

100V, 234A, 2.4mΩ N-channel Power SGT MOSFET

JMSH1002NSQ

Features

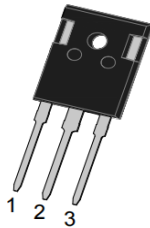
- Ultra-low ON-resistance, $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100% ΔV_{ds} Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

Applications

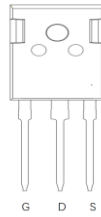
- Load Switch
- PWM Application
- General Automotive Application

Product Summary

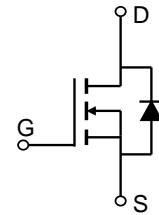
Parameters	Value	Unit
V_{DSS}	100	V
$V_{GS(th)}_{Typ}$	3.0	V
$I_D(@V_{GS}=10V)$	234	A
$R_{DS(ON)}_{Typ}(@V_{GS}=10V)$	2.4	mΩ



TO-247-3L Top



Pin Assignment



Schematic Diagram

Ordering Information

Device	Marking	MSL	Form	Package	Tube(pcs)	Per Carton (pcs)
JMSH1002NSQ-U	SH1002NQ	N A	Tube	TO-247-3L	30	2250

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

Symbol	Parameter	Value	Unit
V_{DS}	Drain-to-Source Voltage	100	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D	Continuous Drain Current	$T_C = 25^\circ\text{C}$	234
		$T_C = 100^\circ\text{C}$	165
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
E_{AS}	Single Pulsed Avalanche Energy ⁽²⁾	1722	mJ
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$	375
		$T_C = 100^\circ\text{C}$	188
T_J, T_{STG}	Junction & Storage Temperature Range	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽³⁾	33	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.4	

**Electrical Characteristics** ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	100	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 80\text{V}$, $V_{GS} = 0\text{V}$	-	-	1.0	μA
I_{GSS}	Gate-Body Leakage Current	$V_{DS} = 0\text{V}$, $V_{GS} = \pm 20\text{V}$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$	2.1	3.0	3.8	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance ⁽⁴⁾	$V_{GS} = 10\text{V}$, $I_D = 20\text{A}$	-	2.4	3.1	m Ω
Dynamic Characteristics						
R_g	Gate Resistance	$f = 1\text{MHz}$	-	2.3	-	Ω
C_{iss}	Input Capacitance	$V_{GS} = 0\text{V}$, $V_{DS} = 50\text{V}$, $f = 1\text{MHz}$	7006	11677	17515	pF
C_{oss}	Output Capacitance		1058	1764	2646	pF
C_{rss}	Reverse Transfer Capacitance		23	38	77	pF
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V $V_{DS} = 50\text{V}$, $I_D = 20\text{A}$	101	169	253	nC
Q_{gs}	Gate Source Charge		33	55	83	nC
Q_{gd}	Gate Drain ("Miller") Charge		22	36	54	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{V}$, $V_{DD} = 50\text{V}$ $I_D = 20\text{A}$, $R_{GEN} = 3\Omega$	-	34	-	ns
t_r	Turn-On Rise Time		-	43	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	95	-	ns
t_f	Turn-Off Fall Time		-	51	-	ns
Body Diode Characteristics						
I_S	Maximum Continuous Body Diode Forward Current		-	-	234	A
I_{SM}	Maximum Pulsed Body Diode Forward Current		-	-	934	A
V_{SD}	Body Diode Forward Voltage	$V_{GS} = 0\text{V}$, $I_S = 20\text{A}$	-		1.2	V
t_{rr}	Body Diode Reverse Recovery Time	$I_F = 15\text{A}$, $di/dt = 100\text{A}/\mu\text{s}$	62	104	155	ns
Q_{rr}	Body Diode Reverse Recovery Charge		-	350	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. E_{AS} condition: Starting $T_J = 25^\circ\text{C}$, $V_{DD} = 50\text{V}$, $V_{GS} = 10\text{V}$, $R_G = 25\text{ohm}$, $L = 3\text{mH}$, $I_{AS} = 33.88\text{A}$, $V_{DD} = 0\text{V}$ during time in avalanche.
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch^2 pad of 2oz copper FR4 PCB.
 4. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 0.5\%$.



