# GPT04N60A

POWER FIELD EFFECT TRANSISTOR

## GENERAL DESCRIPTION

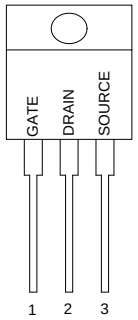
This advanced high voltage MOSFET is designed to withstand high energy in the avalanche mode and switch efficiently. This new high energy device also offers a drain-to-source diode with fast recovery time. Designed for high voltage, high speed switching applications such as power supplies, converters, power motor controls and bridge circuits.

## FEATURES

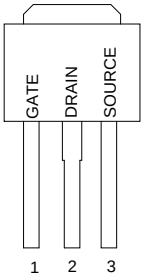
- Higher Current Rating
- Lower Rds(on)
- Lower Capacitances
- Lower Total Gate Charge
- Tighter VSD Specifications
- Avalanche Energy Specified

## PIN CONFIGURATION

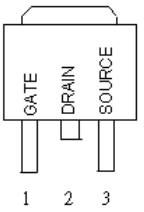
TO-220/TO-220FP Top View



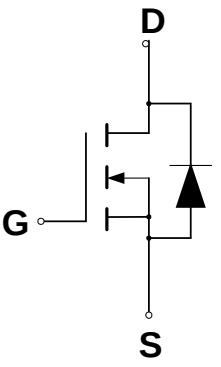

TO-251/ TO-251S Front View




TO-252 Front View




## SYMBOL




N-Channel MOSFET

## ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain to Current — Continuous | $I_D$ | 3.5 | A |
| — Pulsed | $I_{DM}$ | 10.5 | |
| Gate-to-Source Voltage — Continue | $V_{GS}$ | ±30 | V |
| Total Power Dissipation TO-251/ TO-251S /TO-252 | $P_D$ | 44 | W |
| TO-220 | | 70 | |
| TO-220FP | | 23 | W/℃ |
| Derate above 25℃ TO-251/ TO-251S /TO-252 | | 0.34 | |
| TO-220 | | 0.6 | |
| TO-220FP | | 0.2 | |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to 150 | ℃ |
| Single Pulse Drain-to-Source Avalanche Energy — $T_J$ = 25℃ ($V_{DD}$ = 100V, $V_{GS}$ = 10V, $I_L$ = 2.7A, L = 10mH, $R_G$ = 25Ω) | $E_{AS}$ | 36.45 | mJ |
| Thermal Resistance — Junction to Case TO-251/ TO-251S /TO-252 | $\theta_{JC}$ | 2.7 | ℃/W |
| TO-220 | | 1.8 | |
| TO220FP | | 4.9 | |
| — Junction to Ambient TO-251/ TO-251S /TO-252 | $\theta_{JA}$ | 120 | |
| TO-220, TO-220FP | | 62.5 | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | $T_L$ | 260 | ℃ |

## ORDERING INFORMATION

| Part Number | Package |
|---|---|
| GPT04N60AGN220* | TO-220 |
| GPT04N60AGN220FP* | TO-220 Full Package |
| GPT04N60AGN251* | TO-251 |
| GPT04N60AGN251S* | TO-251S |
| GPT04N60AGN252* | TO-252 |

***Note:** G : Suffix for Pb Free Product

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $T_J$ = 25℃.

