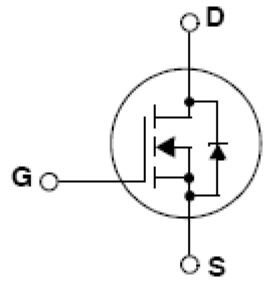
# BF910N60/BF910N60L

## 600V N-Channel MOSFET

BYD Microelectronics Co., Ltd.

## General Description

These N-Channel enhancement mode power field effect transistors are produced using DMOS technology.
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.




## Features

- $V_{DS}$ =600 V
- $I_D$ =10A
- $R_{DS(ON)}$ =0.65 Ω TYP($V_{GS}$=10V,$I_D$=5.0A)
- Low $C_{RSS}$ (typical 16pF)
- Fast switching


## Absolute Maximum Ratings

| Symbol | Parameter | BF910N60L | BF910N60 | Unit |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 600 | | V |
| $I_D$ | Drain Current(continuous)at Tc=25°C | 10 | | A |
| $I_{DM}$ | Drain Current (pulsed) (Note1) | 40 | | A |
| $V_{GS}$ | Gate-Source Voltage | ±30 | | V |
| $E_{AS}$ | SinglePulseAvalanche Energy (Note2) | 490 | | mJ |
| $I_{AR}$ | Avalanche Current (Note1) | 10 | | A |
| $E_{AR}$ | RepetitiveAvalancheEnergy (Note1) | 16 | | mJ |
| dv/dt | PeakDiodeRecoverydv/dt (Note3) | 5.0 | | V/ns |
| $P_D$ | Power Dissipation ($T_C$ = 25°C) | 139 | 48 | W |
| Tstg | Storage Temperature Range | -55 to +150 | | ℃ |
| $T_L$ | Maximum Lead Temperature for Soldering Purpose | 300 | | ℃ |

## Ordering Information

| Part Number | Package | Packaging |
|---|---|---|
| BF910N60 | TO-220F | Tube |
| BF910N60L | TO-220 | Tube |

## Thermal Data

| Symbol | Parameter | TO-220F | TO-220 | Unit |
|---|---|---|---|---|
| Rthj-case | Thermal Resistance Junction-case | 2.6 | 0.9 | ℃/W |
| Rthj-amb | Thermal Resistance Junction-ambient | 62.5 | 62.5 | ℃/W |

## Electrical Characteristics($T_c$ = 25℃)

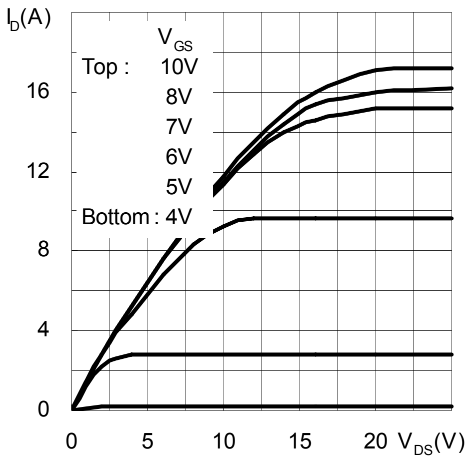
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D$=250uA, $V_{GS}$=0V | 600 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=600V, $V_{GS}$=0V | | | 1 | uA |
| | | $V_{DS}$=600V,$V_{GS}$=0V,Tc=125°C | | | 10 | uA |
| $I_{GSS}$ | Gate-body Leakage Current | $V_{GS}$=±30V ,$V_{DS}$=0V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ ,$I_D$=250uA | 2.0 | | 4.0 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS}$=10V ,$I_D$=5.0A | | 0.65 | 0.73 | Ω |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=25V,f=1MHZ,$V_{GS}$=0V | | 1900 | | pF |
| $C_{oss}$ | Output Capacitance | | | 146 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 16 | | pF |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$=300V, $I_D$=5A $V_{GS}$=10V ,$R_G$=4.7Ω (Note4,5) | | 30 | | ns |
| $t_r$ | Rise Time | | | 18 | | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | | 60 | | ns |
| $t_f$ | Fall Time | | | 24 | | ns |
| $Q_g$ | Total Gate Charge | $V_{DD}$=480V, $I_D$=10A $V_{GS}$=10V (Note4,5) | | 55 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 16 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 17.2 | | nC |
| $V_{SD}$(*) | Forward On Voltage | $I_F$=10A ,$V_{GS}$=0V | | 0.81 | 1.2 | V |
| $T_{rr}$ | Reverse Recovery Time | $V_{DD}$=300V,$I_F$=10A,di/dt=100A/us (Note4) | | 450 | | ns |