Typical Performance Characteristics

Figure 1: Power De-rating



Figure 2: Current De-rating

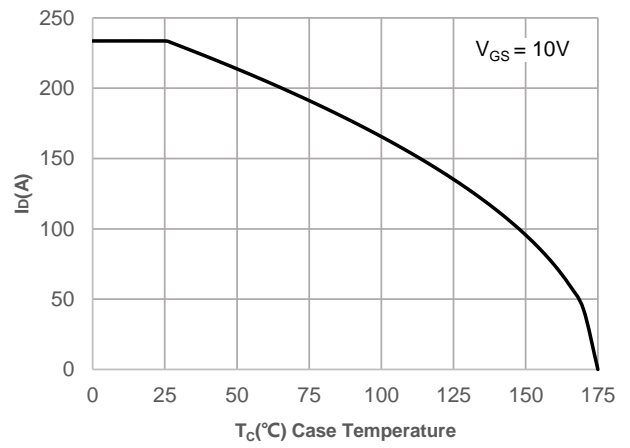


Figure 3: Normalized Maximum Transient Thermal Impedance

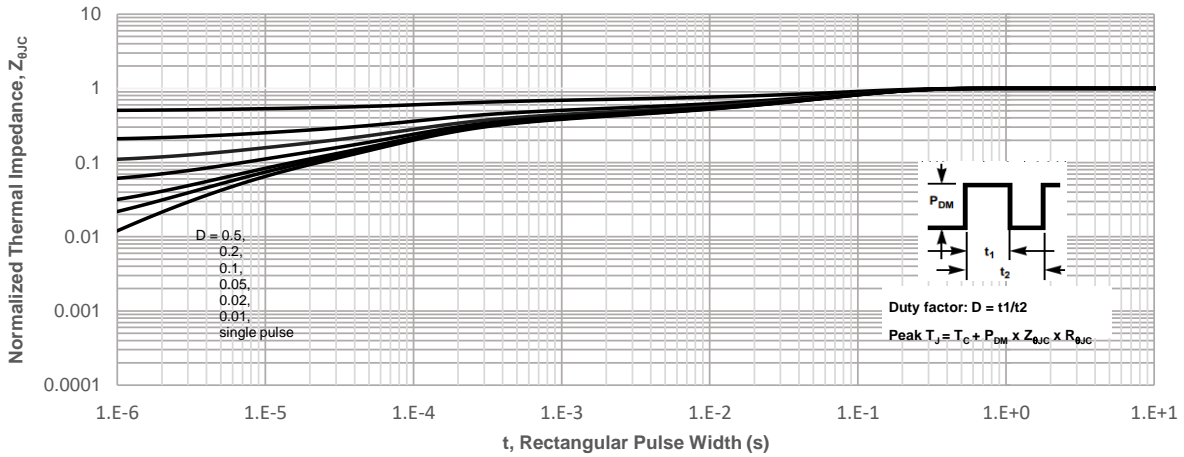
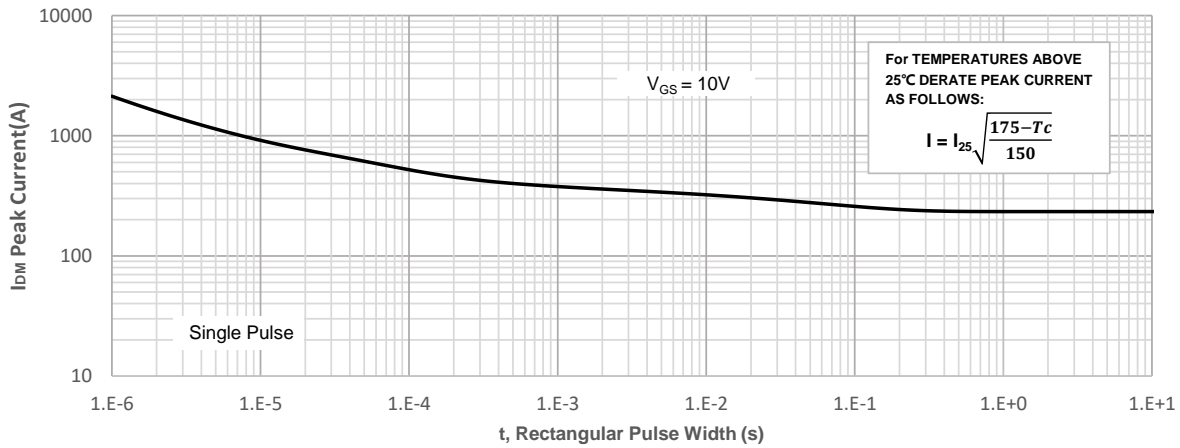


