HC2M0040120K

SiC Power MOSFET N-Channel Enhancement Mode

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

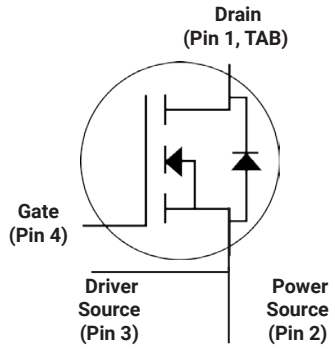
Benefits

- 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

TO247-4L
Package



Ordering Part Number	Package	Marking
HC2M0040120K	TO247-4L	HC2M0040120K

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

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain - Source Voltage	1200	V	V_{GS} = 0 V, I_D = 100 µA
V_{GSmax}	Gate - Source Voltage (dynamic)	-10/+25	V	AC (f >1 Hz)
V_{GSop}	Gate - Source Voltage (static)	-5/+20	V	Static
I_D	Continuous Drain Current	78	A	V_{GS} = 15 V, T_C = 25˚C
		57		V_{GS} = 15 V, T_C = 100˚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˚C, T_J = 175 ˚C
T_J , T_{stg}	Operating Junction and Storage Temperature	-40 to +175	˚C	
T_L	Solder Temperature	260	˚C	1.6mm (0.063”) from case for 10s

Electrical Characteristics (T_C = 25˚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 V, I_D = 100 µA	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.5	4.0	V	V_{DS} = V_{GS}, I_D = 10 mA	Fig. 11
			1.5		V	V_{DS} = V_{GS}, I_D = 10 mA, T_J = 175ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	µA	V_{DS} = 1200 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current		10	200	nA	V_{GS} = 20 V, V_{DS} = 0 V	
		-200	-10		nA	V_{GS} = -10 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance		40	50	mΩ	V_{GS} = 20 V, I_D = 40 A	Fig. 4, 5, 6
			59			V_{GS} = 20 V, I_D = 40 A, T_J = 175ºC	
g_{fs}	Transconductance		10.4		S	V_{DS}= 20 V, I_{DS}= 40 A	Fig. 7
			7.7			V_{DS}= 20 V, I_{DS}= 40 A, T_J = 175ºC	
C_{iss}	Input Capacitance		2101		pF	V_{GS} = 0 V, V_{DS} = 1000 V f = 100 kHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		161				
C_{rss}	Reverse Transfer Capacitance		14				
E_{oss}	C_{oss} Stored Energy		90		µJ		Fig. 16
E_{ON}	Turn-On Switching Energy (SiC Diode FWD)		1100		µJ	V_{DS} = 800 V, V_{GS} = -5 V/+20 V, I_D = 40 A, $R_{G(ext)}$ = 2.5Ω, L= 100 µH, Tj = 175ºC	Fig. 26
E_{OFF}	Turn Off Switching Energy (SiC Diode FWD)		900				
$t_{d(on)}$	Turn-On Delay Time		22		ns	V_{DD} = 800 V, V_{GS} = -5 V/20 V $R_{G(ext)}$ = 2.5 Ω, I_D = 40 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 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		33		nC	V_{DS} = 800 V, V_{GS} = -5 V/20 V I_D = 40 A	Fig. 12
Q_{gd}	Gate to Drain Charge		51				
Q_g	Total Gate Charge		131				

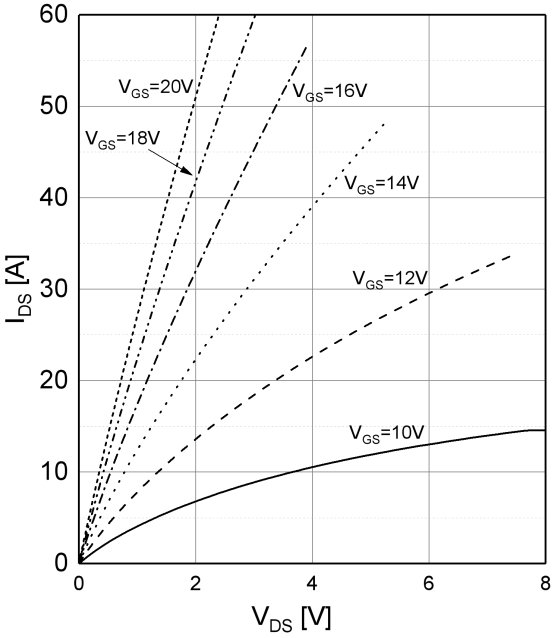
Reverse Diode Characteristics (T_C = 25˚C unless otherwise specified)

