



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

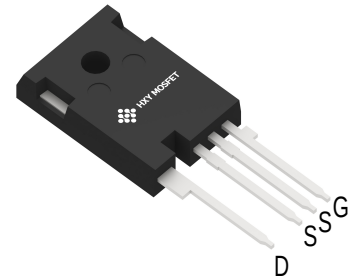
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

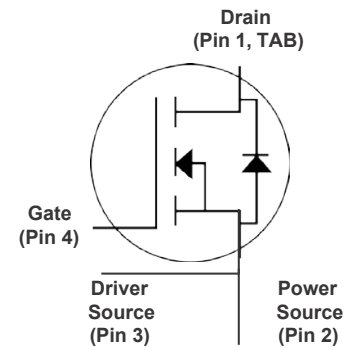
- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



Ordering Part Number	Package	Qty(PCS)
MSC040SMA120B4	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°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 = 175°C	
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 = 175°C	
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 = 175°C	
C _{iss}	Input Capacitance		2101		pF	V _{GS} = 0 V, V _{DS} = 1000 V f = 100kHz 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				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, T _J = 175°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 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

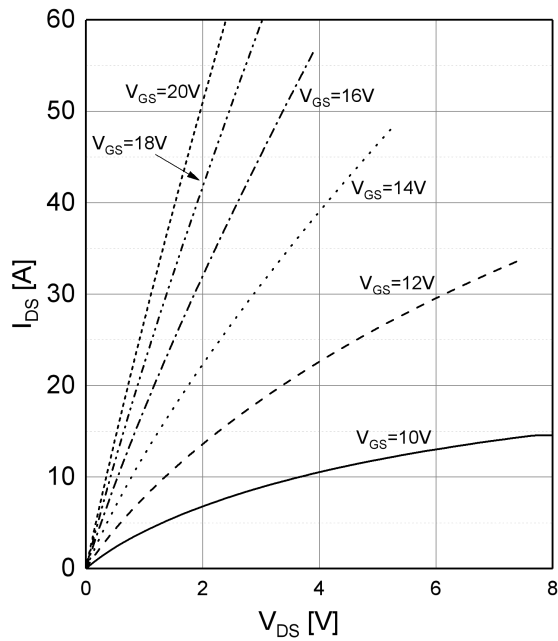
Symbol	Parameter	Typ.	Unit	Test Conditions	Note
R _{θJC}	Thermal Resistance from Junction to Case	0.25	°C/W		Fig. 21
R _{θJA}	Thermal Resistance From Junction to Ambient	40			



