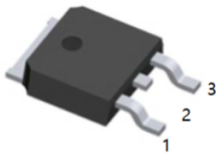
# FQD17P06

## -60V P-Channel MOSFET

## Description

This advanced MOSFET technology has been es pecially tailored to reduce on-st ate resistance, and to provi de super ior sw itching performa nce and high avala nche energy strength. These device s are suitable for switched mode powe r supplies , audio ampl ifier, DC motor control, and variable switching power applications.

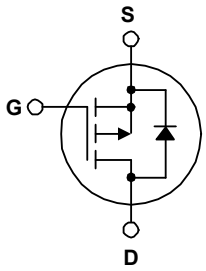



1.G 2.D 3.S

**TO-252(DPAK) top view**

## Features

- $V_{DS}$ (V) = -60V
- $I_D$ = -12A ($V_{GS}$ = -10V)
- $R_{DS(ON)}$ < 135mΩ ($V_{GS}$ = -10V)




## Absolute Maximum Ratings TC = 25°C unless otherwise noted.

| Symbol | Parameter | | FQD17P06 / FQU17P06 | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | -60 | V |
| $I_D$ | Drain Current | - Continuous ($T_C$ = 25°C) | -12 | A |
| | | - Continuous ($T_C$ = 100°C) | -7.6 | A |
| $I_{DM}$ | Drain Current | - Pulsed (Note 1) | -48 | A |
| $V_{GSS}$ | Gate-Source Voltage | | ± 25 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | | 300 | mJ |
| $I_{AR}$ | Avalanche Current (Note 1) | | -12 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | | 4.4 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | | -7.0 | V/ns |
| $P_D$ | Power Dissipation ($T_A$ = 25°C) * | | 2.5 | W |
| | Power Dissipation ($T_C$ = 25°C) | | 44 | W |
| | | - Derate above 25°C | 0.35 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | -55 to +150 | °C |
| $T_L$ | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds. | | 300 | °C |

## Thermal Characteristics

| Symbol | Parameter | FQD17P06 | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max. | 2.85 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper), Max. | 110 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (*1 $in^2$ Pad of 2-oz Copper), Max. | 50 | |

* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = -250 μA | -60 | | | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = -250 μA, Referenced to 25°C | | -0.06 | | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = -60 V, $V_{GS}$ = 0 V | | | -1 | μA |
| | | $V_{DS}$ = -48 V, $T_C$ = 125°C | | | -10 | μA |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS}$ = -25 V, $V_{DS}$ = 0 V | | | -100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS}$ = 25 V, $V_{DS}$ = 0 V | | | 100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = -250 μA | -1.1 | -2 | -3.0 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = -10 V, $I_D$ = -6.0 A | | 110 | 135 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = -30 V, $I_D$ = -6.0 A | | 8.7 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = -25 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 690 | 900 | pF |
| $C_{oss}$ | Output Capacitance | | | 325 | 420 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 80 | 105 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = -30 V, $I_D$ = -8.5 A, $R_G$ = 25 Ω (Note 4) | | 13 | 35 | ns |
| $t_r$ | Turn-On Rise Time | | | 100 | 210 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 22 | 55 | ns |
| $t_f$ | Turn-Off Fall Time | | | 60 | 130 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = -48 V, $I_D$ = -17 A, $V_{GS}$ = -10 V (Note 4) | | 21 | 27 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 4.2 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 10 | | nC |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | | | -12 | A |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current | | | | -48 | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = -12 A | | | -4.0 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_S$ = -17 A, $dI_F$ / dt = 100 A/μs | | 92 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 0.32 | | μC |

**NOTES:**

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 2.4 mH, $I_{AS}$ = -12 A, $V_{DD}$ = -25 V, $R_G$ = 25 Ω, starting $T_J$ = 25°C.
3. $I_{SD} \leq$ -17 A, di/dt ≤ 300 A/μs, $V_{DD} \leq BV_{DSS}$, starting $T_J$ = 25°C.
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

