



N-Chanel Power MOSFET

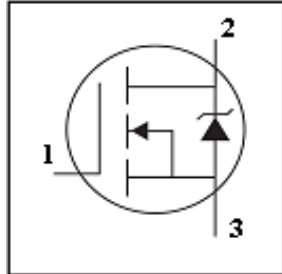
ANA2N65B, ANP2N65B, ANB2N65B,
AND2N65B, ANI2N65B, ANU2N65B
Rdson=5,0 Ω, Vds=650 V, Qg(tot)=8 nC

Applications

- SMPS
- PFC

Features

- Low Qg
- Low Rdson
- RoHS compliant



| | | |
|------|-------|--------|
| 1 | 2 | 3 |
| Gate | Drain | Source |

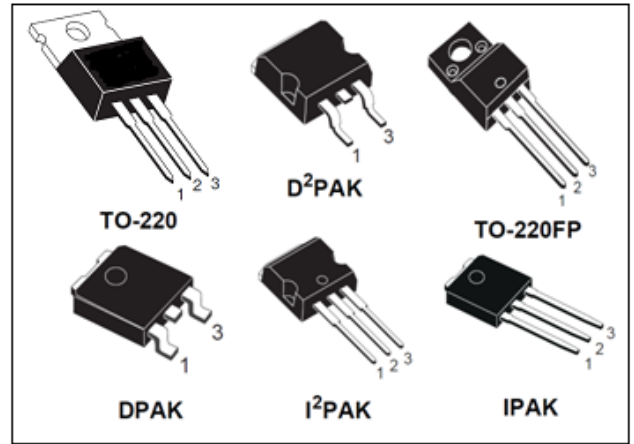


Table 1. Device summary

| Part numbers | Marking | Package | Packaging |
|--------------|---------|--------------------|---------------|
| ANA2N65B | A2N65B | TO-220FP | Tube |
| ANP2N65B | P2N65B | TO-220 | Tube |
| ANB2N65B | B2N65B | D ² PAK | Tape and reel |
| AND2N65B | D2N65B | DPAK | Tape and reel |
| ANI2N65B | I2N65B | I ² PAK | Tape and reel |
| ANU2N65B | I2N65B | IPAK | Tape and reel |

Table 2. Absolute Maximum Ratings

| Symbol | Parameter | Value | | | | | | Units |
|--------------------|---|--------------|--------|--------------------|--------------------|------|------|-------|
| | | TO-220FP | TO-220 | D ² PAK | I ² PAK | DPAK | IPAK | |
| I _D | Drain current (continuous), V _{GS} = at T _C = 25°C | 2,0 | | | | | | A |
| I _D | Drain current (continuous), V _{GS} = at T _C = 100°C | — | | | | | | A |
| I _{DM(1)} | Drain current (pulsed) at T _C = 25°C | 8,0 | | | | | | A |
| V _{GS} | Gate-source voltage | ±20 | | | | | | V |
| P _D | Maximum Power Dissipation at T _C = 25°C | 23 | 54 | | | 44 | | W |
| | Maximum Power Dissipation at T _C = 100°C | — | | | | | | W |
| T _{stg} | Storage temperature | -55 ... +150 | | | | | | °C |
| T _j | Operating junction temperature | -55 ... +150 | | | | | | |
| T _L | Soldering Temperature, for 10 sec. | 260 | | | | | | |
| | Mounting Torque, 6-32 or M3 Screw | 1,13 | | — | | | N·m | |

Table 3. Thermal resistance

| Symbol | Parameter | Value | | | | | | Value |
|-----------------------|---|----------|--------|--------------------|--------------------|------|------|-------|
| | | TO-220FP | TO-220 | D ² PAK | I ² PAK | DPAK | IPAK | |
| R _{thj-case} | Thermal resistance junction-case max | 5,5 | 2,32 | | | 2,87 | | °C/W |
| R _{thj-amb} | Thermal resistance junction-ambient max | 62,5 | | | | 50 | | °C/W |



