

# BRGB40L65AHA

Rev.A Dec.-2025

## 描述 / Descriptions

TO-247 塑封封装绝缘栅双极晶体管。

Insulated-Gate Bipolar Transistor in a TO-247 Plastic Package.

## 特征 / Features

$V_{CES} = 650V$  ,  $I_C (T_C=100^\circ C) = 40A$

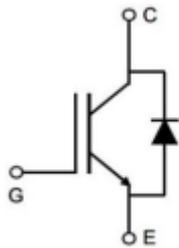
$V_{CE(SAT)} = 2.35 V(\text{typ.}) @ V_{GE} = 15V, I_C = 40A$

## 用途 / Applications

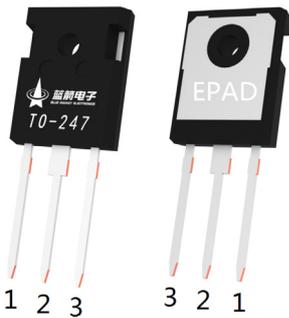
太阳能转换器、不间断电源、焊接转换器、中高范围开关频率转换器。

Solar Converters, Uninterrupted Power Supply, Welding Converters, Mid to High Range Switching Frequency Converters.

## 内部等效电路 / Equivalent Circuit



## 引脚排列 / Pinning



PIN1 : G

PIN 2、EPAD : C

PIN 3 : E

## 印章代码 / Marking

见印章说明。

See Marking Instructions.

**极限参数 / Absolute Maximum Ratings(Ta=25°C)**

参数 Parameter	符号 Symbol	数值 Rating	单位 Unit	
Collector-Emitter Voltage	$V_{CES}$	650	V	
Gate-Emitter Voltage	$V_{GES}$	$\pm 20$	V	
Continuous Collector Current	$I_C$	$T_C=25^\circ\text{C}$	80	A
		$T_C=100^\circ\text{C}$	40	A
Pulsed Collector Current , Limited by $T_{Jmax}$	$I_{CM}$	160	A	
Continuous Diode Forward Current	$I_F$	$T_C=25^\circ\text{C}$	80	A
		$T_C=100^\circ\text{C}$	40	A
Diode Maximum Forward Current	$I_{FM}$	160	A	
Power Dissipation	$P_D$	$T_C=25^\circ\text{C}$	125	W
		$T_C=100^\circ\text{C}$	63	W
Operating Junction Temperature Range	$T_J$	-40 to +175	$^\circ\text{C}$	
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ\text{C}$	
Maximum IGBT Junction-to-Case	$R_{\theta jc1}$	1.2	$^\circ\text{C}/\text{W}$	
Maximum Diode Junction-to-Case	$R_{\theta jc2}$	2.4	$^\circ\text{C}/\text{W}$	

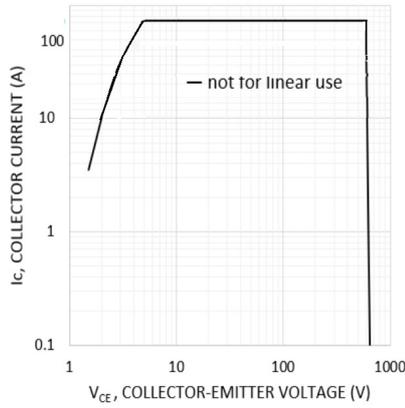
**电性能参数 / Electrical Characteristics(Ta=25°C)**

参数 Parameter	符号 Symbol	测试条件 Test Conditions	最小值 Min	典型值 Typ	最大值 Max	单位 Unit
Collector-Emitter Breakdown Voltage	$BV_{CES}$	$I_C=200\mu\text{A}, V_{GE}=0\text{V}$	650			V
Zero Gate Voltage Collector current	$I_{CES}$	$V_{CE}=650\text{V}, V_{GE}=0\text{V}$			40	$\mu\text{A}$
Gate-Emitter Leakage Current	$I_{GES}$	$V_{CE}=0\text{V}, V_{GE}=\pm 20$			$\pm 100$	nA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_C=150\mu\text{A}$	4	5	6	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15\text{V}, I_C=40\text{A}$	$T_J=25^\circ\text{C}$	2.4	2.9	V
			$T_J=125^\circ\text{C}$	2.9		
Total Gate Charge	$Q_g$	$V_{GE}=15\text{V}, V_{CC}=520\text{V}, I_C=40\text{A}$		27		nC
Gate to Emitter Charge	$Q_{ge}$			6.6		
Gate to Collector Charge	$Q_{gc}$			9.5		

