

## 65V N-Ch Power MOSFET

### Feature

- ◇ High Speed Power Switching
- ◇ Enhanced Body diode dv/dt capability
- ◇ Enhanced Avalanche Ruggedness
- ◇ 100% UIS Tested, 100% Rg Tested
- ◇ Lead Free, Halogen Free

### Application

- ◇ Synchronous Rectification in SMPS
- ◇ Hard Switching and High Speed Circuit
- ◇ DC/DC in Telecoms and Industrial

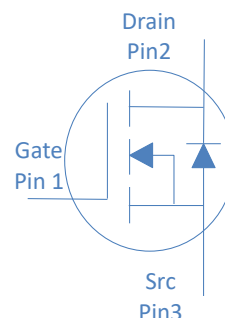
| Part Number | Package | Marking   |
|-------------|---------|-----------|
| KUGB046NE6A | TO-263  | GB046NE6A |
| KEGP046NE6A | TO-220  | GP046NE6A |

|                         |        |     |            |
|-------------------------|--------|-----|------------|
| $V_{DS}$                |        | 65  | V          |
| $R_{DS(on),typ}$        | TO-263 | 3.9 | m $\Omega$ |
| $R_{DS(on),typ}$        | TO-220 | 4.2 | m $\Omega$ |
| $I_D$ (Silicon Limited) |        | 108 | A          |

TO-220



TO-263



### Absolute Maximum Ratings at $T_j=25^{\circ}\text{C}$ (unless otherwise specified)

| Parameter                                  | Symbol            | Conditions                                  | Value      | Unit               |
|--------------------------------------------|-------------------|---------------------------------------------|------------|--------------------|
| Continuous Drain Current (Silicon Limited) | $I_D$             | $T_C=25^{\circ}\text{C}$                    | 108        | A                  |
|                                            |                   | $T_C=100^{\circ}\text{C}$                   | 76         |                    |
| Drain to Source Voltage                    | $V_{DS}$          | -                                           | 65         | V                  |
| Gate to Source Voltage                     | $V_{GS}$          | -                                           | $\pm 20$   | V                  |
| Pulsed Drain Current                       | $I_{DM}$          | -                                           | 340        | A                  |
| Avalanche Energy, Single Pulse             | $E_{AS}$          | $L=0.1\text{mH}$ , $T_C=25^{\circ}\text{C}$ | 31         | mJ                 |
| Power Dissipation                          | $P_D$             | $T_C=25^{\circ}\text{C}$                    | 107        | W                  |
| Operating and Storage Temperature          | $T_J$ , $T_{stg}$ | -                                           | -55 to 175 | $^{\circ}\text{C}$ |

### Absolute Maximum Ratings

| Parameter                           | Symbol          | Max | Unit                 |
|-------------------------------------|-----------------|-----|----------------------|
| Thermal Resistance Junction-Ambient | $R_{\theta JA}$ | 60  | $^{\circ}\text{C/W}$ |
| Thermal Resistance Junction-Case    | $R_{\theta JC}$ | 1.4 | $^{\circ}\text{C/W}$ |

**Electrical Characteristics at  $T_j=25^{\circ}\text{C}$  (unless otherwise specified)**

**Static Characteristics**

| Parameter                         | Symbol        | Conditions                                       | Value |     |           | Unit      |
|-----------------------------------|---------------|--------------------------------------------------|-------|-----|-----------|-----------|
|                                   |               |                                                  | min   | typ | max       |           |
| Drain to Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$                        | 65    | -   | -         | V         |
| Gate Threshold Voltage            | $V_{GS(th)}$  | $V_{GS}=V_{DS}, I_D=250\mu A$                    | 2.0   | 2.7 | 4.0       |           |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{GS}=0V, V_{DS}=60V, T_j=25^{\circ}\text{C}$  | -     | -   | 1         | $\mu A$   |
|                                   |               | $V_{GS}=0V, V_{DS}=60V, T_j=100^{\circ}\text{C}$ | -     | -   | 100       |           |
| Gate to Source Leakage Current    | $I_{GSS}$     | $V_{GS}=\pm 20V, V_{DS}=0V$                      | -     | -   | $\pm 100$ | nA        |
| Drain to Source on Resistance     | $R_{DS(on)}$  | $V_{GS}=10V, I_D=20A$ TO-263                     | -     | 3.9 | 4.6       | $m\Omega$ |
| Drain to Source on Resistance     | $R_{DS(on)}$  | $V_{GS}=10V, I_D=20A$ TO-220                     | -     | 4.2 | 4.9       | $m\Omega$ |
| Transconductance                  | $g_{fs}$      | $V_{DS}=5V, I_D=20A$                             | -     | 50  | -         | S         |
| Gate Resistance                   | $R_G$         | $V_{GS}=0V, V_{DS}$ Open, $f=1\text{MHz}$        | -     | 1.2 | -         | $\Omega$  |

