

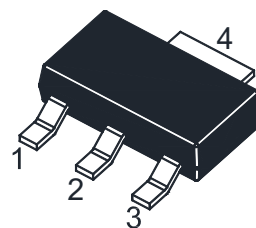
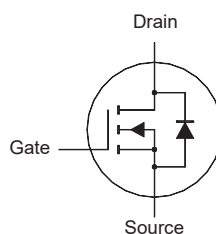
N-Channel Enhancement Mode MOSFET

Features

- Surface-mounted package
- Halogen and Antimony Free(HAF), RoHS compliant

Applications

- BLDC Motor drive applications
- Battery powered circuits
- Synchronous rectifier applications
- Resonant mode power supplies



1.Gate 2.Drain 3.Source 4.Dr.
SOT-223 Plastic Package

Key Parameters

Parameter	Value	Unit
BV_{DSS}	100	V
$R_{DS(ON)} \text{ Max}$	115 @ $V_{GS} = 10 \text{ V}$	m Ω
	125 @ $V_{GS} = 4.5 \text{ V}$	
$V_{GS(th)} \text{ typ}$	1.6	V
$Q_g \text{ typ}$	20 @ $V_{GS} = 10 \text{ V}$	nC

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	100	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current	I_D	5	A
		3.5	
Peak Drain Current, Pulsed ¹⁾	I_{DM}	20	A
Single-Pulse Avalanche Current	I_{AS}	5	A
Single-Pulse Avalanche Energy ²⁾	E_{AS}	3.7	mJ
Total Power Dissipation	P_{tot}	10	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	$R_{\theta JC}$	15	$^\circ\text{C/W}$
Thermal Resistance - Junction to Ambient ³⁾	$R_{\theta JA}$	45	$^\circ\text{C/W}$
Thermal Resistance - Junction to Ambient ⁴⁾ Steady State	$R_{\theta JA}$	100	$^\circ\text{C/W}$

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 $T_j = 25^\circ\text{C}$, $L = 0.3 \text{ mH}$, $R_g = 25 \Omega$, $I_{AS} = 5 \text{ A}$, $V_{GS} = 10 \text{ V}$.

³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate, $t < 10 \text{ s}$.

⁴⁾ Device mounted on FR-4 substrate PC board, minimum recommended footprint.

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}	100	-	-	V
Drain-Source Leakage Current at $V_{DS} = 80\ \text{V}$	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	-	2.5	V
Drain-Source On-State Resistance at $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$ at $V_{GS} = 4.5\ \text{V}$, $I_D = 3\ \text{A}$	$R_{DS(on)}$	- -	106 -	115 125	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5\ \text{V}$, $I_D = 4\ \text{A}$	g_{fs}	-	8	-	S
Gate Resistance at $V_{DS} = 0\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	1.1	-	Ω
Input Capacitance at $V_{DS} = 50\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	1155	-	pF
Output Capacitance at $V_{DS} = 50\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	28	-	pF
Reverse Transfer Capacitance at $V_{DS} = 50\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	25	-	pF
Gate Charge Total at $V_{DS} = 50\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$ at $V_{DS} = 50\ \text{V}$, $V_{GS} = 4.5\ \text{V}$, $I_D = 4\ \text{A}$	Q_g	- -	20 9	- -	nC
Gate to Source Charge at $V_{DS} = 50\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$	Q_{gs}	-	4	-	nC
Gate to Drain Charge at $V_{DS} = 50\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$	Q_{gd}	-	2	-	nC
Turn-On Delay Time at $V_{DS} = 50\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(on)}$	-	14	-	ns
Turn-On Rise Time at $V_{DS} = 50\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$, $R_g = 3.3\ \Omega$	t_r	-	4	-	ns
Turn-Off Delay Time at $V_{DS} = 50\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$, $R_g = 3.3\ \Omega$	$t_{d(off)}$	-	13	-	ns
Turn-Off Fall Time at $V_{DS} = 50\ \text{V}$, $V_{GS} = 10\ \text{V}$, $I_D = 4\ \text{A}$, $R_g = 3.3\ \Omega$	t_f	-	2	-	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	-	-	5	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	20	A
Body Diode Reverse Recovery Time at $I_S = 4\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	21	-	ns
Body Diode Reverse Recovery Charge at $I_S = 4\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	22	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