Typical Characteristics

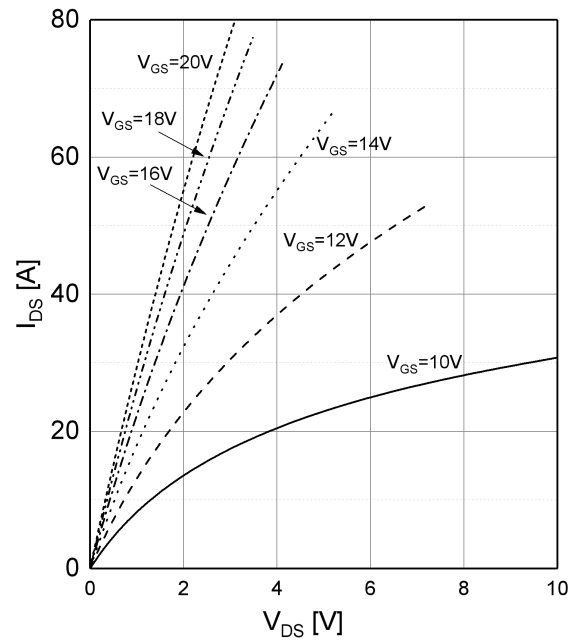
Output characteristics

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



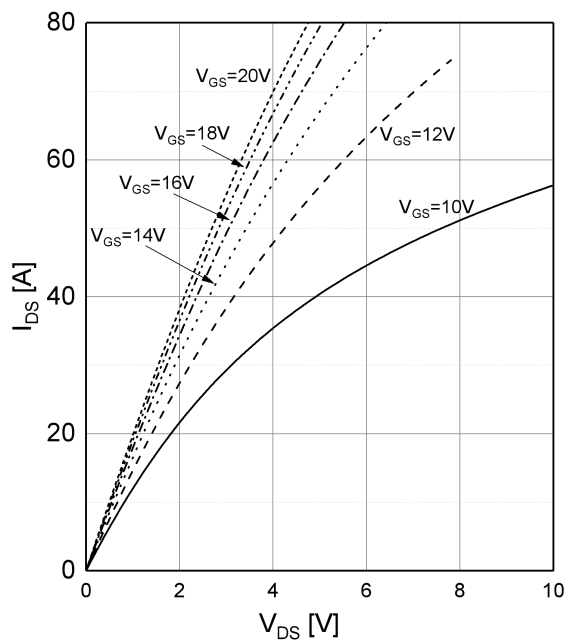
Output characteristics

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



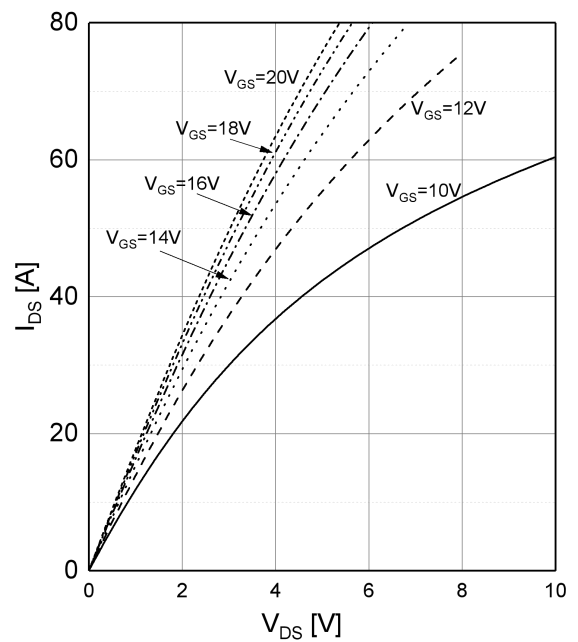
Output characteristics

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



Output characteristics

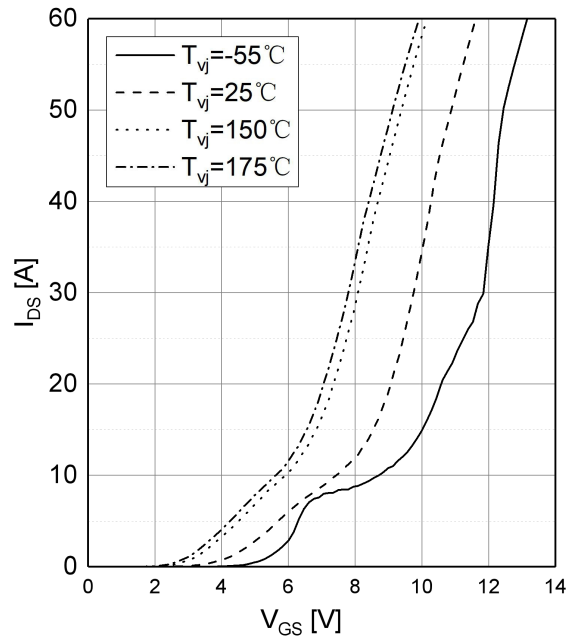
$$I_{DS}=f(V_{DS}), T_J=175^{\circ}\text{C}$$





