

# BMW80N180C1

## Super Junction Power MOSFET

800 V, 23 A, 180 mΩ



### Description

BMW80N180C1 is power MOSFET using bestirpower' s advanced super junction technology that can realize very low on resistance and gate charge. It will provide much high efficiency by using optimized charge coupling technology. These user friendly devices give an advantage of Low EMI to designers as well as low switching loss.

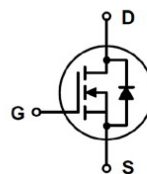
### Applications

- PC power.
- Server power supply.
- Telecom.
- LED lighting.
- EV Charger.
- Solar/UPS.

### Features

| $BV_{DSS} @ T_{J,max}$ | $I_D$ | $R_{DS(on),max}$ | $Q_{g,typ}$ |
|------------------------|-------|------------------|-------------|
| 850 V                  | 23 A  | 180 mΩ           | 56 nC       |

- Ultra-fast body diode.
- Extremely low losses due to very low FOM  $R_{dson} * Q_g$  and  $E_{oss}$ .
- Very high commutation ruggedness.



### Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol         | Parameter   | Value  | Unit             |
|----------------|---|--|------------------|
| $V_{DSS}$      | Drain to Source Voltage(1)  | 800  | V                |
| $V_{GSS}$      | Gate to Source Voltage  | $\pm 30$   | V                |
| $I_D$          | Drain Current(2)  | $V_{GS} = 10 \text{ V}, (T_C = 25^\circ\text{C})$  | 23               |
|                |   | $V_{GS} = 10 \text{ V}, (T_C = 100^\circ\text{C})$ | 15               |
| $I_{DM}$       | Drain Current   | Pulsed   | 70               |
| $E_{AS}$       | Single Pulsed Avalanche Energy(3)                                     | 845  | mJ               |
| $I_{AR}$       | Avalanche Current   | 13   | A                |
| dv/dt          | MOSFET dv/dt  | 50   | V/ns             |
|                | Peak Diode Recovery dv/dt(4)_   | 50   |                  |
| $P_D$          | Power Dissipation   | ( $T_C = 25^\circ\text{C}$ )                       | 250              |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                               | -55 to 150   | $^\circ\text{C}$ |
| $I_S$          | Continuous diode forward current                                      | 23   | A                |
| $I_{S,pulse}$  | Diode pulse current(2)  | 70   | A                |
| $T_L$          | Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds | 260  | $^\circ\text{C}$ |

1) Limited by  $T_J$  max. Maximum duty cycle  $D=0.75$ .

2) Pulse width  $t_p$  limited by  $T_J,max$ .

3)  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$ .

4)  $V_{DClk}=400\text{V}$ ;  $V_{DS,peak}<V(BR)_{DSS}$ ; identical low side and high side switch with identical  $R_G$ .

### Thermal Characteristics

| Symbol          | Parameter                                     | Value | Unit               |
|-----------------|---|-------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 0.5   | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62    |                    |

### Electrical Characteristics (T<sub>J</sub> = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

#### Off Characteristics

|                   |                                   |  |     |  |      |    |
|-------------------|-----------------------------------|--|-----|--|------|----|
| BV <sub>DSS</sub> | Drain to Source Breakdown Voltage | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250μA  | 800 |  |      | V  |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current   | V <sub>DS</sub> = 800 V, V <sub>GS</sub> = 0 V |     |  | 10   | μA |
| I <sub>GSS</sub>  | Gate-Source Leakage Current       | V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V |     |  | ±100 | nA |

#### On Characteristics

|                     |                                      |   |     |     |     |    |
|---------------------|--------------------------------------|---|-----|-----|-----|----|
| V <sub>GS(th)</sub> | Gate Threshold Voltage               | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250μA          | 2.5 | 3.5 | 4.5 | V  |
| R <sub>DS(on)</sub> | Static Drain to Source On Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 12 A T <sub>J</sub> = 25°C |     | 150 | 180 | mΩ |

