

**40V, 435A, 0.8mΩ N-channel Power SGT MOSFET**
**JMSH040SPTLQ**
**Features**

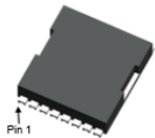
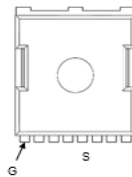
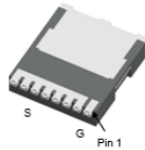
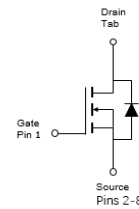
- Ultra-low ON-resistance,  $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100%  $\Delta V_{ds}$  Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

**Applications**

- Load Switch
- PWM Application
- General Automotive Application

**Product Summary**

Parameters	Value	Unit
$V_{DSS}$	40	V
$V_{GS(th\_Typ)}$	2.7	V
$I_D(@V_{GS}=10V)$	435	A
$R_{DS(ON\_Typ)}(@V_{GS}=10V)$	0.8	mΩ


**PowerJE@10x12**

**Pin Assignment**

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

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSH040SPTLQ-13	SH040SPQ	1	Tape&Reel	PowerJE@10x12	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	$\pm 20$	V
$I_D$	Continuous Drain Current	$T_C = 25^\circ\text{C}$	435
		$T_C = 100^\circ\text{C}$	308
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	880	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 <sup>(3)</sup>	43	$^\circ\text{C/W}$
$R_{\theta JC}$	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
<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	2.7	3.5	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(4)</sup>	$V_{GS} = 10\text{V}$ , $I_D = 20\text{A}$	-	0.8	1.0	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	1.4	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}$ , $V_{DS} = 20\text{V}$ , $f = 1\text{MHz}$	4871	6820	9206	pF
$C_{oss}$	Output Capacitance		2793	3910	5278	pF
$C_{riss}$	Reverse Transfer Capacitance		155	217	293	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0$ to $10\text{V}$ $V_{DS} = 20\text{V}$ , $I_D = 20\text{A}$	71	99	134	nC
$Q_{gs}$	Gate Source Charge		21	30	41	nC
$Q_{gd}$	Gate Drain("Miller") Charge		17	24	33	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = 10\text{V}$ , $V_{DD} = 20\text{V}$ $I_D = 20\text{A}$ , $R_{GEN} = 3\Omega$	-	23	-	ns
$t_r$	Turn-On Rise Time		-	33	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	54	-	ns
$t_f$	Turn-Off Fall Time		-	25	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	435	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	1741	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	$I_F = 20\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$	54	76	103	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	144	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 20\text{V}$ ,  $V_G = 10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 24.22\text{A}$ ,  $V_{DD} = 0\text{V}$  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

