

## 650V 0.028Ω Super Junction Power MOSFET

### Description

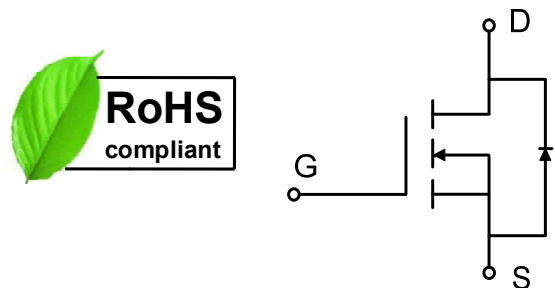
WMOS™ SR is Wayon's new generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ SR is suitable for applications which require superior power density and outstanding efficiency.

### Features

- $V_{DS} = 700V @ T_{j,max}$
- Typ.  $R_{DS(on)} = 0.028\Omega$
- Fast body diode
- Pb-free plating, Halogen free

### Applications

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



### Absolute Maximum Ratings

| Parameter                                                     | Symbol         | WMJ90N65SR  | Unit          |
|---------------------------------------------------------------|----------------|-------------|---------------|
| Drain-source voltage                                          | $V_{DSS}$      | 650         | V             |
| Continuous drain current <sup>1)</sup> ( $T_C = 25^\circ C$ ) | $I_D$          | 99          | A             |
| ( $T_C = 100^\circ C$ )                                       |                | 60          | A             |
| Pulsed drain current <sup>2)</sup>                            | $I_{DM}$       | 350         | A             |
| Gate-source voltage                                           | $V_{GS}$       | $\pm 30$    | V             |
| Avalanche energy, single pulse <sup>3)</sup>                  | $E_{AS}$       | 1100        | mJ            |
| Avalanche energy, repetitive <sup>2)</sup>                    | $E_{AR}$       | 1.4         | mJ            |
| Avalanche current, repetitive <sup>2)</sup>                   | $I_{AR}$       | 7           | A             |
| Power dissipation ( $T_C = 25^\circ C$ )                      | $P_D$          | 460         | W             |
| - Derate above $25^\circ C$                                   |                | 3.68        | W/ $^\circ C$ |
| Operating and storage temperature range                       | $T_j, T_{stg}$ | -55 to +150 | $^\circ C$    |
| Continuous diode forward current                              | $I_S$          | 99          | A             |
| Diode pulse current                                           | $I_{S,pulse}$  | 350         | A             |

### Thermal Characteristics

| Parameter                               | Symbol          | WMJ90N65SR | Unit         |
|-----------------------------------------|-----------------|------------|--------------|
| Thermal resistance, junction-to-case    | $R_{\theta JC}$ | 0.27       | $^\circ C/W$ |
| Thermal resistance, junction-to-ambient | $R_{\theta JA}$ | 62         | $^\circ C/W$ |

