

600V 0.08Ω Super Junction Power MOSFET

Description

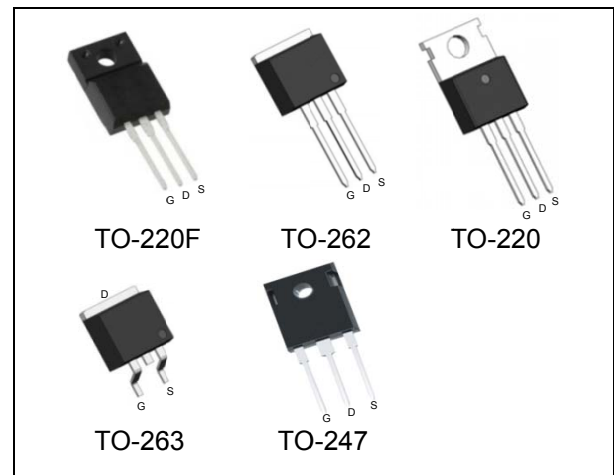
WMOS™ C4 is Wayon's 4th generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ C4 is suitable for applications which require superior power density and outstanding efficiency.

Features

- $V_{DS} = 650V @ T_{j,max}$
- Typ. $R_{DS(on)} = 0.08\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free

Applications

LED Lighting, Charger, Adapter, PC, LCD TV, Server



Absolute Maximum Ratings

| Parameter | Symbol | WMK/WMM/WMN/WMJ | WML | Unit |
|---|------------------|-----------------|------|---------------|
| Drain-source voltage | V_{DSS} | 600 | | V |
| Continuous drain current ¹⁾ ($T_C = 25^\circ C$) | I_D | 36 | | A |
| | | 20 | | A |
| Pulsed drain current ²⁾ | I_{DM} | 100 | | A |
| Gate-source voltage | V_{GS} | ± 30 | | V |
| Avalanche energy, single pulse ³⁾ | E_{AS} | 550 | | mJ |
| Avalanche energy, repetitive ²⁾ | E_{AR} | 0.8 | | mJ |
| Avalanche current, repetitive ²⁾ | I_{AR} | 4 | | A |
| Power dissipation ($T_C = 25^\circ C$) - Derate above $25^\circ C$ | P_D | 277 | 34 | W |
| | | 2.22 | 0.27 | W/ $^\circ C$ |
| Operating and storage temperature range | T_{j}, T_{stg} | -55 to +150 | | $^\circ C$ |
| Continuous diode forward current | I_S | 36 | | A |
| Diode pulse current | $I_{S,pulse}$ | 100 | | A |

Thermal Characteristics

| Parameter | Symbol | WMK/WMM/WMN/WMJ | WML | Unit |
|---|-----------------|-----------------|-----|--------------|
| Thermal resistance, junction-to-case | $R_{\theta JC}$ | 0.45 | 3.6 | $^\circ C/W$ |
| Thermal resistance, junction-to-ambient | $R_{\theta JA}$ | 62 | 80 | $^\circ C/W$ |

Electrical Characteristics $T_c = 25^\circ\text{C}$, unless otherwise noted

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|--------------------------------------|---------------|---|------|------|-------|---------------|
| Static characteristics | | | | | | |
| Drain-source breakdown voltage | BV_{DSS} | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$ | 600 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=0.25\text{mA}$ | 2 | 3 | 4 | V |
| Drain cut-off current | I_{DSS} | $V_{DS}=600\text{ V}, V_{GS}=0\text{V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$ | - | - | 1 | μA |
| | | | - | 30 | - | |
| Gate leakage current, forward | I_{GSSF} | $V_{GS}=20\text{V}, V_{DS}=0\text{V}$ | - | - | 100 | nA |
| Gate leakage current, reverse | I_{GSSR} | $V_{GS}=-20\text{V}, V_{DS}=0\text{V}$ | - | - | -100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=15\text{A}$ $T_j = 25^\circ\text{C}$ | - | - | - | Ω |
| | | | - | 0.08 | 0.097 | |
| Dynamic characteristics | | | | | | |
| Input capacitance | C_{iss} | $V_{DS}= 100\text{V}, V_{GS}= 0\text{V},$ $f = 1\text{ MHz}$ | - | 2250 | - | pF |
| Output capacitance | C_{oss} | | - | 78 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 2.8 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 300\text{V}, I_D = 15\text{A}$ $R_G = 25\Omega, V_{GS}=10\text{V}$ | - | 37 | - | ns |
| Rise time | t_r | | - | 39 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 270 | - | |
| Fall time | t_f | | - | 57 | - | |
| Gate charge characteristics | | | | | | |
| Gate to source charge | Q_{gs} | $V_{DD}=480\text{V}, I_D=15\text{A},$ $V_{GS}=0\text{ to }10\text{V}$ | - | 8.7 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 14.2 | - | |
| Gate charge total | Q_g | | - | 46.0 | - | |
| Gate plateau voltage | $V_{plateau}$ | | - | 5.0 | - | V |
| Reverse diode characteristics | | | | | | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=15\text{A}$ | - | - | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=50\text{V}, I_F=15\text{A},$ $di_f/dt=100\text{A}/\mu\text{s}$ | - | 261 | - | ns |
| Reverse recovery charge | Q_{rr} | | - | 3.6 | - | μC |
| Peak reverse recovery current | I_{rrm} | | - | 27.2 | - | A |

