

40V, 476A, 0.65mΩ N-channel Power SGT MOSFET

JMSH040SMTLQ

Features

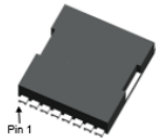
- Ultra-low ON-resistance, $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100% ΔV_d s Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

Applications

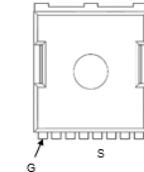
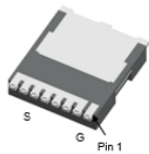
- Load Switch
- PWM Application
- General Automotive Application

Product Summary

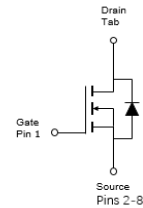
Parameters	Value	Unit
V_{DSS}	40	V
$V_{GS(th)}_{Typ}$	2.6	V
$I_D(@V_{GS}=10V)$	476	A
$R_{DS(ON)}_{Typ}(@V_{GS}=10V)$	0.65	mΩ



PowerJE@10x12



Pin Assignment



Schematic Diagram

Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSH040SMTLQ-13	SH040SMQ	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	± 20	V
I_D	Continuous Drain Current	$T_C = 25^\circ\text{C}$	476
		$T_C = 100^\circ\text{C}$	337
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
E_{AS}	Single Pulsed Avalanche Energy ⁽²⁾	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 ⁽³⁾	43	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.45	



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Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu A, V_{GS} = 0V$	40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 32V, V_{GS} = 0V$	-	-	1.0	μA
I_{GSS}	Gate-Body Leakage Current	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.8	2.6	3.3	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance ⁽⁴⁾	$V_{GS} = 10V, I_D = 20A$	-	0.65	0.85	m Ω
Dynamic Characteristics						
R_g	Gate Resistance	$f = 1MHz$	-	1.4	-	Ω
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DS} = 20V, f = 1MHz$	10654	14915	20135	pF
C_{oss}	Output Capacitance		4871	6820	9206	pF
C_{riss}	Reverse Transfer Capacitance		270	378	511	pF
Q_g	Total Gate Charge	$V_{GS} = 0 \text{ to } 10V, V_{DS} = 20V, I_D = 20A$	148	208	280	nC
Q_{GS}	Gate Source Charge		44	61	82	nC
Q_{gd}	Gate Drain("Miller") Charge		32	45	60	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = 10V, V_{DD} = 20V, I_D = 20A, R_{GEN} = 3\Omega$	-	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
Body Diode Characteristics						
I_S	Maximum Continuous Body Diode Forward Current		-	-	476	A
I_{SM}	Maximum Pulsed Body Diode Forward Current		-	-	1906	A
V_{SD}	Body Diode Forward Voltage	$V_{GS} = 0V, I_S = 20A$	-		1.2	V
t_{rr}	Body Diode Reverse Recovery Time	$I_F = 20A, di/dt = 100A/\mu s$	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 $T_J = 25^\circ C, V_{DD} = 20V, V_{GS} = 10V, R_G = 25\Omega, L = 3mH, I_{AS} = 24.22A, V_{DD} = 0V$ during time in avalanche.
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch² pad of 2oz copper FR4 PCB.
 4. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 0.5\%$.



