

## 40V, 154A, 2.0mΩ N-channel Power SGT MOSFET

### JMSH0403RGQ

#### Features

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

#### Applications

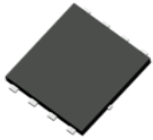
- Load Switch
- PWM Application
- General Automotive Application

#### Product Summary

Parameters	Value	Unit
$V_{DSS}$	40	V
$V_{GS(th)_{Typ}}$	2.6	V
$I_D(@V_{GS}=10V)$	154	A
$R_{DS(ON)_{Typ}}(@V_{GS}=10V)$	2.0	mΩ

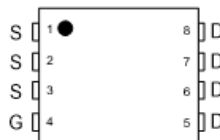
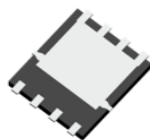


Top View

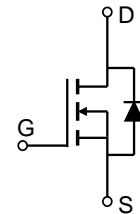


PDFN5X6-8L

Bottom View



Pin Assignment



Schematic Diagram

#### Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSH0403RGQ-13	SH0403RQ	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	$\pm 20$	V
$I_D$	Continuous Drain Current	$T_C = 25^\circ\text{C}$	154
		$T_C = 100^\circ\text{C}$	109
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	265	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	107
		$T_C = 100^\circ\text{C}$	54
$T_J, T_{STG}$	Junction & Storage Temperature Range	-55 to 175	$^\circ\text{C}$

#### Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient <sup>(3)</sup>	44	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.4	

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	40	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 32\text{V}, V_{GS} = 0\text{V}$	-	-	1.0	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}, V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	1.9	2.6	3.4	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(4)</sup>	$V_{GS} = 10\text{V}, I_D = 20\text{A}$	-	2.0	2.6	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	0.9	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = 20\text{V}, f = 1\text{MHz}$	1722	2411	3255	pF
$C_{oss}$	Output Capacitance		985	1378	1861	pF
$C_{riss}$	Reverse Transfer Capacitance		71	100	134	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0 \text{ to } 10\text{V}$ $V_{DS} = 20\text{V}, I_D = 20\text{A}$	26	36	49	nC
$Q_{gs}$	Gate Source Charge		8	11	14	nC
$Q_{gd}$	Gate Drain ("Miller") Charge		7	9	13	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{V}, V_{DD} = 20\text{V}$ $I_D = 20\text{A}, R_{GEN} = 3\Omega$	-	13	-	ns
$t_r$	Turn-On Rise Time		-	25	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	25	-	ns
$t_f$	Turn-Off Fall Time		-	9	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	154	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	615	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	$I_F = 20\text{A}, di/dt = 100\text{A}/\mu\text{s}$	32	44	60	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	44	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 20\text{V}$ ,  $V_{GS} = 10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 13.3\text{A}$ ,  $V_{DD} = 0\text{V}$  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