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

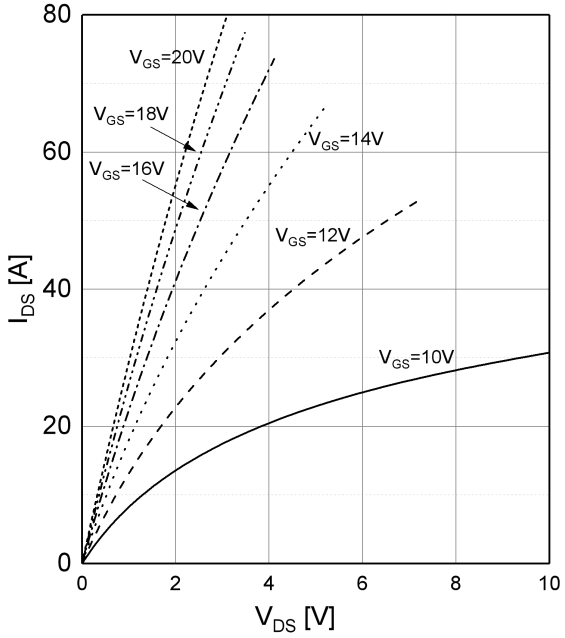
Thermal Characteristics

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

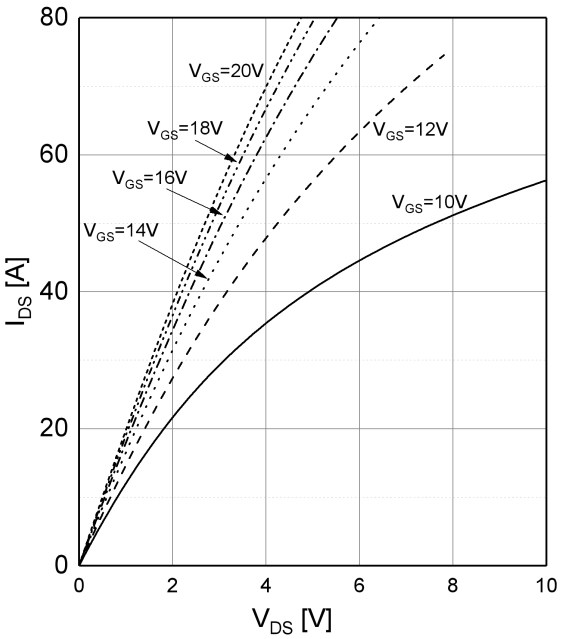
Output characteristics
$I_{DS}=f(V_{DS})$, T_J=-55℃



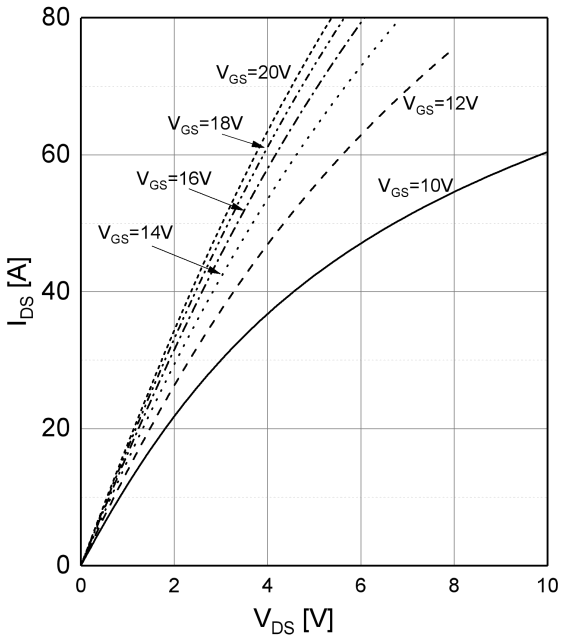
Output characteristics
$I_{DS}=f(V_{DS})$, T_J=25℃



