

## SWITCHING REGULATOR APPLICATIONS

### Features

- High Voltage :  $V_{DSS}=650V(\text{Min.})$
- Low  $C_{RSS}$  :  $C_{RSS}=5.6pF(\text{Typ.})$
- Low gate charge :  $Q_g=11.2nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=3.0\Omega(\text{Max.})$

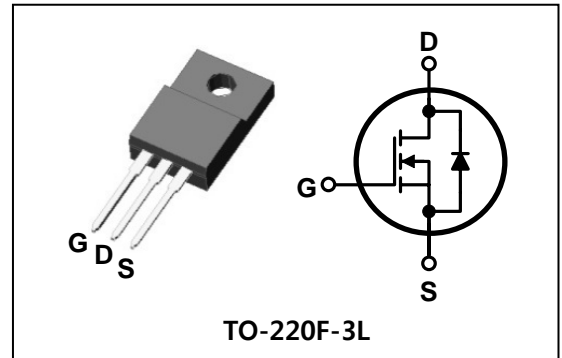
### Ordering Information

Type No.	Marking	Package Code
SMK0465F	SMK0465	TO-220F-3L
SMK0465F (HF)	SMK0465	TO-220F-3L

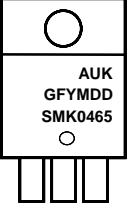
\* SMK0465F : Pb Free Product

\* SMK0465F (HF) : Halogen Free Product

### PIN Connection



### 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

### Absolute maximum ratings ( $T_c=25^\circ\text{C}$ 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) *	$I_D$	$T_c=25^\circ\text{C}$	4
		$T_c=100^\circ\text{C}$	2.0
Drain current (Pulsed) *	$I_{DM}$	16	A
Power dissipation	$P_D$	30	W
Avalanche current (Single) ②	$I_{AS}$	4	A
Single pulsed avalanche energy ②	$E_{AS}$	81.5	mJ
Avalanche current (Repetitive) ①	$I_{AR}$	4	A
Repetitive avalanche energy ①	$E_{AR}$	3.4	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	-	4.16	$^\circ\text{C}/\text{W}$
	Junction-ambient	-	62.5	

## Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Drain-source breakdown voltage	BV <sub>DSS</sub>	I <sub>D</sub> =250μA, V <sub>GS</sub> =0	650	-	-	V	
Gate threshold voltage	V <sub>GS(th)</sub>	I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>	2.0	-	4.0	V	
Drain-source cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	-	-	1	μA	
Gate leakage current	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V	-	-	±100	nA	
Drain-source on-resistance ④	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2.0A	-	2.4	3.0	Ω	
Forward transfer conductance ④	g <sub>fs</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =2.0A	-	4.0	-	S	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	703	878	pF	
Output capacitance	C <sub>oss</sub>		-	54.6	68.2		
Reverse transfer capacitance	C <sub>rss</sub>		-	5.6	7.0		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =300V, I <sub>D</sub> =4.0A R <sub>G</sub> =25Ω	-	10	-	ns	
Rise time	t <sub>r</sub>		-	42	-		
Turn-off delay time	t <sub>d(off)</sub>		③④	-	38		-
Fall time	t <sub>f</sub>		-	46	-		
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> =520V, V <sub>GS</sub> =10V I <sub>D</sub> =4.0A	-	11.2	14.0	nC	
Gate-source charge	Q <sub>gs</sub>		-	3.9	-		
Gate-drain charge	Q <sub>gd</sub>		③④	-	2.5		-

## Source-Drain Diode Ratings and Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	I <sub>S</sub>	Integral reverse diode in the MOSFET	-	-	4	A
Source current (Pulsed) ①	I <sub>SM</sub>		-	-	16	
Forward voltage ④	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =4.0A	-	-	1.4	V
Reverse recovery time	t <sub>rr</sub>	I <sub>S</sub> =4.0A, V <sub>GS</sub> =0V dI <sub>F</sub> /dt=100A/μs	-	300	-	ns
Reverse recovery charge	Q <sub>rr</sub>		-	2.2	-	μC

Note ;

- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=9.4mH, I<sub>AS</sub>=4.0A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C
- ③ Pulse Test : Pulse width≤300μs, Duty cycle≤2%
- ④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1  $I_D - V_{DS}$