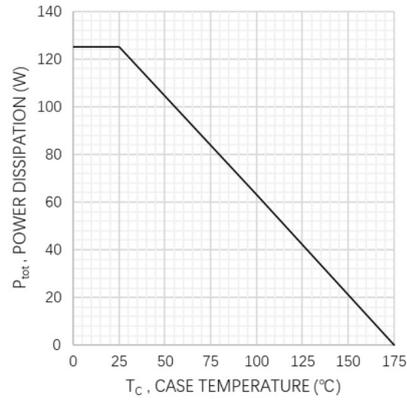
## 电性能参数 / Electrical Characteristics(Ta=25°C)

参数 Parameter	符号 Symbol	测试条件 Test Conditions	最小值 Min	典型值 Typ	最大值 Max	单位 Unit	
Turn-On Delay Time	$t_{d(on)}$	$V_{GE}=\pm 15V$ $V_{CC}=400V$ $I_C=40A$ $R_G=39\Omega$ Inductive Load $T_C=25^\circ C$		40		ns	
Turn-On Rise Time	$t_r$			46		ns	
Turn-Off Delay Time	$t_{d(off)}$			57		ns	
Turn-Off Fall Time	$t_f$			17.5		ns	
Turn-On Energy	$E_{on}$				1.4		mJ
Turn-Off Energy	$E_{off}$				0.7		mJ
Total Switching Energy	$E_{ts}$				2.0		mJ
Input Capacitance	$C_{ies}$	$V_{GE}=0V$ , $V_{CE}=25V$ $f=1MHz$		1040		pF	
Output Capacitance	$C_{oes}$			72		pF	
Reverse Transfer Capacitance	$C_{res}$			10		pF	
Short Circuit Safe Operation Area	SCSOA	$V_{GE}=15V$ , $V_{CC}\leq 400V$ , $T_{J,start}\leq 25^\circ C$	6			$\mu s$	
Diode Forward Voltage	$V_F$	$I_F=40A$	$T_J=25^\circ C$	1.9	2.7	V	
			$T_J=150^\circ C$	1.7	2.5		
Diode Reverse Recovery Time	$T_{rr}$	$V_R=400V$ , $I_F=40A$ $di_F/dt=300A/\mu s$ $T_C=25^\circ C$		90		ns	
Diode Reverse Recovery Charge	$Q_{rr}$			450		nC	
Diode Peak Reverse Recovery Current	$I_{rm}$				8		A

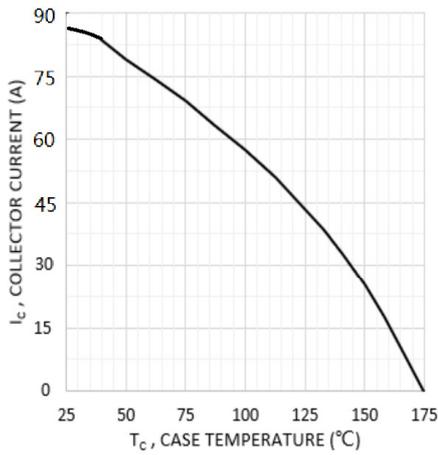
**电参数曲线图 / Electrical Characteristic Curve**



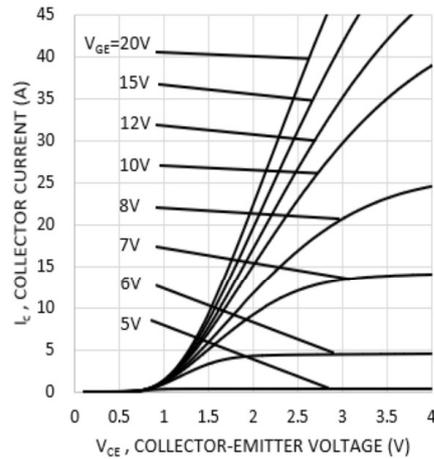
**Fig.1 Collector Current vs. Collector-Emitter Voltage**



