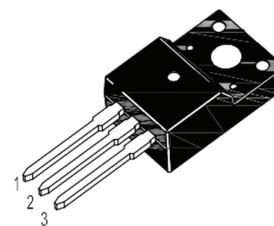
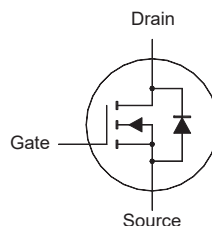


N-Channel Enhancement Mode MOSFET
Features

- Low Gate-Source Threshold Voltage
- Halogen and Antimony Free(HAF),
RoHS compliant



1.Gate 2.Drain 3.Source
TO-220F Plastic Package

Key Parameters

Parameter	Value	Unit
BV _{DSS}	40	V
R _{DS(ON)} Max	4 @ V _{GS} = 10 V	mΩ
	5.1 @ V _{GS} = 4.5 V	
V _{GS(th)} typ	1.4	V
Q _g typ	143 @ V _{GS} = 10 V	nC

Absolute Maximum Ratings(at T_a = 25°C unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V _{DS}	40	V
Gate-Source Voltage	V _{GS}	± 20	V
Drain Current	I _D	58	A
		36.5	
Peak Drain Current, Pulsed ¹⁾	I _{DM}	450	A
Avalanche Current	I _{AS}	58.8	A
Single Pulse Avalanche Energy ²⁾	E _{AS}	172.8	mJ
Power Dissipation	P _D	19	W
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to + 150	°C

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	R _{θJC}	6.5	°C/W
Thermal Resistance from Junction to Ambient	R _{θJA}	45	°C/W

¹⁾ Pulse Test: Pulse Width ≤ 100 μs, Duty Cycle ≤ 2%, Repetitive rating, pulse width limited by junction temperature T_{J(MAX)} = 150°C.

²⁾ Limited by T_{J(MAX)}, starting T_J = 25 °C, L = 0.1 mH, R_g = 25 Ω, I_{AS} = 58.8 A, V_{GS} = 10 V.

Characteristics at $T_a = 25^\circ\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = 250\ \mu\text{A}$	BV_{DS}	40	-	-	V
Drain-Source Leakage Current at $V_{DS} = 40\ \text{V}$	I_{DSS}	-	-	1	μA
Gate Leakage Current at $V_{GS} = \pm 20\ \text{V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	$V_{GS(th)}$	1	-	2.5	V
Drain-Source On-State Resistance at $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$ at $V_{GS} = 4.5\ \text{V}$, $I_D = 20\ \text{A}$	$R_{DS(on)}$	- -	3.2 -	4 5.1	$\text{m}\Omega$
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5\ \text{V}$, $I_D = 20\ \text{A}$	g_{fs}	-	55.8	-	S
Gate Resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	0.5	-	Ω
Input Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	7007	-	pF
Output Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	549	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 20\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	404	-	pF
Gate charge total at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$ at $V_{DS} = 20\ \text{V}$, $V_{GS} = 4.5\ \text{V}$, $I_D = 30\ \text{A}$	Q_g	- -	143 68	- -	nC
Gate to Source Charge at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$	Q_{gs}	-	22	-	nC
Gate to Drain Charge at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$	Q_{gd}	-	28	-	nC
Turn-On Delay Time at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(on)}$	-	40	-	ns
Turn-On Rise Time at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$, $R_g = 3.3\ \Omega$	t_r	-	63	-	ns
Turn-Off Delay Time at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(off)}$	-	37	-	ns
Turn-Off Fall Time at $V_{DS} = 20\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 30\ \text{A}$, $R_g = 3.3\ \Omega$	t_f	-	9	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $I_S = 1\ \text{A}$, $V_{GS} = 0\ \text{V}$	V_{SD}	-	-	1.2	V
Body-Diode Continuous Current	I_S	-	-	58	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	450	A
Body Diode Reverse Recovery Time at $I_S = 30\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	21	-	ns
Body Diode Reverse Recovery Charge at $I_S = 30\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	13	-	nC

