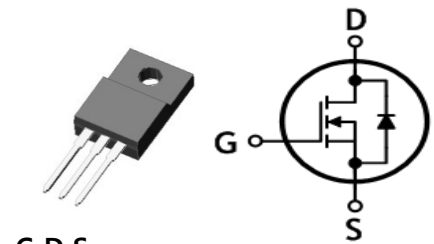


SWITCHING REGULATOR APPLICATIONS

Features

- High Voltage : $BV_{DSS}=650V(\text{Min.})$
- Low C_{rss} : $C_{rss}=16pF(\text{Typ.})$
- Low gate charge : $Q_g=35nC(\text{Typ.})$
- Low $R_{DS(on)}$: $R_{DS(on)}=0.85\Omega(\text{Max.})$



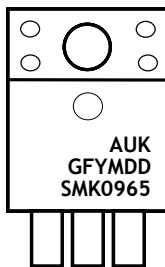
G D S

TO-220F-3L

Ordering Information

Part Number	Marking	Package
SMK0965AF	SMK0965	TO-220F-3L

Marking Diagram



Column 1 : Manufacturer

Column 2 : Production Information

e.g.) GFYMDD

- G : Option Code (H : Halogen Free)

- F : Factory Management Code

- YMDD : Date Code (Year, Month, Date)

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) *	I_D	$T_C=25^\circ\text{C}$	9	A
		$T_C=100^\circ\text{C}$	5.5	A
Drain current (Pulsed) *	I_{DM}	36	A	
Power dissipation	P_D	40	W	
Avalanche current (Single) ②	I_{AS}	9	A	
Single pulsed avalanche energy ②	E_{AS}	250	mJ	
Avalanche current (Repetitive) ①	I_{AR}	9	A	
Repetitive avalanche energy ①	E_{AR}	11.6	mJ	
Junction temperature	T_J	150	$^\circ\text{C}$	
Storage temperature range	T_{stg}	-55-150		

* Limited by maximum junction temperature

Characteristic	Symbol	Typ.	Max.	Unit
Thermal resistance	Junction-case	-	3.1	$^\circ\text{C}/\text{W}$
	Junction-ambient	-	62.5	

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 =250μA, V _{GS} =0V	650	-	-	V	
Gate threshold voltage	V _{GS(th)}	I _D =250μA, V _{DS} =V _{GS}	2.0	-	4.0	V	
Drain-source cut-off current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	-	1	μA	
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 =4.5A	-	0.72	0.85	Ω	
Forward transfer conductance ④	g _{fs}	V _{DS} =10V, I _D =4.5A	-	11	-	S	
Input capacitance	C _{iss}	V _{GS} =0V, V _{DS} =25V f=1 MHz	-	2040	2550	pF	
Output capacitance	C _{oss}		-	153	192		
Reverse transfer capacitance	C _{rss}		-	16	20		
Turn-on delay time	t _{d(on)}	V _{DD} =300V, I _D =9A R _G =25Ω	-	23	-	ns	
Rise time	t _r		-	69	-		
Turn-off delay time	t _{d(off)}		③ ④	-	144		-
Fall time	t _f		-	77	-		
Total gate charge	Q _g	V _{DS} =520V, V _{GS} =10V I _D =9A	-	35	57	nC	
Gate-source charge	Q _{gs}		③ ④	-	10		-
Gate-drain charge	Q _{gd}		-	-	9		-

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	-	-	9	A
Source current (Pulsed) ①	I _{SM}		-	-	36	
Forward voltage ④	V _{SD}	V _{GS} =0V, I _S =9A	-	-	1.4	V
Reverse recovery time	t _{rr}	I _S =9A, V _{GS} =0V	-	420	-	ns
Reverse recovery charge	Q _{rr}	dI _F /dt=100A/μs	-	4.2	-	μC

Note ;

- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=5.7mH, I_{AS}=9A, V_{DD}=50V, R_G=25Ω, Starting T_J=25°C
- ③ Pulse Test : Pulse width≤300μs, Duty cycle≤2%
- ④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1 $I_D - V_{DS}$

