

40V, 318A, 1.1mΩ N-channel Power SGT MOSFET
JMSL0401PGQ
Features

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

Applications

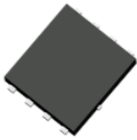
- Load Switch
- PWM Application
- General Automotive Application

Product Summary

Parameters	Value	Unit
V_{DSS}	40	V
$V_{GS(th_Typ)}$	1.6	V
$I_D(@V_{GS}=10V)$	318	A
$R_{DS(ON_Typ)}(@V_{GS}=10V)$	0.8	mΩ
$R_{DS(ON_Typ)}(@V_{GS}=4.5V)$	1.1	mΩ

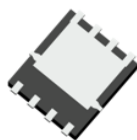


Top View

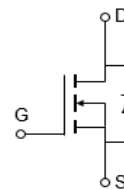


PDFN5X6-

Bottom View



Pin Assignment



Schematic Diagram

Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSL0401PGQ-13	SL0401PQ	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	$T_C = 25^\circ\text{C}$	318
		$T_C = 100^\circ\text{C}$	225
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
E_{AS}	Single Pulsed Avalanche Energy ⁽²⁾	706	mJ
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$	188
		$T_C = 100^\circ\text{C}$	94
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 ⁽³⁾	41	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.8	

**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	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 32\text{V}$, $V_{GS} = 0\text{V}$	-	-	1.0	μA
I_{GSS}	Gate-Body Leakage Current	$V_{DS} = 0\text{V}$, $V_{GS} = \pm 20\text{V}$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$	1.1	1.6	2.1	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance ⁽⁴⁾	$V_{GS} = 10\text{V}$, $I_D = 20\text{A}$	-	0.8	1.1	m Ω
		$V_{GS} = 4.5\text{V}$, $I_D = 15\text{A}$	-	1.1	1.4	m Ω
Dynamic Characteristics						
R_g	Gate Resistance	$f = 1\text{MHz}$	-	1.0	-	Ω
C_{iss}	Input Capacitance	$V_{GS} = 0\text{V}$, $V_{DS} = 20\text{V}$, $f = 1\text{MHz}$	4455	6237	8420	pF
C_{oss}	Output Capacitance		2230	3122	4215	pF
C_{riss}	Reverse Transfer Capacitance		158	222	299	pF
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V $V_{DS} = 20\text{V}$, $I_D = 20\text{A}$	76	106	143	nC
Q_{gs}	Gate Source Charge		12	16	22	nC
Q_{gd}	Gate Drain("Miller") Charge		17	24	32	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = 10\text{V}$, $V_{DD} = 20\text{V}$ $I_D = 20\text{A}$, $R_{GEN} = 3\Omega$	-	15	-	ns
t_r	Turn-On Rise Time		-	34	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	70	-	ns
t_f	Turn-Off Fall Time		-	32	-	ns
Body Diode Characteristics						
I_S	Maximum Continuous Body Diode Forward Current		-	-	318	A
I_{SM}	Maximum Pulsed Body Diode Forward Current		-	-	1273	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	$I_F = 20\text{A}$, $di/dt = 100\text{A/us}$	50	69	94	ns
Q_{rr}	Body Diode Reverse Recovery Charge		-	107	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. E_{AS} condition: Starting $T_J = 25^\circ\text{C}$, $V_{DD} = 20\text{V}$, $V_{GS} = 10\text{V}$, $R_G = 25\text{ohm}$, $L = 3\text{mH}$, $I_{AS} = 21.7\text{A}$, $V_{DD} = 0\text{V}$ during time in avalanche.
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch^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

