

## 600V 0.27Ω Super Junction Power MOSFET

### Description

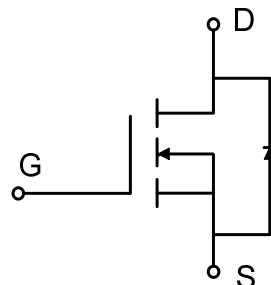
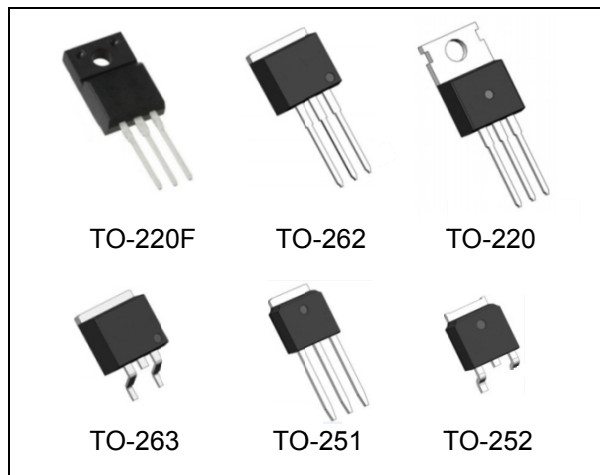
WMOS™ C2 is Wayon's 2<sup>nd</sup> generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ C2 is suitable for applications which require superior power density and outstanding efficiency.

### Features

- $V_{DS} = 650V @ T_{j,max}$
- Typ.  $R_{DS(on)} = 0.27\Omega$
- 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  | $V_{DSS}$        | 600                 |      | V    |
| Continuous drain current <sup>1)</sup> ( $T_C = 25^\circ C$ )           | $I_D$            | 13                  |      | A    |
|   |                  | 7.8                 |      | A    |
| Pulsed drain current <sup>2)</sup>                                      | $I_{DM}$         | 26                  |      | A    |
| Gate-source voltage   | $V_{GS}$         | $\pm 30$            |      | V    |
| Avalanche energy, single pulse <sup>3)</sup>                            | $E_{AS}$         | 145                 |      | mJ   |
| Avalanche energy, repetitive <sup>2)</sup>                              | $E_{AR}$         | 0.21                |      | mJ   |
| Avalanche current, repetitive <sup>2)</sup>                             | $I_{AR}$         | 2                   |      | A    |
| Power dissipation ( $T_C = 25^\circ C$ )<br>- Derate above $25^\circ C$ | $P_D$            | 86                  | 31   | W    |
|   |                  | 0.69                | 0.25 | W/°C |
| Operating and storage temperature range                                 | $T_{j}, T_{stg}$ | -55 to +150         |      | °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   | °C/W |
| Thermal resistance, junction-to-ambient | $R_{\theta JA}$ | 62                  | 80  | °C/W |

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

| Parameter                            | Symbol        | Test Condition   | Min. | Typ. | Max. | Unit          |
|--------------------------------------|---------------|--|------|------|------|---------------|
| <b>Static characteristics</b>        |               |  |      |      |      |               |
| Drain-source breakdown voltage       | $BV_{DSS}$    | $V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$  | 600  | -    | -    | 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                | $I_{DSS}$     | $V_{DS}=600\text{ V}, V_{GS}=0\text{ V},$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | -    | -    | 1    | $\mu\text{A}$ |
| 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     | $R_{DS(on)}$  | $V_{GS}=10\text{ V}, I_D=5.5\text{ A}$<br>$T_j = 25^\circ\text{C}$                                 | -    | 0.27 | 0.32 | $\Omega$      |
| <b>Dynamic characteristics</b>       |               |  |      |      |      |               |
| Input capacitance                    | $C_{iss}$     | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V},$   | -    | 992  | -    | pF            |
| Output capacitance                   | $C_{oss}$     | $f = 1\text{ MHz}$   | -    | 595  | -    |               |
| Reverse transfer capacitance         | $C_{rss}$     |  | -    | 1.4  | -    |               |
| Turn-on delay time                   | $t_{d(on)}$   | $V_{DD} = 300\text{V}, I_D = 5.5\text{A}$  | -    | 28   | -    | ns            |
| Rise time                            | $t_r$         | $R_G = 25\Omega, V_{GS}=10\text{V}$  | -    | 17   | -    |               |
| Turn-off delay time                  | $t_{d(off)}$  |  | -    | 78   | -    |               |
| Fall time                            | $t_f$         |  | -    | 20   | -    |               |
| <b>Gate charge characteristics</b>   |               |  |      |      |      |               |
| Gate to source charge                | $Q_{gs}$      | $V_{DD}=480\text{ V}, I_D=5.5\text{A},$  | -    | 4.9  | -    | nC            |
| Gate to drain charge                 | $Q_{gd}$      | $V_{GS}=0\text{ to }10\text{ V}$   | -    | 7.8  | -    |               |
| Gate charge total                    | $Q_g$         |  | -    | 19.9 | -    |               |
| Gate plateau voltage                 | $V_{plateau}$ |  | -    | 5.4  | -    | V             |
| <b>Reverse diode characteristics</b> |               |  |      |      |      |               |
| Diode forward voltage                | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=5.5\text{A}$   | -    | -    | 1.2  | V             |
| Reverse recovery time                | $t_{rr}$      | $V_R=50\text{ V}, I_F=5.5\text{A},$  | -    | 264  | -    | ns            |
| Reverse recovery charge              | $Q_{rr}$      | $dI_F/dt=100\text{ A}/\mu\text{s}$   | -    | 2.07 | -    | $\mu\text{C}$ |
| Peak reverse recovery current        | $I_{rrm}$     |  | -    | 16   | -    | 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  $T_j = 25^\circ\text{C}$ .

