



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

Benefits

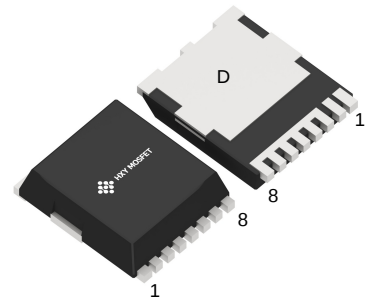
- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink requirements

Applications

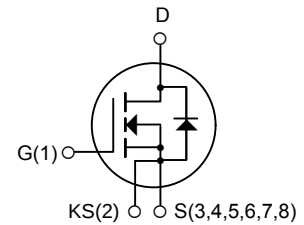
- Switch mode power supplies
- Renewable energy
- On Board Charger
- High Voltage DC/DC Converters



Ordering Part Number	Package	Brand
NTBL050N65S3H	TOLLS	HXY MOSFET



TOLLS



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/+20	V	
I _D	Continuous Drain current	V _{GS} = 20V, T _C = 25°C	63	A	Fig. 14
		V _{GS} = 20V, T _C = 100°C	44		
I _{D,pulse}	Pulsed Drain Current	Pulse with t _p limited by T _{Jmax} at 1 ms Pulse with t _p limited by T _{Jmax} at 100 μs	98 213	A	Fig.18
P _D	Power Dissipation	T _C = 25°C, T _J = 175°C	268	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		0.56		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	$V_{GS} = 0V, I_D = 100\mu A$	650			V	
$V_{GS(th)}$	Gate Threshold voltage	$V_{GS} = V_{DS}, I_D = 5mA$		2.7		V	Fig. 9
		$V_{GS} = V_{DS}, I_D = 5mA, T_j = 175^\circ C$		1.8			
I_{GSS}	Gate-Source Leakage current	$V_{GS} = 20V, V_{DS} = 0V$			250	nA	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650V, V_{GS} = 0V, T_j = 25^\circ C$		1	50	μA	
$R_{DS(on)}$	Drain-Source On-state Resistance	$V_{GS} = 20V, I_D = 20A$		58	72	m Ω	Fig. 3, 4, 5
		$V_{GS} = 20V, I_D = 20A, T_j = 175^\circ C$		75			
g_{fs}	Transconductance	$V_{DS} = 20V, I_D = 20A$		18		S	Fig. 6
		$V_{DS} = 20V, I_D = 20A, T_j = 175^\circ C$		11			



Gate Charge Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
Q_{GS}	Gate to Source Charge	$V_{DS} = 400V$ $I_D = 20A$ $V_{GS} = -4V/18V$		16.4		nC	Fig. 10
Q_{GD}	Gate to Drain Charge			16.5			
Q_G	Total Gate Charge			66.2			

AC Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DS} = 600V$ $f = 1\text{ MHz}$ $V_{AC} = 25mV$		1410		pF	Fig. 13
C_{oss}	Output Capacitance			119		pF	
C_{rss}	Reverse Transfer Capacitance			4		pF	
$R_{G(int)}$	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25mV$		1.8		Ω	



Reverse Diode Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
V_{SD}	Diode Forward Voltage	$V_{GS} = -4V, I_{SD} = 8.8A$		3.7		V	Fig. 7,8
		$V_{GS} = -4V, I_{SD} = 8.8A, T_J = 175^{\circ}C$		3.1			
I_S	Continuous Diode Forward Current	$V_{GS} = -4V, T_C = 25^{\circ}C$		53		A	
$I_{S, pulse}$	Diode pulse Current	$V_{GS} = -4V$, pulse width t_p limited by T_{jmax}		98		A	
t_{rr}	Reverse Recovery Time	$V_{GS} = -4V, I_{SD} = 20A, V_R = 400V$ $diff/dt = 2500A/us$		31.7		nS	
Q_{rr}	Reverse Recovery Charge			188.5		nC	
I_{rrm}	Peak Reverse Recovery Current			11.6		A	