#### Dynamic Characteristics

|                      |                                    |  |  |      |  |    |
|----------------------|------------------------------------|--|--|------|--|----|
| C <sub>iss</sub>     | Input Capacitance                  | V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V,<br>f = 250 kHz                 |  | 2440 |  | pF |
| C <sub>oss</sub>     | Output Capacitance                 |  |  | 83   |  | pF |
| C <sub>rss</sub>     | Reverse transfer capacitance       |  |  | 1.9  |  | pF |
| C <sub>o(tr)</sub>   | Time Related Output Capacitance(2) | V <sub>DS</sub> = 0 to 500 V, V <sub>GS</sub> = 0 V                            |  | 214  |  | pF |
| C <sub>o(er)</sub>   | Energy Related Output Capacitance  |  |  | 66   |  | pF |
| Q <sub>g(tot)</sub>  | Total Gate Charge at 10 V          | V <sub>DS</sub> = 640 V, I <sub>D</sub> = 24 A,<br>V <sub>GS</sub> = 0 to 10 V |  | 56   |  | nC |
| Q <sub>gs</sub>      | Gate Charge total                  |  |  | 15   |  | nC |
| Q <sub>gd</sub>      | Gate to Drain "Miller" Charge      |  |  | 21   |  | nC |
| V <sub>plateau</sub> | Gate plateau voltage               |  |  | 5.5  |  | V  |
| R <sub>G</sub>       | Gate Resistance                    | f = 1 MHz  |  | 4    |  | Ω  |

#### Switching Characteristics

|                     |                     |   |  |     |  |    |
|---------------------|---------------------|---|--|-----|--|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time  | V <sub>DS</sub> = 400 V, I <sub>D</sub> = 12 A,<br>V <sub>GS</sub> = 10 V |  | 20  |  | ns |
| t <sub>r</sub>      | Turn-On Rise Time   |   |  | 13  |  | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time |   |  | 117 |  | ns |
| t <sub>f</sub>      | Turn-Off Fall Time  |   |  | 12  |  | ns |

#### Source-Drain Diode Characteristics

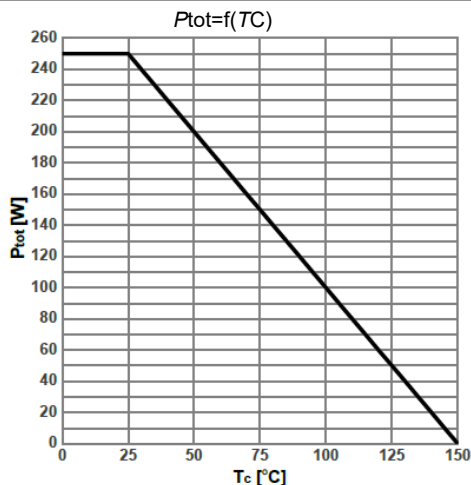
|                  |                               |   |  |     |  |    |
|------------------|-------------------------------|---|--|-----|--|----|
| I <sub>rrm</sub> | Peak reverse recovery current |   |  | 29  |  | A  |
| V <sub>SD</sub>  | Diode Forward Voltage         | V <sub>GS</sub> = 0 V, I <sub>F</sub> = 12A T <sub>J</sub> = 25°C               |  | 0.8 |  | V  |
| t <sub>rr</sub>  | Reverse Recovery Time         | V <sub>R</sub> = 60 V, I <sub>F</sub> = 24 A,<br>di <sub>F</sub> /dt = 100 A/μs |  | 375 |  | ns |
| Q <sub>rr</sub>  | Reverse Recovery Charge       |   |  | 6.7 |  | μC |

#### ※Notes:

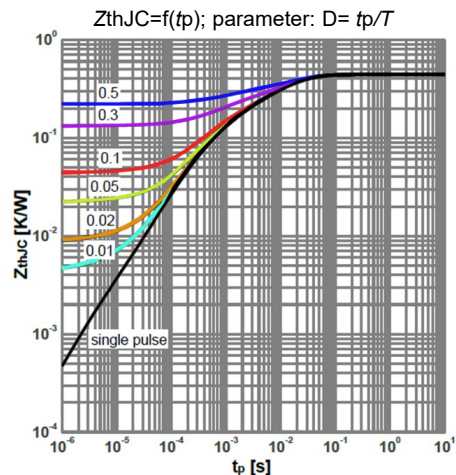
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I<sub>AS</sub> = 4 A, R<sub>G</sub> = 25 Ω starting T<sub>J</sub> = 25°C .
3. I<sub>SD</sub> ≤ 8.5 A, di/dt ≤ 100 A/μs, V<sub>DD</sub> ≤ 400 V, starting T<sub>J</sub> = 25°C .