**Notes:**
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 10mH, $I_{AS}$ = 9.5 A, $V_{DD}$ = 50V, $R_G$ = 25 Ω, Starting $T_J$ = 25°C
3. $I_{SD}$ ≤ 10A, di/dt ≤ 200A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

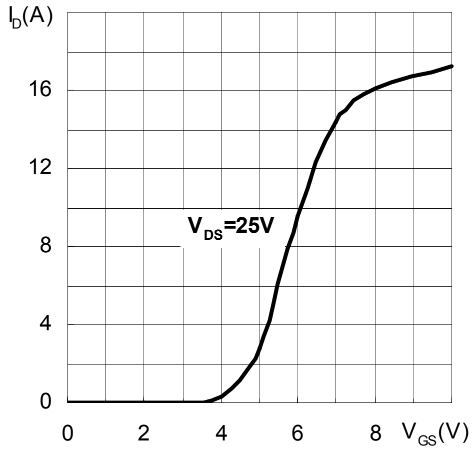
(*).Pulsed:Pulse duration

## Typical characteristics (25℃ unless noted)

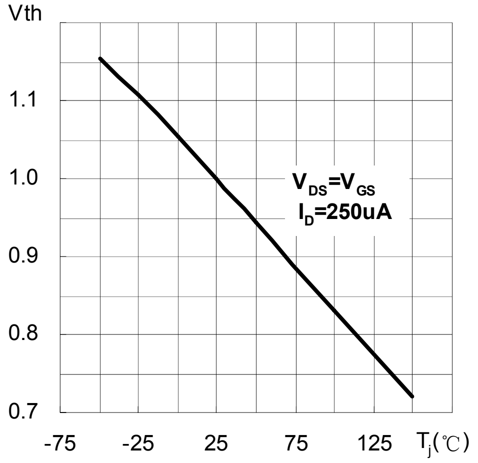
### Figure 1 Output Characteristics



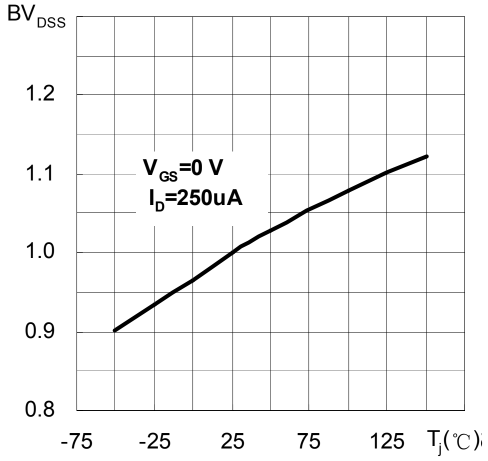