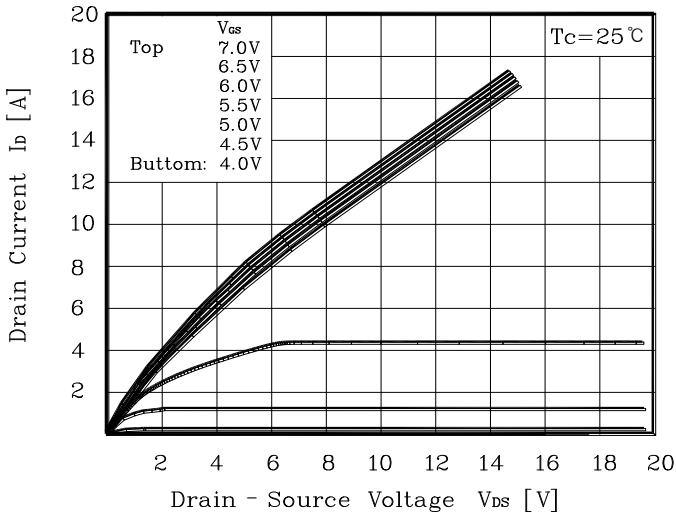


Fig. 2 $I_D - V_{GS}$

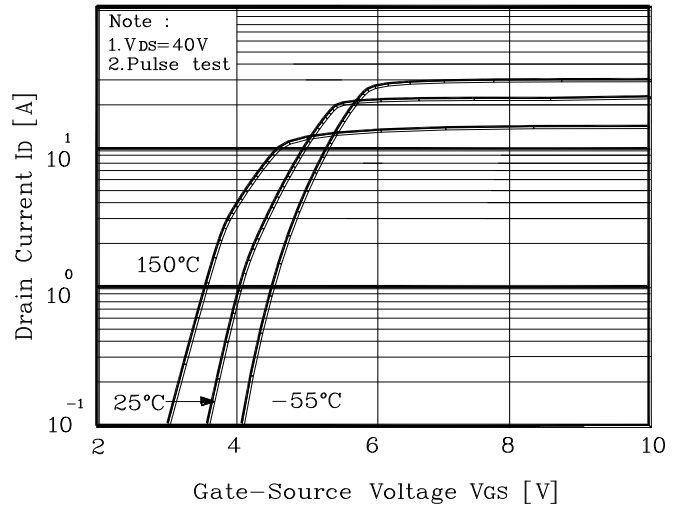


Fig. 3 $R_{DS(on)} - I_D$

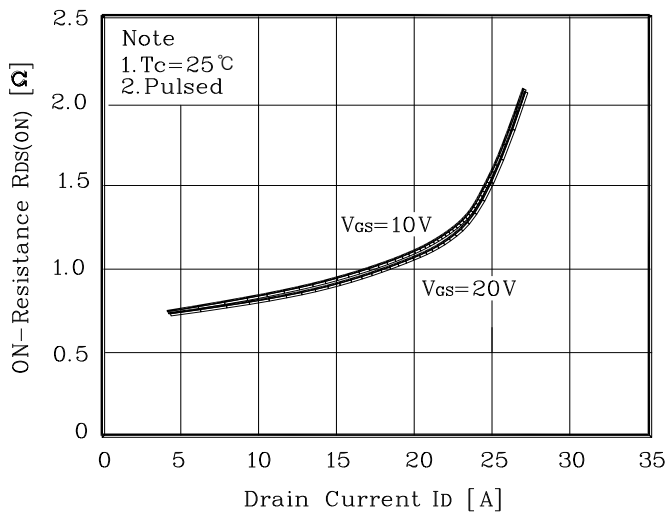


