

2SK1151STL-E-VB Datasheet

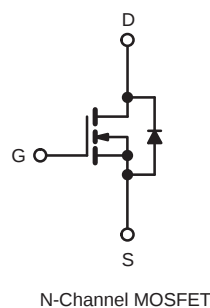
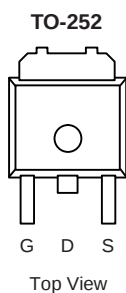
N-Channel 650 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	650	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	3.8
Q_g (Max.) (nC)	15	
Q_{gs} (nC)	3	
Q_{gd} (nC)	6	
Configuration	Single	

FEATURES

- Low Gate Charge Q_g Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Compliant to RoHS directive 2002/95/EC


 Available
RoHS


ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current ^e	I_D	$T_C = 25\text{ }^\circ\text{C}$	A
Continuous Drain Current		$T_C = 100\text{ }^\circ\text{C}$	
Pulsed Drain Current ^a	I_{DM}	8.0	
Linear Derating Factor		0.48	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	165	mJ
Repetitive Avalanche Current ^a	I_{AR}	2	A
Repetitive Avalanche Energy ^a	E_{AR}	4	mJ
Maximum Power Dissipation	P_D	60	W
Peak Diode Recovery dV/dt ^c	dV/dt	2.8	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature) ^d	for 10 s	300	
Mounting Torque	6-32 or M3 screw	10	lbf · in
		1.1	N · m

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 24\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AS} = 3.2\text{ A}$ (see fig. 12).
- $I_{SD} \leq 3.2\text{ A}$, $dI/dt \leq 90\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.
- Drain current limited by maximum junction temperature.

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	65	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	2.1	

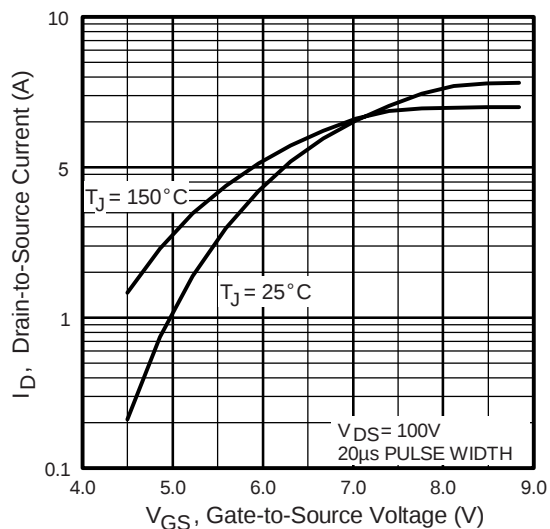
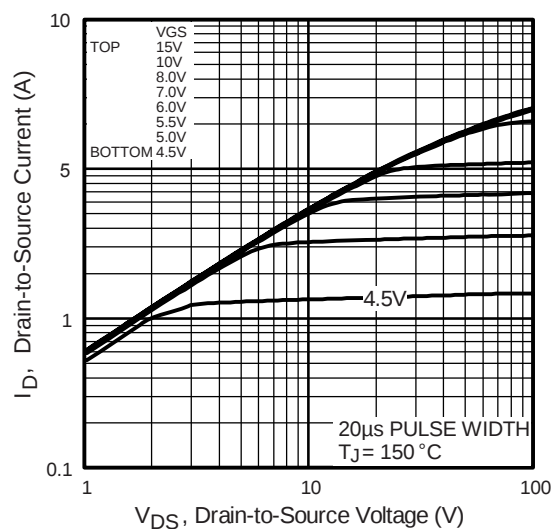
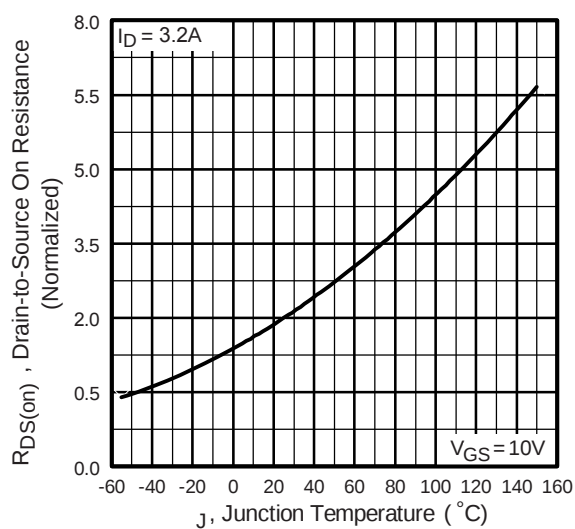
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		650	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA ^d		-	670	-	mV/°C
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 30 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650 V, V _{GS} = 0 V		-	-	25	μA
		V _{DS} = 520 V, V _{GS} = 0 V, T _J = 125 °C		-	-	250	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 3.1 A ^b	-	3.8	-	Ω
Forward Transconductance	g _{fs}	V _{DS} = 50 V, I _D = 3.1 A		3.9	-	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	330	-	pF
Output Capacitance	C _{oss}			-	40	-	
Reverse Transfer Capacitance	C _{rss}			-	5.0	-	
Output Capacitance	C _{oss}	V _{GS} = 0 V	V _{DS} = 1.0 V, f = 1.0 MHz	-	912	-	
Effective Output Capacitance	C _{oss eff.}		V _{DS} = 520 V, f = 1.0 MHz	-	48	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 3.2 A, V _{DS} = 400 V see fig. 6 and 13 ^b	-	-	15	nC
Gate-Source Charge	Q _{gs}			-	-	3	
Gate-Drain Charge	Q _{gd}			-	-	6	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 325 V, I _D = 3.2 A R _G = 9.1 Ω, R _D = 62 Ω, see fig. 10 ^b		-	14	-	ns
Rise Time	t _r			-	20	-	
Turn-Off Delay Time	t _{d(off)}			-	34	-	
Fall Time	t _f			-	18	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	4	A
Pulsed Diode Forward Current ^a	I _{SM}			-	-	21	
Body Diode Voltage	V _{SD}	T _J = 25 °C, I _S = 3.2 A, V _{GS} = 0 V ^b		-	-	1.5	V
Body Diode Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 3.2 A, dI/dt = 100 A/μs ^b		-	493	739	ns
Body Diode Reverse Recovery Charge	Q _{rr}			-	2.1	3.2	μC
Forward Turn-On Time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
 b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
 c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .
 d. $t = 60\text{ s}$, $f = 60\text{ Hz}$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Fig. 1 - Typical Output Characteristics

