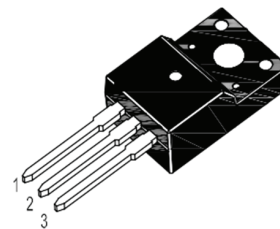
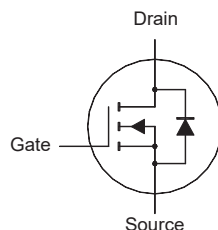


Features

- Low $R_{DS(on)}$
- Low Gate Charge
- Halogen and Antimony Free(HAF),
RoHS compliant

Application

- DC-DC converters
- Lighting



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

Key Parameters

Parameter	Value	Unit
BV_{DSS}	650	V
$R_{DS(ON)} \text{ Max}$	0.64 @ $V_{GS} = 10 \text{ V}$	Ω
$V_{GS(th)} \text{ typ}$	3	V
$Q_g \text{ typ}$	10 @ $V_{GS} = 10 \text{ V}$	nC

Absolute Maximum Ratings(at $T_a = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 30	V
Drain Current	I_D	3.2	A
$T_c = 25^\circ\text{C}$		2	
$T_c = 100^\circ\text{C}$			
Peak Drain Current, Pulsed ¹⁾	I_{DM}	20	A
Avalanche Current	I_{AS}	2.1	A
Single Pulse Avalanche Energy ²⁾	E_{AS}	174	mJ
Power Dissipation	P_D	17.9	W
$T_c = 25^\circ\text{C}$			
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	6.9	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	45	$^\circ\text{C/W}$

¹⁾ Pulse Test: Pulse Width $\leq 100 \mu\text{s}$, Duty Cycle $\leq 2\%$, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)} = 150^\circ\text{C}$.

²⁾ Limited by $T_{J(MAX)}$, starting $T_J = 25^\circ\text{C}$, $L = 79 \text{ mH}$, $R_g = 25 \Omega$, $I_{AS} = 2.1 \text{ A}$, $V_{GS} = 10 \text{ V}$.

Characteristics at T_a = 25°C unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at I _D = 250 μA	BV _{DSS}	650	-	-	V
Drain-Source Leakage Current at V _{DS} = 520 V	I _{DSS}	-	-	1	μA
Gate Leakage Current at V _{GS} = ± 24 V	I _{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at V _{DS} = V _{GS} , I _D = 250 μA	V _{GS(th)}	2	-	4	V
Drain-Source On-State Resistance at V _{GS} = 10 V, I _D = 3.5 A	R _{DS(on)}	-	0.57	0.64	Ω
DYNAMIC PARAMETERS					
Forward Transconductance at V _{DS} = 5 V, I _D = 3.5 A	g _{FS}	-	4.2	-	S
Gate Resistance at V _{GS} = 0 V, V _{DS} = 0 V, f = 1 MHz	R _g	-	5.8	-	Ω
Input Capacitance at V _{GS} = 0 V, V _{DS} = 300 V, f = 1 MHz	C _{iss}	-	399	-	pF
Output Capacitance at V _{GS} = 0 V, V _{DS} = 300 V, f = 1 MHz	C _{oss}	-	25	-	pF
Reverse Transfer Capacitance at V _{GS} = 0 V, V _{DS} = 300 V, f = 1 MHz	C _{rss}	-	4.9	-	pF
Gate charge total at V _{DS} = 325 V, V _{GS} = 10 V, I _D = 3.5 A	Q _g	-	10	-	nC
Gate to Source Charge at V _{DS} = 325 V, V _{GS} = 10 V, I _D = 3.5 A	Q _{gs}	-	2.7	-	nC
Gate to Drain Charge at V _{DS} = 325 V, V _{GS} = 10 V, I _D = 3.5 A	Q _{gd}	-	3.6	-	nC
Turn-On Delay Time at V _{DS} = 325 V, V _{GS} = 10 V, I _D = 3.5 A, R _G = 24 Ω	t _{d(on)}	-	22	-	ns
Turn-On Rise Time at V _{DS} = 325 V, V _{GS} = 10 V, I _D = 3.5 A, R _G = 24 Ω	t _r	-	14	-	ns
Turn-Off Delay Time at V _{DS} = 325 V, V _{GS} = 10 V, I _D = 3.5 A, R _G = 24 Ω	t _{d(off)}	-	17	-	ns
Turn-Off Fall Time at V _{DS} = 325 V, V _{GS} = 10 V, I _D = 3.5 A, R _G = 24 Ω	t _f	-	51	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at I _S = 1 A, V _{GS} = 0 V	V _{SD}	-	-	1.4	V
Body-Diode Continuous Current	I _S	-	-	3.2	A
Body-Diode Continuous Current, Pulsed	I _{SM}	-	-	20	A
Body Diode Reverse Recovery Time at I _S = 3.5 A, di/dt = 100 A / μs	t _{rr}	-	275	-	ns
Body Diode Reverse Recovery Charge at I _S = 3.5 A, di/dt = 100 A / μs	Q _{rr}	-	1.5	-	μC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