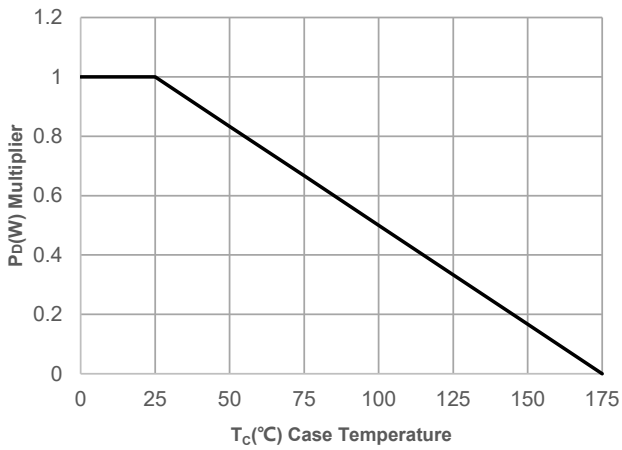


Figure 2: Current De-rating

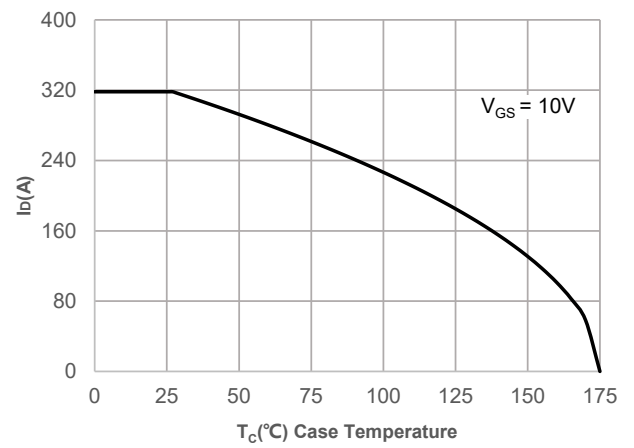


Figure 3: Normalized Maximum Transient Thermal Impedance

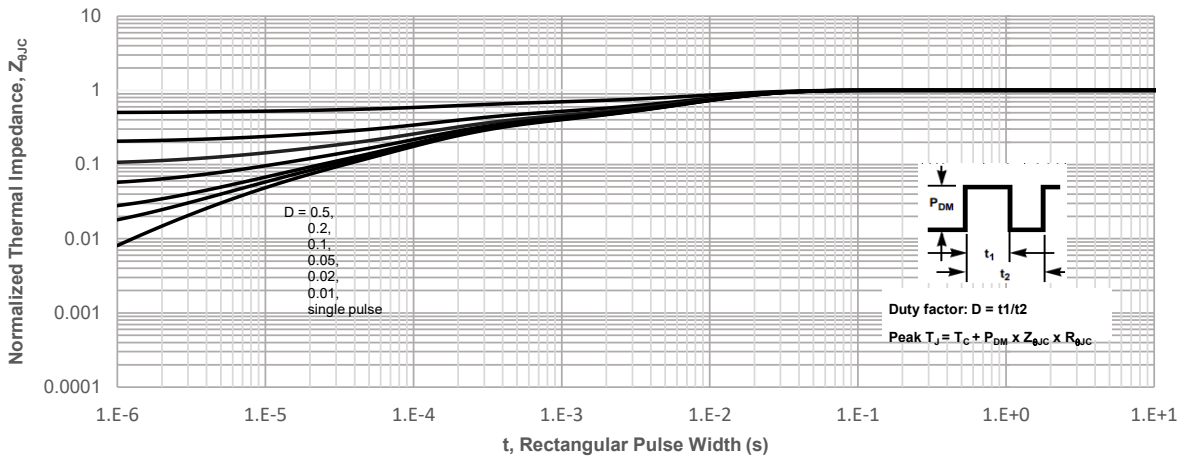
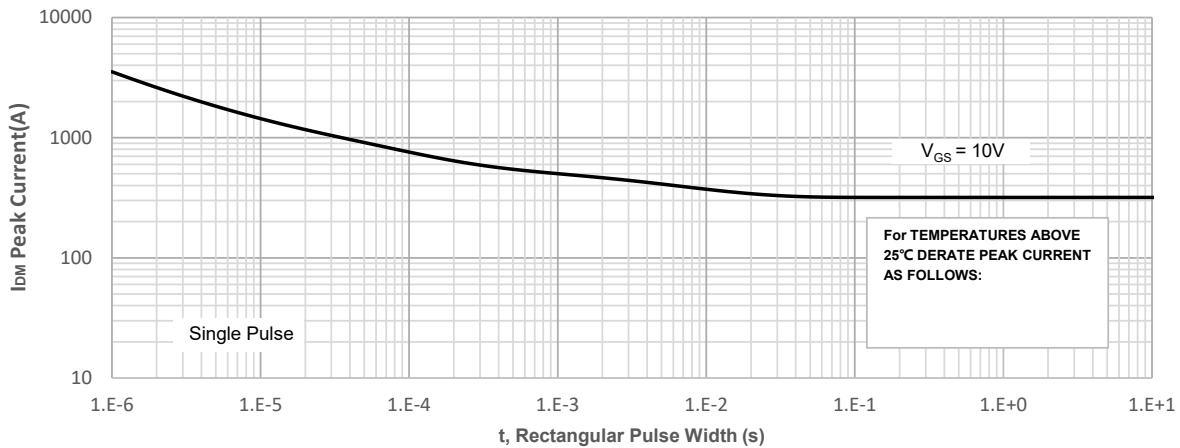


