

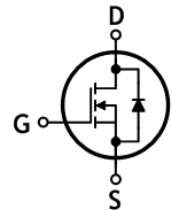
## HIGH SPEED SWITCHING APPLICATION

### Features

- Low drain-source On resistance:  $R_{DS(on)}=2.1\Omega$  (Typ.)
- Low gate charge:  $Q_g=12nC$  (Typ.)
- Low reverse transfer capacitance:  $C_{rss}=9.8pF$  (Typ.)
- RoHS compliant device
- 100% avalanche tested

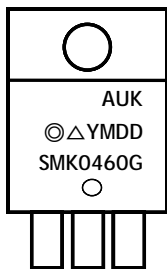
### Ordering Information

Part Number	Marking	Package
SMK0460FG	SMK0460G	TO-220FT-3L (Short Dambar)



TO-220FT-3L

### Marking Information



Column 1: Manufacturer  
 Column 2: Production Information  
 e.g.) ◎△YMDD  
 -. ◎: Option Code  
 -. △: Factory Management Code  
 -. YMDD: Date Code (Year, Month, Daily)  
 Column 3: Device Code

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

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

\* Limited only maximum junction temperature

## Thermal Characteristics

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to case	$R_{th(j-c)}$	Max. 4.16	°C/W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	Max. 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	$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0$	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=10\text{V}$ , $I_D=250\mu\text{A}$	2	-	4	V
Drain-source cut-off current	$I_{DSS}$	$V_{DS}=600\text{V}$ , $V_{GS}=0\text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS}=600\text{V}$ , $T_C=150^\circ\text{C}$	-	-	100	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 30\text{V}$	-	-	$\pm 100$	nA
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=2\text{A}$	-	2.1	2.5	$\Omega$
Forward transfer conductance (Note 3)	$g_{fs}$	$V_{DS}=10\text{V}$ , $I_D=2\text{A}$	-	4	-	S
Input capacitance	$C_{iss}$	$V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ , $f=1\text{MHz}$	-	670	848	pF
Output capacitance	$C_{oss}$		-	57	71	
Reverse transfer capacitance	$C_{rss}$		-	9.8	12.2	
Turn-on delay time (Note 3,4)	$t_{d(on)}$	$V_{DS}=300\text{V}$ , $I_D=4\text{A}$ , $R_G=25\Omega$	-	10	-	ns
Rise time (Note 3,4)	$t_r$		-	42	-	
Turn-off delay time (Note 3,4)	$t_{d(off)}$		-	38	-	
Fall time (Note 3,4)	$t_f$		-	46	-	
Total gate charge (Note 3,4)	$Q_g$	$V_{DS}=480\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=4\text{A}$	9.6	12	15	nC
Gate-source charge (Note 3,4)	$Q_{gs}$		3	4	5	
Gate-drain charge (Note 3,4)	$Q_{gd}$		2.3	3	3.8	

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 (DC)	$I_S$	Integral reverse diode in the MOSFET	-	-	4	A
Source current (Pulsed)	$I_{SM}$		-	-	16	A
Forward voltage	$V_{SD}$	$V_{GS}=0\text{V}$ , $I_{SD}=4\text{A}$	-	-	1.4	V
Reverse recovery time (Note 3,4)	$t_{rr}$	$I_{SD}=4\text{A}$ , $V_{GS}=0\text{V}$ $di_F/dt=100\text{A}/\mu\text{s}$	-	300	-	ns
Reverse recovery charge (Note 3,4)	$Q_{rr}$		-	2.2	-	$\mu\text{C}$

Note:

1. Repeated rating: Pulse width limited by safe operating area
2.  $L=25.9\text{mH}$ ,  $I_{AS}=4\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3. Pulse test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
4. Essentially independent of operating temperature typical characteristics

