



# ATT040K065EQ

## 主要参数 MAIN CHARACTERISTICS

$I_C$	40 A
$V_{CE}$	650V
$V_{cesat-typ}(V_{ge}=15V)$	1.7V

### 用途

- 逆变器
- UPS 电源
- 电机控制

### 产品特性

- 低栅极电荷
- Trench FS 技术
- RoHS 产品

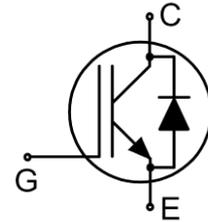
### APPLICATIONS

- General purpose inverters
- UPS
- Motor Control

### FEATURES

- Low gate charge
- Trench FS Technology
- RoHS product

## 封装 Package



## 订货信息 ORDER MESSAGE

订货型号 Order codes	印记 Marking	封装 Package
无卤-条管 Halogen-Free-Tube		
ATT040K065EQ-GE-BR	ATT040K065EQ	TO-247

绝对最大额定值 ABSOLUTE RATINGS (T<sub>C</sub>=25℃)

项 目 Parameter	符 号 Symbol	数 值 Value	单 位 Unit
最高集电极—发射极直流电压 Collector-emitter voltage	V <sub>CE</sub>	650	V
*连续集电极电流 Collector current-continuous	I <sub>C</sub>	80(T <sub>C</sub> =25℃)	A
		40(T <sub>C</sub> =100℃)	A
最大脉冲集电极极电流 (注 1) Collector current – pulse (note 1)	I <sub>CM</sub>	160	A
二极管正向测试电流 Diode forward current	I <sub>F</sub>	80(T <sub>C</sub> =25℃)	A
		40(T <sub>C</sub> =100℃)	A
二极管正向脉冲电流 Diode pulsed current	I <sub>FSM</sub>	160	A
最高栅极发射极电压 Gate-emitter voltage	V <sub>GE</sub>	±20	V
Turn-off safe area	-	160	A
耗散功率 Power dissipation	P <sub>D</sub> T <sub>C</sub> =25℃	340	W
存储温度 Storage temperature range	T <sub>STG</sub>	-55~+150	℃
结温 Junction temperature range	T <sub>VJ</sub>	-55~+175	℃
引线最高焊接温度 Maximum lead temperature for soldering purposes	T <sub>L</sub>	300	℃

\*连续集电极电流由最高结温限制

\*Collector current limited by maximum junction temperature

注释:

1: 脉冲宽度由最高结温限制

Notes:

1: Pulse width limited by maximum junction temperature



## 电特性 ELECTRICAL CHARACTERISTICS

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
<b>关态特性 Off –Characteristics</b>						
集电极-发射极击穿电压 Collector-emitter voltage	$BV_{CES}$	$I_C=1mA, V_{GE}=0V$	650	-	-	V
零栅压下集电极漏电流 Zero gate voltage collector current	$I_{CES}$	$V_{CE}=650V, V_{GE}=0V, T_C=25^\circ C$	-	-	40	$\mu A$
正向栅极体漏电流 Gate-body leakage current, forward	$I_{GESF}$	$V_{CE}=0V, V_{GE}=20V$	-	-	200	nA
反向栅极体漏电流 Gate-body leakage current, reverse	$I_{GESR}$	$V_{CE}=0V, V_{GE}=-20V$	-	-	-200	nA
<b>通态特性 On-Characteristics</b>						
阈值电压 Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C=250\mu A$	4.5	-	6.5	V
饱和压降 Collector-emitter saturation voltage	$V_{CESAT}$	$V_{GE}=15V, I_C=40A$ $T_C=25^\circ C$ $T_C=175^\circ C$	-	1.7 2.2	2.4 -	V
<b>动态特性 Dynamic Characteristics</b>						
输入电容 Input capacitance	$C_{ies}$	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1.0MHz$	-	2392	-	pF
输出电容 Output capacitance	$C_{oes}$		-	193	-	pF
反向传输电容 Reverse transfer capacitance	$C_{res}$		-	64.5	-	pF
栅极电荷总量 Total gate charge	$Q_g$	$V_{CC}=480V, I_C=40A, R_G=10\Omega, V_{GE}=15V$ $T_C=25^\circ C$	-	79.2	-	nC
栅极-发射极 Gate to emitter charge	$Q_{ge}$		-	24.6	-	
栅极-集电极 Gate to collector charge	$Q_{gc}$		-	34.1	-	
栅极电阻-Gate resistance	$R_g$	$f=1MHz, open collector$	-	1.3	-	$\Omega$



