**MOSFET Silicon N-Channel MOS**

## 1. Applications

Synchronous rectification in SMPS,
Hard switching and High speed circuit
DC/DC in telecoms and industrial

## 2. Features

Low drain-source on-resistance: RDS(on) = 1.9mΩ (typ.)
High speed power switching
Enhanced body diode dv/dt capability
Enhanced avalanche ruggedness

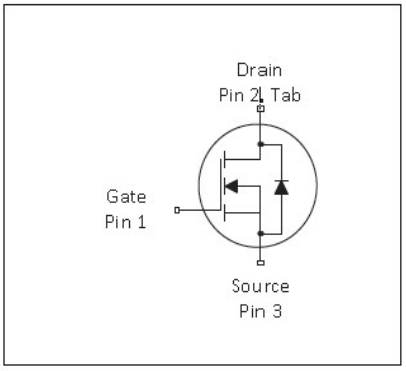
**Table 1 Key Performance Parameters**

| Parameter | Value | Unit |
|---|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 60 | V |
| $R_{DS(on),max}$ | 2.3 | mΩ |
| $Q_{g,typ}$ | 157.4 | nC |
| $I_{D,pulse}$ | 870 | A |

## 3. Packaging and Internal Circuit

| Part Name | Package | Marking |
|---|---|---|
| AUP023N06 | TO220 | AUP023N06 |

TO220

# 1 Maximum ratings

At $T_j$= 25°C, unless otherwise specified

## Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Continuous drain current at silicon[1)] | $I_D$ | | - | 290 | A | $T_C$=25°C |
| Continuous drain current at package[1)] | $I_D$ | | - | 255 | A | $T_C$=25°C |
| Continuous drain current at silicon[1)] | $I_D$ | | | 205 | A | $T_C$=100°C |
| Pulsed drain current[2)] | $I_{D,pulse}$ | - | | 870 | A | $T_C$=25°C |
| Avalanche energy, single pulse | $E_{AS}$ | - | - | 870 | mJ | Tc=25°C,VDD=50V,Vgs=10V, L=0.5mH, RG=25Ω |
| Avalanche current, single pulse | $I_{AR}$ | - | - | 59 | A | Tc=25°C, VDD=50V, L=0.5mH, RG=25Ω |
| Gate source voltage (static) | $V_{GS}$ | -20 | - | 20 | V | static; |
| Power dissipation | $P_{tot}$ | - | - | 310 | W | $T_C$=25°C |
| Storage temperature | $T_{stg}$ | -55 | - | 175 | °C | |
| Operating junction temperature | $T_j$ | -55 | - | 175 | °C | |
| Soldering Temperature<br>Distance of 1.6mm from case for 10s | $T_L$ | | | 300 | °C | |

[1)] Limited by $T_{j,max}$. Maximum Duty Cycle D = 0.50
[2)] Pulse width $t_p$ limited by $T_{j,max}$
[3)] Identical low side and high side switch with identical $R_G$

## 2 Thermal characteristics

**Table Thermal characteristics**

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | - | 0.48 | °C/W | - |
| Thermal resistance, junction - ambient | $R_{thJA}$ | - | - | 60 | °C/W | device on PCB, minimal footprint |

# 3 Electrical characteristics

at$T_j$=25°C, unless otherwise specified

## Table 4 Static characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | 60 | - | - | V | $V_{GS}$=0V, $I_D$=250uA |
| Gate threshold voltage | $V_{(GS)th}$ | 2.5 | | 4.5 | V | $V_{DS}$=$V_{GS}$, $I_D$=250uA |
| Zero gate voltage drain current | $I_{DSS}$ | - | - | 1 | uA | $V_{DS}$=60V, $V_{GS}$=0V, $T_j$=25°C |
| Gate-source leakage current | $I_{GSS}$ | - | - | +/-100 | nA | $V_{GS}$=+/-20V, $V_{DS}$=0V |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 1.9 | 2.3 | mΩ | $V_{GS}$=10V, $I_D$=20A, $T_j$=25°C |
| Gate resistance (Intrinsic) | $R_G$ | - | 2.2 | - | Ω | $f$=1MHz, open drain |
| Transconductance | $Gfs$ | | 139.2 | | S | $V_{DS}$=5V, $I_D$=50A |

## Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance | $C_{iss}$ | - | 10843 | - | pF | $V_{GS}$=0V, $V_{DS}$=30V, $f$=1MHz |
| Output capacitance | $C_{oss}$ | - | 3631 | - | pF | $V_{GS}$=0V, $V_{DS}$=30V, $f$=1MHz |
| Reverse transfer capacitance | $C_{rss}$ | - | 185.9 | - | pF | $V_{GS}$=0V, $V_{DS}$=30V, $f$=1MHz |
| Turn-on delay time | $t_{d(on)}$ | - | 21 | - | ns | $V_{DD}$=30V,$V_{GS}$=10V,$I_D$=20A, $R_G$=2.5Ω |
| Rise time | $t_r$ | - | 49 | - | ns | $V_{DD}$=30V,$V_{GS}$=10V,$I_D$=20A, $R_G$=2.5Ω |
| Turn-off delay time | $t_{d(off)}$ | - | 90.2 | - | ns | $V_{DD}$=30V,$V_{GS}$=10V,$I_D$=20A, $R_G$=2.5Ω |
| Fall time | $t_f$ | - | 58 | - | ns | $V_{DD}$=30V,$V_{GS}$=10V,$I_D$=20A, $R_G$=2.5Ω |

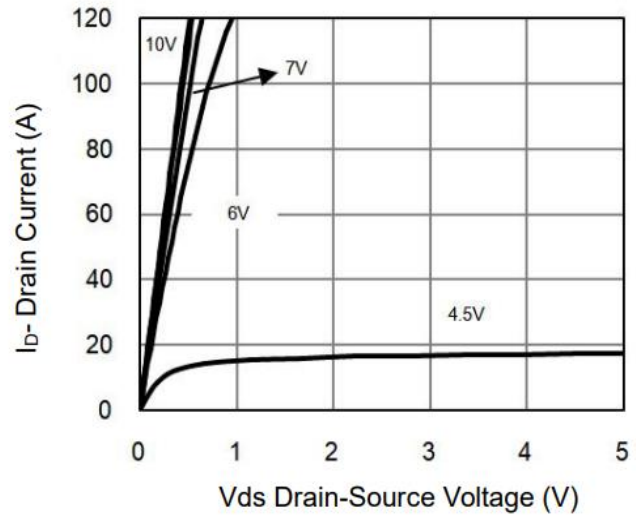
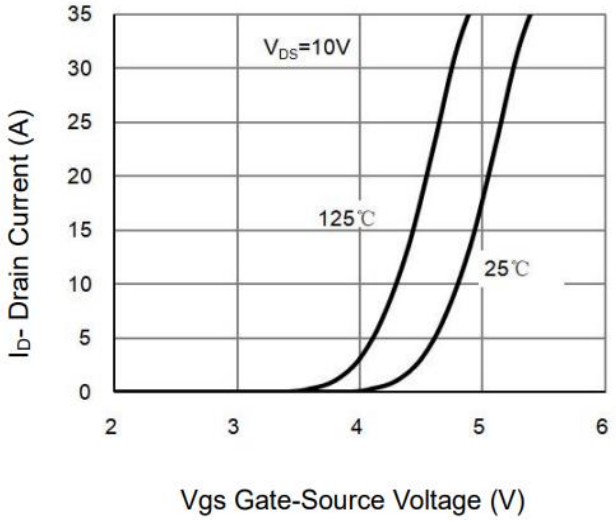
## Table 6 Gate charge characteristics

