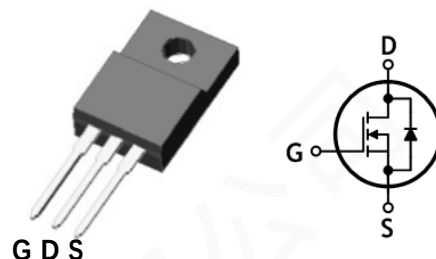


N-Channel Super Junction MOSFET

Features

- 650V Super-junction MOSFET
- Ultra fast body diode: $t_{rr}=200\text{ns}(\text{typ.})$
- Low drain-source On-resistance: $R_{DS(on)}=0.099\Omega (\text{Max.})$
- 100% avalanche tested
- RoHS compliant device

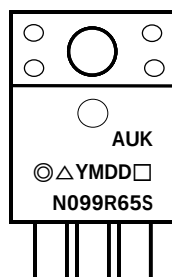


Ordering Information

Part Number	Marking	Package
SJMN099R65SF	N099R65S	TO-220F-3L

TO-220F-3L

Marking Information



Column 1: Manufacturer
Column 2: Production Information
e.g.) $\odot \triangle \text{YMDD} \square$
-. $\odot$ = Management Code
-. $\triangle$ = Machine Code
-. YMDD: Date Code (Year, Monthly, Daily)
-. $\square$: Factory Management 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_{DSS}		650	V
Gate-source voltage	V_{GSS}		± 30	V
Drain current (DC) ^(Note 1)	I_D	$T_C=25^{\circ}C$	40	A
		$T_C=100^{\circ}C$	25	A
Drain current (Pulsed) ^(Note 1)	I_{DM}		160	A
Single pulsed avalanche energy ^(Note 2)	E_{AS}		470	mJ
Repetitive avalanche current ^(Note 1)	I_{AR}		9	A
Repetitive avalanche energy ^(Note 1)	E_{AR}		4.5	mJ
Power dissipation	P_D		45	W
Diode dv/dt ruggedness ^(Note 3)	dv/dt		4.5	V/ns
MOSFET dv/dt ruggedness ^(Note 4)	dv/dt		50	V/ns
Junction temperature	T_J		150	$^{\circ}C$
Storage temperature range	T_{stg}		-55~150	$^{\circ}C$

Thermal Characteristics

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to case	$R_{th(j-c)}$	Max. 2.78	°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	4	5	V
Drain-source cut-off current	I_{DSS}	$V_{DS}=650\text{V}$, $V_{GS}=0\text{V}$	-	-	10	μA
Gate leakage current	I_{GSS}	$V_{DS}=0\text{V}$, $V_{GS}=\pm 30\text{V}$	-	-	-	nA
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=15.4\text{A}$	-	0.081	0.099	Ω
Internal gate resistance	R_g	$F=1\text{MHz}$, open drain	-	1.1	-	Ω
Input capacitance	C_{iss}	$V_{DS}=100\text{V}$, $V_{GS}=0\text{V}$, $f=1\text{MHz}$	-	3596	-	pF
Output capacitance	C_{oss}		-	122	-	
Reverse transfer capacitance	C_{rss}		-	3.7	-	
Turn-on delay time (Note 5)	$t_{d(on)}$	$V_{DS}=400\text{V}$, $I_D=15.4\text{A}$, $R_G=10\Omega$	-	120	-	ns
Rise time (Note 5)	t_r		-	80	-	
Turn-off delay time (Note 5)	$t_{d(off)}$		-	165	-	
Fall time (Note 5)	t_f		-	8.5	-	
Total gate charge (Note 6)	Q_g	$V_{DS}=400\text{V}$, $V_{GS}=10\text{V}$, $I_D=30.8\text{A}$	-	74	-	nC
Gate-source charge (Note 6)	Q_{gs}		-	26.5	-	
Gate-drain charge (Note 6)	Q_{gd}		-	27.5	-	
Gate plateau voltage (Note 6)	$V_{plateau}$		-	7.2	-	V

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	-	-	40	A
Source current (Pulsed)	I_{SM}		-	-	160	A
Forward voltage	V_{SD}	$V_{GS}=0\text{V}$, $I_S=30.8\text{A}$	-	-	1.5	V
Reverse recovery time (Note 5, 6)	t_{rr}	$I_S=15.4\text{A}$, $V_{GS}=0\text{V}$, $di_S/dt=100\text{A}/\mu\text{s}$	-	200	-	ns
Reverse recovery charge (Note 5, 6)	Q_{rr}		-	0.51	-	μC

