



Features

- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant

Benefits

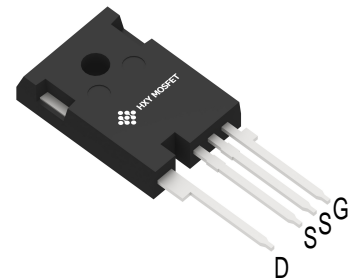
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

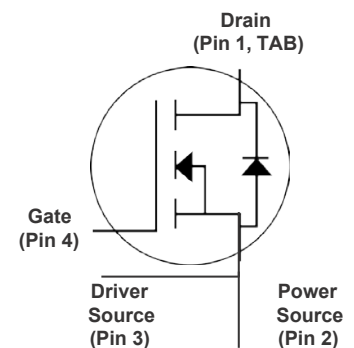
- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



Ordering Part Number	Package	Qty(PCS)
S1M040120H	TO-247H-4L	30



TO-247H-4L



Maximum Ratings ($T_c = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain - Source Voltage	1200	V	$V_{GS} = 0\text{ V}$, $I_D = 100\text{ }\mu\text{A}$
V_{GSmax}	Gate - Source Voltage (dynamic)	-10/+25	V	AC ($f > 1\text{ Hz}$)
V_{GSop}	Gate - Source Voltage (static)	-5/+20	V	Static
I_D	Continuous Drain Current	78	A	$V_{GS} = 15\text{ V}$, $T_c = 25^\circ\text{C}$
		57		$V_{GS} = 15\text{ V}$, $T_c = 100^\circ\text{C}$
$I_{D(pulse)}$	Pulsed Drain Current	TBD	A	Pulse width t_p limited by T_{jmax}
P_D	Power Dissipation	405	W	$T_c = 25^\circ\text{C}$, $T_j = 175^\circ\text{C}$
T_j, T_{stg}	Operating Junction and Storage Temperature	-40 to +175	$^\circ\text{C}$	
T_L	Solder Temperature	260	$^\circ\text{C}$	1.6mm (0.063") from case for 10s



Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200			V	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.5	4.0	V	$V_{DS} = V_{GS}, I_D = 10\text{ mA}$	Fig. 11
			1.5		V	$V_{DS} = V_{GS}, I_D = 10\text{ mA}, T_J = 175^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	μA	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	
I_{GSS}	Gate-Source Leakage Current		10	200	nA	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	
		-200	-10		nA	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	
$R_{DS(on)}$	Drain-Source On-State Resistance		40	50	m Ω	$V_{GS} = 20\text{ V}, I_D = 40\text{ A}$	Fig. 4, 5, 6
			59			$V_{GS} = 20\text{ V}, I_D = 40\text{ A}, T_J = 175^\circ\text{C}$	
g_{fs}	Transconductance		10.4		S	$V_{DS} = 20\text{ V}, I_{DS} = 40\text{ A}$	Fig. 7
			7.7			$V_{DS} = 20\text{ V}, I_{DS} = 40\text{ A}, T_J = 175^\circ\text{C}$	
C_{iss}	Input Capacitance		2101		pF	$V_{GS} = 0\text{ V}, V_{DS} = 1000\text{ V}$ $f = 100\text{ kHz}$ $V_{AC} = 25\text{ mV}$	Fig. 17, 18
C_{oss}	Output Capacitance		161				
C_{rss}	Reverse Transfer Capacitance		14				
E_{oss}	C_{oss} Stored Energy		90				Fig. 16
E_{ON}	Turn-On Switching Energy (SiC Diode FWD)		1100		μJ	$V_{DS} = 800\text{ V}, V_{GS} = -5\text{ V}/+20\text{ V}, I_D = 40\text{ A},$ $R_{G(ext)} = 2.5\text{ }\Omega, L = 100\text{ }\mu\text{H}, T_J = 175^\circ\text{C}$	Fig. 26
E_{OFF}	Turn Off Switching Energy (SiC Diode FWD)		900				
$t_{d(on)}$	Turn-On Delay Time		22		ns	$V_{DD} = 800\text{ V}, V_{GS} = -5\text{ V}/20\text{ V}$ $R_{G(ext)} = 2.5\text{ }\Omega, I_D = 40\text{ A}$ Timing relative to V_{DS}	Fig. 27
t_r	Rise Time		49				
$t_{d(off)}$	Turn-Off Delay Time		71				
t_f	Fall Time		23				
$R_{G(int)}$	Internal Gate Resistance		1.7		Ω	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	
Q_{gs}	Gate to Source Charge		33		nC	$V_{DS} = 800\text{ V}, V_{GS} = -5\text{ V}/20\text{ V}$ $I_D = 40\text{ A}$	Fig. 12
Q_{gd}	Gate to Drain Charge		51				
Q_g	Total Gate Charge		131				

