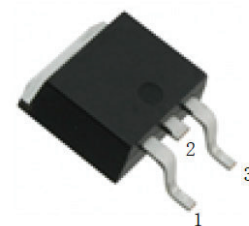
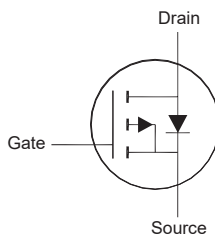


P-Channel Enhancement Mode MOSFET

Features

- AEC-Q101 Qualified
- Low On-Resistance
- Surface-mounted package
- Low Gate-Source Threshold Voltage
- Halogen and Antimony Free(HAF), RoHS compliant



1.Gate 2.Drain 3.Source
TO-252 Plastic Package

Key Parameters

Parameter	Value	Unit
$-BV_{DS}$	40	V
$R_{DS(ON)} \text{ Max}$	7.3 @ $-V_{GS} = 10 \text{ V}$	mΩ
	10.5 @ $-V_{GS} = 4.5 \text{ V}$	
$-V_{GS(th)} \text{ typ}$	1.5	V
$Q_g \text{ typ}$	125 @ $-V_{GS} = 10 \text{ V}$	nC

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$-V_{DS}$	40	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current	$-I_D$	71	A
		44	
Peak Drain Current, Pulsed ¹⁾	$-I_{DM}$	300	A
Single-Pulse Avalanche Current	$-I_{AS}$	45	A
Single-Pulse Avalanche Energy ²⁾	E_{AS}	101	mJ
Power Dissipation	P_D	65.2	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 175	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	2.3	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	35	$^\circ\text{C/W}$

¹⁾ Pulse Test: Pulse Width $\leq 100 \mu\text{s}$, Duty Cycle $\leq 2\%$, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)} = 175^\circ\text{C}$.

²⁾ Limited by $T_{J(MAX)}$, starting $T_J = 25^\circ\text{C}$, $L = 0.1 \text{ mH}$, $R_g = 25 \Omega$, $-I_{AS} = 45 \text{ A}$, $V_{GS} = 10 \text{ V}$.

³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.

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 $V_{DS} = V_{GS}$, $-I_D = 250\ \mu\text{A}$	$-V_{GS(th)}$	1.0	-	2.5	V
Drain-Source On-State Resistance at $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$ at $-V_{GS} = 4.5\ \text{V}$, $-I_D = 10\ \text{A}$	$R_{DS(on)}$	- -	6 -	7.3 10.5	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $-V_{DS} = 5\ \text{V}$, $-I_D = 10\ \text{A}$	g_{FS}	-	40.6	-	S
Gate Resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	1.6	-	Ω
Input Capacitance at $-V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	7560	-	pF
Output Capacitance at $-V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	521	-	pF
Reverse Transfer Capacitance at $-V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	344	-	pF
Total Gate Charge at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$ at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 4.5\ \text{V}$, $-I_D = 20\ \text{A}$	Q_g	- -	125 59	- -	nC
Gate-Source Charge at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$	Q_{gs}	-	24	-	nC
Gate-Drain Charge at $-V_{DS} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$	Q_{gd}	-	19	-	nC
Turn-On Delay Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$, $R_G = 3.3\ \Omega$	$t_{d(on)}$	-	37	-	ns
Turn-On Rise Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$, $R_G = 3.3\ \Omega$	t_r	-	48	-	ns
Turn-Off Delay Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$, $R_G = 3.3\ \Omega$	$t_{d(off)}$	-	43	-	ns
Turn-Off Fall Time at $-V_{DD} = 20\ \text{V}$, $-V_{GS} = 10\ \text{V}$, $-I_D = 20\ \text{A}$, $R_G = 3.3\ \Omega$	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	$-I_S$	-	-	71	A
Body-Diode Continuous Current, Pulsed	$-I_{SM}$	-	-	300	A
Body Diode Reverse Recovery Time at $-I_S = 20\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	21	-	ns
Body Diode Reverse Recovery Charge at $-I_S = 20\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	16	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