Note:

1. Calculated continuous current based on maximum allowable junction temperature
2. $L=10\text{mH}$, $I_{AS}=9\text{A}$, $V_{DD}=90\text{V}$, Starting $T_J=25^{\circ}\text{C}$
3. $I_S \leq 9\text{A}$, $V_{DS} \leq 400\text{V}$, $di_S/dt \leq 100\text{A}/\mu\text{s}$, $T_J=25^{\circ}\text{C}$
4. $V_{DS} \leq 400\text{V}$, $T_J=25^{\circ}\text{C}$
5. Guaranteed by design, not subject to production testing
6. Pulse test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$

Typical Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

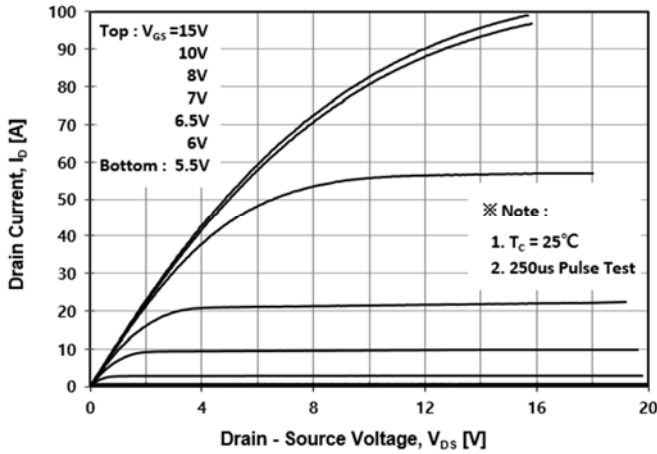


Fig. 2 Typical Transfer Characteristics

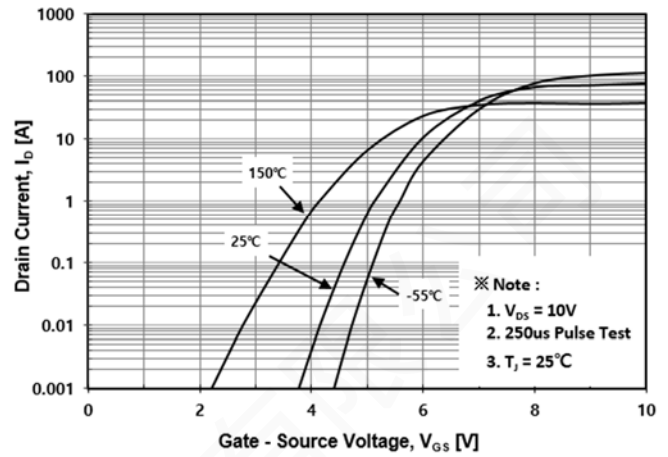


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

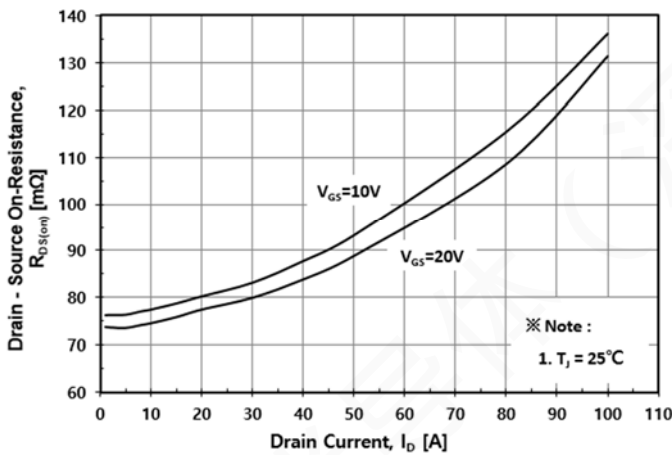


Fig. 4 Body Diode Forward Voltage Variation with Source Current

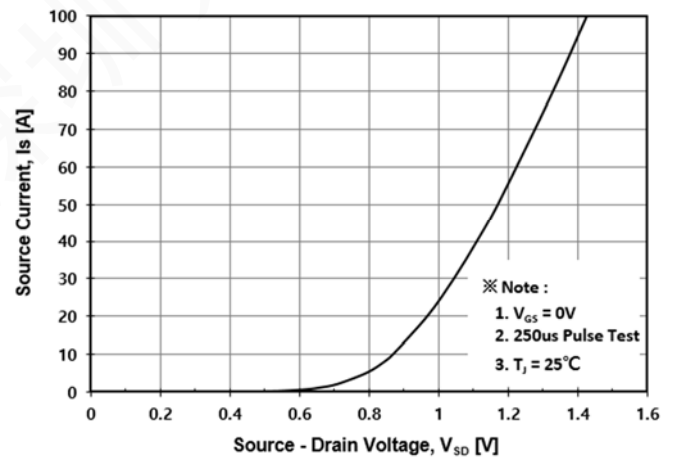


