

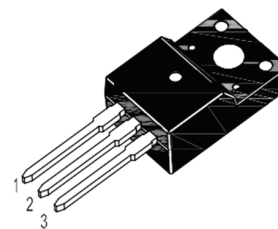
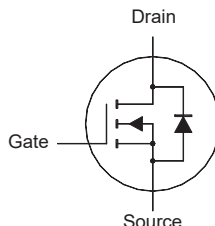
N-Channel Enhancement Mode MOSFET

Features

- Low Gate Charge
- Halogen and Antimony Free(HAF),
RoHS compliant

Application

- DC-DC converters
- Hard / Soft switching topology



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

Key Parameters

Parameter	Value	Unit
$V_{(BR)DSS}$	600	V
$R_{DS(ON)} \text{ Max}$	580 @ $V_{GS} = 10 \text{ V}$	m Ω
$V_{GS(th)} \text{ typ}$	3	V
$Q_g \text{ typ}$	14.1 @ $V_{GS} = 10 \text{ V}$	nC

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	V
Drain Current	I_D	7 4.4	A $T_c = 25^\circ\text{C}$ $T_c = 100^\circ\text{C}$
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	78.1	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	$R_{\theta JC}$	1.6	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	55	$^\circ\text{C/W}$

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

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = 250\ \mu\text{A}$	BV_{DSS}	600	-	-	V
Drain-Source Leakage Current at $V_{DS} = 600\ \text{V}$	I_{DSS}	-	-	1	μA
Gate Leakage Current at $V_{GS} = \pm 30\ \text{V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	$V_{GS(th)}$	2	-	4	V
Drain-Source On-State Resistance at $V_{GS} = 10\ \text{V}$, $I_D = 3.5\ \text{A}$	$R_{DS(on)}$	-	500	580	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5\ \text{V}$, $I_D = 3.5\ \text{A}$	g_{FS}	-	4.2	-	S
Gate Resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	4.1	-	Ω
Input Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 300\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	427	-	pF
Output Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 300\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	25	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 300\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	6.4	-	pF
Gate charge total at $V_{DS} = 300\ \text{V}$, $I_D = 3.5\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_g	-	14.1	-	nC
Gate to Source Charge at $V_{DS} = 300\ \text{V}$, $I_D = 3.5\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_{gs}	-	2.9	-	nC
Gate to Drain Charge at $V_{DS} = 300\ \text{V}$, $I_D = 3.5\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_{gd}	-	6.5	-	nC
Turn-On Delay Time at $V_{DS} = 300\ \text{V}$, $I_D = 3.5\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 24\ \Omega$	$t_{d(on)}$	-	26	-	ns
Turn-On Rise Time at $V_{DS} = 300\ \text{V}$, $I_D = 3.5\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 24\ \Omega$	t_r	-	12	-	ns
Turn-Off Delay Time at $V_{DS} = 300\ \text{V}$, $I_D = 3.5\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 24\ \Omega$	$t_{d(off)}$	-	23	-	ns
Turn-Off Fall Time at $V_{DS} = 300\ \text{V}$, $I_D = 3.5\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 24\ \Omega$	t_f	-	49.5	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $I_S = 1\ \text{A}$, $V_{GS} = 0\ \text{V}$	V_{SD}	-	-	1.4	V
Body-Diode Continuous Current	I_S	-	-	7	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	20	A
Body Diode Reverse Recovery Time at $I_S = 3.5\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	276	-	ns
Body Diode Reverse Recovery Charge at $I_S = 3.5\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	1.88	-	μC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

