

# 40V, 143A, 2.5mΩ N-channel Power SGT MOSFET

## JMSH0403PGQ

### Features

- Ultra-low ON-resistance, RDS(ON)
- Low Gate Charge
- 100% UIS Tested
- 100% ΔVds Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

### Applications

- Load Switch
- PWM Application
- General Automotive Application

### Product Summary

Parameters	Value	Unit
$V_{DS}$	40	V
$V_{GS(th)}_{Typ}$	3.1	V
$I_D(@V_{GS}=10V)$	143	A
$R_{DS(ON)}_{Typ}(@V_{GS}=10V)$	2.5	mΩ



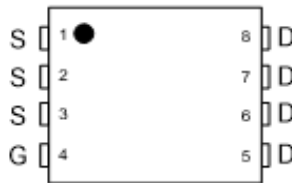
Top View



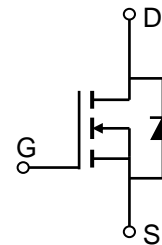
Bottom View



PDFN5X6-8L



Pin Assignment



Schematic Diagram

### Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSH0403PGQ-13	SH0403PQ	1	Tape&Reel	PDFN5x6-8L	5000	50000

### Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ 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	$T_C = 25^\circ\text{C}$ : 143 $T_C = 100^\circ\text{C}$ : 101	A
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	238	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$ : 125 $T_C = 100^\circ\text{C}$ : 63	W
$T_J, T_{STG}$	Junction & Storage Temperature Range	-55 to 175	°C

### Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient <sup>(3)</sup>	44	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.2	°C/W

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V	40	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 32V, V <sub>GS</sub> = 0V	-	-	1.0	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>DS</sub> = 0V, V <sub>GS</sub> = ±20V	-	-	±100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.2	3.1	4.0	V
R <sub>DS(ON)</sub>	Static Drain-Source ON-Resistance <sup>(4)</sup>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 20A	-	2.5	3.3	mΩ
Dynamic Characteristics						
R <sub>g</sub>	Gate Resistance	f = 1MHz	-	0.8	-	Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 20V, f = 1MHz	1412	1976	2668	pF
C <sub>oss</sub>	Output Capacitance		856	1198	1618	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		79	110	149	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> = 0 to 10V V <sub>DS</sub> = 20V, I <sub>D</sub> = 20A	24	33	45	nC
Q <sub>gs</sub>	Gate Source Charge		-	10	13	nC
Q <sub>gd</sub>	Gate Drain("Miller") Charge		-	10	13	nC
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> = 10V, V <sub>DD</sub> = 20V I <sub>D</sub> = 20A, R <sub>GEN</sub> = 3Ω	-	13	-	ns
t <sub>r</sub>	Turn-On Rise Time		-	24	-	ns
t <sub>d(off)</sub>	Turn-Off DelayTime		-	22	-	ns
t <sub>f</sub>	Turn-Off Fall Time		-	9	-	ns
Body Diode Characteristics						
I <sub>S</sub>	Maximum Continuous Body Diode Forward Current		-	-	143	A
I <sub>SM</sub>	Maximum Pulsed Body Diode Forward Current		-	-	572	A
V <sub>SD</sub>	Body Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A	-		1.2	V
trr	Body Diode Reverse Recovery Time	I <sub>F</sub> = 15A, di/dt = 100A/us	29	40	55	ns
Qrr	Body Diode Reverse Recovery Charge		-	37	-	nC

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 20\text{V}$ ,  $V_G = 10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 12.6\text{A}$ ,  $V_{DD} = 0\text{V}$  during time in avalanche.
3.  $R_{\theta JA}$  is measured with the device mounted on a  $1\text{inch}^2$  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