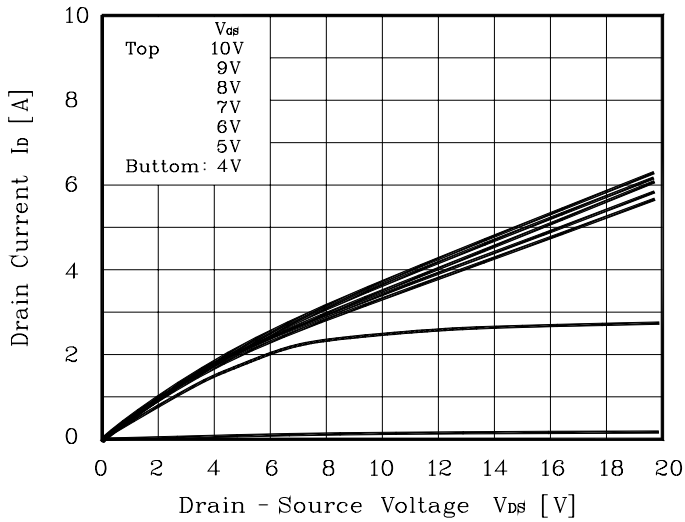


Fig. 2  $I_D - V_{GS}$

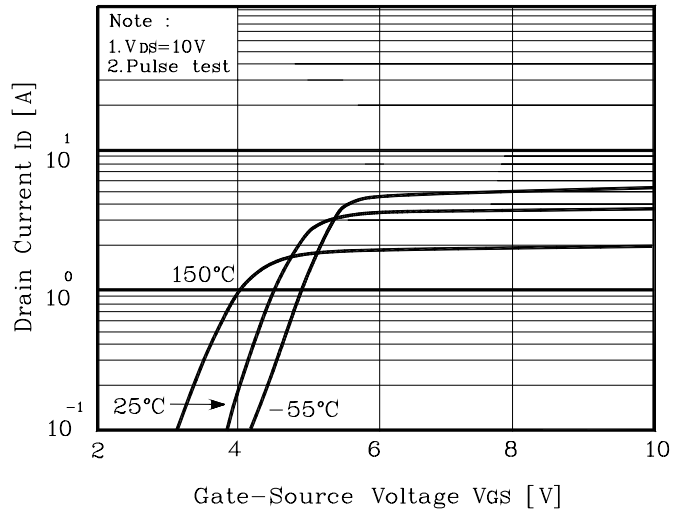


Fig. 3  $R_{DS(on)} - I_D$

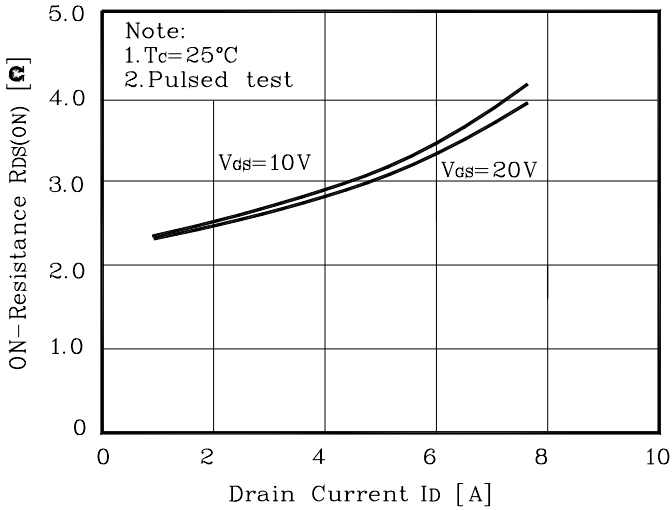


Fig. 4  $I_S - V_{SD}$

