

# -12V, -4.1A, 24mΩ P-channel Power Trench MOSFET

## JMTL2305B

### Features

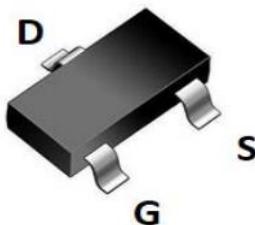
- Excellent  $R_{DS(ON)}$  and Low Gate Charge
- Halogen-free; RoHS-compliant
- Pb-free plating

### Applications

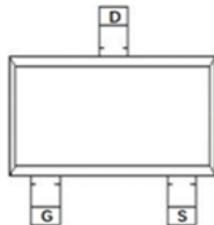
- Load Switch
- PWM Application
- Power Management

### Product Summary

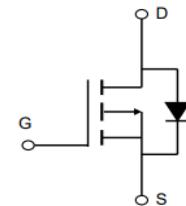
Parameters	Value	Unit
$V_{DSS}$	-12	V
$V_{GS(th)}_{Typ}$	-0.6	V
$I_D(@V_{GS}=10V)$	-4.1	A
$R_{DS(ON)}_{Typ}(@V_{GS}=-4.5V)$	24	mΩ
$R_{DS(ON)}_{Typ}(@V_{GS}=-2.5V)$	29	mΩ



SOT-23-3L Top View



Pin Assignment



Schematic Diagram

### Ordering Information

Device	Marking	MSL	Form	Package	Reel Size	Reel(pcs)	Per Carton (pcs)
JMTL2305B	2305B	3	Tape&Reel	SOT-23-3L	7"	3000	120000

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

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-to-Source Voltage	-12	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 12$	V
$I_D$	Continuous Drain Current	$T_A = 25^\circ\text{C}$	-4.1
		$T_A = 100^\circ\text{C}$	-2.9
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$P_D$	Power Dissipation	$T_A = 25^\circ\text{C}$	1.2
		$T_A = 100^\circ\text{C}$	0.5
$T_J, T_{STG}$	Junction & Storage Temperature Range	-55 to 150	°C

### Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient <sup>(3)</sup>	150	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient <sup>(4)</sup>	106	°C/W

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$V_{(\text{BR})\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-12	-	-	V
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS} = -12\text{V}, V_{GS} = 0\text{V}$	-	-	1.0	$\mu\text{A}$
$I_{\text{GSS}}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}, V_{GS} = \pm 12\text{V}$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$	-0.4	-0.6	-1.0	V
$R_{\text{DS}(\text{ON})}$	Static Drain-Source ON-Resistance <sup>(5)</sup>	$V_{GS} = -4.5\text{V}, I_D = -4.1\text{A}$	-	24	31	$\text{m}\Omega$
		$V_{GS} = -2.5\text{V}, I_D = -3\text{A}$	-	29	38	$\text{m}\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	11	-	$\Omega$
$C_{\text{iss}}$	Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = -6\text{V}, f = 1\text{MHz}$	722	1010	1364	pF
$C_{\text{oss}}$	Output Capacitance		93	130	176	pF
$C_{\text{rss}}$	Reverse Transfer Capacitance		76	106	144	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0 \text{ to } -10\text{V}$ $V_{DS} = -6\text{V}, I_D = -2\text{A}$	-	10	-	nC
$Q_{\text{gs}}$	Gate Source Charge		-	2	-	nC
$Q_{\text{gd}}$	Gate Drain("Miller") Charge		-	1	-	nC
<b>Switching Characteristics</b>						
$t_{d(\text{on})}$	Turn-On Delay Time	$V_{GS} = -10\text{V}, V_{DD} = -6\text{V}$ $I_D = -2.0\text{A}, R_{\text{GEN}} = 2.7\Omega$	-	5	-	ns
$t_r$	Turn-On Rise Time		-	12	-	ns
$t_{d(\text{off})}$	Turn-Off Delay Time		-	50	-	ns
$t_f$	Turn-Off Fall Time		-	23	-	ns
<b>Body Diode Characteristics</b>						
$I_s$	Maximum Continuous Body Diode Forward Current	-	-	-4.1	-	A
$I_{\text{SM}}$	Maximum Pulsed Body Diode Forward Current	-	-	-16	-	A
$V_{SD}$	Body Diode Forward Voltage	$V_{GS} = 0\text{V}, I_s = -4.1\text{A}$	-		1.2	V
$\text{trr}$	Body Diode Reverse Recovery Time	$I_F = -2\text{A}, di/dt = 60\text{A/us}$	-	9	-	ns
$Q_{\text{rr}}$	Body Diode Reverse Recovery Charge		-	1.3	-	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.

