

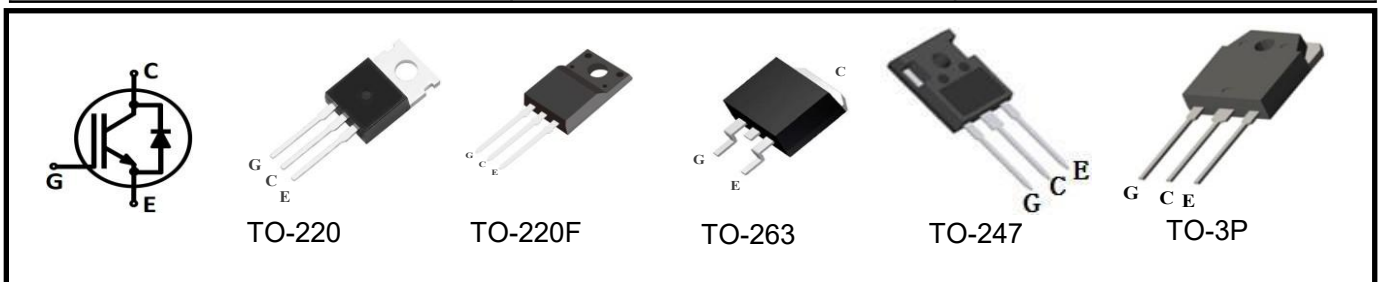
### 特征/Features

- 饱和压降为正温度系数，易于并联使用  
Easy parallel switching capability due to positive temperature coefficient in  $V_{CEsat}$
- 内置快速恢复二极管  
Built-in fast recovery diode
- 高可靠性及热稳定性，良好的参数一致性  
High reliability and thermal stability, good parameter consistency

### 应用领域/Applications

- 电机驱动/Motor Drives

型号/Type	打标/Marking	封装/Package
QMP20N65EF	QMP20N65EF	TO-220
QMA20N65EF	QMA20N65EF	TO-220F
QMC20N65EF	QMC20N65EF	TO-263
QMW20N65EF	QMW20N65EF	TO-247
QMT20N65EF	QMT20N65EF	TO-3P



### 电学特性/Electrical Characteristics

#### 静态特性/Static Characteristics (at $T_j=25^\circ\text{C}$ unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
集电极-发射极击穿电压 Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V$ , $I_C=0.25mA$	650	-	-	V
集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V$ , $I_C=20A$ $T_j=25^\circ\text{C}$	-	1.45	1.90	
		$T_j=125^\circ\text{C}$	-	1.53	-	
		$T_j=150^\circ\text{C}$	-	1.55	-	
二极管正向压降 Diode forward voltage	$V_F$	$V_{GE}=0V$ , $I_F=20A$ $T_j=25^\circ\text{C}$	-	1.55	1.80	
		$T_j=125^\circ\text{C}$	-	1.44	-	
		$T_j=150^\circ\text{C}$	-	1.40	-	
阈值电压 G-E threshold voltage	$V_{GE(th)}$	$I_C=250\mu A$ , $V_{CE}=V_{GE}$	4.5	5.8	6.5	
集电极-发射极漏电流 C-E leakage current	$I_{CES}$	$V_{CE}=650V$ , $V_{GE}=0V$ $T_j=25^\circ\text{C}$	-	-	0.01	mA
		$T_j=150^\circ\text{C}$	-	-	1.0	
栅极-发射极漏电流 G-E leakage current	$I_{GES}$	$V_{CE}=0V$ , $V_{GE}=20V$	-	-	250	nA

