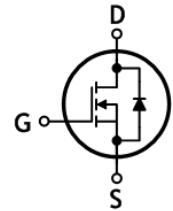
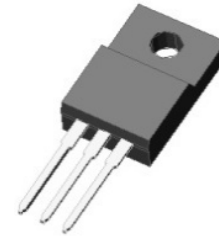


HIGH SPEED SWITCHING APPLICATION

Features

- Low drain-source On resistance: $R_{DS(on)}=2.1\Omega$ (Typ.)
- Low gate charge: $Q_g=12nC$ (Typ.)
- Low reverse transfer capacitance: $C_{rss}=6.3pF$ (Typ.)
- Lower EMI noise
- RoHS compliant device
- 100% avalanche tested



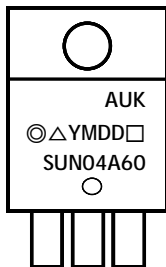
G D S

TO-220F-3L

Ordering Information

Part Number	Marking	Package
SUN04A60F	SUN04A60	TO-220F-3L

Marking Information



Column 1: Manufacturer
Column 2: Production Information

e.g.) ◎△YMDD□

- . ◎: Option Code

- . △: Factory Management Code

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

- . □: Package Option Code

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}	±30	V	
Drain current (DC) *	I_D	$T_c=25^\circ\text{C}$	4	A
		$T_c=100^\circ\text{C}$	2.53	A
Drain current (Pulsed) *	I_{DM}	16	A	
Single avalanche energy ^(Note 2)	E_{AS}	87.3	mJ	
Repetitive avalanche current ^(Note 1)	I_{AR}	4	A	
Repetitive avalanche energy ^(Note 1)	E_{AR}	3.2	mJ	
Power dissipation	P_D	32	W	
Junction temperature	T_J	150	°C	
Storage temperature range	T_{stg}	-55-150	°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	$V_{GS(th)}$	$I_D=250\mu\text{A}$, $V_{DS}=V_{GS}$	3	-	5	V
Drain-source cut-off current	I_{DSS}	$V_{DS}=600\text{V}$, $V_{GS}=0\text{V}$	-	-	1	μA
		$V_{DS}=600\text{V}$, $T_C=150^\circ\text{C}$	-	-	100	μA
Gate leakage current	I_{GSS}	$V_{DS}=0\text{V}$, $V_{GS}=\pm 30\text{V}$	-	-	± 100	nA
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=2\text{A}$	-	2.1	2.5	Ω
Forward transfer conductance (Note 3)	g_{fs}	$V_{DS}=10\text{V}$, $I_D=2\text{A}$	-	5	-	S
Input capacitance	C_{iss}	$V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$, $f=1.0\text{MHz}$	-	720	-	pF
Output capacitance	C_{oss}		-	53	-	
Reverse transfer capacitance	C_{rss}		-	6.3	-	
Turn-on delay time (Note 3,4)	$t_{d(on)}$	$V_{DS}=300\text{V}$, $I_D=4\text{A}$, $R_G=25\Omega$	-	47	-	ns
Rise time (Note 3,4)	t_r		-	33	-	
Turn-off delay time (Note 3,4)	$t_{d(off)}$		-	78	-	
Fall time (Note 3,4)	t_f		-	24	-	
Total gate charge (Note 3,4)	Q_g	$V_{DS}=480\text{V}$, $V_{GS}=10\text{V}$, $I_D=4\text{A}$	-	12	15	nC
Gate-source charge (Note 3,4)	Q_{gs}		-	5	-	
Gate-drain charge (Note 3,4)	Q_{gd}		-	2.5	-	

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	-	-	4	A
Source current (Pulsed)	I_{SM}		-	-	16	A
Forward voltage	V_{SD}	$V_{GS}=0\text{V}$, $I_{SD}=4\text{A}$	-	-	1.4	V
Reverse recovery time (Note 3,4)	t_{rr}	$I_{SD}=4\text{A}$, $V_{GS}=0\text{V}$ $di_F/dt=100\text{A}/\mu\text{s}$	-	472	-	ns
Reverse recovery charge (Note 3,4)	Q_{rr}		-	0.98	-	μC

Note:

