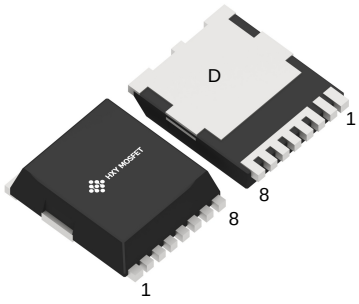
NTBL023N065M3S

SiC Power MOSFET N-Channel Enhancement Mode

Features

- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)
- Halogen free, RoHs compliant



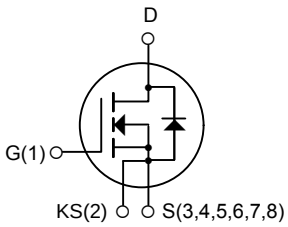
TOLLS

Benefits

- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink reguirements

Applications

- Switch mode power supplies
- Renewable energy
- On Board Charger
- High Voltage DC/DC Converters



Ordering Part Number	Package	Brand
NTBL023N065M3S	TOLLS	HXY MOSFET

Maximum Ratings (T_C = 25 ˚C unless otherwise specified)

Symbol	Parameter	Test conditions	Value	Unit	Note
V_{DSmax}	Drain-Source Voltage	V_{GS} = 0V, I_D = 100μA	650	V	
V_{GSmax}	Gate-Source voltage	AC (f > 1 Hz)	-10/+25	V	
V_{GSop}	Recommend Gate-Source Voltage	Static	-4/+18	V	
I_D	Continuous Drain current	V_{GS} = 18V, T_C = 25°C	99	A	Fig. 14
		V_{GS} = 18V, T_C = 100°C	70		
$I_{D,pulse}$	Pulsed Drain Current	Pulse with t_p limited by T_{jmax}	157	A	
P_D	Power Dissipation	T_C = 25°C, Tj = 175°C	333	W	Fig.16
T_j	Operating junction temperature		-55~175	°C	
T_{stg}	Storage temperature		-55~175	°C	
	TO-247 miunting torque	M3 Screw	0.7	Nm	

Thermal Characteristics

Symbol	Parameter	Value			Unit	Note
		Min.	Typ.	Max.		
$R_{th(jc)}$	Thermal resistance from Junction to Case		0.45		K/W	Fig. 15
$R_{th(ja)}$	Thermal resistance from Junction to Ambient		40		K/W	

Electrical Characteristics (T_C = 25˚C unless other wise specified)

Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown voltage	V_{GS} = 0V, I_D = 100μA	650			V	
$V_{GS(th)}$	Gate Threshold voltage	V_{GS} = V_{DS}, I_D =16mA		3.0		V	Fig. 9
		V_{GS} = V_{DS}, I_D =16mA, T_j=175°C		2.0			
I_{GSS}	Gate-Source Leakage current	V_{GS} = 18V, V_{DS} = 0V			250	nA	
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} =650V, V_{GS} = 0V, T_j = 25°C		1	50	μA	
$R_{DS(on)}$	Drain-Source On-state Resistance	V_{GS} = 18V, I_D =40A		26	38	mΩ	Fig. 3, 4 , 5
		V_{GS} = 18V, I_D =40A, T_j = 175°C		35			
g_{fs}	Transconductance	V_{DS} = 18V, I_D =40A		27		S	Fig. 6
		V_{DS} = 18V, I_D =40A, T_j = 175°C		25			

Gate Charge Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
Q_{GS}	Gate to Source Charge	V_{DS} = 400V I_D =40A V_{GS} = -4V/18V		29		nC	Fig. 10
Q_{GD}	Gate to Drain Charge			35			
Q_G	Total Gate Charge			74.5			

AC Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 600V f =1 MHz V_{AC} = 25mV		2543		pF	Fig. 13
C_{oss}	Output Capacitance			173		pF	
C_{rss}	Reverse Transfer Capacitance			8		pF	
$R_{G(int)}$	Internal Gate Resistance	f=1 MHz, V_{AC} = 25mV		1.2		Ω	