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Figure 1: Power De-rating

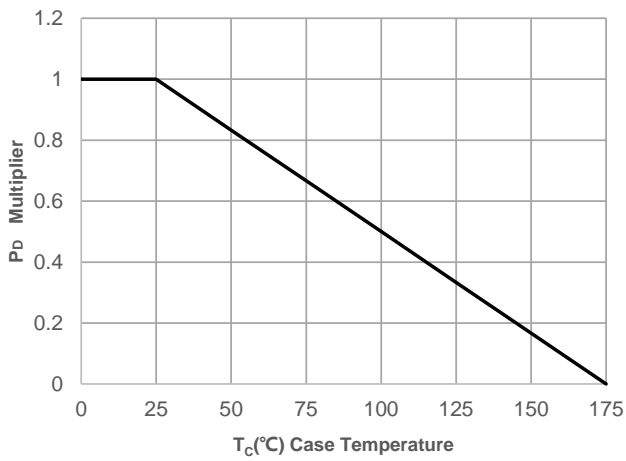


Figure 2: Current De-rating

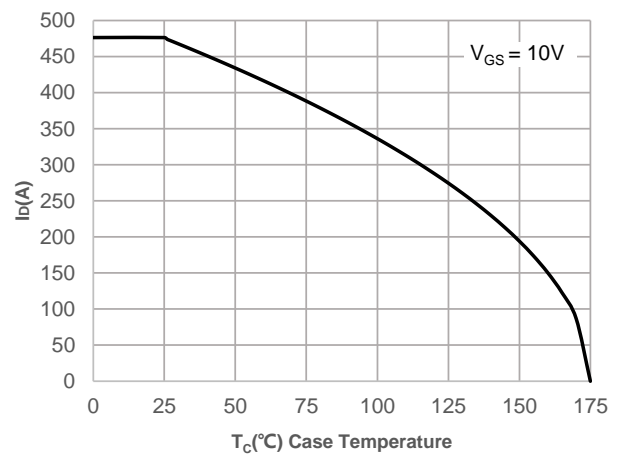


