

# HRLF33N03K

## 30V N-Channel Trench MOSFET

### Features

- ❑ Low Dense Cell Design, Logic Level
- ❑ Reliable and Rugged
- ❑ Advanced Trench Process Technology
- ❑ 100% UIS Tested, 100% Rg Tested

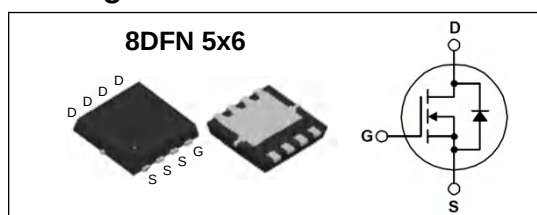
### Application

- ❑ Power Management in Inverter System
- ❑ Synchronous Rectification

### Key Parameters

| Parameter                | Value | Unit |
|--------------------------|-------|------|
| $BV_{DSS}$               | 30    | V    |
| $I_D$ (Silicon Limited)  | 85    | A    |
| $R_{DS(on)}$ , typ @10V  | 2.7   | mΩ   |
| $R_{DS(on)}$ , typ @4.5V | 3.2   | mΩ   |

### Package & Internal Circuit



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

| Symbol         | Parameter                               |                             | Value       | Units              |
|----------------|-----------------------------------------|-----------------------------|-------------|--------------------|
| $V_{DSS}$      | Drain-Source Voltage                    |                             | 30          | V                  |
| $V_{GS}$       | Gate-Source Voltage                     |                             | $\pm 16$    | V                  |
| $I_D$          | Drain Current (Silicon Limited)         | $T_C = 25^{\circ}\text{C}$  | 85          | A                  |
|                |                                         | $T_C = 100^{\circ}\text{C}$ | 54          | A                  |
|                | Drain Current (Package Limited)         | $T_C = 25^{\circ}\text{C}$  | 60          | A                  |
| $I_{DM}$       | Pulsed Drain Current                    |                             | 255         | A                  |
| $E_{AS}$       | Single Pulsed Avalanche Energy          | $L=1\text{mH}$              | 870         | mJ                 |
| $P_D$          | Power Dissipation                       | $T_C = 25^{\circ}\text{C}$  | 36          | W                  |
|                |                                         | $T_A = 25^{\circ}\text{C}$  | 2.0         | W                  |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range |                             | -55 to +150 | $^{\circ}\text{C}$ |

### Thermal Resistance Characteristics

| Symbol          | Parameter                          | Typ. | Max. | Units                |
|-----------------|------------------------------------|------|------|----------------------|
| $R_{\theta JC}$ | Junction-to-Case                   | --   | 3.5  | $^{\circ}\text{C/W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient (steady state) | --   | 62   | $^{\circ}\text{C/W}$ |

