

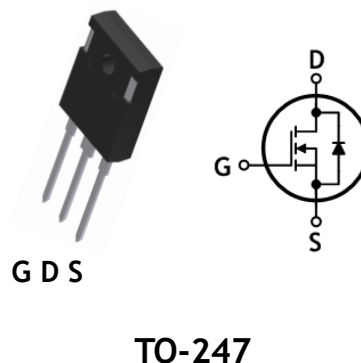
## SWITCHING REGULATOR APPLICATION

### Features

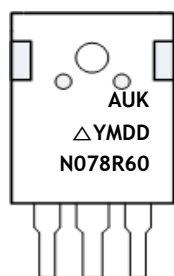
- 600V Super-junction MOSFET
- Low FOM  $R_{DS(on)} * Q_g$
- Low drain-source On-resistance:  $R_{DS(on)}=78m\Omega$  (Max.)
- 100% avalanche tested
- RoHS compliant device

### Ordering Information

Part Number	Marking	Package
SJMN078R60W	N078R60	TO-247



### Marking Information



Column 1: Manufacturer  
Column 2: Production Information  
e.g.)  $\Delta$ YMDD  
-  $\Delta$ : 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	$V_{DS}$		600	V
Gate-source voltage	$V_{GS}$		$\pm 30$	V
Drain current (DC) *	$I_D$	$T_c=25^\circ\text{C}$	48	A
		$T_c=100^\circ\text{C}$	30.4	A
Drain current (Pulsed) *	$I_{DM}$		144	A
Single pulsed avalanche energy (Note 2)	$E_{AS}$		1508	mJ
Repetitive avalanche current (Note 1)	$I_{AR}$		9.6	A
Repetitive avalanche energy (Note 1)	$E_{AR}$		41.7	mJ
Power dissipation	$P_D$		417	W
Junction temperature	$T_J$		150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$		-55~150	$^\circ\text{C}$

\* Limited only maximum junction temperature

## Thermal Characteristics

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to case	$R_{th(j-c)}$	Max. 0.3	°C/W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	Max. 40	

## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D=250\mu\text{A}$ , $V_{DS}=V_{GS}$	2.5	-	4.5	V
Drain-source cut-off current	$I_{DSS}$	$V_{DS}=600\text{V}$ , $V_{GS}=0\text{V}$	-	-	1	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 30\text{V}$	-	-	$\pm 100$	nA
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=24\text{A}$	-	66	78	$\text{m}\Omega$
Forward transfer conductance (Note 4)	$g_{fs}$	$V_{DS}=30\text{V}$ , $I_D=24\text{A}$	-	45	-	S
Input capacitance	$C_{iss}$	$V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ , $f=1.0\text{MHz}$	-	5631	-	pF
Output capacitance	$C_{oss}$		-	3945	-	
Reverse transfer capacitance	$C_{rss}$		-	44	-	
Turn-on delay time (Note 4,5)	$t_{d(on)}$	$V_{DD}=300\text{V}$ , $I_D=48\text{A}$ , $R_G=25\Omega$ , $V_{GS}=10\text{V}$	-	82	-	ns
Rise time (Note 4,5)	$t_r$		-	186	-	
Turn-off delay time (Note 4,5)	$t_{d(off)}$		-	352	-	
Fall time (Note 4,5)	$t_f$		-	111	-	
Total gate charge (Note 4,5)	$Q_g$	$V_{DS}=480\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=48\text{A}$	-	140	-	nC
Gate-source charge (Note 4,5)	$Q_{gs}$		-	38	-	
Gate-drain charge (Note 4,5)	$Q_{gd}$		-	46	-	

## 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	-	-	48	A
Source current (Pulsed)	$I_{SM}$		-	-	144	A
Forward voltage	$V_{SD}$	$V_{GS}=0\text{V}$ , $I_S=48\text{A}$	-	-	1.25	V
Reverse recovery time (Note 4,5)	$t_{rr}$	$I_S=48\text{A}$ , $V_{GS}=0\text{V}$ $di_S/dt=100\text{A}/\mu\text{s}$	-	680	-	ns
Reverse recovery charge (Note 4,5)	$Q_{rr}$		-	12	-	$\mu\text{C}$