1. Repeated rating: Pulse width limited by safe operating area
2. $L=10\text{mH}$, $I_{AS}=4\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$
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

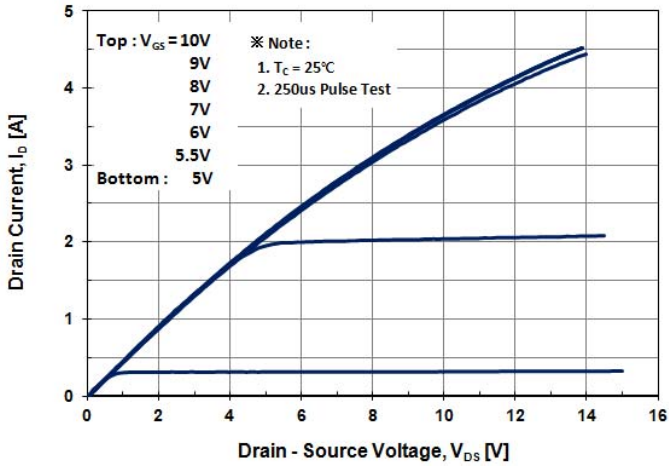


Fig. 2 Typical Output Characteristics

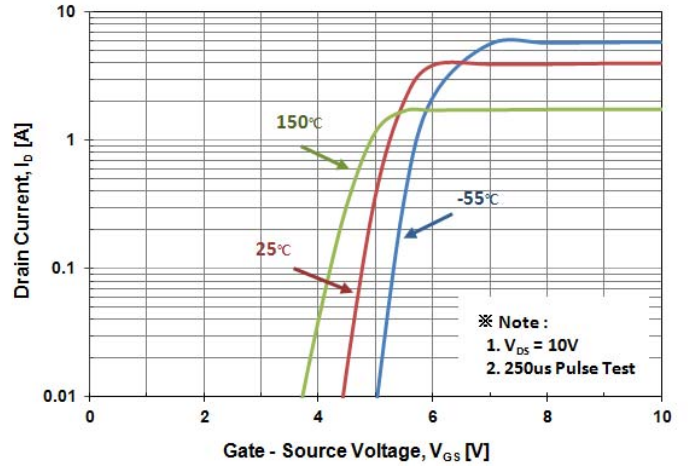