Switching Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 400V, V_{GS} = -4/+20V$ $I_D = 20A, R_{G(ext)} = 5\Omega$ $L = 276\mu H$		10.3		nS	Fig.21
t_r	Rise Time			8.9		nS	
$t_{d(off)}$	Turn-Off Delay Time			16.3		nS	
t_f	Fall Time			8		nS	
E_{on}	Turn-On Energy			47.9		μJ	Fig.19
E_{off}	Turn-Off Energy			45.8		μJ	
E_{tot}	Total switching energy			93.7		μJ	



Typical Performance

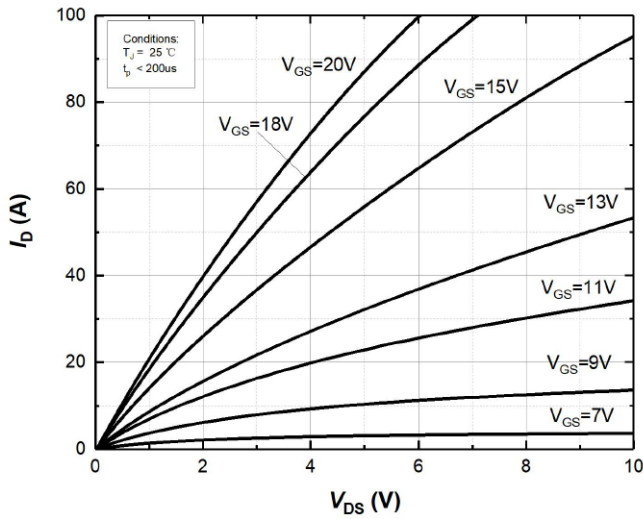


Figure 1. Output characteristics at $T_j=25^\circ\text{C}$

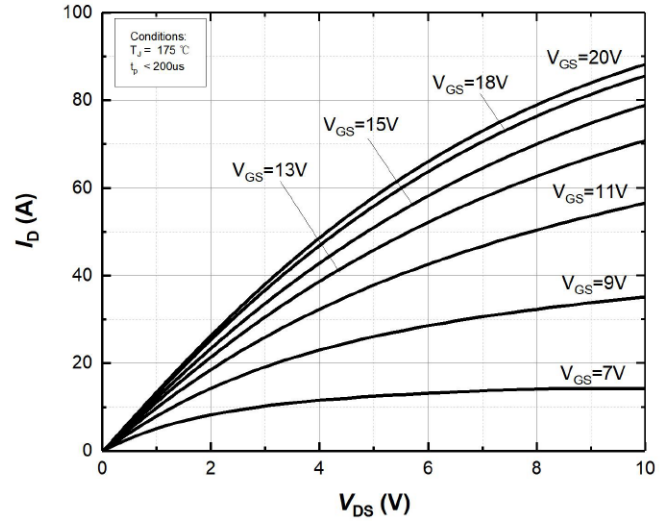


Figure 2. Output characteristics at $T_j=175^\circ\text{C}$

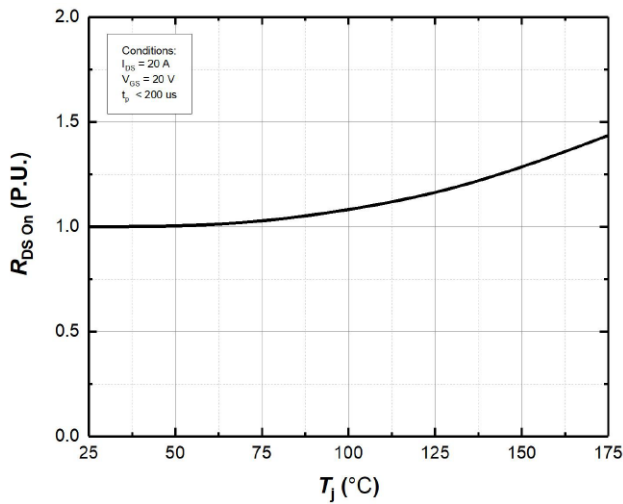


Figure 3. Normalized On-Resistance vs. Temperature

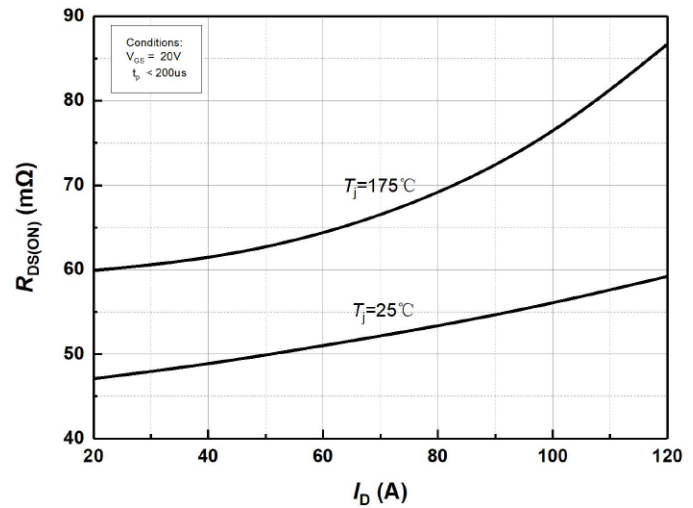