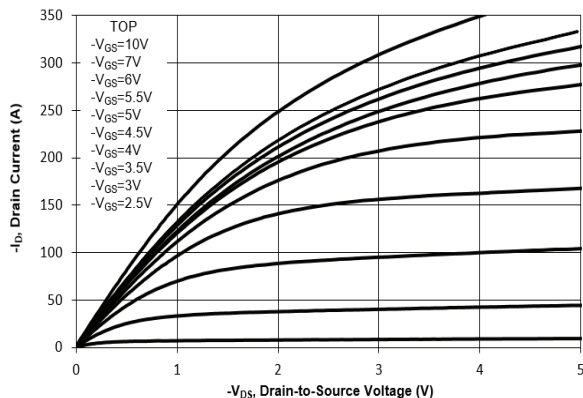


Fig. 2 Typical Transfer Characteristics

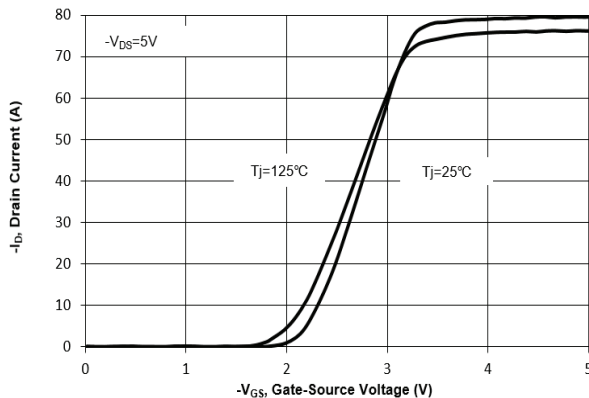


Fig. 3 on-Resistance vs. Drain Current

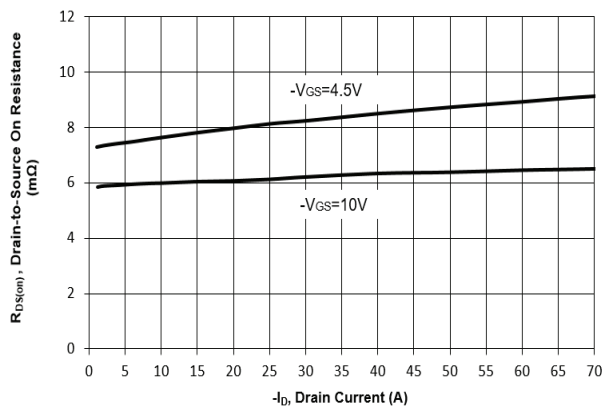


Fig. 4 on-Resistance vs. Gate to Source Voltage

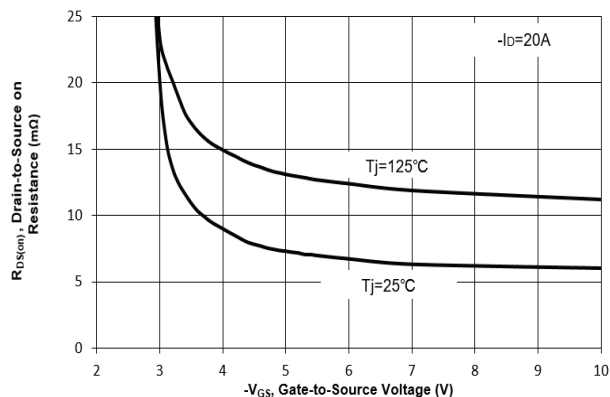


Fig. 5 on-Resistance vs. T_J

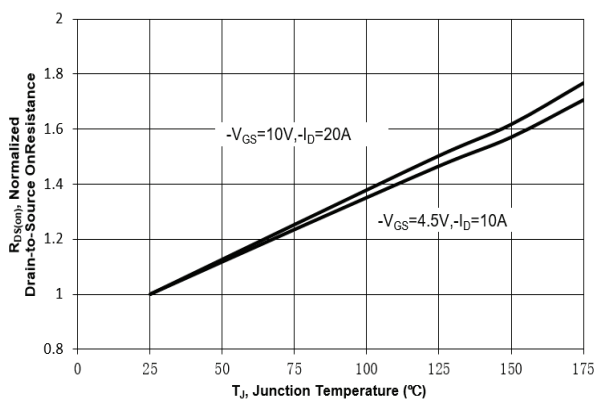
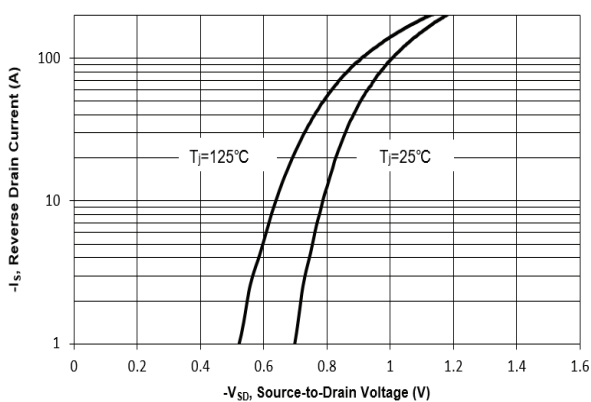