Note:

1. Repeated rating: Pulse width limited by safe operating area
2.  $I_{AS}=9.6\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , starting  $T_J=25^{\circ}\text{C}$ , not subject to production test - verified by design/characterization
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

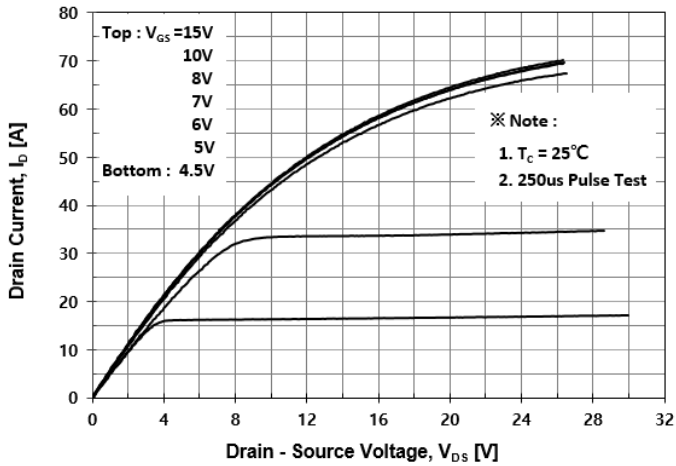


Fig. 2 Typical Transfer Characteristics