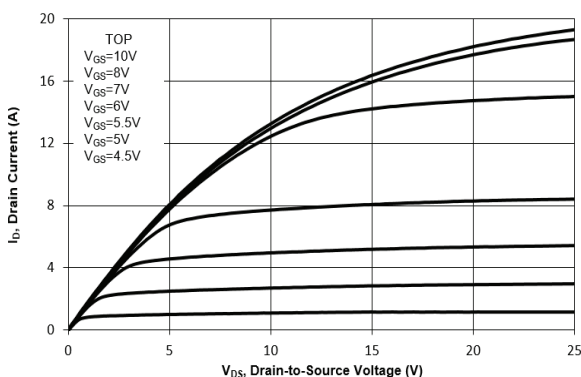


Fig. 2 Typical Transfer Characteristics

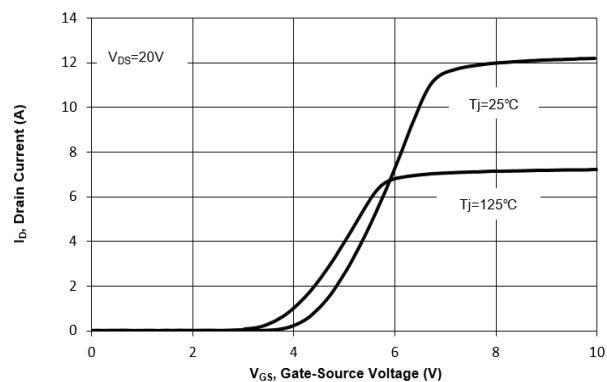


Fig. 3 On-Resistance vs. Drain Current

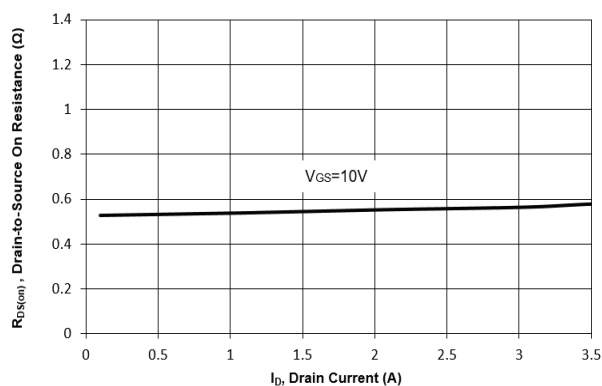


Fig. 4 On-Resistance vs. Gate to Source Voltage

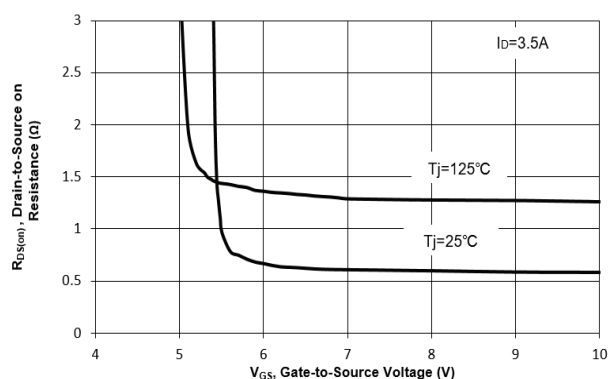