**最大额定值/Maximum Rated Values <sup>1</sup>**

Item	Symbol	Value				Unit
		220F	263/ 220	247	3P	
集电极-发射极电压 Collector-emitter voltage	$V_{CE}$	650				V
集电极电流 DC collector current <sup>2</sup>	$I_C$	40				A
$T_C=25^\circ\text{C}$		20				
$T_C=100^\circ\text{C}$		60				
集电极脉冲电流 Pulsed collector current <sup>3</sup>	$I_{Cpuls}$	60				
二极管正向电流 Diode forward current <sup>2</sup>	$I_F$	40				
$T_C=25^\circ\text{C}$		20				
$T_C=100^\circ\text{C}$		60				
二极管脉冲电流 Diode pulsed current <sup>3</sup>	$I_{Fpuls}$	60				
短路承受时间 Short circuit withstanding time $V_{GE} = 15\text{V}, V_{CC} \leq 400\text{V}, T_J \leq 150^\circ\text{C}$	$t_{SC}$	5				us
栅极-发射极电压 Gate-emitter voltage	$V_{GE}$	$\pm 20$				V
瞬态栅极-发射极电压 Transient Gate-emitter voltage ( $t_p \leq 10\text{us}$ )		$\pm 30$				
耗散功率 Power dissipation	$P_{tot}$	55				W
$T_C=25^\circ\text{C}$		214	166	166		
工作结温 Operating junction temperature	$T_j$	-55~175				°C
储存温度 Storage temperature	$T_{stg}$	-55~150				

1: Reference standard: JESD-022

2: limited by  $T_{jmax}$

3:  $T_p$  limited by  $T_{jmax}$  ;

**热学特性/Thermal Characteristics**

Item	Symbol	Conditions	Max.				Unit
			220/ 263	220F	247	3P	
结-外壳热阻 IGBT thermal resistance, junction- case	$R_{thJC}$	-	0.7	2.7	0.9	0.9	K/W
二极管结-外壳热阻 Diode thermal resistance, junction- case	$R_{thJCD}$	-	1.6	3.8	1.9	1.9	

## 动态特性/Dynamic Characteristics

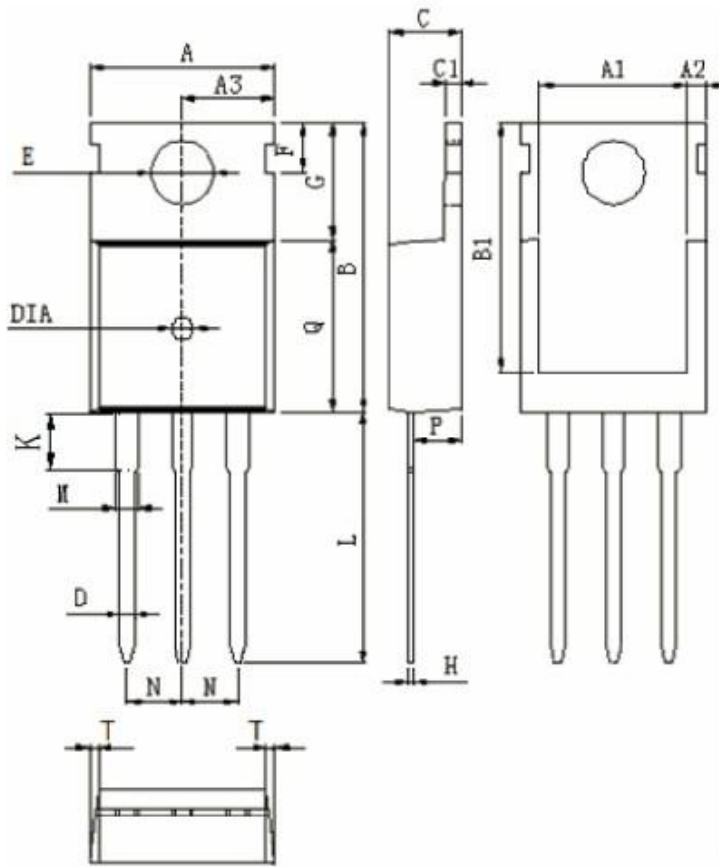
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
输入电容 Input capacitance	$C_{iss}$	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$	-	2091	-	pF
输出电容 Output capacitance	$C_{oss}$		-	69	-	
反馈电容 Reverse transfer capacitance	$C_{rss}$		-	32	-	
栅电荷 Gate charge	$Q_G$	$V_{CC}=300V, I_C=20A,$ $V_{GE}=15V$	-	113	-	nC

