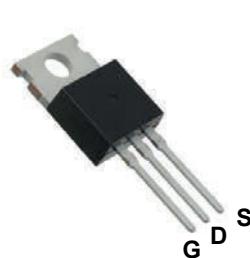
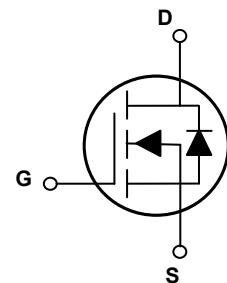


## Main Product Characteristics

|               |              |
|---------------|--------------|
| $V_{(BR)DSS}$ | 600V         |
| $R_{DS(ON)}$  | 0.19Ω (Max.) |
| $I_D$         | 20A          |



TO-220



Schematic Diagram

## Features and Benefits

- Advanced MOSFET process technology
- Ideal for high efficiency switched mode power supplies
- Low on-resistance with low gate charge
- Fast switching and reverse body recovery



## Description

The GSFH60R190 utilizes the latest techniques to achieve high cell density and low on-resistance. These features make this device extremely efficient and reliable for use in high efficiency switch mode power supplies and a wide variety of other applications.

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

| Parameter  | Symbol          | Parameter.  | Unit                      |
|--|-----------------|-------------|---------------------------|
| Drain-Source Voltage   | $V_{DS}$        | 600         | V                         |
| Gate-to-Source Voltage   | $V_{GS}$        | $\pm 30$    | V                         |
| Continuous Drain Current, @ Steady-State ( $T_C=25^\circ\text{C}$ )  | $I_D$           | 20          | A                         |
| Continuous Drain Current, @ Steady-State ( $T_C=100^\circ\text{C}$ ) |                 | 12          | A                         |
| Pulsed Drain Current   | $I_{DM}$        | 80          | A                         |
| Power Dissipation ( $T_C=25^\circ\text{C}$ )                         | $P_D$           | 66          | W                         |
|  |                 | 0.52        | W/ $^\circ\text{C}$       |
| Single Pulse Avalanche Energy <sup>1</sup>                           | $E_{AS}$        | 967         | mJ                        |
| Body Diode Reverse Voltage Slope <sup>2</sup>                        | $dv/dt$         | 15          | V/ns                      |
| MOS $dv/dt$ Ruggedness <sup>3</sup>                                  | $dv/dt$         | 50          | V/ns                      |
| Junction-to-Ambient (PCB Mounted, Steady-State)                      | $R_{\theta JA}$ | 62.5        | $^\circ\text{C}/\text{W}$ |
| Junction-to-Case   | $R_{\theta JC}$ | 1.90        | $^\circ\text{C}/\text{W}$ |
| Operating Junction and Storage Temperature Range                     | $T_J/T_{STG}$   | -55 to +150 | $^\circ\text{C}$          |

