

650V 0.83Ω Super Junction Power MOSFET

Description

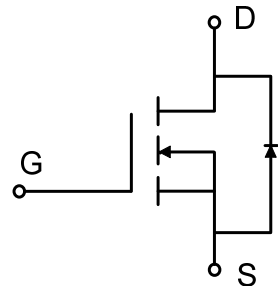
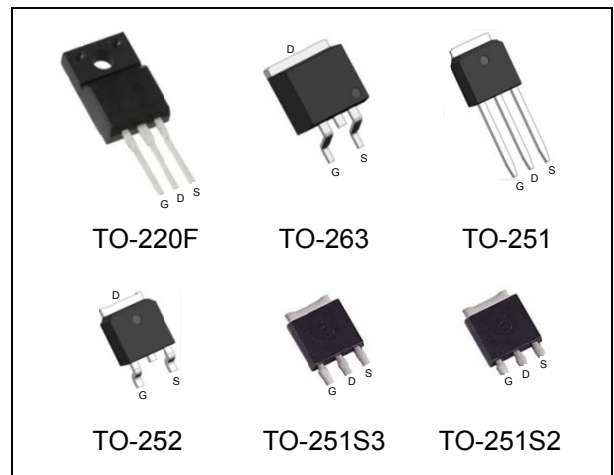
WMOS™ C2 is Wayon's 2nd generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ C2 is suitable for applications which require superior power density and outstanding efficiency.

Features

- $V_{DS} = 700V @ T_{j,max}$
- Typ. $R_{DS(on)} = 0.83\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free

Applications

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



Absolute Maximum Ratings

| Parameter | Symbol | WMH/WMM/WMO/WMP/WMG | WML | Unit |
|---|------------------|---------------------|------|---------------|
| Drain-source voltage | V_{DSS} | 650 | | V |
| Continuous drain current ¹⁾ ($T_C = 25^\circ C$) | I_D | 6 | | A |
| | | 3.6 | | A |
| Pulsed drain current ²⁾ | I_{DM} | 12 | | A |
| Gate-source voltage | V_{GS} | ± 30 | | V |
| Avalanche energy, single pulse ³⁾ | E_{AS} | 26 | | mJ |
| Avalanche energy, repetitive ²⁾ | E_{AR} | 0.1 | | mJ |
| Avalanche current, repetitive ²⁾ | I_{AR} | 0.9 | | A |
| Power dissipation ($T_C = 25^\circ C$) - Derate above $25^\circ C$ | P_D | 45 | 26 | W |
| | | 0.36 | 0.21 | W/ $^\circ C$ |
| Operating and storage temperature range | T_{j}, T_{stg} | -55 to +150 | | $^\circ C$ |
| Continuous diode forward current | I_S | 6 | | A |
| Diode pulse current | $I_{S,pulse}$ | 12 | | A |

Thermal Characteristics

| Parameter | Symbol | WMH/WMM/WMO/WMP/WMG | WML | Unit |
|---|-----------------|---------------------|-----|--------------|
| Thermal resistance, junction-to-case | $R_{\theta JC}$ | 2.8 | 4.9 | $^\circ C/W$ |
| 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} | $V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$ | 650 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=0.25\text{ mA}$ | 2.5 | 3.3 | 4.5 | V |
| Drain cut-off current | I_{DSS} | $V_{DS}=650\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$ | - | - | 1 | μA |
| Gate leakage current, forward | I_{GSSF} | $V_{GS}=30\text{ V}, V_{DS}=0\text{ V}$ | - | - | 100 | nA |
| Gate leakage current, reverse | I_{GSSR} | $V_{GS}=-30\text{ V}, V_{DS}=0\text{ V}$ | - | - | -100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=2.5\text{ A}$ $T_j = 25^\circ\text{C}$ | - | 0.83 | 0.94 | Ω |
| Dynamic characteristics | | | | | | |
| Input capacitance | C_{iss} | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V},$ $f = 1\text{ MHz}$ | - | 302 | - | pF |
| Output capacitance | C_{oss} | | - | 221 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 2.1 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 300\text{ V}, I_D = 2\text{ A}$ $R_G = 25\Omega, V_{GS}=10\text{ V}$ | - | 8 | - | ns |
| Rise time | t_r | | - | 17 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 27 | - | |
| Fall time | t_f | | - | 13 | - | |
| Gate charge characteristics | | | | | | |
| Gate to source charge | Q_{gs} | $V_{DD}=480\text{ V}, I_D=2\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 1.8 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 2 | - | |
| Gate charge total | Q_g | | - | 6.8 | - | |
| Gate plateau voltage | $V_{plateau}$ | | - | 5.4 | - | V |
| Reverse diode characteristics | | | | | | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=2.5\text{ A}$ | - | - | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=50\text{ V}, I_F=2\text{ A},$ $dI_F/dt=100\text{ A}/\mu\text{s}$ | - | 166 | - | ns |
| Reverse recovery charge | Q_{rr} | | - | 0.91 | - | μC |
| Peak reverse recovery current | I_{rrm} | | - | 11.4 | - | A |

