

# B1M032120HC

1200V ▲ 32mΩ ▲ 84A ▲ SiC MOSFET

SILICON CARBIDE SiC MOSFET ▲ THT type

N-channel enhancement mode

Low on-resistance and capacitance

TO-247-3L package ▲ Epoxy meets UL94-V0

Avalanche ruggedness

Especially for higher system efficiency

## SPECIFICATION



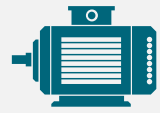




Item (T <sub>c</sub> = 25°C, unless otherwise noted)		Characteristics
Operating Temperature Range	T <sub>J</sub>	-55°C to +150°C
Storage Temperature Range	T <sub>S</sub>	-55°C to +150°C
Drain-Source Voltage	V <sub>DS</sub> MAX	1200V
Continuous Drain Current	I <sub>D</sub>	84A
Drain-Source On-State Resistance <sup>Note 1</sup>	R <sub>DS(ON)TYP</sub>	32mΩ
Reverse Transfer Capacitance <sup>Note 2</sup>	C <sub>RSS</sub>	33pF
Power Dissipation	P <sub>D</sub>	335W

### Notes

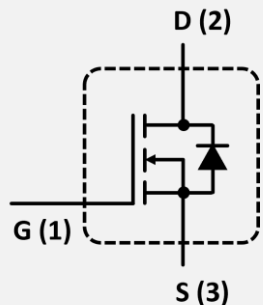
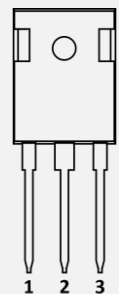
1: V<sub>GS</sub> = 20V, I<sub>D</sub> = 50A

2: V<sub>DS</sub> = 800V, V<sub>GS</sub> = 0V, f = 1MHz, V<sub>AC</sub> = 25mV

## APPLICATIONS

EV Charging	Industrial Inverters	Motors & Drives	Power Factor Correction	Renewable Energy	SMPS	UPS
						

## PIN DESCRIPTION

Circuit Diagram	Outline - Front View	Pin No.	Symbol	Description
		1 2 3	G D S	Gate Drain Source

## ABSOLUT MAXIMUM RATINGS ▲ $T_C = 25^\circ\text{C}$ , unless otherwise noted

Item	Condition	Symbol		Unit
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_{DS} = 100\mu\text{A}$	$V_{DS\text{ MAX}}$	1200	V
Continuous Drain Current	$V_{GS} = 20\text{V}, T_C = 25^\circ\text{C}$	$I_D$	84	A
Continuous Drain Current	$V_{GS} = 20\text{V}, T_C = 100^\circ\text{C}$	$I_D$	53	A
Pulse Drain Current	Pulse with $t_p$ limited by $T_{J\text{ MAX}}$	$I_{D, \text{ pulse}}$	200	A
Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	335	W
Gate Source Voltage		$V_{GS, \text{ MAX}}$	-10/+25	V
Recommended Gate Source Voltage		$V_{GS, \text{ op}}$	-5/+20	V
Operating Junction Temperature		$T_J$	-55 to +150	$^\circ\text{C}$
Storage Temperature Range		$T_{STG}$	-55 to +150	$^\circ\text{C}$

## ELECTRICAL CHARACTERISTICS ▲ $T_J = 25^\circ\text{C}$ , unless otherwise noted

Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 100\mu\text{A}$	$V_{(BR)DSS}$	1200			V
Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5\text{mA}$	$V_{GS(th)}$		2.9		V
Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5\text{mA}, T_J = 150^\circ\text{C}$	$V_{GS(th)}$		2.1		V
Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{V}, V_{GS} = 0\text{V}$	$I_{DSS}$		0.7	45	$\mu\text{A}$
Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{V}, V_{GS} = 0\text{V}, T_J = 150^\circ\text{C}$	$I_{DSS}$		5	200	$\mu\text{A}$
Gate-Source Leakage Current	$V_{GS} = 20\text{V}, V_{DS} = 0\text{V}$	$I_{GSS}$			250	nA
Drain-Source On-State Resistance	$V_{GS} = 20\text{V}, I_D = 50\text{A}$	$R_{DS(ON)}$		32		m $\Omega$
Drain-Source On-State Resistance	$V_{GS} = 20\text{V}, I_D = 50\text{A}, T_J = 150^\circ\text{C}$	$R_{DS(ON)}$		47		m $\Omega$

Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Dynamic Characteristics</b>						
Input Capacitance	$V_{DS} = 800\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}, V_{AC} = 25\text{mV}$	$C_{ISS}$		4874		pF
Output Capacitance	$V_{DS} = 800\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}, V_{AC} = 25\text{mV}$	$C_{OSS}$		220		pF
Reverse Transfer Capacitance	$V_{DS} = 800\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}, V_{AC} = 25\text{mV}$	$C_{RSS}$		33		pF
Internal Gate Resistance	$f = 1\text{MHz}, V_{AC} = 25\text{mV}$	$R_{G(INT.)}$		1.7		$\Omega$
Turn-On Delay Time	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}, R_{G(ext)} = 2.2\Omega, \text{ Inductive Load}$	$t_{D(ON)}$		28		ns
Rise Time	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}, R_{G(ext)} = 2.2\Omega, \text{ Inductive Load}$	$t_R$		93		ns
Turn-Off Delay Time	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}, R_{G(ext)} = 2.2\Omega, \text{ Inductive Load}$	$t_{D(OFF)}$		86		ns
Fall Time	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}, R_{G(ext)} = 2.2\Omega, \text{ Inductive Load}$	$t_F$		27		ns
Turn-on Switching Energy	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}, R_{G(ext)} = 2.2\Omega, \text{ Inductive Load}$	$E_{ON}$		1215		$\mu\text{J}$
Turn-off Switching Energy	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}, R_{G(ext)} = 2.2\Omega, \text{ Inductive Load}$	$E_{OFF}$		463		$\mu\text{J}$

## BUILT-IN SiC DIODE CHARACTERISTICS ▲ $T_J = 25^\circ\text{C}$ , unless otherwise noted

Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Source-Drain Diode</b>						
Inverse Diode Forward Voltage	$V_{GS} = -5\text{V}, I_{SD} = 25\text{A}$	$V_{SD}$		4.6		V
Reverse Recovery Charge	$V_{GS} = 5\text{V}, I_{SD} = 25\text{A}, V_{DS} = 800\text{V},$ $di/dt = 400\text{A}/\mu\text{s}$	$Q_{RR}$		310		nC
Peak Reverse Recovery Current	$V_{GS} = 5\text{V}, I_{SD} = 25\text{A}, V_{DS} = 800\text{V},$ $di/dt = 400\text{A}/\mu\text{s}$	$I_{RRM}$		12		A

## GATE CHARGE CHARACTERISTICS ▲ $T_J = 25^\circ\text{C}$ , unless otherwise noted

Item	Condition	Symbol	Min.	Typ.	Max.	Unit
Gate to Source Charge	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}$	$Q_{GS}$		104		nC
Gate to Drain Charge	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}$	$Q_{GD}$		93		nC
Total Gate Charge	$V_{DS} = 800\text{V}, V_{GS} = -5/+20\text{V}, I_D = 50\text{A}$	$Q_G$		314		nC

## THERMAL RESISTANCE PERFORMANCE

Item	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$		0.373		K/W

## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 1 • Forward Output Characteristics  $I_{DS}$  vs.  $V_{DS}$ ,  
 $T_C = 25^\circ\text{C}$

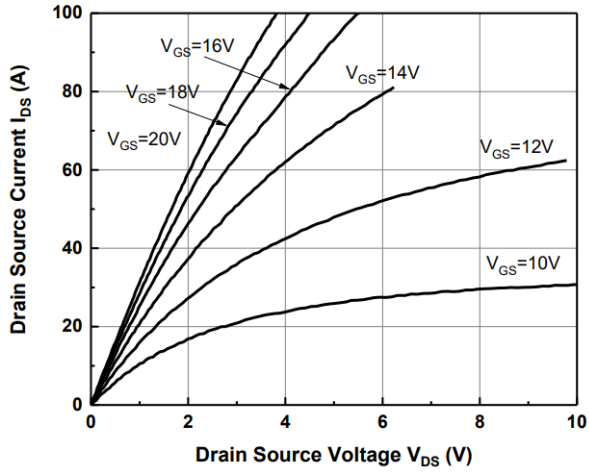


Fig. 2 • Forward Output Characteristics  $I_{DS}$  vs.  $V_{DS}$ ,  
 $T_C = 150^\circ\text{C}$