Reverse Diode Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.1		V	$V_{GS} = -5\text{ V}, I_{SD} = 20\text{ A}, T_J = 25^\circ\text{C}$	Fig. 8, 9, 10
		3.5		V	$V_{GS} = -5\text{ V}, I_{SD} = 20\text{ A}, T_J = 175^\circ\text{C}$	
I_S	Continuous Diode Forward Current		83	A	$V_{GS} = -4\text{ V}, T_C = 25^\circ\text{C}$	Note 1
$I_{S, pulse}$	Diode pulse Current		TBD	A	$V_{GS} = -4\text{ V},$ pulse width t_p limited by T_{Jmax}	Note 1
t_{rr}	Reverse Recover time	56		ns	$V_{GS} = -5\text{ V}, I_{SD} = 40\text{ A}, V_R = 800\text{ V}$ $\text{diff/dt} = 2250\text{ A}/\mu\text{s}, T_J = 175^\circ\text{C}$	Note 1
Q_{rr}	Reverse Recovery Charge	508		nC		
I_{rrm}	Peak Reverse Recovery Current	18		A		

Thermal Characteristics

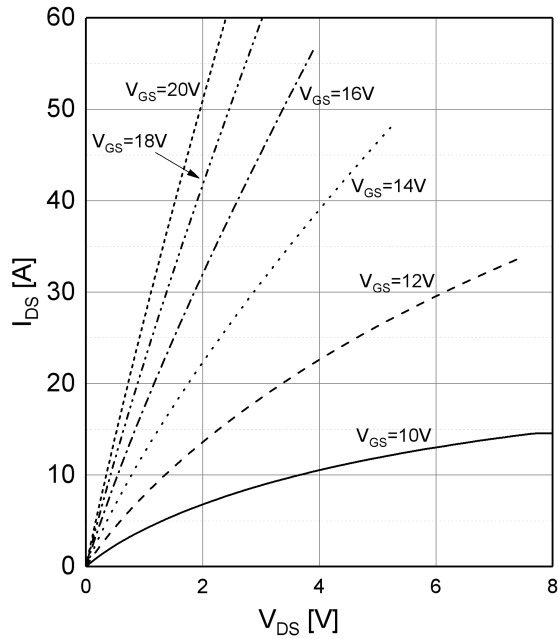
Symbol	Parameter	Typ.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.25	$^\circ\text{C/W}$		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40			



