# UMW FQP47P06

-60V P-Channel MOSFET

## 1.Description

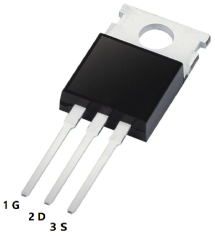
This P−Channel enhancement mode power MOSFET is produced using planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduceon−state resistance, and to provide superior switching performance and high a valanche energy strength.

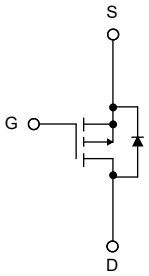
## 2.Features

- $V_{DS\ (V)}$=-60V
- $I_D$=-47A
- $R_{DS(ON)}$=26mΩ($V_{GS}$=-10V)
- Low Gate Charge (Typ. 84 nC)
- Low Crss (Typ. 320 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating

## 3.Pinning information

| Pin | Symbol | Description |
|---|---|---|
| 1 | G | GATE |
| 2 | D | SOURCE |
| 3 | S | DRAIN |




## 4.Absolute Maximum Ratings $T_C$= 25°C

| Parameter | | | Symbol | Rating | Units |
|---|---|---|---|---|---|
| Drain Source Voltage | | | $V_{DSS}$ | -60 | V |
| Drain Current - Continuous | $T_C$=25°C | | $I_D$ | -47 | A |
| - Continuous | $T_C$=100°C | | | -33.2 | A |
| - Pulsed | | (Note 1) | $I_{DM}$ | -188 | A |
| Gate-Source Voltage | | | $V_{GSS}$ | ±25 | V |
| Single Pulsed Avalanche Energy | | (Note 2) | $E_{AS}$ | 820 | mJ |
| Avalanche Current | | (Note 1) | $I_{AR}$ | -47 | A |
| Repetitive Avalanche Energy | | (Note 1) | $E_{AR}$ | 16 | mJ |
| Peak Diode Recovery dv/dt | | (Note 3) | dv/dt | -7 | V/ns |

| | | | |
|---|---|---|---|
| Power Dissipation ($T_C$=25°C) | $P_D$ | 160 | W |
| - Derate above 25°C | | 1.06 | W/°C |
| Temperature Range | $T_J$, $T_{STG}$ | -55 to 175 | °C |
| Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | $T_L$ | 300 | °C |

## 5.Thermal Characteristics

| Parameter | Symbol | Rating | Units |
|---|---|---|---|
| Thermal Resistance, Junction-to-Case, Max. | $R_{\theta JC}$ | 0.94 | °C/W |
| Thermal Resistance, Case-to-Sink, Typ. | $R_{\theta CS}$ | 0.5 | °C/W |
| Thermal Resistance, Junction-to-Ambient, Max. | $R_{\theta JA}$ | 62.5 | °C/W |

## 6.Electrical Characteristic ($T_C$=25°C unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Drain to Source Breakdown Voltage | $BV_{DSS}$ | $I_D$=-250μA, $V_{GS}$=0V | -60 | | | V |
| Breakdown Voltage Temperature Coefficient | $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | $I_D$=-250μA<br>Referenced to 25°C | | -0.06 | | V/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-60V, $V_{GS}$=0V | | | -1 | μA |
| | | $V_{DS}$=-48V, $T_C$=150°C | | | -10 | μA |
| Gate-Body Leakage Current, Forward | $I_{GSSF}$ | $V_{GS}$=-25V, $V_{DS}$=0V | | | -100 | nA |
| Gate-Body Leakage Current, Reverse | $I_{GSSR}$ | $V_{GS}$=25V, $V_{DS}$=0V | | | 100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=-250μA | -1.1 | -1.8 | -2.5 | V |
| Static Drain to Source On Resistance | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-23.5A | | 21 | 26 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-30V, $I_D$=-23.5A (Note 4) | | 21 | | S |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=-25V, $V_{GS}$=0V, f=1MHz | | 2800 | 3600 | pF |
| Output Capacitance | $C_{oss}$ | | | 1300 | 1700 | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 320 | 420 | pF |
| Turn-On Delay Time | $t_{D(on)}$ | $V_{DD}$=-30V, $I_D$=-23.5A<br>$R_G$=25Ω (Note 4,5) | | 50 | 110 | ns |
| Rise Time | $t_r$ | | | 450 | 910 | ns |
| Turn-Off Delay Time | $t_{D(off)}$ | | | 100 | 210 | ns |
| Fall Time | $t_f$ | | | 195 | 400 | ns |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-48V, $I_D$=-47A<br>$V_{GS}$=-10V (Note 4,5) | | 84 | 110 | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 18 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | | 44 | | nC |
| Maximum Continuous Drain to Source Diode Forward Current | $I_S$ | | | | -47 | A |
| Maximum Pulsed Drain to Source Diode Forward Current | $I_{SM}$ | | | | -188 | A |