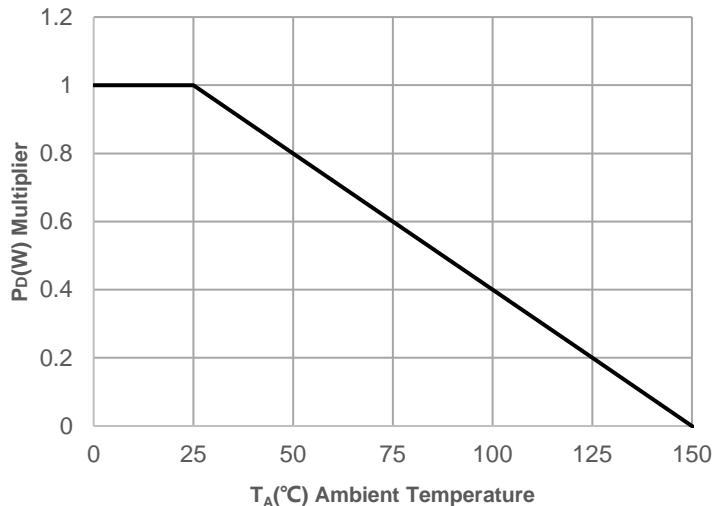
3.  $R_{\theta JA}$  is measured with the device mounted on a 1inch<sup>2</sup> pad of 2oz copper FR4 PCB.

4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 0.5\%$ .

