MU4N60

Power MOSFET

## SWITCHING REGULATOR APPLICATIONS

Features

- High Voltage : BV_{DSS}=600V(Min.)
- Low C_{rss} : C_{rss}=14pF(Typ.)
- Low gate charge : Qg=16nC(Typ.)
- Low $R_{DS(on)}$: $R_{DS(on)}$=2.5Ω(Max.)

PIN Connection

TO-252

Ordering Information

Type No.	Marking	Package Code
MU4N60	MU4N60	TO-252
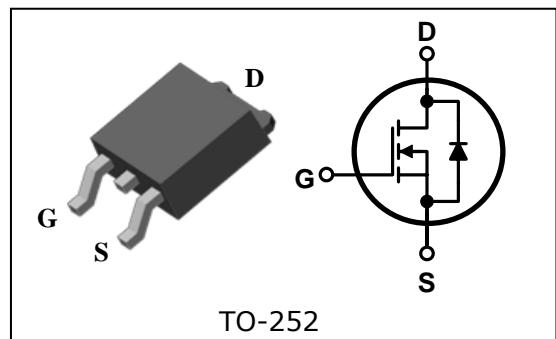
Absolute maximum ratings (T_C=25°C unless otherwise noted)

Characteristic		Symbol		Rating	Unit
Drain-source voltage		V_{DSS}		600	V
Gate-source voltage		V_{GSS}		±30	V
Drain current (DC) *	I_D		(Tc=25℃)	4.0	A
			(Tc=100℃)	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	°C
Storage temperature range		T_{stg}		-55~150	

 * Limited by maximum junction temperature

Characteristic		Symbol	Typ.	Max.	Unit
Thermal resistance	Junction-case	$R_{th(J-C)}$	-	1.56	°C/W
	Junction-ambient	$R_{th(J-A)}$	-	110	

Electrical Characteristics (T$_C$=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV$_{DSS}$	I$_D$=250uA, V$_{GS}$=0	600	-	-	V
Gate threshold voltage	V$_{GS(th)}$	I$_D$=250uA, V$_{DS}$=V$_{GS}$	2.0	-	4.0	V
Drain-source cut-off current	I$_{DSS}$	V$_{DS}$=600V, V$_{GS}$=0	-	-	10	uA
Gate leakage current	I$_{GSS}$	V$_{DS}$=0V, V$_{GS}$=±30V	-	-	±100	nA
Drain-source on-resistance ④	R$_{DS(ON)}$	V$_{GS}$=10V, I$_D$=3.25A		2.1	2.5	Ω
Forward transfer conductance ④	g$_{fs}$	V$_{DS}$=10V, I$_D$=0.5A	-	0.8	-	S
Input capacitance	Ciss	V$_{GS}$=0V, V$_{DS}$=25V, f=1MHz	-	710	920	pF
Output capacitance	Coss		-	65	85	pF
Reverse transfer capacitance	Crss		-	14	19	pF
Turn-on delay time	t$_{d(on)}$	V$_{DD}$=300V, I$_D$=4.4A R$_G$=25Ω ③④	-	20	50	ns
Rise time	t$_r$		-	55	120	ns
Turn-off delay time	t$_{d(off)}$		-	70	150	ns
Fall time	t$_f$		-	50	120	ns
Total gate charge	Q$_g$	V$_{DS}$=480V, V$_{GS}$=10V I$_D$=4.4A ③④	-	16	20	nC
Gate-source charge	Q$_{gs}$		-	3.4	-	nC
Gate-drain charge	Q$_{gd}$		-	7.0	-	nC

Source-Drain Diode Ratings and Characteristics (T$_C$=25°C unless otherwise noted)

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

Note ;