Figure 4: Peak Current Capacity



Typical Performance Characteristics

Figure 5: Output Characteristics

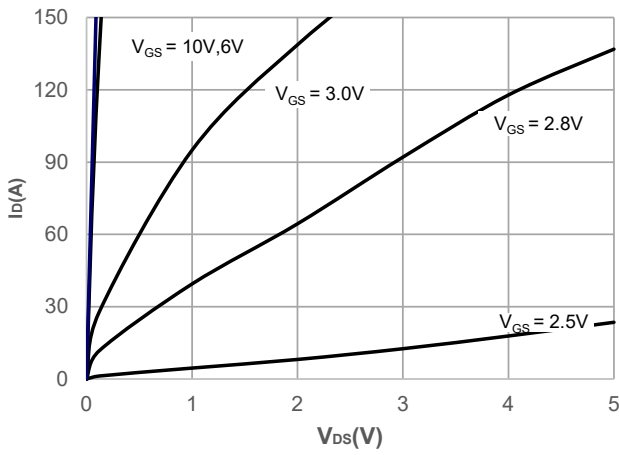


Figure 6: Typical Transfer Characteristics

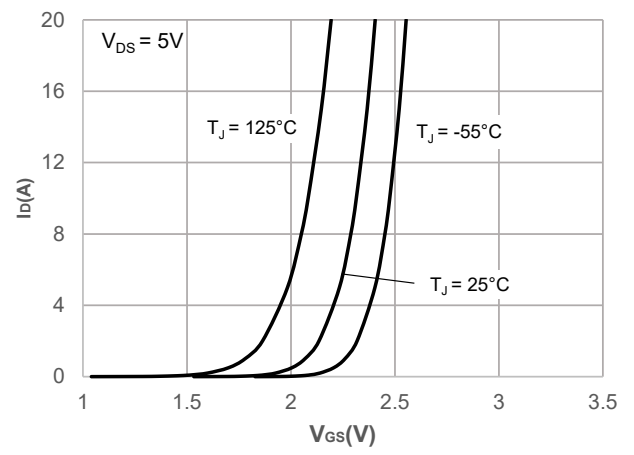


Figure 7: On-resistance vs. Drain Current