## 电特性 ELECTRICAL CHARACTERISTICS

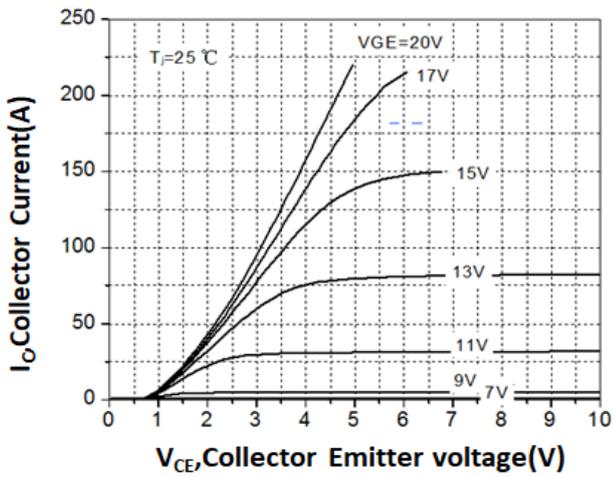
开关特性 Switching Characteristics						
项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
开启延迟时间 Turn-on delay time	$t_d(\text{on})$	$V_{CC}=400V, I_c=40A, R_G=10.5\Omega$ $V_{GE}=15V$ $T_C=25^\circ C$	-	24	-	ns
上升时间 Turn-on rise time	$t_r$		-	84	-	ns
关断延迟时间 Turn-off delay time	$t_d(\text{off})$		-	70	-	ns
下降时间 Turn-off fall time	$t_f$		-	78	-	ns
开通损耗 Turn-on energy	$E_{on}$		-	1.11	-	mJ
关断损耗 Turn-off energy	$E_{off}$		-	1.11	-	mJ
总开关损耗 Total switching energy	$E_{tot}$		-	2.22	-	mJ
开启延迟时间 Turn-on delay time	$t_d(\text{on})$	$V_{CC}=400V, I_c=40A, R_G=10.5\Omega$ $V_{GE}=15V$ $T_C=175^\circ C$	-	30	-	ns
上升时间 Turn-on rise time	$t_r$		-	78	-	ns
关断延迟时间 Turn-off delay time	$t_d(\text{off})$		-	96	-	ns
下降时间 Turn-off Fall time	$t_f$		-	160	-	ns
开通损耗 Turn-on energy	$E_{on}$		-	1.13	-	mJ
关断损耗 Turn-off energy	$E_{off}$		-	1.25	-	mJ
总开关损耗 Total switching energy	$E_{tot}$		-	2.38	-	mJ
反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings						
正向压降 Diode Forward Voltage	$V_F$	$V_{GE}=0V, I_F=20A, T_C=25^\circ C$	-	1.5	2.1	V
		$V_{GE}=0V, I_F=20A, T_C=175^\circ C$	-	1.15	-	V
反向恢复时间 Diode reverse recovery time	$t_{rr}$	$V_{GE}=0V, V_R=400V, I_F=15A$	-	36	-	ns
反向恢复电荷 Diode reverse recovery charge	$Q_{rr}$	$dl_F/dt=1000A/\mu s$	-	0.3	-	$\mu C$
反向恢复电流 Diode reverse recovery current	$I_{rrm}$	$T_C=25^\circ C$	-	10	-	A
反向恢复时间 Diode reverse recovery time	$t_{rr}$	$V_{GE}=0V, V_R=400V, I_F=15A$	-	116	-	ns
反向恢复电荷 Diode reverse recovery charge	$Q_{rr}$	$dl_F/dt=1000A/\mu s$	-	1.1	-	$\mu C$
反向恢复电流 Diode reverse recovery current	$I_{rrm}$	$T_C=175^\circ C$	-	15.8	-	A

项 目 Parameter	符 号 Symbol	TYP	MAX	单 位 Unit
结到管壳的热阻 Thermal Resistance, Junction to Case IGBT	$R_{th(j-c)}$	0.44	0.55	$^\circ C/W$
结到管壳的热阻 Thermal Resistance, Junction to Case diode	$R_{th(j-c)}$	0.81	1.0	$^\circ C/W$
结到环境的热阻 Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$		40	$^\circ C/W$

