



# BCL120N160W1

## N-Channel Silicon Carbide Power MOSFET

1200 V, 22 A, 160 mΩ

### Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

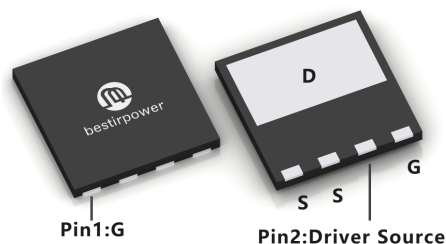
| $BV_{DSS}, T_c=25^{\circ}\text{C}$ | $I_D, T_c=25^{\circ}\text{C}$ | $R_{DS(on), typ}$ | $Q_{g, typ}$ |
|------------------------------------|-------------------------------|-------------------|--------------|
| 1200 V                             | 22 A                          | 160 mΩ            | 40 nC        |

### Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

### Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives
- Pulsed Power applications



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

| Symbol         | Parameter                                  | Test Conditions                       | Value      | Unit                  |
|----------------|--------------------------------------------|---------------------------------------|------------|-----------------------|
| $V_{DSmax}$    | Drain - Source Voltage                     | $V_{GS}=0V, I_D=100\mu A$             | 1200       | V                     |
| $V_{GSmax}$    | Gate - Source Voltage                      | Absolute maximum values               | -8 / +22   | V                     |
| $V_{GSop}$     | Gate - Source Voltage                      | Recommended operational values        | -5 / +18   | V                     |
| $I_D$          | Continuous Drain Current                   | $V_{GS}=18V, T_c=25^{\circ}\text{C}$  | 22         | A                     |
|                |                                            | $V_{GS}=18V, T_c=100^{\circ}\text{C}$ | 16         |                       |
| $I_{DM}$       | Pulse Drain Current                        | Pulse width limited by $T_{jmax}$     | 58         | A                     |
| $P_D$          | Power Dissipation                          | ( $T_c = 25^{\circ}\text{C}$ )        | 126        | W                     |
|                |                                            | Derate Above $25^{\circ}\text{C}$     | 0.84       | W/ $^{\circ}\text{C}$ |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature |                                       | -55 to 175 | $^{\circ}\text{C}$    |

### Thermal Characteristics

| Symbol          | Parameter                                                   | Value | Unit                        |
|-----------------|-------------------------------------------------------------|-------|-----------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.                  | 1.19  | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max.               | 27.47 |                             |
| $T_{sold}$      | Soldering temperature, wave soldering only allowed at leads | 260   | $^{\circ}\text{C}$          |