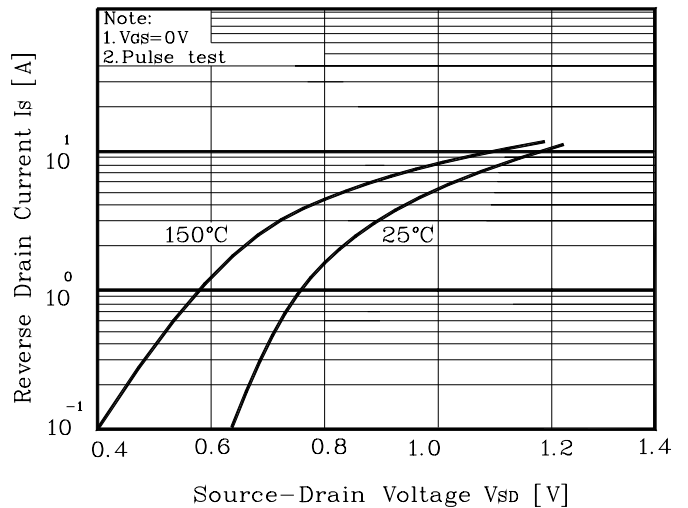


Fig. 5 Capacitance -  $V_{DS}$

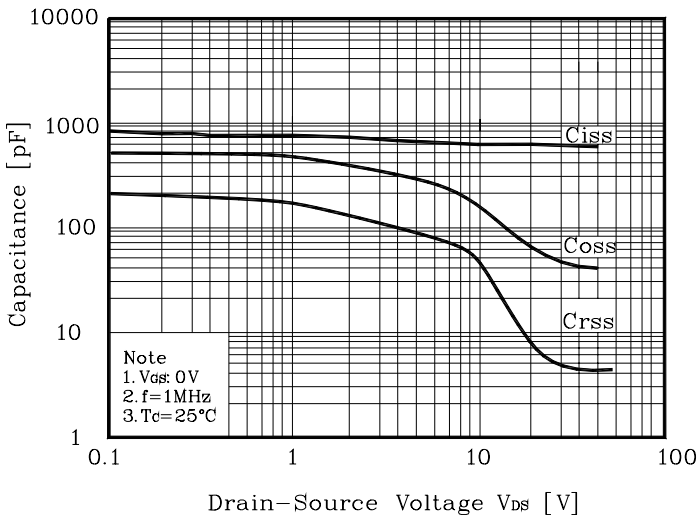
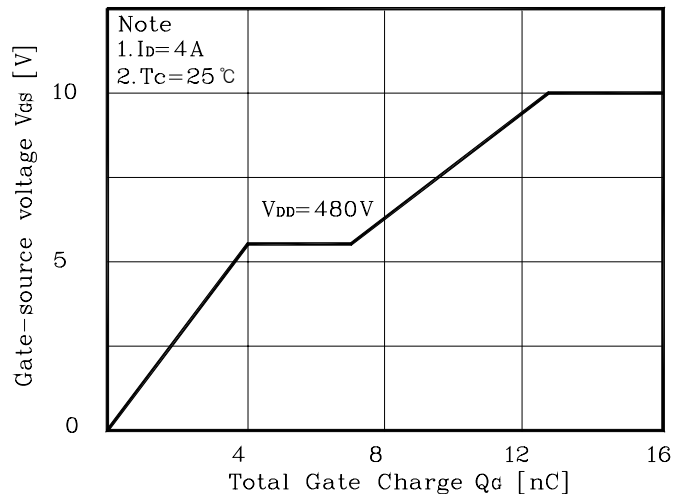
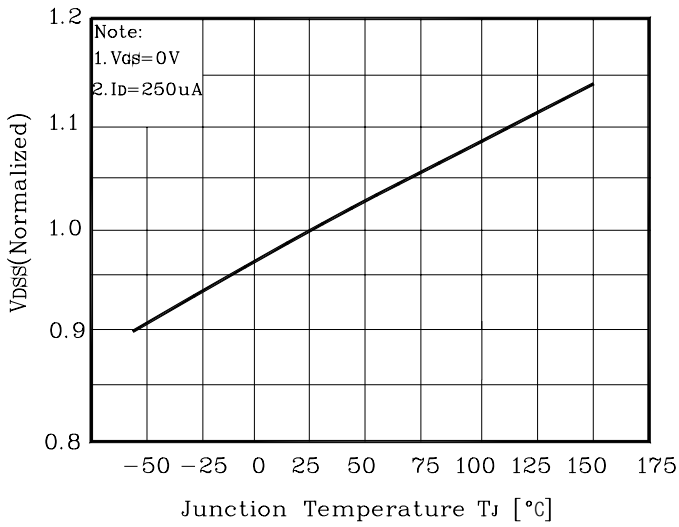