Figure 4: Peak Current Capacity



Typical Performance Characteristics

Figure 5: Output Characteristics

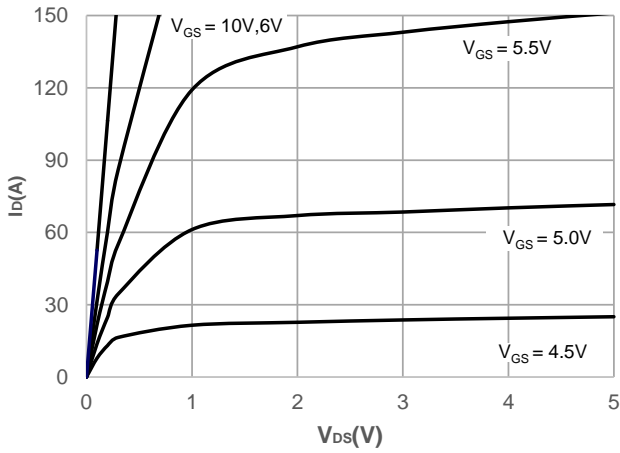


Figure 6: Typical Transfer Characteristics

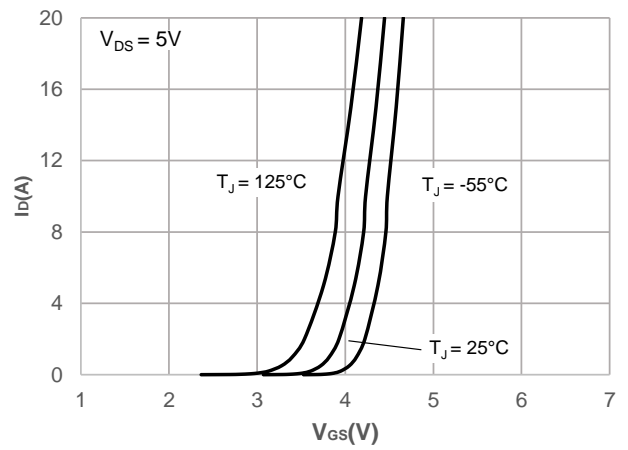


Figure 7: On-resistance vs. Drain Current

