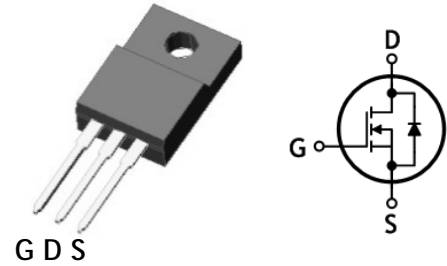


## HIGH SPEED SWITCHING APPLICATION

### Features

- Low drain-source On resistance:  $R_{DS(on)}=0.7\Omega$  (Typ.)
- Low gate charge:  $Q_g=33nC$  (Typ.)
- Low reverse transfer capacitance:  $C_{rss}=13pF$  (Typ.)
- Lower EMI noise
- RoHS compliant device
- 100% avalanche tested

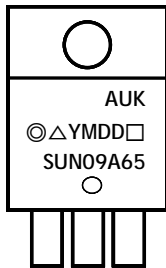


### Ordering Information

Part Number	Marking	Package
SUN09A65F	SUN09A65	TO-220F-3L

TO-220F-3L

### Marking Information



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

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

Characteristic	Symbol	Rating	Unit	
Drain-source voltage	$V_{DS}$	650	V	
Gate-source voltage	$V_{GS}$	±30	V	
Drain current (DC) *	$I_D$	$T_c=25^\circ\text{C}$	9	A
		$T_c=100^\circ\text{C}$	5.7	A
Drain current (Pulsed) *	$I_{DM}$	36	A	
Single avalanche energy <sup>(Note 2)</sup>	$E_{AS}$	250	mJ	
Repetitive avalanche current <sup>(Note 1)</sup>	$I_{AR}$	9	A	
Repetitive avalanche energy <sup>(Note 1)</sup>	$E_{AR}$	3.2	mJ	
Power dissipation	$P_D$	32	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. 3.9	°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	$BV_{DSS}$	$I_D=250\mu\text{A}, V_{GS}=0$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu\text{A}, V_{DS}=V_{GS}$	3	-	5	V
Drain-source cut-off current	$I_{DSS}$	$V_{DS}=650\text{V}, V_{GS}=0\text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS}=650\text{V}, T_C=150^\circ\text{C}$	-	-	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	$R_{DS(ON)}$	$V_{GS}=10\text{V}, I_D=4.5\text{A}$	-	0.7	0.9	$\Omega$
Forward transfer conductance (Note 3)	$g_{fs}$	$V_{DS}=10\text{V}, I_D=4.5\text{A}$	-	11	-	S
Input capacitance	$C_{iss}$	$V_{DS}=25\text{V}, V_{GS}=0\text{V}, f=1.0\text{MHz}$	-	2150	-	pF
Output capacitance	$C_{oss}$		-	145	-	
Reverse transfer capacitance	$C_{rss}$		-	13	-	
Turn-on delay time (Note 3,4)	$t_{d(on)}$	$V_{DS}=325\text{V}, I_D=9\text{A}, R_G=25\Omega$	-	94	-	ns
Rise time (Note 3,4)	$t_r$		-	43	-	
Turn-off delay time (Note 3,4)	$t_{d(off)}$		-	182	-	
Fall time (Note 3,4)	$t_f$		-	28	-	
Total gate charge (Note 3,4)	$Q_g$	$V_{DS}=520\text{V}, V_{GS}=10\text{V}, I_D=9\text{A}$	-	33	40	nC
Gate-source charge (Note 3,4)	$Q_{gs}$		-	12.5	-	
Gate-drain charge (Note 3,4)	$Q_{gd}$		-	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	-	-	9	A
Source current (Pulsed)	$I_{SM}$		-	-	36	A
Forward voltage	$V_{SD}$	$V_{GS}=0\text{V}, I_{SD}=9\text{A}$	-	-	1.4	V
Reverse recovery time (Note 3,4)	$t_{rr}$	$I_{SD}=9\text{A}, V_{GS}=0\text{V}, di_F/dt=100\text{A}/\mu\text{s}$	-	490	-	ns
Reverse recovery charge (Note 3,4)	$Q_{rr}$		-	2.7	-	$\mu\text{C}$