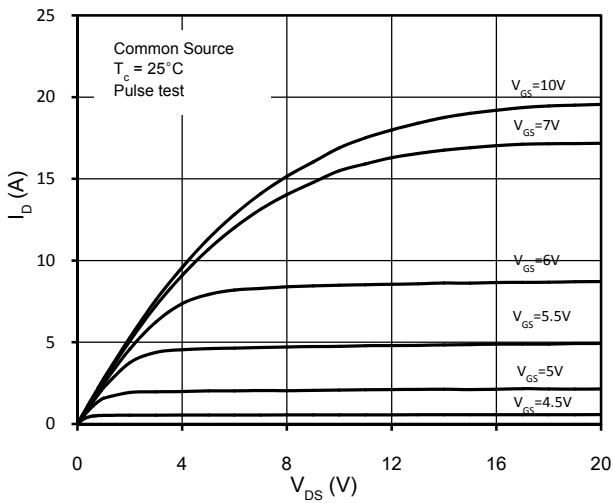


Figure 1. On-Region Characteristics

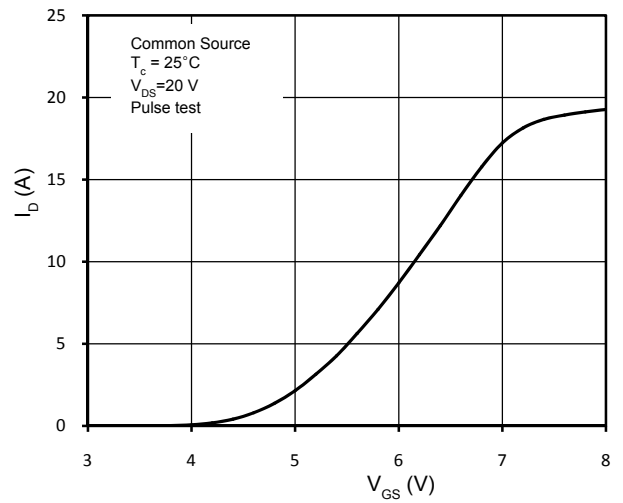


Figure 2. Transfer Characteristics

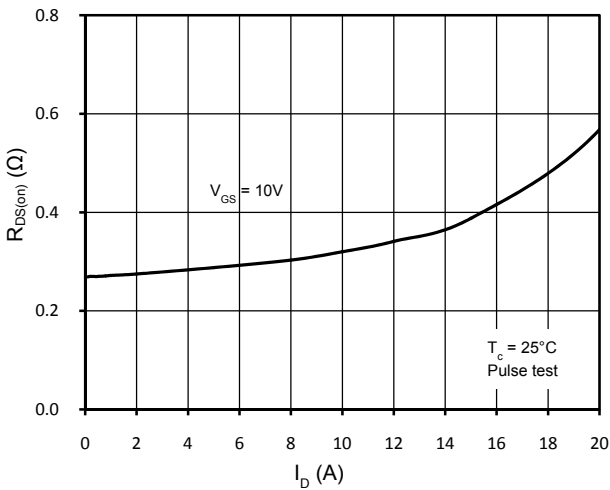


Figure 3. Static Drain-Source On Resistance

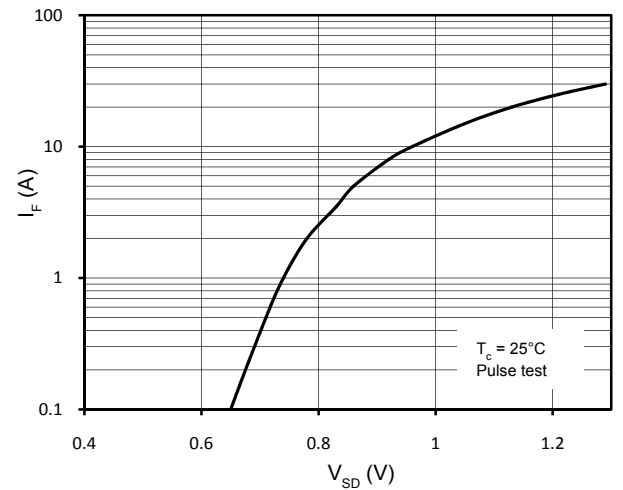


Figure 4. Body-Diode Forward Characteristics