**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 <sub>DSS</sub>    | V <sub>GS</sub> =0 V, I <sub>D</sub> =1 mA                                                      | 650    | -         | -         | V     |
| Gate threshold voltage           | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =0.25mA                                       | 2.5    | 3.5       | 4.5       | V     |
| Drain cut-off current            | I <sub>DSS</sub>     | V <sub>DS</sub> =650 V, V <sub>GS</sub> =0V,<br>T <sub>J</sub> = 25°C<br>T <sub>J</sub> = 125°C | -<br>- | -<br>800  | 60<br>-   | μA    |
| Gate leakage current, forward    | I <sub>GSSF</sub>    | V <sub>GS</sub> =20V, V <sub>DS</sub> =0V                                                       | -      | -         | 500       | nA    |
| Gate leakage current, reverse    | I <sub>GSSR</sub>    | V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V                                                      | -      | -         | -500      | nA    |
| Drain-source on-state resistance | R <sub>DS(on)</sub>  | V <sub>GS</sub> =10 V, I <sub>D</sub> =30A<br>T <sub>J</sub> = 25°C                             | -<br>- | <br>0.028 | <br>0.033 | <br>Ω |
| Dynamic characteristics          |                      |                                                                                                 |        |           |           |       |
| Input capacitance                | C <sub>iss</sub>     | V <sub>DS</sub> = 100V, V <sub>GS</sub> = 0V,<br>f = 1 MHz                                      | -      | 9250      | -         | pF    |
| Output capacitance               | C <sub>Oss</sub>     |                                                                                                 | -      | 300       | -         |       |
| Reverse transfer capacitance     | C <sub>rss</sub>     |                                                                                                 | -      | 6.5       | -         |       |
| Turn-on delay time               | t <sub>d(on)</sub>   | V <sub>DD</sub> = 300V, I <sub>D</sub> = 30A<br>R <sub>G</sub> = 25Ω, V <sub>GS</sub> =10V      | -      | 123       | -         | ns    |
| Rise time                        | t <sub>r</sub>       |                                                                                                 | -      | 125       | -         |       |
| Turn-off delay time              | t <sub>d(off)</sub>  |                                                                                                 | -      | 625       | -         |       |
| Fall time                        | t <sub>f</sub>       |                                                                                                 | -      | 143       | -         |       |
| Gate charge characteristics      |                      |                                                                                                 |        |           |           |       |
| Gate to source charge            | Q <sub>gs</sub>      | V <sub>DD</sub> =480V, I <sub>D</sub> =30A,<br>V <sub>GS</sub> =0 to 10V                        | -      | 47        | -         | nC    |
| Gate to drain charge             | Q <sub>gd</sub>      |                                                                                                 | -      | 73        | -         |       |
| Gate charge total                | Q <sub>g</sub>       |                                                                                                 | -      | 183       | -         |       |
| Gate plateau voltage             | V <sub>plateau</sub> |                                                                                                 | -      | 5.5       | -         | V     |
| Reverse diode characteristics    |                      |                                                                                                 |        |           |           |       |
| Diode forward voltage            | V <sub>SD</sub>      | V <sub>GS</sub> =0 V, I <sub>F</sub> =30A                                                       | -      | -         | 1.2       | V     |
| Reverse recovery time            | t <sub>rr</sub>      | V <sub>R</sub> =50V, I <sub>F</sub> =30A,<br>dI <sub>F</sub> /dt=100A/μs                        | -      | 230       | -         | ns    |
| Reverse recovery charge          | Q <sub>rr</sub>      |                                                                                                 | -      | 3.9       | -         | μC    |
| Peak reverse recovery current    | I <sub>rrm</sub>     |                                                                                                 | -      | 41        | -         | A     |

## Notes:

- Limited by  $T_{j\max}$ . Maximum duty cycle  $D=0.5$ .
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 7\text{ A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , starting  $T_j = 25^\circ\text{C}$ .