Reverse Diode Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
V_{SD}	Diode Forward Voltage	V_{GS} = -4V, I_{SD} = 20A		4.3		V	Fig. 7,8
		V_{GS} = -4V, I_{SD} = 20A, T_j = 175°C		3.7			
I_S	Continuous Diode Forward Current	V_{GS} = -4V, T_C = 25°C		66		A	
$I_{S,\ pulse}$	Diode pulse Current	V_{GS} = -4V, pulse width t_p limited by T_{jmax}		157		A	
t_{rr}	Reverse Recovery Time	V_{GS} = -4V, I_{SD} = 40A, V_R = 400V dif/dt = 3600A/us		18		nS	
Q_{rr}	Reverse Recovery Charge			309		nC	
I_{rrm}	Peak Reverse Recovery Current			26		A	

Switching Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 400V, V_{GS} = -4/+18V I_D=40 A, $R_{G(iext)}$ = 5 Ω L = 294μH		3		nS	Fig.20
t_r	Rise Time			18		nS	
$t_{d(off)}$	Turn-Off Delay Time			22		nS	
t_f	Fall Time			5		nS	
E_{on}	Turn-On Energy			56		μJ	Fig.19
E_{off}	Turn-Off Energy			66		μJ	
E_{tot}	Total switching energy			122		μJ	