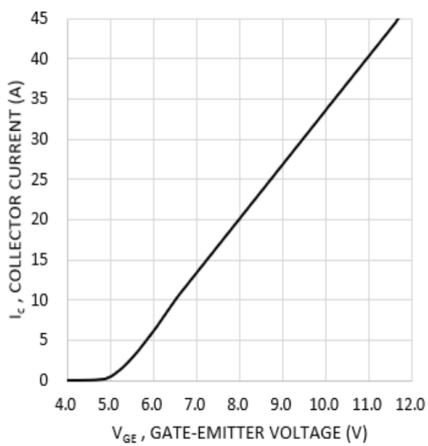
**Fig.2 Power Dissipation**



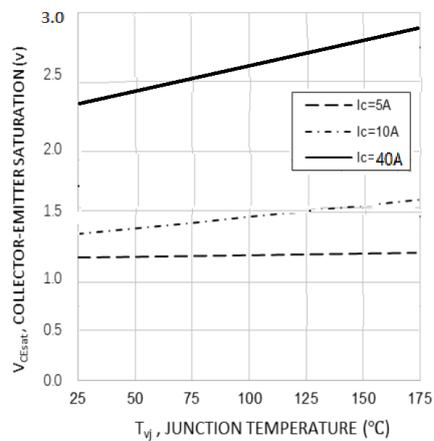
**Fig. 3 Collector current as a function of case temperature ( $V_{GE} \geq 15V, T_{vj} \leq 175^\circ C$ )  
 $r_{\theta} = 39\Omega$**



**Fig. 4 Typical output characteristic ( $T_{vj} = 25^\circ C$ )**



**Fig. 5 Typical transfer characteristics ( $V_{CE} = 20V$ )**



**Fig. 6 Typical collector-emitter saturation voltage as a function of junction temperature ( $V_{GE} = 15V$ )**

电参数曲线图 / Electrical Characteristic Curve

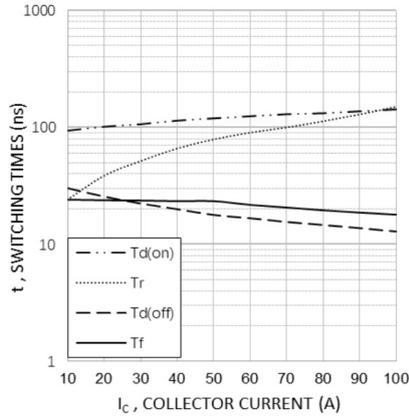


Fig. 7 Typical switching times as a function of collector current (inductive load,  $T_{yj}=25^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $r_G=39\Omega$ )

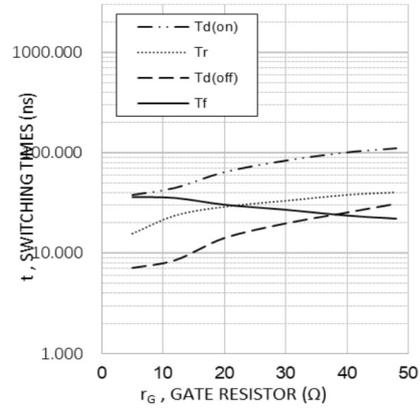


Fig. 8 Typical switching times as a function of gate resistor (inductive load,  $T_{yj}=25^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_C=40\text{A}$ )

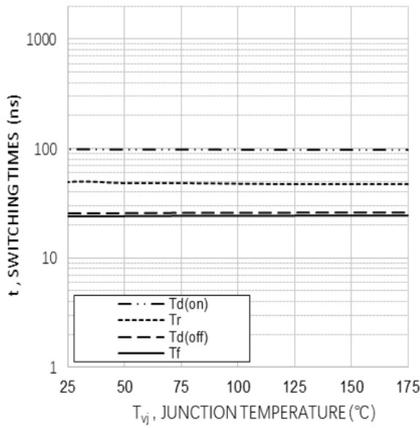


Fig. 9 Typical switching times as a function of junction temperature (inductive load,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_C=40\text{A}$ ,  $r_G=39\Omega$ )

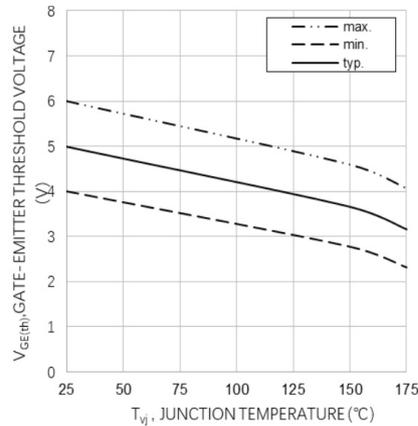


Fig. 10 Gate-emitter threshold voltage as a function of junction temperature ( $I_C=0.15\text{mA}$ )

