

EVVOSEMI[®]

THINK CHANGE DO



ESD



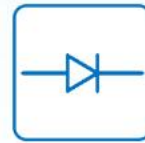
TVS



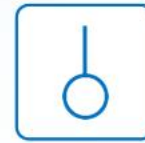
MOS



LDO



Diode



Sensor



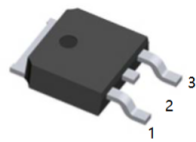
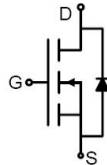
DC-DC

Product Specification

| | | |
|--------------|-------------|-----------|
| ▶ Domestic | Part Number | FQD13N06L |
| ▶ Overseas | Part Number | FQD13N06L |
| ▶ Equivalent | Part Number | FQD13N06L |

EV is the abbreviation of name EVVO

60V N-Channel Enhancement Mode Power MOSFET

| | |
|--|---|
| <p>General Description</p> <p>The FQD13N06L uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.</p> <p>Features</p> <ul style="list-style-type: none"> ● $V_{DS} = 60V, I_D = 20A$ ● $R_{DS(ON)}, 23m\ \Omega$ (Typ) @ $V_{GS} = 10V$ ● $R_{DS(ON)}, 29m\ \Omega$ (Typ) @ $V_{GS} = 4.5V$ ● Advanced Trench Technology ● Excellent $R_{DS(ON)}$ and Low Gate Charge ● Lead free product is acquired <p>Application</p> <ul style="list-style-type: none"> ● Load Switch ● PWM Application ● Power management |  <p>1.Date 2.Drain 3.Source TO-252(DPAK) top view</p>  <p>Schematic Diagram</p> |
|--|---|

Absolute Maximum Ratings(TA=25°C unless otherwise noted)

| Parameter | | Symbol | Value | Unit |
|---|----------|-----------|-------------|------|
| Drain-Source Voltage | | V_{DS} | 60 | V |
| Gate-Source Voltage | | V_{GS} | ±20 | V |
| Drain Current-Continuous ^{Note3} | TC=25°C | I_D | 20 | A |
| | TC=100°C | | 14 | A |
| Drain Current-Pulsed ^{Note1} | | I_{DM} | 120 | A |
| Avalanche Energy ^{Note4} | | E_{AS} | 72 | mJ |
| Maximum Power Dissipation | TC=25°C | P_D | 55 | W |
| Storage Temperature Range | | T_{STG} | -55 to +150 | °C |
| Operating Junction Temperature Range | | T_J | -55 to +150 | °C |

Thermal Resistance

| Parameter | Symbol | Min. | Typ. | Max | Unit |
|-------------------------------------|-----------------|------|------|-----|------|
| Thermal Resistance,Junction-to-Case | $R_{\theta JC}$ | - | - | 2.7 | °C/W |

60V N-Channel Enhancement Mode Power MOSFET

Electrical Characteristics(T_J=25°C unless otherwise noted)

| OFF CHARACTERISTICS | | | | | | |
|---------------------------------|-------------------|---|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V, I _{DS} =250uA | 60 | - | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =60V, V _{GS} =0V | - | - | 1 | uA |
| Gate-Body Leakage | I _{GSS} | V _{GS} =±20V, V _{DS} =0V | - | - | ±100 | nA |

| ON CHARACTERISTICS | | | | | | |
|----------------------------------|---------------------|---|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Gate Threshold Voltage | V _{GS(TH)} | V _{DS} =V _{GS} , I _{DS} =250uA | 1.0 | 1.6 | 2.5 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =10V, I _{DS} =15A | - | 23 | 29 | mΩ |
| | | V _{GS} =4.5V, I _{DS} =10A | - | 29 | 40 | mΩ |

| DYNAMIC CHARACTERISTICS | | | | | | |
|------------------------------|------------------|---|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Input Capacitance | C _{ISS} | V _{DS} =25V, V _{GS} = 0V, f=1MHz | - | 1562 | - | pF |
| Output Capacitance | C _{OSS} | | - | 75.4 | - | |
| Reverse Transfer Capacitance | C _{rss} | | - | 66.8 | - | |

