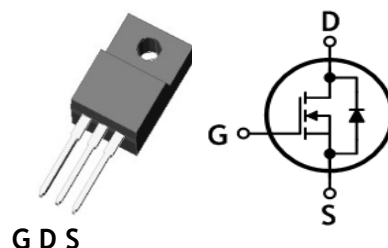


N-Channel Super Junction MOSFET

Features

- Drain-Source voltage: $V_{DS}=650V$ (@ $T_J=150^{\circ}C$)
- Low drain-source On resistance: $R_{DS(on)}=0.19\Omega$ (Max.)
- Ultra low gate charge: $Q_g=36nC$ (Typ.)
- RoHS compliant device
- 100% avalanche tested



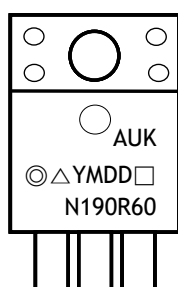
G D S

TO-220F-3L

Ordering Information

Part Number	Marking	Package
SJMN190R60F	N190R60	TO-220F-3L

Marking Information



Column 1 : Manufacture Logo
Column 2 : Production Information
e.g) ©△YMDD□

- © = Management Code
- △ = Machine Code
- YMDD = Date Code (year, week, daily)
- □ = Factory Management Code

Column 3 : Device Code

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

Characteristic	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	600	V
Gate-source voltage	V_{GSS}	± 30	V
Drain current (DC) (Note 1)	I_D	$T_C=25^{\circ}C$	20
		$T_C=100^{\circ}C$	12.6
Drain current (Pulsed) (Note 1)	I_{DM}	80	A
Single pulsed avalanche energy (Note 2)	E_{AS}	265	mJ
Repetitive avalanche current (Note 1)	I_{AR}	7	A
Repetitive avalanche energy (Note 1)	E_{AR}	3.2	mJ
Power dissipation	P_D	32	W
Junction temperature	T_J	150	$^{\circ}C$
Storage temperature range	T_{stg}	-55~150	$^{\circ}C$

* 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}	$I_D=250\mu\text{A}$, $V_{GS}=0$	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu\text{A}$, $V_{DS}=V_{GS}$	2	3	4	V
Drain-source cut-off current	I_{DSS}	$V_{DS}=600\text{V}$, $V_{GS}=0\text{V}$	-	-	1	μA
		$V_{DS}=600\text{V}$, $T_J=125^\circ\text{C}$	-	-	100	μA
Gate leakage current	I_{GSS}	$V_{DS}=0\text{V}$, $V_{GS}=\pm 30\text{V}$	-	-	± 100	nA
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=10\text{A}$	-	-	0.19	Ω
Input capacitance	C_{iss}	$V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$, $f=1\text{MHz}$	-	1533	-	pF
Output capacitance	C_{oss}		-	46	-	
Reverse transfer capacitance	C_{rss}		-	23	-	
Turn-on delay time (Note 3)	$t_{d(on)}$	$V_{DS}=350\text{V}$, $I_D=20\text{A}$, $R_G=25\Omega$	-	25	-	ns
Rise time (Note 3)	t_r		-	21	-	
Turn-off delay time (Note 3)	$t_{d(off)}$		-	60	-	
Fall time (Note 3)	t_f		-	4	-	
Total gate charge (Note 4)	Q_g	$V_{DS}=400\text{V}$, $V_{GS}=10\text{V}$, $I_D=10\text{A}$	-	36	-	nC
Gate-source charge (Note 4)	Q_{gs}		-	10	-	
Gate-drain charge (Note 4)	Q_{gd}		-	10	-	

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	-	-	20	A
Source current (Pulsed)	I_{SM}		-	-	80	A
Forward voltage	V_{SD}	$V_{GS}=0\text{V}$, $I_S=20\text{A}$	-	-	1.2	V
Reverse recovery time (Note 3,4)	t_{rr}	$I_S=20\text{A}$, $V_{GS}=0\text{V}$, $di_S/dt=100\text{A}/\mu\text{s}$	-	383	-	ns
Reverse recovery charge (Note 3,4)	Q_{rr}		-	4.6	-	μC