Table 4. Electrical Characteristics of the MOSFET

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions | Ref. Fig |
|----------------------------------|--|------|------|-----------|----------|---|----------|
| Off Characteristics | | | | | | | |
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 650 | | | V | $V_{GS} = 0V, I_D = 250\mu A$ | |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Temperature Coefficient of Breakdown Voltage | | 0,4 | | V/°C | $I_D = 250\mu A$, Referenced to 25°C | |
| I_{DSS} | Zero Gate Voltage Drain Current | | | 10 | μA | $V_{DS} = 650V, V_{GS} = 0V$ | |
| I_{GSS} | Gate to Body Leakage Current | | | ± 100 | nA | $V_{GS} = 30V, V_{DS} = 0V$ | |
| On Characteristics | | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2,0 | | 4,0 | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ | |
| $\Delta V_{GS(th)}/\Delta T_J$ | Threshold Voltage temp. coefficient | | — | | mV/°C | | |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | | | 5,0 | Ω | $V_{GS} = 10V, I_D = 1A$ | |
| g_{fs} | Forward Transconductance | | — | | S | | |
| Dynamic Characteristics | | | | | | | |
| C_{iss} | Input Capacitance | | 270 | | pF | $V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$ | |
| C_{oss} | Output Capacitance | | 40 | | pF | | |
| C_{rss} | Reverse Transfer Capacitance | | 5 | | pF | | |
| $Q_{g(tot)}$ | Total Gate Charge | | 9,0 | | nC | $V_{DS} = 480V, V_{GS} = 10V, I_D = 2.4A$ | |
| Q_{gs} | Gate to Source Gate Charge | | 1,6 | | nC | | |
| Q_{gd} | Gate to Drain "Miller" Charge | | 4,3 | | nC | | |
| Switching Characteristics | | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | | 10 | | ns | $V_{DD} = 300V, I_D = 2.4A, R_G = 25\Omega$ | |
| t_r | Rise Time | | 25 | | ns | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 20 | | ns | | |
| t_f | Fall Time | | 25 | | ns | | |

Table 5. Avalanche Characteristic

| Symbol | Parameter | Typ. | Max. | Units | Conditions | Ref.Fig |
|---------------------|-------------------------------|------|------|-------|------------|---------|
| E_{AS} | Single Pulse Avalanche Energy | | 140 | mJ | | |
| E_{AR} | Repetitive Avalanche Energy | | 4,5 | mJ | | |
| $V_{DS(Avalanche)}$ | Repetitive Avalanche Voltage | | — | V | | |
| I_{AR} | Avalanche Current | | 2,0 | A | | |



