

## SWITCHING REGULATOR APPLICATIONS

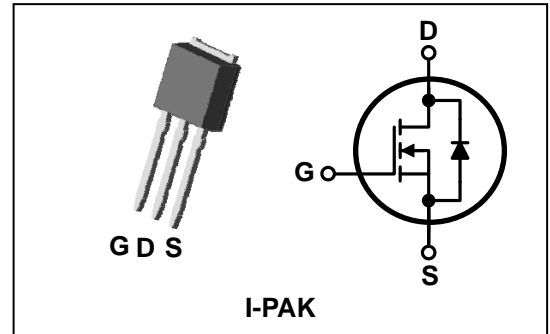
### Features

- High Voltage:  $BV_{DSS}=600V(\text{Min.})$
- Low  $C_{rSS}$  :  $C_{rSS}=9.8pF(\text{Typ.})$
- Low gate charge :  $Q_g=12nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=2.5\Omega(\text{Max.})$

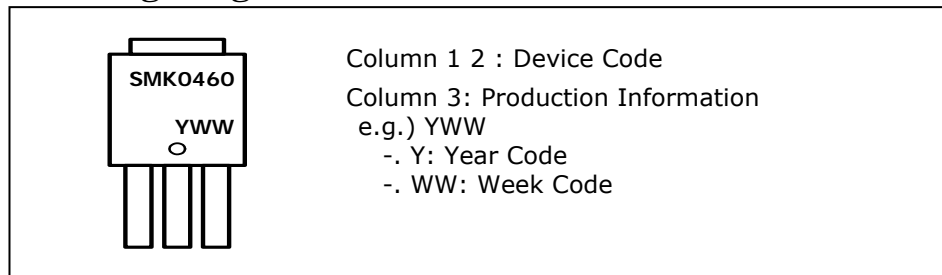
### Ordering Information

Type No.	Marking	Package Code
SMK0460I	SMK0460	I-PAK

### PIN Connection



### Marking Diagram



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

Characteristic	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	600	V
Gate-source voltage	$V_{GSS}$	$\pm 30$	V
Drain current (DC)	$I_D$	( $T_C=25^\circ\text{C}$ )	4
		( $T_C=100^\circ\text{C}$ )	2.53
Drain current (Pulsed) *	$I_{DM}$	16	A
Drain Power dissipation	$P_D$	48	W
Avalanche current (Single) ②	$I_{AS}$	4	A
Single pulsed avalanche energy ②	$E_{AS}$	225	mJ
Avalanche current (Repetitive) ①	$I_{AR}$	4	A
Repetitive avalanche energy ①	$E_{AR}$	10	mJ
Junction temperature	$T_J$	150	°C
Storage temperature range	$T_{stg}$	-55~150	

\* Limited by maximum junction temperature

Characteristic	Symbol	Typ.	Max	Unit	
Thermal resistance	Junction-case	$R_{th(J-C)}$	-	2.6	°C/W
	Junction-ambient	$R_{th(J-a)}$	-	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	600	-	-	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 leakage current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V	-	-	1	μA	
Gate-source leakage	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	-	2.1	2.5	Ω	
Forward transfer admittance 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	-	670	848	pF	
Output capacitance	C <sub>oss</sub>		-	57	71		
Reverse transfer capacitance	C <sub>rss</sub>		-	9.8	12.2		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =300V, I <sub>D</sub> =4A 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> =480V, V <sub>GS</sub> =10V I <sub>D</sub> =4A	-	12	15	nC	
Gate-source charge	Q <sub>gs</sub>		-	4	-		
Gate-drain charge	Q <sub>gd</sub>		③④	-	3		-

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

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Continuous source current	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> =4A	-	-	1.4	V
Reverse recovery time	t <sub>rr</sub>	I <sub>S</sub> =4A di <sub>s</sub> /dt=100A/us	-	300	-	ns
Reverse recovery charge	Q <sub>rr</sub>		-	2.2	-	uC

Note ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ② L=25.9mH, I<sub>AS</sub>=4A, V<sub>DD</sub>=50V, R<sub>G</sub>=27Ω, Starting T<sub>J</sub> = 25 °C
- ③ Pulse Test : Pulse Width < 300us, Duty cycle ≤ 2%
- ④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1  $I_D - V_{DS}$