Note:

1. Calculated continuous current based on maximum allowable junction temperature
2. $L=10\text{mH}$, $I_{AS}=7\text{A}$, $V_{DD}=50\text{V}$, Starting $T_J=25^\circ\text{C}$
3. Guaranteed by design, not subject to production testing
4. Pulse test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$

Typical Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

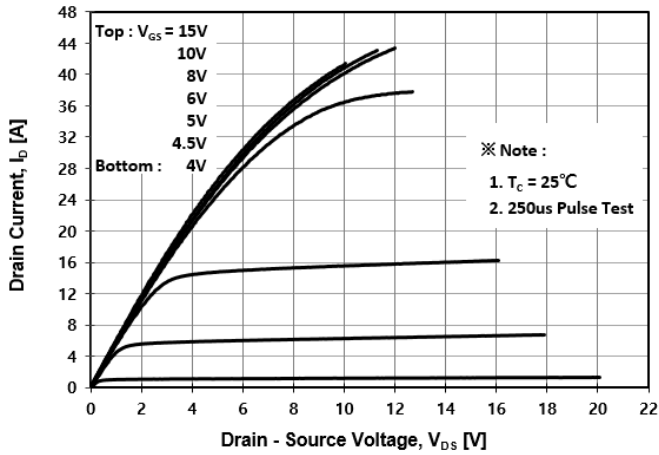


