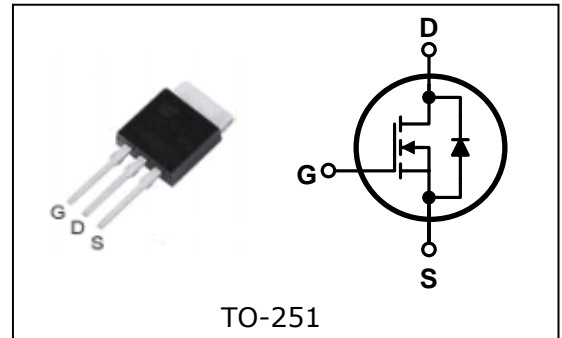


## SWITCHING REGULATOR APPLICATIONS

### Features

- High Voltage :  $BV_{DSS}=650V(\text{Min.})$
- Low  $C_{RSS}$  :  $C_{RSS}=14pF(\text{Typ.})$
- Low gate charge :  $Qg=16nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=2.5\Omega(\text{Max.})$

### PIN Connection



### Ordering Information

Type No.	Marking	Package Code
MU4N65	MU4N65	TO-251

### 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	$V_{GSS}$	$\pm 30$	V	
Drain current (DC) *	$I_D$	( $T_C=25^\circ\text{C}$ )	4.0	A
		( $T_C=100^\circ\text{C}$ )	2.5	A
Drain current (Pulsed) *	$I_{DM}$	16.0	A	
Power dissipation	$P_D$	80	W	
Avalanche current (Single) ②	$I_{AS}$	4.0	A	
Single pulsed avalanche energy ②	$E_{AS}$	240	mJ	
Avalanche current (Repetitive) ①	$I_{AR}$	4.0	A	
Repetitive avalanche energy ①	$E_{AR}$	10	mJ	
Junction temperature	$T_J$	150	$^\circ\text{C}$	
Storage temperature range	$T_{stg}$	-55~150		
ESD (HBM)		1000	V	

\* Limited by maximum junction temperature

Characteristic	Symbol	Typ.	Max.	Unit
Thermal resistance	Junction-case	-	1.56	$^\circ\text{C}/\text{W}$
	Junction-ambient	-	110	

## Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Drain-source breakdown voltage	BV <sub>DSS</sub>	I <sub>D</sub> =250μA, V <sub>GS</sub> =0	650	-	-	V	
Gate threshold voltage	V <sub>GS(th)</sub>	I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>	2.0	-	4.0	V	
Drain-source cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0	-	-	10	μA	
Gate leakage current	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V	-	-	±100	nA	
Drain-source on-resistance ④	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =3.25A	1.6	1.8	2.5	Ω	
Forward transfer conductance ④	g <sub>fs</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =0.5A	-	0.8	-	S	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz	-	710	920	pF	
Output capacitance	C <sub>oss</sub>		-	65	85		
Reverse transfer capacitance	C <sub>rss</sub>		-	14	19		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =300V, I <sub>D</sub> =4.4A R <sub>G</sub> =25Ω	-	20	50	ns	
Rise time	t <sub>r</sub>		-	55	120		
Turn-off delay time	t <sub>d(off)</sub>		③④	-	70		150
Fall time	t <sub>f</sub>		-	50	120		
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> =480V, V <sub>GS</sub> =10V I <sub>D</sub> =4.4A	-	16	20	nC	
Gate-source charge	Q <sub>gs</sub>		-	3.4	-		
Gate-drain charge	Q <sub>gd</sub>		③④	-	7.0		-