Typical Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

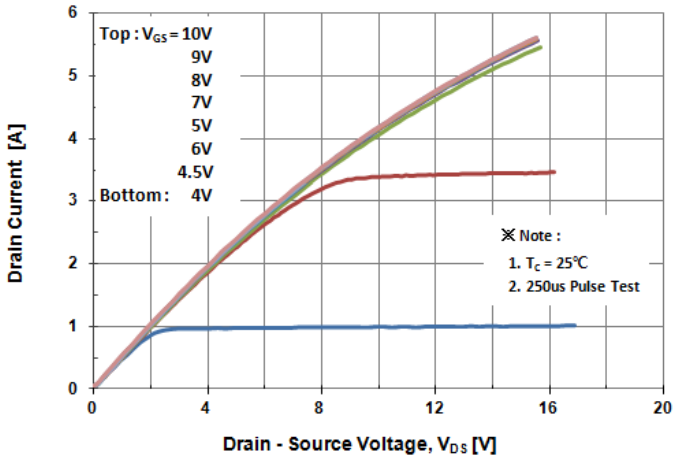


Fig. 2 Typical Output Characteristics

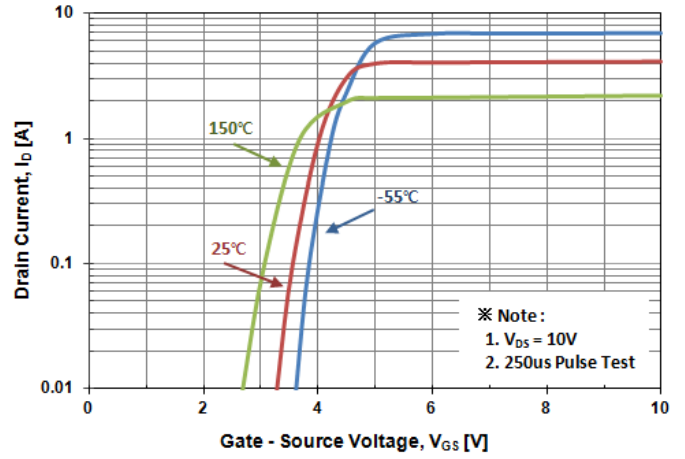


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

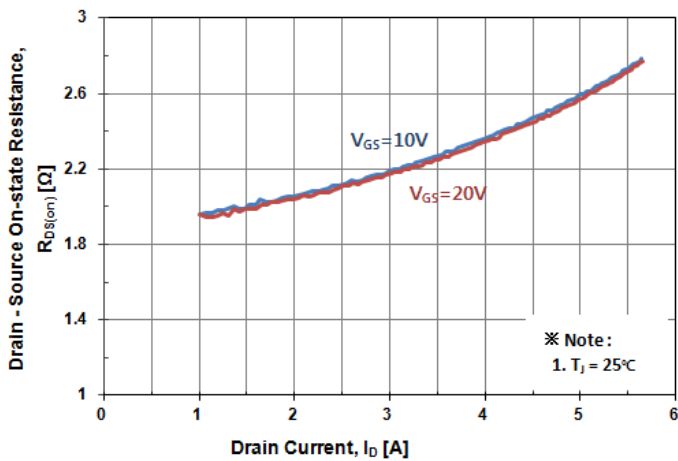