Fig. 4 $I_S - V_{SD}$

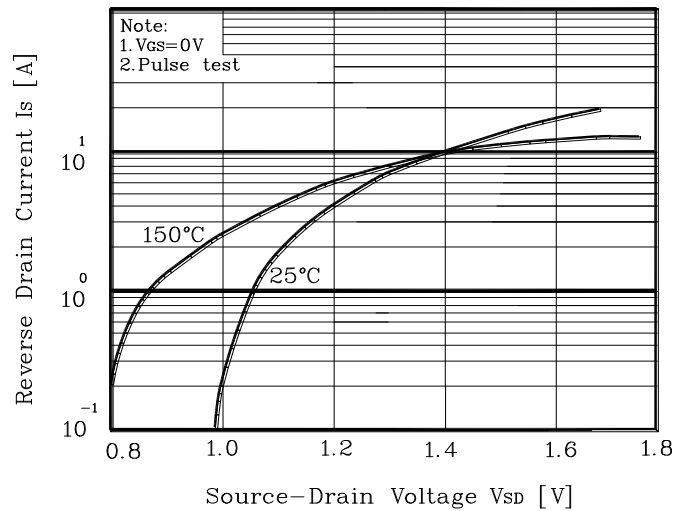


Fig. 5 Capacitance - V_{DS}

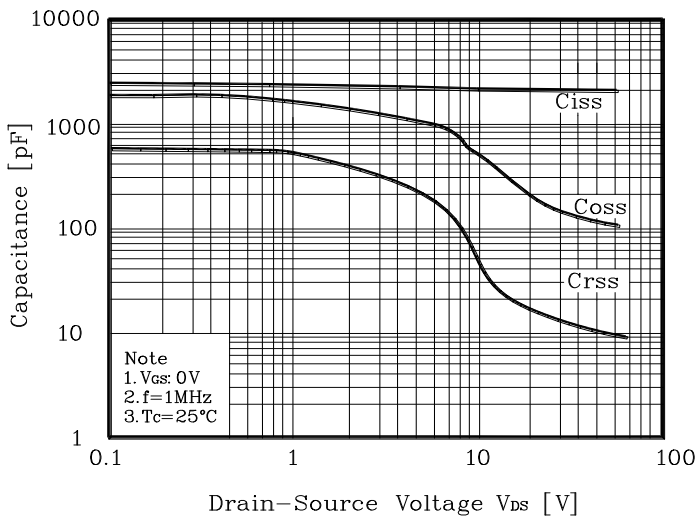
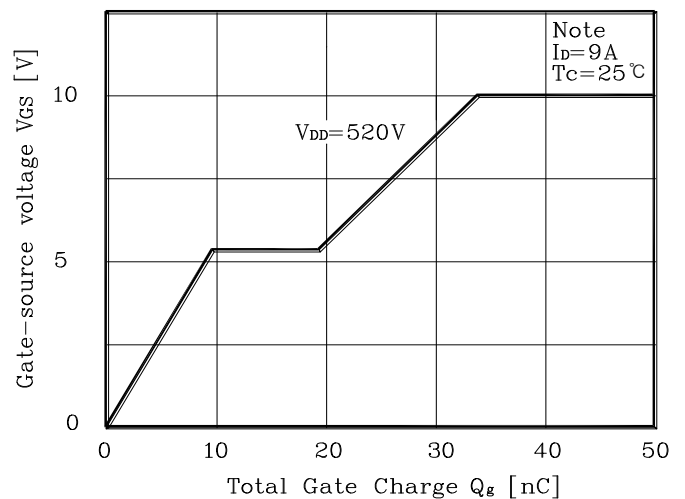