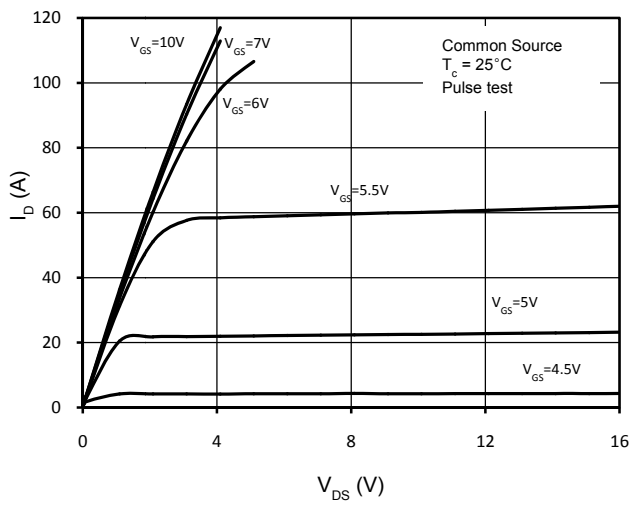


Figure 1. On-Region Characteristics

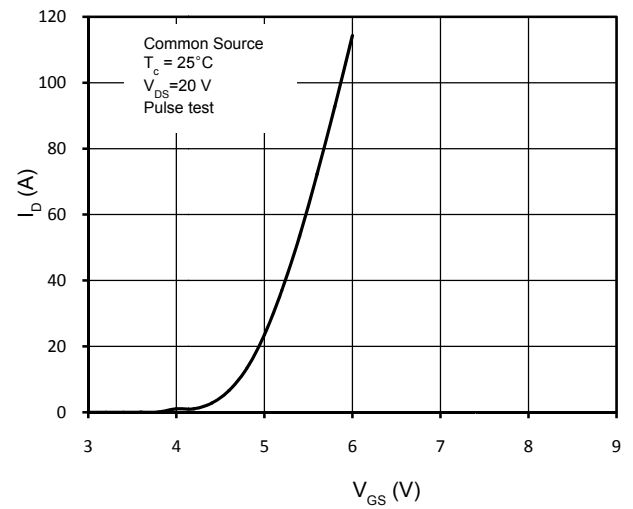


Figure 2. Transfer Characteristics

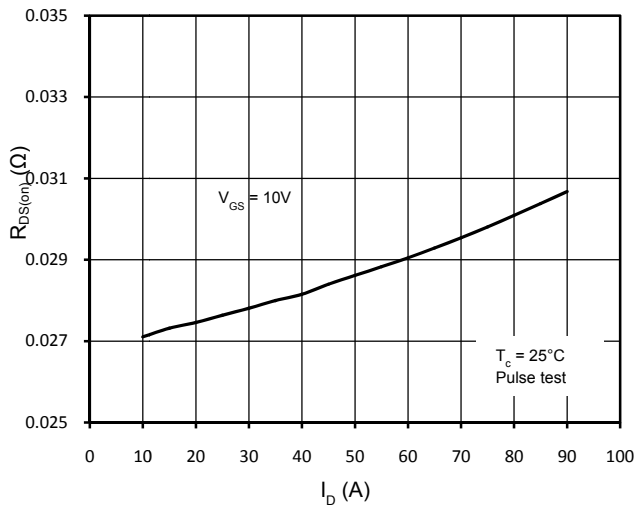


Figure 3. Static Drain-Source On Resistance