Fig. 4 Body Diode Forward Voltage Variation with Source Current

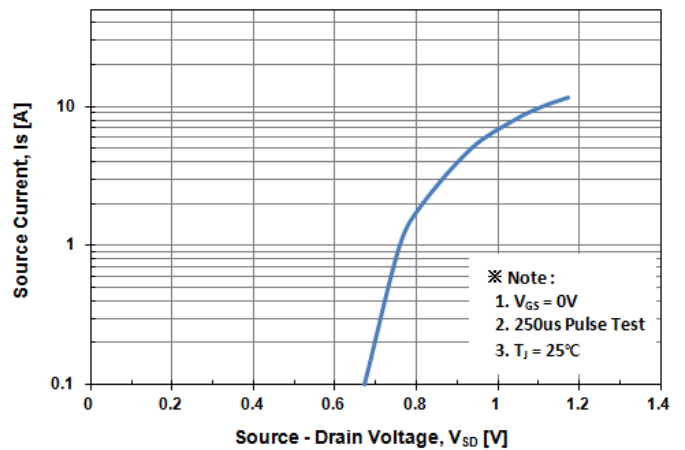


Fig. 5 Typical Capacitance Characteristics

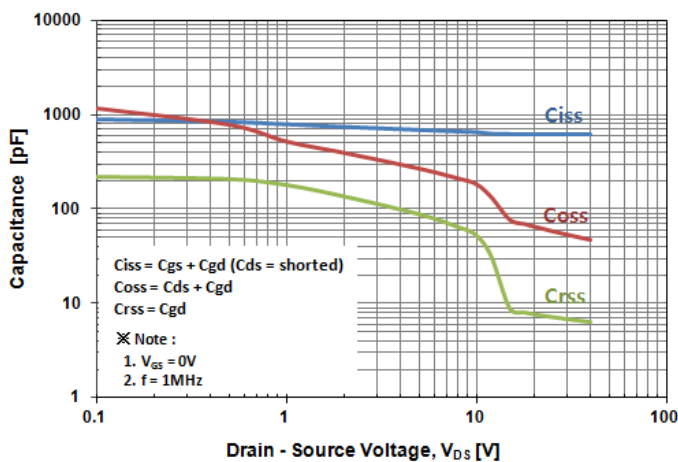


Fig. 6 Typical Total Gate Charge Characteristics

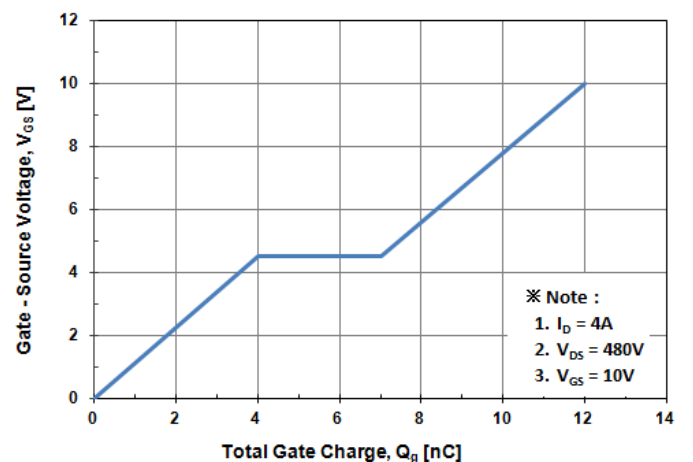