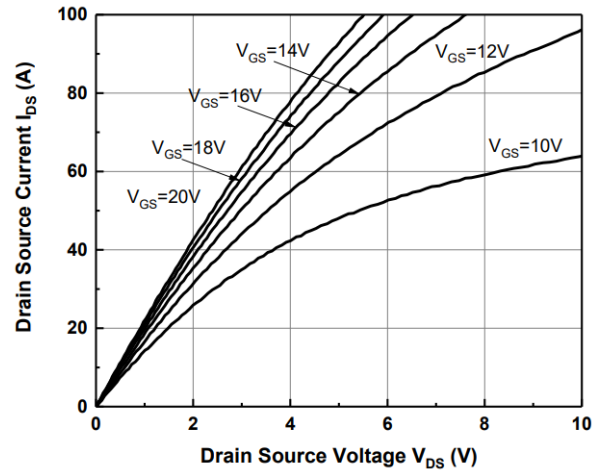


Fig. 3 • Transfer Characteristics at  $T_C = 25^\circ\text{C}$

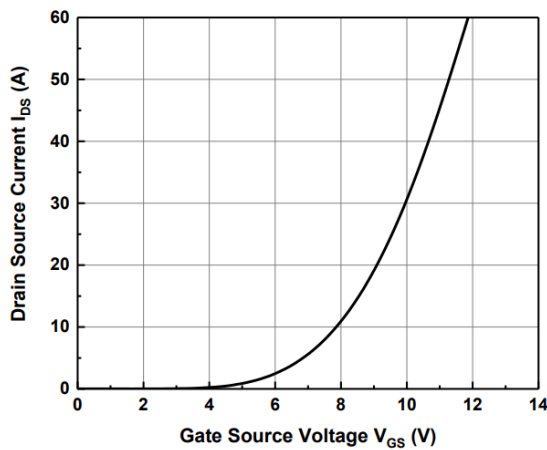


Fig. 4 • On-Resistance  $R_{ON}$  vs. Junction Temperature  $T_J$   
at  $V_{GS} = 20\text{V}$ ,  $I_{DS} = 20\text{A}$

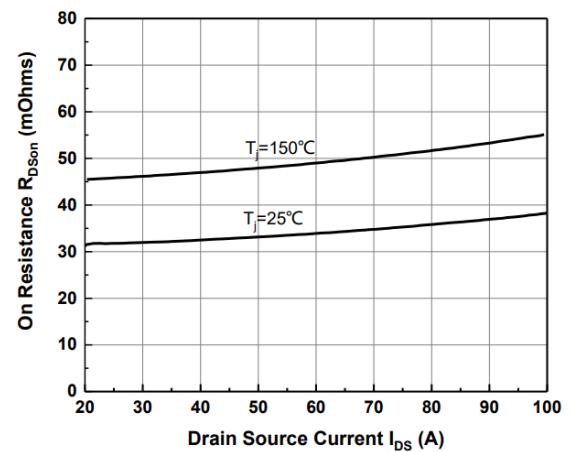


Fig. 6 • On-Resistance  $R_{ON}$  vs. Junction Temperature  $T_J$   
for various Gate Voltage  $V_{GS}$

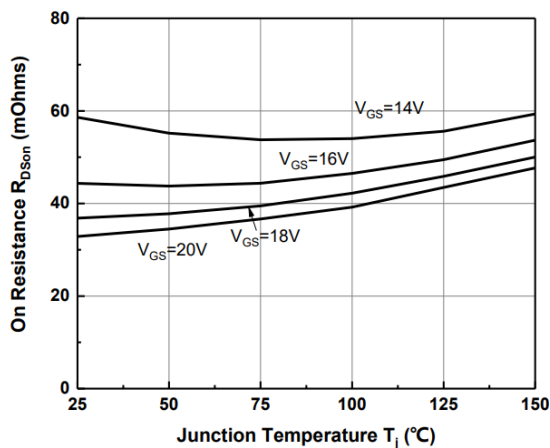
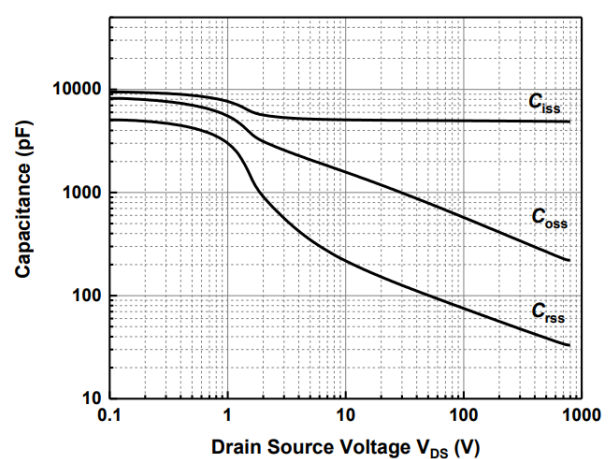