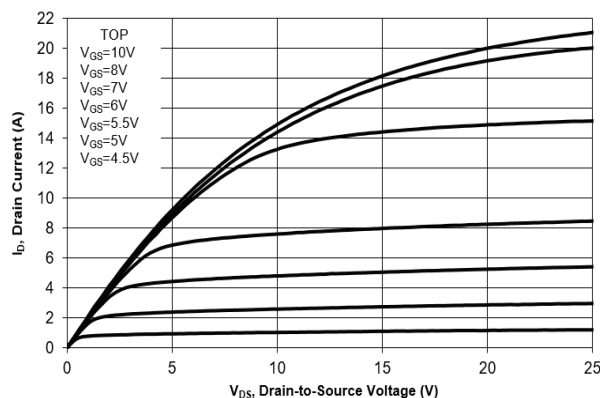


Fig. 2 Typical Transfer Characteristics

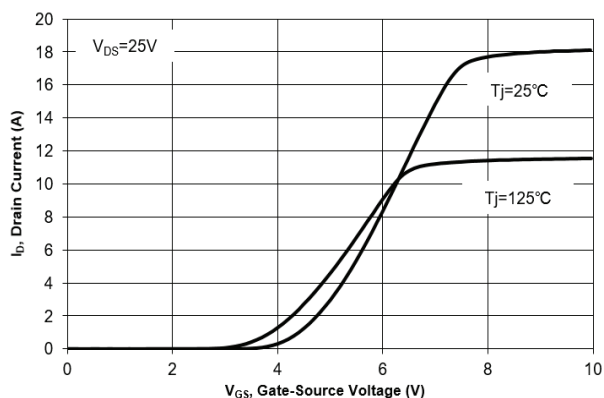


Fig. 3 on-Resistance vs Drain Current

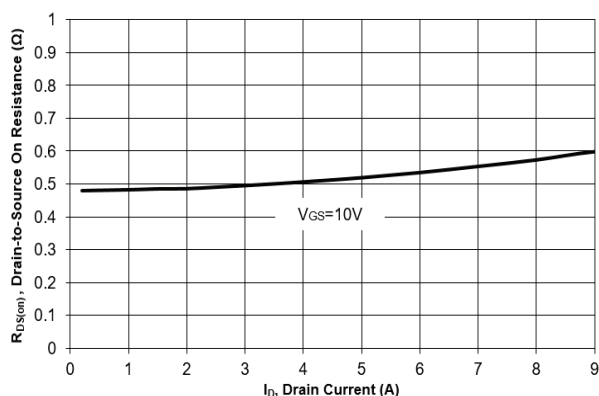


Fig. 4 on-Resistance vs. Gate to Source Voltage

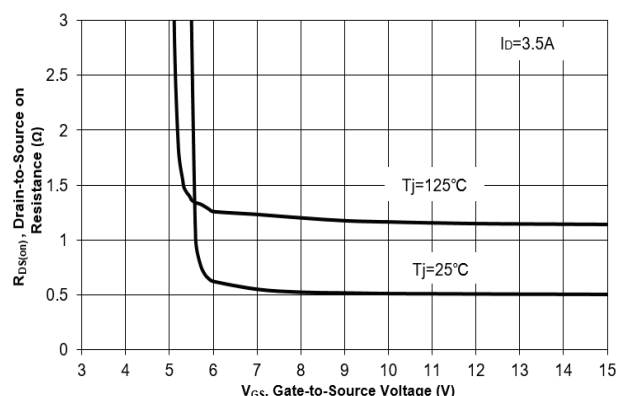


