

## SWITCHING REGULATOR APPLICATIONS

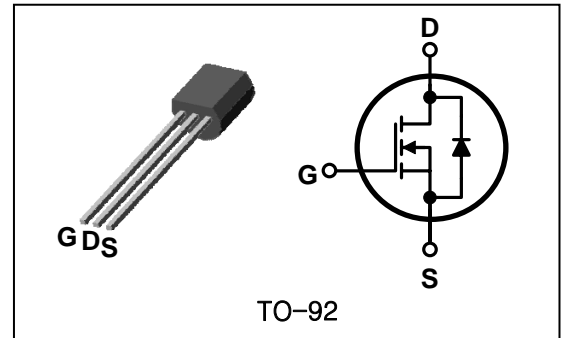
### Features

- High Voltage :  $BV_{DSS}=600V(\text{Min.})$
- Low  $C_{RSS}$  :  $C_{RSS}=3.4pF(\text{Typ.})$
- Low gate charge :  $Q_g=3.9nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=11.5\Omega(\text{Max.})$

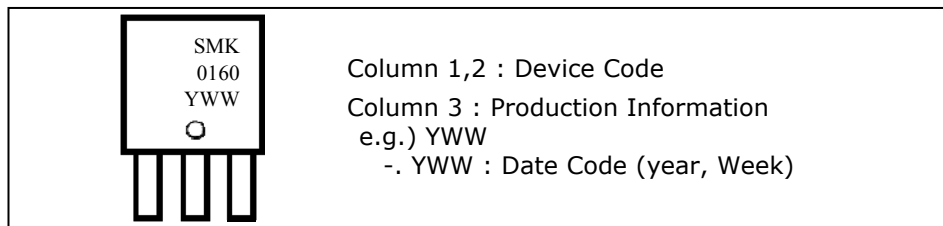
### Ordering Information

Type No.	Marking	Package Code
SMK0160	SMK0160	TO-92

### 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) *	$I_D$	( $T_C=25^\circ\text{C}$ )	0.3
		( $T_C=100^\circ\text{C}$ )	0.18
Drain current (Pulsed) *	$I_{DM}$	1.2	A
Power dissipation	$P_D$	625	mW
Avalanche current (Single) ②	$I_{AS}$	0.3	A
Single pulsed avalanche energy ②	$E_{AS}$	53	mJ
Avalanche current (Repetitive) ①	$I_{AR}$	0.3	A
Repetitive avalanche energy ①	$E_{AR}$	1.1	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-ambient	$R_{th(J-A)}$ **	-	200	$^\circ\text{C}/\text{W}$

\*\* Limited by maximum junction temperature

## 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 cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, 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> =150mA	-	9.3	11.5	Ω	
Forward transfer conductance ④	g <sub>fs</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =150mA	-	0.32	-	S	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	131	164	pF	
Output capacitance	C <sub>oss</sub>		-	19.4	24.3		
Reverse transfer capacitance	C <sub>rss</sub>		-	3.4	4.3		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =300V, I <sub>D</sub> =0.3A R <sub>G</sub> =25Ω	-	5.5	-	ns	
Rise time	t <sub>r</sub>		-	5	-		
Turn-off delay time	t <sub>d(off)</sub>		③④	-	13		-
Fall time	t <sub>f</sub>		-	28	-		
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> =480V, V <sub>GS</sub> =10V I <sub>D</sub> =0.3A	-	3.9	4.9	nC	
Gate-source charge	Q <sub>gs</sub>		-	1.7	-		
Gate-drain charge	Q <sub>gd</sub>		③④	-	0.85		-

## 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	-	-	0.3	A
Source current (Pulsed) ①	I <sub>SM</sub>		-	-	1.2	
Forward voltage ④	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =0.3A	-	-	1.4	V
Reverse recovery time	t <sub>rr</sub>	I <sub>S</sub> =0.3A, V <sub>GS</sub> =0V dI <sub>F</sub> /dt=100A/μs	-	190	-	ns
Reverse recovery charge	Q <sub>rr</sub>		-	0.53	-	μC

Note ;

- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=1080mH, I<sub>AS</sub>=0.3A, 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  $I_D - V_{DS}$

