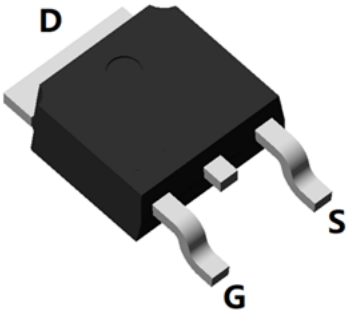
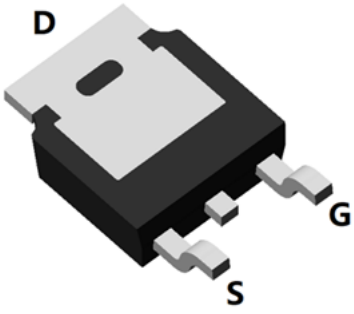
# P-Channel Enhancement Mode Field Effect Transistor

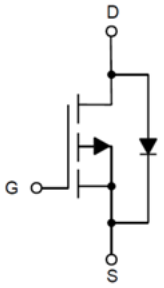



Top View




Bottom View

TO-252




## Product Summary

- $V_{DS}$ -40 V
- $I_D$ -50 A
- $R_{DS(ON)}$( at $V_{GS}$=-10V) ＜15 mΩ
- $R_{DS(ON)}$( at $V_{GS}$=-4.5V) ＜22 mΩ
- 100% EAS Tested
- 100% ▽$V_{DS}$ Tested
- ESD Level(HBM) Class 1C

## General Description

- Low $R_{DS(on)}$ & FOM
- Extremely low switching loss
- Excellent stability and uniformity
- Moisture Sensitivity Level 1
- Epoxy Meets UL 94 V-0 Flammability Rating
- Halogen Free

## Applications

- Power management
- Portable equipment

## ■ Limiting Values

| Parameter | Conditions | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-source Voltage | $T_J$ ≥ 25 °C; $T_J$≤ 150 °C | | $V_{DS}$ | - | -40 | V |
| Gate-source Voltage | $T_J$≤ 150 °C; DC | | $V_{GS}$ | -20 | 20 | |
| Continuous Drain Current | Steady-State | $T_A$=25℃, $V_{GS}$= 10V | $I_D$ | - | -8 | A |
| | | $T_A$=100℃, $V_{GS}$= 10V | | - | -7 | |
| Continuous Drain Current | Steady-State | $T_C$=25℃, $V_{GS}$= 10V | | - | -50 | |
| | | $T_C$ =100℃, $V_{GS}$= 10V | | - | -31 | |
| Pulsed Drain Current [A] | $T_C$=25℃, $t_p$≤10μs | | $I_{DM}$ | - | -200 | |
| Maximum Body-Diode Continuous Current | | | $I_S$ | | -50 | |
| Avalanche energy [B] (non-repetitive ) | $V_G$=-10V, $R_G$=25Ω, L=0.5mH, IAS=-9.5A | | EAS | - | 22.5 | mJ |
| Total Power Dissipation [C] | Steady-State | $T_A$=25℃ | $P_D$ | - | 2.5 | W |
| | | $T_A$=100℃ | | - | 1 | |
| Total Power Dissipation [C] | Steady-State | $T_C$=25℃ | | - | 83 | |
| | | $T_C$ =100℃ | | - | 33 | |
| Junction and Storage Temperature Range | | | $T_J$ ,$T_{STG}$ | -55 | 150 | ℃ |

## ■Thermal resistance

| Parameter | | Symbol | Typ | Max | Units |
|---|---|---|---|---|---|
| Thermal Resistance Junction-to-Ambient [D] | Steady-State | $R_{\theta JA}$ | 40 | 50 | ℃/W |
| Thermal Resistance Junction-to-Case | Steady-State | $R_{\theta JC}$ | 1.2 | 1.5 | |

## ■ Ordering Information (Example)

| PREFERED P/N | PACKING CODE | Marking | MINIMUM PACKAGE(pcs) | INNER BOX QUANTITY(pcs) | OUTER CARTON QUANTITY(pcs) | DELIVERY MODE |
|---|---|---|---|---|---|---|
| D50P04AJ | F1 | D50P04AJ | 2500 | / | 25000 | 13“ reel |