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

| Parameter                                       | Symbol                      | Conditions  | Min. | Typ. | Max. | Unit          |
|---|-----------------------------|---|------|------|------|---------------|
| <b>On / Off Characteristics</b>                 |                             |   |      |      |      |               |
| Drain-to-Source Breakdown Voltage               | $V_{(\text{BR})\text{DSS}}$ | $V_{\text{GS}}=0\text{V}, I_D=250\mu\text{A}$   | 600  | -    | -    | V             |
| Drain-to-Source Leakage Current                 | $I_{\text{DSS}}$            | $V_{\text{DS}}=600\text{V}, V_{\text{GS}}=0\text{V}$                                    | -    | -    | 200  | nA            |
| Gate-to-Source Forward Leakage                  | $I_{\text{GSS}}$            | $V_{\text{DS}}=0\text{V}, V_{\text{GS}}=30\text{V}$                                     | -    | -    | 100  | nA            |
|   |                             | $V_{\text{DS}}=0\text{V}, V_{\text{GS}}=-30\text{V}$                                    | -    | -    | -100 |               |
| Static Drain-to-Source On-Resistance            | $R_{\text{DS}(\text{ON})}$  | $V_{\text{GS}}=10\text{V}, I_D=10\text{A}, T_J=25^\circ\text{C}$                        | -    | 0.16 | 0.19 | $\Omega$      |
|   |                             | $V_{\text{GS}}=10\text{V}, I_D=10\text{A}, T_J=125^\circ\text{C}$                       | -    | 0.3  | -    | $\Omega$      |
| Gate Threshold Voltage                          | $V_{\text{GS}(\text{th})}$  | $V_{\text{DS}}=V_{\text{GS}}, I_D=250\mu\text{A}$                                       | 2.0  | -    | 4.0  | V             |
| <b>Dynamic and Switching Characteristics</b>    |                             |   |      |      |      |               |
| Input Capacitance                               | $C_{\text{iss}}$            | $V_{\text{GS}}=0\text{V}, V_{\text{DS}}=100\text{V}, F=1\text{MHz}$                     | -    | 1174 | -    | pF            |
| Output Capacitance                              | $C_{\text{oss}}$            |   | -    | 67   | -    |               |
| Reverse Transfer Capacitance                    | $C_{\text{rss}}$            |   | -    | 4.0  | -    |               |
| Total Gate Charge <sup>4,5</sup>                | $Q_g$                       | $I_D=20\text{A}, V_{\text{DD}}=480\text{V}, V_{\text{GS}}=10\text{V}$                   | -    | 39   | -    | nC            |
| Gate-to-Source Charge <sup>4,5</sup>            | $Q_{\text{gs}}$             |   | -    | 9.6  | -    |               |
| Gate-to-Drain ("Miller") Charge <sup>4,5</sup>  | $Q_{\text{gd}}$             |   | -    | 20   | -    |               |
| Turn-on Delay Time <sup>4,5</sup>               | $t_{\text{d}(\text{on})}$   | $V_{\text{DD}}=300\text{V}, V_{\text{GS}}=10\text{V}, R_G=25 \Omega, I_D=20\text{A}$    | -    | 20   | -    | nS            |
| Rise Time <sup>4,5</sup>                        | $t_r$                       |   | -    | 60   | -    |               |
| Turn-Off Delay Time <sup>4,5</sup>              | $t_{\text{d}(\text{off})}$  |   | -    | 105  | -    |               |
| Fall Time <sup>4,5</sup>                        | $t_f$                       |   | -    | 42   | -    |               |
| Gate Resistance                                 | $R_g$                       | $F=1\text{MHz}$   | -    | 2.6  | -    | $\Omega$      |
| <b>Source-Drain Ratings and Characteristics</b> |                             |   |      |      |      |               |
| Continuous Source Current (Body Diode)          | $I_S$                       | $T_C=25^\circ\text{C}$ , MOSFET symbol showing the integral reverse p-n junction diode. | -    | -    | 20   | A             |
| Source Pulse Current                            | $I_{\text{SM}}$             |   | -    | -    | 80   | A             |
| Diode Forward Voltage                           | $V_{\text{SD}}$             | $I_S=20\text{A}, V_{\text{GS}}=0\text{V}$   | -    | -    | 1.2  | V             |
| Reverse Recovery Time <sup>3</sup>              | $T_{\text{rr}}$             | $I_F=20\text{A}, V_{\text{DD}}=50\text{V}, dI/dt=100\text{A/us}$                        | -    | 426  | -    | nS            |
| Reverse Recovery Charge <sup>3</sup>            | $Q_{\text{rr}}$             |   | -    | 6.2  | -    | $\mu\text{C}$ |

Note:

1.  $L=79\text{mH}, I_{AS}=4.6\text{A}, V_{\text{DD}}=100\text{V}$ , starting temperature  $T_J=25^\circ\text{C}$ .
2.  $V_{\text{DS}}=0\text{-}400\text{V}, I_{SD}\leq 20\text{A}, T_J=25^\circ\text{C}$ .
3.  $V_{\text{DS}}=0\text{-}480\text{V}$ .
4. Pulse Test : pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
5. Essentially independent of operating temperature.

