

# JMSH0401MGQ

## Features

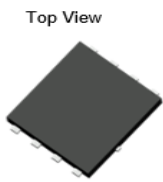
- Ultra-low ON-resistance,  $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100%  $V_{ds}$  Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

## Applications

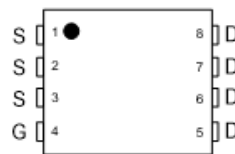
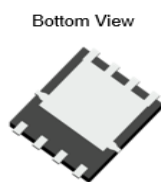
- Load Switch
- PWM Application
- General A Application

## Product Summary

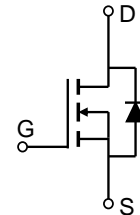
Parameters	Value	Unit
$V_{DSS}$	40	V
$V_{GS(th)\_Typ}$	2.7	V
$I_D(@V_{GS}=10V)$	223	A
$R_{DS(ON)\_Typ}(@V_{GS}=10V)$	1.4	m $\Omega$



PDFN5X6-8L



Pin Assignment



Schematic Diagram

## Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSH0401MGQ-13	SH0401MQ	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	$T_C = 25^\circ\text{C}$	223
		$T_C = 100^\circ\text{C}$	158
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	459	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	157
		$T_C = 100^\circ\text{C}$	78
$T_{J\_STG}$	Junction & Storage Temperature Range	-55 to 175	$^\circ\text{C}$

## Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta 90}$	Thermal Resistance, Junction to Ambient <sup>(3)</sup>	42	$^\circ\text{C/W}$
$R_{\theta 92}$	Thermal Resistance, Junction to Case	1.0	

**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	$\mu$
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}$ , $V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	1.9	2.7	3.5	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(4)</sup>	$V_{GS} = 10\text{V}$ , $I_D = 20\text{A}$	-	1.4	1.7	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	0.9	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}$ , $V_{DS} = 20\text{V}$ , $f = 1\text{MHz}$	2589	3625	4893	pF
$C_{oss}$	Output Capacitance		1413	1979	2671	pF
$C_{riss}$	Reverse Transfer Capacitance		113	158	213	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0$ to $10\text{V}$ $V_{DS} = 20\text{V}$ , $I_D = 20\text{A}$	42	59	80	nC
$Q_{GS}$	Gate Source Charge		11	15	21	nC
$Q_{gd}$	Gate Drain("Miller") Charge		12	16	22	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = 10\text{V}$ , $V_{DD} = 20\text{V}$ $I_D = 20\text{A}$ , $R_{GEN} = 3\Omega$	-	16	-	ns
$t_r$	Turn-On Rise Time		-	29	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	35	-	ns
$t_f$	Turn-Off Fall Time		-	13	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	223	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	891	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	$I_F = 20\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$	37	52	70	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	66	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 20\text{V}$ ,  $V_{GS} = 10\text{V}$ ,  $R_G = 250\text{ohm}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 17.5\text{A}$ ,  $V_{DD} = 0\text{V}$  during time in avalanche.
  3.  $R_{\theta}$  is measured with the device mounted on a  $1\text{inch}^2$  pad of 2oz copper FR4 PCB.
  4. Pulse Test: Pulse Width  $\leq 3 \mu\text{s}$  &  $2 \mu\text{s}$   $\leq 0.5\%$ .