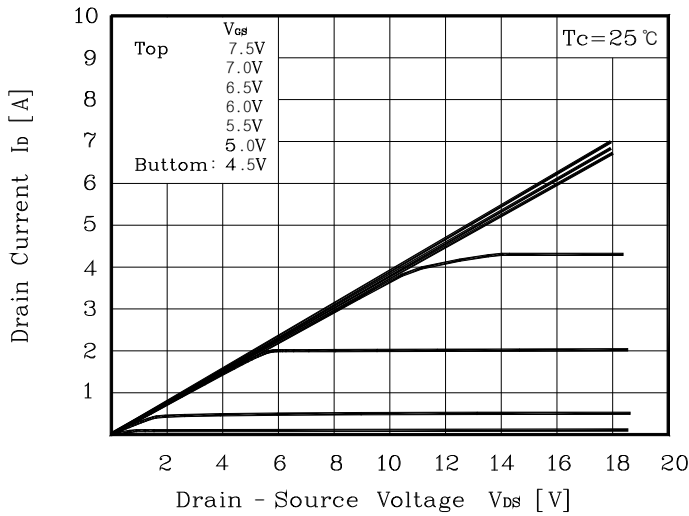


Fig. 2  $I_D - V_{GS}$

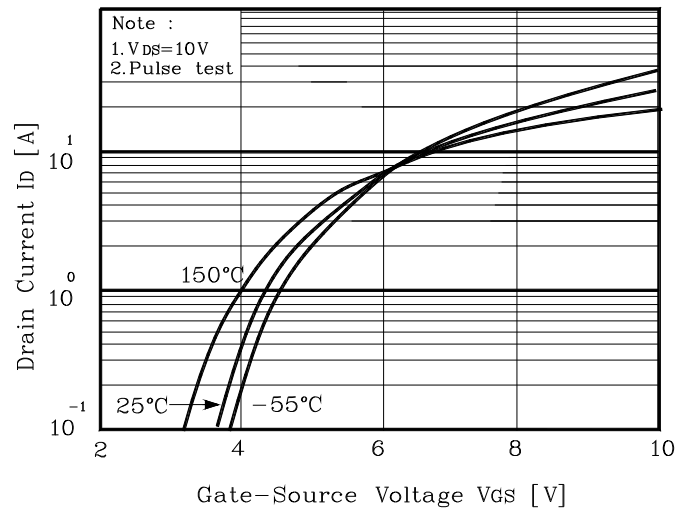


Fig. 3  $R_{DS(on)} - I_D$

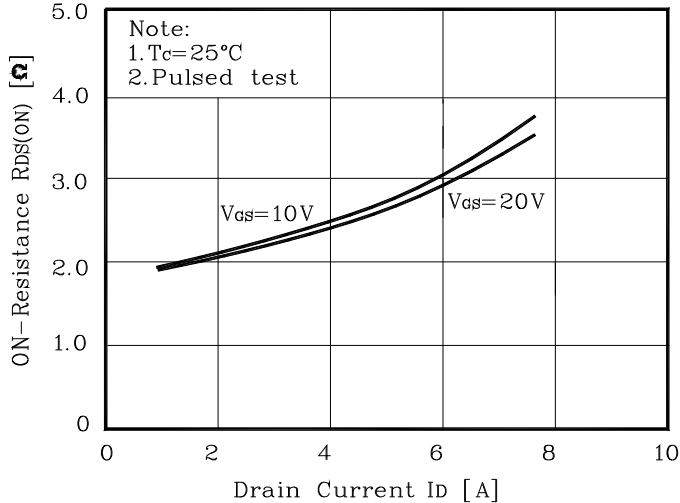


