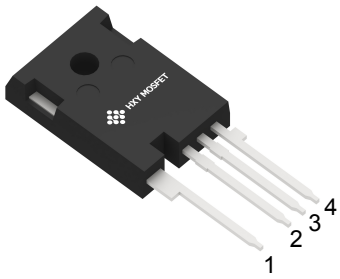
IPZA60R045P7XKSA1

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



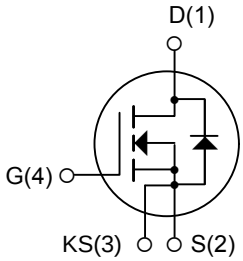
TO-247H-4L

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
IPZA60R045P7XKSA1	TO-247H-4L	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	55	A	Fig. 14
		V_{GS} = 18V, T_C = 100°C	39		
$I_{D,pulse}$	Pulsed Drain Current	Pulse with t_p limited by T_{jmax}	112	A	
P_D	Power Dissipation	T_C = 25°C, Tj = 175°C	208	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		0.72		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 =5mA		2.7		V	Fig. 9
		V_{GS} = V_{DS}, I_D =5mA, T_j=175°C		1.8			
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 =20A		45	58	mΩ	Fig. 3, 4 , 5
		V_{GS} = 18V, I_D =20A, T_j = 175°C		60			
g_{fs}	Transconductance	V_{DS} =18V, I_D =20A		18		S	Fig. 6
		V_{DS} = 18V, I_D =20A, T_j = 175°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		15		nC	Fig. 10
Q_{GD}	Gate to Drain Charge			21			
Q_G	Total Gate Charge			47			

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		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 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°C		3.1			
I_S	Continuous Diode Forward Current	V_{GS} = -4V, T_C = 25°C		46		A	
$I_{S,\ pulse}$	Diode pulse Current	V_{GS} = -4V, pulse width t_p limited by T_{jmax}		112		A	
t_{rr}	Reverse Recovery Time	V_{GS} = -4V, I_{SD} = 20 A , V_R = 400V dif/dt = 2800A/us		14		nS	
Q_{rr}	Reverse Recovery Charge			150		nC	
I_{rrm}	Peak Reverse Recovery Current			16		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= 20 A, $R_{G(iext)}$ = 5Ω L = 294μH		2		nS	Fig.21
t_r	Rise Time			15		nS	
$t_{d(off)}$	Turn-Off Delay Time			17		nS	
t_f	Fall Time			6		nS	
E_{on}	Turn-On Energy			43		μJ	Fig.19
E_{off}	Turn-Off Energy			21		μJ	
E_{tot}	Total switching energy			64		μJ	

