

Features

- Excellent $R_{DS(ON)}$ and Low Gate Charge
- Halogen-free; RoHS-compliant
- Pb-free plating
- ESD Rating: HBM 2.0KV

Applications

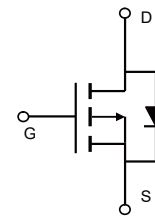
- Load Switch
- PWM Application
- Power Management

Product Summary

Parameters	Value	Unit
V_{DSS}	-20	V
$V_{GS(th)_{Typ}}$	-0.7	V
$I_D(@V_{GS}=10V)$	-4.1	A
$R_{DS(ON)_{Typ}}(@V_{GS}=-4.5V)$	24	m Ω
$R_{DS(ON)_{Typ}}(@V_{GS}=-2.5V)$	32	m Ω



SOT-23



Schematic

Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
VSM3415KL-S2	VSM3415KL	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	-20	V
V_{GS}	Gate-to-Source Voltage	± 10	V
I_D	Continuous Drain Current	$T_A = 25^\circ\text{C}$	A
		$T_A = 100^\circ\text{C}$	
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
P_D	Power Dissipation	$T_A = 25^\circ\text{C}$	W
		$T_A = 100^\circ\text{C}$	
T_J, T_{STG}	Junction & Storage Temperature Range	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

