

ASR12N650MD02

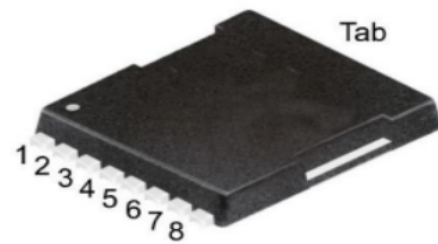
650V N-Channel MOSFET

Description

Silicon Carbide (SiC) MOSFET use a completely new technology that provide superior switching performance and higher reliability compared to Silicon. In addition, the low ON resistance and compact chip size ensure low capacitance and gate charge. Consequently, system benefits include highest efficiency, faster operating frequency, increased power density, reduced EMI, and reduced system size.

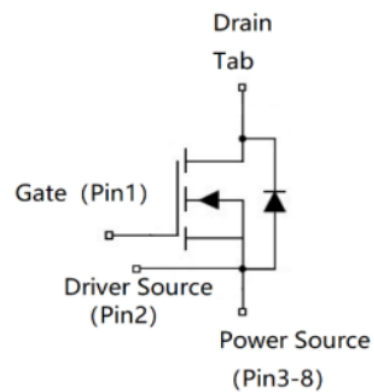
Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to parallel and simple to drive
- ROHS Compliant, Halogen free



Application

- EV Charging
- DC/DC Converters
- Switch Mode Power Supplies
- Power Factor Correction Modules
- Solar PV inverters



Ordering Information

Part Number	Marking	Package	Packaging
ASR12N650MD02	ASR12N650MD02	ToLL	Reel

Absolute Maximum Ratings(Tc=25 °C)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage	650	V
I_D	Drain Current(continuous)at Tc=25 °C	150	A
I_D	Drain Current(continuous)at Tc=100 °C	100	A
I_{DM}	Drain Current (pulsed)	300	A
V_{GS}	Gate-Source Voltage	-10/+22	V
P_D	Power Dissipation T _C = 25 °C	428	W
T _J , Tstg	Junction and Storage Temperature Range	-55 to +175	°C

Electrical Characteristics(T_J = 25 °C unless otherwise specified)
Typical Performance-Static

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{DS}	Drain-source Breakdown Voltage	$I_D=250\mu A, V_{GS}=0V$	650			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=650V,$ $V_{GS}=0V, T_J=25^\circ C$			100	μA
I_{GSS}	Gate-body Leakage Current	$V_{DS}=0V ; V_{GS}=-10$ to 20V			250	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=22mA$	2	3	4	V
$V_{GS(on)}$	Recommended turn-on Voltage	Static		18		V
$V_{GS(off)}$	Recommended turn-off Voltage			-5		V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS}=18V, I_D=75A$		12	20	m Ω
		$V_{GS}=18V, I_D=75A$ $T_J=175^\circ C$		16		m Ω

Typical Performance-Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	$V_{DS}=400V, f=1MHz,$ $V_{AC}=25mV$		7160		pF
C_{oss}	Output Capacitance			325		pF
C_{rss}	Reverse Transfer Capacitance			31		pF
g_{fs}	Transconductance	$V_{DS}=20V, I_D=15A$		42		S
E_{OSS}	C_{OSS} Stored Energy	$V_{DS}=400V, f=1MHz$		32		μJ
E_{ON}	Turn-On Energy (Body Diode)	$V_{DS}=400V, V_{GS}=-5/20V,$ $I_D=50A, L=60\mu H$ $T_J=175^\circ C$		426		μJ
E_{OFF}	Turn-Off Energy (Body Diode)			282		μJ
Q_g	Total Gate Charge	$V_{DS}=400V, V_{GS}=-5V/20V,$ $I_D = 50 A$		236		nC
Q_{gs}	Gate-source Charge			56		nC
Q_{gd}	Gate-Drain Charge			64		nC
$R_{G(int)}$	Internal Gate Resistance	$f=1MHz, V_{AC}=25mV$		2.2		Ω
$t_{d(on)}$	Turn-on Delay Time	$V_{DS}=400V, V_{GS}=-5V/20V,$ $I_D = 50A, L=60 \mu H$ $R_{ext}=5\Omega$		25		ns
t_r	Rise Time			34		ns
$t_{d(off)}$	Turn-off Delay Time			62		ns
t_f	Fall Time			16		ns