Figure 4. On-Resistance vs. Drain current for Various Temperature

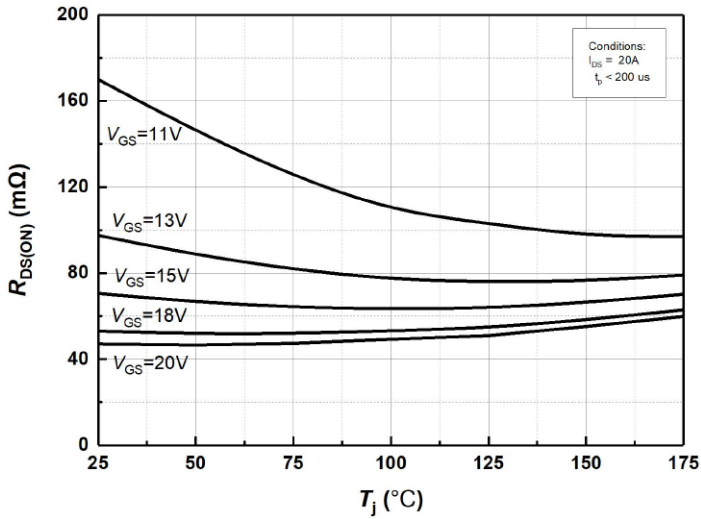


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

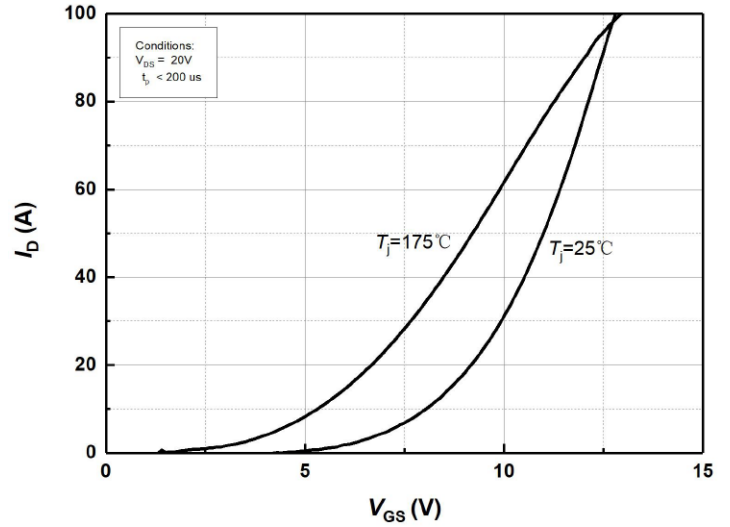


Figure 6. Transfer Characteristics for Various Junction Temperatures

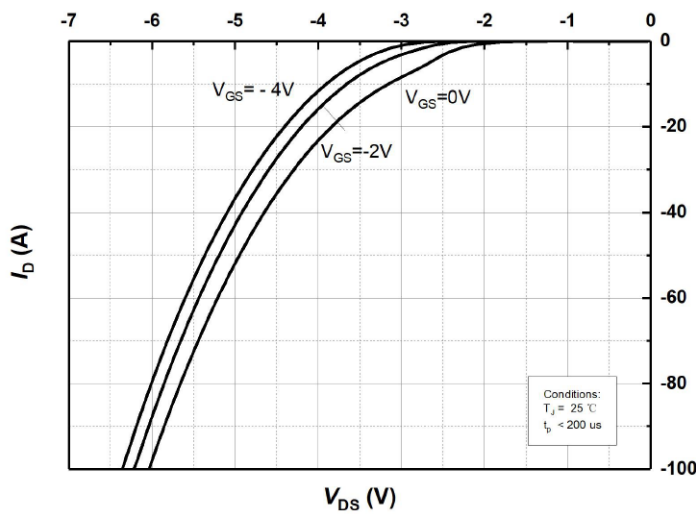


Figure 7. Body Diode Characteristics at $T_J=25^\circ C$

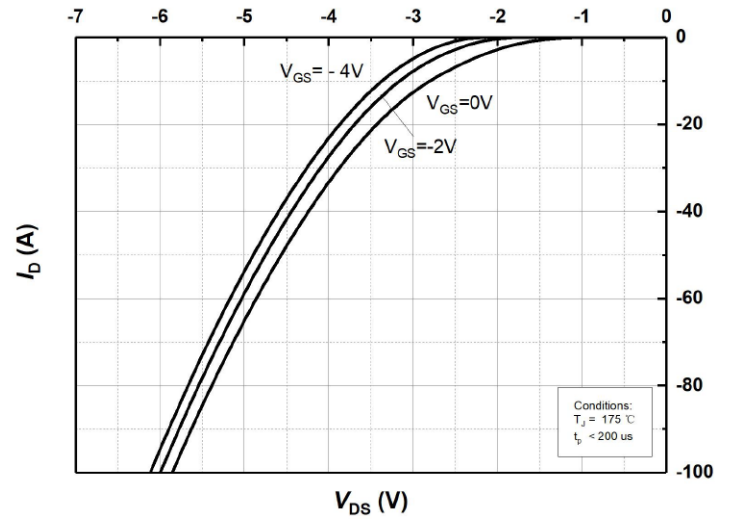


