ $f=1\text{ MHz}$	-	2040	2550	pF
Output capacitance	$C_{oss}$		-	153	192	
Reverse transfer capacitance	$C_{rss}$		-	16	20	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=300V, I_D=9A$ $R_G=25\Omega$	-	23	-	ns
Rise time	$t_r$		-	69	-	
Turn-off delay time	$t_{d(off)}$		-	144	-	
Fall time	$t_f$		-	77	-	
Total gate charge	$Q_g$	$V_{DS}=520V, V_{GS}=10V$ $I_D=9A$	-	35	57	nC
Gate-source charge	$Q_{gs}$		-	10	-	
Gate-drain charge	$Q_{gd}$		-	9	-	

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

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	$I_S$	Integral reverse diode in the MOSFET	-	-	9	A
Source current (Pulsed) ①	$I_{SM}$		-	-	36	
Forward voltage ④	$V_{SD}$	$V_{GS}=0V, I_S=9A$	-	-	1.4	V
Reverse recovery time	$t_{rr}$	$I_S=9A, V_{GS}=0V$ $dI_F/dt=100A/\mu s$	-	420	-	ns
Reverse recovery charge	$Q_{rr}$		-	4.2	-	$\mu C$

Note ;

- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ②  $L=5.7mH, I_{AS}=9A, V_{DD}=50V, R_G=25\Omega, \text{Starting } T_J=25^\circ C$
- ③ Pulse Test : Pulse width $\leq 300\mu s$ , Duty cycle $\leq 2\%$
- ④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1  $I_D - V_{DS}$