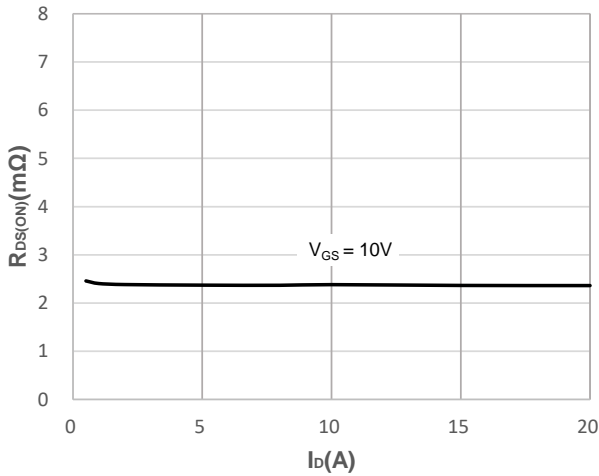


Figure 8: Body Diode Characteristics

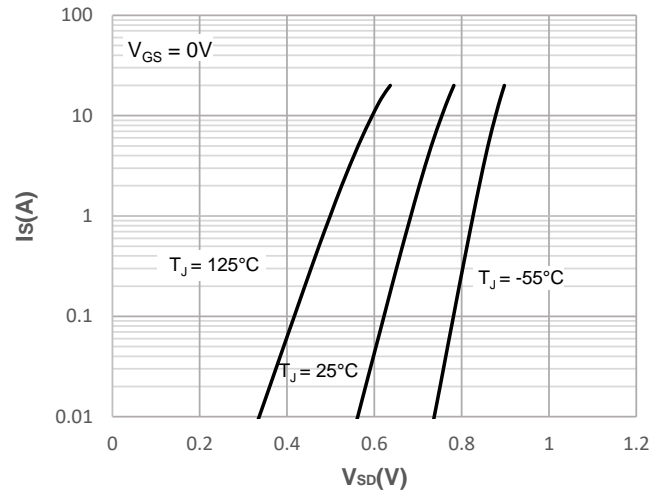


Figure 9: Gate Charge Characteristics

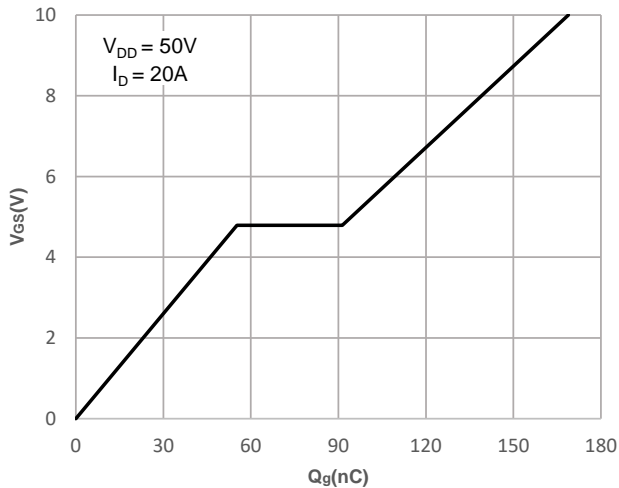
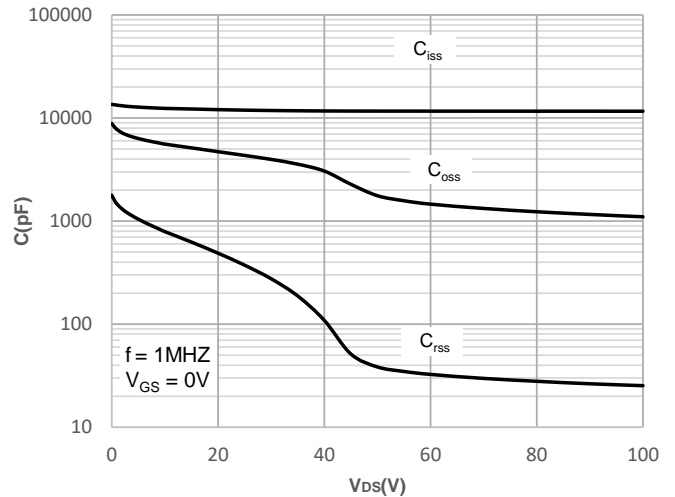