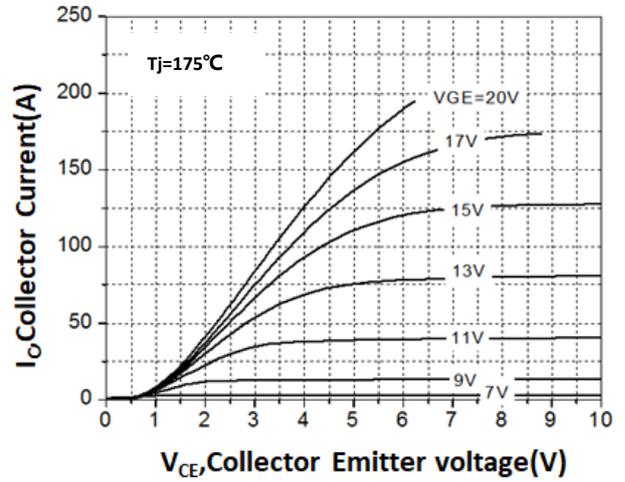


## 特征曲线 ELECTRICAL CHARACTERISTICS (curves)

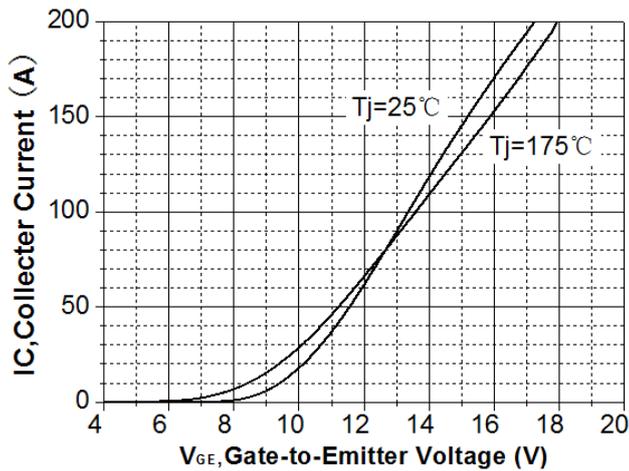
Output Characteristics (25°C)



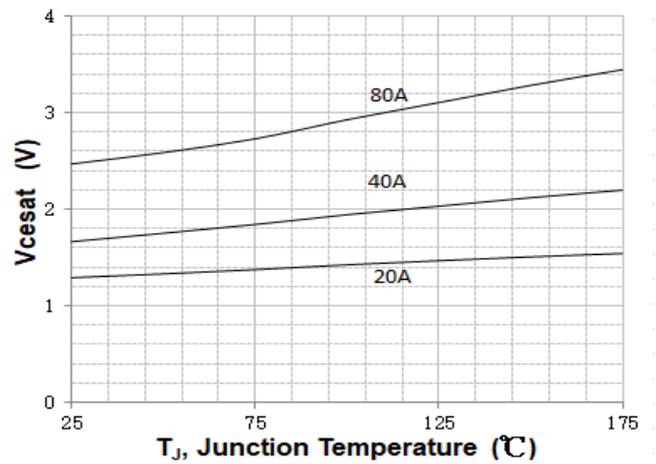
Output Characteristics (175°C)