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

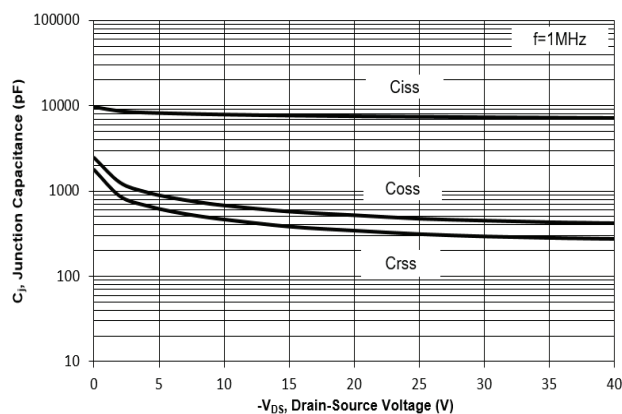


Fig. 8 Drain-Source Leakage Current vs. T_J

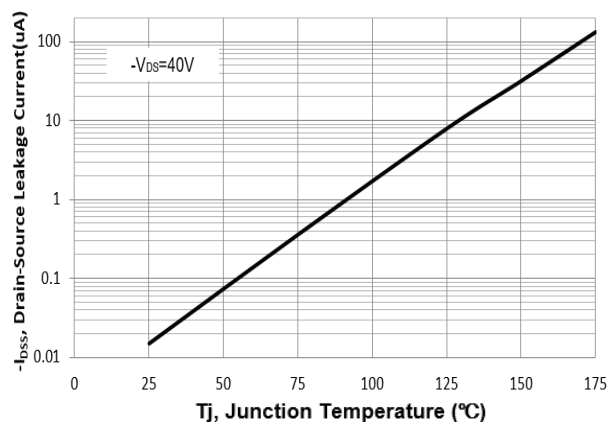


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

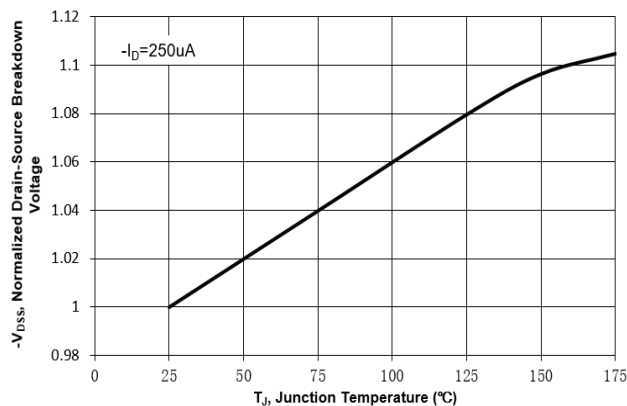


Fig. 10 Gate Threshold Variation vs. T_J