Typical Characteristics

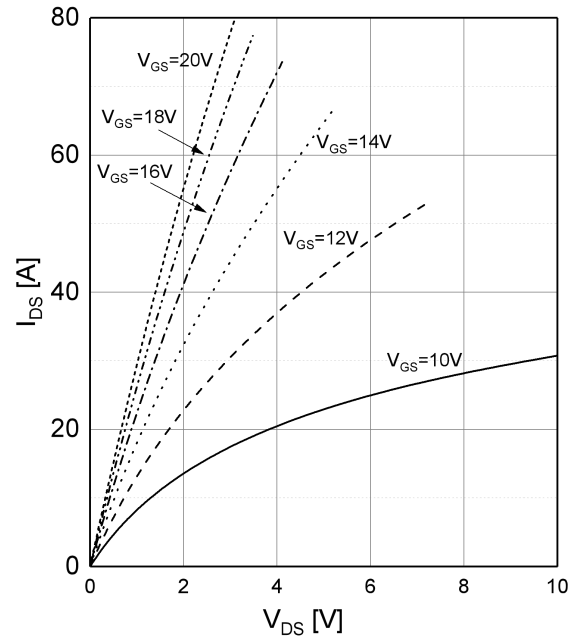
Output characteristics

$$I_{DS}=f(V_{DS}), T_J=-55^{\circ}\text{C}$$



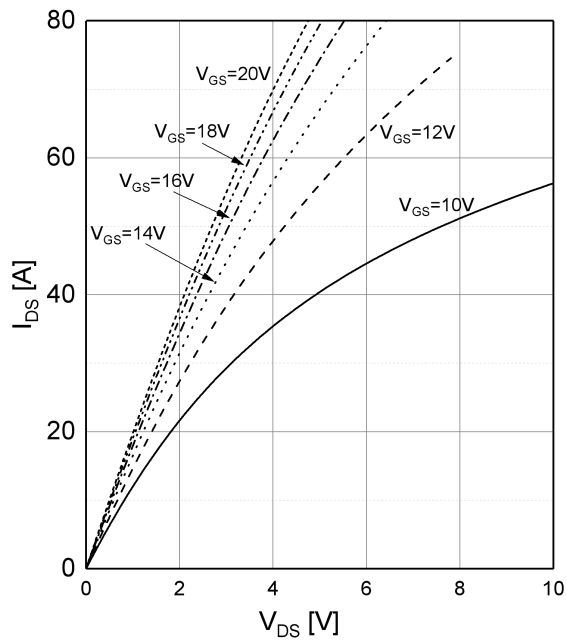
Output characteristics

$$I_{DS}=f(V_{DS}), T_J=25^{\circ}\text{C}$$



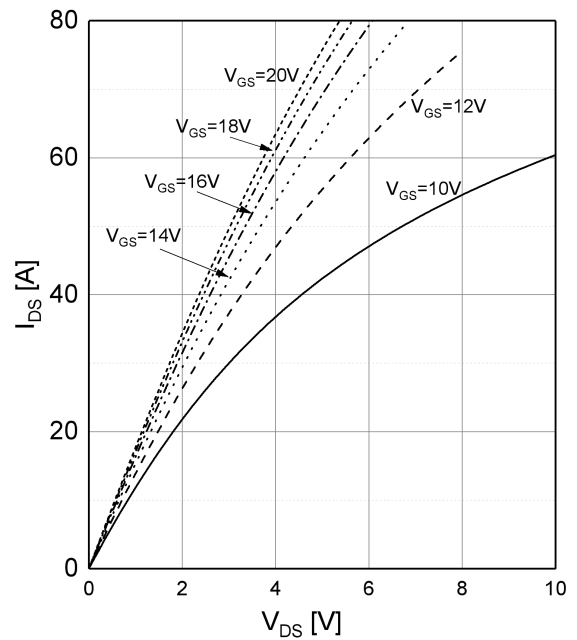
Output characteristics

$$I_{DS}=f(V_{DS}), T_J=150^{\circ}\text{C}$$



Output characteristics

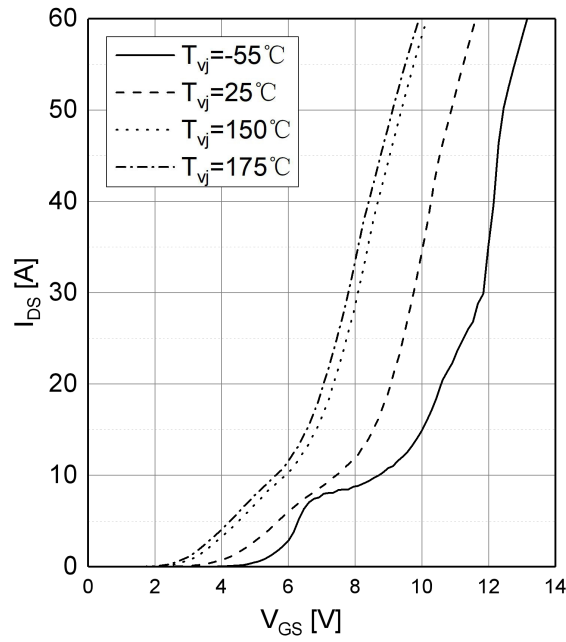
$$I_{DS}=f(V_{DS}), T_J=175^{\circ}\text{C}$$