Typical Performance

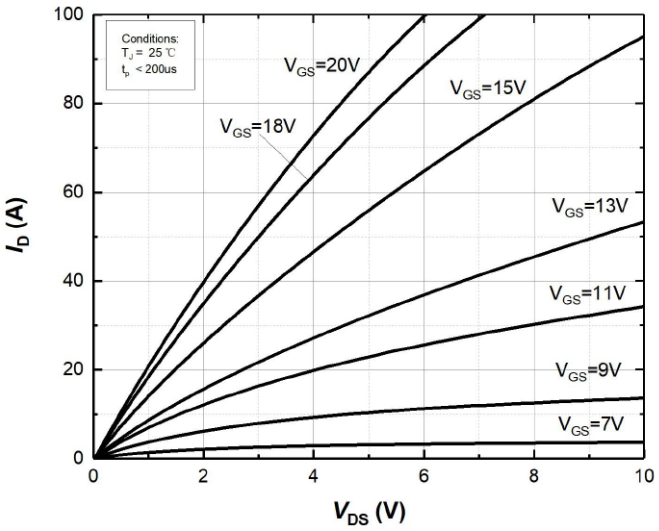


Figure 1. Output characteristics at Tj=25°C

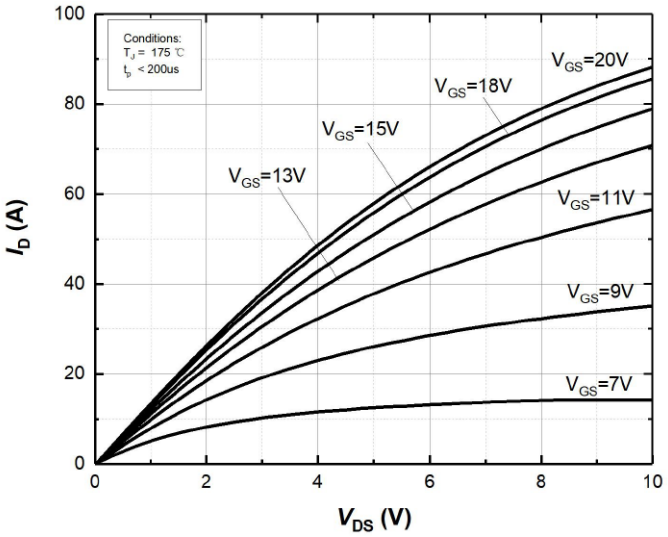


Figure 2. Output characteristics at Tj=175°C

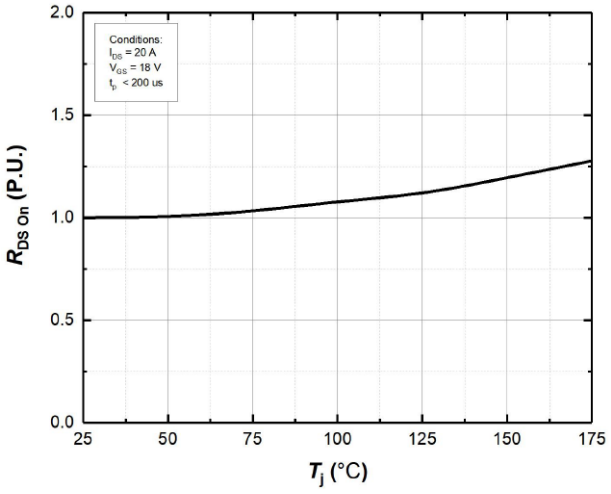


Figure 3. Normalized On-Resistance vs. Temperature

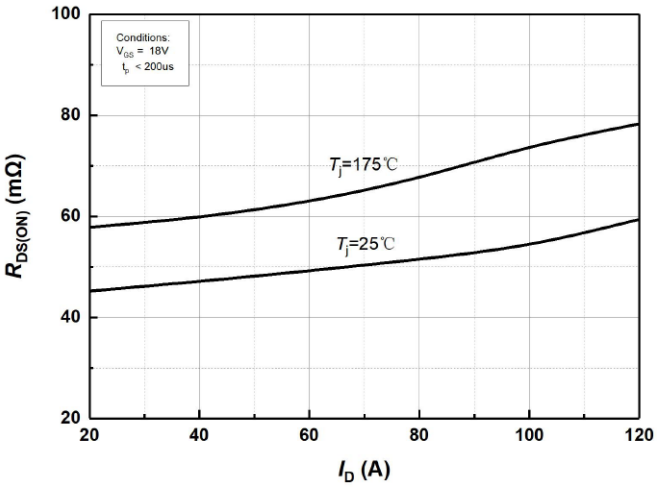