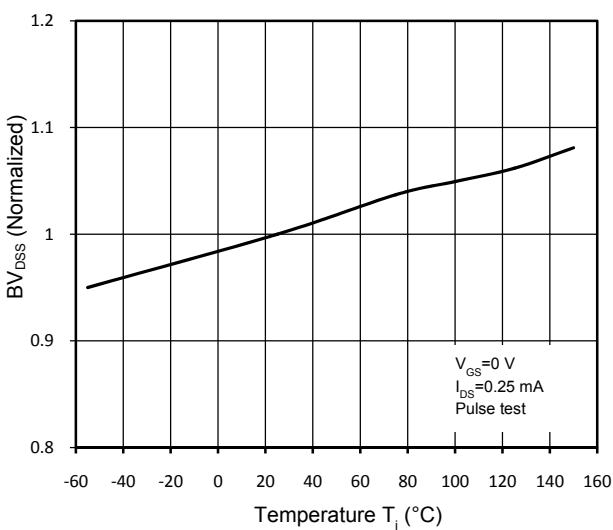


Figure 5. Normalized BV<sub>DS</sub> vs. Temperature

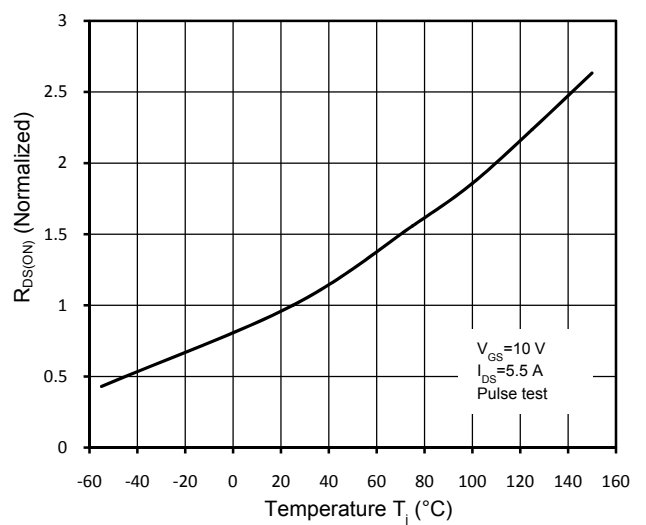


Figure 6. Normalized R<sub>DS(on)</sub> vs. Temperature

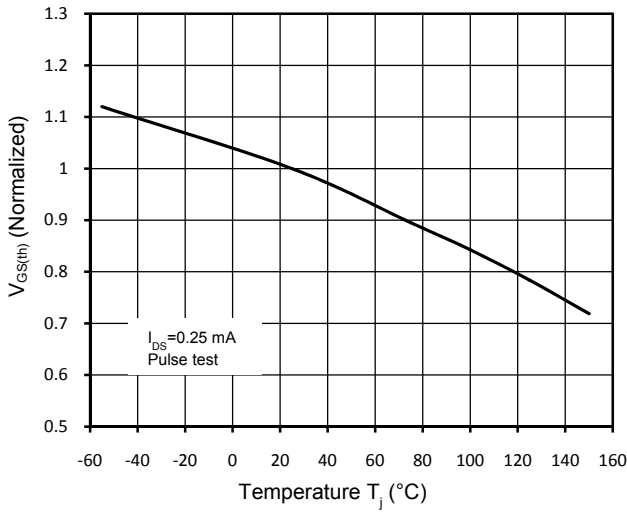


Figure 7. Threshold Voltage vs. Temperature

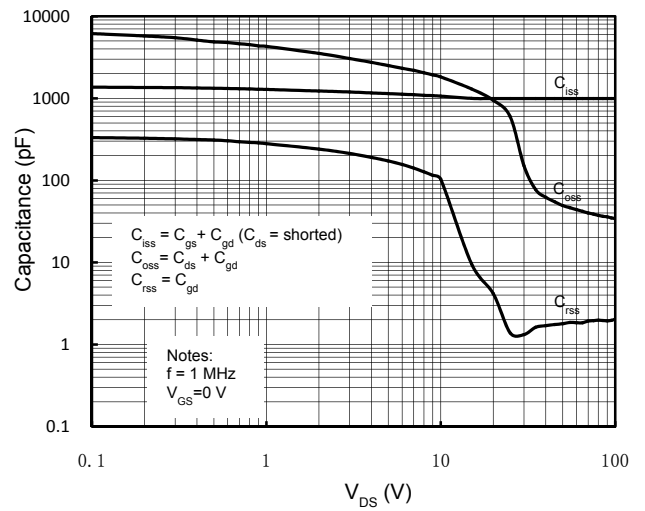


Figure 8. Capacitance Characteristics