Fig. 1 Typical Output Characteristics

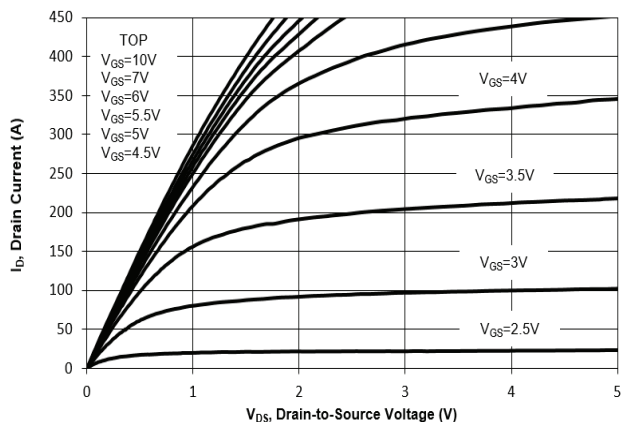


Fig. 2 Typical Transfer Characteristics

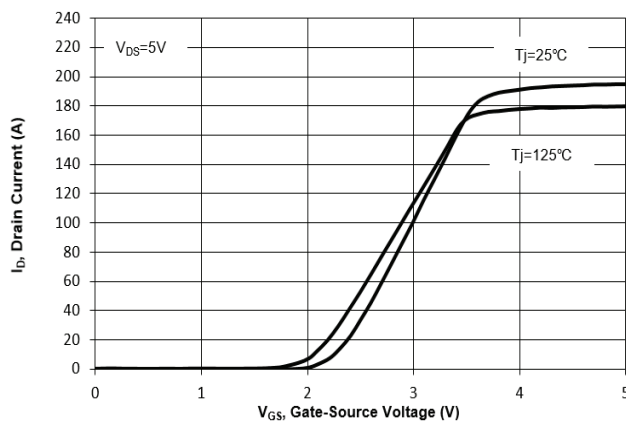


Fig. 3 On-Resistance vs. Drain Current

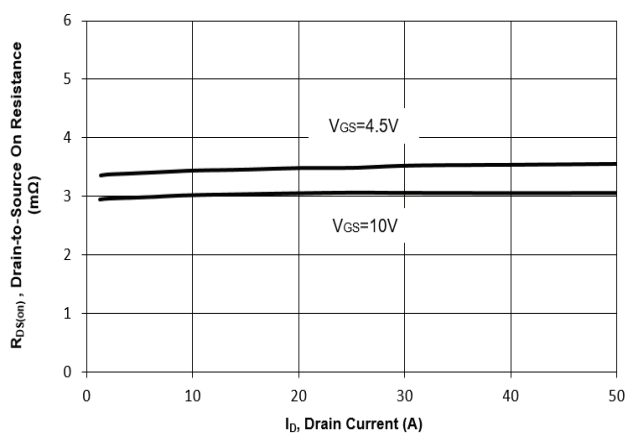


Fig. 4 On-Resistance vs. Gate to Source Voltage

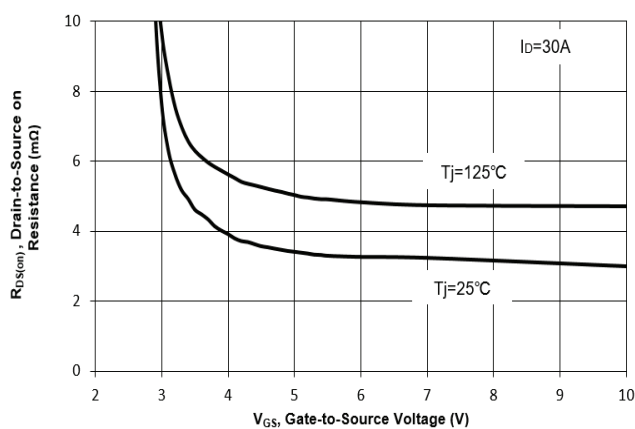


Fig. 5 On-Resistance vs. TJ

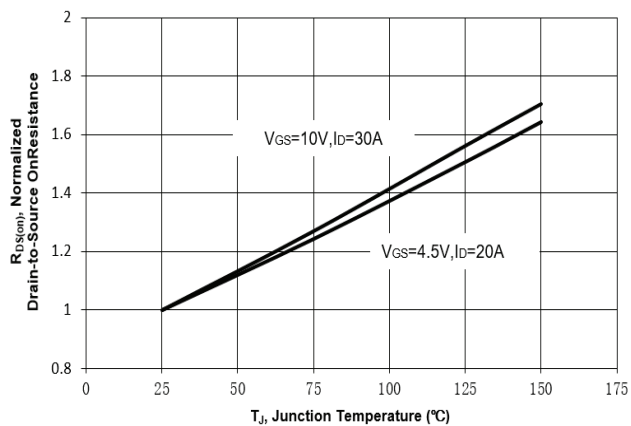
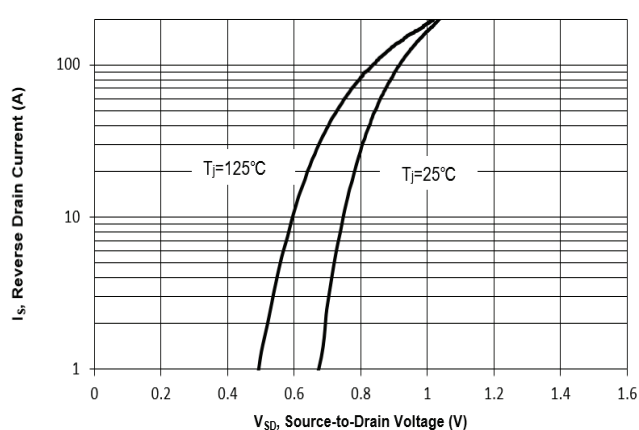