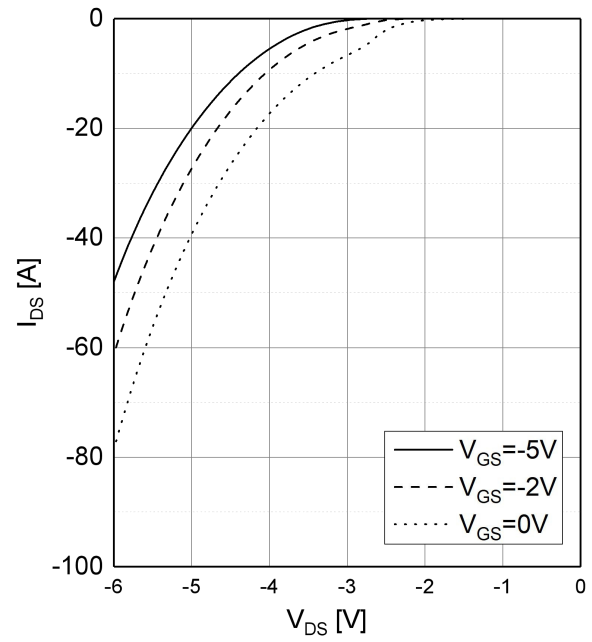
Transfer Characteristics

$$I_{DS}=f(V_{GS}), V_{DS}=20V$$



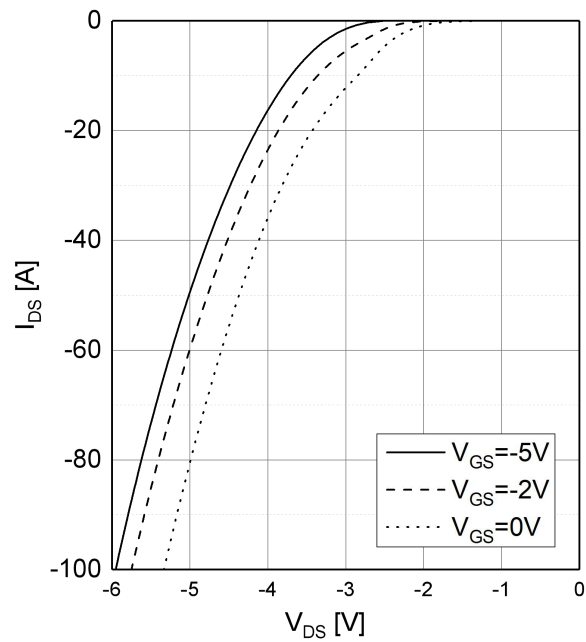
Body Diode Characteristics

$$I_{DS}=f(V_{DS}), T_J=-55^{\circ}C$$



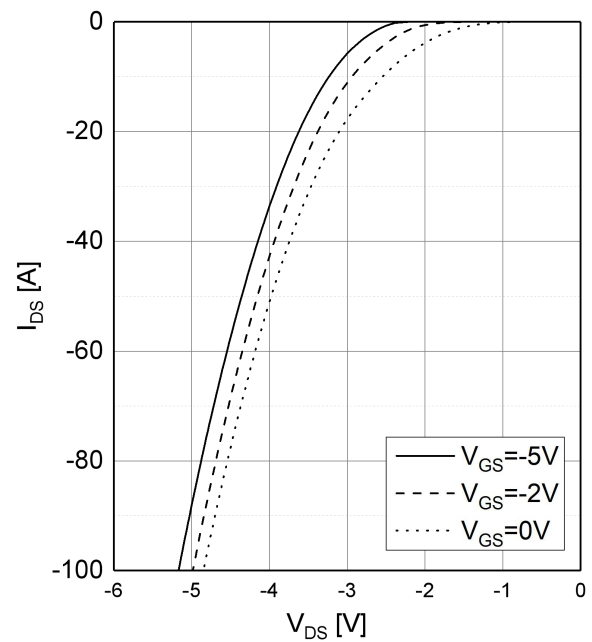
Body Diode Characteristics

$$I_{DS}=f(V_{DS}), T_J=25^{\circ}C$$



Body Diode Characteristics