Typical Performance

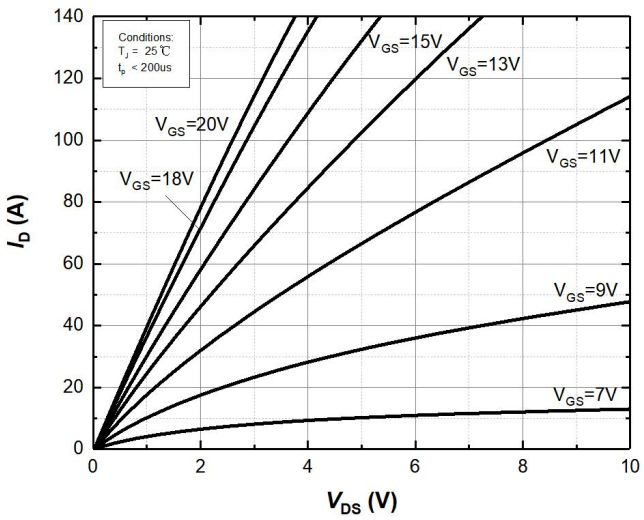


Figure 1. Output characteristics at Tj=25°C

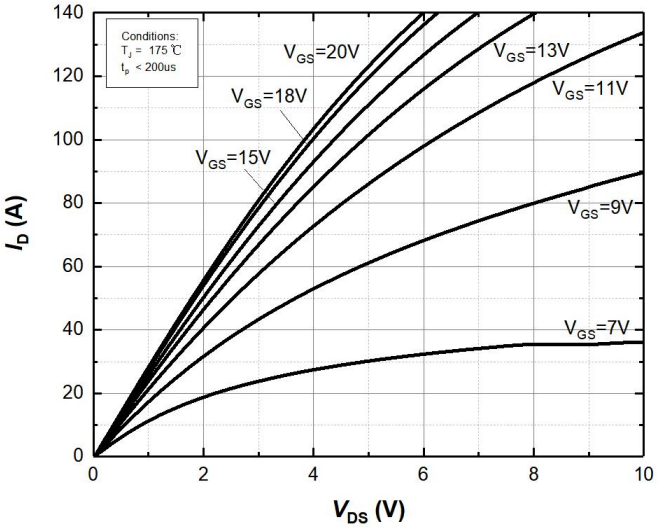


Figure 2. Output characteristics at Tj=175°C

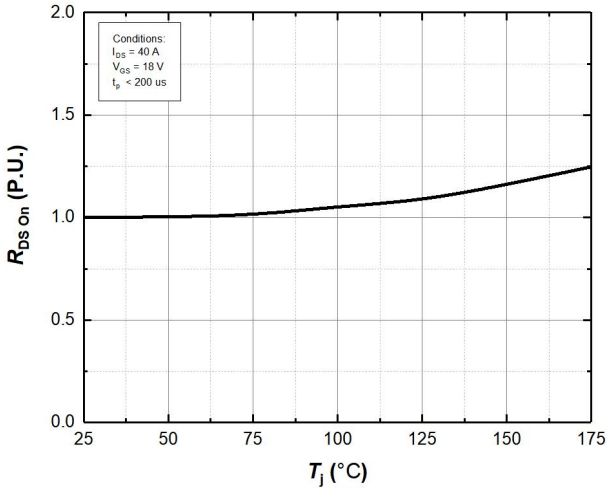


Figure 3. Normalized On-Resistance vs. Temperature

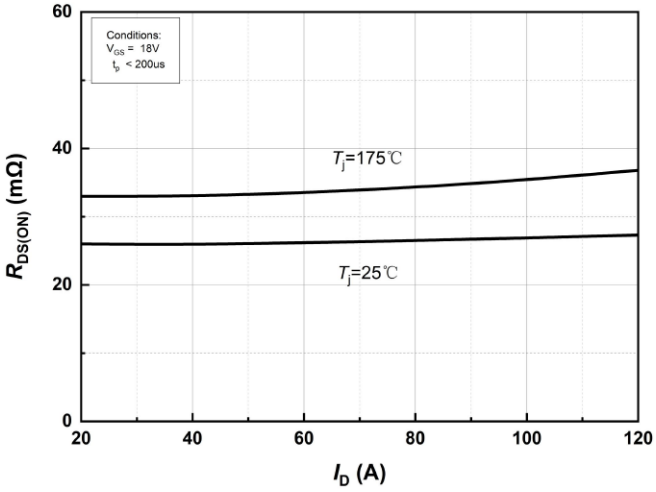


Figure 4. On-Resistance vs. Drain current for Various Temperature