① Repetitive rating : Pulse width limited by maximum junction temperature

② L=1080mH, I$_{AS}$=0.3A, V$_{DD}$=50V, R$_G$=25Ω, Starting T$_J$=25℃

③ Pulse Test : Pulse width≤300us, Duty cycle≤2%

④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1 I_D - V_{DS}
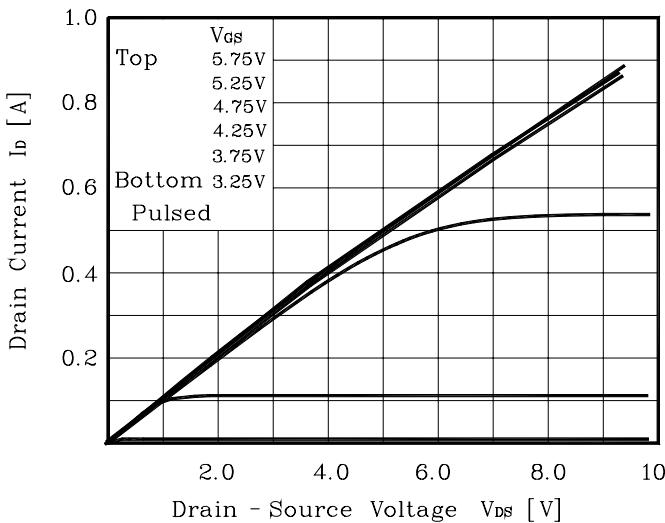

Fig. 2 I_D - V_{GS}
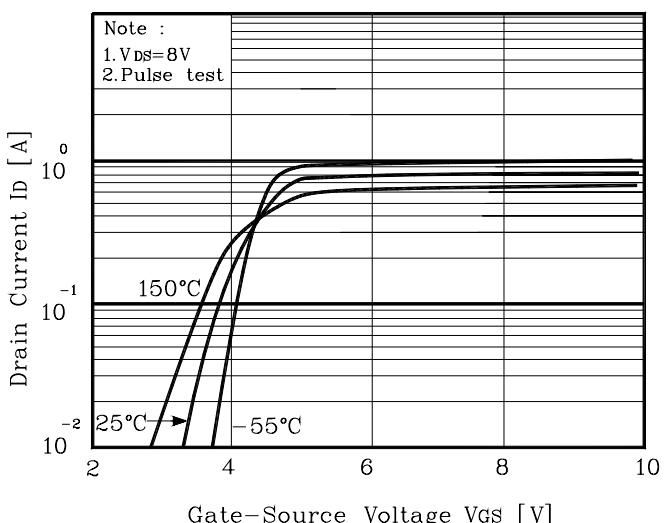
Fig. 3 $R_{DS(on)}$ - I_D
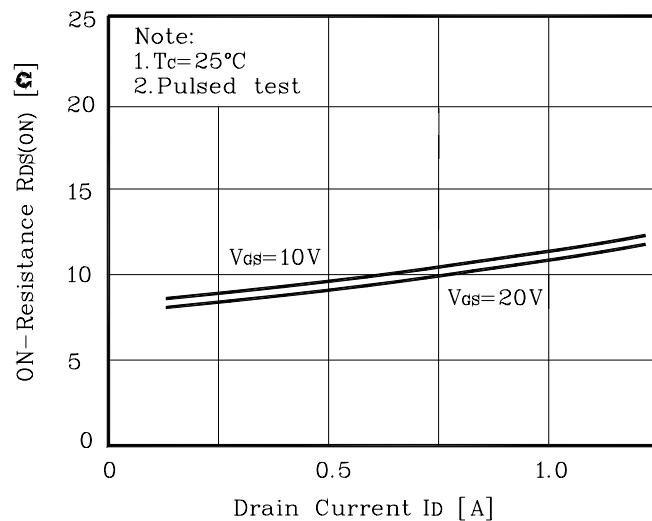
Fig. 4 I_S - V_{SD}
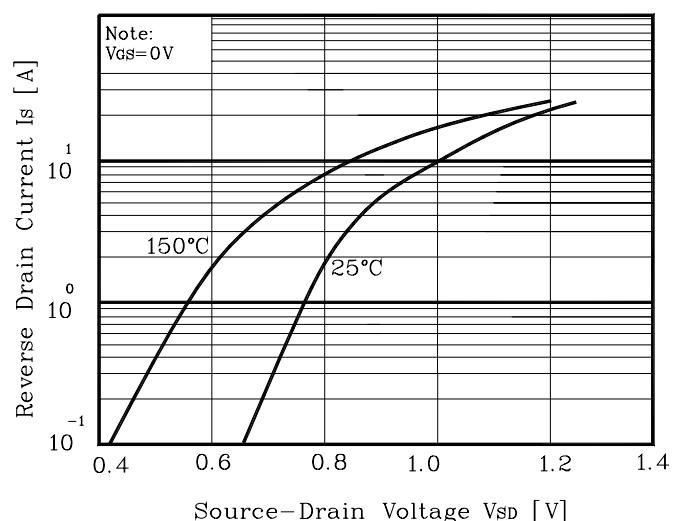
Fig. 5 Capacitance - V_{DS}