## Source-Drain Diode Ratings and Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

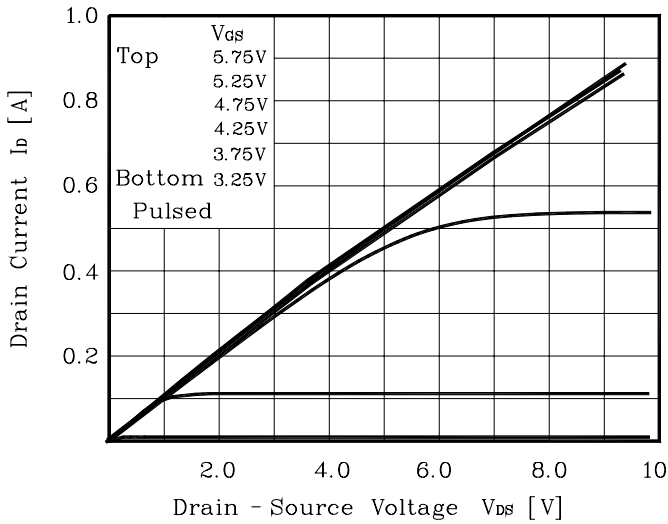
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	I <sub>S</sub>	Integral reverse diode in the MOSFET			4	A
Source current (Pulsed) ①	I <sub>SM</sub>				17.6	
Forward voltage ④	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> A=4.4A			1.4	V
Reverse recovery time	t <sub>rr</sub>	I <sub>S</sub> =4.4A, V <sub>GS</sub> =0V dI <sub>F</sub> /dt=100A/us	-	390	-	ns
Reverse recovery charge	Q <sub>rr</sub>		-	2.2	-	μC

Note ;

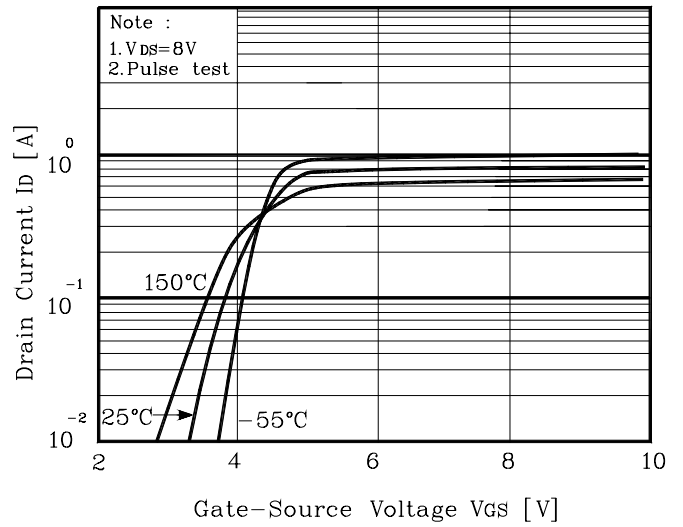
- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=1080mH, I<sub>AS</sub>=0.3A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C
- ③ Pulse Test : Pulse width≤300us, Duty cycle≤2%
- ④ Essentially independent of operating temperature