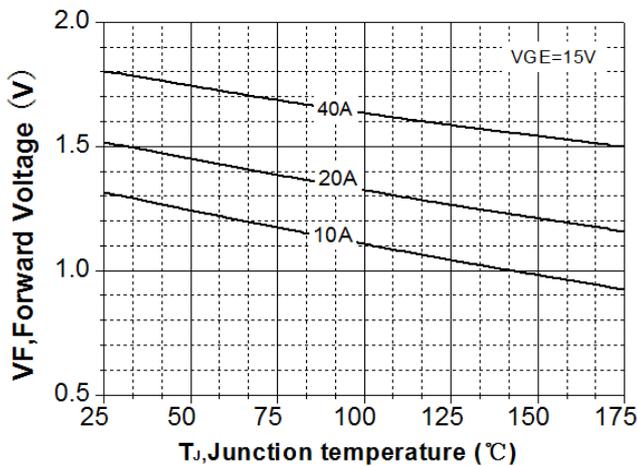
Transfer Characteristics



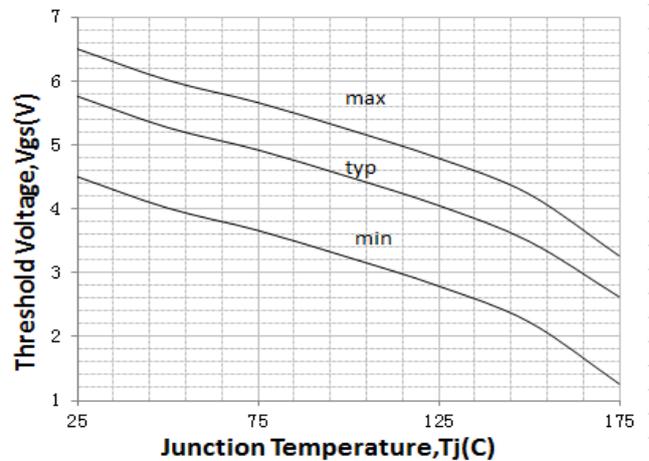
V\_CEsat vs. T\_J



V\_F vs. T\_J

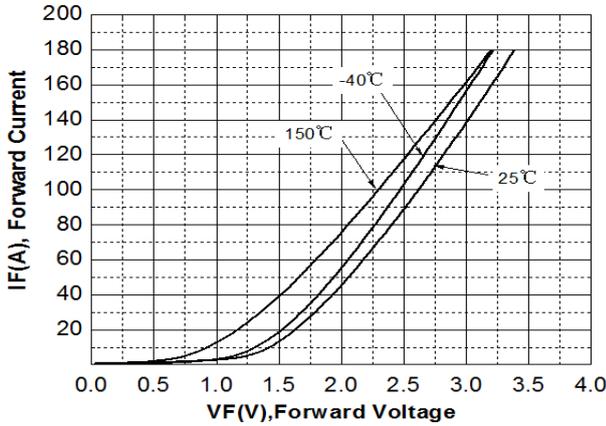


V\_TH vs. T\_J

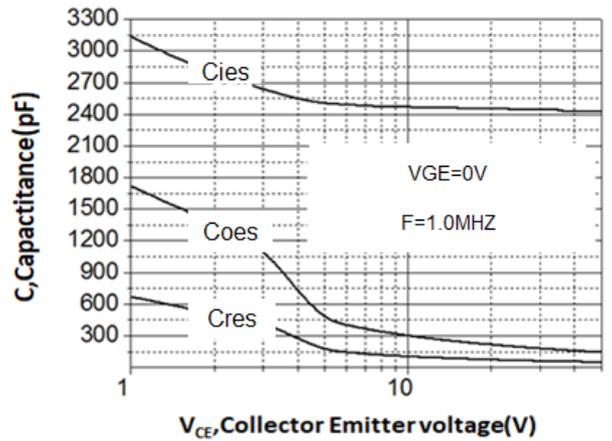




**Diode Characteristic**

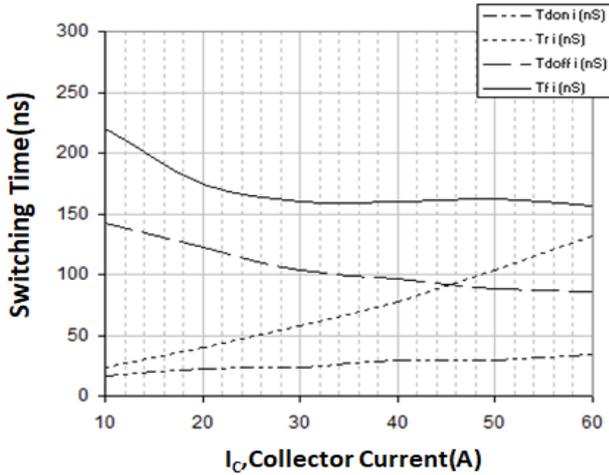


**Capacitance Characteristic**



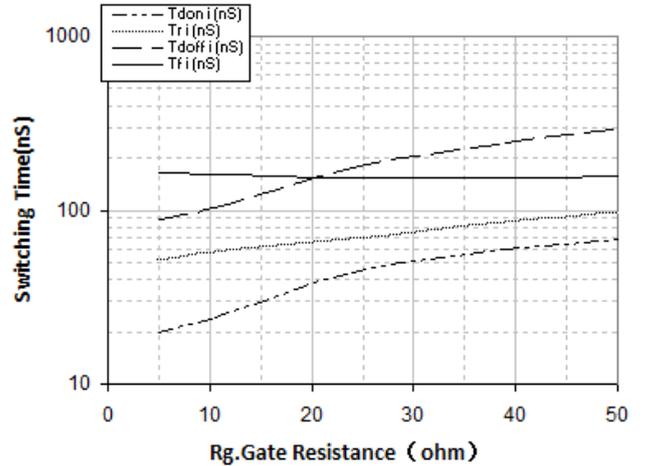