Figure 4. On-Resistance vs. Drain current for Various Temperature

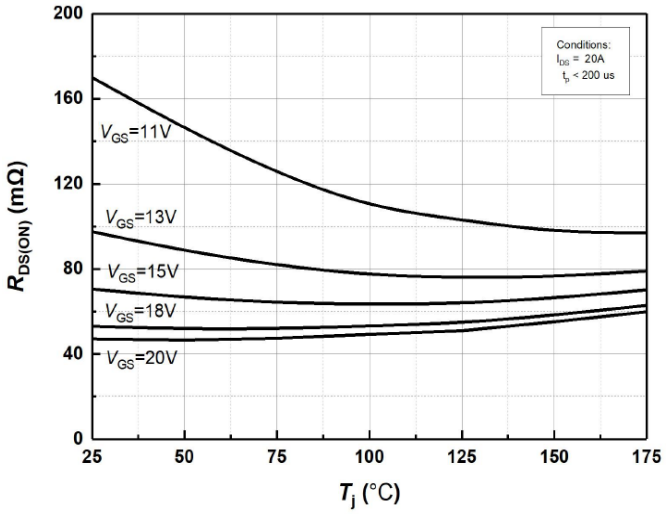


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

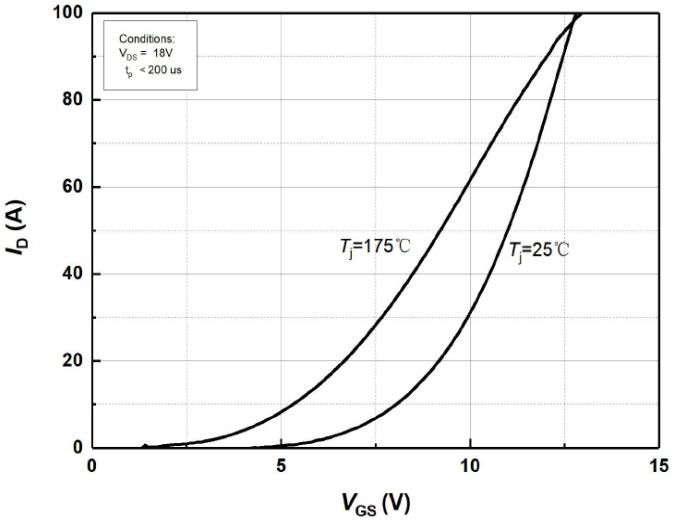


Figure 6. Transfer Characteristics for Various Junction Temperatures

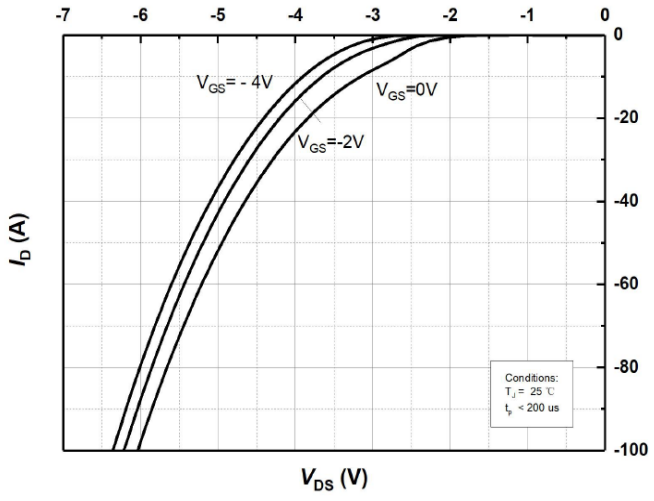


Figure 7. Body Diode Characteristics at Tj=25°C

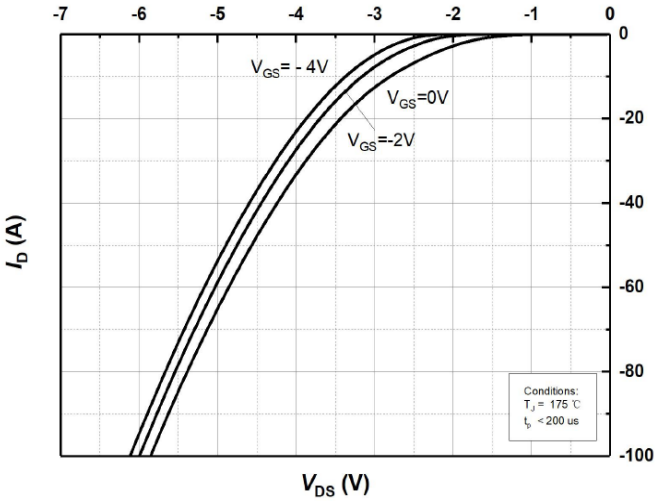