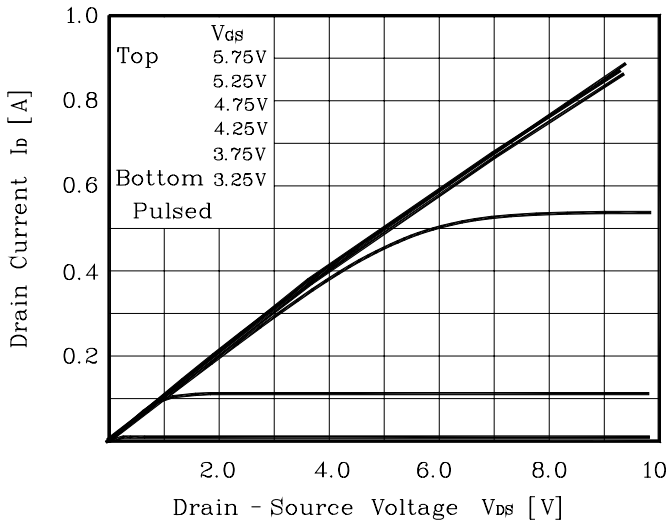


Fig. 2  $I_D - V_{GS}$

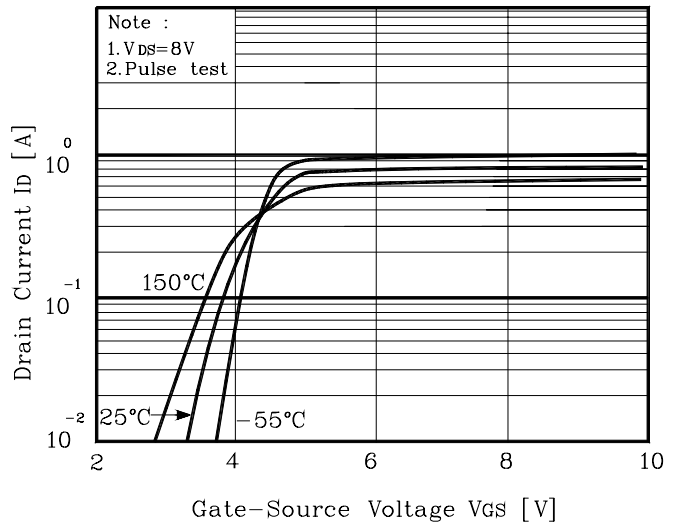


Fig. 3  $R_{DS(on)} - I_D$

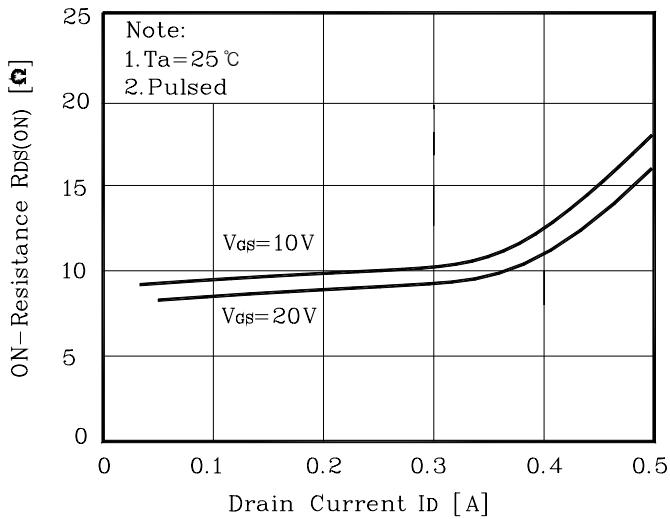


Fig. 4  $I_S - V_{SD}$

