| | | |
|---|---|---|
| $V_{GS}$=4.5V | 9.5 | m |
| | 44 | A |

| Part Number | Marking |
|---|---|
| HGA093N12SL | GA093N12SL |

## Absolute Maximum Ratings at $T_j$=25℃ (unless otherwise specified)

| | Symbol | Conditions | Value | |
|---|---|---|---|---|
| Continuous Drain Current (Silicon Limited) | $I_D$ | $T_C$=25℃ | 44 | A |
| | | $T_C$=100℃ | 31 | |
| Drain to Source Voltage | $V_{DS}$ | - | 120 | V |
| Gate to Source Voltage | | | | |
| Pulsed Drain Current | | - | 250 | |
| Avalanche Energy, Single Pulse | | | | |
| Operating and Storage Temperature | $T_J$, $T_{stg}$ | - | -55 to175 | |

| Parameter | Symbol | | Unit |
|---|---|---|---|
| Thermal Resistance Junction-Ambient | $R_{JA}$ | 65 | ℃/W |
| Thermal Resistance Junction-Case | $R_{JC}$ | | ℃/W |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | $V_{DS}$=5V, I | - | 70 | - | S |
| Gate Resistance | $R_G$ | $V_{GS}$=0V, $V_{DS}$ Open, f=1MHz | - | 1 | - | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=60V, f=1MHz | - | 2626 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 329 | - | |
| | $C_{rss}$ | | - | 11 | - | |
| Total Gate Charge | $Q_g$(10V) | $V_{DD}$=60V, $I_D$=20A, $V_{GS}$=10V | - | 38 | - | nC |
| Total Gate Charge | $Q_g$(4.5V) | | - | 18 | - | |
| Gate to Source Charge | $Q_{gs}$ | | - | 7 | - | |
| Gate to Drain (Miller) Charge | $Q_{gd}$ | | - | 5 | - | |
| Turn on Delay Time | $t_{d(on)}$ | $V_{DD}$=60V, $I_D$=20A, $V_{GS}$=10V, $R_G$=10 , | - | 13 | - | ns |
| Rise time | $t_r$ | | - | 7 | - | |
| Turn off Delay Time | $t_{d(off)}$ | | - | 22 | - | |
| Fall Time | $t_f$ | | - | 9 | - | |

### Reverse Diode Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_F$=20A | - | 0.9 | 1.2 | V |
| Reverse Recovery Time | $t_{rr}$ | $V_R$=60V, $I_F$=20A, $dI_F/dt$=100A/ s | - | 53 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 58 | - | nC |