| | | | GPT04N60A | | | |
|---|---|---|---|---|---|---|
| **Characteristic** | | **Symbol** | **Min** | **Typ** | **Max** | **Units** |
| Drain-Source Breakdown Voltage ($V_{GS}$ = 0 V, $I_D$ = 250 μA) | | $V_{(BR)DSS}$ | 600 | | | V |
| Drain-Source Leakage Current ($V_{DS}$ =600 V, $V_{GS}$ = 0 V) | | $I_{DSS}$ | | | 1 | uA |
| Gate-Source Leakage Current-Forward ($V_{gsf}$ = 30 V, $V_{DS}$ = 0 V) | | $I_{GSSF}$ | | | 100 | nA |
| Gate-Source Leakage Current-Reverse ($V_{gsr}$ = - 30 V, $V_{DS}$ = 0 V) | | $I_{GSSR}$ | | | 100 | nA |
| Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA) | | $V_{GS(th)}$ | 2.5 | 3.5 | 4.5 | V |
| Static Drain-Source On-Resistance ($V_{GS}$ = 10 V, $I_D$ = 2.0A) * | | $R_{DS(on)}$ | | | 3.2 | Ω |
| Forward Transconductance ($V_{DS}$ = 15 V, $I_D$ = 2.0 A) * | | $g_{FS}$ | | 2.5 | | S |
| Input Capacitance | ($V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 MHz) | $C_{iss}$ | | 480.4 | | pF |
| Output Capacitance | | $C_{oss}$ | | 44.7 | | pF |
| Reverse Transfer Capacitance | | $C_{rss}$ | | 2.56 | | pF |
| Turn-On Delay Time | ($V_{DD}$ = 300 V, $I_D$ = 3.5 A, $V_{GS}$ = 10 V, $R_G$ = 9.1Ω) * | $t_{d(on)}$ | | 14.4 | | ns |
| Rise Time | | $t_r$ | | 15.1 | | ns |
| Turn-Off Delay Time | | $t_{d(off)}$ | | 30.4 | | ns |
| Fall Time | | $t_f$ | | 13.9 | | ns |
| Total Gate Charge | ($V_{DS}$ = 480 V, $I_D$ = 3.5 A, $V_{GS}$ = 10 V)* | $Q_g$ | | 11.9 | | nC |
| Gate-Source Charge | | $Q_{gs}$ | | 2.72 | | nC |
| Gate-Drain Charge | | $Q_{gd}$ | | 5.57 | | nC |
| **SOURCE-DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Forward On-Voltage(1) | ($I_S$ = 3.5 A, $dI_S/d_t$ = 100A/μs) | $V_{SD}$ | | | 1.5 | V |
| Forward Turn-On Time | | $t_{on}$ | | ** | | ns |
| Reverse Recovery Time | | $t_{rr}$ | | 200 | | ns |