**Electrical Characteristic Curves**

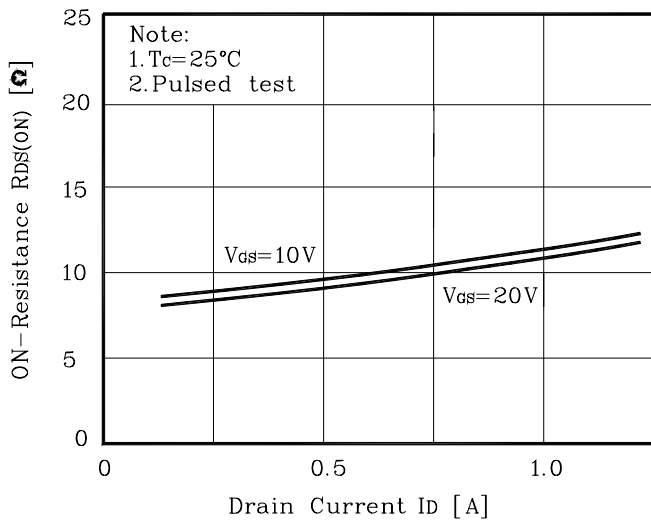
**Fig. 1  $I_D - V_{DS}$**



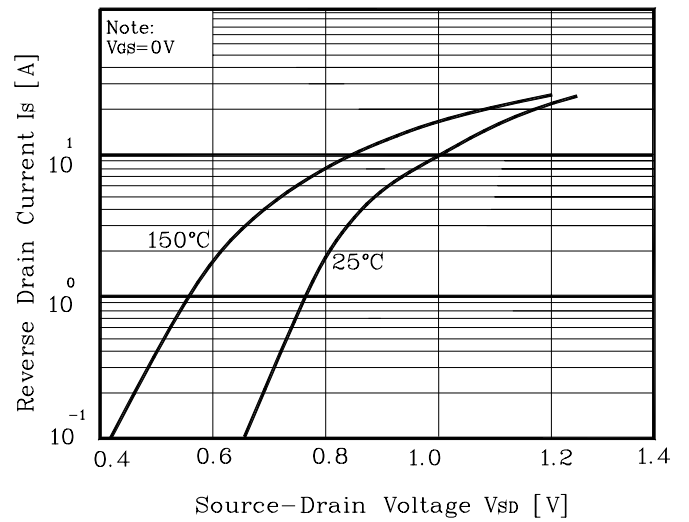
**Fig. 2  $I_D - V_{GS}$**



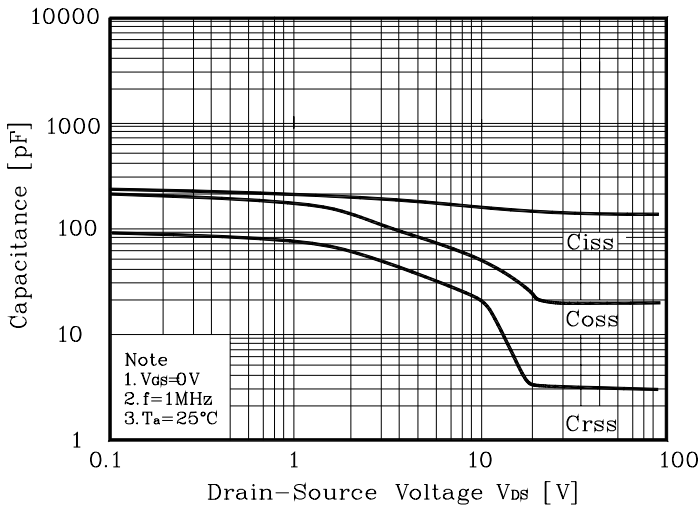