Notes:

- Limited by $T_{j\text{max}}$. Maximum duty cycle $D=0.5$.
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 4\text{ A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, starting $T_j = 25^\circ\text{C}$.

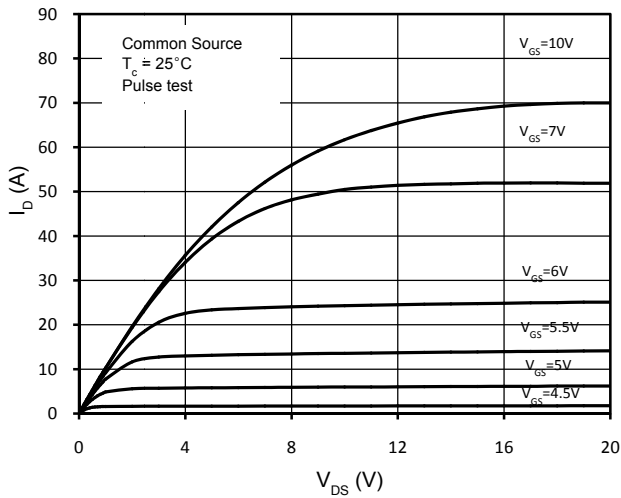


Figure 1. On-Region Characteristics

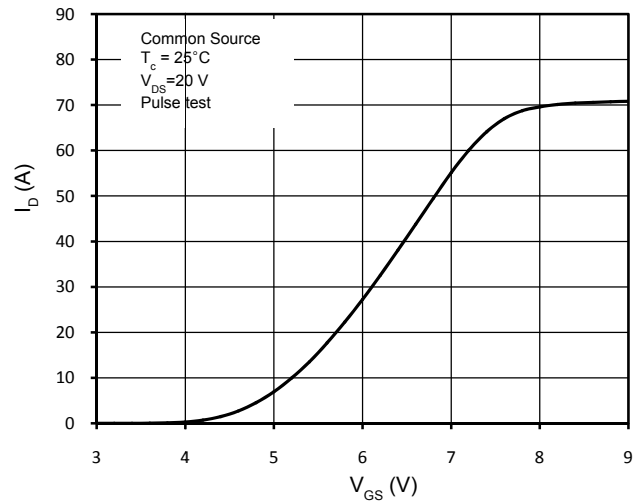