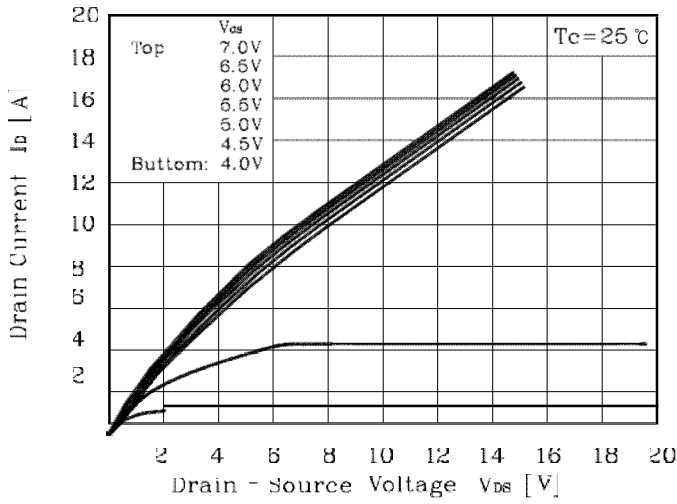


Fig. 2  $I_D - V_{GS}$

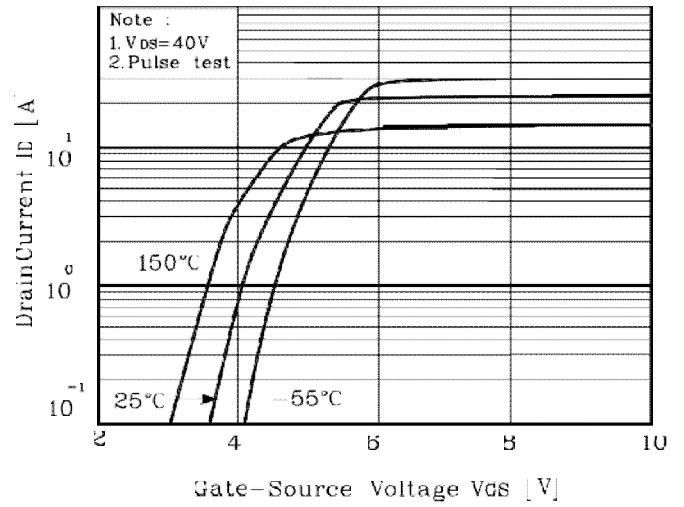


Fig. 3  $R_{DS(on)} - I_D$

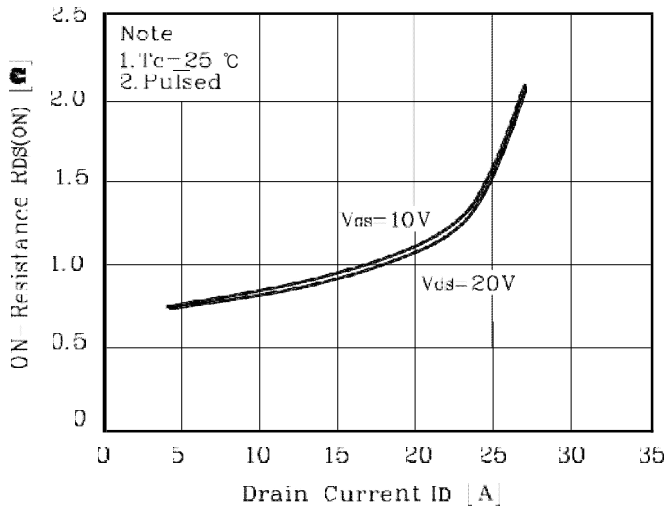


Fig. 4  $I_S - V_{SD}$