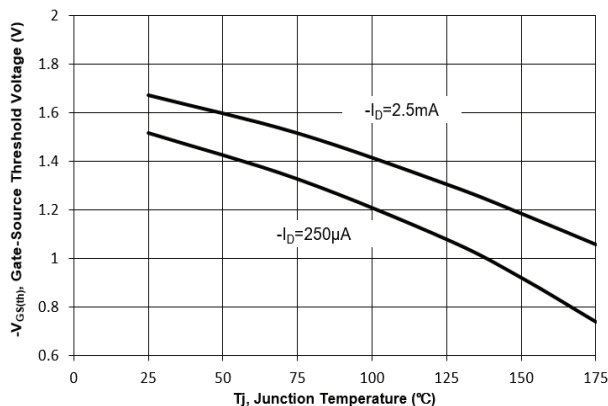


Fig. 11 Gate Charge

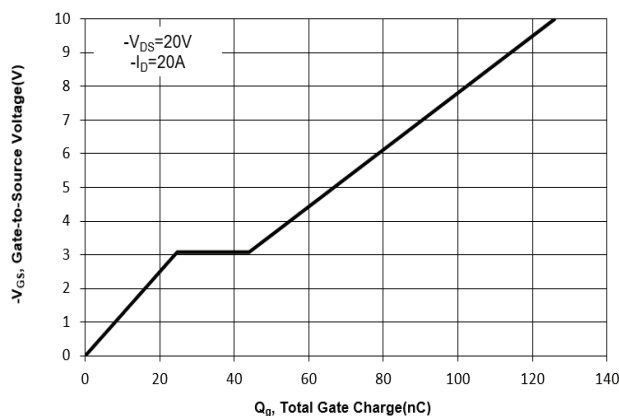
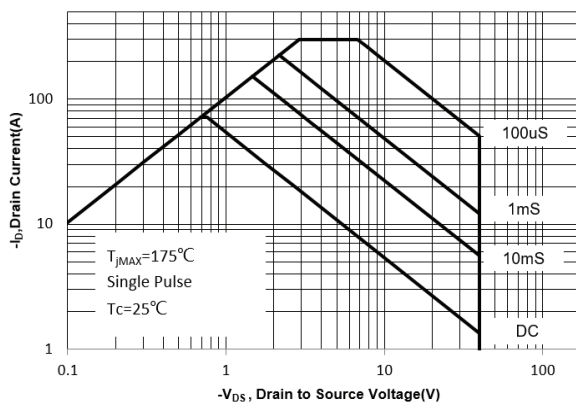


Fig. 12 Safe Operation Area



Electrical Characteristics Curves

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

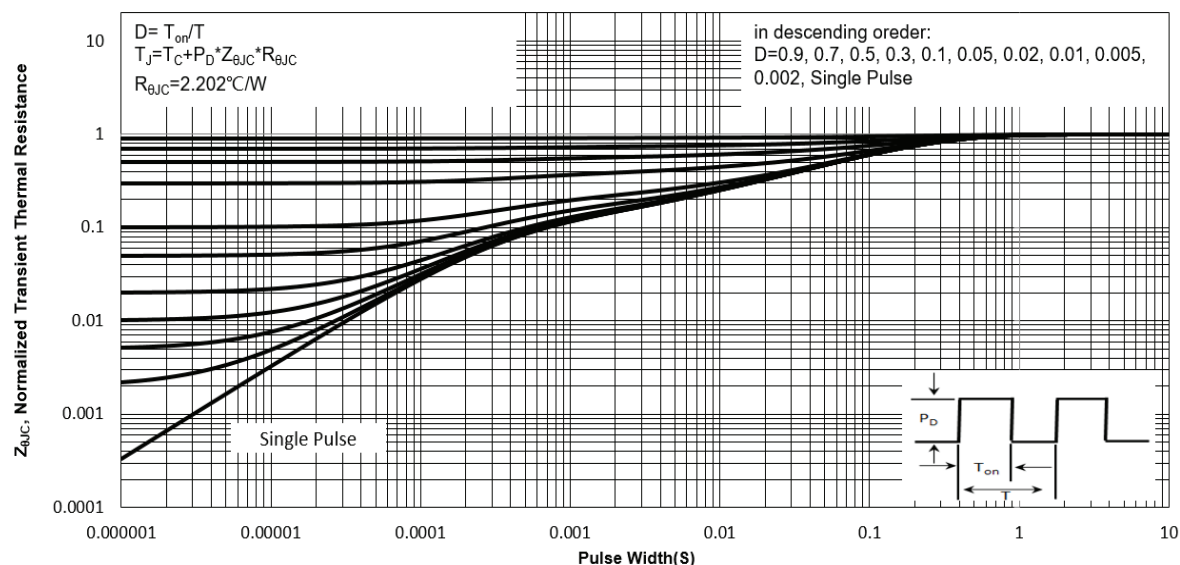
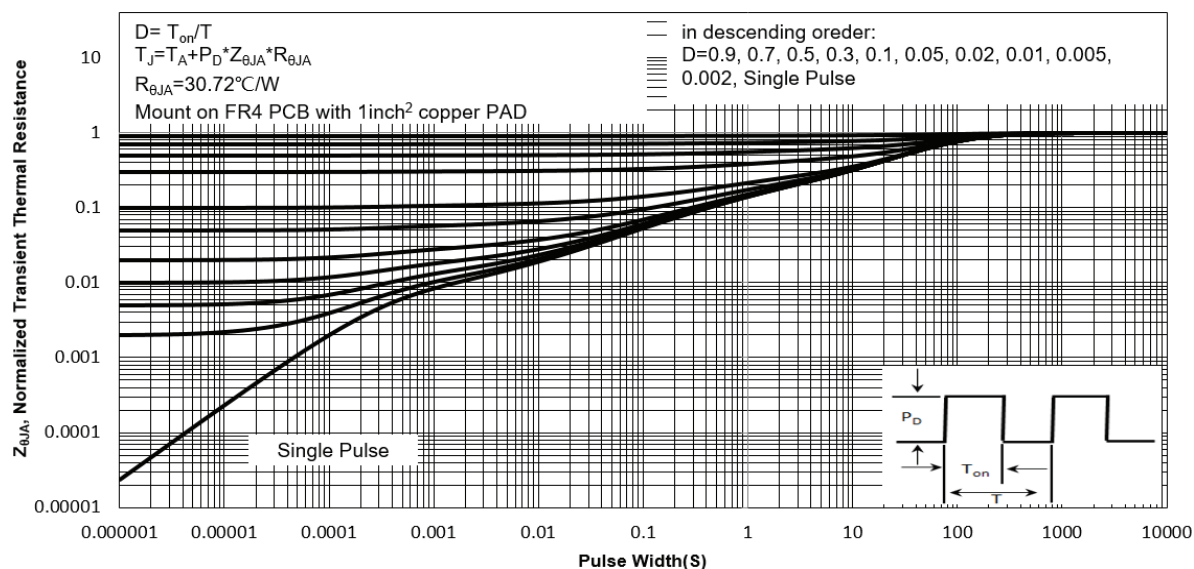