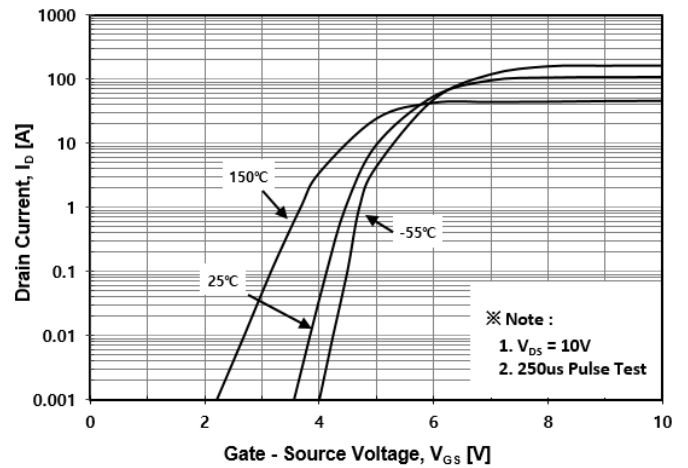


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

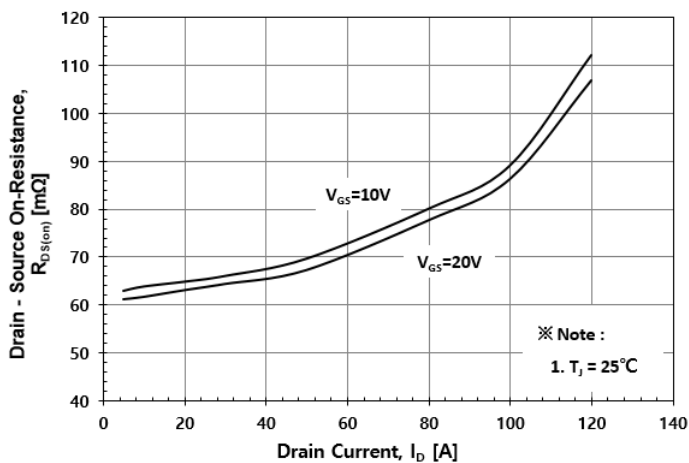


Fig. 4 Body Diode Forward Voltage Variation with Source Current

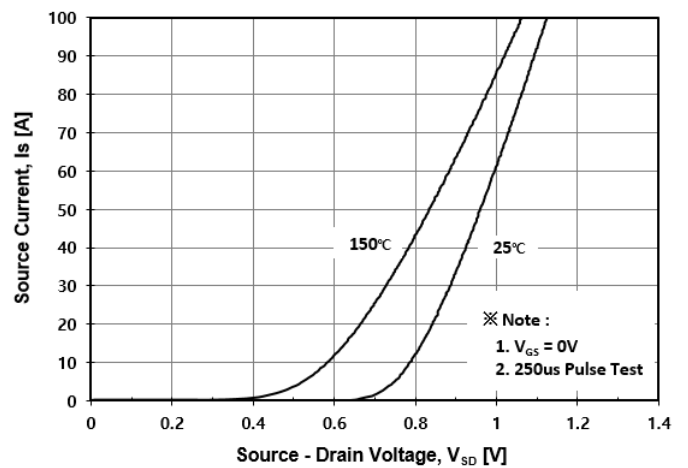


Fig. 5 Typical Capacitance Characteristics

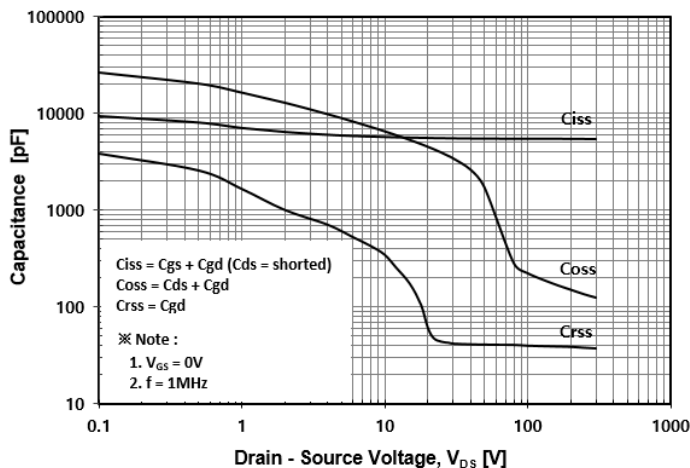
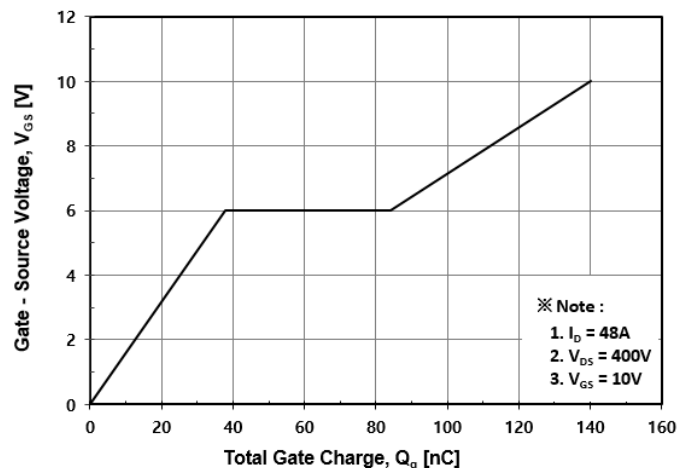
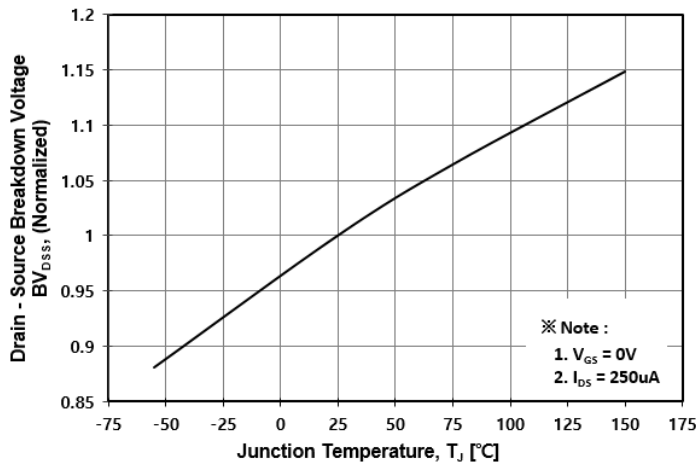