Figure 2. Transfer Characteristics

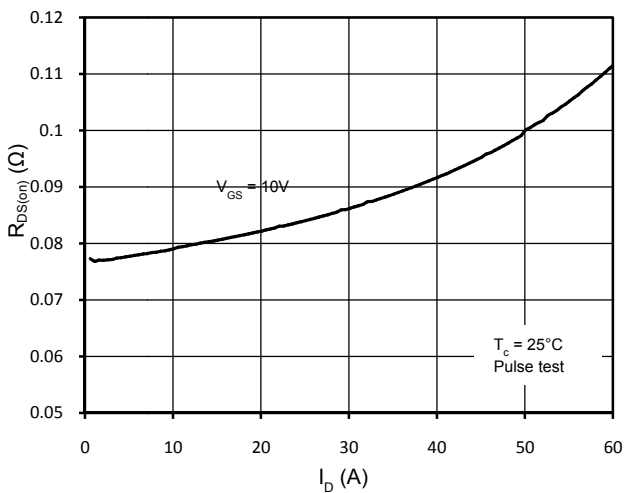


Figure 3. Static Drain-Source On Resistance

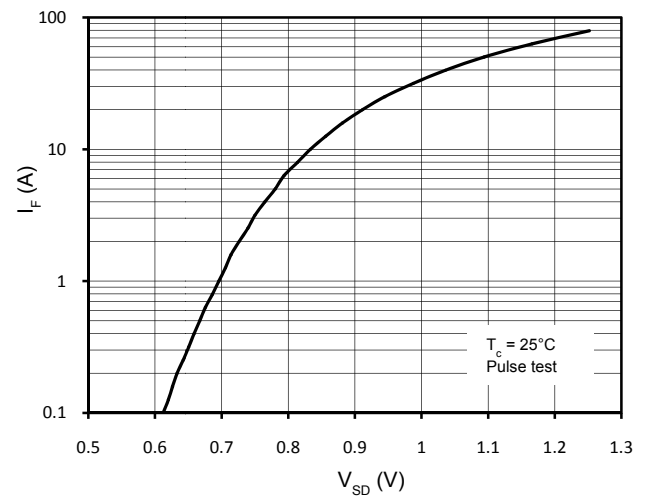


Figure 4. Body-Diode Forward Characteristics

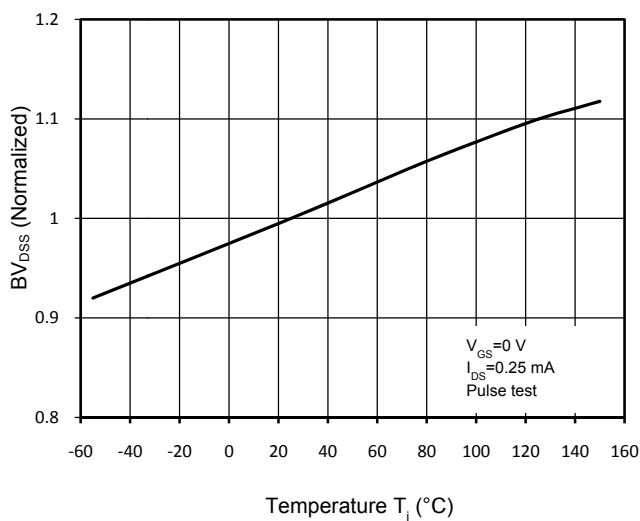


Figure 5. Normalized BV_{DS} vs. Temperature

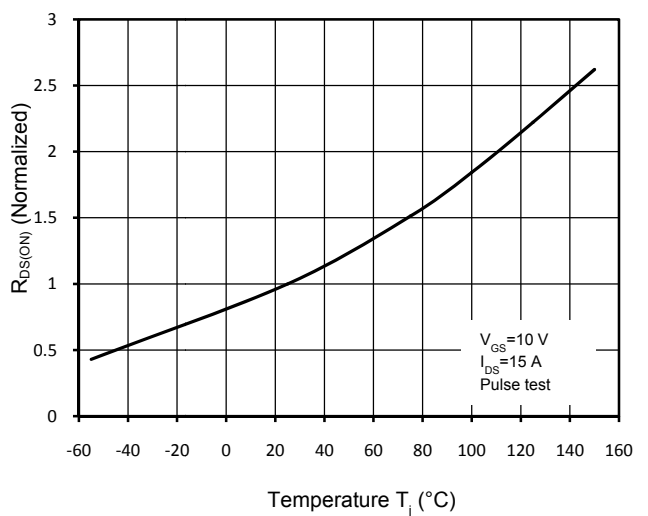