**Switching Time vs. IC(175°C)**

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, R<sub>G</sub>=10.5Ω



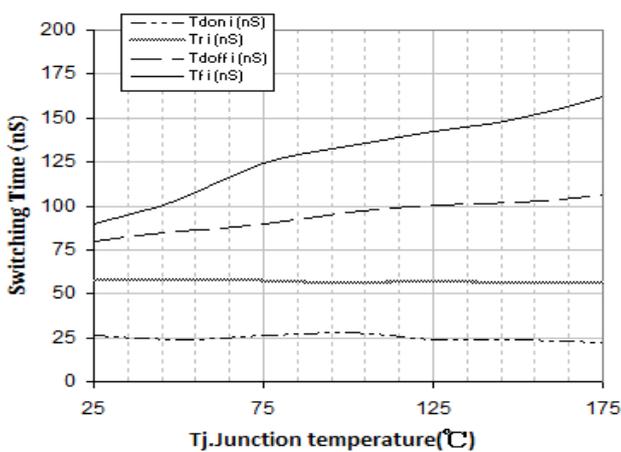
**Switching Time vs. Rg(175°C)**

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, I<sub>C</sub>=40A



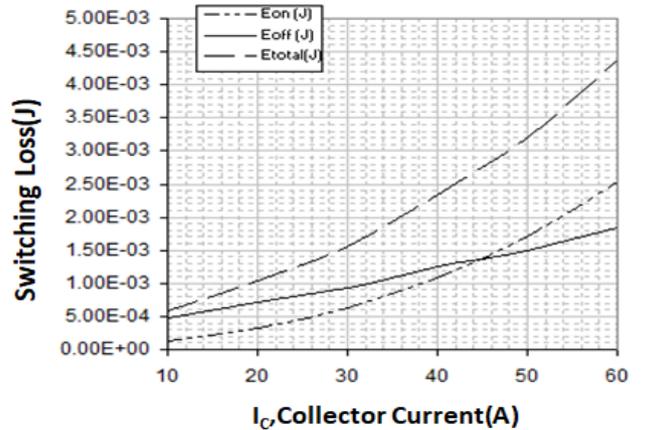
**Switching Time vs. Tj**

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, I<sub>C</sub>=40A, R<sub>G</sub>=10.5Ω



