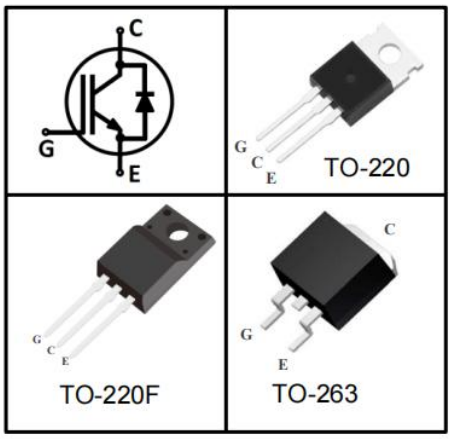
QMX15N65EF
650V-15A Trench and Field Stop IGBT

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
QMP15N65EF	QM15N65EF	TO-220-3
QMA15N65EF	QM15N65EF	TO-220F-3
QMC15N65EF	QM15N65EF	TO-263

最大额定值/Maximum Rated Values[1]

Item	Symbol	Value			Unit
		220	220F	263	
集电极-发射极电压 Collector-emitter voltage	V_{CE}	650			V
集电极电流 DC collector current[2]					A
T_C=25℃	I_C	30			
T_C=100℃		15			
集电极脉冲电流 Pulsed collector current[3]	I_{Cpuls}	45			
二极管正向电流 Diode forward current[2]					
T_C=25℃	I_F	30			
T_C=100℃		15			
二极管脉冲电流 Diode pulsed current[3]	I_{Fpuls}	45			
短路承受时间 Short circuit withstanding time V_{GE} = 15V, V_{CC} ≤ 400V, T_J ≤150℃	t_{SC}	10			us
栅极-发射极电压 Gate-emitter voltage	V_{GE}	±20			V
瞬态栅极-发射极电压 Transient Gate-emitter voltage (t_p≤10us)		±30			
耗散功率 Power dissipation					W
T_C=25℃	P_{tot}	125	52	107	
T_C=100℃		63	26	54	
工作结温 Operating junction temperature	T_j	-55~175			℃
储存温度 Storage temperature	T_{stg}	-55~150			

1 :Reference standard: JESD-022
2: limited by Tjmax
3: Tp limited by Tjmax ;

热学特性/Thermal Characteristics

Item	Symbol	Conditions	Max.			Unit
			220	220F	263	
结一外壳热阻 IGBT thermal resistance, junction-case	R_{thJC}	-	1.2	2.9	1.4	K/W
二极管结一外壳热阻 Diode thermal resistance, junction-case	R_{thJCD}	-	2.0	4.6	2.8	
结-环境热阻 Thermal Resistance, junction-ambient	R_{thJA}	-	65	65	65	

电学特性/Electrical Characteristics

静态特性/Static Characteristics（at Tj=25℃ unless otherwise specified）

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
集电极一发射极击穿电压 Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0 25mA	650	-	-	V
集电极一发射极饱和电压 Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=15A T_j=25 ℃	-	1.45	1.95	
		T_j=125 ℃	-	1.60	-	
		T_j=150 ℃	-	1.80	-	
二极管正向压降 Diode forward voltage	V_F	V_{GE}=0V， I_F=15A T_j=25 ℃	-	1.50	1.80	
		T_j=125 ℃	-	1.40	-	
		T_j=150 ℃	-	1.30	-	
阈值电压 G-E threshold voltage	$V_{GE(th)}$	I_C=250uA, 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 ℃	-	-	0.01	mA
		T_j=150℃	-	-	1.0	
栅极-发射极漏电流 G-E leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	250	nA

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	-	12 85	-	pF
输出电容 Output capacitance	C_{oss}		-	69	-	
反馈电容 Reverse transfer capacitance	C_{rss}		-	9	-	
栅电荷 Gate charge	Q_G	V_{CC}=300V,I_C=15A, V_{GE}=15V	-	53	-	nC