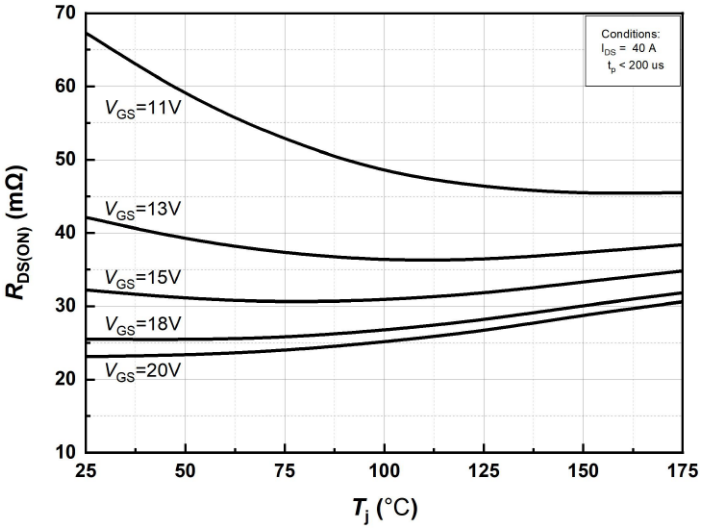


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

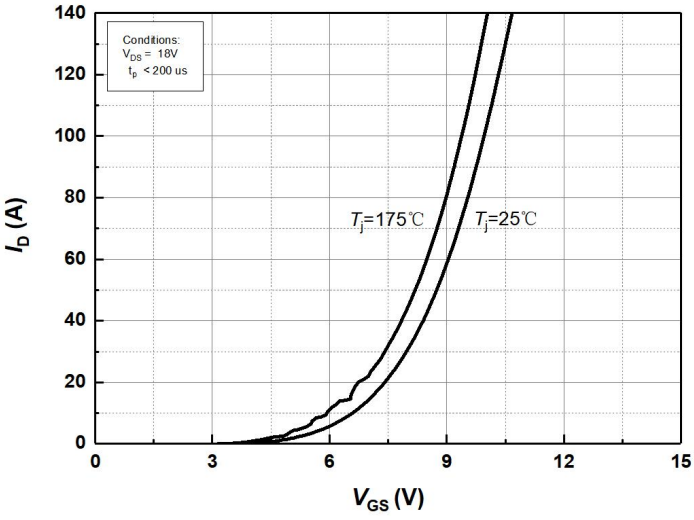


Figure 6. Transfer Characteristics for Various Junction Temperatures

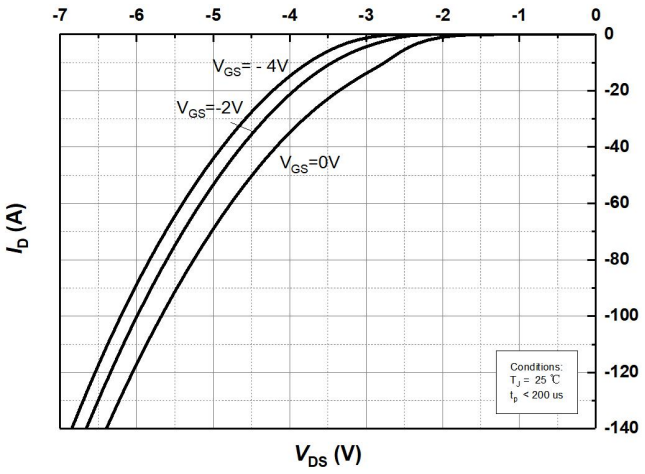


Figure 7. Body Diode Characteristics at Tj=25°C

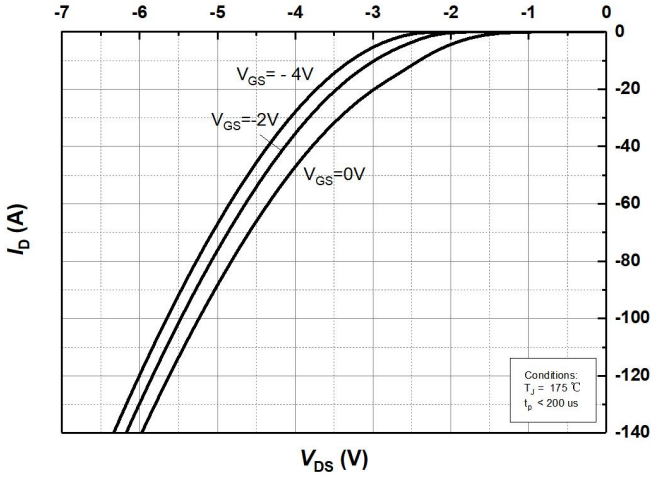


Figure 8. Body Diode Characteristics at Tj=175°C

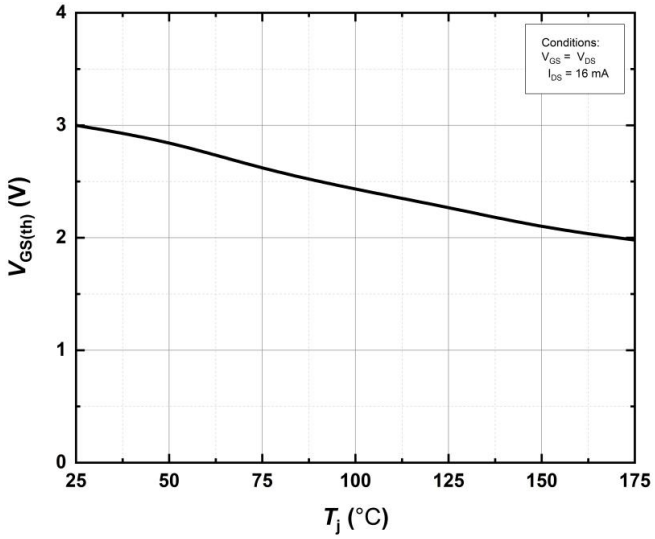