Fig. 2 Typical Transfer Characteristics

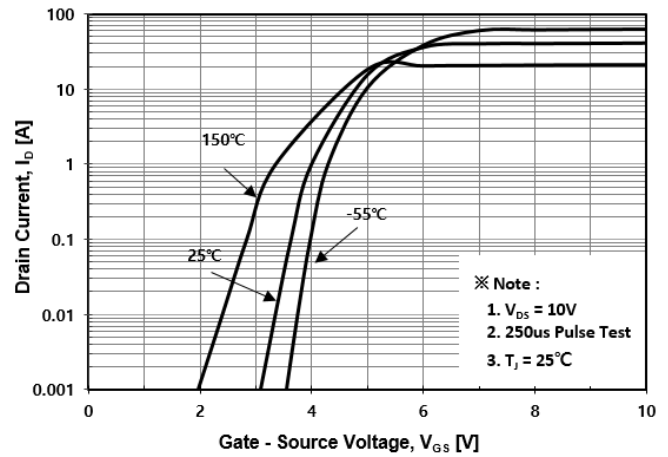


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

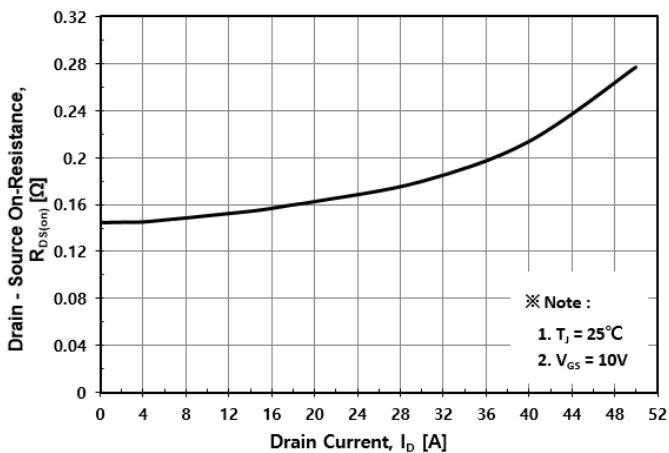


Fig. 4 Body Diode Forward Voltage Variation with Source Current

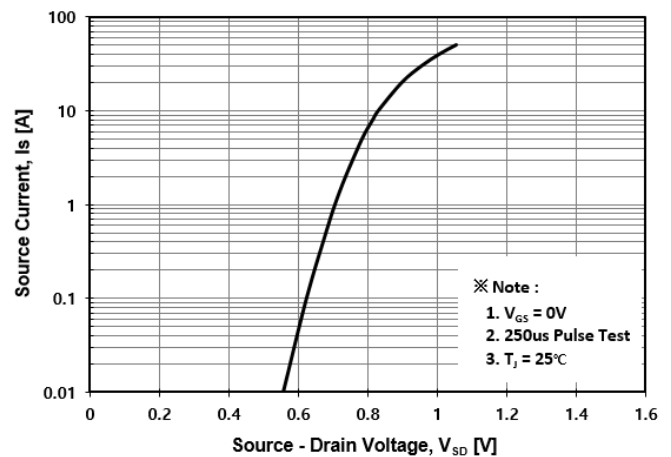


Fig. 5 Typical Capacitance Characteristics

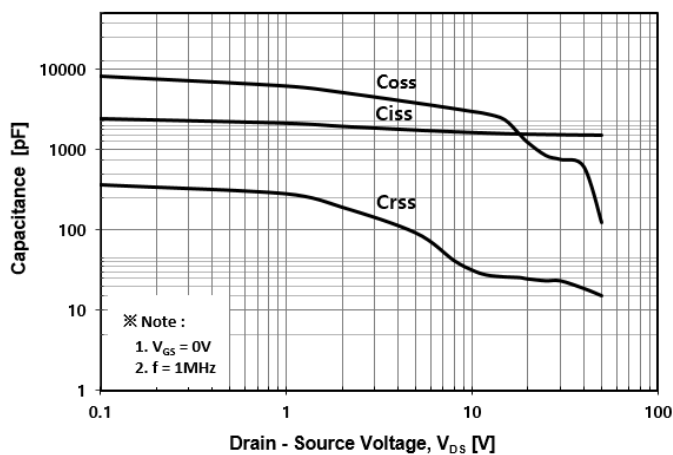
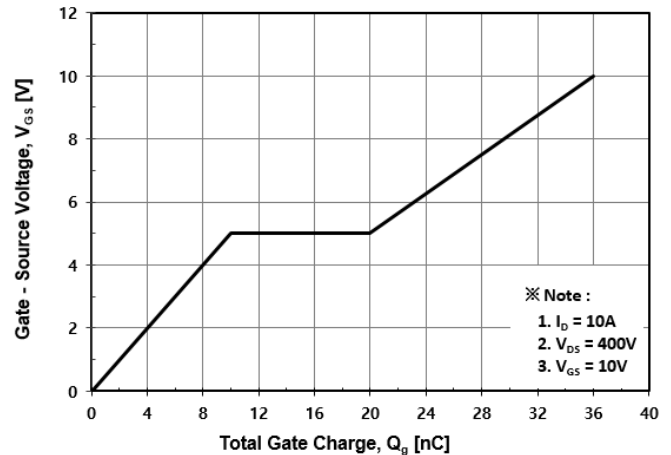