Figure 6. Normalized $R_{DS(on)}$ vs. Temperature

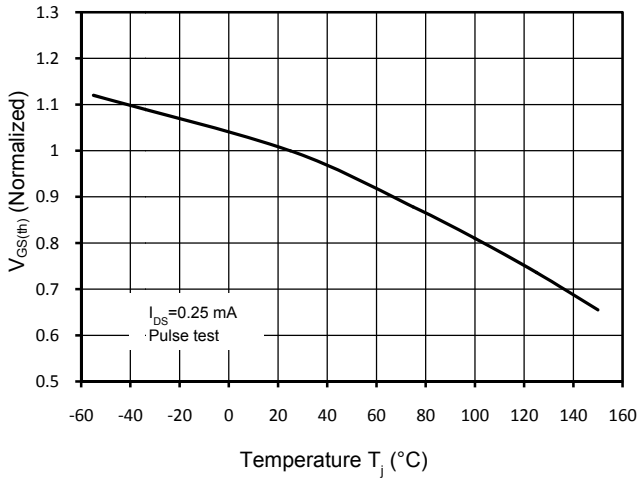


Figure 7. Threshold Voltage vs. Temperature

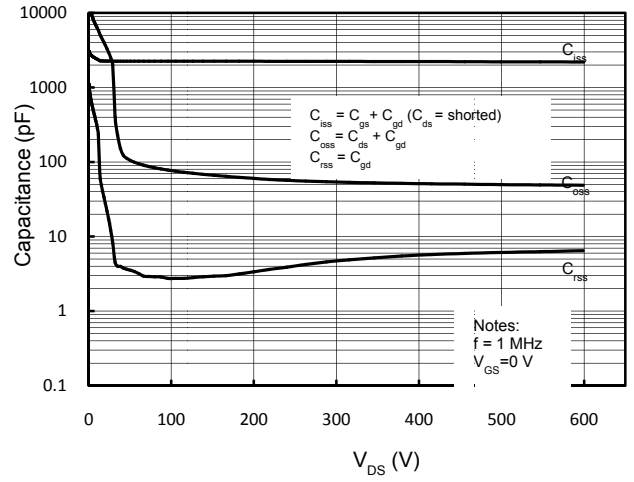


Figure 8. Capacitance Characteristics

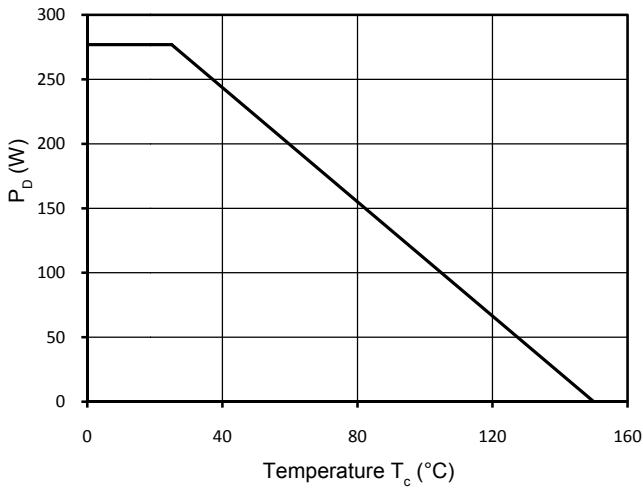


Figure 9. Power Dissipation

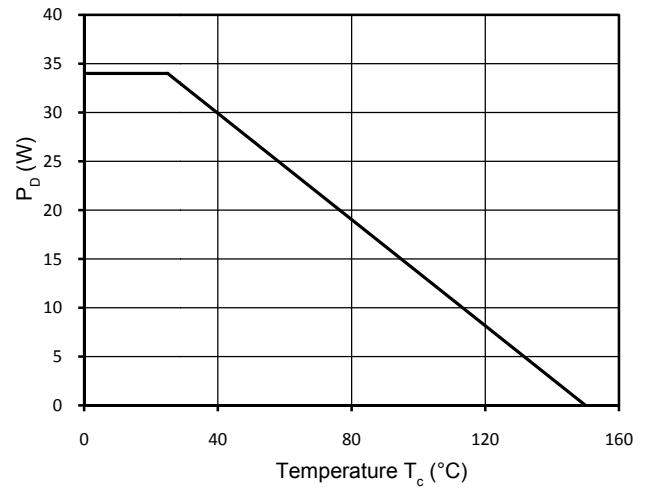


Figure 10. Power Dissipation (TO-220F)