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

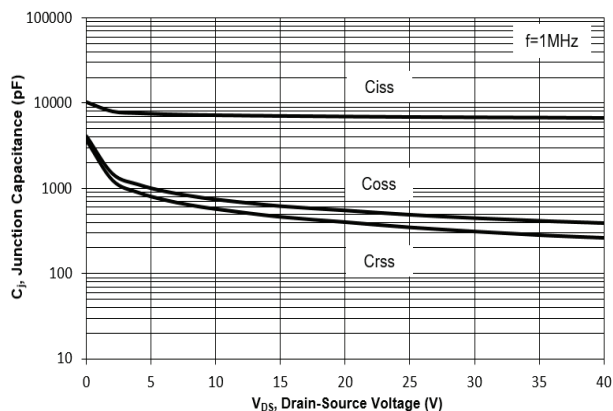


Fig. 8 Drain-Source Leakage Current vs. Tj

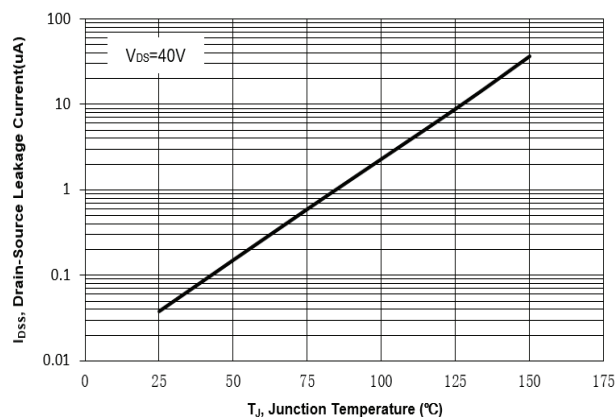


Fig. 9 V(BR)DSS vs. Junction Temperature

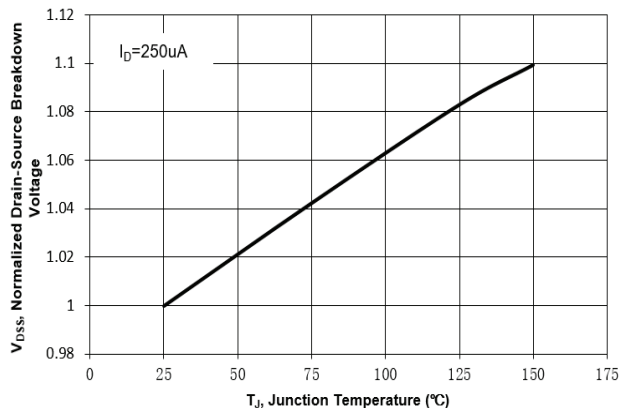


Fig. 10 Gate Threshold Variation vs. Tj

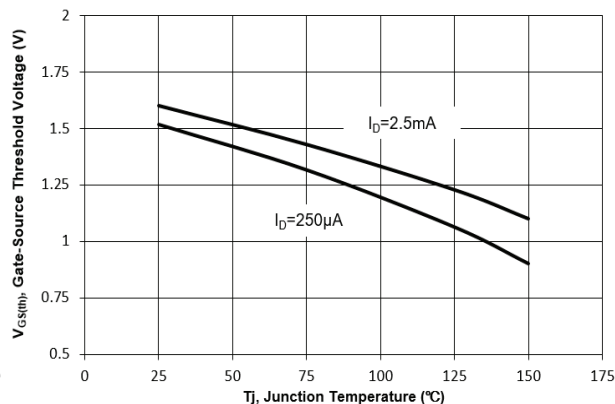


Fig. 11 Gate Charge

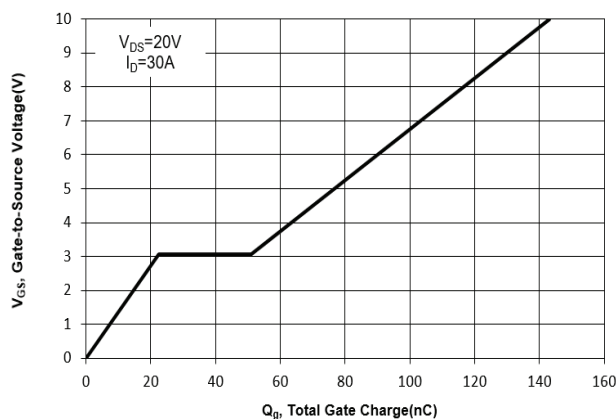


Fig. 12 Safe Operation Area

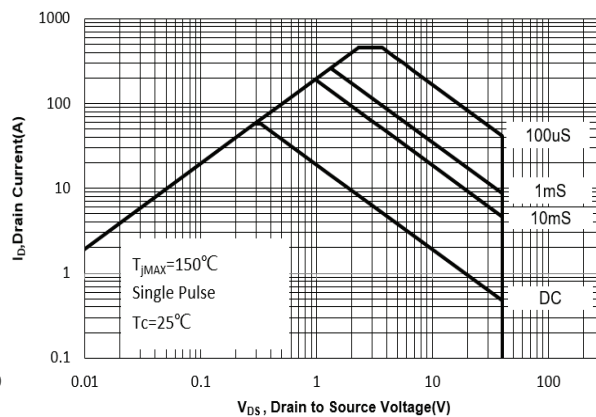


Fig. 13 Normalized Maximum Transient Thermal Impedance($Z_{\theta JC}$)