## Electrical Characteristics (T<sub>J</sub> = 25°C, Note1)

| Symbol              | Parameter                            | Test Conditions                                                                                                                          | Min  | Typ  | Max | Unit |
|---------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----|------|
| BV <sub>DSS</sub>   | Drain to Source Breakdown Voltage    | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μA                                                                                           | 1200 | -    | -   | V    |
| V <sub>GS(th)</sub> | Gate Threshold Voltage               | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 5.0 mA, T <sub>C</sub> = 25°C                                                       | 2.0  | 3.4  | 4.0 | V    |
|                     |                                      | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 5.0 mA, T <sub>C</sub> = 150°C                                                      | -    | 2.7  | -   |      |
| I <sub>DSS</sub>    | Zero Gate Voltage Drain Current      | V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = 0 V                                                                                          | -    | 10   | 100 | μA   |
| I <sub>GSS</sub>    | Gate-Source Leakage Current          | V <sub>GS</sub> = 18 V, V <sub>DS</sub> = 0 V                                                                                            | -    | 10   | 200 | nA   |
| R <sub>DS(on)</sub> | Static Drain to Source On Resistance | V <sub>GS</sub> = 18 V, I <sub>D</sub> = 10 A, T <sub>C</sub> = 25°C                                                                     | -    | 130  | 180 | mΩ   |
|                     |                                      | V <sub>GS</sub> = 15 V, I <sub>D</sub> = 10 A, T <sub>C</sub> = 25°C                                                                     | -    | 160  | 190 |      |
|                     |                                      | V <sub>GS</sub> = 18 V, I <sub>D</sub> = 10 A, T <sub>C</sub> = 150°C                                                                    | -    | 230  | -   |      |
| g <sub>fs</sub>     | Transconductance                     | V <sub>GS</sub> = 18 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 25°C                                                                     | -    | 6.2  | -   | S    |
|                     |                                      | V <sub>GS</sub> = 18 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 150°C                                                                    | -    | 3.7  | -   |      |
| C <sub>iss</sub>    | Input Capacitance                    | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 800 V, f = 1MHz,<br>V <sub>AC</sub> = 25 mV                                                      | -    | 818  | -   | pF   |
| C <sub>oss</sub>    | Output Capacitance                   |                                                                                                                                          | -    | 41   | -   |      |
| C <sub>rss</sub>    | Reverse Transfer Capacitance         |                                                                                                                                          | -    | 8    | -   |      |
| E <sub>ON</sub>     | Turn-On Switching Energy             | V <sub>DS</sub> = 800V, V <sub>GS</sub> = -5/18V, I <sub>D</sub> = 10A,<br>R <sub>G(ext)</sub> = 0Ω, L = 256μH                           | -    | 200  | -   | μJ   |
| E <sub>OFF</sub>    | Turn-Off Switching Energy            |                                                                                                                                          | -    | 50   | -   |      |
| t <sub>d(on)</sub>  | Turn-On Delay Time                   | V <sub>DS</sub> = 800V, V <sub>GS</sub> = -5/18V, I <sub>D</sub> = 100A,<br>R <sub>G(ext)</sub> = 0Ω, Timing relative to V <sub>DS</sub> | -    | 20   | -   | ns   |
| t <sub>r</sub>      | Rise Time                            |                                                                                                                                          | -    | 45   | -   |      |
| t <sub>d(off)</sub> | Turn-Off Delay Time                  |                                                                                                                                          | -    | 20   | -   |      |
| t <sub>f</sub>      | Fall Time                            |                                                                                                                                          | -    | 15   | -   |      |
| R <sub>G(int)</sub> | Internal Gate Resistance             | f = 1 MHz, V <sub>AC</sub> = 25mV open drain                                                                                             | -    | 10.0 | -   | Ω    |
| Q <sub>gs</sub>     | Gate to Source Charge                | V <sub>DD</sub> = 800V, V <sub>GS</sub> = -5/18V, I <sub>D</sub> = 10A                                                                   | -    | 9.6  | -   | nC   |
| Q <sub>gd</sub>     | Gate to Drain Charge                 |                                                                                                                                          | -    | 19   | -   |      |
| Q <sub>g</sub>      | Total Gate Charge                    |                                                                                                                                          | -    | 40   | -   |      |