Fig. 6 Typical Total Gate Charge Characteristics



Typical Electrical Characteristics Curves

Fig. 7 Breakdown Voltage Variation vs. Temperature

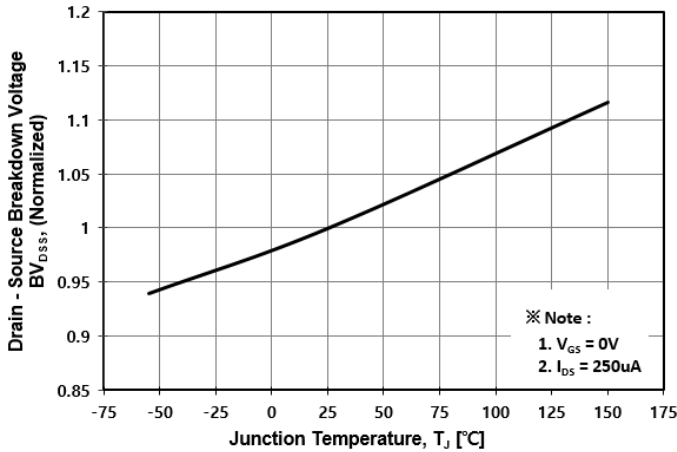


Fig. 8 On-Resistance Variation vs. Temperature

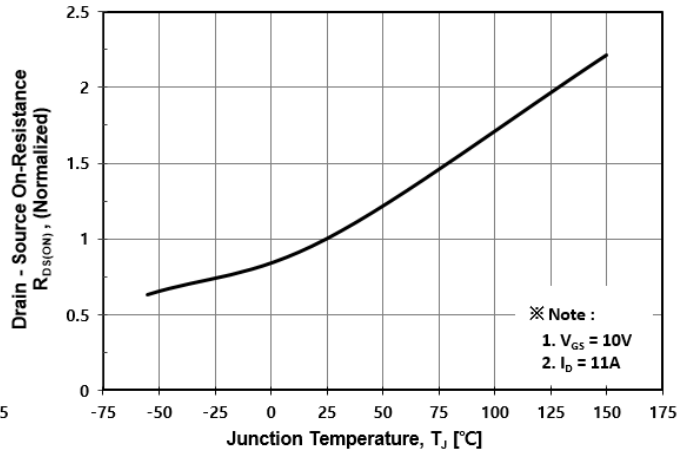


Fig. 9 Maximum Drain Current vs. Case Temperature

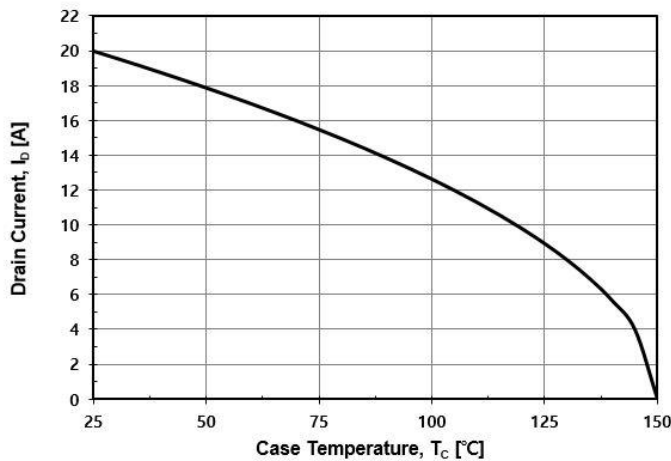


Fig. 10 Maximum Safe Operating Area

