

40V, 430A, 0.85mΩ N-channel Power SGT MOSFET

JMSH040SPTSQ

Features

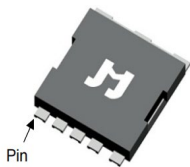
- Ultra-low ON-resistance $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100% ΔV_{ds} Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

Applications

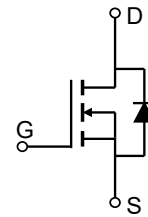
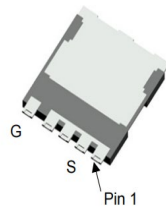
- Load Switch
- PWM Application
- General Automotive Application

Product Summary

Parameters	Value	Unit
V_{DSS}	40	V
$V_{GS(th_Typ)}$	2.6	V
$I_D(@V_{GS}=10V)$	430	A
$R_{DS(ON)_Typ}(@V_{GS}=10V)$	0.85	mΩ



PowerJE®7x8



Schematic Diagram

Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSH040SPTSQ-13	SH040SPQ	1	Tape&Reel	PowerJE®7x8	2000	10000

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	$T_C = 25^\circ\text{C}$	430
		$T_C = 100^\circ\text{C}$	304
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
E_{AS}	Single Pulsed Avalanche Energy ⁽²⁾	850	mJ
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$	333
		$T_C = 100^\circ\text{C}$	167
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⁾	37	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.45	

**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	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$	1.8	2.6	3.4	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance ⁽⁴⁾	$V_{GS} = 10\text{V}$, $I_D = 20\text{A}$	-	0.85	1.1	m Ω
Dynamic Characteristics						
R_g	Gate Resistance	$f = 1\text{MHz}$	-	1.2	-	Ω
C_{iss}	Input Capacitance	$V_{GS} = 0\text{V}$, $V_{DS} = 20\text{V}$, $f = 1\text{MHz}$	5165	7231	9762	pF
C_{oss}	Output Capacitance		2479	3471	4685	pF
C_{rss}	Reverse Transfer Capacitance		166	232	314	pF
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V $V_{DS} = 20\text{V}$, $I_D = 20\text{A}$	75	105	142	nC
Q_{gs}	Gate Source Charge		22	31	42	nC
Q_{gd}	Gate Drain ("Miller") Charge		17	23	31	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{V}$, $V_{DD} = 20\text{V}$ $I_D = 20\text{A}$, $R_{GEN} = 3\Omega$	-	23	-	ns
t_r	Turn-On Rise Time		-	35	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	56	-	ns
t_f	Turn-Off Fall Time		-	26	-	ns
Body Diode Characteristics						
I_S	Maximum Continuous Body Diode Forward Current		-	-	430	A
I_{SM}	Maximum Pulsed Body Diode Forward Current		-	-	1719	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	$I_F = 20\text{A}$, $di/dt = 100\text{A}/\mu\text{s}$	50	70	95	ns
Q_{rr}	Body Diode Reverse Recovery Charge		-	114	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. E_{AS} condition: Starting $T_J = 25^\circ\text{C}$, $V_{DD} = 20\text{V}$, $V_{GS} = 10\text{V}$, $R_G = 25\text{ohm}$, $L = 3\text{mH}$, $I_{AS} = 23.8\text{A}$, $V_{DD} = 0\text{V}$ 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