Fig. 6 V_{GS} - Q_G

Fig. 7 V_{DSS} - T_J

Note:
1. $V_{GS}=0V$
2. $I_D=250uA$

VDSS(Normalized)

Junction Temperature T_J [°C]

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

Note:
1. $V_{GS}=10V$
2. $I_D=1.0A$

RDS(ON)(Normalized)

Junction Temperature T_J [°C]

Fig. 9 I_D - T_a

Drain current I_D [A]

Case Temperature T_C [°C]
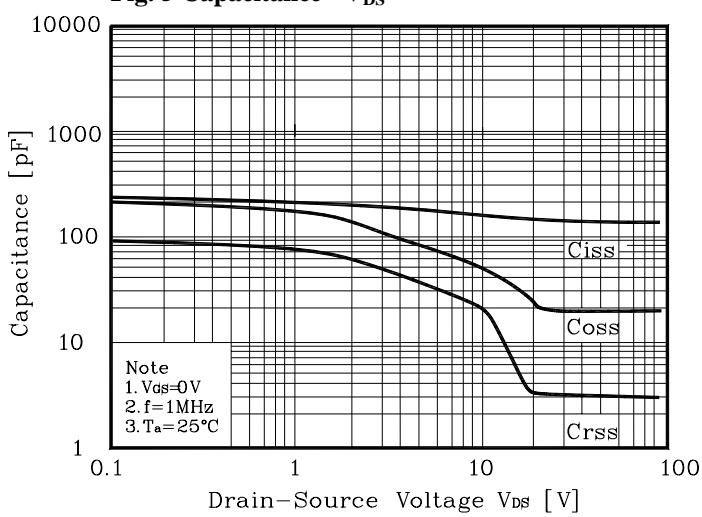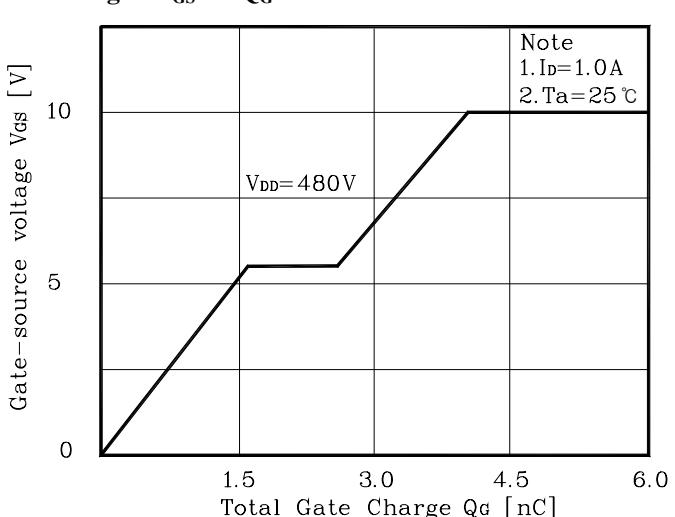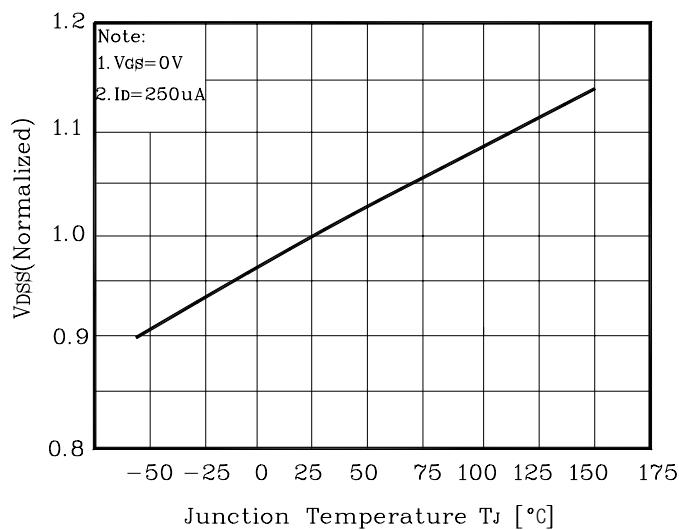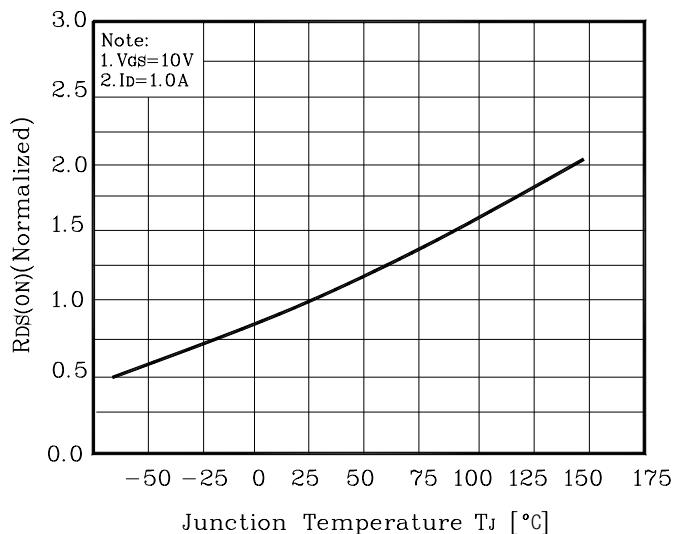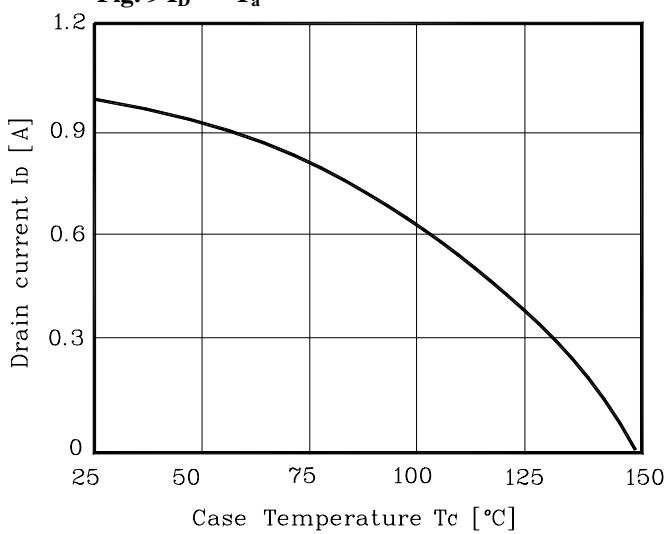
Fig. 10 Safe Operating Area

Operation in this area is limited by $R_{DS(on)}$

Note
1. $T_C=25°C$

I_D MAX (Pulsed)

I_D MAX (DC)

100us
1ms
10ms
100ms
DC

SINGLE NONREPETITIVE CURVES MUST BE DERATED LINEARLY WITH INCREASE IN TEMPERATURE.