## ■ Electrical Characteristics ($T_J$=25℃ unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Static Parameter** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$= 0V, $I_D$=-250μA | -40 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-40V, $V_{GS}$=0V | - | - | -1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$= ±20V, $V_{DS}$=0V | - | - | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$= $V_{GS}$, $I_D$=-250μA | -1 | -1.5 | -2.5 | V |
| Static Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$=-10V, $I_D$=-20A | | 11.5 | 15 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-20A | - | 14 | 22 | |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=-20A, $V_{GS}$=0V | - | -0.85 | -1.2 | V |
| Gate resistance | $R_G$ | f=1MHz | - | 10 | - | Ω |
| **Dynamic Parameters** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=-25V, $V_{GS}$=0V, f=1MHz | - | 3500 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 270 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 230 | - | |
| **Switching Parameters** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{GS}$=-10V, $V_{DS}$=-20V, $I_D$=-25A | - | 73.3 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 8.9 | - | |
| Gate-Drain Charge | $Q_{gd}$ | | - | 15.3 | - | |
| Reverse Recovery Charge | $Q_{rr}$ | $I_F$=-25A, di/dt=100A/us | - | 12.9 | - | nC |
| Reverse Recovery Time | $t_{rr}$ | | - | 25.4 | - | ns |
| Turn-on Delay Time | $t_{D(on)}$ | $V_{GS}$=-10V, $V_{DD}$=-20V, $I_D$=-25A $R_{GEN}$=6Ω | - | 13.6 | - | ns |
| Turn-on Rise Time | $t_r$ | | - | 11.8 | - | |
| Turn-off Delay Time | $t_{D(off)}$ | | - | 201.5 | - | |
| Turn-off fall Time | $t_f$ | | - | 92.5 | - | |

A. Repetitive rating; pulse width limited by max. junction temperature.
B. $T_J$=25℃, $V_{DD}$=--70V, $V_G$=-10V, L=0.5mH, IAS=-9.5A.
C. $P_d$ is based on max. junction temperature, using junction-case and junction-ambient thermal resistance.
D. The value of RθJA is measured with the device mounted on the minimum recommend pad size, in the still air environment with TA =25℃. The maximum allowed junction temperature of 150℃. The value in any given application depends on the user's specific board design.