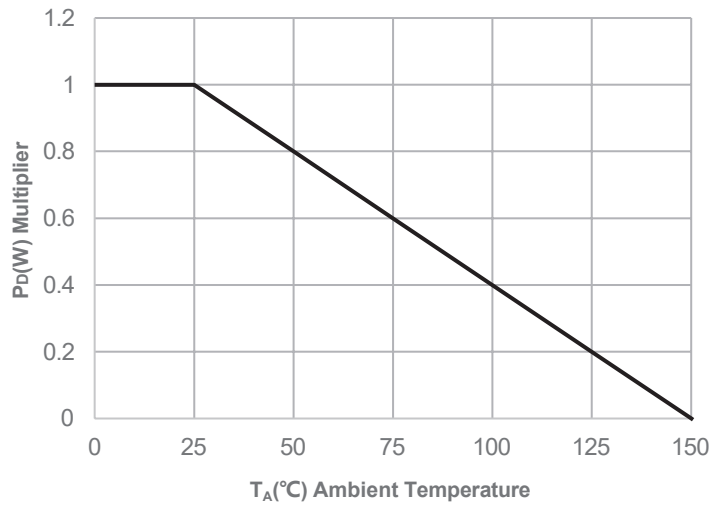
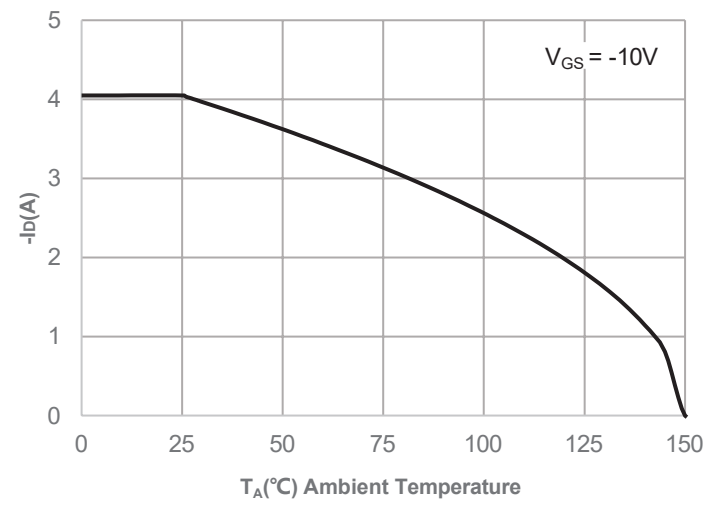
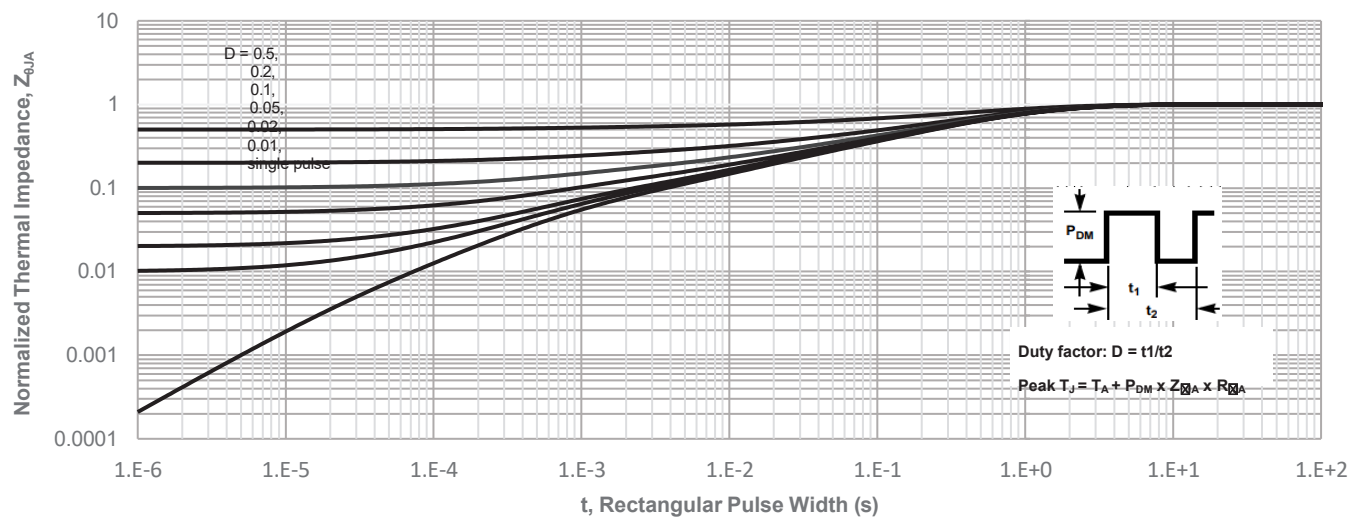
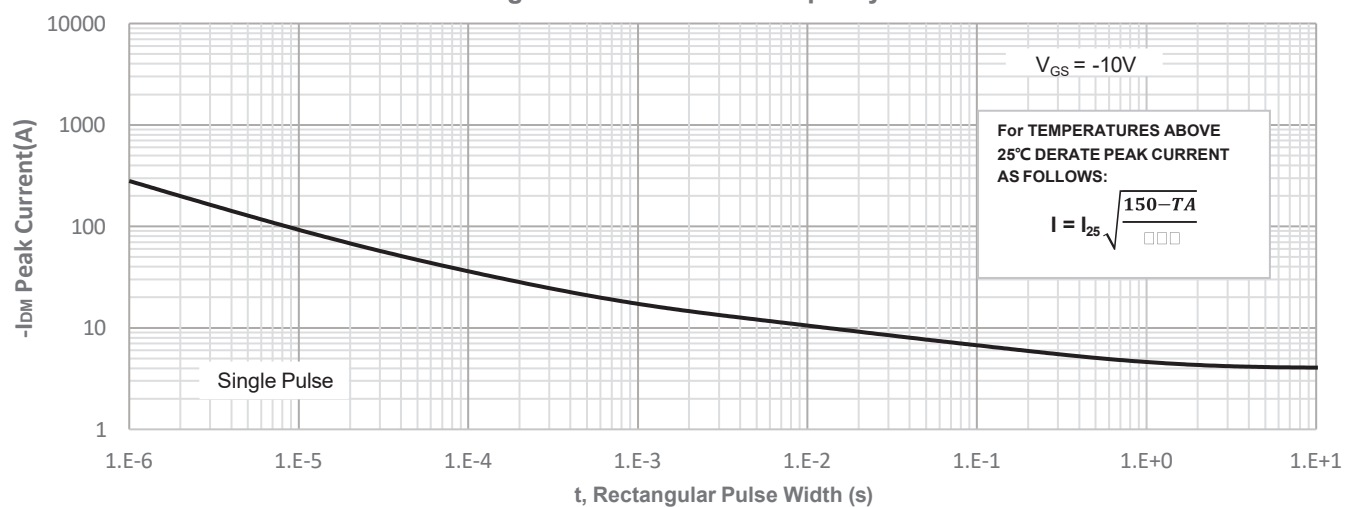
Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽²⁾	187	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽³⁾	133	