Fig. 5 On-Resistance vs. TJ

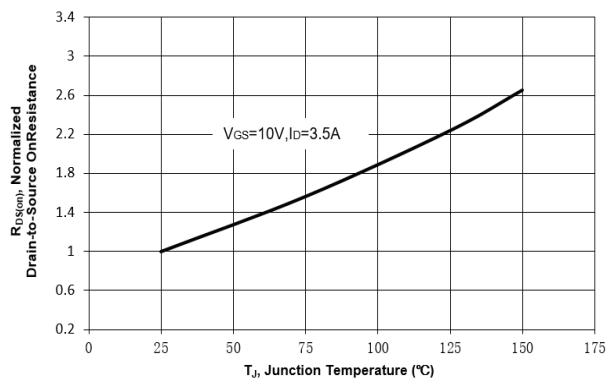


Fig. 6 Typical Body-Diode Forward Characteristics

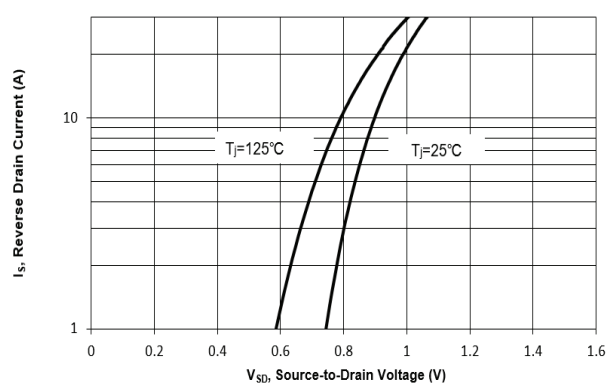


Fig. 7 Typical Junction Capacitance

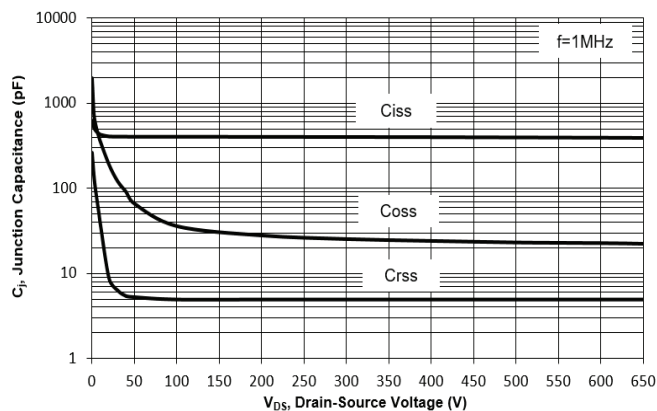


Fig. 8 Drain-Source Leakage Current vs. Tj