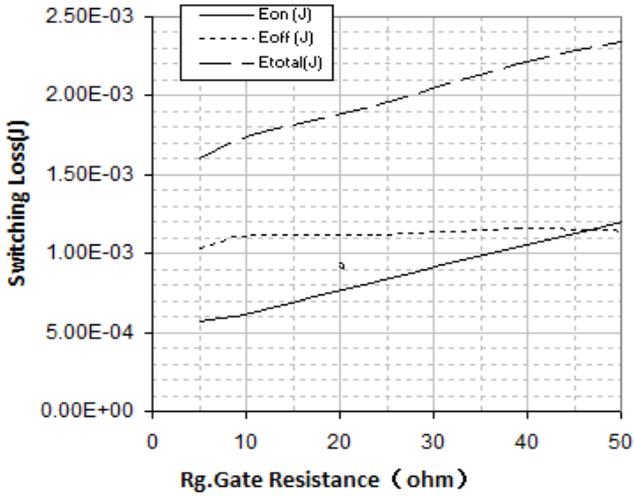
**Switching Loss vs. IC(175°C)**

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, R<sub>G</sub>=10.5Ω

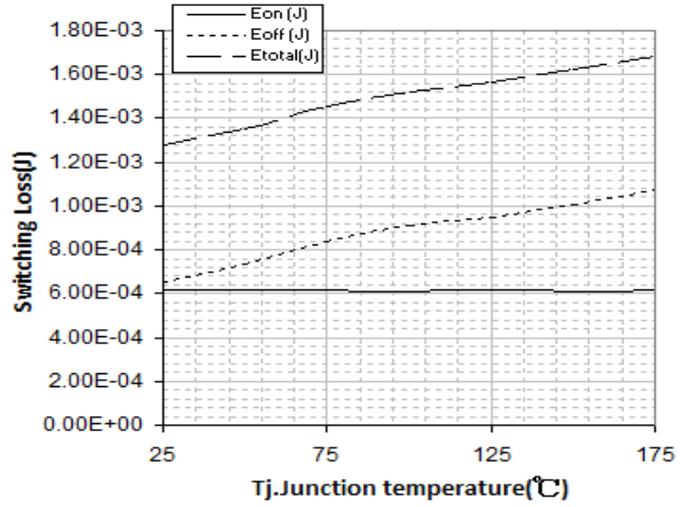




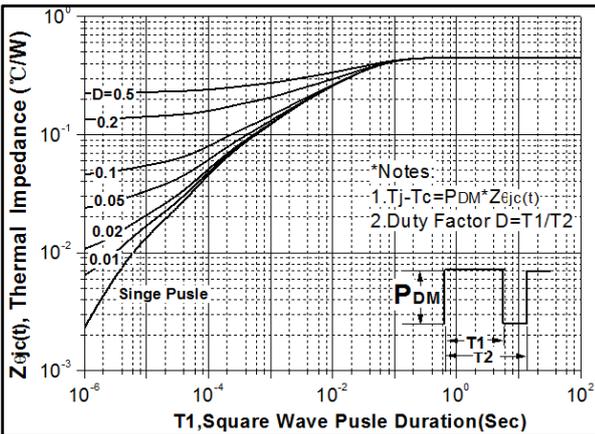
Switching Loss vs. Rg(175°C)  
VGE=15V, VCE=400V, IC=40A



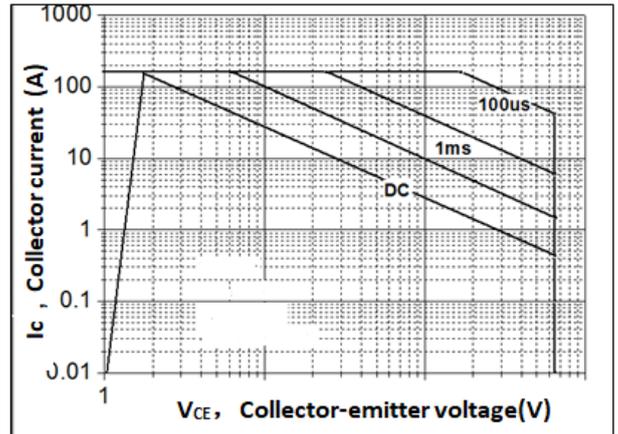
Switching Loss vs. Tj  
VGE=15V, VCE=400V, IC=40A, Rg=10.5Ω



Transient Thermal Impedance for IGBT



Forward Bias SOA

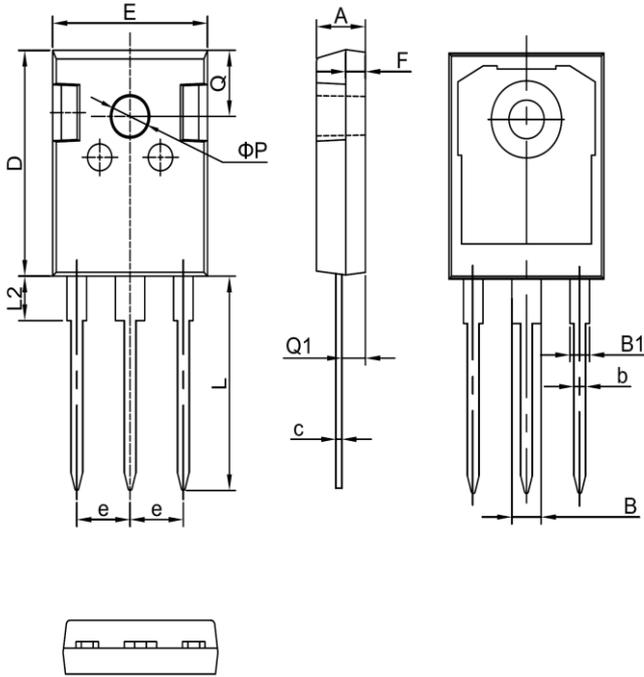




## 外形尺寸 PACKAGE MECHANICAL DATA

## TO-247

单位 Unit : mm



符号 symbol	MIN	MAX
A	4.90	5.10
B	2.95	3.35
B1	1.95	2.35
b	1.15	1.35
c	0.50	0.70
D	20.90	21.10
E	15.70	15.90
e	5.34	5.54
F	1.90	2.10
L	19.40	20.40
L2	4.03	4.23
Q	6.00	6.40
Q1	2.30	2.50
P	3.50	3.70



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