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

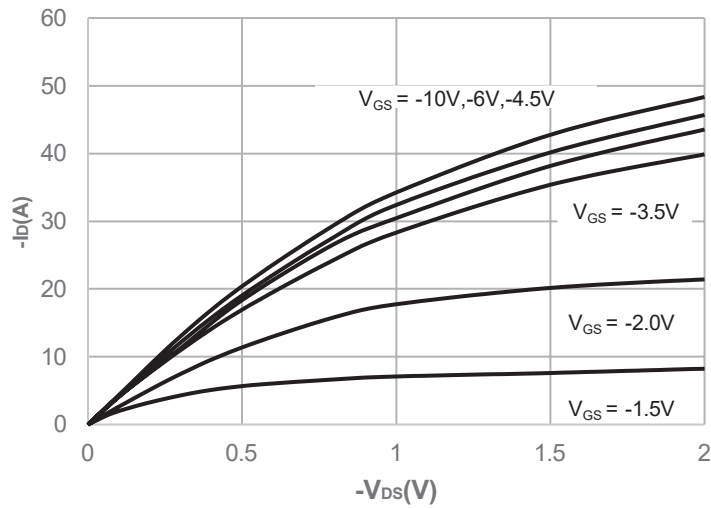
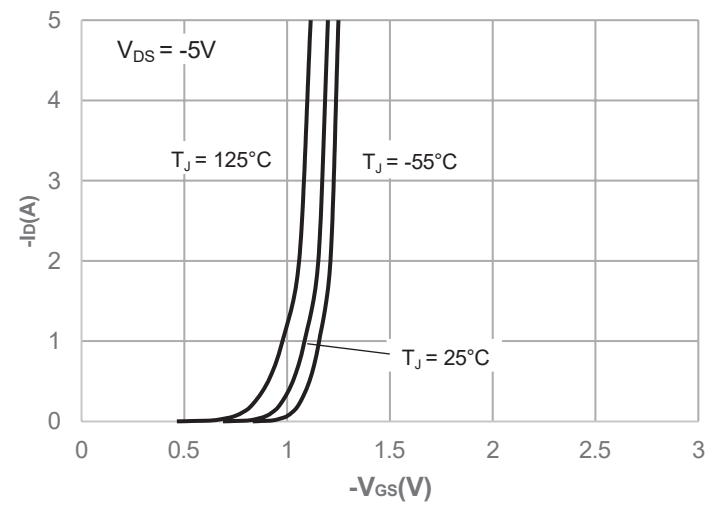
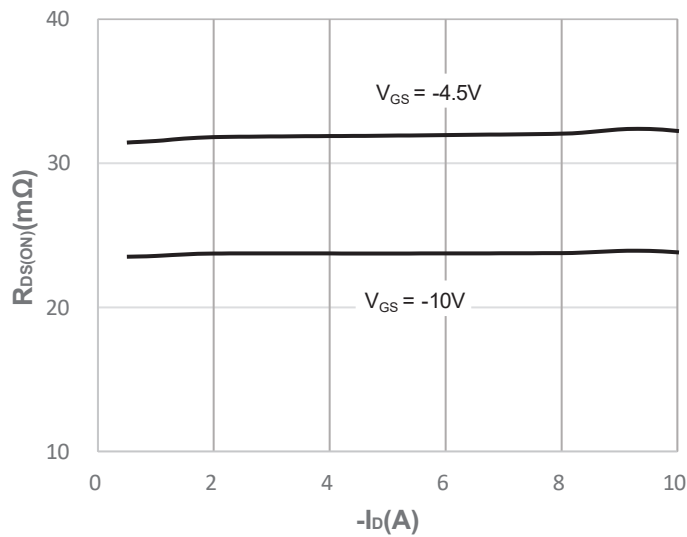
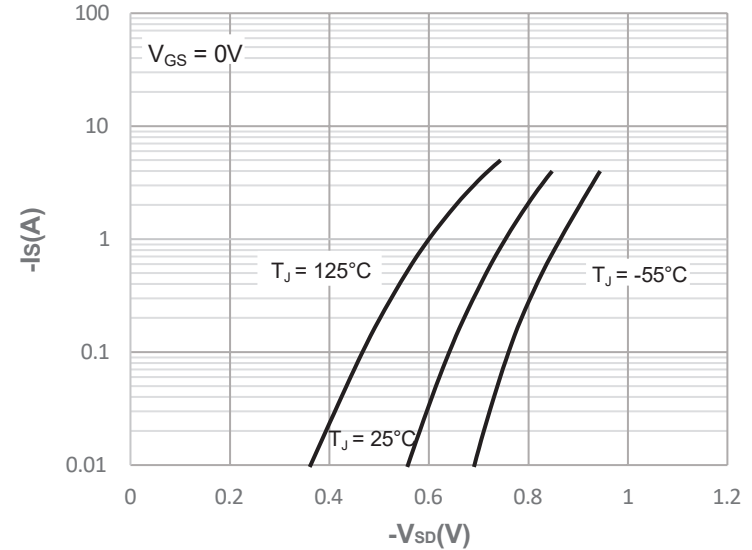
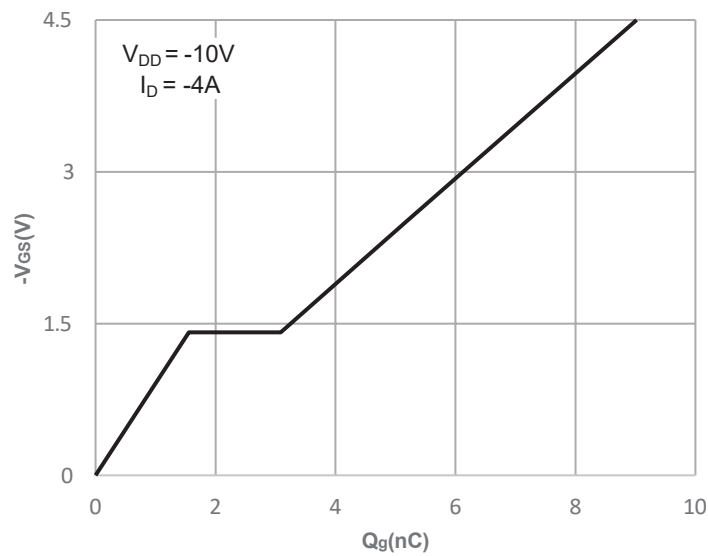
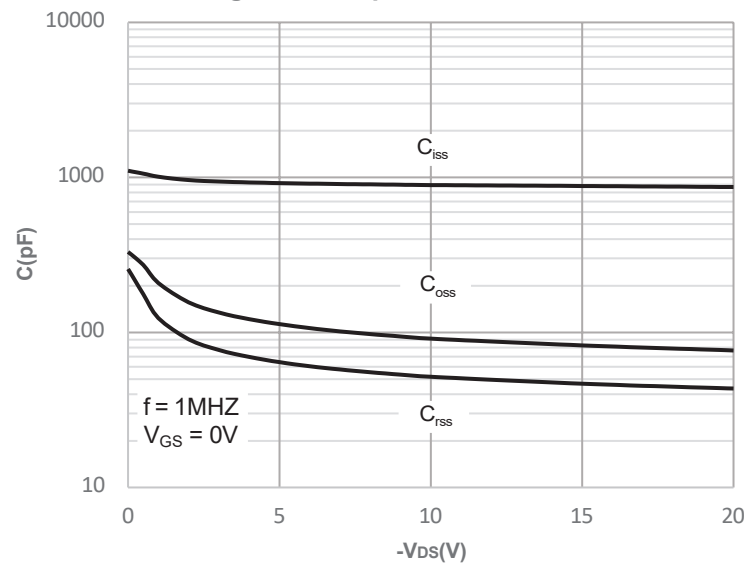
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	I _D = -250 μA, V _{GS} = 0V	-20	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = -20V, V _{GS} = 0V	-	-	1.0	μA
I _{GSS}	Gate-Body Leakage Current	V _{DS} = 0V, V _{GS} = ±10V	-	-	±10	uA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = -250 μA	-0.5	-0.7	-0.9	V
R _{DS(ON)}	Static Drain-Source ON-Resistance ⁽⁴⁾	V _{GS} = -4.5V, I _D = -4A	-	23.8	40	mΩ
		V _{GS} = -2.5V, I _D = -3A	-	32.2	56	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{GS} = 0V, V _{DS} = -10V, f = 1MHz	638	893	1205	pF
C _{oss}	Output Capacitance		65	91	123	pF