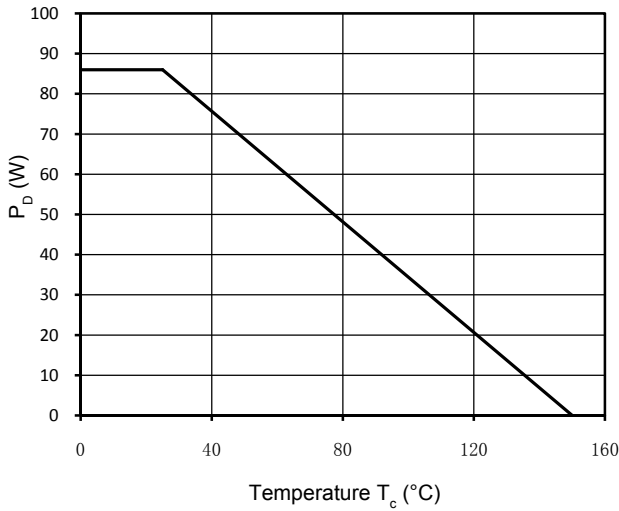


Figure 9. Power Dissipation

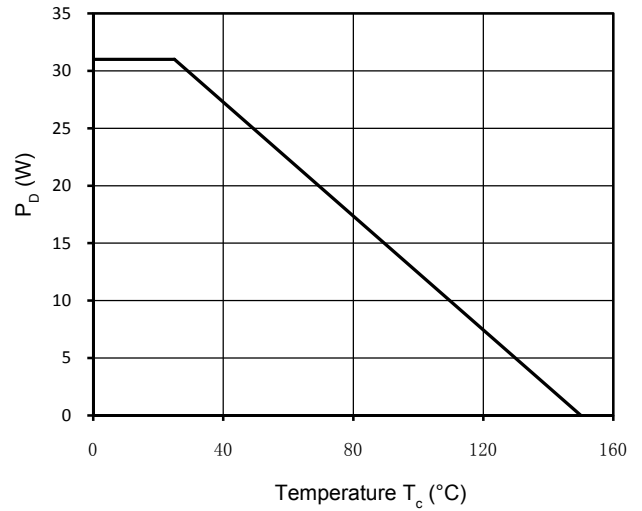


Figure 10. Power Dissipation (TO-220F)

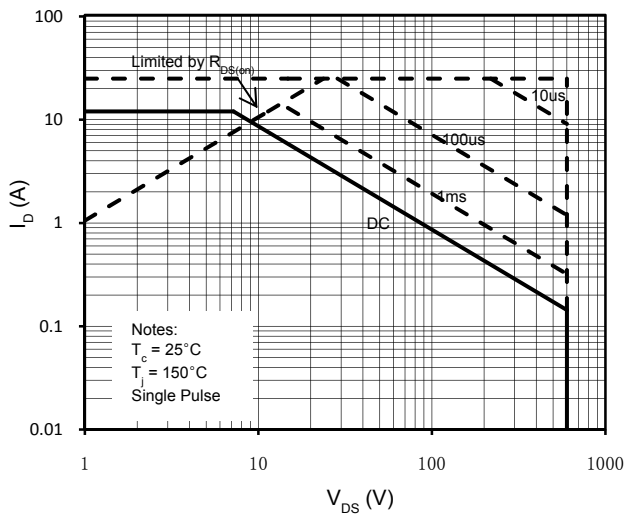


Figure 11. Maximum Safe Operating Area

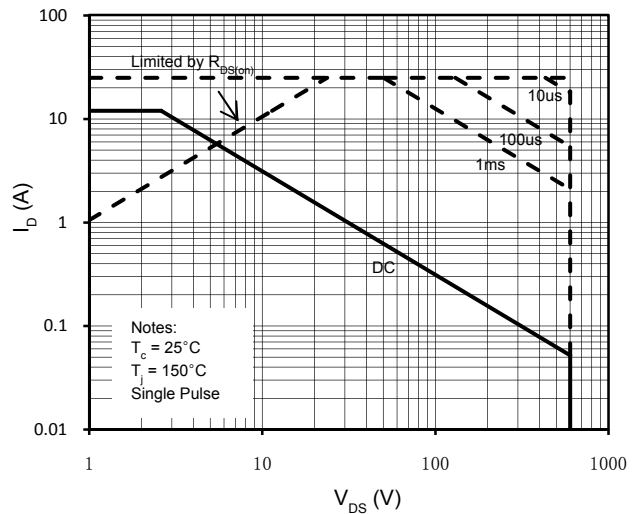


Figure 12. Maximum Safe Operating Area (TO-220F)