VDSS MAX

Drain current I_D [A]

Drain−Source Voltage V_{DS} [V]
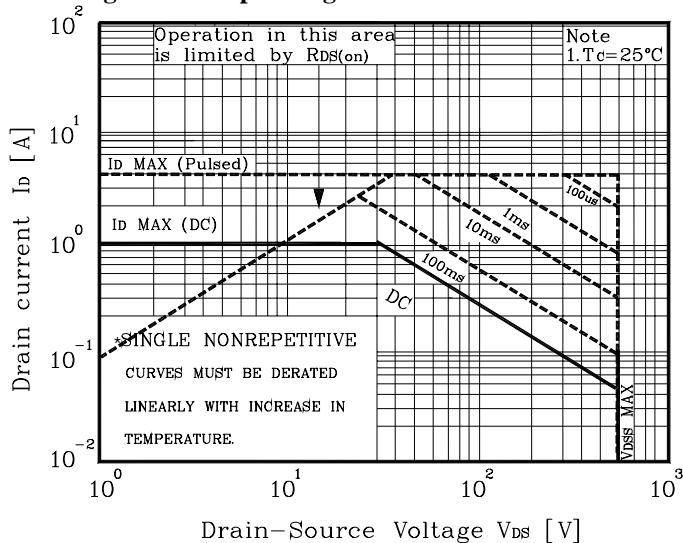
**Fig. 11 Gate Charge Test Circuit & Waveform**
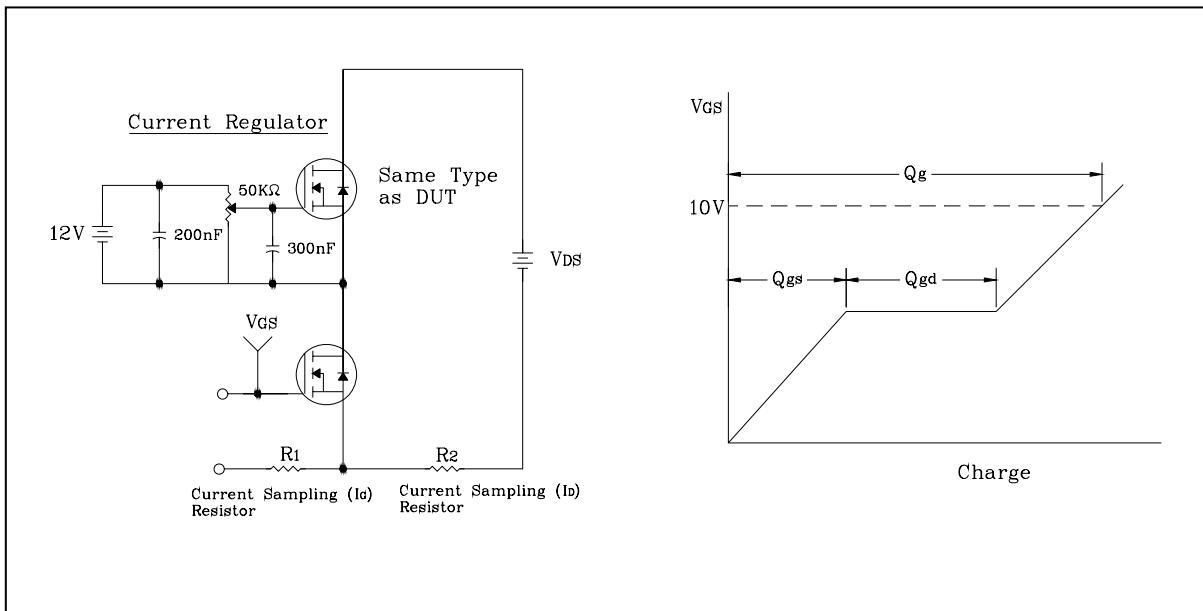