C _{rss}	Reverse Transfer Capacitance		37	52	70	pF
Q _g	Total Gate Charge	V _{GS} = 0 to -4.5V V _{DS} = -10V, I _D = -4A	-	9	-	nC
Q _{gs}	Gate Source Charge		-	1.6	-	nC
Q _{gd}	Gate Drain("Miller") Charge		-	1.5	-	nC
Switching Characteristics						
t _{d(on)}	Turn-On DelayTime	V _{GS} = -10V, V _{DD} = -10V I _D = -4A, R _{GEN} = 1 Ω	-	12	-	ns
t _r	Turn-On Rise Time		-	35	-	ns
t _{d(off)}	Turn-Off DelayTime		-	30	-	ns
t _f	Turn-Off Fall Time		-	10	-	ns
Body Diode Characteristics						
I _S	Maximum Continuous Body Diode Forward Current		-	-	-4	A
I _{SM}	Maximum Pulsed Body Diode Forward Current		-	-	-16	A
V _{SD}	Body Diode Forward Voltage	V _{GS} = 0V, I _S = -4A	-		1.2	V
t _{rr}	Body Diode Reverse Recovery Time	I _F = -4A, di/dt = 40A/us	124	173	234	ns
Q _{rr}	Body Diode Reverse Recovery Charge		-	64	-	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