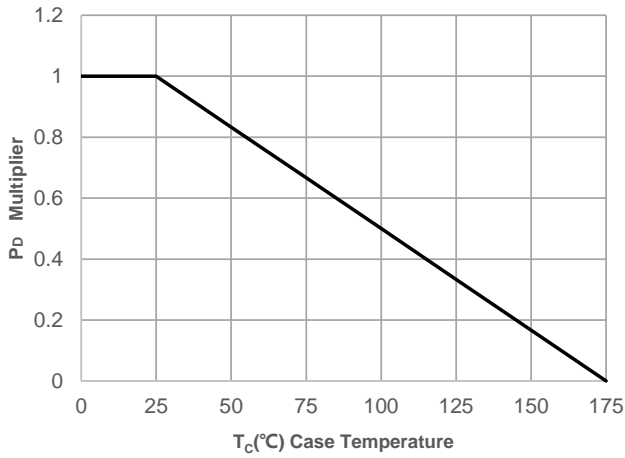


Figure 2: Current De-rating

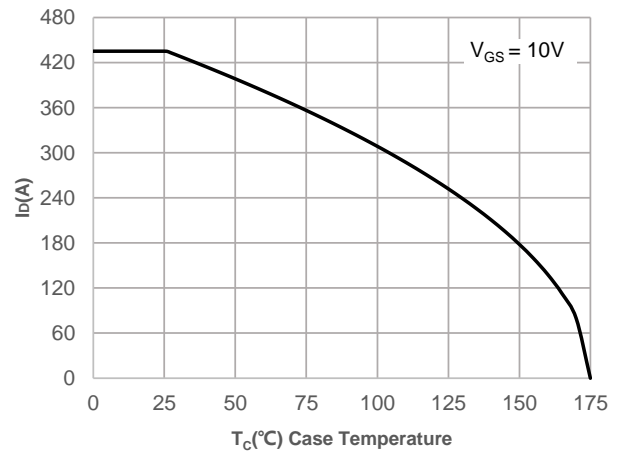


Figure 3: Normalized Maximum Transient Thermal Impedance