二极管开关特性/Diode Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
反向恢复时间 Diode reverse recovery time	t_{rr}	T_j=25℃, V_R=400V, I_F=15A, di_F/dt=570A/us	-	82	-	ns
反向恢复电荷 Diode reverse recovery charge	Q_{rr}		-	0.40	-	μC
反向恢复峰值电流 Diode peak reverse recovery current	I_{rrm}		-	8.5	-	A

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℃, V_{CC}=400V, I_C=15A, V_{GE}=0/15V, R_G=10Ω, Inductive load	-	66	-	ns
上升时间 Rise time	t_r		-	35	-	
关断延迟时间 Turn-off delay time	$t_{d(off)}$		-	126	-	
下降时间 Fall time	t_f		-	57	-	
开通损耗 Turn-on energy	E_{on}		-	0.28	-	mJ
关断损耗 Turn-off energy	E_{off}		-	0.30	-	
开关损耗 Total switching energy	E_{ts}		-	0.58	-	

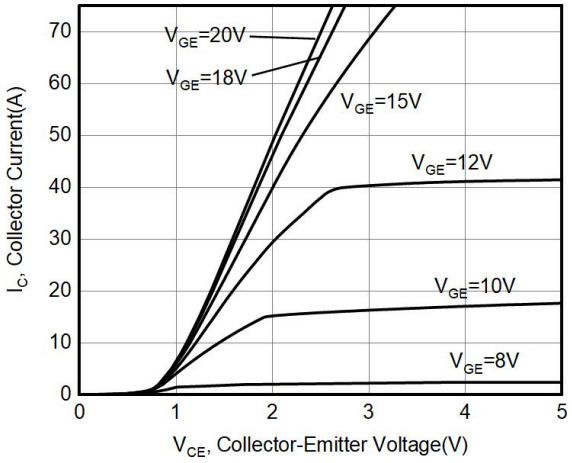


Figure 1. 典型输出特性/ Typical output characteristic (T_j =25 ℃)

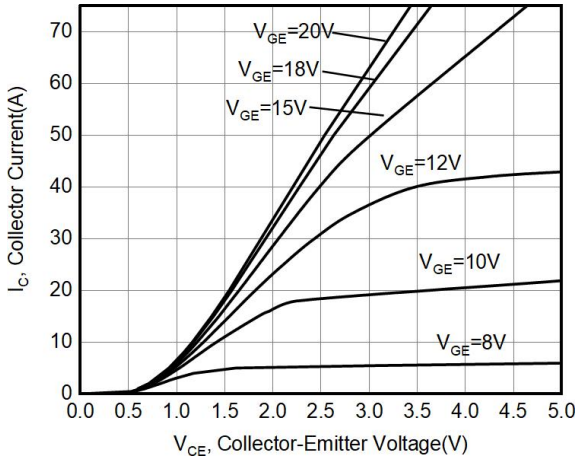


Figure 2. 典型输出特性/Typical output characteristic (T_j =150 ℃)

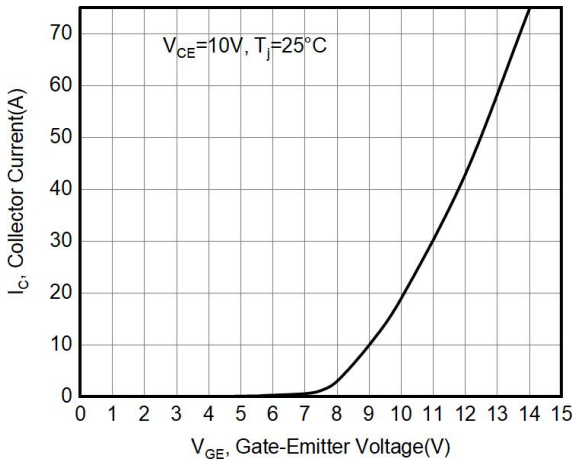


Figure 3. 典型输出特性/Typical transfer characteristic (T_j =25 ℃)