Note:

1. Repeated rating: Pulse width limited by safe operating area
2.  $L=5.7\text{mH}, I_{AS}=9\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , 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

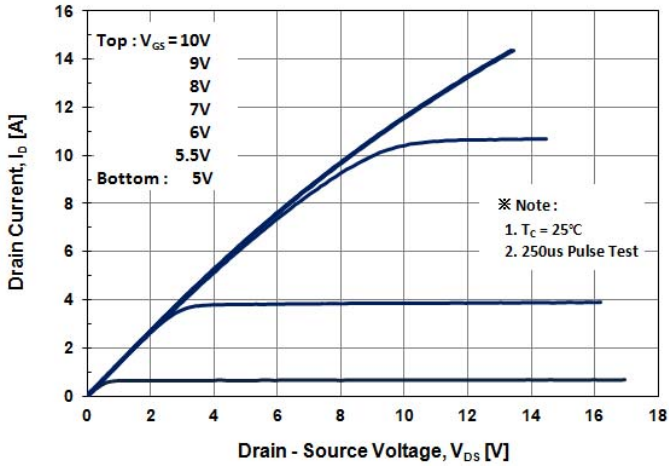


Fig. 2 Typical Transfer Characteristics

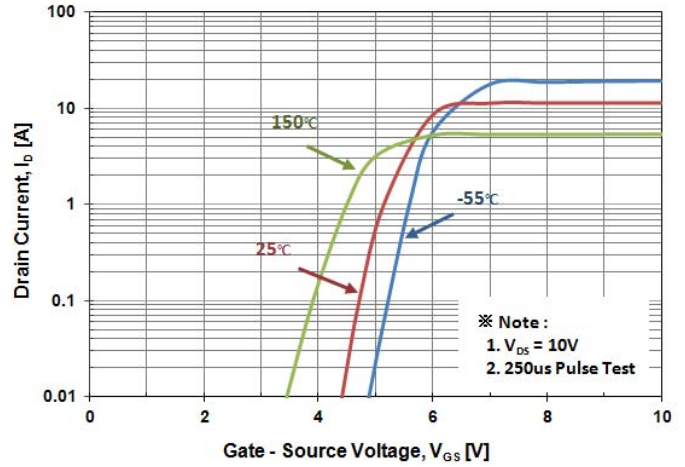


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

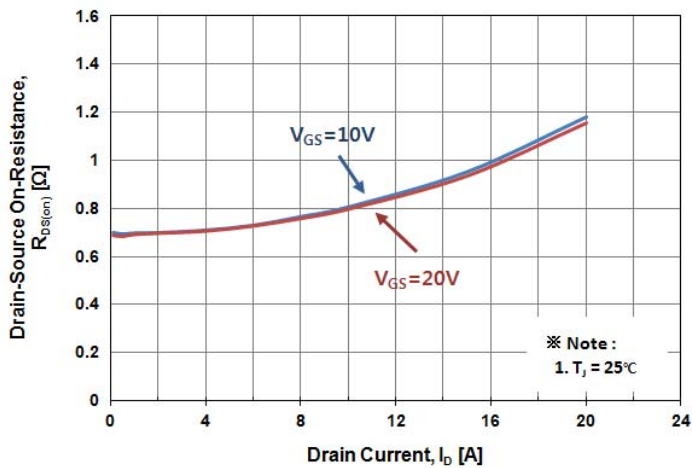


Fig. 4 Body Diode Forward Voltage Variation with Source Current

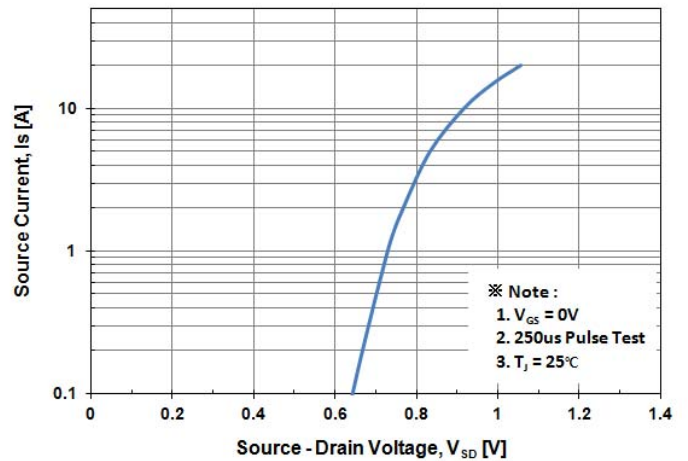


Fig. 5 Typical Capacitance Characteristics