**Fig. 3  $R_{DS(on)} - I_D$**



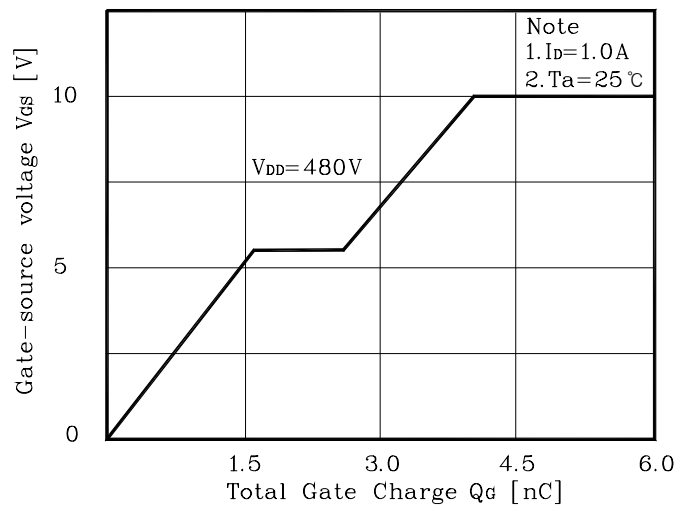
**Fig. 4  $I_S - V_{SD}$**



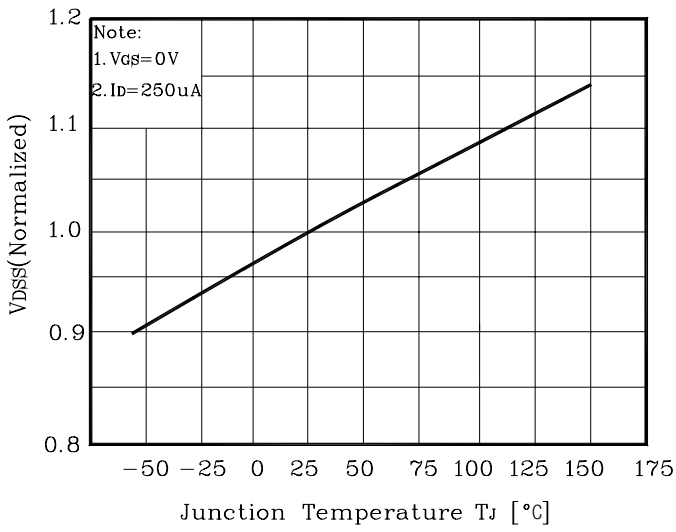
**Fig. 5 Capacitance -  $V_{DS}$**



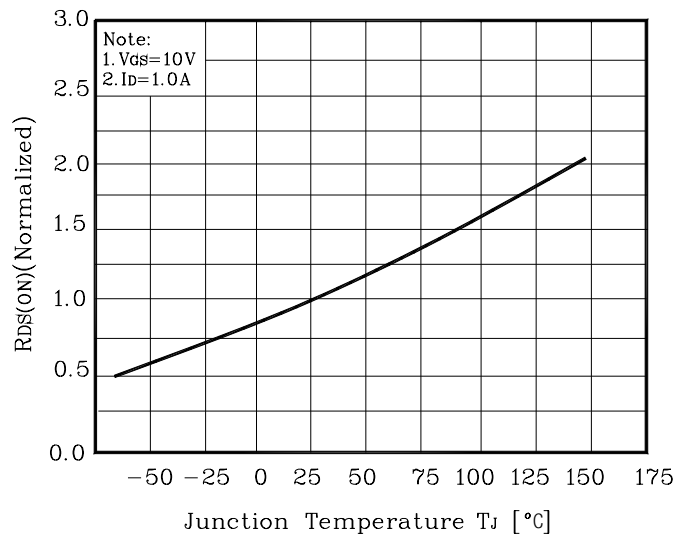
**Fig. 6  $V_{GS} - Q_G$**



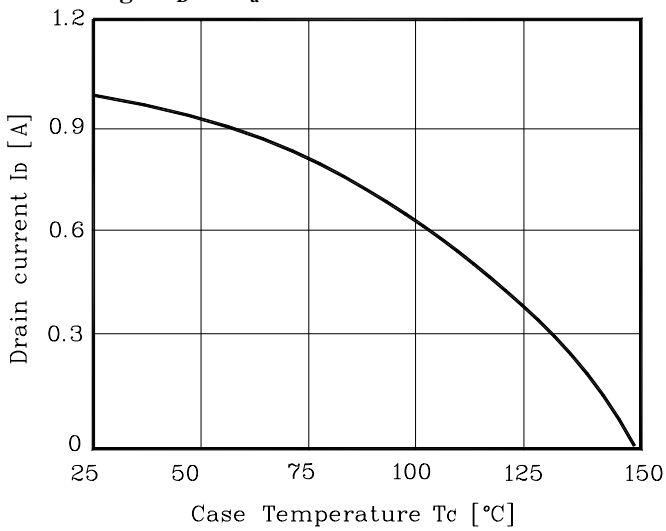