Fig. 5 on-Resistance vs. TJ

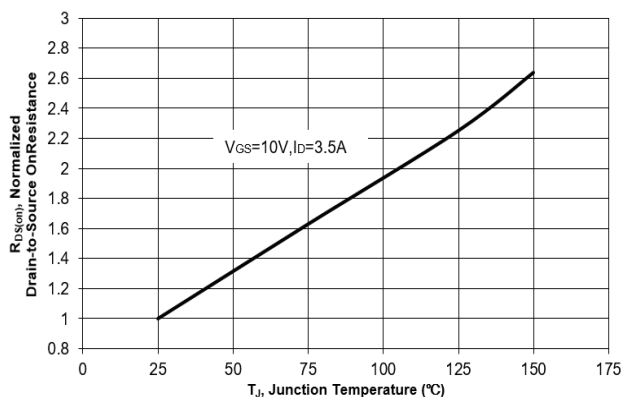


Fig. 6 Typical Body Diode Forward Characteristics

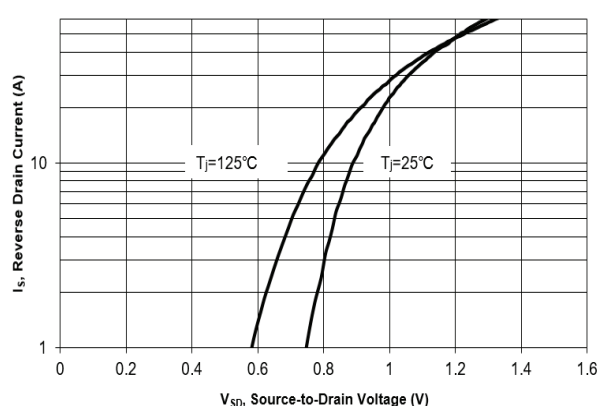


Fig. 7 Typical Junction Capacitance

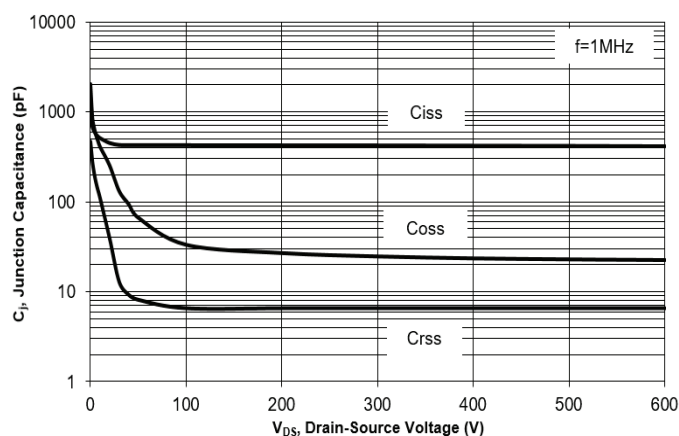


Fig. 8 Drain-Source Leakage Current vs. T_j

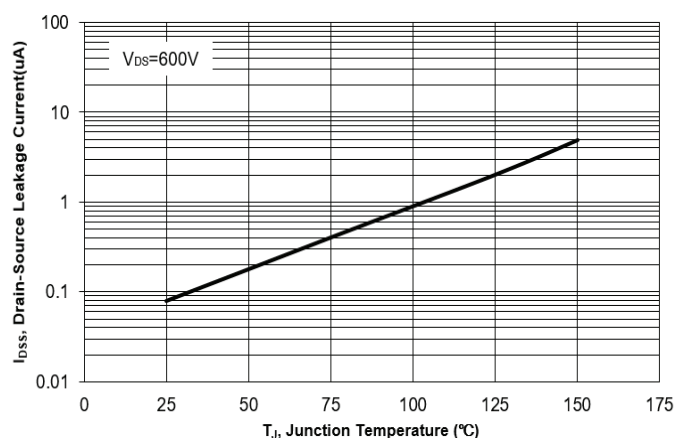