* Pulse Test: Pulse Width ≦300μs, Duty Cycle ≦2%

** Negligible, Dominated by circuit inductance

## TYPICAL ELECTRICAL CHARACTERISTICS

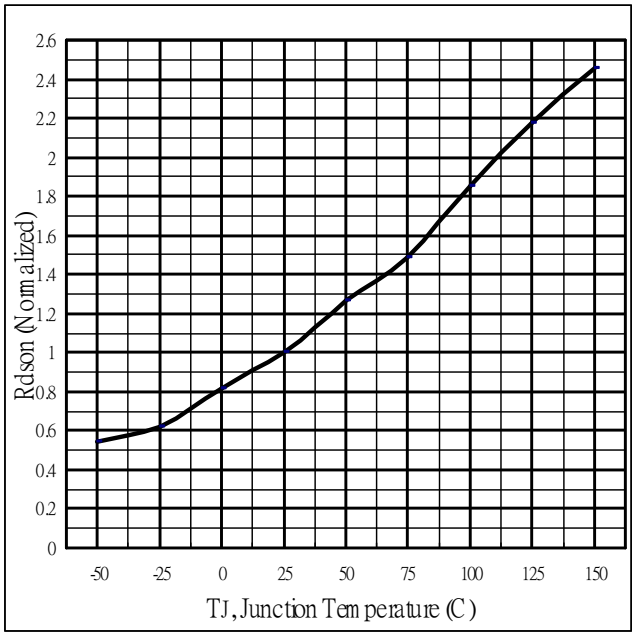



**Fig 1. On-Resistance Variation with vs. Temperature**

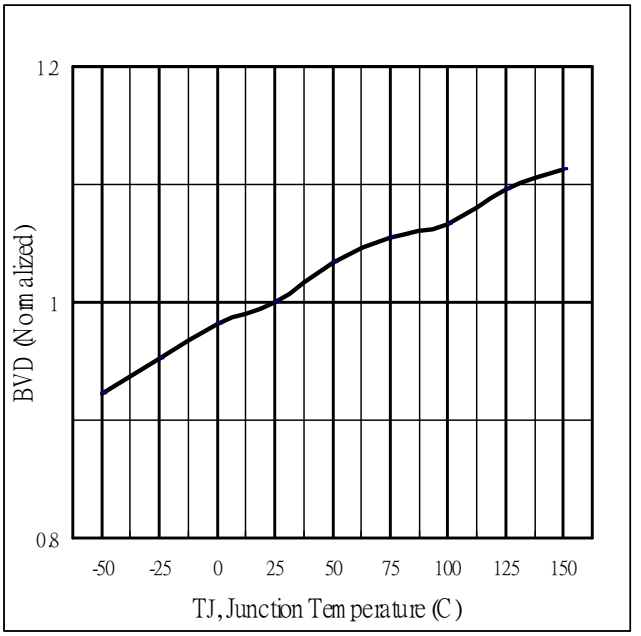



**Fig.2 Breakdown Voltage Variation vs. Temperature**

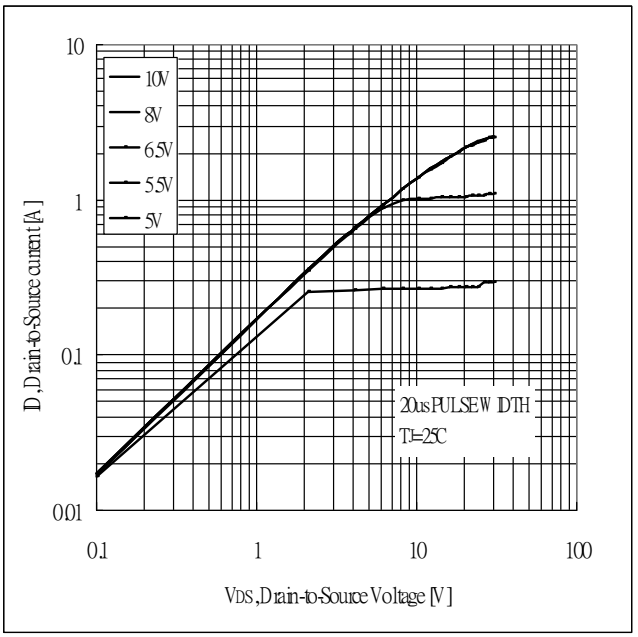



