

650V 0.28Ω Super Junction Power MOSFET

Description

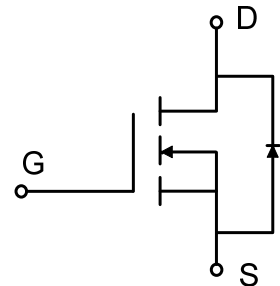
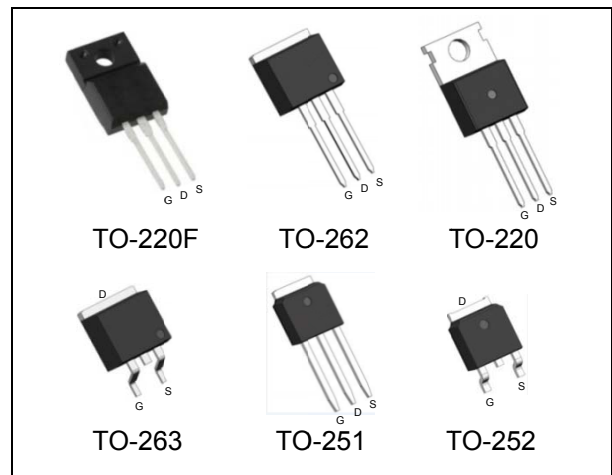
WMOS™ FD is Wayon's first generation super junction MOSFET family with fast body diode. FD series provide all benefits of a fast switching SJ-MOSFET while offering an extremely fast body diode. WMOS™ FD makes especially resonant switching applications more reliable.

Features

- Ultra-fast body diode
- Typ. $R_{DS(on)} = 0.28\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free

Applications

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



Absolute Maximum Ratings

| Parameter | Symbol | WMK/WMM/WMO/WMP/WMN | WML | Unit |
|-------------------------------------------------------------------------------------|------------------|---------------------|------|---------------------|
| Drain-source voltage | V_{DSS} | 650 | | V |
| Continuous drain current ¹⁾ ($T_C = 25^\circ\text{C}$) | I_D | 13 | | A |
| | | 7.8 | | A |
| Pulsed drain current ²⁾ | I_{DM} | 26 | | A |
| Gate-source voltage | V_{GS} | ± 30 | | V |
| Avalanche energy, single pulse ³⁾ | E_{AS} | 145 | | mJ |
| Avalanche energy, repetitive ²⁾ | E_{AR} | 0.21 | | mJ |
| Avalanche current, repetitive ²⁾ | I_{AR} | 2 | | A |
| Power dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C | P_D | 86 | 31 | W |
| | | 0.69 | 0.25 | W/ $^\circ\text{C}$ |
| Operating and storage temperature range | T_{j}, T_{stg} | -55 to +150 | | $^\circ\text{C}$ |
| Continuous diode forward current | I_S | 13 | | A |
| Diode pulse current | $I_{S,pulse}$ | 26 | | A |

Thermal Characteristics

| Parameter | Symbol | WMK/WMM/WMO/WMP/WMN | WML | Unit |
|-----------------------------------------|-----------------|---------------------|-----|---------------------------|
| Thermal resistance, junction-to-case | $R_{\theta JC}$ | 1.45 | 4 | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, junction-to-ambient | $R_{\theta JA}$ | 62 | 80 | $^\circ\text{C}/\text{W}$ |

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 | 3.3 | 4 | V |
| Drain cut-off current | I_{DSS} | $V_{DS}=650\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$ | - | - | 10 | μA |
| | | | - | 100 | - | |
| 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 | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=2\text{ A}$ $T_j = 25^\circ\text{C}$ | - | - | - | Ω |
| | | | - | 0.28 | 0.34 | |
| Dynamic characteristics | | | | | | |
| Input capacitance | C_{iss} | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V},$ $f = 1\text{ MHz}$ | - | 992 | - | pF |
| Output capacitance | C_{oss} | | - | 595 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 1.4 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 300\text{V}, I_D = 5.5\text{A}$ $R_G = 25\Omega, V_{GS}=10\text{V}$ | - | 28 | - | ns |
| Rise time | t_r | | - | 17 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 78 | - | |
| Fall time | t_f | | - | 20 | - | |
| Gate charge characteristics | | | | | | |
| Gate to source charge | Q_{gs} | $V_{DD}=480\text{ V}, I_D=5.5\text{A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 4.9 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 7.8 | - | |
| Gate charge total | Q_g | | - | 19.9 | - | |
| Gate plateau voltage | $V_{plateau}$ | | - | 5.4 | - | V |
| Reverse diode characteristics | | | | | | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=2\text{A}$ | - | - | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=50\text{ V}, I_F=5.5\text{A},$ $dI_F/dt=100\text{ A}/\mu\text{s}$ | - | 145 | - | ns |
| Reverse recovery charge | Q_{rr} | | - | 1.25 | - | μC |
| Peak reverse recovery current | I_{rrm} | | - | 11 | - | A |