Figure 8. Body Diode Characteristics at Tj=175°C

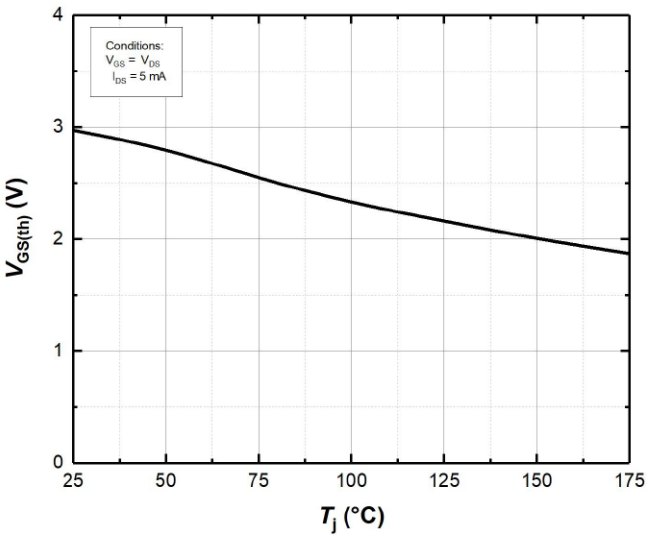


Figure 9. Threshold Voltage vs. Temperature

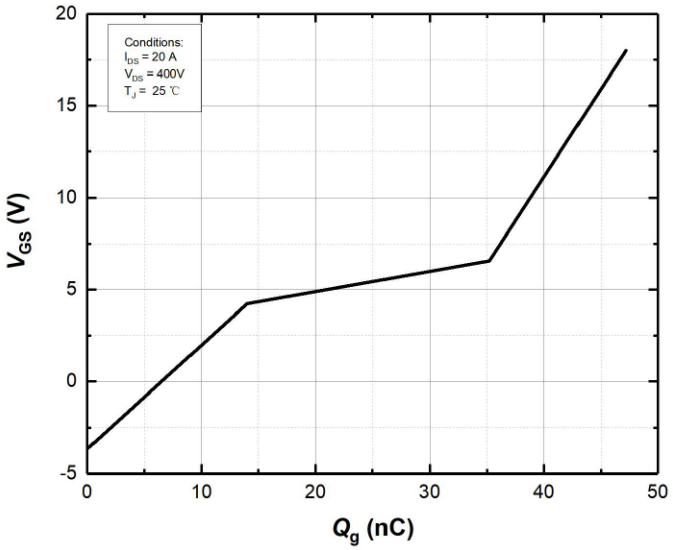


Figure 10 Gate Charge Characteristics

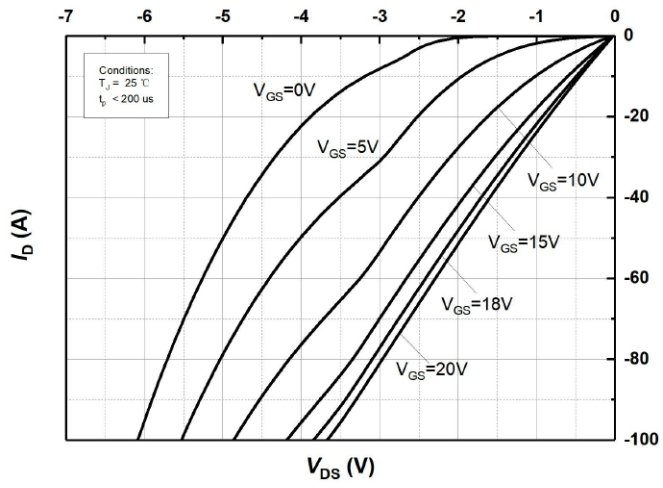


Figure 11. 3rd Quadrant Characteristic at Tj=25°C

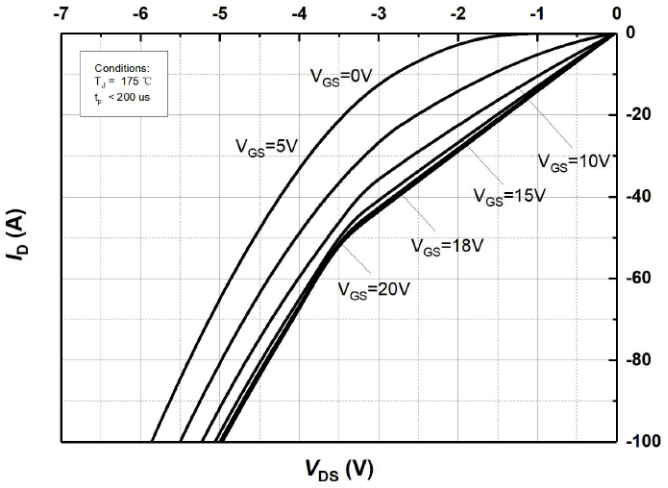