**Dynamic Characteristics**

|                               |              |                                                  |   |      |   |    |
|-------------------------------|--------------|--------------------------------------------------|---|------|---|----|
| Input Capacitance             | $C_{iss}$    | $V_{GS}=0V, V_{DS}=30V, f=1\text{MHz}$           | - | 2373 | - | pF |
| Output Capacitance            | $C_{oss}$    |                                                  | - | 769  | - |    |
| Reverse Transfer Capacitance  | $C_{rss}$    |                                                  | - | 45   | - |    |
| Total Gate Charge             | $Q_g(10V)$   | $V_{DD}=30V, I_D=20A, V_{GS}=10V$                | - | 41   | - | nC |
| Gate to Source Charge         | $Q_{gs}$     |                                                  | - | 10   | - |    |
| Gate to Drain (Miller) Charge | $Q_{gd}$     |                                                  | - | 10   | - |    |
| Turn on Delay Time            | $t_{d(on)}$  | $V_{DD}=30V, I_D=20A, V_{GS}=10V, R_G=10\Omega,$ | - | 11   | - | ns |
| Rise time                     | $t_r$        |                                                  | - | 7    | - |    |
| Turn off Delay Time           | $t_{d(off)}$ |                                                  | - | 35   | - |    |
| Fall Time                     | $t_f$        |                                                  | - | 9    | - |    |

**Reverse Diode Characteristics**

|                         |          |                                        |   |     |     |    |
|-------------------------|----------|----------------------------------------|---|-----|-----|----|
| Diode Forward Voltage   | $V_{SD}$ | $V_{GS}=0V, I_F=30A$                   | - | 0.9 | 1.2 | V  |
| Reverse Recovery Time   | $t_{rr}$ | $V_R=30V, I_F=20A, dI_F/dt=400A/\mu s$ | - | 35  | -   | ns |
| Reverse Recovery Charge | $Q_{rr}$ |                                        | - | 88  | -   | nC |