Fig. 5 Typical Capacitance Characteristics

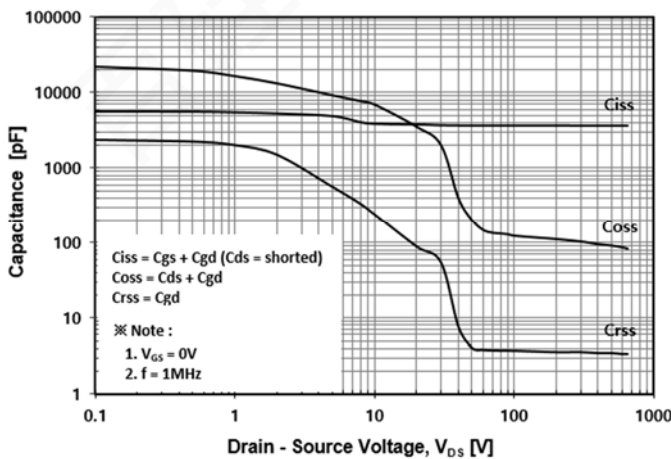


Fig. 6 Typical Total Gate Charge Characteristics

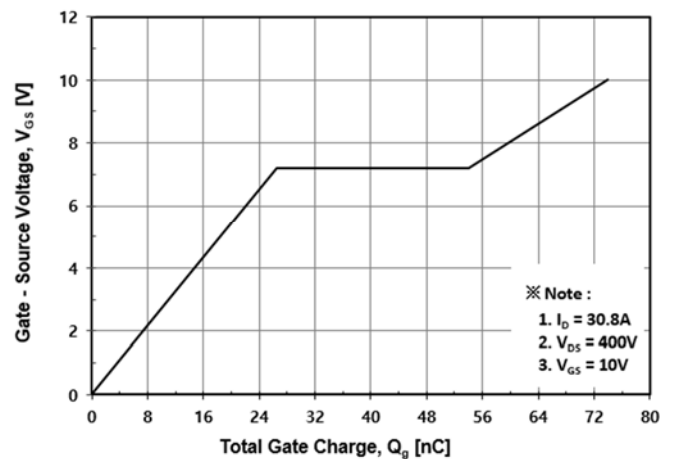


Fig. 7 Breakdown Voltage Variation vs. Temperature

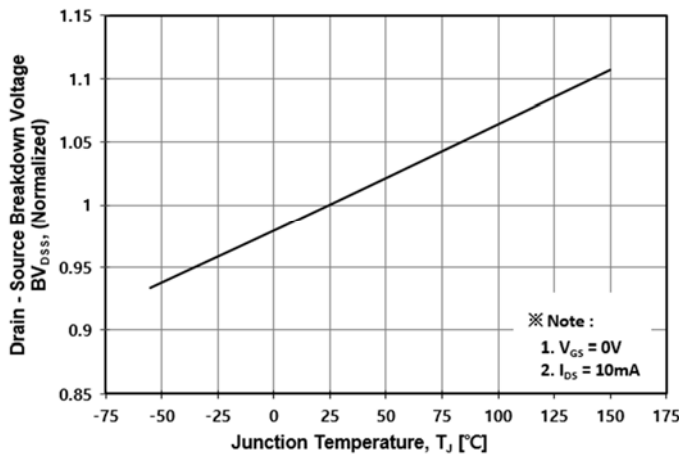


Fig. 8 On-Resistance Variation vs. Temperature

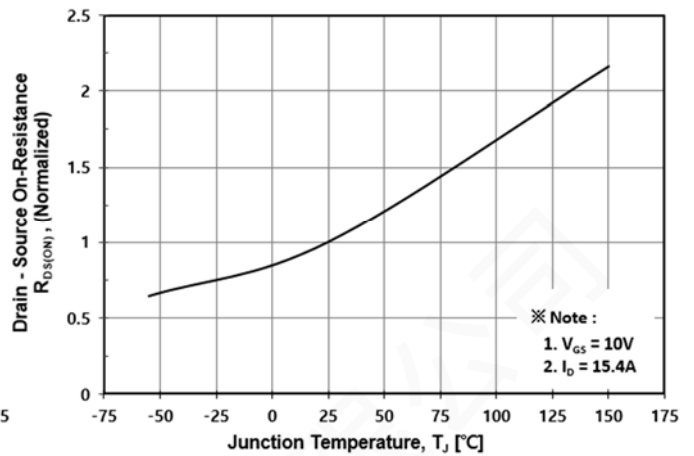


Fig. 9 Maximum Drain Current vs. Case Temperature

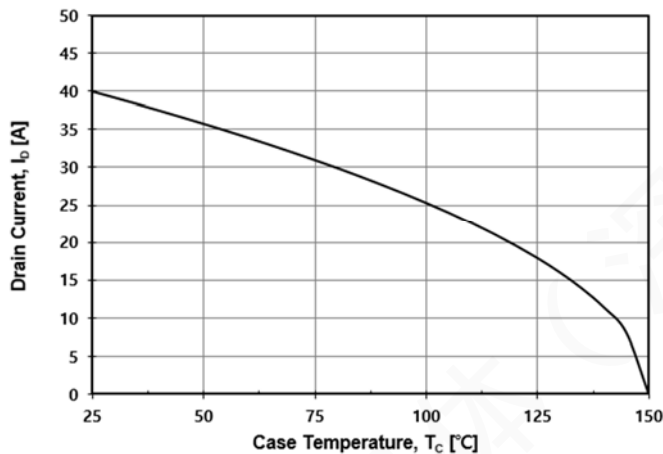


