

**40V, 443A, 0.85mΩ N-channel Power SGT MOSFET**
**JMSH0401PGLQ**
**Features**

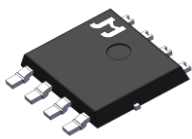
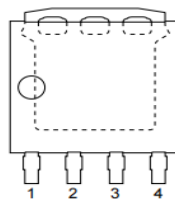
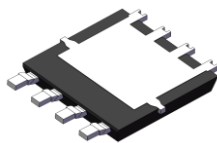
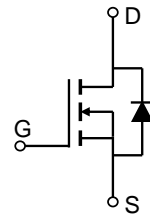
- Ultra-low ON-resistance,  $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100%  $\Delta V_d$ s Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

**Applications**

- Load Switch
- PWM Application
- General Automotive Application

**Product Summary**

Parameters	Value	Unit
$V_{DSS}$	40	V
$V_{GS(th)}_{Typ}$	2.8	V
$I_D(@V_{GS}=10V)$	443	A
$R_{DS(ON)}_{Typ}(@V_{GS}=10V)$	0.85	mΩ


**LFP5X6-8L-PS**

**Pin Assignment**

**Schematic Diagram**
**Ordering Information**

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSH0401PGLQ-13	SH0401PQ	1	Tape&Reel	LFP5X6-8L-PS	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	$T_C = 25^\circ\text{C}$	443
		$T_C = 100^\circ\text{C}$	313
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	1693	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	375
		$T_C = 100^\circ\text{C}$	188
$T_J, T_{STG}$	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>	42	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.4	



**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	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	2.0	2.8	4.0	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(4)</sup>	$V_{GS} = 10\text{V}$ , $I_D = 20\text{A}$	-	0.85	1.1	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	2.3	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}$ , $V_{DS} = 20\text{V}$ , $f = 1\text{MHz}$	-	5816	7860	pF
$C_{oss}$	Output Capacitance		-	3104	4190	pF
$C_{rss}$	Reverse Transfer Capacitance		-	154	210	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0$ to $10\text{V}$ $V_{DS} = 20\text{V}$ , $I_D = 20\text{A}$	-	85	-	nC
$Q_{gs}$	Gate Source Charge		-	23	-	nC
$Q_{gd}$	Gate Drain ("Miller") Charge		-	20	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{V}$ , $V_{DD} = 20\text{V}$ $I_D = 20\text{A}$ , $R_{GEN} = 3\Omega$	-	20	-	ns
$t_r$	Turn-On Rise Time		-	43	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	76	-	ns
$t_f$	Turn-Off Fall Time		-	51	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	443	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	1772	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	$I_F = 20\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$	33	66	100	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	113	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 20\text{V}$ ,  $V_{GS} = 10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 33.6\text{A}$ ,  $V_{DD} = 0\text{V}$  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