Fig. 7 Breakdown Voltage Variation vs. Temperature

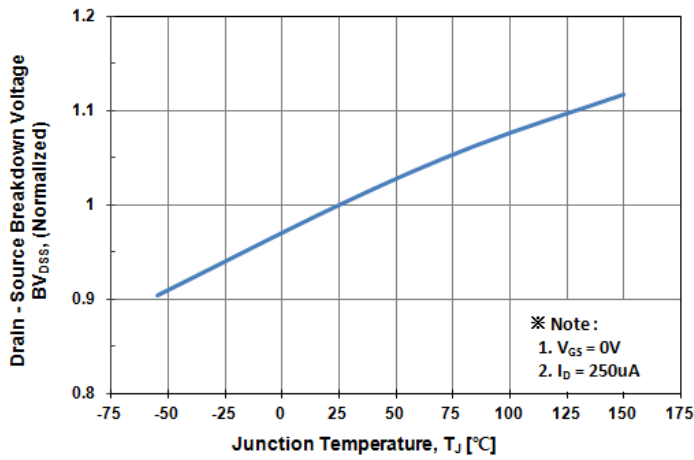


Fig. 8 On-Resistance Variation vs. Temperature

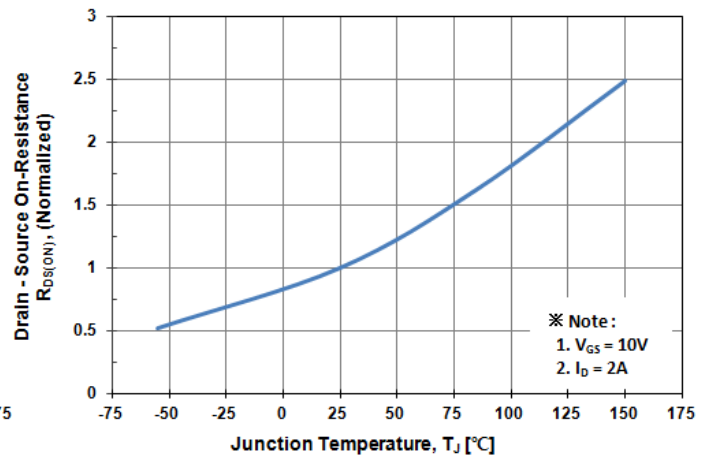


Fig. 9 Maximum Drain Current vs. Case Temperature

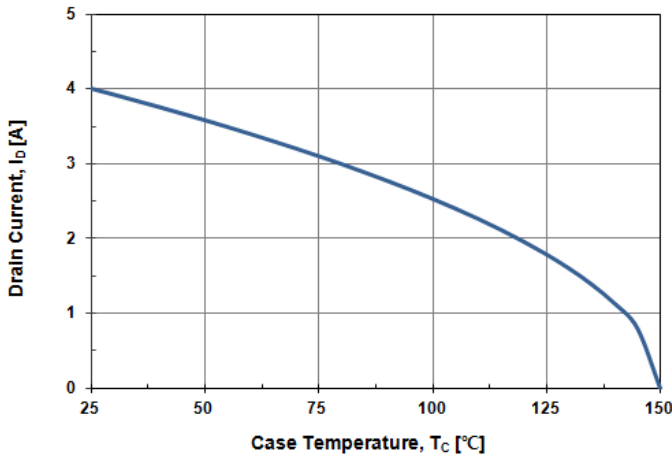