Figure 3: Normalized Maximum Transient Thermal Impedance

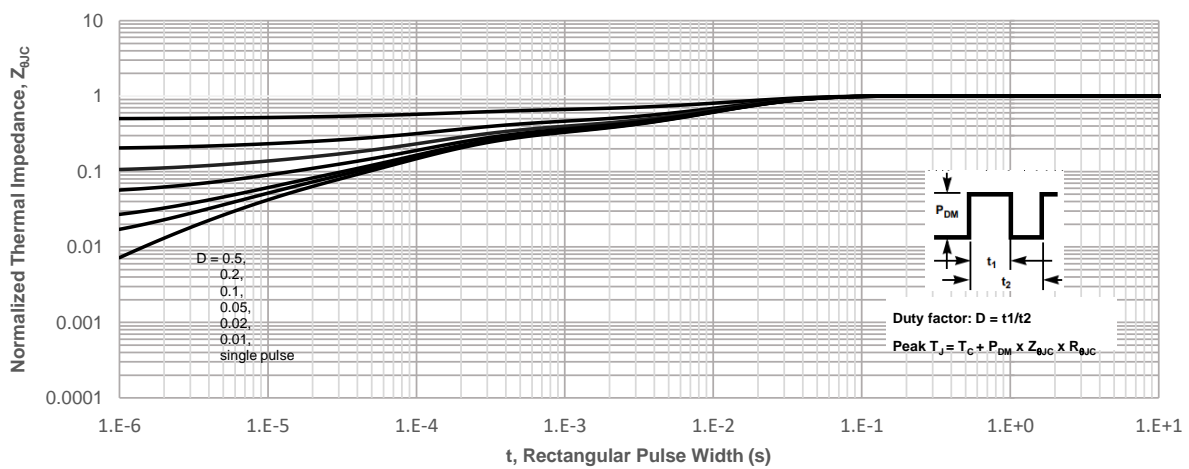
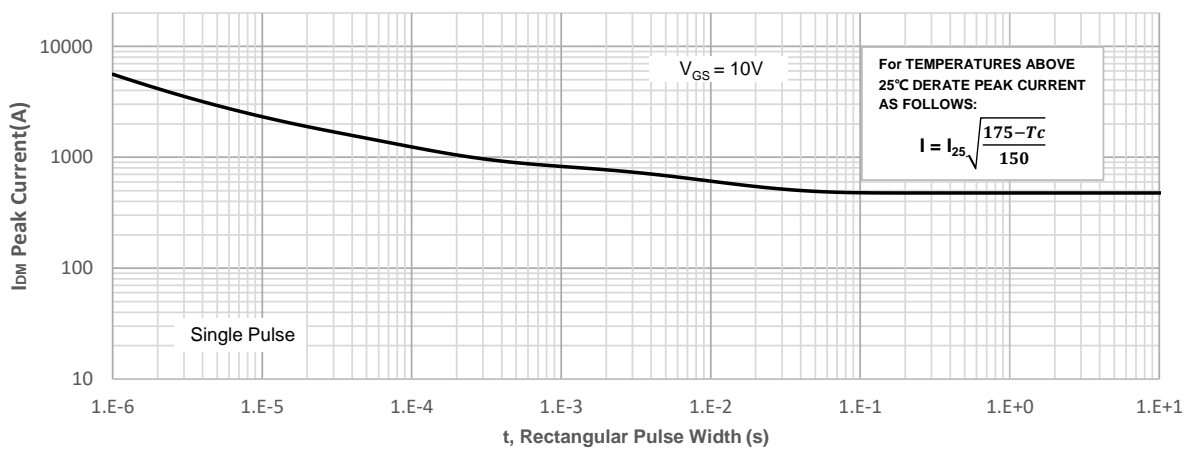
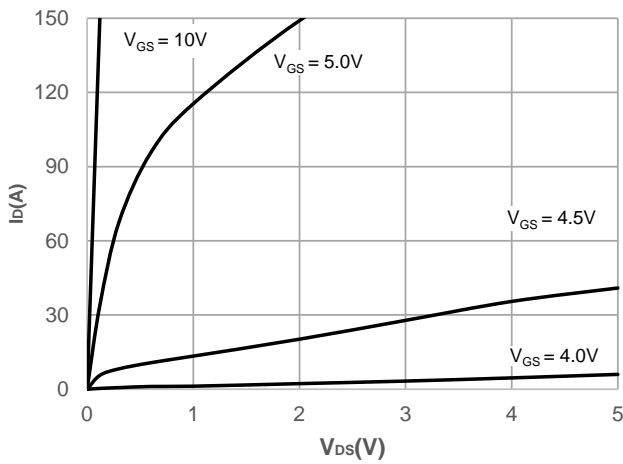
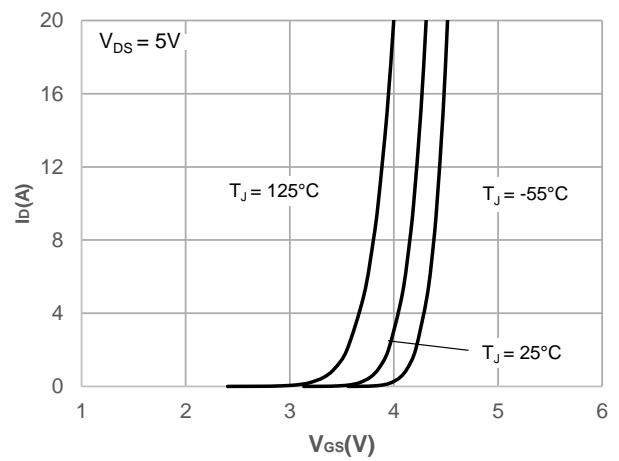