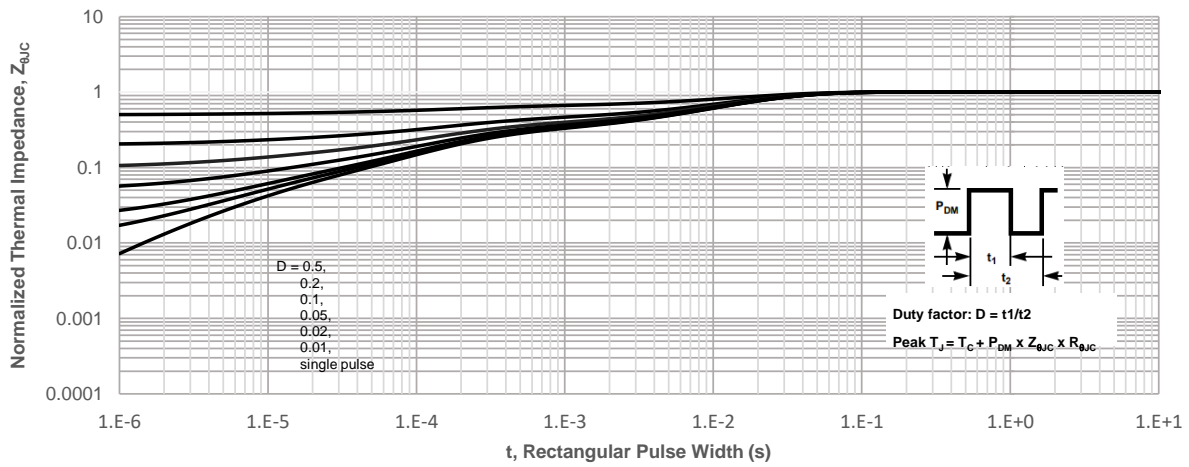
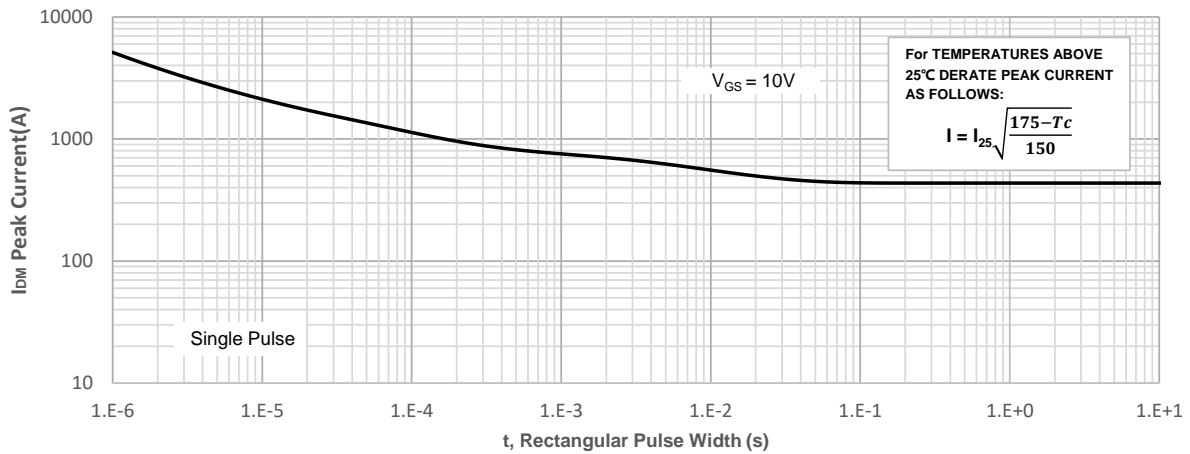
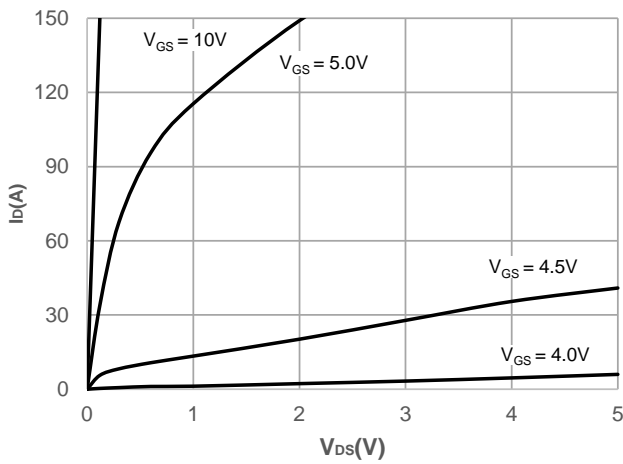
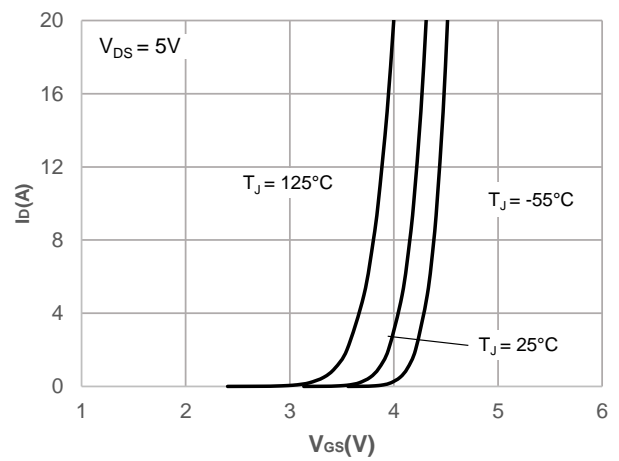