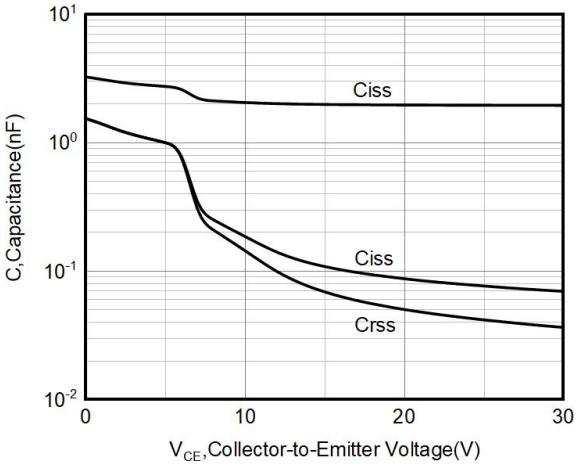


Figure 4. 电容特性/Capacitance characteristic(V_{GE}=0V, f=1MHz)

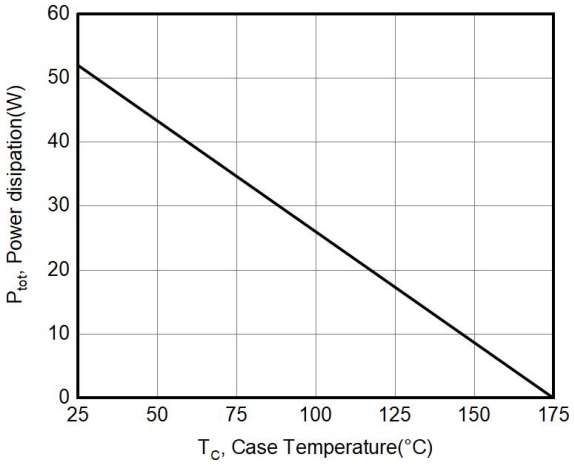


Figure 5. 功耗与外壳温度的关系/Power dissipation as a function of case temperature (T_j≤175 ℃)

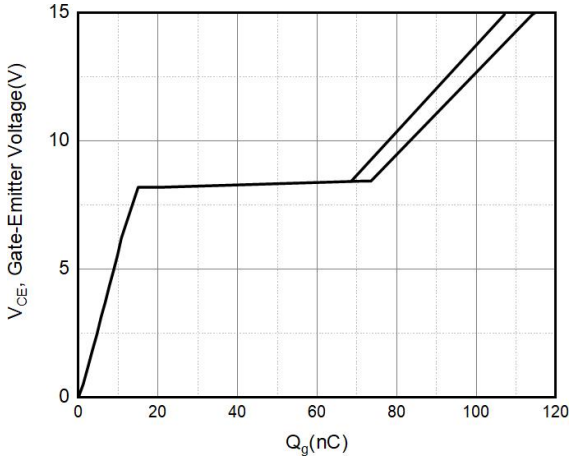


Figure 6. 典型栅极电荷/Typical gate charge (I_C=15A)

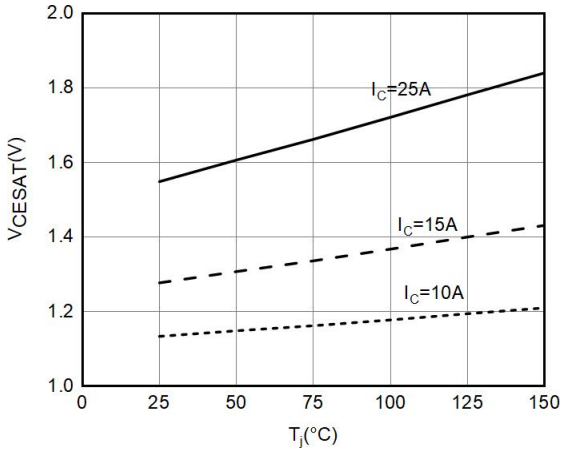


Figure 7. **V_{CESAT}作为结温的函数曲线/ V_{CESAT} as a function of junction temperature (V_{GE}=15V)**