Figure 8. Body Diode Characteristics at $T_J=175^\circ C$

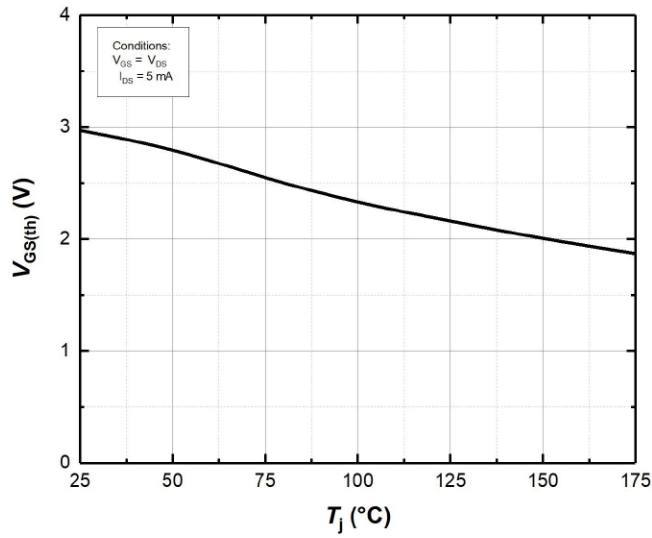


Figure 9. Threshold Voltage vs. Temperature

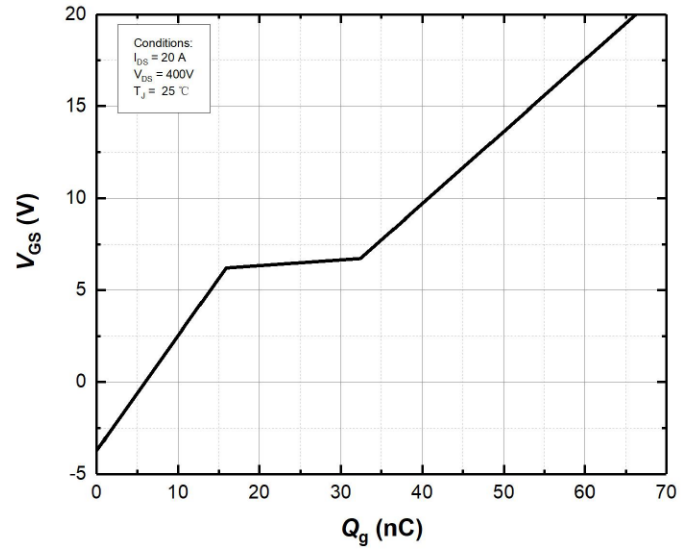


Figure 10 Gate Charge Characteristics

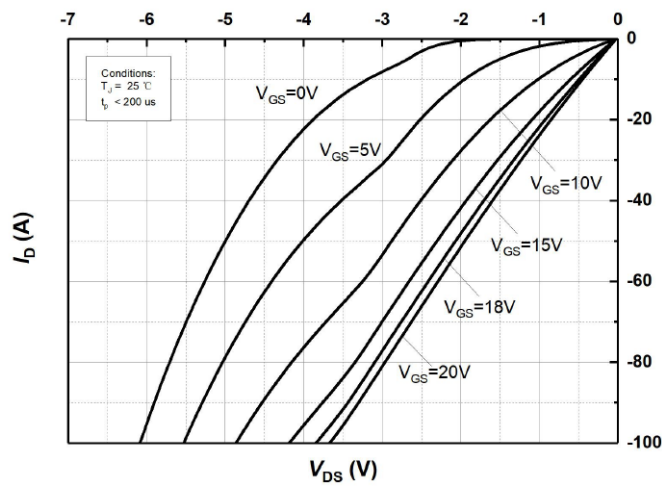


Figure 11. 3rd Quadrant Characteristic at $T_J=25^\circ\text{C}$

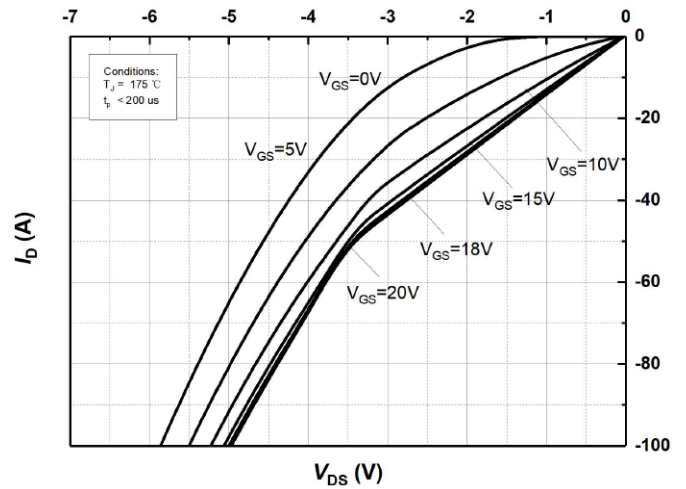