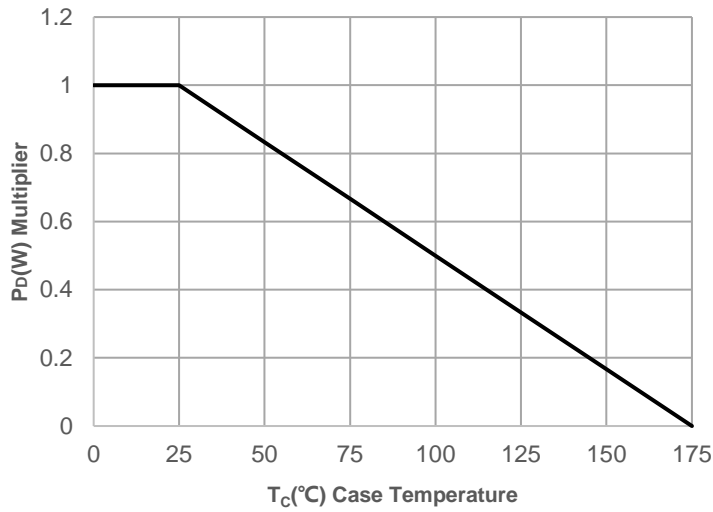


Figure 2: Current De-rating

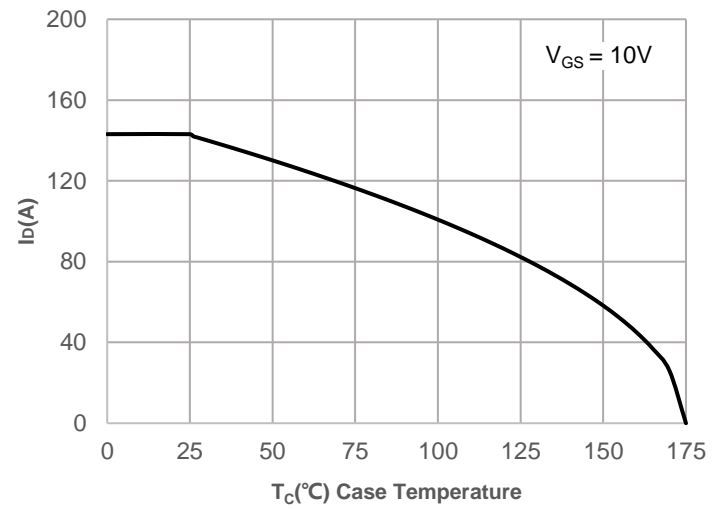