Fig. 4  $I_S - V_{SD}$

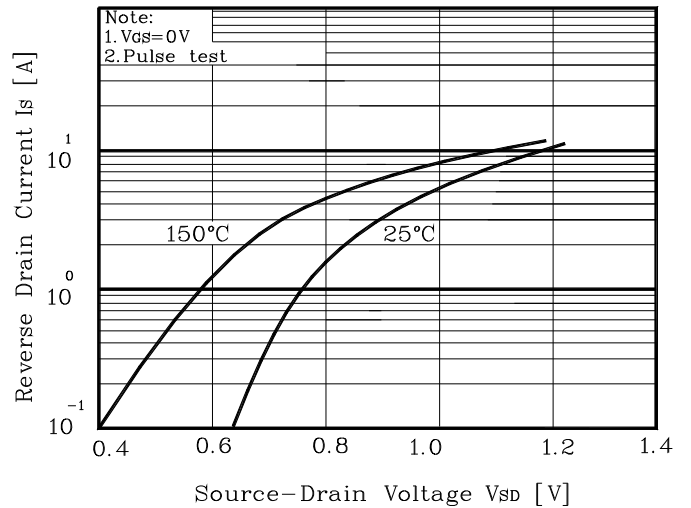


Fig. 5 Capacitance -  $V_{DS}$

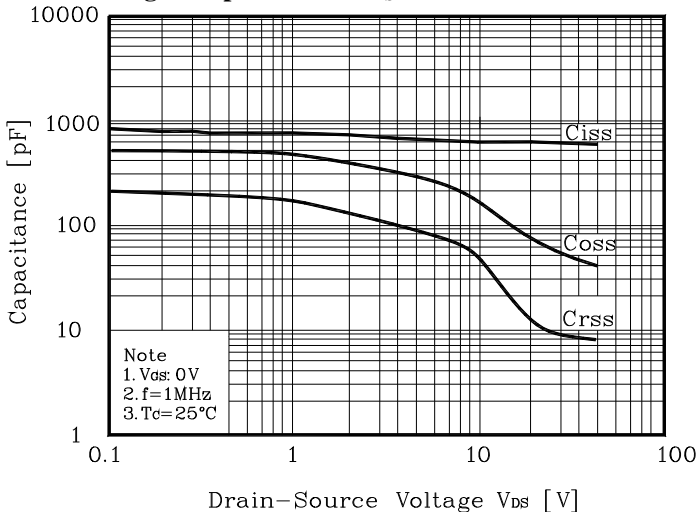
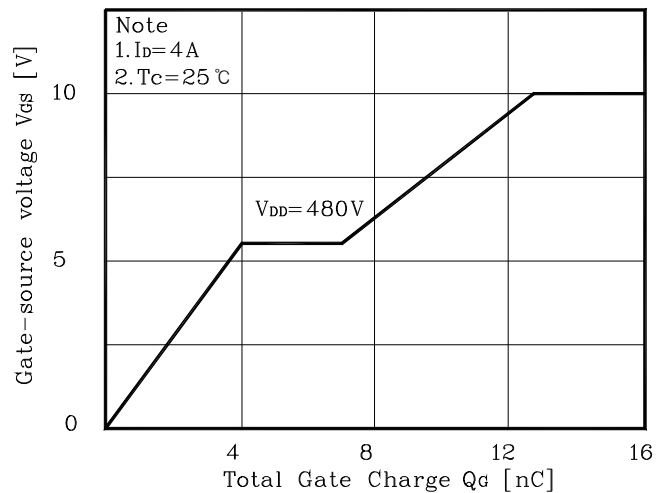