Figure 9. Threshold Voltage vs. Temperature

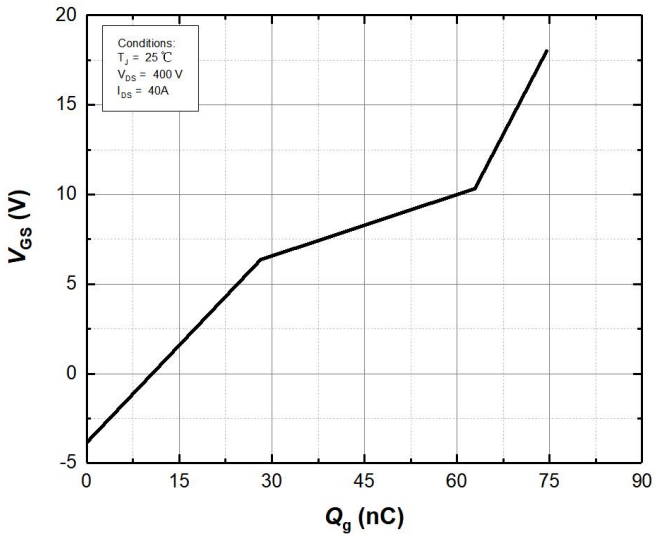


Figure 10 Gate Charge Characteristics

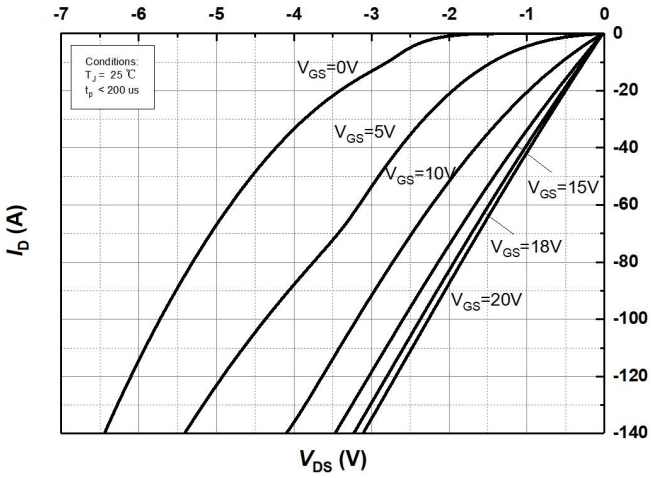


Figure 11. 3rd Quadrant Characteristic at Tj=25°C

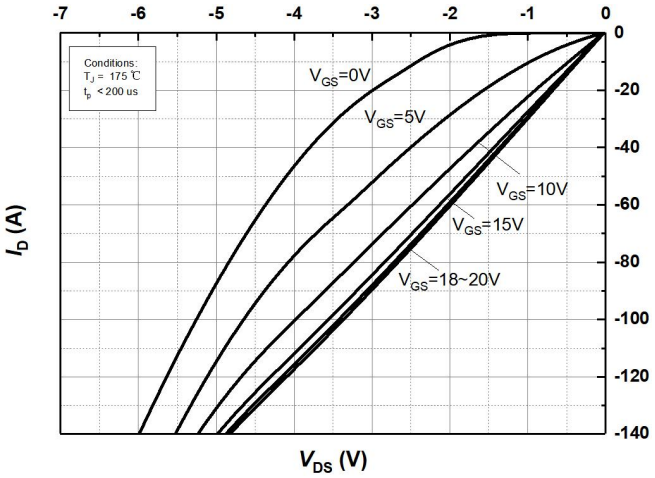


Figure 12. 3rd Quadrant Characteristic at Tj=175°C

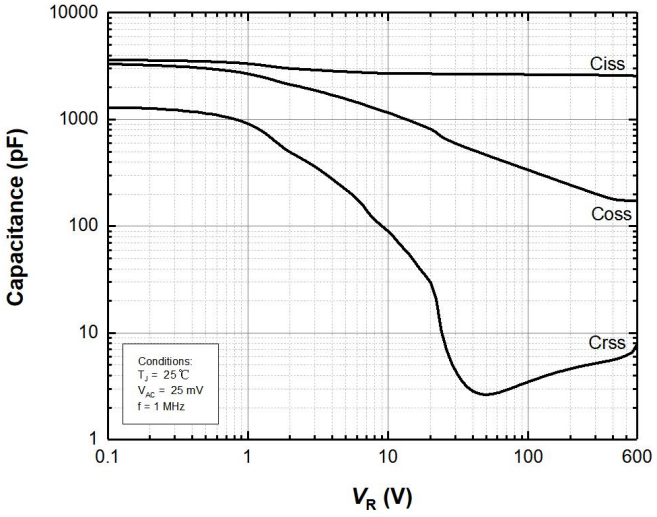


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)