Figure 3: Normalized Maximum Transient Thermal Impedance

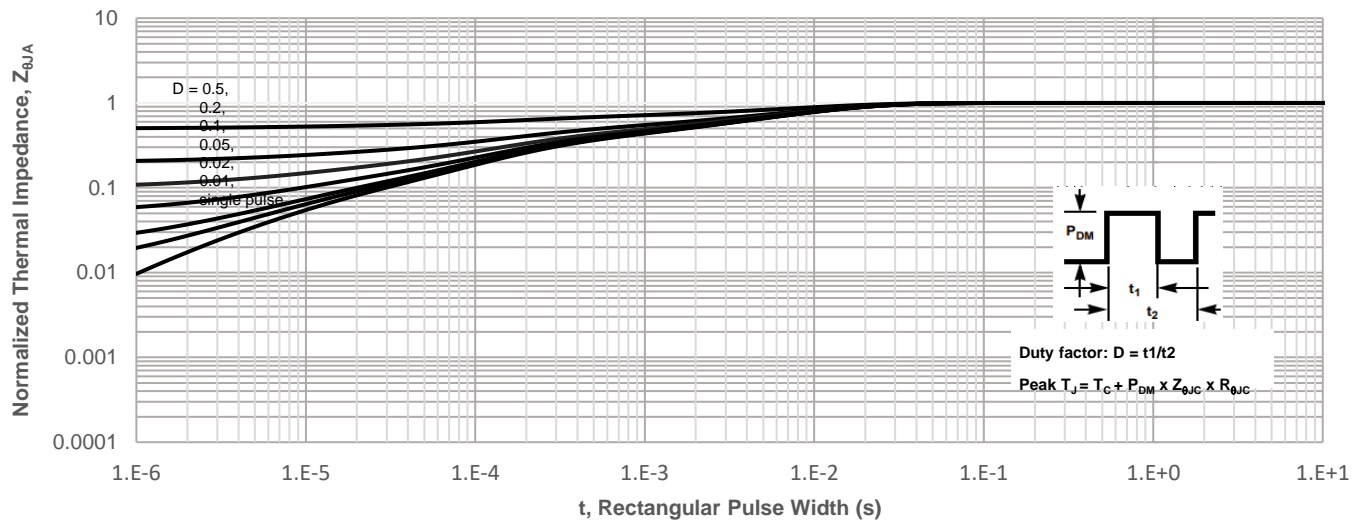
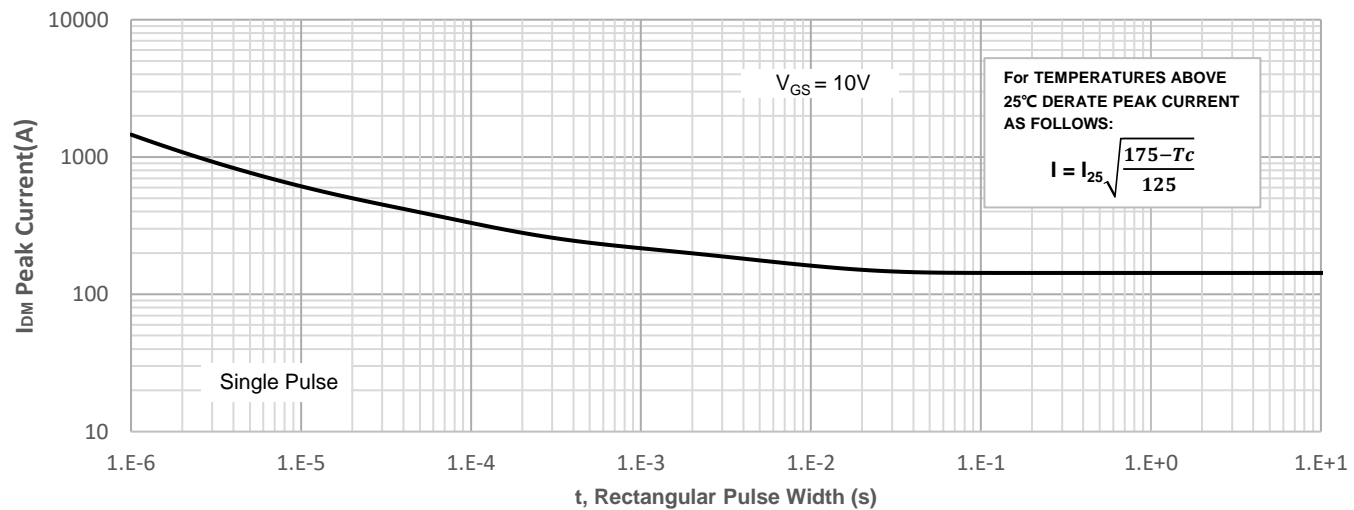