Fig. 6  $V_{GS} - Q_G$



Electrical Characteristic Curves

Fig. 7  $V_{DSS} - T_J$

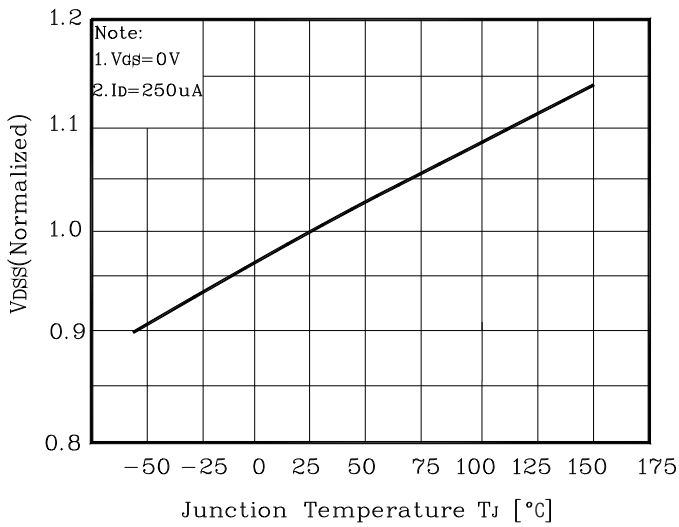


Fig. 8  $R_{DS(on)} - T_J$