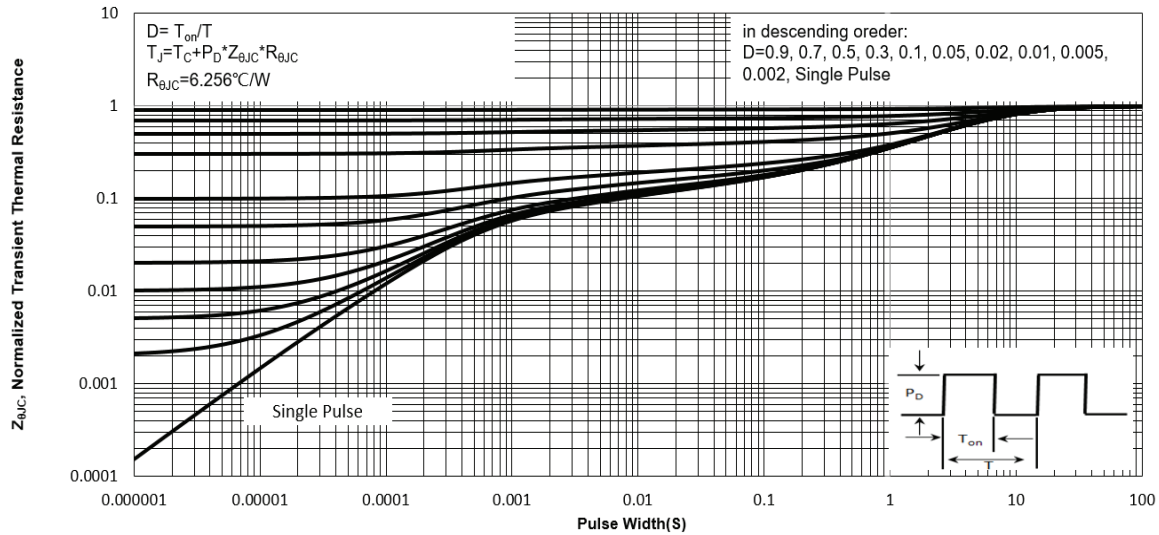
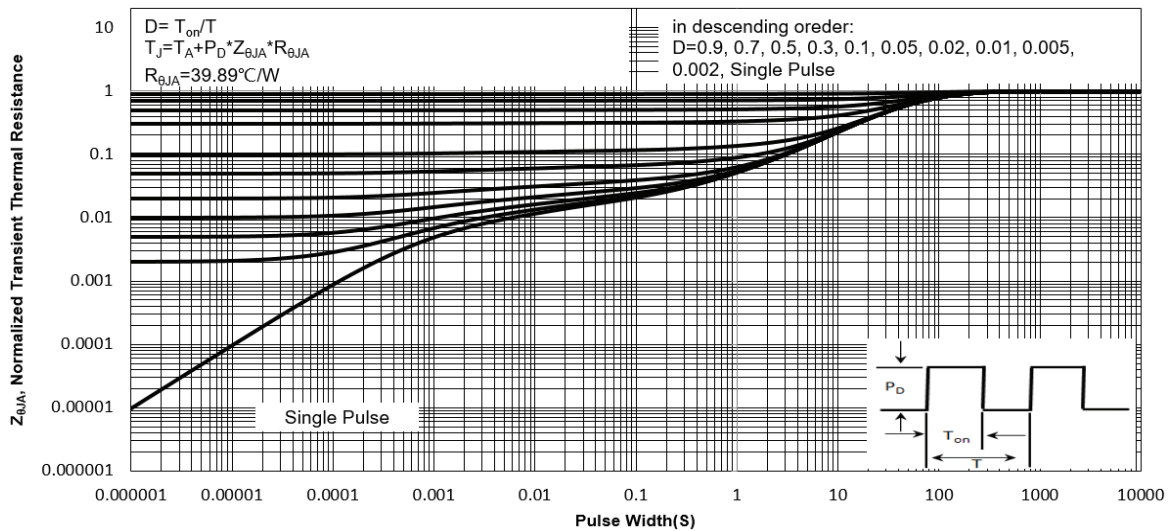