### Typical Performance Characteristics

Figure 1: Power De-rating

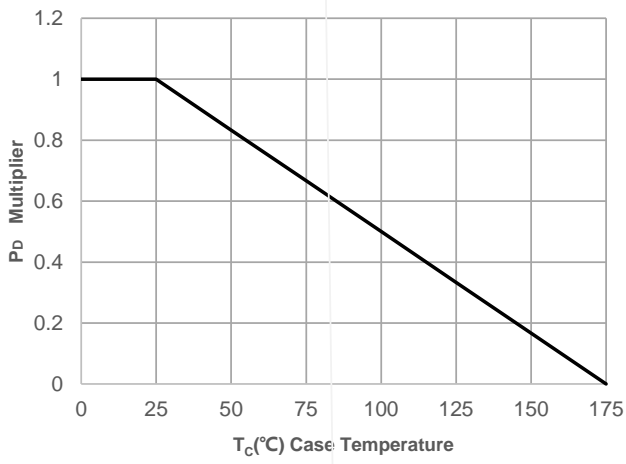
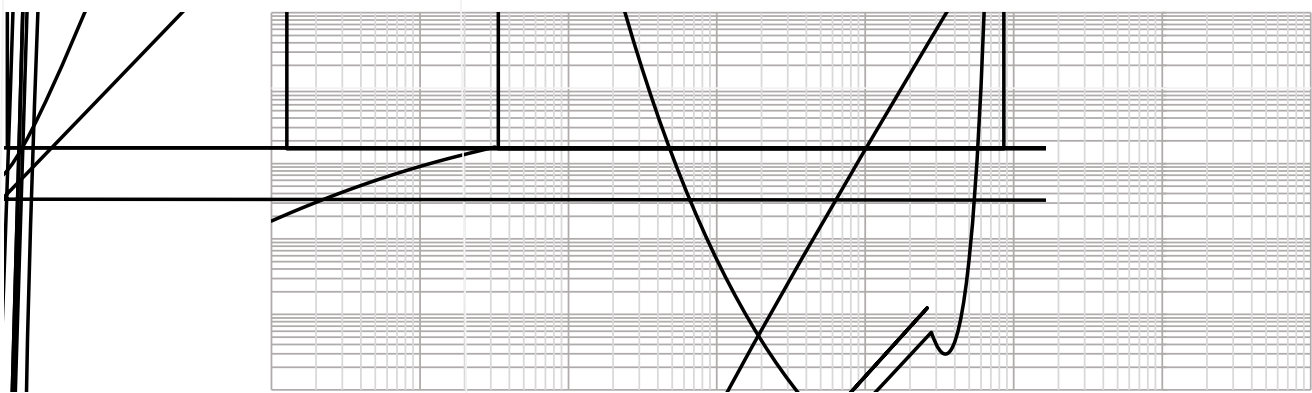
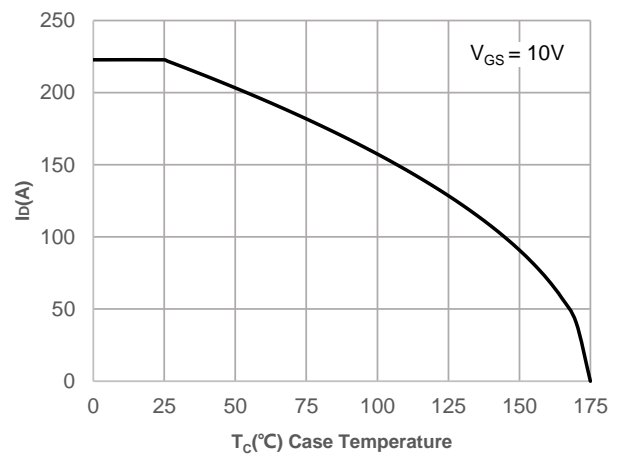