| | | | | | | |
|---|---|---|---|---|---|---|
| Drain-Source Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=-47A | | | -4 | V |
| Reverse Recovery Time | $t_{rr}$ | $V_{GS}$=0V, $I_S$=-47A | | 130 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | $dI_F/dt$=100A/μs (Note 4) | | 0.55 | | μC |

Notes:

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted.

Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

5. Essentially independent of operating temperature.

## 7.1Typical characteristic

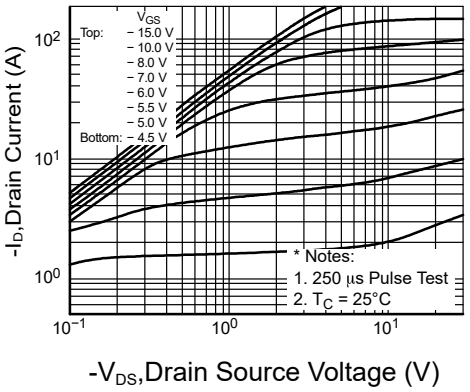



Figure 1: Output Characteristics

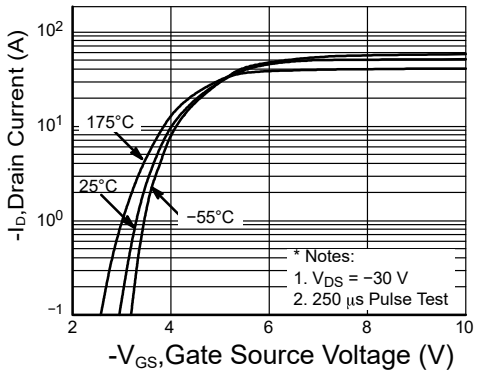



Figure 2: Transfer Characteristics

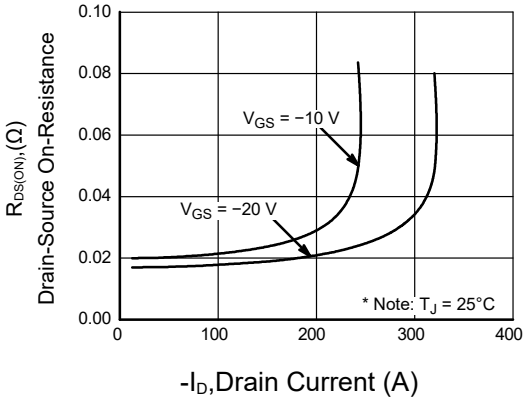



Figure 3: On-Resistance Variation vs. Drain Current and Gate Voltage

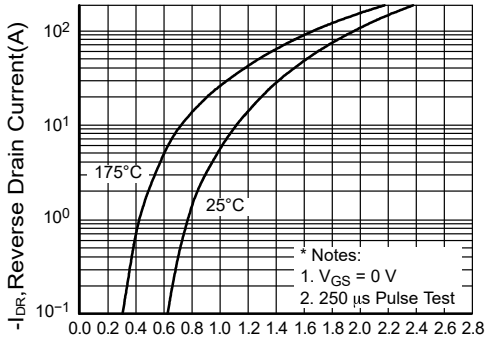



Figure 4: Body Diode Forward Voltage Variation vs. Source Current and Temperature