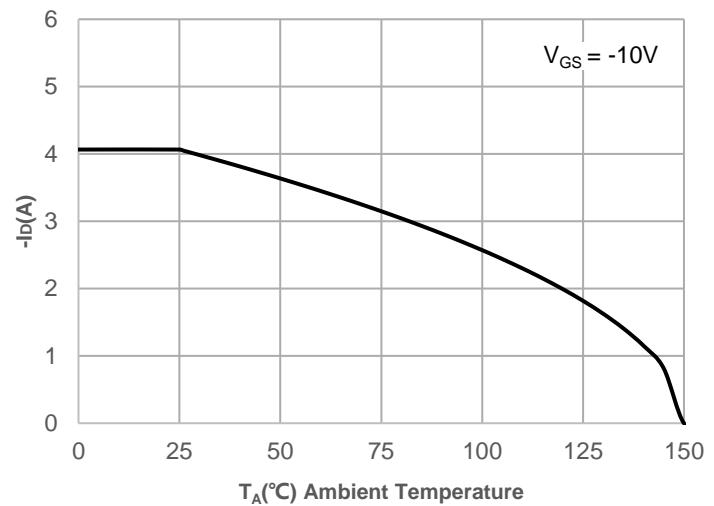


## Typical Performance Characteristics

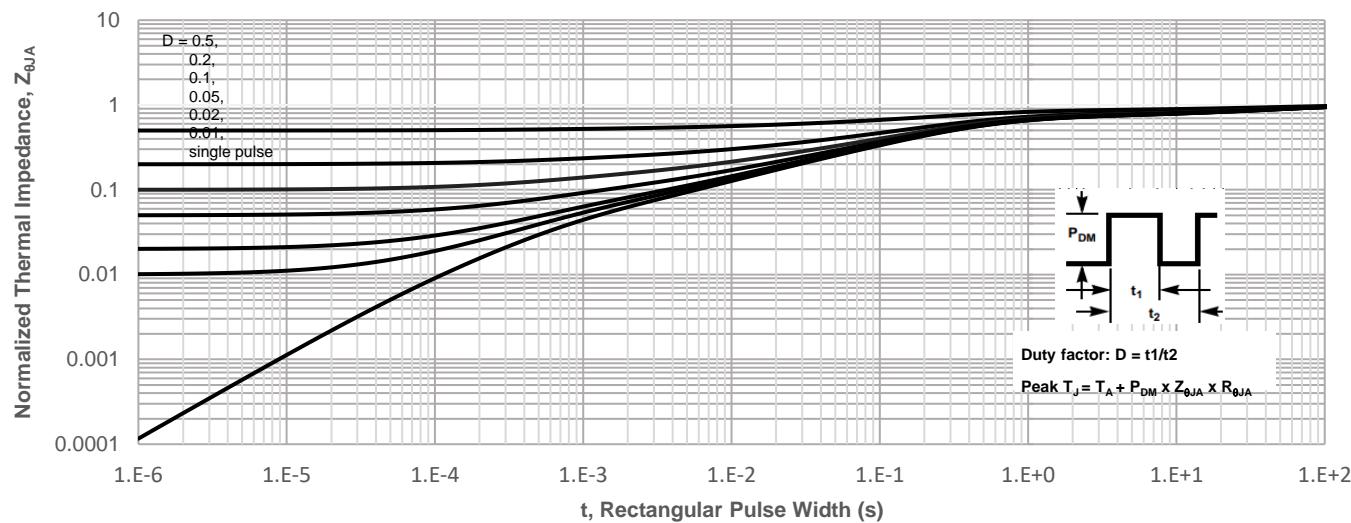
**Figure 1: Power De-rating**



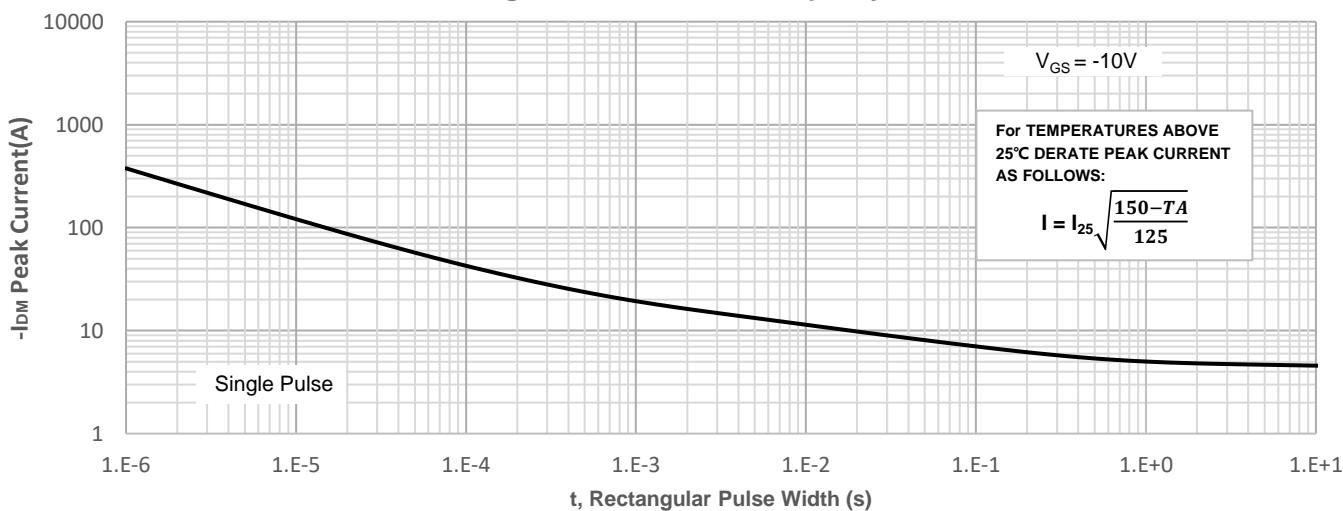
**Figure 2: Current De-rating**



**Figure 3: Normalized Maximum Transient Thermal Impedance**

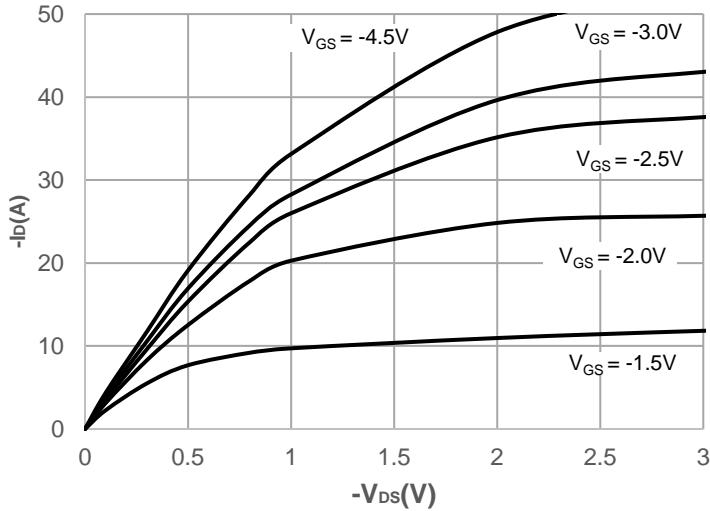


