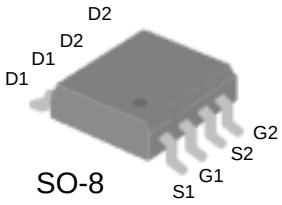
# DUAL N-CHANNEL ENHANCEMENT-MODE POWER MOSFETS

Simple drive requirement

Lower gate charge

Fast switching characteristics



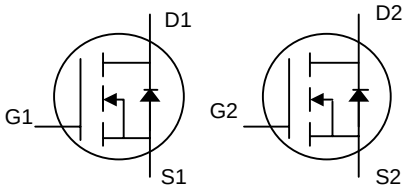

SO-8

| | |
|---|---|
| $BV_{DSS}$ | 40V |
| $R_{DS(ON)}$ | 20mΩ |
| $I_D$ | 7.8A |

## Description

Advanced Power MOSFETs from Silicon Standard provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SSM9960M is in the SO-8 package, which is widely preferred for commercial and industrial surface mount applications, and is well suited for low voltage applications such as DC/DC converters.




**This device is available with Pb-free lead finish (second-level interconnect) as SSM9960GM.**

## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ± 20 | V |
| $I_D$ @ $T_A$=25°C | Continuous Drain Current[3] | 7.8 | A |
| $I_D$ @ $T_A$=100°C | Continuous Drain Current[3] | 6.2 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | 20 | A |
| $P_D$ @ $T_A$=25°C | Total Power Dissipation | 2 | W |
| | Linear Derating Factor | 0.016 | W/°C |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C |

## Thermal Data

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| Rthj-a | Thermal Resistance Junction-ambient[3] | Max. | 62.5 | °C/W |

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250uA | 40 | - | - | V |
| $\Delta BV_{DSS}/\Delta Tj$ | Breakdown Voltage Temperature Coefficient | Reference to 25°C, $I_D$=1mA | - | 0.032 | - | V/°C |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V, $I_D$=7A | - | - | 20 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=5A | - | - | 32 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=250uA | 1 | - | 3 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=10V, $I_D$=7A | - | 25 | - | S |
| $I_{DSS}$ | Drain-Source Leakage Current ($T_j$=25°C) | $V_{DS}$=40V, $V_{GS}$=0V | - | - | 1 | uA |
| | Drain-Source Leakage Current ($T_j$=70°C) | $V_{DS}$=32V ,$V_{GS}$=0V | - | - | 25 | uA |
| $I_{GSS}$ | Gate-Source Leakage | $V_{GS}$= ± 20V | - | - | ±100 | nA |
| $Q_g$ | Total Gate Charge[2] | $I_D$=7A | - | 14.7 | - | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{DS}$=20V | - | 7.1 | - | nC |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | $V_{GS}$=4.5V | - | 6.8 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time[2] | $V_{DS}$=20V | - | 11.5 | - | ns |
| $t_r$ | Rise Time | $I_D$=1A | - | 6.3 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | $R_G$=3.3Ω ,$V_{GS}$=10V | - | 28.2 | - | ns |
| $t_f$ | Fall Time | $R_D$=20Ω | - | 12.6 | - | ns |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V | - | 1725 | - | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$=25V | - | 235 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | f=1.0MHz | - | 145 | - | pF |

## Source-Drain Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current ( Body Diode ) | $V_D$=$V_G$=0V , $V_S$=1.3V | - | - | 1.54 | A |
| $V_{SD}$ | Forward On Voltage[2] | $T_j$=25°C,$I_S$=2.3A, $V_{GS}$=0V | - | - | 1.3 | V |

**Notes:**

1.Pulse width limited by max. junction temperature.

2.Pulse width ≤300us , duty cycle ≤2%.

3.Surface mounted on 1 $in^2$ copper pad of FR4 board ; 135°C/W when mounted on min. copper pad.