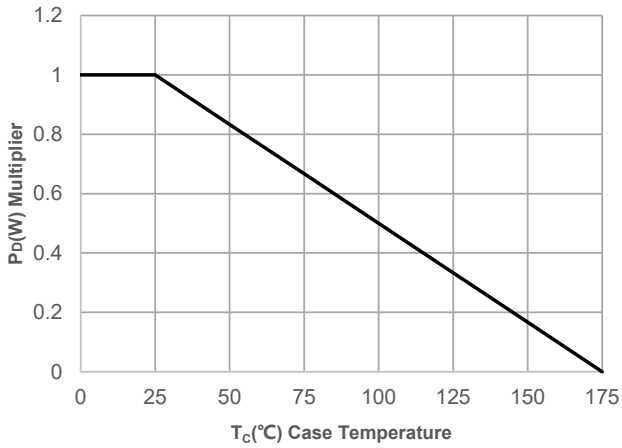


Figure 2: Current De-rating

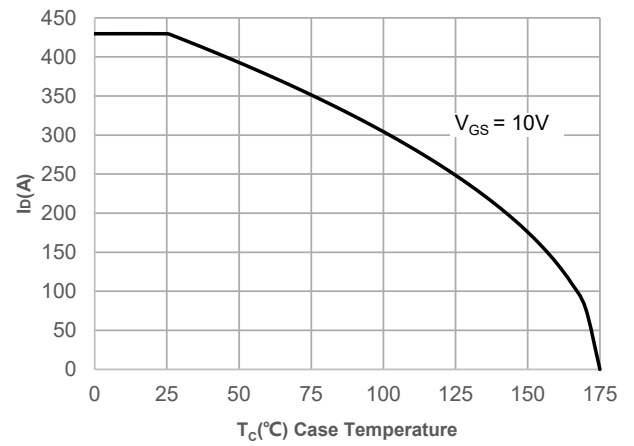


Figure 3: Normalized Maximum Transient Thermal Impedance

