

40V, 4A, 40mΩ N-channel Power Trench MOSFET

JMTL400N04A

Features

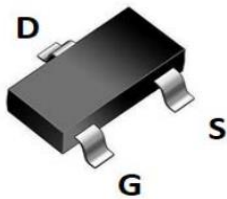
- Excellent $R_{DS(ON)}$ and Low Gate Charge
- Halogen-free; RoHS-compliant
- Pb-free plating

Applications

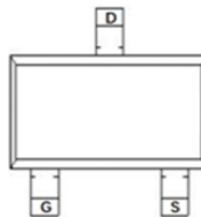
- Load Switch
- PWM Application
- Power Management

Product Summary

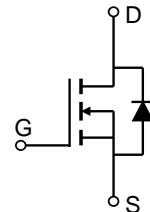
Parameters	Value	Unit
V_{DSS}	40	V
$V_{GS(th_Typ)}$	2.0	V
$I_D(@V_{GS}=10V)$	4	A
$R_{DS(ON_Typ)}(@V_{GS}=10V)$	30	mΩ
$R_{DS(ON_Typ)}(@V_{GS}=4.5V)$	40	mΩ



SOT-23 Top View



Pin Assignment



Schematic Diagram

Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMTL400N04A	4040	3	Tape&Reel	SOT-23	3000	120000

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

Symbol	Parameter	Value	Unit
V_{DS}	Drain-to-Source Voltage	40	V
V_{GS}	Gate-to-Source Voltage	±20	V
I_D	Continuous Drain Current	$T_A = 25^\circ\text{C}$	4
		$T_A = 100^\circ\text{C}$	2
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
P_D	Power Dissipation	$T_A = 25^\circ\text{C}$	1.1
		$T_A = 100^\circ\text{C}$	0.4
T_J, T_{STG}	Junction & Storage Temperature Range	-55 to 150	°C

Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽²⁾	166	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽³⁾	114	