Figure 12. 3rd Quadrant Characteristic at Tj=175°C

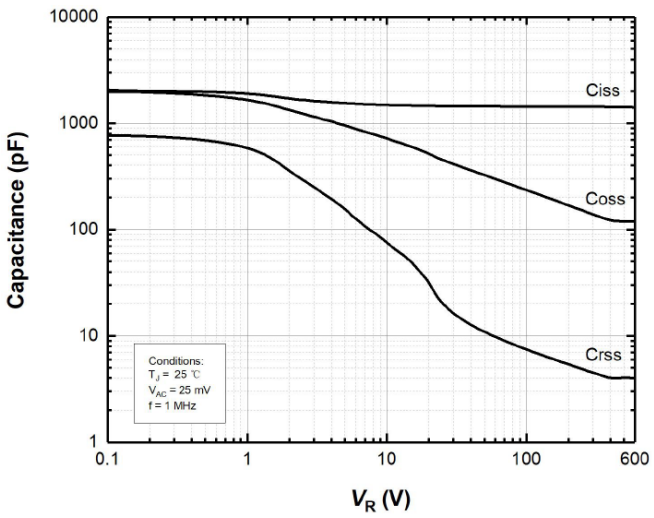


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)

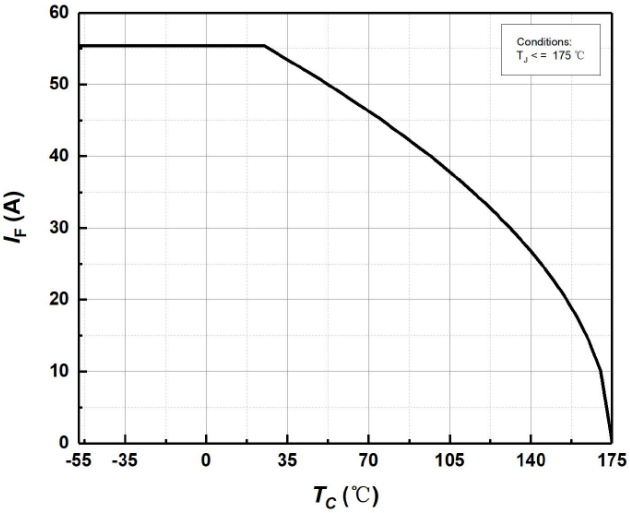


Figure 14. Continuous Drain Current Derating vs Case Temperature

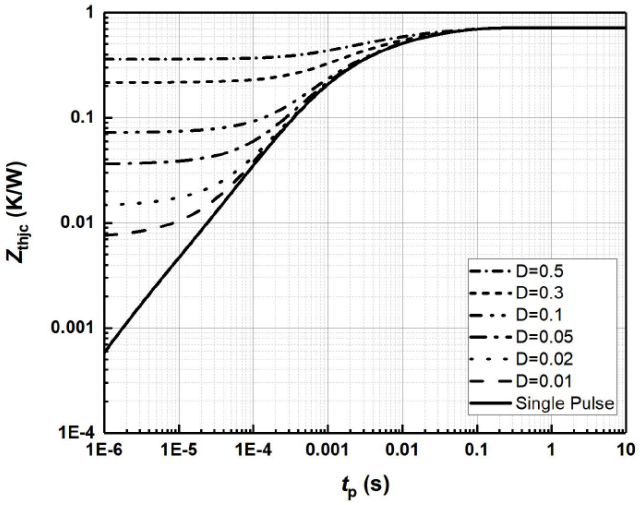


Figure 15.Transient Thermal Impedance (Junction – Case)