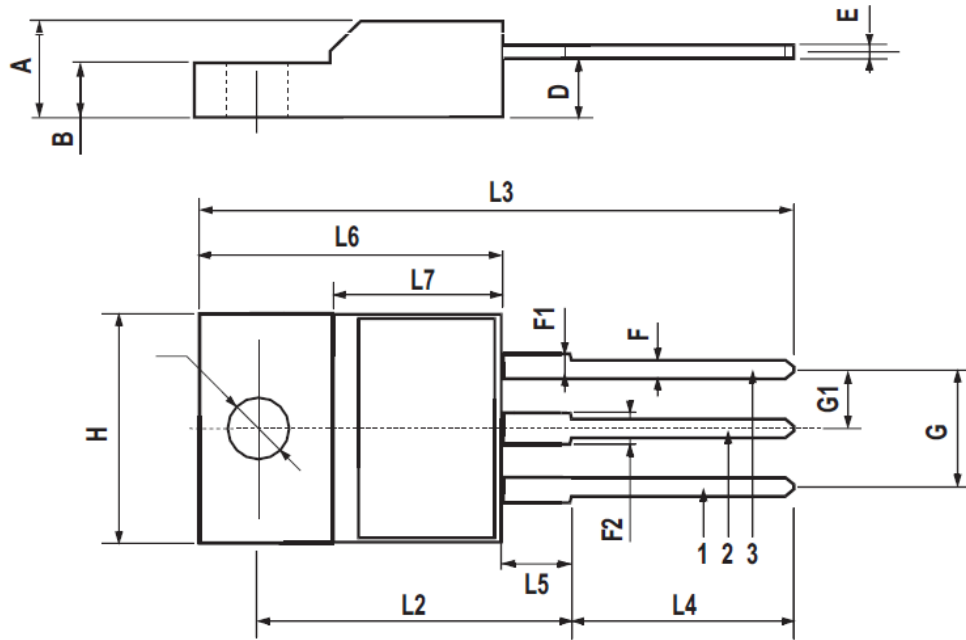
Table 6. Source drain diode

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions | Ref.Fig |
|----------|---|------|------|------|-----------|---|---------|
| V_{SD} | Diode Forward Voltage | | | 1,4 | V | $V_{GS} = 0\text{ V}, I_{SD} = 2.0\text{ A}$ | |
| I_S | Continuous Source Current (Body Diode) | | | 2,0 | A | | |
| I_{SM} | Pulsed Source Current (Body Diode) | | | 8,0 | A | | |
| t_{rr} | Reverse Recovery Time | | 180 | | ns | $V_{GS} = 0\text{ V}, I_{SD} = 2.4\text{ A}, di/dt$ $= 100\text{ A}/\mu\text{s}$ | |
| Q_{rr} | Reverse Recovery Charge | | 0,72 | | nC | | |

PRELIMINARY



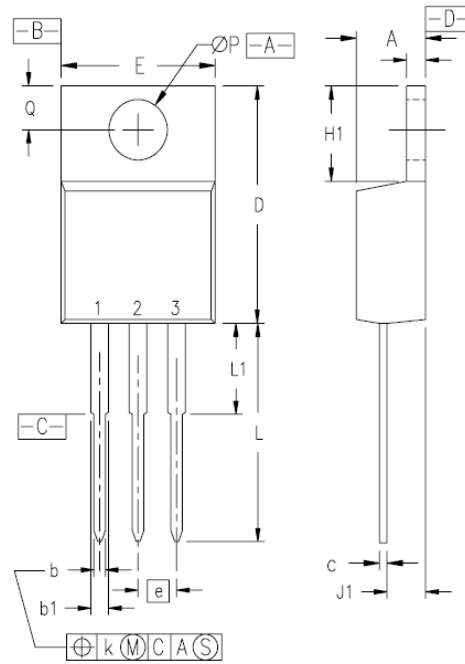
TO-220FP



| DIM. | mm. | | | inch | | |
|------|------|-----|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| B | 2.5 | | 2.7 | 0.098 | | 0.106 |
| D | 2.5 | | 2.75 | 0.098 | | 0.108 |
| E | 0.45 | | 0.7 | 0.017 | | 0.027 |
| F | 0.75 | | 1 | 0.030 | | 0.039 |
| F1 | 1.15 | | 1.5 | 0.045 | | 0.067 |
| F2 | 1.15 | | 1.5 | 0.045 | | 0.067 |
| G | 4.95 | | 5.2 | 0.195 | | 0.204 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H | 10 | | 10.4 | 0.393 | | 0.409 |
| L2 | | 16 | | | 0.630 | |
| L3 | 28.6 | | 30.6 | 1.126 | | 1.204 |
| L4 | 9.8 | | 10.6 | .0385 | | 0.417 |
| L5 | 2.9 | | 3.6 | 0.114 | | 0.141 |
| L6 | 15.9 | | 16.4 | 0.626 | | 0.645 |
| L7 | 9 | | 9.3 | 0.354 | | 0.366 |
| Ø | 3 | | 3.2 | 0.118 | | 0.126 |