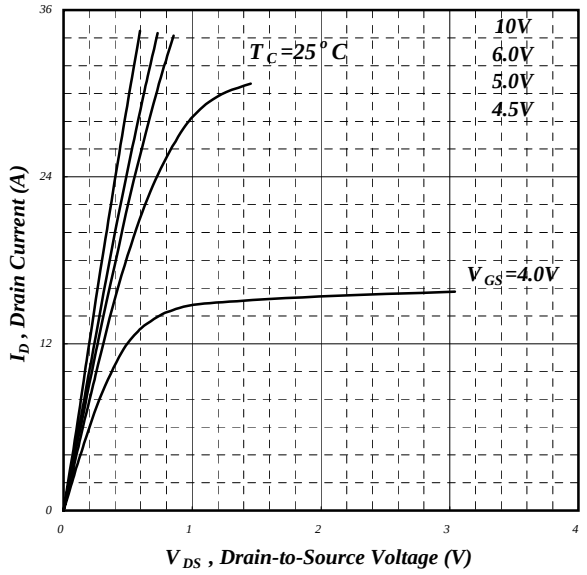



Fig 1. Typical Output Characteristics

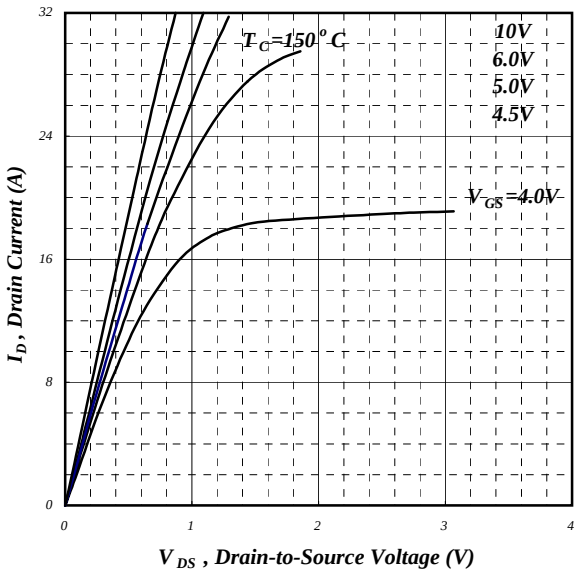



Fig 2. Typical Output Characteristics

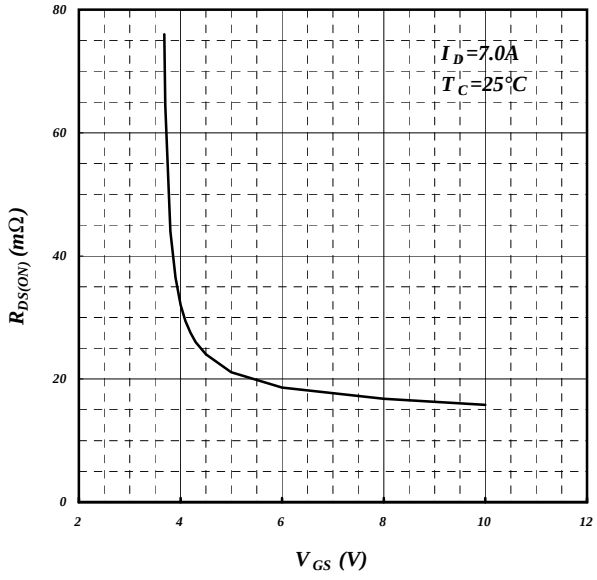



Fig 3. On-Resistance v.s. Gate Voltage

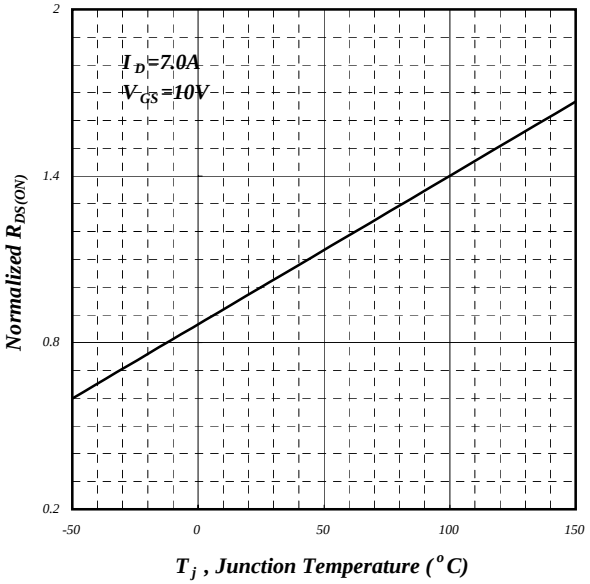