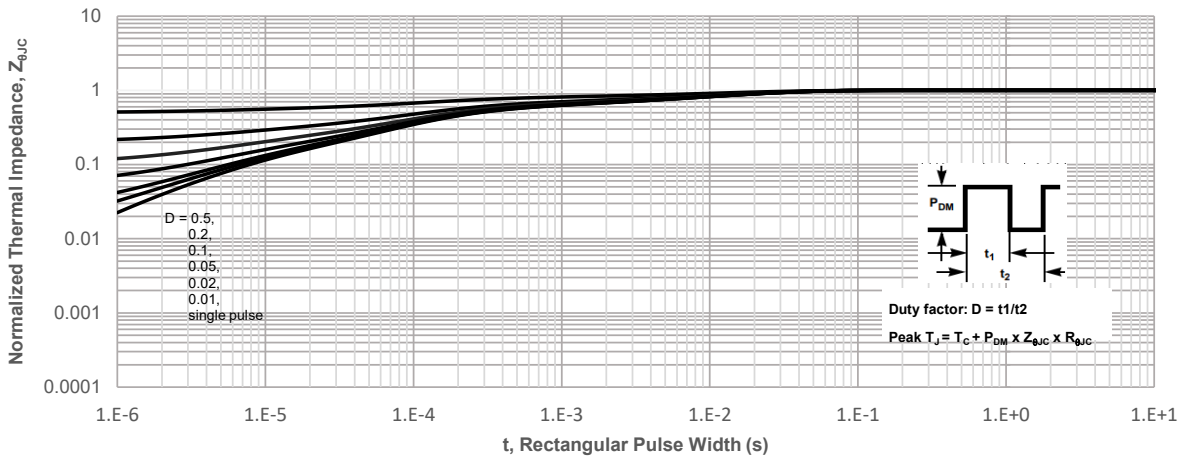
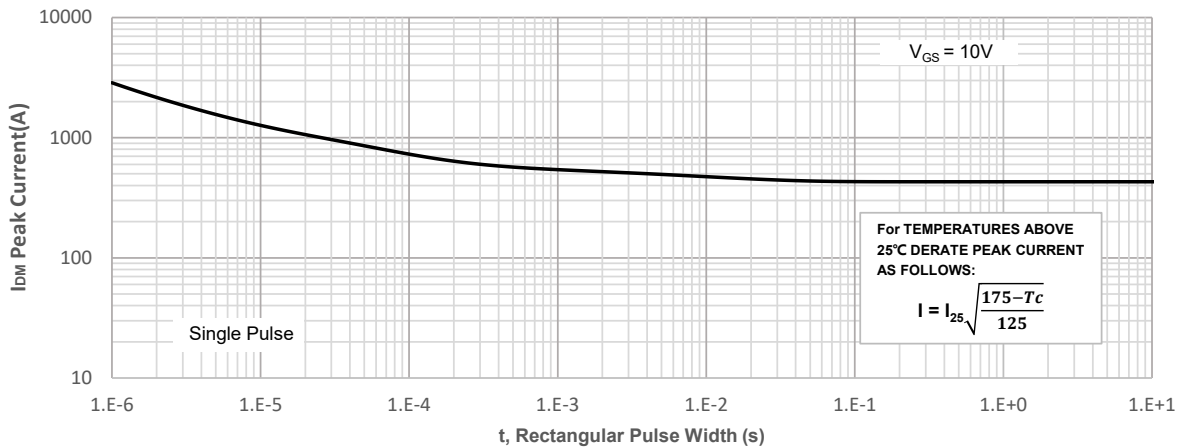
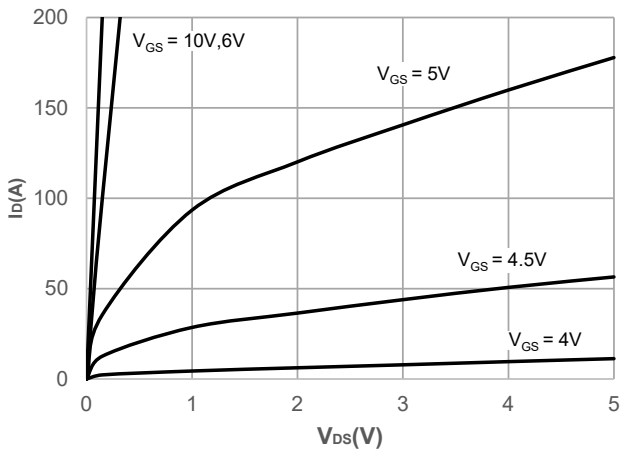
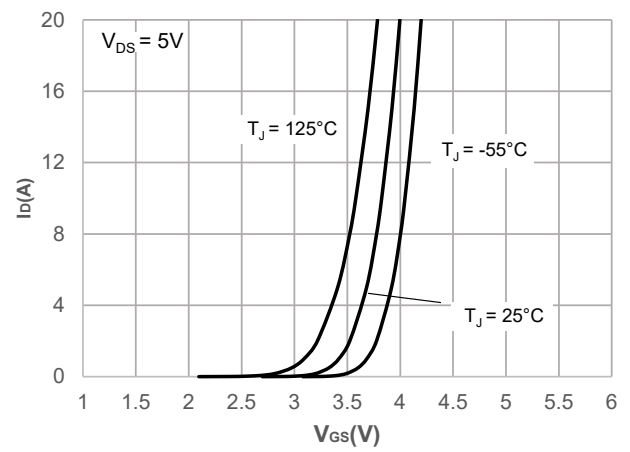