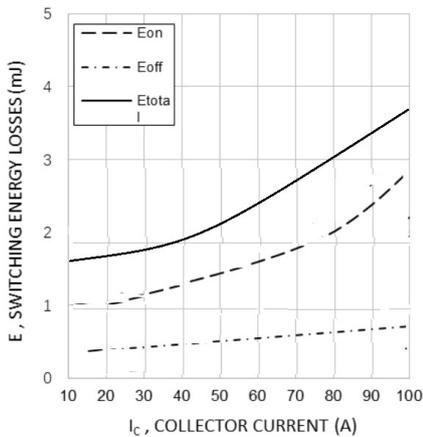


Fig. 11 Typical switching energy losses as a function of collector current (inductive load,  $T_{yj}=25^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $r_G=39\Omega$ )

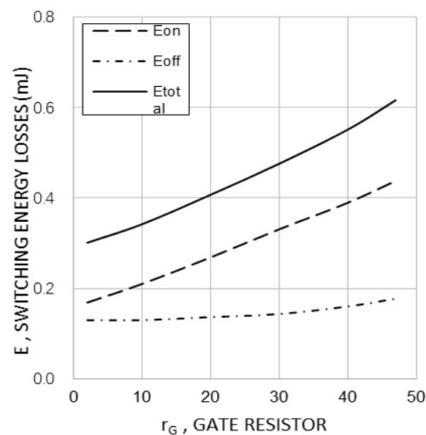
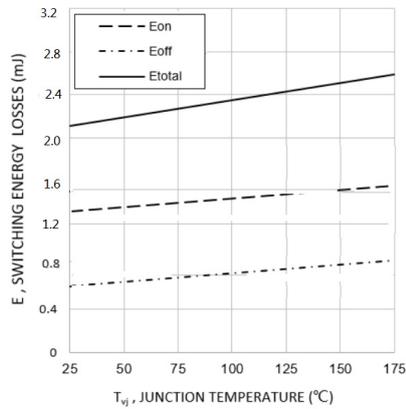
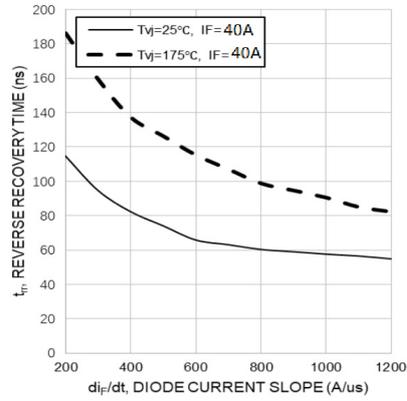


Fig. 12 Typical switching energy losses as a function of gate resistor (inductive load,  $T_{yj}=25^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15/0\text{V}$ ,  $I_C=40\text{A}$ )

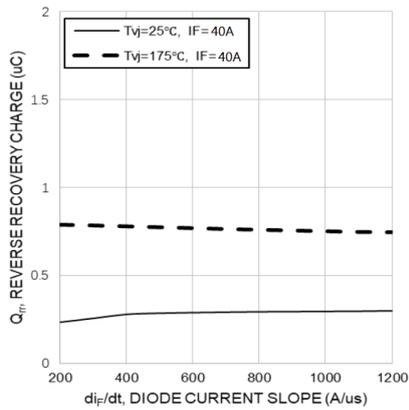
## 电参数曲线图 / Electrical Characteristic Curve



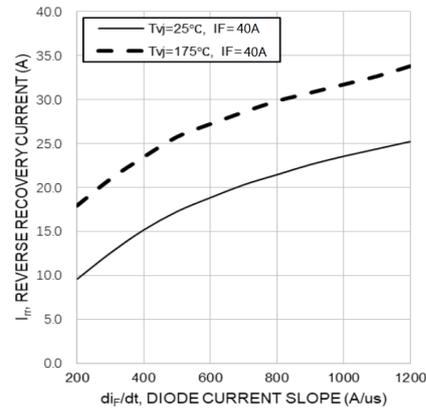
**Fig. 13** Typical switching energy losses as a function of junction temperature (inductive load,  $V_{CE}=400V$ ,  $V_{GE}=15/0V$ ,  $I_C=40A$ ,  $r_G=39\Omega$ )