Notes:

- Limited by $T_{j\text{max}}$. Maximum duty cycle $D=0.5$.
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 0.9\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\Omega$, starting $T_j = 25^\circ\text{C}$.

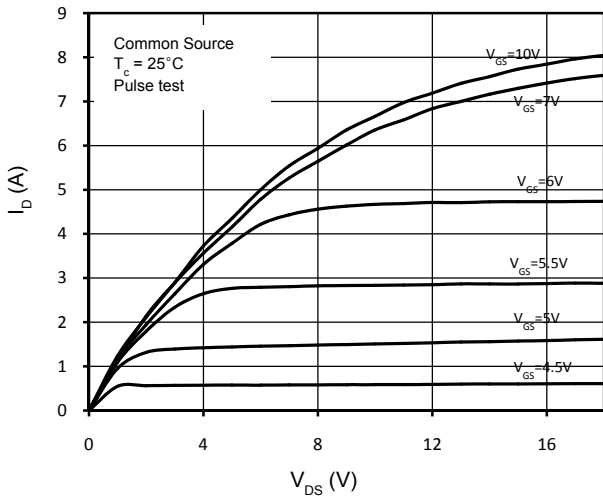


Figure 1. On-Region Characteristics

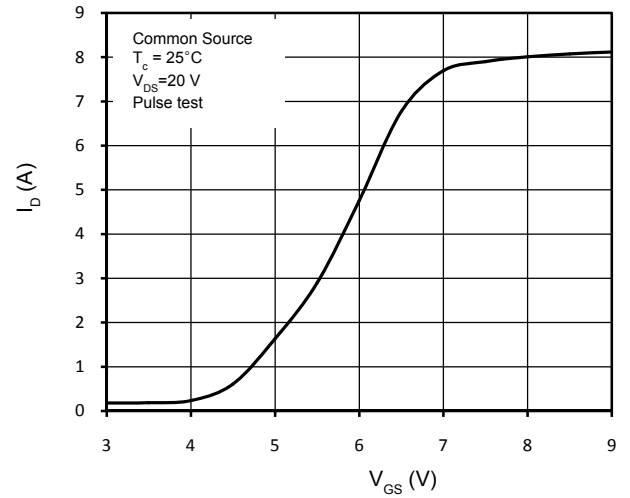


Figure 2. Transfer Characteristics

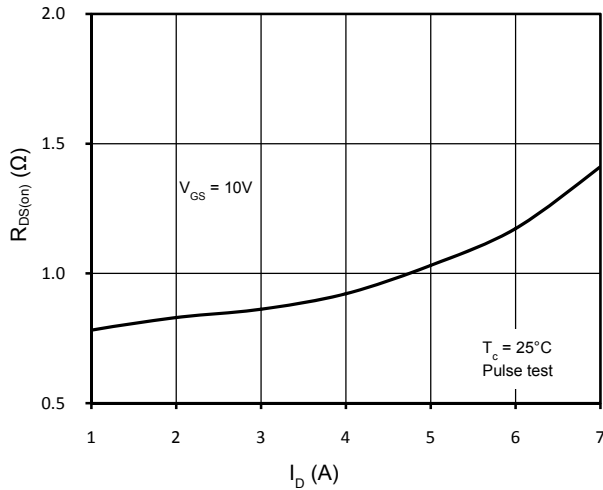