Fig. 6 $V_{GS} - Q_G$



Electrical Characteristic Curves

Fig. 7 $V_{DSS} - T_J$

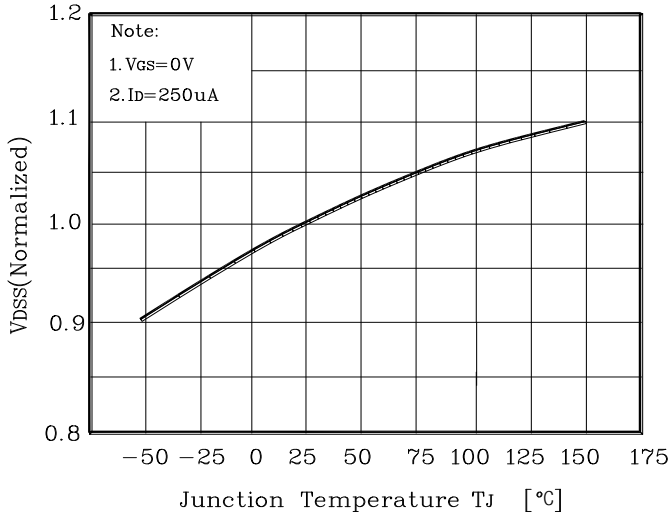


Fig. 8 $R_{DS(on)} - T_J$

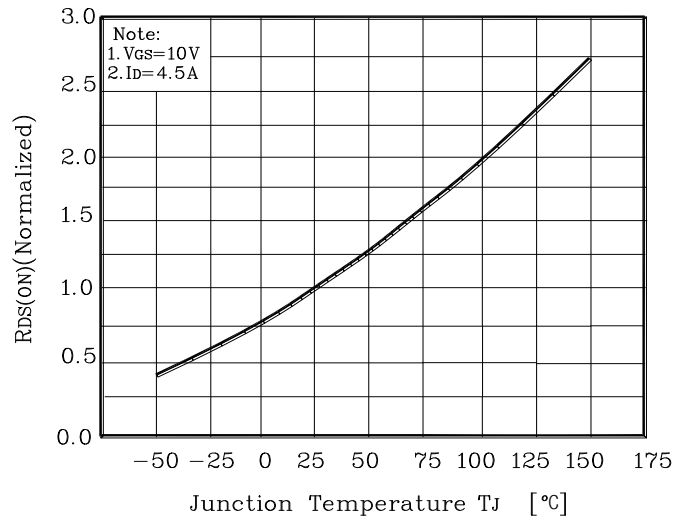


Fig. 9 $I_D - T_C$

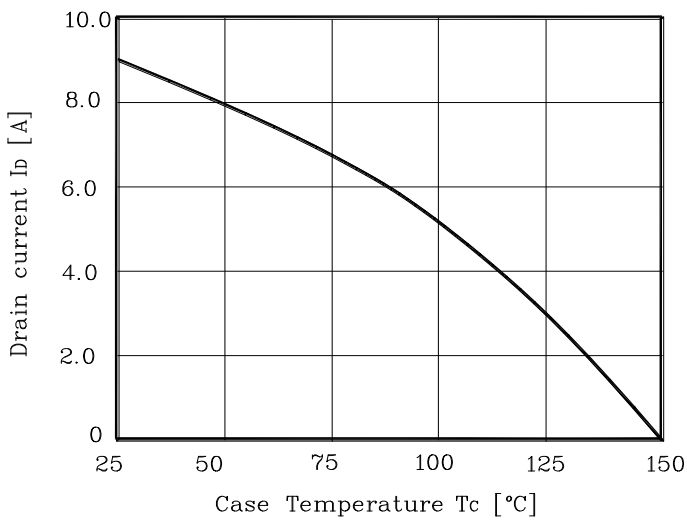


Fig. 10 Safe Operating Area