Fig 1. Typical Output Characteristics

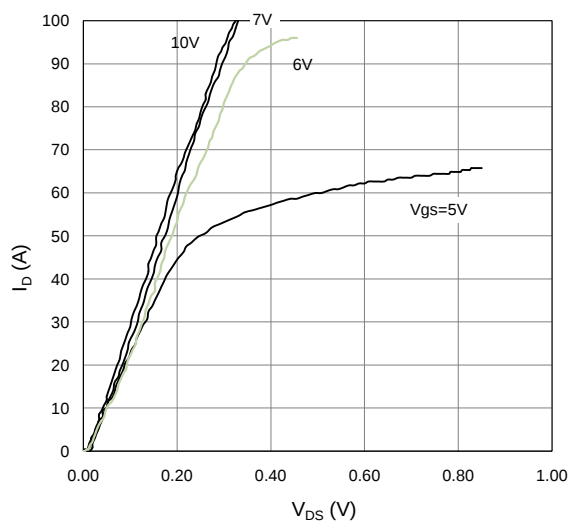


Figure 2. On-Resistance vs. Gate-Source Voltage

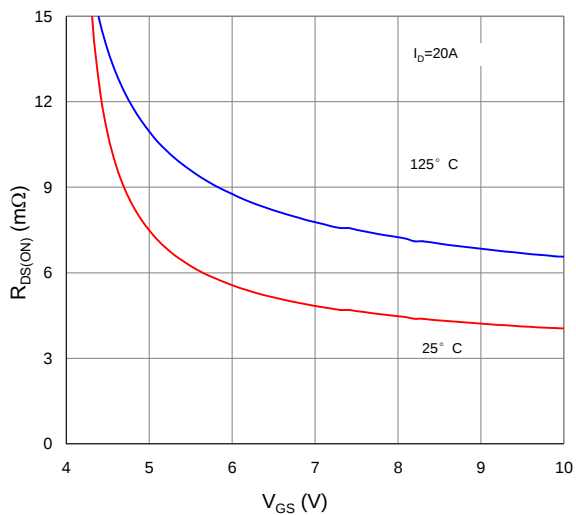


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

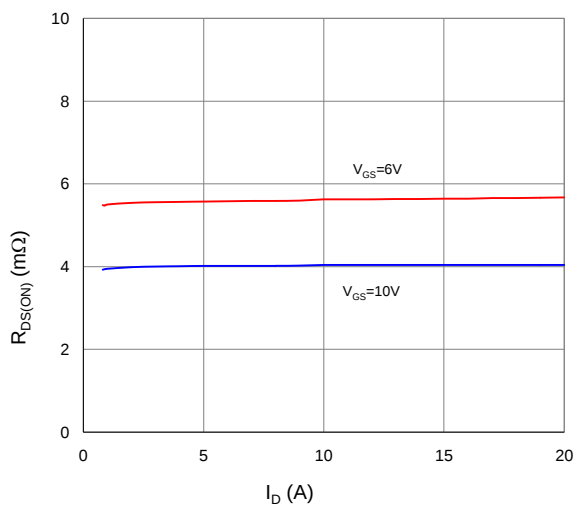


Figure 4. Normalized On-Resistance vs. Junction Temperature