### Figure 2 Transfer Characteristics



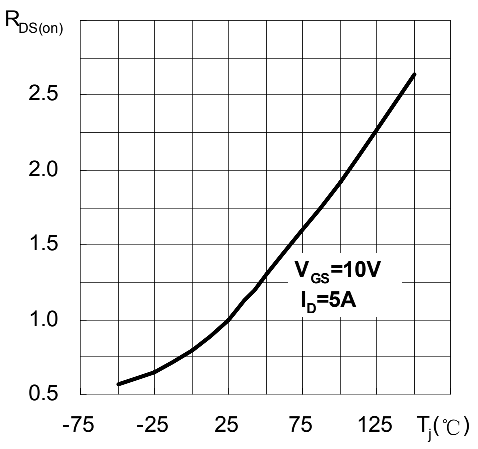

### Figure 3 Normalized Threshold Voltage vs. Temperature




### Figure 4 Normalized $BV_{DSS}$ vs.Temperature




### Figure 5 Normalized on Resistance vs Temperature




### Figure 6 Source-Drain Diode Forward Characteristics

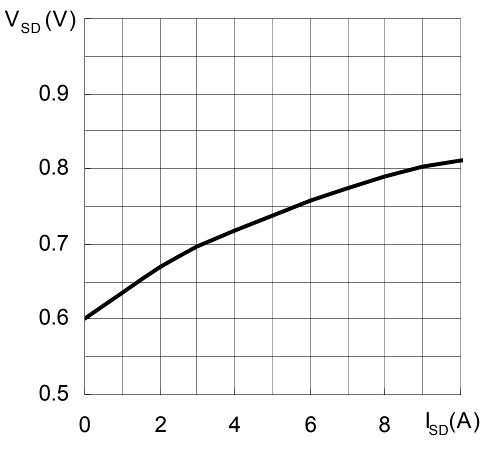


**Figure 7 Capacitance**

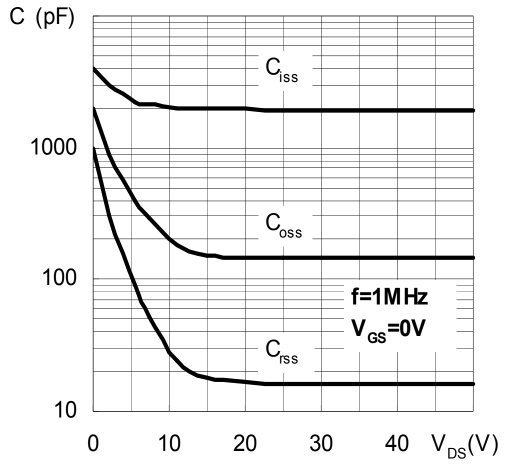



**Figure 8 Gate Charge**

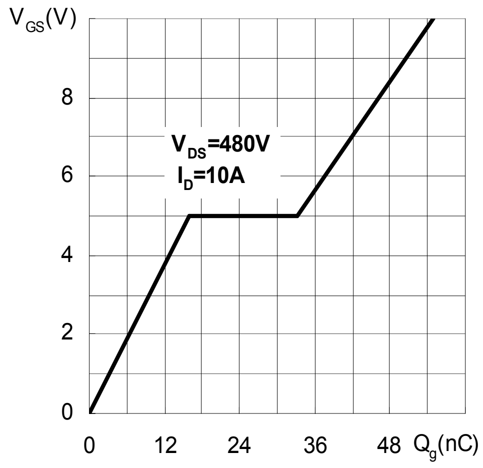