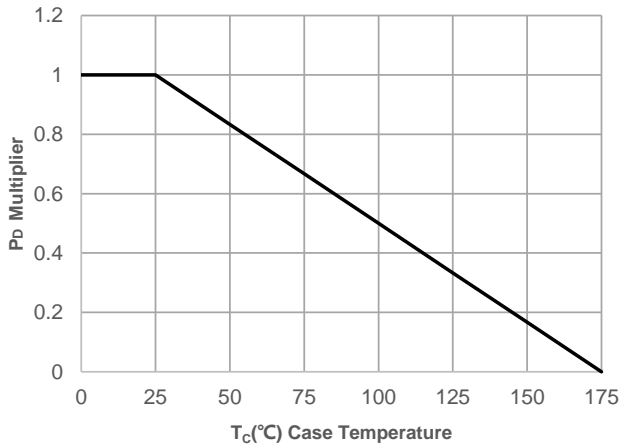


Figure 2: Current De-rating

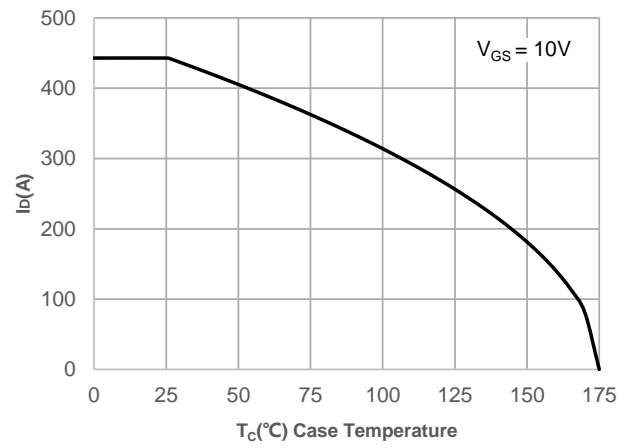


Figure 3: Normalized Maximum Transient Thermal Impedance

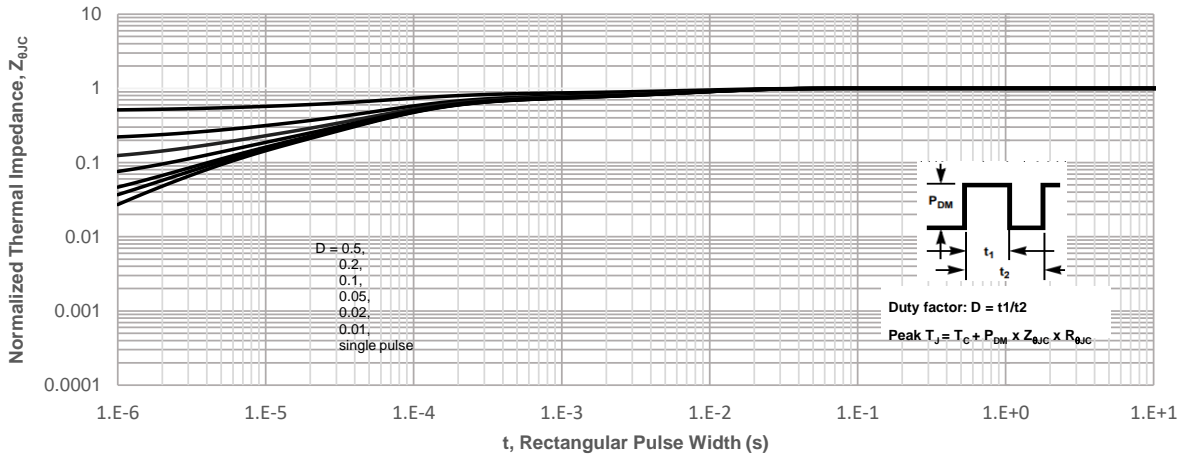
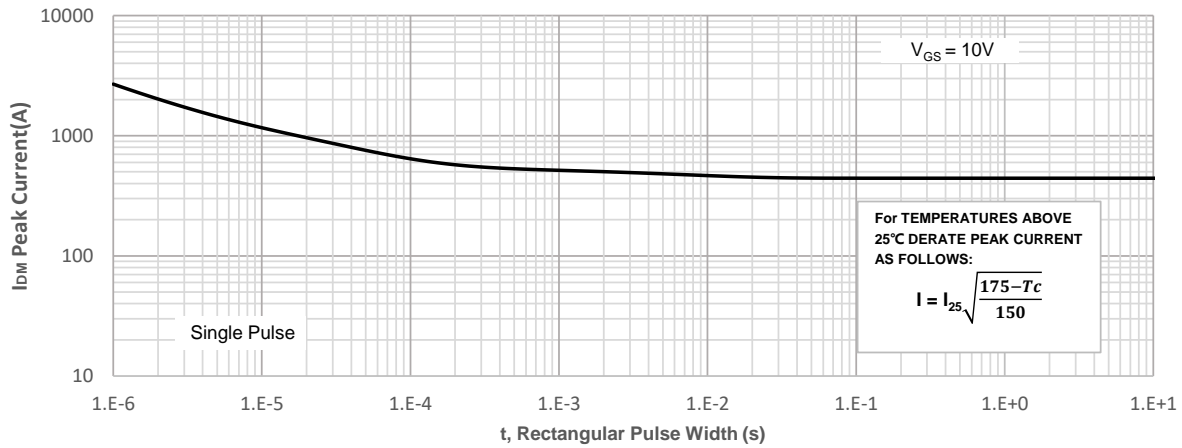