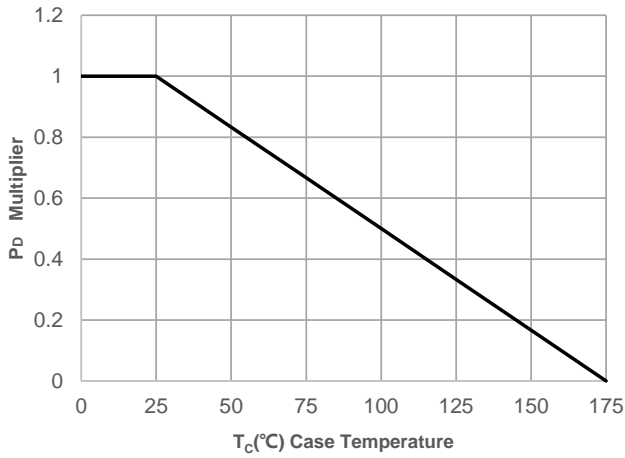


Figure 2: Current De-rating

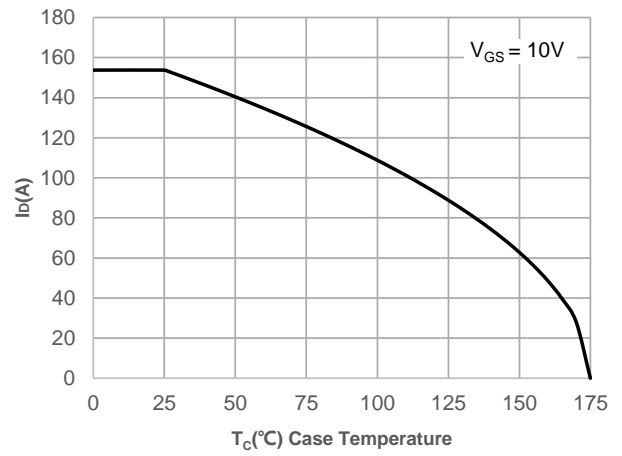


Figure 3: Normalized Maximum Transient Thermal Impedance