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

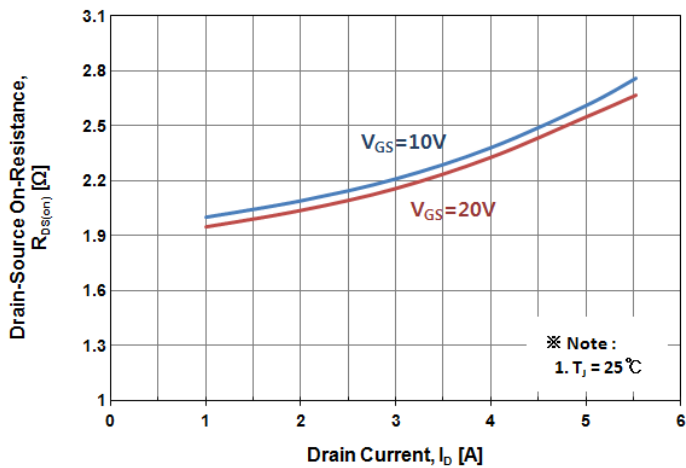


Fig. 4 Body Diode Forward Voltage Variation with Source Current

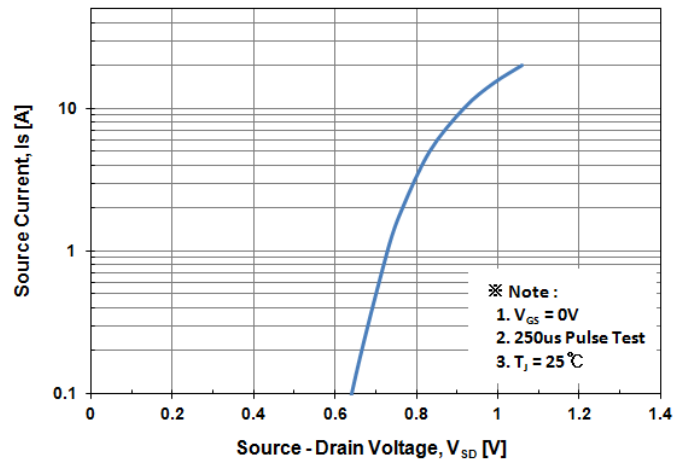


Fig. 5 Typical Capacitance Characteristics

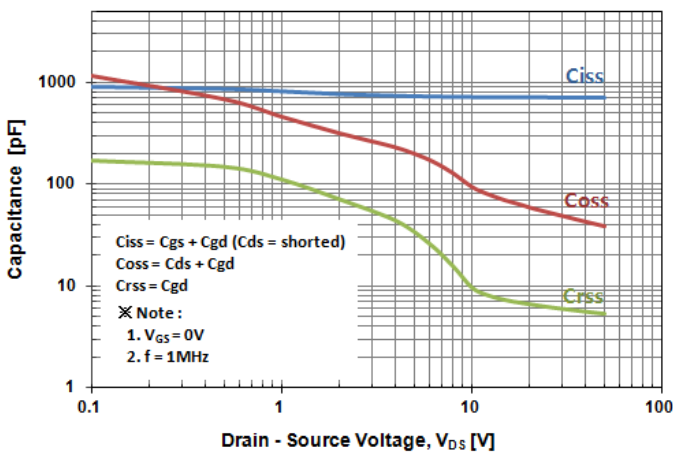


Fig. 6 Typical Total Gate Charge Characteristics