## IGBT开关特性(感性负载)/IGBT Switching Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
开通延迟时间 Turn-on delay time	$t_{d(on)}$	$T_j=25^\circ C,$ $V_{CC}=400V,$ $I_C=20A,$ $V_{GE}=0/15V,$ $R_G=10\Omega,$ Inductive load	-	79	-	ns
上升时间 Rise time	$t_r$		-	39	-	
关断延迟时间 Turn-off delay time	$t_{d(off)}$		-	155	-	
下降时间 Fall time	$t_f$		-	52	-	mJ
开通损耗 Turn-on energy	$E_{on}$		-	0.373	-	
关断损耗 Turn-off energy	$E_{off}$		-	0.376	-	
开关损耗 Total switching energy	$E_{ts}$	-	0.749	-		

## 二极管开关特性/Diode

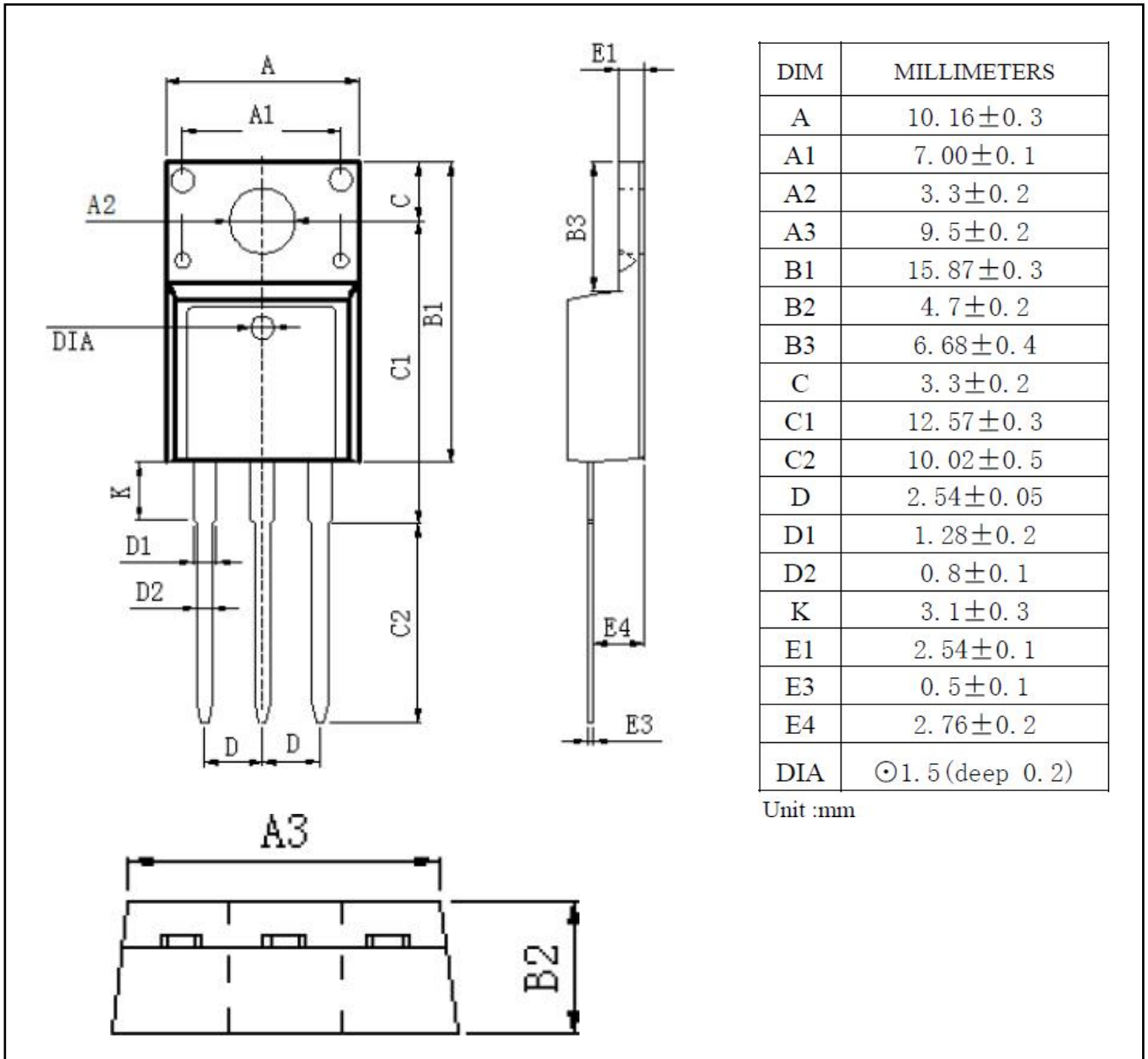
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
反向恢复时间 Diode reverse recovery time	$t_{rr}$	$T_j=25^\circ C,$ $V_R=400V,$ $I_F=20A,$ $di_F/dt=520A/us$	-	74	-	ns
反向恢复电荷 Diode reverse recovery charge	$Q_{rr}$		-	0.389	-	$\mu C$
反向恢复峰值电流 Diode peak reverse recovery current	$I_{rrm}$		-	7.8	-	A