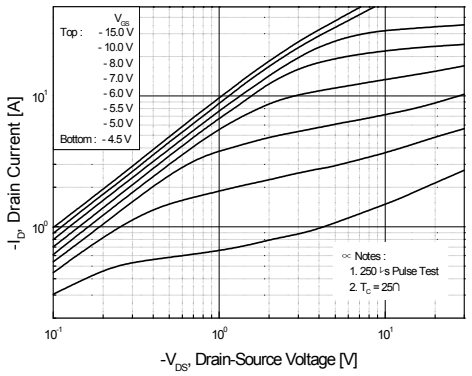



**Figure 1. On-Region Characteristics**

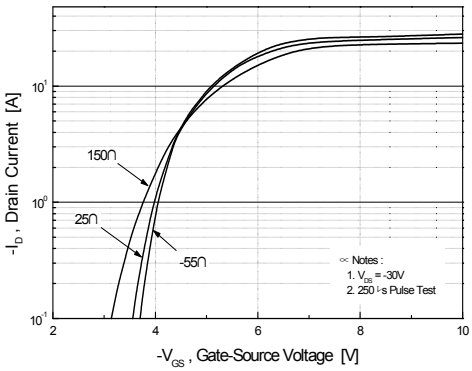



**Figure 2. Transfer Characteristics**

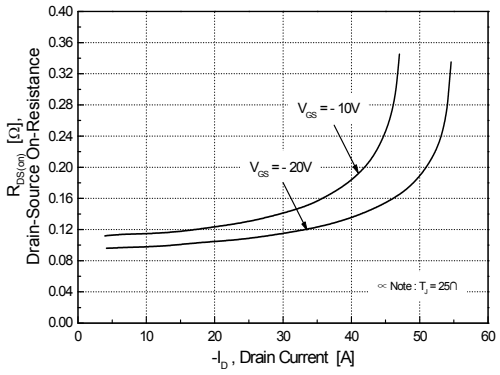



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

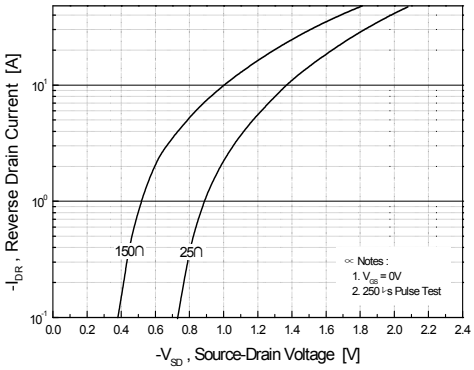



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

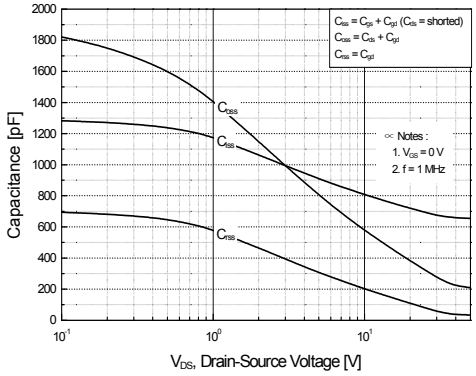



**Figure 5. Capacitance Characteristics**

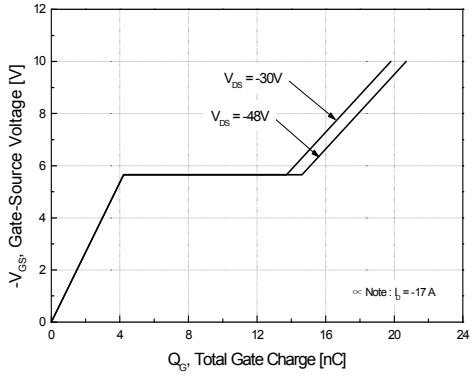



**Figure 6. Gate Charge Characteristics**

## Typical Performance Characteristics

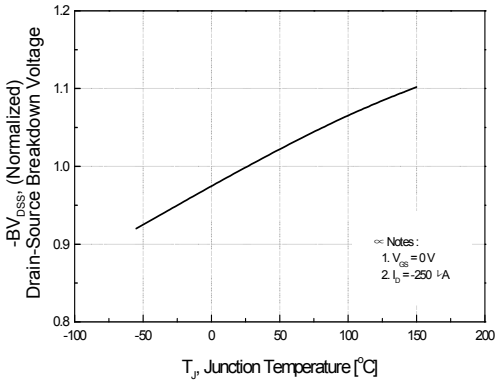