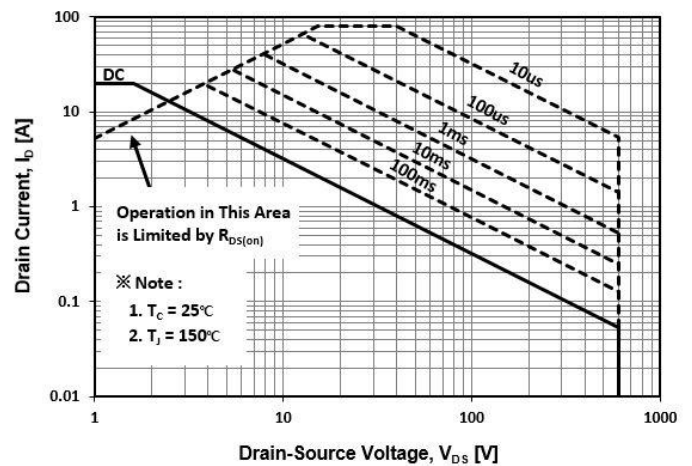


Fig. 11 Transient Thermal Impedance

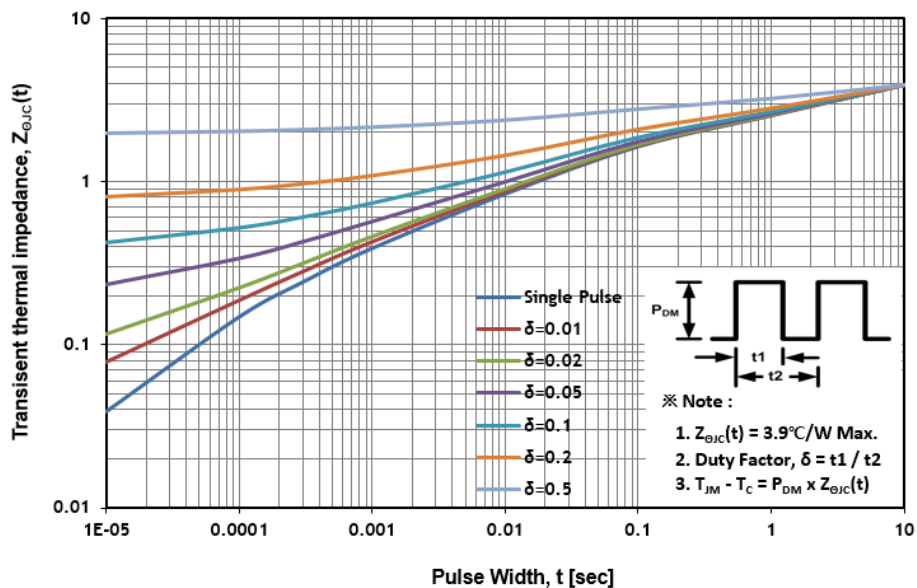


Fig. 12 Gate Charge Test Circuit & Waveform

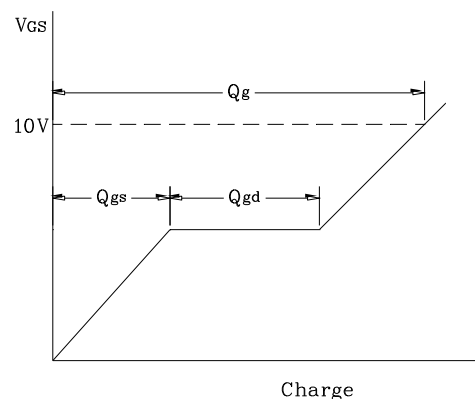
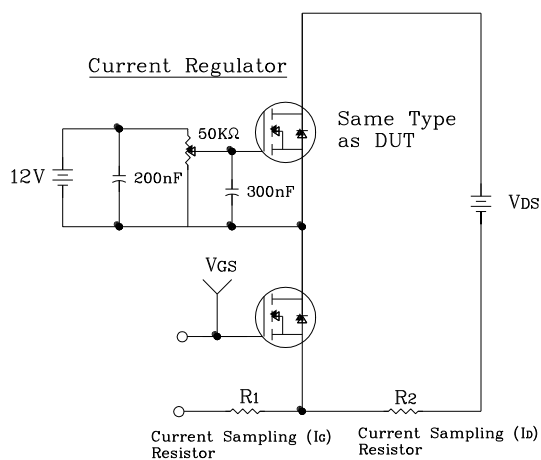


Fig. 13 Resistive Switching Test Circuit & Waveform

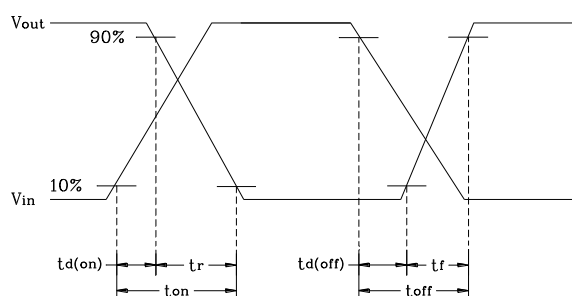
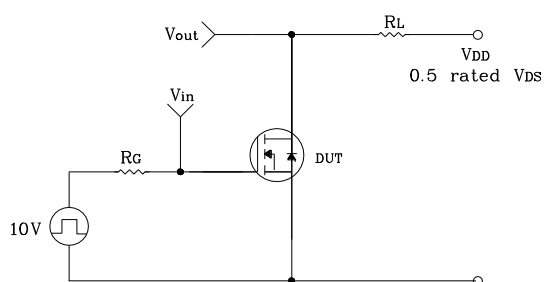