Fig 4. Normalized On-Resistance vs. Junction Temperature

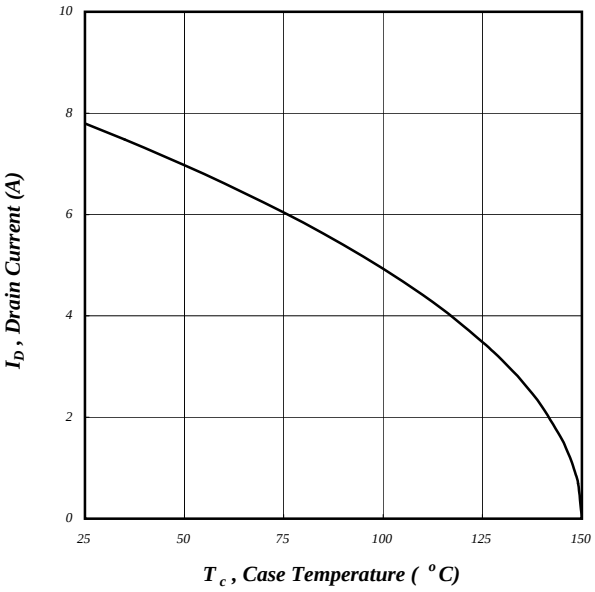



Fig 5. Maximum Drain Current vs. Case Temperature

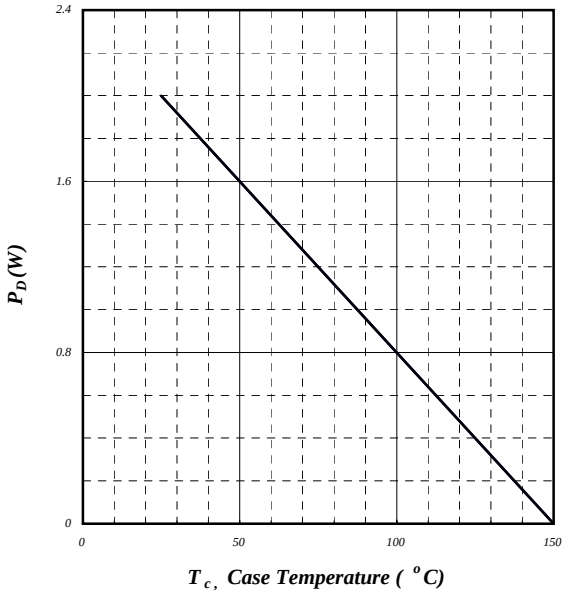



Fig 6. Typical Power Dissipation

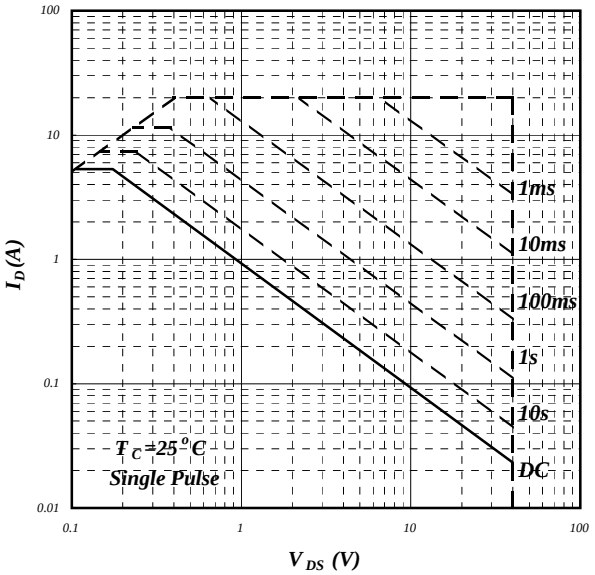



Fig 7. Maximum Safe Operating Area

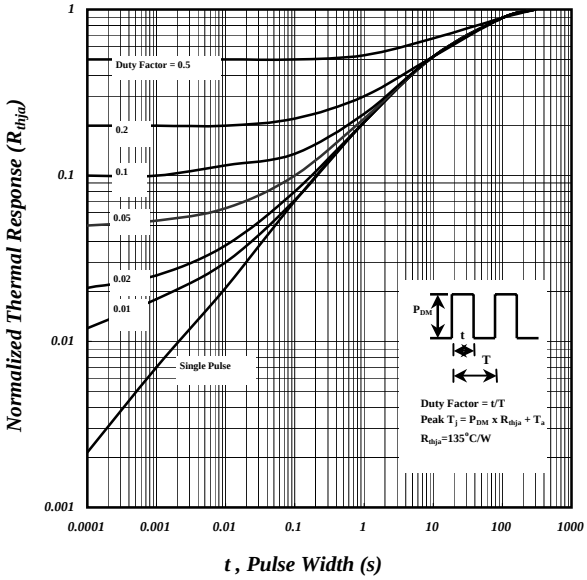