Fig. 3 - Typical Transfer Characteristics

Fig. 2 - Typical Output Characteristics

Fig. 4 - Normalized On-Resistance vs. Temperature

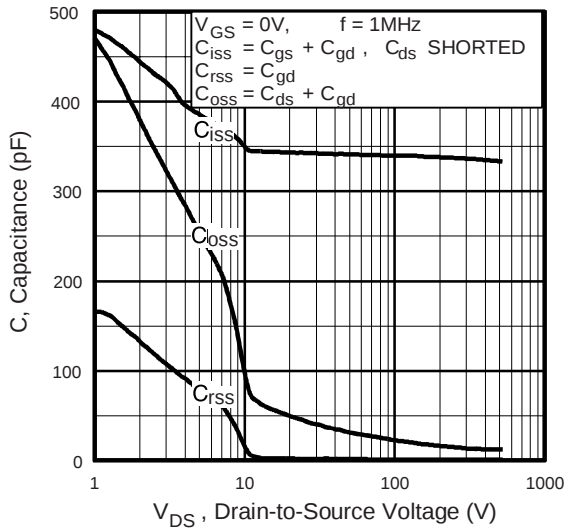


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage



Fig. 7 - Typical Source-Drain Diode Forward Voltage



Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

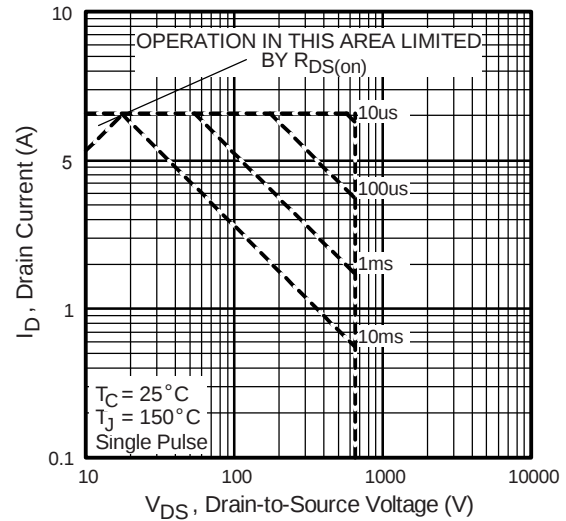


Fig. 8 - Maximum Safe Operating Area

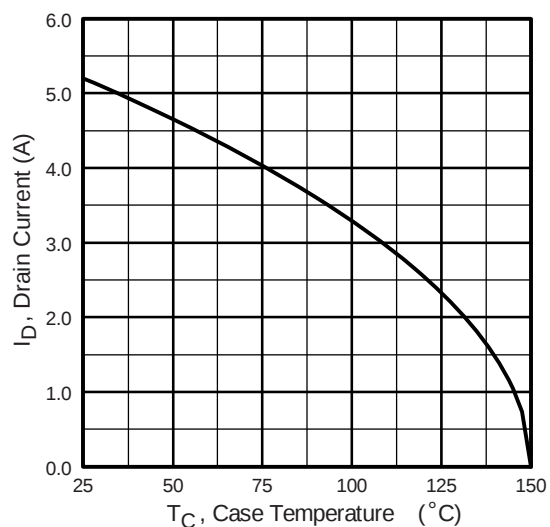


Fig. 9 - Maximum Drain Current vs. Case Temperature

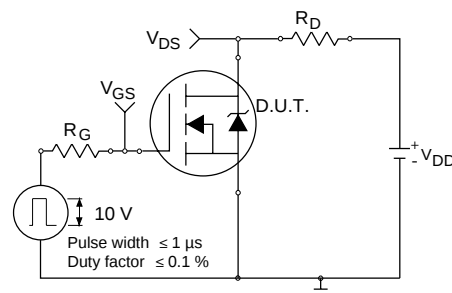


Fig. 10a - Switching Time Test Circuit

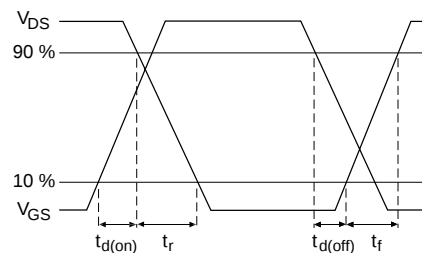


Fig. 10b - Switching Time Waveforms

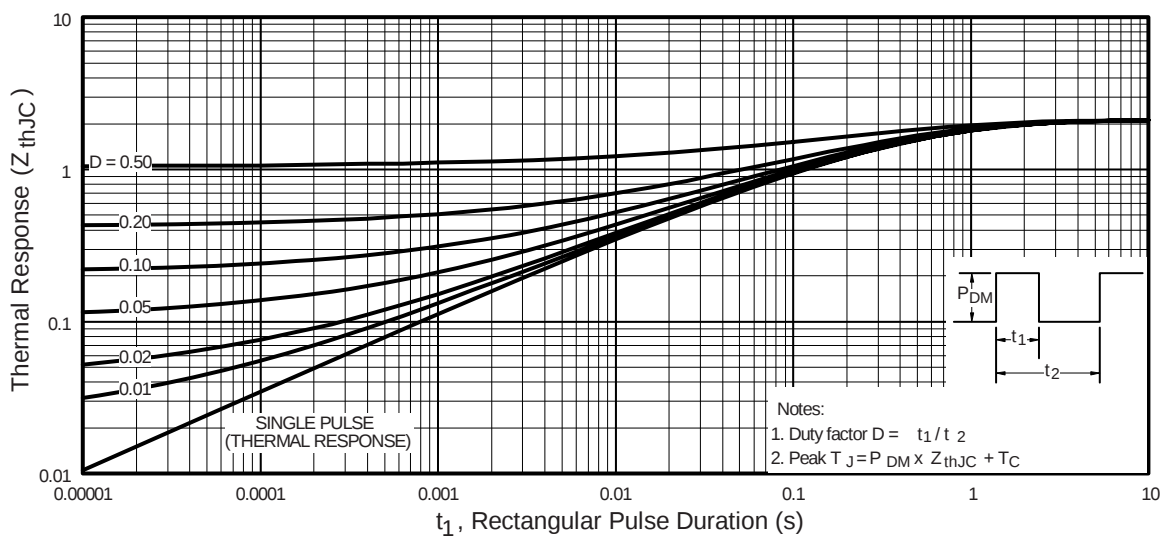


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

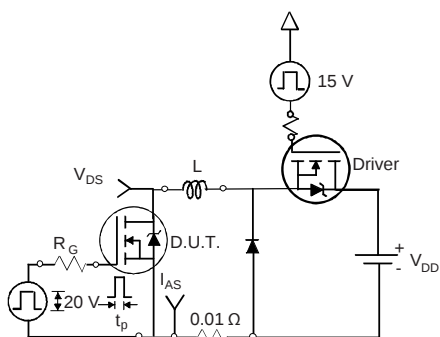


Fig. 12a - Unclamped Inductive Test Circuit

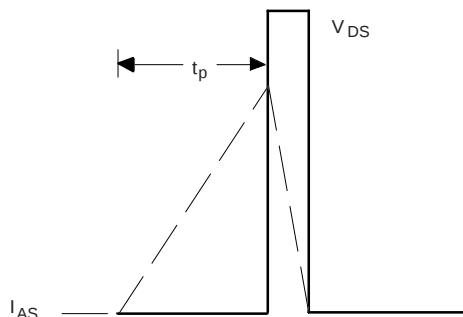