TO-220

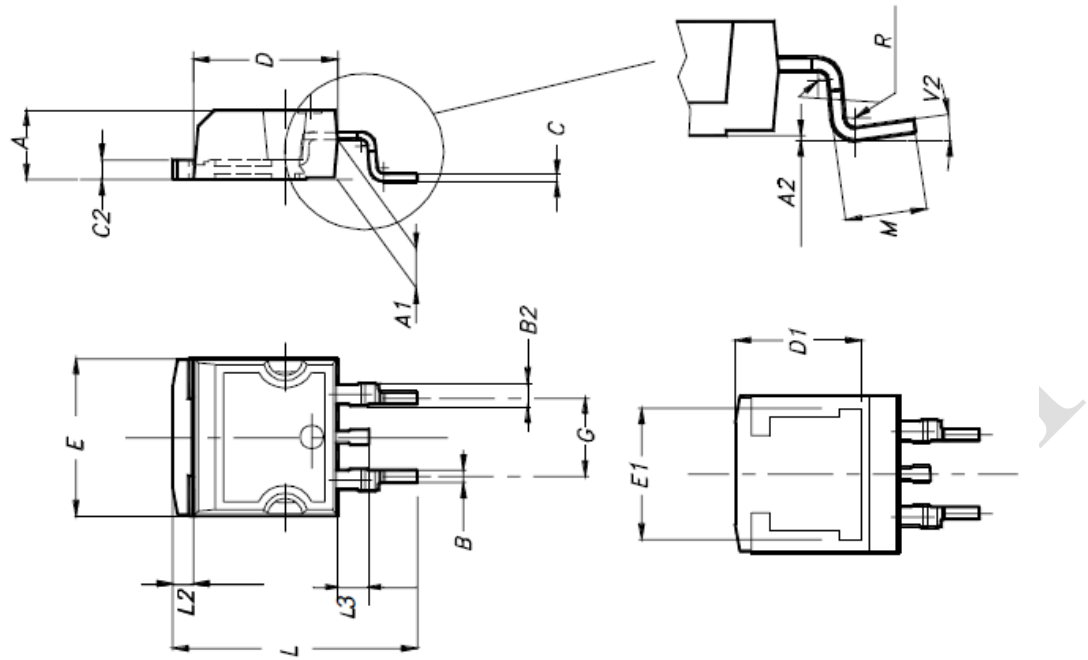


Pins: 1 - Gate 2 - Drain
 3 - Source 4 - Drain

| SYM | INCHES | | MILLIMETERS | |
|-----|----------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .170 | .190 | 4.32 | 4.83 |
| b | .025 | .040 | 0.64 | 1.02 |
| b1 | .045 | .065 | 1.15 | 1.65 |
| c | .014 | .022 | 0.35 | 0.56 |
| D | .580 | .630 | 14.73 | 16.00 |
| E | .390 | .420 | 9.91 | 10.66 |
| e | .100 BSC | | 2.54 BSC | |
| F | .045 | .055 | 1.14 | 1.40 |
| H1 | .230 | .270 | 5.85 | 6.85 |
| J1 | .090 | .110 | 2.29 | 2.79 |
| k | 0 | .015 | 0 | 0.38 |
| L | .500 | .550 | 12.70 | 13.97 |
| L1 | .110 | .230 | 2.79 | 5.84 |
| ØP | .139 | .161 | 3.53 | 4.08 |
| Q | .100 | .125 | 2.54 | 3.18 |