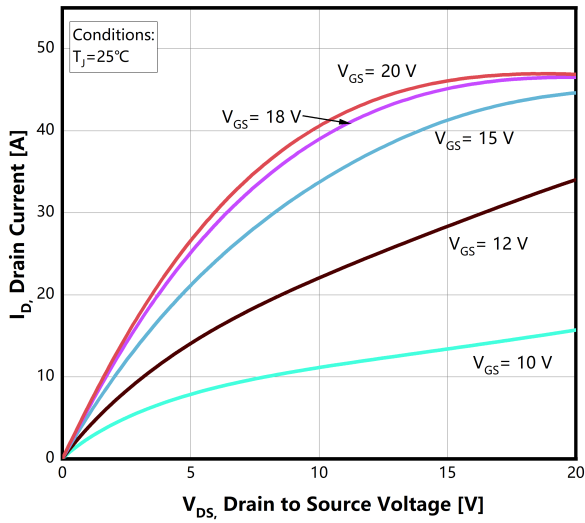
## Reverse Diode Characteristics

| Symbol           | Parameter                        | Test Conditions                                                                              | Min | Typ | Max | Unit |
|------------------|----------------------------------|----------------------------------------------------------------------------------------------|-----|-----|-----|------|
| V <sub>SD</sub>  | Diode Forward Voltage            | V <sub>GS</sub> = -5 V, I <sub>SD</sub> = 5 A, T <sub>J</sub> = 25°C                         | -   | 3.7 | -   | V    |
|                  |                                  | V <sub>GS</sub> = -5 V, I <sub>SD</sub> = 5 A, T <sub>J</sub> = 150°C                        | -   | 3.2 | -   |      |
| I <sub>S</sub>   | Continuous Diode Forward Current | T <sub>C</sub> = 25°C                                                                        | -   | -   | 30  | A    |
| t <sub>rr</sub>  | Reverse Recovery time            | V <sub>GS</sub> = -5V, I <sub>SD</sub> = 10 A, V <sub>R</sub> = 800V,<br>dif / dt = 1200A/μs | -   | 10  | -   | ns   |
| Q <sub>rr</sub>  | Reverse Recovery Charge          |                                                                                              | -   | 40  | -   | nC   |
| I <sub>rrm</sub> | Peak Reverse Recovery Current    |                                                                                              | -   | 3   | -   | A    |

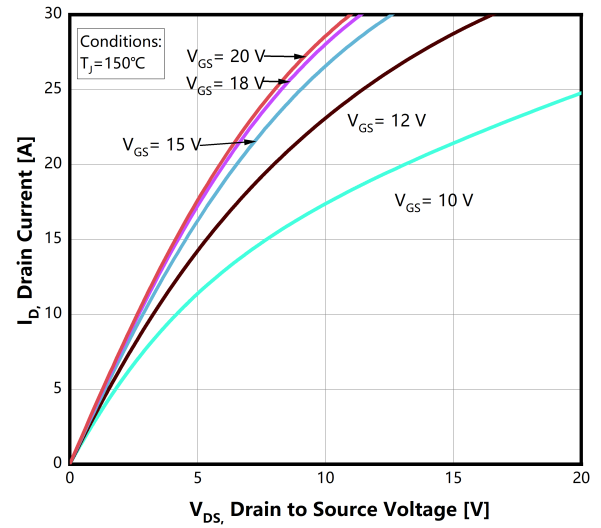
※. Note 1 : Limited by maximum junction temperature.

## Typical Performance Characteristics

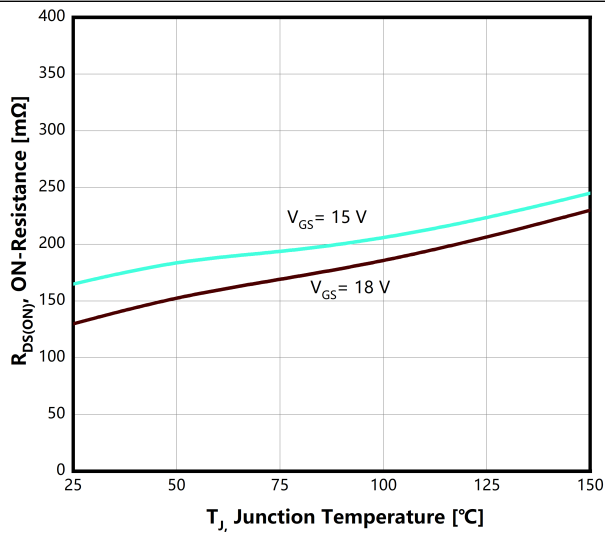
**Figure 1. On-Region Characteristics  $T_J = 25^\circ\text{C}$**