Figure 2: Current De-rating



## Typical Performance Characteristics

Figure 5: Output Characteristics

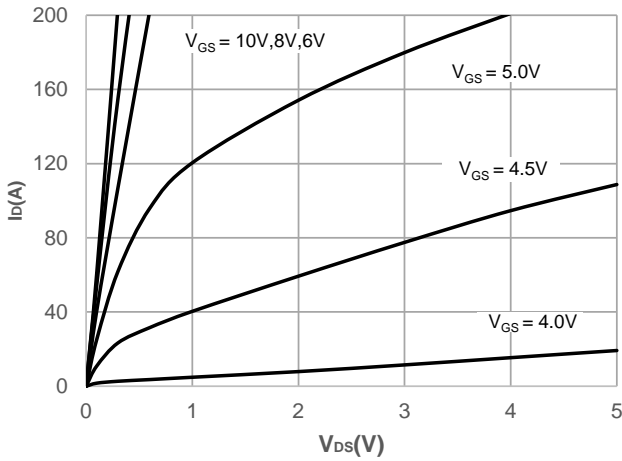


Figure 6: Typical Transfer Characteristics

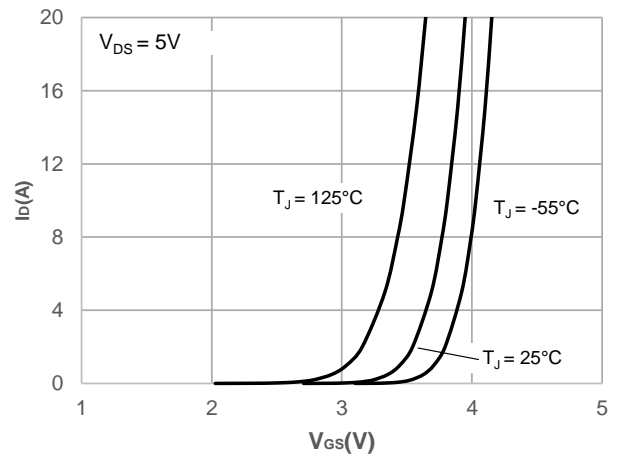


Figure 7: On-resistance vs. Drain Current

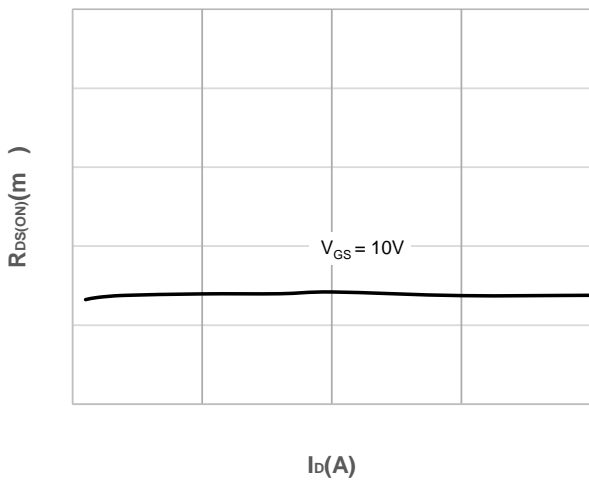


Figure 8: Body Diode Characteristics

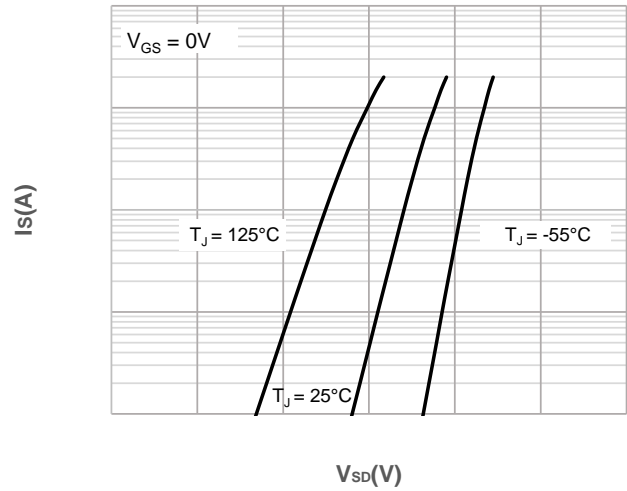


Figure 9: Gate Charge Characteristics

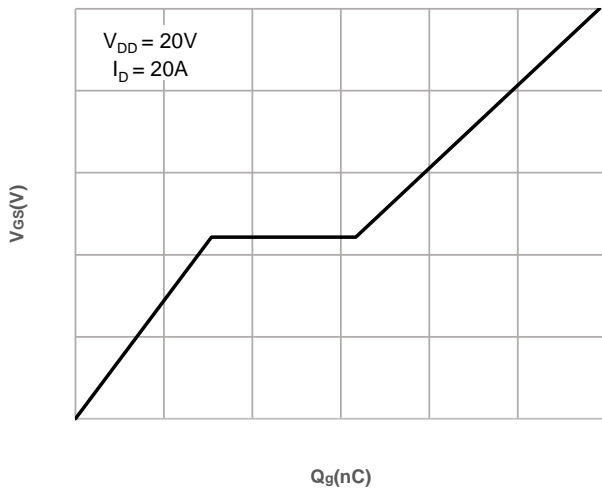
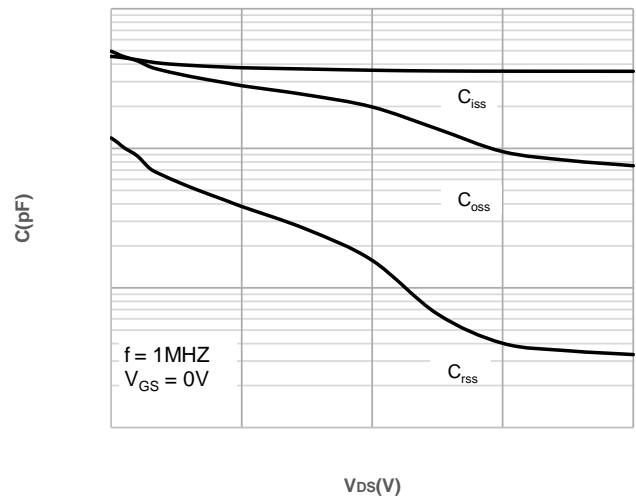