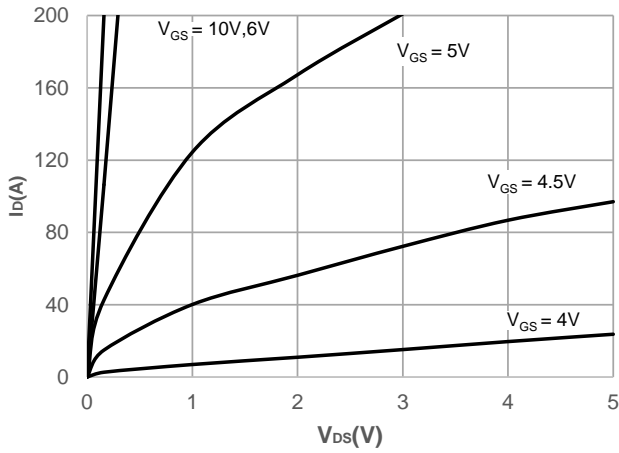
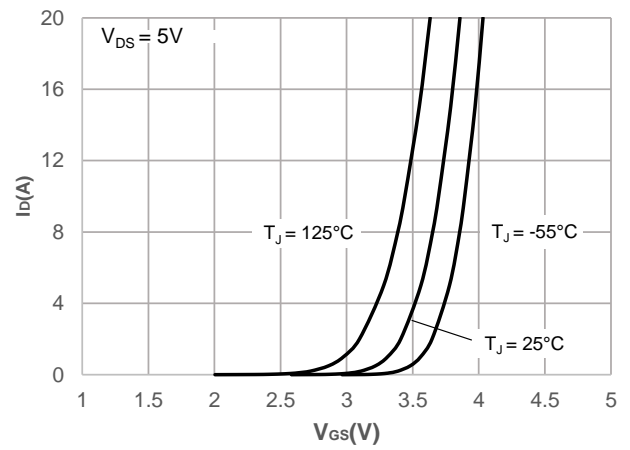
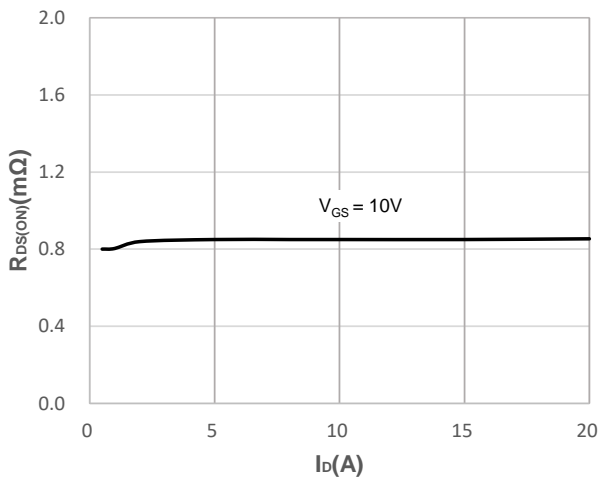
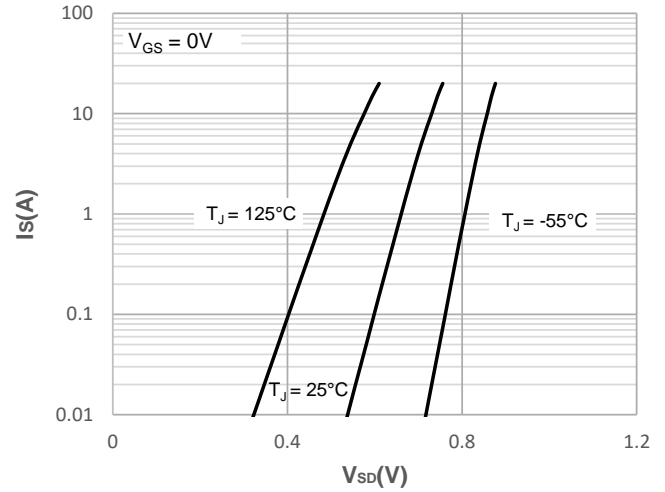
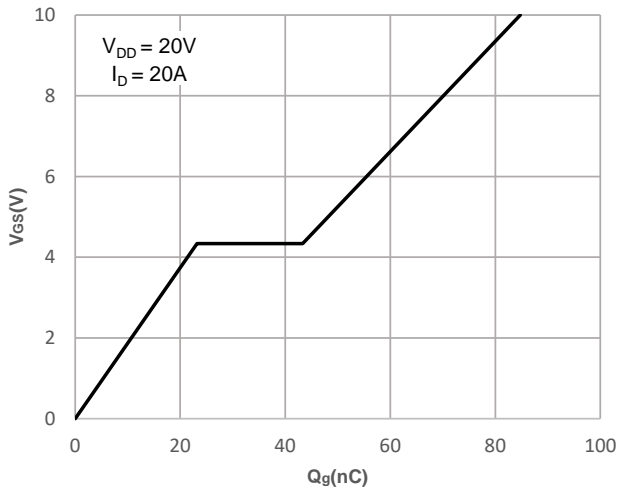
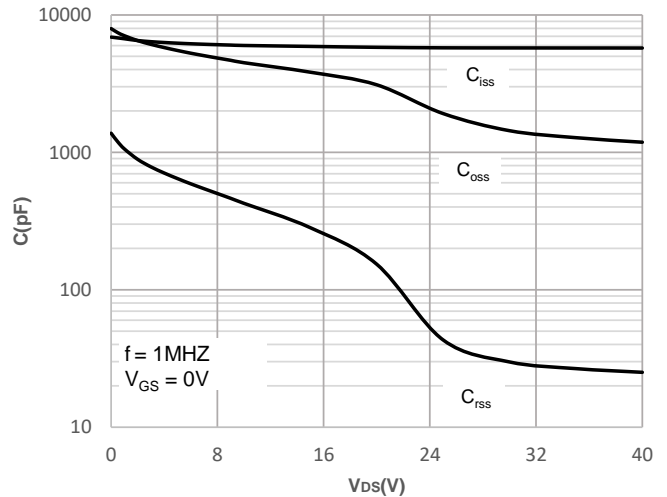