### Typical Performance Characteristics

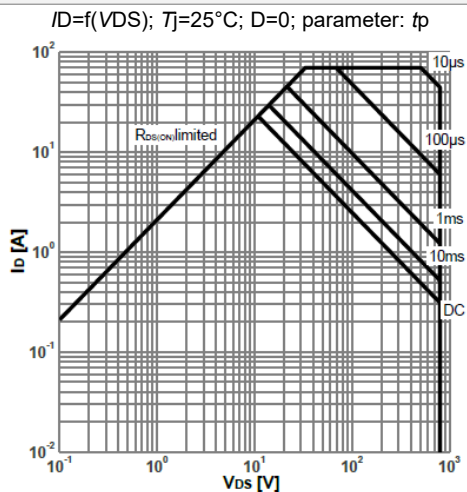
**Figure 1: Power dissipation (Non FullPAK)**



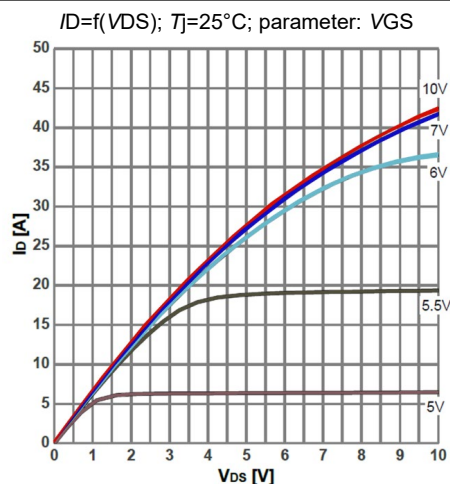
**Figure 2: Max. transient thermal impedance**



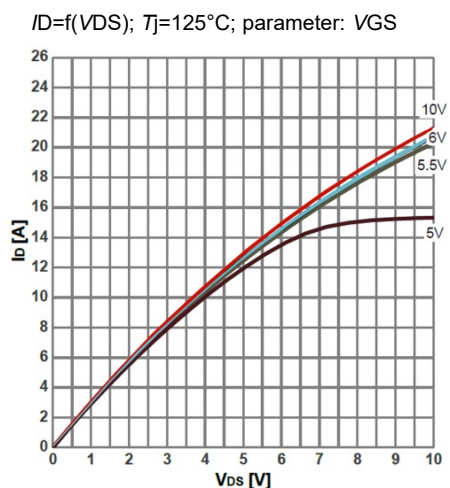
**Figure 3: Safe operating area**



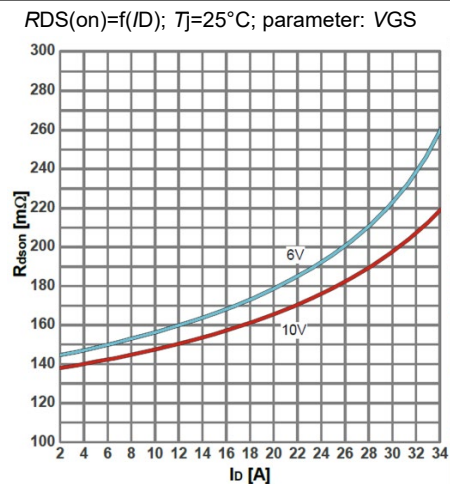
**Figure 4: Typ. output characteristics**