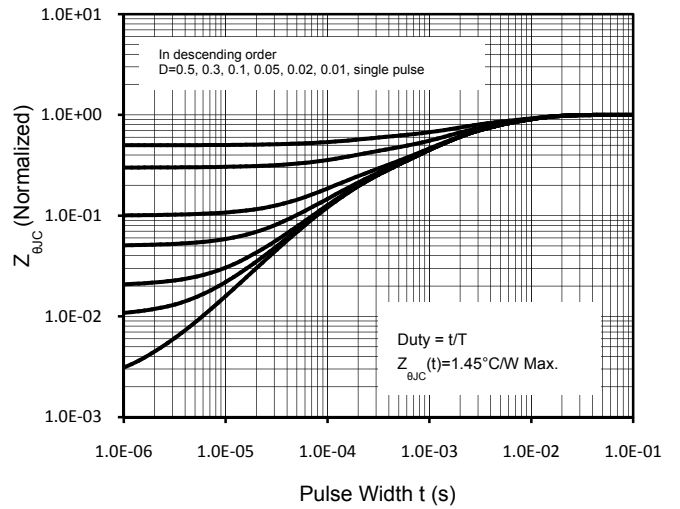
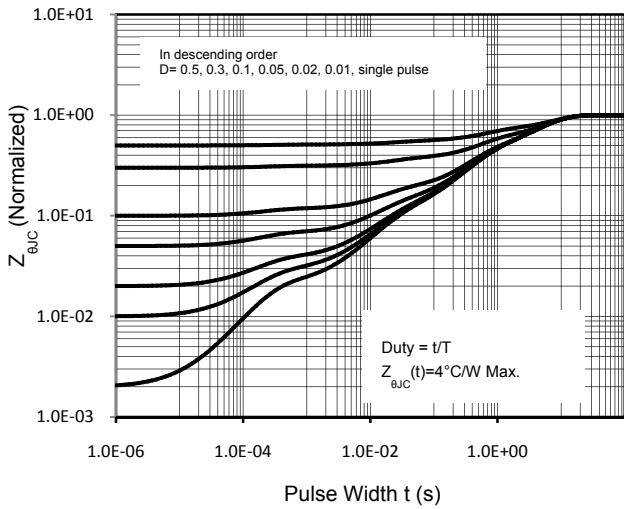


Figure 13. Transient Thermal Response Curve (TO-220F) Figure 14. Transient Thermal Response Curve