Figure 12. 3rd Quadrant Characteristic at $T_J=175^\circ\text{C}$

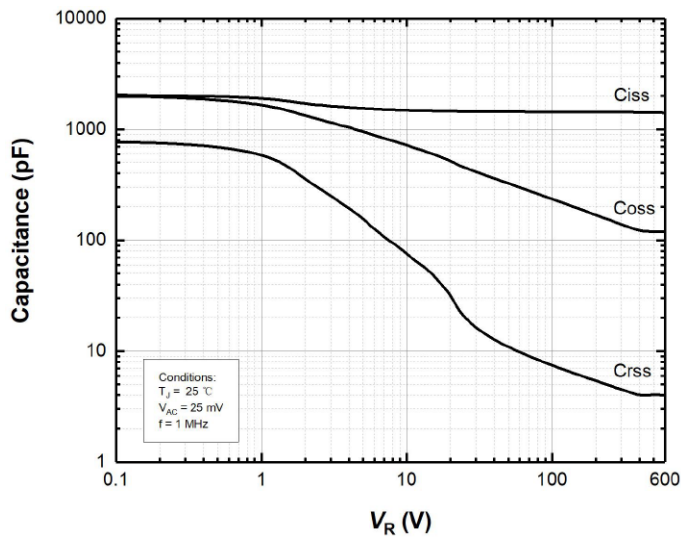


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)

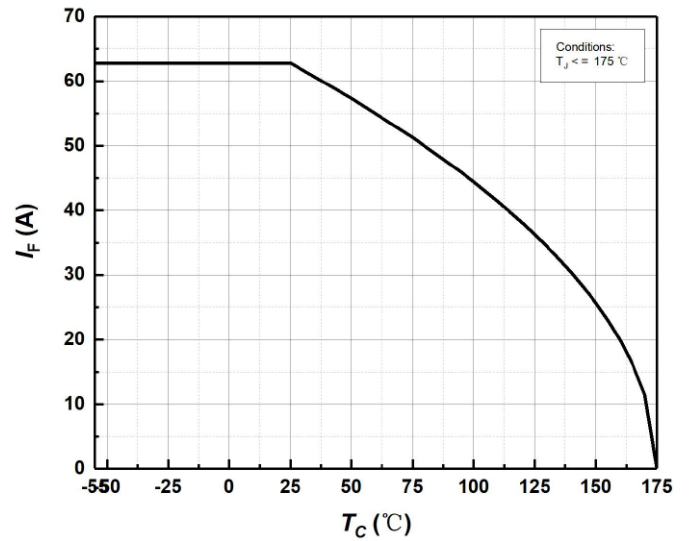


Figure 14. Continuous Drain Current Derating vs Case Temperature

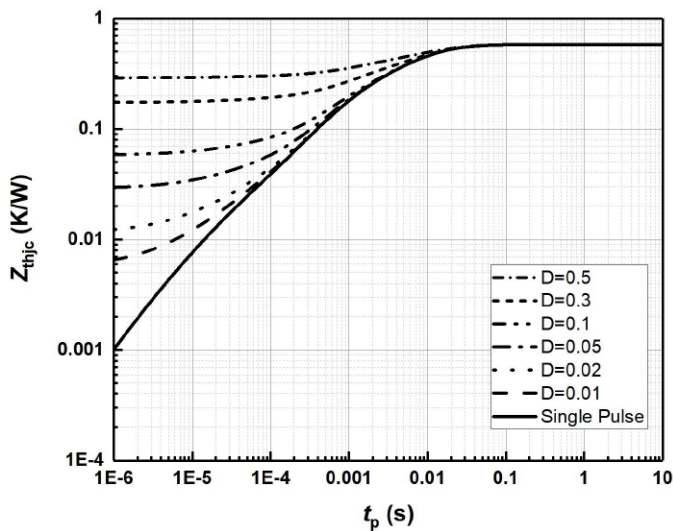


Figure 15. Transient Thermal Impedance (Junction – Case)