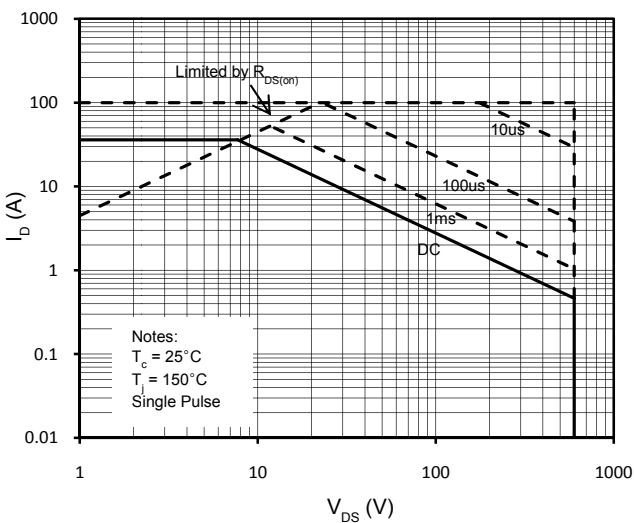


Figure 11. Maximum Safe Operating Area

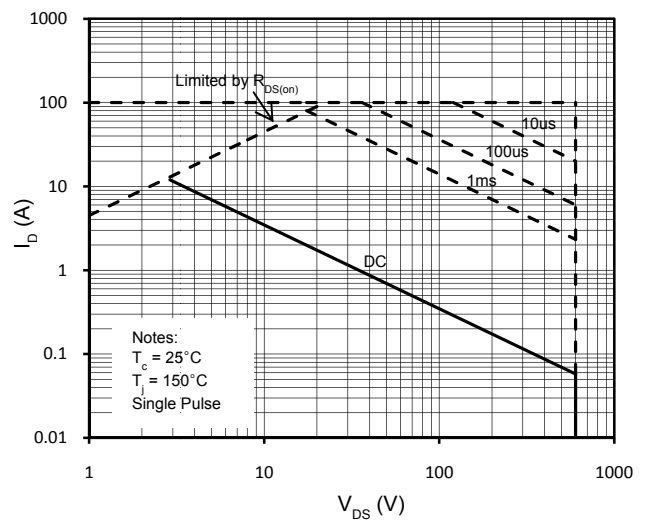


Figure 12. Maximum Safe Operating Area (TO-220F)

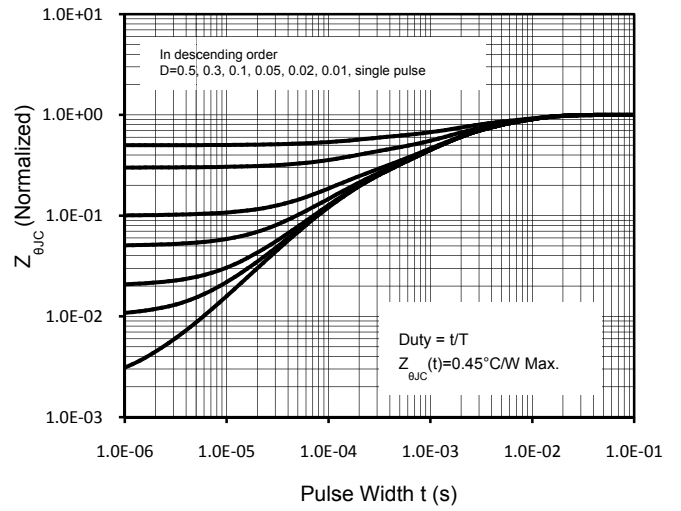
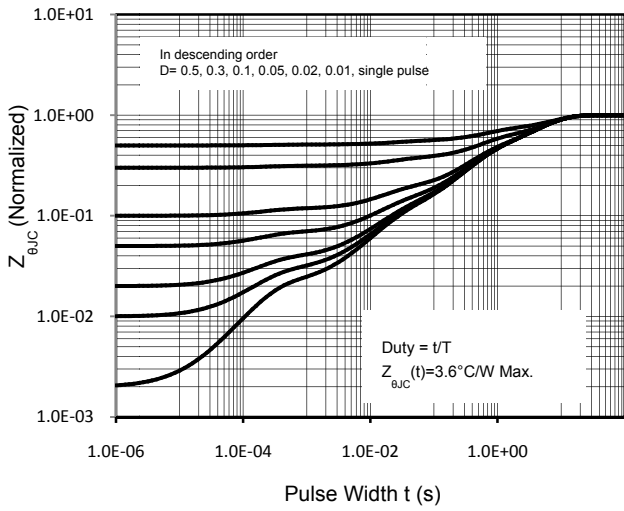


Figure 13. Transient Thermal Response Curve (TO-220F) Figure 14. Transient Thermal Response Curve