Figure 10: Capacitance Characteristics



### Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

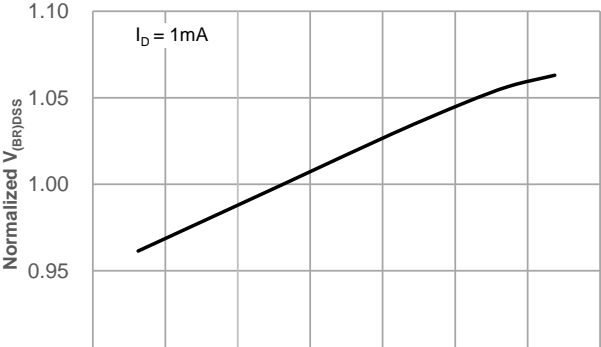


Figure 12: Normalized on Resistance vs. Junction Temperature

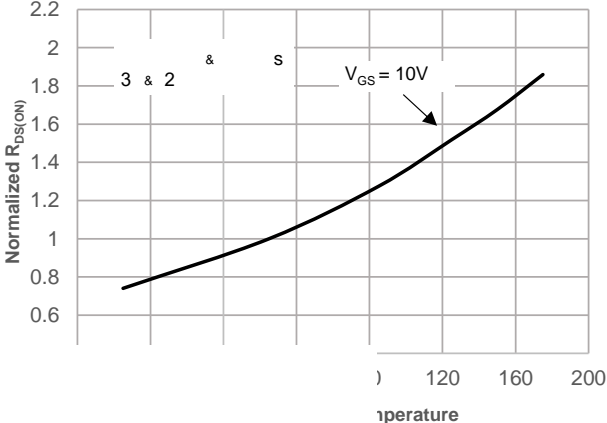
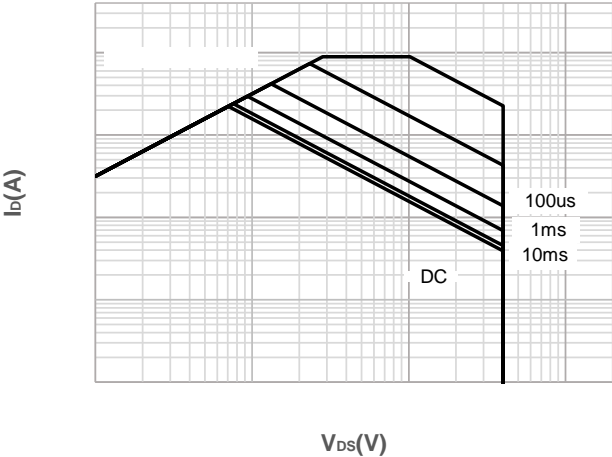