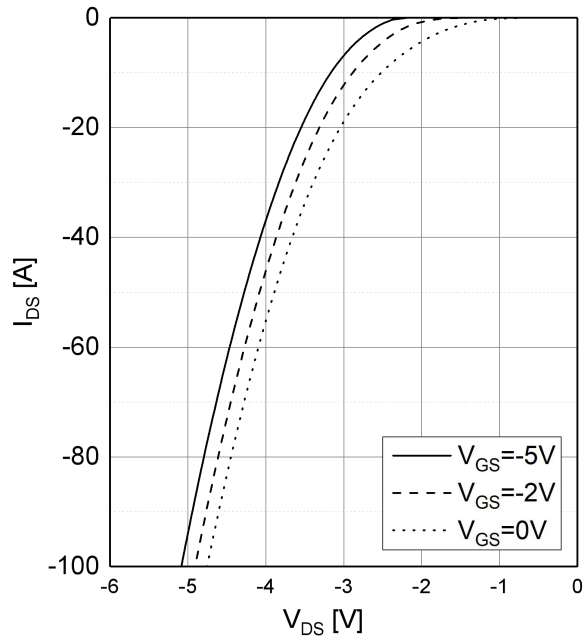
$$I_{DS}=f(V_{DS}), T_J=150^{\circ}C$$





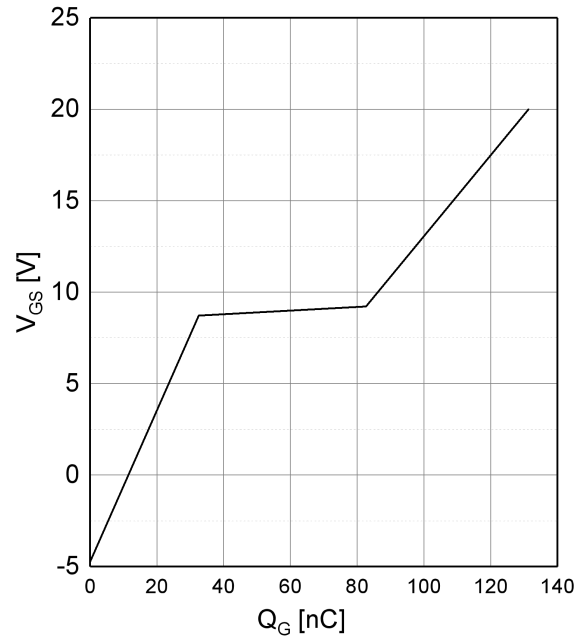
Body Diode Characteristics

$$I_{DS} = f(V_{DS}), T_J = 175^\circ\text{C}$$



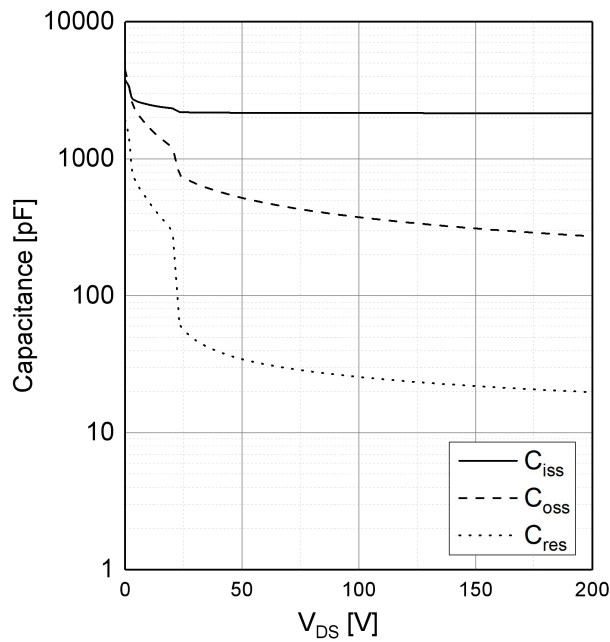
Gate Charge Characteristics

$$V_{GS} = f(Q_G), I_{DS} = 40\text{A}, V_{DS} = 800\text{V}, T_J = 25^\circ\text{C}$$