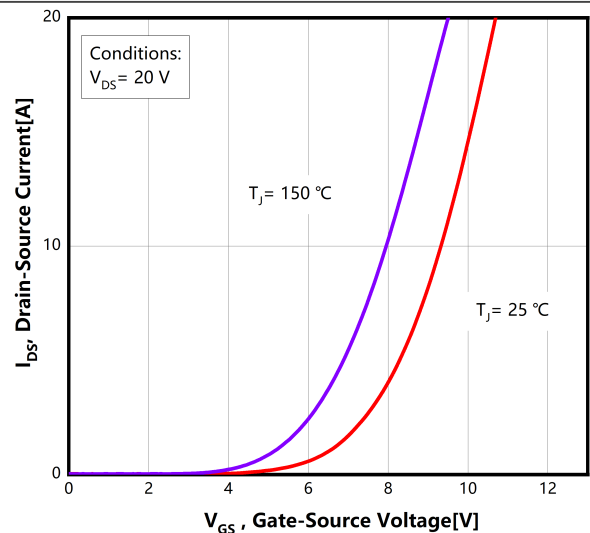
**Figure 2. On-Region Characteristics  $T_J = 150^\circ\text{C}$**



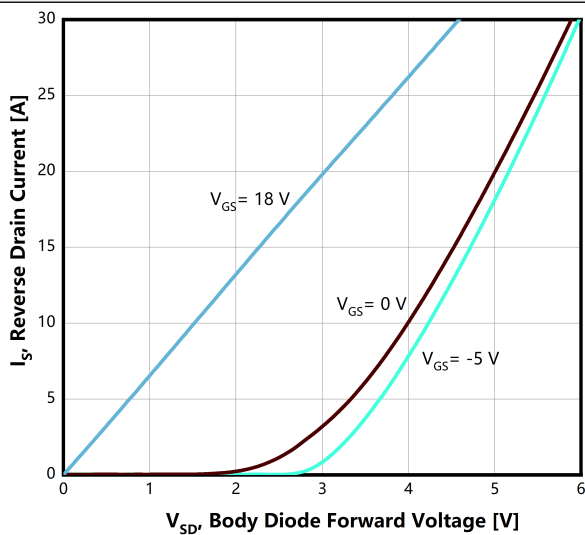
**Figure 3. On-Resistance Characteristics vs. Temperature**