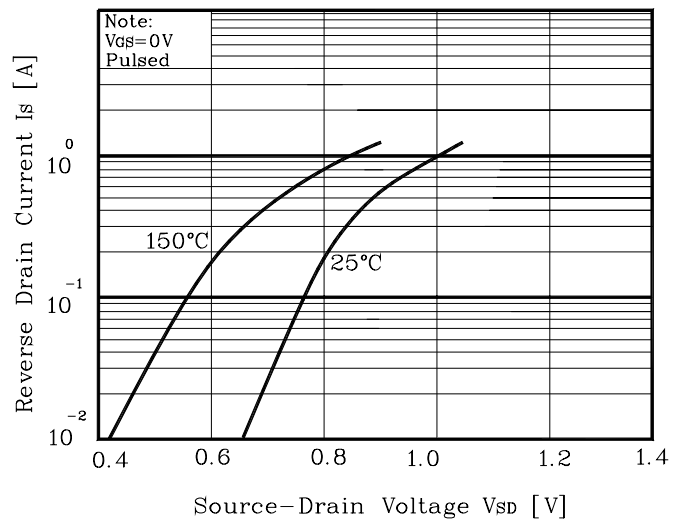


Fig. 5 Capacitance -  $V_{DS}$

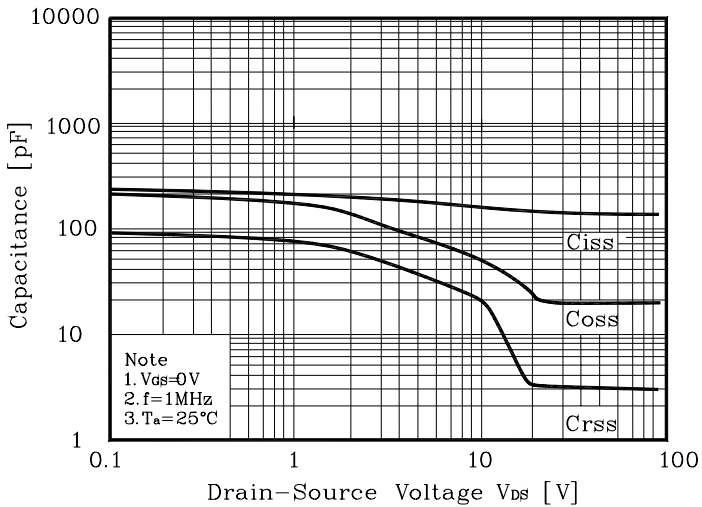
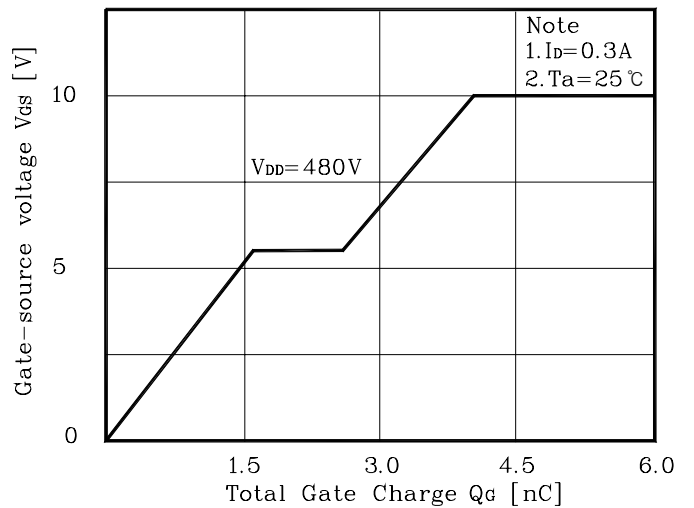
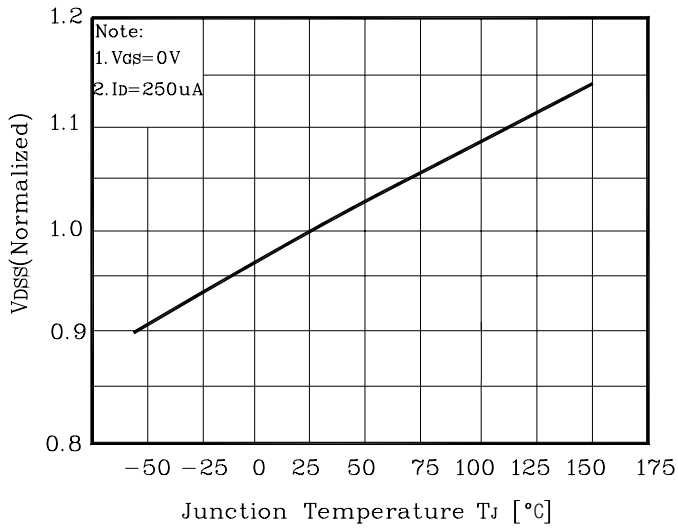