## Typical Electrical and Thermal Characteristic Curves

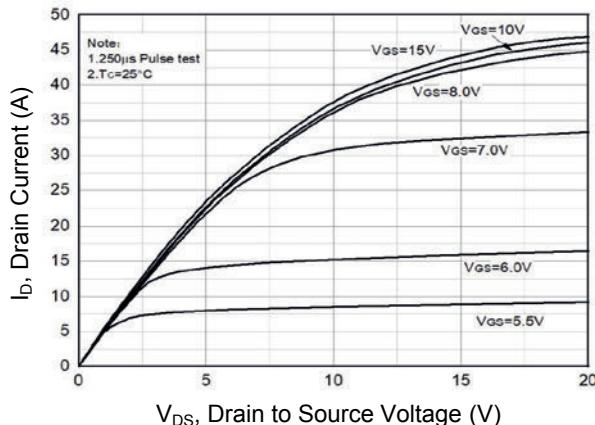


Figure 1. Typical Output Characteristics

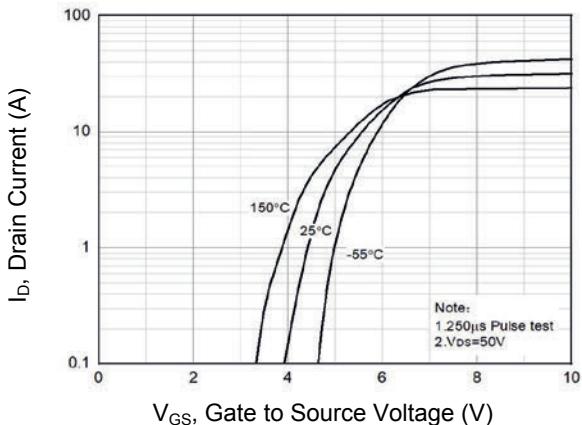


Figure 2. Transfer Characteristics

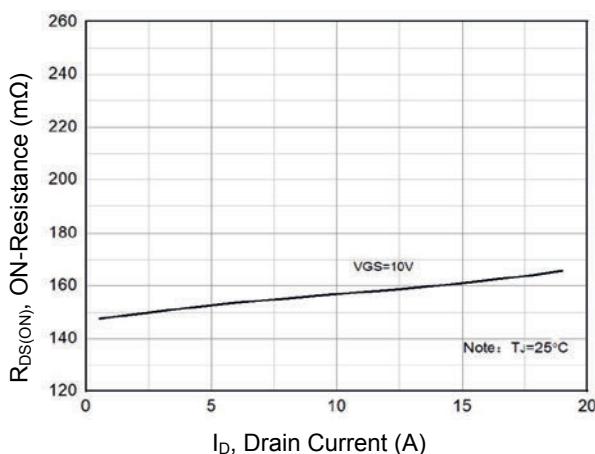


Figure 3. On-Resistance vs. Drain Current

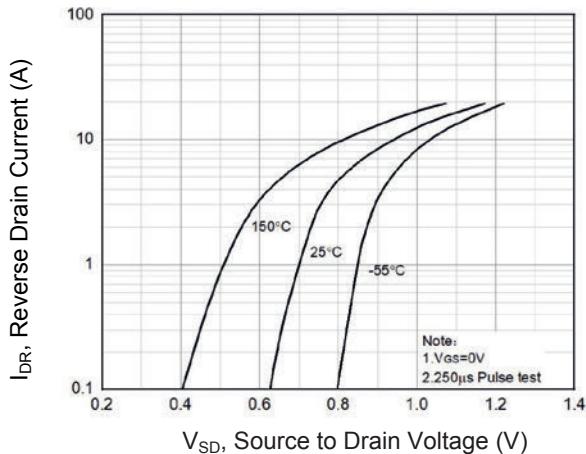


Figure 4. Body Diode Characteristics

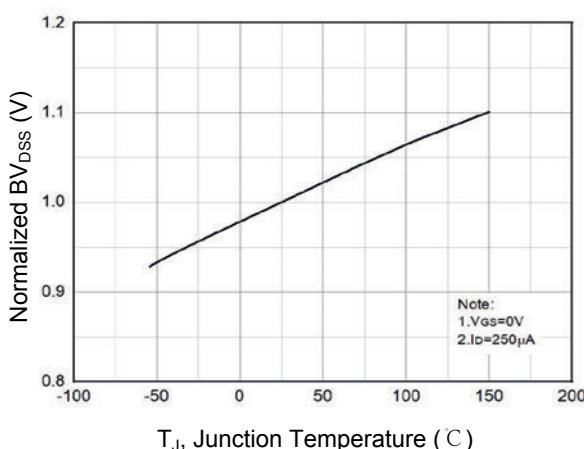


Figure 5. Normalized  $BV_{DSs}$  Vs.  $T_J$

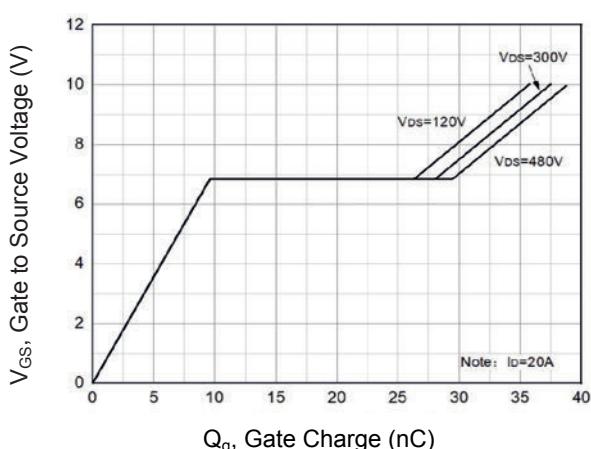


Figure 6. Gate Charge

## Typical Electrical and Thermal Characteristic Curves

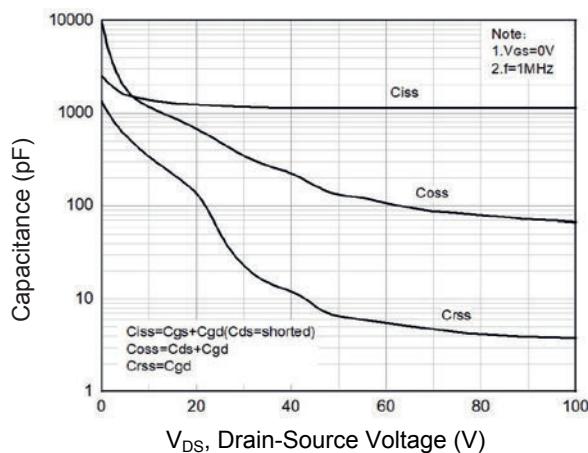


Figure 7. Capacitance Characteristics

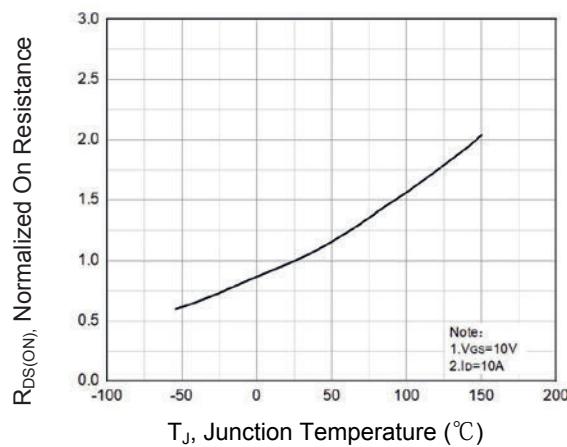


Figure 8. Normalized On-Resistance Vs.  $T_J$

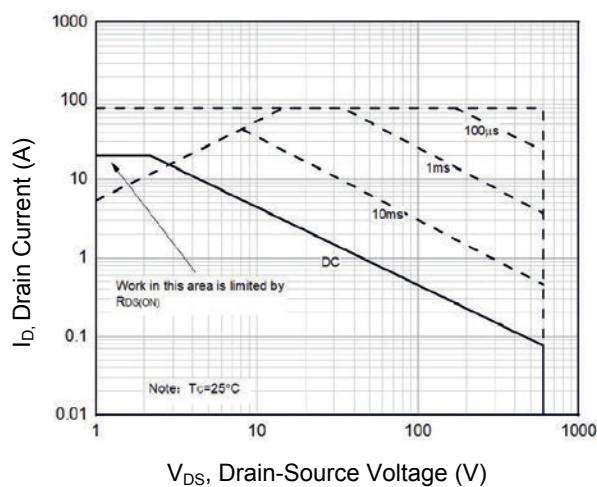
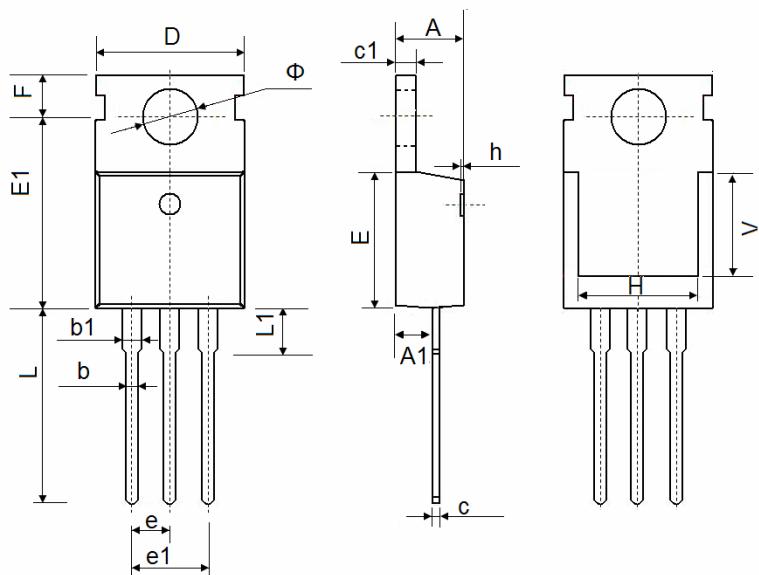