Notes:

- Limited by $T_{j\text{max}}$. Maximum duty cycle $D=0.5$.
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 2\text{ A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, starting $T_j = 25^\circ\text{C}$.

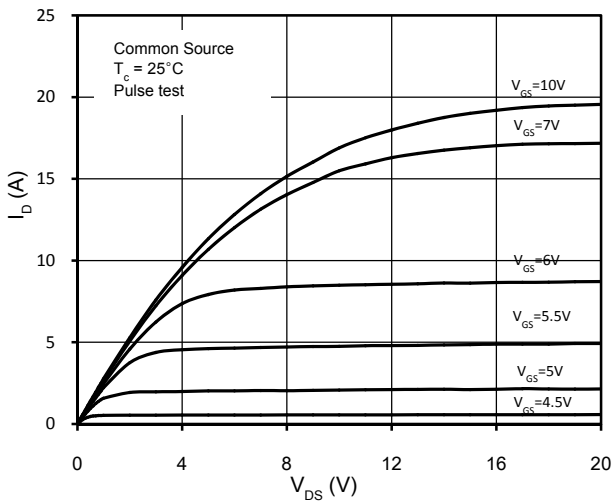


Figure 1. On-Region Characteristics

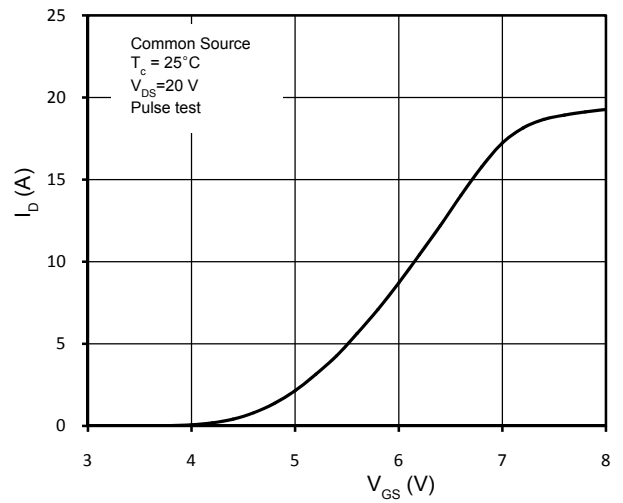