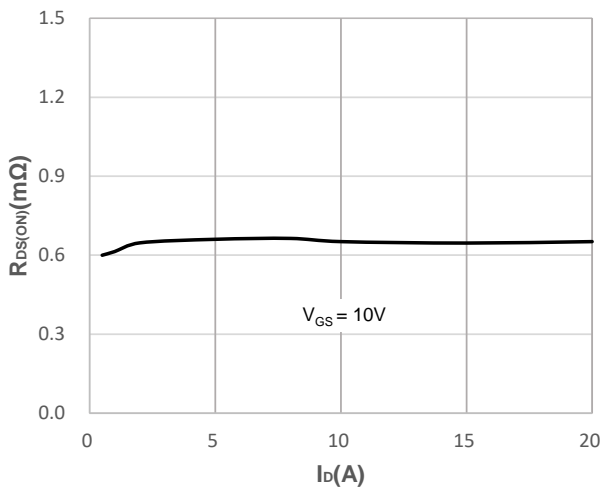
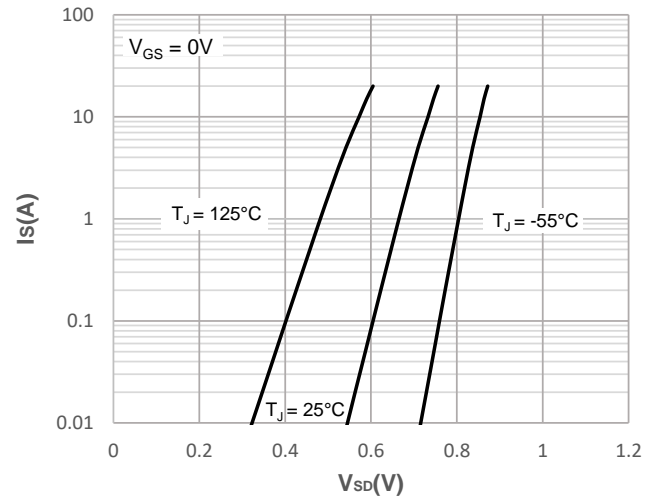
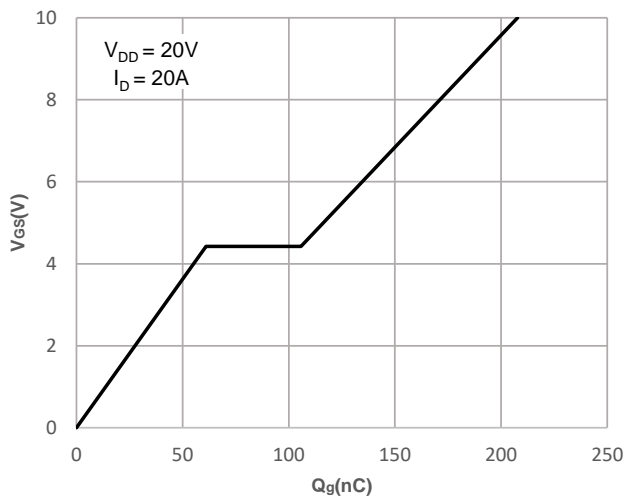
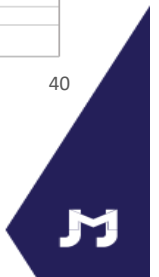
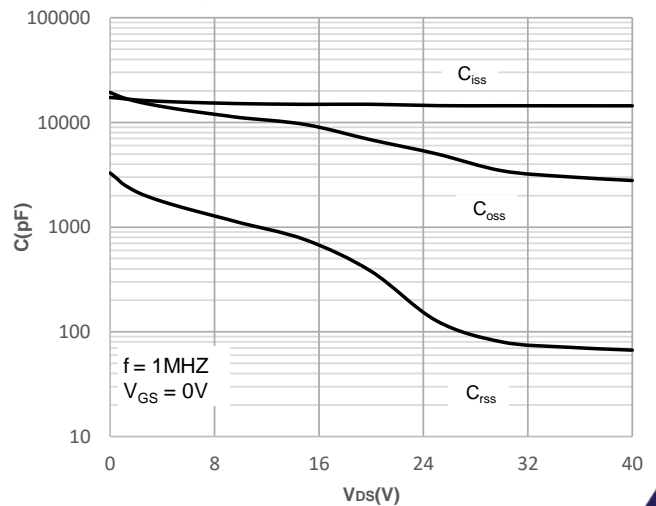