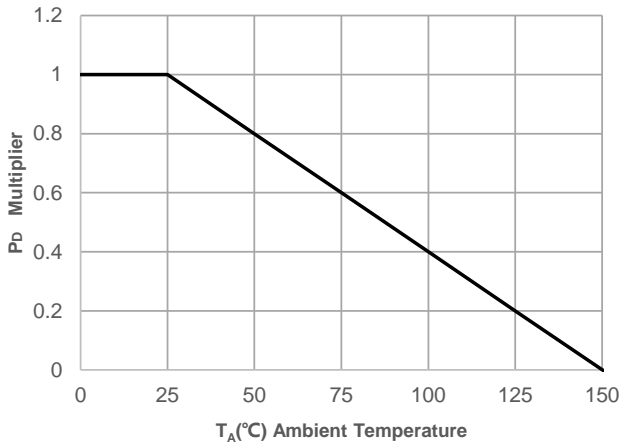
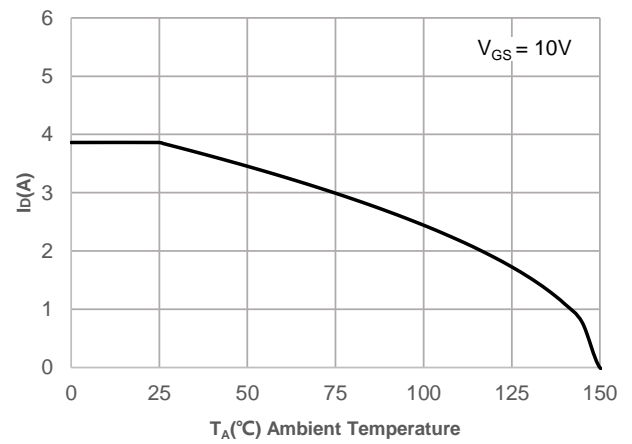
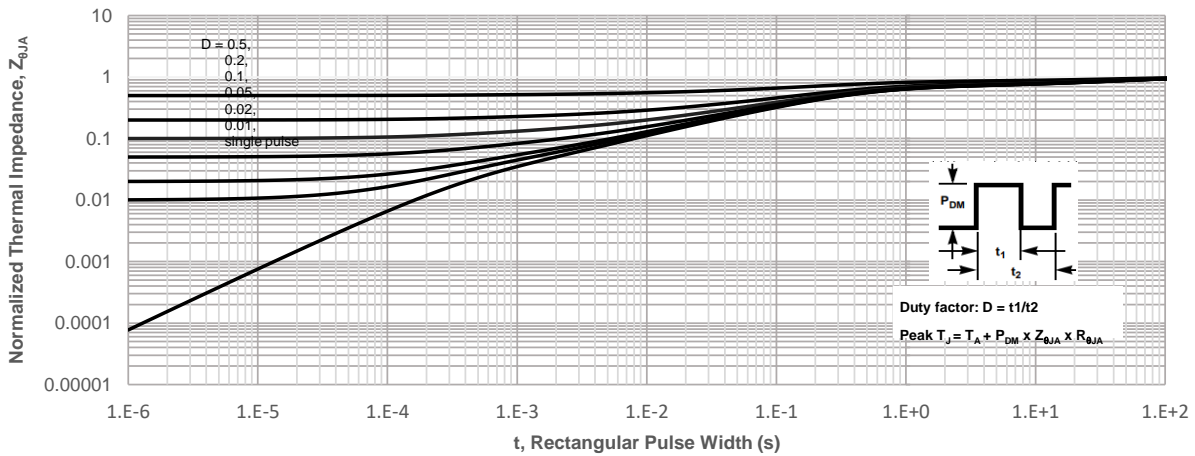
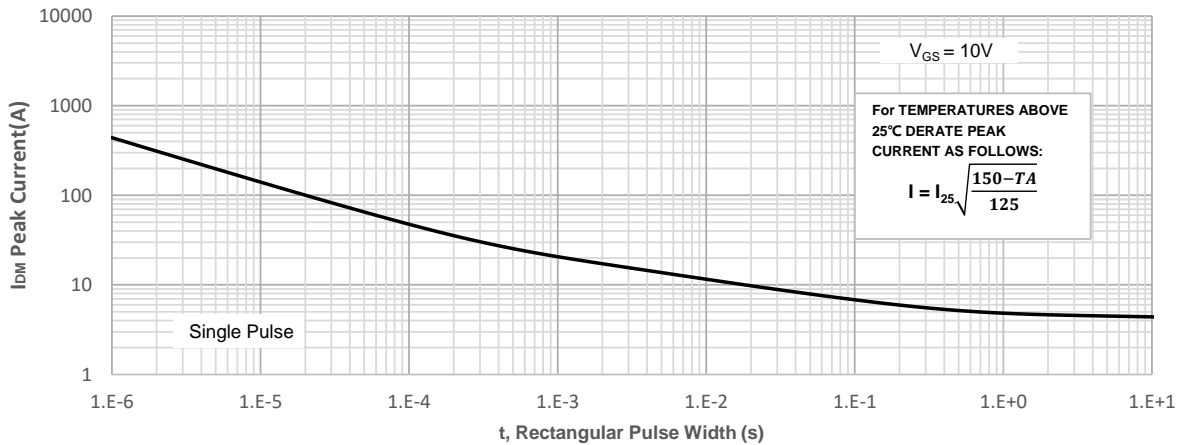
**Electrical Characteristics** ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 0\text{V}$, $V_{GS} = 40\text{V}$	-	-	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	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$	1.4	2.0	2.6	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance ⁽⁴⁾	$V_{GS} = 10\text{V}$, $I_D = 4\text{A}$	-	30	39	m Ω
		$V_{GS} = 4.5\text{V}$, $I_D = 3\text{A}$	-	40	52	m Ω
Dynamic Characteristics						
R_g	Gate Resistance	$f = 1\text{MHz}$	-	2.3	-	Ω
C_{iss}	Input Capacitance	$V_{GS} = 0\text{V}$, $V_{DS} = 20\text{V}$, $f = 1\text{MHz}$	383	536	723	pF
C_{oss}	Output Capacitance		30	42	57	pF
C_{riss}	Reverse Transfer Capacitance		24	33	45	pF
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V $V_{DS} = 20\text{V}$, $I_D = 3\text{A}$	-	11	-	nC
Q_{gs}	Gate Source Charge		-	2.2	-	nC
Q_{gd}	Gate Drain ("Miller") Charge		-	2	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{V}$, $V_{DD} = 20\text{V}$ $I_D = 3\text{A}$, $R_{GEN} = 3\Omega$	-	4.6	-	ns
t_r	Turn-On Rise Time		-	2	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	45	-	ns
t_f	Turn-Off Fall Time		-	355	-	ns
Body Diode Characteristics						
I_S	Maximum Continuous Body Diode Forward Current		-	-	4	A
I_{SM}	Maximum Pulsed Body Diode Forward Current		-	-	15	A
V_{SD}	Body Diode Forward Voltage	$V_{GS} = 0\text{V}$, $I_S = 3\text{A}$	-		1.2	V
t_{rr}	Body Diode Reverse Recovery Time	$I_F = 3\text{A}$, $di/dt = 100\text{A}/\mu\text{s}$	-	8.5	-	ns
Q_{rr}	Body Diode Reverse Recovery Charge		-	3.8	-	nC