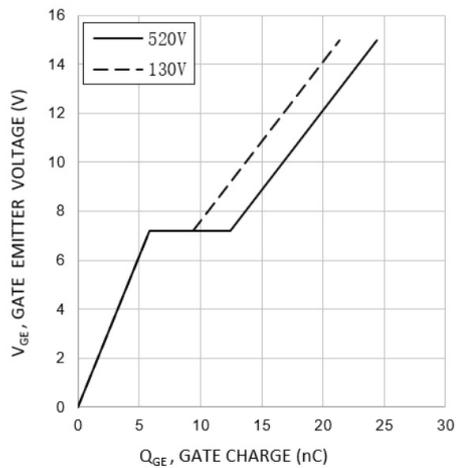
**Fig. 14** Typical reverse recovery time as a function of diode current slope ( $V_R=400V$ )



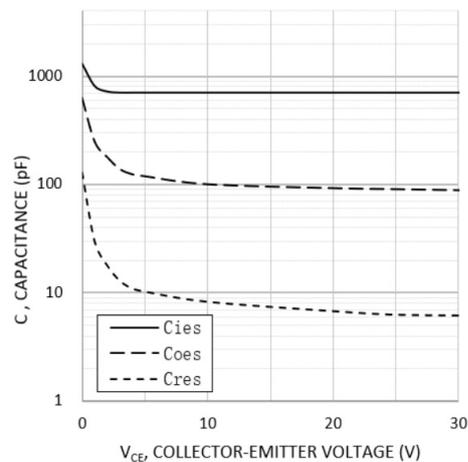
**Fig. 15** Typical reverse recovery charge as a function of diode current slope ( $V_R=400V$ )



**Fig. 16** Typical reverse recovery current as a function of diode current slope ( $V_R=400V$ )



**Fig. 17** Typical gate charge ( $I_C=40A$ )



**Fig. 18** Typical capacitance as a function of collector-emitter voltage ( $V_{GE}=0V$ ,  $f=1MHz$ )

电参数曲线图 / Electrical Characteristic Curve

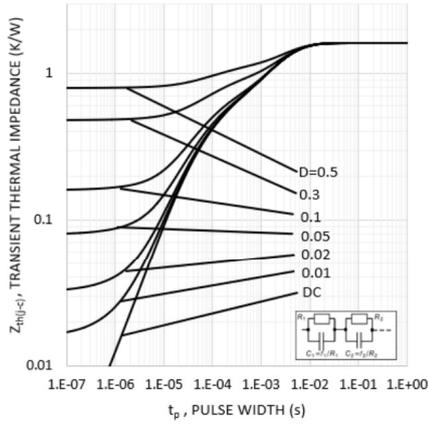


Fig. 19 IGBT transient thermal impedance ( $D=t_p/T$ )