Typical Performance-Reverse Diode($T_J = 25^\circ C$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{FSD}	Forward Voltage	$V_{GS}=0V, I_F=50A, T_J=25^\circ C$		3.5	6	V
		$V_{GS}=0V, I_F=50A, T_J=175^\circ C$		3.0	6	V
I_S	Continuous Diode Forward Current	$V_{GS}=0V, T_C=25^\circ C$		80		A
t_{rr}	Reverse Recovery Time	$V_{GS}=-5 V, I_F=50 A,$ $V_R=400 V, T_J=175^\circ C$ $di/dt= 2400 A/\mu s$		88		nS
Q_{rr}	Reverse Recovery Charge			680		nC
I_{rrm}	Peak Reverse Recovery Current			17		A

Thermal Characteristics

Symbol	Parameter	Value.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.35	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	$^\circ C/W$

The values are based on the junction-to case thermal impedance which is measured with the device mounted to a large heat sink assuming maximum junction temperature of $T_J(max)=175^\circ C$

Electrical Characteristics

Fig1. Output characteristics ($T_J = 25^\circ\text{C}$)

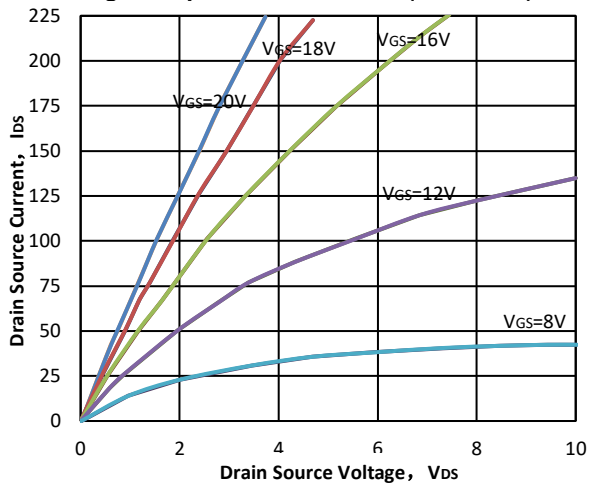


Fig2. Output characteristics ($T_J = 175^\circ\text{C}$)

