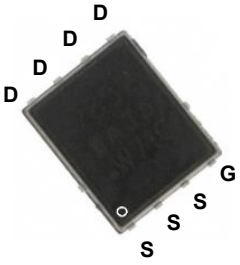
GOOD-ARK SEMICONDUCTOR

# GSGP1R404

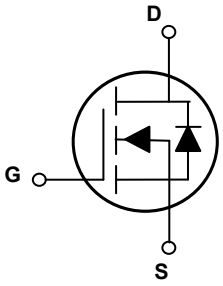
**40V N-Channel MOSFET**

## Main Product Characteristics

| | |
|---|---|
| $BV_{DSS}$ | 40V |
| $R_{DS(ON)}$ | 1.4mΩ (Max) |
| $I_D$ | 160A |




PPAK5x6




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 GSGP1R404 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 ($T_A$=25°C unless otherwise specified)

| Parameter | Symbol | Max. | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 40 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous, @Steady-State ($T_C$=25°C)[1] | $I_D$ | 160 | A |
| Drain Current-Continuous, @Steady-State ($T_C$=100°C)[1] | | 101 | |
| Drain Current-Pulsed ($T_C$=25°C)[2] | $I_{DM}$ | 640 | A |
| Single Pulse Avalanche Energy | $E_{AS}$ | 115 | mJ |
| Single Pulse Current | $I_{AS}$ | 48 | A |
| Power Dissipation ($T_C$=25°C)[3] | $P_D$ | 96 | W |
| Junction-to-Ambient (PCB Mounted, Steady-State) | $R_{\theta JA}$ | 50 | °C/W |
| Junction-to-Case | $R_{\theta JC}$ | 1.3 | °C/W |
| Operating Junction Temperature Range | $T_J$ | -55 To +150 | °C |
| Storage Temperature Range | $T_{STG}$ | -55 To +150 | °C |
| Soldering Temperature (SMD) | $T_{sold}$ | 260 | °C |

## Electrical Characteristics ($T_A$=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **On / Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250uA | 40 | - | - | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=40V, $V_{GS}$=0V, $T_J$=25°C | - | - | 1 | μA |
| | | $V_{DS}$=40V, $V_{GS}$=0V, $T_J$=125°C | - | 1.0 | - | μA |
| Gate-Source Forward Leakage | $I_{GSS}$ | $V_{GS}$=±20V, $V_{DS}$=0V | - | - | ±100 | nA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=50A | - | 1.2 | 1.4 | mΩ |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$=$V_{DS}$, $I_D$=250uA | 1.4 | - | 2.4 | V |
| **Dynamic and Switching Characteristics** | | | | | | |
| Total Gate Charge[4,5] | $Q_g$ | $V_{DD}$=20V, $I_D$=40A, $V_{GS}$=10V | - | 72 | - | nC |
| Gate-Source Charge[4,5] | $Q_{gs}$ | | - | 24 | - | |
| Gate-Drain ("Miller") Charge[4,5] | $Q_{gd}$ | | - | 7.9 | - | |
| Gate to Plateau[4,5] | $V_{plateau}$ | | - | 4.5 | - | V |
| Turn-On Delay Time[4,5] | $t_{d(on)}$ | $V_{DD}$=20V, $R_G$=2.7Ω, $V_{GS}$=10V, $I_D$=40A | - | 20 | - | nS |
| Rise Time[4,5] | $t_r$ | | - | 63 | - | |
| Turn-Off Delay Time[4,5] | $t_{d(off)}$ | | - | 58 | - | |
| Fall Time[4,5] | $t_f$ | | - | 16 | - | |
| Input Capacitance | $C_{Iss}$ | $V_{DS}$=20V, $V_{GS}$=0V, F=1MHz | - | 4822 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 2123 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 129 | - | |
| Gate Resistance | $R_g$ | F=1MHz | - | 1.2 | - | Ω |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| Continuous Source Current (Body Diode) | $I_S$ | MOSFET symbol showing the integral reverse p-n junction diode. | - | - | 160 | A |
| Diode Pulsed Current | $I_{S.pulse}$ | | - | - | 640 | A |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=50A | - | - | 1.4 | V |
| Reverse Recovery Time[4] | $t_{rr}$ | $V_{GS}$=0V, $V_R$=40V, $I_S$=40A, diF/dt=100A/μs | - | 58 | - | nS |
| Reverse Recovery Charge[4] | $Q_{rr}$ | | - | 67 | - | nC |