Fig. 14 E_{AS} Test Circuit & Waveform

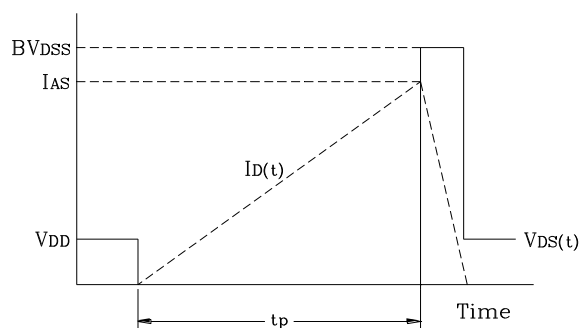
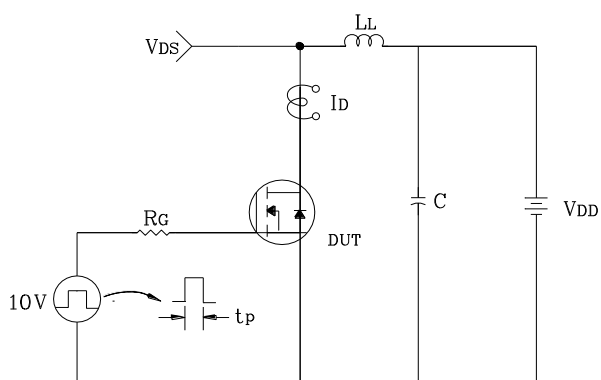
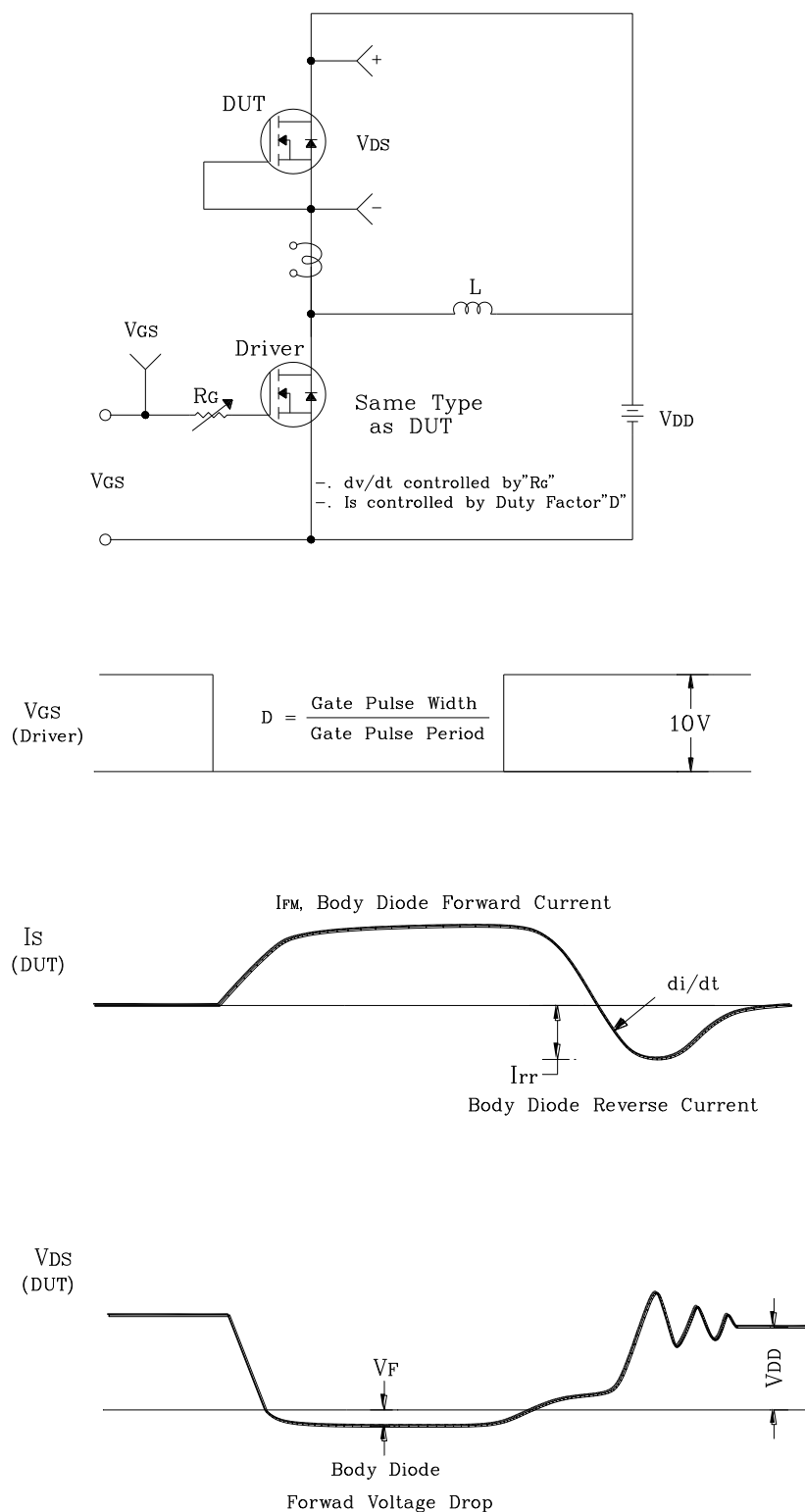