| SWITCHING CHARACTERISTICS | | | | | | |
|-------------------------------|---------------------|--|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Turn-On Delay Time | T _{d(on)} | V _{GS} =10V, V _{DS} =30V, R _{GEN} =1.8Ω I _D =15A | - | 7.5 | - | ns |
| Rise Time | t _r | | - | 21 | - | |
| Turn-Off Delay Time | T _{d(off)} | | - | 16 | - | |
| Fall Time | t _f | | - | 23.5 | - | |
| Total Gate Charge at 10V | Q _g | V _{DS} =30V, I _{DS} =15A, V _{GS} =10V | - | 25 | - | nC |
| Gate to Source Gate Charge | Q _{gs} | | - | 4.5 | - | |
| Gate to Drain "Miller" Charge | Q _{gd} | | - | 6.5 | - | |

| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS | | | | | | |
|--|-----------------|---|---------------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Drain-Source Diode Forward Voltage | V _{SD} | V _{GS} =0V, I _{DS} =15A | - | - | 1.2 | V |
| Reverse Recovery Time | t _{rr} | T _J =25°C, I _F =15A | - | 29 | - | nS |
| Reverse Recovery Charge | Q _{rr} | | di/dt=100A/us | - | 45 | - |

Notes:

- 1: Repetitive rating, pulse width limited by maximum junction temperature.
- 2: Surface mounted on FR4 Board, t_s≤10sec.
- 3: Pulse width ≤ 300μs, duty cycle ≤ 2%.
- 4: EAS condition: L=0.5mH, V_{DD}=30V, V_G=10V, V_{GATE}=60V, Start T_J=25°C.