Fig 1. Typical Output Characteristics

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

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

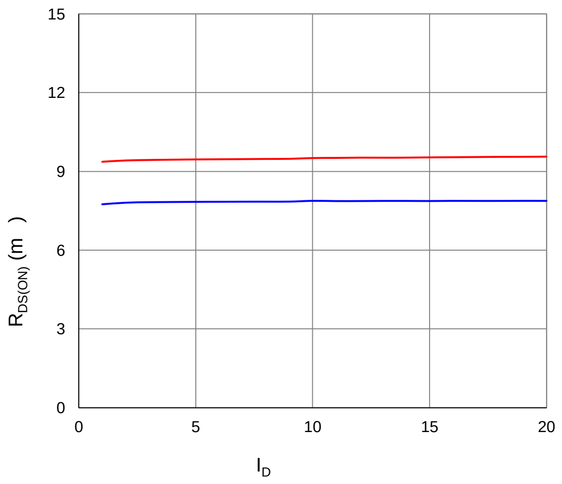


Figure 4. Normalized On-Resistance vs. Junction Temperature

Figure 5. Typical Transfer Characteristics

Figure 6. Typical Source-Drain Diode Forward Voltage

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

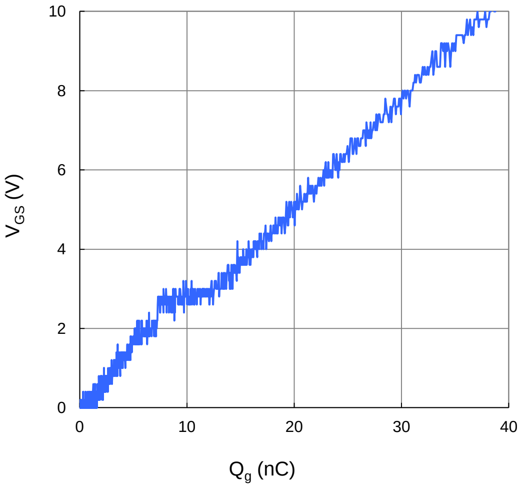


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

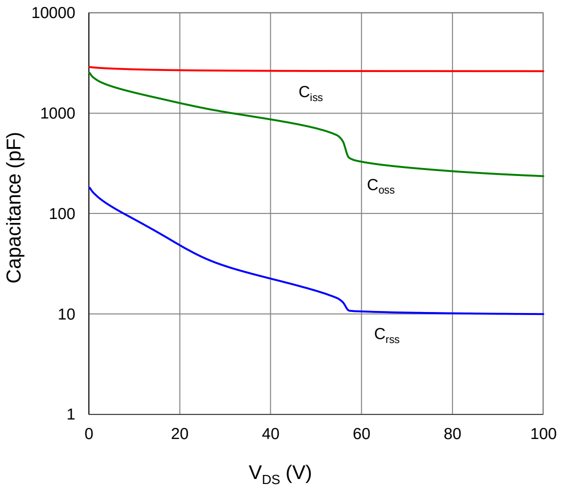


Figure 9. Maximum Safe Operating Area

Figure 10. Maximun Drain Current vs. Case Temperature

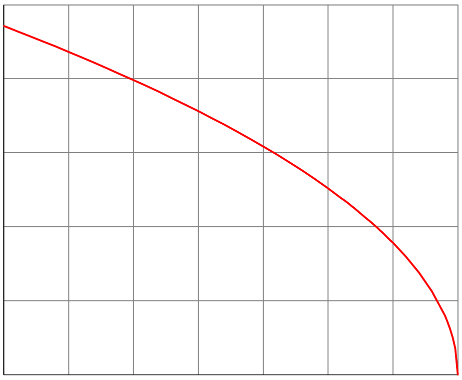
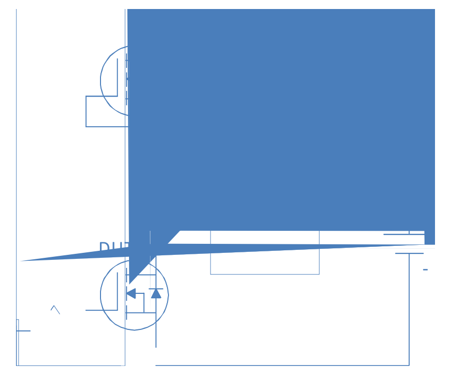
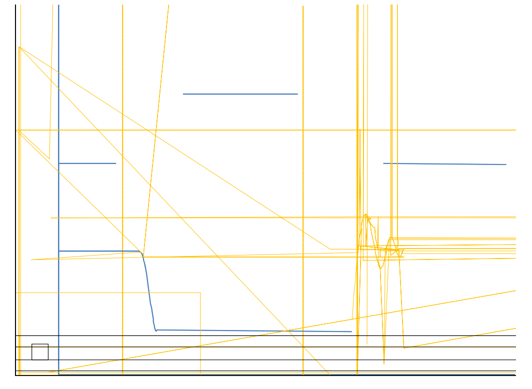


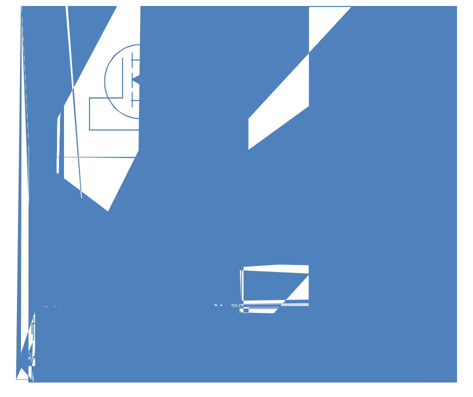
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Ambient