**Fig. 7  $V_{DSS} - T_J$**



**Fig. 8  $R_{DS(on)} - T_J$**



**Fig. 9  $I_D - T_c$**



**Fig. 10 Safe Operating Area**

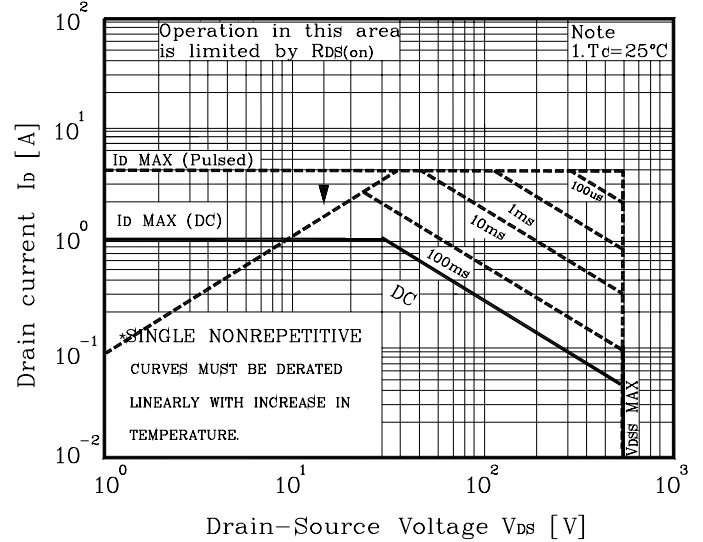


Fig. 11 Gate Charge Test Circuit & Waveform