Figure 4: Peak Current Capacity



## 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

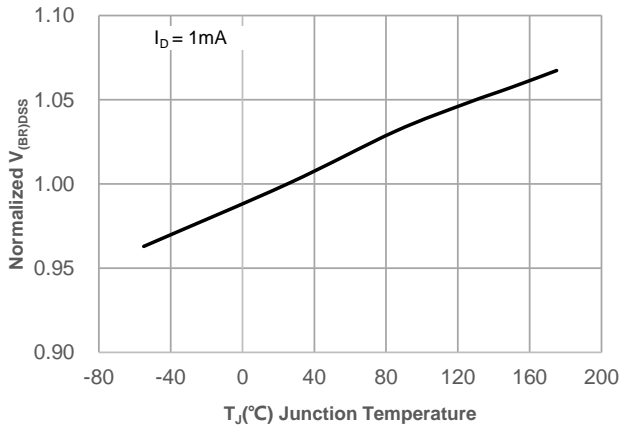


Figure 12: Normalized on Resistance vs. Junction Temperature

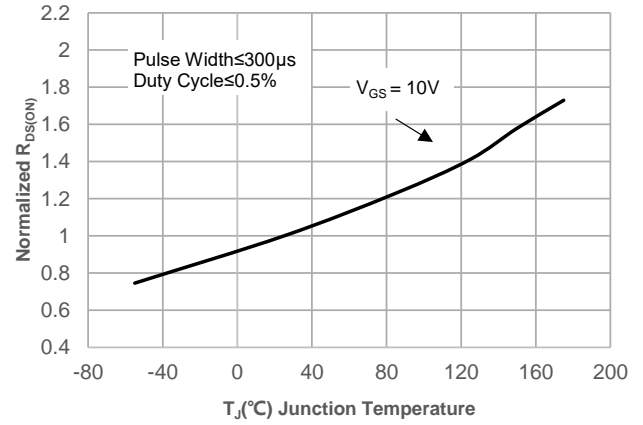


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

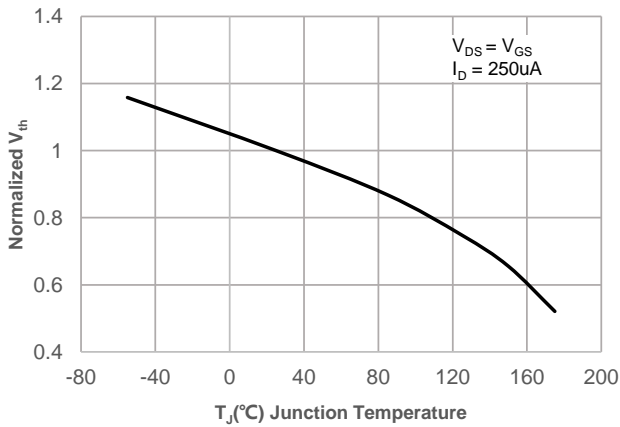


Figure 14:  $R_{DS(ON)}$  vs.  $V_{GS}$

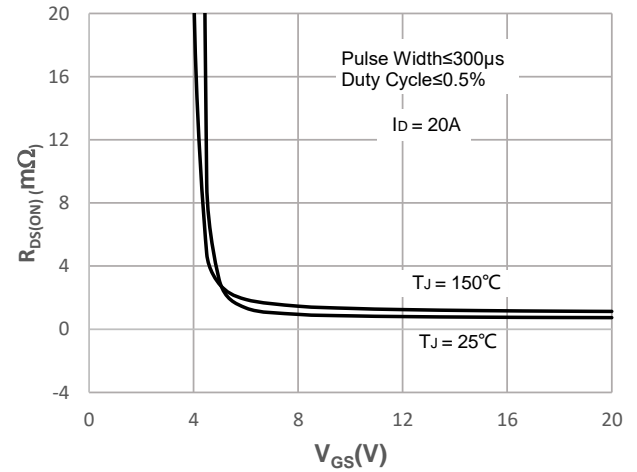
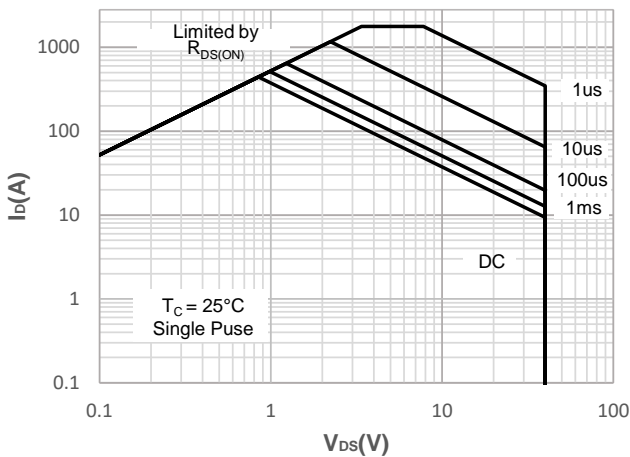