## ■Typical Electrical and Thermal Characteristics Diagrams

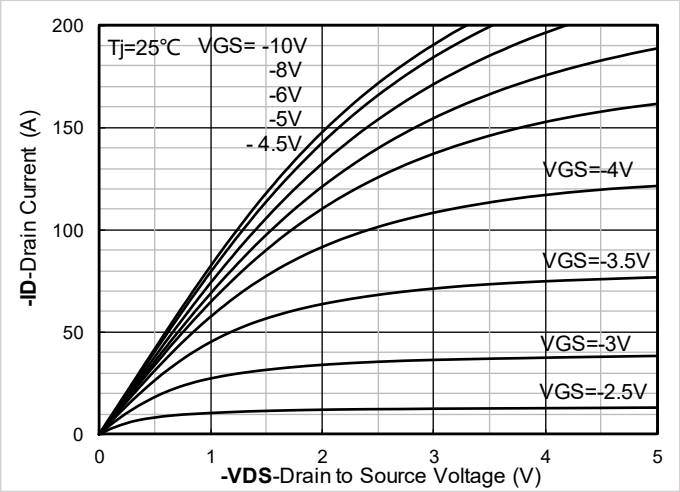



Figure 1. Output Characteristics

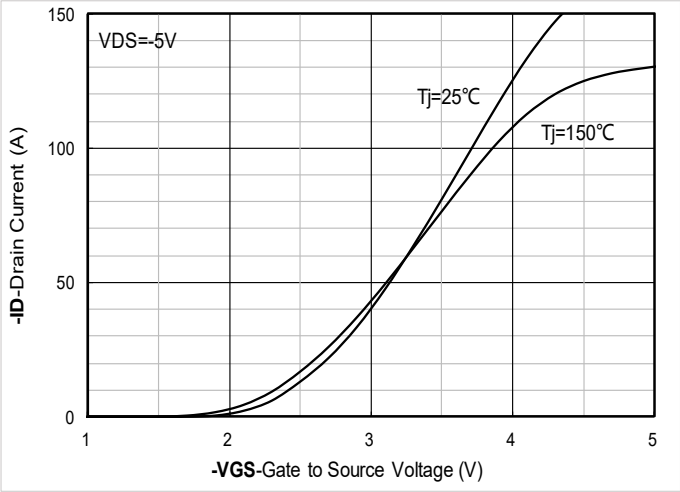



Figure 2. Transfer Characteristics

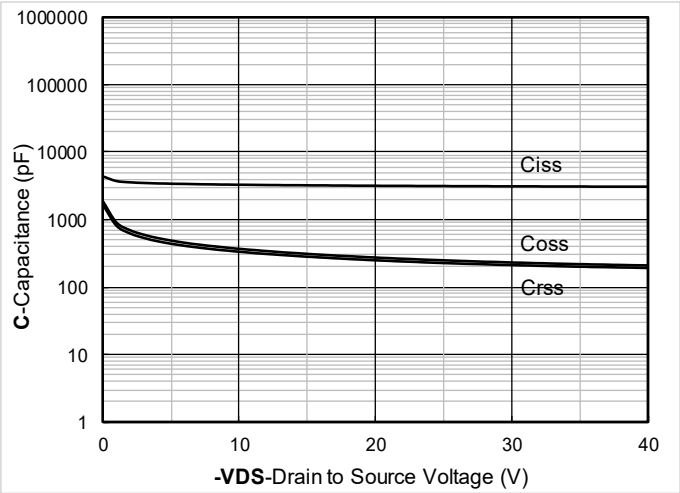



Figure 3. Capacitance Characteristics

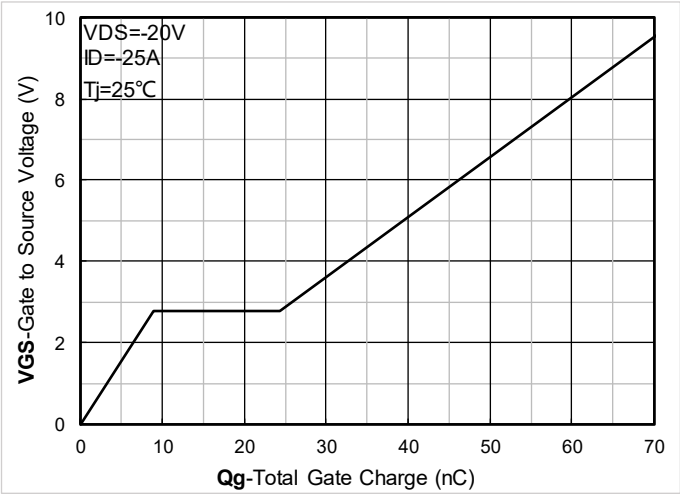



Figure 4. Gate Charge

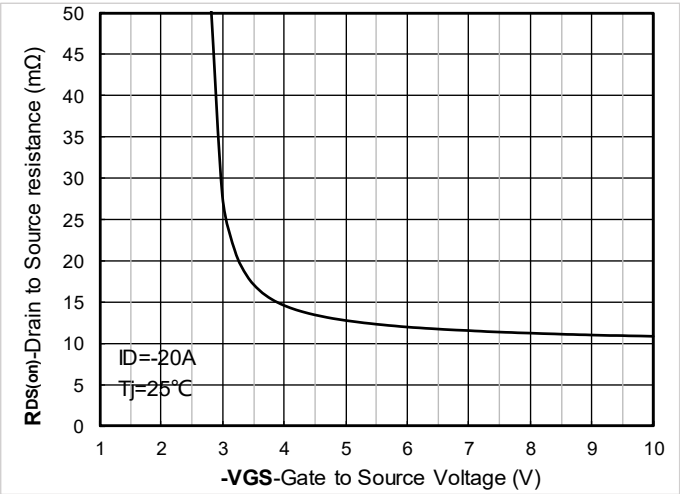



Figure 5. On-Resistance vs Gate to Source Voltage

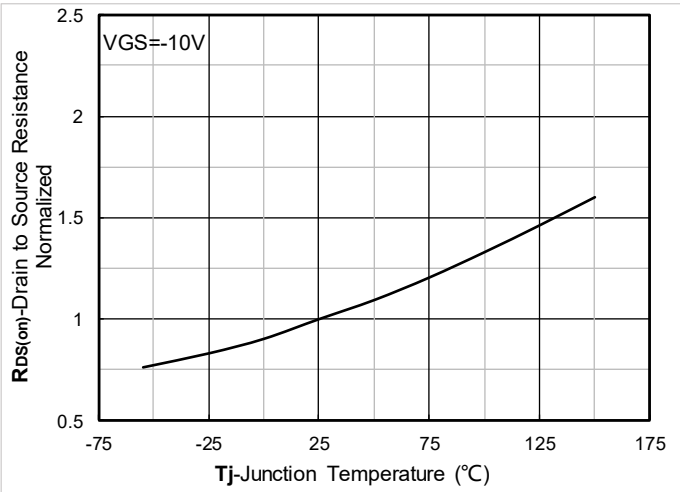