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

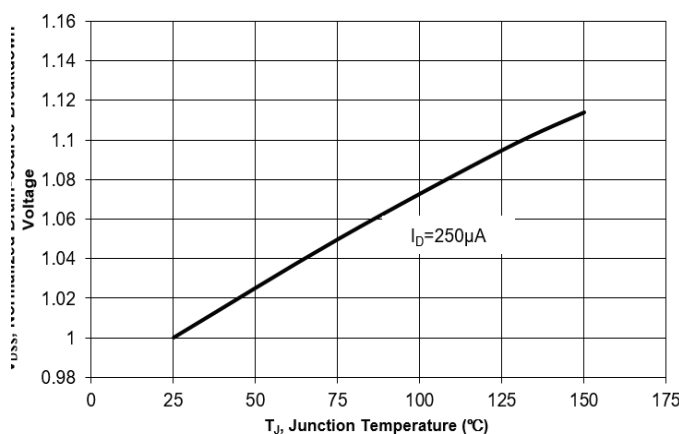


Fig. 10 Gate Threshold Variation vs. T_j

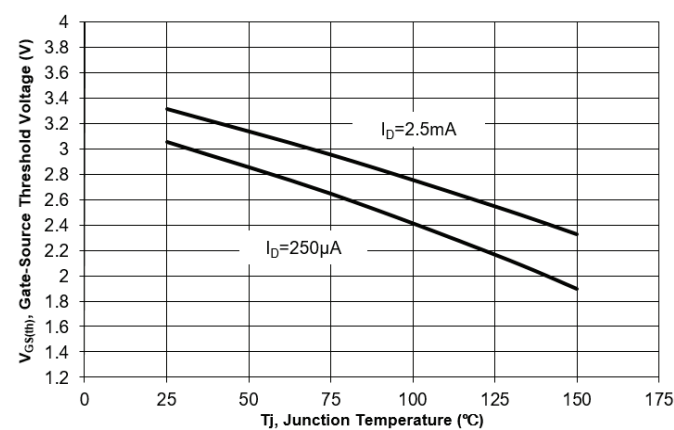


Fig. 11 Gate Charge

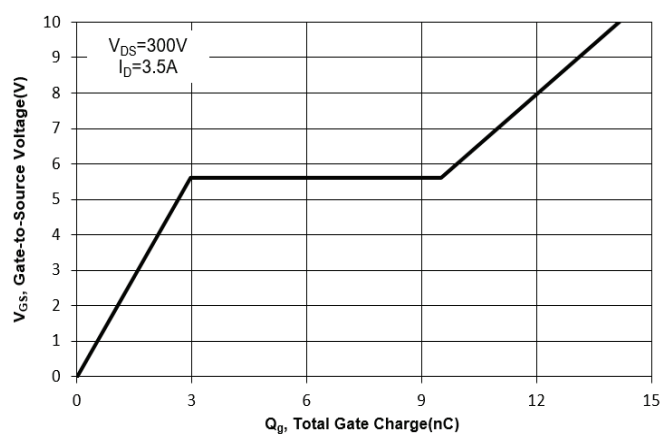
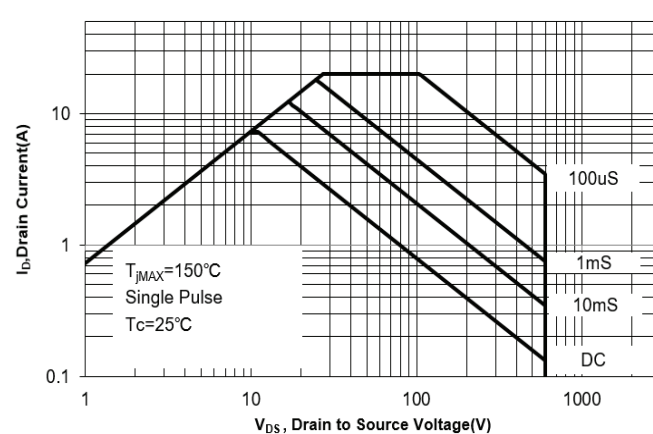