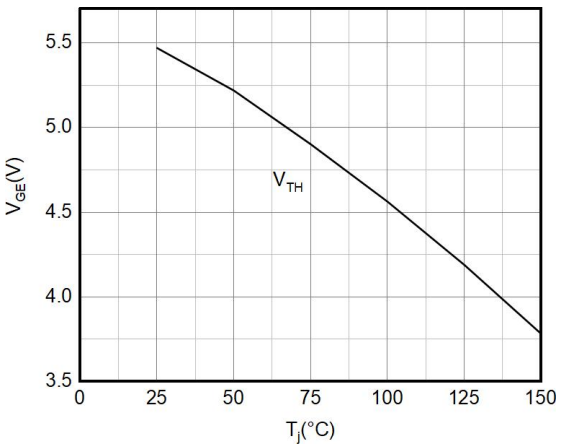


Figure 8. V_{TH}与结温的关系曲线/V_{TH} as a function of junction temperature (I_{CE}=250uA)

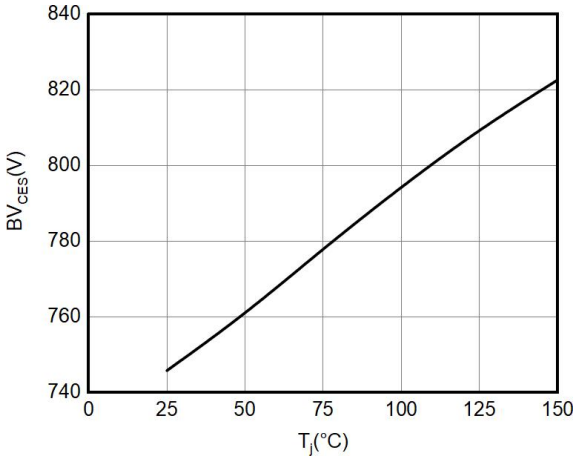


Figure 9. BV作为结温的函数曲线/BV as a function of junctiontemperature (I_{CE}=250uA)

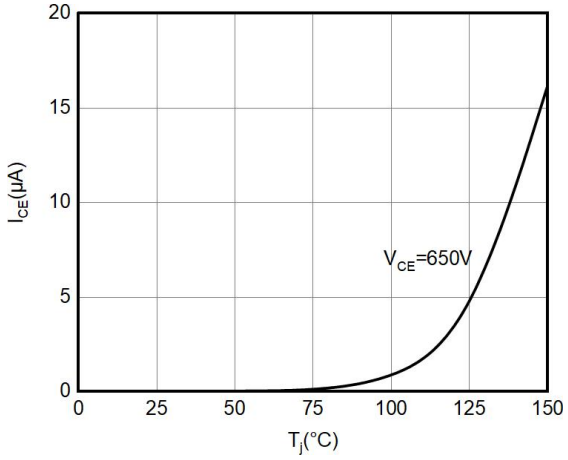


Figure 10. I_{CES}漏电流与结温的关系曲线/I_{CES} leakage current as a function of junction temperature

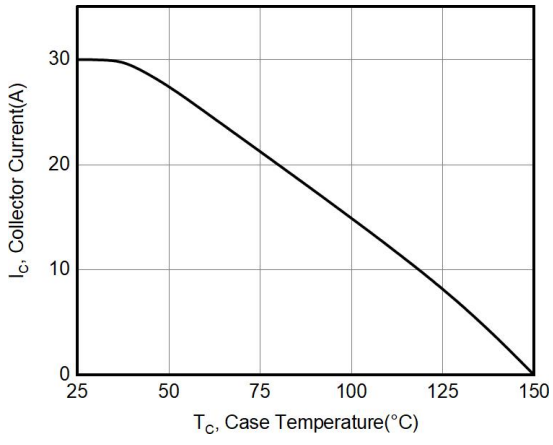


Figure 11. 集电极电流与外壳温度的关系/Collector current as a function of case temperature(V_{GE}≥15V, T_j≤150 ℃)