Figure 6. Normalized On-Resistance

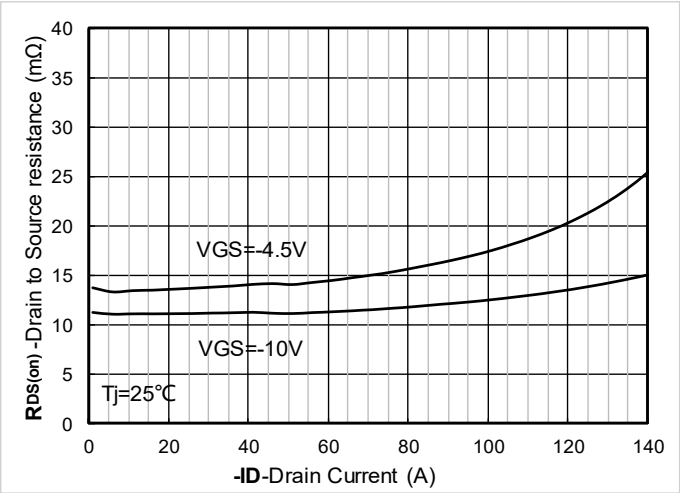



Figure 7. $R_{DS(on)}$ VS Drain Current

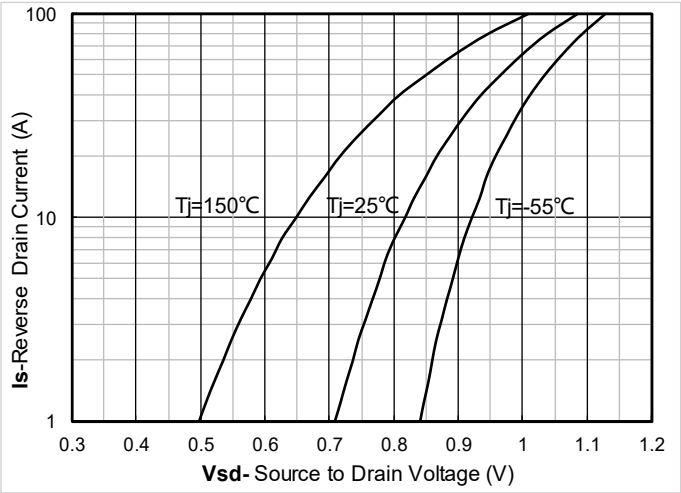



Figure 8. Forward characteristics of reverse diode

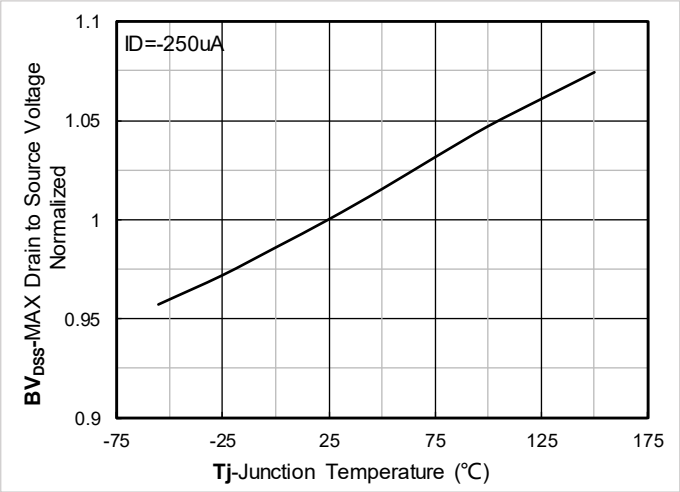



Figure 9. Normalized breakdown voltage

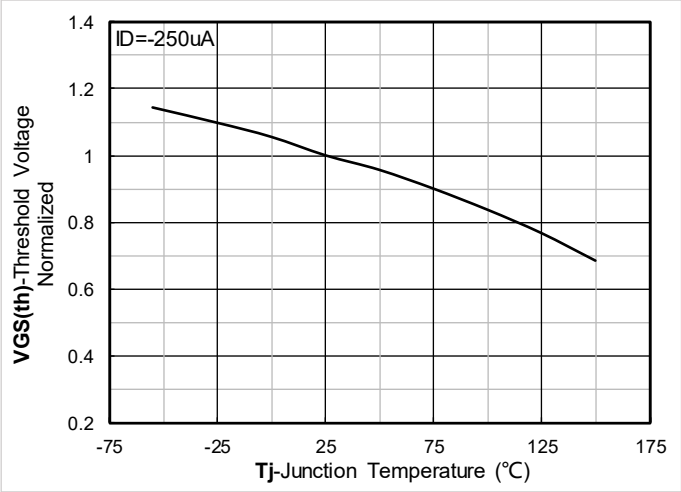



Figure 10. Normalized Threshold voltage

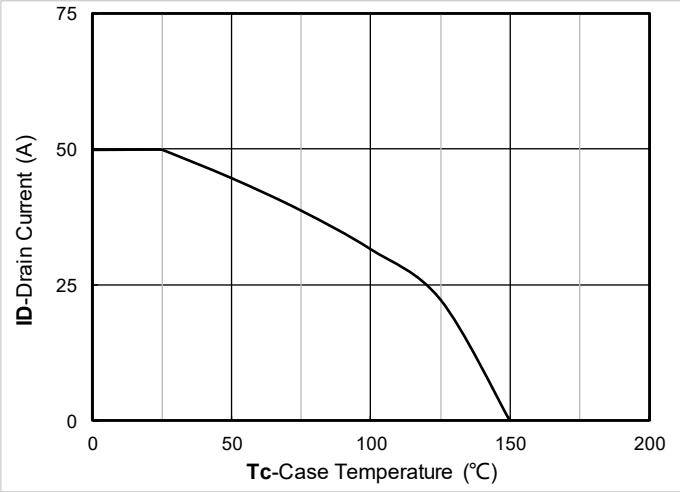



Figure 11. Current dissipation

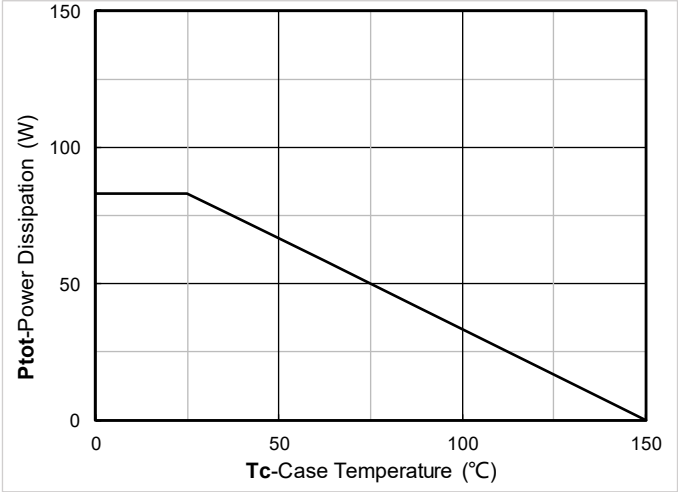