**Figure 7. Breakdown Voltage Variation vs. Temperature**

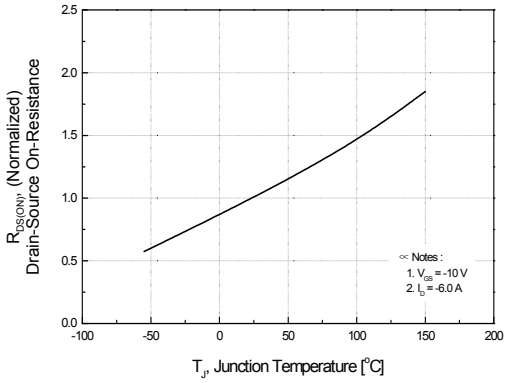



**Figure 8. On-Resistance Variation vs. Temperature**

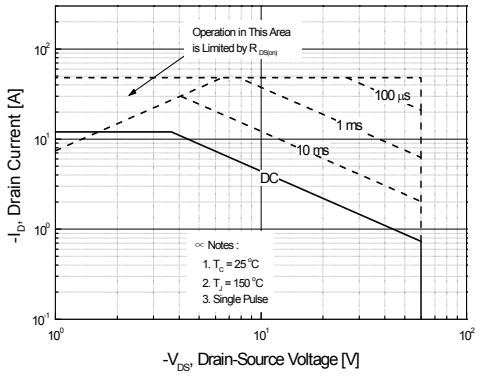



**Figure 9. Maximum Safe Operating Area**

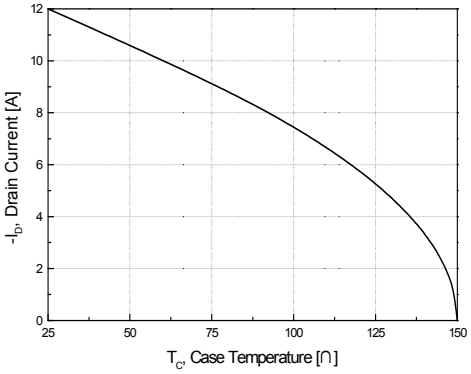



**Figure 10. Maximum Drain Current vs. Case Temperature**

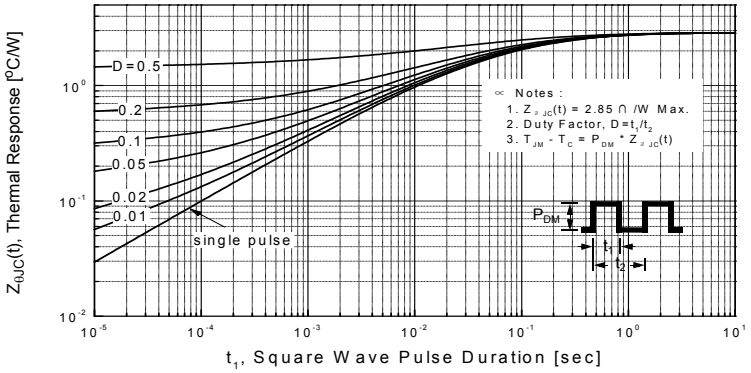



**Figure 11. Transient Thermal Response Curve**

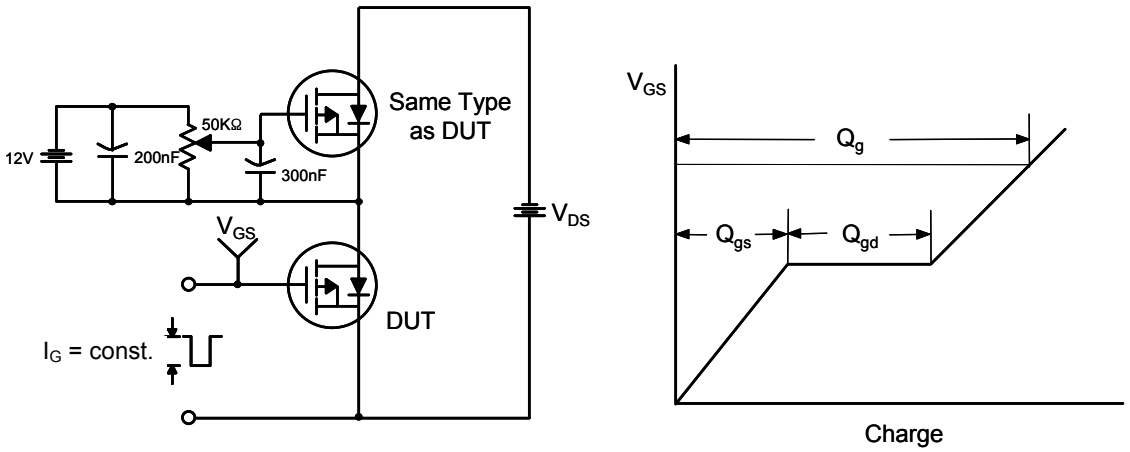



**Figure 12. Gate Charge Test Circuit & Waveform**

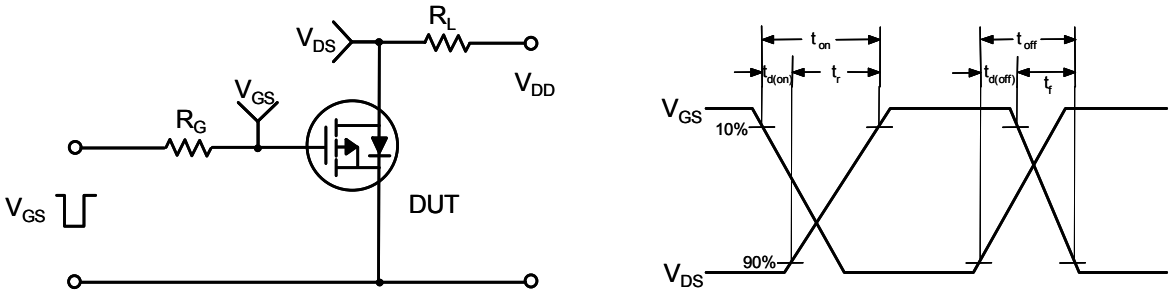