**Figure 4: Peak Current Capacity**

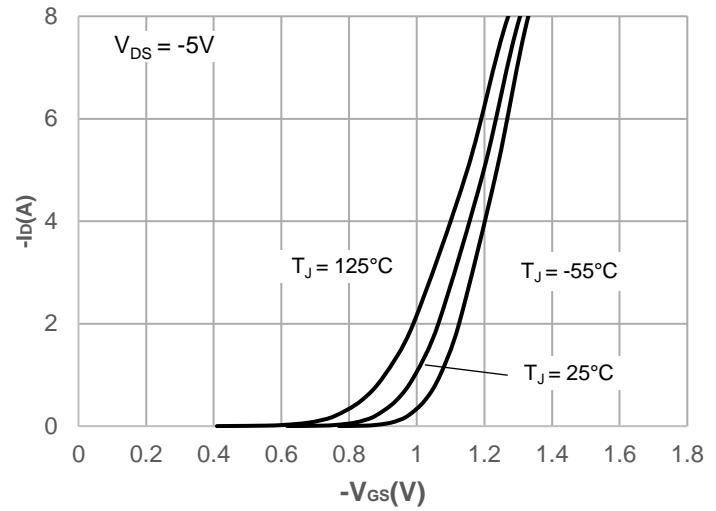


## Typical Performance Characteristics

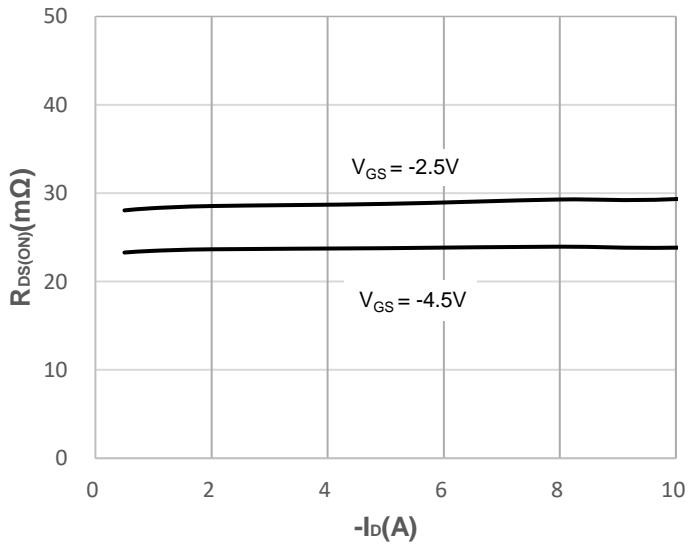
**Figure 5: Output Characteristics**



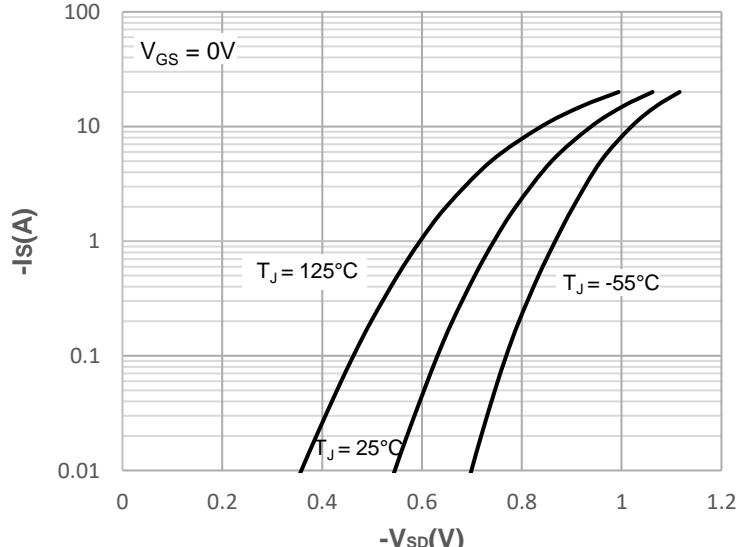
**Figure 6: Typical Transfer Characteristics**