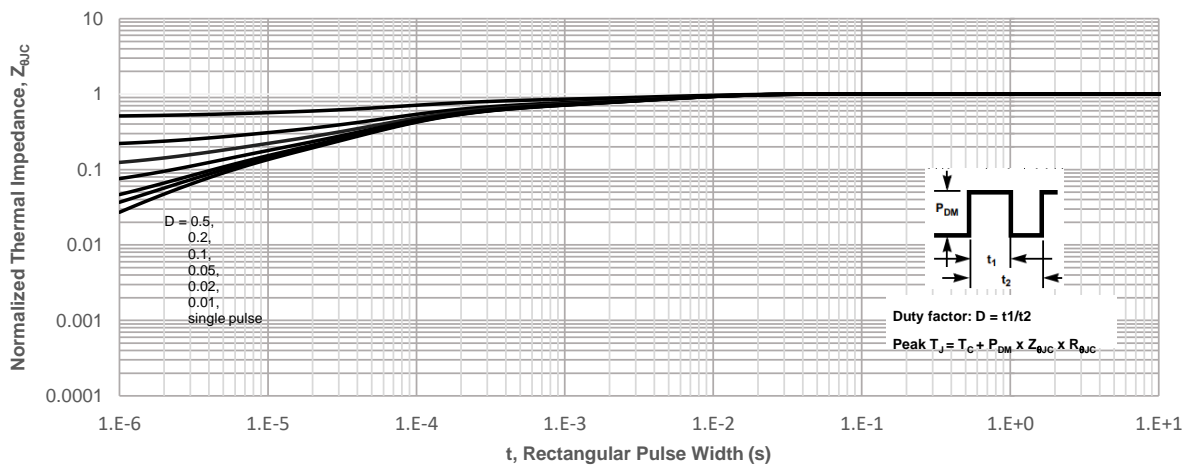
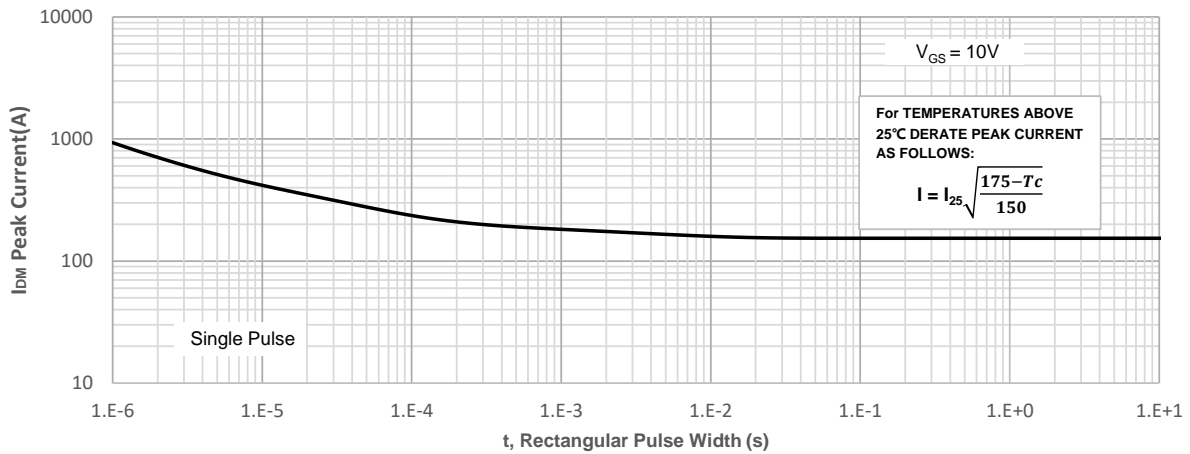
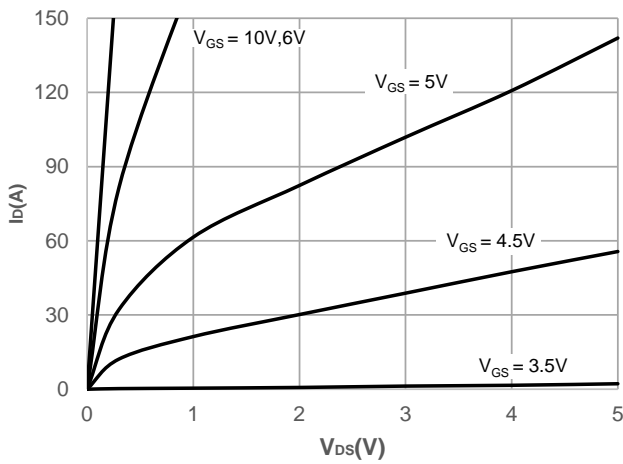
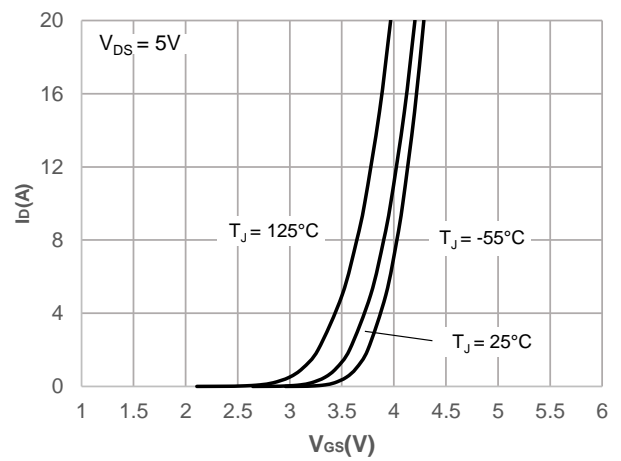