Figure 2. Transfer Characteristics

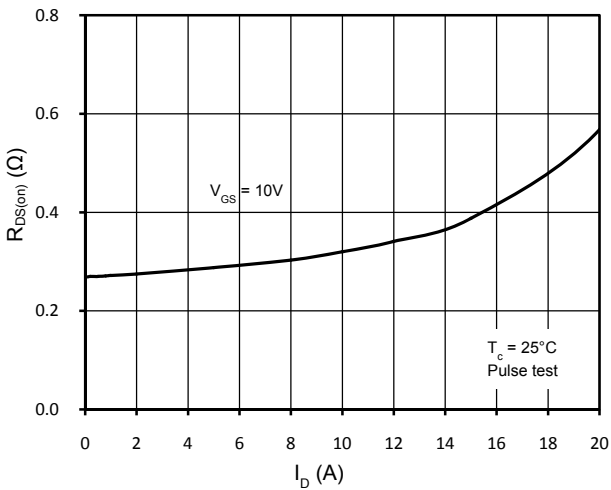


Figure 3. Static Drain-Source On Resistance

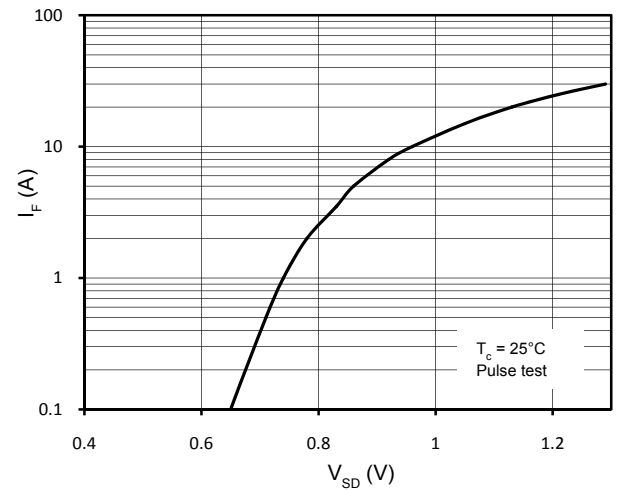


Figure 4. Body-Diode Forward Characteristics

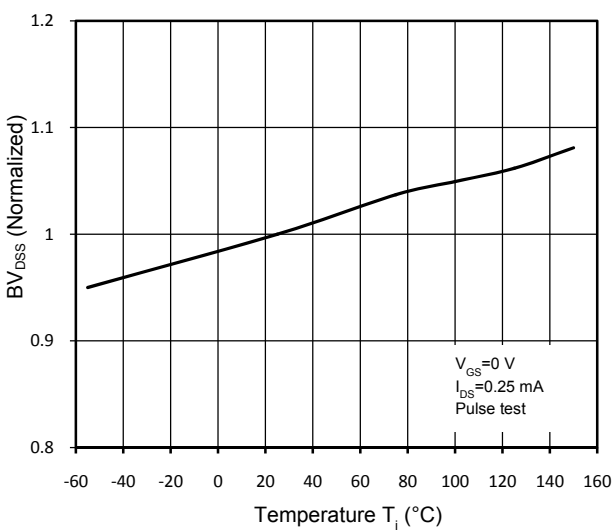


Figure 5. Normalized BV_{DS} vs. Temperature

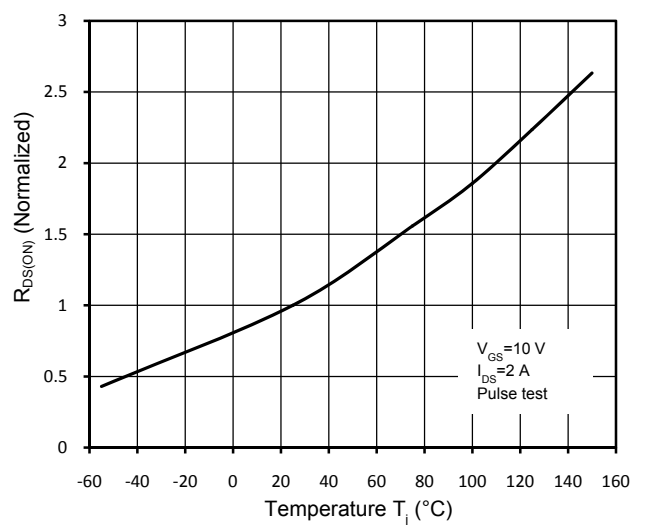