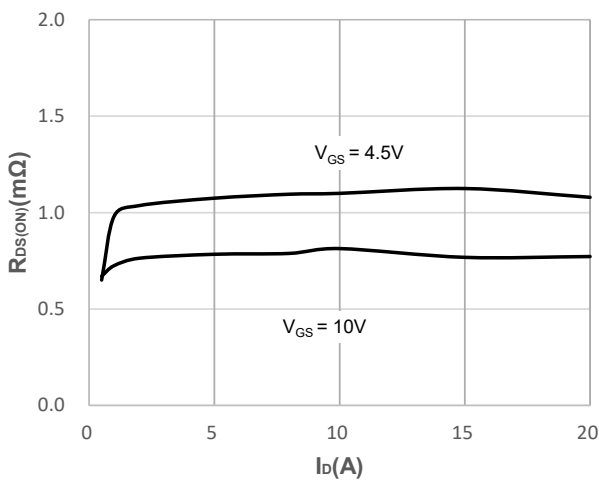


Figure 8: Body Diode Characteristics

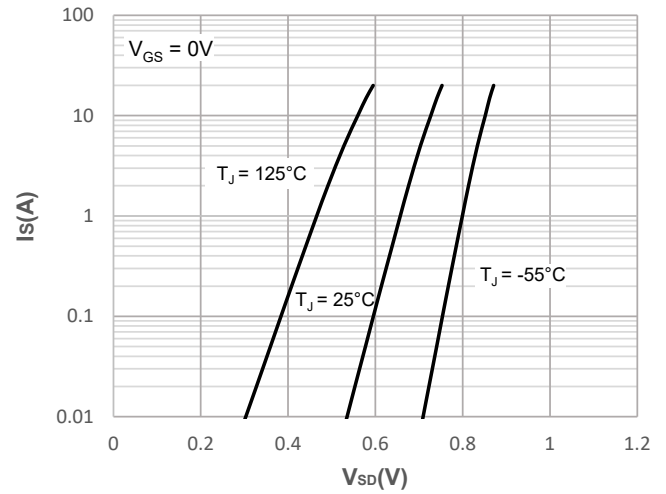


Figure 9: Gate Charge Characteristics

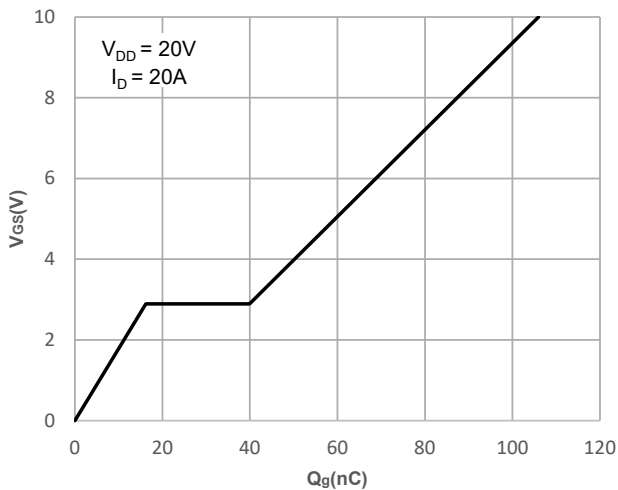
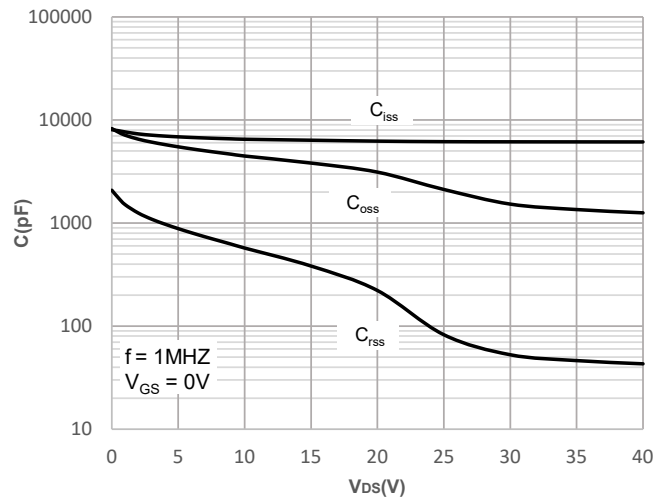