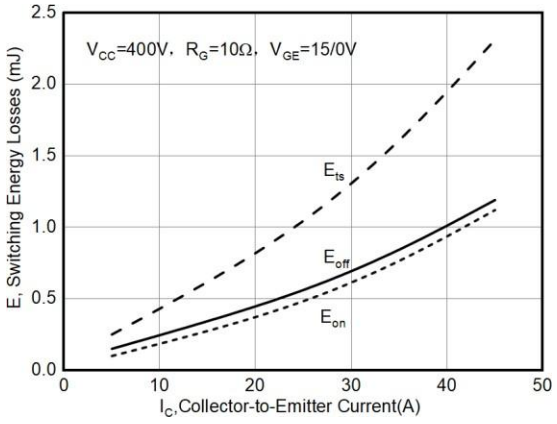


Figure 12. E_{on}， E_{off} 作为 I_C 的函数曲线/E_{on}, E_{off} as a function of I_C(T_j=25 ℃)

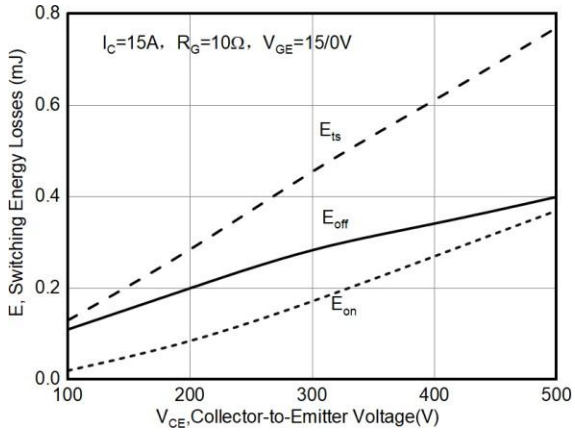


Figure 13. E_{on}, E_{off} 作为 V_{CE} 的函数曲/E_{on}, E_{off} as a function of V_{CE}(T_j=25 ℃)

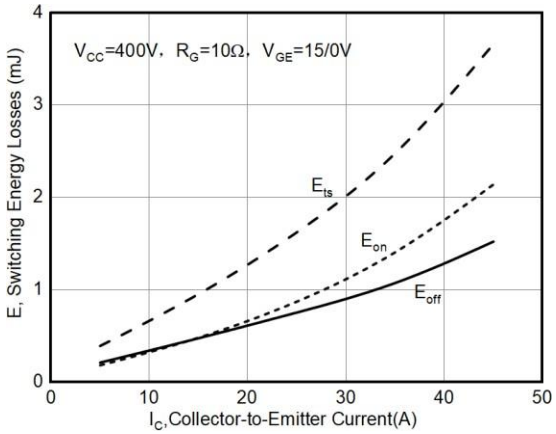


Figure 14. E_{on},E_{off} 作为 I_C 的函数曲线 /E_{on}, E_{off} as a function of I_C(T_j=150 ℃)

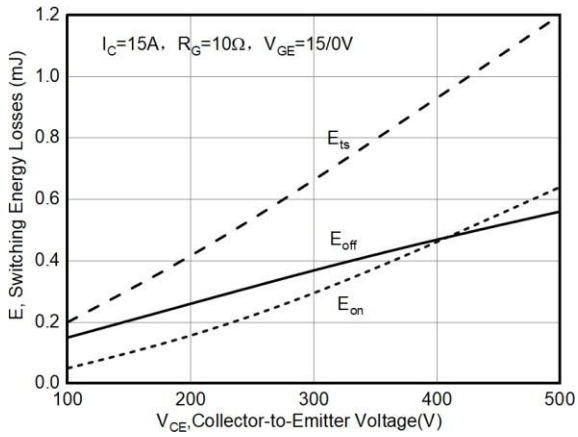


Figure 15. E_{on}, E_{off} 作为 V_{CE} 的函数曲线 /E_{on}, E_{off} as a function of V_{CE} (Tj=150 ℃)