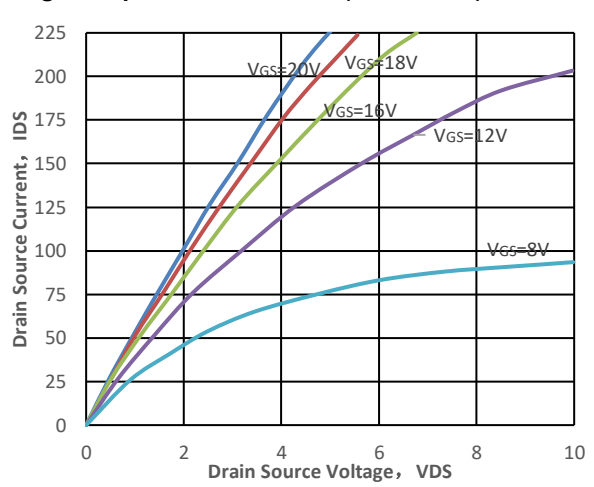


Fig3. Normalized On-Resistance vs. Temperature

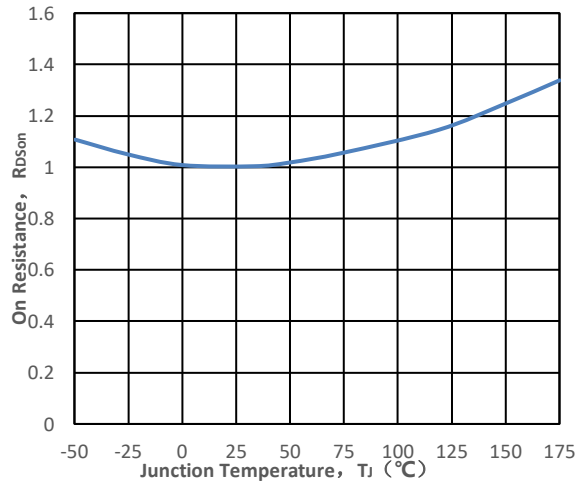


Fig4. On-Resistance vs. Temperature

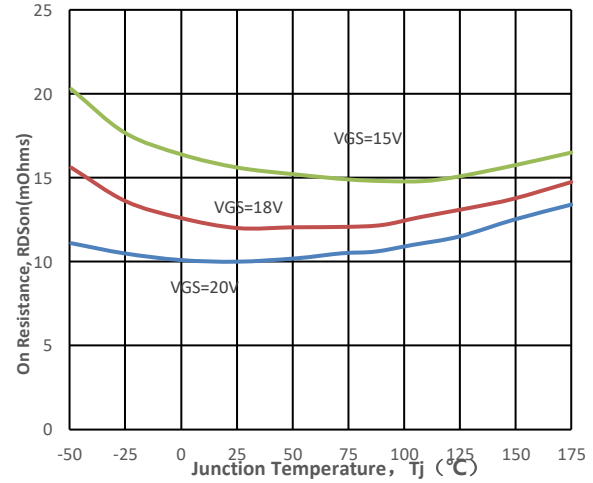


Fig5. Transfer Characteristic

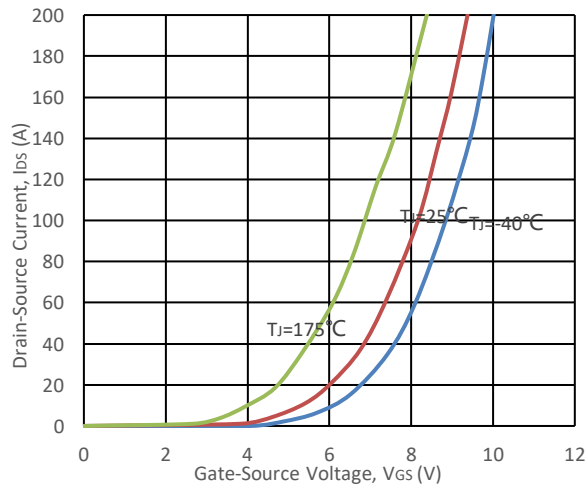


Fig6. Body Diode Characteristic at 25°C

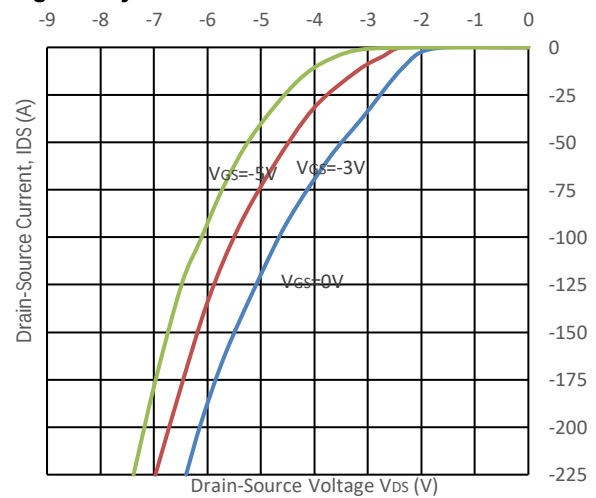


Fig7. Threshold Voltage vs. Temperature