Figure 12. Power dissipation

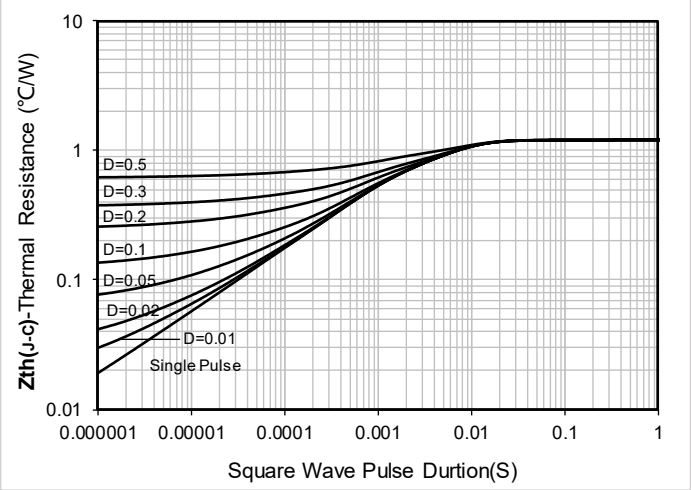



Figure 13. Maximum Transient Thermal Impedance

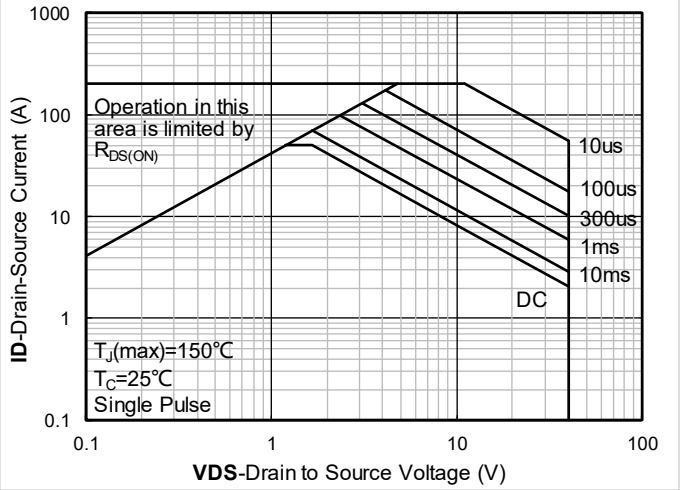
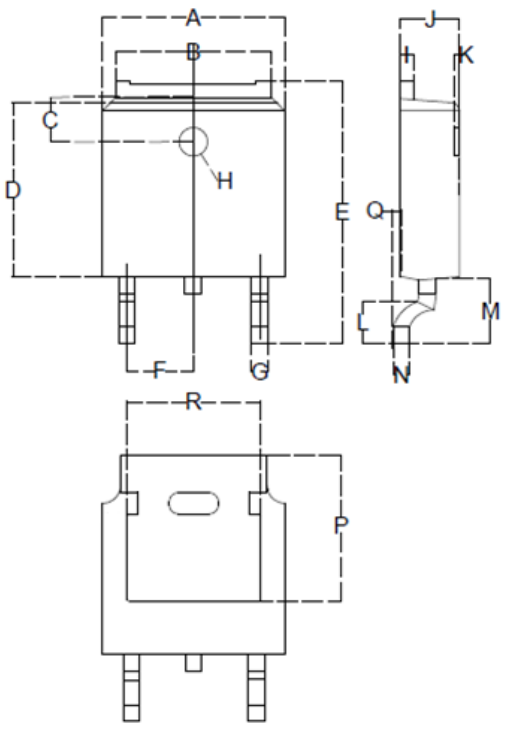



Figure 14. Safe Operation Area

## ■ TO-252 Package information

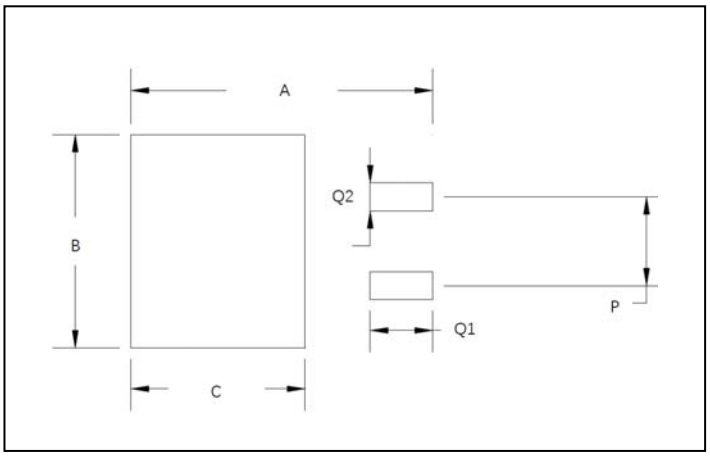
TO-252




Dimensions in millimeters

| TO-252 | | |
|---|---|---|
| Dim | Min | Max |
| A | 6.500 | 6.700 |
| B | 5.100 | 5.460 |
| C | 1.400 | 1.800 |
| D | 6.000 | 6.200 |
| E | 10.000 | 10.400 |
| F | 2.166 | 2.366 |
| G | 0.660 | 0.860 |
| H | Φ1.050 | Φ1.350 |
| I | 0.460 | 0.580 |
| J | 2.200 | 2.400 |
| K | 0 | 0.300 |
| L | 0.890 | 2.290 |
| M | 2.730 | 3.080 |
| N | 0.430 | 0.580 |
| P | 5.15 | 5.45 |
| Q | 0 | 0.2 |
| R | 4.500 | 5.100 |

## ■ Suggested Pad Layout




| Dim | Millimeters |
|---|---|
| A | 11.4 |
| B | 6.74 |
| C | 6.23 |
| P | 4.56 |
| Q1 | 2.28 |
| Q2 | 1.52 |

## Notice

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