Figure 10: Capacitance Characteristics



Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

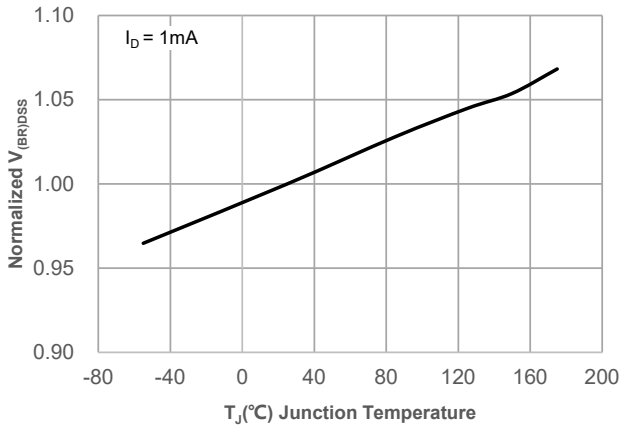


Figure 12: Normalized on Resistance vs. Junction Temperature

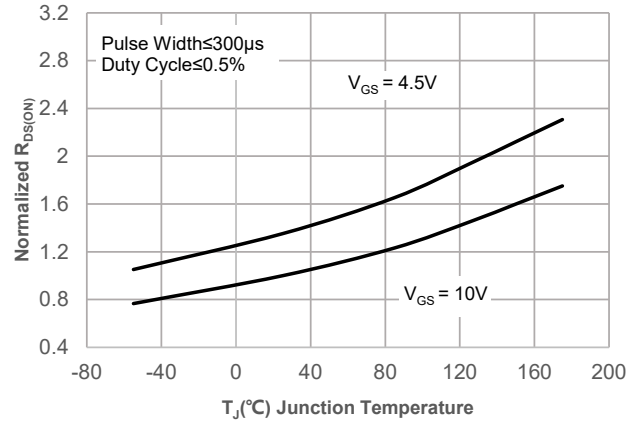


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

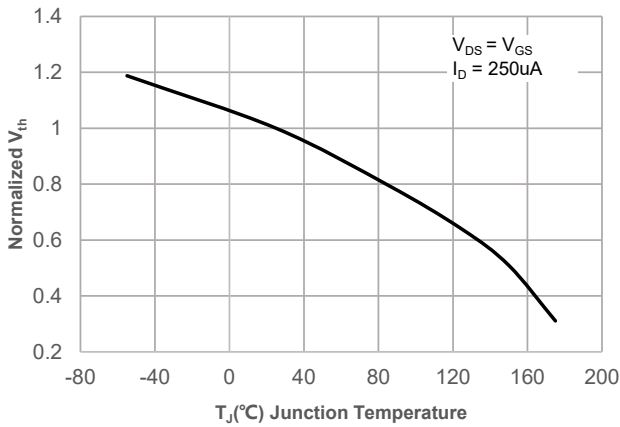


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

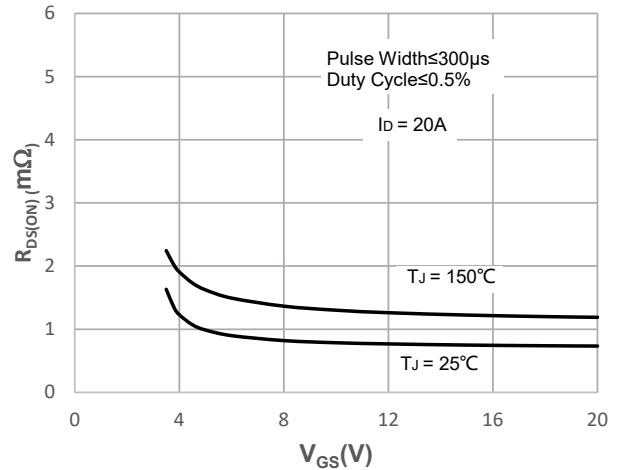
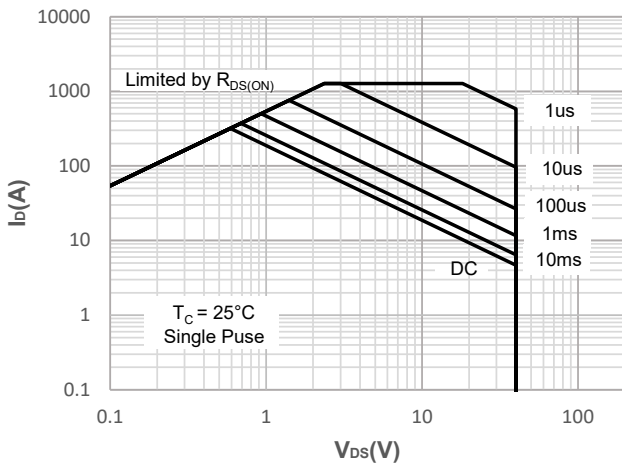