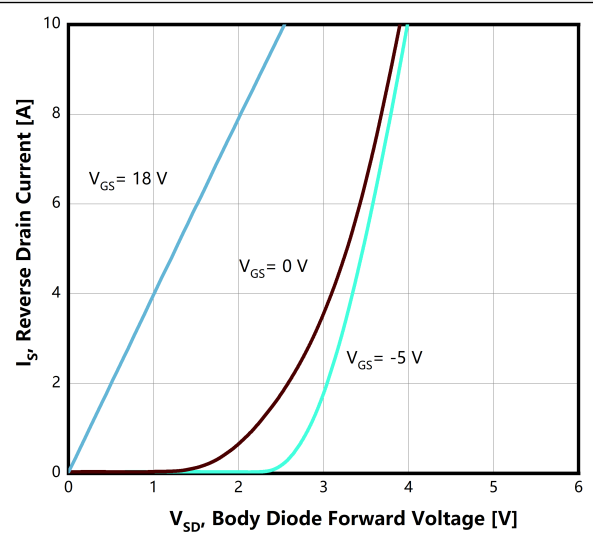
**Figure 4. Transfer Characteristics**



**Figure 5. Diode Forward Voltage Characteristics vs. Source-Drain Current  $T_J = 25^\circ\text{C}$**

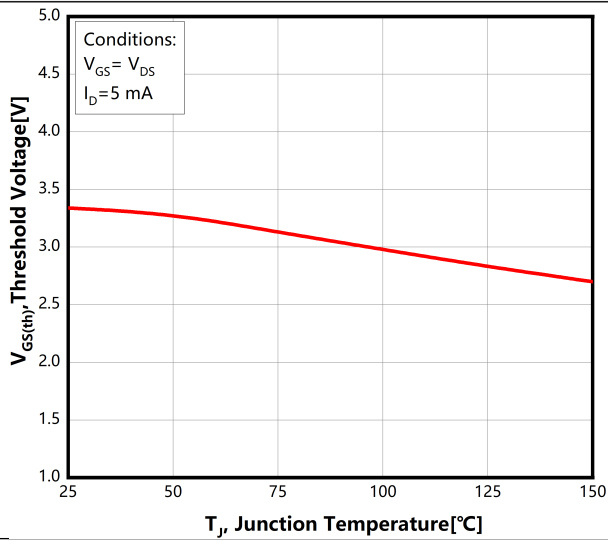


**Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current  $T_J = 150^\circ\text{C}$**

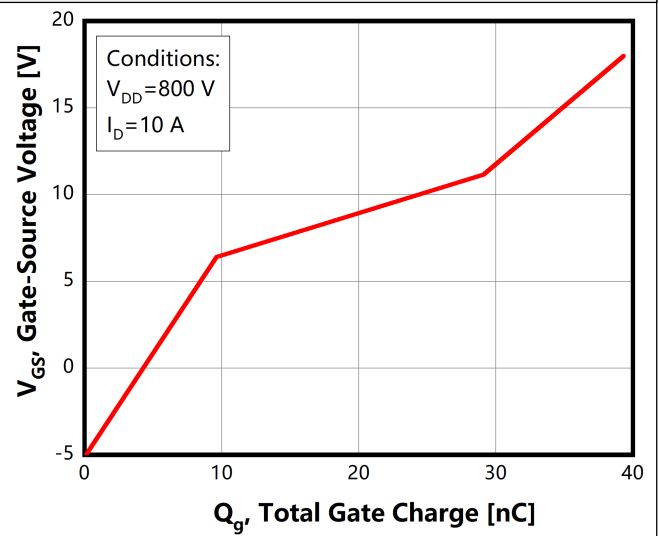


## Typical Performance Characteristics

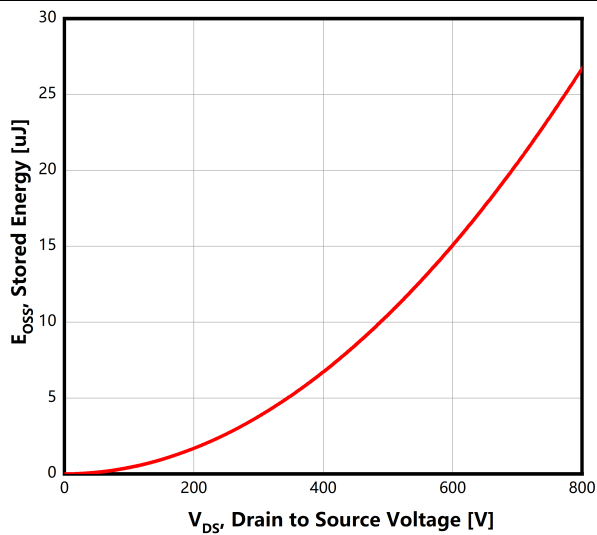
**Figure 7. Threshold Voltage vs. Temperature**



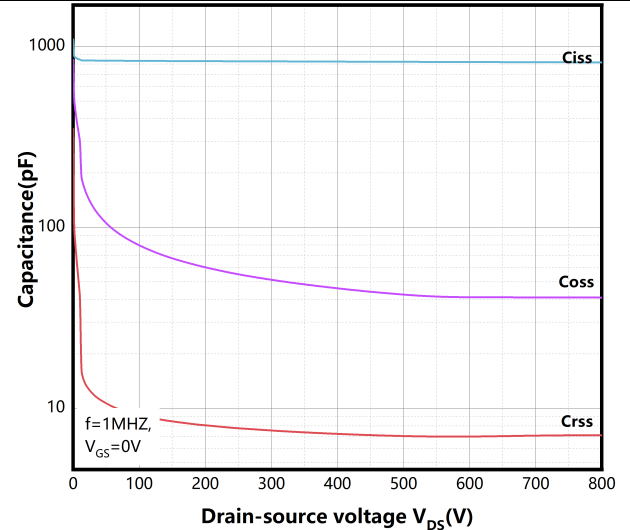
**Figure 8. Gate Charge Characteristics**