Note:

1. The rated value only refers to the maximum absolute value under the case temperature of 25 degrees. If the case temperature is higher than 25 degrees, the frequency needs to be reduced according to the actual environmental conditions.
2. Pulse time of 5us, pulse width limited by maximum junction temperature.
3. The dissipated power value will change with the temperature. When it is greater than 25°C, the dissipated power value will decrease by 0.77°C/W for every 1 degree of temperature increase.
4. Pulse test: Pulse width ≤ 300us, duty cycle ≤ 2%.
5. Essentially independent of operating temperature.

## Typical Electrical and Thermal Characteristic Curves

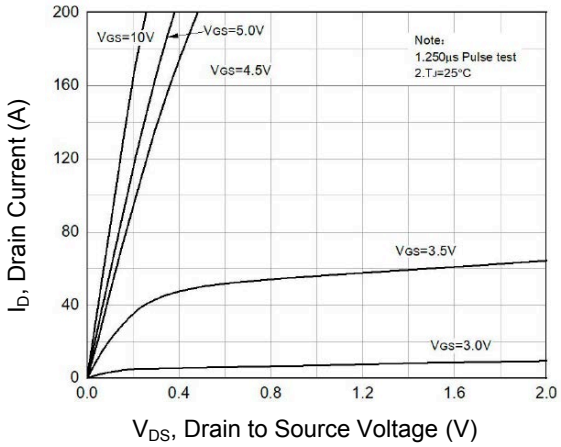