**TO-220-3L**


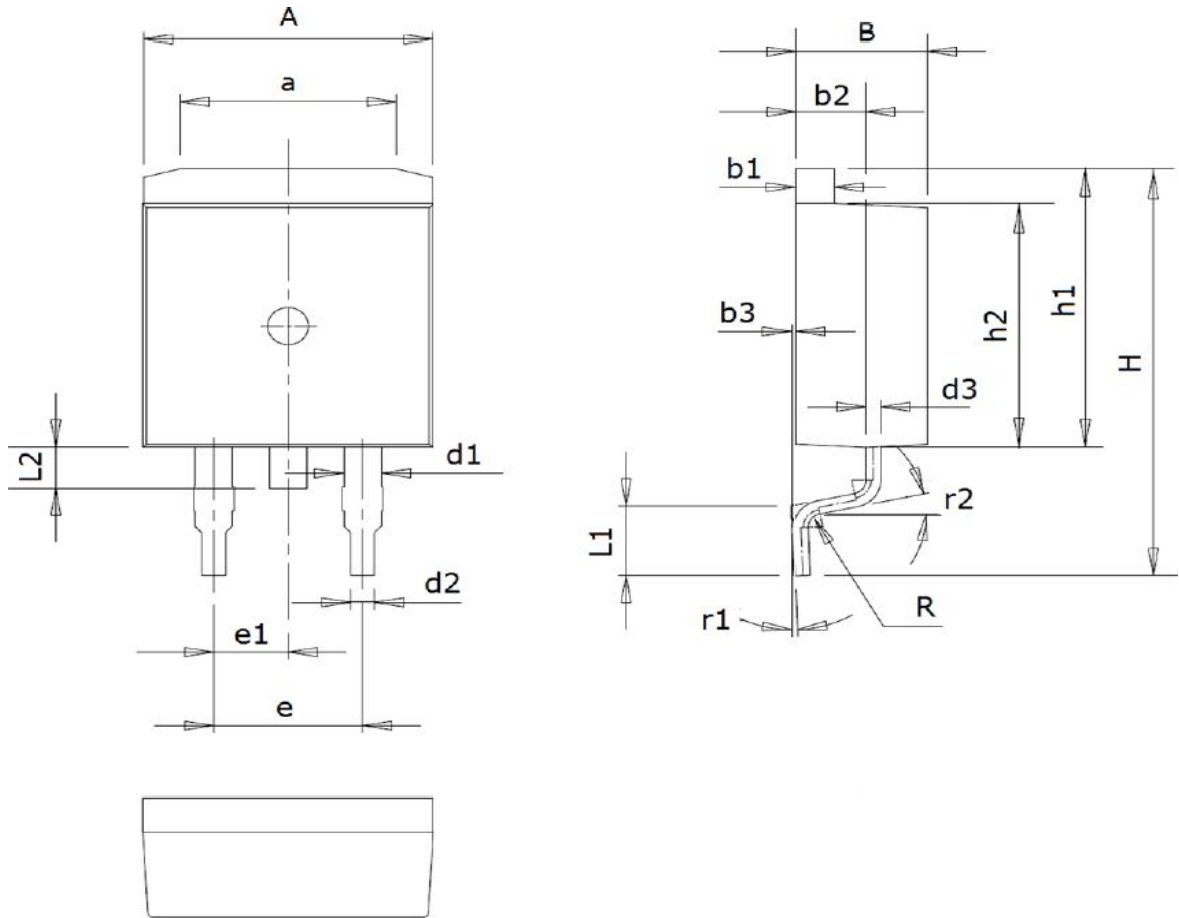
DIM	MILLIMETERS
A	10.0±0.3
A1	8.64±0.2
A2	1.15±0.1
A3	5.0±0.2
B	15.8±0.4
B1	13.2±0.3
C	4.56±0.1
C1	1.3±0.2
D	0.8±0.2
E	3.6±0.2
F	2.95±0.3
G	6.5±0.3
H	0.5±0.1
K	3.1±0.2
L	13.2±0.4
M	1.25±0.1
N	2.54±0.1
P	2.4±0.3
Q	9.0±0.3
T	W:0.35
DIA	⊙1.5(deep 0.2)