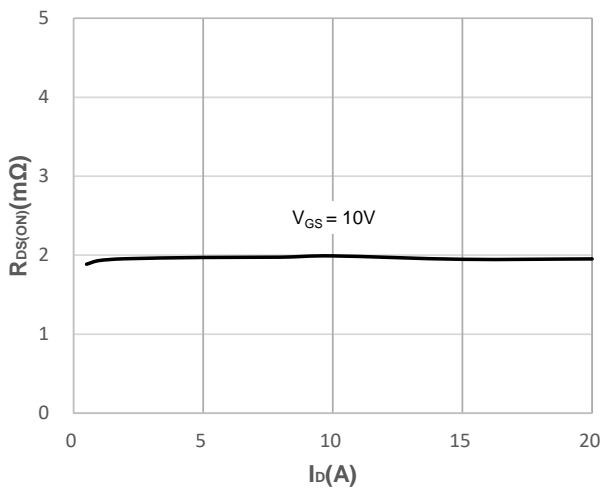
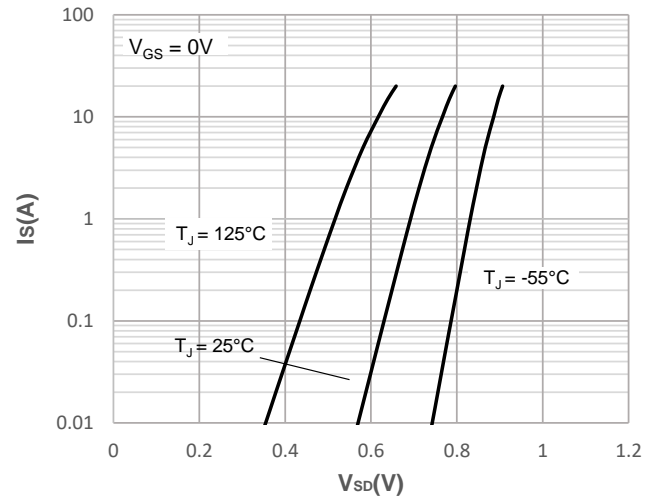
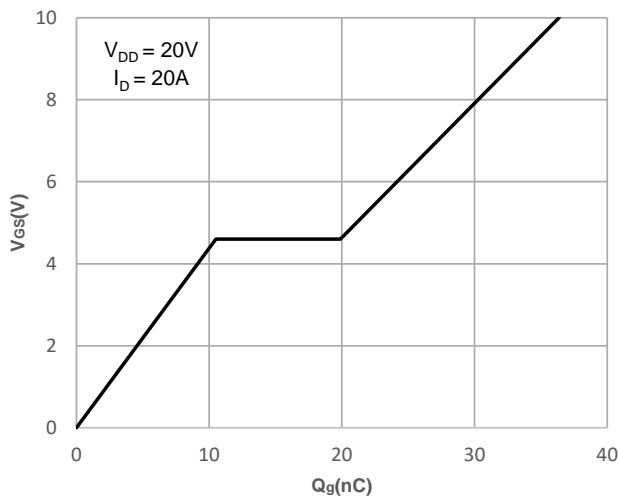
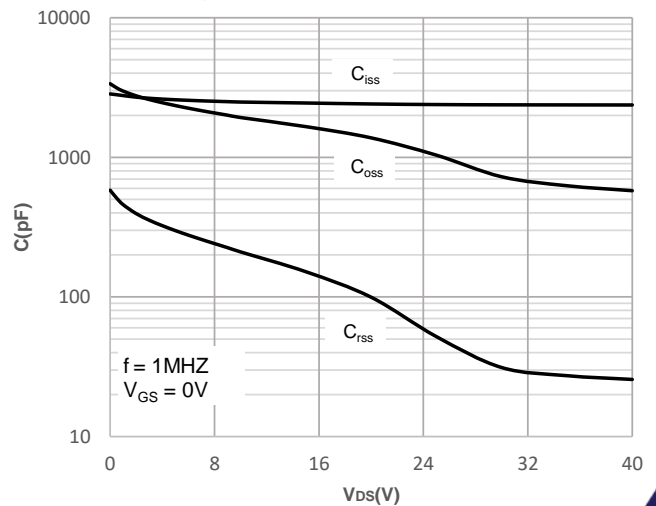