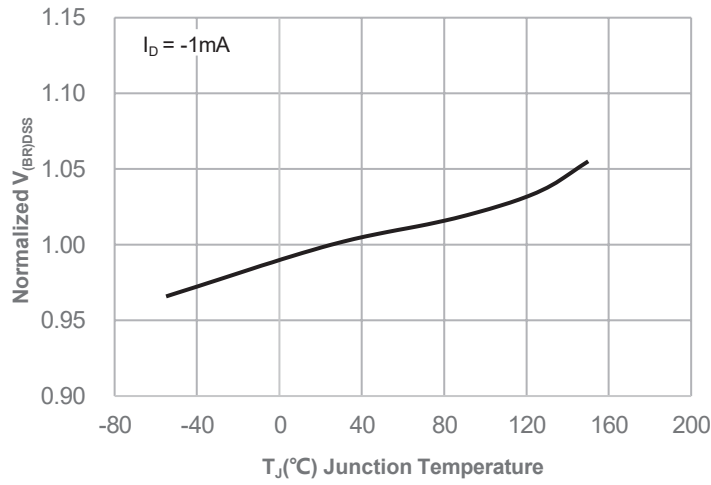


Figure 12: Normalized on Resistance vs. Junction Temperature

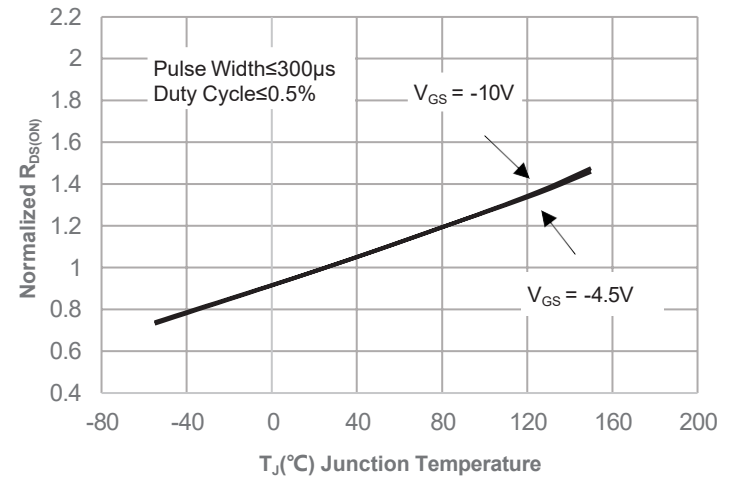


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

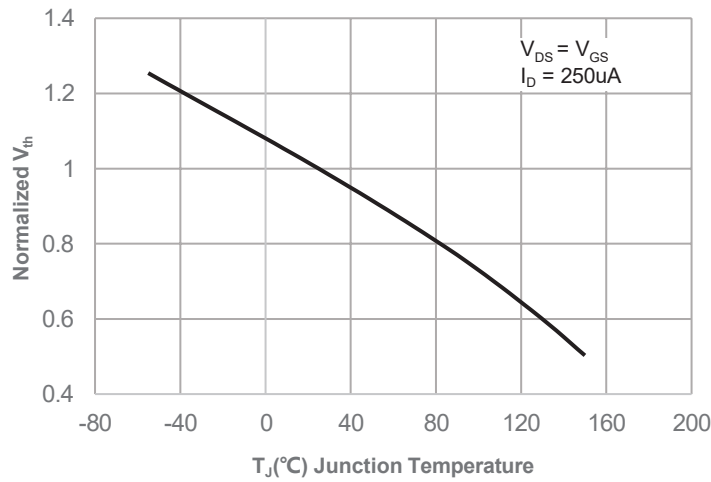


Figure 14: R_{DS(ON)} vs. V_{GS}

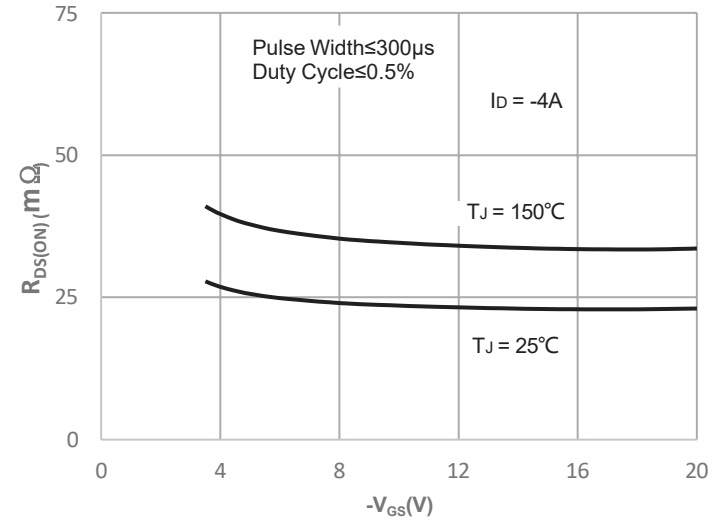
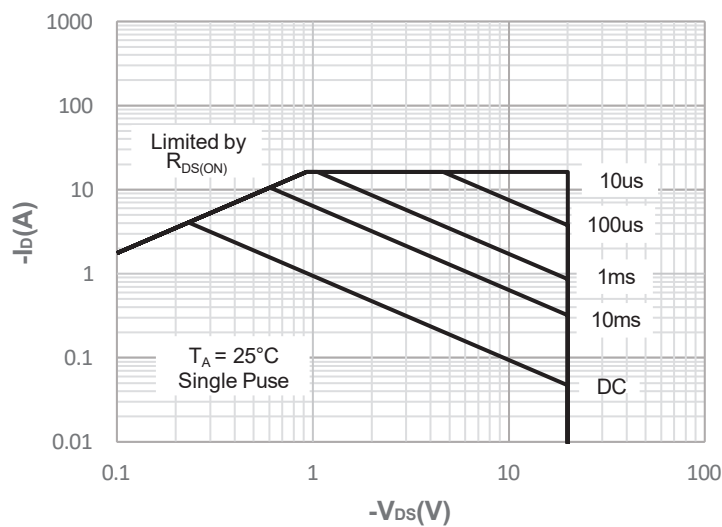