Fig. 12 Resistive Switching Test Circuit & Waveform
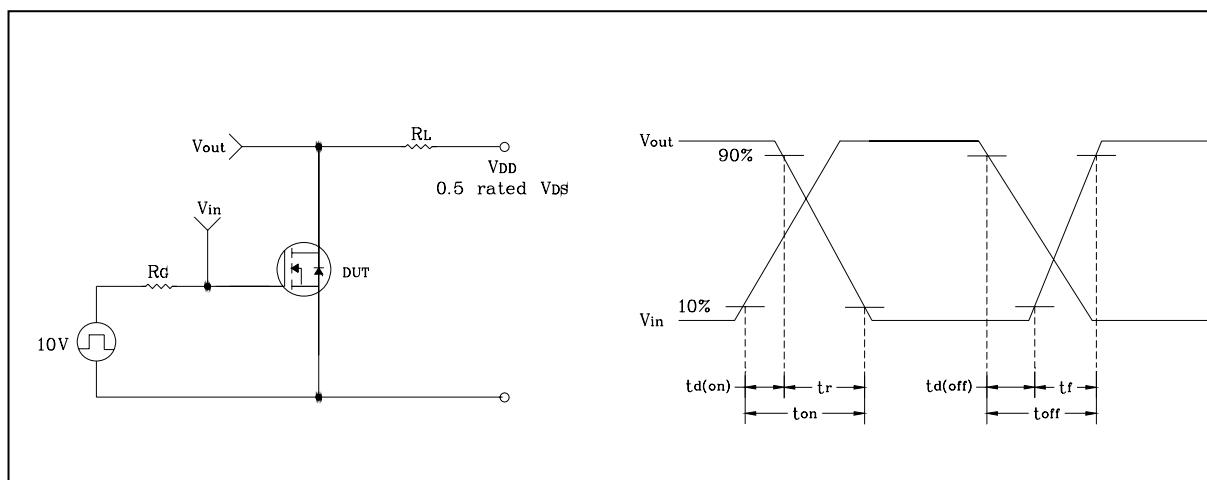
**Fig. 13 E$_{AS}$ Test Circuit & Waveform**
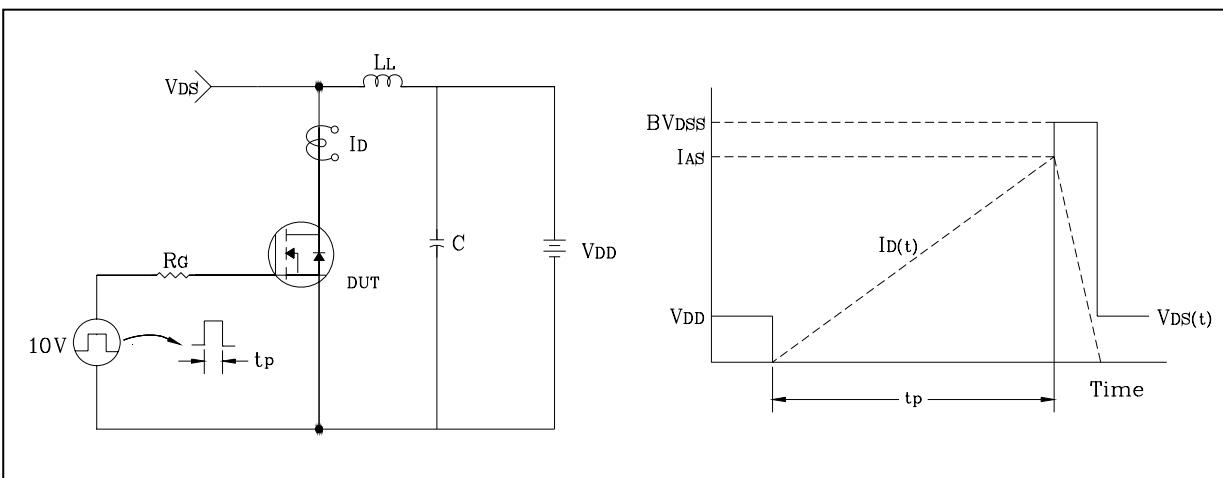
Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform