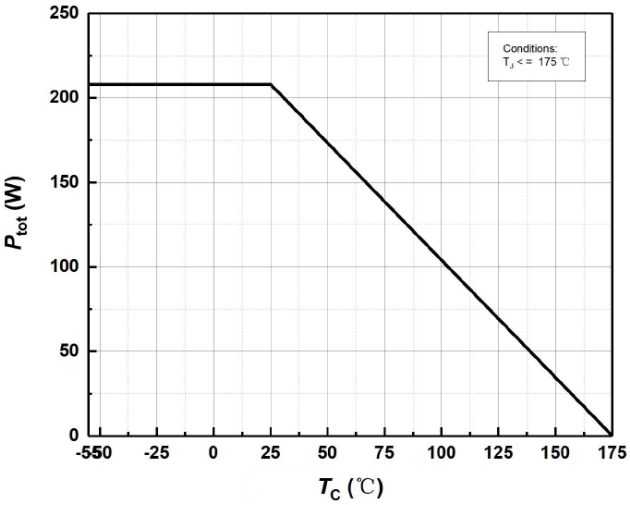


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

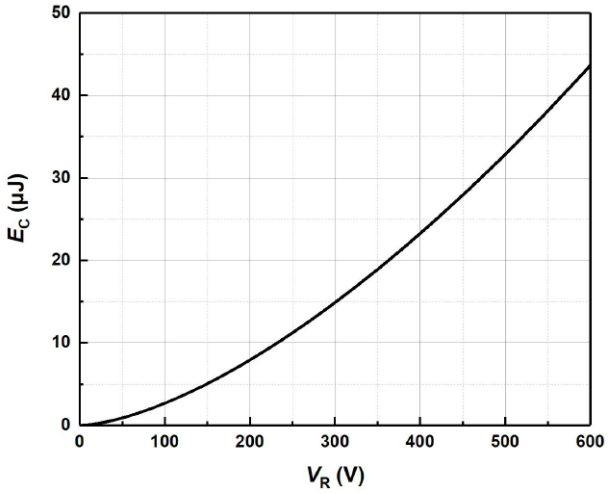


Figure 17. Output Capacitor Stored Energy

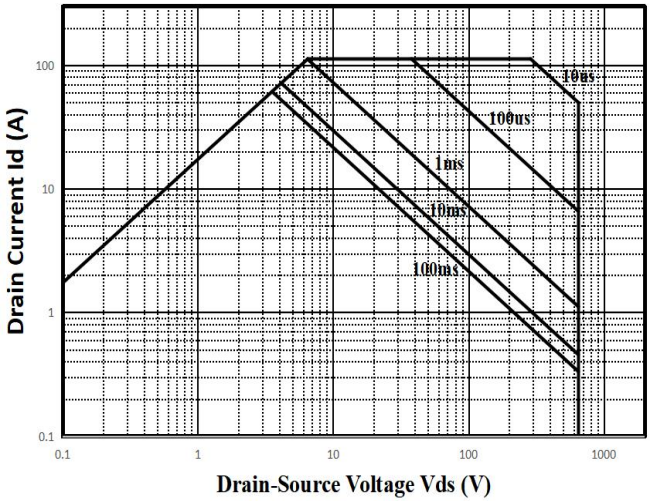


Figure 18. Safe Operating Area

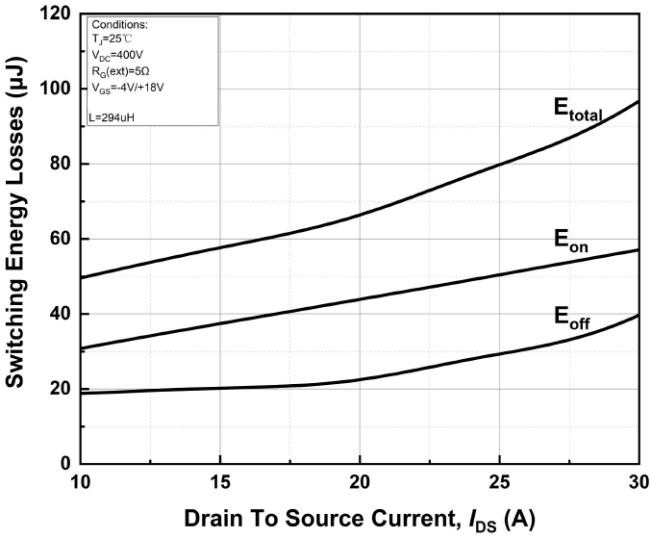


Figure 19. Clamped Inductive Switching Energy vs. Drain Current(V_{DD} = 400V)