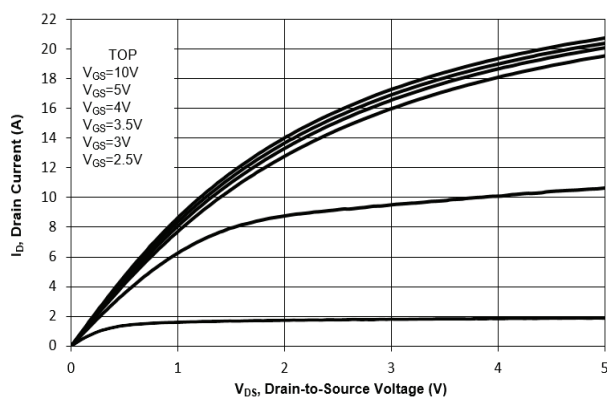


Fig. 2 Typical Transfer Characteristics

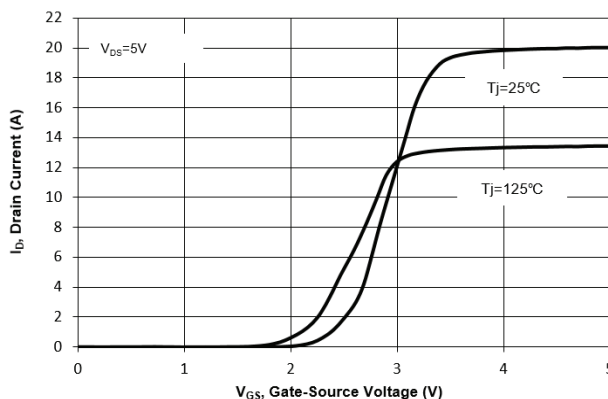


Fig. 3 on-Resistance vs Drain Current

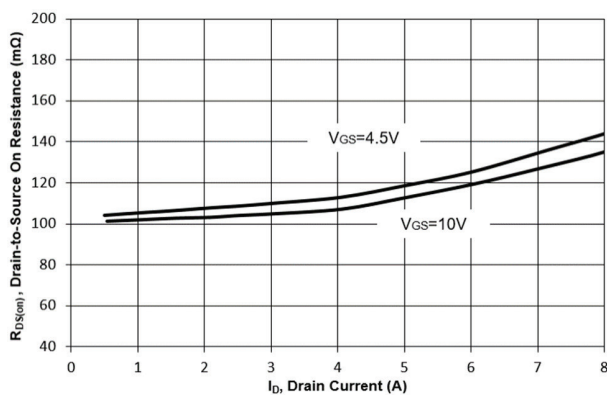


Fig. 4 on-Resistance vs. Gate to Source Voltage

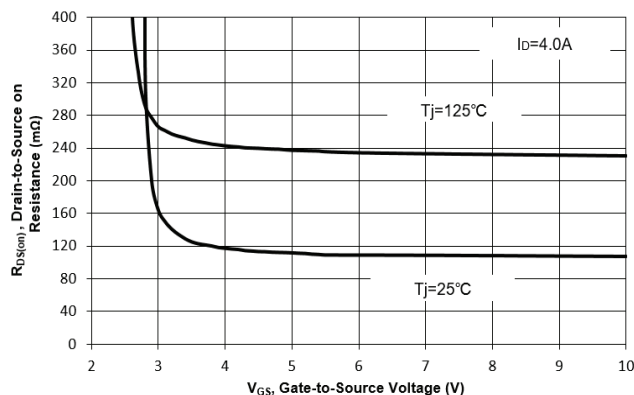


Fig. 5 on-Resistance vs. Tj

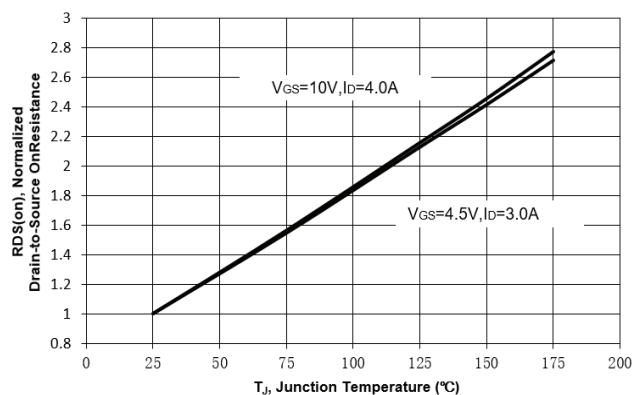
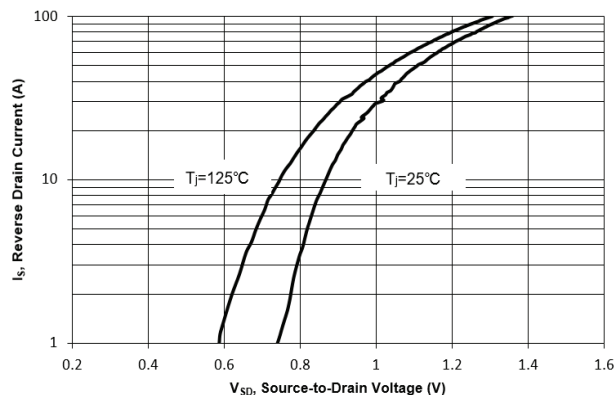