**Figure 9-1 Maximum Safe Operating Area For BF910N60**

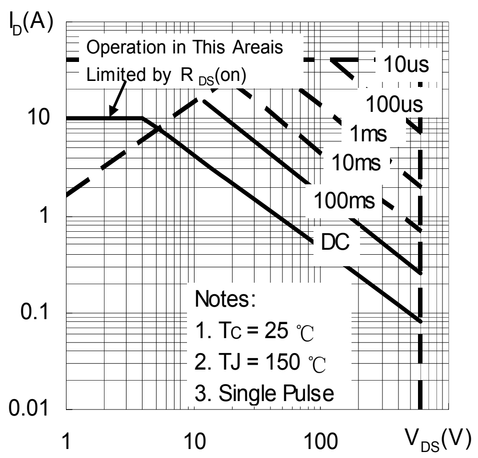



**Figure 9-2 Maximum Safe Operating Area For BF910N60L**

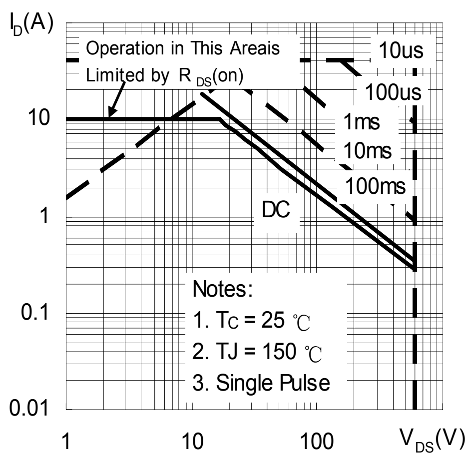



**Figure 10 Maximum Drain Current vs Case Temperature**

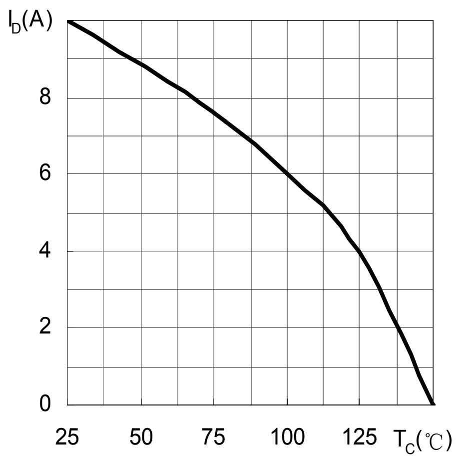


**Figure 11-1 Maximum Transient Thermal Impedance For BF910N60**

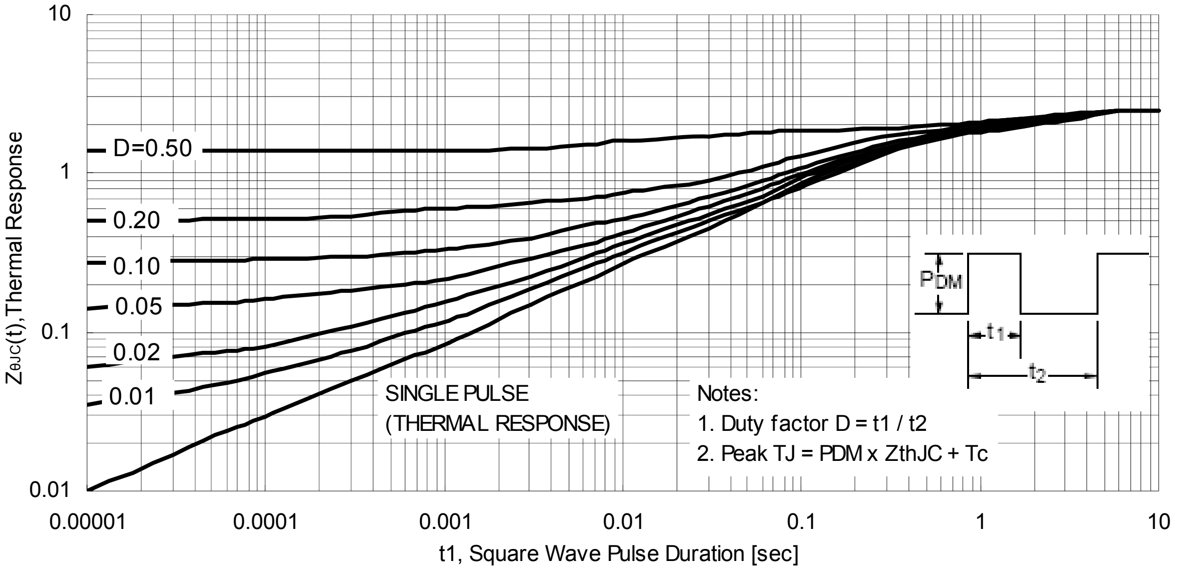
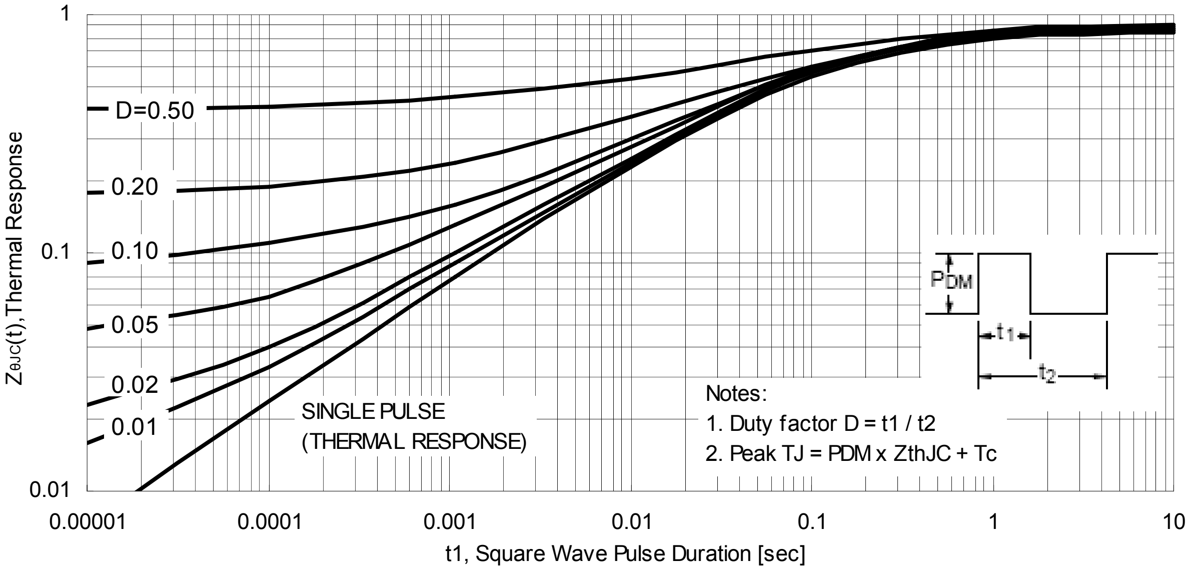
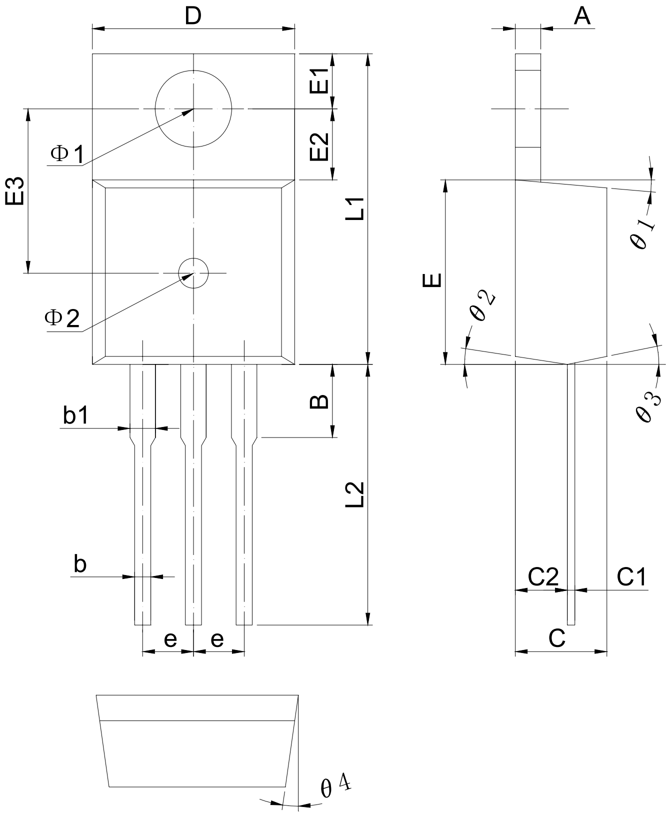