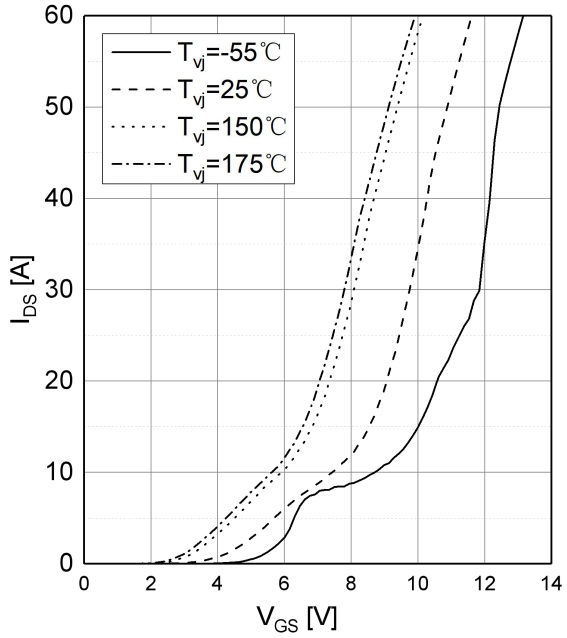
Output characteristics
$I_{DS}=f(V_{DS})$, T_J=150℃



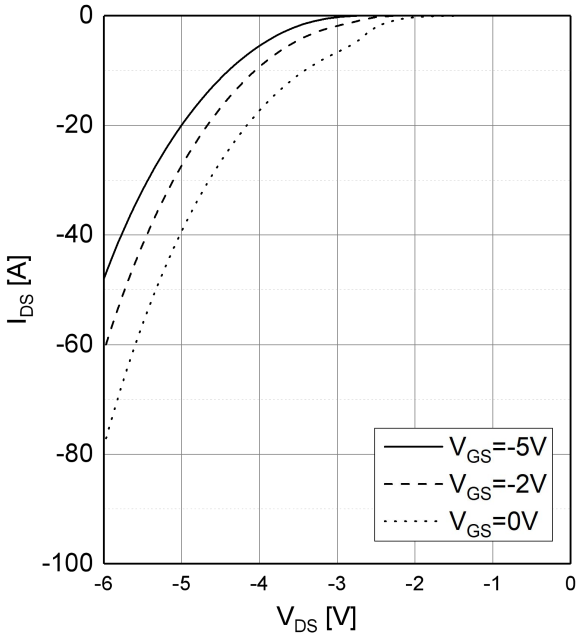
Output characteristics
$I_{DS}=f(V_{DS})$, T_J=175℃



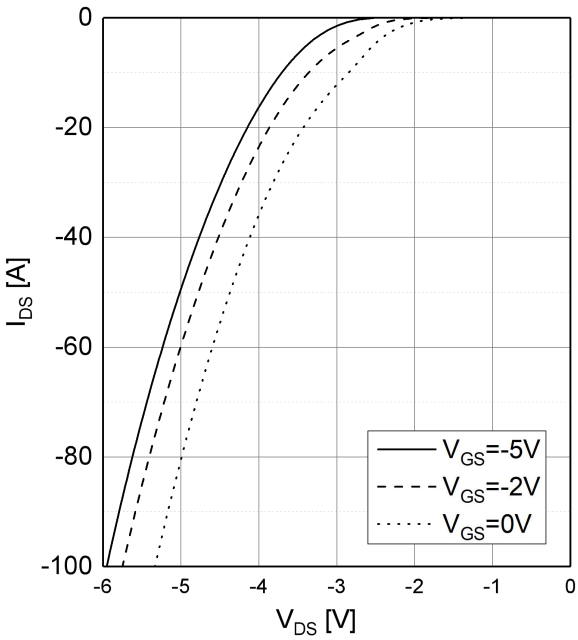
Transfer Characteristics
I_{DS}=f(V_{GS}), V_{DS}=20V