Figure 9. Safe Operation Area

### Package Outline Dimensions (TO-220)



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.400                     | 4.600  | 0.173                | 0.181 |
| A1     | 2.250                     | 2.550  | 0.089                | 0.100 |
| b      | 0.710                     | 0.910  | 0.028                | 0.036 |
| b1     | 1.170                     | 1.370  | 0.046                | 0.054 |
| c      | 0.330                     | 0.650  | 0.013                | 0.026 |
| c1     | 1.200                     | 1.400  | 0.047                | 0.055 |
| D      | 9.910                     | 10.250 | 0.390                | 0.404 |
| E      | 8.9500                    | 9.750  | 0.352                | 0.384 |
| E1     | 12.650                    | 12.950 | 0.498                | 0.510 |
| e      | 2.540 TYP.                |        | 0.100 TYP.           |       |
| e1     | 4.980                     | 5.180  | 0.196                | 0.204 |
| F      | 2.650                     | 2.950  | 0.104                | 0.116 |
| H      | 7.900                     | 8.100  | 0.311                | 0.319 |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| L      | 12.900                    | 13.400 | 0.508                | 0.528 |
| L1     | 2.850                     | 3.250  | 0.112                | 0.128 |
| V      | 6.900 REF.                |        | 0.276 REF.           |       |
| Φ      | 3.400                     | 3.800  | 0.134                | 0.150 |

### Order Information

| Device     | Package | Marking | Quantity     | HSF Status     |
|------------|---------|---------|--------------|----------------|
| GSFH60R190 | TO-220  | H60R190 | 50pcs / Tube | RoHS Compliant |