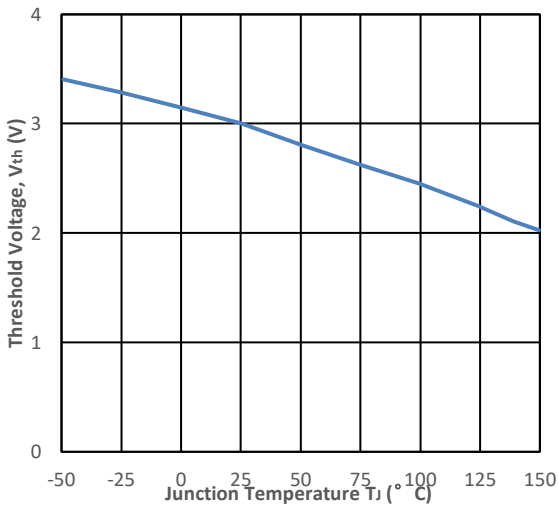


Fig8. Gate Charge Characteristics

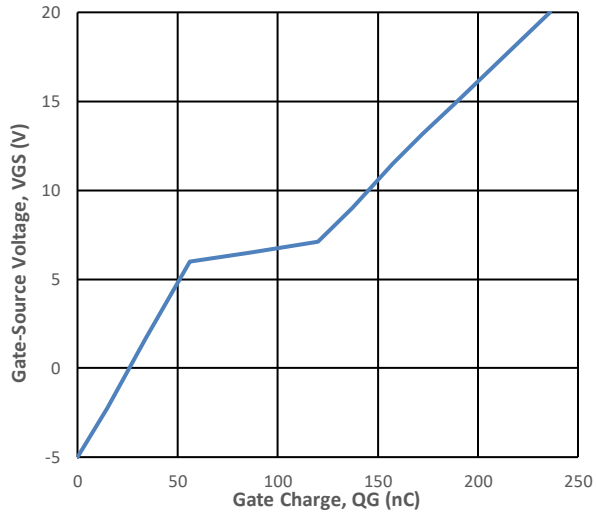


Fig9. 3rd Quadrant Characteristic at 25 $^{\circ}C$

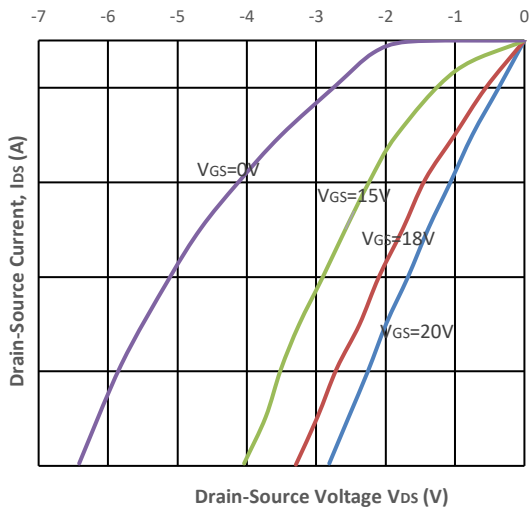


Fig10. Output Capacitor Stored Energy

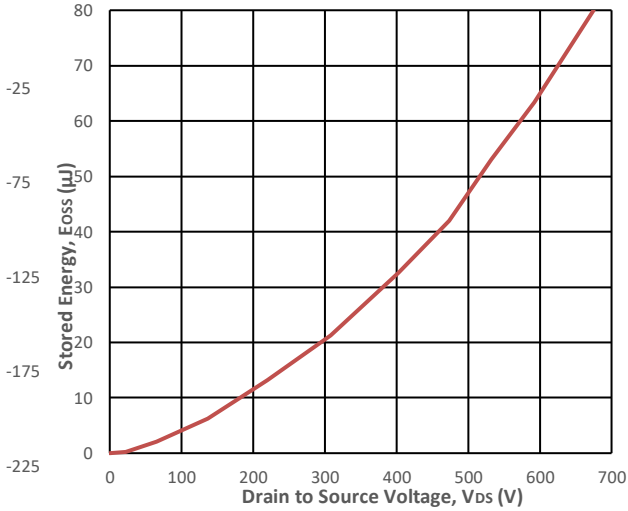


Fig11. Capacitances vs. Drain-Source

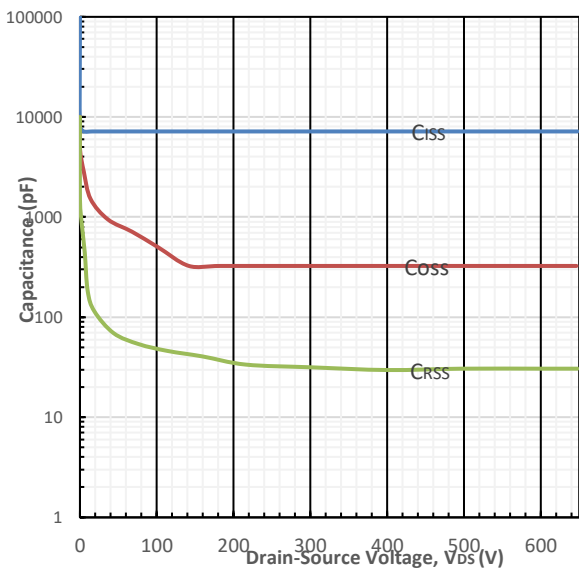


Fig12. Max Power Dissipation Derating Vs T_c

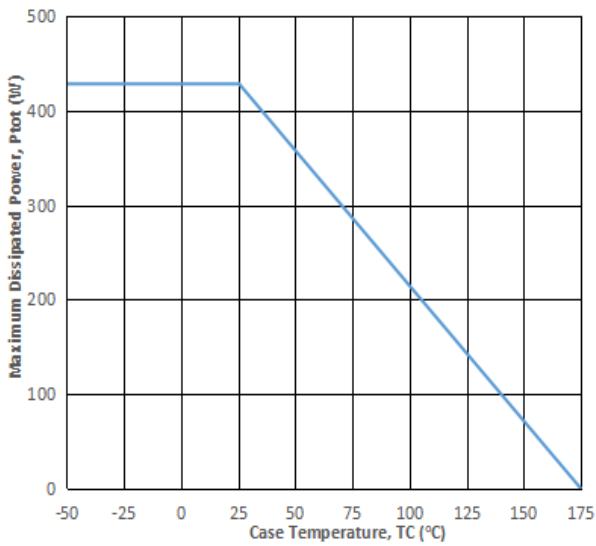