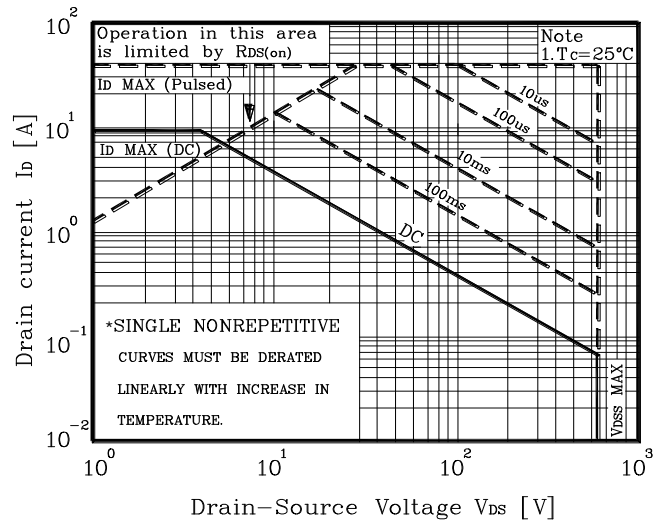


Fig. 11 Gate Charge Test Circuit & Waveform

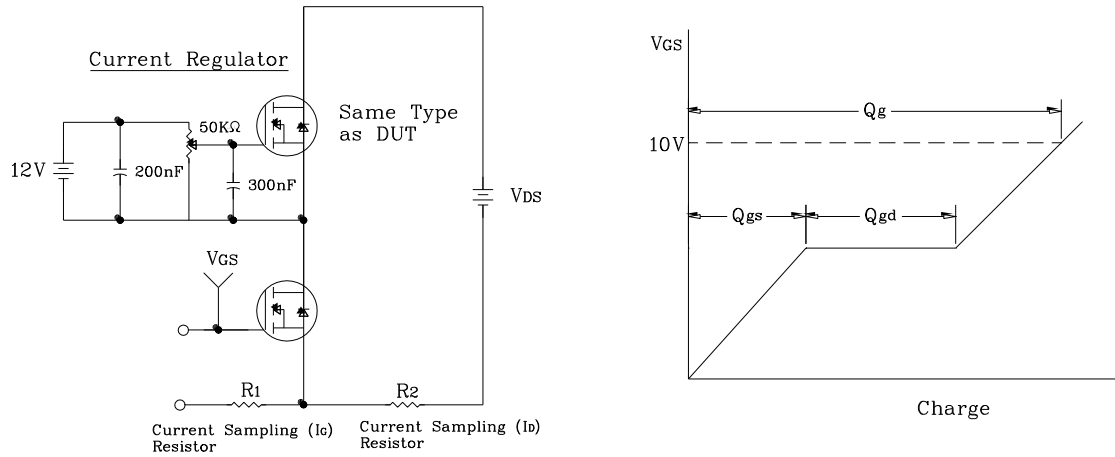


Fig. 12 Resistive Switching Test Circuit & Waveform

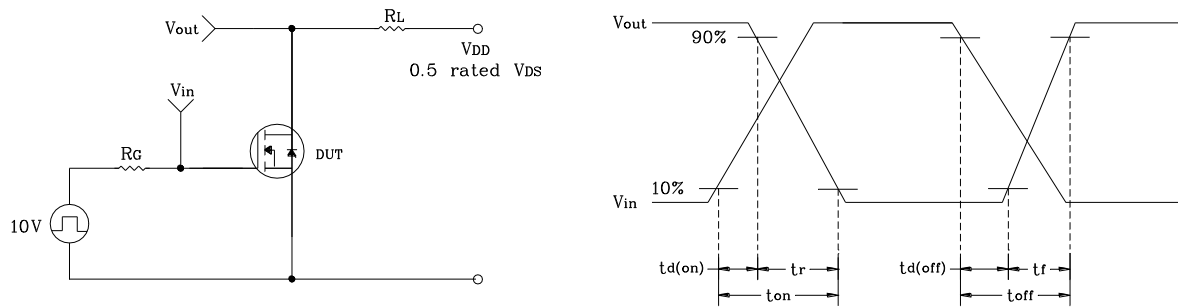


Fig. 13 E_{AS} Test Circuit & Waveform