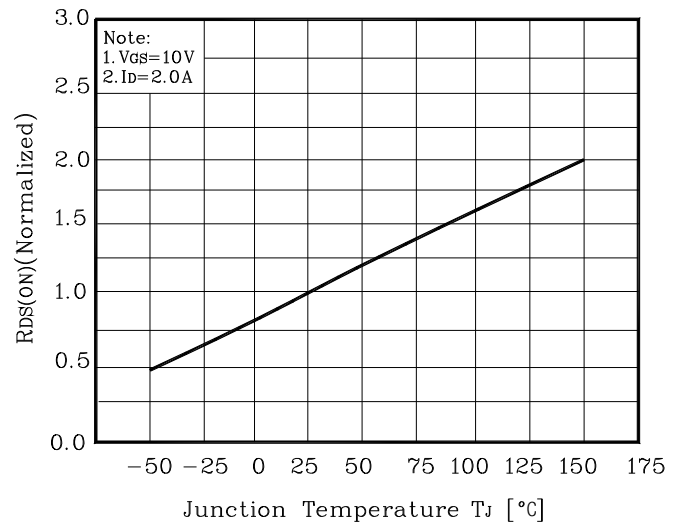


Fig. 9  $I_D - T_C$

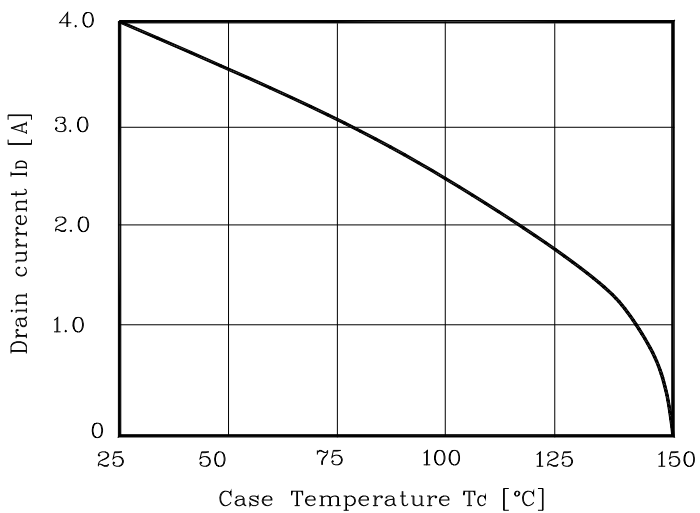
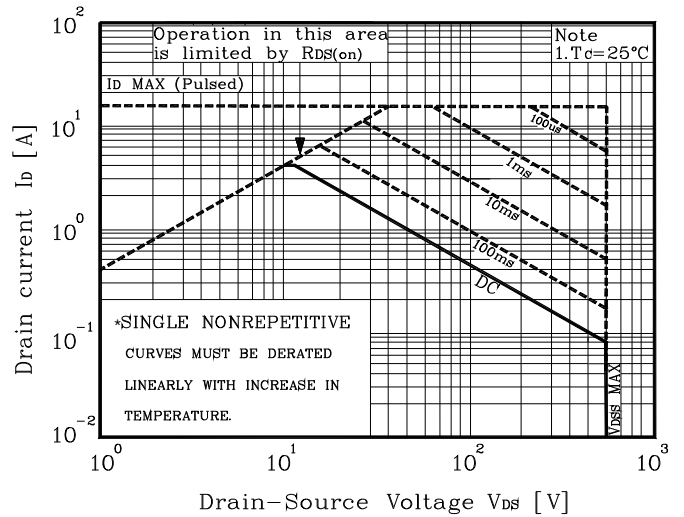
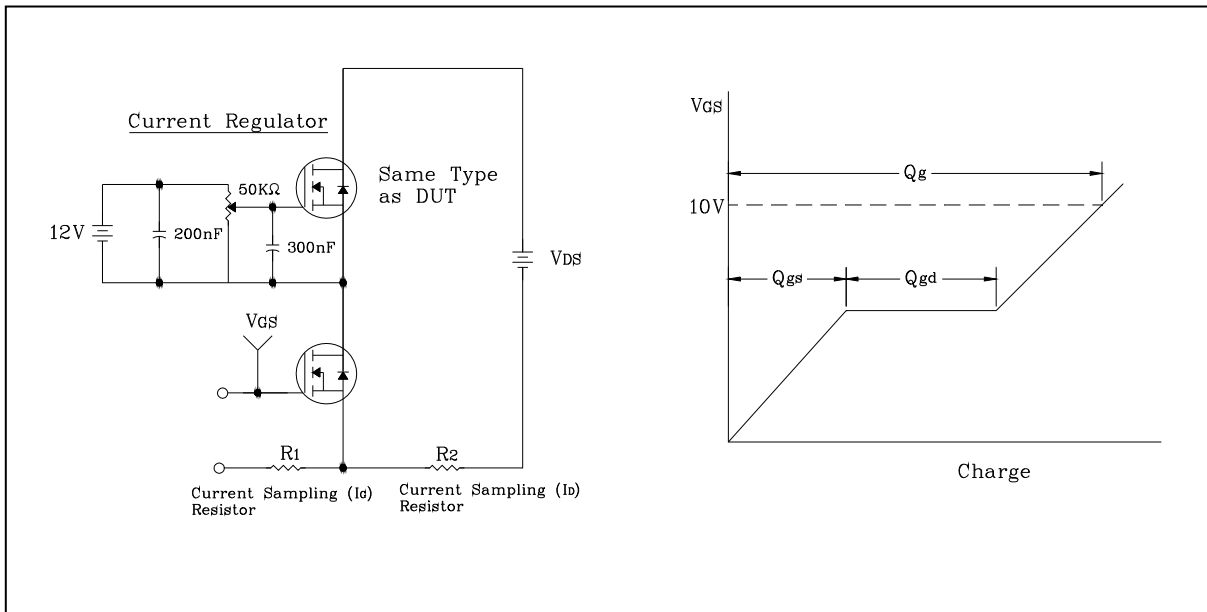