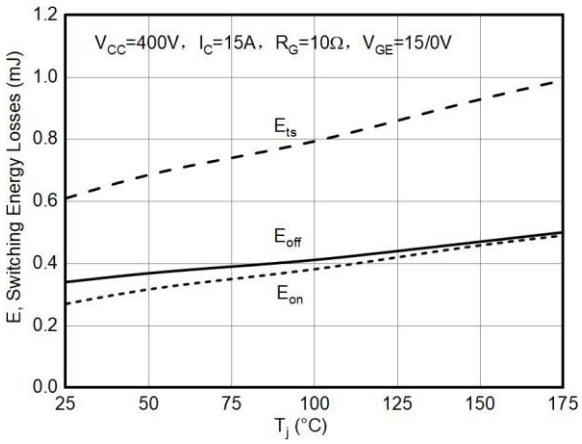


Figure 16. E_{on}，E_{off}作为结温的函数/E_{on}，E_{off} as a function of junction temperature

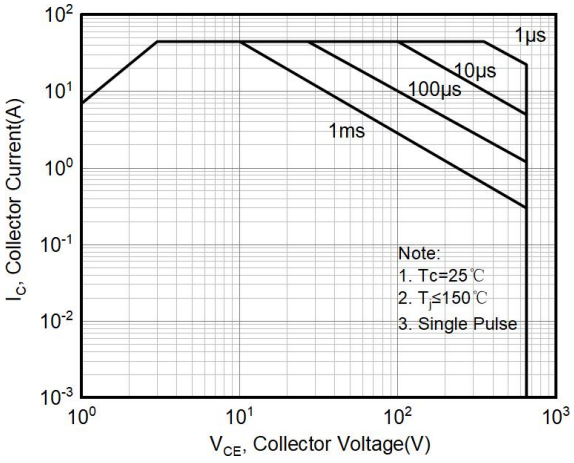
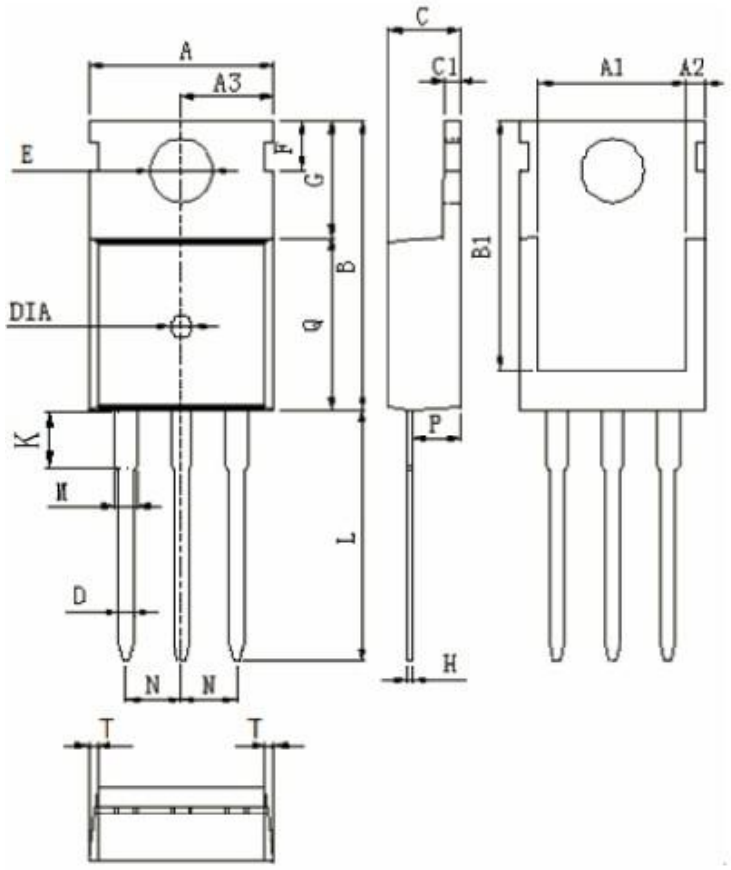