**Figure 5: Typ. output characteristics**

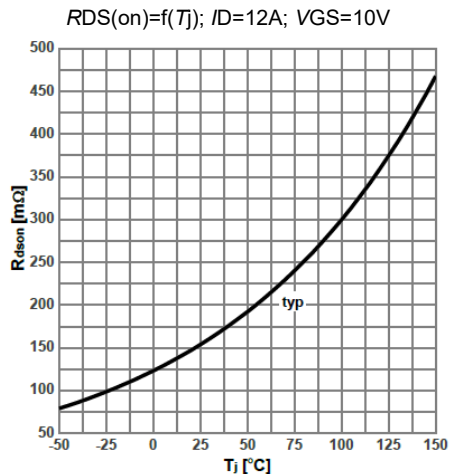


**Figure 6: Typ. drain-source on-state resistance**

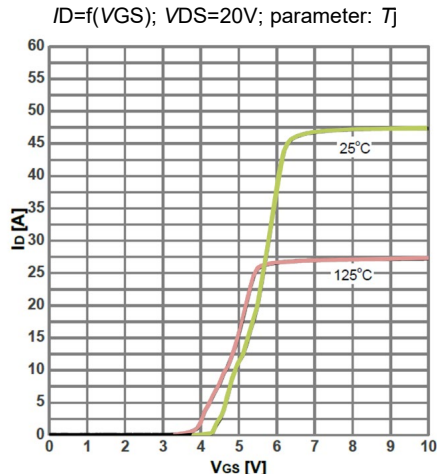


### Typical Performance Characteristics

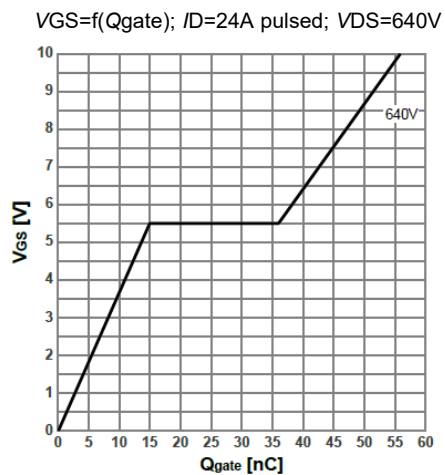
**Figure 7: Drain-source on-state resistance**



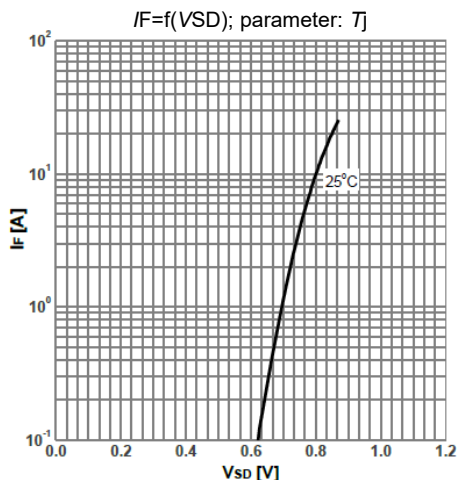
**Figure 8: Typ. transfer characteristics**



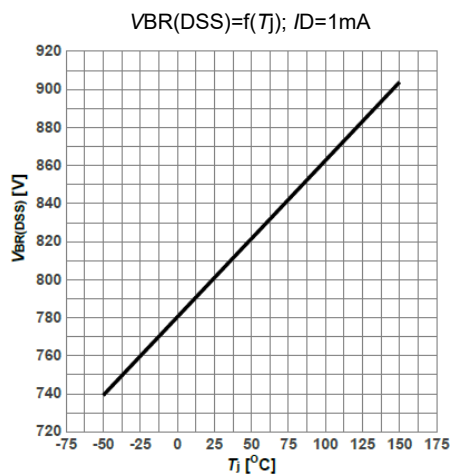
**Figure 9: Typ. gate charge**



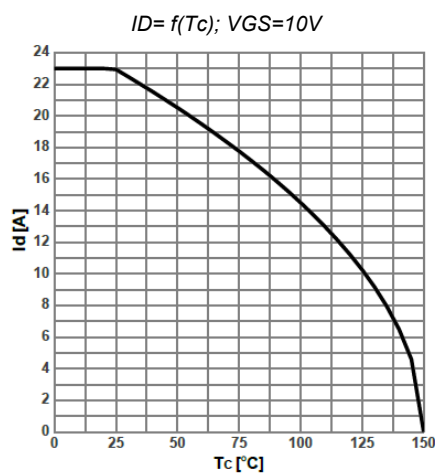
**Figure 10: Forward characteristics of reverse diode**