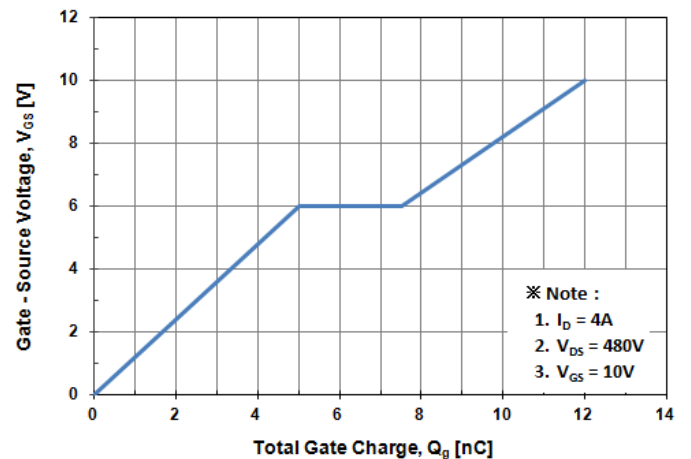


Fig. 7 Breakdown Voltage Variation vs. Temperature

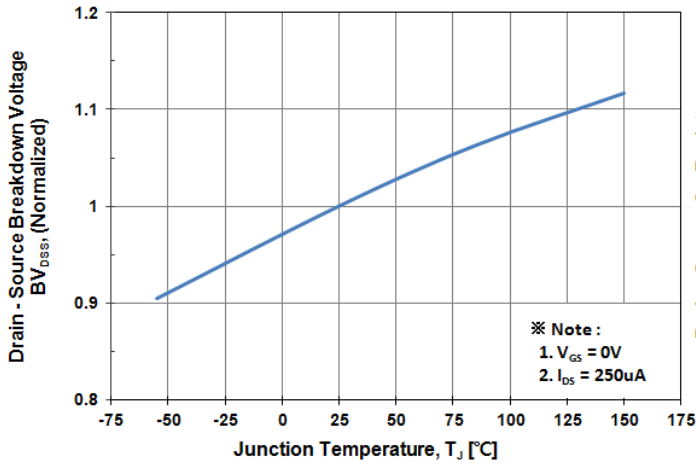


Fig. 8 On-Resistance Variation vs. Temperature

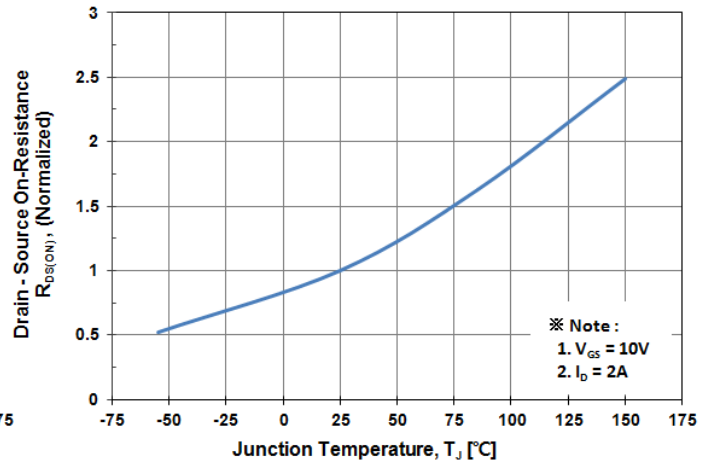


Fig. 9 Maximum Drain Current vs. Case Temperature

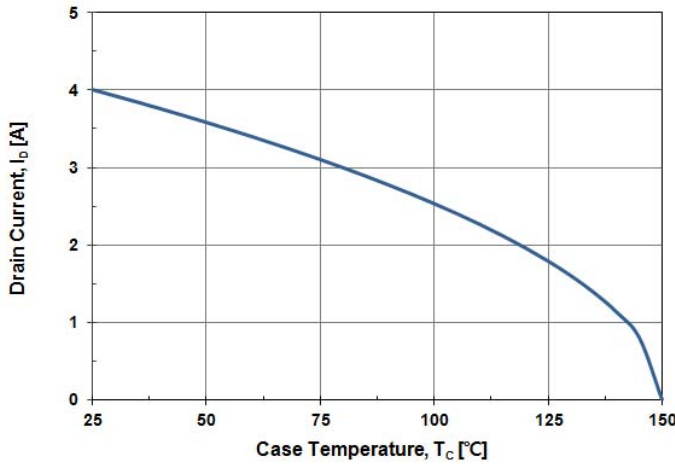