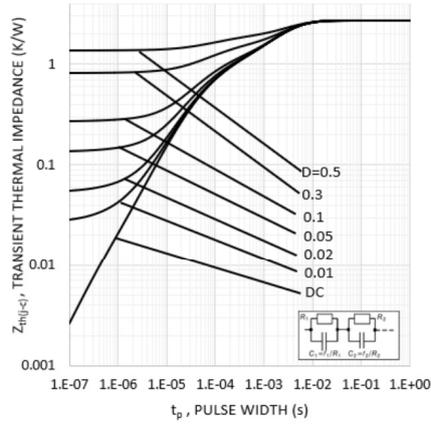
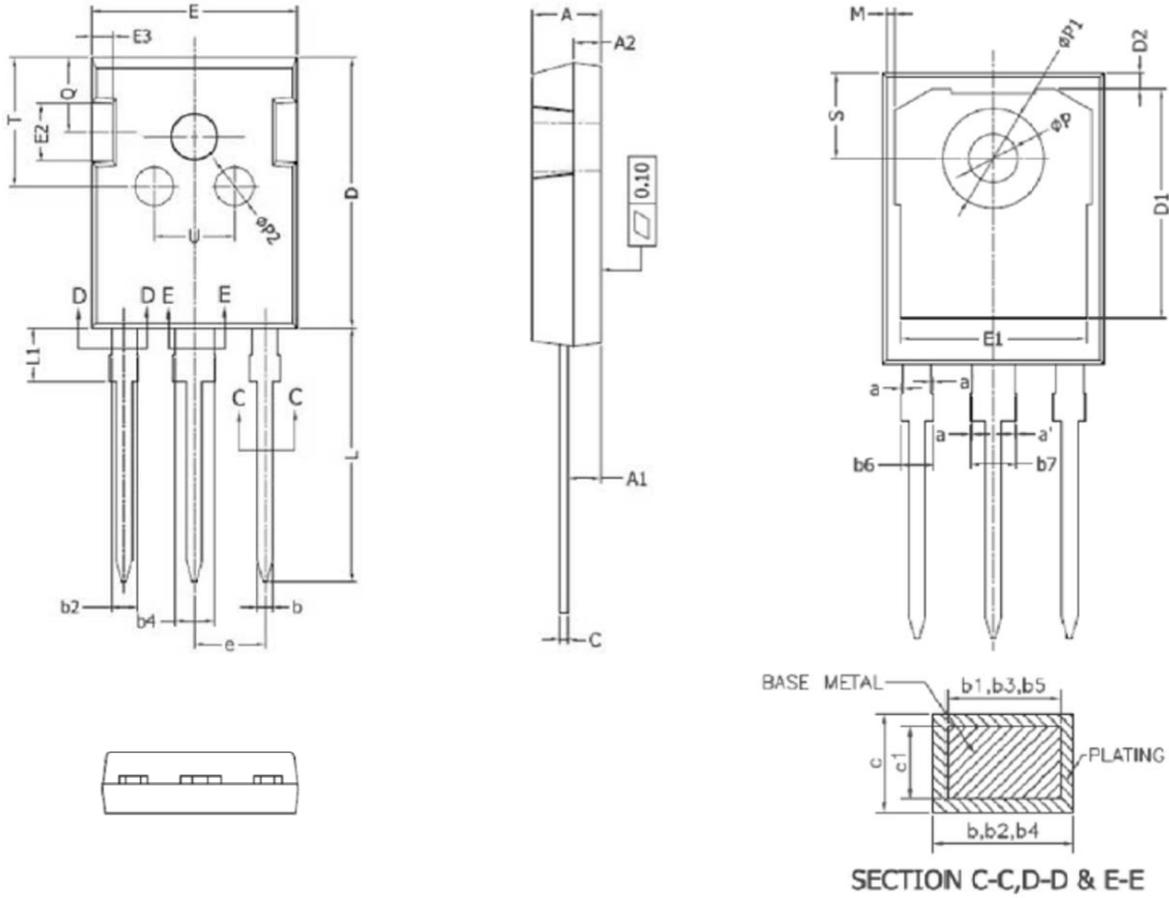


Fig. 20 Diode transient thermal impedance as a function of pulse width ( $D=t_p/T$ )

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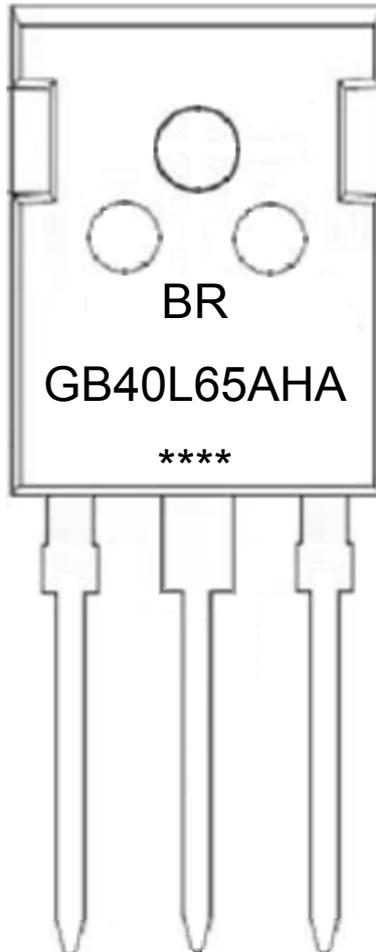
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## 外形尺寸图 / Package Dimensions