Figure 4: Peak Current Capacity



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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


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Figure 11: Normalized Breakdown voltage vs. Junction Temperature

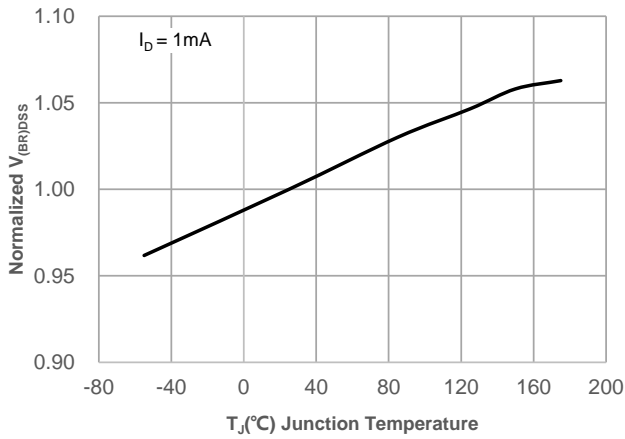


Figure 12: Normalized on Resistance vs. Junction Temperature

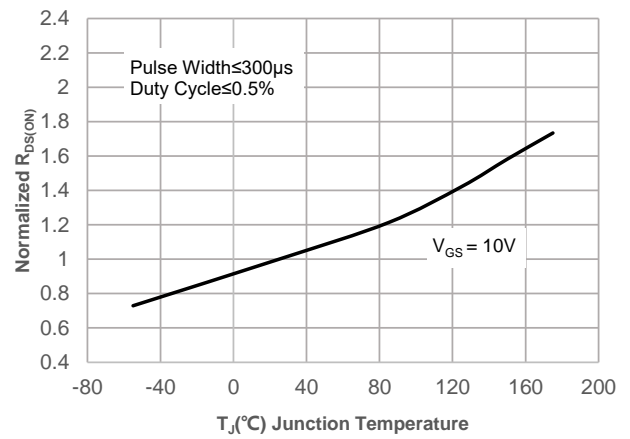


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

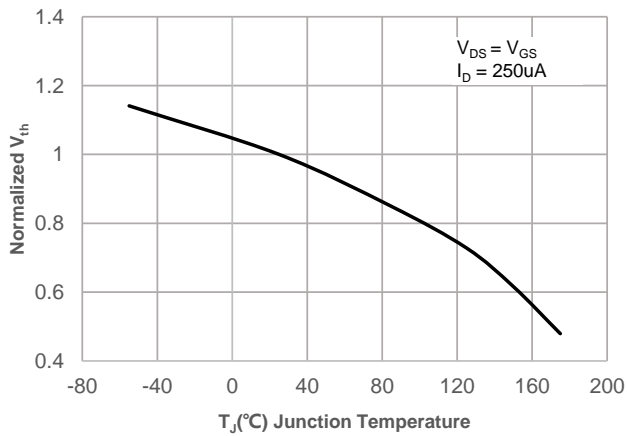


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

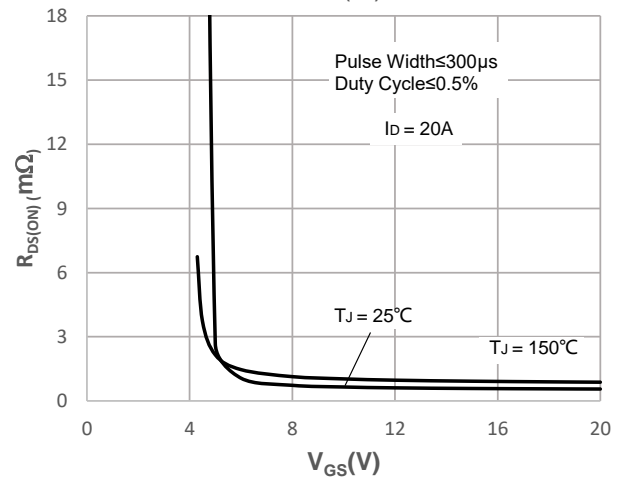
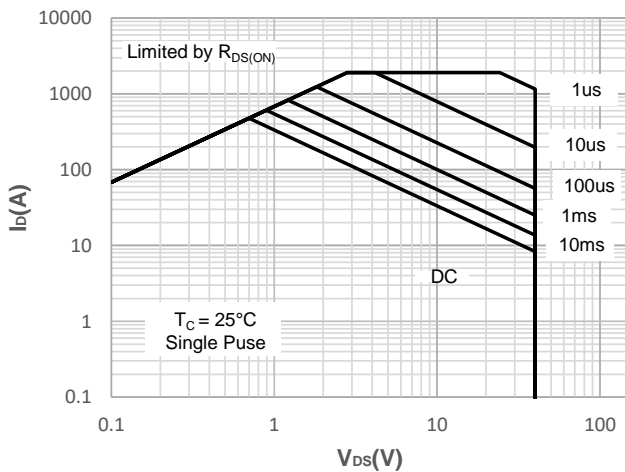