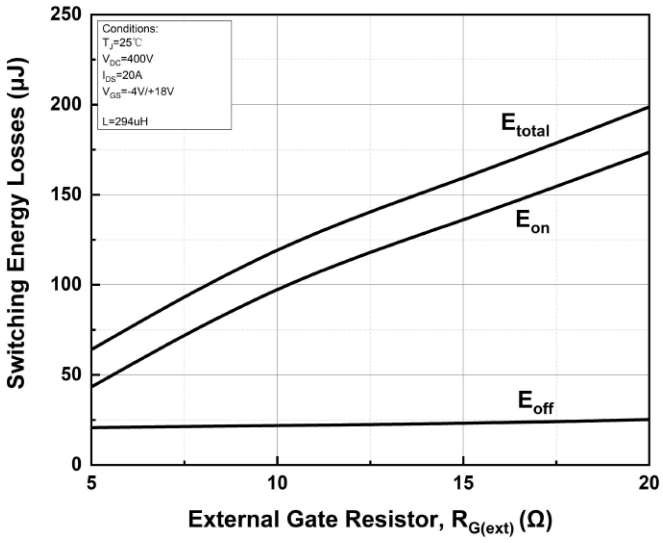


Figure 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

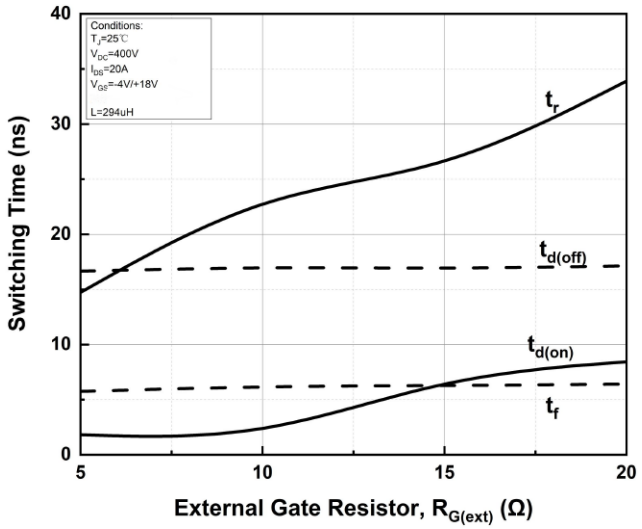
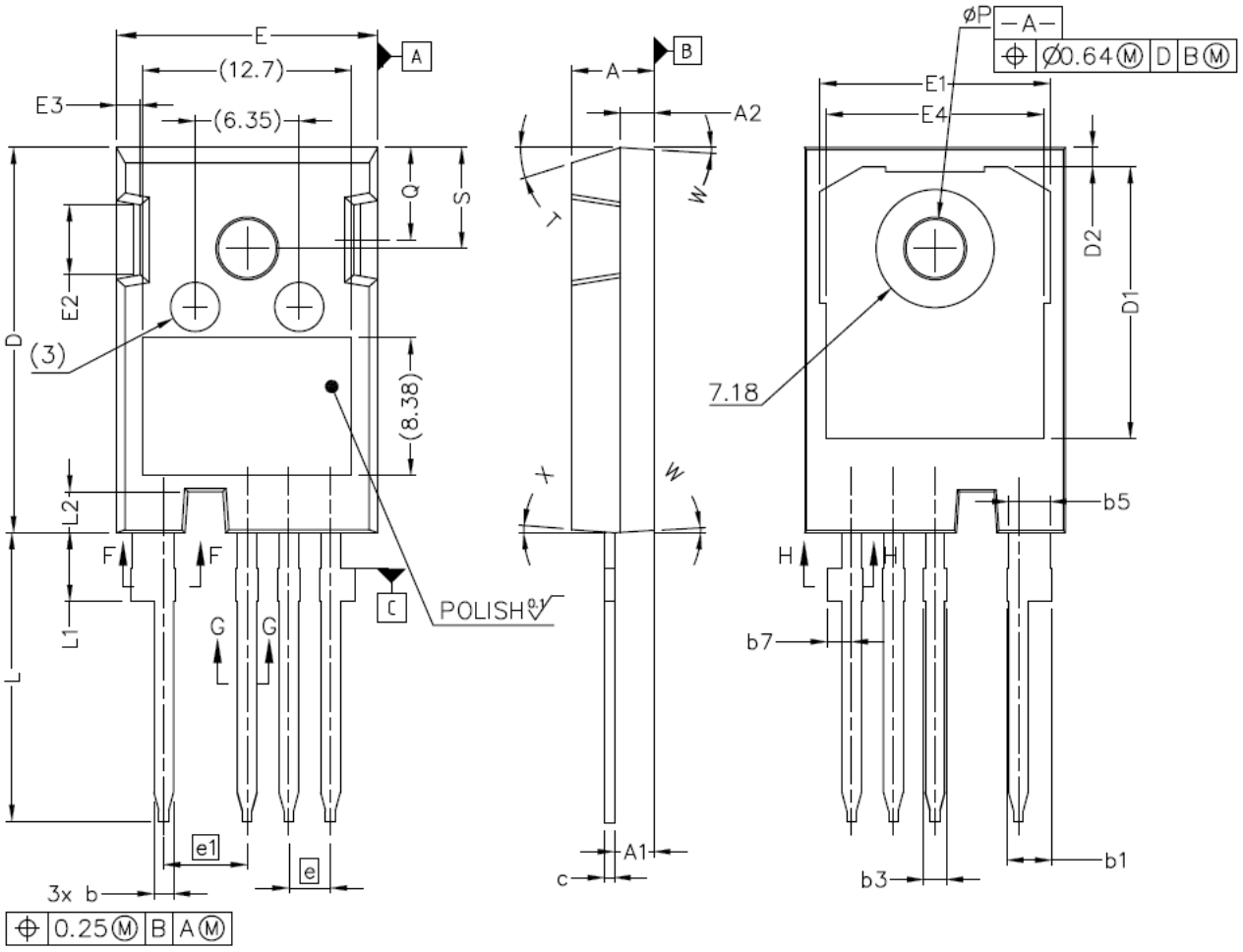
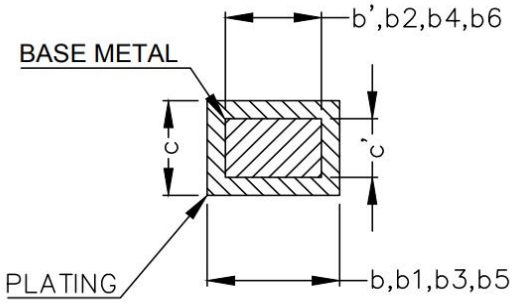