Figure 3. Static Drain-Source On Resistance

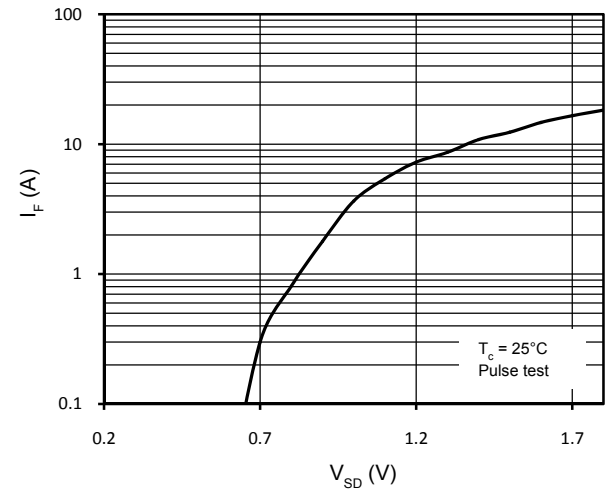


Figure 4. Body-Diode Forward Characteristics

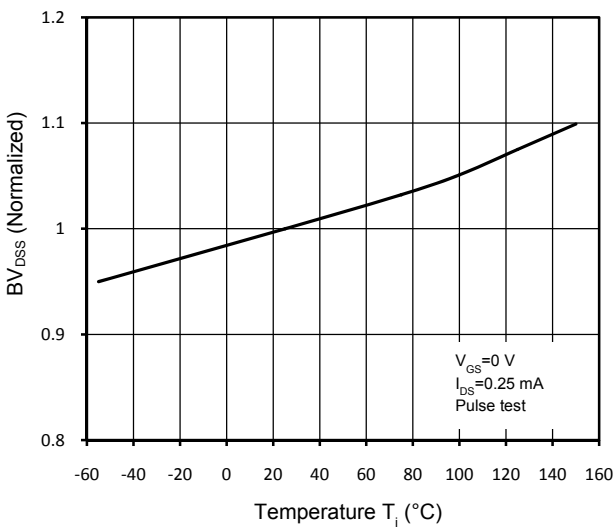


Figure 5. Normalized BV_{DS} vs. Temperature

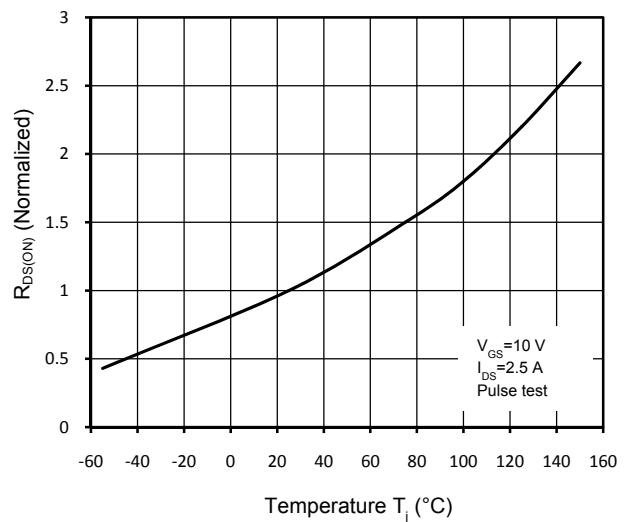


Figure 6. Normalized $R_{DS(on)}$ vs. Temperature

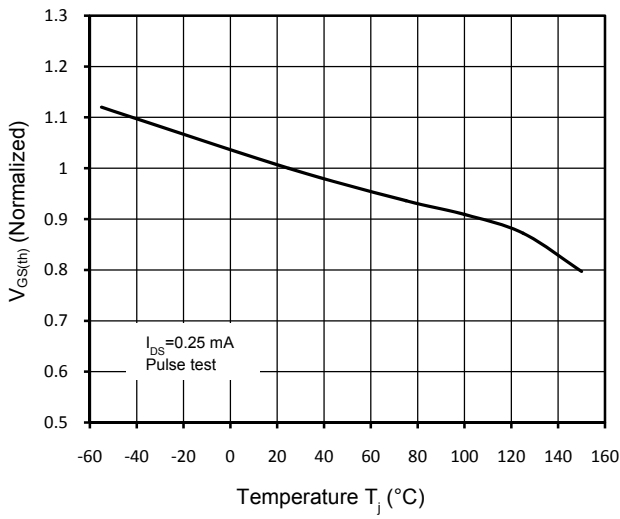


Figure 7. Threshold Voltage vs. Temperature