Fig. 6  $V_{GS} - Q_G$

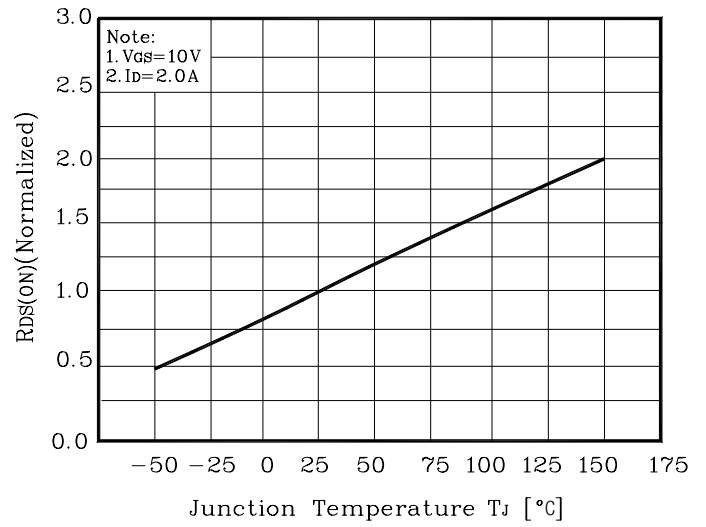


## Electrical Characteristic Curves

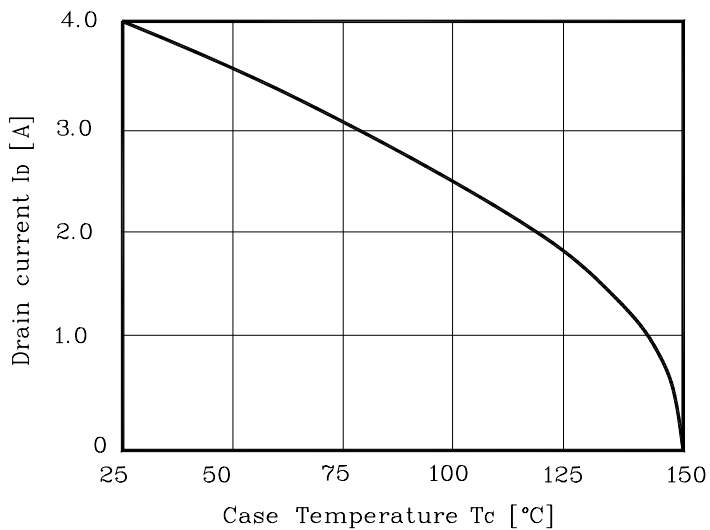
**Fig. 7**  $V_{DSS} - T_J$



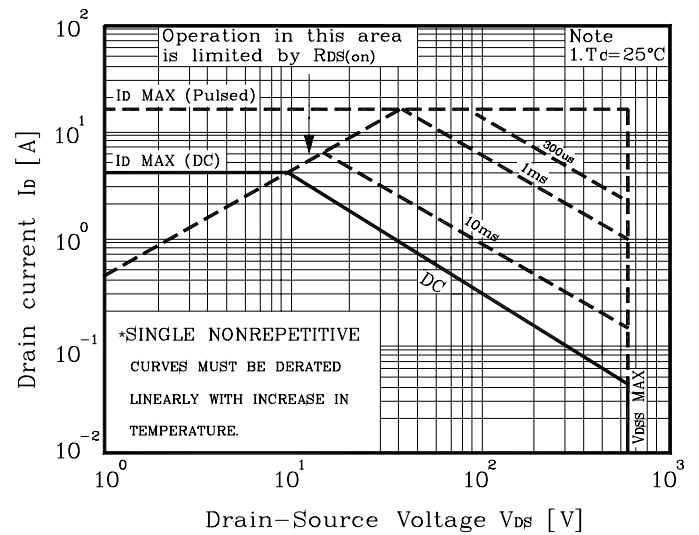