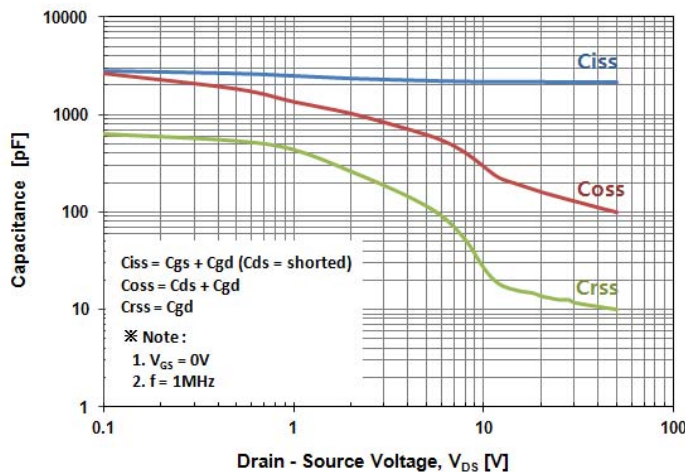


Fig. 6 Typical Total Gate Charge Characteristics

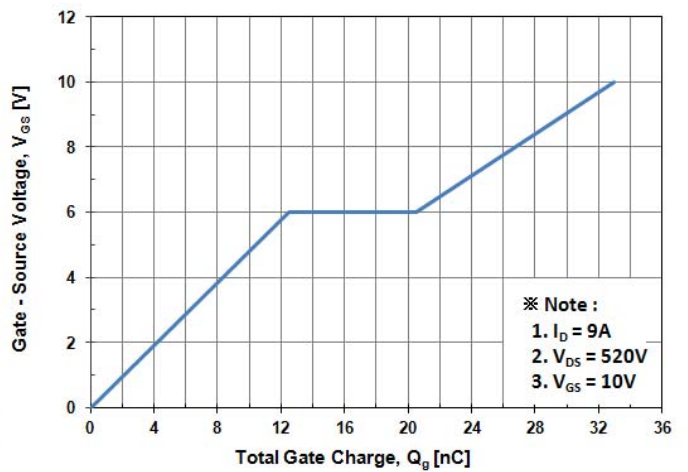


Fig. 7 Breakdown Voltage Variation vs. Temperature

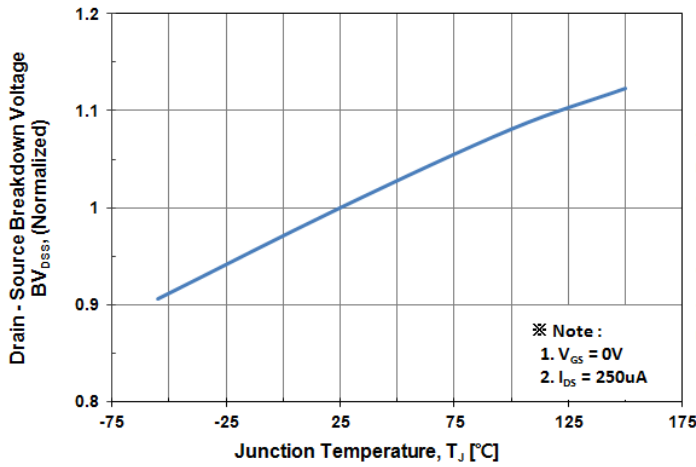


Fig. 8 On-Resistance Variation vs. Temperature