Fig. 12b - Unclamped Inductive Waveforms

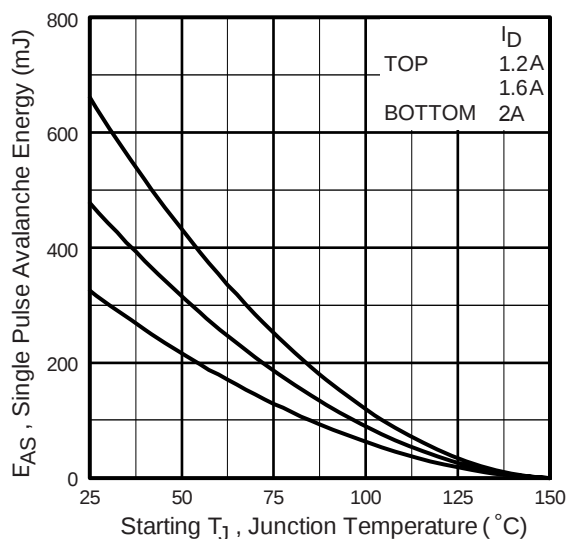


Fig. 12c - Maximum Avalanche Energy vs. Drain Current



Fig. 12d - Typical Drain-to Source Voltage vs. Avalanche Current



Fig. 13a - Basic Gate Charge Waveform

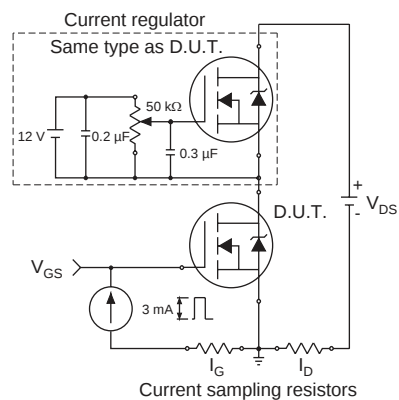


Fig. 13b - Gate Charge Test Circuit

The diagram shows a differential-mode common-emitter amplifier circuit. It consists of two identical signal paths. The input signal, labeled ①, is a square wave applied to the base of the first transistor through a resistor R_G . The base-emitter junction of this transistor is labeled "D.U.T." (Device Under Test). The emitter of the first transistor is connected to the emitter of the second transistor, which is also connected to ground. The collector of the first transistor is connected to a transformer's primary winding, labeled ②. The secondary winding of the transformer is connected to