**Figure 11-2 Maximum Transient Thermal Impedance For BF910N60L**



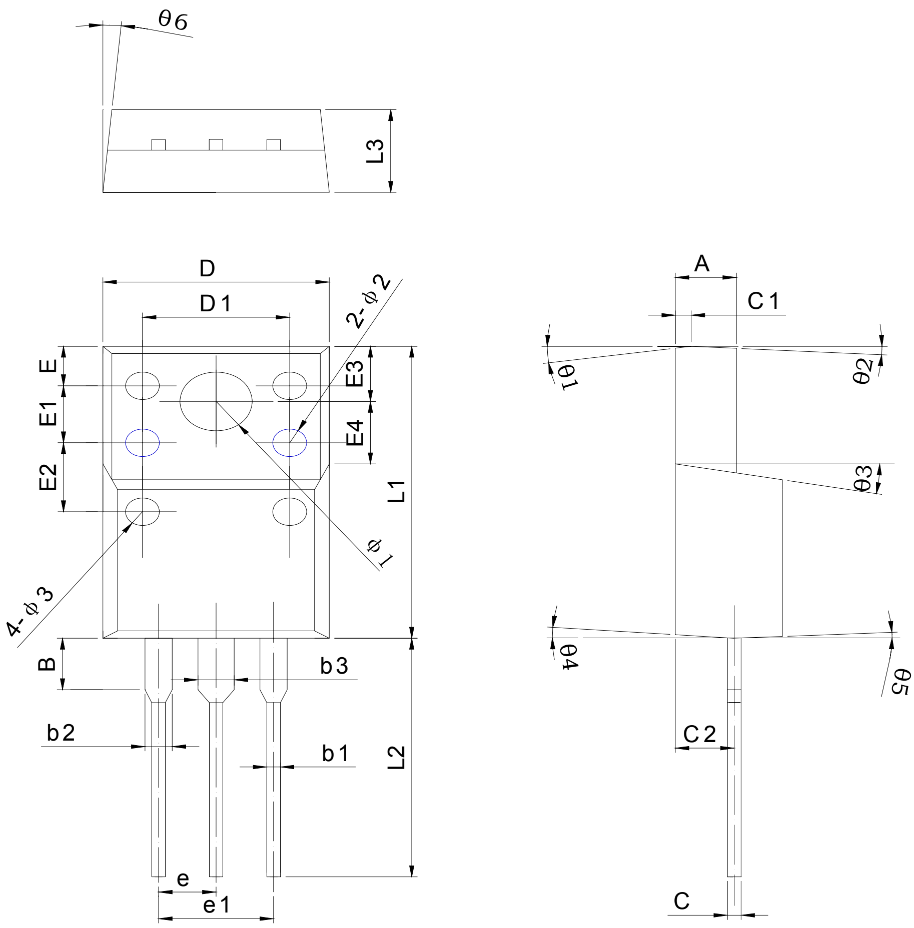
## Package Drawing

**TO-220**




| Symbol | Dimensions In Millimeters | | | Dimensions In Inches | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | - | 1.27 | - | - | 0.050 | - |
| B | - | 3.65 | - | - | 0.144 | - |
| b | - | 0.81 | - | - | 0.032 | - |
| b1 | - | 1.27 | - | - | 0.050 | - |
| C | - | 4.58 | - | - | 0.180 | - |
| C1 | - | 0.38 | - | - | 0.015 | - |
| C2 | - | 2.60 | - | - | 0.102 | - |
| D | 10.10 | 10.12 | 10.14 | 0.398 | 0.398 | 0.399 |
| E | - | 9.20 | - | - | 0.362 | - |
| E1 | - | 2.74 | - | - | 0.108 | - |
| E2 | - | 3.55 | - | - | 0.140 | - |
| E3 | - | 8.20 | - | - | 0.323 | - |
| e | 2.515 | 2.54 | 2.565 | 0.099 | 0.100 | 0.101 |
| L1 | 15.47 | 15.49 | 15.51 | 0.609 | 0.610 | 0.611 |
| L2 | 13.00 | - | - | 0.512 | - | - |
| Θ1 | 3° | | | 3° | | |
| Θ2 | 3° | | | 3° | | |
| Θ3 | 3° | | | 3° | | |
| Θ4 | 3° | | | 3° | | |
| φ1 | 3.84 | | | 0.151 | | |
| φ2 | 1.5 | | | 0.059 | | |

**TO-220F**


θ6
L3
D
D1
2-φ2
E
E1
E2
E3
E4
L1
φ1
4-φ3
B
b3
b2
b1
L2
e
e1
A
C1
θ1
θ2
θ3
θ4
θ5
C2
C

| Symbol | Dimensions In Millimeters | | | Dimensions In Inches | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | 2.50 | 2.70 | 2.90 | 0.098 | 0.106 | 0.114 |