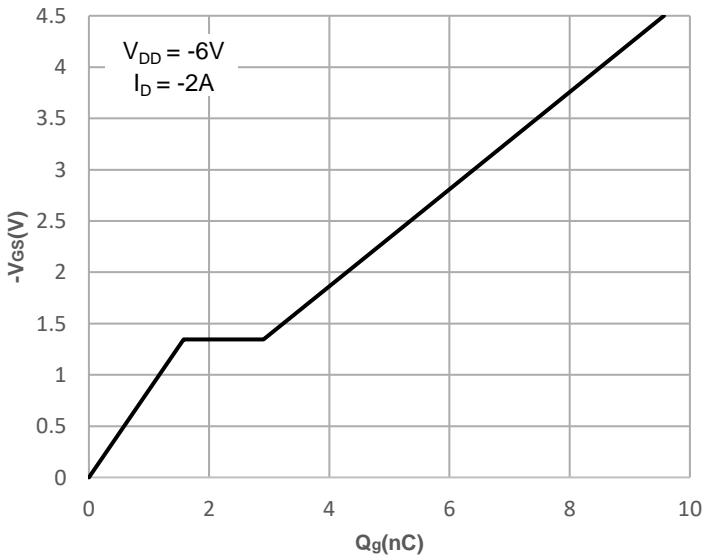
**Figure 7: On-resistance vs. Drain Current**



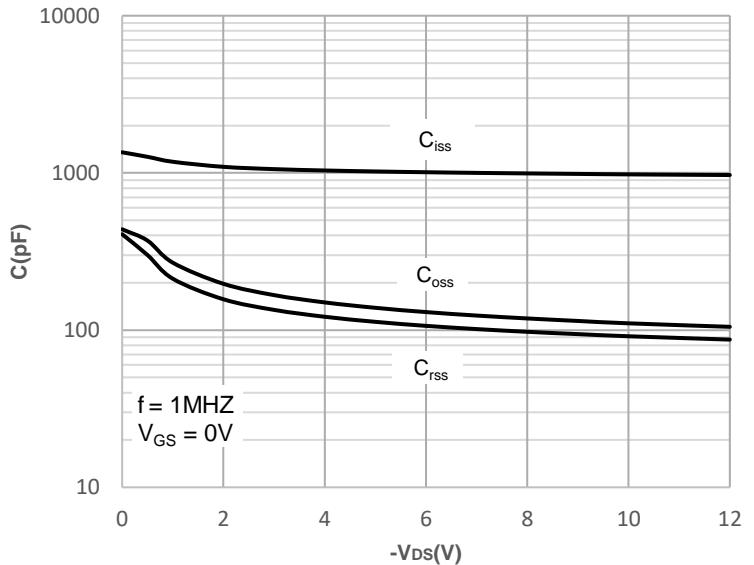
**Figure 8: Body Diode Characteristics**