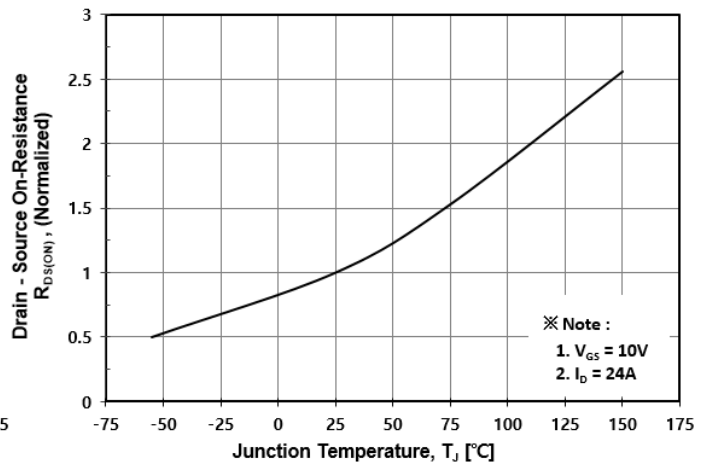
Fig. 6 Typical Total Gate Charge Characteristics



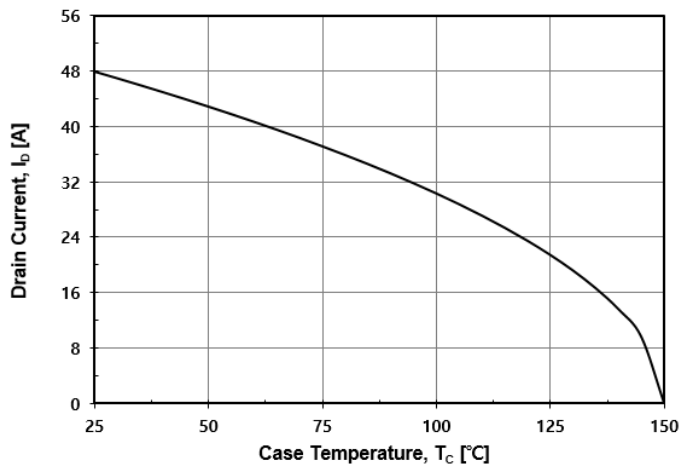
**Fig. 7 Breakdown Voltage Variation vs. Temperature**



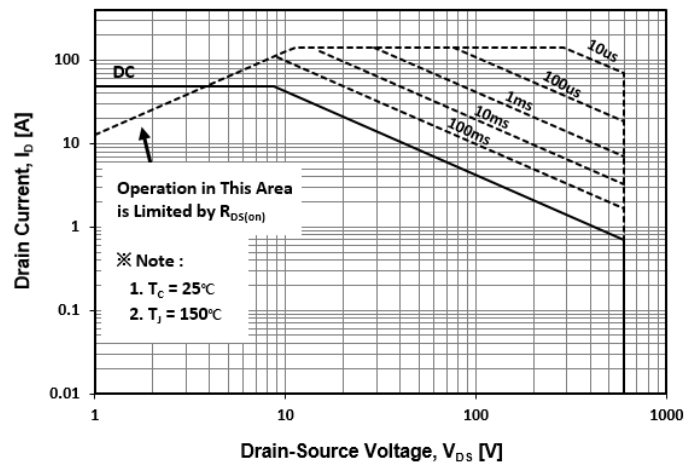
**Fig. 8 On-Resistance Variation vs. Temperature**