**Electrical Characteristics**  $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

| Symbol                             | Parameter                          | Test Conditions                                                            | Min | Typ  | Max  | Units |
|------------------------------------|------------------------------------|----------------------------------------------------------------------------|-----|------|------|-------|
| On Characteristics                 |                                    |                                                                            |     |      |      |       |
| V <sub>GS</sub>                    | Gate Threshold Voltage             | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                | 0.7 | --   | 2.0  | V     |
| R <sub>DS(ON)</sub>                | Static Drain-Source On-Resistance  | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A                              | --  | 2.7  | 3.3  | mΩ    |
|                                    |                                    | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 25 A                             | --  | 3.2  | 4.0  | mΩ    |
| g <sub>FS</sub>                    | Forward Transconductance           | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 30 A                               | --  | 65   | --   | S     |
| Off Characteristics                |                                    |                                                                            |     |      |      |       |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage     | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                             | 30  | --   | --   | V     |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current    | V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V                              | --  | --   | 1    | μA    |
|                                    |                                    | V <sub>DS</sub> = 24 V, T <sub>J</sub> = 125℃                              | --  | --   | 100  | μA    |
| I <sub>GSS</sub>                   | Gate-Body Leakage Current          | V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0 V                             | --  | --   | ±100 | nA    |
| Dynamic Characteristics            |                                    |                                                                            |     |      |      |       |
| C <sub>iss</sub>                   | Input Capacitance                  | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz                 | --  | 4900 | --   | pF    |
| C <sub>oss</sub>                   | Output Capacitance                 |                                                                            | --  | 550  | --   | pF    |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance       |                                                                            | --  | 500  | --   | pF    |
| R <sub>g</sub>                     | Gate Resistance                    | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 0 V, f = 1MHz                     | --  | 1    | --   | Ω     |
| Switching Characteristics          |                                    |                                                                            |     |      |      |       |
| t <sub>d(on)</sub>                 | Turn-On Time                       | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A, R <sub>G</sub> = 6 Ω        | --  | 30   | --   | ns    |
| t <sub>r</sub>                     | Turn-On Rise Time                  |                                                                            | --  | 50   | --   | ns    |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                |                                                                            | --  | 230  | --   | ns    |
| t <sub>f</sub>                     | Turn-Off Fall Time                 |                                                                            | --  | 70   | --   | ns    |
| Q <sub>g (10V)</sub>               | Total Gate Charge                  | V <sub>DS</sub> = 24 V, I <sub>D</sub> = 30 A, V <sub>GS</sub> = 10 V      | --  | 110  | --   | nC    |
| Q <sub>g (4.5V)</sub>              | Total Gate Charge                  |                                                                            | --  | 50   | --   | nC    |
| Q <sub>gs</sub>                    | Gate-Source Charge                 |                                                                            | --  | 15   | --   | nC    |
| Q <sub>gd</sub>                    | Gate-Drain Charge                  |                                                                            | --  | 20   | --   | nC    |
| Source-Drain Diode Characteristics |                                    |                                                                            |     |      |      |       |
| V <sub>SD</sub>                    | Source-Drain Diode Forward Voltage | I <sub>S</sub> = 30 A, V <sub>GS</sub> = 0 V                               | --  | --   | 1.3  | V     |
| trr                                | Reverse Recovery Time              | I <sub>S</sub> = 25 A, V <sub>GS</sub> = 0 V di <sub>F</sub> /dt = 50 A/μs | --  | 60   | --   | ns    |
| Qrr                                | Reverse Recovery Charge            |                                                                            | --  | 30   | --   | nC    |