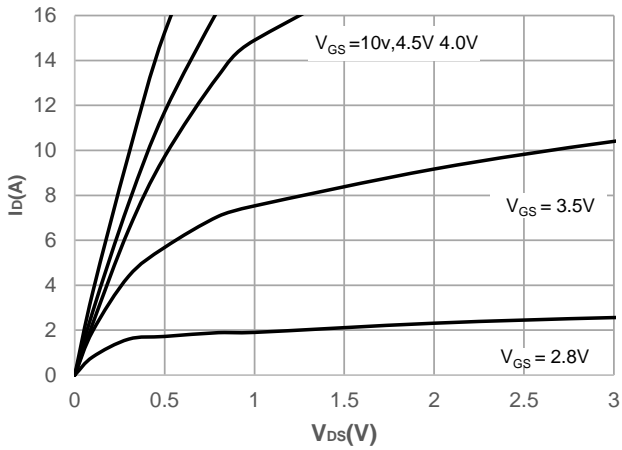
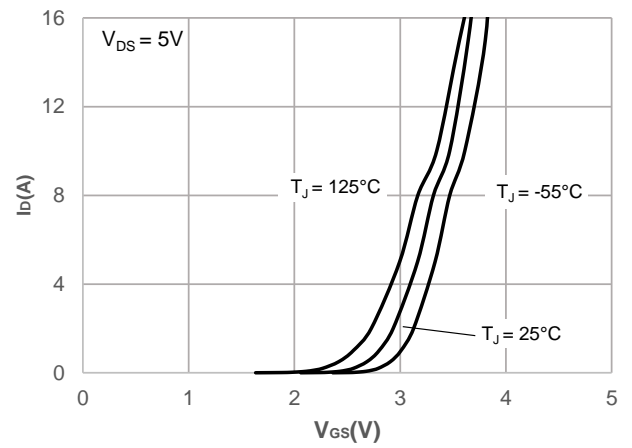
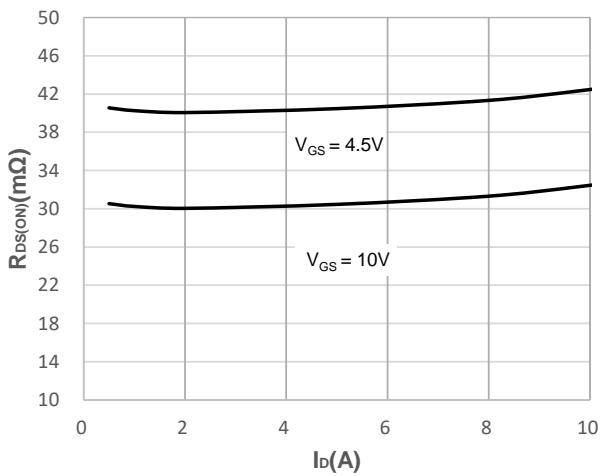
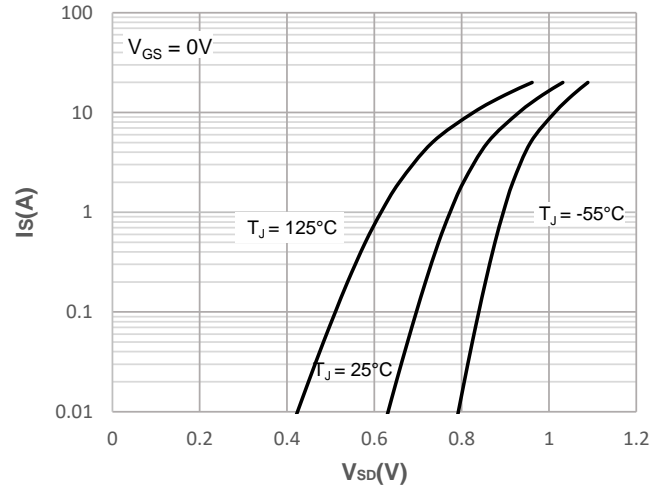
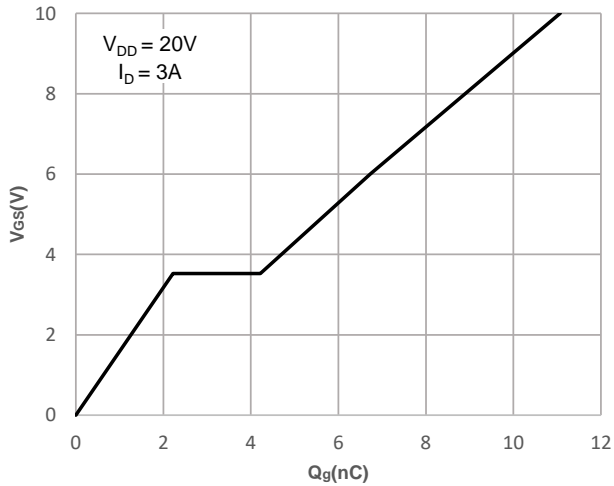
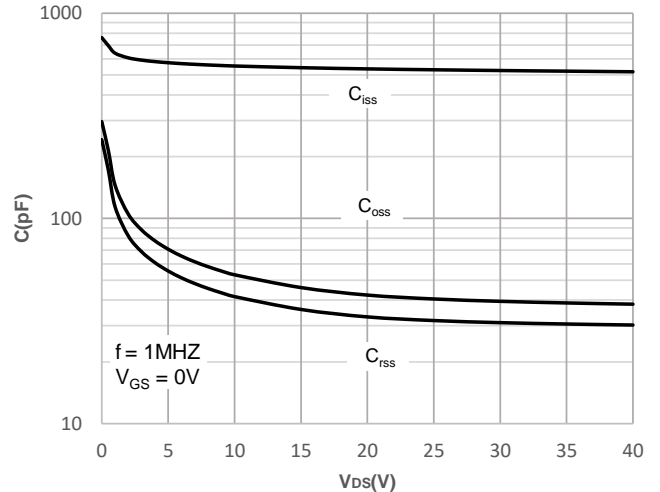
- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. $R_{\theta JA}$ is measured with the device mounted on a minimum recommended pad of 2oz copper FR4 PCB.
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch² pad of 2oz copper FR4 PCB.
 4. Pulse Test: 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