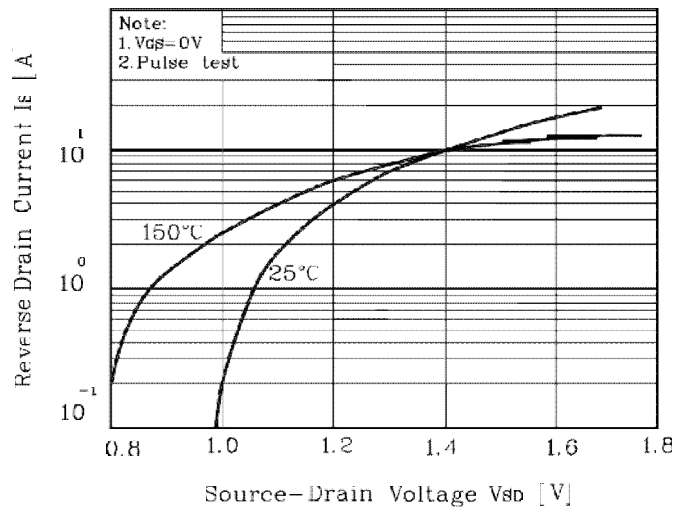


Fig. 5 Capacitance -  $V_{DS}$

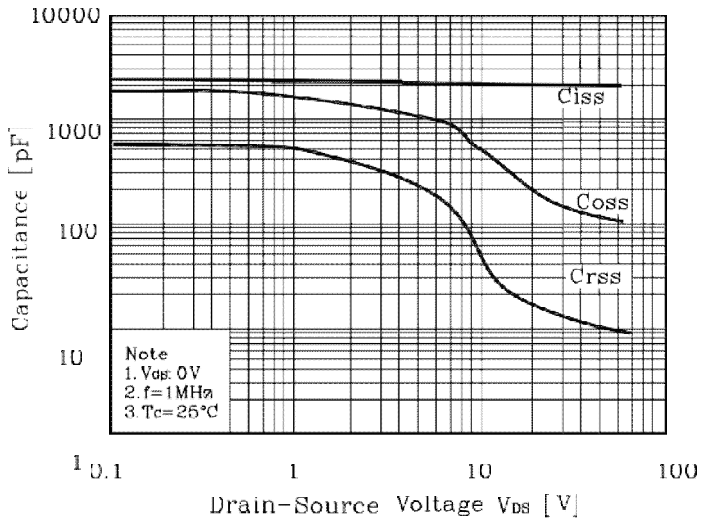
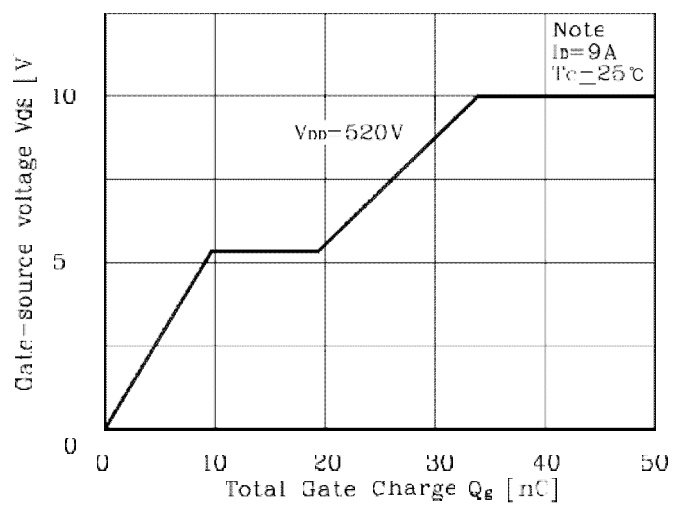
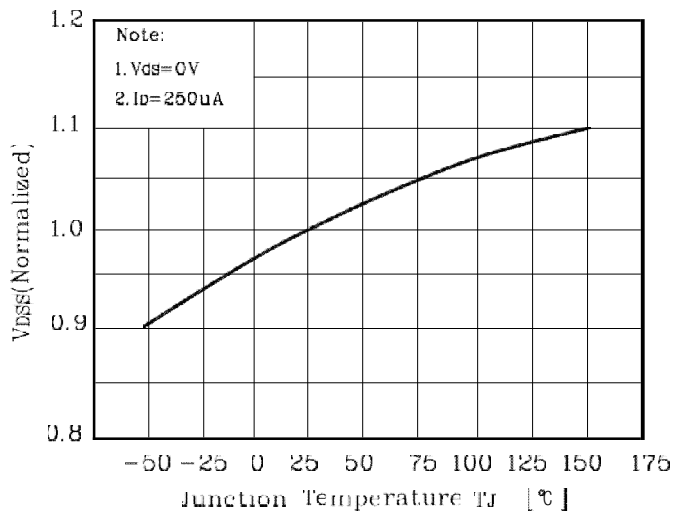