Fig13. Switching Energy vs. Drain Current

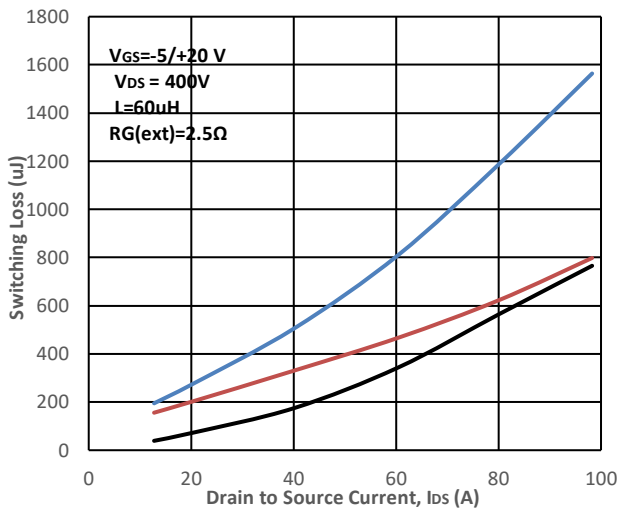


Fig14. Switching Energy vs. $R_{G(ext)}$

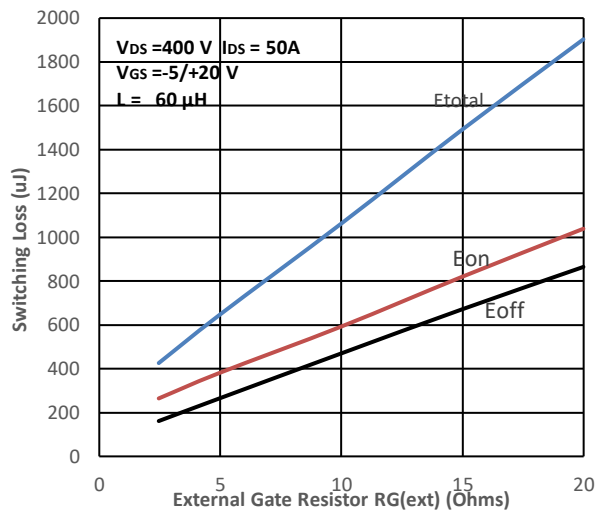


Fig15. Switching Energy vs. Temperature

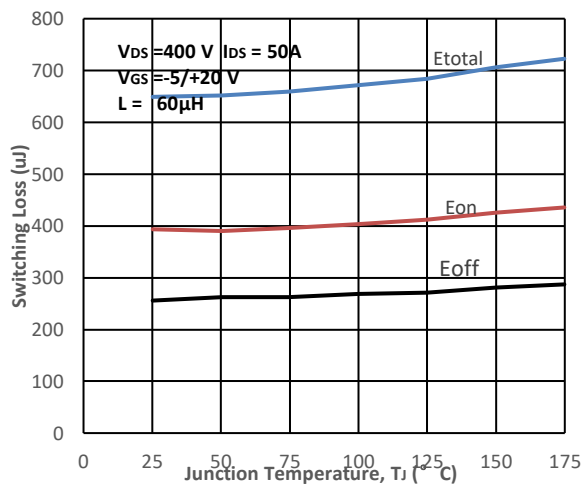


Fig16. Switching Times vs. $R_{G(ext)}$

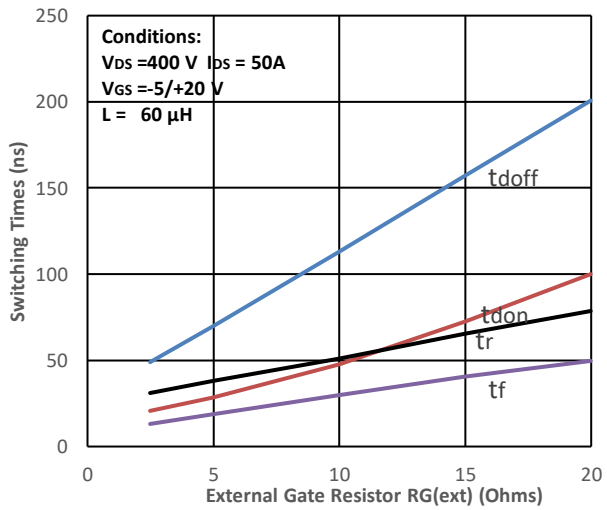


Fig17. Transient Thermal Impedance

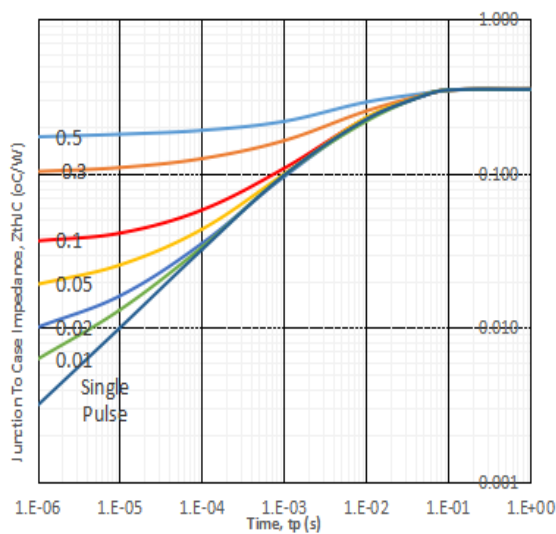