Figure 17. 正偏安全工作区/FBSOA

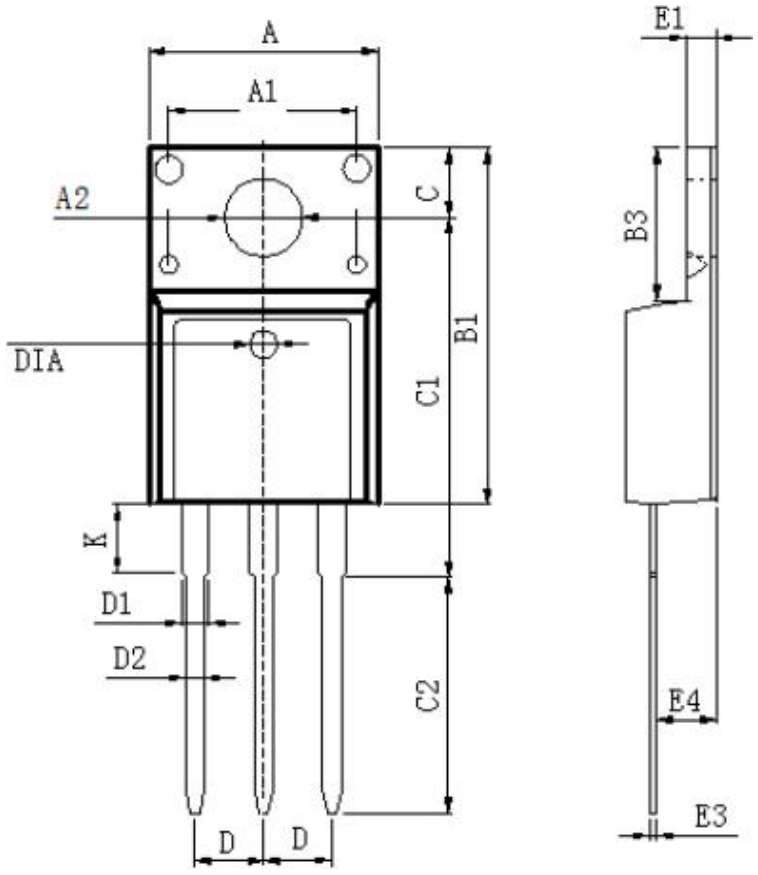
TO-220-3L

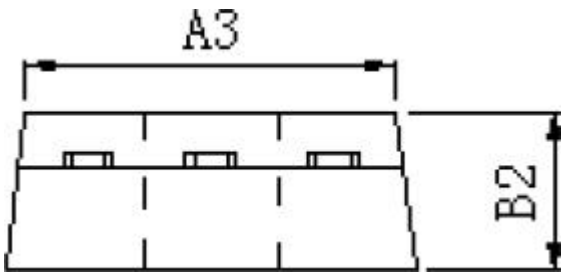


DIM	MILLIMETERS
A	10.0±0.3
A1	8.64±0.2
A2	1.15±0.1
A3	5.0±0.2
B	15.8±0.4
B1	13.2±0.3
C	4.56±0.1
C1	1.3±0.2
D	0.8±0.2
E	3.6±0.2
F	2.95±0.3
G	6.5±0.3
H	0.5±0.1
K	3.1±0.2
L	13.2±0.4
M	1.25±0.1
N	2.54±0.1
P	2.4±0.3
Q	9.0±0.3
T	W:0.35
DIA	⊙1.5(deep 0.2)