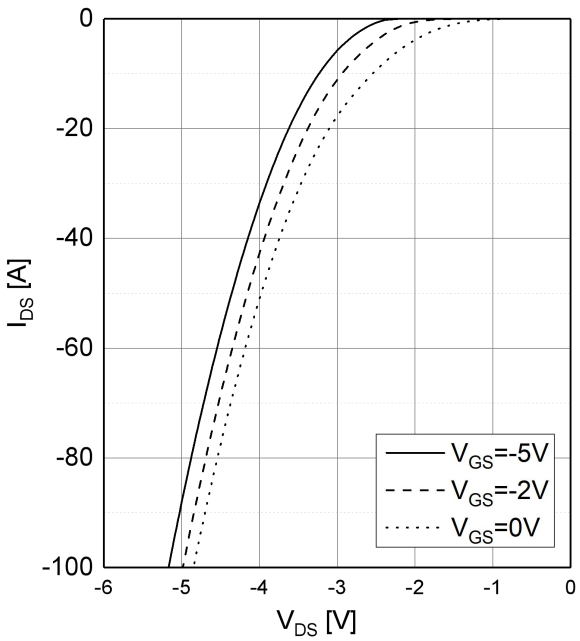
Body Diode Characteristics
I_{DS}=f(V_{DS}), T_J=-55℃



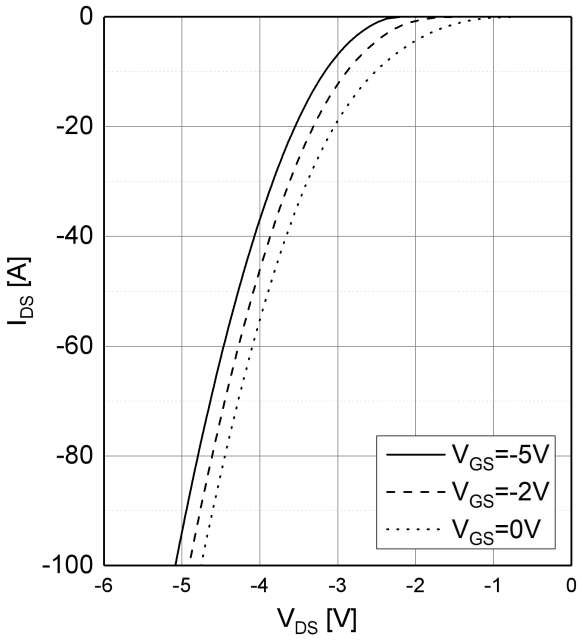
Body Diode Characteristics
I_{DS}=f(V_{DS}), T_J=25℃



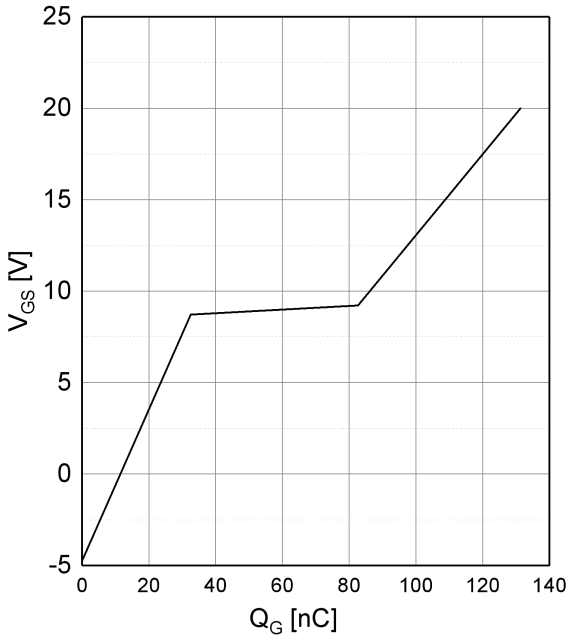
Body Diode Characteristics
I_{DS}=f(V_{DS}), T_J=150℃



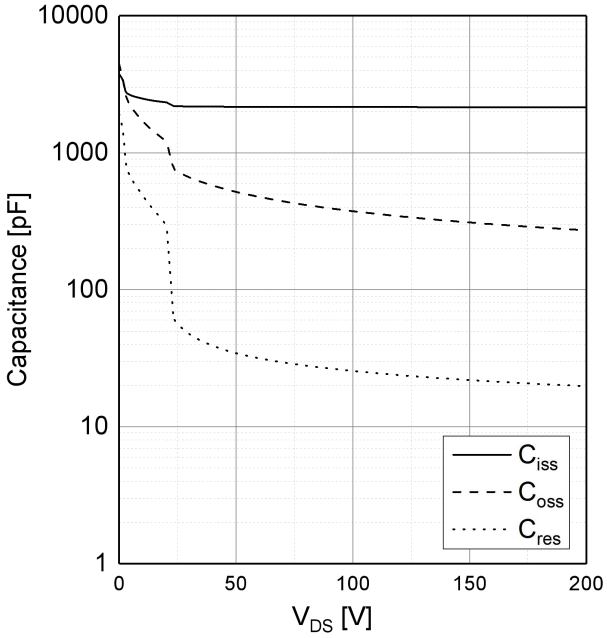
Body Diode Characteristics
I_{DS} =f(V_{DS}), T_J=175℃