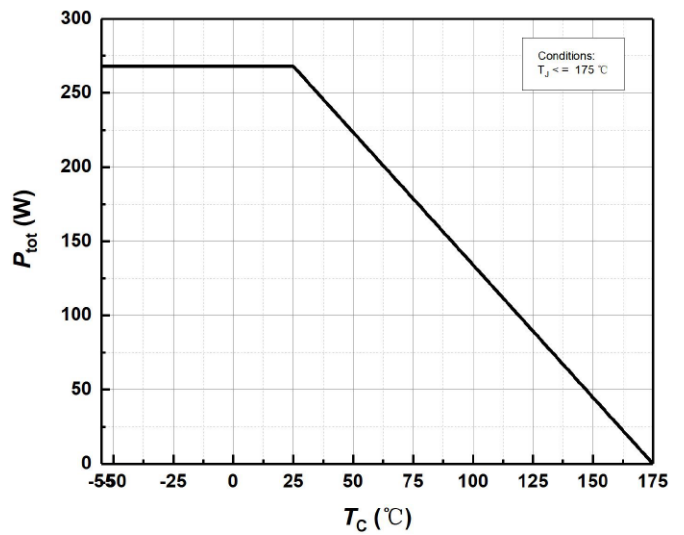


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

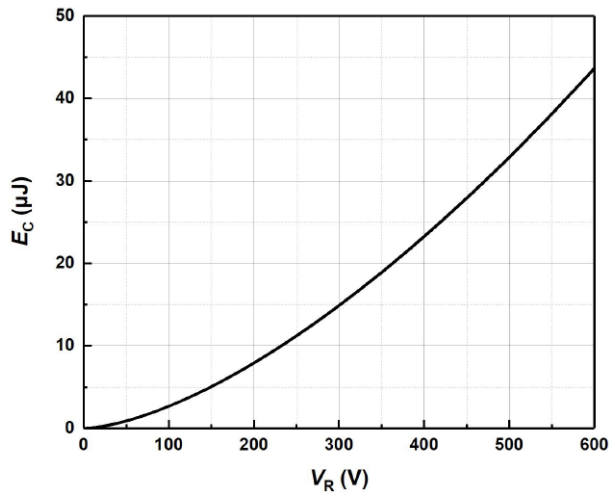


Figure 17. Output Capacitor Stored Energy

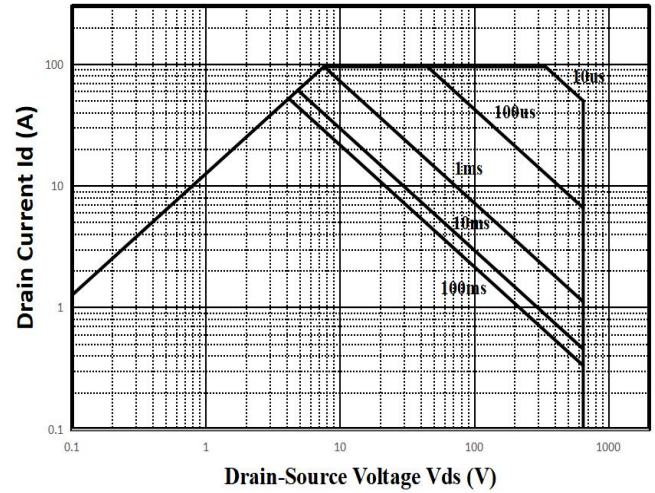


Figure 18. Safe Operating Area

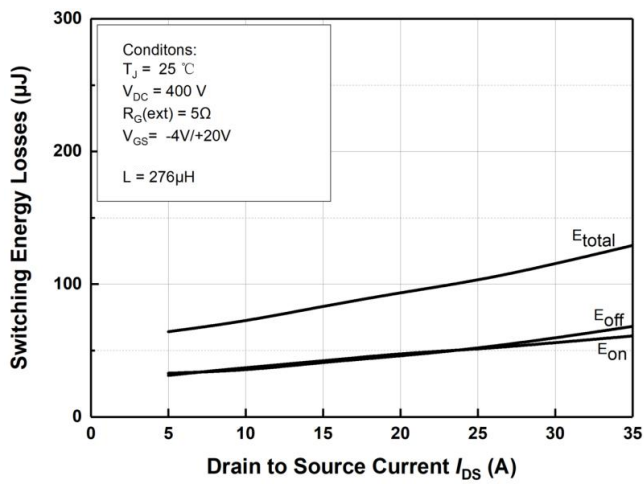


Figure 19. Clamped Inductive Switching Energy vs. Drain Current($V_{DD} = 400\text{V}$)