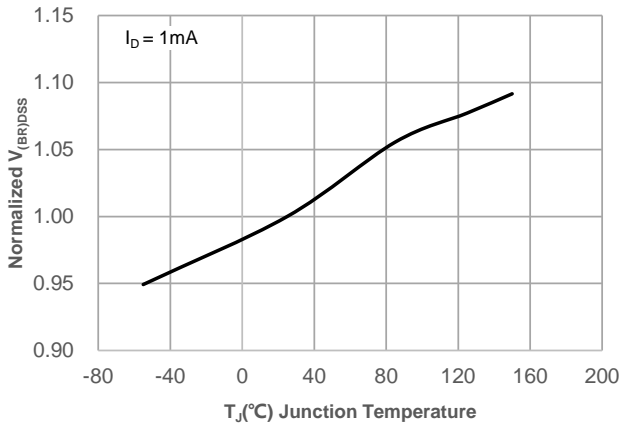


Figure 12: Normalized on Resistance vs. Junction Temperature

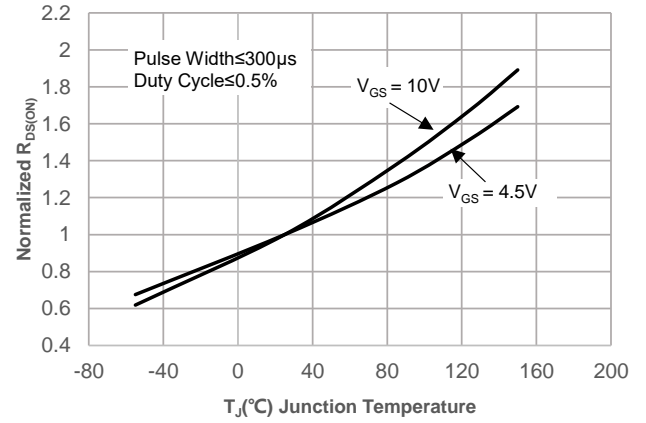


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

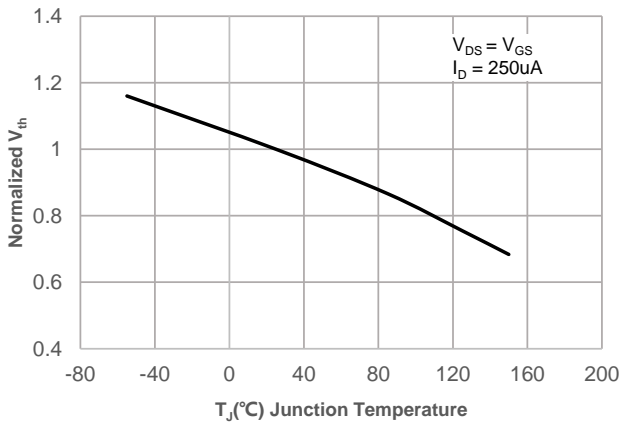


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

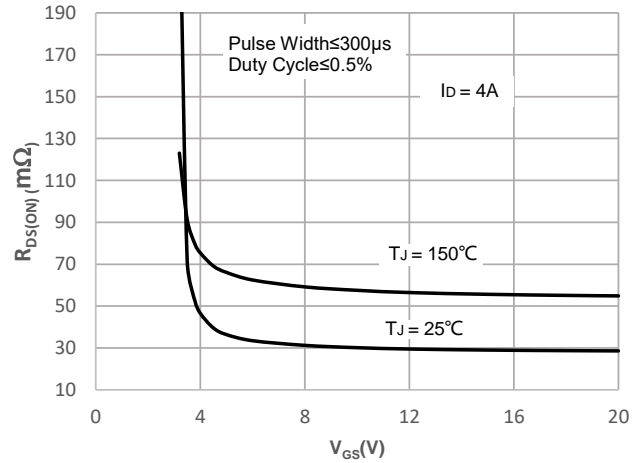
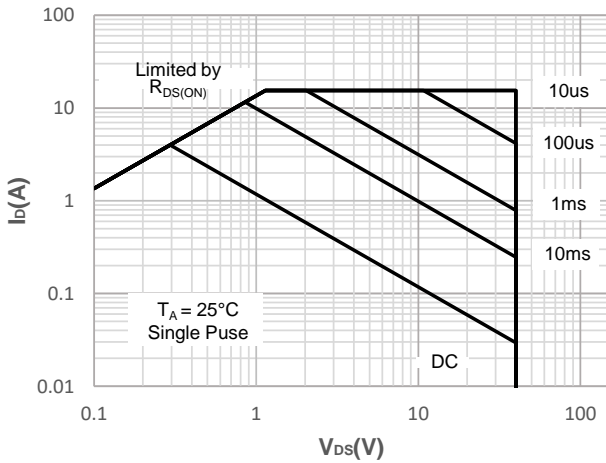