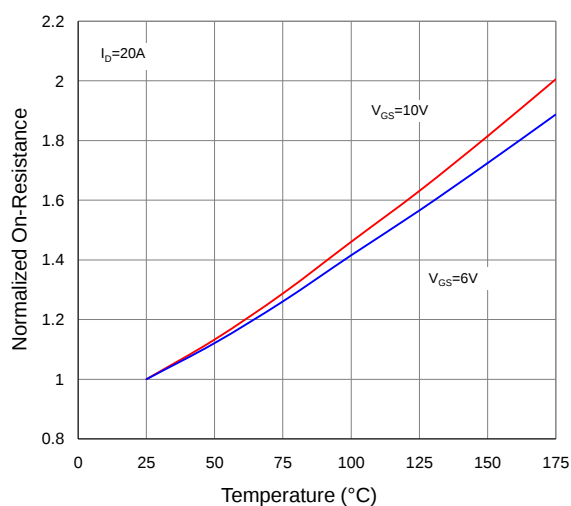


Figure 5. Typical Transfer Characteristics

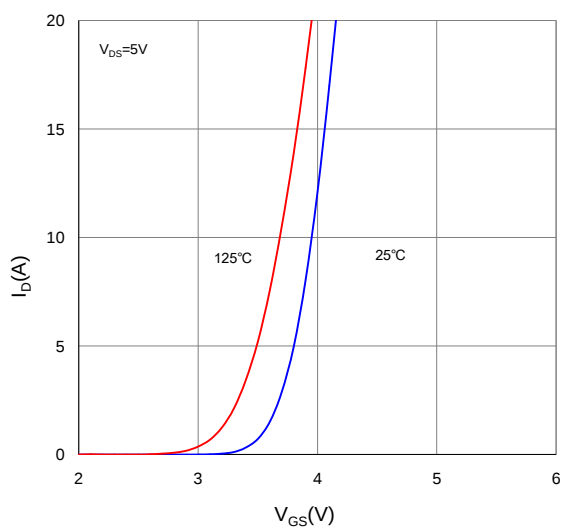


Figure 6. Typical Source-Drain Diode Forward Voltage

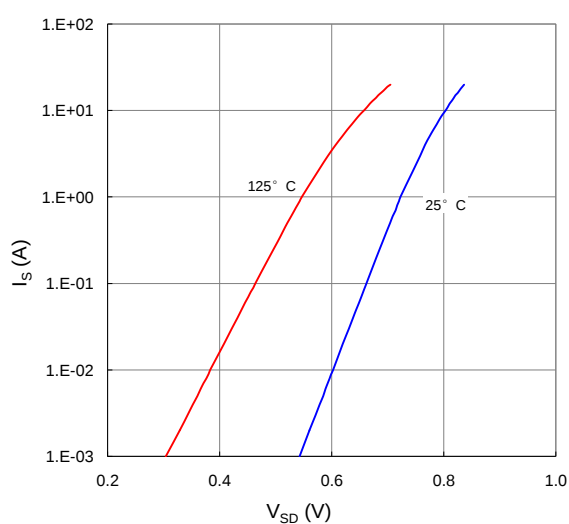


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

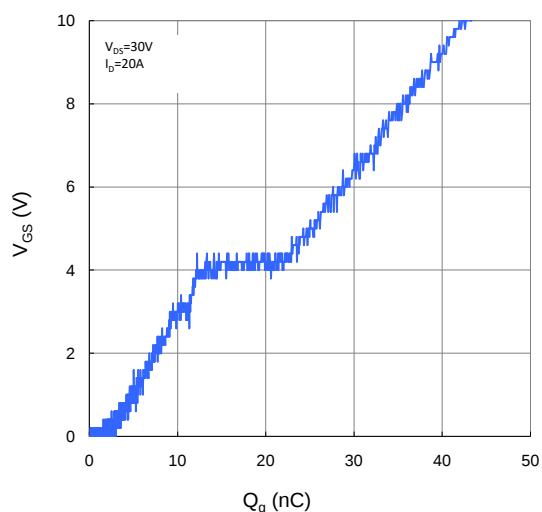


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