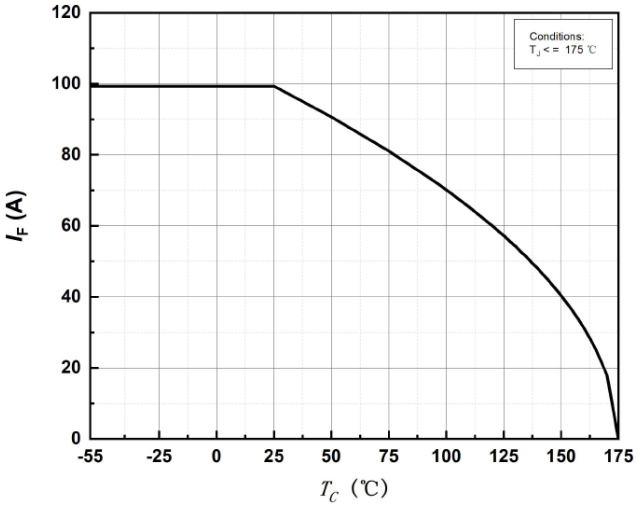


Figure 14. Continuous Drain Current Derating vs Case Temperature

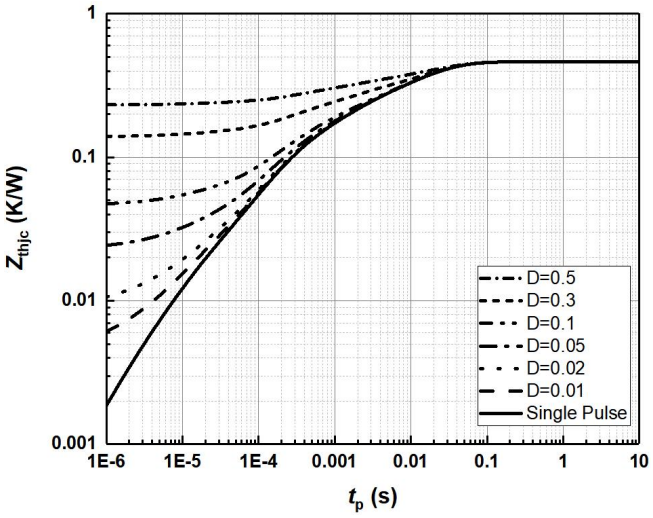


Figure 15.Transient Thermal Impedance (Junction – Case)