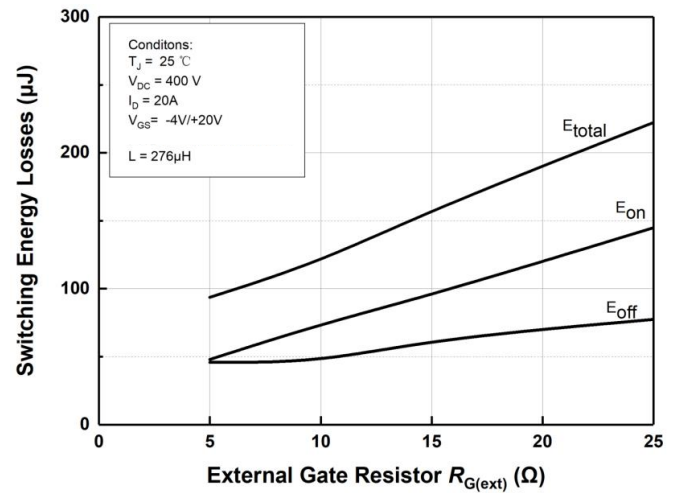


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

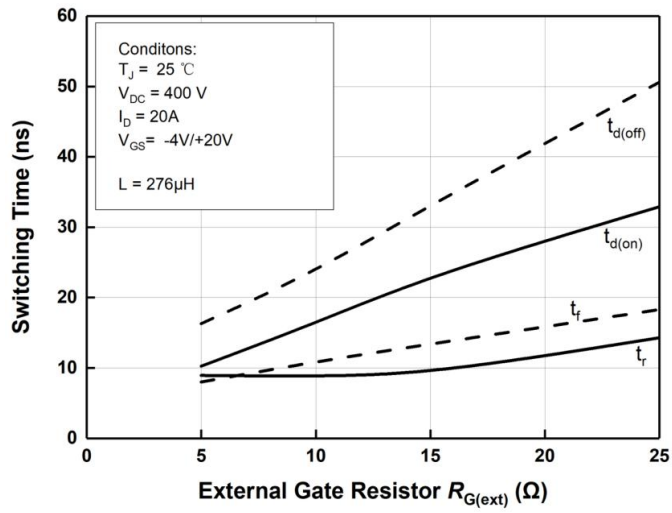
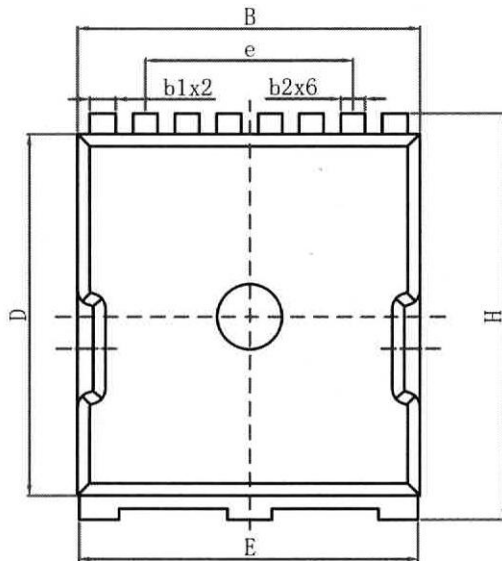


Figure 21. Switching Times vs. $R_{G(ext)}$



Package Dimensions

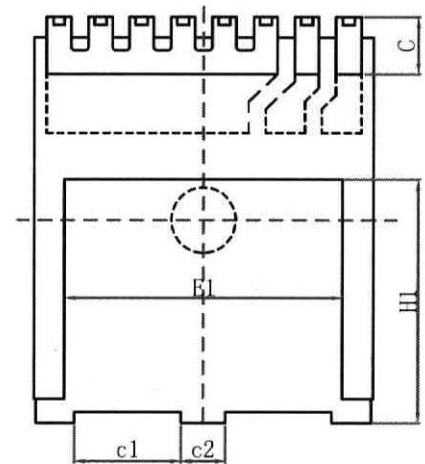
Package TOLLS



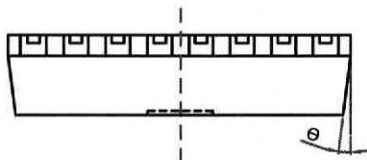
TOP VIEW



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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