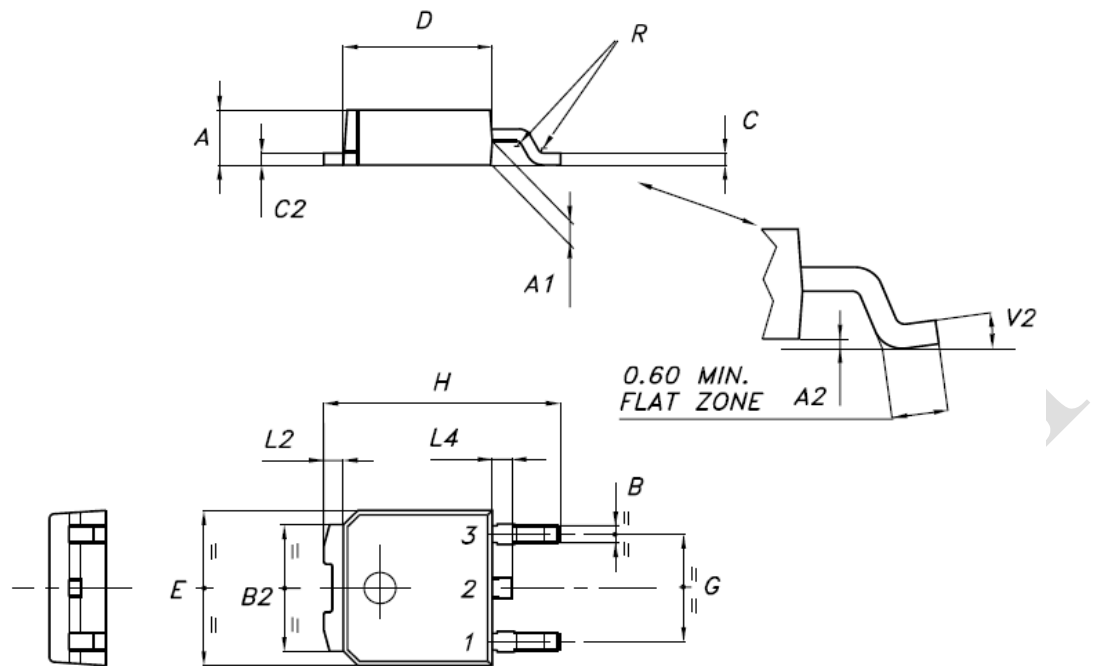
D²PAK



| DIM. | mm. | | | inch | | |
|------|------|-----|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | | 8 | | | 0.315 | |
| E | 10 | | 10.4 | 0.393 | | |
| E1 | | 8.5 | | | 0.334 | |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15 | | 15.85 | 0.590 | | 0.625 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |
| L3 | 1.4 | | 1.75 | 0.055 | | 0.068 |
| M | 2.4 | | 3.2 | 0.094 | | 0.126 |
| R | | 0.4 | | | 0.015 | |
| V2 | 0° | | 8° | | | |



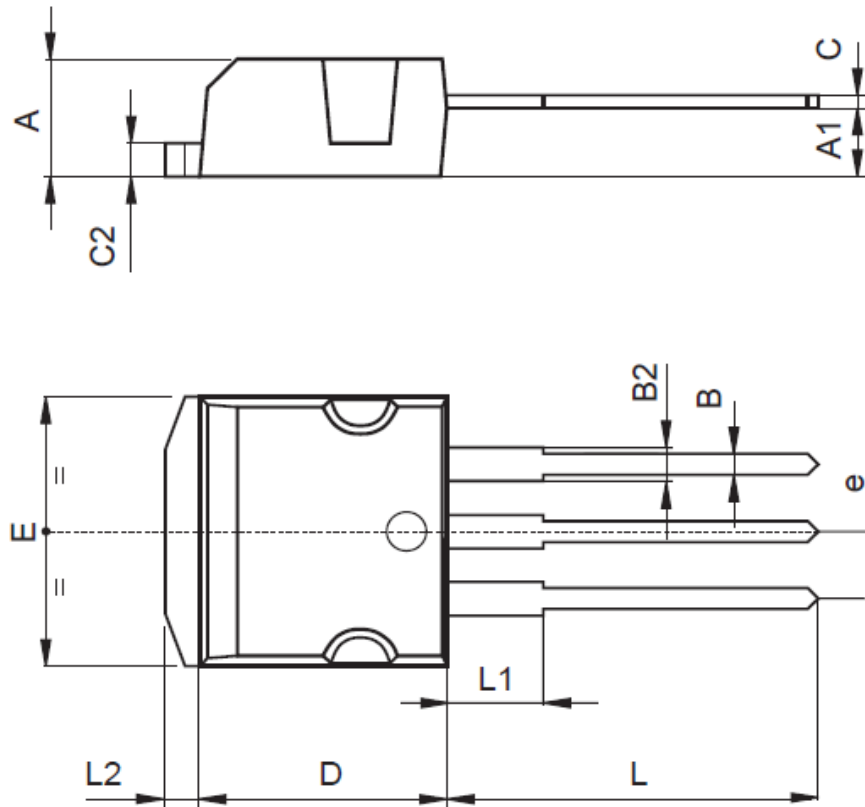
DPAK



| DIM. | mm | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 2.20 | | 2.40 | 0.087 | | 0.094 |
| A1 | 0.90 | | 1.10 | 0.035 | | 0.043 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.64 | | 0.90 | 0.025 | | 0.035 |
| B2 | 5.20 | | 5.40 | 0.204 | | 0.213 |
| C | 0.45 | | 0.60 | 0.018 | | 0.024 |
| C2 | 0.48 | | 0.60 | 0.019 | | 0.024 |
| D | 6.00 | | 6.20 | 0.236 | | 0.244 |
| E | 6.40 | | 6.60 | 0.252 | | 0.260 |
| G | 4.40 | | 4.60 | 0.173 | | 0.181 |
| H | 9.35 | | 10.10 | 0.368 | | 0.398 |
| L2 | | 0.8 | | | 0.031 | |
| L4 | 0.60 | | 1.00 | 0.024 | | 0.039 |
| V2 | 0° | | 8° | 0° | | 0° |