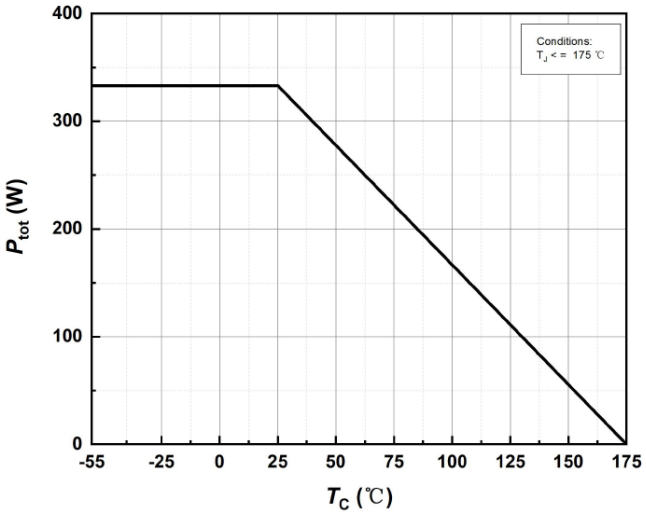


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

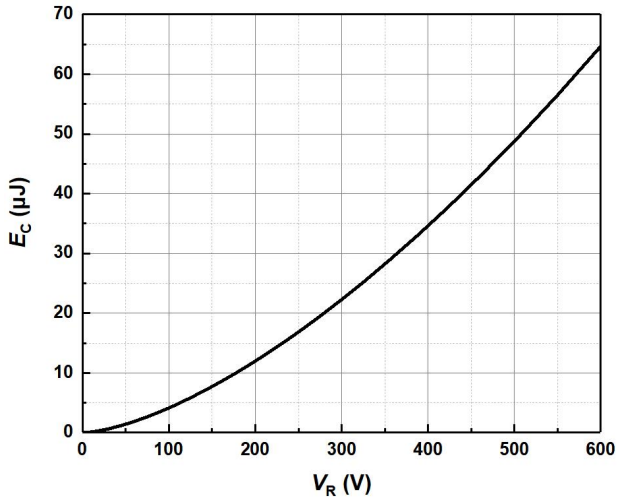


Figure 17. Output Capacitor Stored Energy

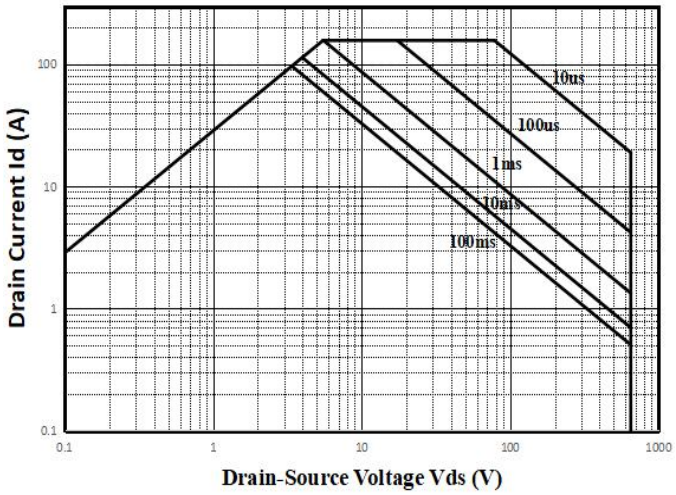


Figure 18. Safe Operating Area

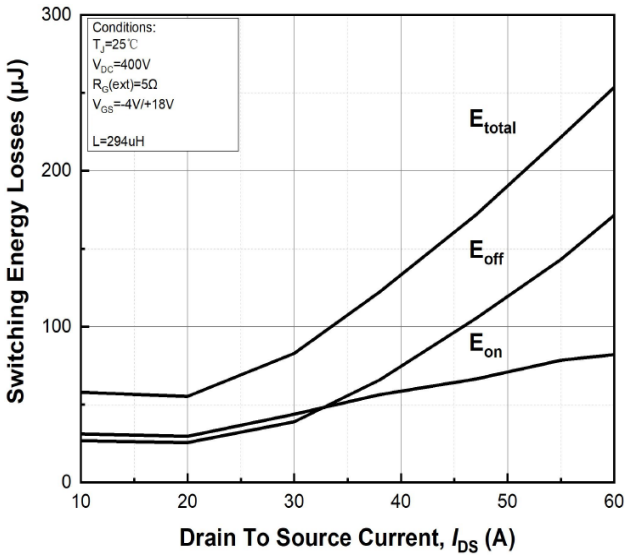


Figure 19. Clamped Inductive Switching Energy vs. Drain Current(V_{DD} = 400V)