Figure 4: Peak Current Capacity



## Typical Performance Characteristics

Figure 5: Output Characteristics

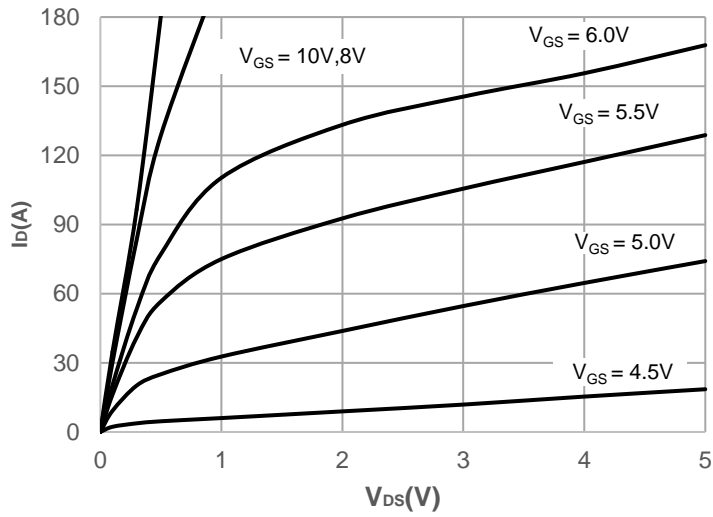


Figure 6: Typical Transfer Characteristics

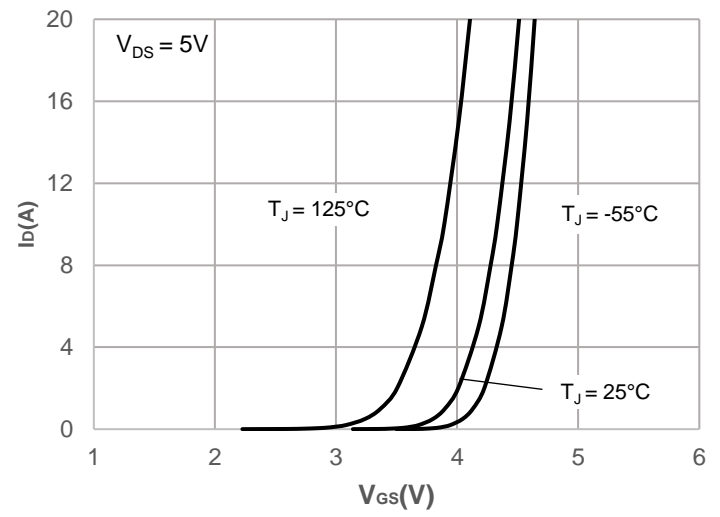


Figure 7: On-resistance vs. Drain Current