**Figure 13. Resistive Switching Test Circuit & Waveforms**

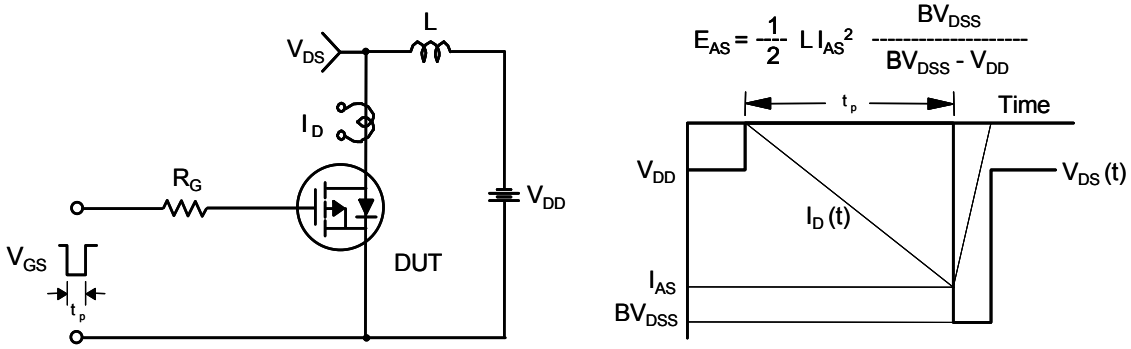



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

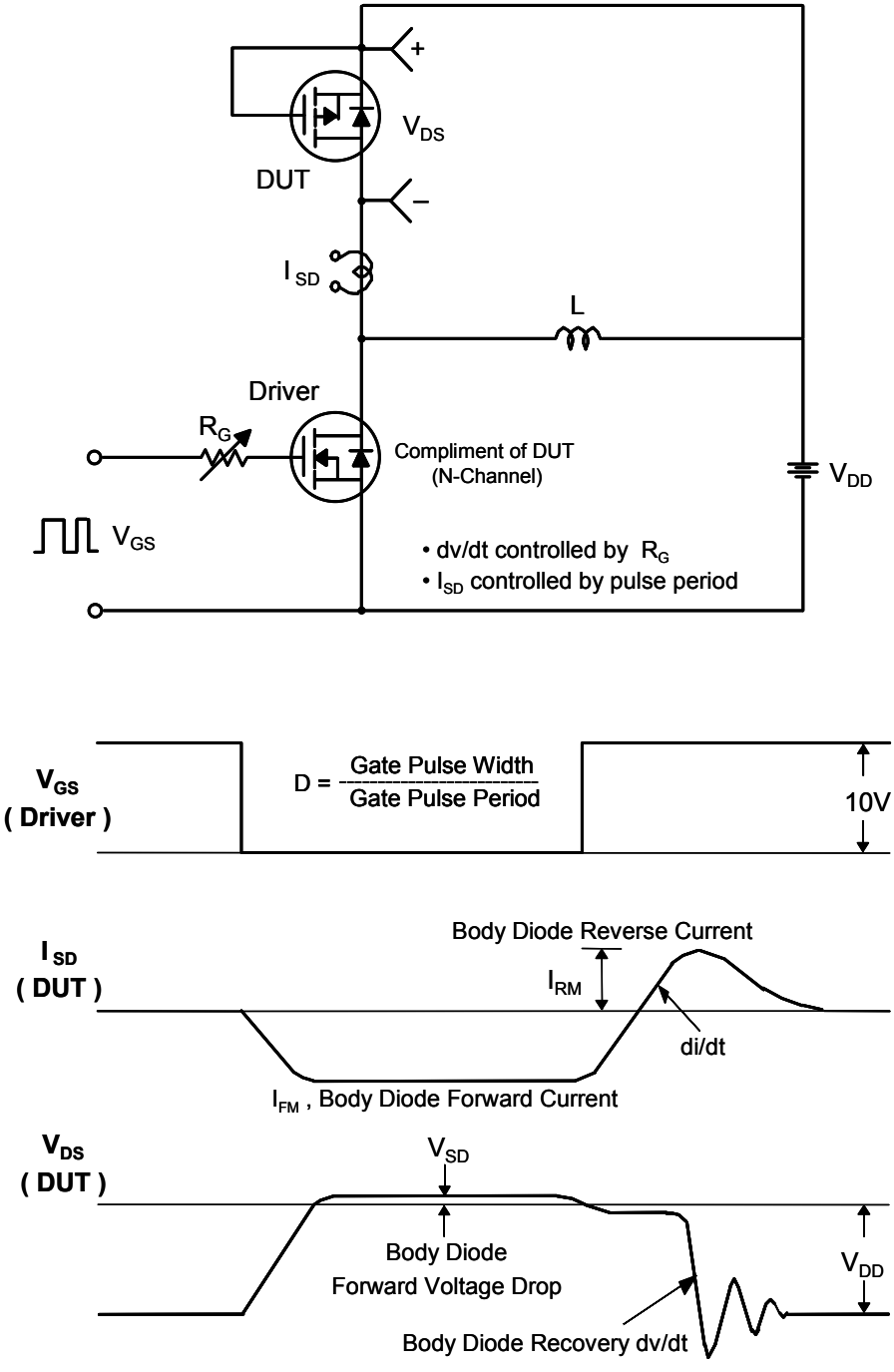
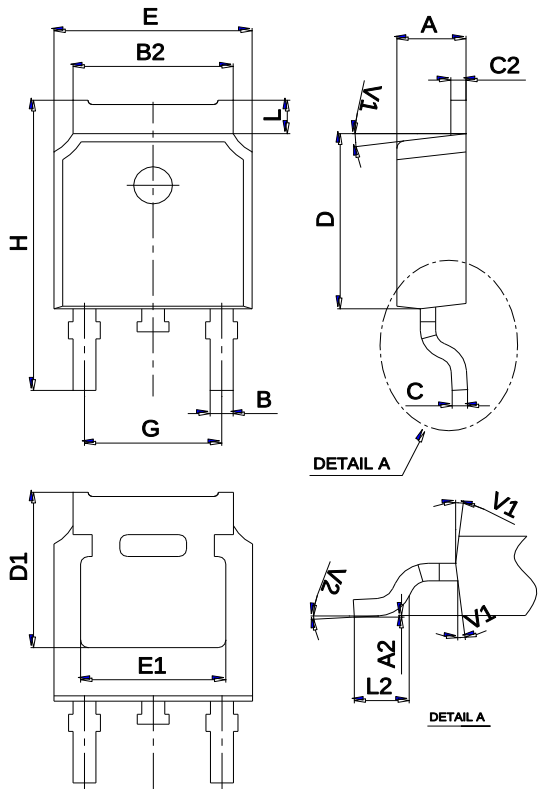


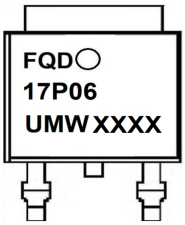

**Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

## Package Mechanical Data TO-252




| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.10 | | 2.50 | 0.083 | | 0.098 |
| A2 | 0 | | 0.10 | 0 | | 0.004 |
| B | 0.66 | | 0.86 | 0.026 | | 0.034 |
| B2 | 5.18 | | 5.48 | 0.202 | | 0.216 |
| C | 0.40 | | 0.60 | 0.016 | | 0.024 |
| C2 | 0.44 | | 0.58 | 0.017 | | 0.023 |
| D | 5.90 | | 6.30 | 0.232 | | 0.248 |
| D1 | 5.30REF | | | 0.209REF | | |
| E | 6.40 | | 6.80 | 0.252 | | 0.268 |
| E1 | 4.63 | | | 0.182 | | |
| G | 4.47 | | 4.67 | 0.176 | | 0.184 |
| H | 9.50 | | 10.70 | 0.374 | | 0.421 |
| L | 1.09 | | 1.21 | 0.043 | | 0.048 |
| L2 | 1.35 | | 1.65 | 0.053 | | 0.065 |
| V1 | | 7° | | | 7° | |
| V2 | 0° | | 6° | 0° | | 6° |

## Marking




## Ordering information

| Order code | Package | Baseqty | Deliverymode |
|---|---|---|---|
| UMW FQD17P06TM | TO-252 | 2500 | Tape and reel |