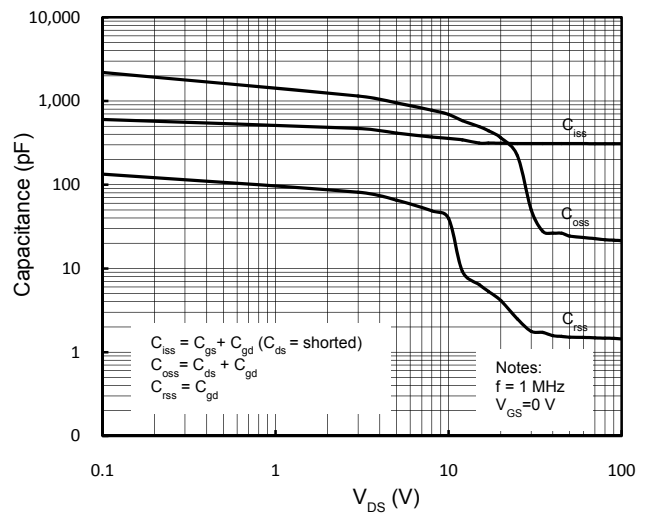


Figure 8. Capacitance Characteristics

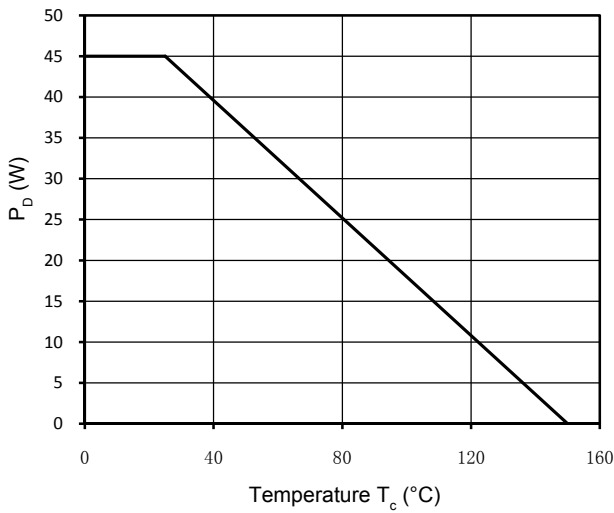


Figure 9. Power Dissipation

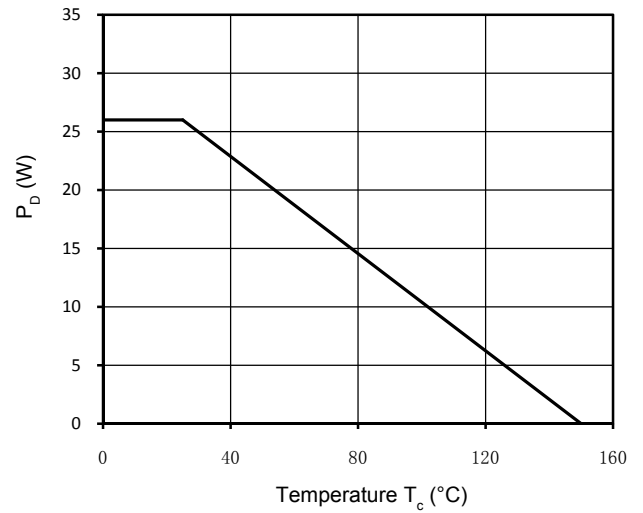


Figure 10. Power Dissipation (TO-220F)

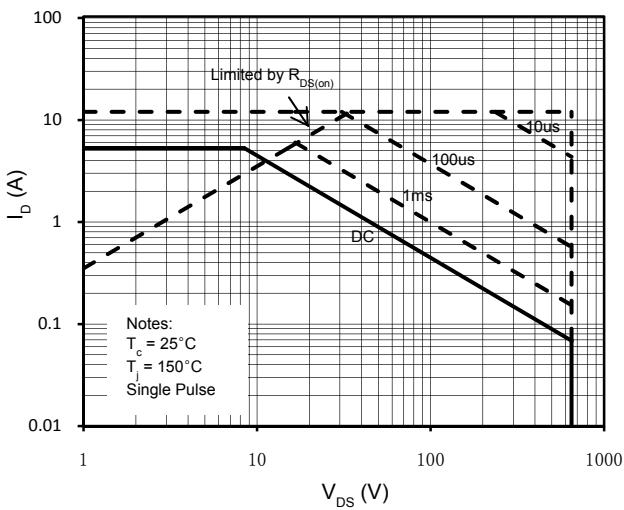


Figure 11. Maximum Safe Operating Area

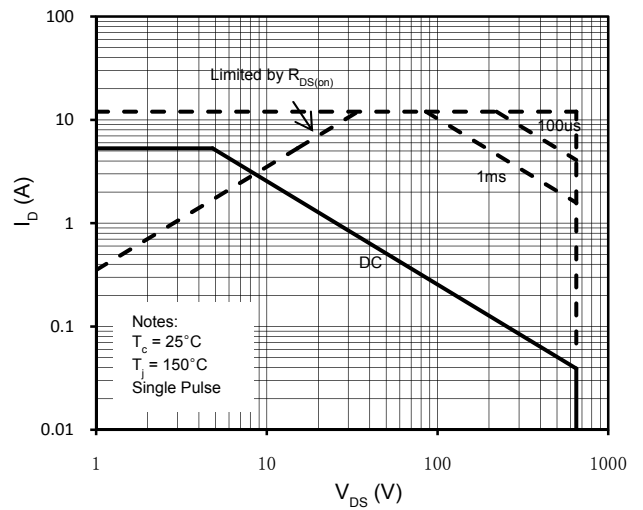


Figure 12. Maximum Safe Operating Area (TO-220F)