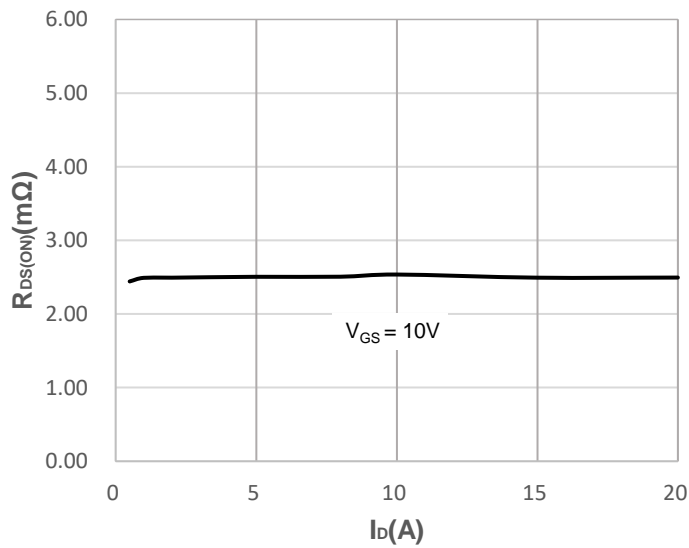


Figure 8: Body Diode Characteristics

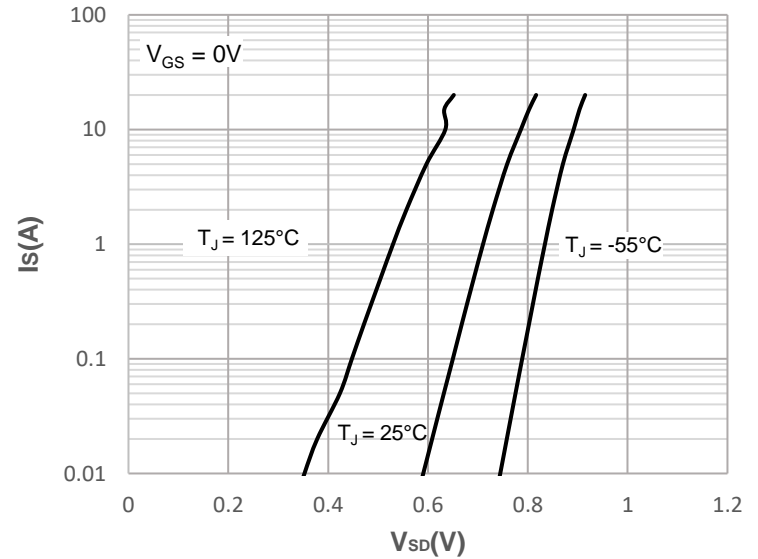


Figure 9: Gate Charge Characteristics

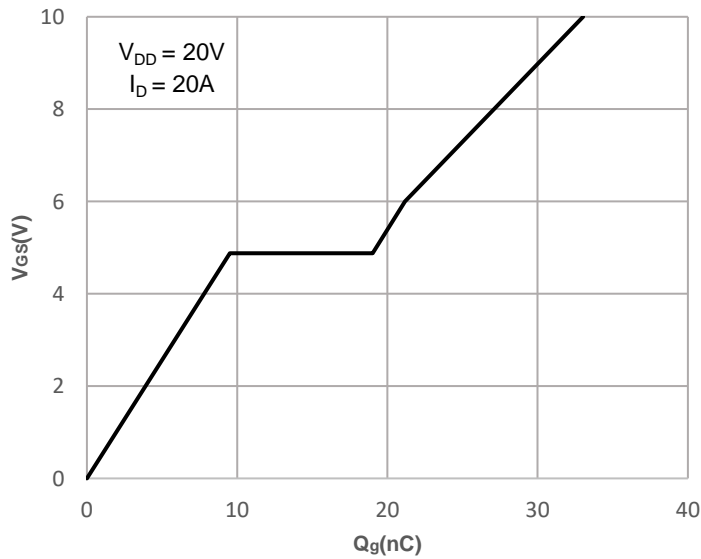
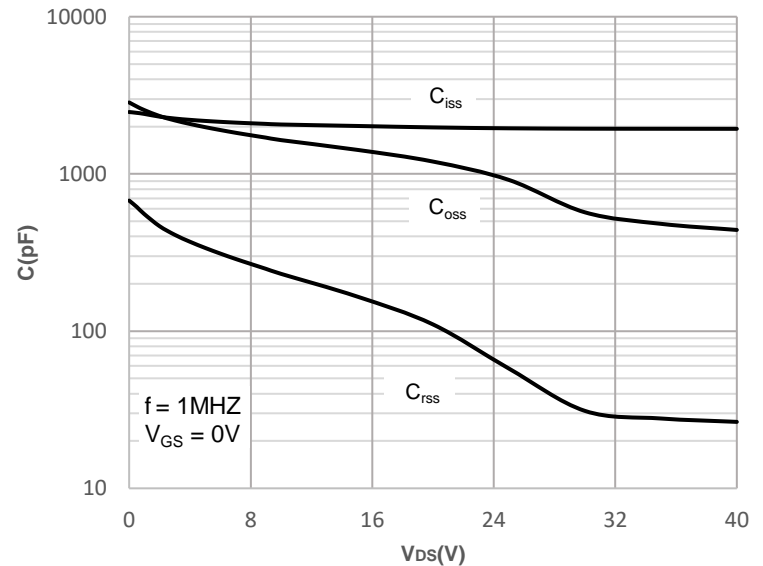