Fig. 6  $V_{GS} - Q_G$

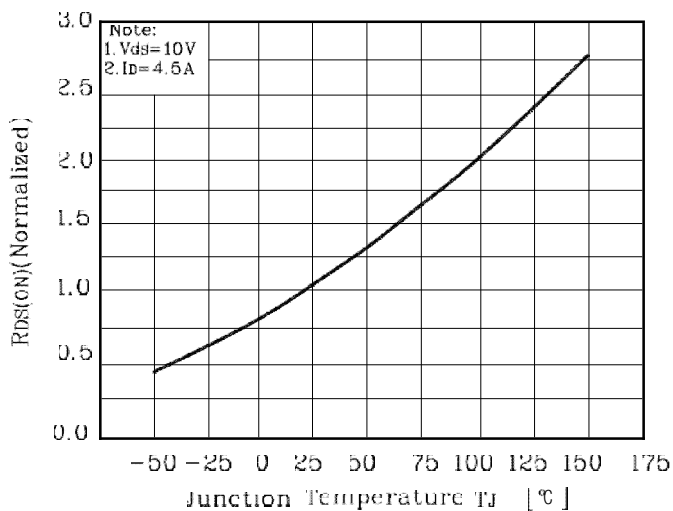


## Electrical Characteristic Curves

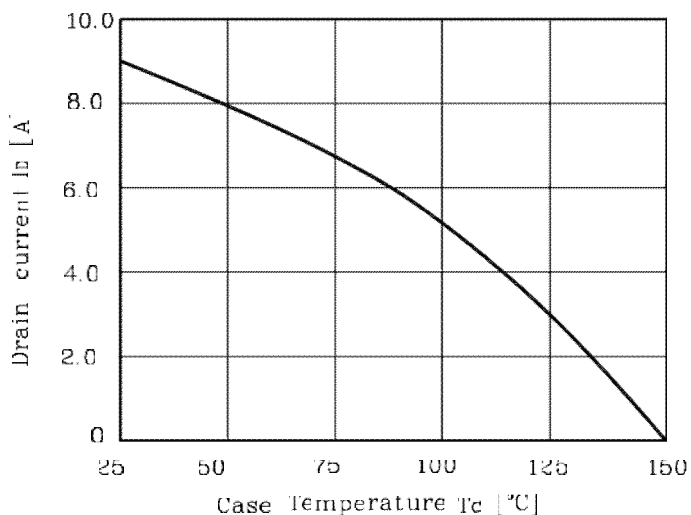
**Fig. 7  $V_{DS} - T_J$**



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



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