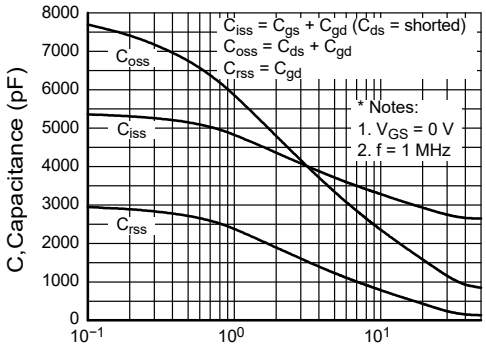



Figure 5: . Capacitance Characteristics

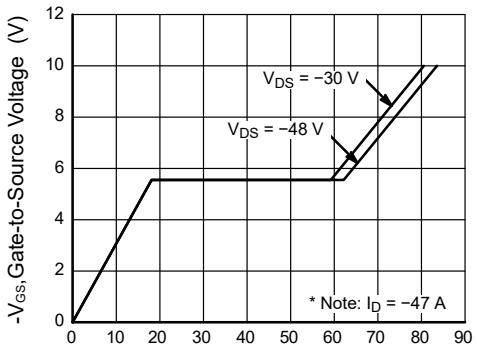



Figure 6: Gate Charge Characteristics

## 7.2Typical characteristic

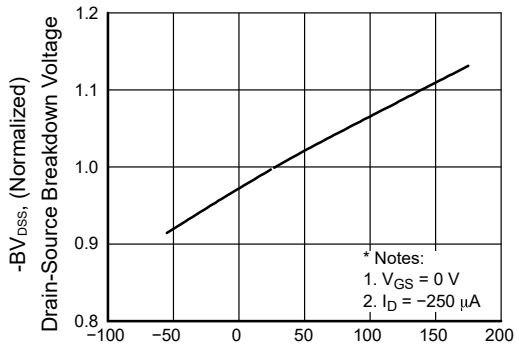



Figure 7: Breakdown Voltage Variation vs. Temperature

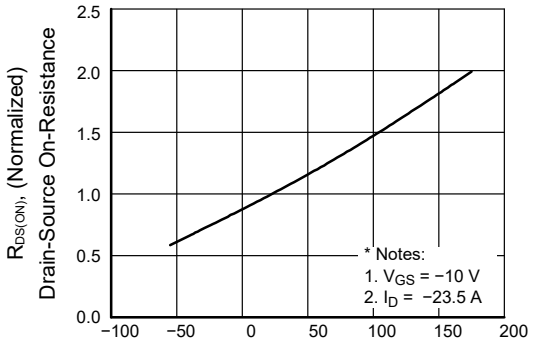



Figure 8: On-Resistance Variation vs. Temperature