Fig. 14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

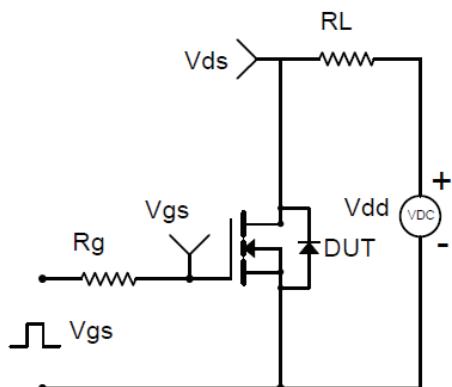


Fig.1-2 Switching Waveform

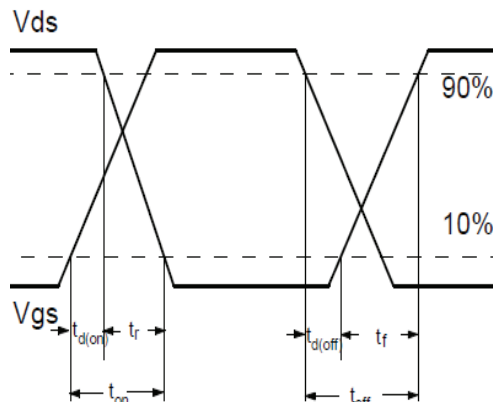


Fig.2-1 Gate charge test circuit

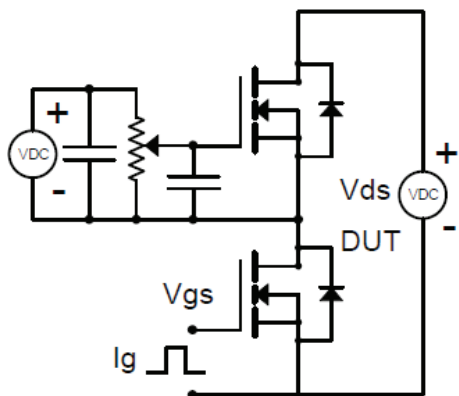


Fig.2-2 Gate charge waveform

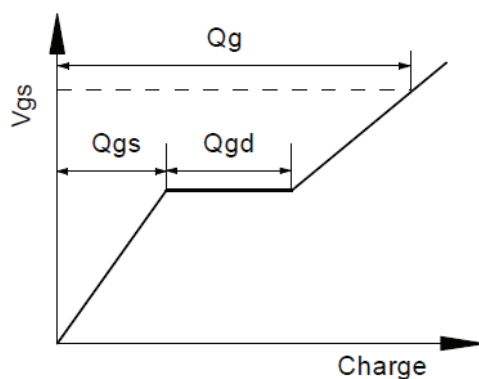


Fig.3-1 Avalanche test circuit

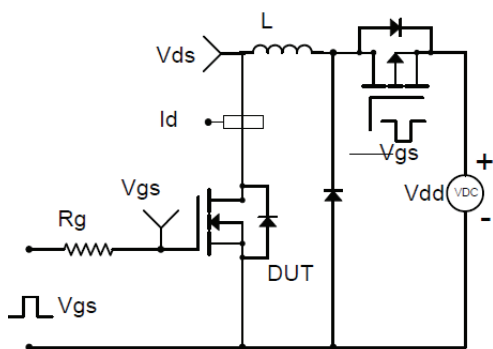
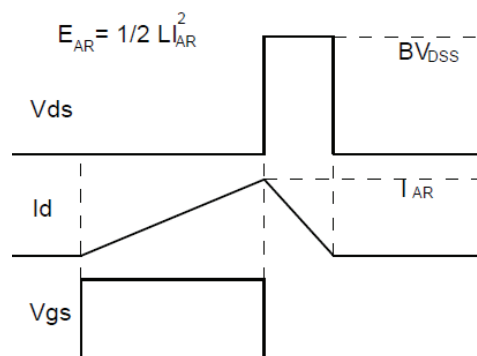
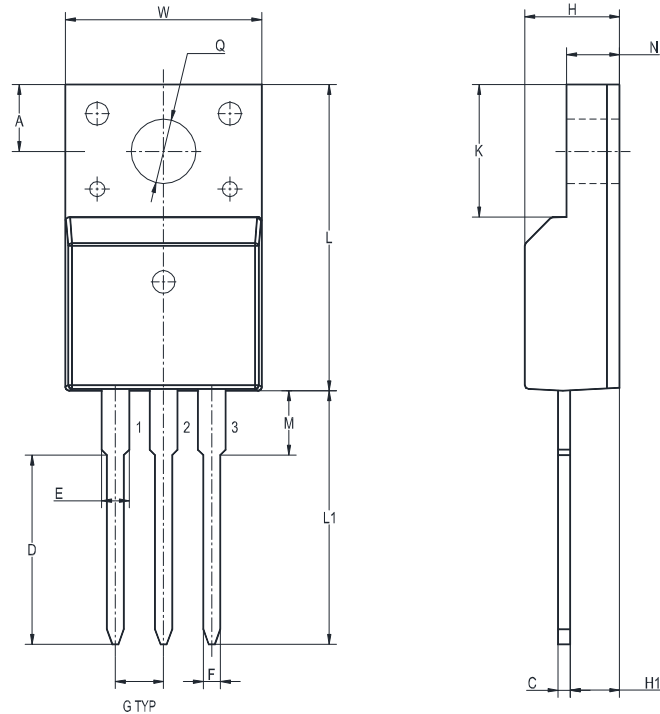


Fig.3-2 Avalanche waveform



Package Outline Dimensions (Units: mm)
TO-220F


UNIT	A	C	D	E	F	G	W	H	H1	Q	L	L1	M	K	N
mm	3.5	0.7	10.3	1.5	0.9	2.54	10.5	4.9	2.9	3.4	16	13.5	3.5	6.7	2.8
	2.8	0.4	9.7	1.1	0.7	TYP.	9.5	4.5	2.5	2.9	15	12.5	2.9	6.2	2.3

Packing information

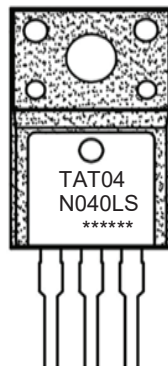
Package	Carton Quantity	Box Quantity	Base Quantity	Delivery Mode
TO-220F	5 K / Carton	1 K / Box	50 pcs / Tube	Tube

Marking information

" TAT04N040LS " = Part No.

" ***** " = Date Code Marking

Font type: Arial



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