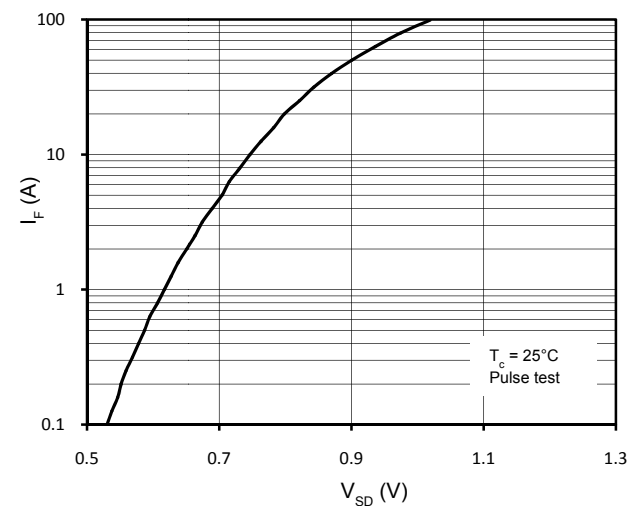
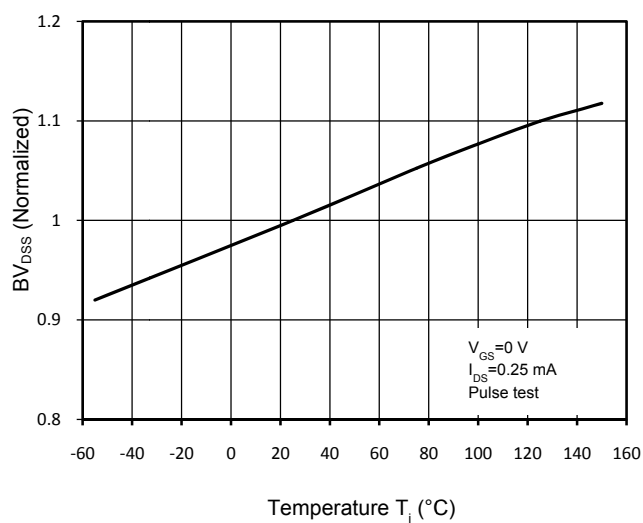
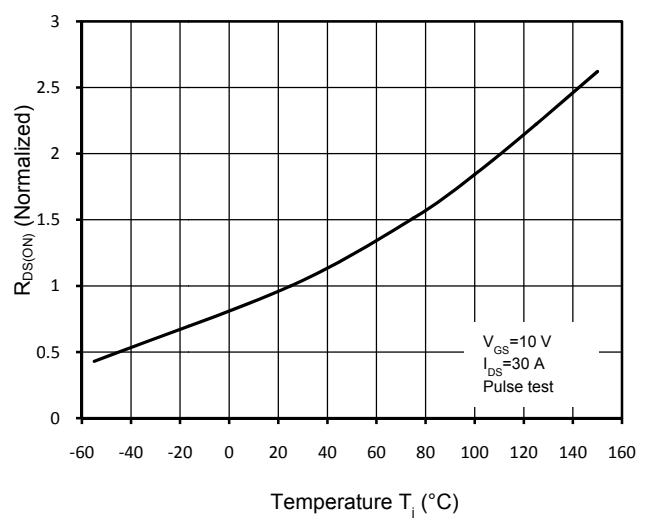


Figure 4. Body-Diode Forward Characteristics

Figure 5. Normalized  $BV_{DS}$  vs. TemperatureFigure 6. Normalized  $R_{DS(on)}$  vs. Temperature