Fig. 14 Normalized Maximum Transient Thermal Impedance($z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

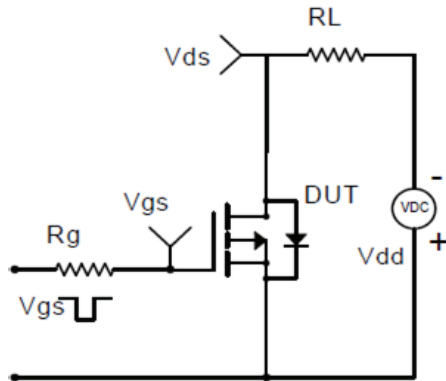


Fig.1-2 Switching Waveform

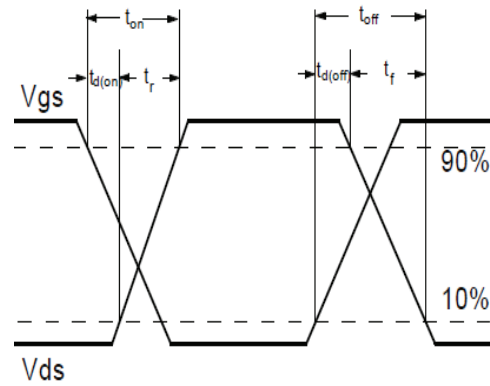


Fig.2-1 Gate charge test circuit

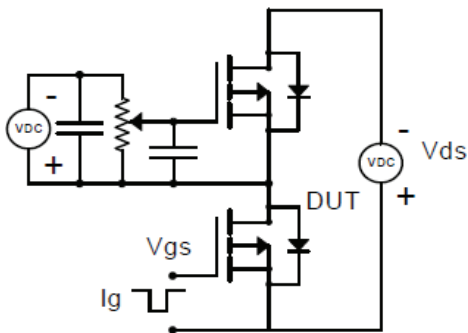


Fig.2-2 Gate charge waveform

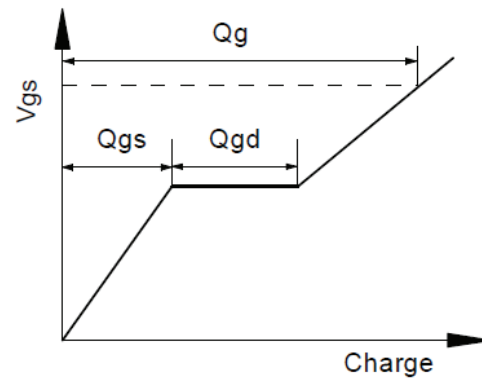


Fig.3-1 Avalanche test circuit

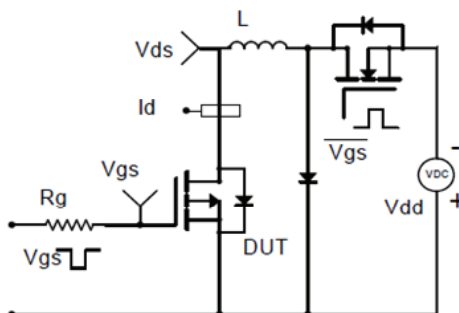
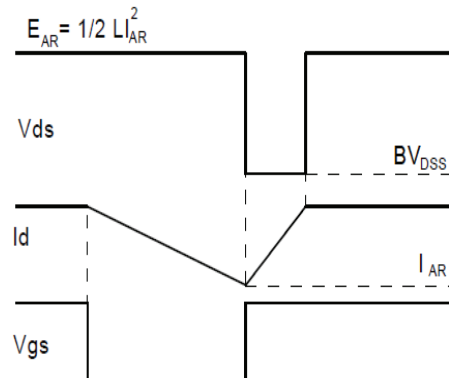
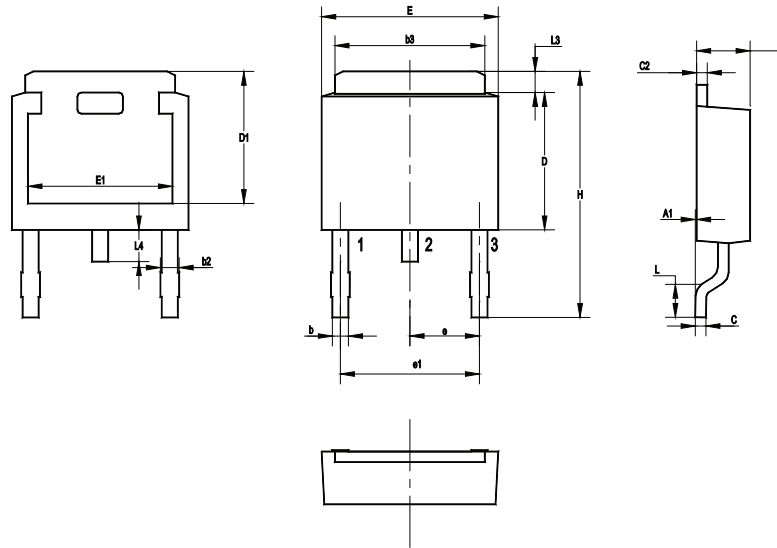


Fig.3-2 Avalanche waveform



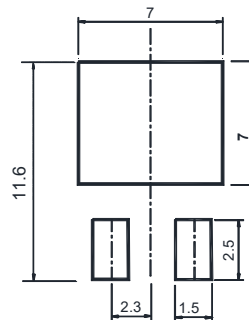
Package Outline (Dimensions in mm)

TO-252



UNIT	A	A1	b	b2	b3	C	C2	D	D1	E	E1	e	e1	H	L	L3	L4
mm	2.5	0.15	1.0	1.15	5.5	0.65	0.65	6.2	5.4	6.7	5.0	2.30	4.60	10.7	1.78	1.20	1.10
	2.1	0	0.5	0.65	4.9	0.4	0.4	5.6	5.0	6.1	4.6	TYP.	TYP.	9	1.40	0.85	0.51

Recommended Soldering Footprint



Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
TO-252	16	8 ± 0.1	0.315 ± 0.004	330	13	2,500

Marking information

" TR04P065LS " = 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.