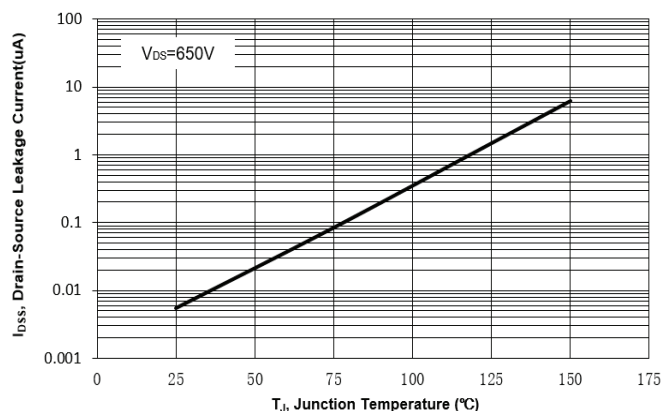


Fig. 9 V_{(BR)DSS} vs. Junction Temperature

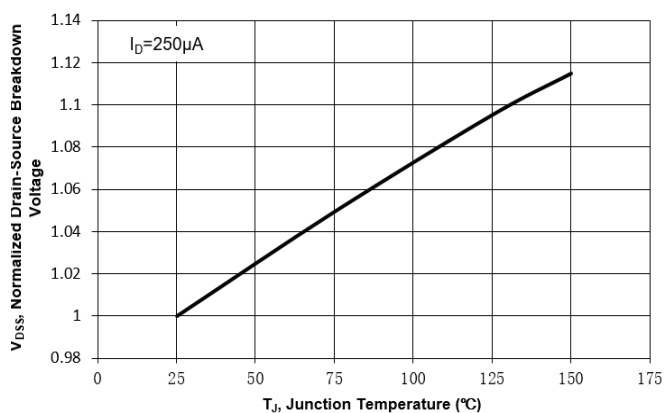


Fig. 10 Gate Threshold Variation vs. Tj

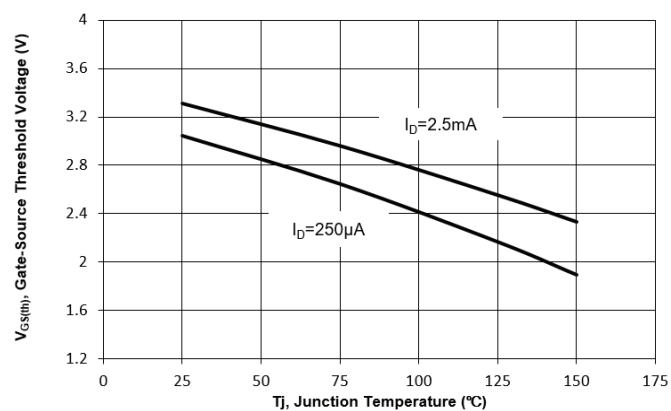


Fig. 11 Gate Charge

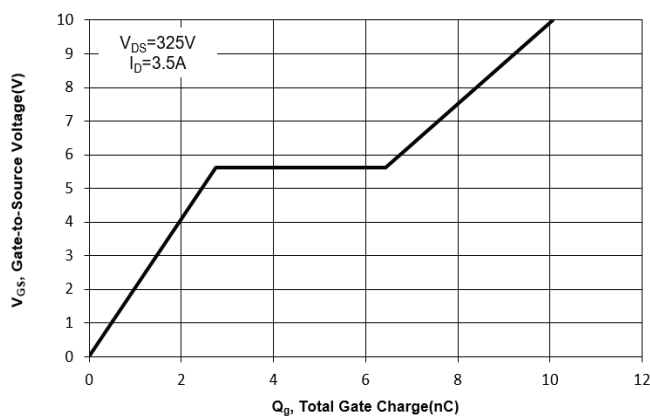
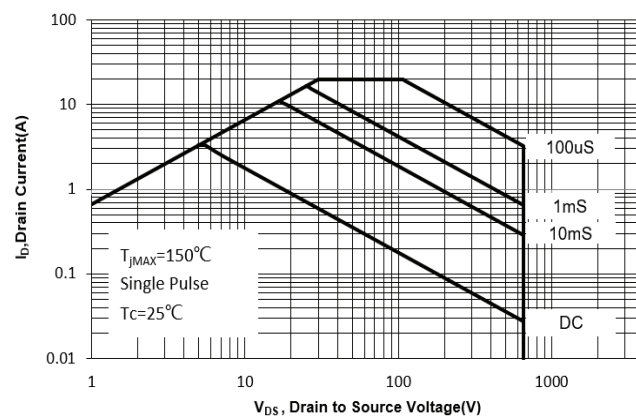