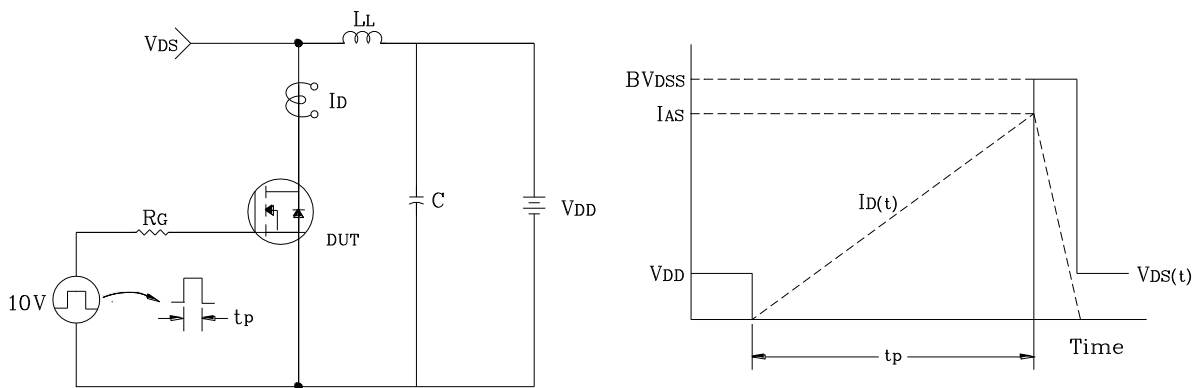
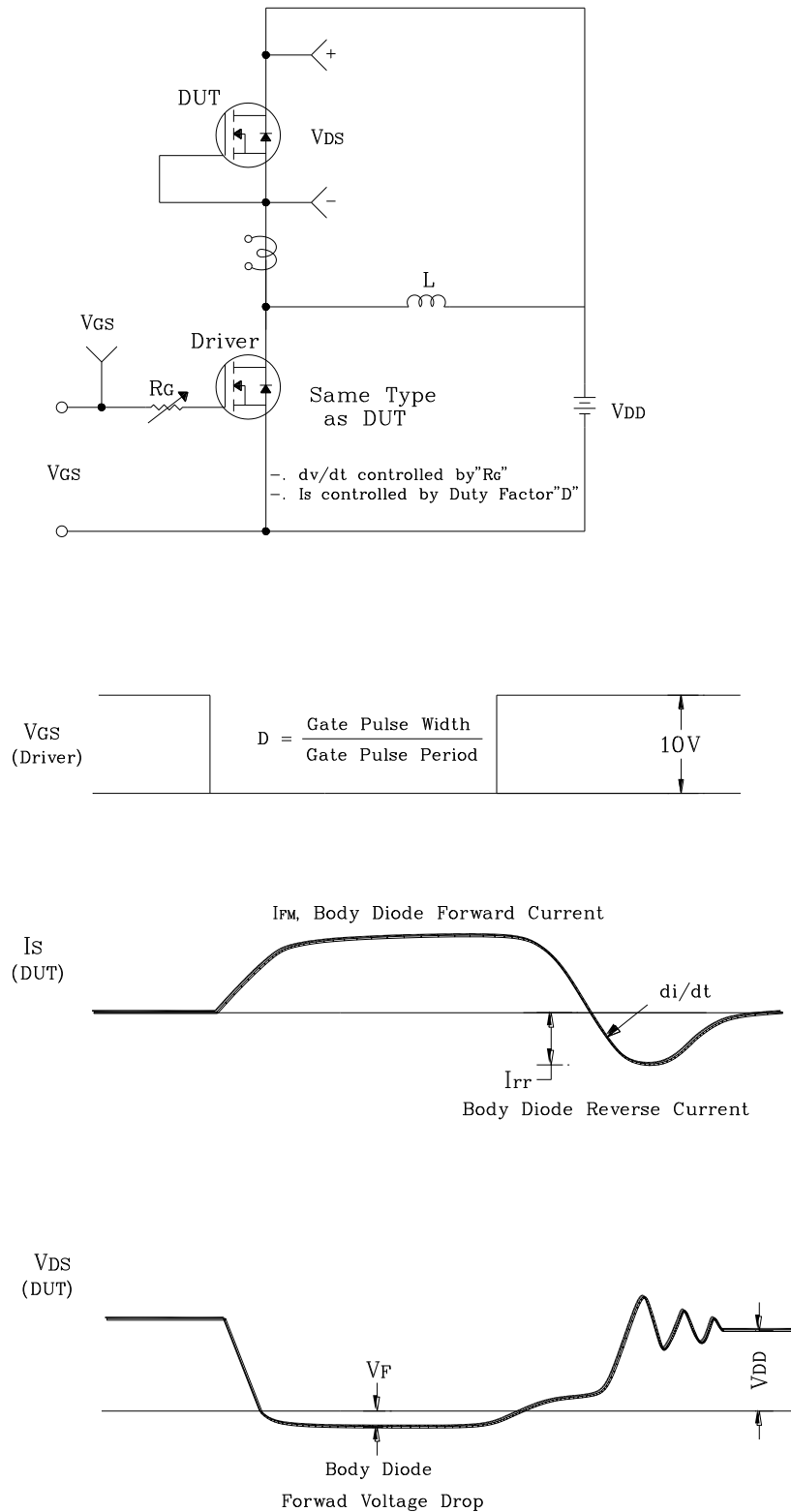
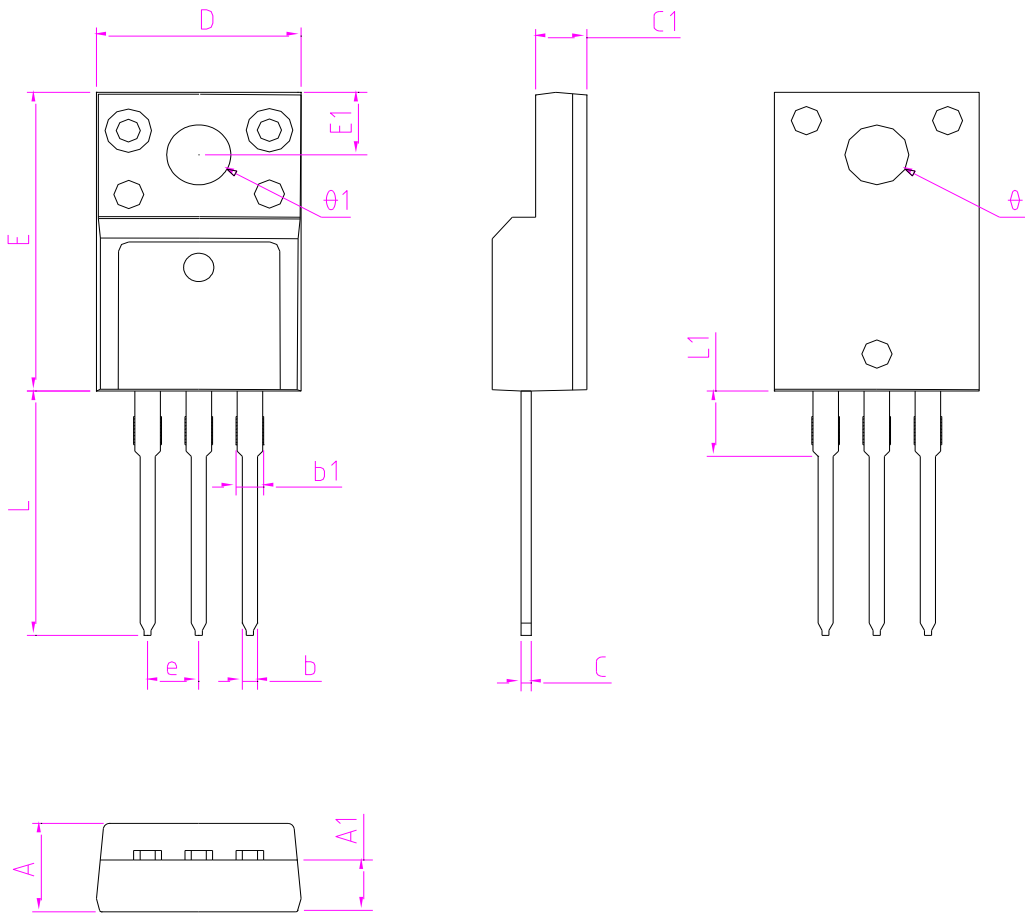


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



Package Outline Dimension



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	4.65	4.70	4.75	
A1	2.71	2.76	2.81	
b	0.70	0.80	0.90	
b1	1.28	1.38	1.43	
C	0.40	0.50	0.60	
C1	2.04	2.54	3.04	
D	10.06	10.16	10.26	
e	2.54 REF			
E	15.77	15.87	15.97	
E1	3.05	3.30	3.55	
L	12.68	12.98	13.28	
L1	3.18 REF			
θ	3.30	3.40	3.50	
θ1	3.08	3.18	3.28	

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