Fig. 6 Typical Body Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

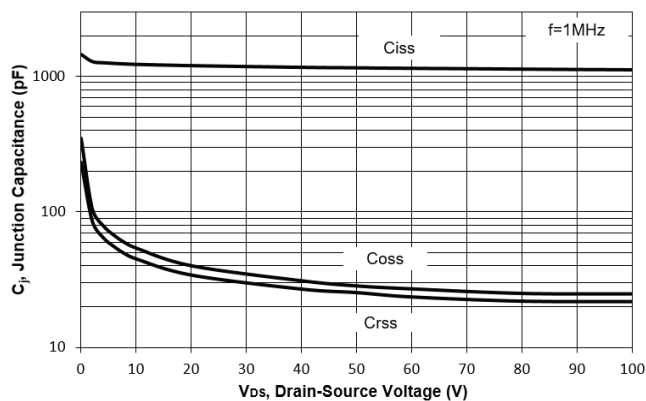


Fig. 8 Drain-Source Leakage Current vs. T_j

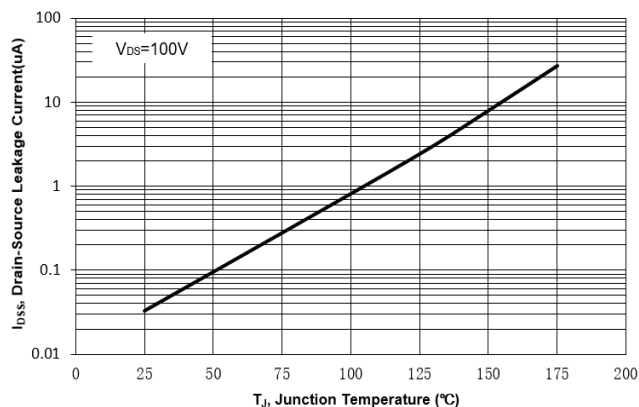


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