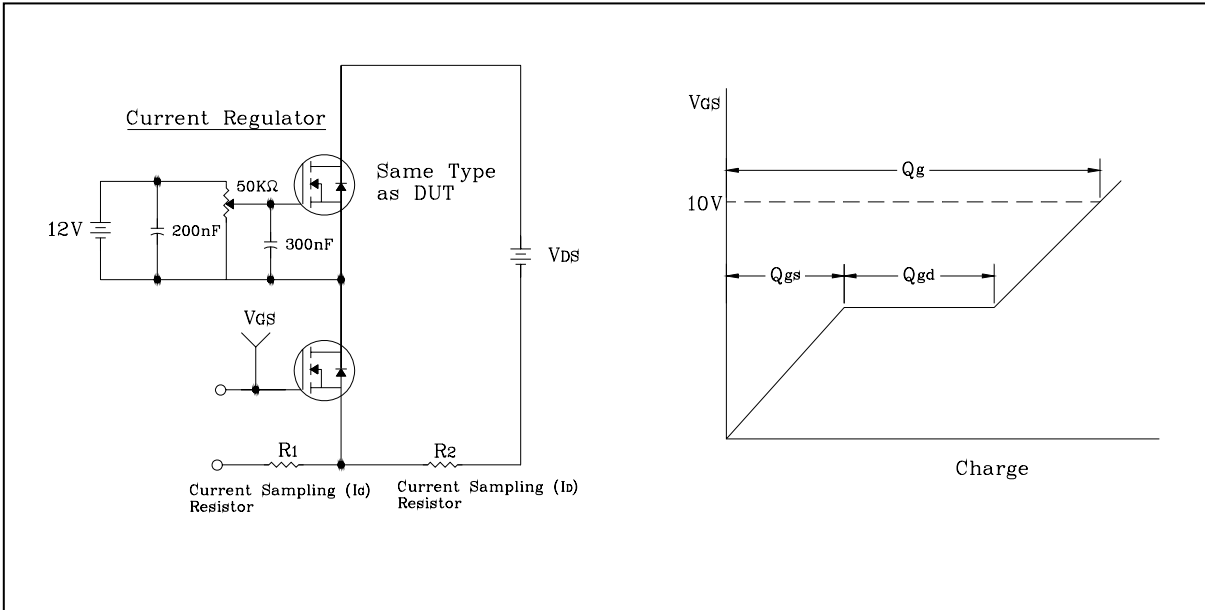


Fig. 12 Resistive Switching Test Circuit & Waveform

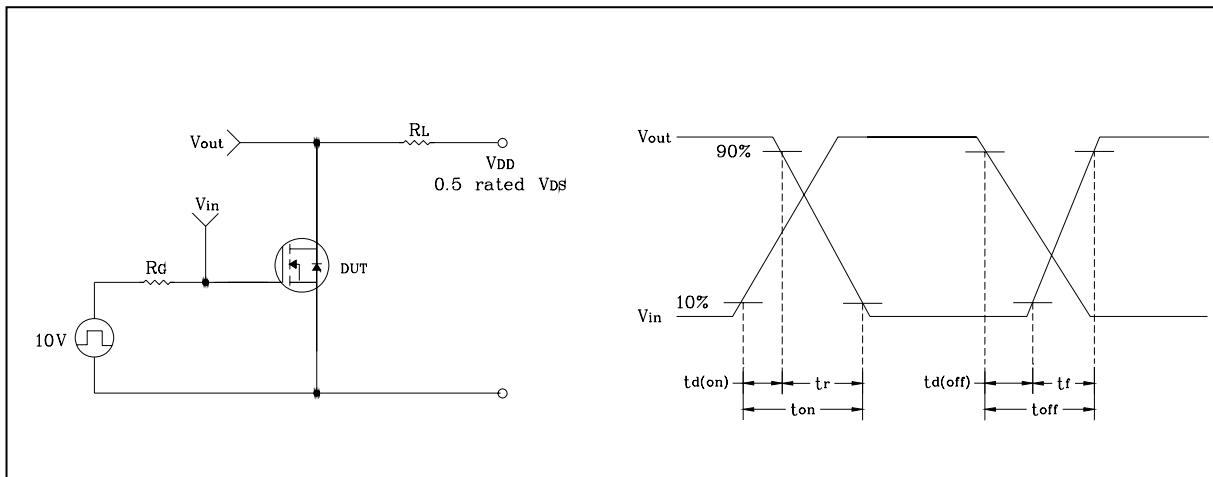


Fig. 13 EAS Test Circuit & Waveform

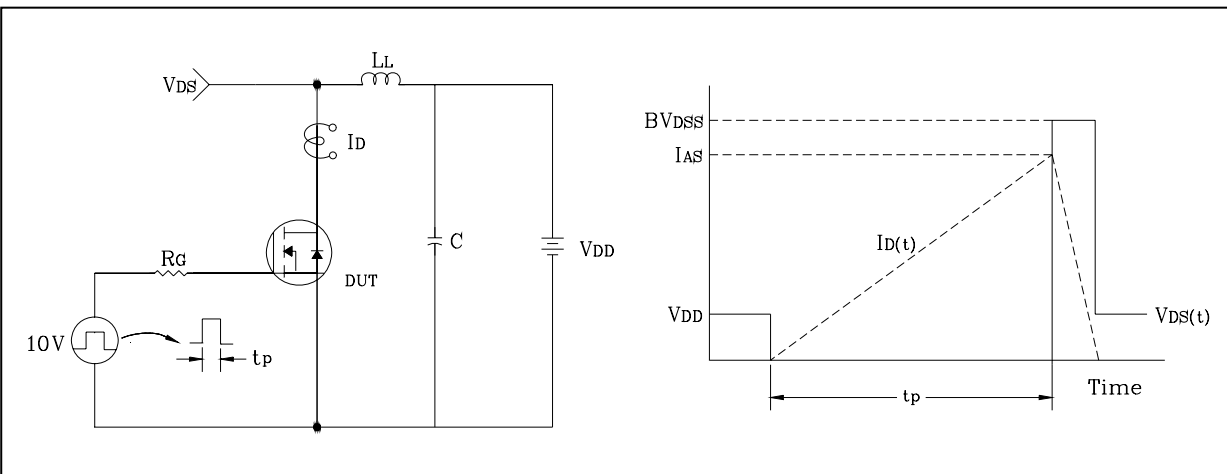
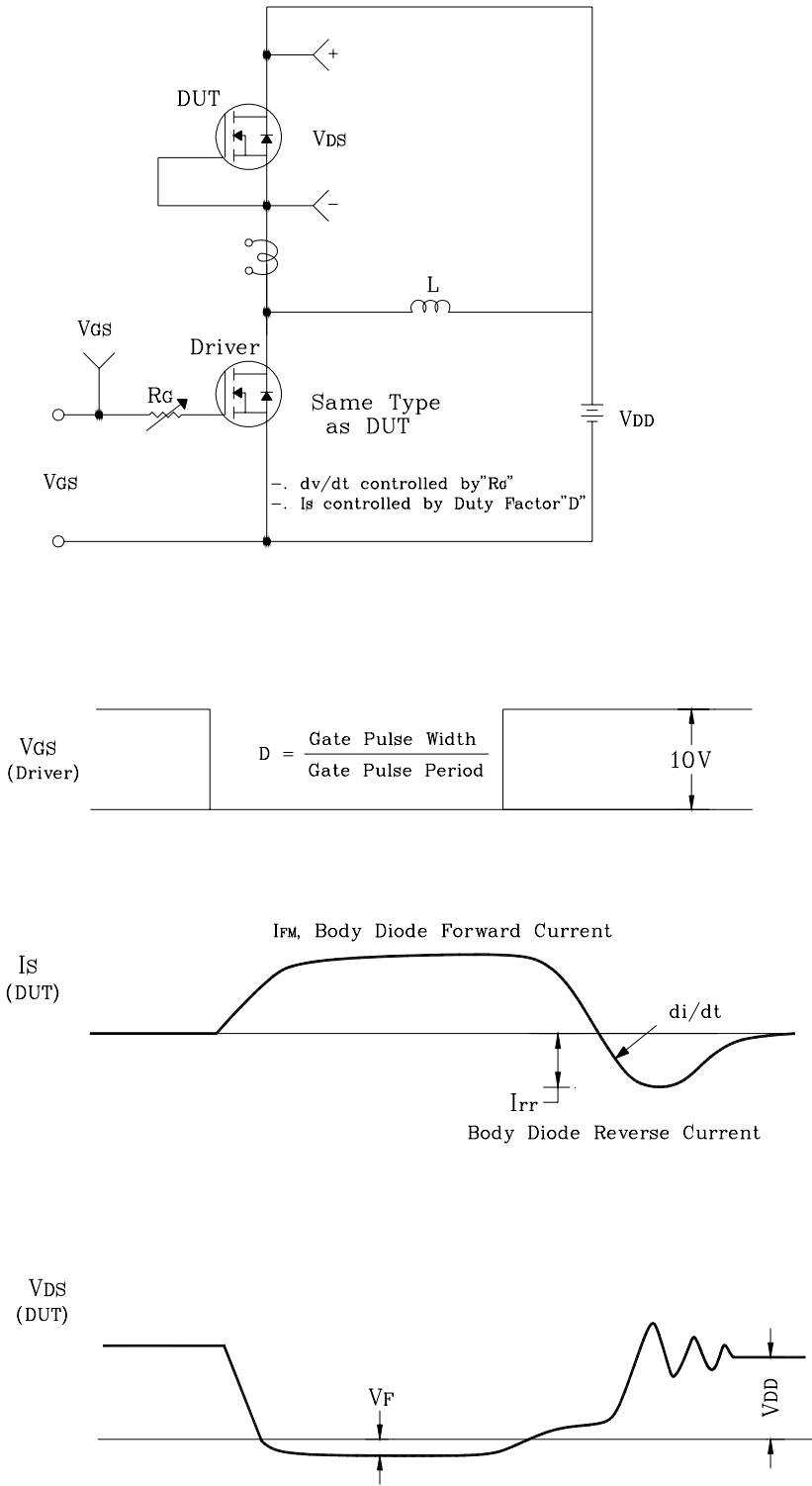