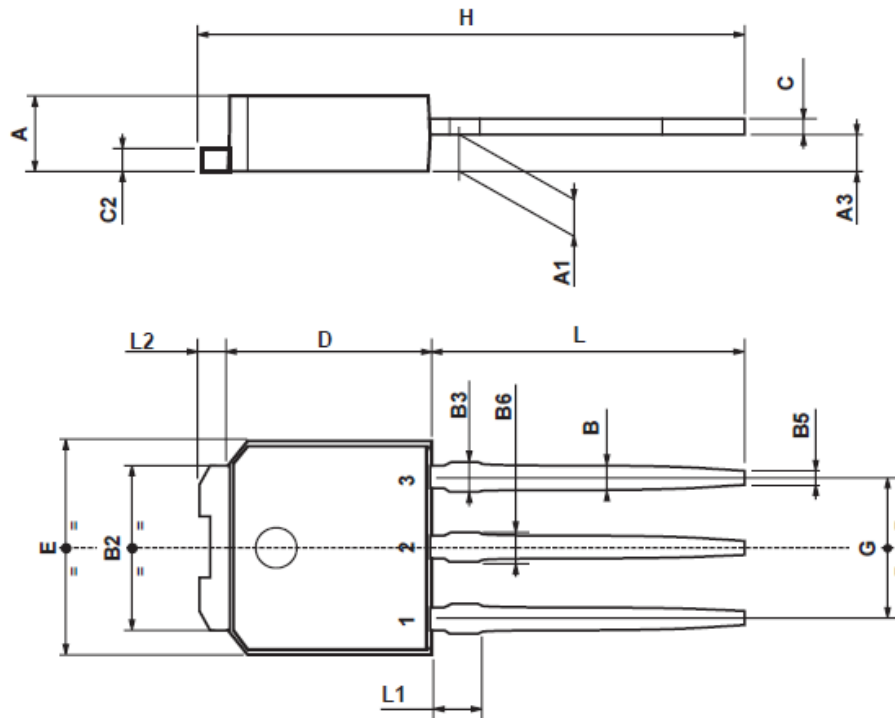
I²PAK



| DIM. | mm | | | inch | | |
|------|------|------|------|-------|------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| e | 2.4 | | 2.7 | 0.094 | | 0.106 |
| E | 10 | | 10.4 | 0.393 | | 0.409 |
| L | 13.1 | | 13.6 | 0.515 | | 0.531 |
| L1 | 3.48 | | 3.78 | 0.137 | | 0.149 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |



IPAK



| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 2.2 | | 2.4 | 0.086 | | 0.094 |
| A1 | 0.9 | | 1.1 | 0.035 | | 0.043 |
| A3 | 0.7 | | 1.3 | 0.027 | | 0.051 |
| B | 0.64 | | 0.9 | 0.025 | | 0.031 |
| B2 | 5.2 | | 5.4 | 0.204 | | 0.212 |
| B3 | | | 0.85 | | | 0.033 |
| B5 | | 0.3 | | | 0.012 | |
| B6 | | | 0.95 | | | 0.037 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 0.48 | | 0.6 | 0.019 | | 0.023 |
| D | 6 | | 6.2 | 0.236 | | 0.244 |
| E | 6.4 | | 6.6 | 0.252 | | 0.260 |
| G | 4.4 | | 4.6 | 0.173 | | 0.181 |
| H | 15.9 | | 16.3 | 0.626 | | 0.641 |
| L | 9 | | 9.4 | 0.354 | | 0.370 |
| L1 | 0.8 | | 1.2 | 0.031 | | 0.047 |
| L2 | | 0.8 | 1 | | 0.031 | 0.039 |