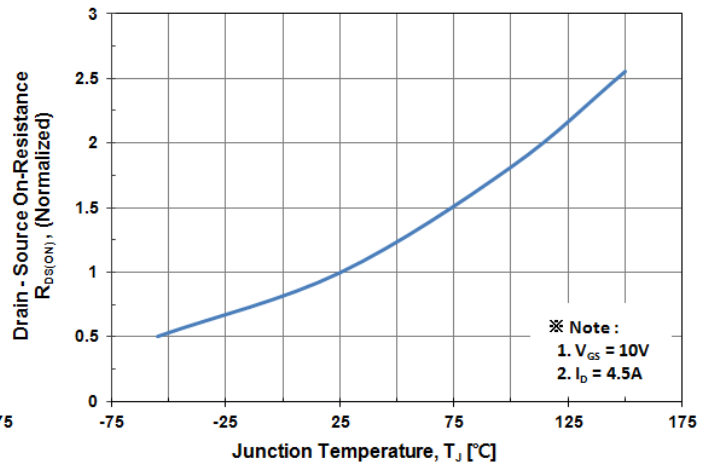


Fig. 9 Maximum Drain Current vs. Case Temperature

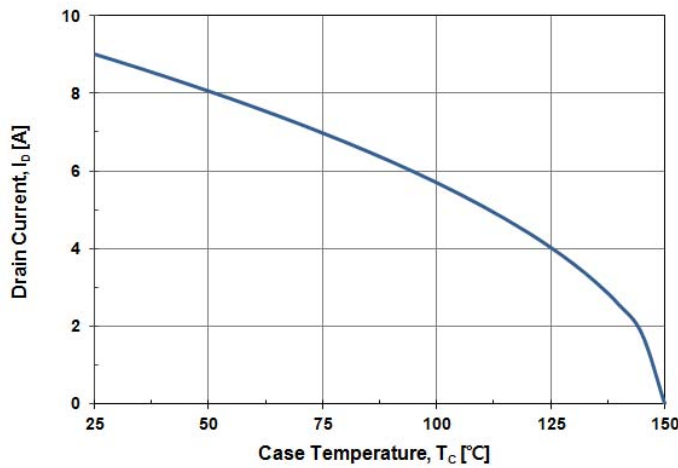


Fig. 10 Maximum Safe Operating Area

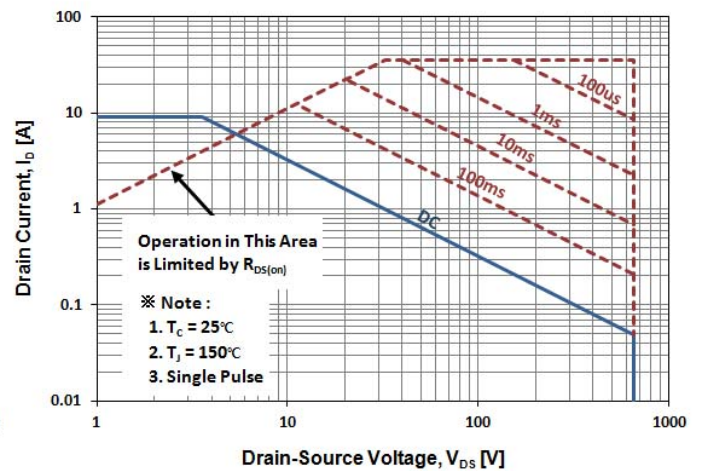


Fig. 11 Transient Thermal Impedance