**Fig. 10 Safe Operating Area**

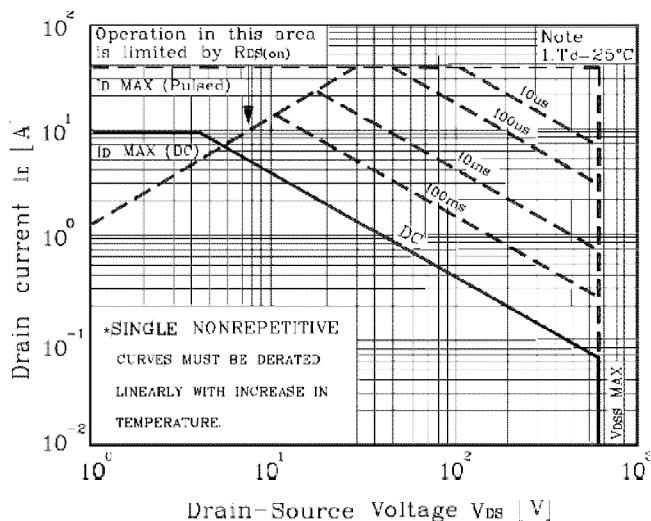


Fig. 11 Gate Charge Test Circuit & Waveform

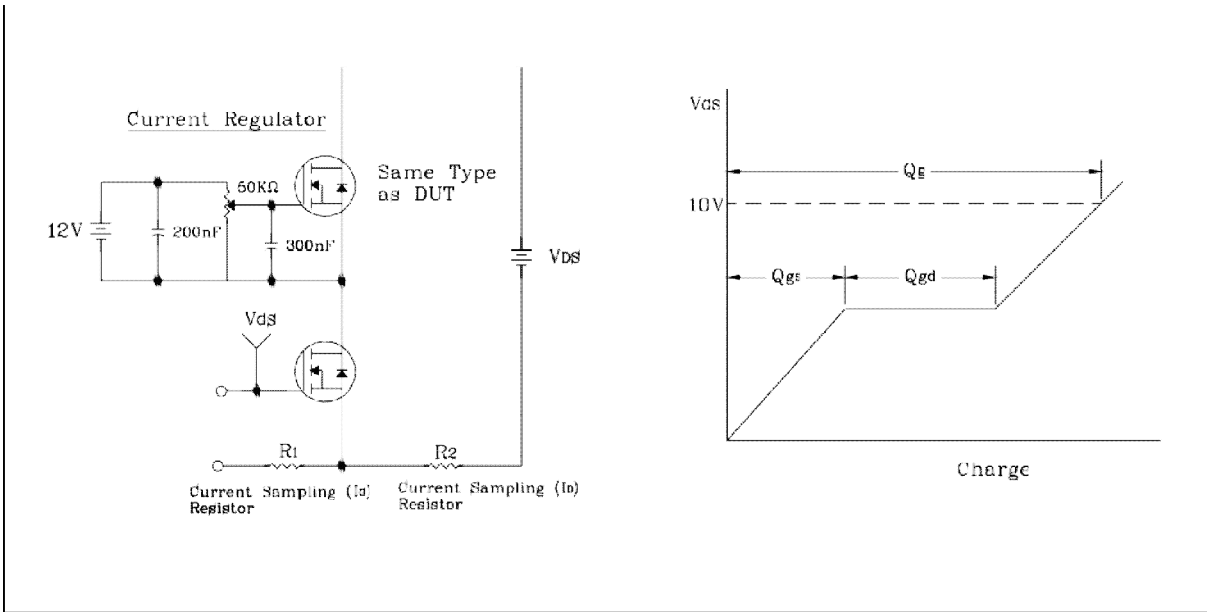


Fig. 12 Resistive Switching Test Circuit & Waveform

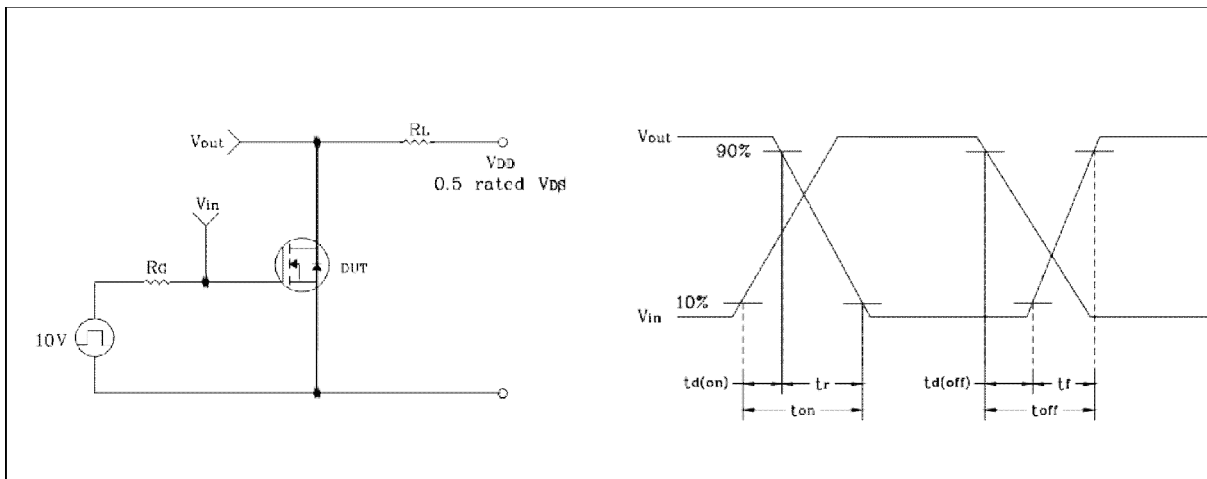


Fig. 13 EAS Test Circuit & Waveform

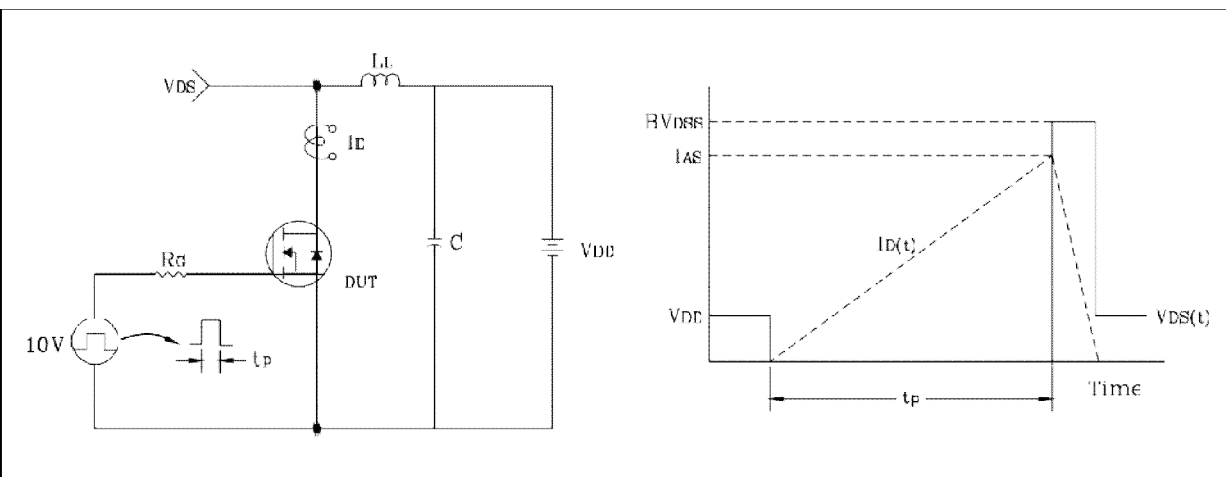