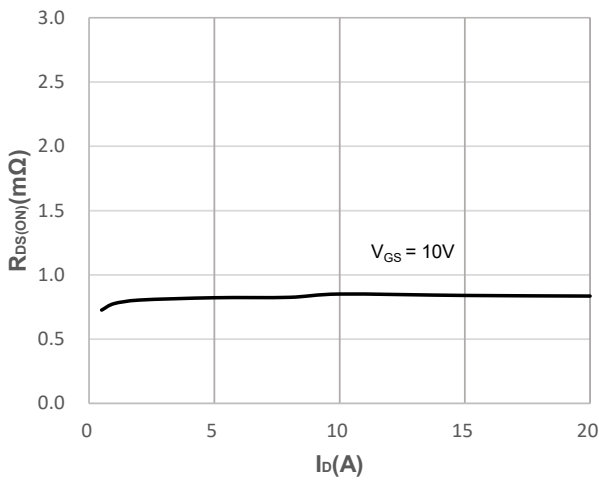
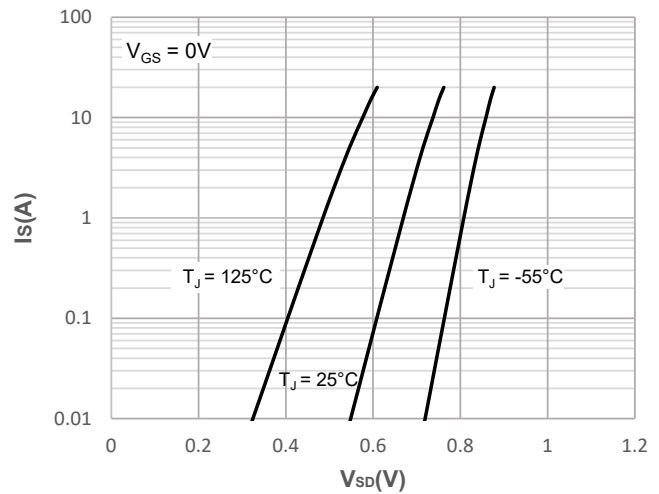
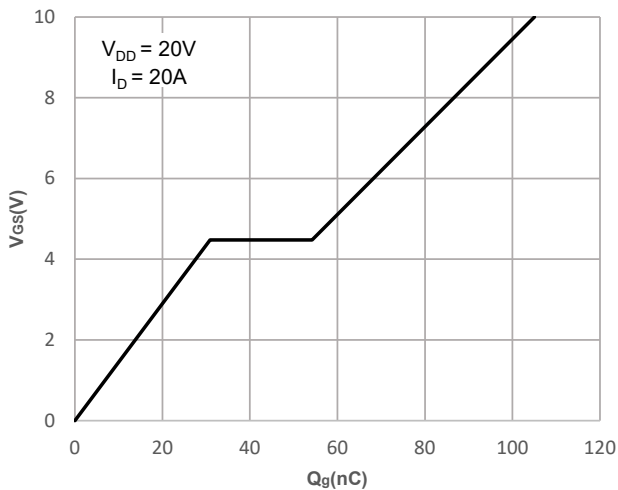
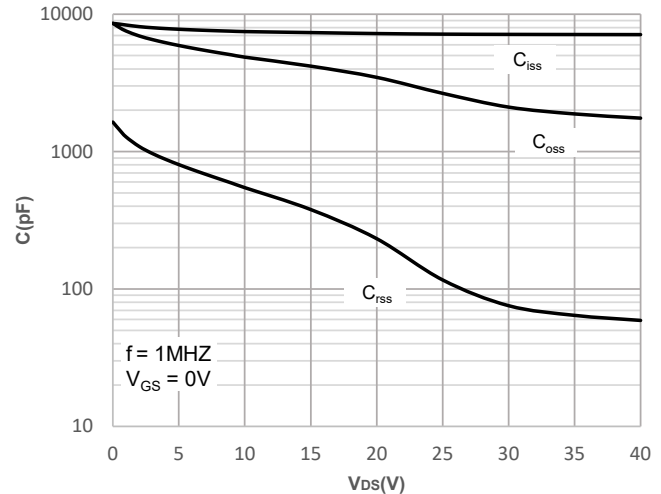