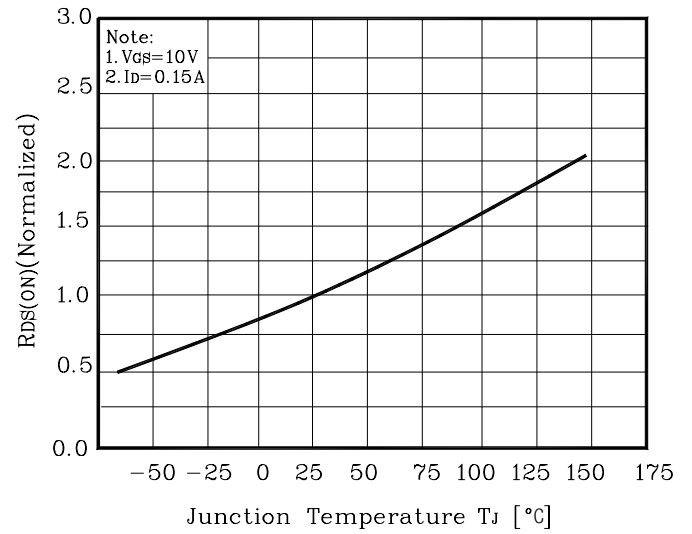
Fig. 6  $V_{GS} - Q_G$



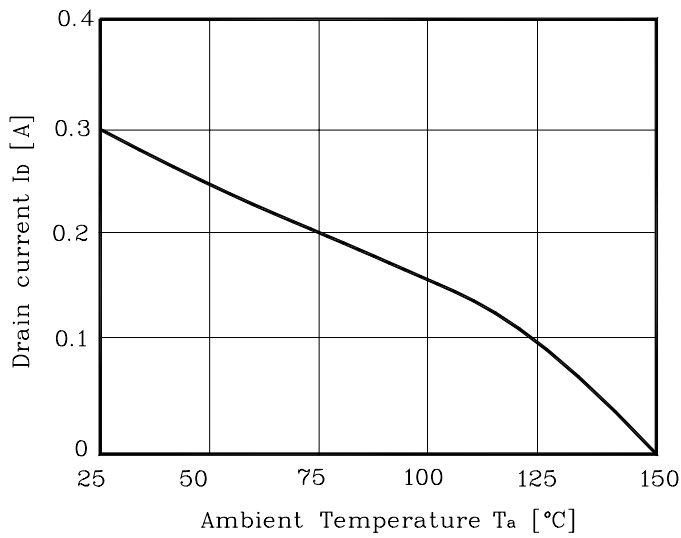
**Fig. 7  $V_{DSS} - T_J$**



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



**Fig. 9  $I_D - T_a$**



**Fig. 10 Safe Operating Area**