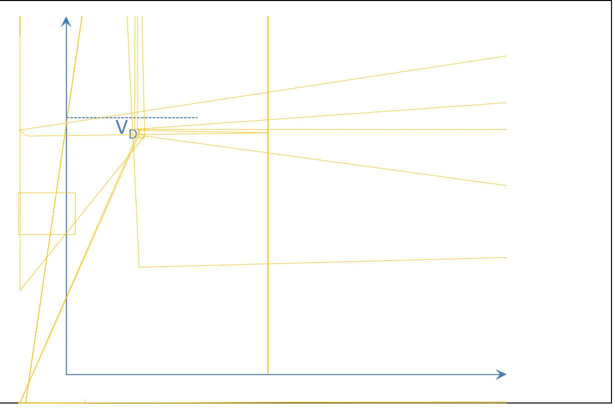
## Inductive switching Test



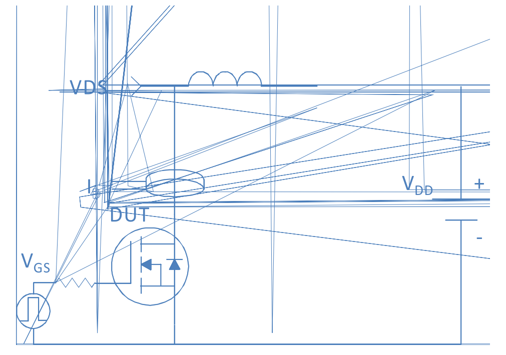


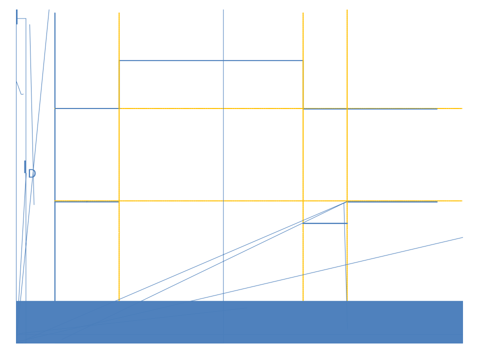
## Gate Charge Test



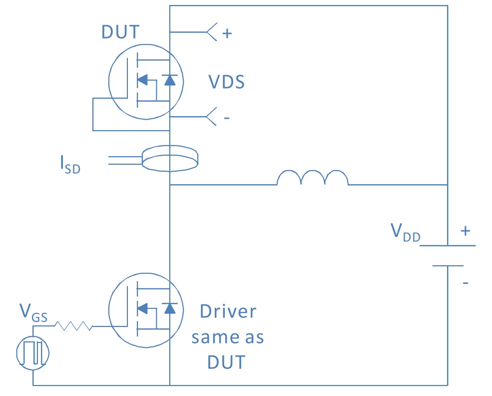


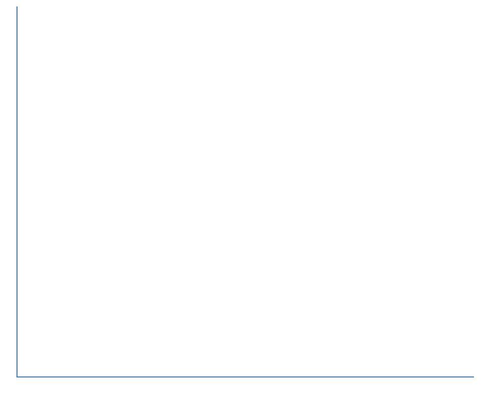
## Uclamped Inductive Switching (UIS) Test





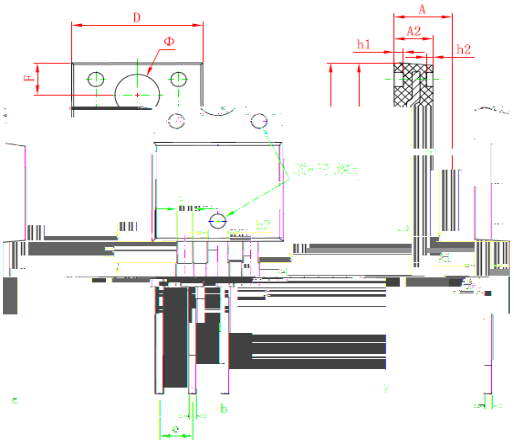
## Diode Recovery Test





Package Outline

## TO-220F, 3 leads



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.300 | 4.700 | 0.169 | 0.185 |
| A1 | 1.300 REF. | | 0.051 REF. | |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | 9.960 | 10.360 | 0.392 | 0.408 |
| [illegible] | 14.800 | 15.200 | 0.583 | 0.598 |
| [illegible] | 2.540 TYP. | | 0.100 TYP. | |
| [illegible] | 2.700 REF. | | 0.106 REF. | |
| Φ | 3.500 REF. | | 0.138 REF. | |
| [illegible] | 0.000 | 0.300 | 0.000 | 0.012 |
| h1 | 0.800 REF. | | 0.031 REF. | |
| h2 | 0.500 REF. | | 0.020 REF. | |
| L | 28.000 | 28.400 | 1.102 | 1.118 |
| L1 | 1.700 | 1.900 | 0.067 | 0.075 |
| L2 | 1.900 | 2.100 | 0.075 | 0.083 |