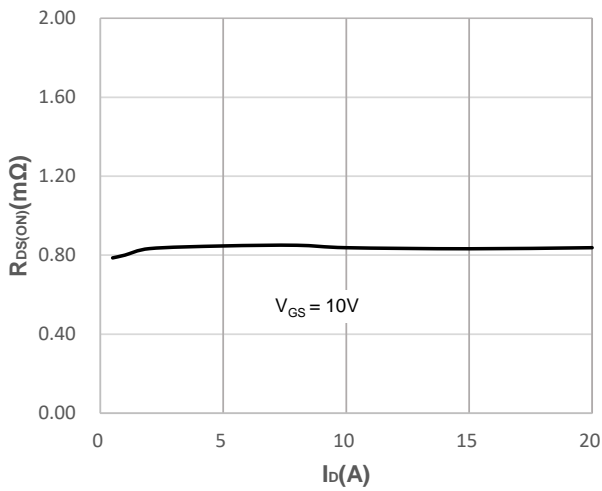
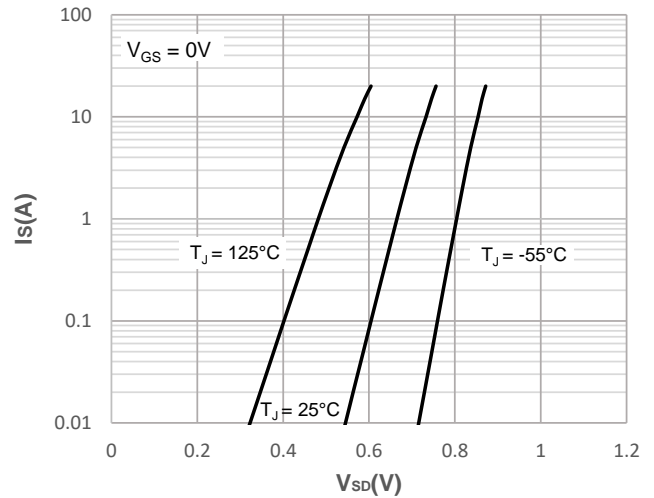
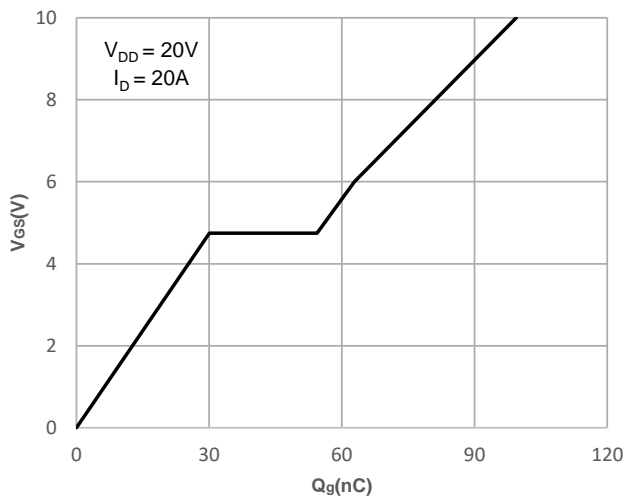
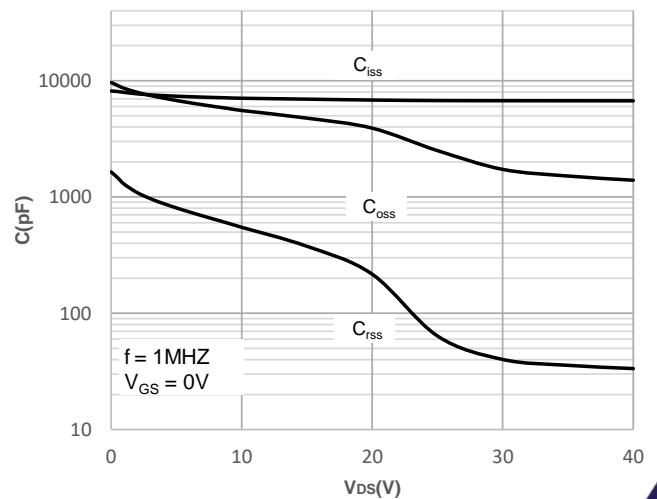