Figure 15: Maximum Safe Operating Area



Test Circuit



Figure 1: Gate Charge Test Circuit & Waveform

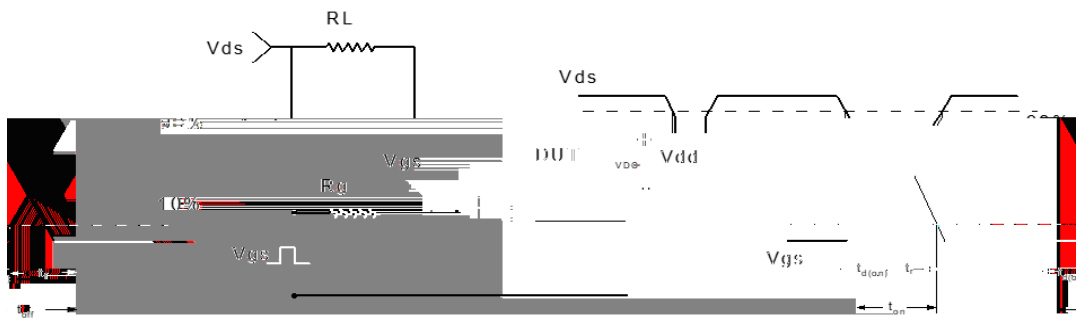


Figure 2: Resistive Switching Test Circuit & Waveform

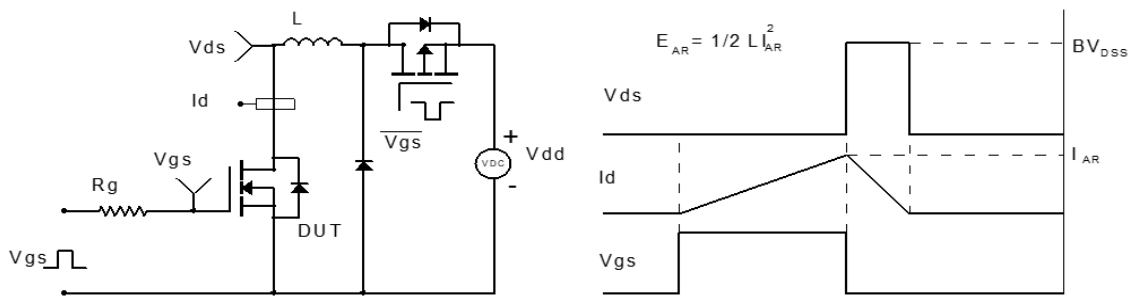


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

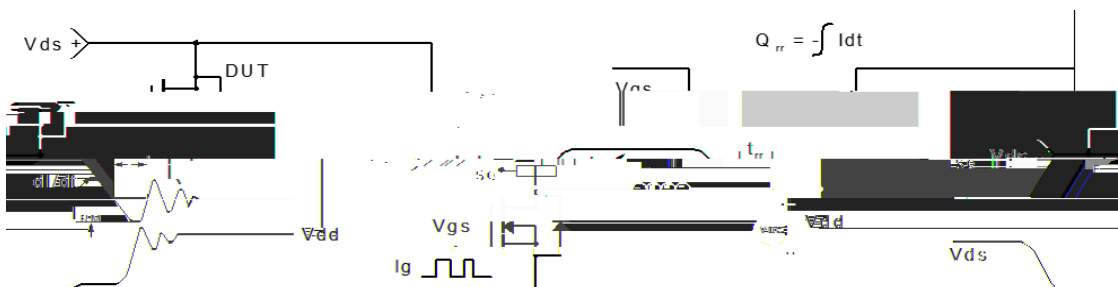
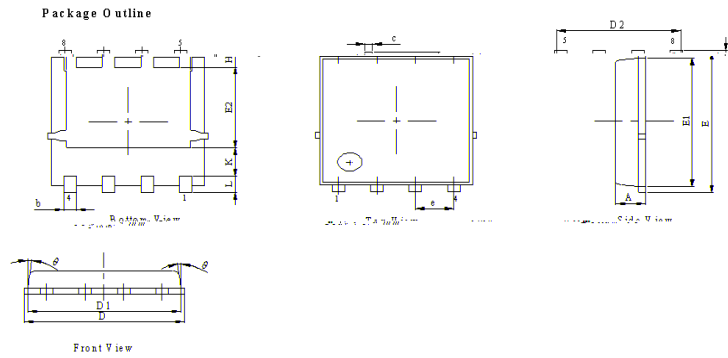


Figure 4: Diode Recovery Test Circuit & Waveform



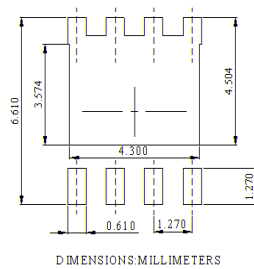
## Package Mechanical Data(PDFN5X6-8L)



- NOTES:
1. Dimension and tolerance per ASME Y 14.5M, 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		
0			10

### Recommended Soldering Footprint



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