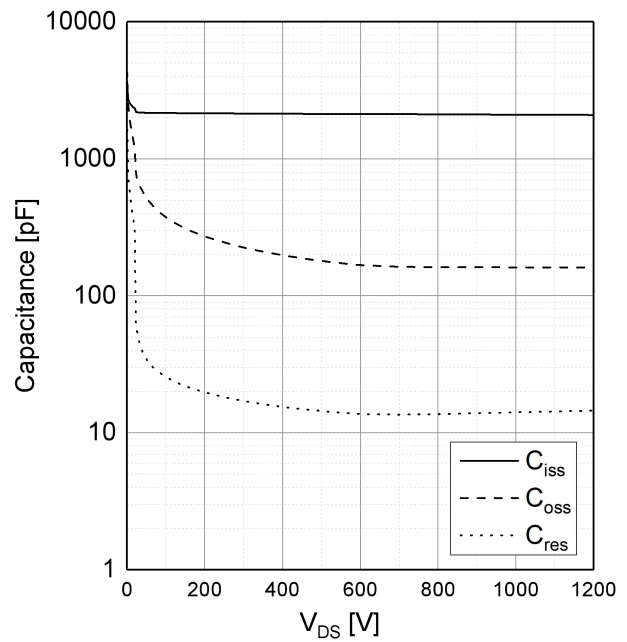
Capacitances vs Drain-Source Voltage (0-200V)

$$C = f(V_{DS}), T_J = 25^\circ\text{C}, V_{AC} = 25\text{mV}, f = 100\text{KHz}$$



Capacitances vs Drain-Source Voltage (0-1200V)

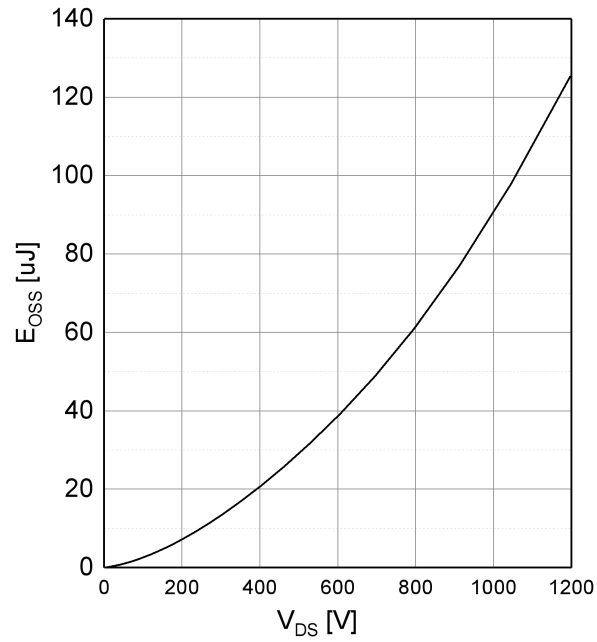
$$C = f(V_{DS}), T_J = 25^\circ\text{C}, V_{AC} = 25\text{mV}, f = 100\text{KHz}$$