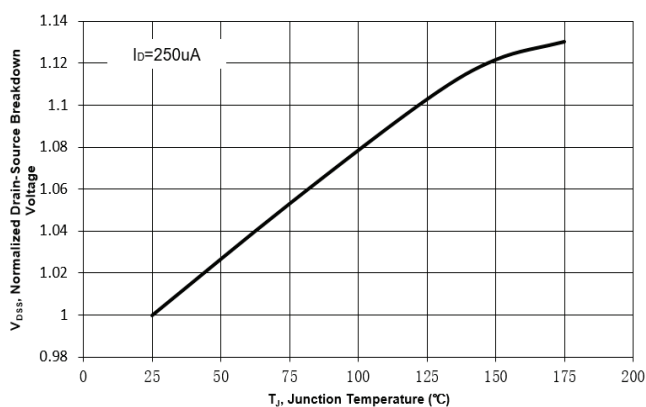


Fig. 10 Gate Threshold Variation vs. T_j

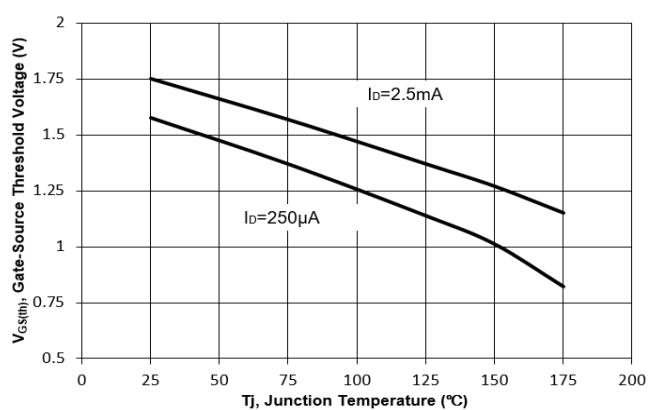


Fig. 11 Gate Charge

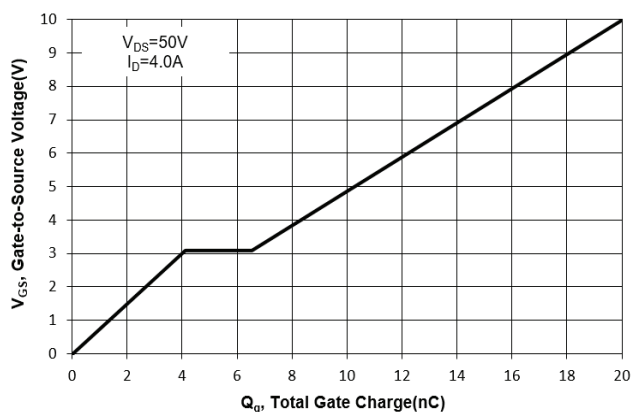
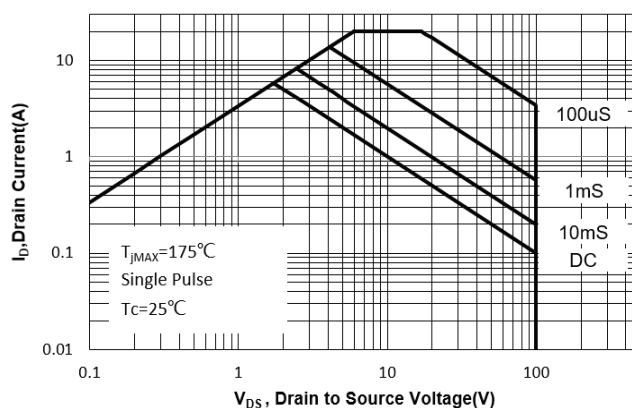