Fig. 12 Safe Operation Area



Electrical Characteristics Curves

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

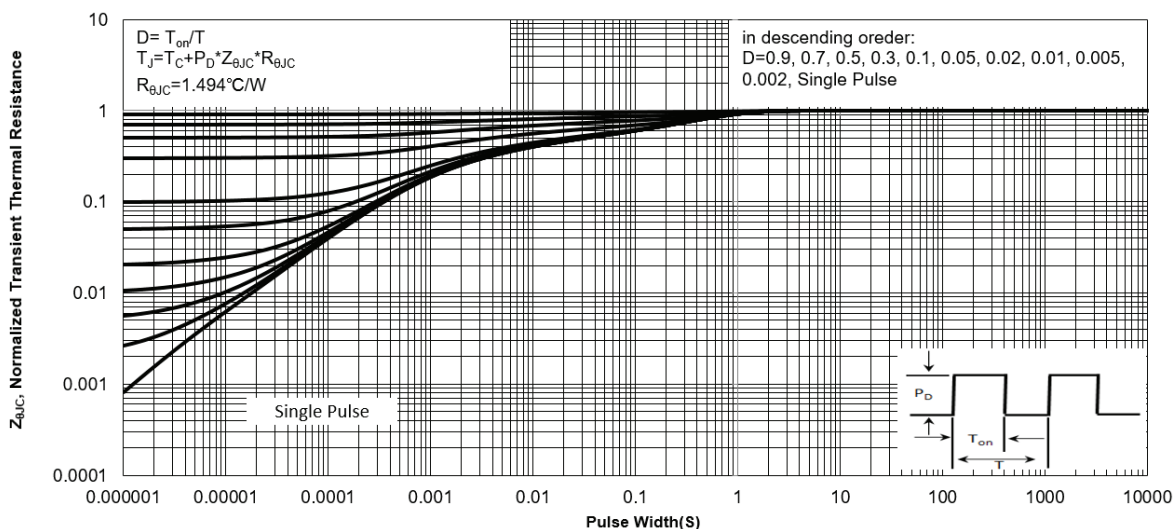
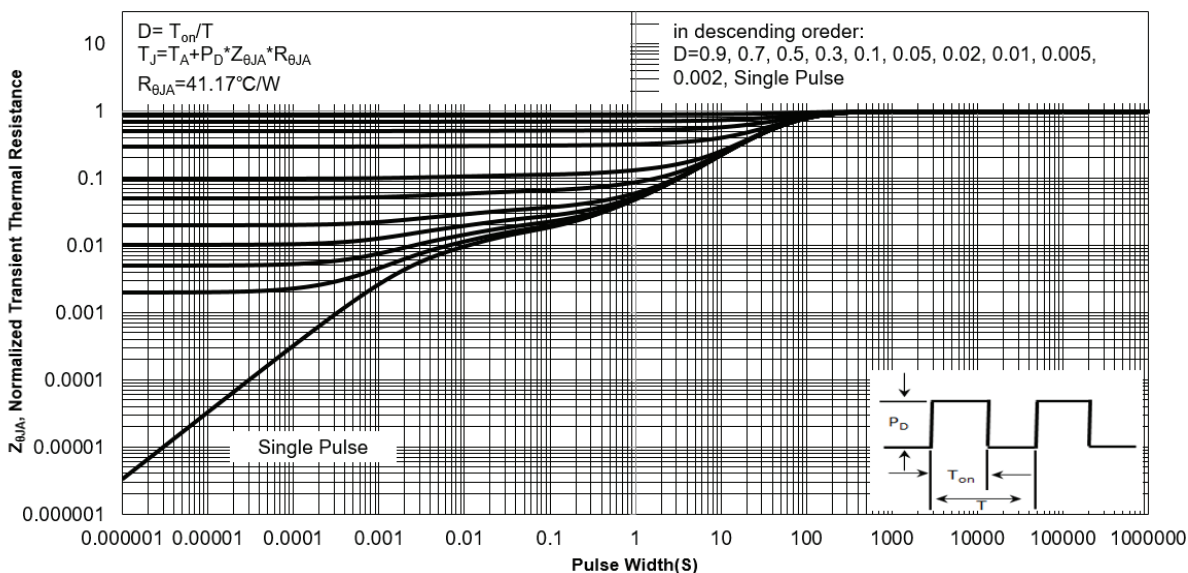