60V N-Channel Enhancement Mode Power MOSFET

Typical Performance Characteristics

Figure 1: Output Characteristics

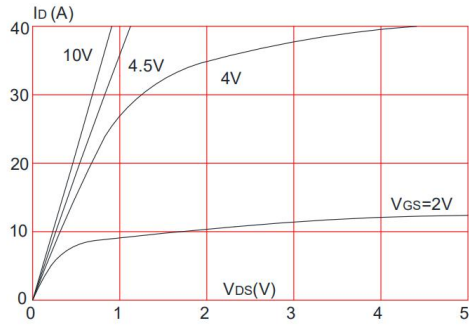


Figure 2: Typical Transfer Characteristics

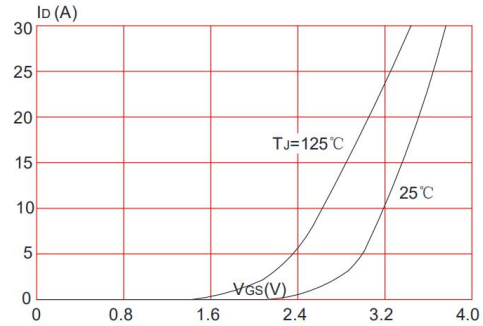


Figure 3: On-resistance vs. Drain Current

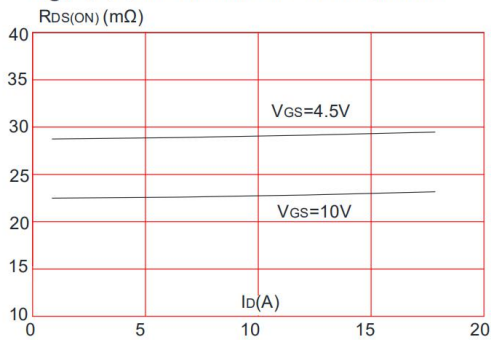


Figure 4: Body Diode Characteristics

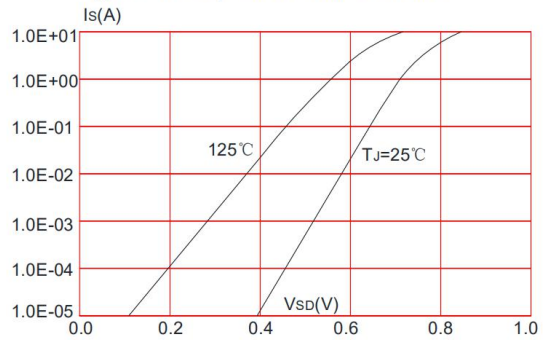


Figure 5: Gate Charge Characteristics

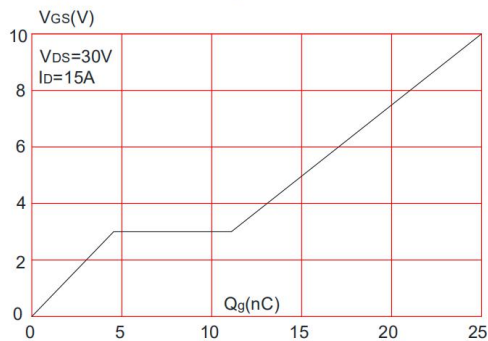
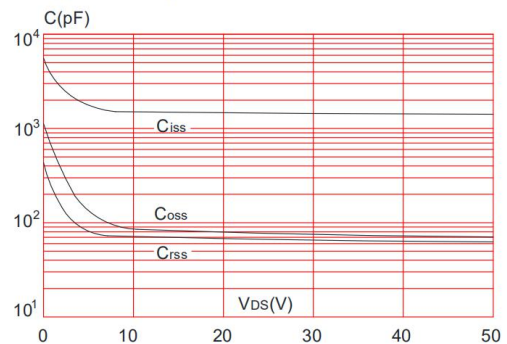