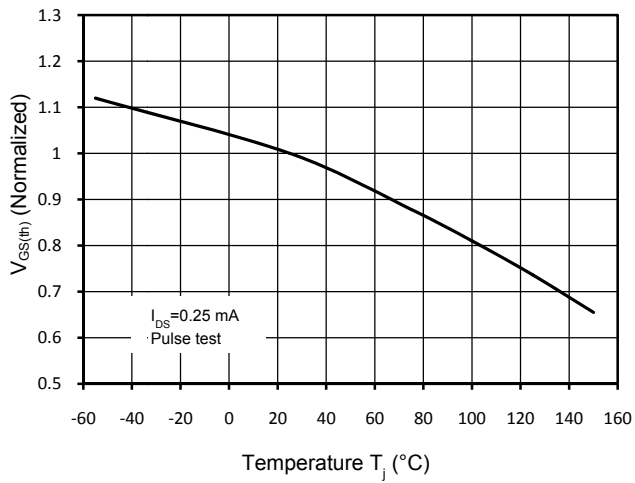


Figure 7. Threshold Voltage vs. Temperature

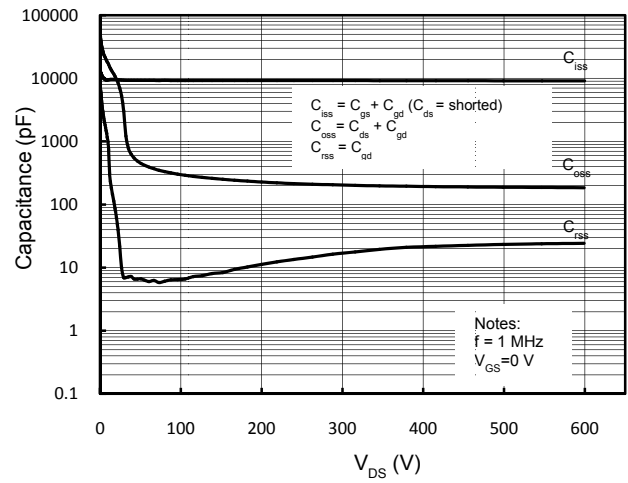


Figure 8. Capacitance Characteristics

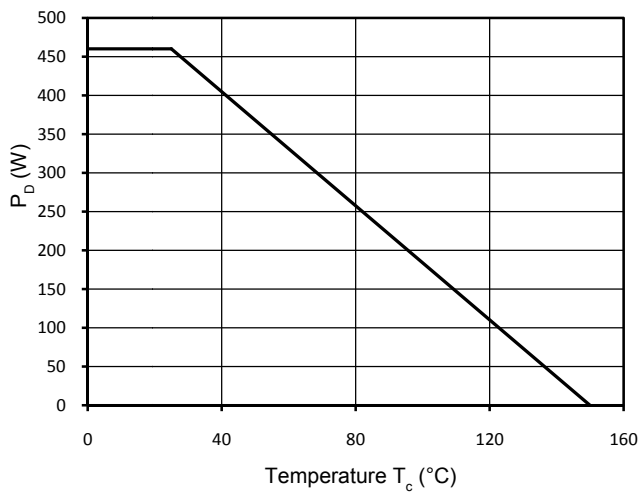


Figure 9. Power Dissipation

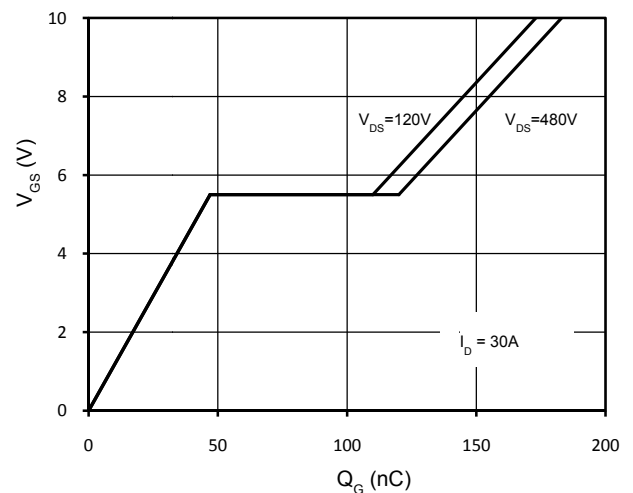