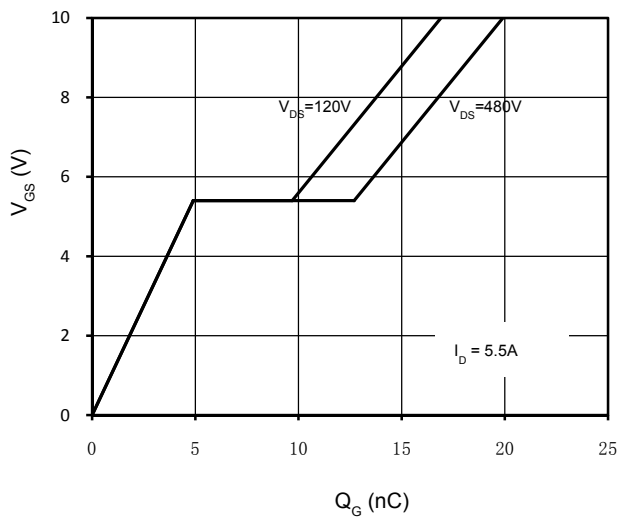
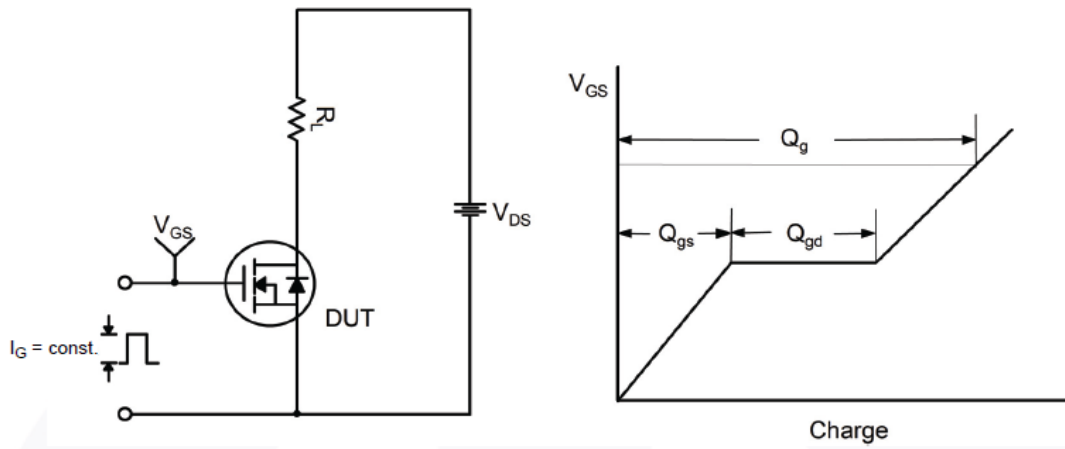
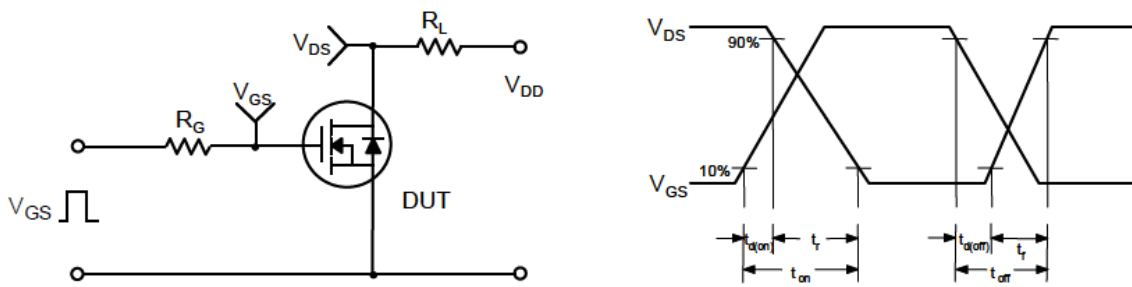


Figure 15. Gate Charge Characteristics

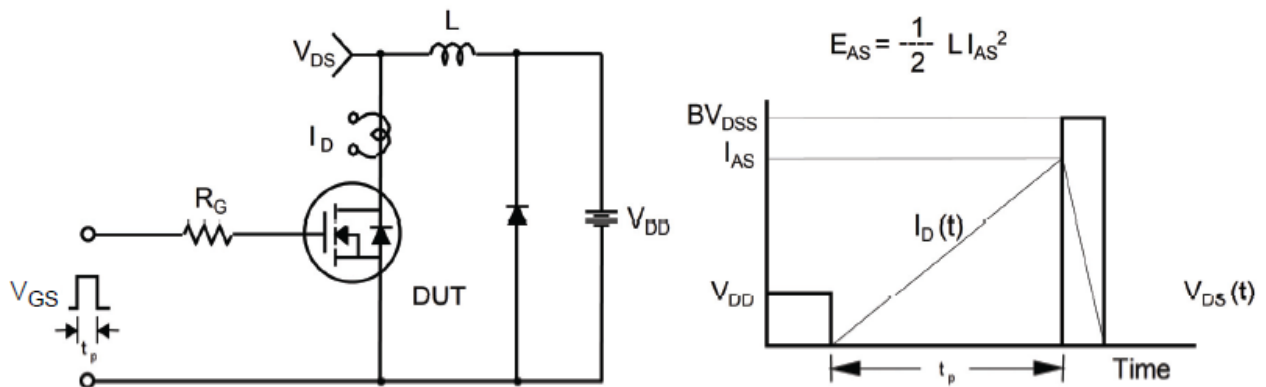
**Gate Charge Test Circuit & Waveform**



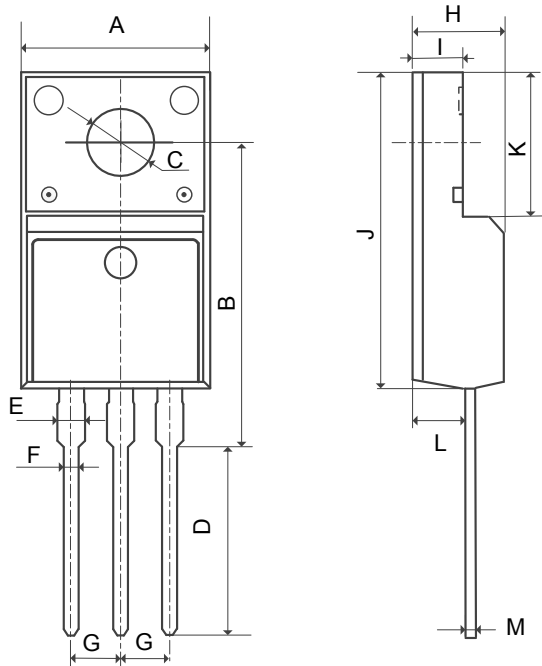
**Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**