Fig. 6 • Capacitances vs. Drain to Source Voltage  $V_{DS}$   
(0 to 1000V)



## REFERENCE DATA ▲ TYPICAL DEVICE PERFORMANCE

Fig. 7 • Body Diode Characteristics at  $T_C = 25^\circ\text{C}$

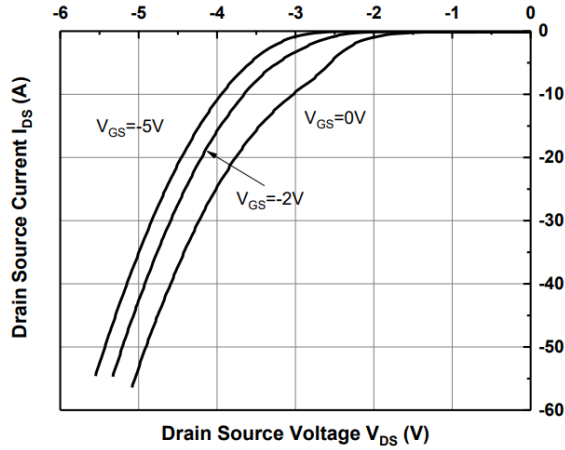


Fig. 7 • Body Diode Characteristics at  $T_C = 150^\circ\text{C}$

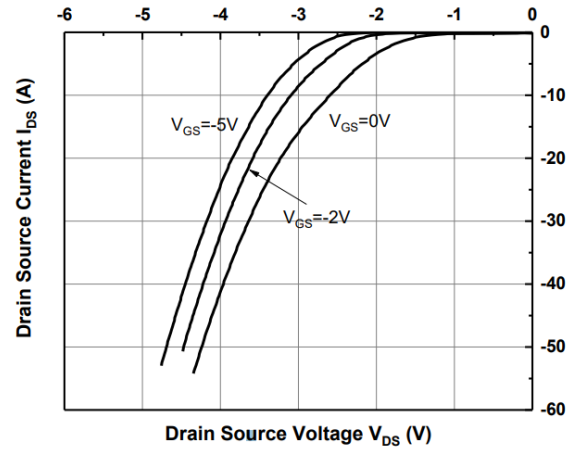


Fig. 9 • Output Capacitor  
Stored Energy

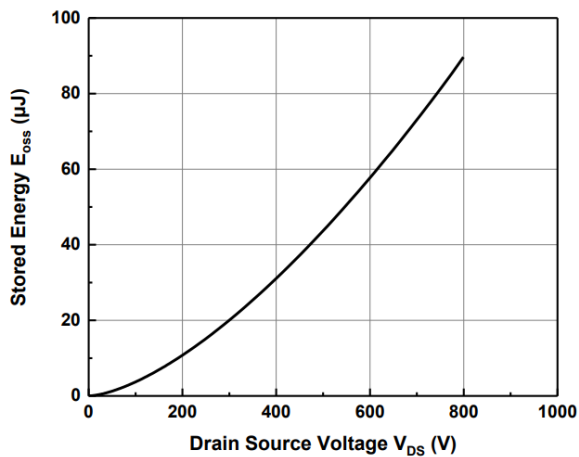


Fig. 10 • Maximum Power Dissipation  $P_D$  Derating  
vs. Case Temperature  $T_C$