Fig. 12 Safe Operation Area



Electrical Characteristics Curves

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

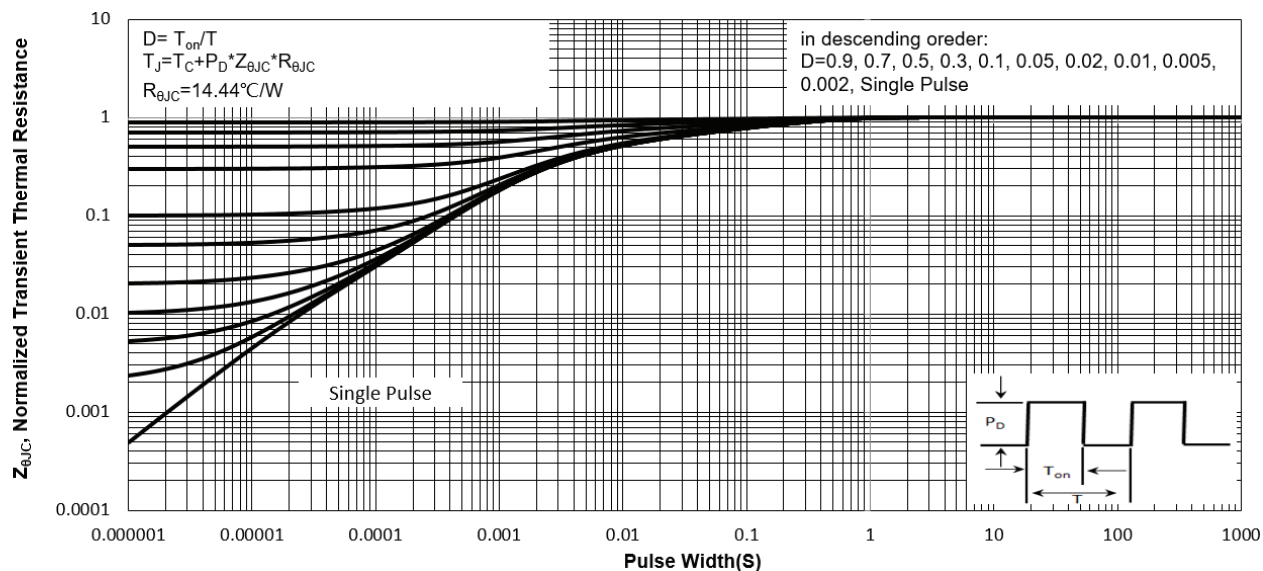
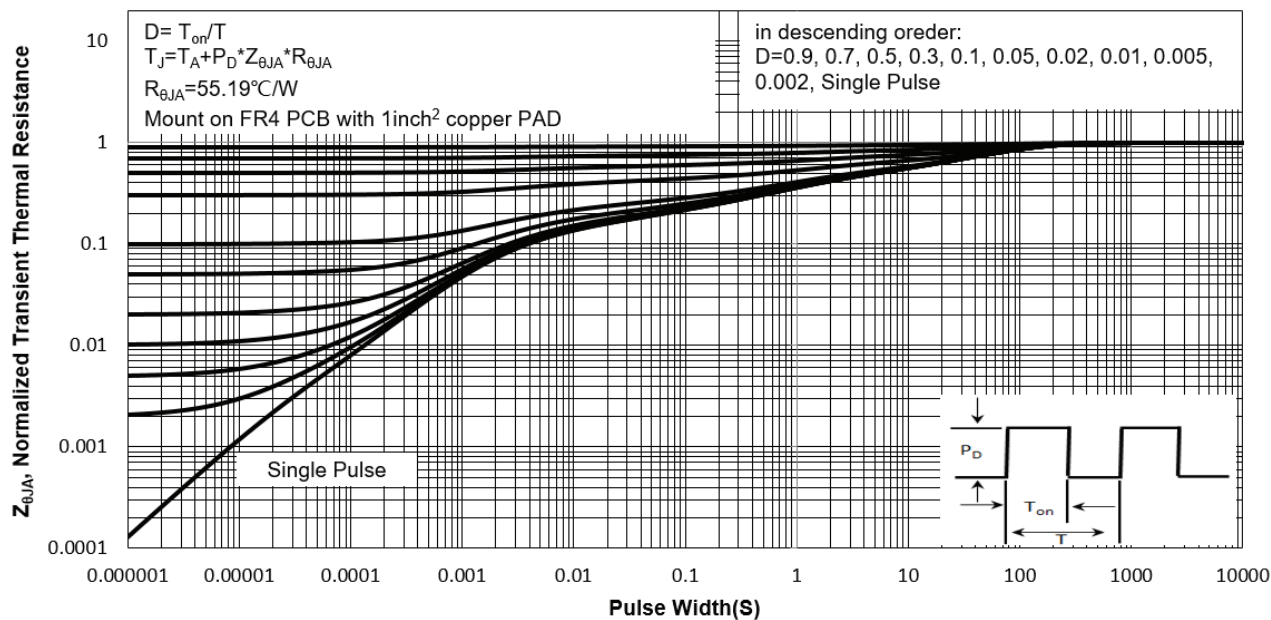