Fig. 10 Maximum Safe Operating Area

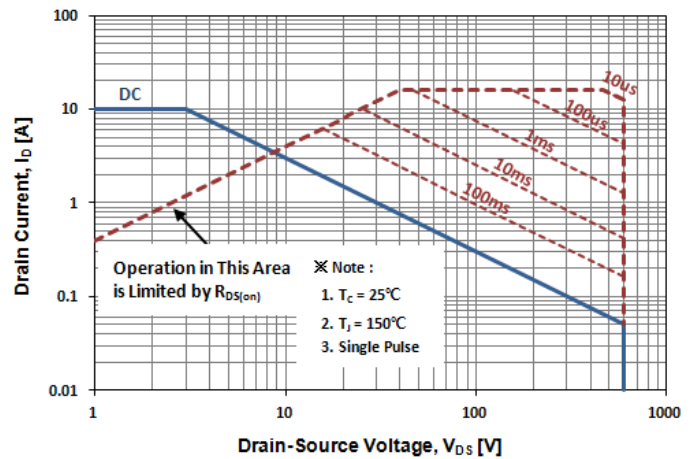


Fig. 11 Threshold Voltage Variation vs. Temperature

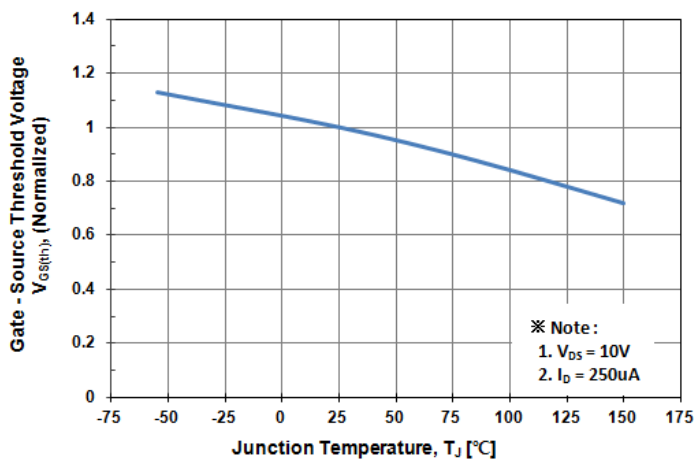


Fig. 12 Avalanche Energy vs. Temperature

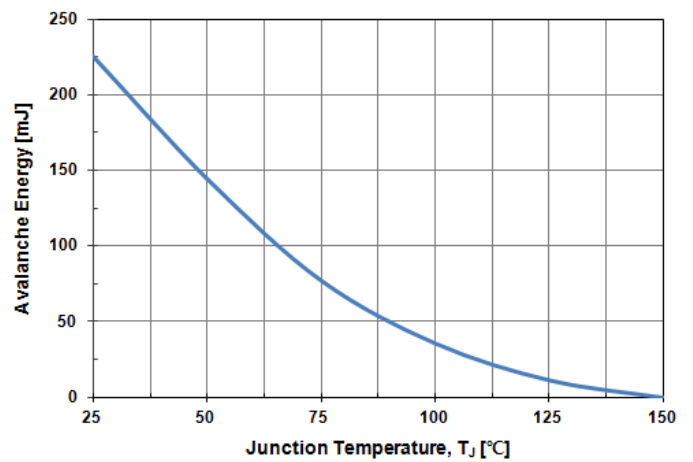