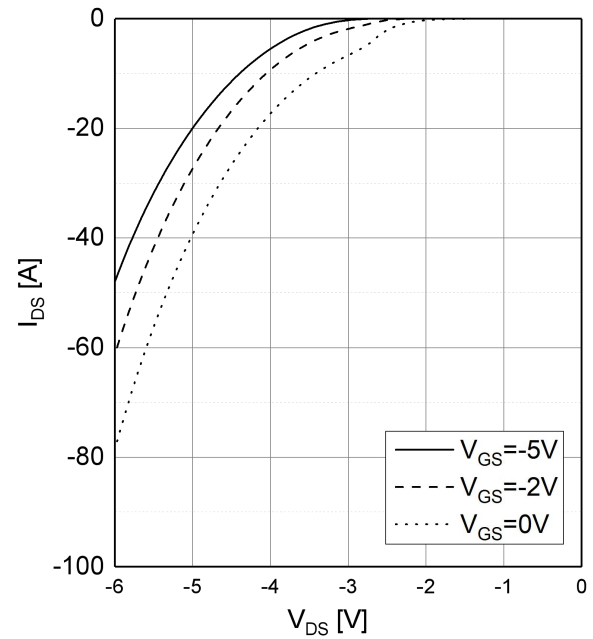
Transfer Characteristics

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



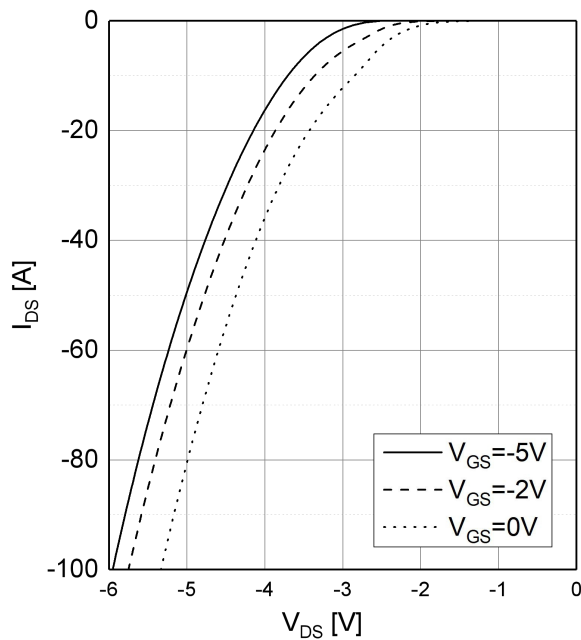
Body Diode Characteristics

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



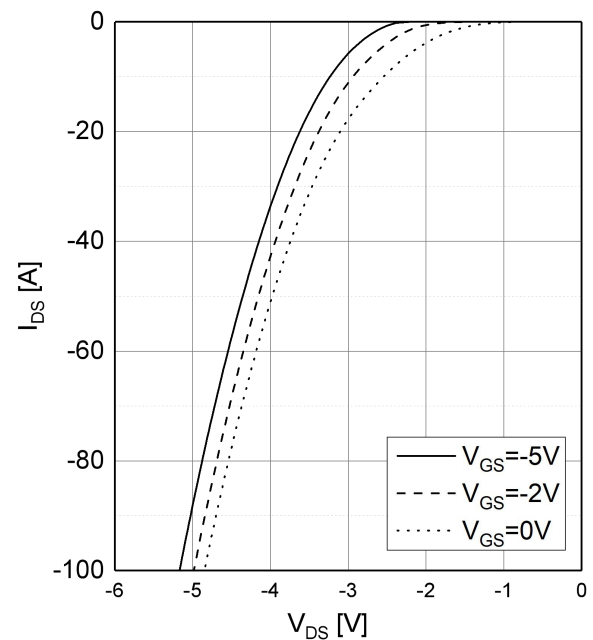
Body Diode Characteristics

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



Body Diode Characteristics

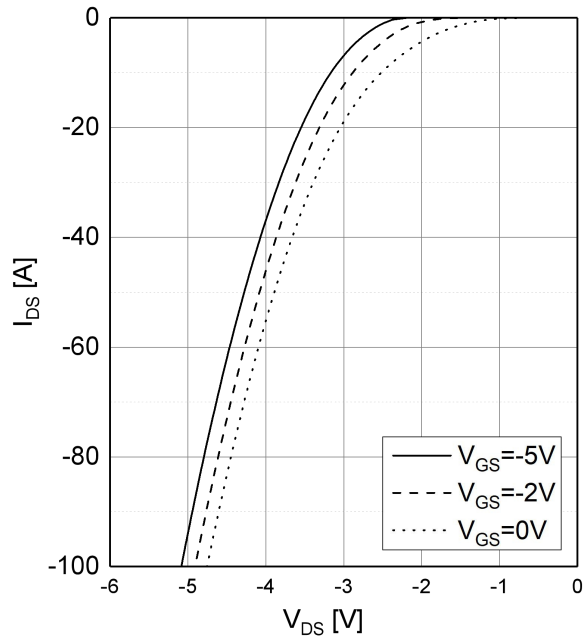
$I_{DS}=f(V_{DS}), T_J=150^{\circ}C$





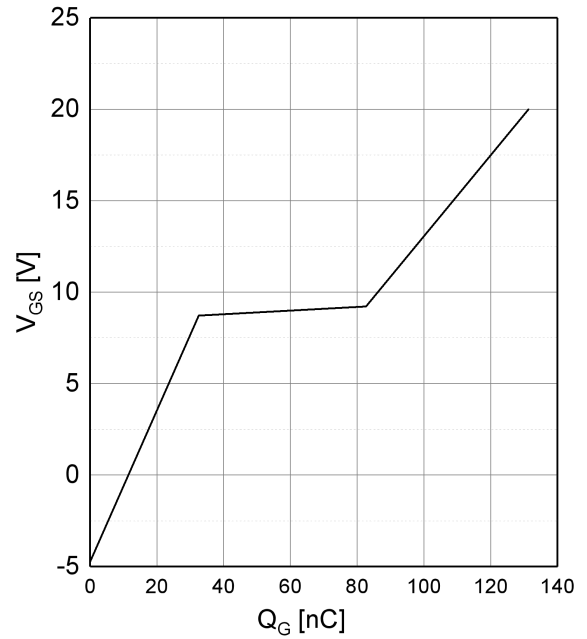