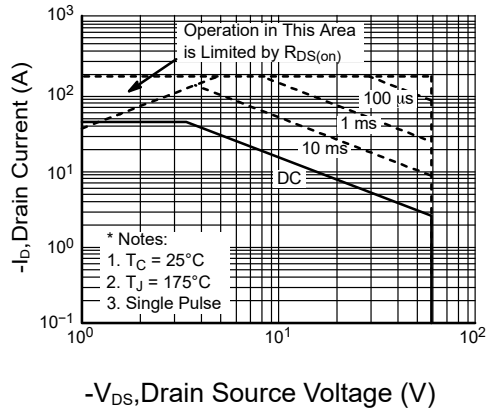



Figure 9: Maximum Drain Current vs. Ambient Temperature

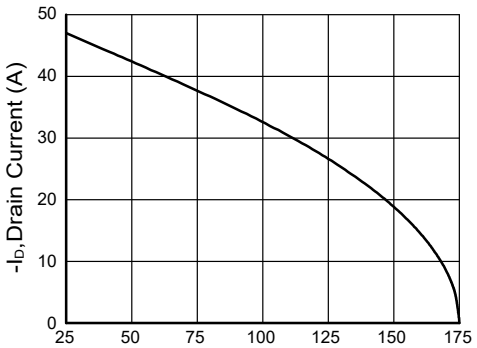



Figure 10: Maximum Drain Current vs. Case Temperature

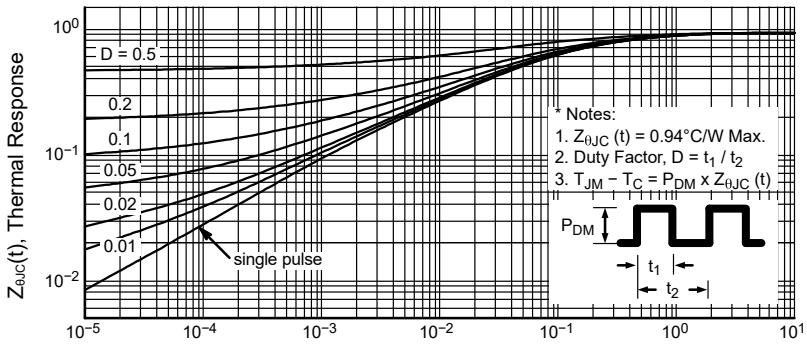



Figure 11: Transient Thermal Response Curve

## 7.3Typical characteristic

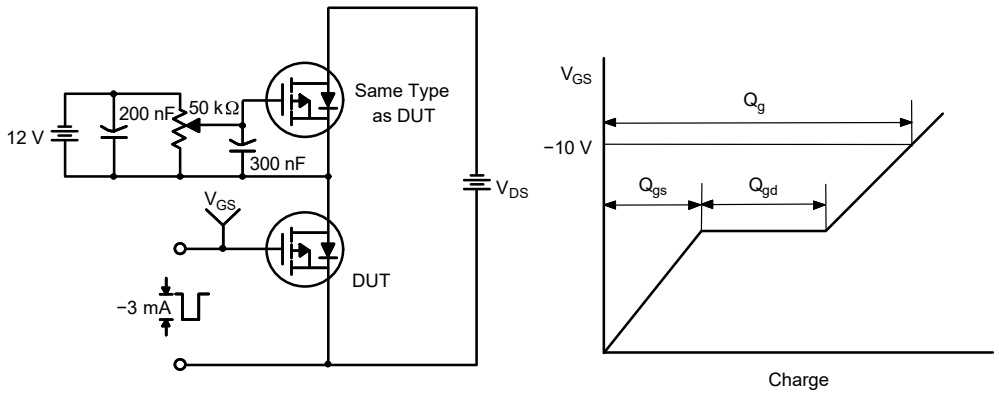