Fig. 13 Transient Thermal Impedance

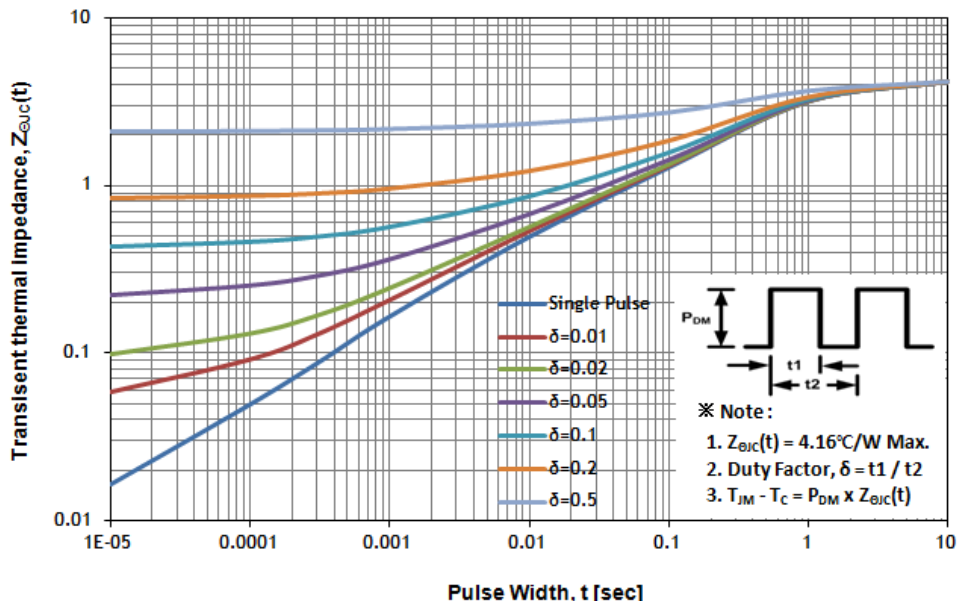


Fig. 14 Gate Charge Test Circuit & Waveform

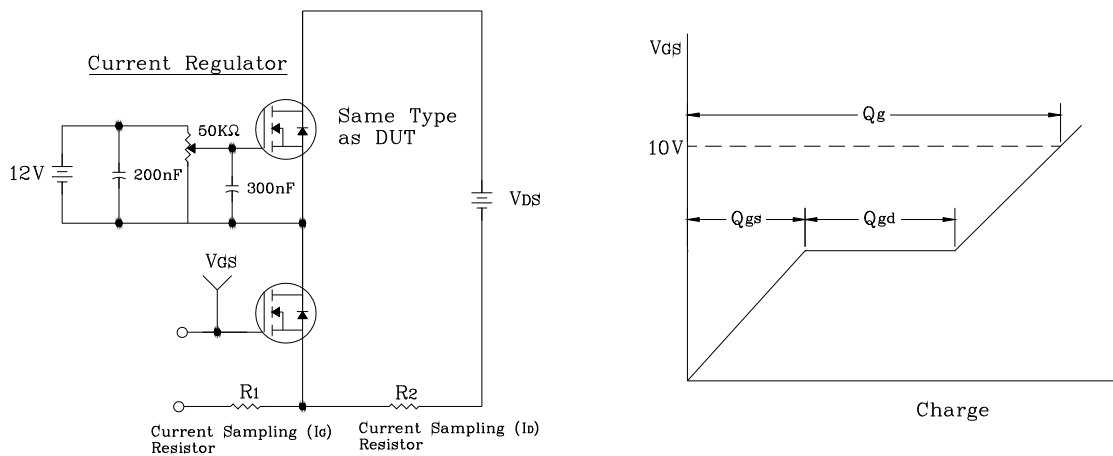


Fig. 15 Resistive Switching Test Circuit & Waveform

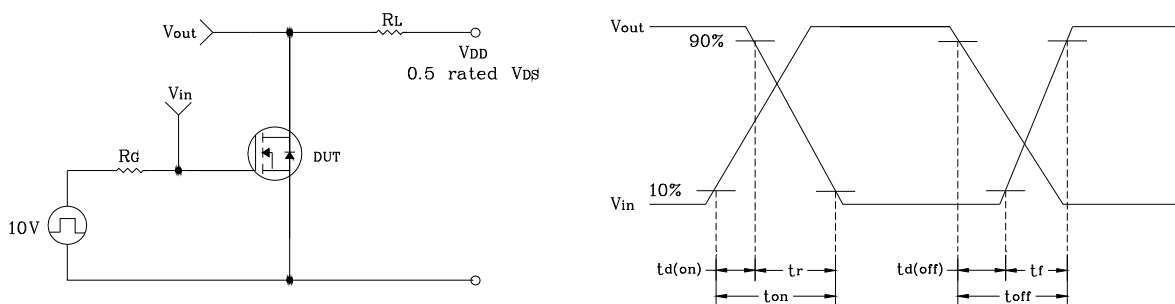


Fig. 16 E<sub>AS</sub> Test Circuit & Waveform