Figure 6. Normalized R_{DS(on)} vs. Temperature

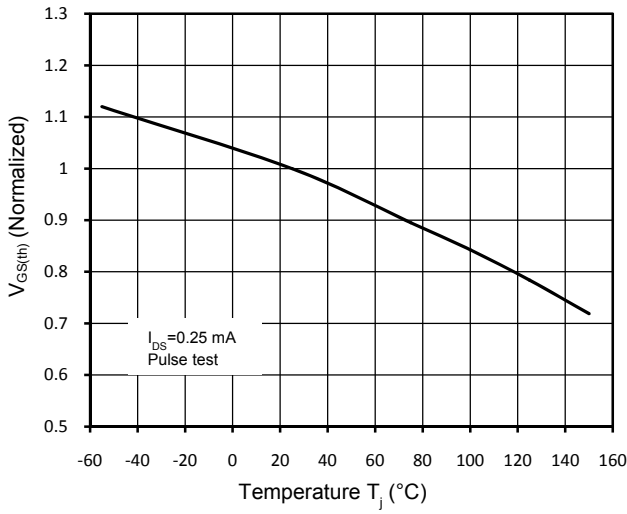


Figure 7. Threshold Voltage vs. Temperature

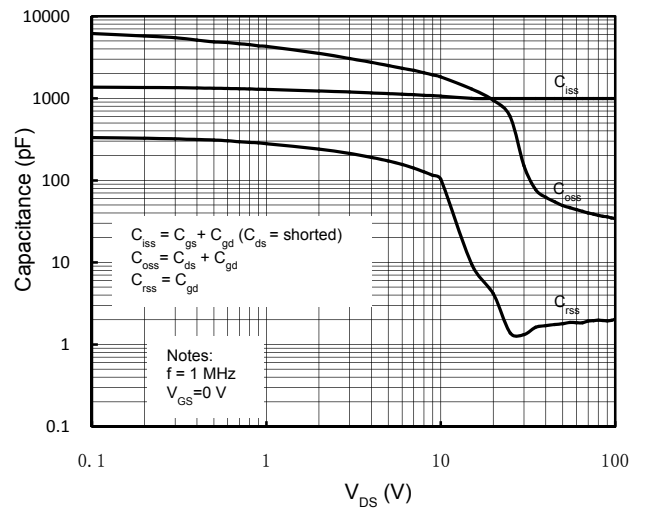


Figure 8. Capacitance Characteristics

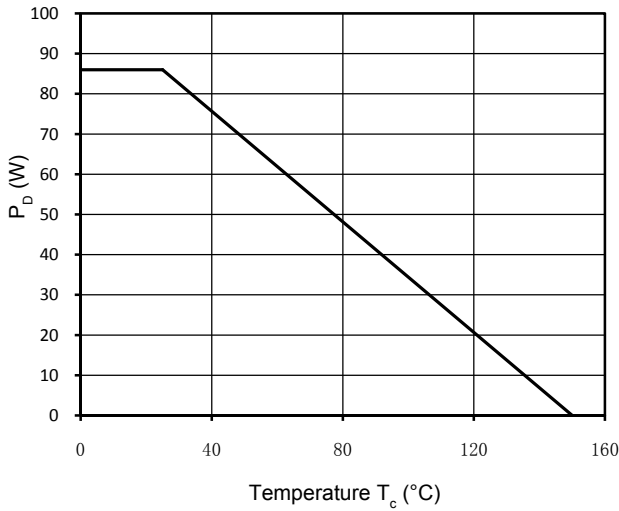


Figure 9. Power Dissipation

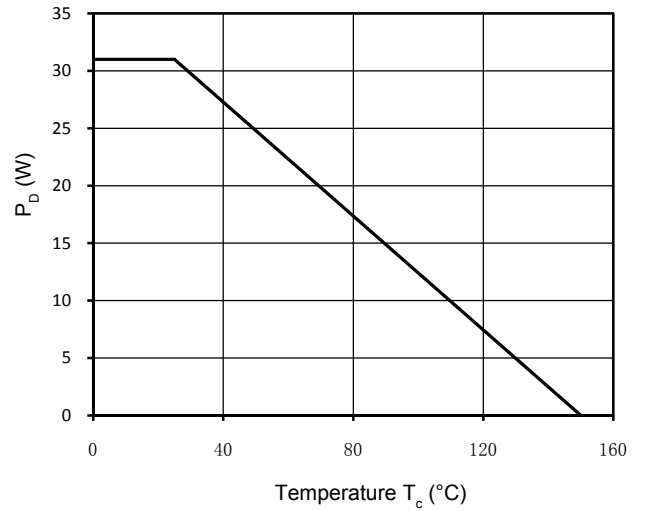


Figure 10. Power Dissipation (TO-220F)