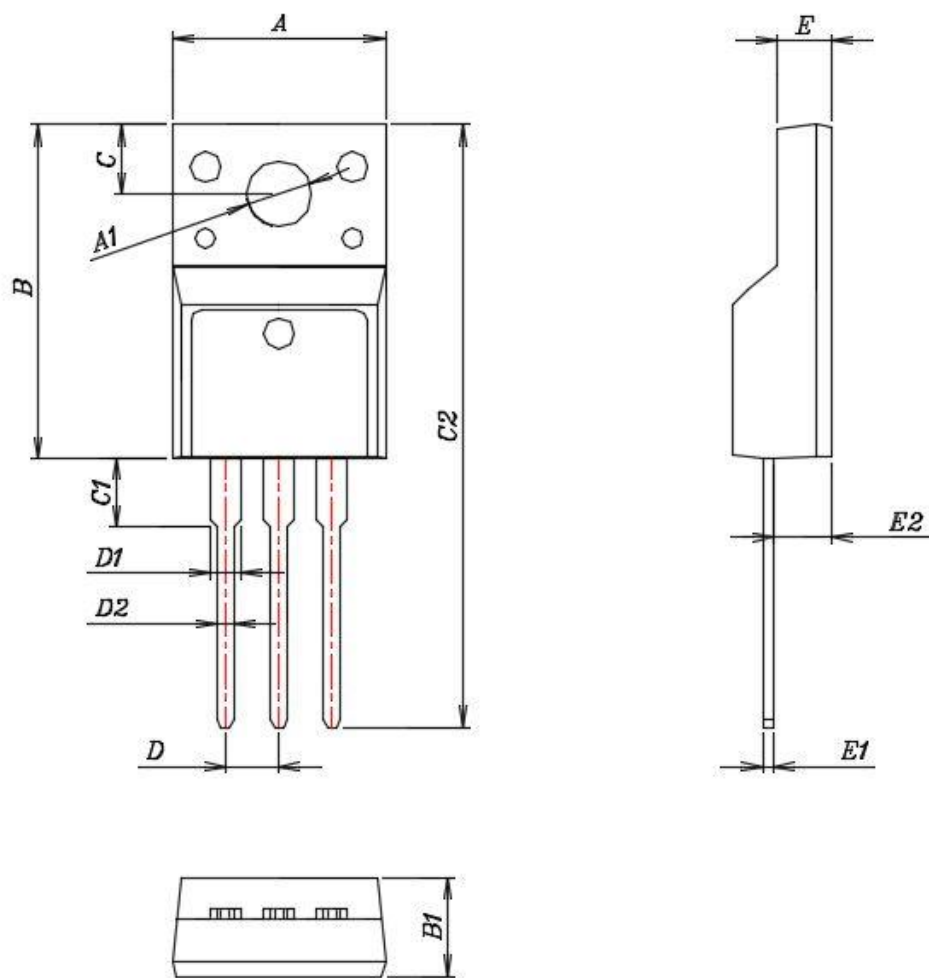


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



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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