Figure 12: Gate Charge Test Circuit & Waveform

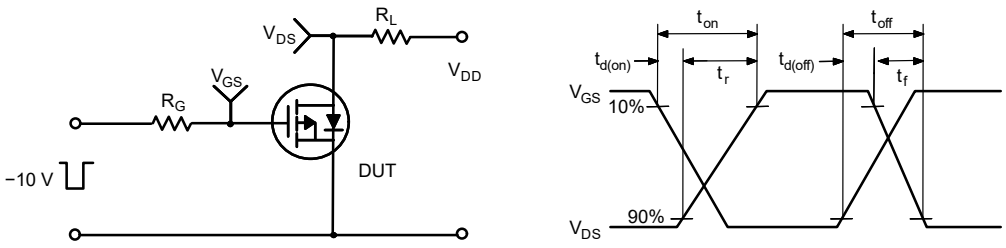



Figure 13: Resistive Switching Test Circuit & Waveforms

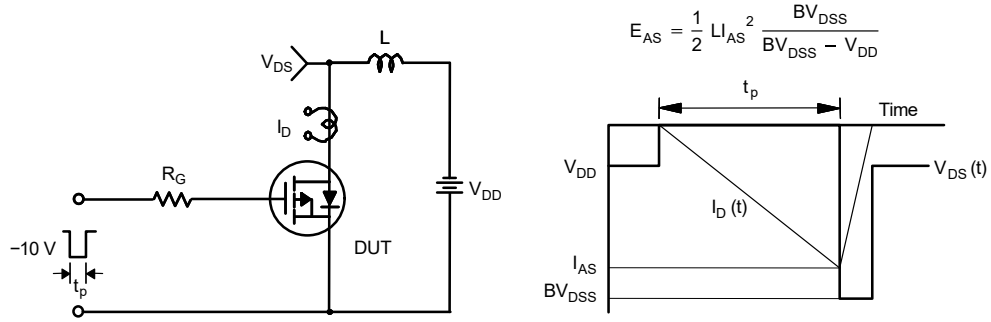



Figure 14: Unclamped Inductive Switching Test Circuit & Waveforms

## 7.4Typical characteristic

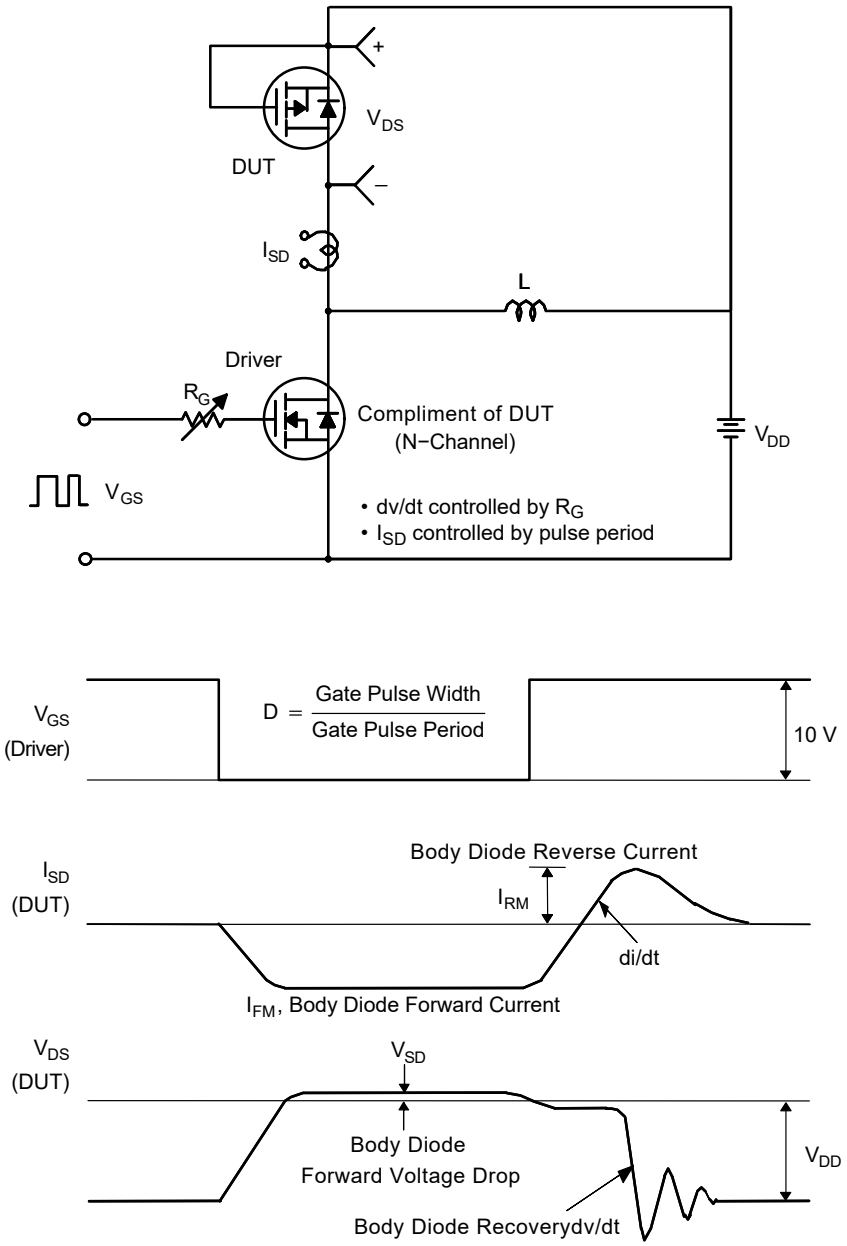
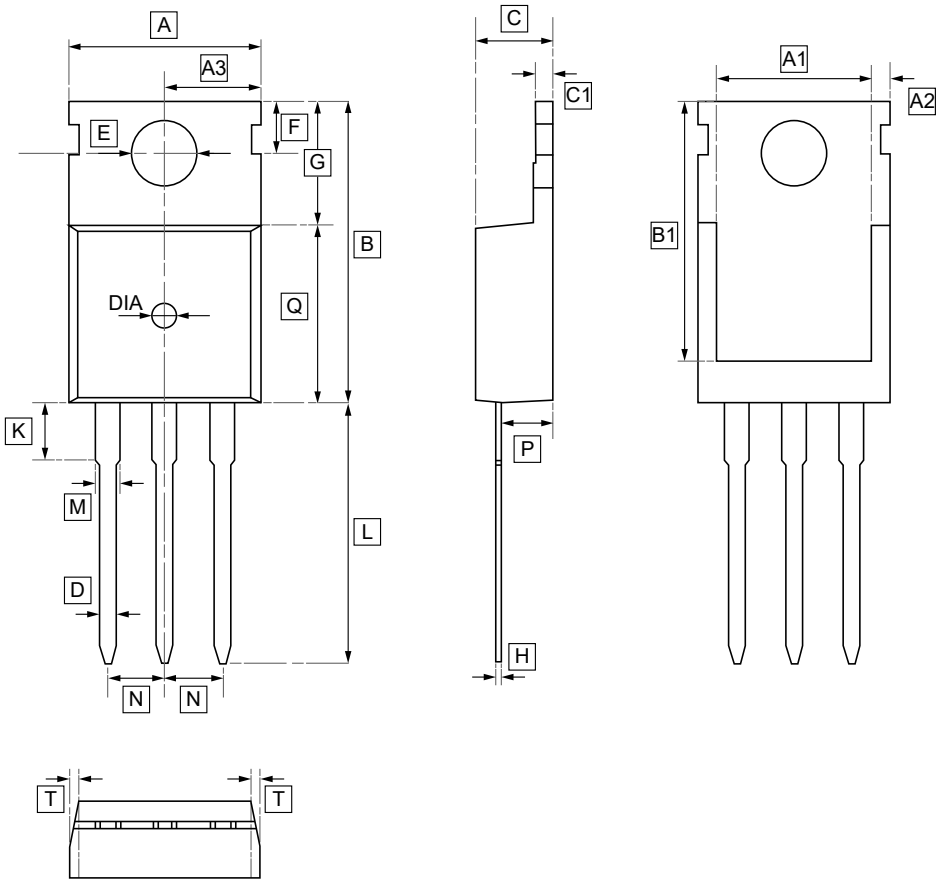