Figure 15: Maximum Safe Operating Area



### Test Circuit

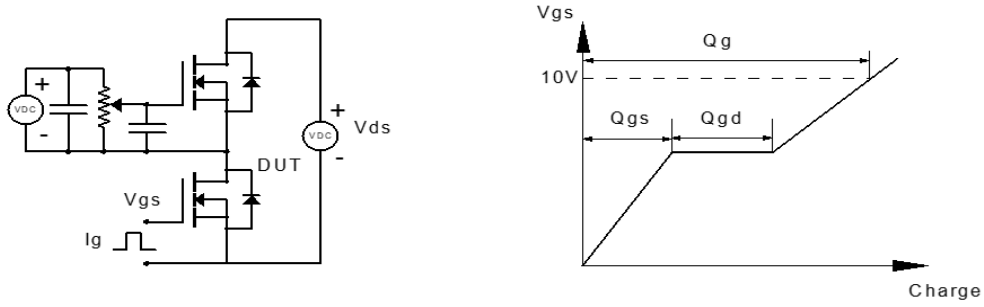


Figure 1: Gate Charge Test Circuit & Waveform

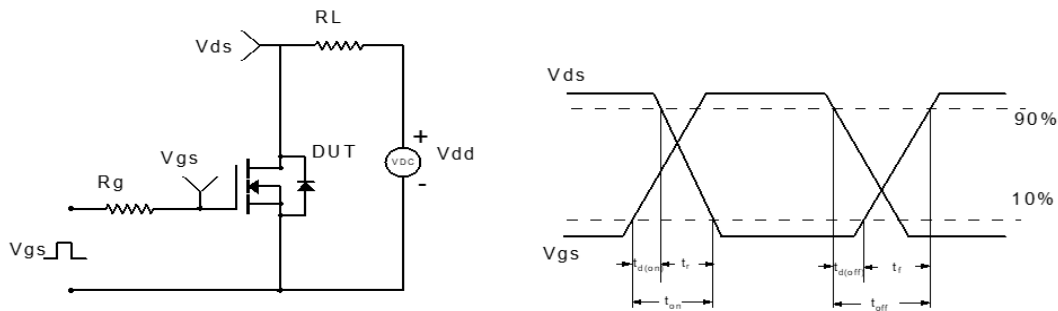


Figure 2: Resistive Switching Test Circuit & Waveform

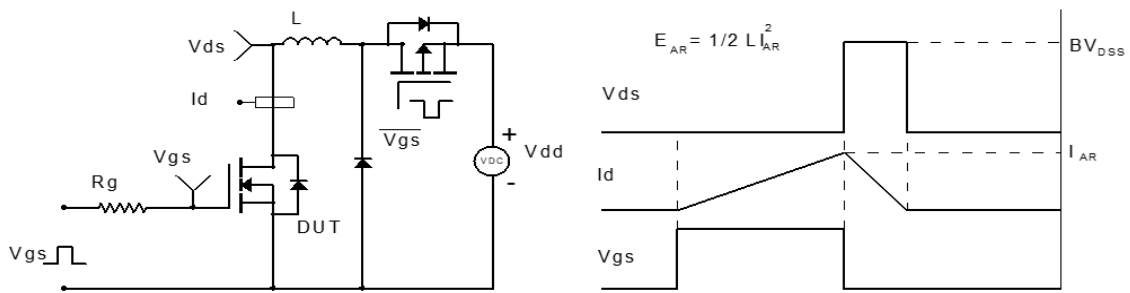
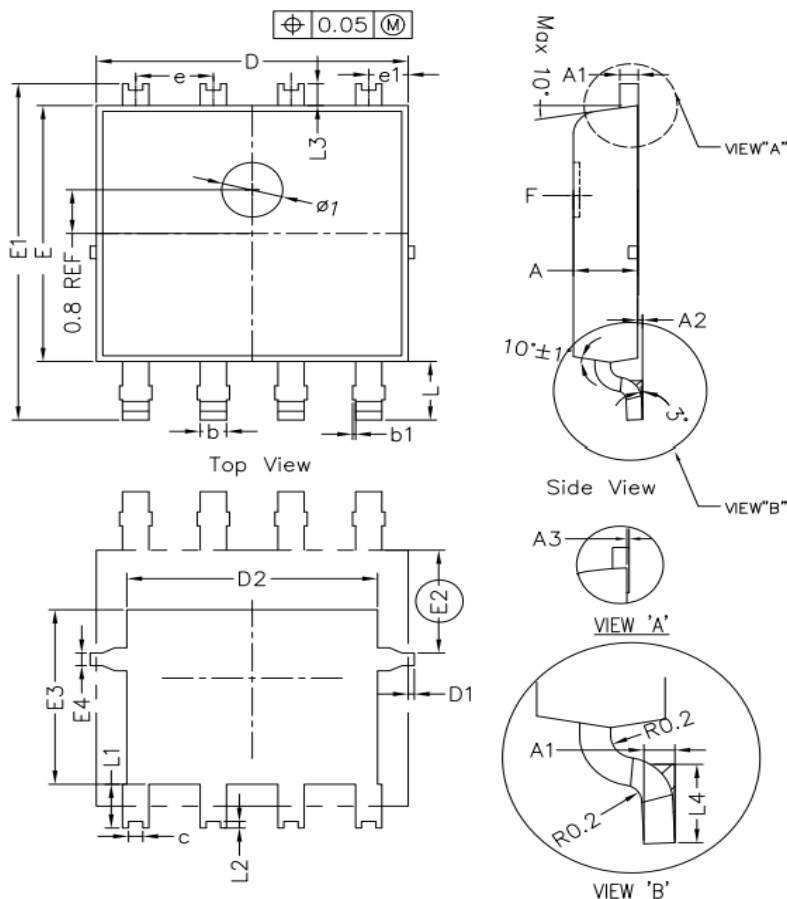


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform



Figure 4: Diode Recovery Test Circuit & Waveform



**Package Mechanical Data(LFPAK5X6-8L-PS)**


SYMBOLS	DIMENSION IN MM			DIMENSION IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
*A	0.950	1.050	1.200	0.037	0.041	0.047
*A1	0.228	0.278	0.328	0.009	0.011	0.013
A2	0.030	0.080	0.130	0.001	0.003	0.005
A3	--	--	0.050	--	--	0.002
*b	0.330	0.430	0.530	0.013	0.017	0.021
b1	0.05REF			0.002REF		
C	0.235REF			0.009REF		
*D	5.000	5.100	5.200	0.197	0.201	0.205
D1	0.125REF			0.005REF		
D2	4.000	4.100	4.200	0.157	0.161	0.165
*E1	6.000	6.150	6.300	0.236	0.242	0.248
*E	4.580	4.680	4.780	0.18	0.184	0.188
e1	0.645REF			0.025REF		
e	1.27REF			0.05REF		
E2	1.880REF			0.074REF		
E3	3.090	3.190	3.290	0.122	0.126	0.130
E4	0.230REF			0.009REF		
F	--	--	0.100	--	--	0.004
*L	0.970	1.070	1.170	0.038	0.042	0.046
L1	0.650	0.800	0.950	0.026	0.031	0.037
L2	0.125REF			0.005REF		
L3	0.300	0.400	0.500	0.012	0.016	0.020
L4	0.620	0.720	0.820	0.024	0.028	0.032

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