Fig. 10 Maximum Safe Operating Area

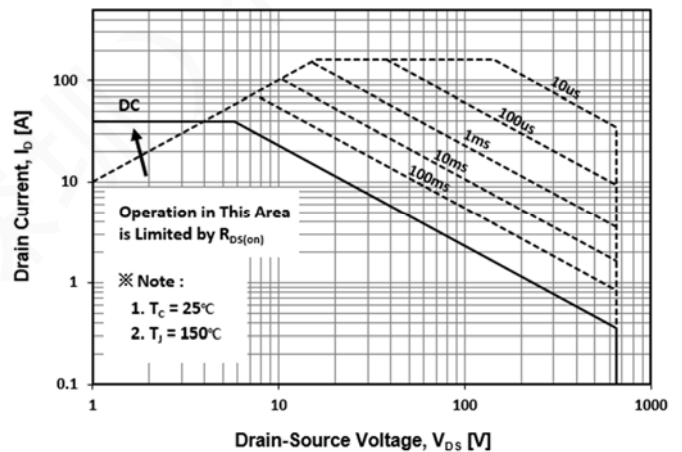


Fig. 11 Transient Thermal Impedance

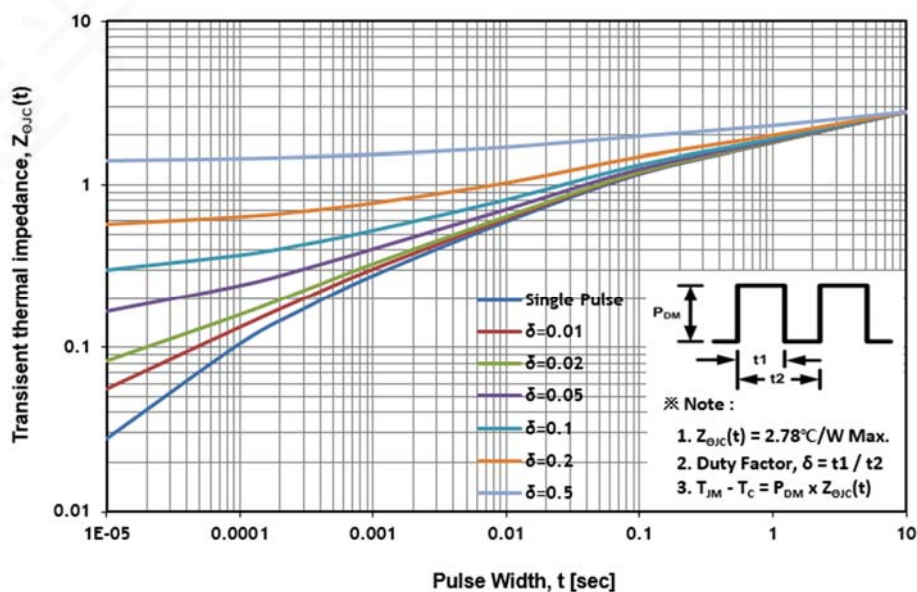


Fig. 12 Gate Charge Test Circuit & Waveform

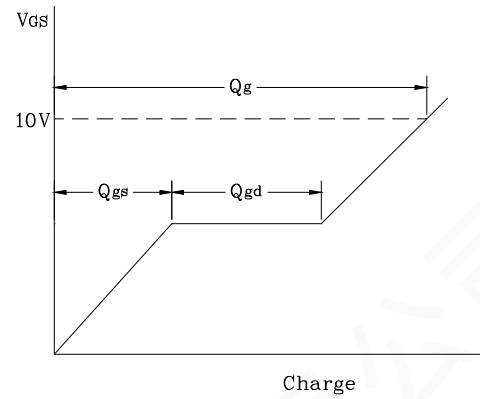
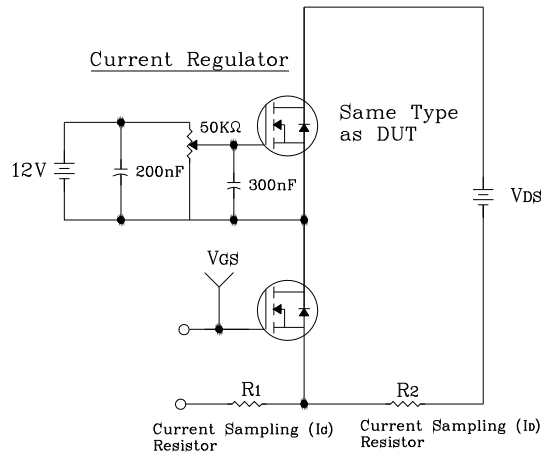


Fig. 13 Resistive Switching Test Circuit & Waveform

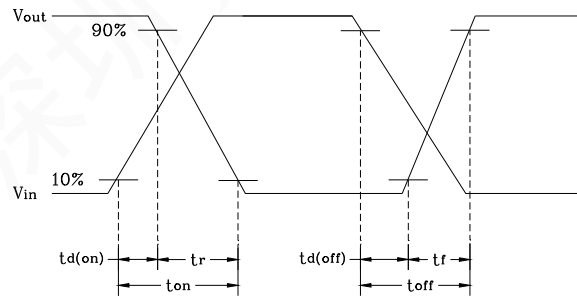
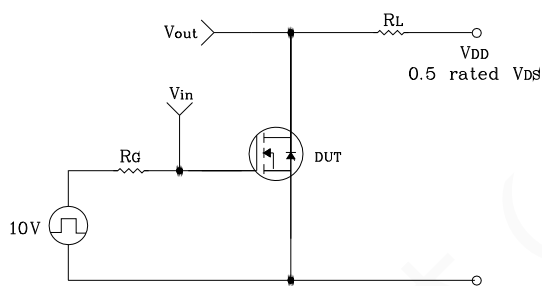