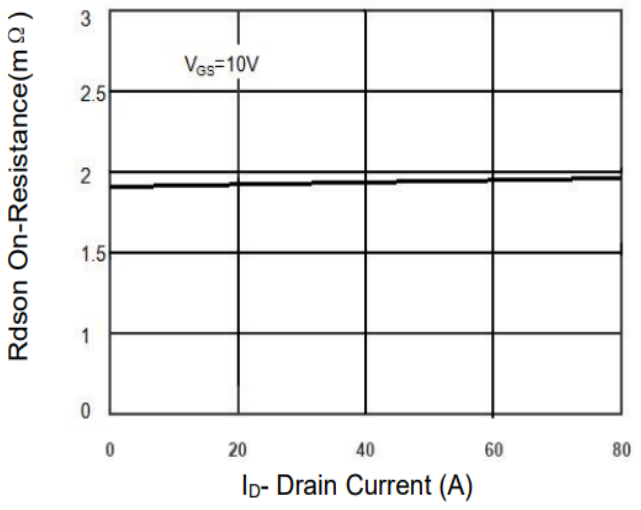
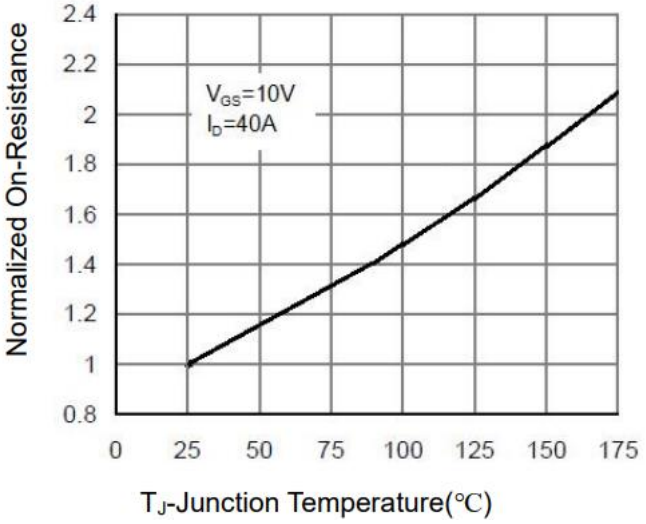
| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | $Q_{gs}$ | - | 42.9 | - | nC | $V_{DD}$=30V, $I_D$=20A, $V_{GS}$=10V |
| Gate to drain charge | $Q_{gd}$ | - | 30.5 | - | nC | $V_{DD}$=30V, $I_D$=20A, $V_{GS}$=10V |
| Gate charge total | $Q_g$ | - | 157.4 | - | nC | $V_{DD}$=30V, $I_D$=20A, $V_{GS}$=10V |

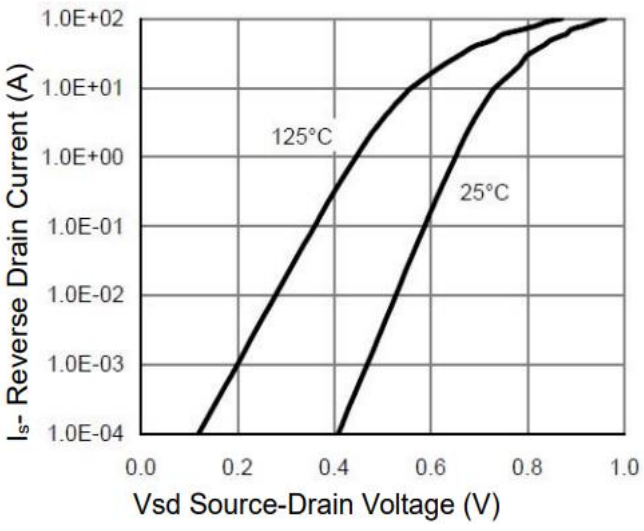
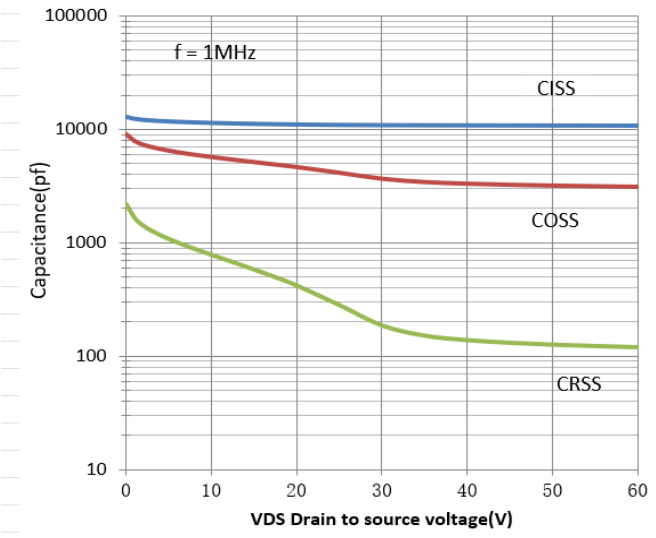
## Table 7 Reverse diode characteristics