Figure 15: Maximum Safe Operating Area



Test Circuit

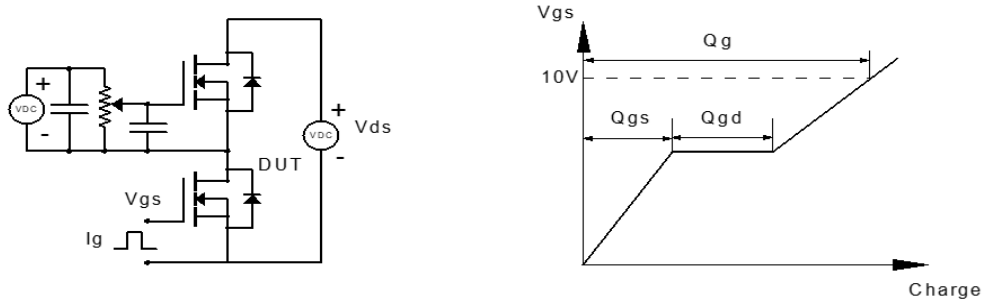


Figure 1: Gate Charge Test Circuit & Waveform

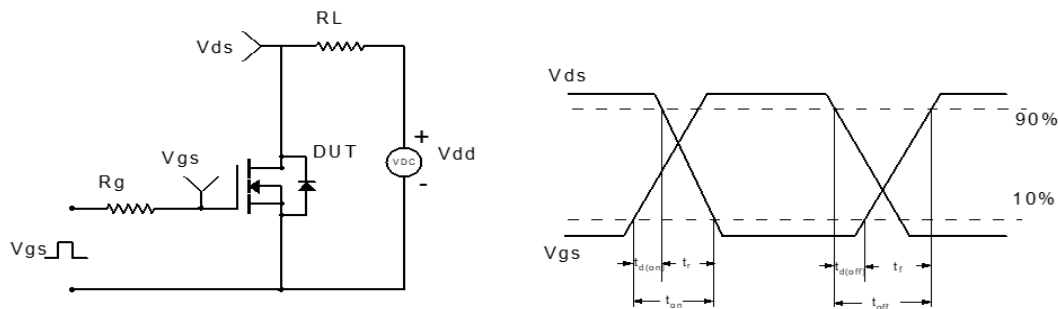


Figure 2: Resistive Switching Test Circuit & Waveform

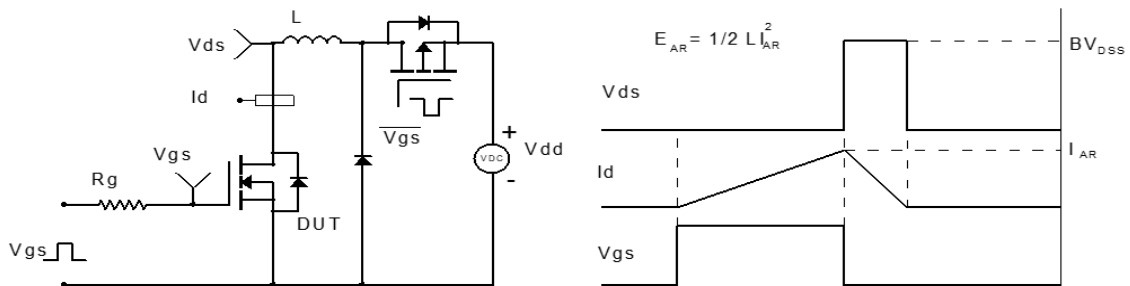


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

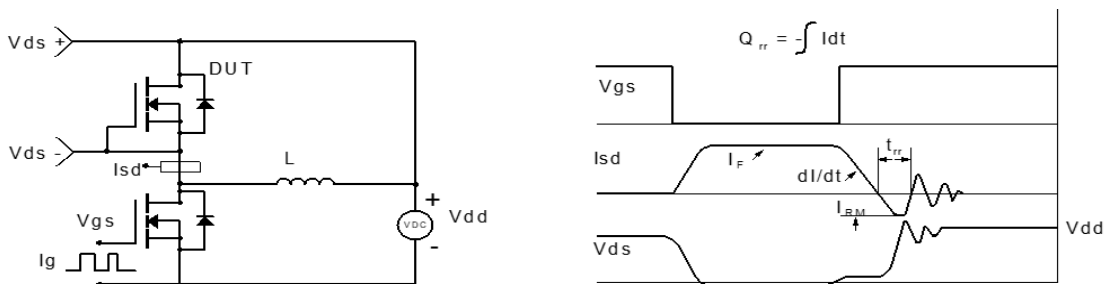
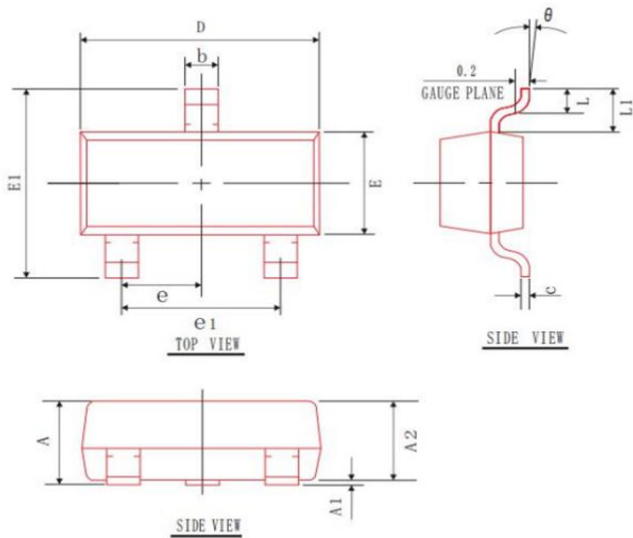
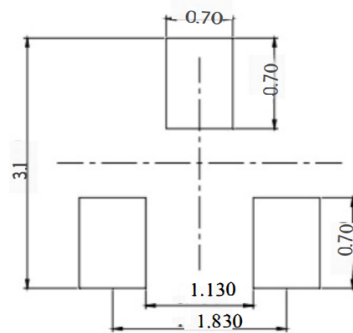


Figure 4: Diode Recovery Test Circuit & Waveform



Package Mechanical Data(SOT-23)

**COMMON DIMENSIONS
(UNITS OF MEASURE=mm)**

SYMBOL	MIN	NOM	MAX
A	0.90	1.05	1.20
A1	0.00	0.05	0.10
A2	0.90	1.00	1.10
b	0.30	0.40	0.50
c	0.08	0.10	0.15
D	2.80	2.90	3.00
E	1.20	1.30	1.40
E1	2.30	2.40	2.50
L	0.30	0.40	0.50
θ	0°	5°	10°
L1	0.55 REF		
e	0.95 BSC		
e1	1.90 REF		

Recommended Footprint


DIMENSIONS:MILLIMETERS

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