Fig. 12 Safe Operation Area



Electrical Characteristics Curves

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

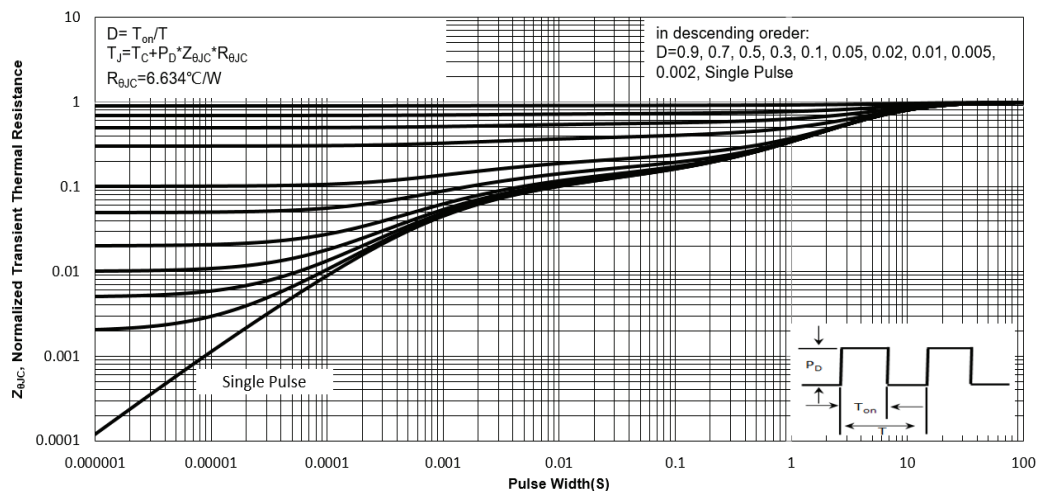
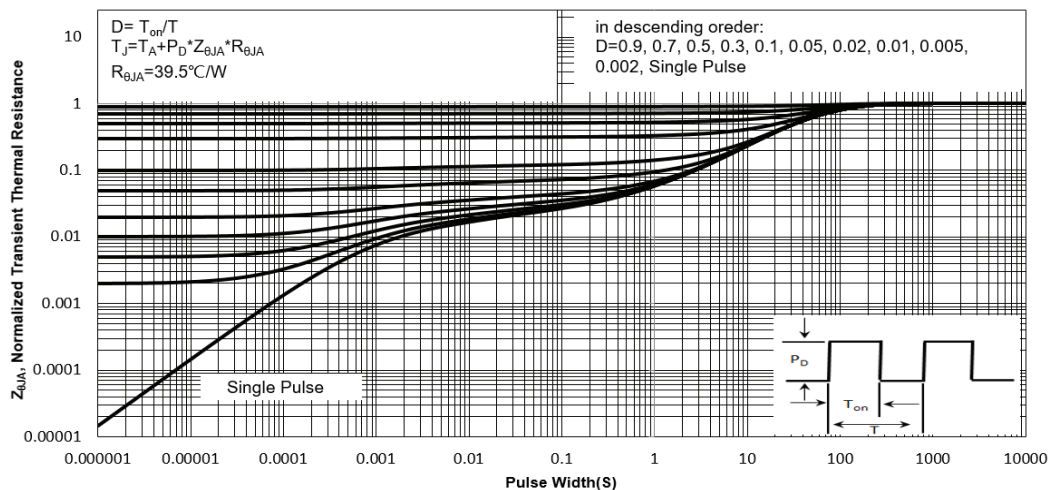


Fig.14 Normalized Maximum Transient Thermal Impedance($z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