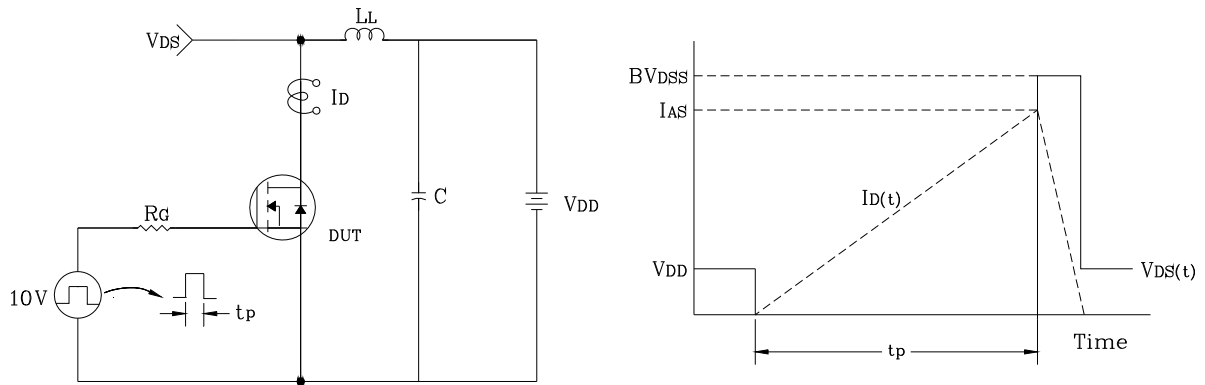
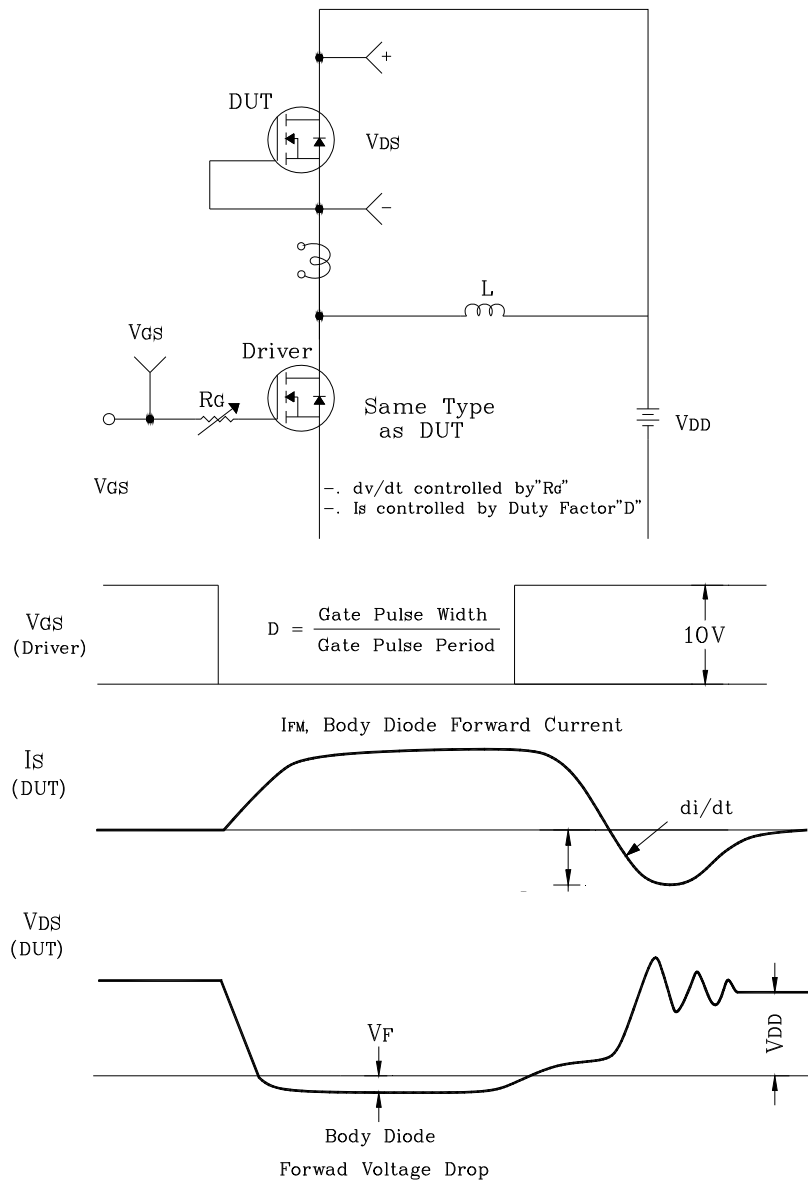
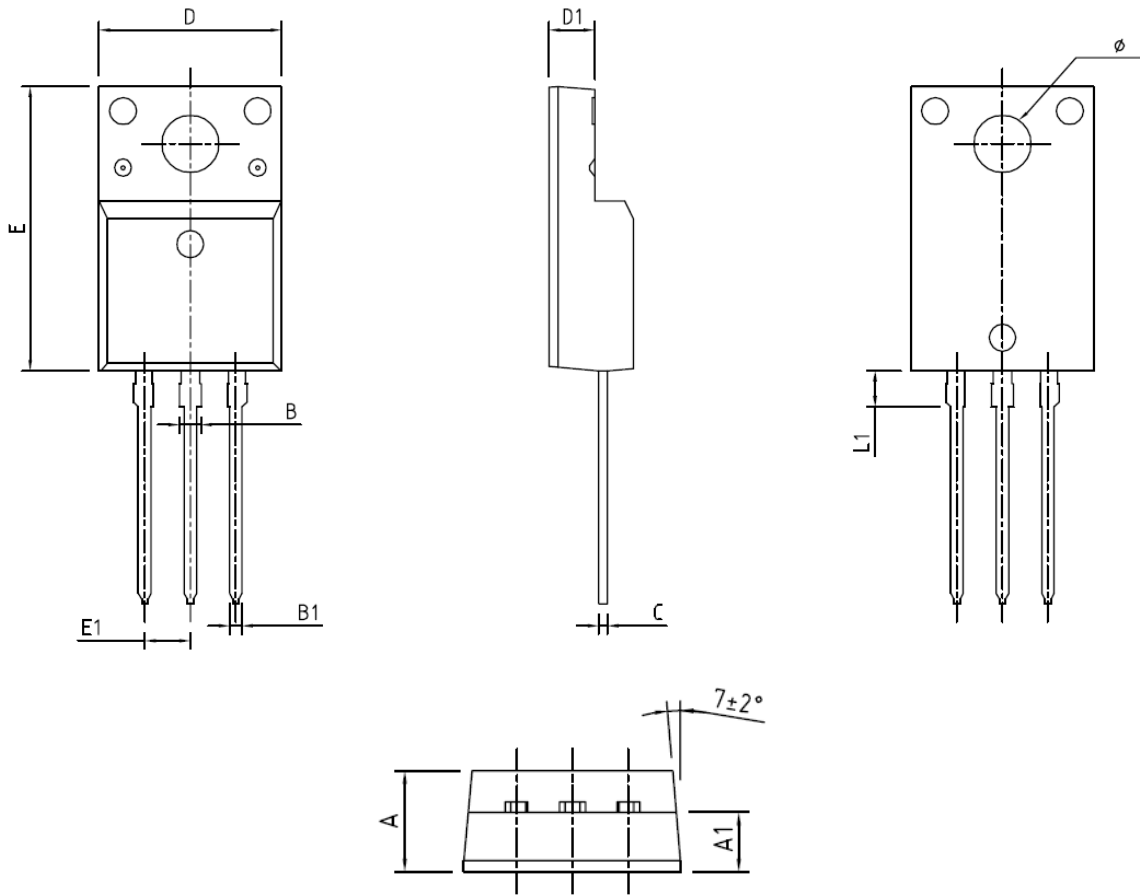


Fig. 17 Diode Reverse Recovery Time Test Circuit & Waveform



Package Outline Dimensions



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	4.50	4.70	4.90	
A1	2.61	2.76	2.91	
B	1.14	1.22	1.22	
B1	0.59	0.69	0.79	
C	0.45	0.50	0.60	
D	9.96	10.16	10.36	
D1	2.42	2.54	2.72	
E	15.67	15.87	16.07	
E1	2.44	2.54	2.64	
L	12.70	13.00	13.30	
L1	1.80	2.00	2.22	
φ	3.08	3.18	3.28	

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