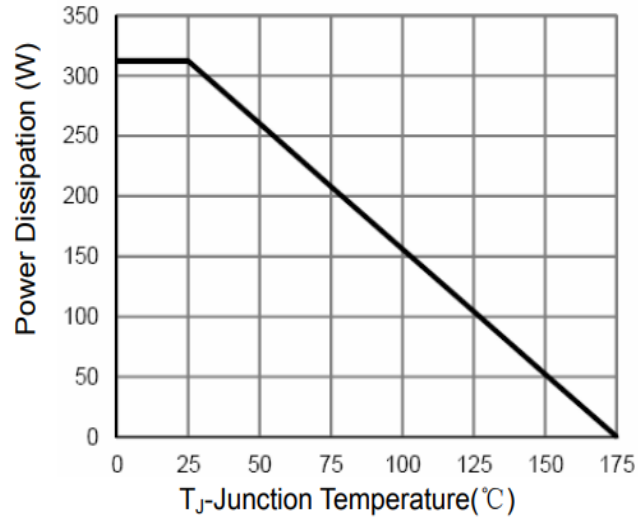
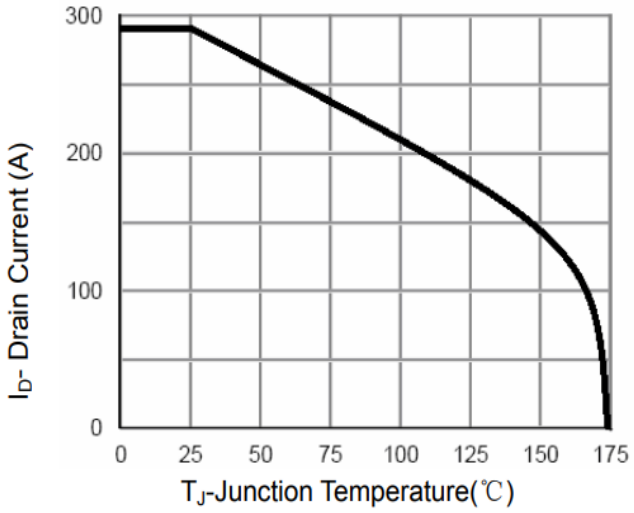
| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Diode forward voltage | $V_{SD}$ | - | 0.67 | 1.2 | V | $V_{GS}$=0V, $I_S$=1A, $T_j$=25°C |
| Reverse recovery time | $t_{rr}$ | - | 128.9 | - | ns | *Vgs=0V*, $I_F$=20A, d$i_F$/d$t$=100A/μs |
| Reverse recovery charge | $Q_{rr}$ | - | 252.9 | - | nC | *Vgs=0V*, $I_F$=20A, d$i_F$/d$t$=100A/μs |
| Peak Reverse Recovery Current | $I_{rrm}$ | - | 3.3 | - | A | *Vgs=0V*, $I_F$=20A, d$i_F$/d$t$=100A/μs |

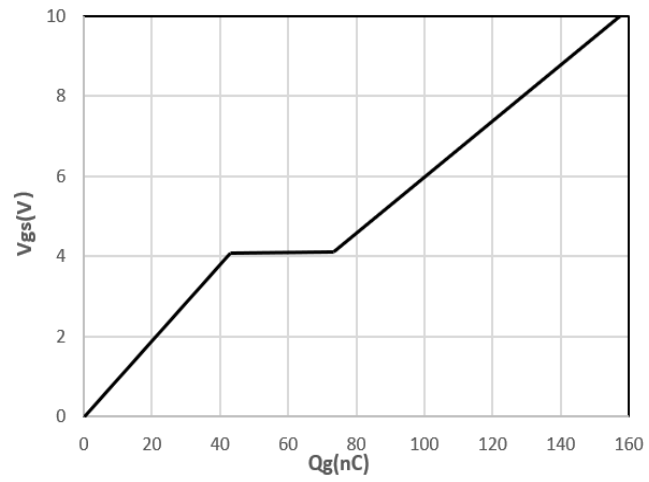
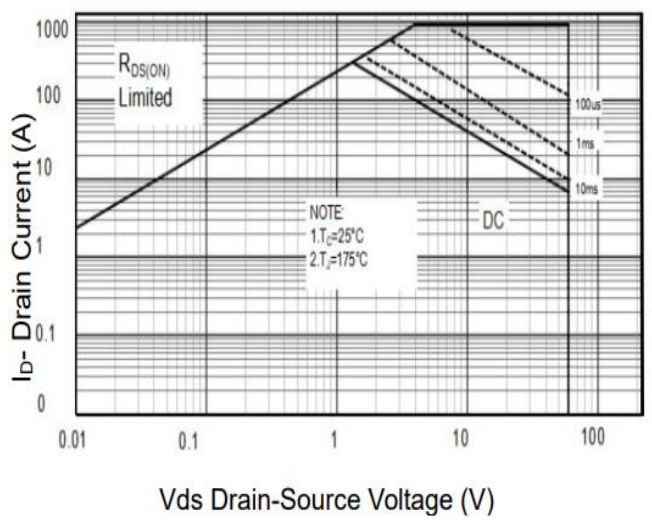
## 4 Electrical characteristics diagram