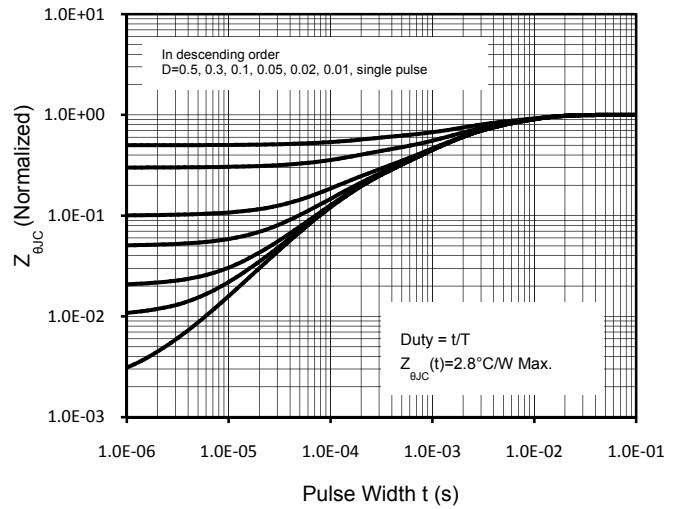
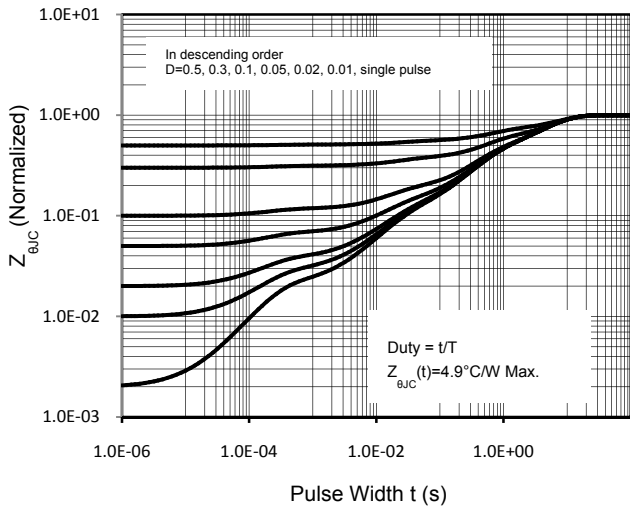


Figure 13. Transient Thermal Response Curve (TO-220F) Figure 14. Transient Thermal Response Curve