Figure 15: Maximum Safe Operating Area



Test Circuit

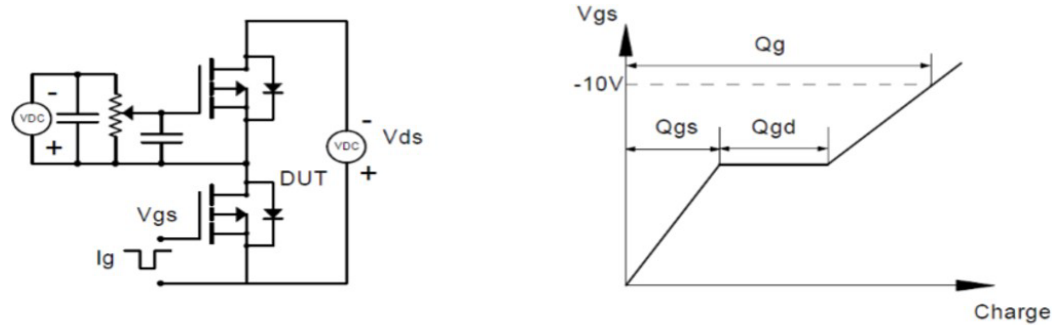


Figure 1: Gate Charge Test Circuit & Waveform

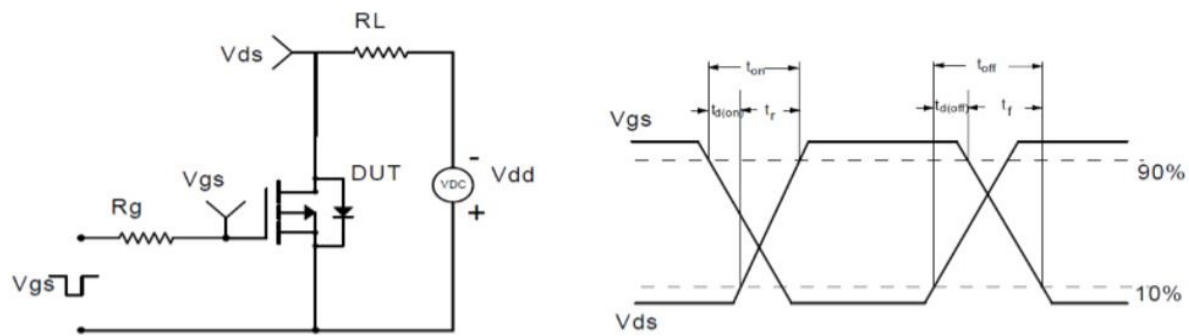


Figure 2: Resistive Switching Test Circuit & Waveform

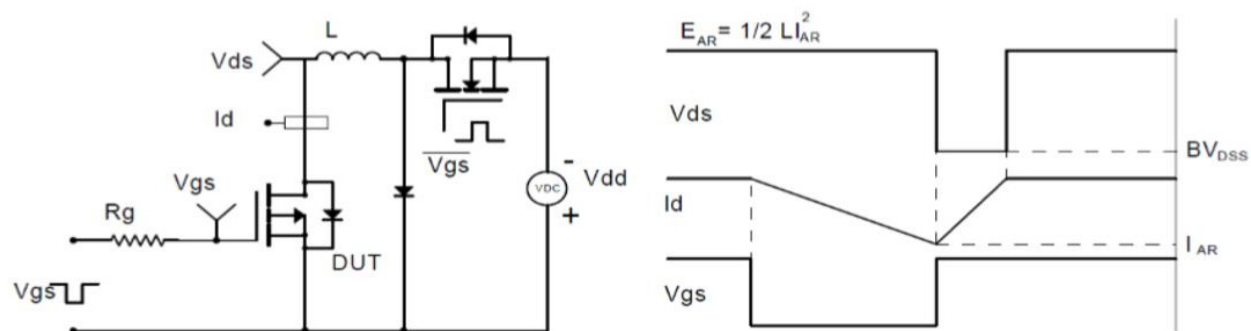


Figure 3: Unclamped Inductive Switching Test Circuit& Waveform

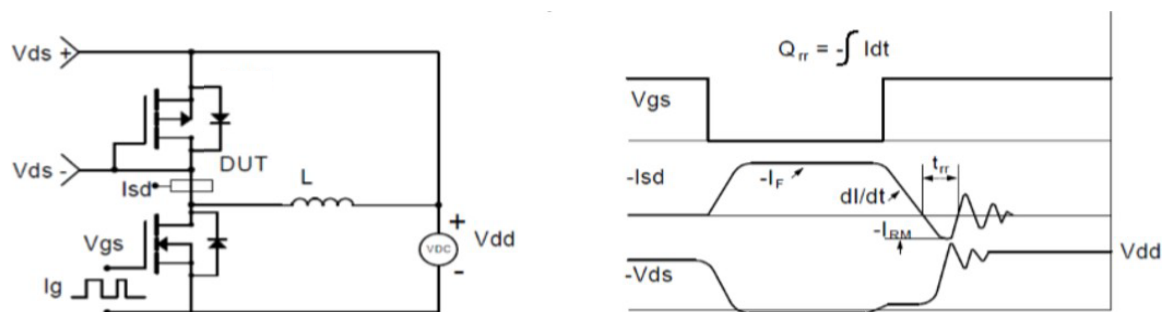


Figure 4: Diode Recovery Test Circuit & Waveform