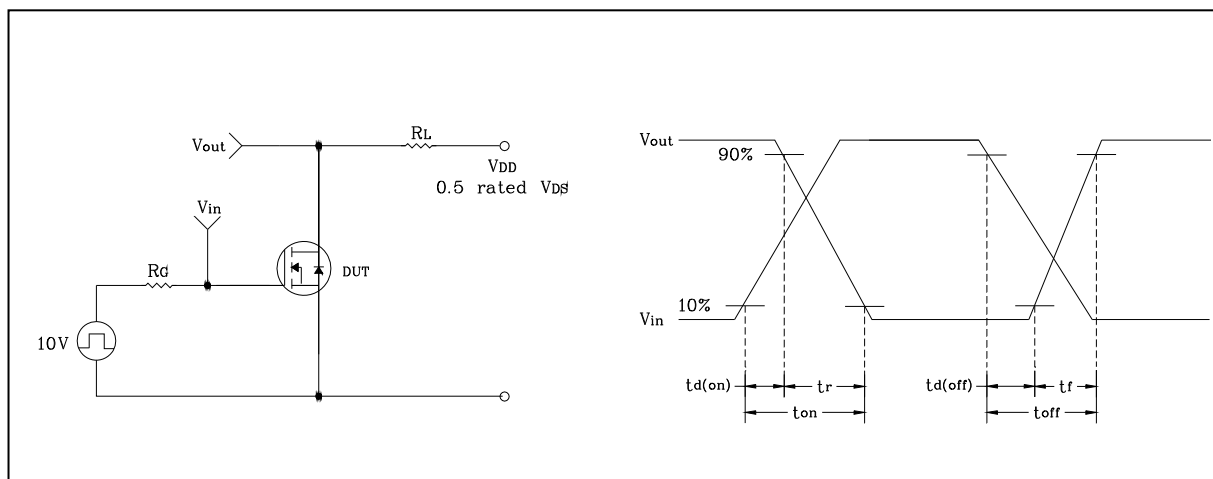
Fig. 10 Safe Operating Area



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



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



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

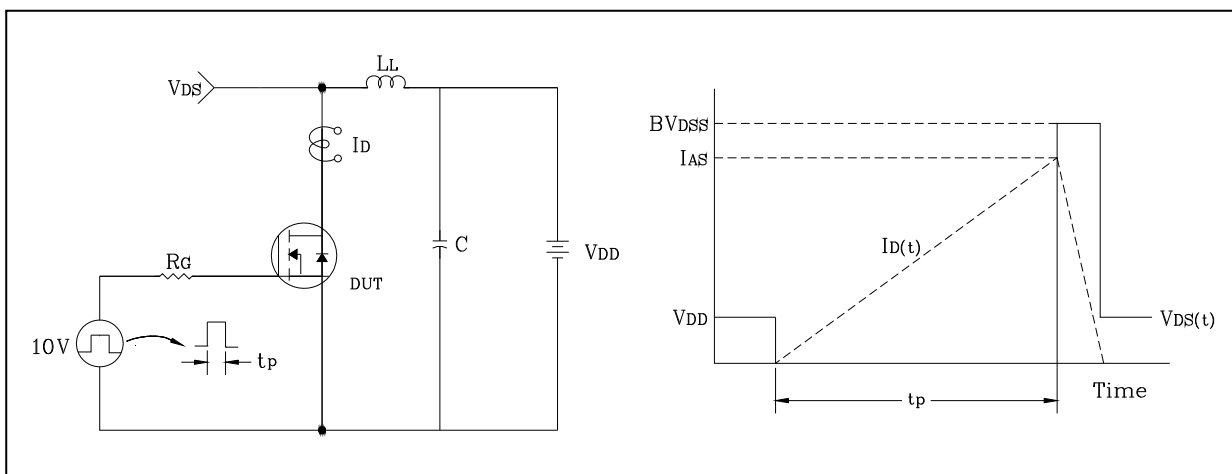
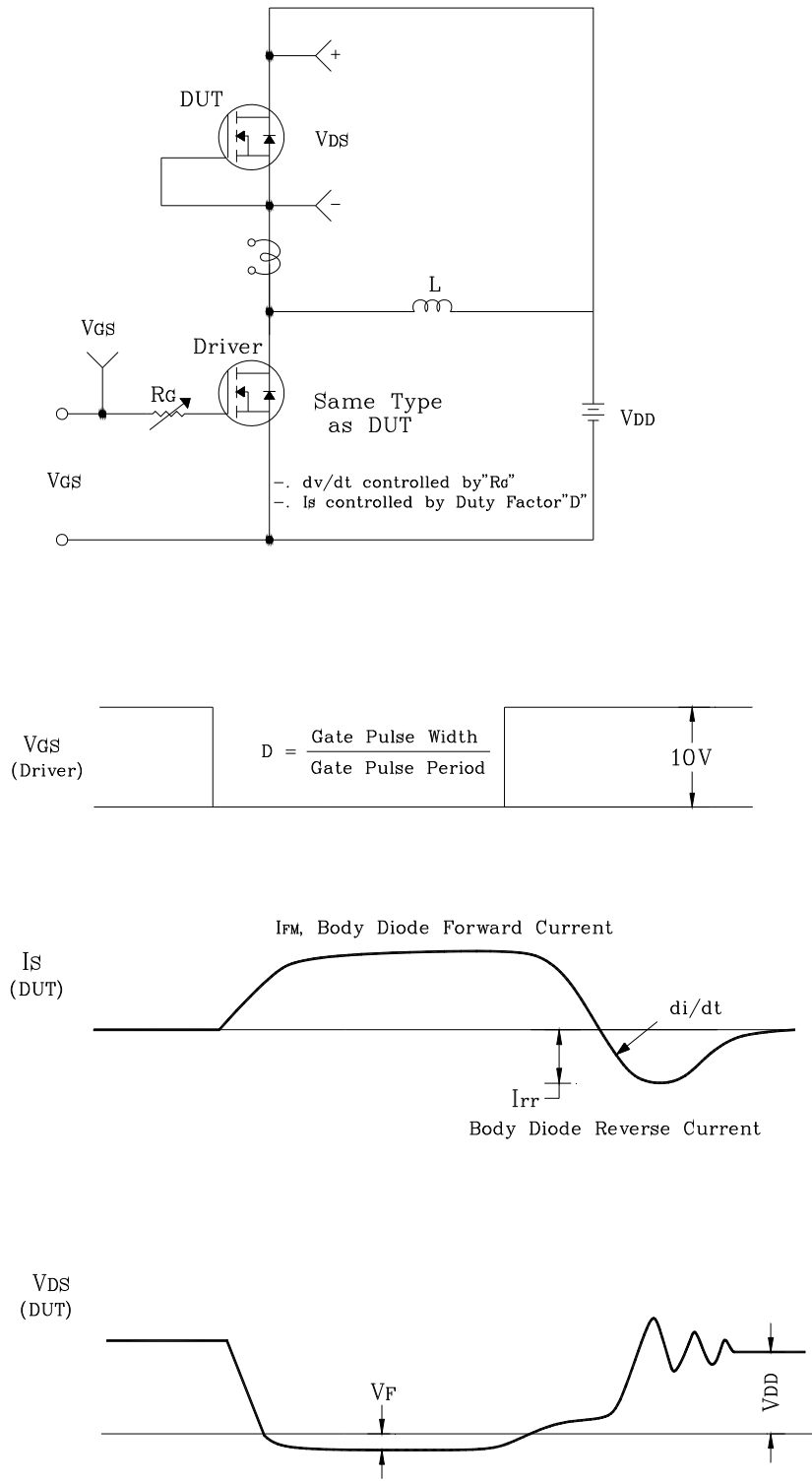
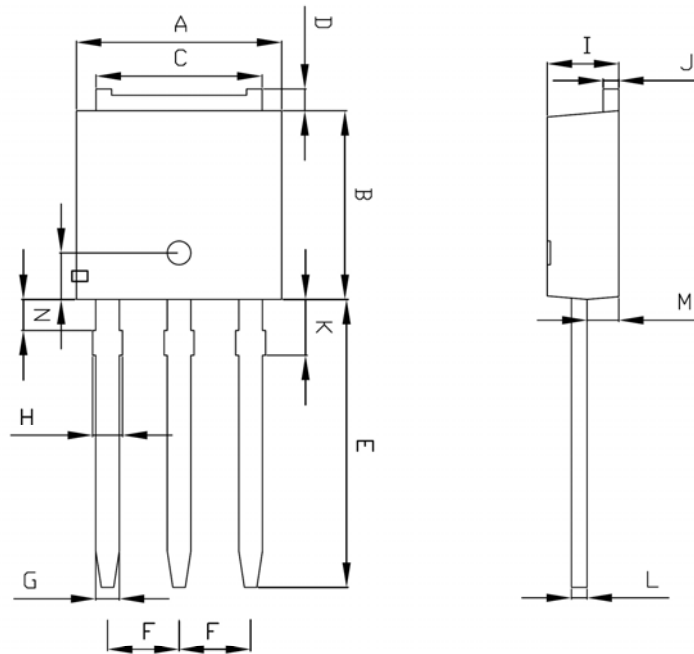


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



Outline Dimension



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	6.40	6.60	6.80	
B	5.90	6.10	6.30	
C	5.04	5.34	5.64	
D	0.50	0.70	0.90	
E	9.00	9.30	9.60	
F	2.10	2.30	2.50	
G	0.66	0.76	0.86	
H	0.96 MAX			
I	2.20	2.30	2.40	
J	0.40	0.50	0.60	
K	1.60	1.80	2.00	
L	0.40	0.50	0.60	
M	0.72	1.02	1.32	
N	0.90	1.00	1.10	
O	1.50			

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