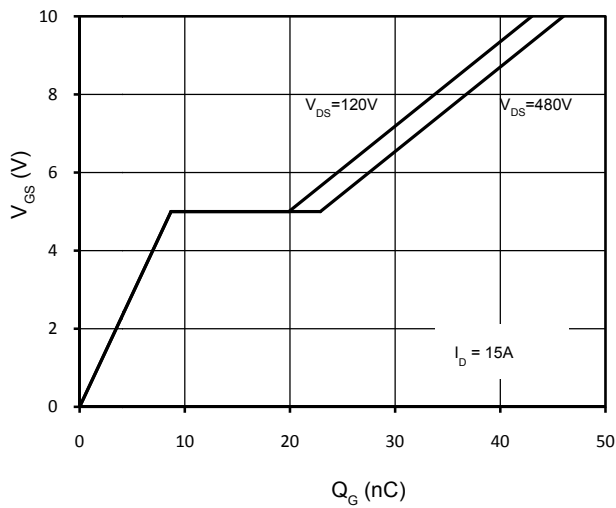


Figure 15. Gate Charge Characteristics

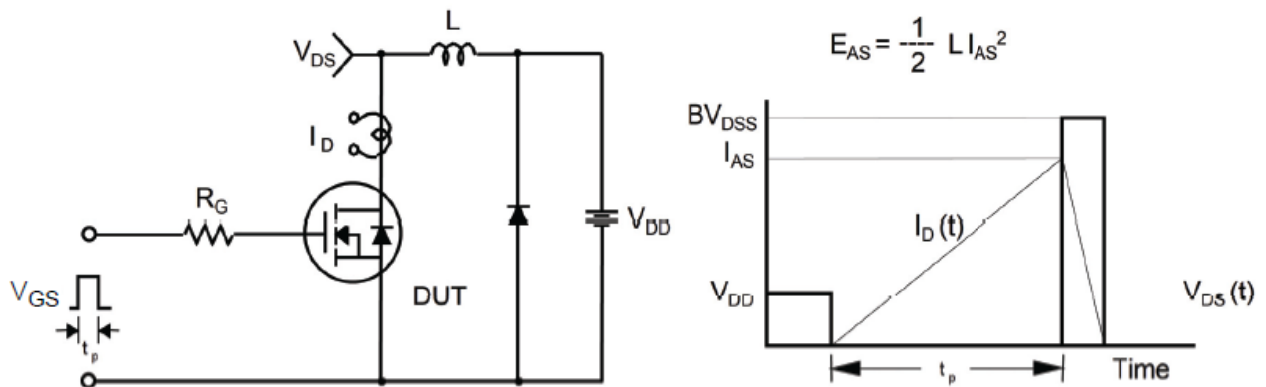
Gate Charge Test Circuit & Waveform



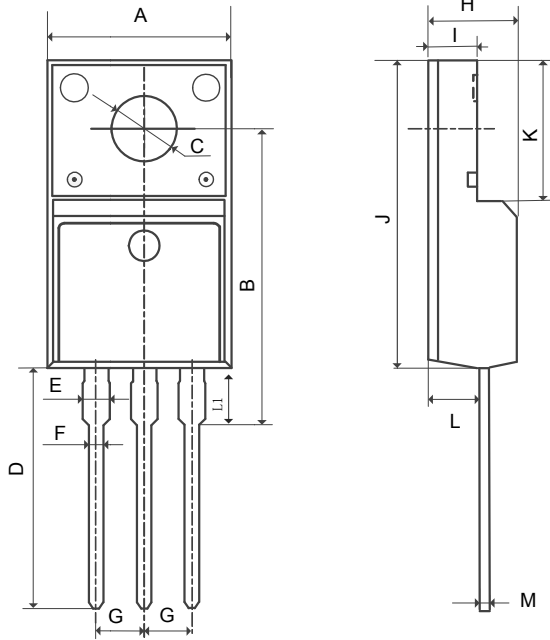
Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions for TO-220F

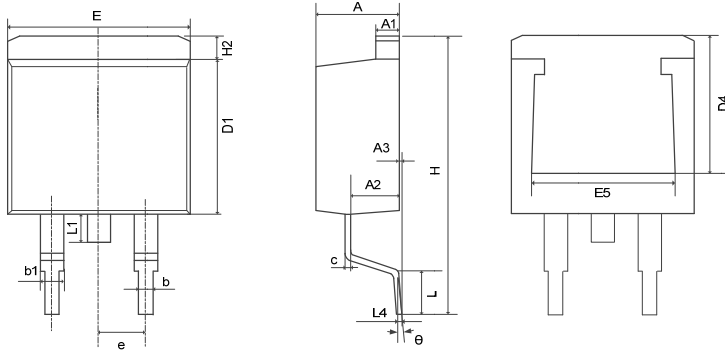


COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|---------|-------|
| | MIN | MAX |
| A | 9.96 | 10.36 |
| B | 15.10 | 16.10 |
| C | 3.03 | 3.38 |
| D | 12.64 | 13.28 |
| E | 1.18 | 1.58 |
| F | 0.70 | 0.95 |
| G | 2.54REF | |
| H | 4.50 | 4.90 |
| I | 2.34 | 2.74 |
| J | 15.57 | 16.17 |
| K | 6.70REF | |
| L | 2.56 | 2.96 |
| M | 0.40 | 0.65 |
| L1 | 2.85 | 3.45 |