Fig. 14 Normalized Maximum Transient Thermal Impedance($z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

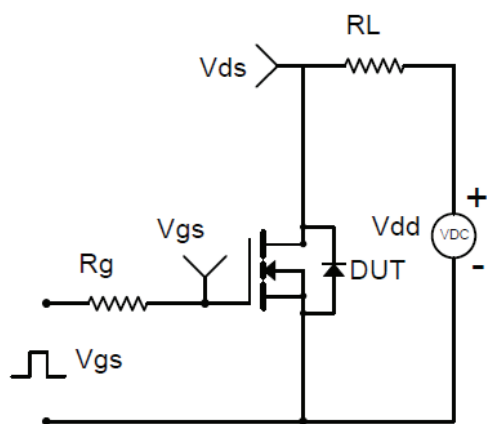


Fig.1-2 Switching Waveform

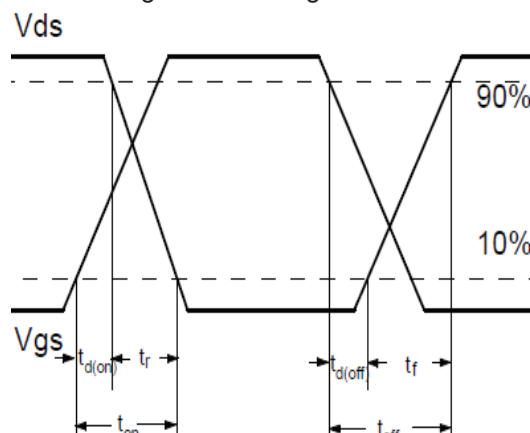


Fig.2-1 Gate charge test circuit

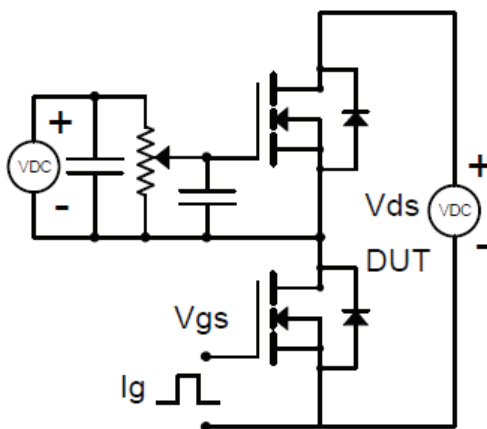


Fig.2-2 Gate charge waveform

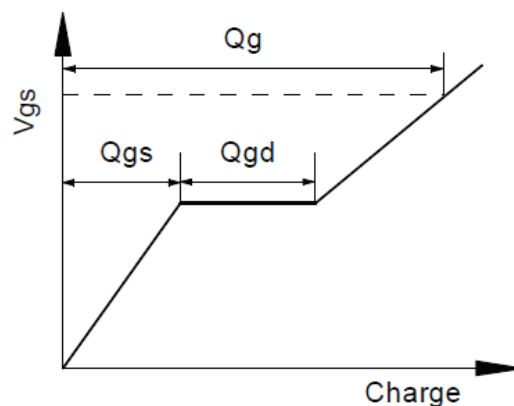


Fig.3-1 Avalanche test circuit

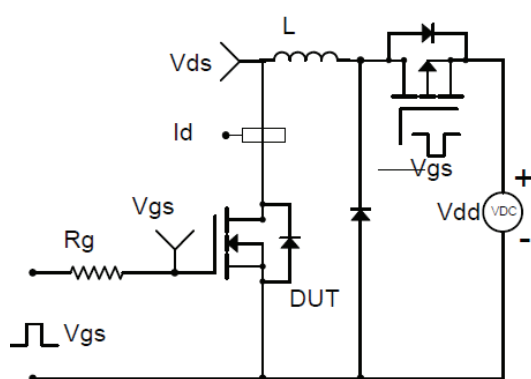
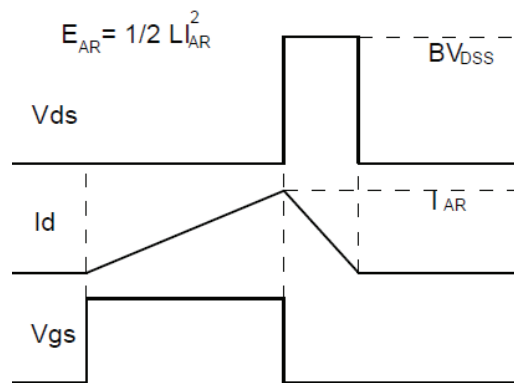
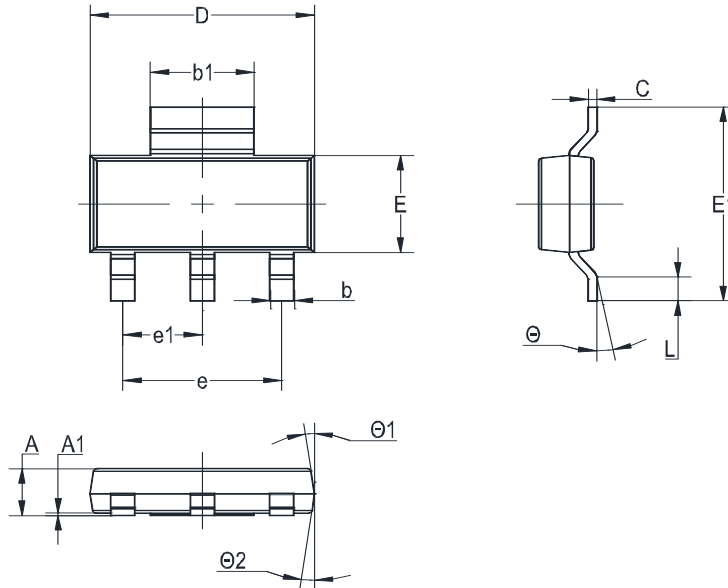


Fig.3-2 Avalanche waveform



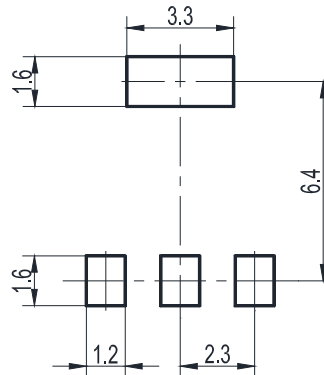
Package Outline (Dimensions in mm)

SOT-223



Unit	A	A1	b	b1	C	D	E	E1	e	e1	L	Θ	Θ1	Θ2
mm	1.8 1.5	0.1 MAX	0.8 0.6	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	7.3 6.7	4.6 TYP	2.3 TYP	1.1 0.7	10° 0°	7° 0°	7° 0°

Recommended Soldering Footprint



Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
SOT-223	12	8 ± 0.1	0.315 ± 0.004	330	13	3,000

Marking information

" TQ10N1K1LS " = Part No.

" ***** " = Date Code Marking

Font type: Arial



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