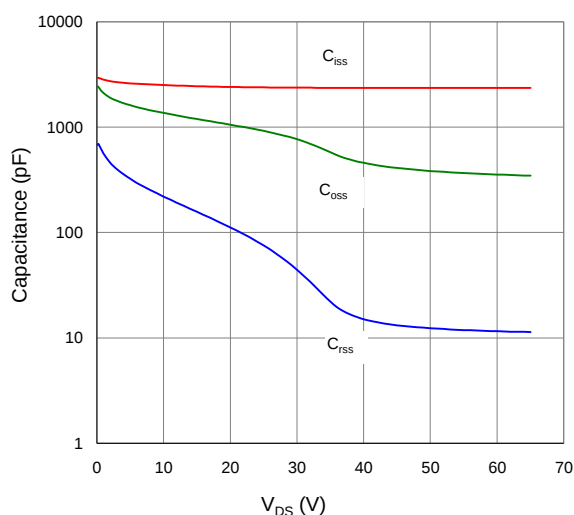


Figure 9. Maximum Safe Operating Area

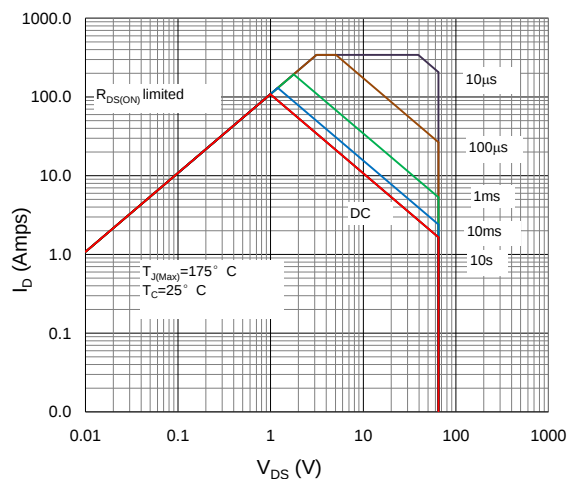


Figure 10. Maximum Drain Current vs. Case Temperature

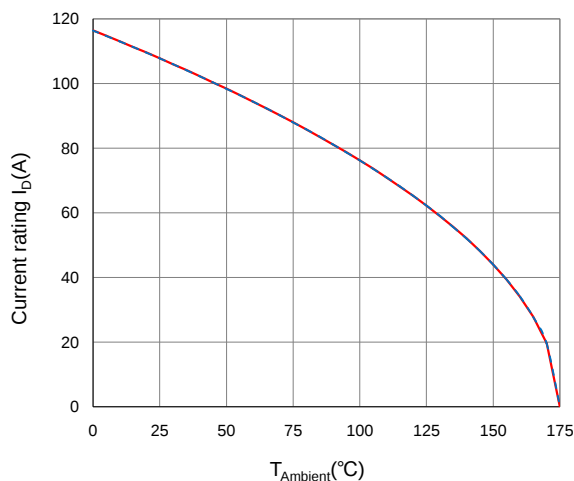
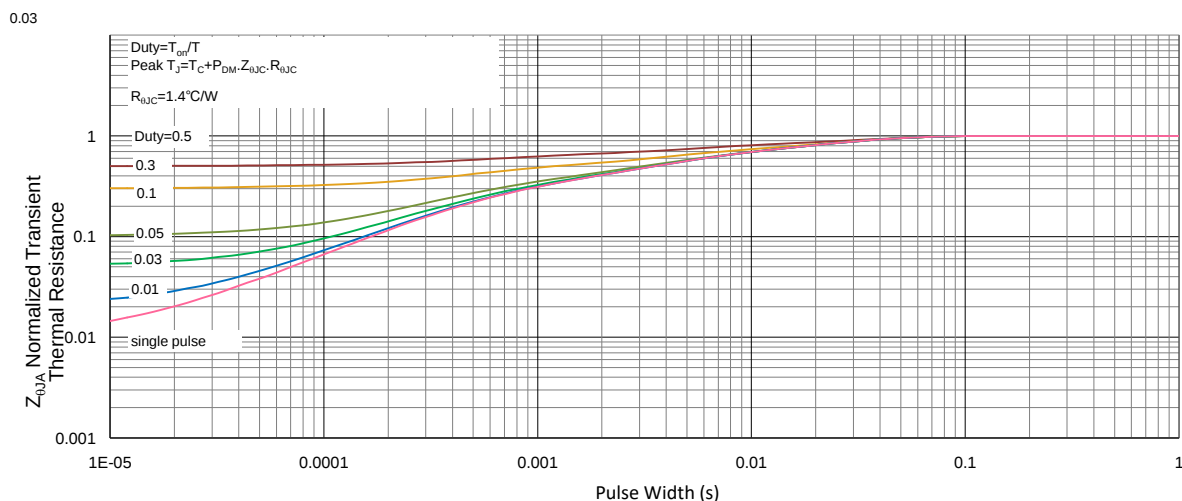
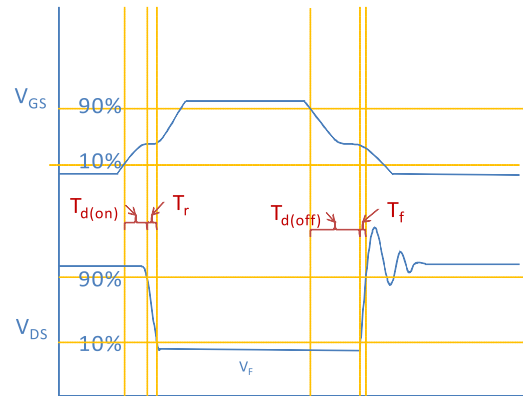
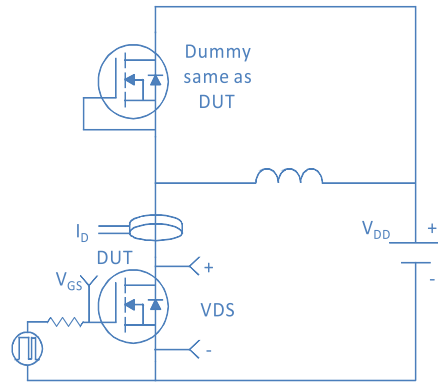