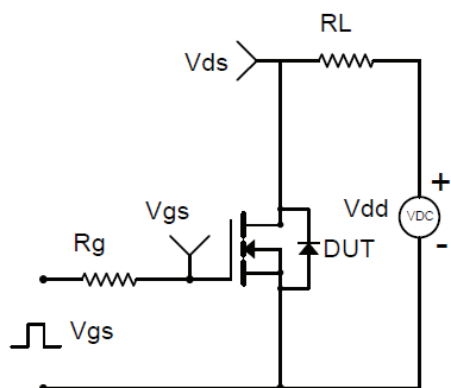


Fig.1-2 Switching Waveform

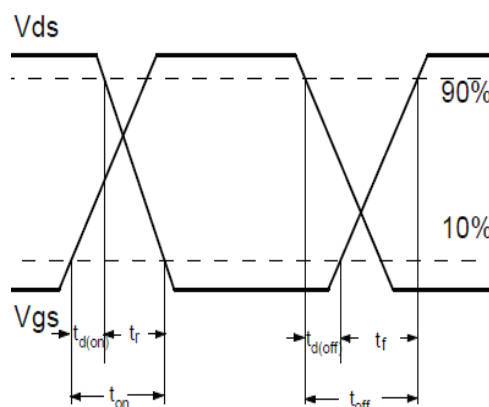


Fig.2-1 Gate charge test circuit

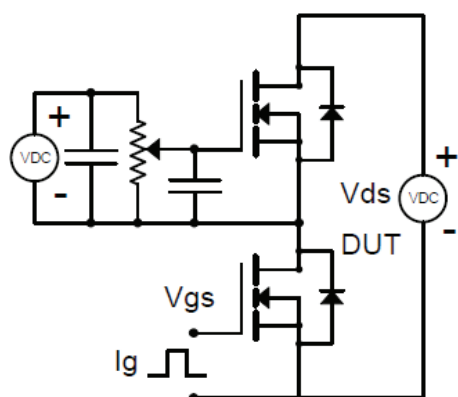


Fig.2-2 Gate charge waveform

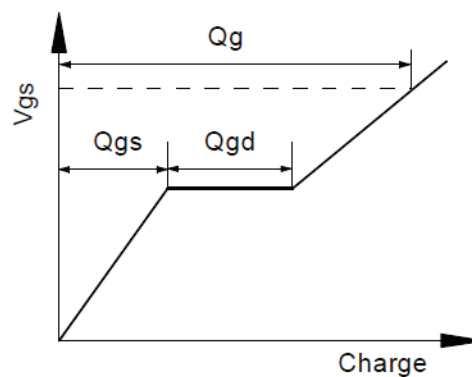


Fig.3-1 Avalanche test circuit

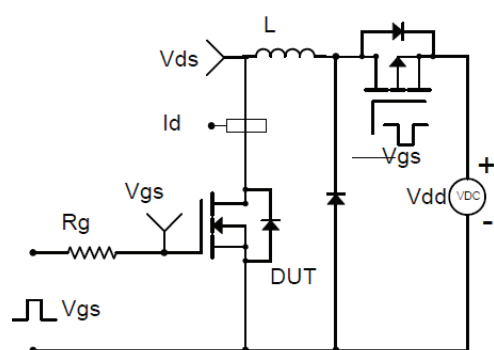
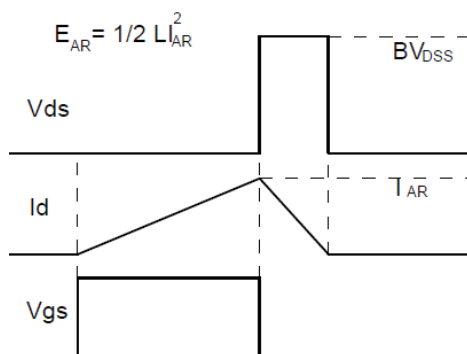
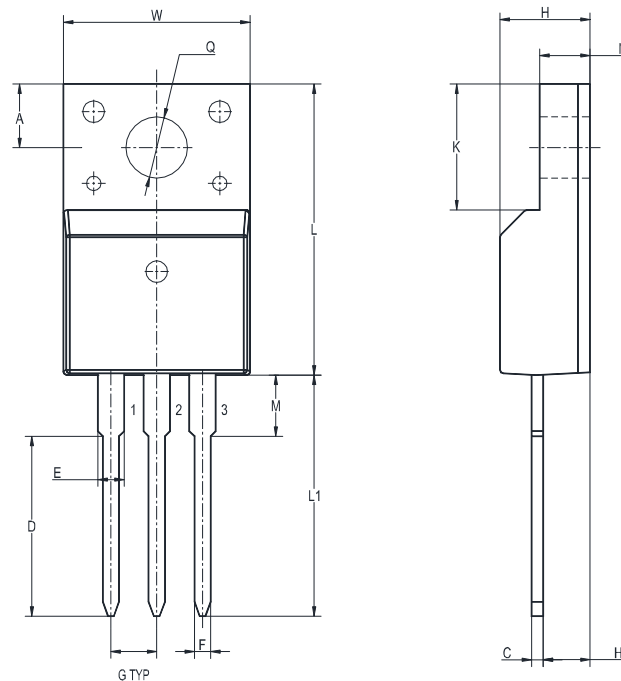


Fig.3-2 Avalanche waveform



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

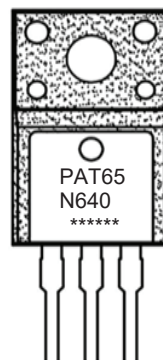
Package	Carton Quantity	Box Quantity	Base Quantity	Delivery Mode
TO-220F	5 K / Carton	1 K / Box	50 pcs / Tube	Tube

Marking information

" PAT65N640 " = Part No.

" ***** " = Date Code Marking

Font type: Arial



Disclaimer: Our company reserve the right to make modifications, enhancements, improvements, corrections or other changes to improve product design, functions and reliability, anytime without notice.