**Figure 9: Gate Charge Characteristics**

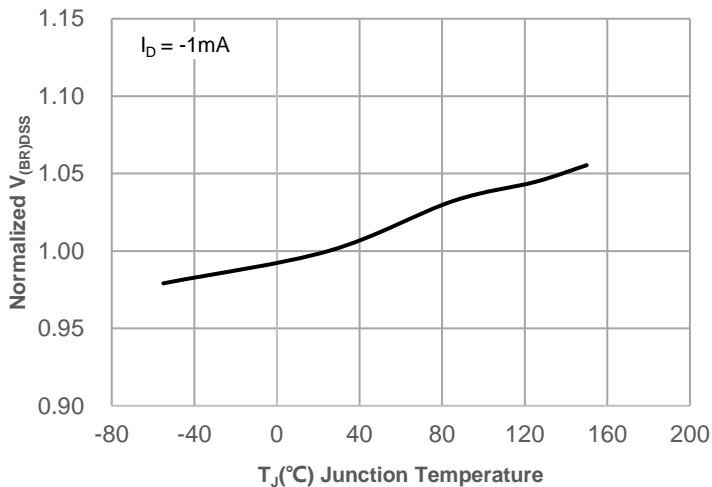


**Figure 10: Capacitance Characteristics**

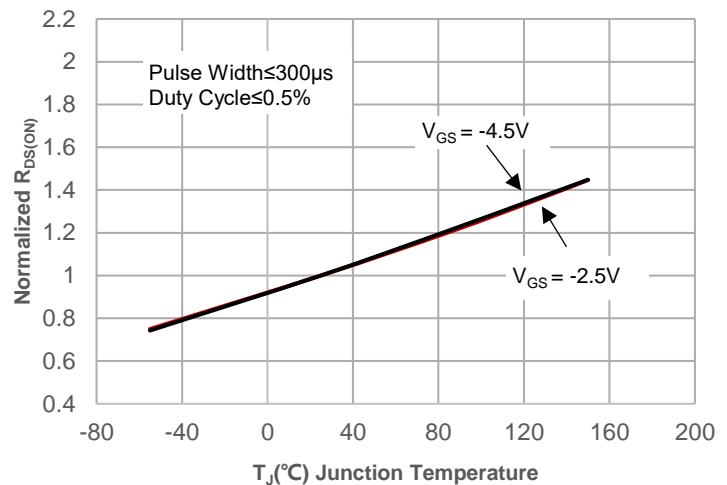


## Typical Performance Characteristics

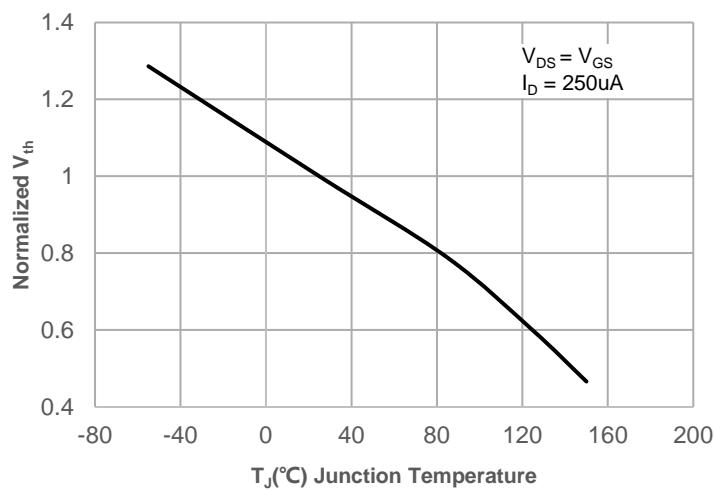
**Figure 11: Normalized Breakdown voltage vs. Junction Temperature**



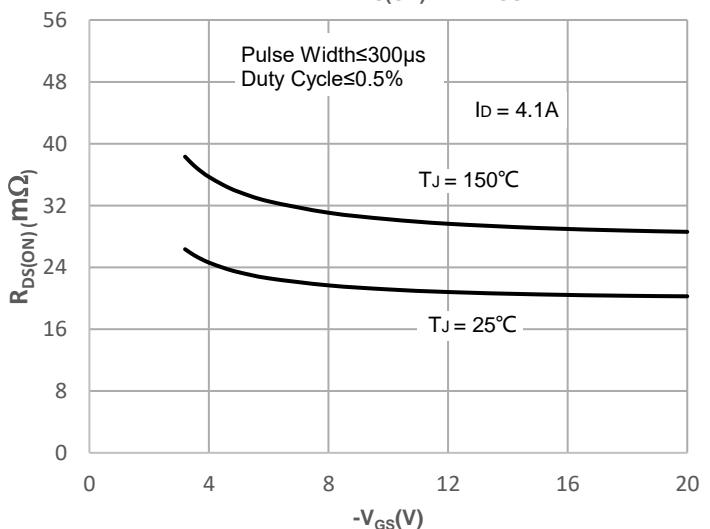
**Figure 12: Normalized on Resistance vs. Junction Temperature**



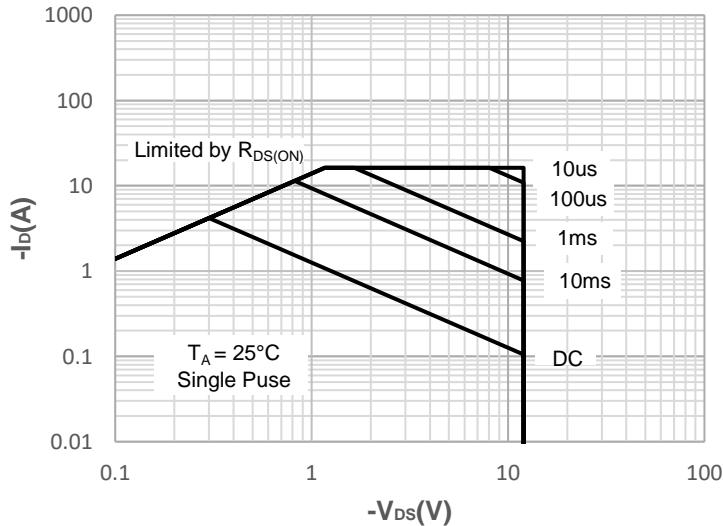
**Figure 13: Normalized Threshold Voltage vs. Junction Temperature**