Fig. 10 Maximum Safe Operating Area

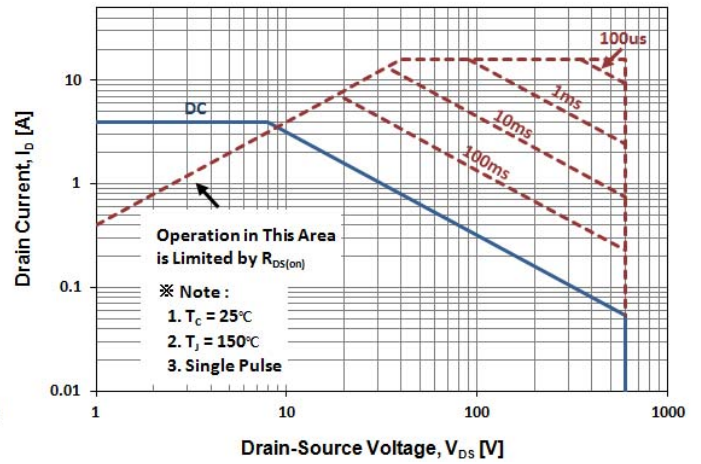


Fig. 11 Transient Thermal Impedance

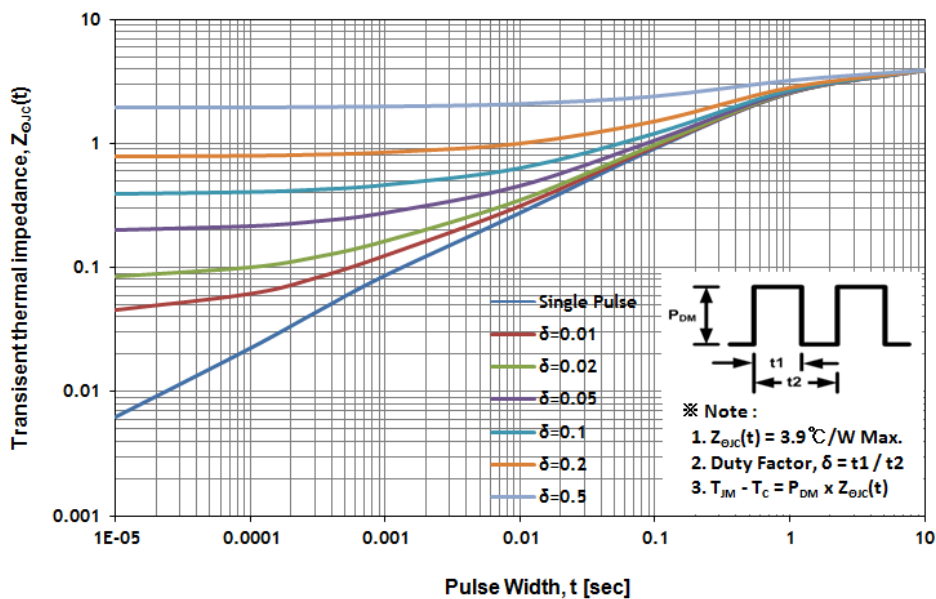


Fig. 12 Gate Charge Test Circuit & Waveform

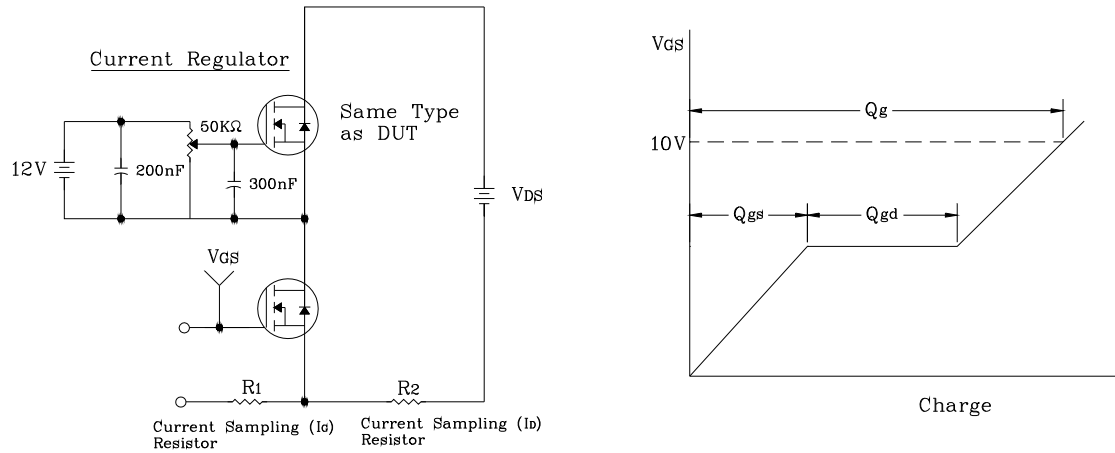


Fig. 13 Resistive Switching Test Circuit & Waveform

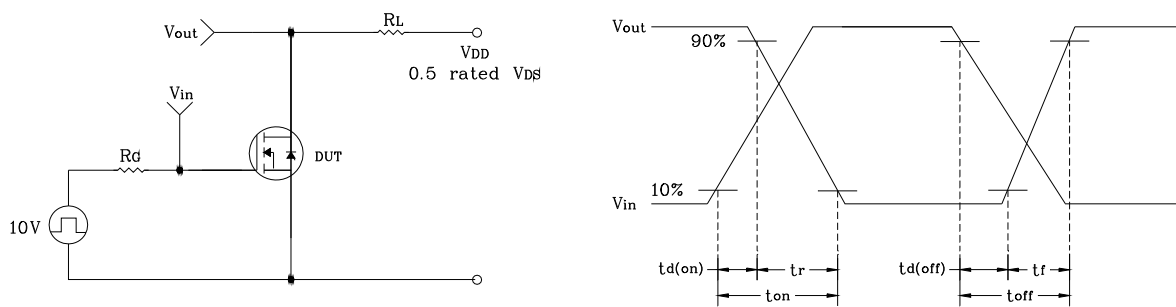