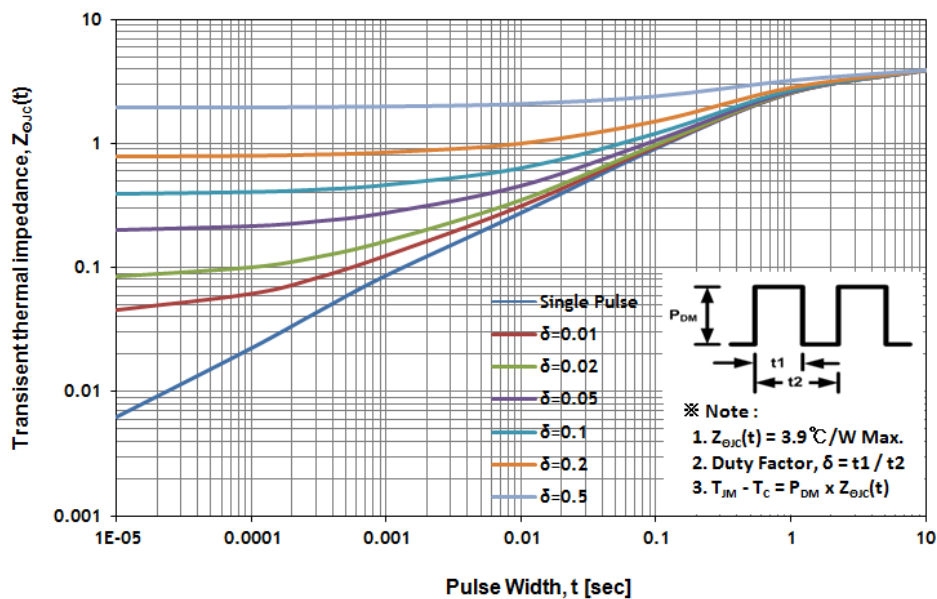


Fig. 12 Gate Charge Test Circuit & Waveform

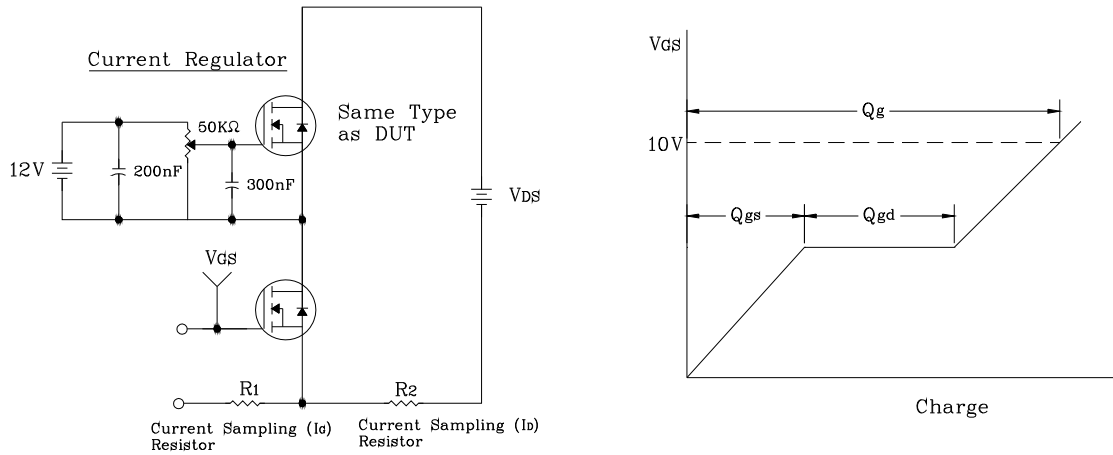


Fig. 13 Resistive Switching Test Circuit & Waveform

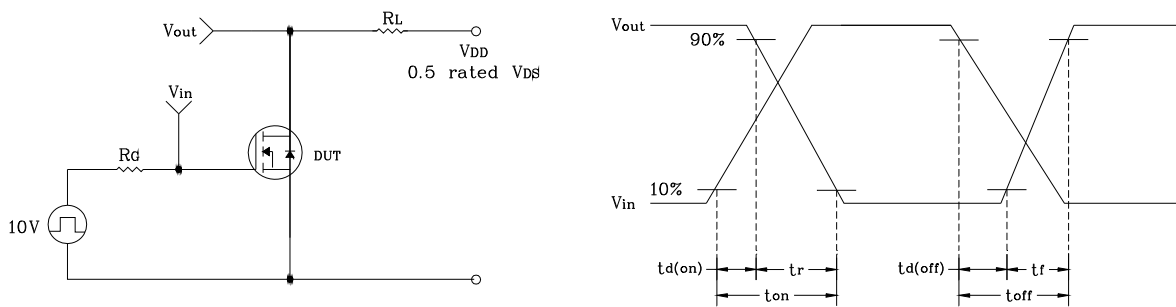


Fig. 14  $E_{AS}$  Test Circuit & Waveform

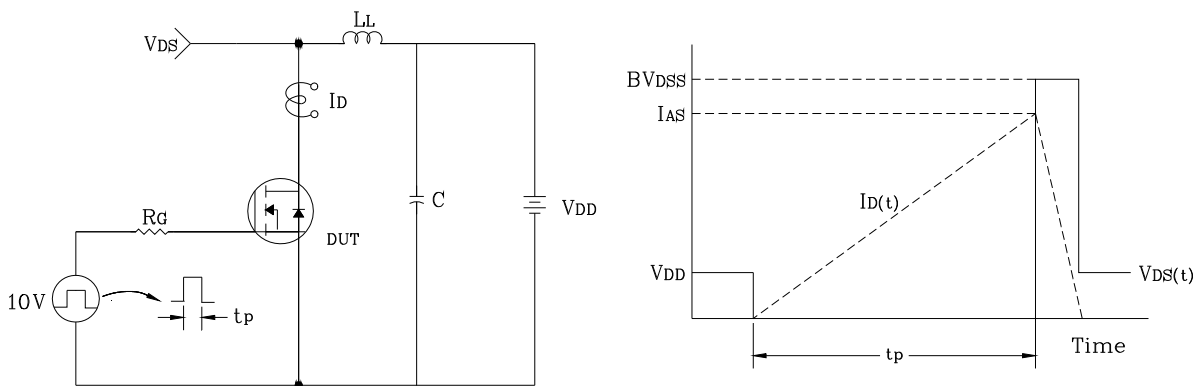