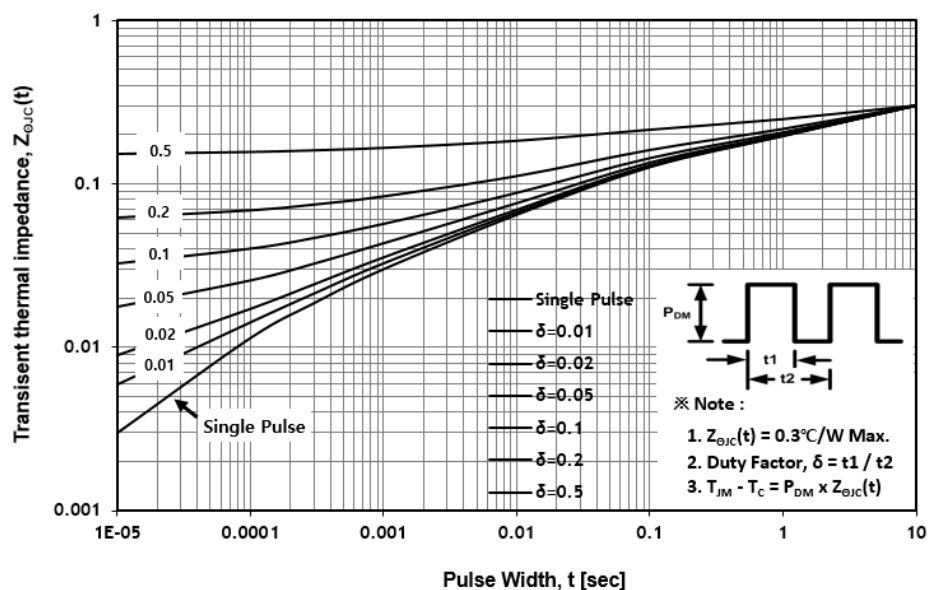
**Fig. 9 Maximum Drain Current vs. Case Temperature**



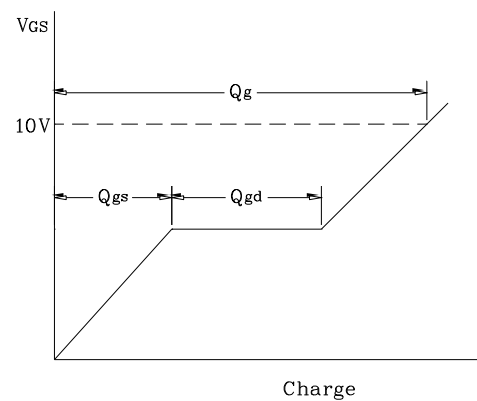
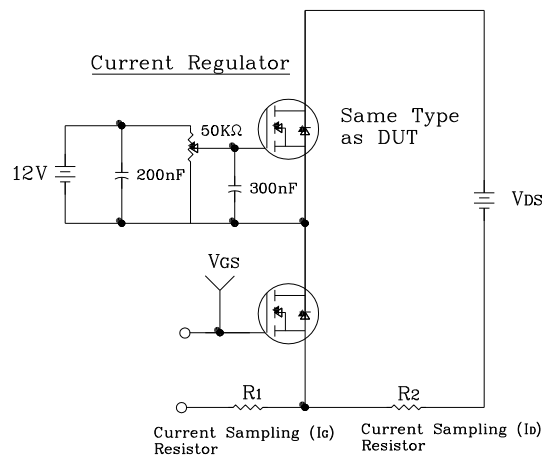
**Fig. 10 Maximum Safe Operating Area**



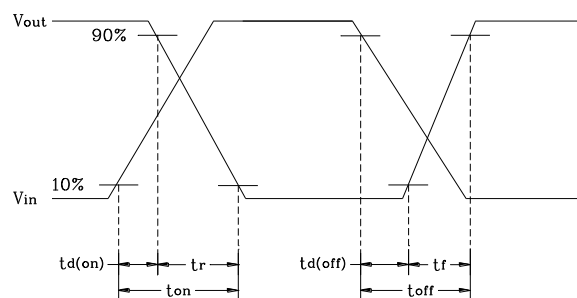
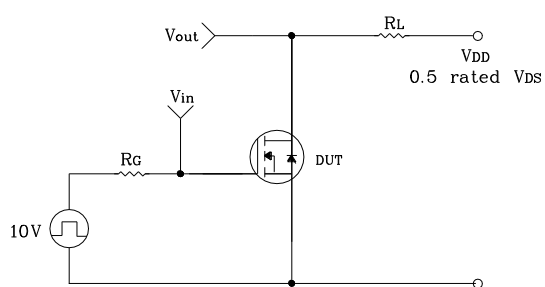
**Fig. 11 Transient Thermal Impedance**