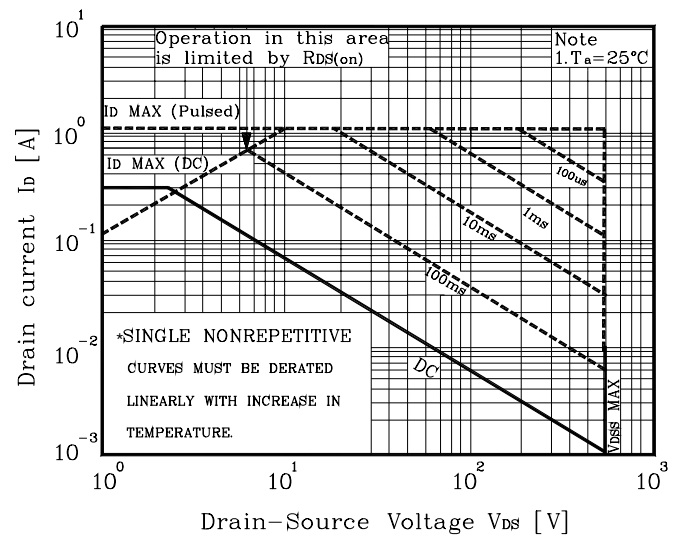


Fig. 11 Gate Charge Test Circuit & Waveform

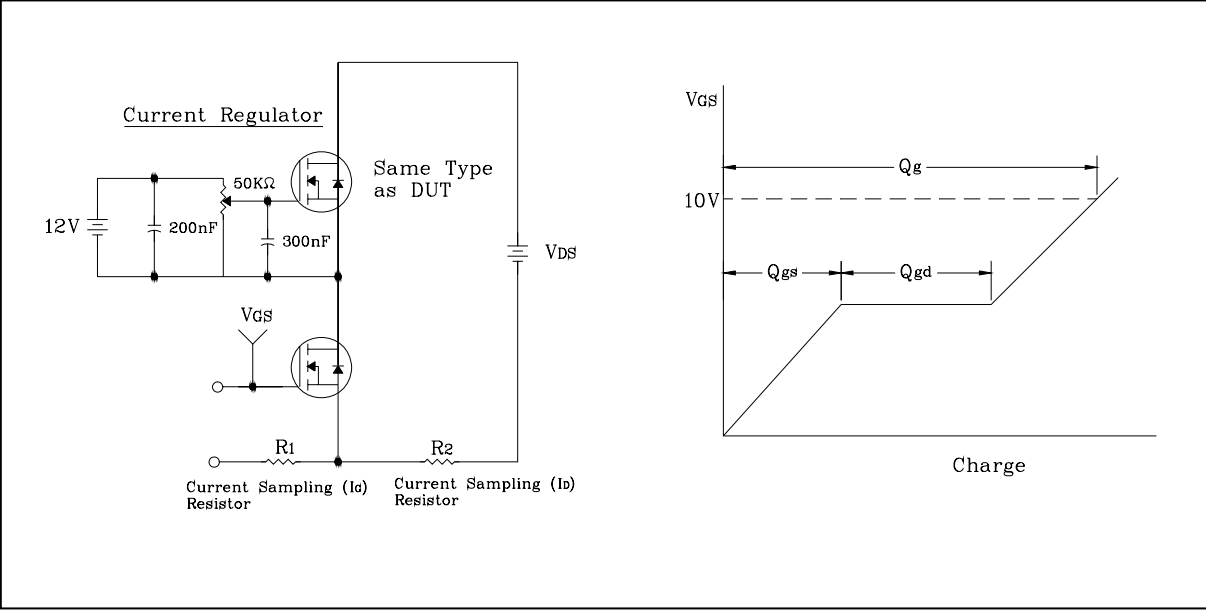


Fig. 12 Resistive Switching Test Circuit & Waveform

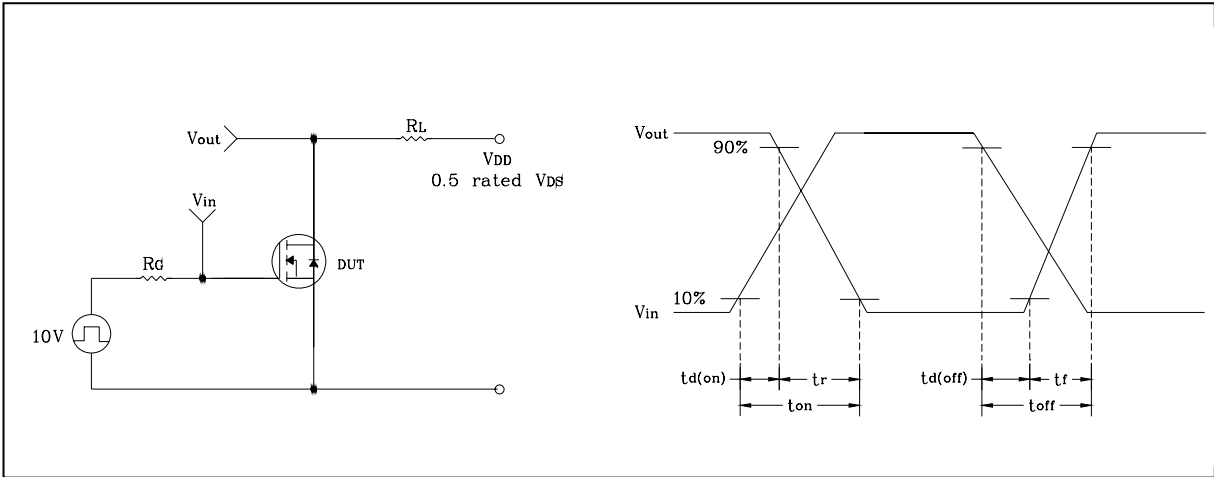


Fig. 13 E<sub>AS</sub> Test Circuit & Waveform