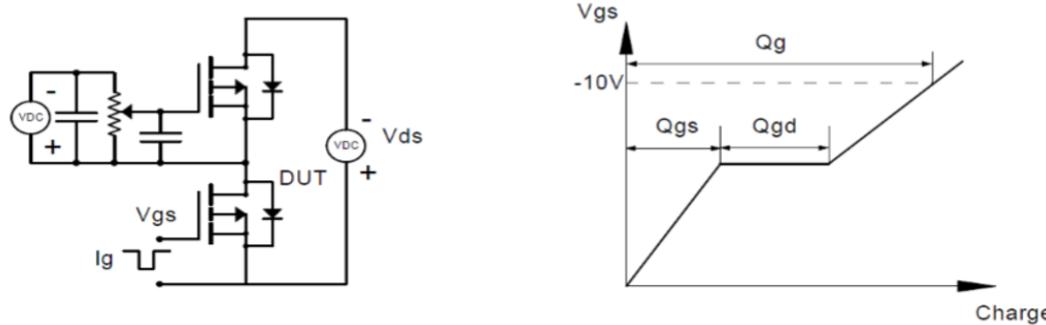
**Figure 14: R<sub>DS(ON)</sub> vs. V<sub>GS</sub>**



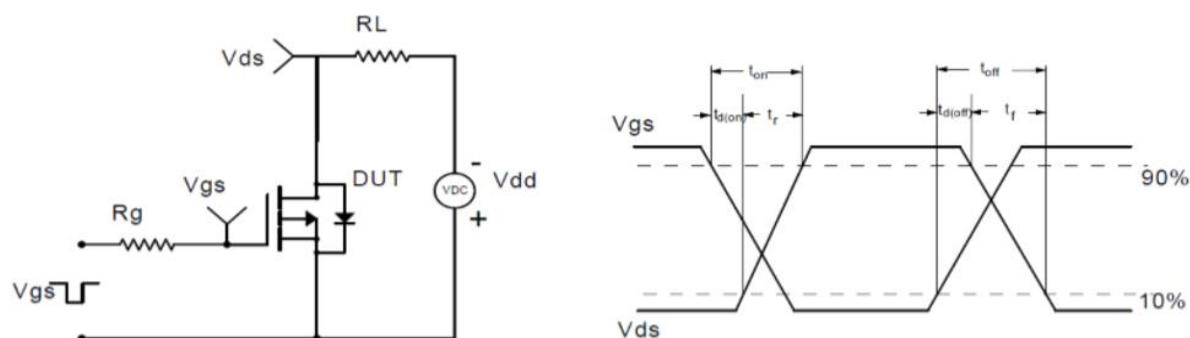
**Figure 15: Maximum Safe Operating Area**