Unit :mm

TO-220F-3L

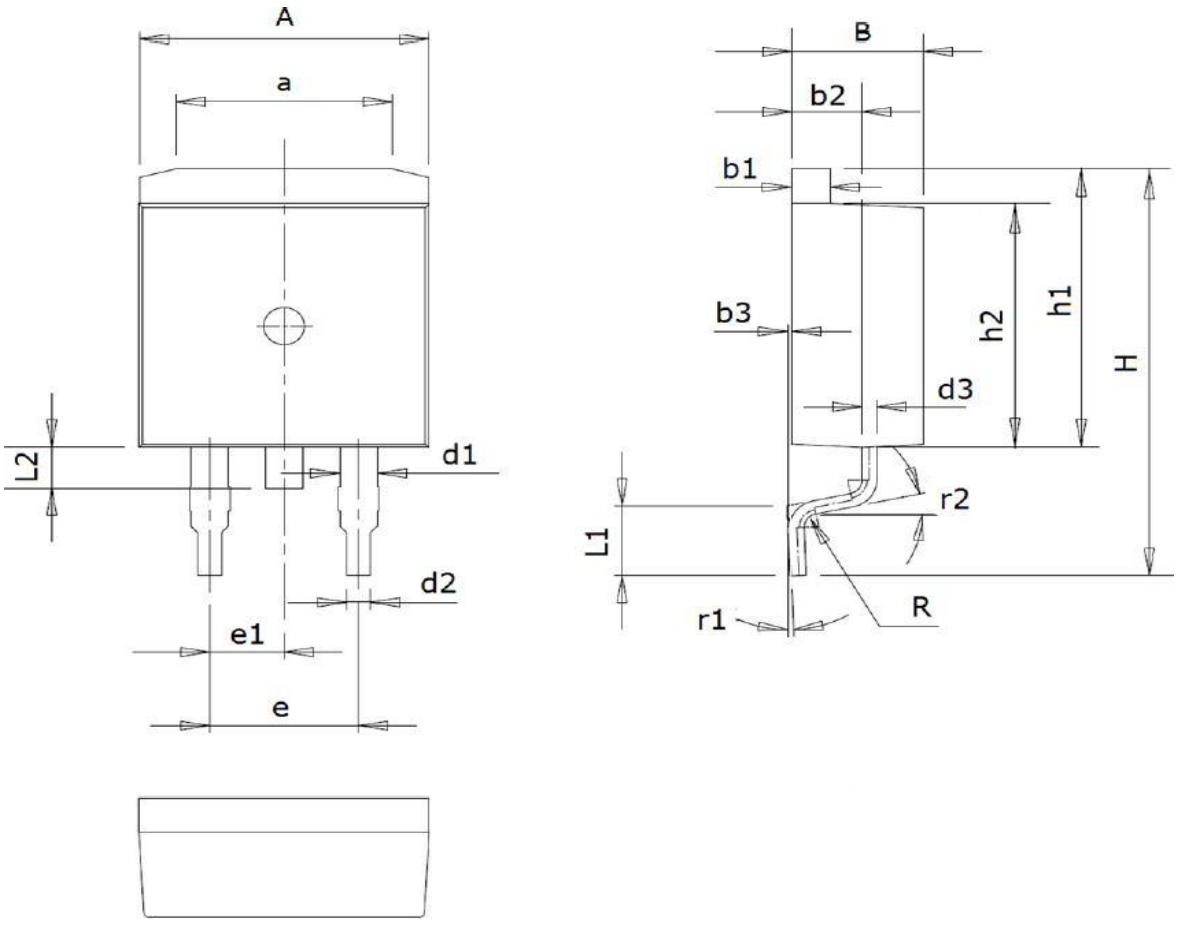




DIM	MILLIMETERS
A	10.16±0.3
A1	7.00±0.1
A2	3.3±0.2
A3	9.5±0.2
B1	15.87±0.3
B2	4.7±0.2
B3	6.68±0.4
C	3.3±0.2
C1	12.57±0.3
C2	10.02±0.5
D	2.54±0.05
D1	1.28±0.2
D2	0.8±0.1
K	3.1±0.3
E1	2.54±0.1
E3	0.5±0.1
E4	2.76±0.2
DIA	⊙1.5(deep 0.2)

Unit :mm

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		

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	2020-04
2.0	Update the English and Chinese versions	2023-04

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