Figure 10: Capacitance Characteristics



## Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

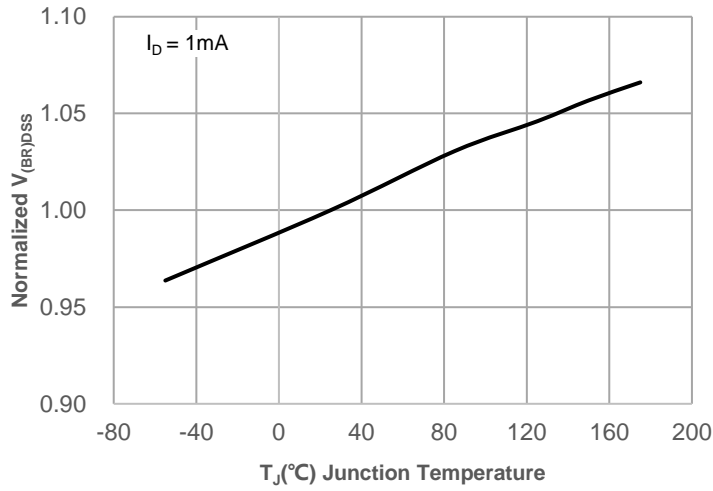


Figure 12: Normalized on Resistance vs. Junction Temperature

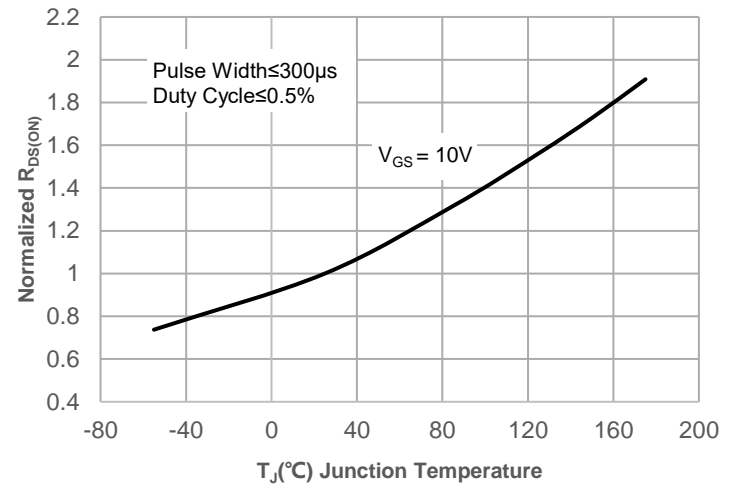


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

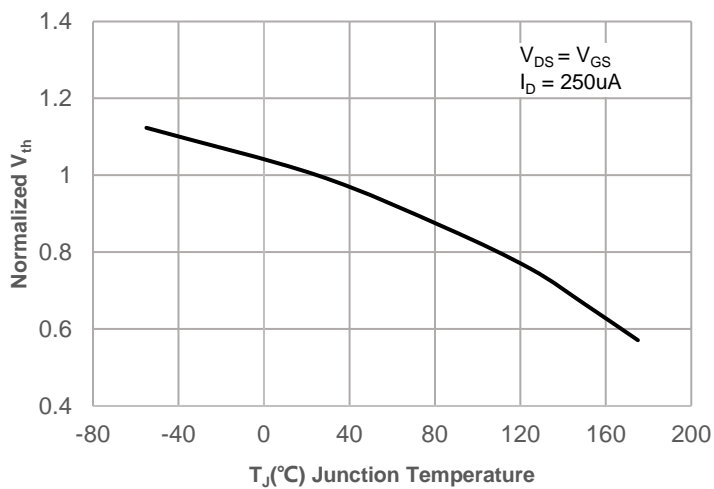


Figure 14:  $R_{DS(ON)}$  vs.  $V_{GS}$

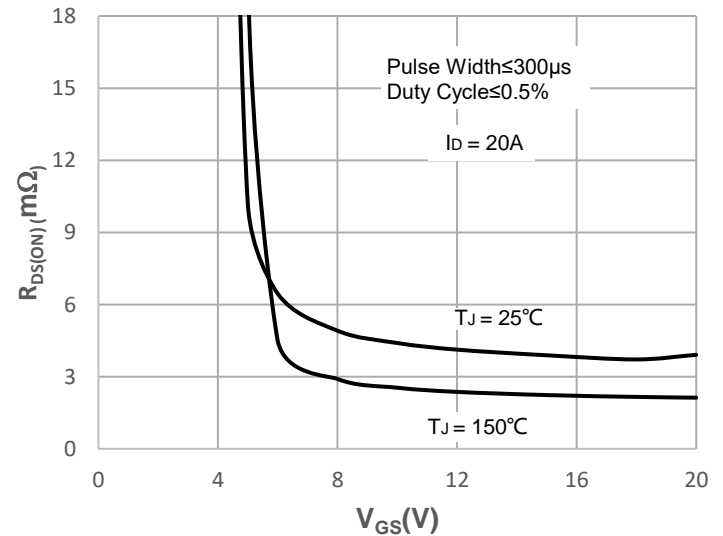
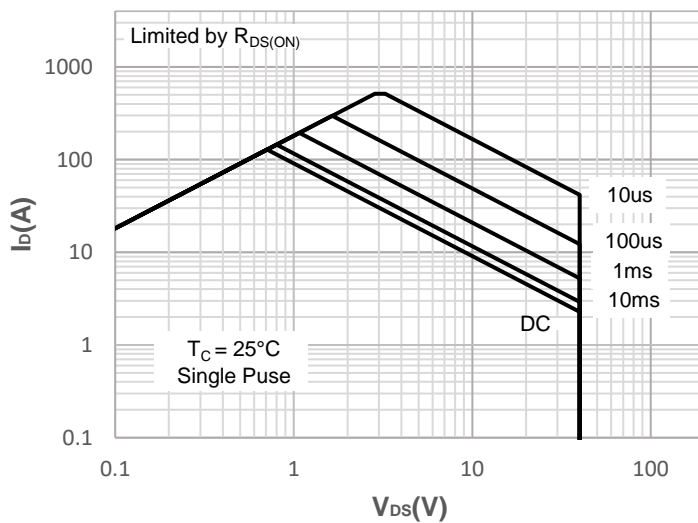