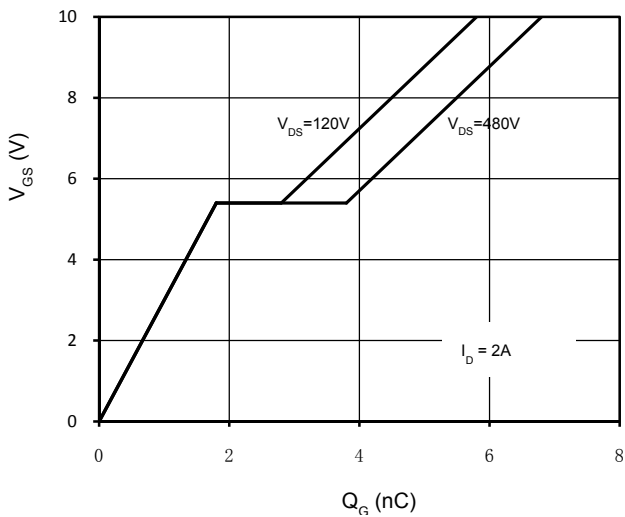
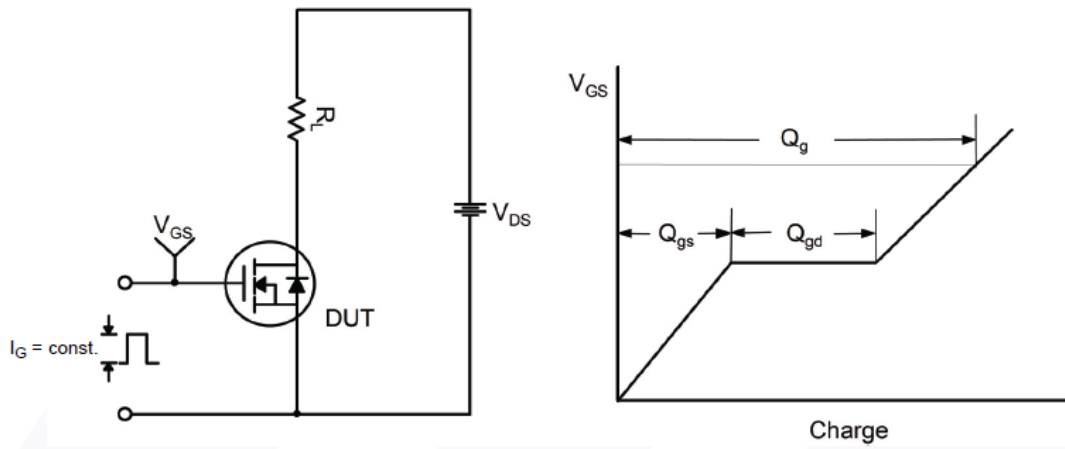
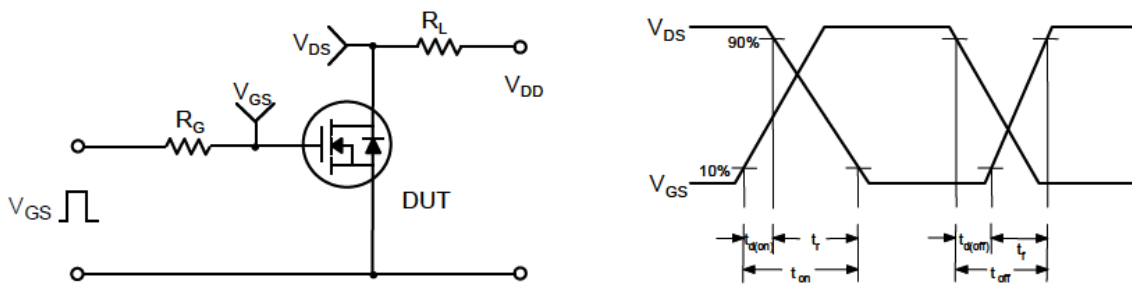


Figure 15. Gate Charge Characteristics

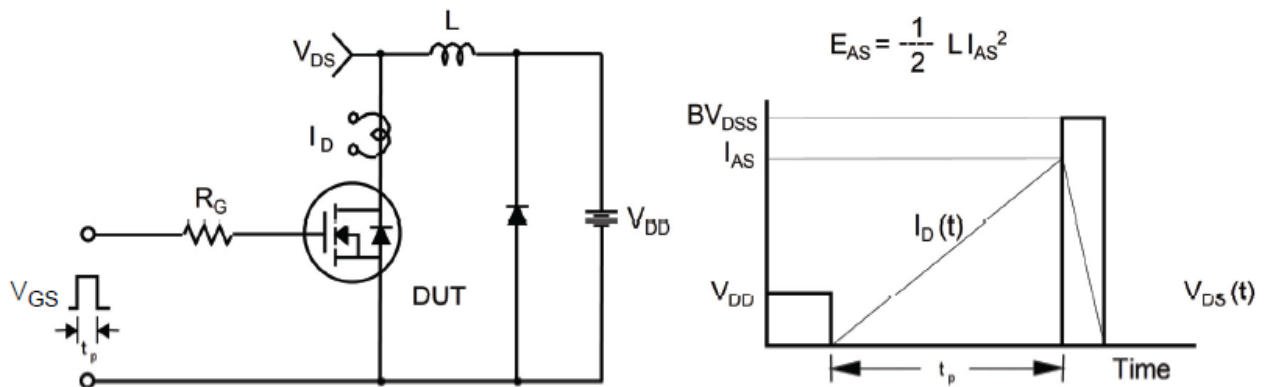
Gate Charge Test Circuit & Waveform



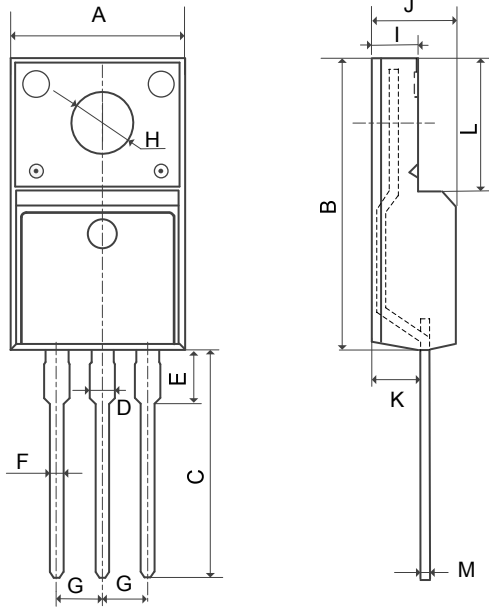
Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