Fig. 14 E_{AS} Test Circuit & Waveform

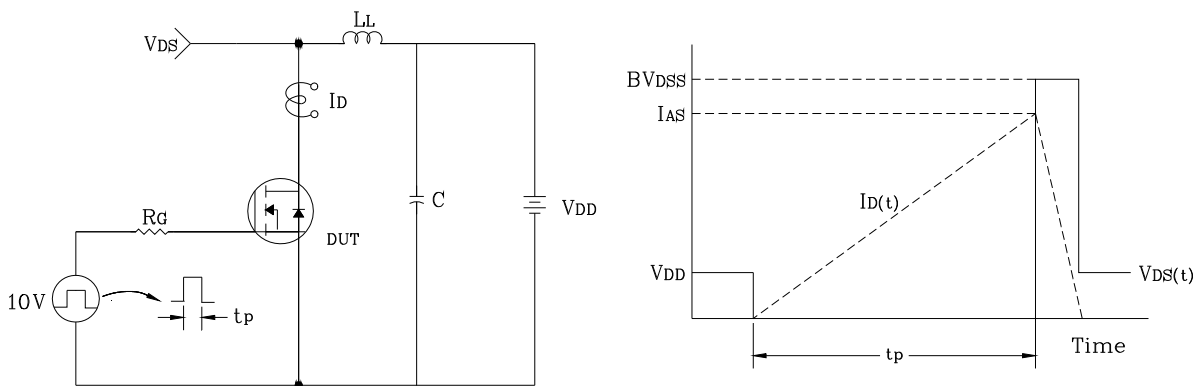
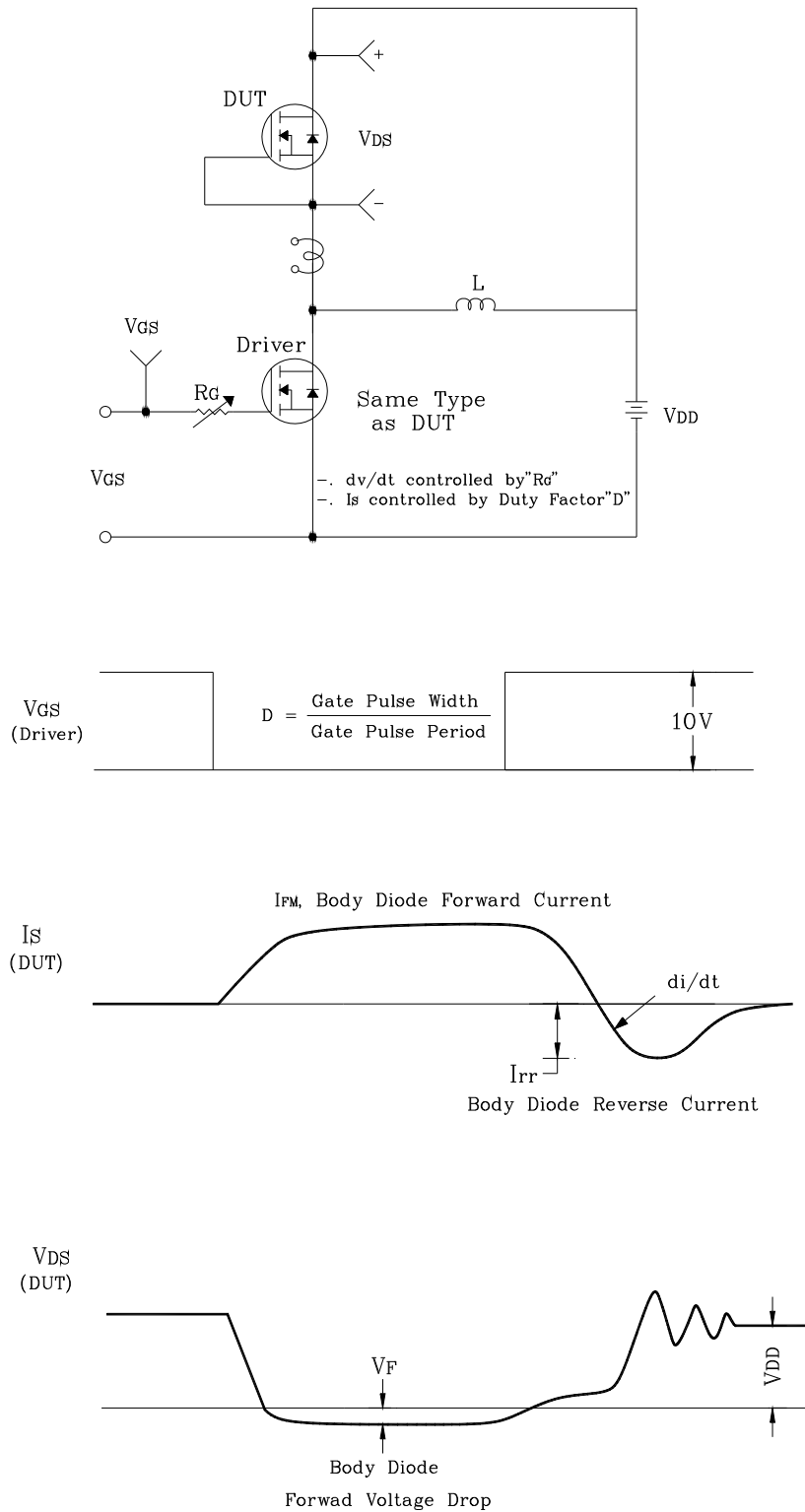
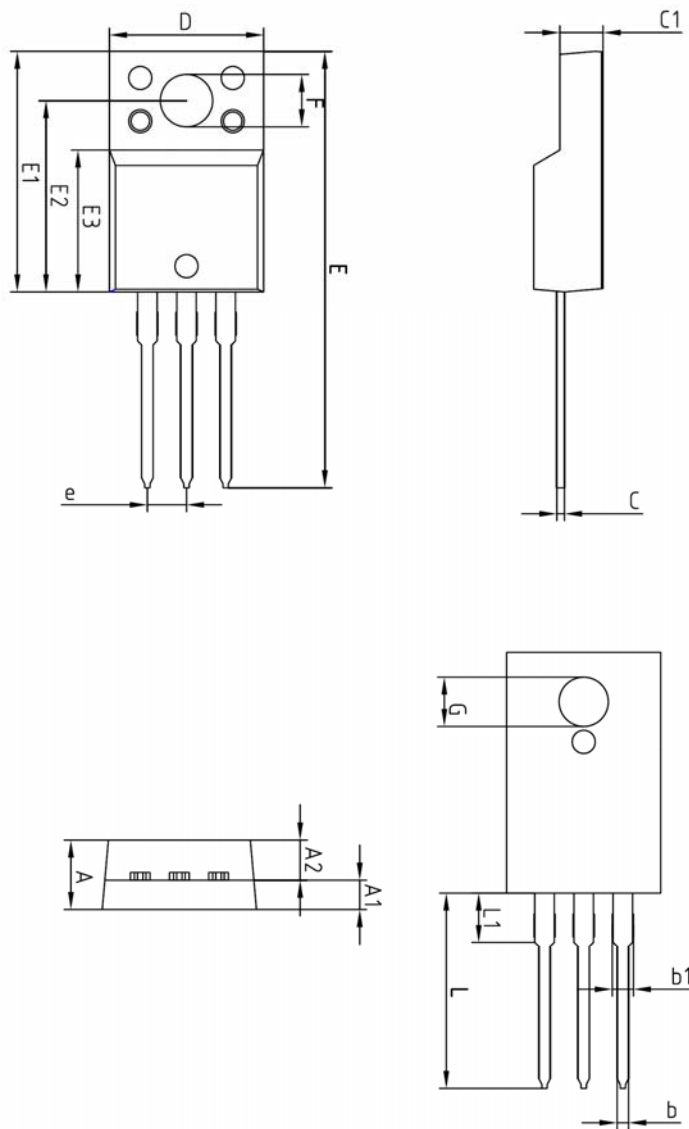


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



Package Outline Dimensions



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	-	-	4.60	
A1	2.45	2.50	2.55	
A2	1.95	2.00	2.05	
b	0.65	0.75	0.85	
b1	1.07	1.27	1.47	
C	0.40	0.50	0.60	
C1	2.70	2.80	2.90	
D	9.90	10.00	10.10	
E	28.00	-	28.60	
E1	15.50	15.60	15.70	
E2	12.30	12.40	12.50	
E3	9.15	9.20	9.25	
F	3.30	3.40	3.50	
G	3.10	3.20	3.30	
e	2.54 BSC			
L	12.40	-	13.00	
L1	3.46 BSC			

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