Figure 15: Maximum Safe Operating Area



Test Circuit

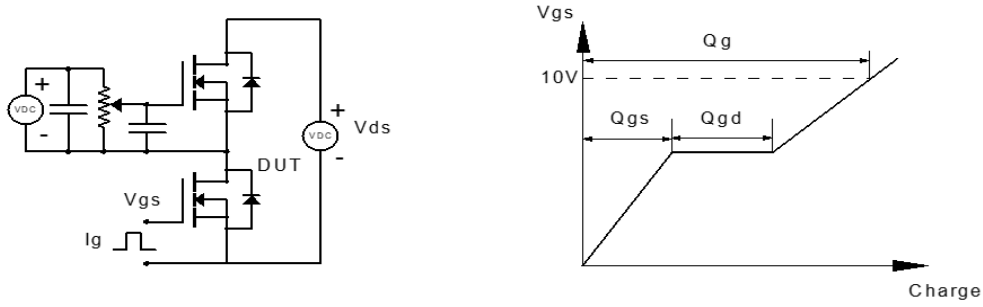


Figure 1: Gate Charge Test Circuit & Waveform



Figure 2: Resistive Switching Test Circuit & Waveform



Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

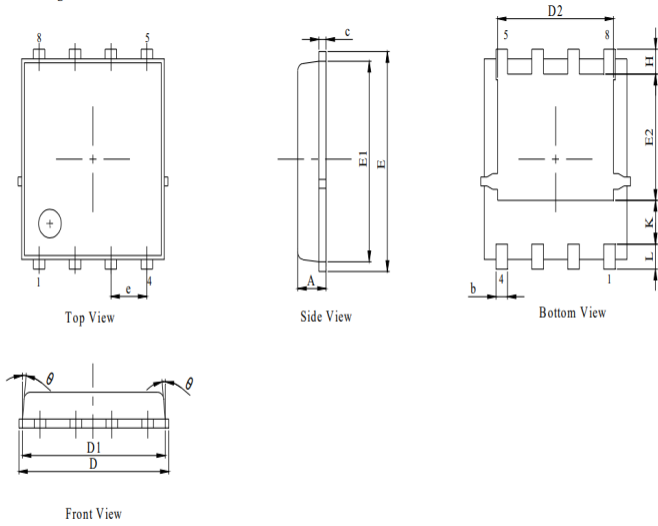


Figure 4: Diode Recovery Test Circuit & Waveform



Package Mechanical Data(PDFN5X6-8L)

Package Outline

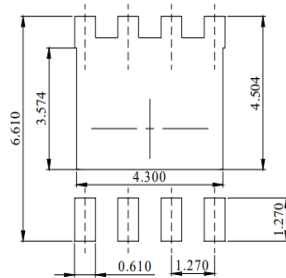


DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	0.9	1	1.15
b	0.31	0.41	0.51
C	0.24	0.32	0.4
D	5	5.2	5.4
D1	4.95	5.05	5.15
D2	4	4.1	4.2
E	6.05	6.15	6.25
E1	5.5	5.6	5.7
E2	3.42	3.53	3.63
e	1.27BSC		
H	0.6	0.7	0.8
L	0.5	0.7	0.8
K	1.23 REF		
O			10

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.

Recommended Soldering Footprint



DIMENSIONS:MILLIMETERS

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