Figure 4: Peak Current Capacity



## 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

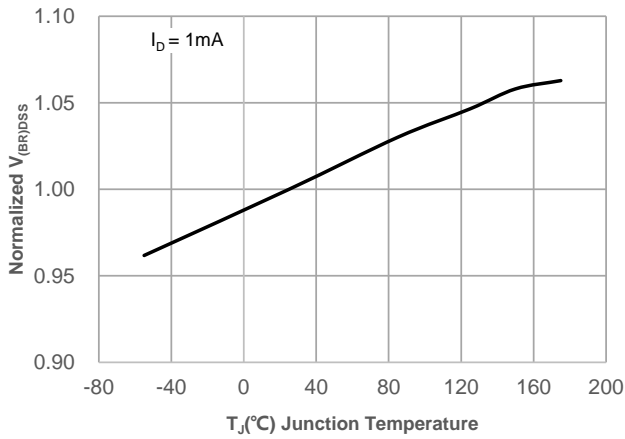


Figure 12: Normalized on Resistance vs. Junction Temperature

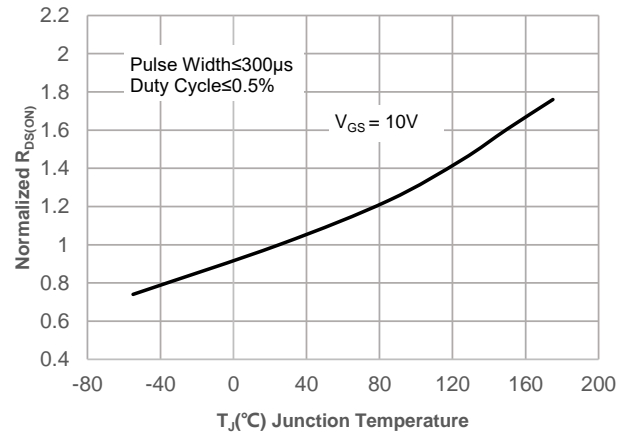


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

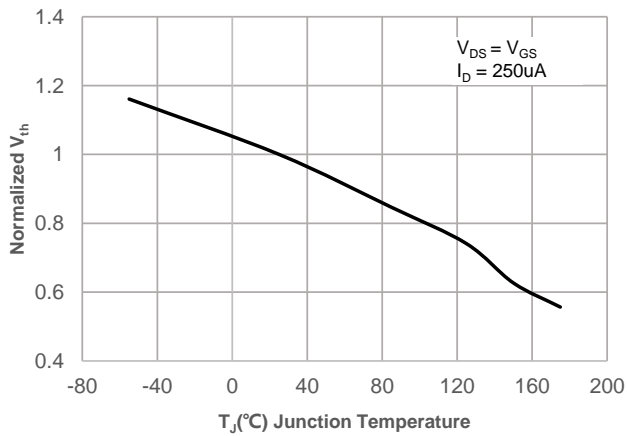


Figure 14:  $R_{DS(ON)}$  vs.  $V_{GS}$

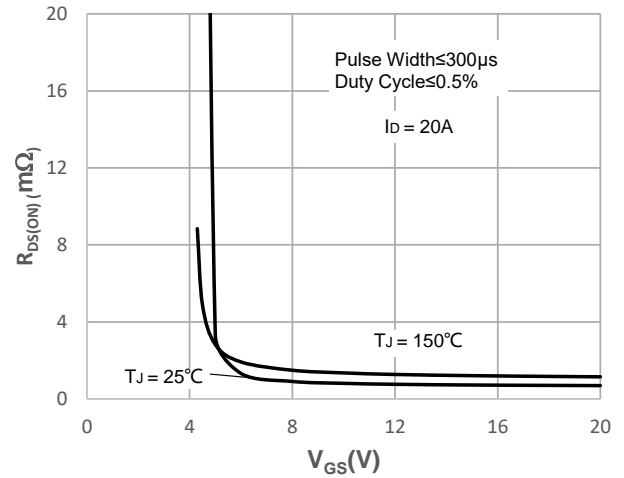
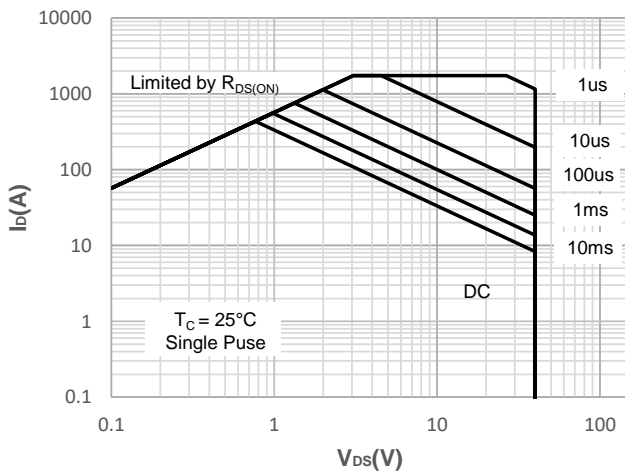