**Fig. 8**  $R_{DS(on)} - T_J$



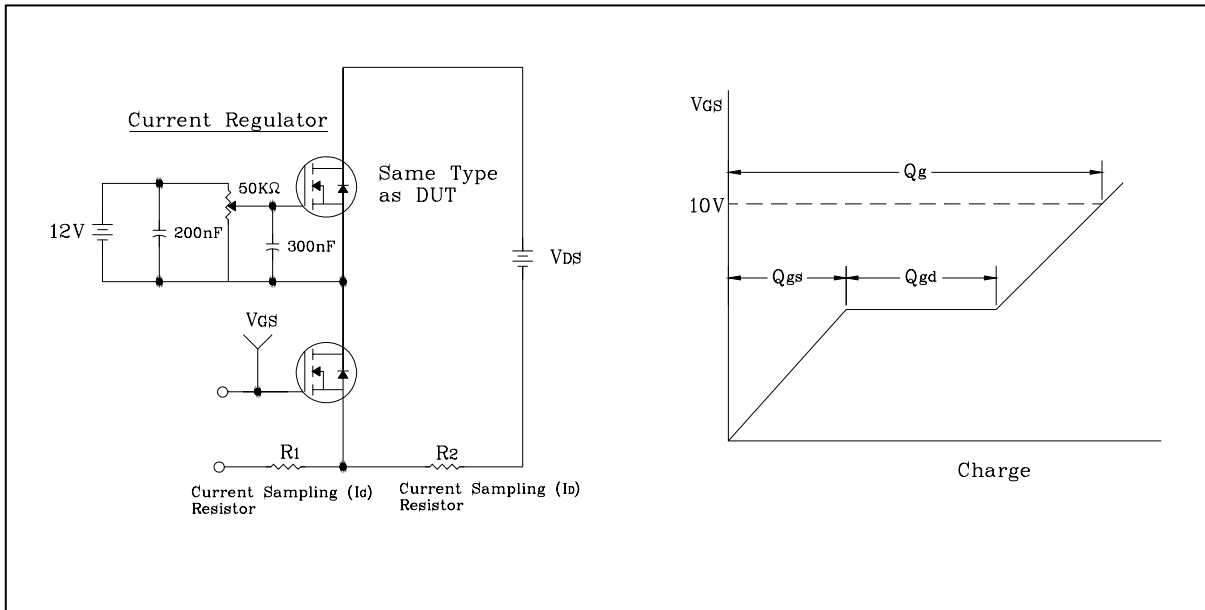
**Fig. 9**  $I_D - T_C$



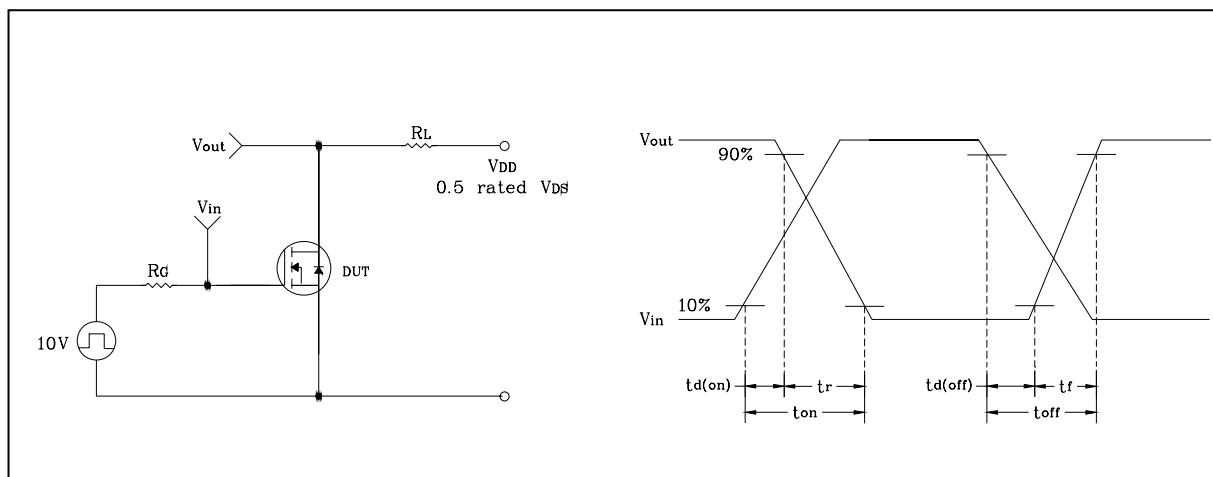
**Fig. 10** Safe Operating Area



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