Figure 4: Peak Current Capacity



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

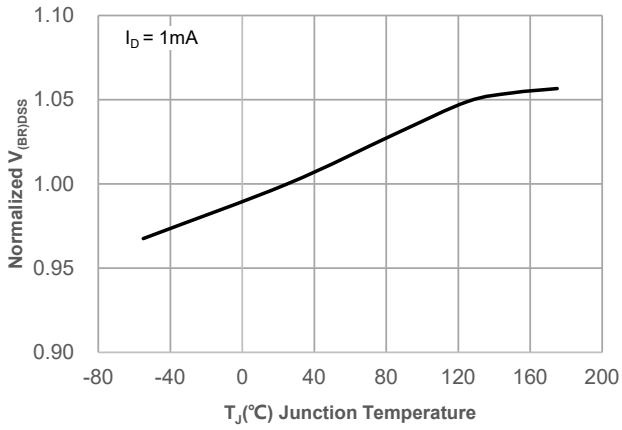


Figure 12: Normalized on Resistance vs. Junction Temperature

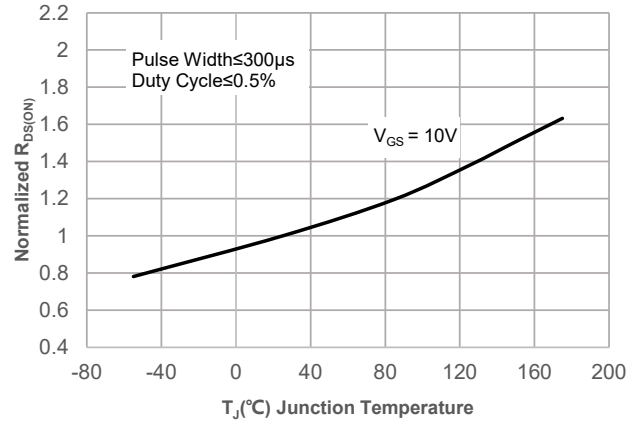


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

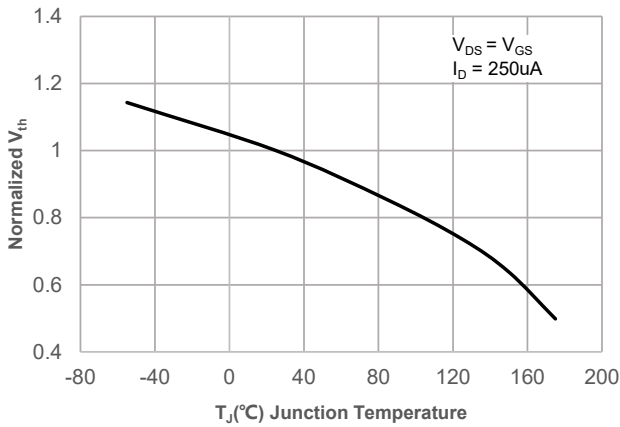


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

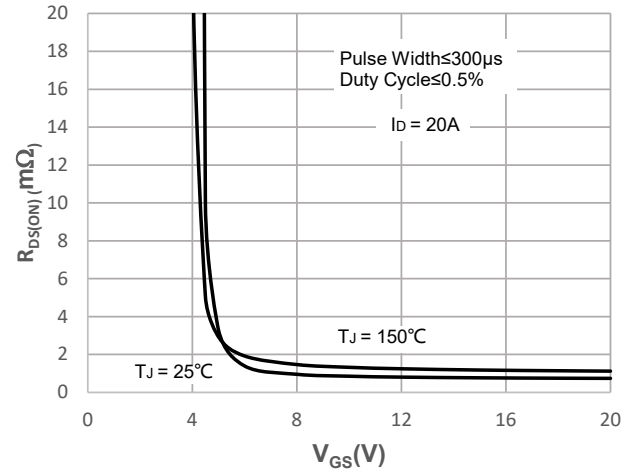
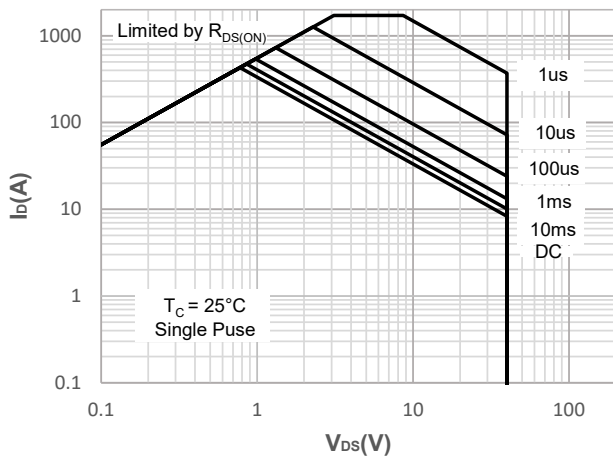