Symbol	Dimensions In Millimeters			Symbol	Dimensions In Millimeters		
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.
A	4.90	5.00	5.10	E	15.70	15.80	15.90
A1	2.31	2.41	2.51	E1	13.10	13.30	13.50
A2	1.90	2.00	2.10	E2	4.40	4.50	4.60
a	0.00	-	0.15	E3	1.50	1.60	1.70
a'	0.00	-	0.15	e	5.436 BSC		
b	1.16	-	1.26	L	19.80	19.92	20.10
b1	1.15	1.20	1.22	L1	-	-	4.30
b2	1.96	-	2.06	M	0.35	-	0.95
b3	1.95	2.00	2.02	P	3.40	3.50	3.60
b4	2.96	-	3.06	P1	7.00	-	7.40
b5	2.96	3.00	3.02	P2	2.40	2.50	2.60
b6	-	-	2.25	Q	5.60	-	6.00
b7	-	-	3.25	S	6.05	6.15	6.25
c	0.59	-	0.66	T	9.80	-	10.20
c1	0.58	0.60	0.62	U	6.00	-	6.40
D	20.90	21.00	21.10				
D1	16.25	16.55	16.85				
D2	1.05	1.17	1.35				

## 印章说明 / Marking Instructions



说明：

BR： 为公司代码

GB40L65AHA： 为型号代码

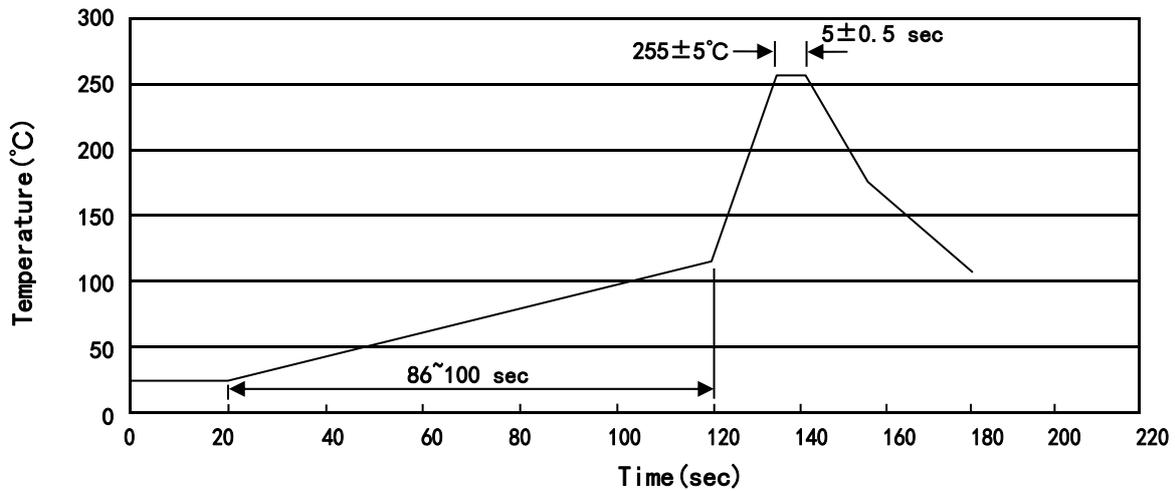
\*\*\*\*： 为生产批号代码，随生产批号变化

Note:

BR: Company Code

GB40L65AHA: Product Type Code

\*\*\*\*: Lot No. Code, code change with Lot No.

**波峰焊温度曲线图(无铅) / Temperature Profile for Dip Soldering(Pb-Free)**


说明：

- 1、预热温度 25~150°C，时间 60~90sec;
- 2、峰值温度 255±5°C，时间持续为 5±0.5sec;
- 3、焊接制程冷却速度为 2~10°C/sec.

Note:

- 1.Preheating:25~150°C, Time:60~90sec.
- 2.Peak Temp.:255±5°C, Duration:5±0.5sec.
3. Cooling Speed: 2~10°C/sec.

**耐焊接热试验条件 / Resistance to Soldering Heat Test Conditions**

温度：270±5°C

时间：10±1 sec.

Temp.:270±5°C

Time:10±1 sec

**包装规格 / Packaging SPEC.**

套管包装 / TUBE

Package Type 封装形式	Units 包装数量					Dimension 包装尺寸 (unit: mm <sup>3</sup> )		
	Units/Tube 只/套管	Tubes/Inner Box 套管/盒	Units/Inner Box 只/盒	Inner Boxes/Outer Box 盒/箱	Units/Outer Box 只/箱	Tube 套管	Inner Box 盒	Outer Box 箱
TO-247	30	15	450	5	2250	520×44×6	580×158×55	595×300×178

**使用说明 / Notices**

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