Figure 10. Gate Charge Characteristics

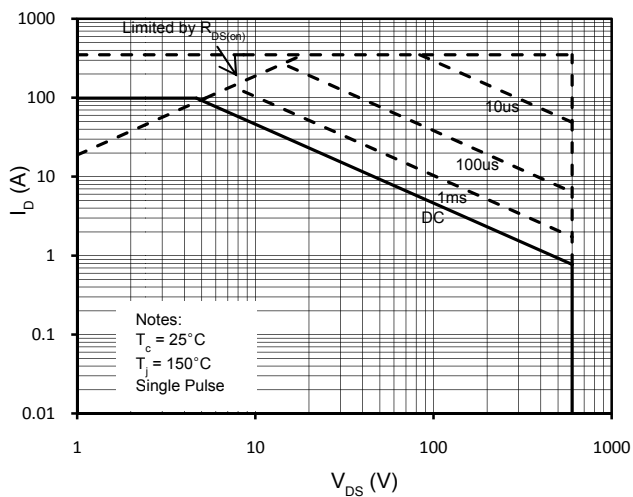


Figure 11. Maximum Safe Operating Area

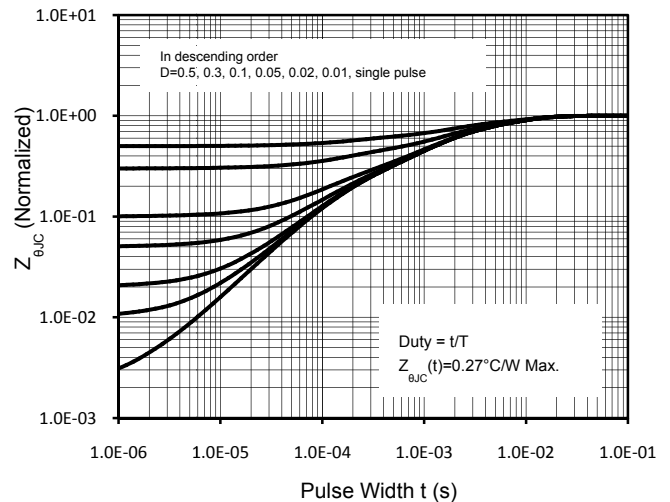
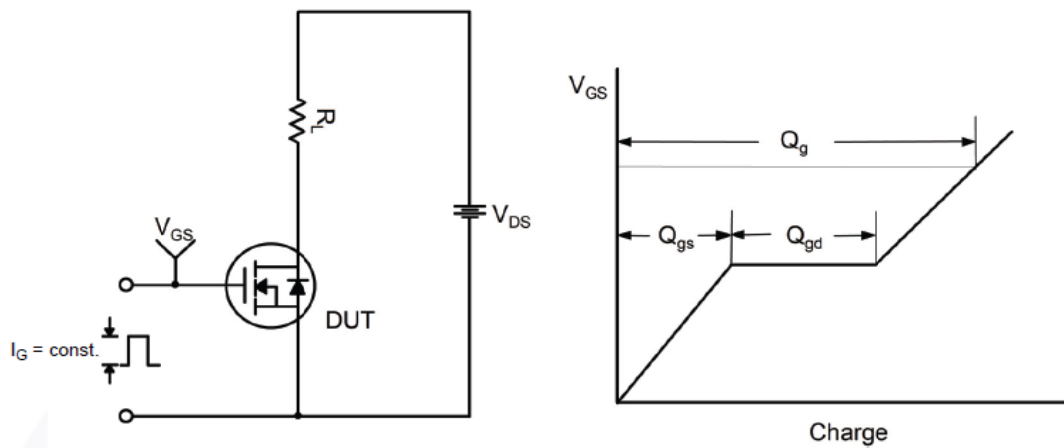
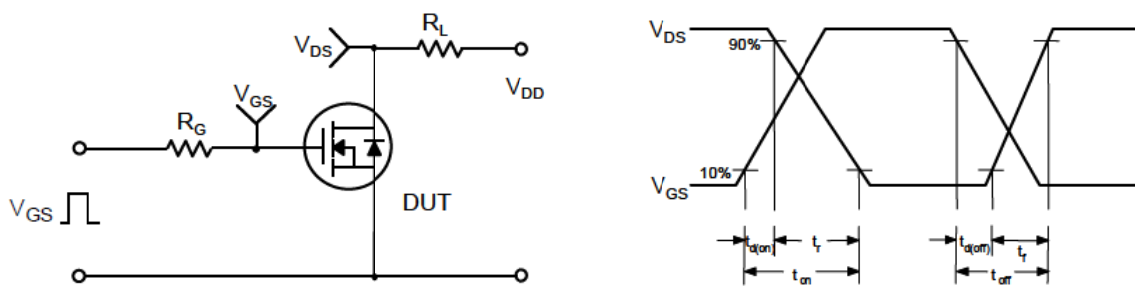