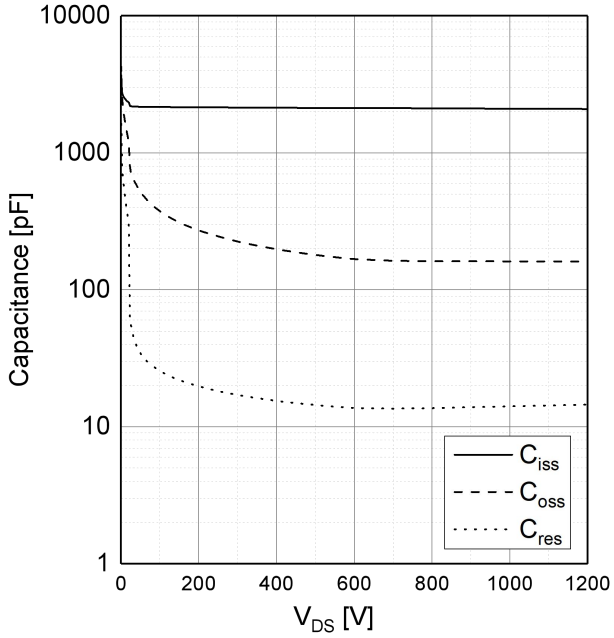
Gate Charge Characteristics
V_{GS} =f(Q_G), I_{DS}=40A, V_{DS}=800V, T_J=25℃



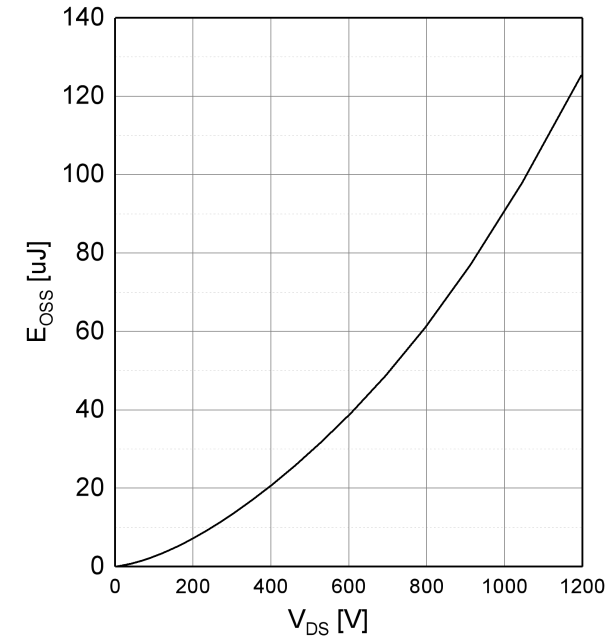
Capacitances vs Drain-Source Voltage (0-200V)
C=f(V_{DS}), T_J=25℃, V_{AC}=25mV, f=100KHz



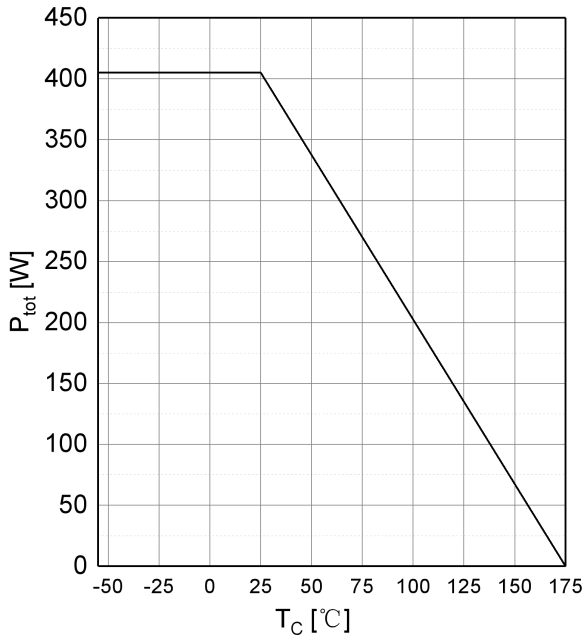
Capacitances vs Drain-Source Voltage (0-1200V)
C=f(V_{DS}), T_J=25℃, V_{AC}=25mV, f=100KHz