Figure 15: Peak Diode Recovery dv/dt Test Circuit & Waveforms

## 8.1 TO-220 Package Outline Dimensions

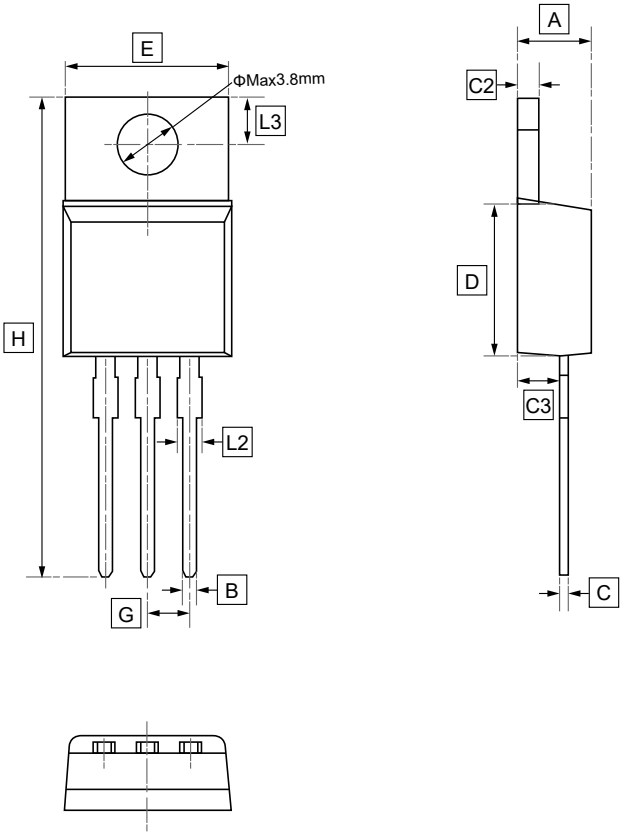



**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | A1 | A2 | A3 | B | B1 | C | C1 | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | 9.7 | 8.44 | 1.05 | 4.8 | 15.4 | 12.9 | 4.28 | 1.1 | 0.6 | 3.4 | 2.65 | 5.2 |
| Max | 10.3 | 8.84 | 1.25 | 5.2 | 16.2 | 13.5 | 4.68 | 1.5 | 1.0 | 3.8 | 3.25 | 5.8 |

| Symbol | H | K | L | L1 | M | N | P | Q | T | DIA |
|---|---|---|---|---|---|---|---|---|---|---|
| Min | 0.4 | 2.9 | 12.8 | 2.7 | 1.15 | 2.49 | 2.1 | 8.7 | W:0.35 | ⊙1.5 |
| Max | 0.6 | 3.3 | 13.6 | 3.3 | 1.35 | 2.59 | 2.7 | 9.3 | | (deep 0.2) |

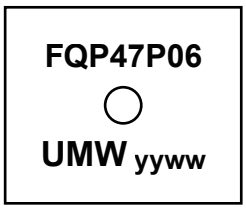
## 8.2 TO-220 Package Outline Dimensions




**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | B | C | C2 | C3 | D | E | G | H | L2 | L3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Min** | 4.30 | 0.60 | 0.28 | 1.17 | 2.30 | 8.80 | 9.80 | 2.44 | 28.55 | 1.10 | 2.59 |
| **Max** | 4.70 | 1.00 | 0.48 | 1.37 | 2.70 | 9.20 | 10.20 | 2.64 | 29.15 | 1.50 | 2.89 |

## 9.Ordering Information




yy: Year Code
ww: Week Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW FQP47P06 | TO-220 | 1000 | Tube and box |

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