| Diagram 1: Typ. Output characteristics | Diagram 2: Typ. Transfer characteristics |
|---|---|
|  |  |
| $I_D$=f($V_{DS}$);$T_j$=25 °C; parameter: $V_{GS}$ | $I_D$=f($V_{GS}$);parameter: $T_j$ |

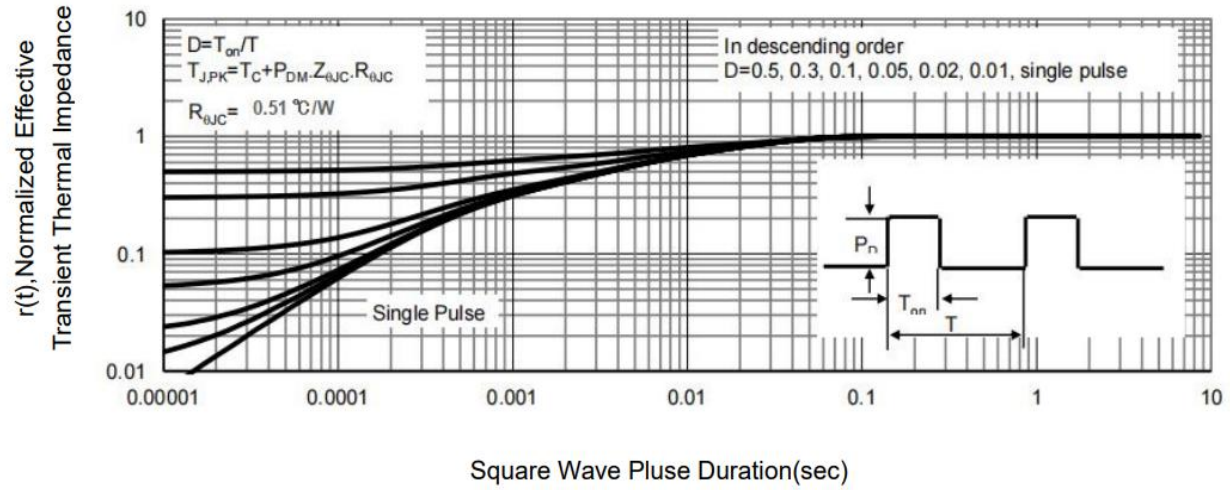
| Diagram 3: Typ. Rdson vs. Drain Current | Diagram 4: Typ. Rdson – Junction Temperature |
|---|---|
|  |  |
| $R_{ds(on)}$=f($Id$);Vgs=10V | $R_{ds(on)}$=f($T_j$);Vgs=10V/$I_D$=40A |

| Diagram 5: Typ. Body-Diode Characteristics | Diagram 6: Typ. Capacitance vs. Vds |
|---|---|
|  |  |
| $I_F$=f($V_{DS}$);parameter: $Tj$ | $C$=f($V_{DS}$);$V_{GS}$=0V; $f$=1MHz |