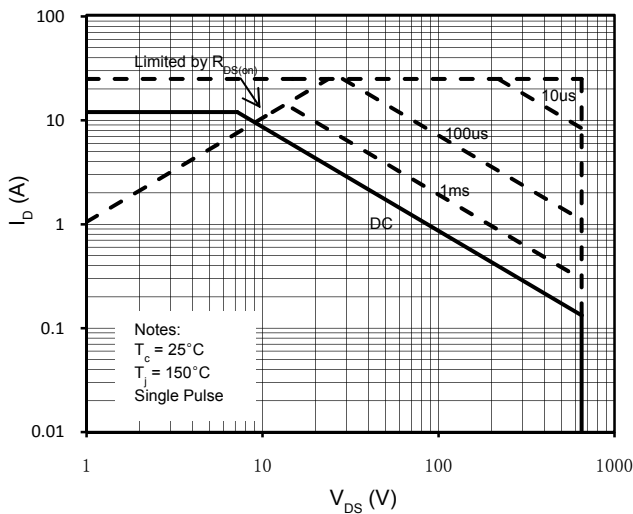


Figure 11. Maximum Safe Operating Area

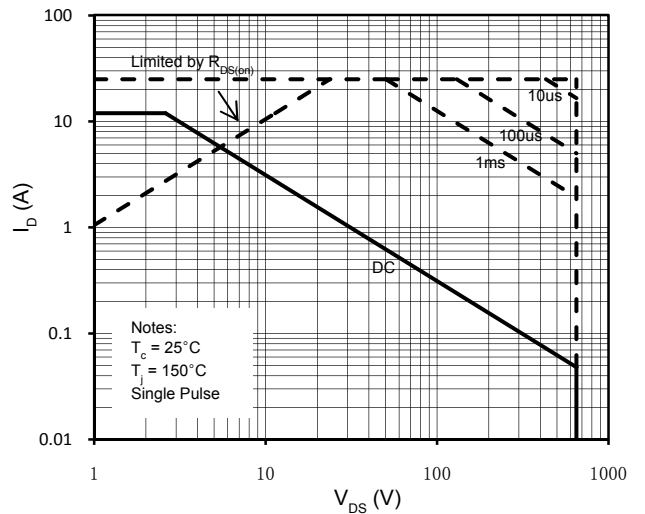


Figure 12. Maximum Safe Operating Area (TO-220F)

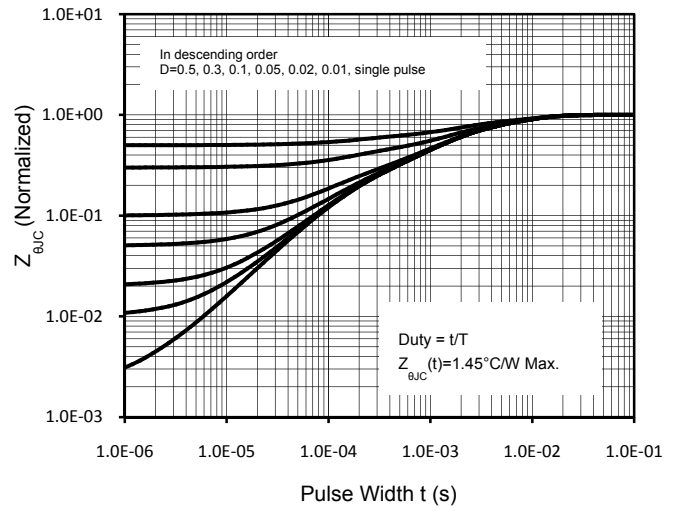
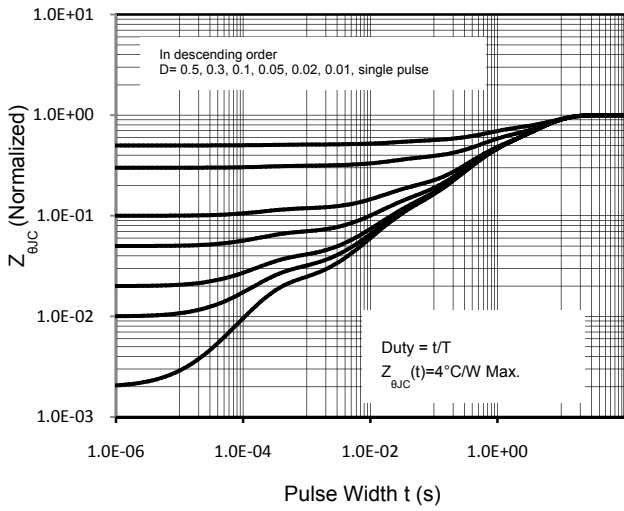