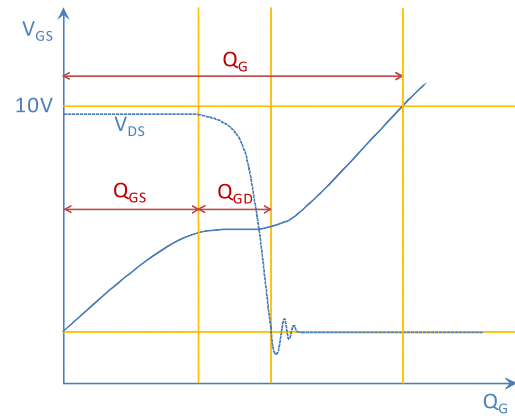
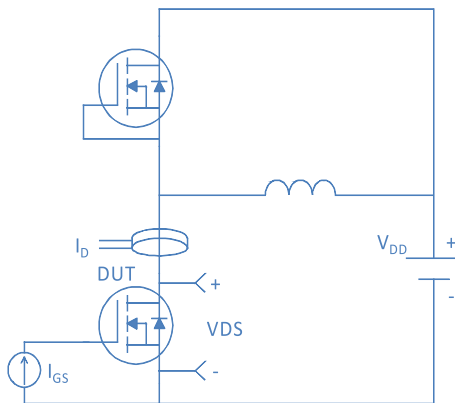
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Ambient



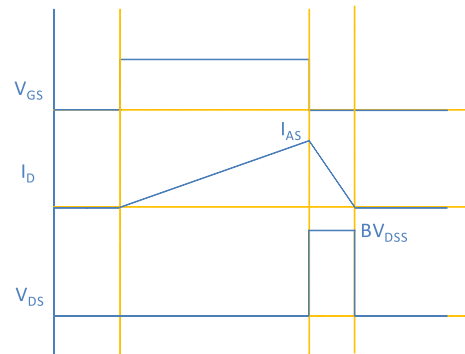
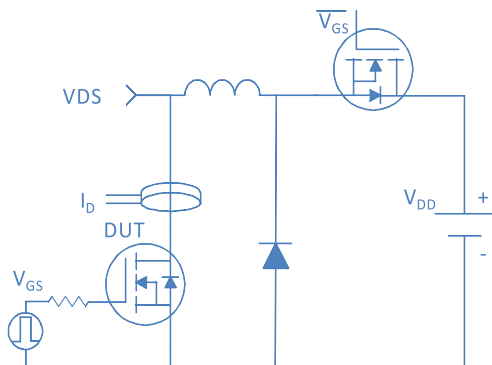
### Inductive switching Test



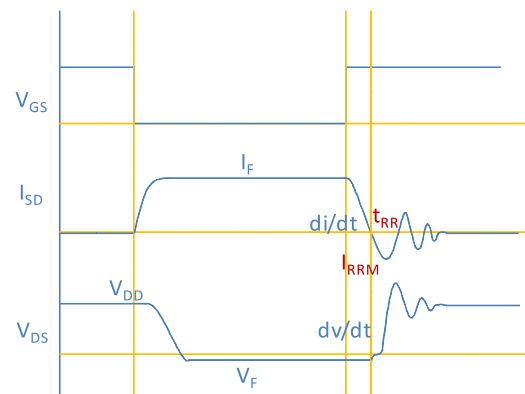
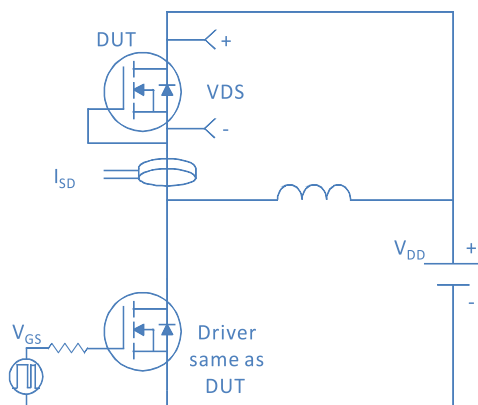
### Gate Charge Test