Figure 12. Transient Thermal Response Curve

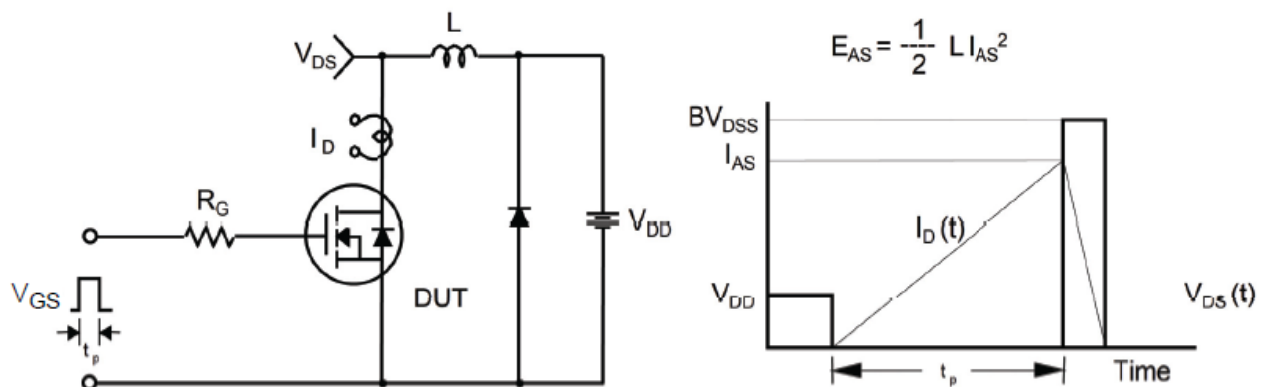
## Gate Charge Test Circuit &amp; Waveform



## Switching Test Circuit &amp; Waveforms

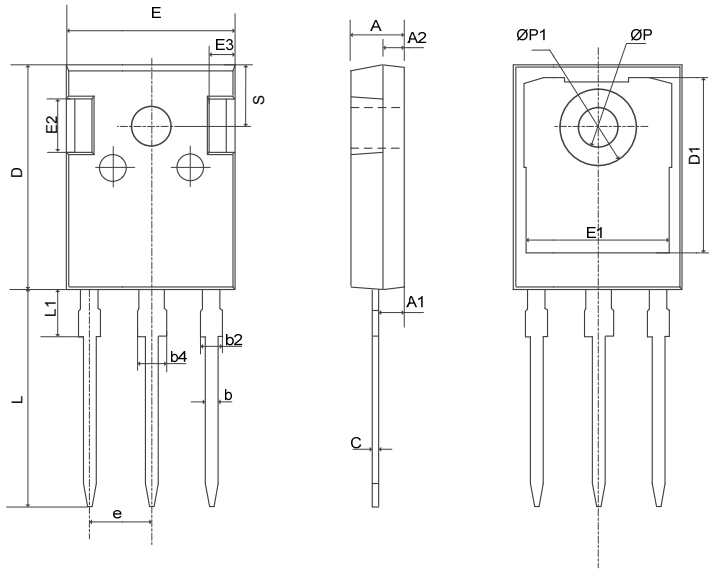


## Unclamped Inductive Switching Test Circuit &amp; Waveforms



## Mechanical Dimensions for TO-247

## COMMON DIMENSIONS

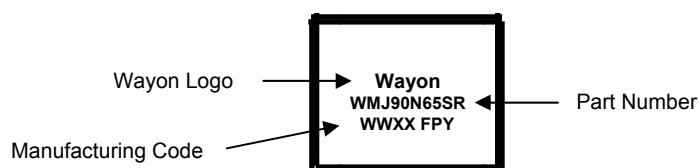


| SYMBOL | MM      |       |
|--------|---------|-------|
|        | MIN     | MAX   |
| A      | 4.80    | 5.21  |
| A1     | 2.21    | 2.61  |
| A2     | 1.85    | 2.16  |
| b      | 1.07    | 1.36  |
| b2     | 1.91    | 2.41  |
| b4     | 2.87    | 3.38  |
| c      | 0.51    | 0.75  |
| D      | 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 |
|------------|---------|------------|----------------|
| WMJ90N65SR | TO-247  | WMJ90N65SR | Tube           |

## Marking Information



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