# Typical Characteristics

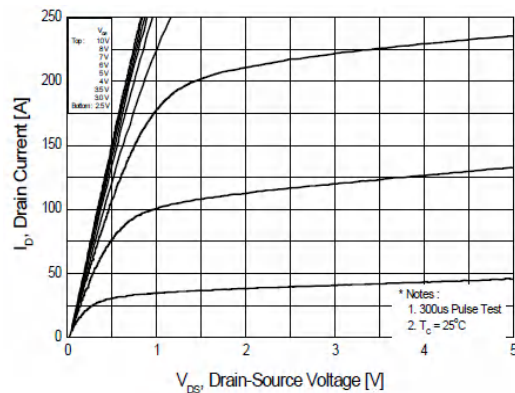


Figure 1. On Region Characteristics

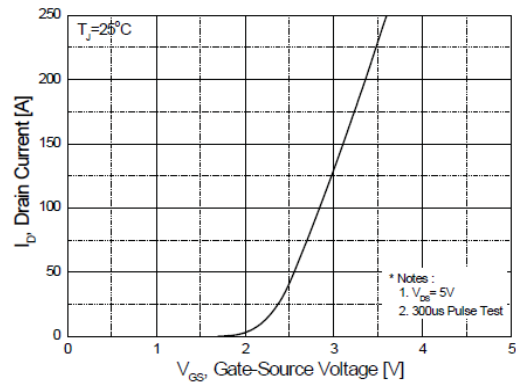


Figure 2. Transfer Characteristics

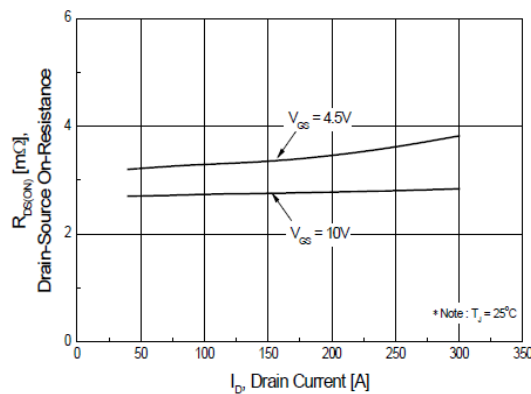


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

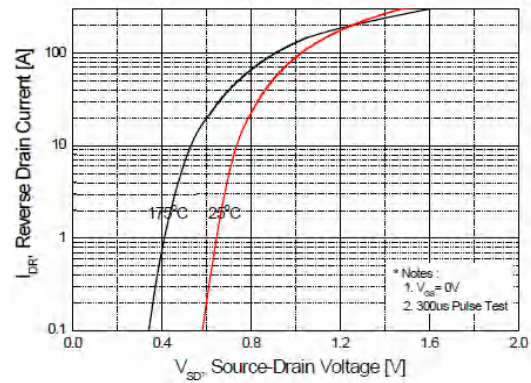


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

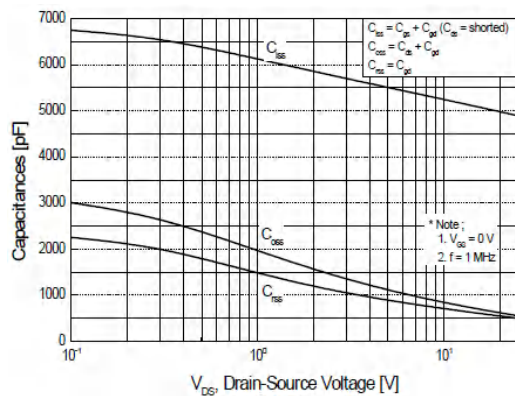


Figure 5. Capacitance Characteristics

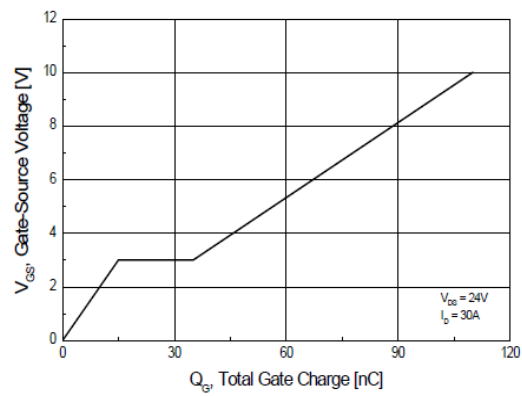


Figure 6. Gate Charge Characteristics