Figure 15: Maximum Safe Operating Area



Test Circuit

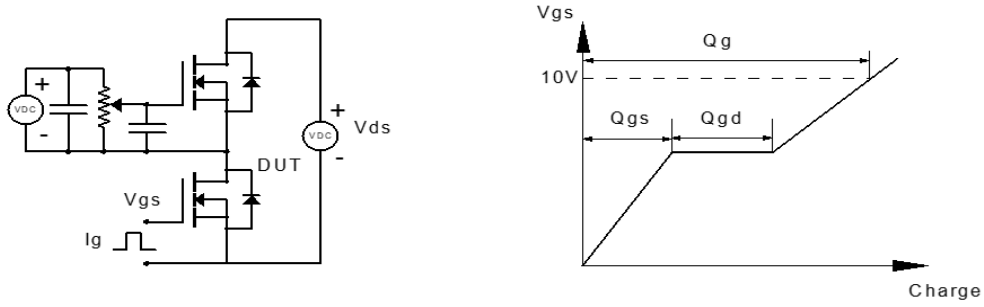


Figure 1: Gate Charge Test Circuit & Waveform

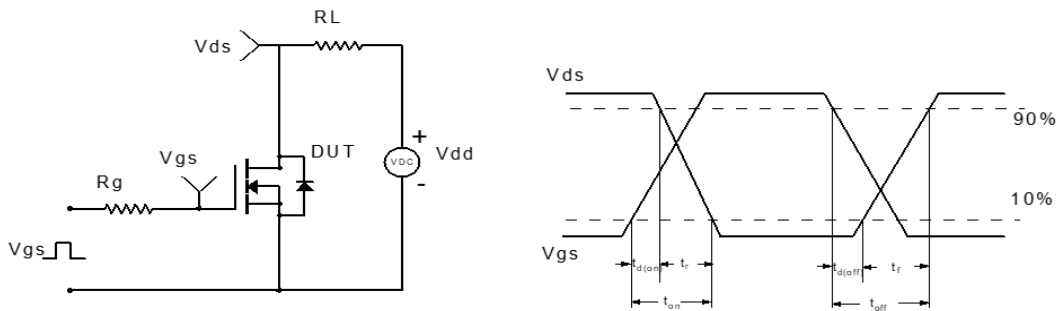


Figure 2: Resistive Switching Test Circuit & Waveform

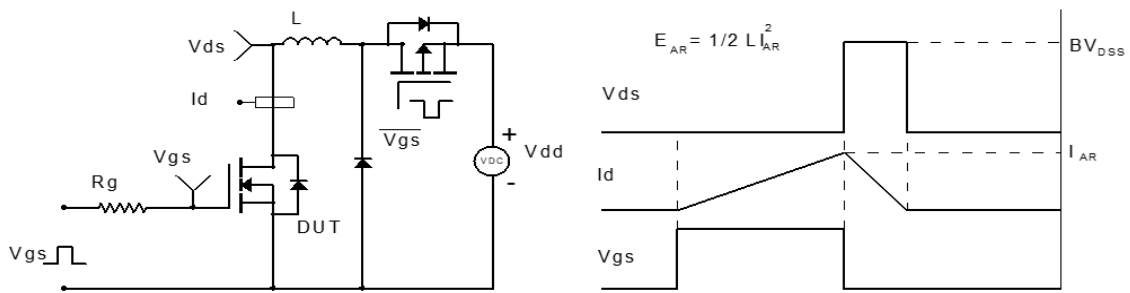


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

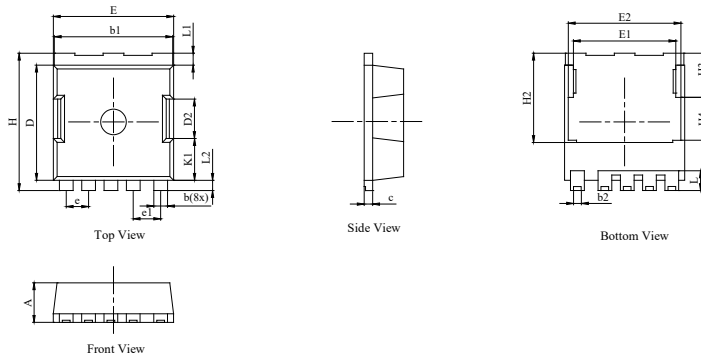


Figure 4: Diode Recovery Test Circuit & Waveform



Package Mechanical Data(PowerJE®7x8)

Package Outlines

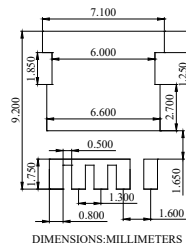


NOTES:

1. Dimension and tolerance per ASME Y14.5M, 1994.
2. All dimensions in millimeter.
3. Dimensions do not include burrs or mold flash.

DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
b	0.70	0.80	0.90
b1	6.80	6.90	7.00
b2	0.40	0.45	0.50
c	0.40	0.50	0.60
D	6.50	6.70	6.90
D2		2.30 (REF)	
E	6.80	7.00	7.20
E1		5.96 (REF)	
E2		6.56 (REF)	
e		1.30 (BSC)	
e1		1.60 (BSC)	
H	7.80	8.00	8.20
H2		5.20 (REF)	
H3		2.57 (REF)	
H4		2.50 (REF)	
K1		2.43 (REF)	
L	1.05	1.15	1.25
L1		0.70	
L2		0.60	

Recommended Soldering Footprint



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