DUT

V_{DS}

+

−

L

V_{GS}

Driver

R_G

Same Type
as DUT

V_{DD}

V_{GS}

−. dv/dt controlled by"R_G"
−. Is controlled by Duty Factor"D"

V_{GS}

V_{GS}
(Driver)

$D = \dfrac{Gate\ Pulse\ Width}{Gate\ Pulse\ Period}$

10V

I_{FM}, Body Diode Forward Current

I_S
(DUT)

di/dt

Irr

Body Diode Reverse Current

V_{DS}
(DUT)

V_F

V_{DD}
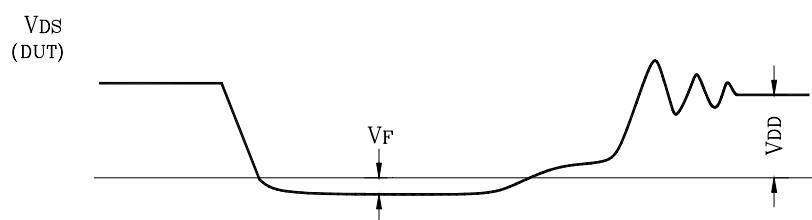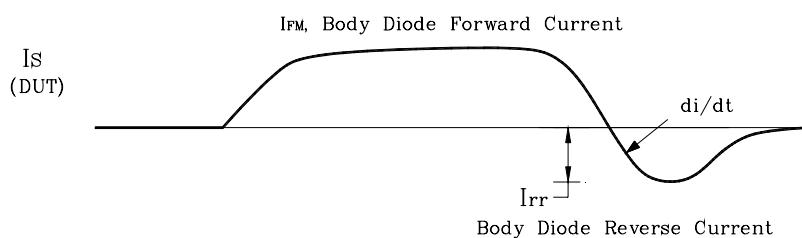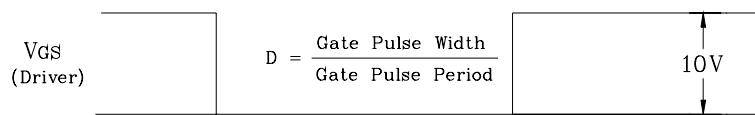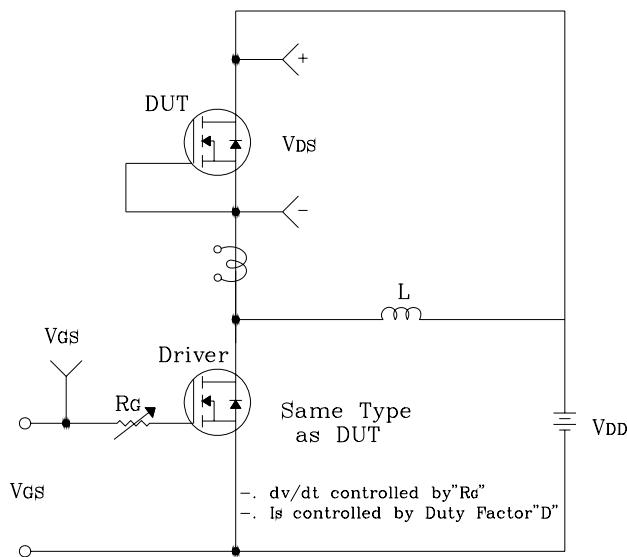
Outline Dimension

unit: mm