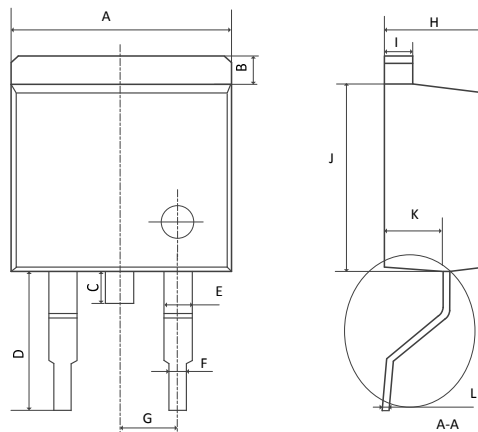
**Mechanical Dimensions for TO-220F**



**COMMON DIMENSIONS**

| SYMBOL | MM    |       |
|--------|-------|-------|
|        | MIN   | MAX   |
| A      | 9.96  | 10.36 |
| B      | 15.50 | 16.10 |
| C      | 3.08  | 3.28  |
| D      | 12.64 | 13.24 |
| E      | 1.18  | 1.58  |
| F      | 0.70  | 0.90  |
| G      | 2.39  | 2.69  |
| H      | 4.50  | 4.90  |
| I      | 2.34  | 2.74  |
| J      | 15.67 | 16.07 |
| K      | 6.50  | 6.90  |
| L      | 2.56  | 2.96  |
| M      | 0.40  | 0.60  |

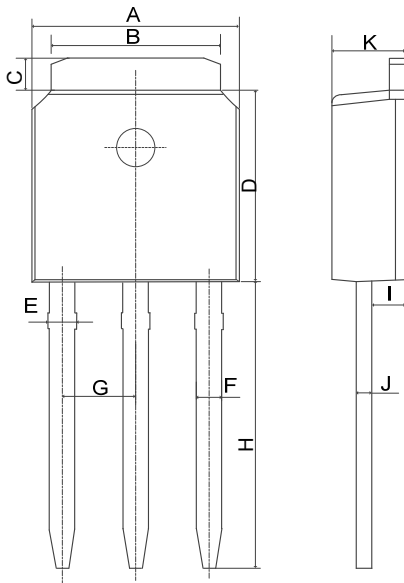
**Mechanical Dimensions for TO-263**



**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  | 0.91  |
| 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  | 0.48  |

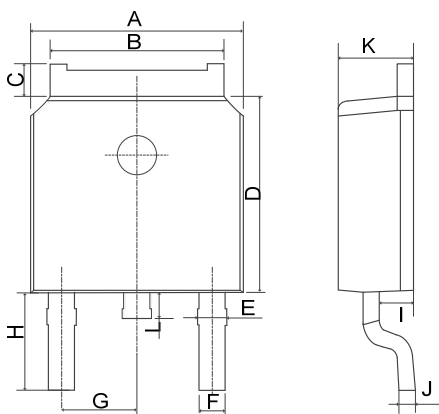
**Mechanical Dimensions for TO-251**



**COMMON DIMENSIONS**

| SYMBOL | MM   |      |
|--------|------|------|
|        | MIN  | MAX  |
| A      | 6.40 | 6.80 |
| B      | 5.13 | 5.46 |
| C      | 0.90 | 1.25 |
| D      | 5.90 | 6.20 |
| E      | 0.80 | 1.00 |
| F      | 0.71 | 0.91 |
| G      | 2.19 | 2.39 |
| H      | 9.00 | 9.60 |
| I      | 0.90 | 1.10 |
| J      | 0.40 | 0.60 |
| K      | 2.10 | 2.50 |