**Fig 3. Typical Output Characteristics**

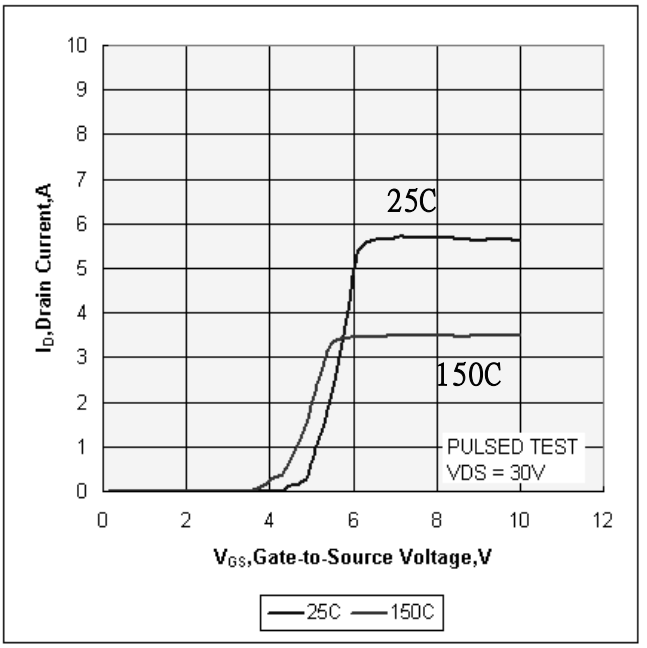



**Fig 4. Typical Transfer Characteristics**

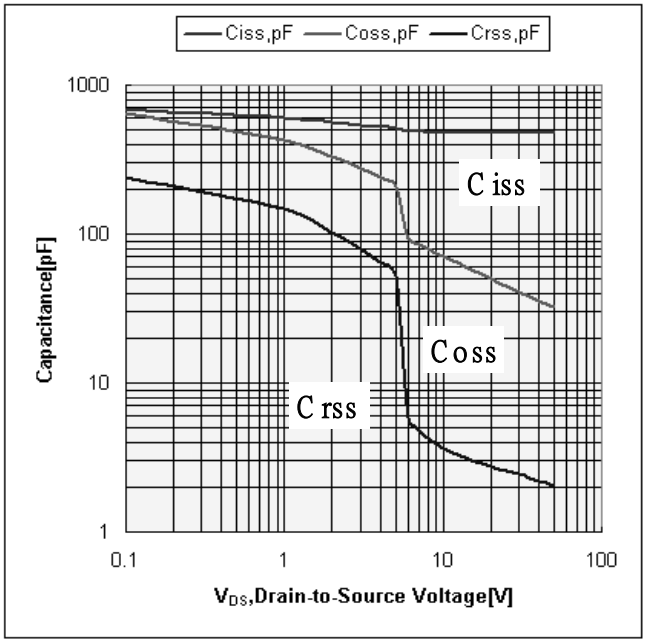



**Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage**

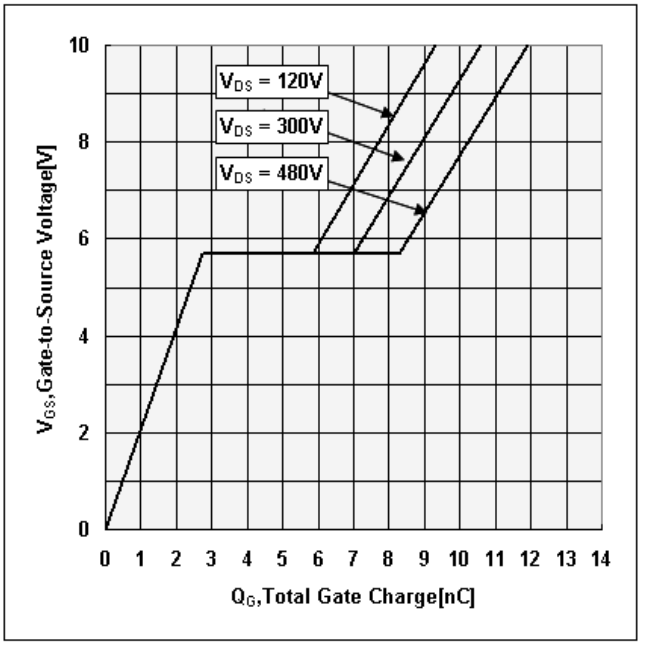
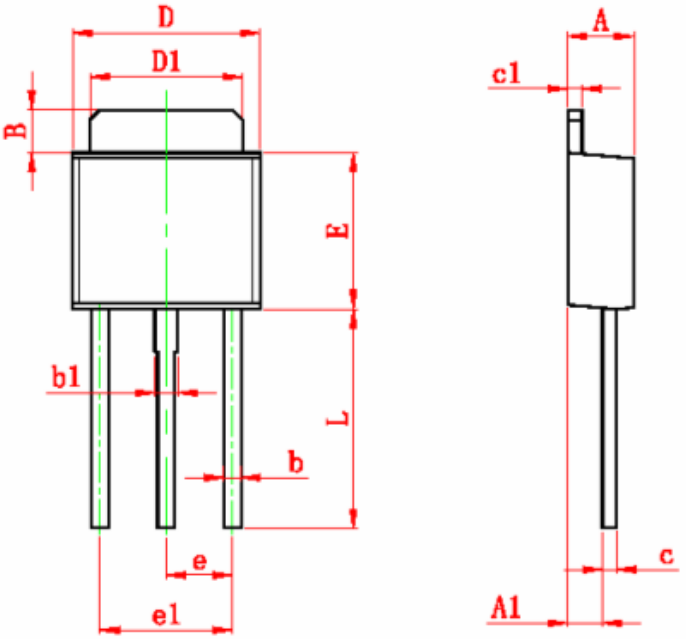



**Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage**

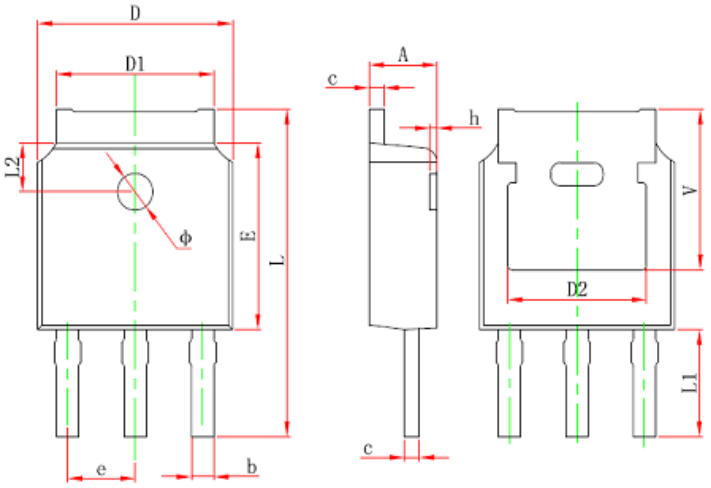
## PACKAGE DIMENSION

**TO-251**



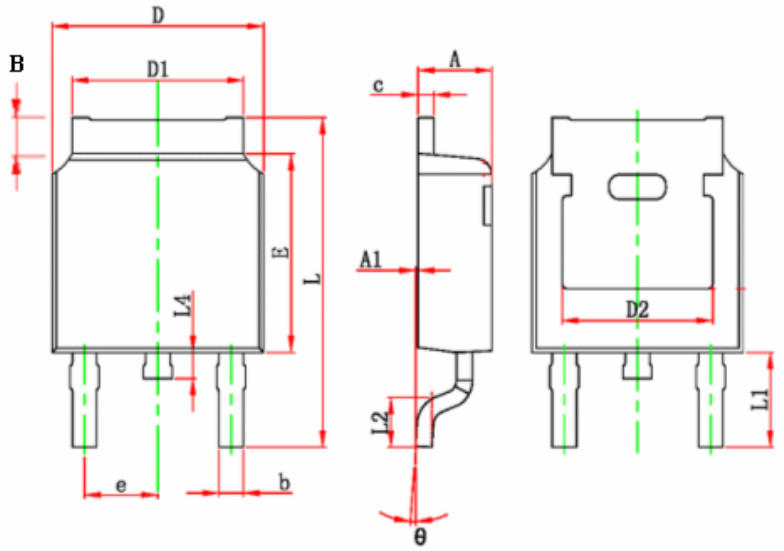

| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | Min. | Max |
| A | 2.10 | 2.50 |
| A1 | 0.90 | 1.35 |
| B | 0.90 | 1.65 |
| b | 0.45 | 0.75 |
| b1 | 0.65 | 0.95 |
| c | 0.40 | 0.60 |
| c1 | 0.40 | 0.60 |
| D | 6.30 | 6.80 |
| D1 | 5.00 | 5.50 |
| E | 5.40 | 6.30 |
| e | 2.3 TYP. | |
| e1 | 4.40 | 4.80 |
| L | 7.40 | 8.00 |

**TO-251S**



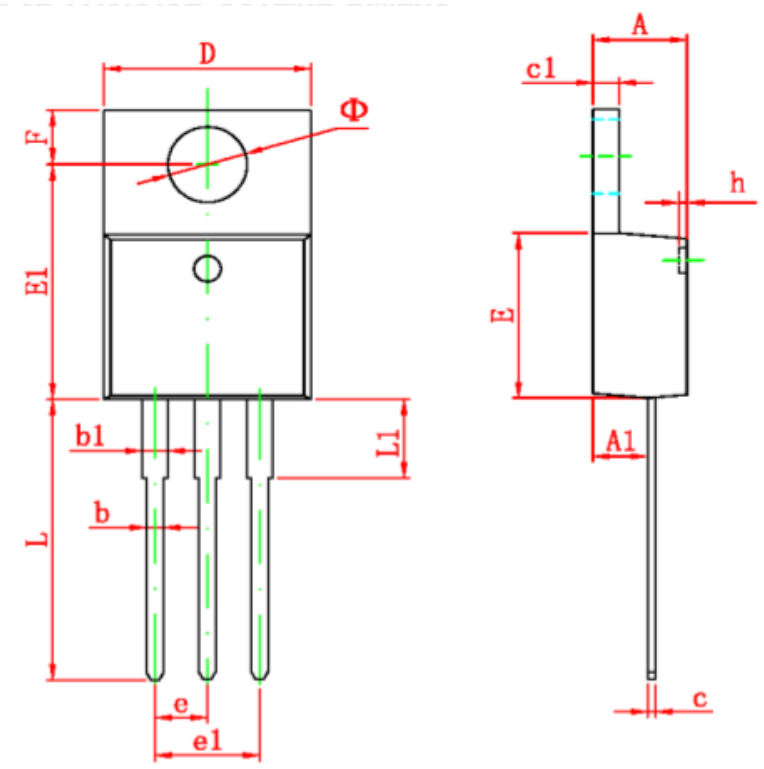

| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | Min. | Max |
| A | 2.10 | 2.50 |
| b | 0.64 | 0.90 |
| c | 0.44 | 0.60 |
| D | 6.30 | 6.90 |
| D1 | 5.00 | 5.50 |
| D2 | 4.83 TYP. | |
| E | 5.80 | 6.40 |
| e | 2.286 TYP. | |
| L1 | 3.5 TYP. | |
| L2 | 1.6 TYP. | |
| Φ | 1.2 TYP. | |
| h | 0.00 | 0.30 |
| V | 5.35 TYP. | |