Fig. 14 E_{AS} Test Circuit & Waveform

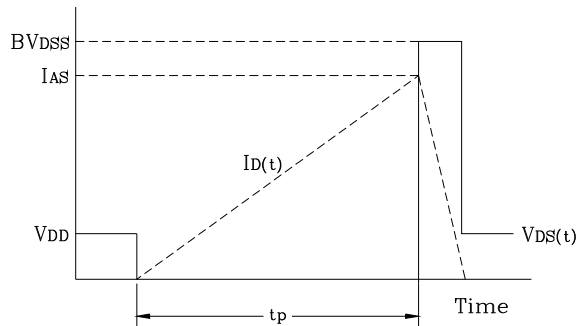
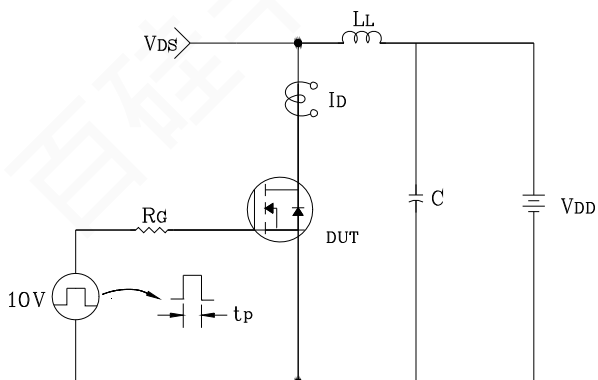
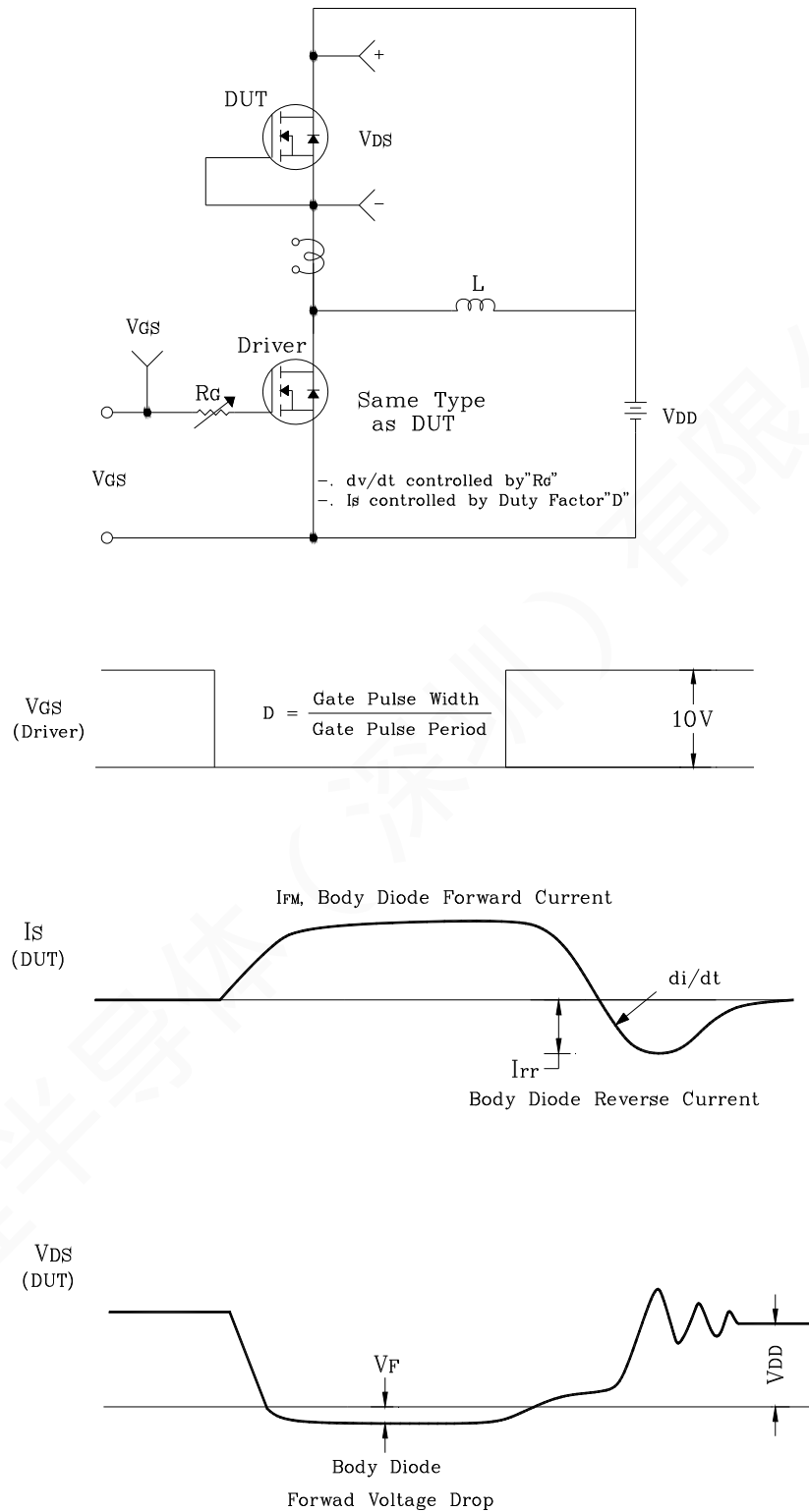
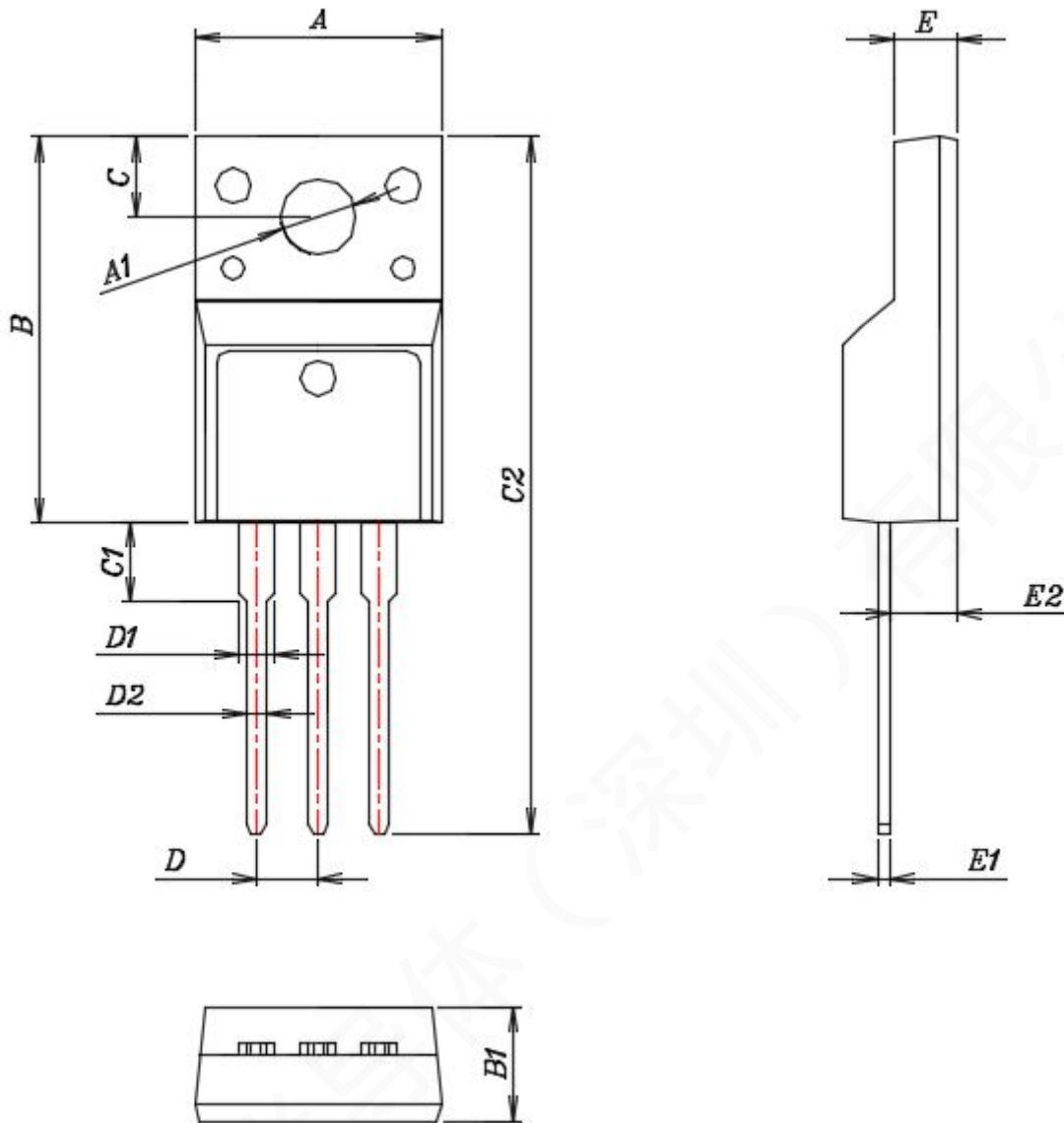


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



Package Outline Dimensions



SYMBOL	MILLIMETERS
A	10.16±0.30
A1	3.12±0.20
B	15.90±0.50
B1	4.70±0.30
C	3.30±0.25
C1	3.25±0.30
C2	28.70±0.50
D	Typical 2.54
D1	1.47(MAX)
D2	0.80±0.20
E	2.55±0.25
E1	0.50±0.20
E2	2.75±0.30

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