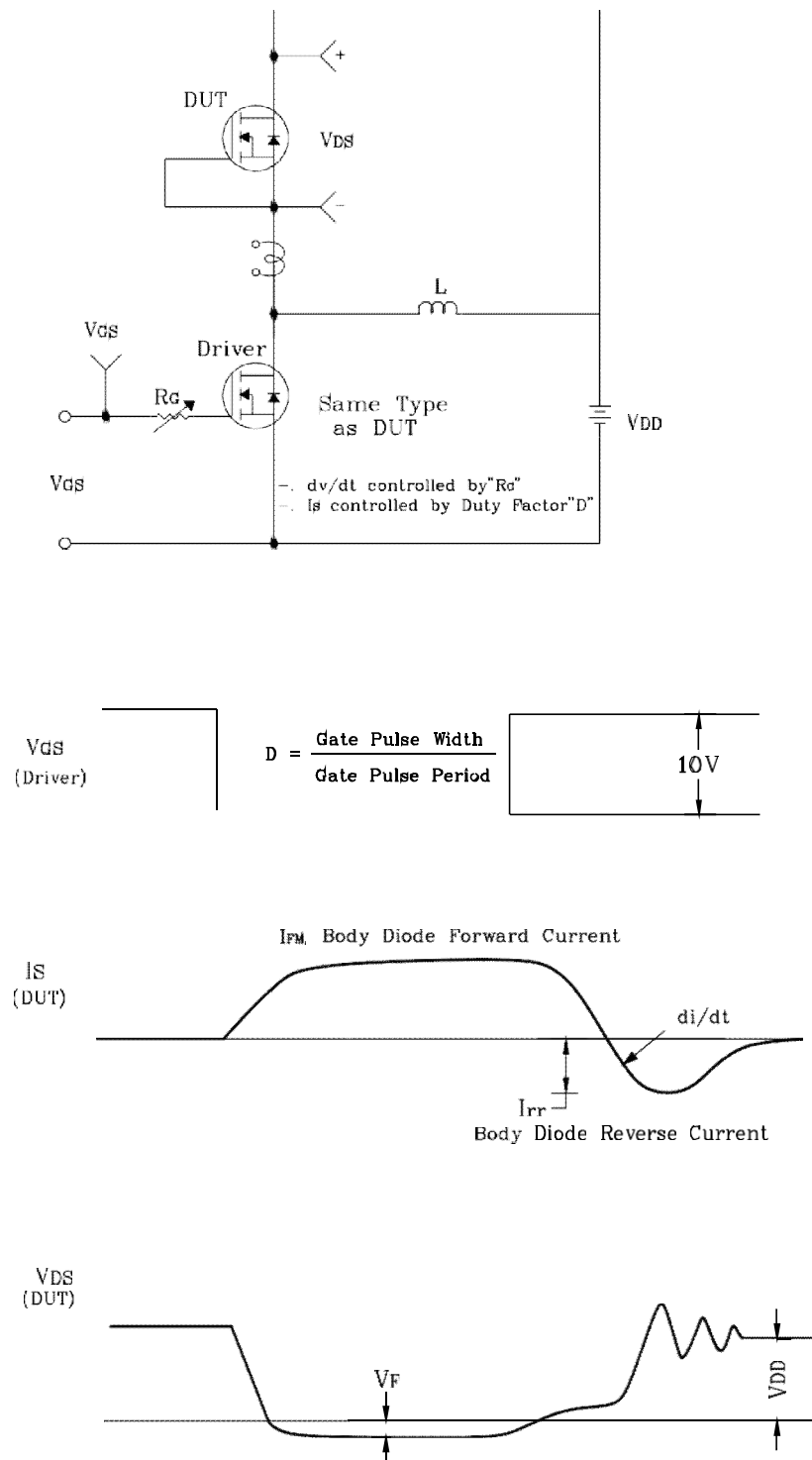
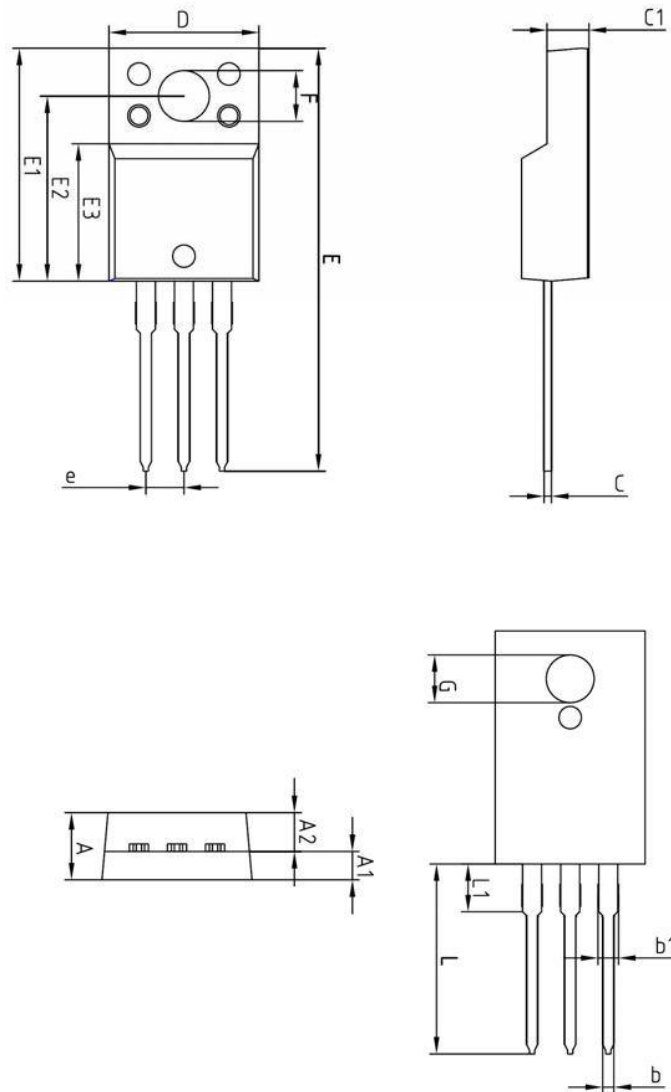


Fig. 14 Diode Reverse Recovery Time Test Circuit &amp; Waveform



## Outline Dimension

unit: mm



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			

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