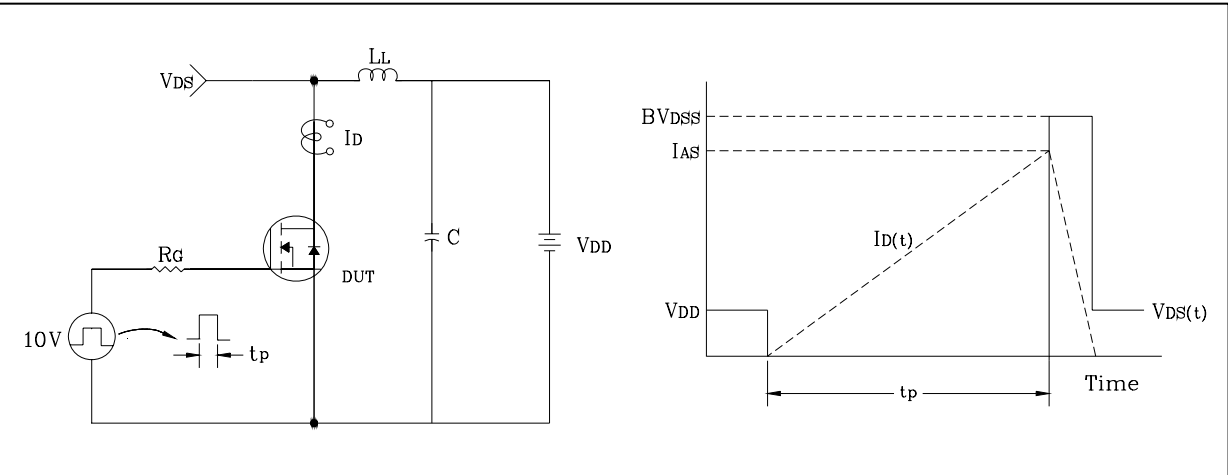
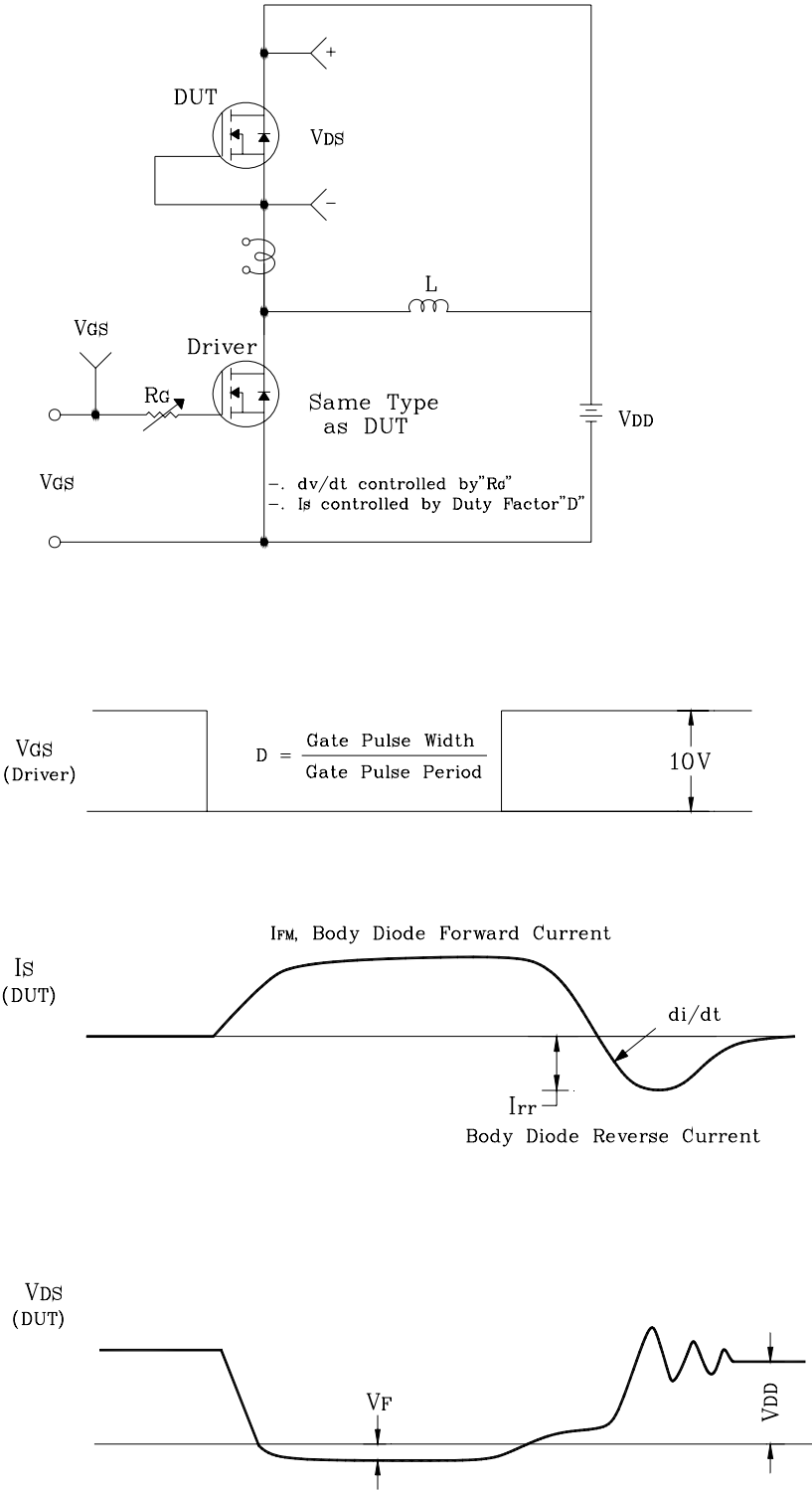
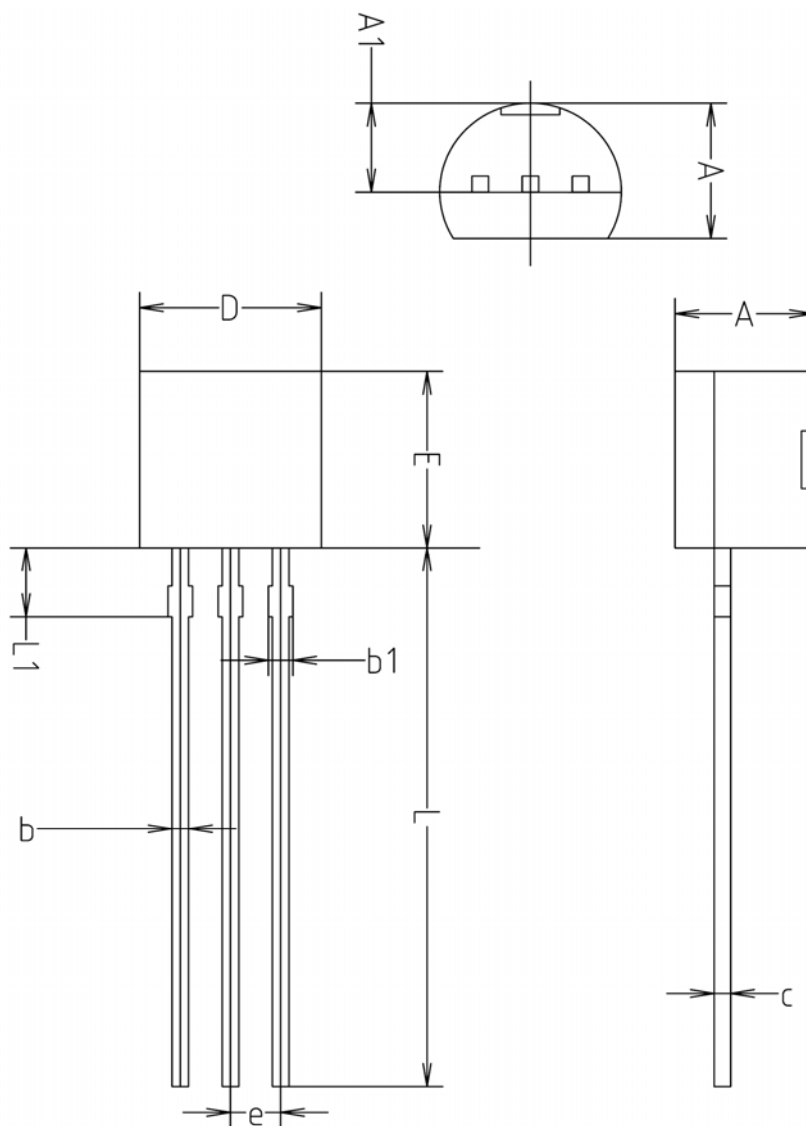


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



## Outline Dimension

unit: mm



SYMBOL	MILLIMETERS(mm)		
	MINIMUM	NOMINAL	MAXIMUM
A	3.40	3.50	3.66
A1	2.46	2.51	2.59
b	0.39	0.44	0.53
b1	0.39	—	0.63
c	0.35	0.42	0.47
D	4.48	4.60	4.70
E	4.48	4.60	4.70
e	1.17	1.27	1.37
L	13.70	14.00	14.77
L1	1.55	1.70	2.15

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