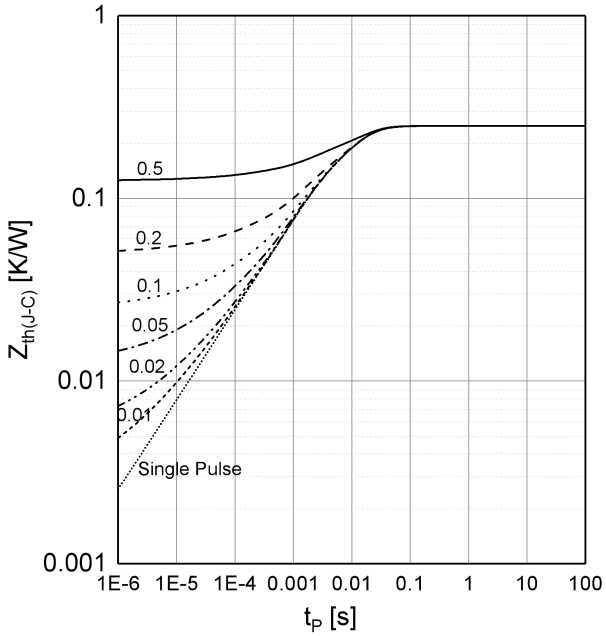
Output Capacitor Stored Energy
E_{OSS} =f(V_{DS}), T_J=25℃