**Figure 11: Drain-source breakdown voltage**

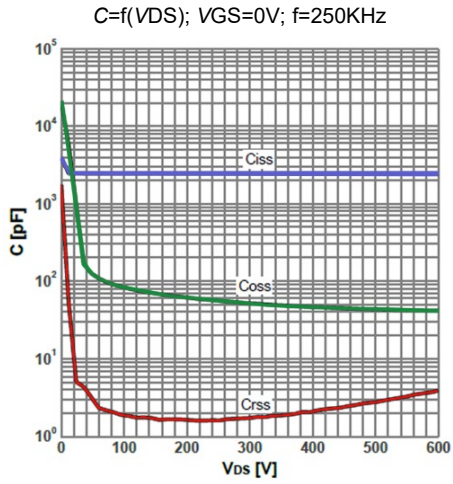


**Figure 12: Maximum Drain Current**

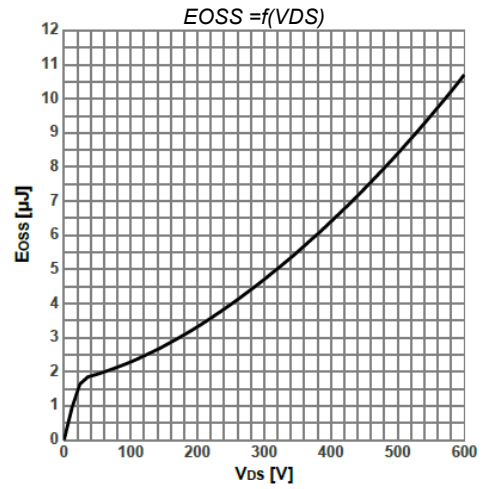


### Typical Performance Characteristics

**Figure 13: Typ. capacitances**



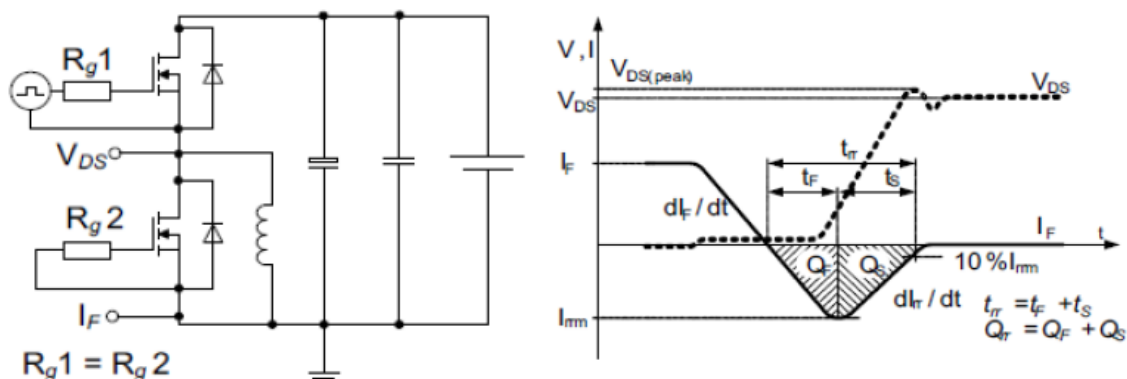
**Figure 14: Typ. Coss stored energy**



### Test Circuits

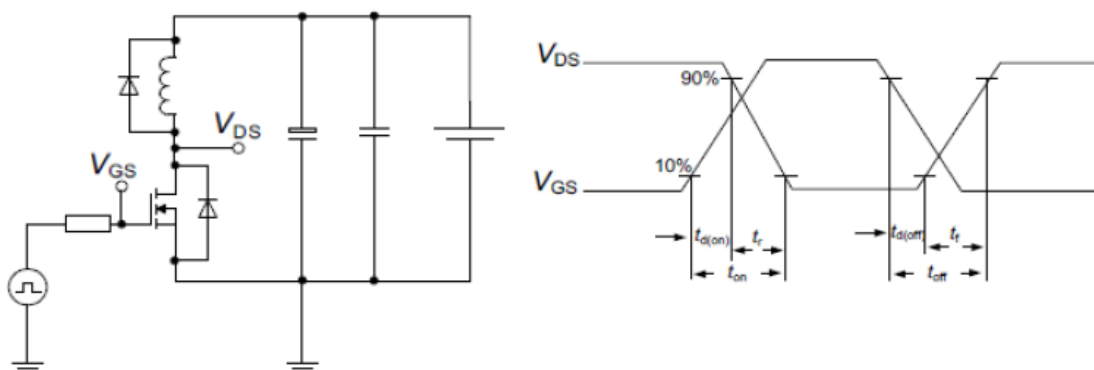
**Figure 15. Diode Characteristics**

Test circuit for diode characteristics and Diode recovery waveform



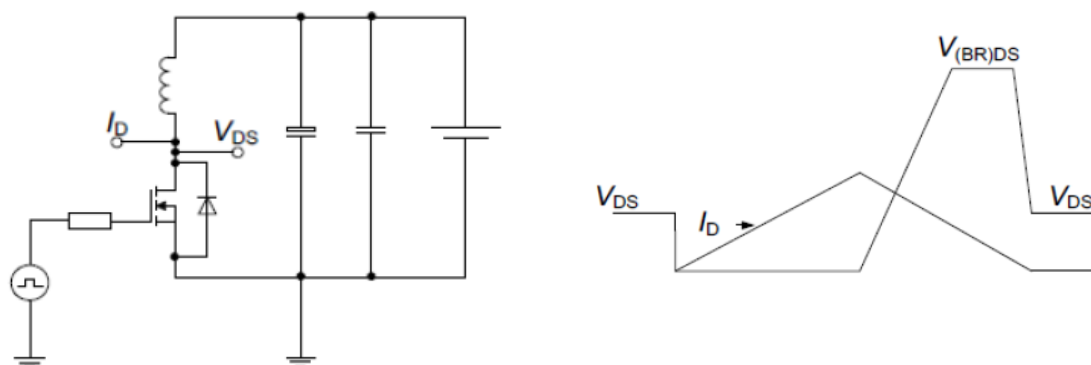
**Figure 16. Switching Times**

Switching times test circuit for inductive load and Switching times waveform



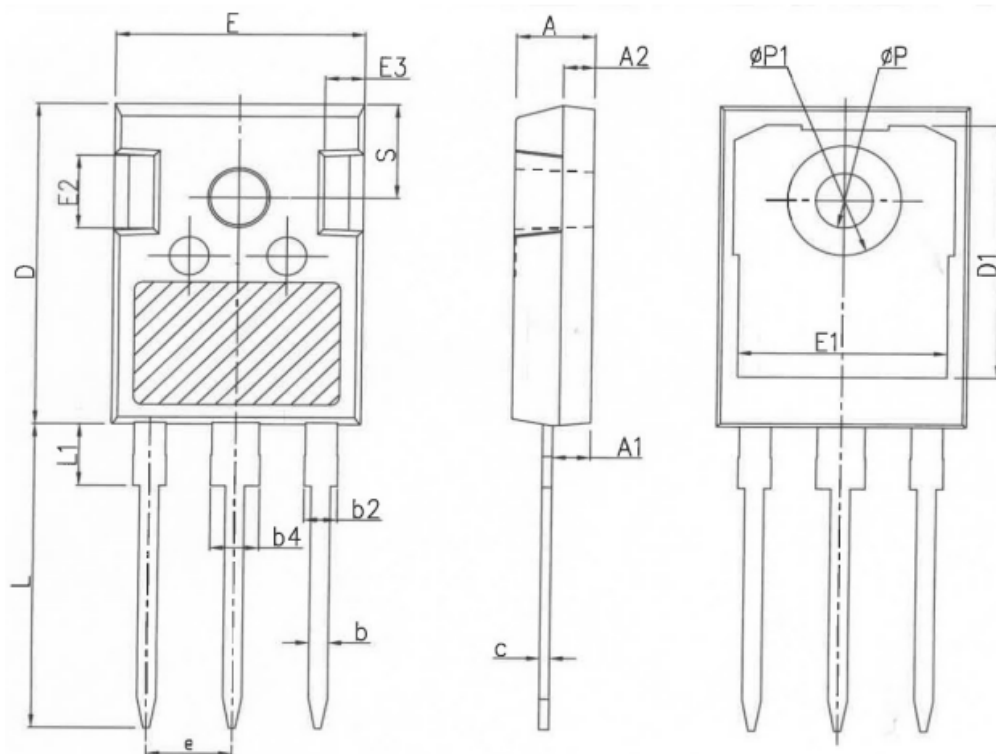
**Figure 17. Unclamped Inductive Load**

Unclamped inductive load test circuit and Unclamped inductive waveform



**Package Outlines**

**TO247-3L**



| SYMBOL   | MIN      | NOM   | MAX   |
|----------|----------|-------|-------|
| A        | 4.80     | 5.00  | 5.20  |
| A1       | 2.29     | 2.42  | 2.54  |
| A2       | 1.90     | 2.00  | 2.10  |
| b        | 1.10     | 1.20  | 1.30  |
| b1       | 1.91     | 2.06  | 2.20  |
| b2       | 2.92     | 3.06  | 3.20  |
| c        | 0.50     | 0.60  | 0.70  |
| D        | 20.80    | 21.07 | 21.34 |
| D1       | 17.43    | 17.63 | 17.83 |
| E        | 15.75    | 15.94 | 16.13 |
| E1       | 13.06    | 13.26 | 13.46 |
| E2       | 4.32     | 4.58  | 4.83  |
| e        | 5.45 BSC |       |       |
| L        | 19.85    | 20.05 | 20.25 |
| L1       | 4.05     | 4.27  | 4.49  |
| $\phi P$ | 3.55     | 3.60  | 3.65  |
| Q        | 5.59     | 5.89  | 6.19  |
| S        | 6.15 BSC |       |       |

\* Dimensions in millimeters

**Package Marking and Ordering Information**

| Part Number | Top Marking | Package | Packing Method | Quantity |
|-------------|-------------|---------|----------------|----------|
| BMW80N180C1 | BMW80N180C1 | TO247   | Tube           | 30 units |

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