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



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

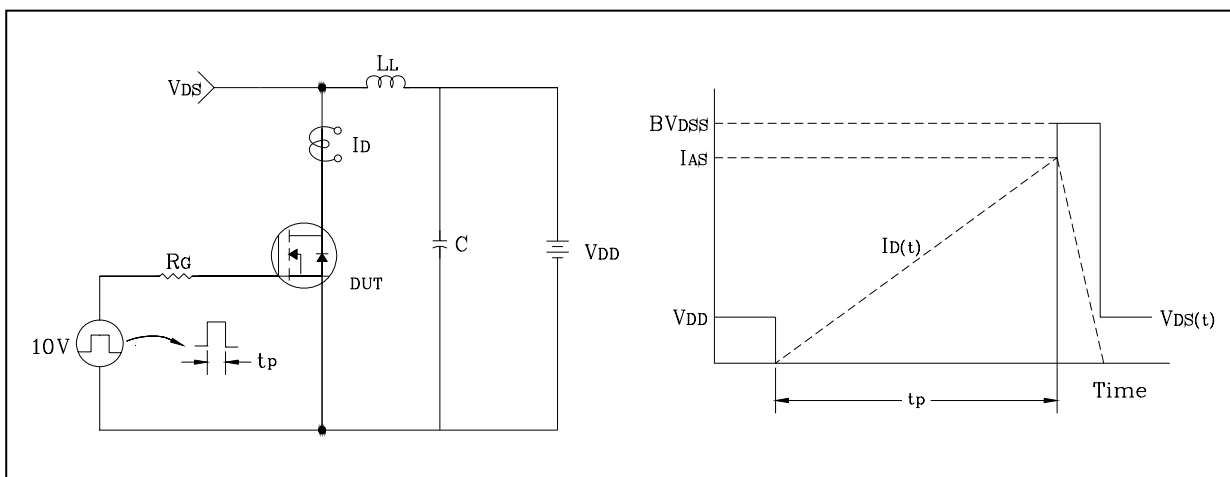
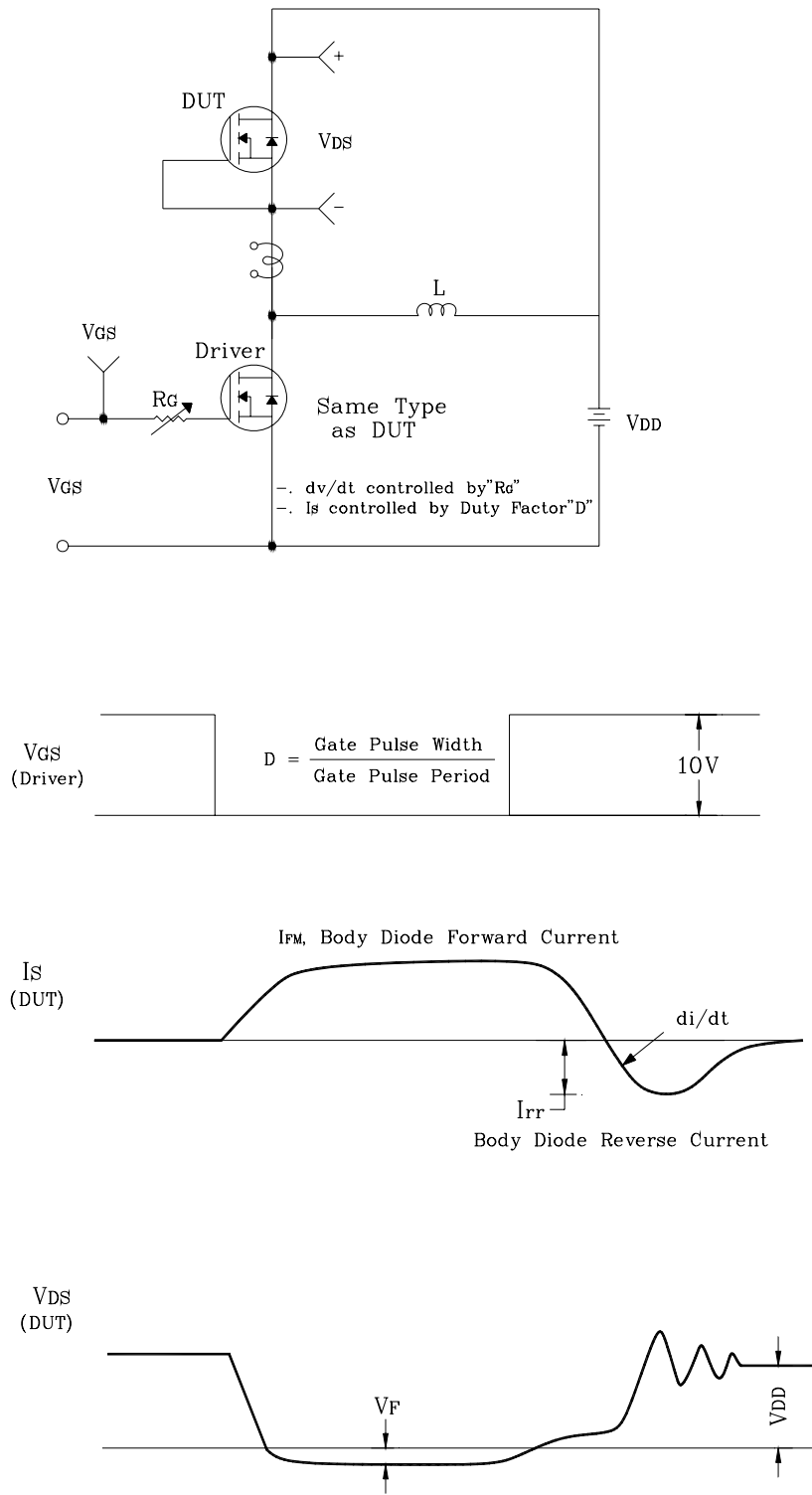