Maximum Power Dissipation Derating
P_{tot} =f(T_C), T_J≤175℃

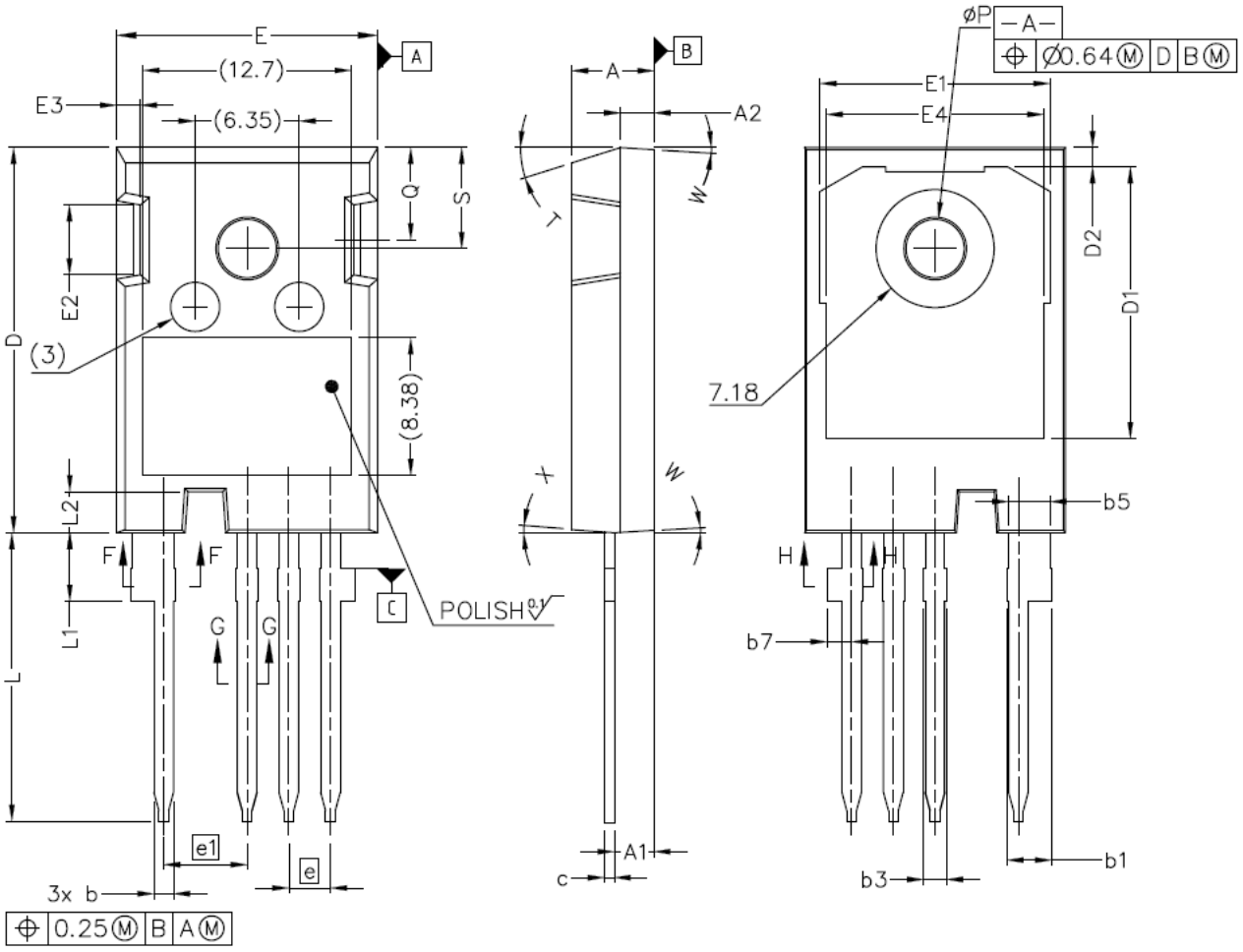


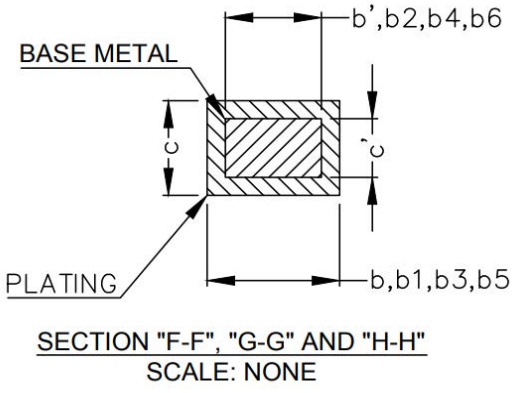
Transient Thermal Impedance (Junction to Case)
$Z_{th(J-C)}$=f(t), T_C=25℃



Package Dimensions

Package TO247-4L





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

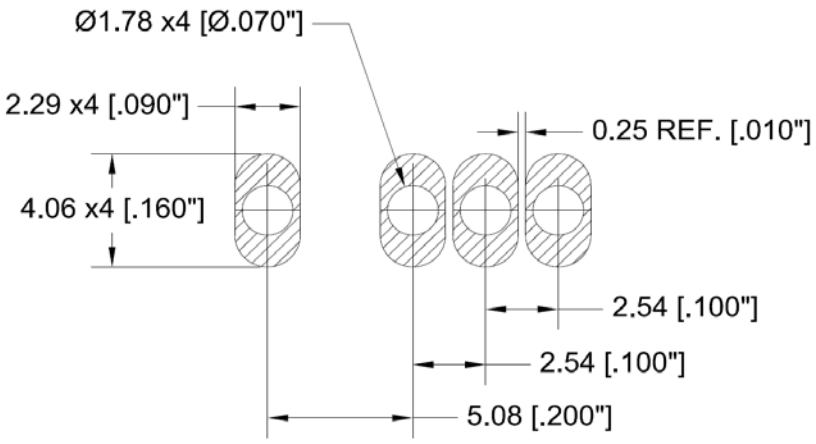
Package Dimensions

Package TO247-4L

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.	



Attention

■ Any and all HUA XUAN YANG ELECTRONICS products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your HUA XUAN YANG ELECTRONICS representative nearest you before using any HUA XUAN YANG ELECTRONICS products described or contained herein in such applications.

■ HUA XUAN YANG ELECTRONICS assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all HUA XUAN YANG ELECTRONICS products described or contained herein.

■ Specifications of any and all HUA XUAN YANG ELECTRONICS products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

■ HUA XUAN YANG ELECTRONICS CO.,LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could
give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.

■ In the event that any or all HUA XUAN YANG ELECTRONICS products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.

■ Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. HUA XUAN YANG ELECTRONICS believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

■ Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the HUA XUAN YANG ELECTRONICS product that you intend to use.