Mechanical Dimensions for TO-263

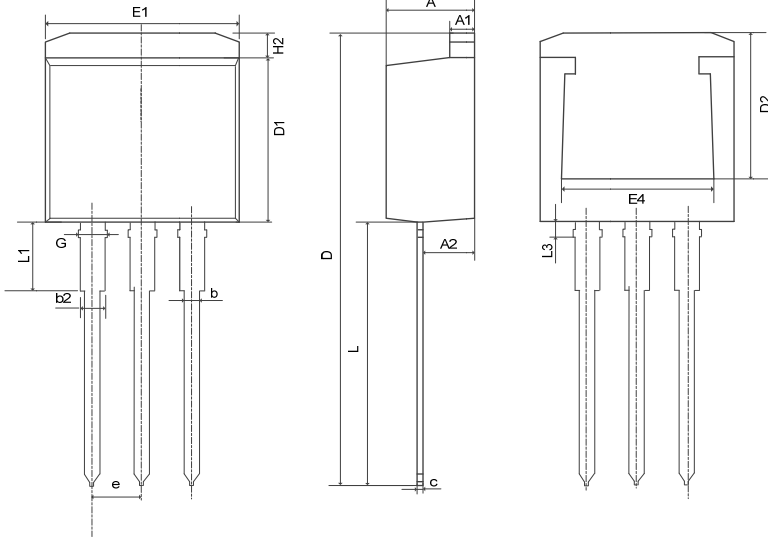
COMMON DIMENSIONS



| SYMBOL | MM | |
|--------|---------|-------|
| | MIN | MAX |
| A | 4.37 | 4.89 |
| A1 | 1.17 | 1.42 |
| A2 | 2.49 | 2.89 |
| b | 0.70 | 0.96 |
| b1 | 1.17 | 1.47 |
| c | 0.30 | 0.53 |
| D1 | 8.45 | 8.90 |
| D4 | 6.60 | — |
| E | 9.86 | 10.40 |
| E5 | 7.06 | — |
| e | 2.54BSC | |
| H | 14.70 | 15.50 |
| H2 | 1.07 | 1.47 |
| L | 2.00 | 2.70 |
| L1 | 1.40 | 1.70 |
| L4 | 0.25BSC | |
| θ | 0° | 9° |

Mechanical Dimensions for TO-262

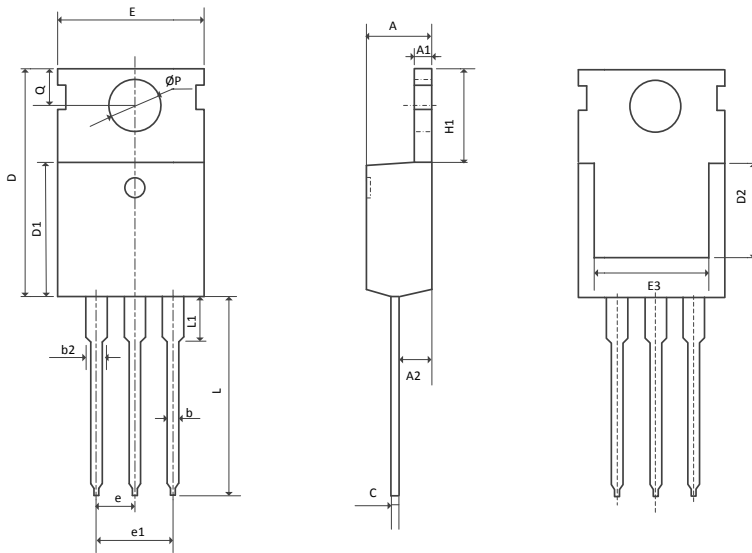
COMMON DIMENSIONS



| SYMBOL | MM | |
|--------|---------|-------|
| | MIN | MAX |
| A | 4.37 | 4.90 |
| A1 | 1.17 | 1.42 |
| A2 | 2.49 | 2.89 |
| b | 0.71 | 0.96 |
| b2 | 1.07 | 1.47 |
| c | 0.28 | 0.53 |
| D | 23.20 | 24.02 |
| D1 | 8.45 | 8.90 |
| D2 | 6.00 | — |
| E1 | 9.86 | 10.40 |
| E4 | 7.06 | — |
| e | 2.54BSC | |
| G | 1.25 | 1.50 |
| H2 | — | 1.50 |
| L | 13.33 | 14.16 |
| L1 | 3.50 | 4.00 |
| L3 | 1.28 | 1.58 |