Figure 15: Maximum Safe Operating Area



### Test Circuit

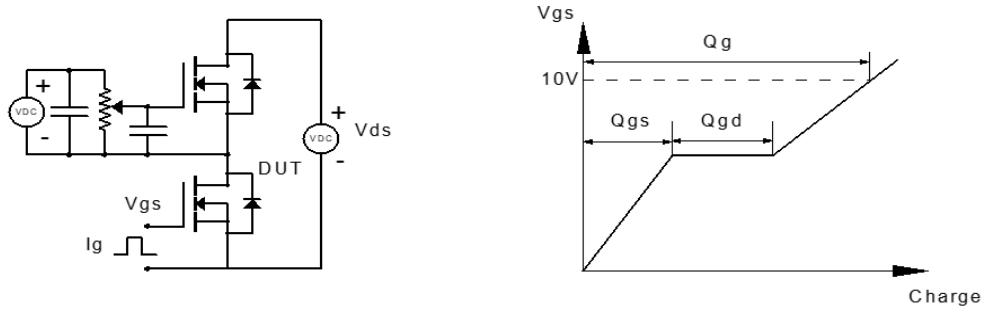


Figure 1: Gate Charge Test Circuit & Waveform

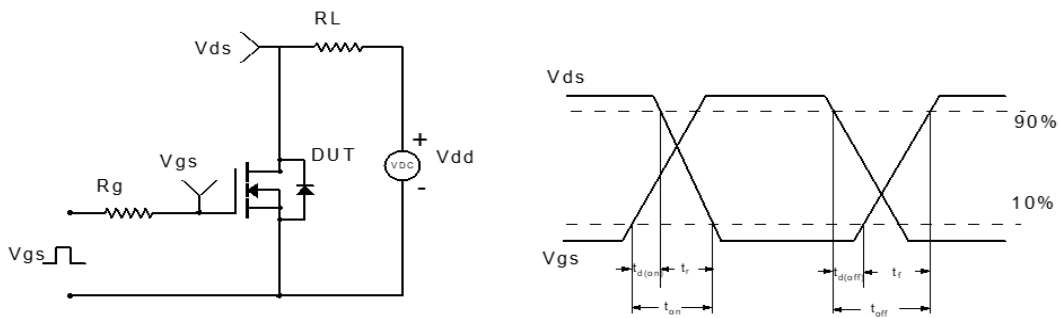


Figure 2: Resistive Switching Test Circuit & Waveform

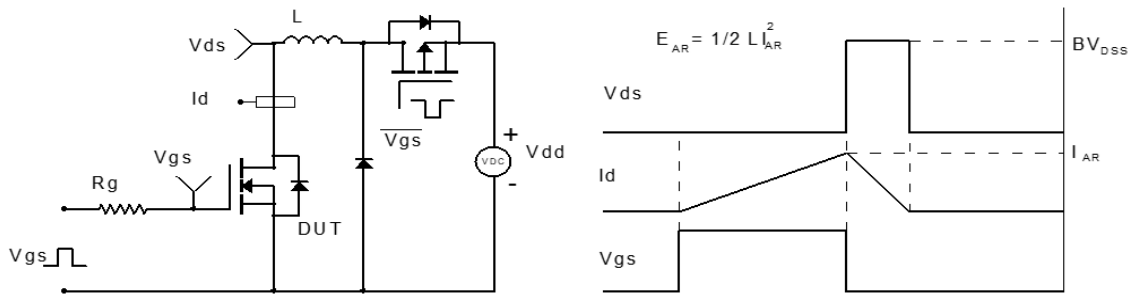


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

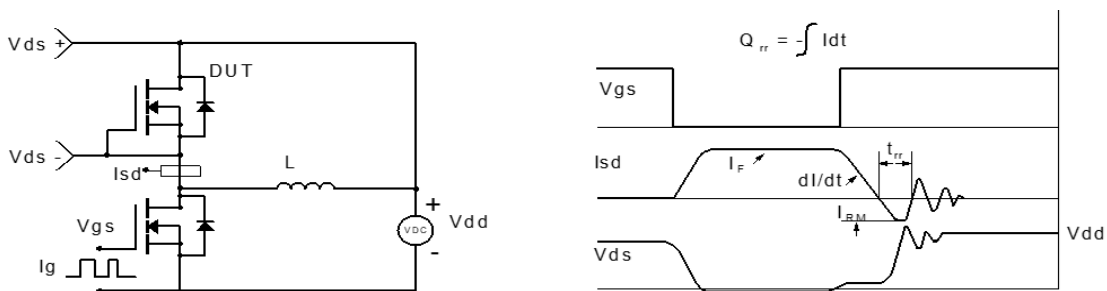
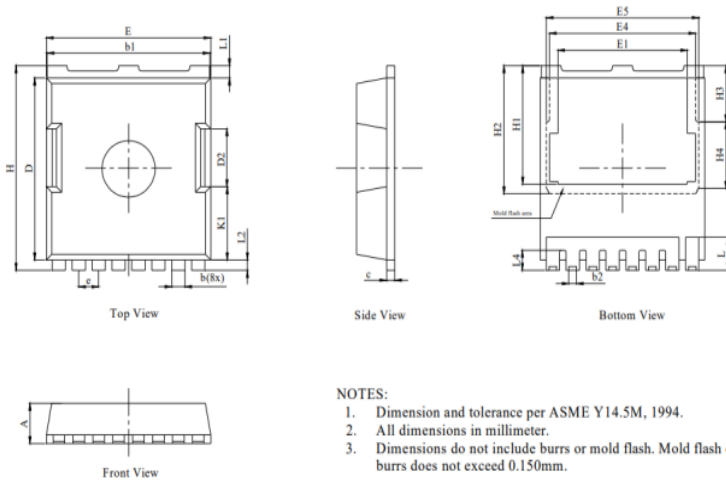


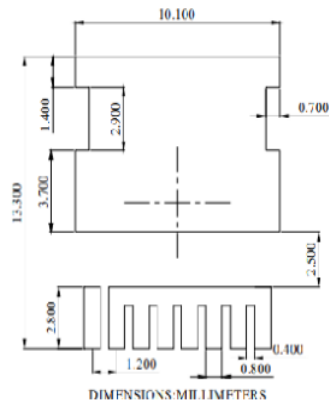
Figure 4: Diode Recovery Test Circuit & Waveform



## Package Mechanical Data(PowerJE®10x12 )

**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. Mold flash or burrs does not exceed 0.150mm.

**Recommended Soldering Footprint**


DIM.	MILLIMETER		
	MIN	NOM	MAX
A	2.20	2.30	2.50
b	0.70	0.80	0.90
bl	9.70	9.80	9.90
b2	0.42	0.46	0.50
C	0.40	0.50	0.65
D	10.28	10.38	10.58
D2	3.30		
E	9.70	9.90	10.10
E1	7.80		
E4	8.80		
E5	9.20		
e	1.20(BSC)		
H	11.48	11.68	11.88
H1	6.55	6.75	6.85
H2	7.30		
H3	3.20		
H4	3.80		
K1	4.18		
L	1.70	1.90	2.10
L1	0.70		
L2	0.60		
L4	1.00	1.15	1.30

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