**Mechanical Dimensions for TO-252**

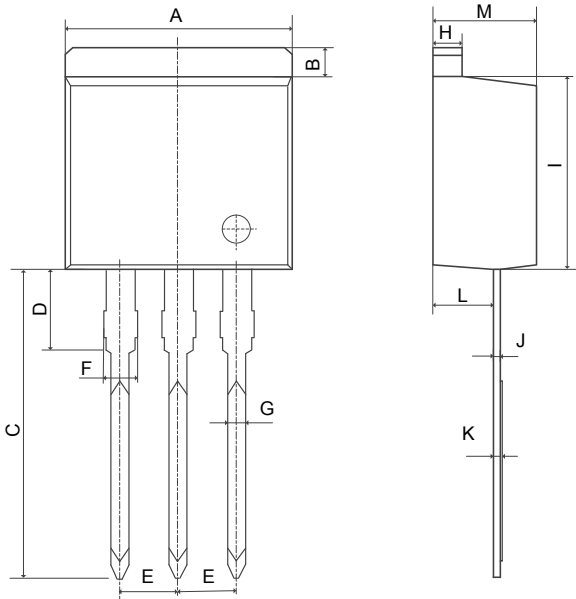


**COMMON DIMENSIONS**

| SYMBOL | MM   |      |
|--------|------|------|
|        | MIN  | MAX  |
| A      | 6.40 | 6.80 |
| B      | 5.13 | 5.46 |
| C      | 0.90 | 1.25 |
| D      | 5.90 | 6.20 |
| E      | 0.80 | 1.00 |
| F      | 0.71 | 0.91 |
| G      | 2.19 | 2.39 |
| H      | 2.60 | 3.10 |
| I      | 0.90 | 1.10 |
| J      | 0.40 | 0.60 |
| K      | 2.10 | 2.50 |
| L      | 0.60 | 1.00 |



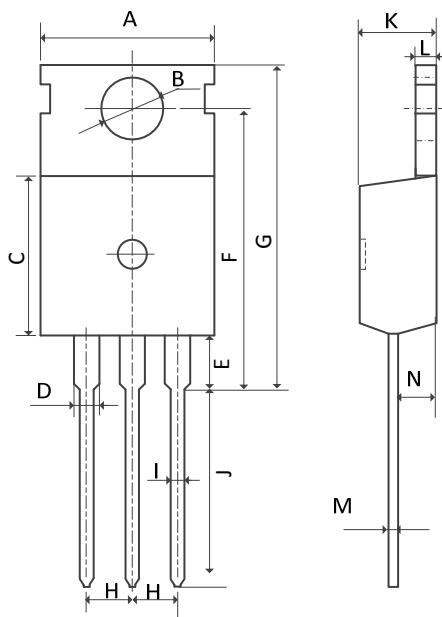
**Mechanical Dimensions for TO-262**



**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  | 0.91  |
| H      | 1.17  | 1.37  |
| I      | 8.45  | 8.85  |
| J      | 0.28  | 0.48  |
| K      | 0.32  | 0.52  |
| L      | 2.54  | 2.84  |
| M      | 4.50  | 4.90  |

**Mechanical Dimensions for TO-220**



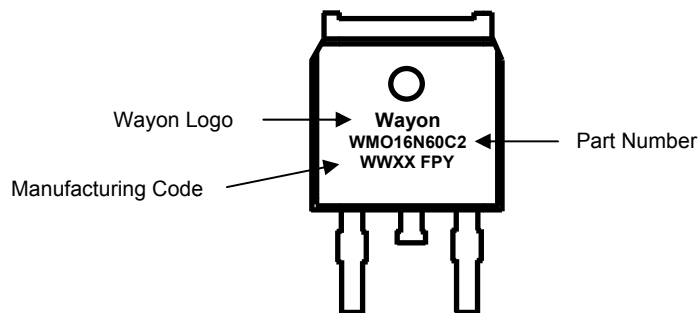
**COMMON DIMENSIONS**

| SYMBOL | MM       |       |
|--------|----------|-------|
|        | MIN      | MAX   |
| A      | 9.70     | 10.10 |
| B      | 3.50     | 3.70  |
| C      | 9.00     | 9.40  |
| D      | 1.17     | 1.47  |
| E      | 2.80     | 3.20  |
| F      | 15.80    | 16.20 |
| G      | 18.95MAX |       |
| H      | 2.44     | 2.64  |
| I      | 0.70     | 0.90  |
| J      | 9.78     | 10.38 |
| K      | 4.30     | 4.70  |
| L      | 1.20     | 1.40  |
| M      | 0.40     | 0.60  |
| N      | 2.25     | 2.55  |

## Ordering Information

| Part       | Package | Marking    | Packing method | Quantity |
|------------|---------|------------|----------------|----------|
| WML16N60C2 | TO-220F | WML16N60C2 | Tube           | 50       |
| WMK16N60C2 | TO-220  | WMK16N60C2 | Tube           | 50       |
| WMN16N60C2 | TO-262  | WMN16N60C2 | Tube           | 50       |
| WMM16N60C2 | TO-263  | WMM16N60C2 | Tape and Reel  | 800      |
| WMO16N60C2 | TO-252  | WMO16N60C2 | Tape and Reel  | 2500     |
| WMP16N60C2 | TO-251  | WMP16N60C2 | Tube           | 80       |

## Marking Information



## Contact Information

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WAYON website: <http://www.way-on.com>

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