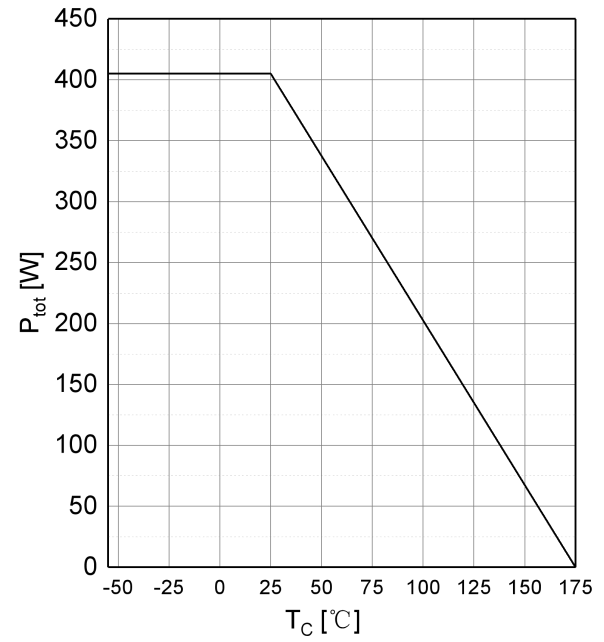
Output Capacitor Stored Energy

$$E_{OSS} = f(V_{DS}), T_J = 25^\circ\text{C}$$



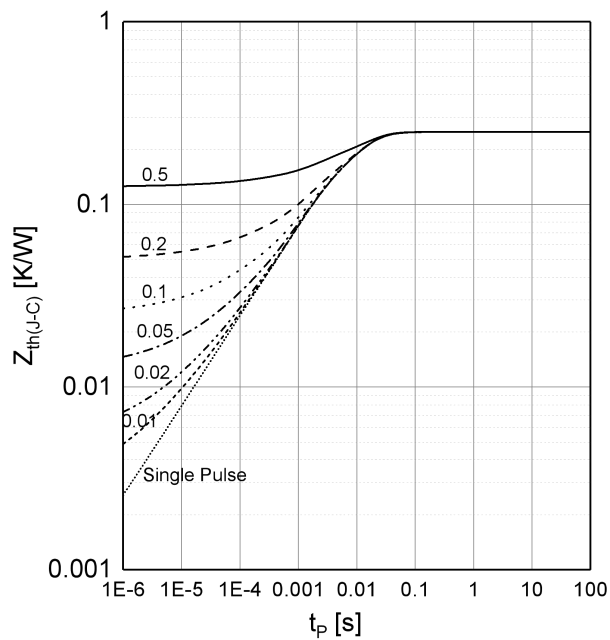
Maximum Power Dissipation Derating

$$P_{tot} = f(T_C), T_J \leq 175^\circ\text{C}$$



Transient Thermal Impedance (Junction to Case)