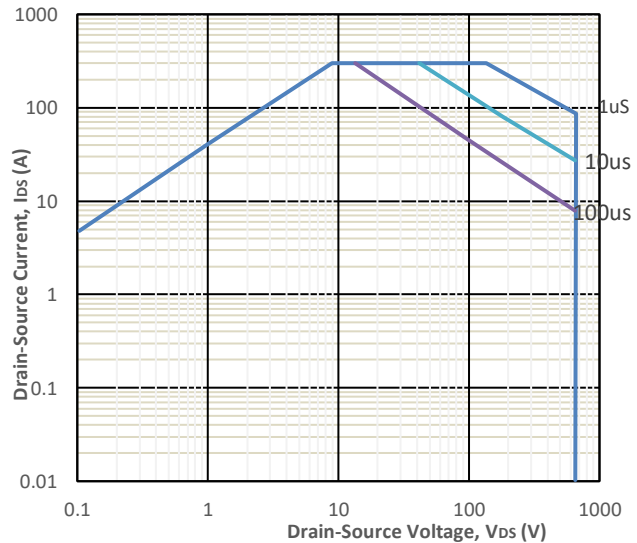
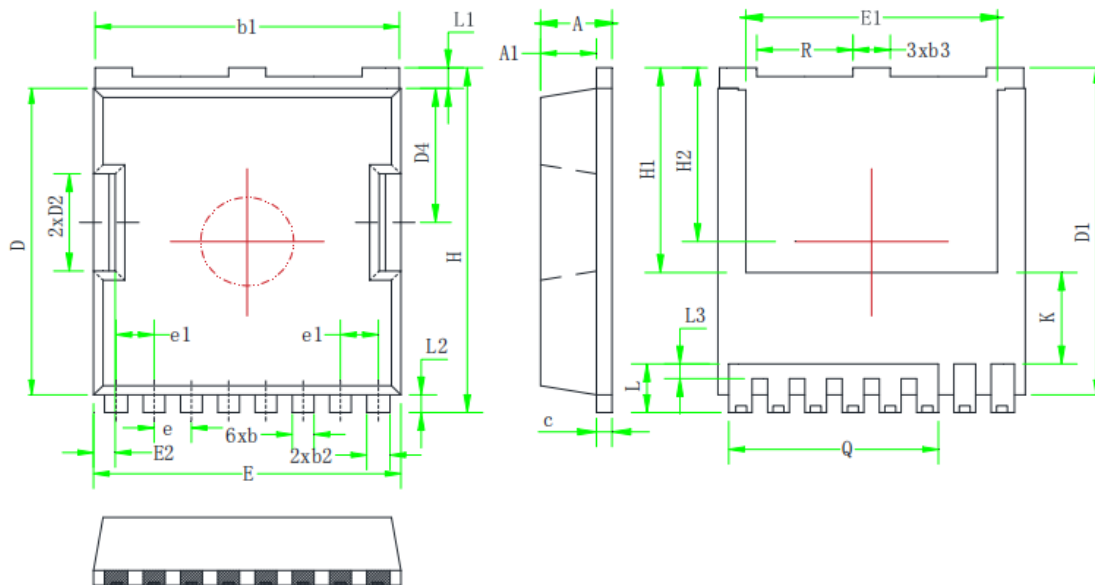


Fig18. Safe Operating Area



Package Drawing:



Dimensions (UNIT: mm)

Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	2.25	2.30	2.35	E	9.85	9.90	9.95
A1	1.75	1.80	1.85	E1	8.00	8.10	8.20
b	0.65	0.70	0.75	E2	0.65	0.70	0.75
b1	9.75	9.80	9.90	H	11.60	11.70	11.80
b2	0.70	0.75	0.80	H1	6.95 BSC		
b3	1.15	1.20	1.25	H2	5.90 BSC		
c	0.45	0.50	0.55	K	3.10 REF		
D	10.35	10.40	10.45	L	1.55	1.65	1.75
D1	11.00	11.10	11.20	L1	0.65	0.70	0.75
D2	3.25	3.30	3.35	L2	0.50	0.60	0.70
D4	4.50	4.55	4.60	L3	0.40	0.50	0.60
e	1.20 BSC			Q	6.75 REF		
e1	1.225 BSC			R	3.00	3.10	3.20

Notes:

- The information in this document is subject to change without notice.
- For more product and company information, please contact us or visit the website.

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