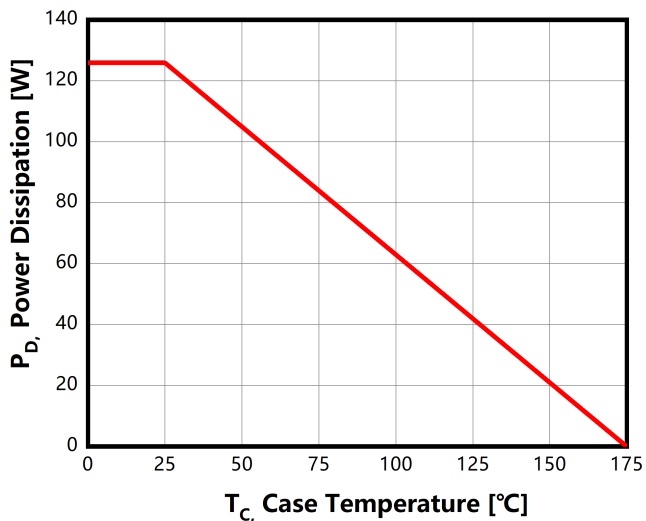
**Figure 9. Stored Energy in Output Capacitance**



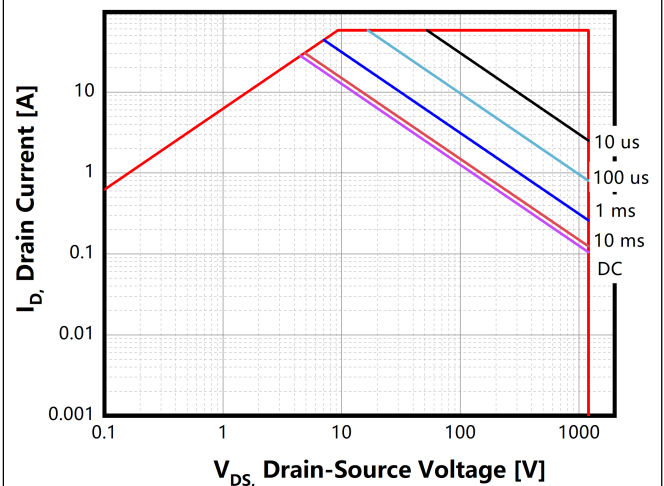
**Figure 10. Capacitance Characteristics**



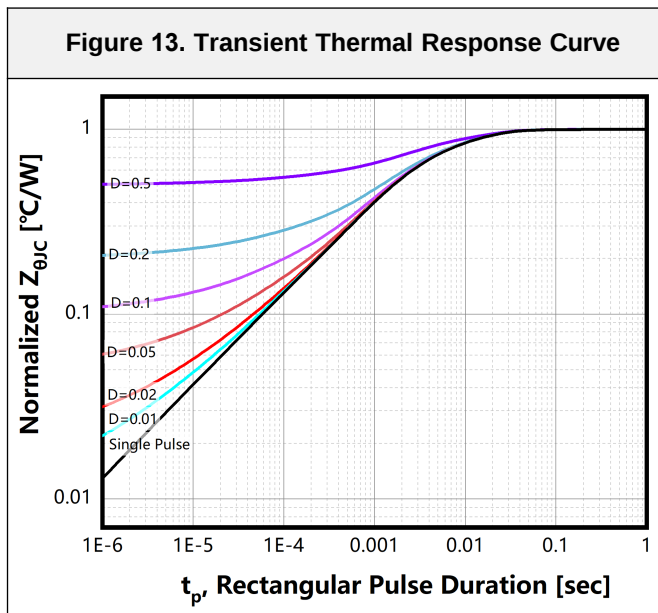
**Figure 11. Maximum Power Dissipation Derating vs. Case Temperature**