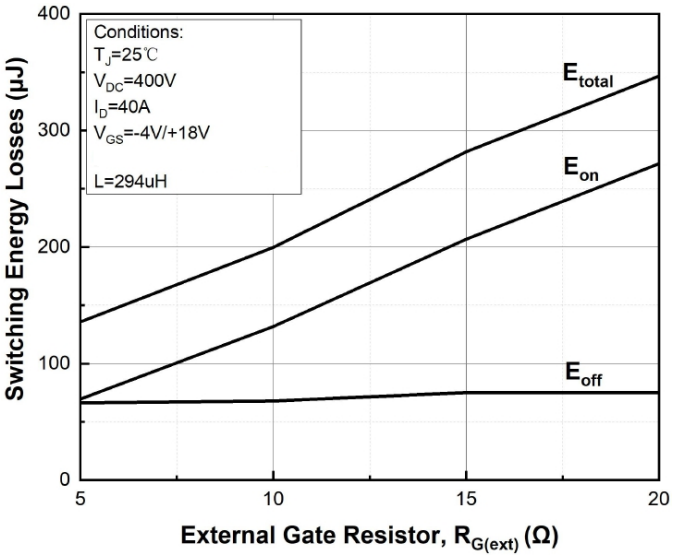


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

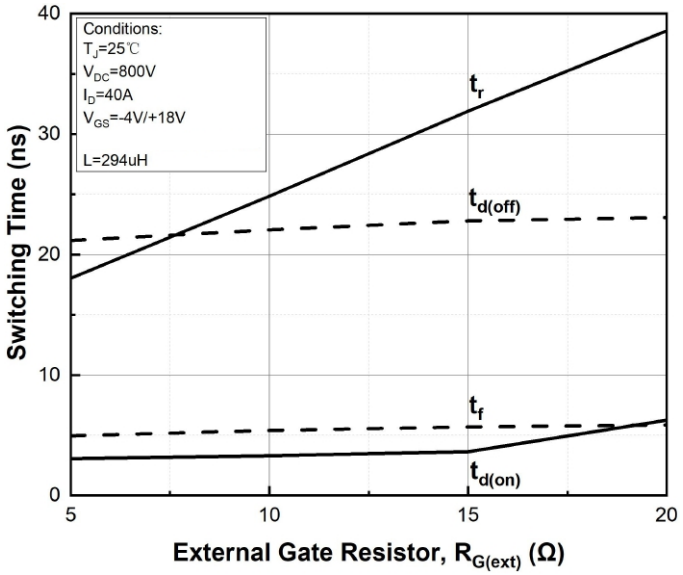
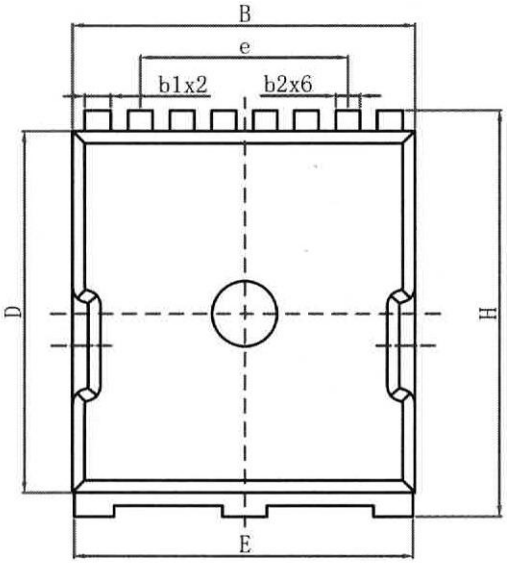


Figure 21. Switching Times vs. $R_{G(ext)}$

Package Dimensions

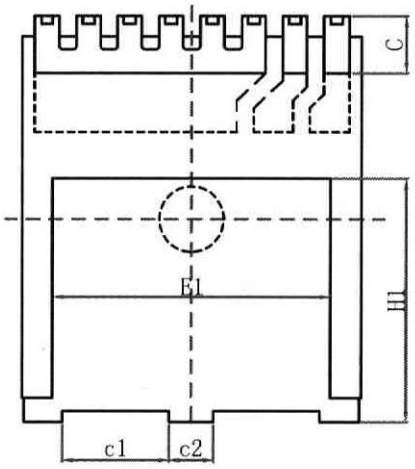
Package TOLLS



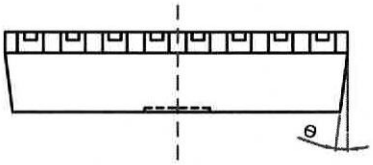
TOP VIEW



SIDE VIEW



BOTTOM VIEW



FRONT VIEW

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
B	9.85	9.90	9.95
C	1.50	1.60	1.70
D	10.40	10.50	10.60
E	9.75	9.80	9.85
E1	7.95	8.10	8.25
H	11.60	11.70	11.80
H1	6.80	6.95	7.10
L1	0.55	0.65	0.75
L2	0.65	0.70	0.75
e	6.0BSC		
e1	0.45	0.50	0.55
b1	0.70	0.75	0.80
b2	0.60	0.70	0.80
c1	3.00	3.10	3.20
c2	1.10	1.20	1.30
θ	11°		

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HXY MOSFET:

AZ4836-01L HACPDQC5V0-HF HCEZ36V,L3F PESDNC2XD5VBF HAZ4007-01H HSD15C.TCT HSEN3611D3 HSG3D15B3.3MA TPSMB28A-VR AQ15C-01FTG BV05C-H HESDSLC3V3D3B PESDLC2FD3V3BH HSEN2411D3 LM393DR-HXY PESDNC2XD5VBL PESDSC2FD5VU PJEC5V0M1FN2 HPTVSUC3D5VB HLY323BC1524L HRCLAMP3371ZCTFT HSTS521050B331 TPSMB100CA-VR 60N06 AZ4007-01H PJSD24CW_R1 RLSD32A121V ESD5L5.0C-HXY ESD5LM5.0C-HXY HESD36VD3B