Body Diode Characteristics

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



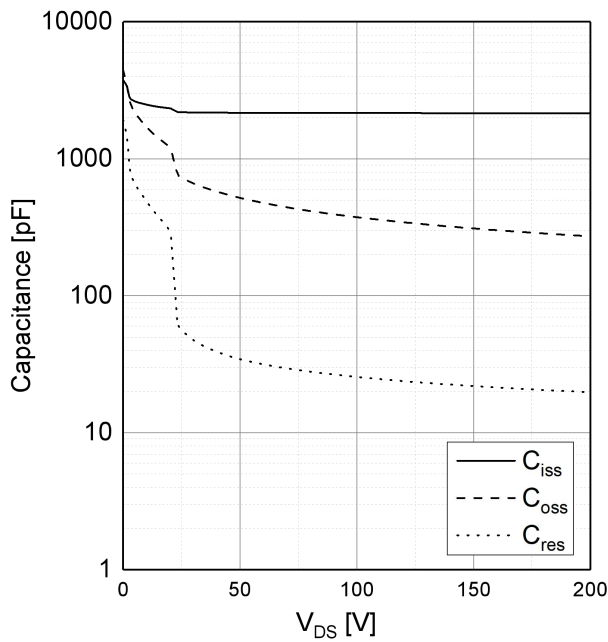
Gate Charge Characteristics

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



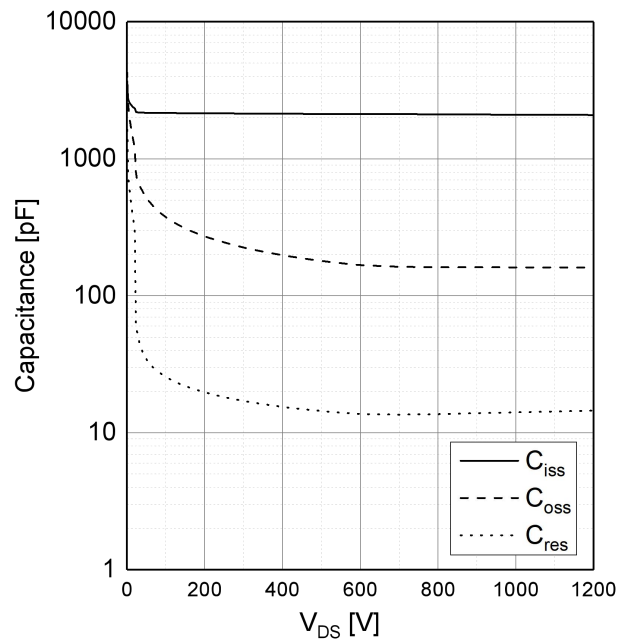
Capacitances vs Drain-Source Voltage (0-200V)

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



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

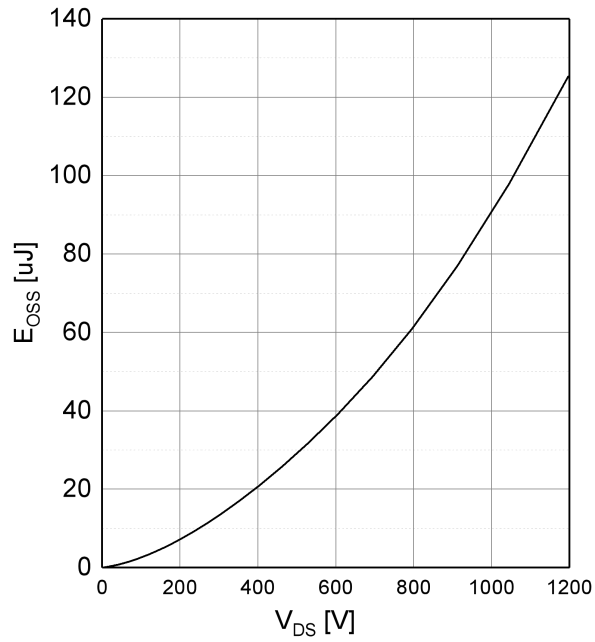
$C=f(V_{DS}), T_J=25^{\circ}\text{C}, V_{AC}=25\text{mV}, f=100\text{KHz}$