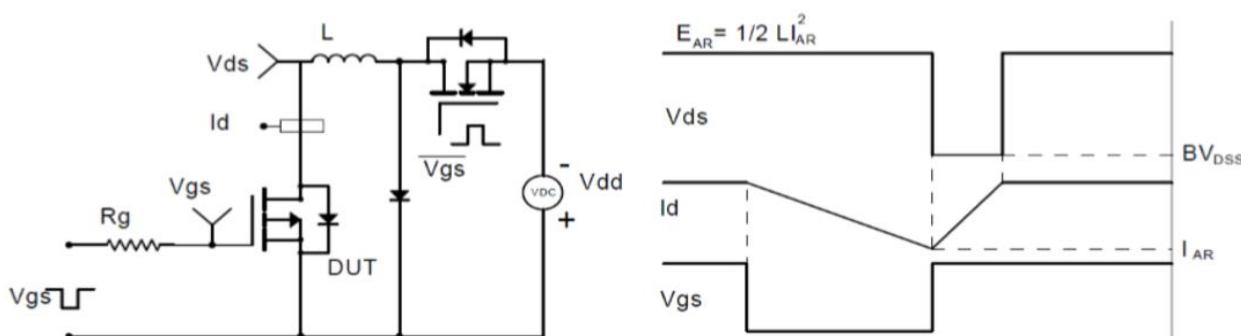
## Test Circuit



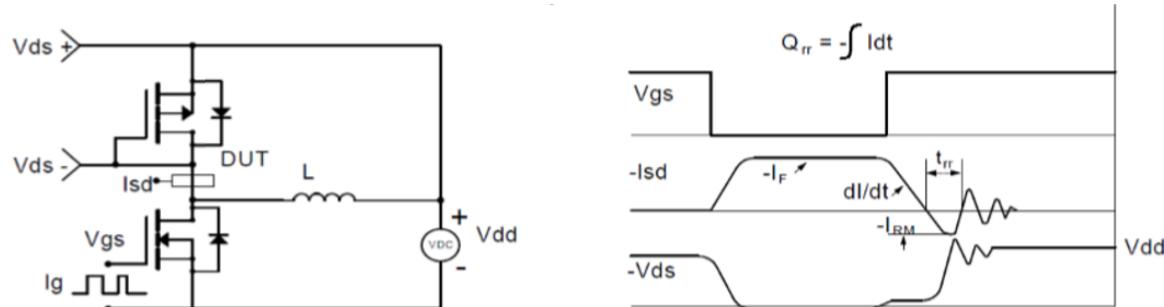
**Figure 1: Gate Charge Test Circuit & Waveform**



**Figure 2: Resistive Switching Test Circuit & Waveform**

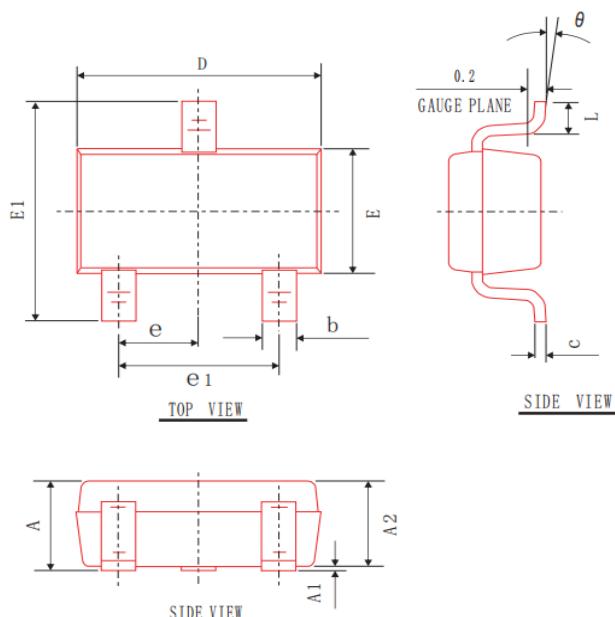


**Figure 3: Unclamped Inductive Switching Test Circuit & Waveform**



**Figure 4: Diode Recovery Test Circuit & Waveform**

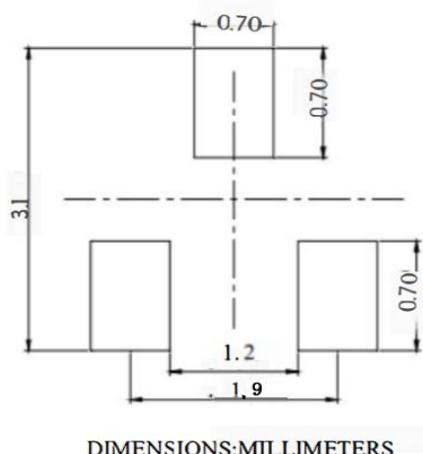
## Package Mechanical Data(SOT-23-3L)



COMMON DIMENSIONS  
(UNITS OF MEASURE=mm)

SYMBOL	MIN	NOM	MAX
A	—	—	1.30
A1	0.00	0.05	0.10
A2	1.00	1.10	1.20
b	0.30	0.40	0.50
c	0.119	0.127	0.135
e1	1.80	1.90	2.00
D	2.80	2.90	3.00
E	1.50	1.60	1.70
E1	2.60	2.80	3.00
L	0.30	0.45	0.60
θ	0°	4°	8°
e	0.95BSC		

### Recommended Footprint



DIMENSIONS: MILLIMETERS

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