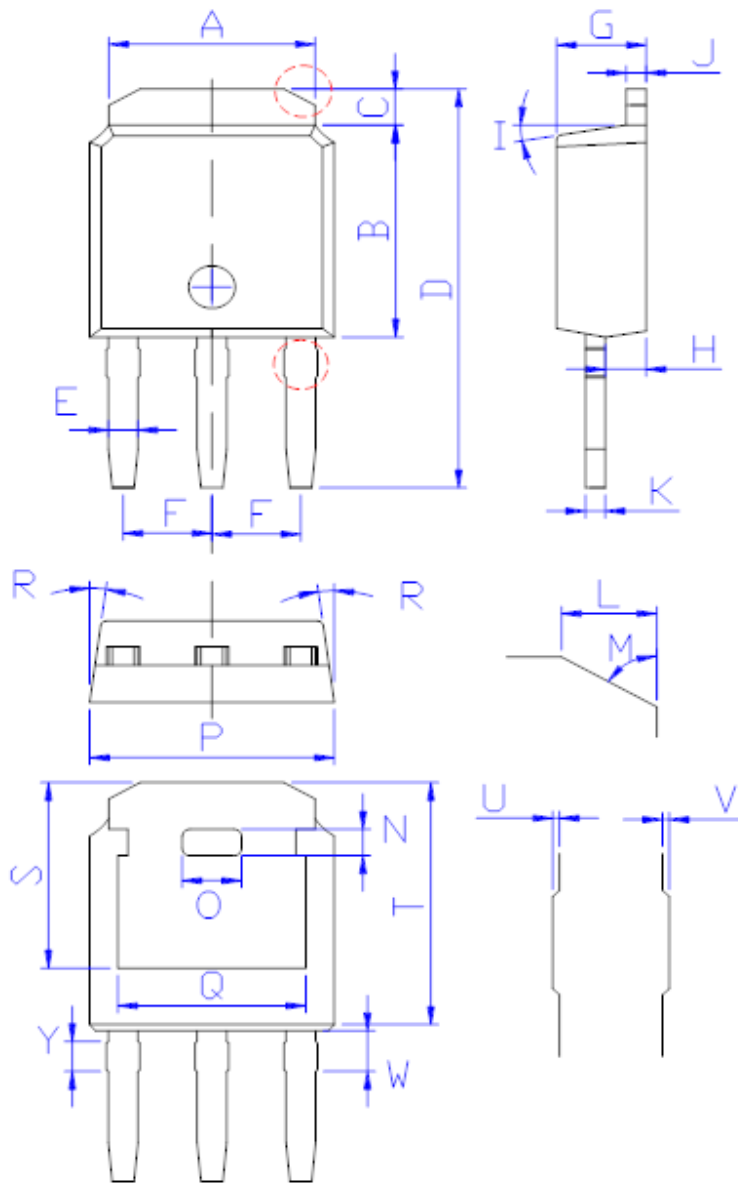


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



Outline Dimension

unit: mm



DIM	MILLIMETERS
A	5.34 ± 0.30
B	6.00 ± 0.30
C	1.05 ± 0.30
D	11.31 ± 0.30
E	0.76 ± 0.15
F	2.28 ± 0.15
G	2.30 ± 0.30
H	1.06 ± 0.30
I	(4-10)°
J	0.51 ± 0.15
K	0.52 ± 0.15
L	0.80 ± 0.30
M	60°
N	0.75 ± 0.30
O	1.80 ± 0.30
P	6.60 ± 0.30
Q	4.85 ± 0.30
R	(4-8.5)°
S	5.30 ± 0.30
T	6.90 ± 0.30
U	0.05 ± 0.05
V	0.05 ± 0.05
W	1.15 ± 0.25
Y	0.85 ± 0.25

(单位: mm)