Figure 10: Capacitance Characteristics



Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

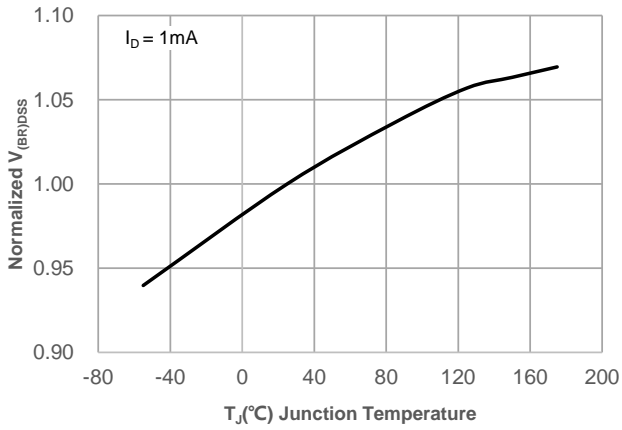


Figure 12: Normalized on Resistance vs. Junction Temperature

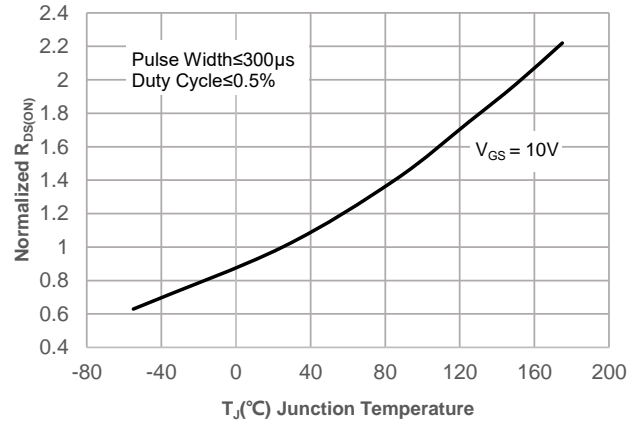


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

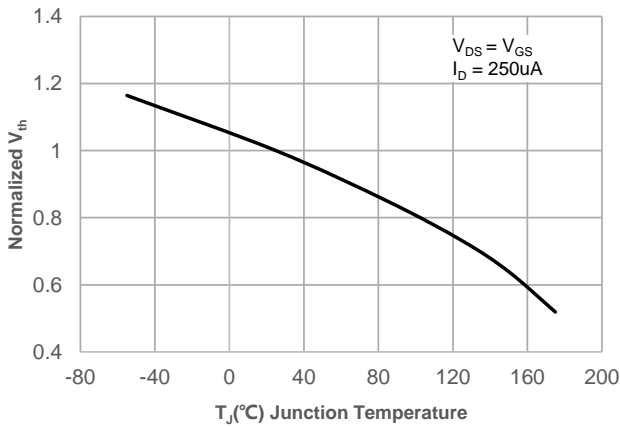


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

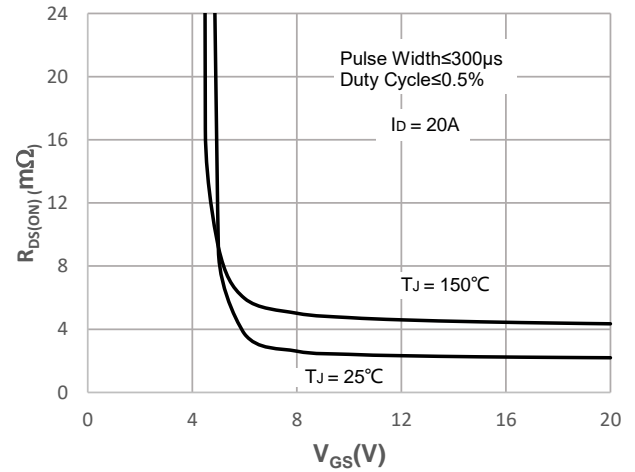
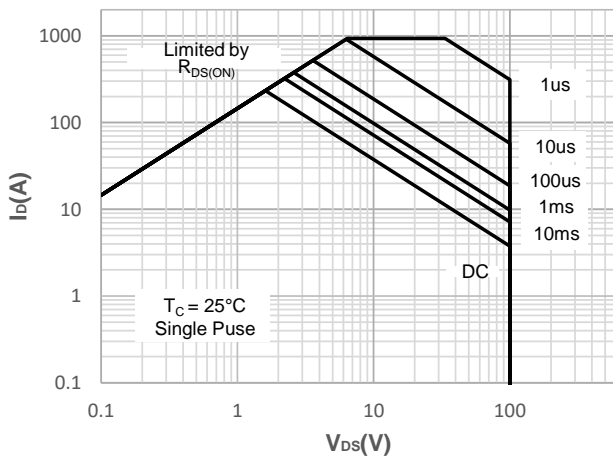