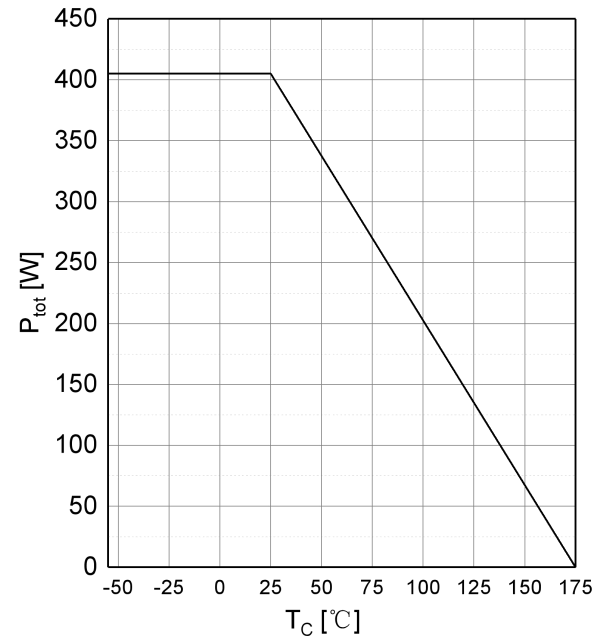
Output Capacitor Stored Energy

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



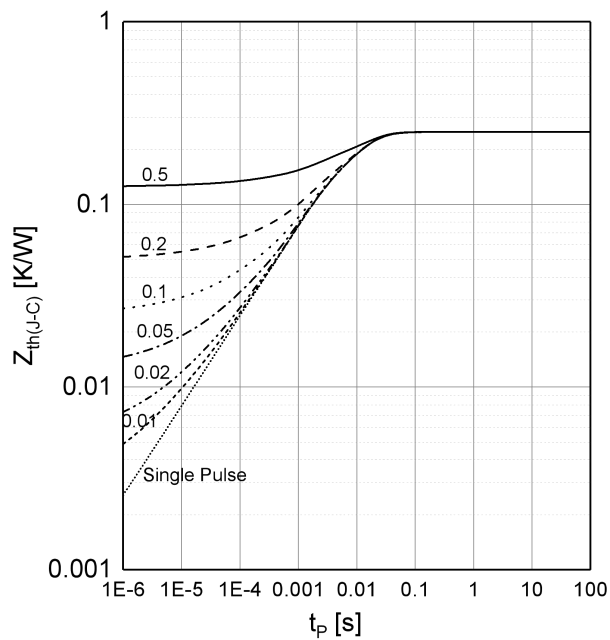
Maximum Power Dissipation Derating

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



Transient Thermal Impedance (Junction to Case)