**Fig. 12 Gate Charge Test Circuit & Waveform**



**Fig. 13 Resistive Switching Test Circuit & Waveform**



**Fig. 14 E<sub>AS</sub> Test Circuit & Waveform**

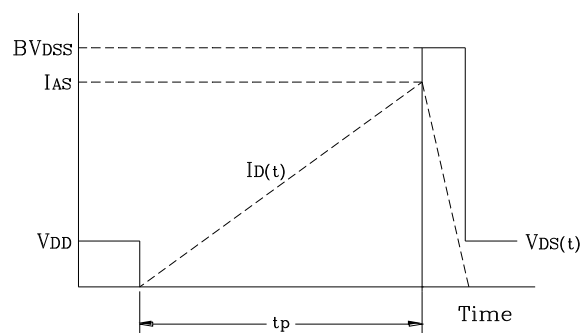
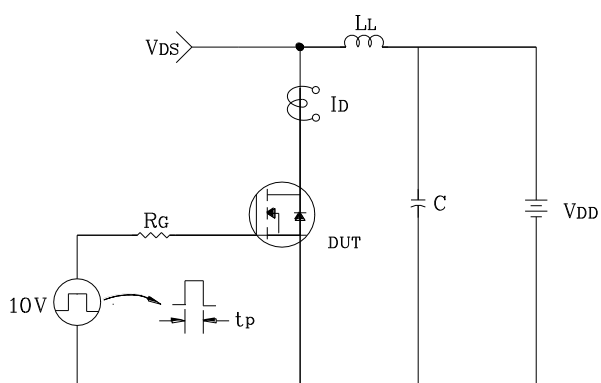
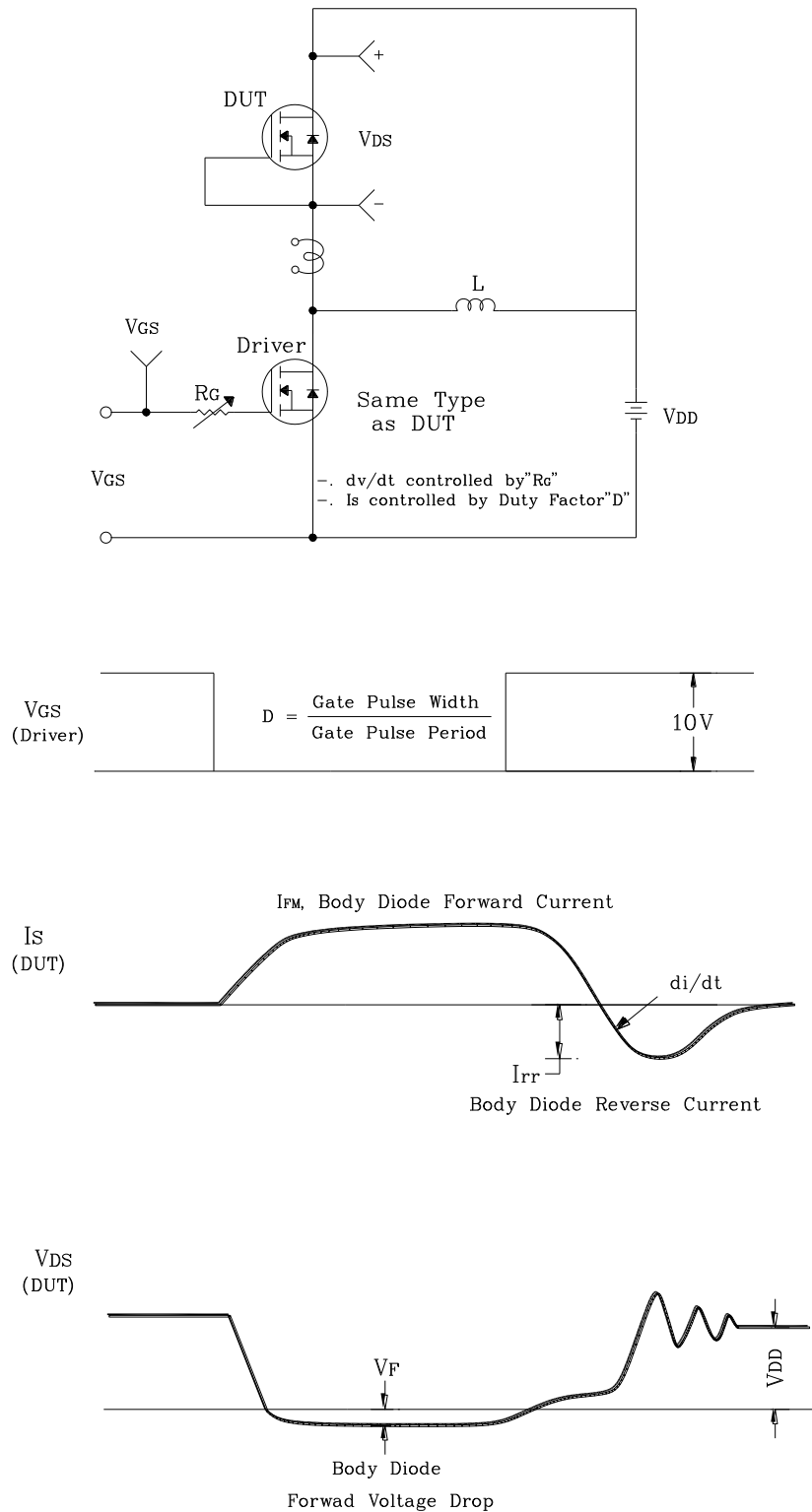
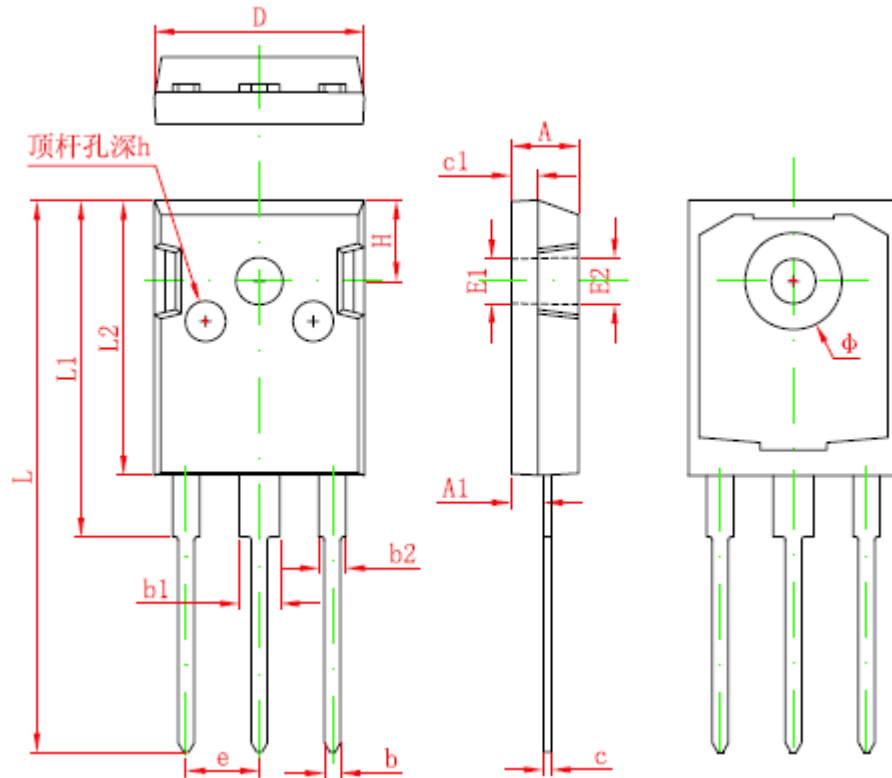


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



Package Outline Dimensions (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		0.138 REF	
E2	3.600 REF		0.142 REF	
L	40.900	41.300	1.610	1.626
L1	24.800	25.100	0.976	0.988
L2	20.300	20.600	0.799	0.811
Φ	7.100	7.300	0.280	0.287
e	5.450 TYP		0.215 TYP	
H	5.980 REF		0.235 REF	
h	0.000	0.300	0.000	0.012

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