Figure 15: Maximum Safe Operating Area



Test Circuit

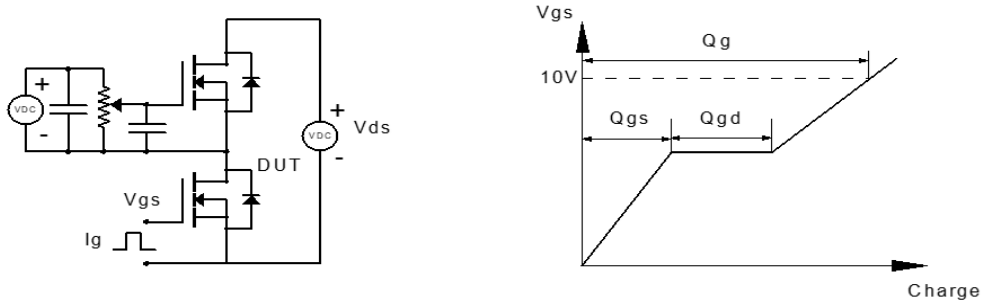


Figure 1: Gate Charge Test Circuit & Waveform

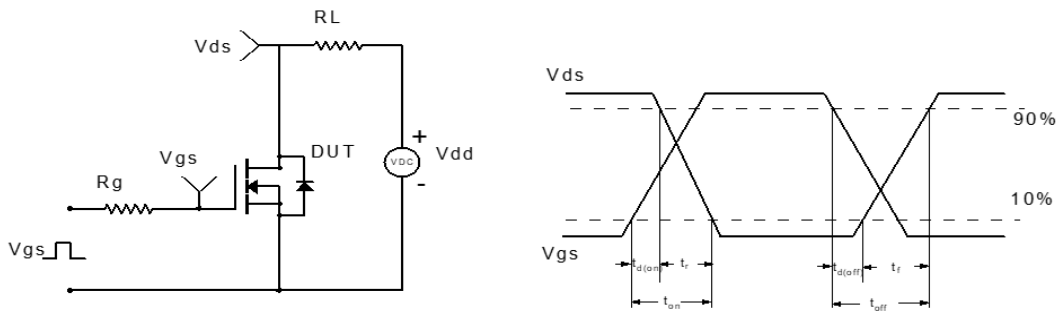


Figure 2: Resistive Switching Test Circuit & Waveform

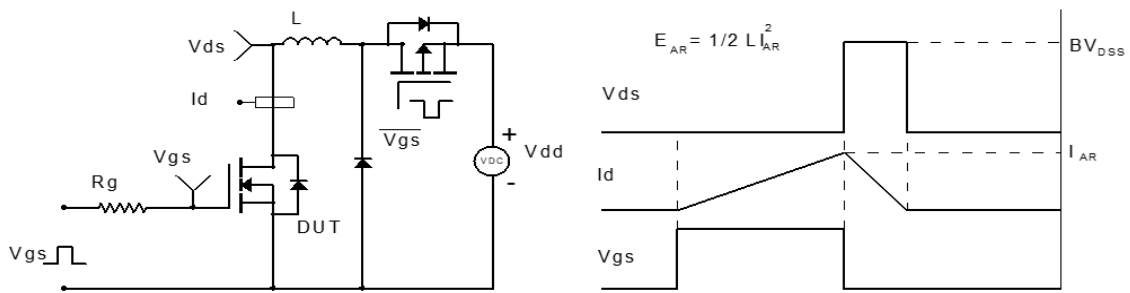


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

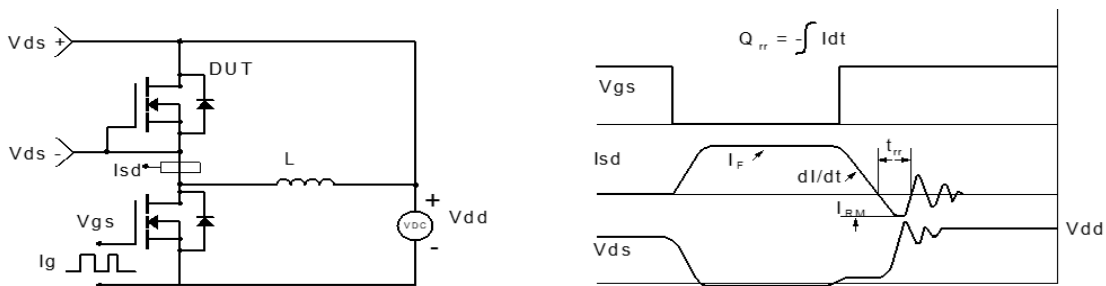
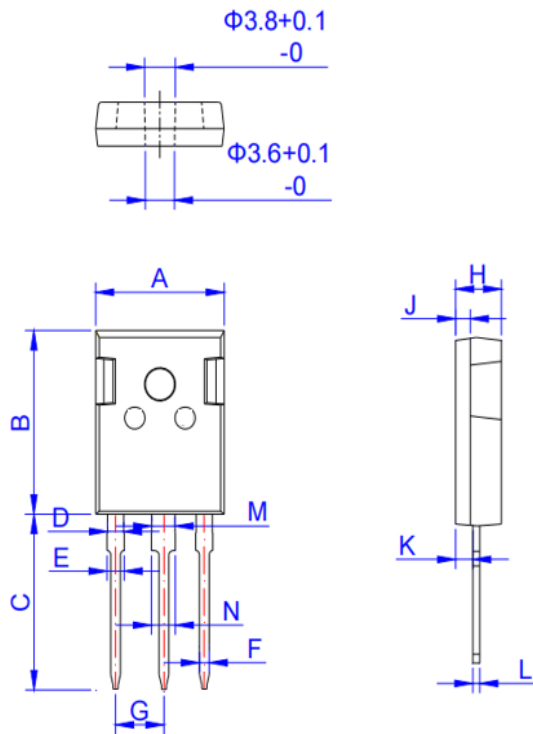


Figure 4: Diode Recovery Test Circuit & Waveform



Package Mechanical Data(TO-247-3L)

Package Outline



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.50	15.80	16.10	0.610	0.622	0.634
B	20.80	21.00	21.20	0.819	0.827	0.835
C	19.70	20.00	20.30	0.776	0.787	0.799
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.90	2.10	2.30	0.075	0.083	0.091
F	1.00	1.20	1.40	0.039	0.047	0.055
G	5.25		5.65	0.207		0.222
H	4.80	5.00	5.20	0.189	0.197	0.205
J	1.90	2.00	2.10	0.075	0.079	0.083
K	2.20	2.35	2.50	0.087	0.093	0.098
L	0.41	0.60	0.79	0.016	0.024	0.031
M	2.80	3.00	3.20	0.110	0.118	0.126
N	2.90	3.10	3.30	0.114	0.122	0.130

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