**Figure 1. Typical Output Characteristics**

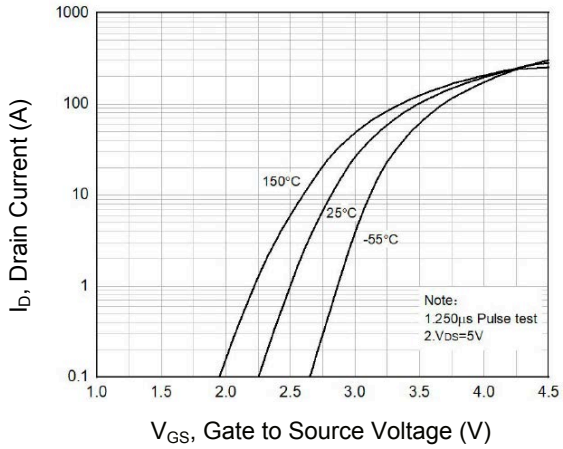



**Figure 2. Transfer Characteristics**

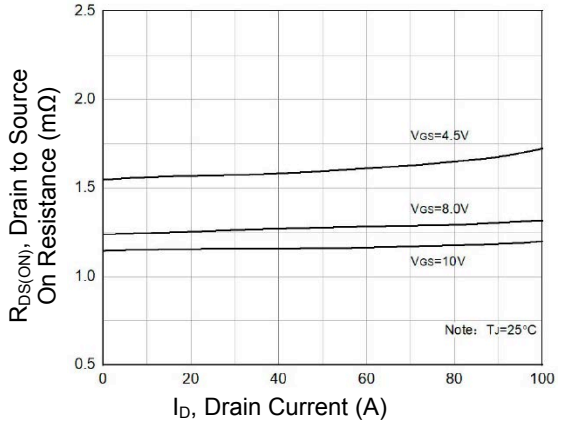



**Figure 3. $R_{DS(ON)}$ vs. Drain Current**

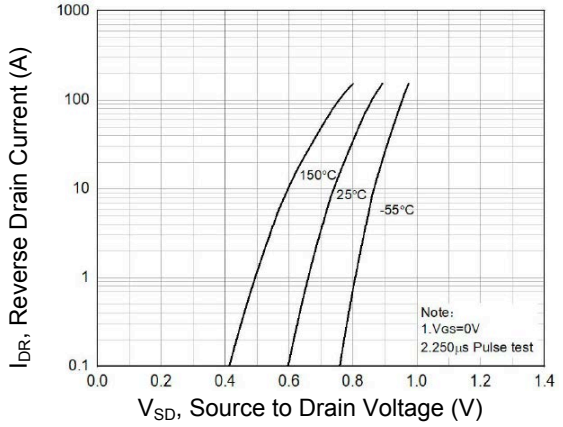



**Figure 4. Body Diode Characteristics**

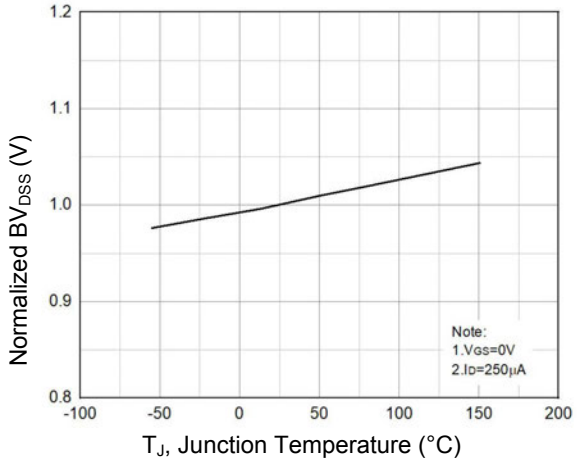



**Figure 5. Normalized $BV_{DSS}$ vs. $T_J$**

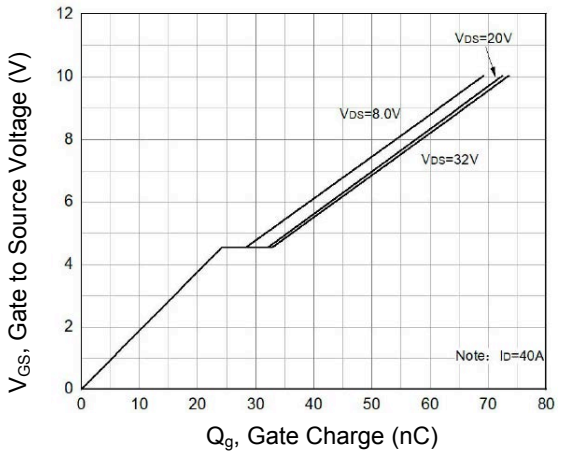



**Figure 6. Gate Charge Characteristics**

## Typical Electrical and Thermal Characteristic Curves

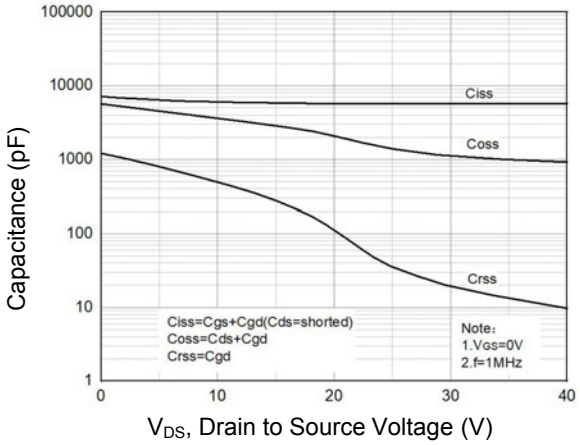



**Figure 7. Capacitance Characteristics**

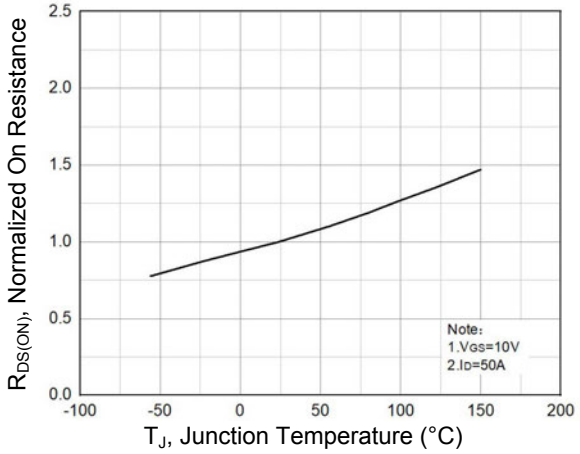