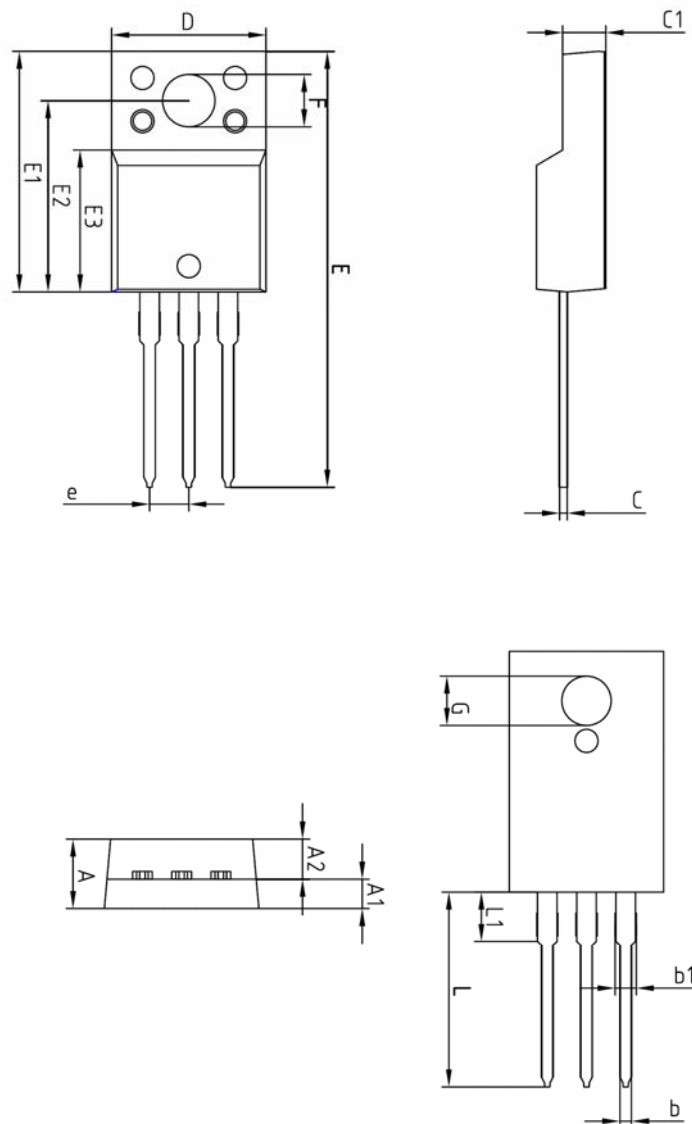


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



## Outline Dimension

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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