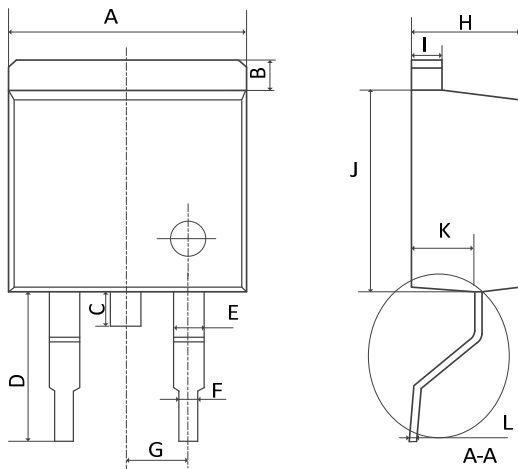
Mechanical Dimensions for TO-220F



COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|-------|-------|
| | MIN | MAX |
| A | 9.96 | 10.36 |
| B | 15.67 | 16.07 |
| C | 12.70 | 13.30 |
| D | 1.12 | 1.32 |
| E | 1.85 | 2.15 |
| F | 0.59 | 0.79 |
| G | 2.39 | 2.69 |
| H | 3.08 | 3.29 |
| I | 2.34 | 2.74 |
| J | 4.50 | 4.90 |
| K | 2.61 | 2.91 |
| L | 6.50 | 6.90 |
| M | 0.40 | 0.60 |

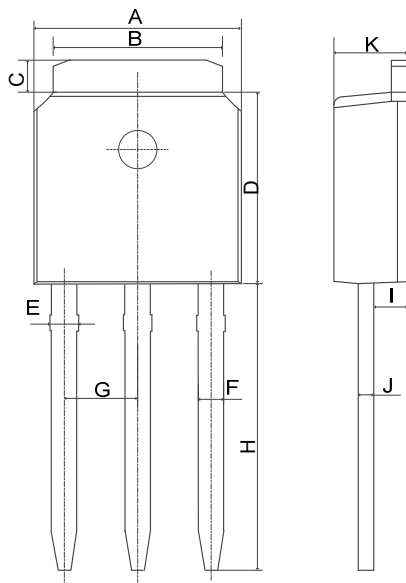
Mechanical Dimensions for TO-263



COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|-------|-------|
| | MIN | MAX |
| A | 10.00 | 10.40 |
| B | 1.11 | 1.41 |
| C | 1.25 | 1.55 |
| D | 5.10 | 5.50 |
| E | 1.12 | 1.42 |
| F | 0.71 | 0.92 |
| G | 2.39 | 2.69 |
| H | 4.49 | 4.89 |
| I | 1.17 | 1.37 |
| J | 8.45 | 8.85 |
| K | 2.54 | 2.84 |
| L | 0.28 | 0.49 |