Figure 15: Maximum Safe Operating Area



## Test Circuit

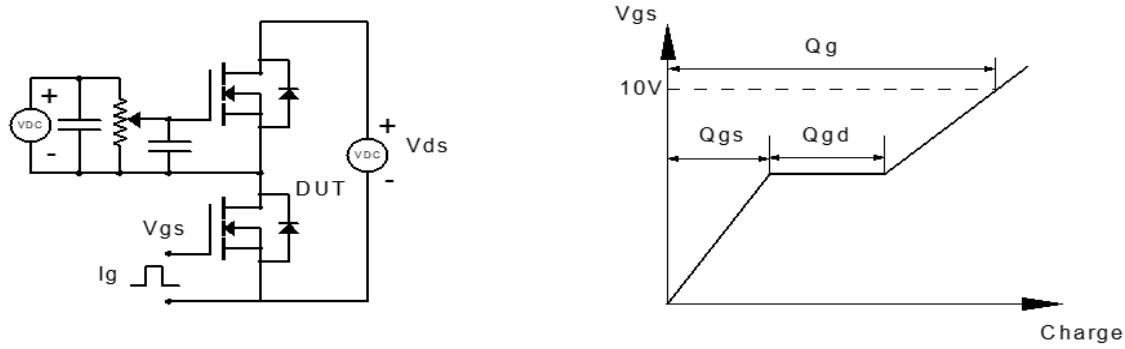


Figure 1: Gate Charge Test Circuit & Waveform

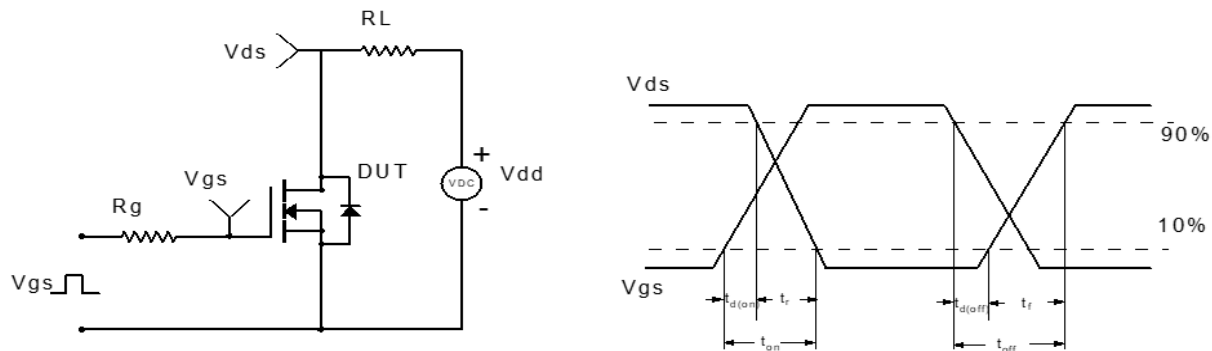


Figure 2: Resistive Switching Test Circuit & Waveform

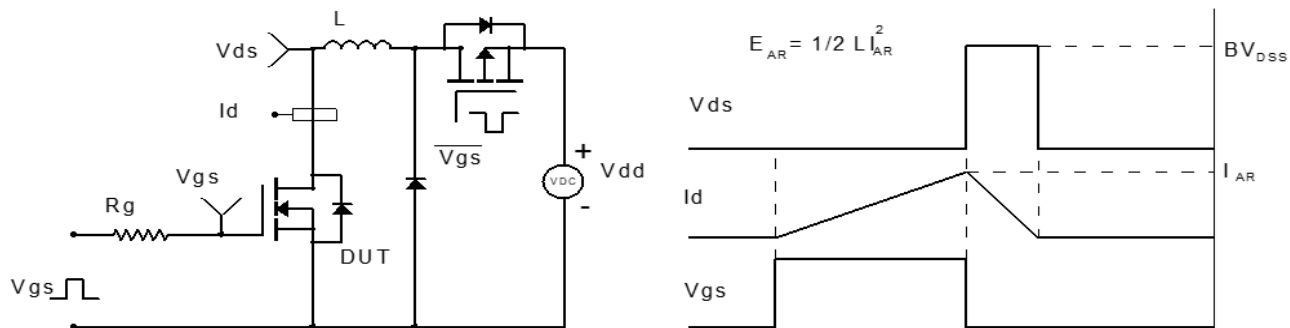


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

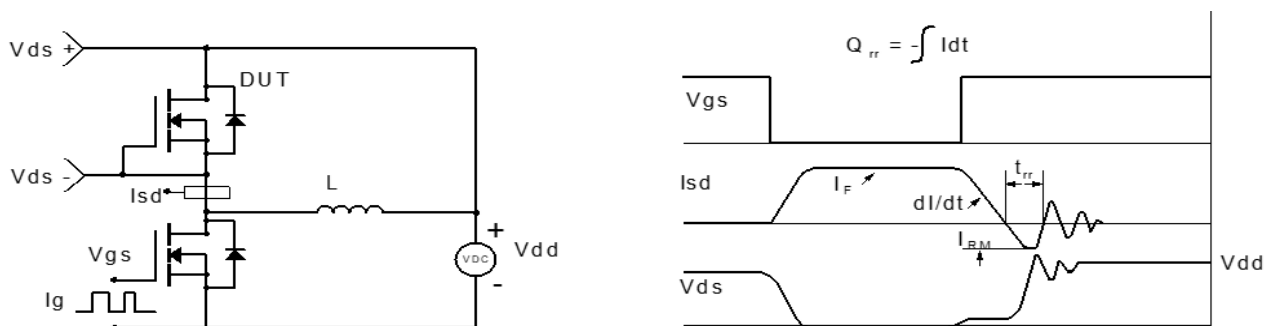
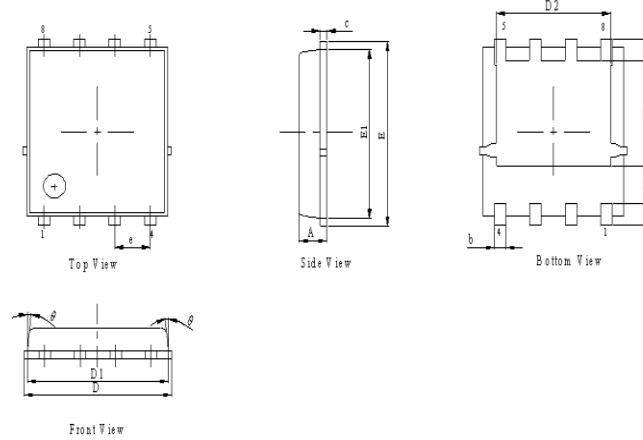


Figure 4: Diode Recovery Test Circuit & Waveform

## Package Mechanical Data(PDFN5X6-8L)

Package Outline

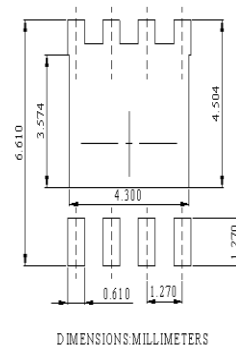


NOTES:

1. Dimension and tolerance per ASME Y14.5M, 1994.
2. All dimensions in millimeter (angle in degree).
3. Dimensions D1 and E1 do not include mold flash protrusions or gate burrs.

DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	0.9	1	1.15
b	0.31	0.41	0.51
C	0.24	0.32	0.4
D	5	5.2	5.4
D1	4.95	5.05	5.15
D2	4	4.1	4.2
E	6.05	6.15	6.25
E1	5.5	5.6	5.7
E2	3.42	3.53	3.63
e	1.27BSC		
H	0.6	0.7	0.8
L	0.5	0.7	0.8
K	1.23 REF		
O			10

Recommended Soldering Footprint



DIMENSIONS: MILLIMETERS

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