Figure 6: Capacitance Characteristics



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

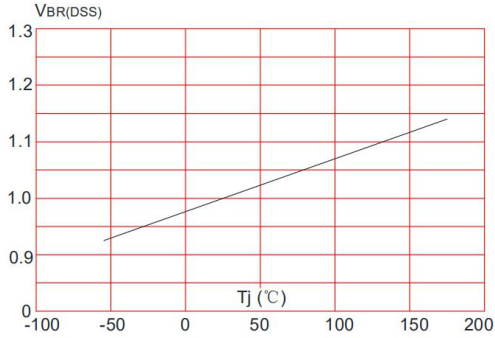


Figure 8: Normalized on Resistance vs. Junction Temperature

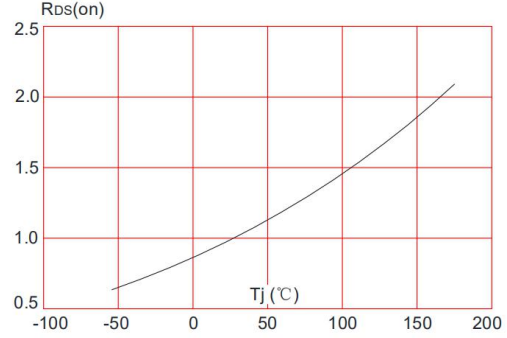


Figure 9: Maximum Safe Operating Area

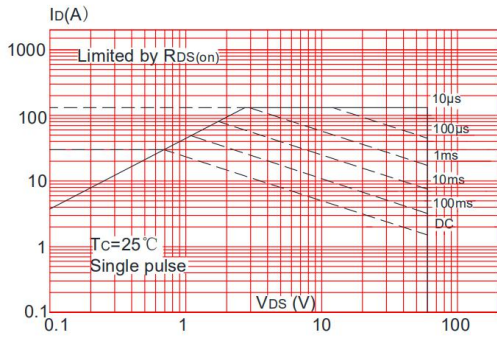


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

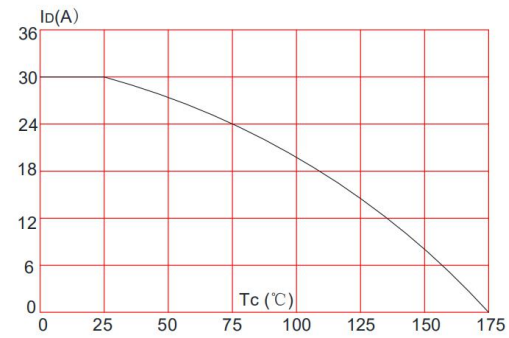
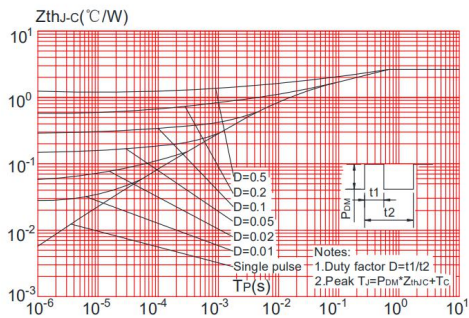