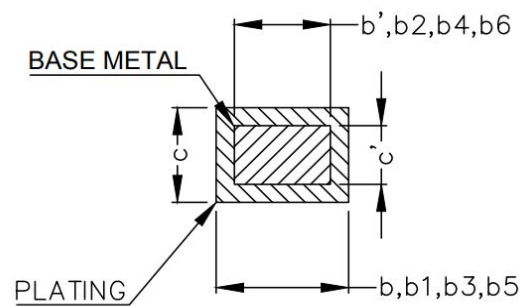
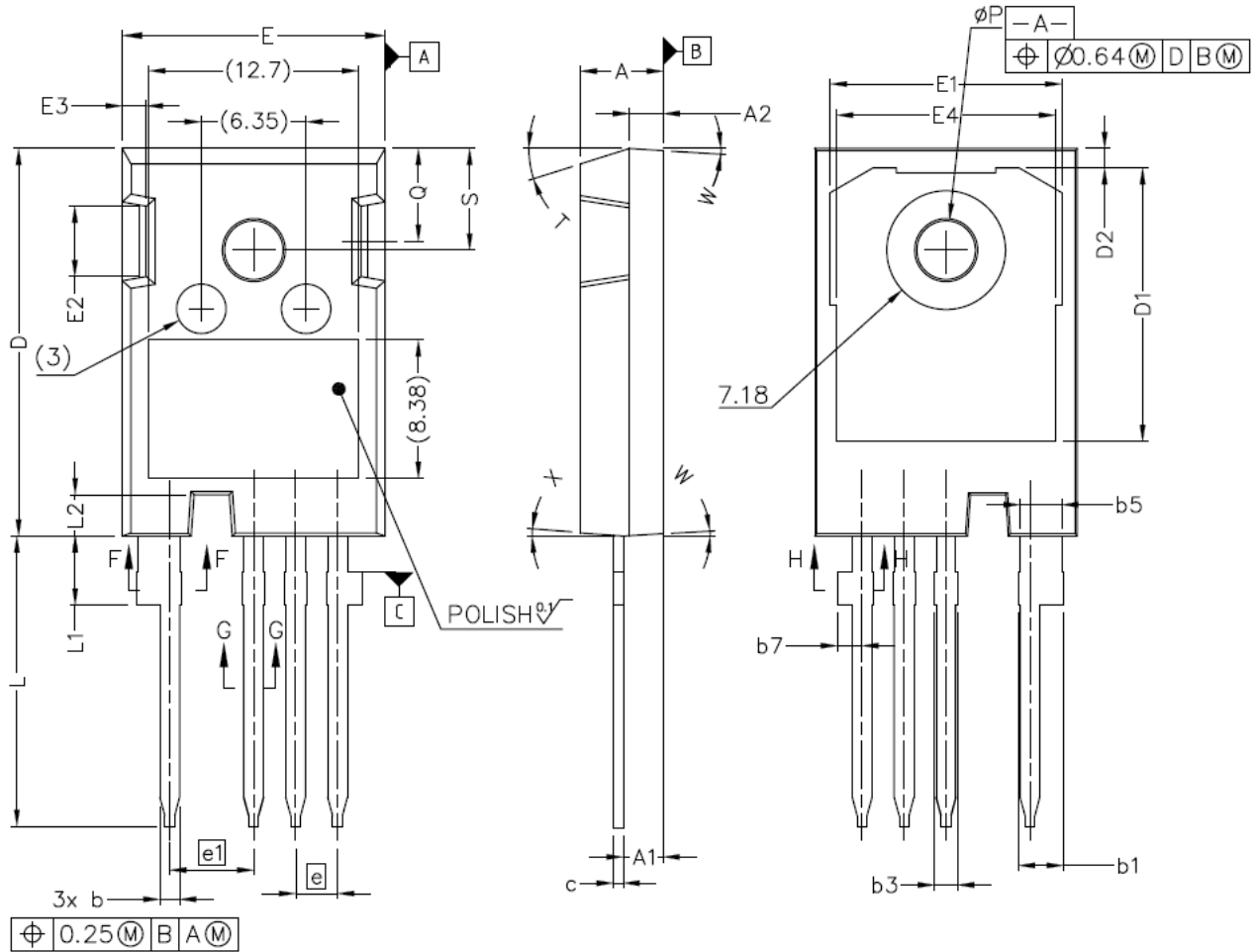
$$Z_{th(J-C)} = f(t), T_C = 25^{\circ}\text{C}$$





Package Dimensions

Package TO-247H-4L



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



Package Dimensions

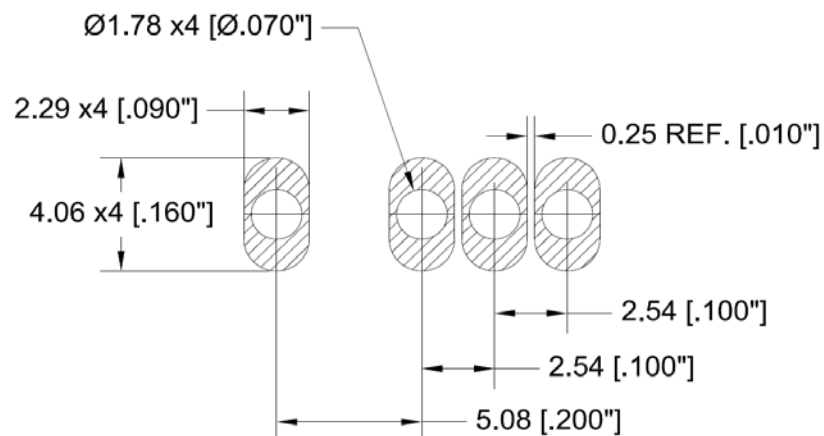
Package TO-247H-4L

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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