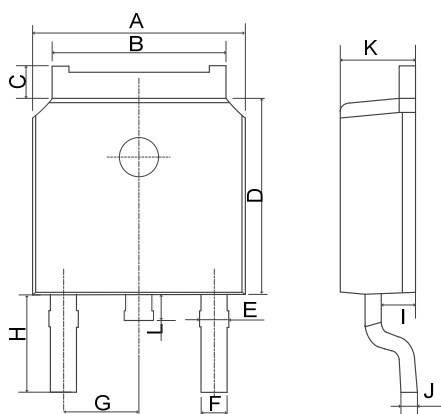
Mechanical Dimensions for TO-251



COMMON DIMENSIONS

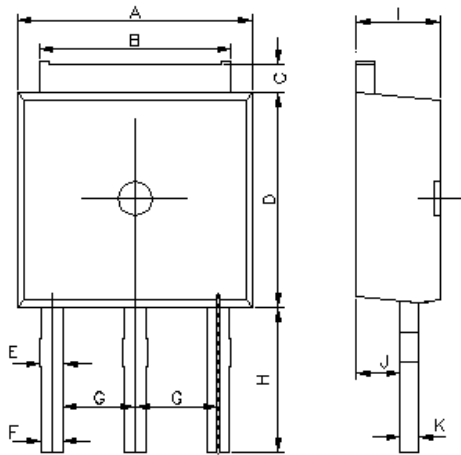
| SYMBOL | MM | |
|--------|---------|------|
| | MIN | MAX |
| A | 6.40 | 6.80 |
| B | 5.13 | 5.46 |
| C | 0.88 | 1.28 |
| D | 5.90 | 6.22 |
| E | 0.68 | 1.10 |
| F | 0.68 | 0.91 |
| G | 2.29REF | |
| H | 9.00 | 9.65 |
| I | 0.90 | 1.17 |
| J | 0.40 | 0.61 |
| K | 2.10 | 2.50 |

Mechanical Dimensions for TO-252

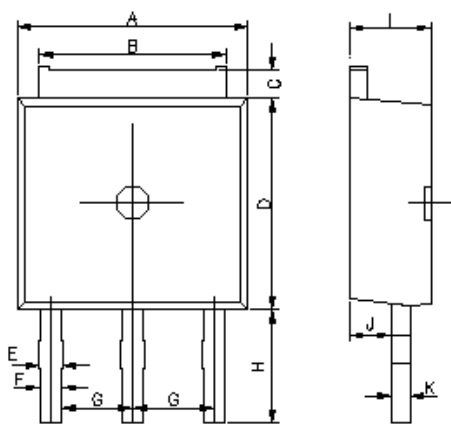


COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|---------|------|
| | MIN | MAX |
| A | 6.40 | 6.80 |
| B | 5.13 | 5.50 |
| C | 0.88 | 1.28 |
| D | 5.90 | 6.22 |
| E | 0.68 | 1.10 |
| F | 0.68 | 0.91 |
| G | 2.29REF | |
| H | 2.90REF | |
| I | 0.85 | 1.17 |
| J | 0.51REF | |
| K | 2.10 | 2.50 |
| L | 0.40 | 1.00 |

Mechanical Dimensions for TO-251S3

COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|------|------|
| | MIN | MAX |
| A | 6.40 | 6.80 |
| B | 5.15 | 5.48 |
| C | 0.71 | 1.02 |
| D | 5.95 | 6.35 |
| E | 0.70 | 1.00 |
| F | 0.70 | 0.90 |
| G | 2.13 | 2.44 |
| H | 3.20 | 3.80 |
| I | 2.10 | 2.50 |
| J | 0.85 | 1.15 |
| K | 0.40 | 0.61 |

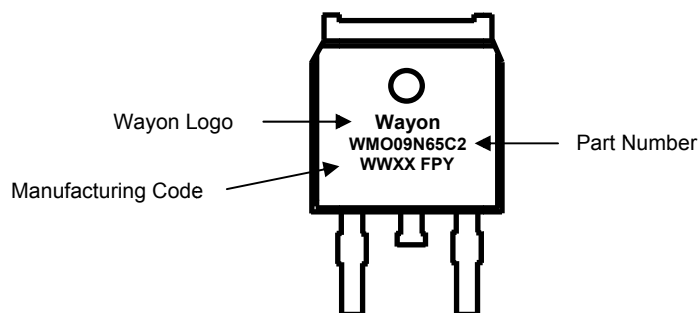
Mechanical Dimensions for TO-251S2

COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|------|------|
| | MIN | MAX |
| A | 6.40 | 6.80 |
| B | 5.15 | 5.48 |
| C | 0.71 | 1.02 |
| D | 5.95 | 6.35 |
| E | 0.70 | 1.00 |
| F | 0.70 | 0.90 |
| G | 2.13 | 2.44 |
| H | 2.20 | 2.80 |
| I | 2.10 | 2.50 |
| J | 0.85 | 1.15 |
| K | 0.40 | 0.61 |

Ordering Information

| Part | Package | Marking | Packing method |
|------------|----------|------------|----------------|
| WML09N65C2 | TO-220F | WML09N65C2 | Tube |
| WMM09N65C2 | TO-263 | WMM09N65C2 | Tape and Reel |
| WMO09N65C2 | TO-252 | WMO09N65C2 | Tape and Reel |
| WMP09N65C2 | TO-251 | WMP09N65C2 | Tube |
| WMG09N65C2 | TO-251S3 | WMG09N65C2 | Tube |
| WMH09N65C2 | TO-251S2 | WMH09N65C2 | Tube |

Marking Information



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