Fig. 14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

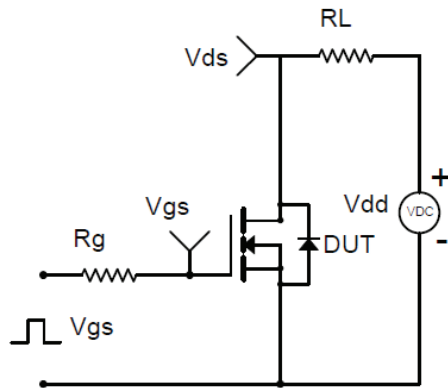


Fig.1-2 Switching Waveform

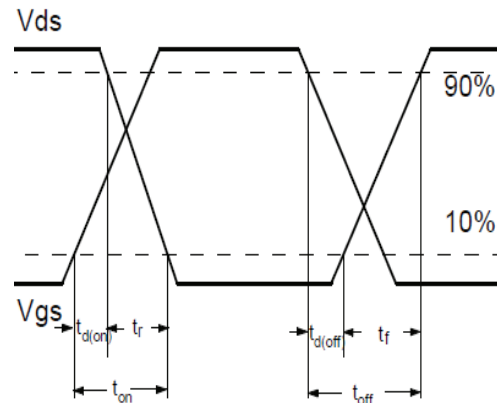


Fig.2-1 Gate charge test circuit

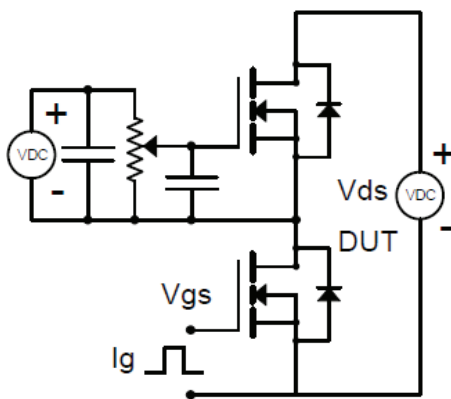


Fig.2-2 Gate charge waveform

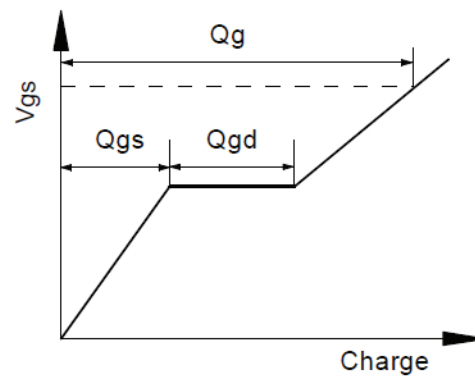


Fig.3-1 Avalanche test circuit

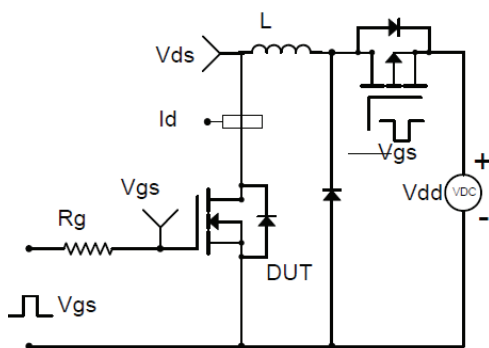
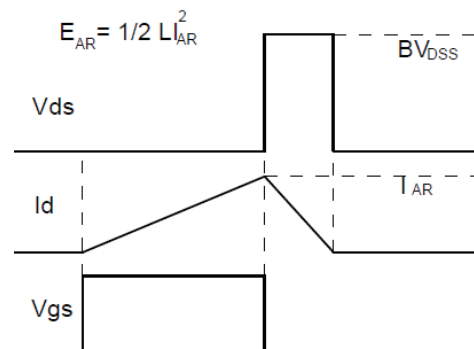
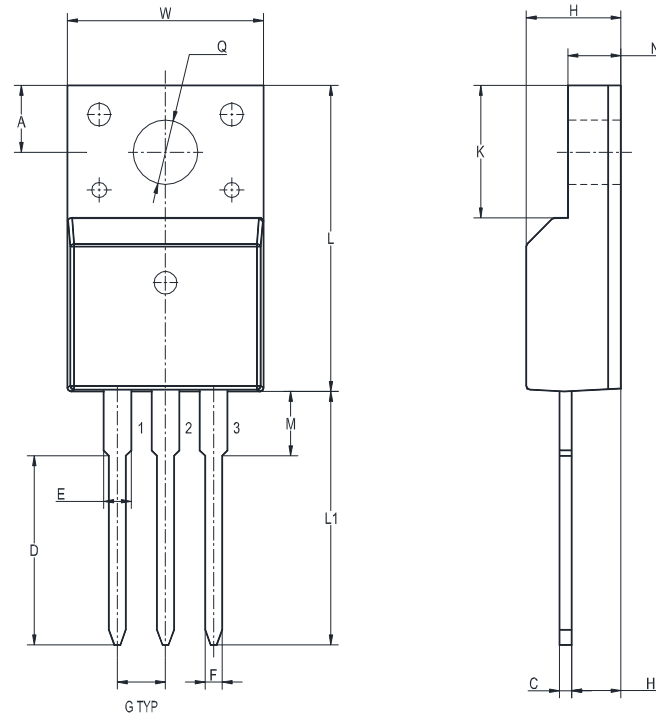


Fig.3-2 Avalanche waveform



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

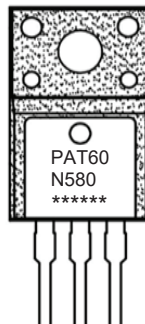
Package	Carton Quantity	Box Quantity	Base Quantity	Delivery Mode
TO-220F	5 K / Carton	1 K / Box	50 pcs / Tube	Tube

Marking information

" PAT60N580 " = 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. Semtech Electronics Limited makes no warranties, representations or warranties regarding the suitability of its products for any particular purpose, and does not accept any liability arising from the application or use of any product or circuit such as: Apply to medical, military, aircraft, space or life support equipment and expressly waive any and all liability, including but not limited to special, consequential or collateral damage.