# Typical Characteristics (continued)

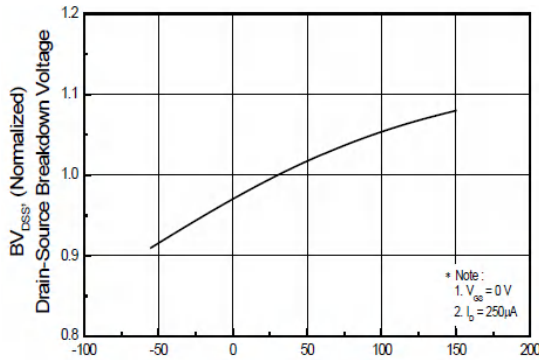


Figure 7. On-Resistance Variation vs Gate-Source Voltage

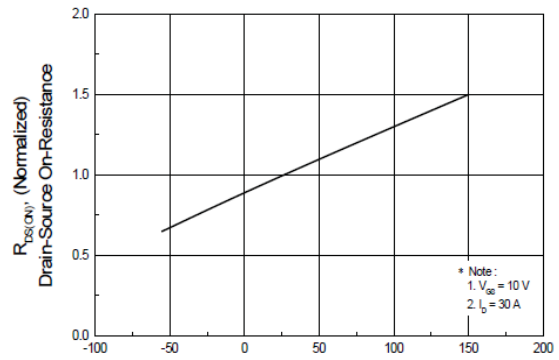


Figure 8. On-Resistance Variation vs Temperature

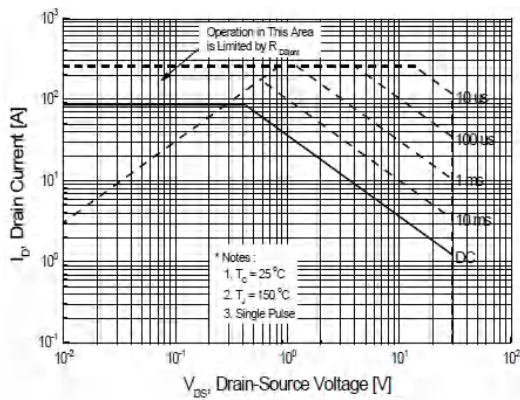


Figure 9. Maximum Safe Operating Area

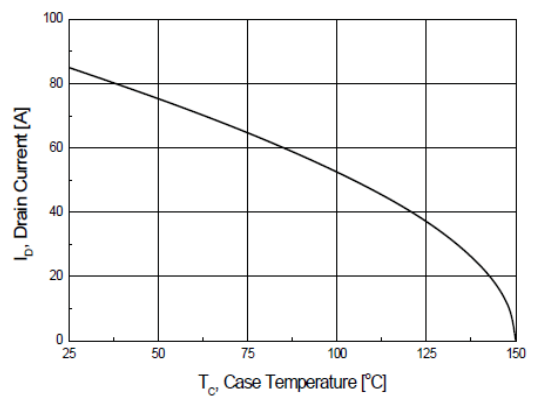


Figure 10. Maximum Drain Current vs Case Temperature

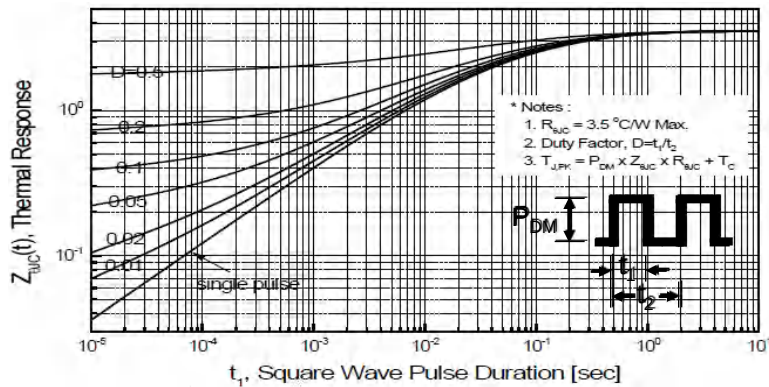


Figure 11. Transient Thermal Response Curve