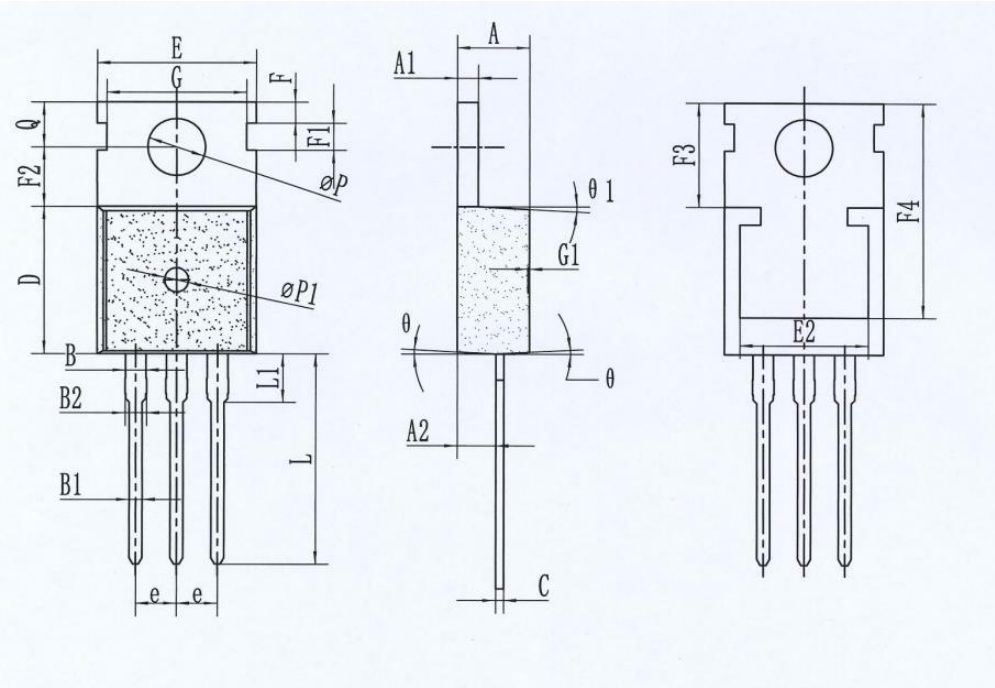
| Diagram 7: Typ. Power Dissipation | Diagram 8: Typ. Drain Current De-rating |
|---|---|
|  |  |
| $P_{tot}$=f($T_C$); | $Id$=f($T_C$); |

| Diagram 9: Typ. Gate charge | Diagram 10: Typ. Maximum Safe Operating Area |
|---|---|
|  |  |
| $V_{GS}$=f($Q_{gate}$);$I_D$=20A pulsed; parameter: $V_{DD}$ | $I_D$=f($V_{DS}$); $T_C$=25 °C; $V_{GS}$> 7V; D=0; parameter tp |

## Figure 11 Normalized Maximum Transient Thermal Impedance



## 5. Package Outlines




COMMON DIMENSIONS

| SYMBOL | MM | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.40 | 4.50 | 4.60 |
| A1 | 1.25 | 1.30 | 1.35 |
| A2 | 2.30 | 2.40 | 2.50 |
| B | 1.22 | 1.27 | 1.32 |
| B1 | 0.70 | 0.80 | 0.90 |
| B2 | 1.32 | 1.37 | 1.42 |
| C | 0.45 | 0.50 | 0.55 |
| D | 9.10 | 9.20 | 9.30 |
| E | 9.70 | 9.90 | 10.10 |
| E1 | 9.90 | 10.00 | 10.10 |
| E2 | 7.80 | 8.00 | 8.20 |
| e | 2.54 BSC | | |
| F | 1.22 | 1.30 | 1.38 |
| F1 | 1.60 | 1.70 | 1.80 |
| F2 | 3.60 | 3.70 | 3.80 |
| F3 | 6.30 | 6.50 | 6.70 |
| F4 | 13.10 | 13.40 | 13.70 |
| G | 8.60 | 8.70 | 8.80 |
| G1 | 0.05 | 0.10 | 0.15 |
| L | 12.80 | 13.10 | 13.40 |
| L1 | 2.80 | 3.00 | 3.20 |
| ΦP | 3.50 | 3.60 | 3.70 |
| ΦP1 | 1.40 | 1.50 | 1.60 |
| Q | 2.70 | 2.80 | 2.90 |
| θ | 1° | 3° | 5° |
| θ1 | 1° | 3° | 5° |

Figure： Outline PG-TO220(LM)

## Revision History

| Revision | Date | Subjects (major changes since last revision) |
|---|---|---|
| 1.0 | 2023-06-05 | Preliminary version |

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