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



60V N-Channel Enhancement Mode Power MOSFET

Test Circuit

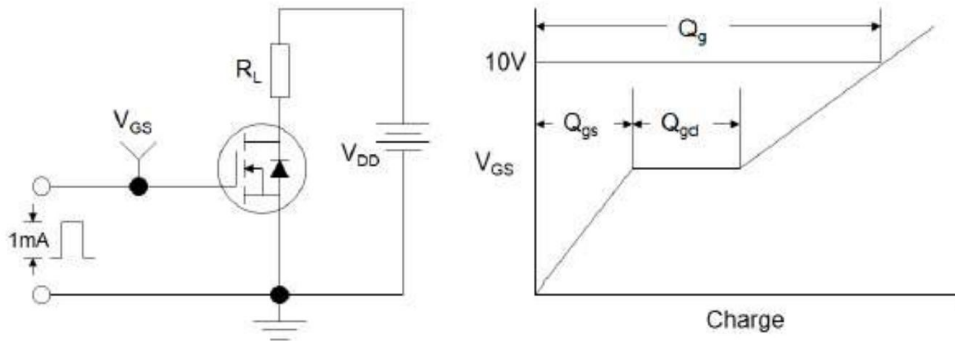


Figure1:Gate Charge Test Circuit & Waveform

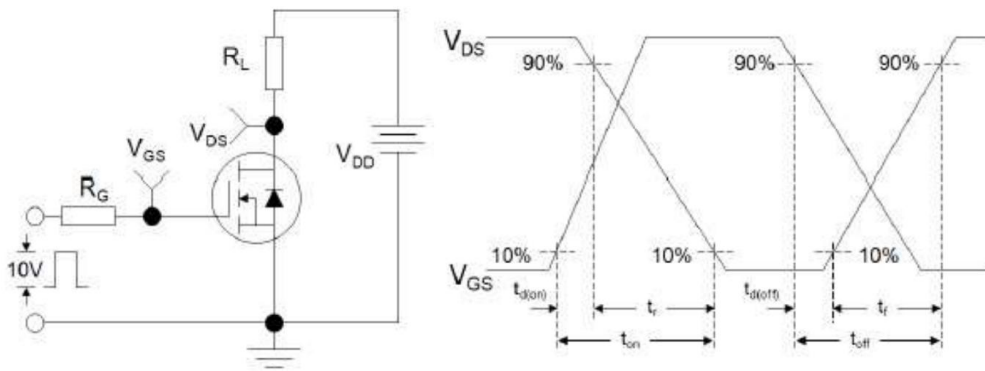


Figure 2: Resistive Switching Test Circuit & Waveforms

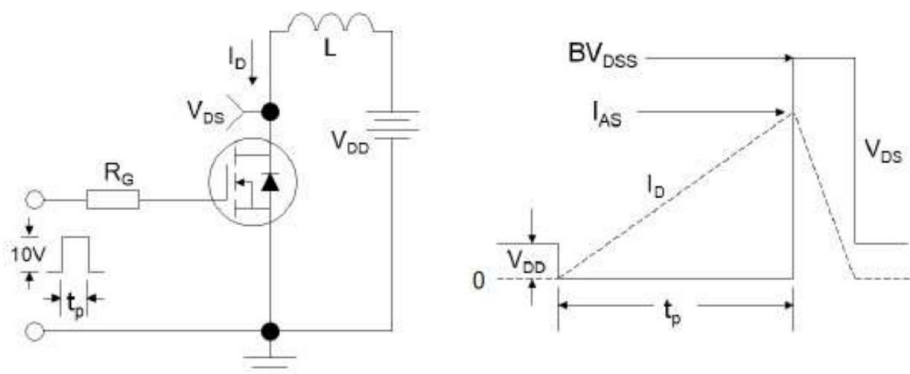
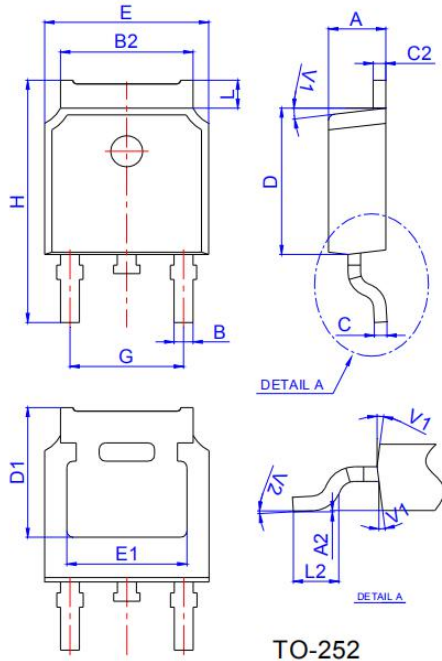


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms

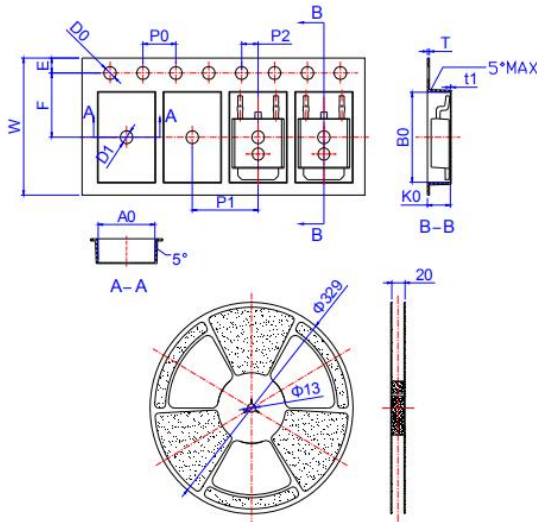
60V N-Channel Enhancement Mode Power MOSFET

Package Mechanical Data



| 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° |

Reel Specification-TO-252



| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| W | 15.90 | 16.00 | 16.10 | 0.626 | 0.630 | 0.634 |
| E | 1.65 | 1.75 | 1.85 | 0.065 | 0.069 | 0.073 |
| F | 7.40 | 7.50 | 7.60 | 0.291 | 0.295 | 0.299 |
| D0 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| D1 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| P0 | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| P1 | 7.90 | 8.00 | 8.10 | 0.311 | 0.315 | 0.319 |
| P2 | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| A0 | 6.85 | 6.90 | 7.00 | 0.270 | 0.271 | 0.276 |
| B0 | 10.45 | 10.50 | 10.60 | 0.411 | 0.413 | 0.417 |
| K0 | 2.68 | 2.78 | 2.88 | 0.105 | 0.109 | 0.113 |
| T | 0.24 | | 0.27 | 0.009 | | 0.011 |
| t1 | 0.10 | | | 0.004 | | |
| 10P0 | 39.80 | 40.00 | 40.20 | 1.567 | 1.575 | 1.583 |

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