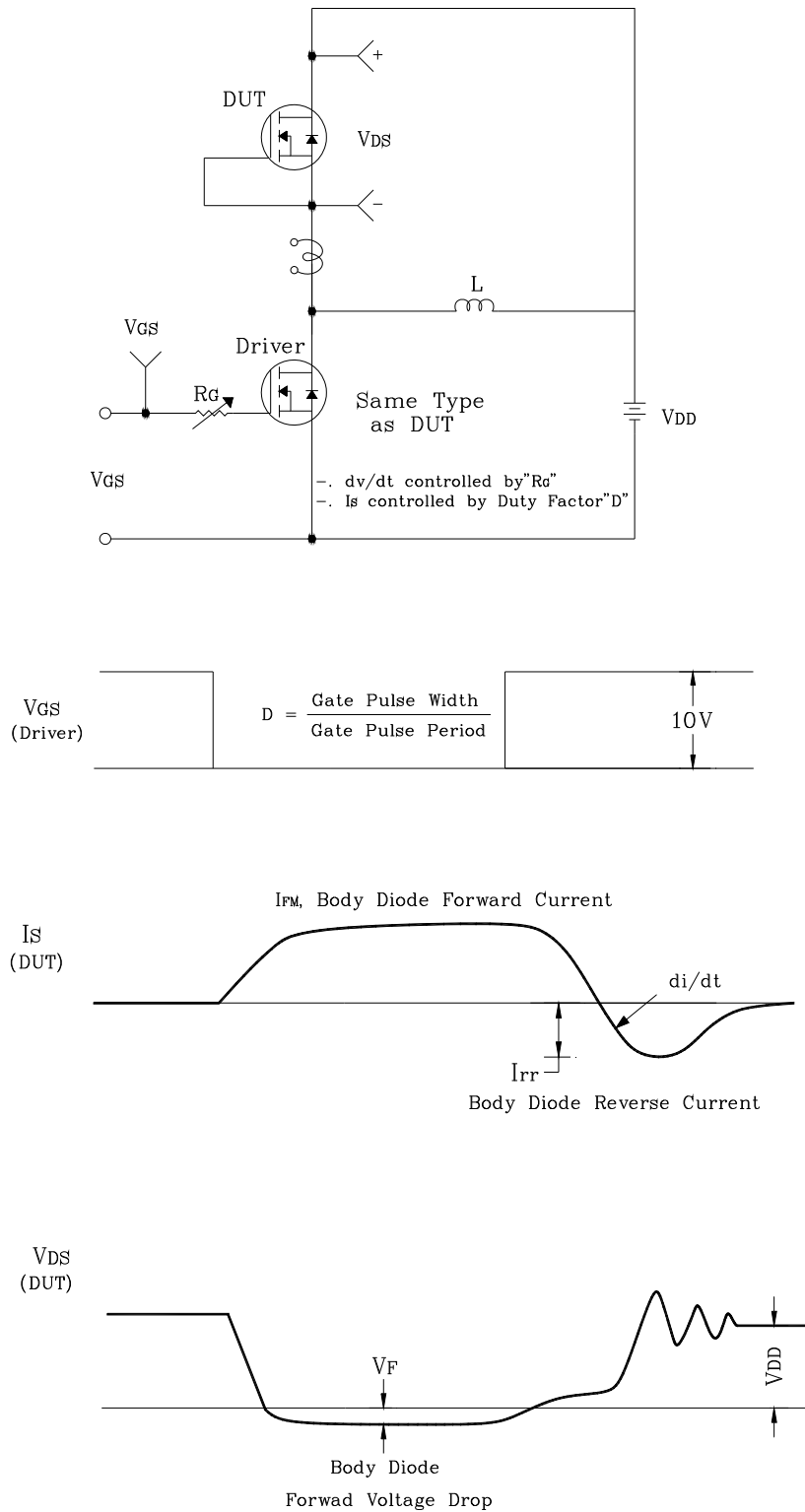
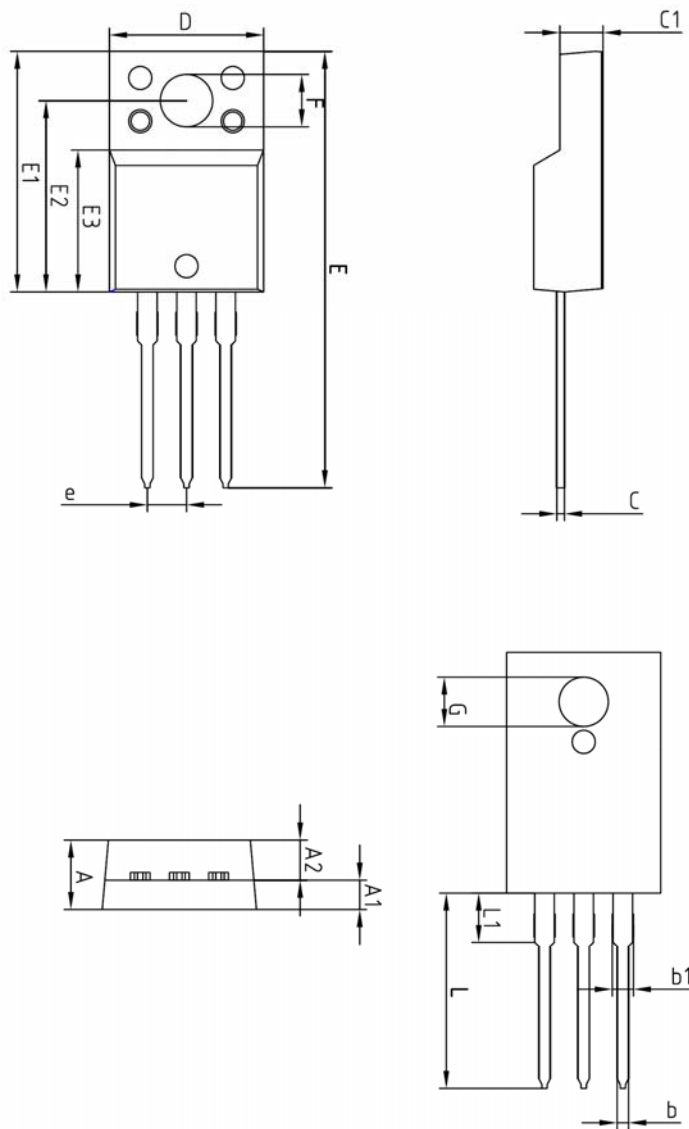


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



Package Outline Dimensions



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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