the base of the second transistor. The collector of the second transistor is connected to a load network, labeled ④, which includes a series inductor, a parallel combination of a capacitor and a resistor, and is connected to a positive supply voltage V_{DD} . The output of the circuit is taken differentially from the collectors of both transistors, labeled ③. The circuit layout considerations listed are: Low stray inductance, Ground plane, and Low leakage inductance current transformer.

Circuit layout considerations

- Low stray inductance
- Ground plane
- Low leakage inductance current transformer

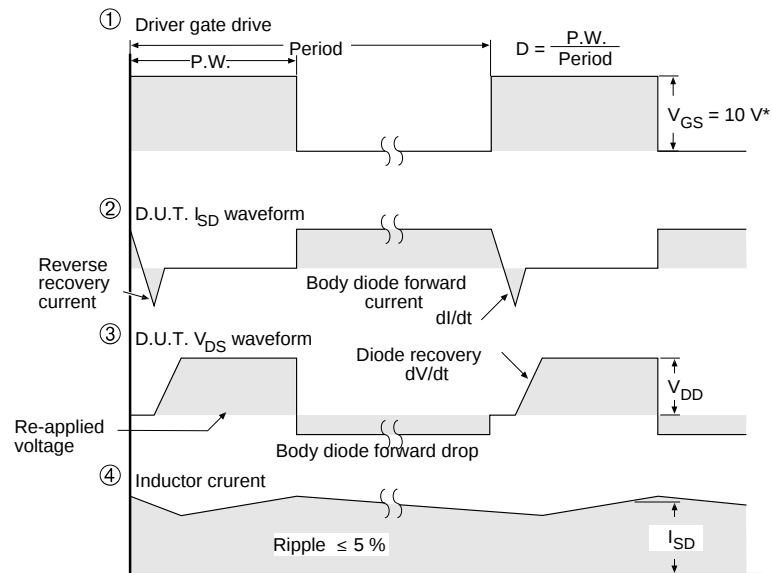


Fig. 14 - For N-Channel

TO-252AA CASE OUTLINE



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.14	1.52	0.045	0.060
ECN: X12-0247-Rev. M, 24-Dec-12				
DWG: 5347				

Note

- Dimension L3 is for reference only.

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