**Figure 12. Maximum Safe Operating Area**

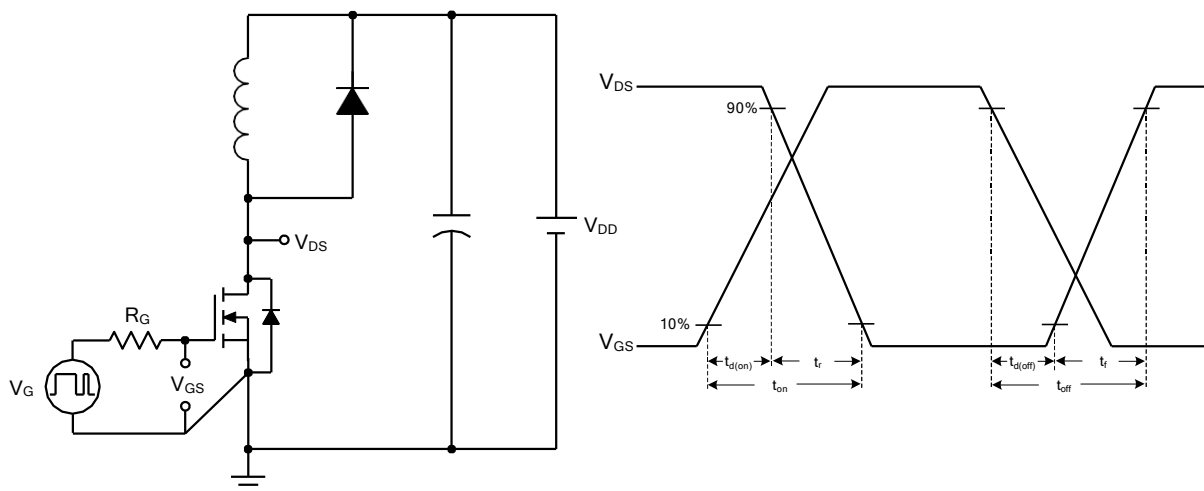


## Typical Performance Characteristics

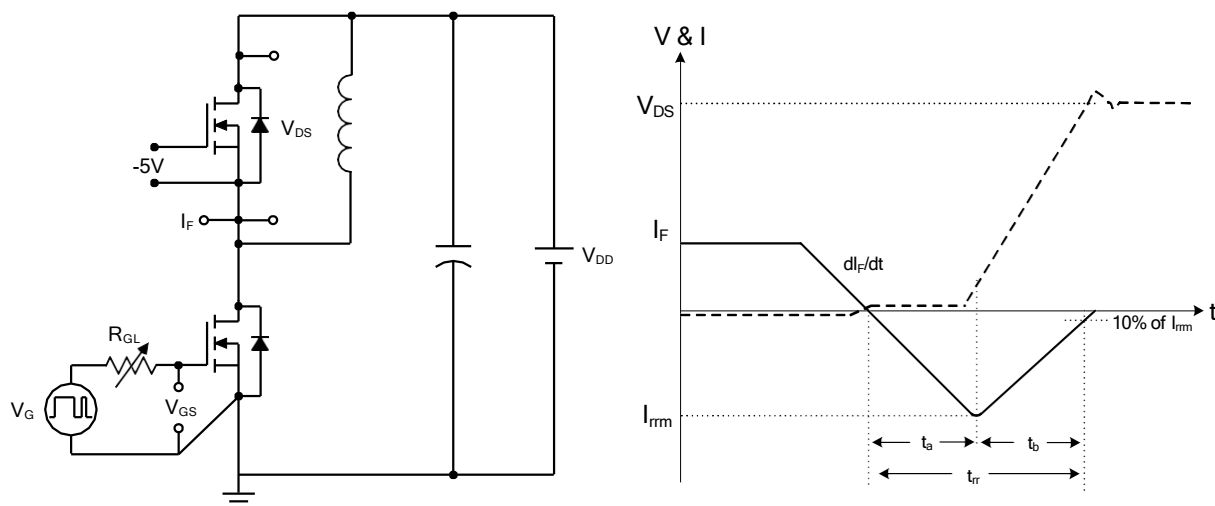


## Typical Performance Characteristics

**Figure 14. Inductive Load Switching Test Circuit and Waveforms**

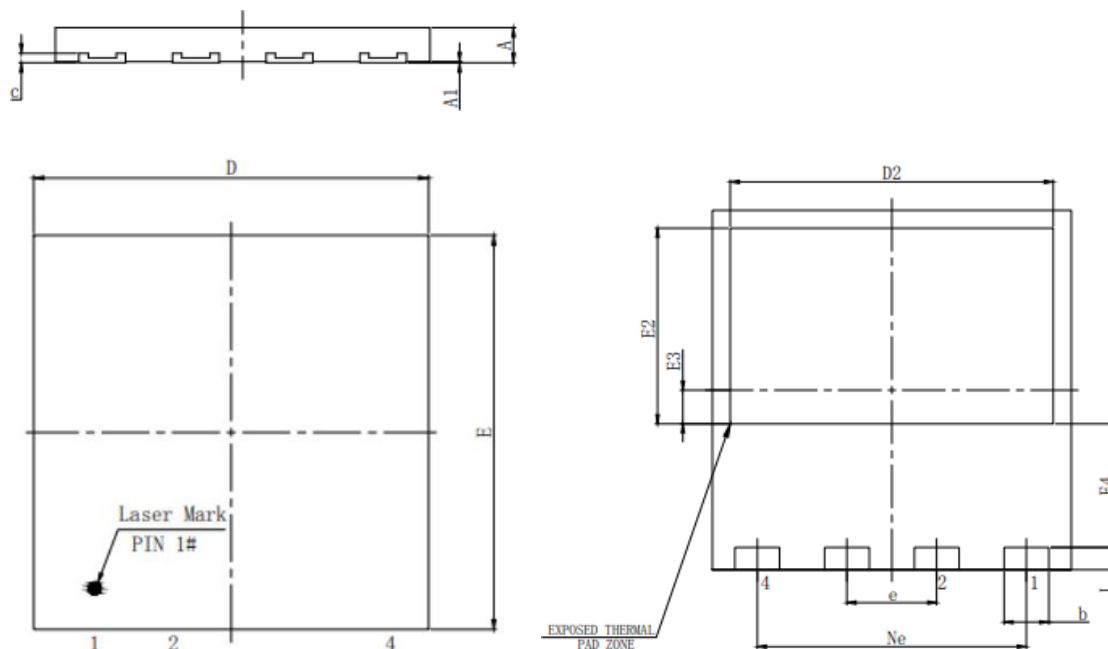


**Figure 15. Peak Diode Recovery dv/dt Test Circuit and Waveforms**



## Package Outlines

# DFN 8\*8



| Symbol | Dimensions In Millimeters |      |       |
|--------|---------------------------|------|-------|
|        | Min                       | Nom  | Max   |
| D      | 7.90                      | 8.00 | 8.10  |
| E      | 7.90                      | 8.00 | 8.10  |
| D2     | 7.10                      | 7.20 | 7.30  |
| E2     | 4.25                      | 4.35 | 4.45  |
| e      | 2.00BSC                   |      |       |
| E3     | 0.75REF                   |      |       |
| E4     | 2.75REF                   |      |       |
| Ne     | 6.00BSC                   |      |       |
| b      | 0.95                      | 1.00 | 1.05  |
| A      | 0.70                      | 0.75 | 0.80  |
| c      | 0.203REF                  |      |       |
| A1     | 0                         | /    | 0.050 |
| L      | 0.40                      | 0.50 | 0.55  |

## Package Marking and Ordering Information

| Part Number  | Top Marking  | Package | Packing Method | Quantity   |
|--------------|--------------|---------|----------------|------------|
| BCL120N160W1 | BCL120N160W1 | DFN8*8  | Tape & Reel    | 5000 units |

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