Figure 13. Transient Thermal Response Curve (TO-220F) Figure 14. Transient Thermal Response Curve

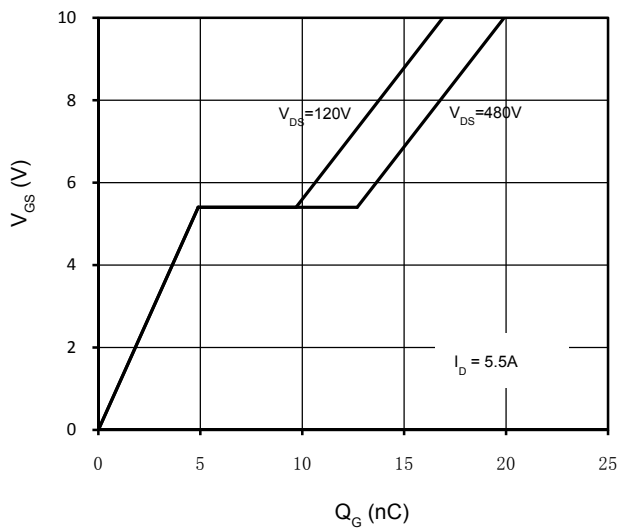


Figure 15. Gate Charge Characteristics

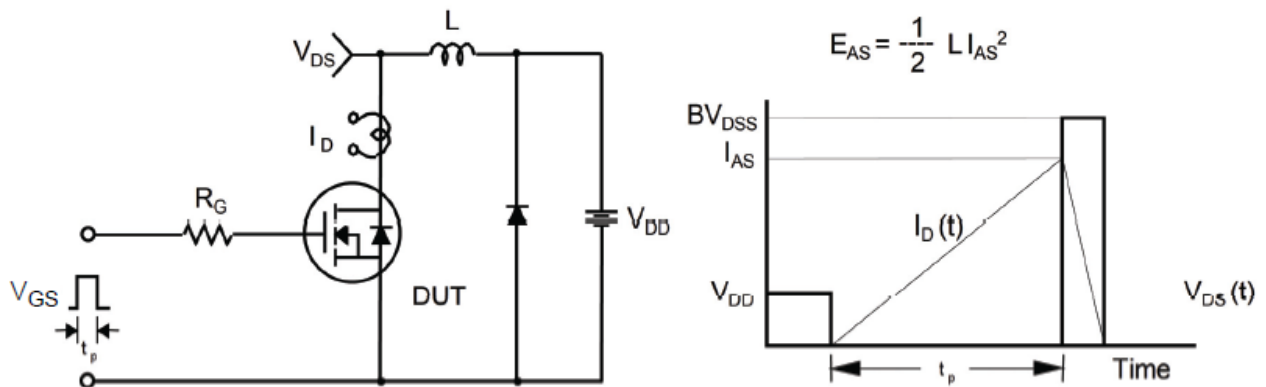
Gate Charge Test Circuit & Waveform



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 | 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 |