**TO-252**



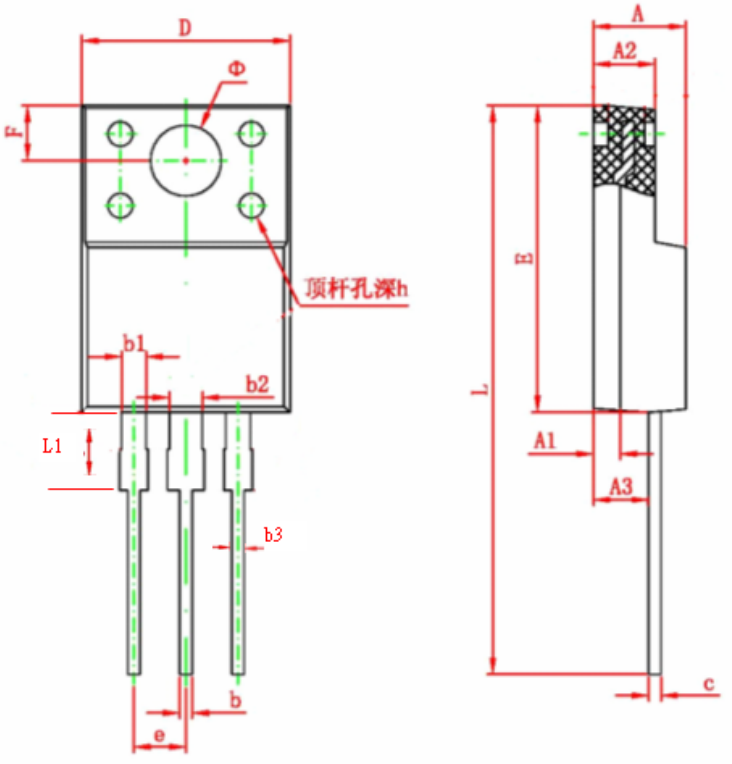

| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | Min. | Max |
| A | 2.10 | 2.50 |
| A1 | 0.90 | 1.35 |
| B | 0.90 | 1.65 |
| b | 0.45 | 0.90 |
| c | 0.40 | 0.60 |
| D | 6.30 | 6.80 |
| D1 | 5.00 | 5.50 |
| D2 | 4.83 TYP. | |
| E | 5.90 | 6.30 |
| e | 2.3 TYP. | |
| L | 9.30 | 10.50 |
| L2 | 1.20 | 1.80 |
| L4 | 0.60 | 1.00 |
| θ | 0.00 | 10.00 |

**TO-220**




| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | Min. | Max |
| A | 4.40 | 4.80 |
| A1 | 2.10 | 2.84 |
| b | 0.71 | 0.91 |
| b1 | 1.17 | 1.37 |
| c | 0.30 | 0.60 |
| c1 | 1.17 | 1.47 |
| D | 9.40 | 10.60 |
| E | 8.40 | 9.60 |
| e | 2.54 TYP. | |
| e1 | 4.90 | 5.60 |
| F | 3.00 REF. | |
| Φ | 3.50 REF. | |
| h | 0.00 | 0.30 |
| L | 12.50 | 14.00 |
| L1 | 3.50 | 4.00 |

**TO-220FP**




| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | Min. | Max |
| A | 3.80 | 4.70 |
| A1 | 1.3 REF. | |
| A2 | 2.20 | 3.20 |
| A3 | 2.10 | 3.20 |
| b | 0.30 | 0.95 |
| b1 | 1.00 | 1.75 |
| b2 | 1.00 | 1.75 |
| b3 | 0.50 | 0.80 |
| c | 0.30 | 0.90 |
| D | 9.90 | 10.40 |
| E | 14.60 | 16.20 |
| e | 2.54 TYP. | |
| F | 3.00 REF. | |
| Φ | 3.50 REF. | |
| h | 0.00 | 0.30 |
| L | 28.00 | 30.00 |
| L1 | 3.20 | 3.55 |

# IMPORTANT NOTICE

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| 新北市汐止區新台五路一段 96 號 21F | 深圳市福田区深南大道 7002 号财富广场 A 座 4V, |
| 21F., No. 96, Sec. 1, Sintai 5th Rd., Sijhih City, Taipei County 22102, Taiwan, R.O.C. | 4V, Tower A, Fortune Plaza, No. 7002, Shennan Road, Futian District, Shenzhen City, China PC : 518040 |
| TEL: +886-2-2696 3558 | TEL: +86-755-83709176 |
| FAX: +886-2-2696 3559 | FAX: +86-755-83709276 |