Mechanical Dimensions for TO-220

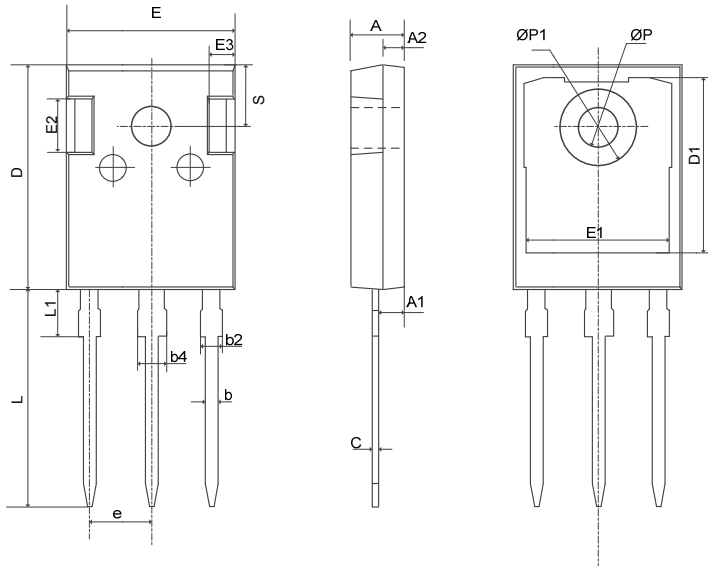
COMMON DIMENSIONS



| SYMBOL | MM | |
|--------|---------|-------|
| | MIN | MAX |
| A | 4.37 | 4.70 |
| A1 | 1.25 | 1.40 |
| A2 | 2.20 | 2.60 |
| b | 0.70 | 0.95 |
| b2 | 1.17 | 1.47 |
| c | 0.45 | 0.60 |
| D | 15.10 | 16.10 |
| D1 | 8.80 | 9.40 |
| D2 | 5.50 | - |
| E | 9.70 | 10.30 |
| E3 | 7.00 | - |
| e | 2.54BSC | |
| e1 | 5.08BSC | |
| H1 | 6.25 | 6.85 |
| L | 12.75 | 13.80 |
| L1 | - | 3.40 |
| ØP | 3.40 | 3.80 |
| Q | 2.60 | 3.00 |

Mechanical Dimensions for TO-247

COMMON DIMENSIONS

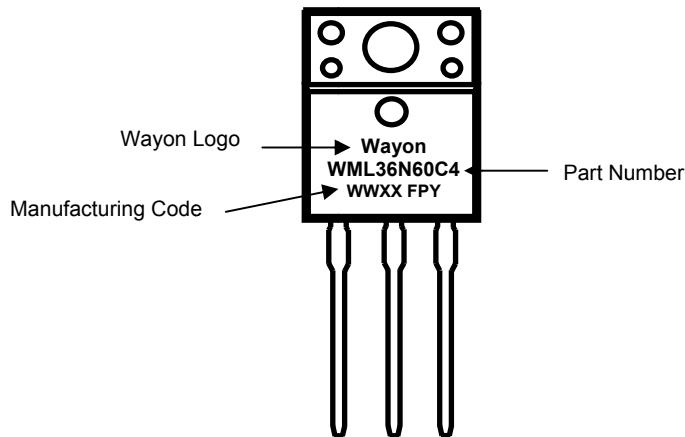


| SYMBOL | MM | |
|--------|---------|-------|
| | MIN | MAX |
| A | 4.80 | 5.21 |
| A1 | 2.21 | 2.61 |
| A2 | 1.85 | 2.16 |
| b | 1.07 | 1.36 |
| b2 | 1.91 | 2.41 |
| b4 | 2.87 | 3.38 |
| c | 0.51 | 0.75 |
| D | 20.70 | 21.30 |
| D1 | 16.25 | 17.65 |
| E | 15.50 | 16.13 |
| E1 | 12.38 | 13.60 |
| E2 | 3.68 | 5.20 |
| E3 | 1.00 | 2.70 |
| e | 5.44BSC | |
| L | 19.62 | 20.32 |
| L1 | — | 4.40 |
| ØP | 3.40 | 3.80 |
| ØP1 | — | 7.30 |
| S | 6.15BSC | |

Ordering Information

| Part | Package | Marking | Packing method |
|------------|---------|------------|----------------|
| WML36N60C4 | TO-220F | WML36N60C4 | Tube |
| WMK36N60C4 | TO-220 | WMK36N60C4 | Tube |
| WMN36N60C4 | TO-262 | WMN36N60C4 | Tube |
| WMM36N60C4 | TO-263 | WMM36N60C4 | Tape and Reel |
| WMJ36N60C4 | TO-247 | WMJ36N60C4 | Tube |

Marking Information




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