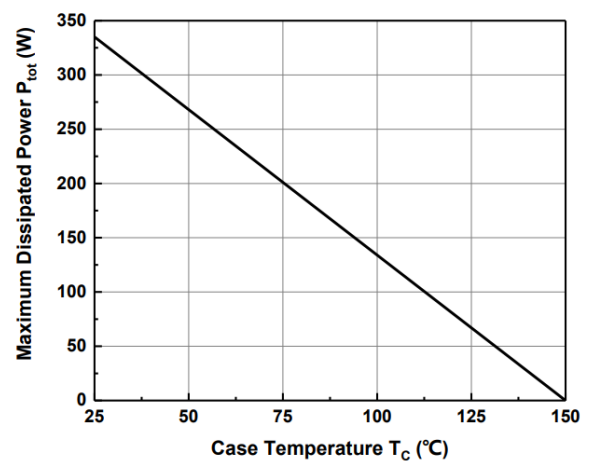
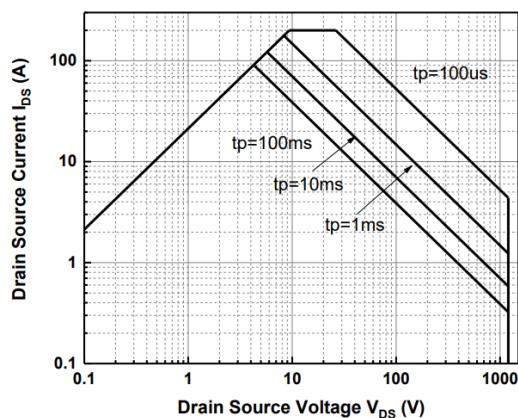
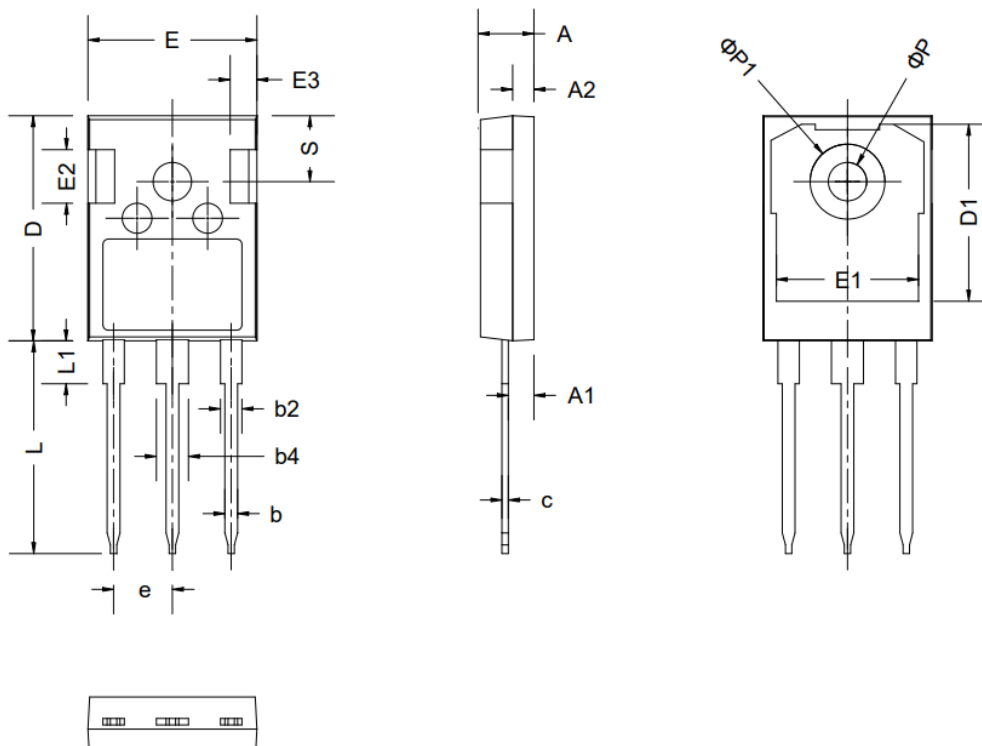