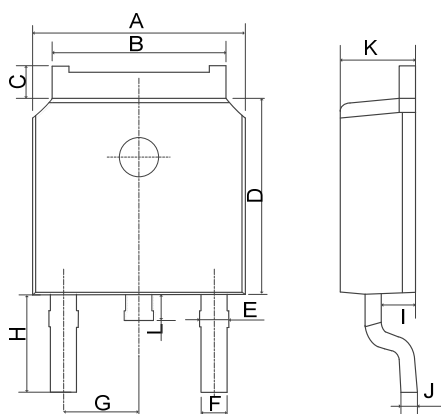
Mechanical Dimensions for TO-251



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 |

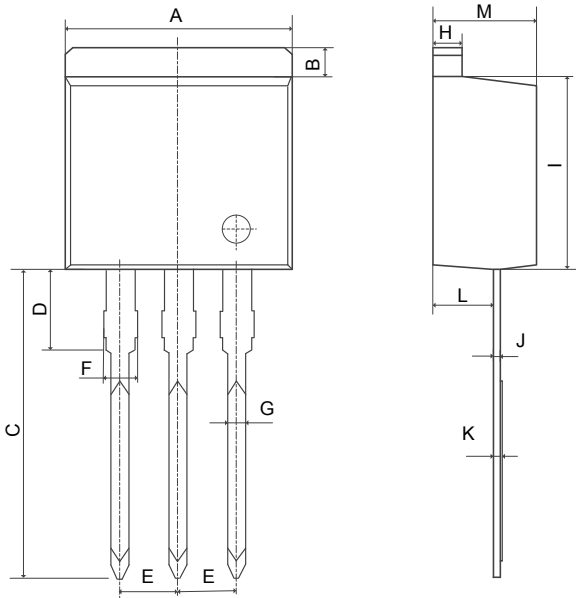
Mechanical Dimensions for TO-252



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 |

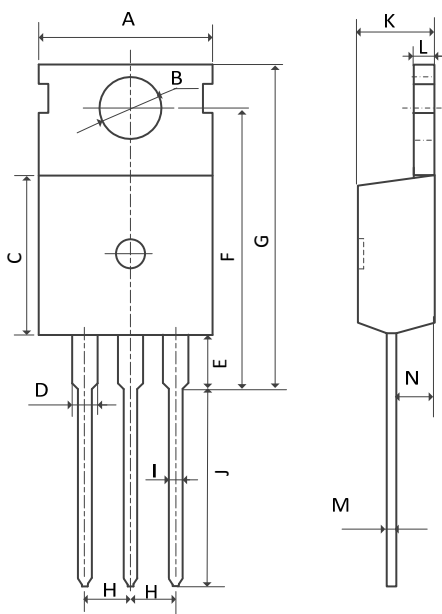
Mechanical Dimensions for TO-262



COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|-------|-------|
| | MIN | MAX |
| A | 10.00 | 10.40 |
| B | 1.11 | 1.41 |
| C | 13.56 | 14.16 |
| D | 3.58 | 3.98 |
| E | 2.39 | 2.69 |
| F | 1.07 | 1.47 |
| G | 0.71 | 0.92 |
| H | 1.17 | 1.37 |
| I | 8.45 | 8.85 |
| J | 0.28 | 0.49 |
| K | 0.32 | 0.52 |
| L | 2.54 | 2.85 |
| M | 4.50 | 4.90 |

Mechanical Dimensions for TO-220



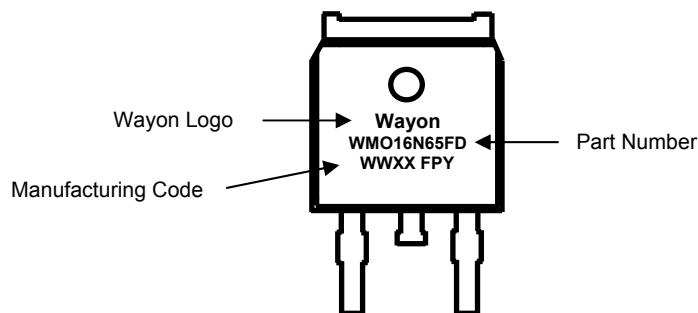
COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|----------|-------|
| | MIN | MAX |
| A | 9.70 | 10.20 |
| B | 3.40 | 3.80 |
| C | 8.90 | 9.40 |
| D | 1.17 | 1.47 |
| E | 2.60 | 3.40 |
| F | 15.10 | 16.70 |
| G | 19.55MAX | |
| H | 2.54REF | |
| I | 0.70 | 0.95 |
| J | 9.35 | 11.00 |
| K | 4.30 | 4.77 |
| L | 1.20 | 1.45 |
| M | 0.40 | 0.65 |
| N | 2.20 | 2.60 |

Ordering Information

| Part | Package | Marking | Packing method |
|------------|---------|------------|----------------|
| WML16N65FD | TO-220F | WML16N65FD | Tube |
| WMK16N65FD | TO-220 | WMK16N65FD | Tube |
| WMN16N65FD | TO-262 | WMN16N65FD | Tube |
| WMM16N65FD | TO-263 | WMM16N65FD | Tape and Reel |
| WMO16N65FD | TO-252 | WMO16N65FD | Tape and Reel |
| WMP16N65FD | TO-251 | WMP16N65FD | Tube |

Marking Information



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