Figure 4: Peak Current Capacity



## 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

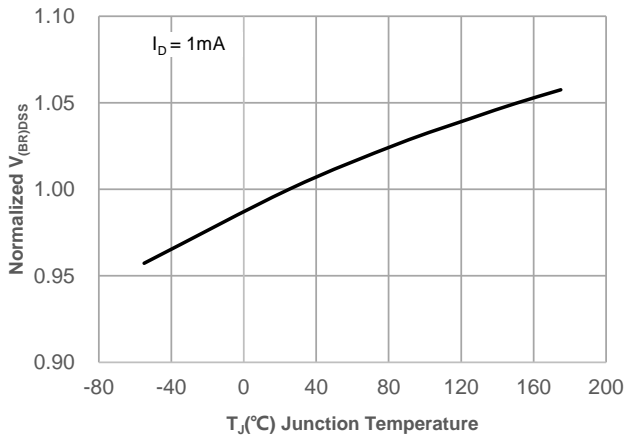


Figure 12: Normalized on Resistance vs. Junction Temperature

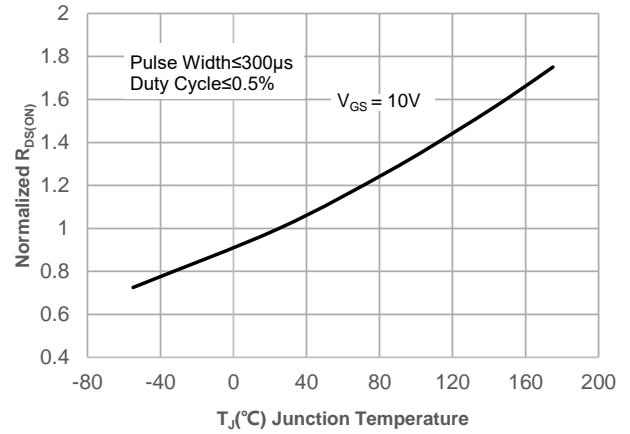


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

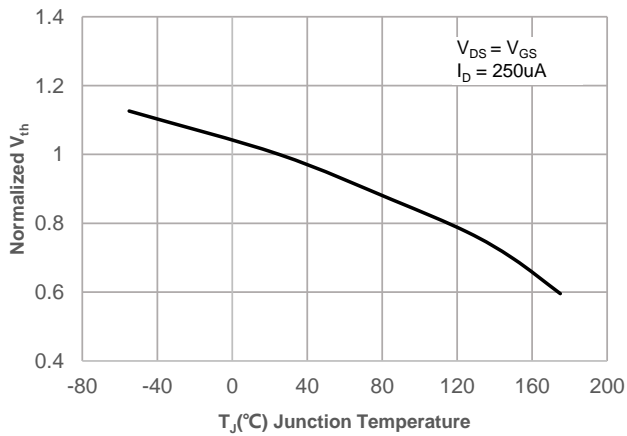


Figure 14: R<sub>DS(ON)</sub> vs. V<sub>GS</sub>

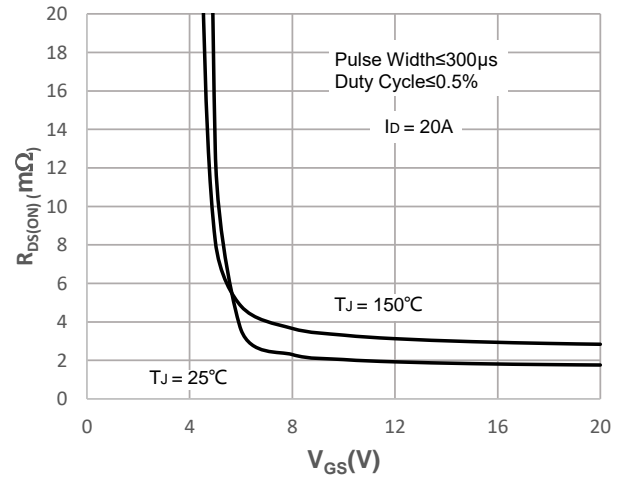
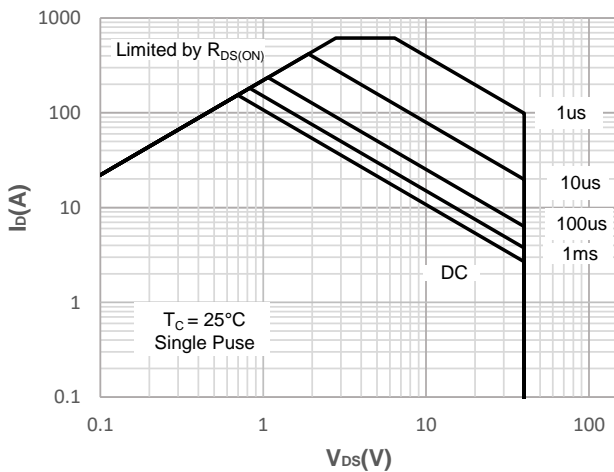