Fig. 11 • Safe Operating Area



## PACKAGE OUTLINE



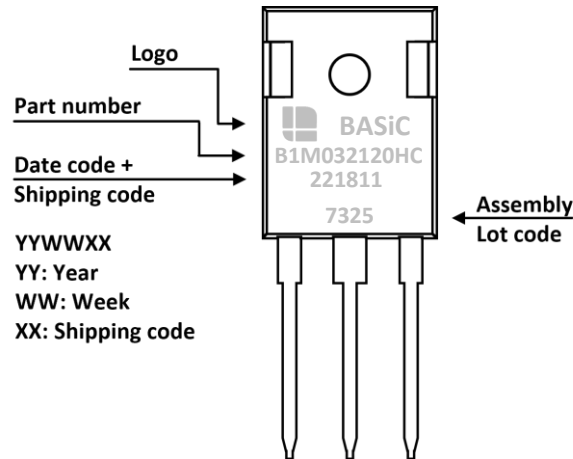
Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10

Sym	Millimeters (Min.)	Millimeters (Typ.)	Millimeters (Max.)
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44 BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ØP	3.40	3.60	3.80
ØP1	-	-	7.30
S	6.16 BSC		

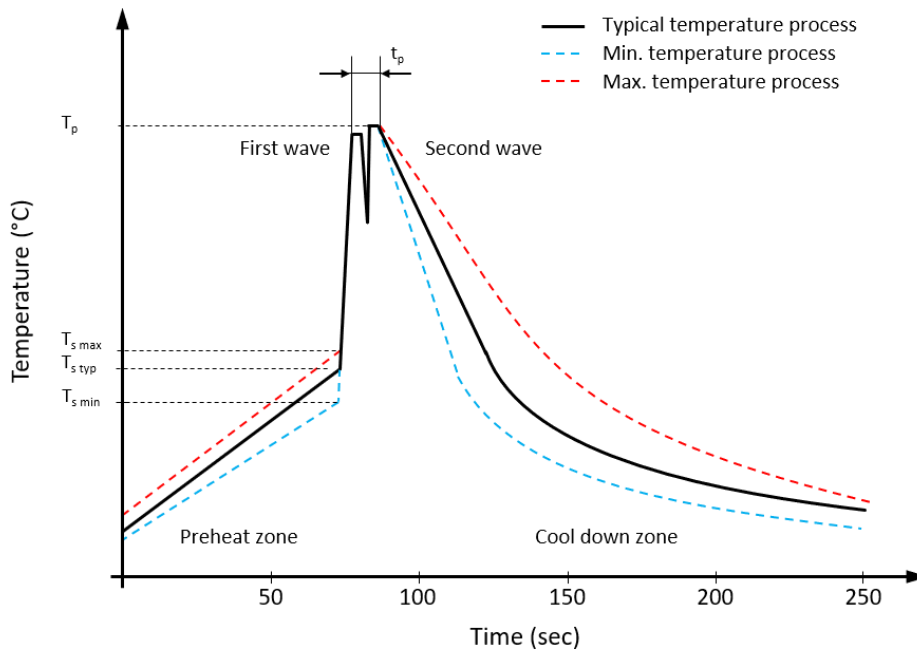
## ORDERING INFORMATION

Part Number	Package	Packing	Tube Qty.	Inner Box Qty.	Outer Box Qty.
B1M032120HC	TO-247-3L	Tube	30pcs	300pcs	1,800pcs

## PART MARKING



## RECOMMENDED WAVE SOLDERING PROFILE ▲ THT PACKAGE



### Classification wave soldering profile ▲ Refer to EN 61760-1: 2006

Profile Features		Value ▲ Sn-Pb Assembly	Value ▲ Pb-free Assembly
Preheat temperature min.	$T_{s\ min}$	100 °C	100 °C
Preheat temperature typical	$T_{s\ typ}$	120 °C	120 °C
Preheat temperature max.	$T_{s\ max}$	130 °C	130 °C
Preheat time $t_s$ from $T_{s\ min}$ to $T_{s\ max}$	$t_s$	70 seconds	70 seconds
Peak temperature	$T_p$	235 °C to 260 °C	245 °C to 260 °C
Time of actual peak temperature	$t_p$	Max. 10 seconds Max. 5 second each wave	Max. 10 seconds Max. 5 second each wave
Ramp-down date min.		~ 2 °C/second	~ 2 °C/second
Ramp-down rate typical		~ 3.5 °C/second	~ 3.5 °C/second
Ramp-down rate max.		~ 5 °C/second	~ 5 °C/second

## REVISION TABLE

Revision	Date	Status	Notes
001	30/09/2022	Initial release	Initial publication

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