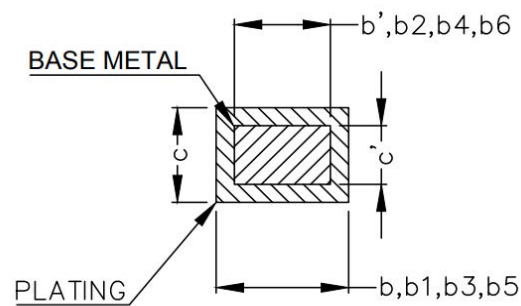
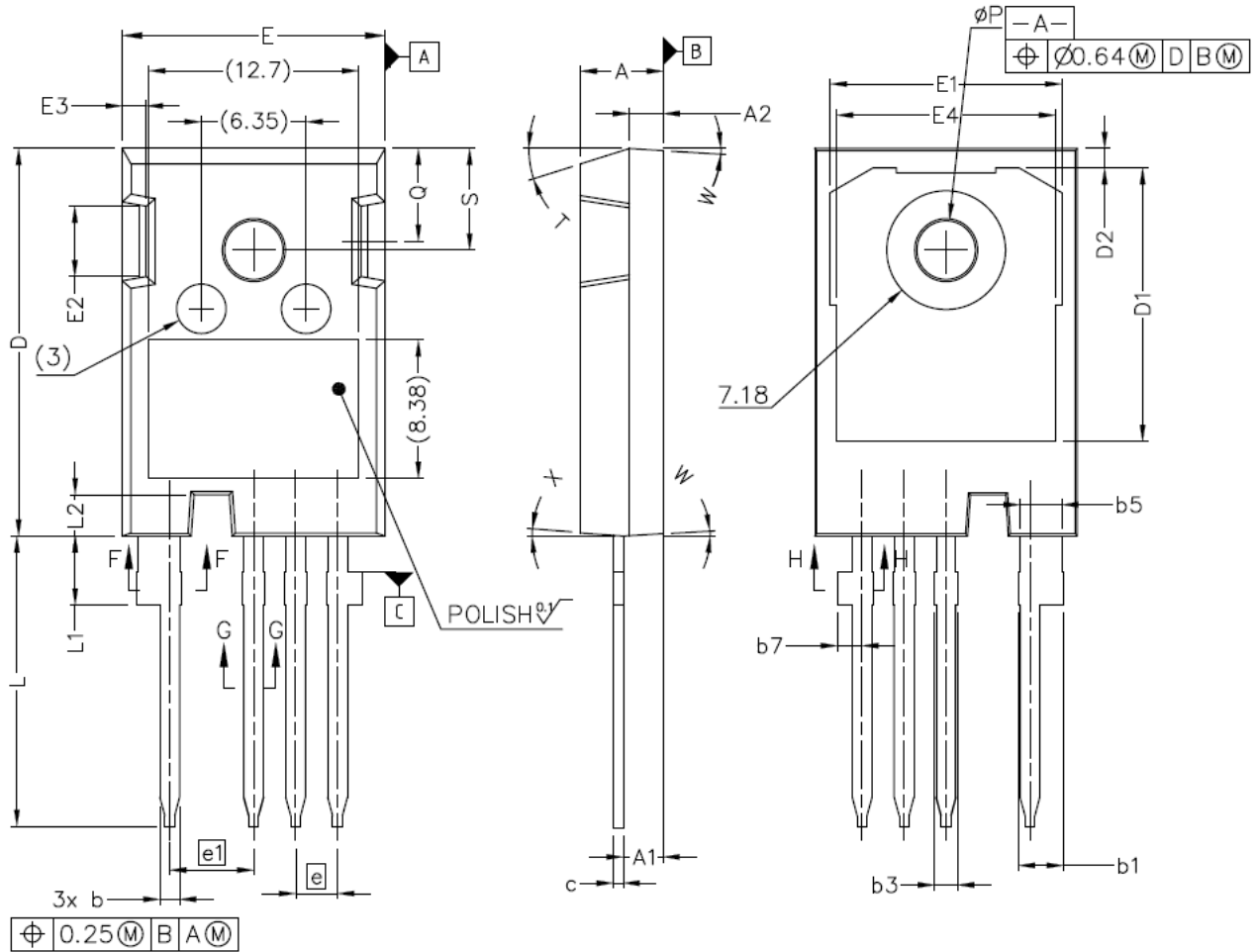
$$Z_{th(J-C)} = f(t), T_C = 25^\circ\text{C}$$





Package Dimensions

Package TO-247H-4L



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



Package Dimensions

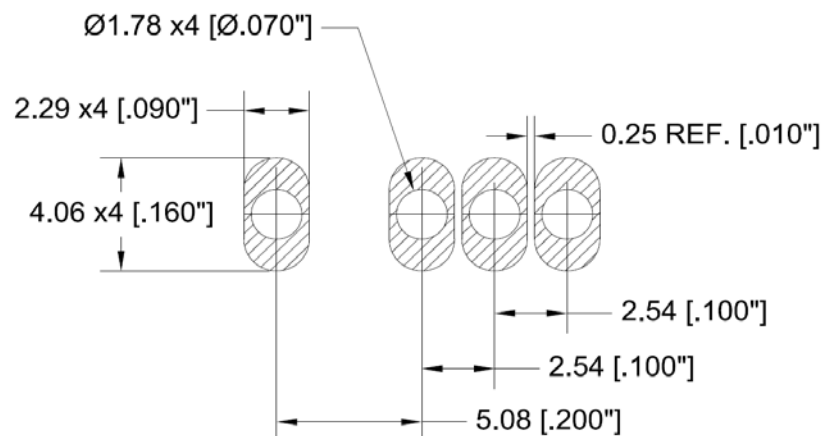
Package TO-247H-4L

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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