Fig 12. Gate Charge Test Circuit & Waveform

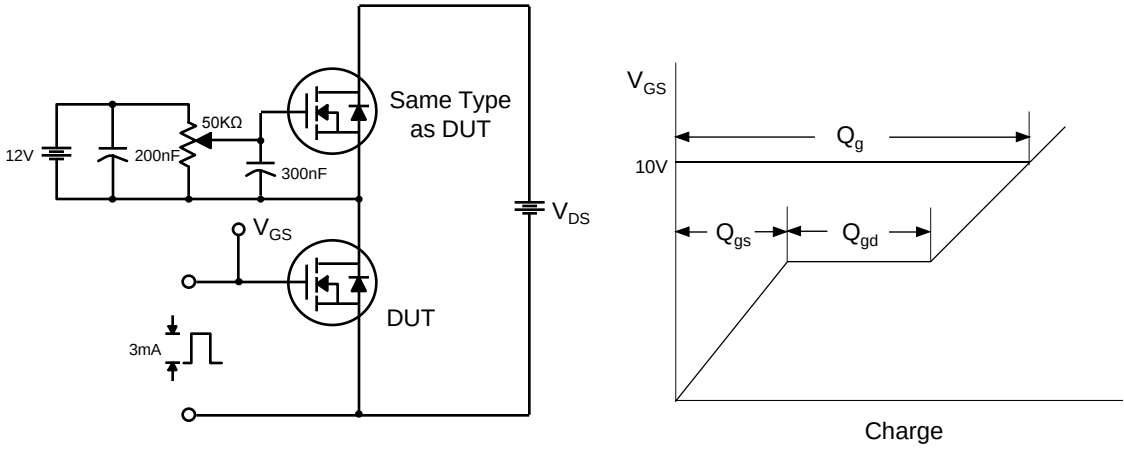


Fig 13. Resistive Switching Test Circuit & Waveforms

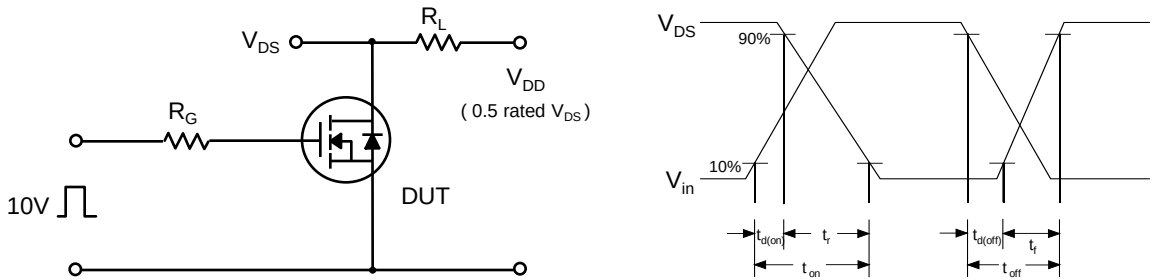


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

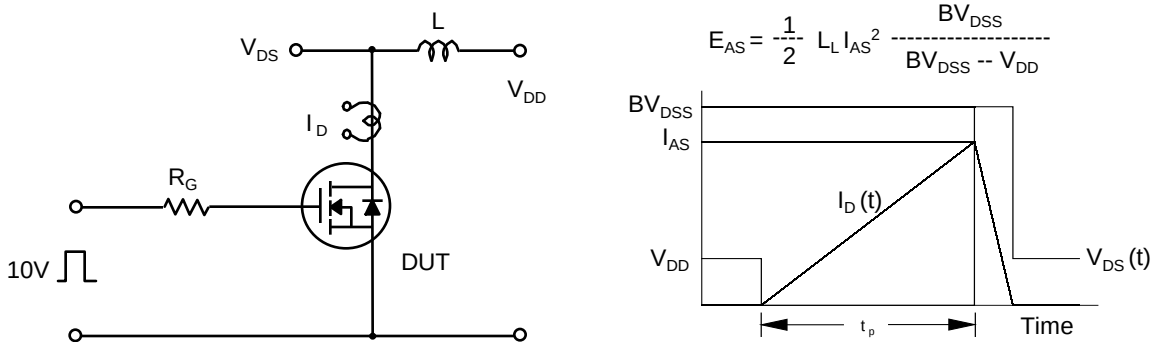
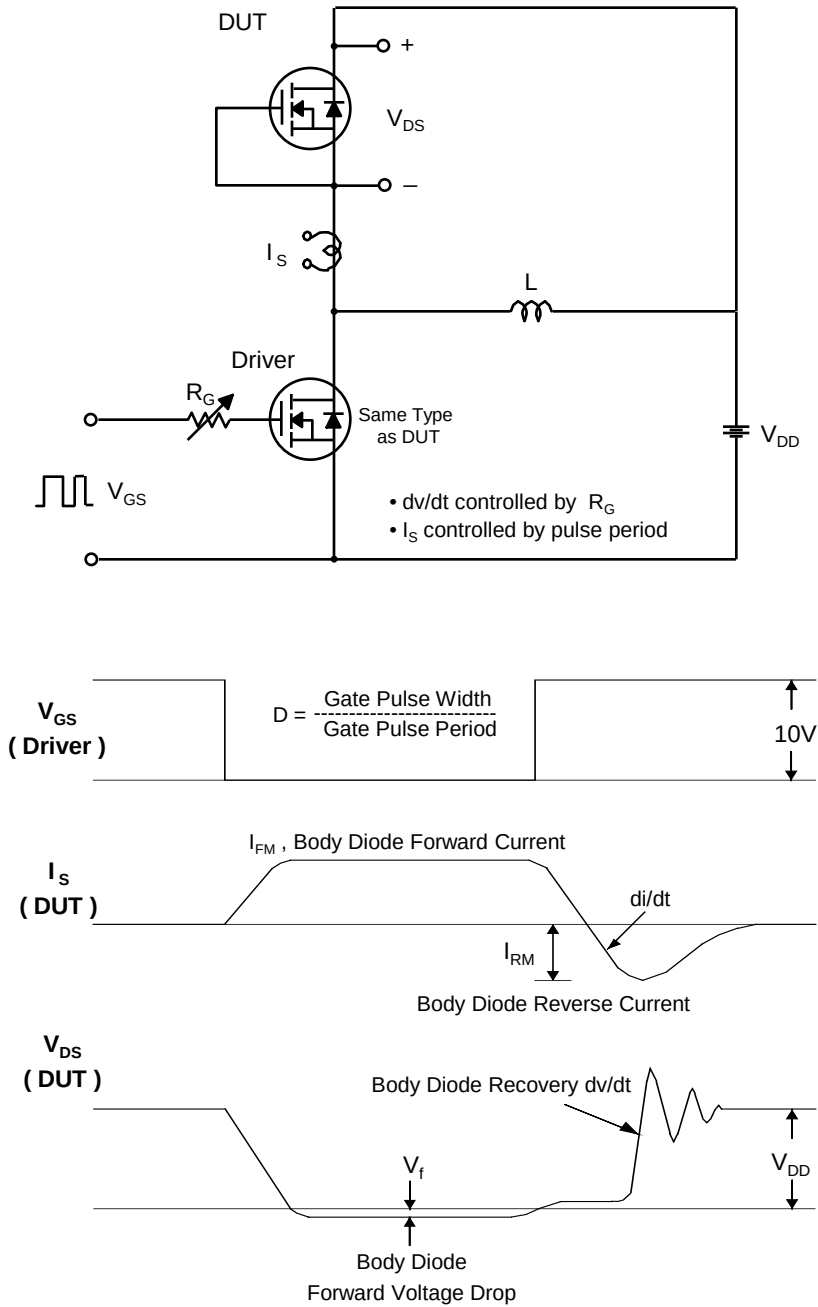
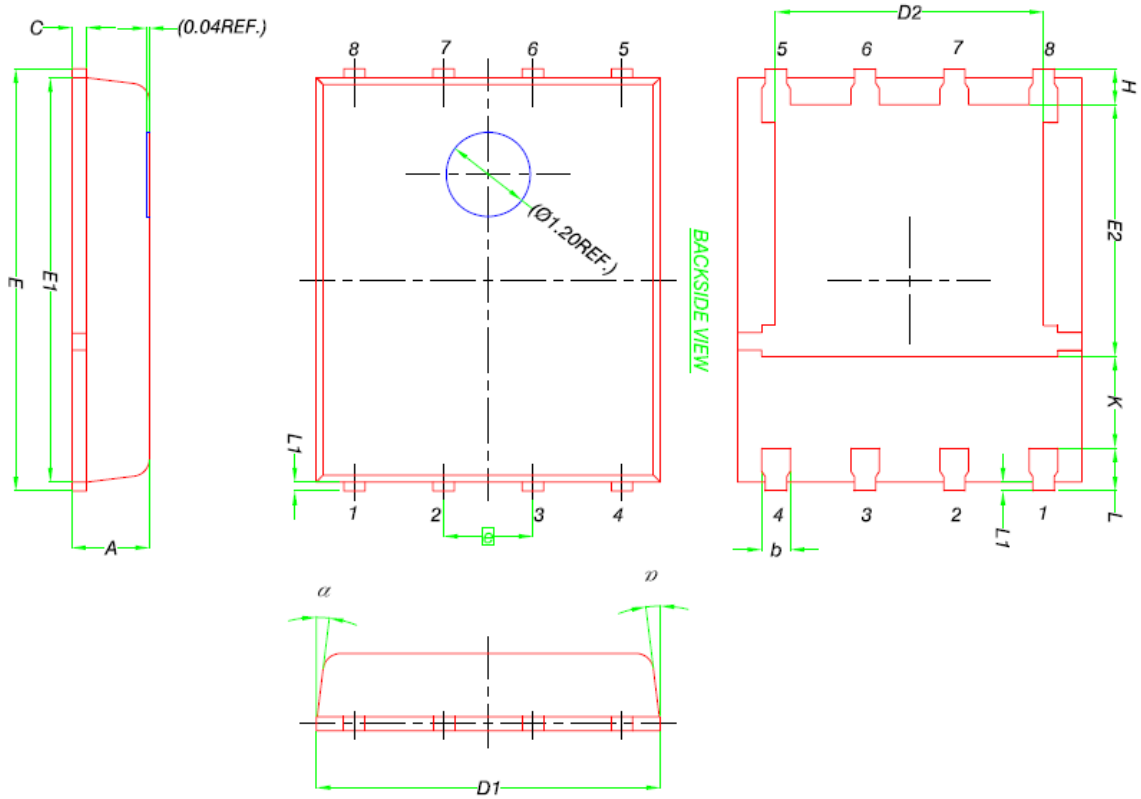


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Package Dimension

## 8DFN 5x6



| DIM. | MILLIMETERS |      |      |
|------|-------------|------|------|
|      | MIN.        | NOM. | MAX. |
| A    | 0.90        | 1.00 | 1.10 |
| b    | 0.33        | 0.41 | 0.51 |
| C    | 0.20        | 0.25 | 0.30 |
| D1   | 4.80        | 4.90 | 5.00 |
| D2   | 3.61        | 3.81 | 3.96 |
| E    | 5.90        | 6.00 | 6.10 |
| E1   | 5.70        | 5.75 | 5.80 |
| E2   | 3.38        | 3.58 | 3.78 |
| ⌀    | 1.27 BSC    |      |      |
| H    | 0.41        | 0.51 | 0.61 |
| K    | 1.10        | -    | -    |
| L    | 0.51        | 0.61 | 0.71 |
| L1   | 0.06        | 0.13 | 0.20 |
| α    | 0°          | -    | 12°  |