Figure 15: Maximum Safe Operating Area



### Test Circuit

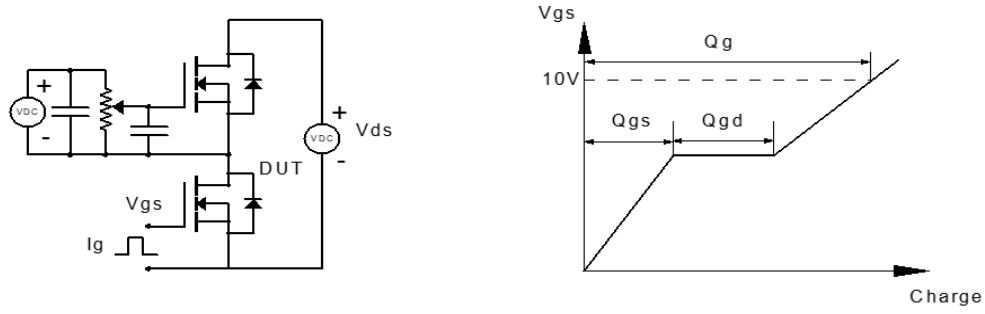


Figure 1: Gate Charge Test Circuit & Waveform

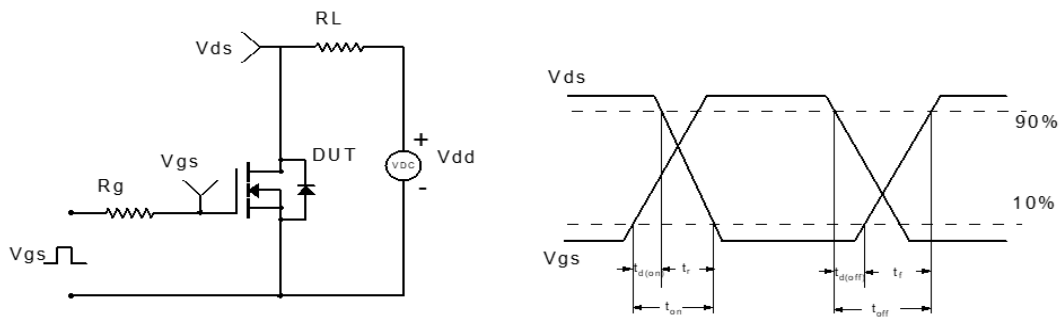


Figure 2: Resistive Switching Test Circuit & Waveform

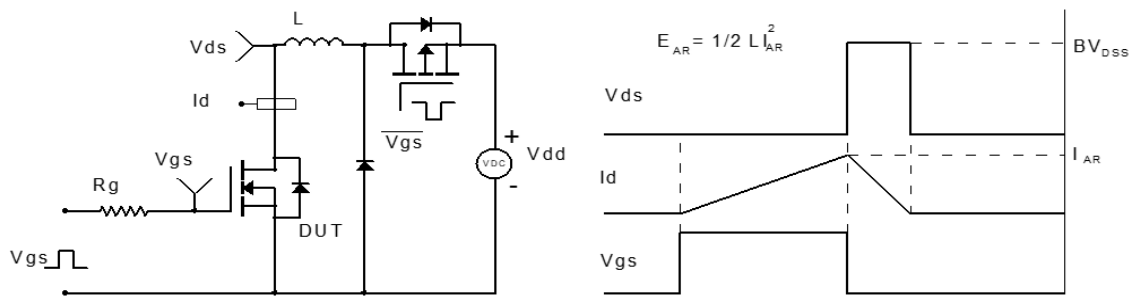


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

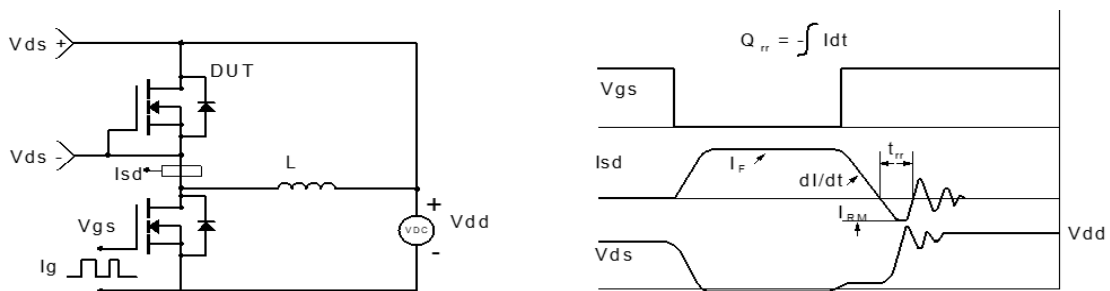
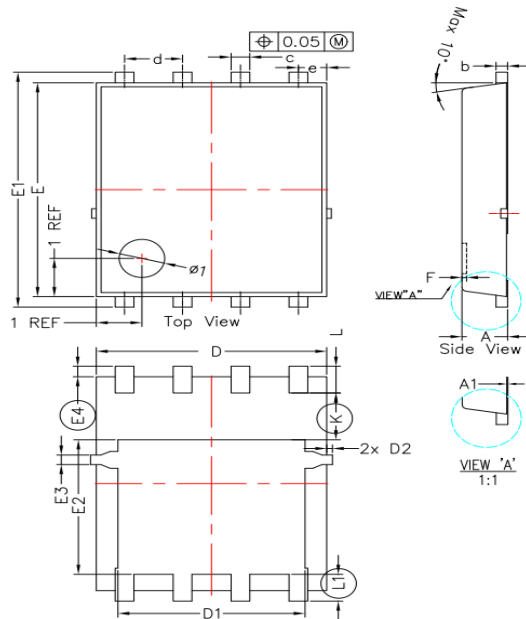


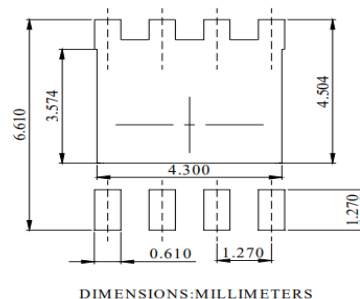
Figure 4: Diode Recovery Test Circuit & Waveform

## Package Mechanical Data(PDFN5X6-8L)



SYMBOLS	DIMENSION IN MM			DIMENSION IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
*A	0.900	1.000	1.150	0.035	0.039	0.045
A1	0.000	---	0.050	0.000	---	0.002
b	0.246	0.254	0.350	0.010	0.010	0.014
*C	0.310	0.410	0.510	0.012	0.016	0.020
d	1.27BSC			0.050BSC		
*D	4.950	5.050	5.150	0.195	0.199	0.203
D1	4.000	4.100	4.200	0.157	0.161	0.165
*D2	0.125REF			0.005REF		
e	0.62BSC			0.024BSC		
*E	5.500	5.600	5.700	0.217	0.220	0.224
*E1	6.050	6.150	6.250	0.238	0.242	0.246
E2	3.425	3.525	3.625	0.135	0.139	0.143
E3	0.250REF			0.010REF		
*E4	0.275REF			0.011REF		
F	-	-	0.100	-	-	0.004
*L	0.500	0.600	0.700	0.02	0.02	0.03
L1	0.600	0.700	0.800	0.02	0.03	0.03
K	1.225REF			0.05REF		

### Recommended Soldering Footprint



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