### Uclamped Inductive Switching (UIS) Test



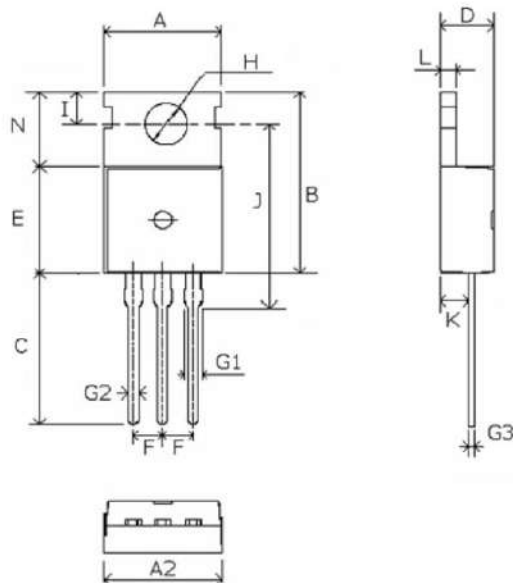
### Diode Recovery Test



## Package Outline

### TO-220, 3 leads

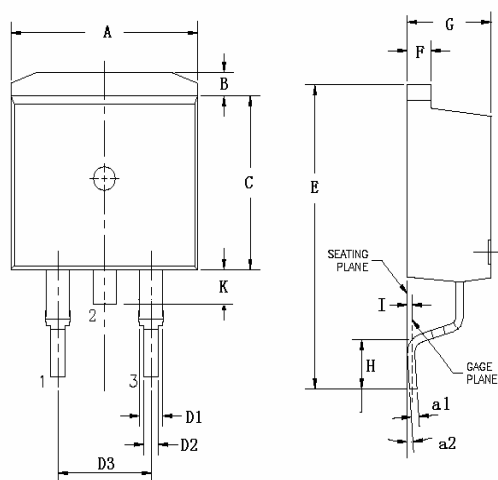
Dimintions in mm unless otherwise specified



| Symbol | Min   | Nom   | Max   |
|--------|-------|-------|-------|
| A      | 9.66  | 9.97  | 10.28 |
| A2     | 9.80  | 10.00 | 10.20 |
| B      | 15.60 | 15.70 | 15.80 |
| C      | 12.70 | 13.48 | 14.27 |
| D      | 4.30  | 4.50  | 4.70  |
| E      | 9.00  | 9.20  | 9.40  |
| F      |       | 2.54  |       |
| G1     | 1.32  | 1.52  | 1.72  |
| G2     | 0.70  | 0.82  | 0.95  |
| G3     | 0.45  | 0.52  | 0.60  |
| H      | 3.50  | 3.60  | 3.70  |
| I      | 2.70  | 2.80  | 2.90  |
| J      | 15.70 | 15.97 | 16.25 |
| K      | 2.20  | 2.40  | 2.60  |
| L      | 1.15  | 1.27  | 1.40  |
| N      | 6.40  | 6.60  | 6.80  |

### TO-263, 3 leads

Dimintions in mm unless otherwise specified



| Symbol     | Min   | Nom   | Max   |
|------------|-------|-------|-------|
| A          | 9.66  | 9.97  | 10.28 |
| B          | 1.02  | 1.17  | 1.32  |
| C          | 8.59  | 9.00  | 9.40  |
| D1         | 1.14  | 1.27  | 1.40  |
| D2         | 0.70  | 0.83  | 0.95  |
| D3         |       | 5.08  |       |
| E          | 15.09 | 15.24 | 15.39 |
| F          | 1.15  | 1.28  | 1.40  |
| G          | 4.30  | 4.50  | 4.70  |
| H          | 2.29  | 2.54  | 2.79  |
| I          |       | 0.25  |       |
| K          | 1.30  | 1.45  | 1.60  |
| a1         | 0.45  | 0.55  | 0.65  |
| a2(degree) | 0°    |       | 8°    |