**Figure 8. Normalized $R_{DS(ON)}$ vs. $T_J$**

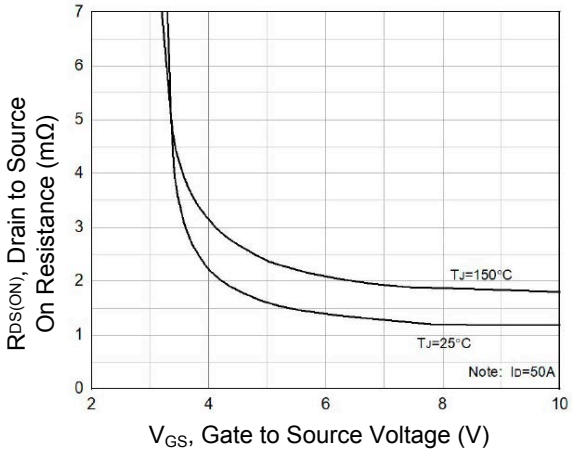



**Figure 9. Normalized $R_{DS(ON)}$ vs. $V_{GS}$**

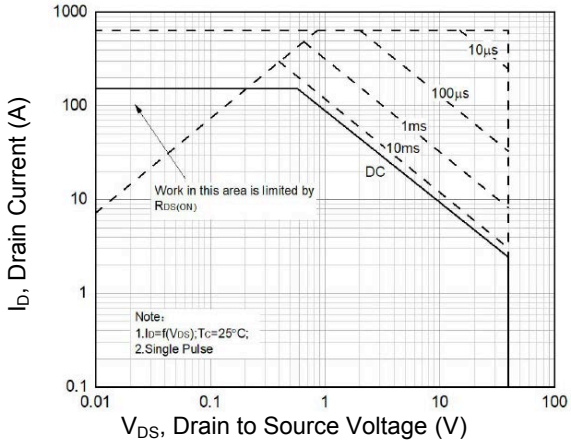



**Figure 10. Maximum Safe Operation Area**

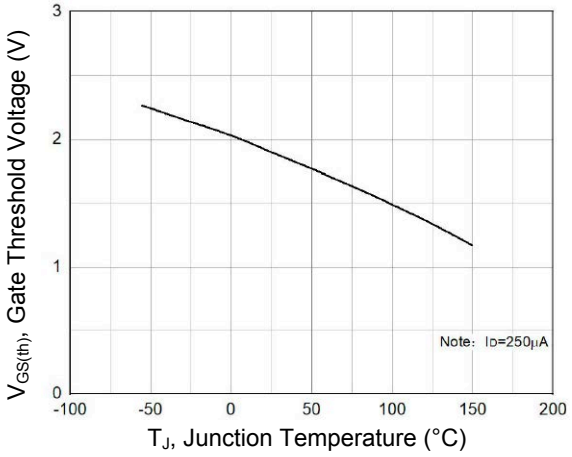



**Figure 11. Gate Threshold Voltage vs. $T_J$**

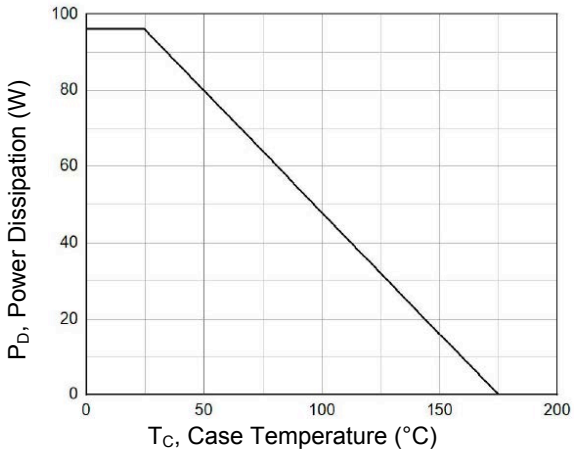



**Figure 12. Power Dissipation vs. $T_C$**

## Typical Electrical and Thermal Characteristic Curves

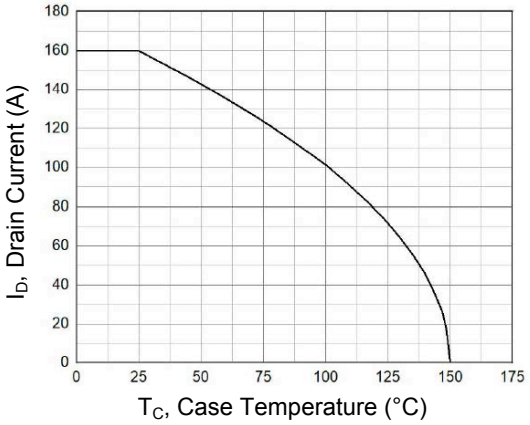



**Figure 13. Drain Current vs. $T_C$**

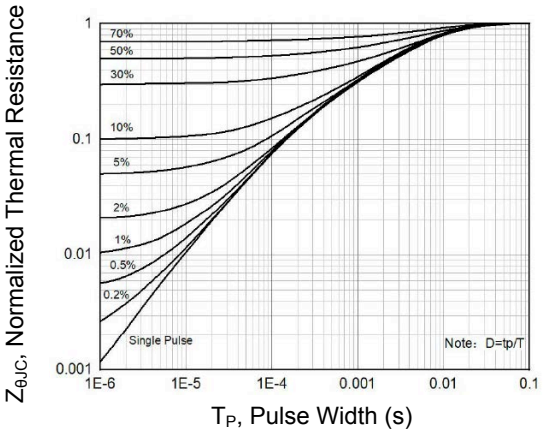
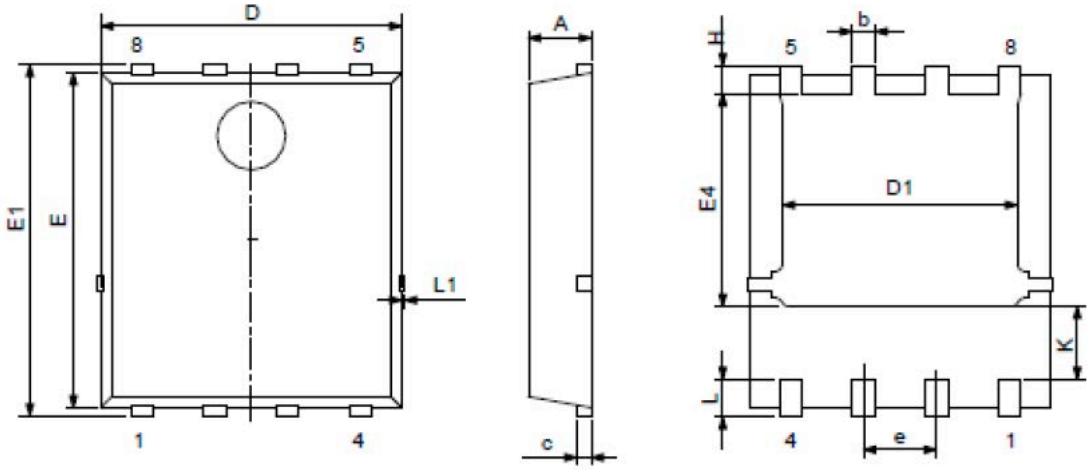



**Figure 14. Transient Thermal Impedance vs. $T_P$**

## Package Outline Dimensions (PPAK5x6)




| Symbol | Dimensions in Millimeters | | Dimensions in Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.900 | 1.200 | 0.035 | 0.047 |
| c | 0.154 | 0.354 | 0.006 | 0.014 |
| D | 4.800 | 5.400 | 0.189 | 0.213 |
| E | 5.660 | 6.060 | 0.223 | 0.239 |
| D1 | 3.760 | 4.300 | 0.148 | 0.169 |
| E1 | 5.900 | 6.350 | 0.232 | 0.250 |
| b | 0.300 | 0.550 | 0.012 | 0.022 |
| k | 1.100 | 1.500 | 0.043 | 0.059 |
| e | 1.070 | 1.370 | 0.042 | 0.054 |
| E4 | 3.340 | 3.920 | 0.131 | 0.154 |
| L | 0.300 | 0.710 | 0.012 | 0.028 |
| L1 | - | 0.120 | - | 0.005 |
| H | 0.400 | 0.710 | 0.016 | 0.028 |