| B | 2.60 | 2.80 | 3.00 | 0.102 | 0.110 | 0.118 |
| b1 | 0.50 | 0.60 | 0.70 | 0.020 | 0.024 | 0.028 |
| b2 | 1.10 | 1.20 | 1.30 | 0.043 | 0.047 | 0.051 |
| b3 | - | 1.60 | - | - | 0.063 | - |
| C | 0.55 | 0.60 | 0.65 | 0.022 | 0.024 | 0.026 |
| C1 | - | 0.60 | - | - | 0.024 | - |
| C2 | 2.40 | 2.60 | 2.80 | 0.094 | 0.102 | 0.110 |
| D | 9.80 | 10.00 | 10.20 | 0.386 | 0.394 | 0.402 |
| D1 | - | 6.50 | - | - | 0.256 | - |
| E | - | 2.15 | - | - | 0.085 | - |
| E1 | - | 3.10 | - | - | 0.122 | - |
| E2 | - | 3.75 | - | - | 0.148 | - |
| E3 | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| E4 | 3.30 | 3.40 | 3.50 | 0.130 | 0.134 | 0.138 |
| e | - | 2.54 | - | - | 0.100 | - |
| e1 | 4.98 | 5.08 | 5.18 | 0.196 | 0.200 | 0.204 |
| L1 | 14.80 | 15.00 | 15.20 | 0.583 | 0.591 | 0.598 |
| L2 | 13.00 | 13.20 | 13.40 | 0.512 | 0.520 | 0.528 |
| L3 | 4.30 | 4.50 | 4.70 | 0.169 | 0.177 | 0.185 |
| Θ1 | 5° | | | 5° | | |
| Θ2 | 3° | | | 3° | | |
| Θ3 | 10° | | | 10° | | |
| Θ4 | 5° | | | 5° | | |
| Θ5 | 3° | | | 3° | | |
| Θ6 | 5° | | | 5° | | |
| φ1 | 3.00 | 3.20 | 3.40 | 0.118 | 0.126 | 0.134 |
| φ2 | 1.50 深 1.2 头部 160° | | | 1.50 深 1.2 头部 160° | | |
| φ3 | 1.50 深 0.1 | | | 1.50 深 0.1 | | |

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