Figure 15: Maximum Safe Operating Area



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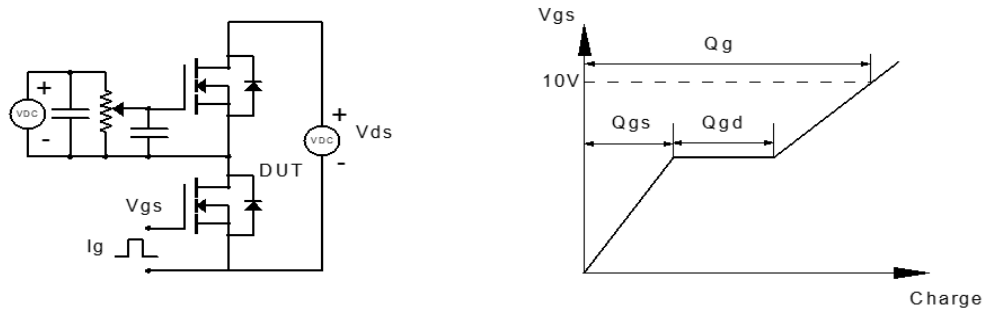


Figure 1: Gate Charge Test Circuit & Waveform

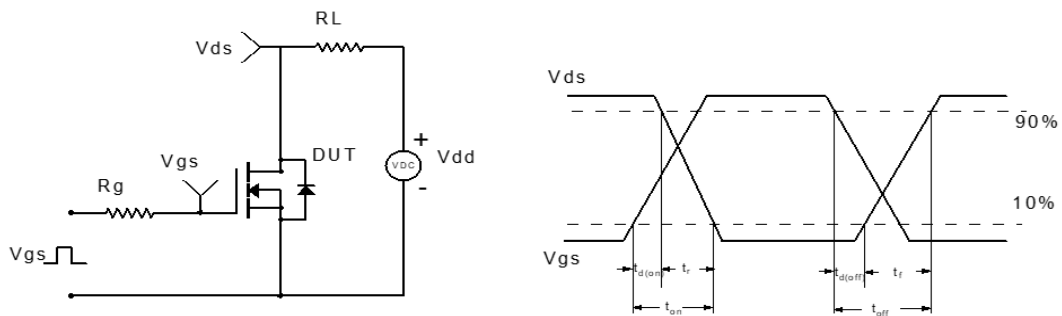


Figure 2: Resistive Switching Test Circuit & Waveform



Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

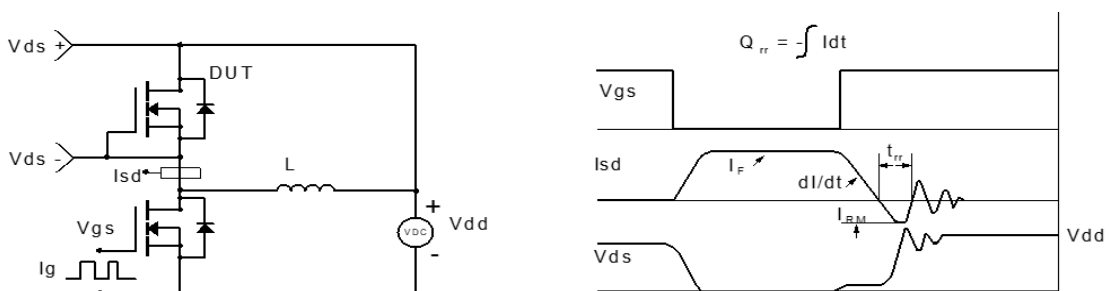
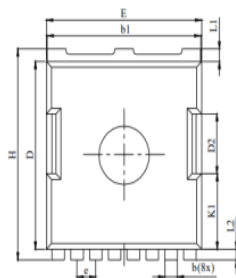
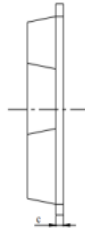


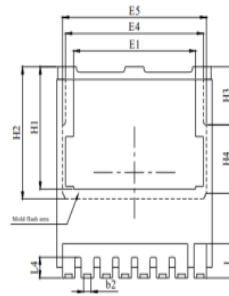
Figure 4: Diode Recovery Test Circuit & Waveform

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Package Outlines


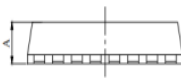
Top View



Side View



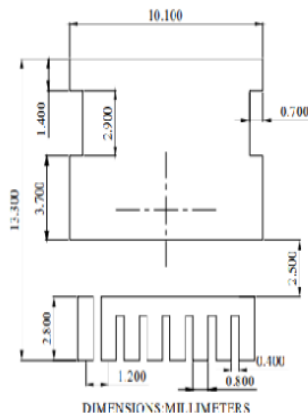
Bottom View



Front View

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
b1	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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