Figure 21. Switching Times vs. $R_{G(ext)}$

Package Dimensions

Package TO-247H-4L



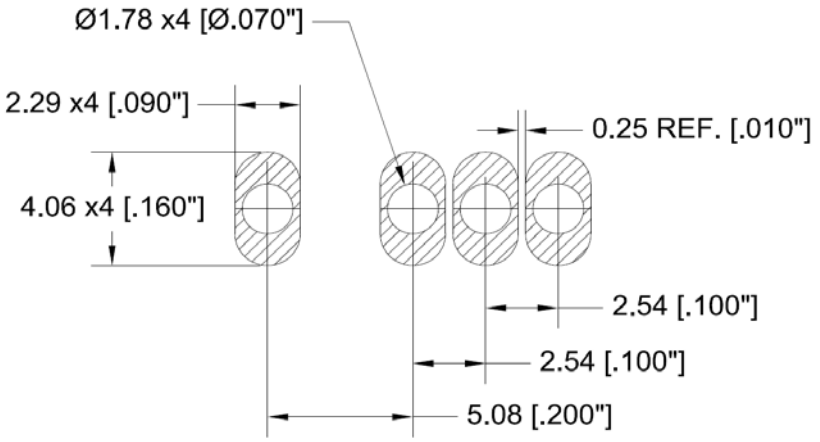


SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

NOTE ;
1. ALL METAL SURFACES: TIN PLATED, EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
4. 'N' IS THE NUMBER OF TERMINAL POSITIONS

SYM	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b`	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
b7	1.30	1.70
c`	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13

SYM	MILLIMETERS	
	MIN	MAX
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
N*	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
Ø P	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	



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