Unit :mm

TO-220F-3L

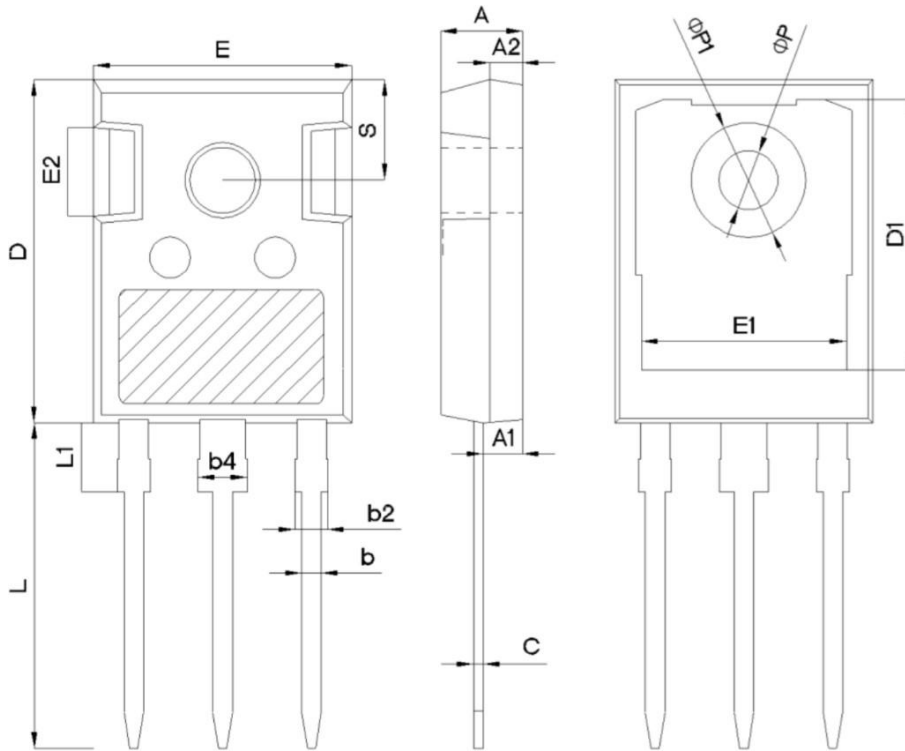


TO-263

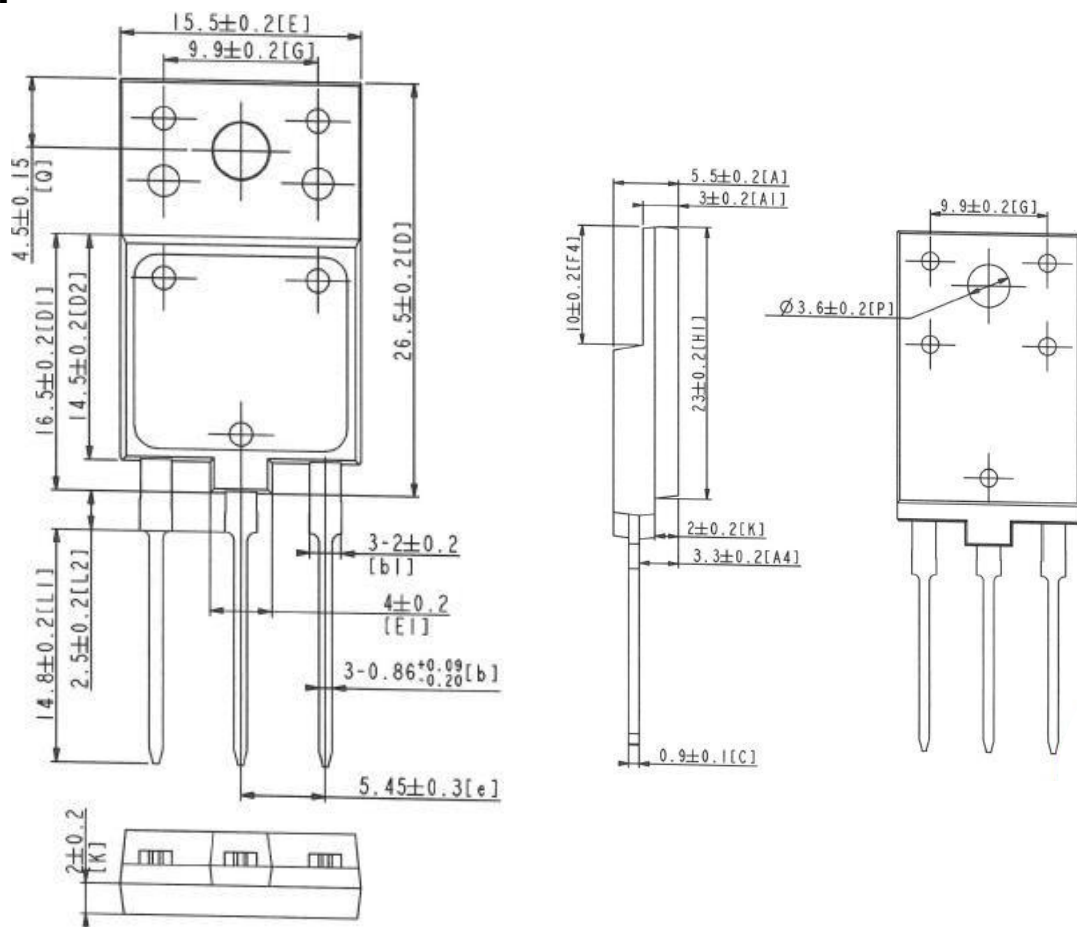


Symbol	Dimensions (mm)	Symbol	Dimensions (mm)	Symbol	Dimensions (mm)
A	9.86~10.26	d2	0.7~0.96	L1	2.0~2.6
a	7.0~7.8	d3	0.3~0.53	L2	1.3~1.8
B	4.37~4.77	e	5.08	R	0.5
b1	1.22~1.42	e1	2.54	r1	0-9°
b2	2.2~2.6	H	14.7~15.5	r2	12°
b3	0~0.25	h1	10.3~10.7		
d1	1.17~1.47	h2	9.1~9.4		

# TO-247-3L



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
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	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		

**TO-3P**


SYMBOL	mm		
	MIN	NOM	MAX
A	5.3	5.5	5.7
A1	2.8	3.0	3.2
b	0.66	0.86	0.95
b1	1.8	2.0	2.2
A4	3.1	3.3	3.5
C	0.8	0.9	1
D	26.3	26.5	26.7
D1	16.3	16.5	16.7
D2	14.3	14.5	14.7
P	3.4	3.6	3.8
E	15.3	15.5	15.7
E1	3.8	4.0	4.2
e	5.15	5.45	5.75
G	9.7	9.9	10.1
Q	4.35	4.5	4.65
L1	14.6	14.8	15
L2	2.3	2.5	2.7
K	1.8	2	2.2
F4	9.8	10	10.2
H1	22.8	23	23.2
K	1.8	2	2.2



**修订历史/Revision History:**

修订 /Revision	主题（自上次修订以来的主要变化） /Subjects (major changes since last revision)	日期 /Date
1.0	Initial Version	2020-01
2.0	Update the English and Chinese versions	2023-04

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