Fig 8. Effective Transient Thermal Impedance

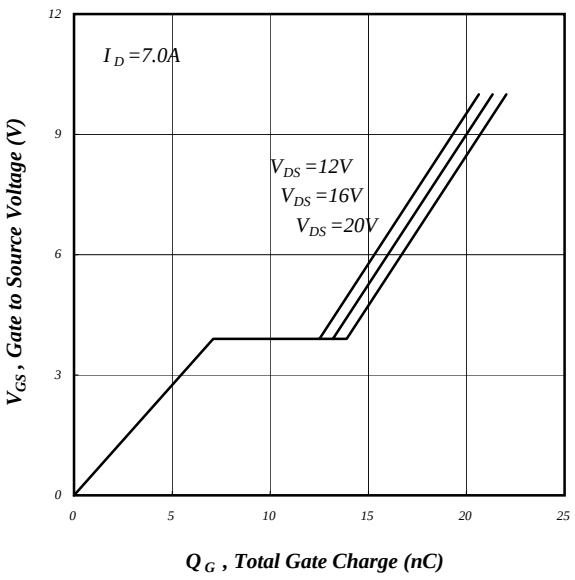



Fig 9. Gate Charge Characteristics

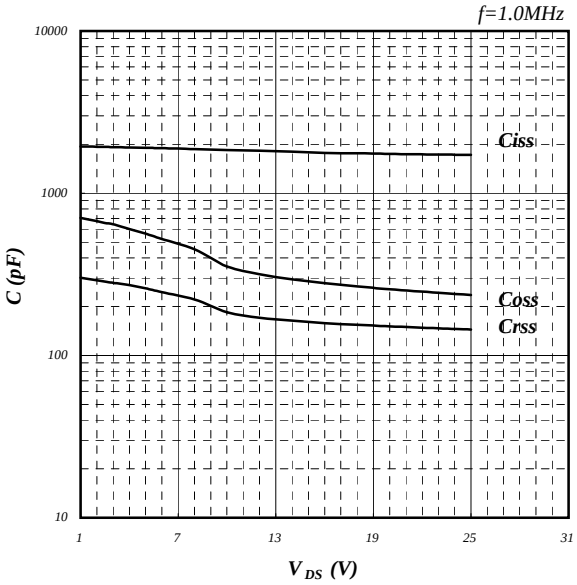



Fig 10. Typical Capacitance Characteristics

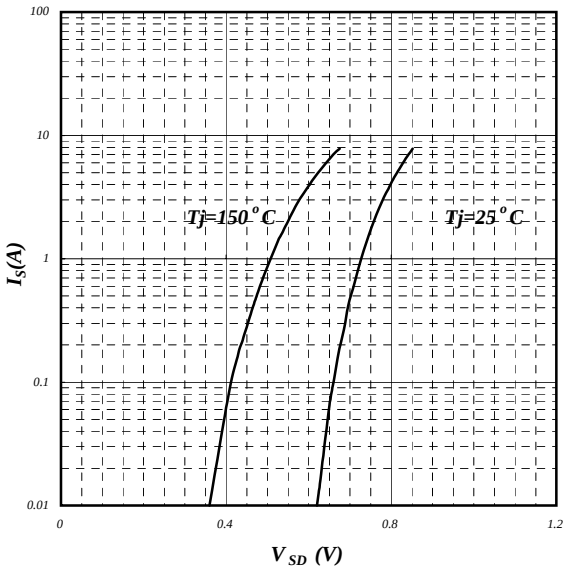



Fig 11. Forward Characteristic of Reverse Diode

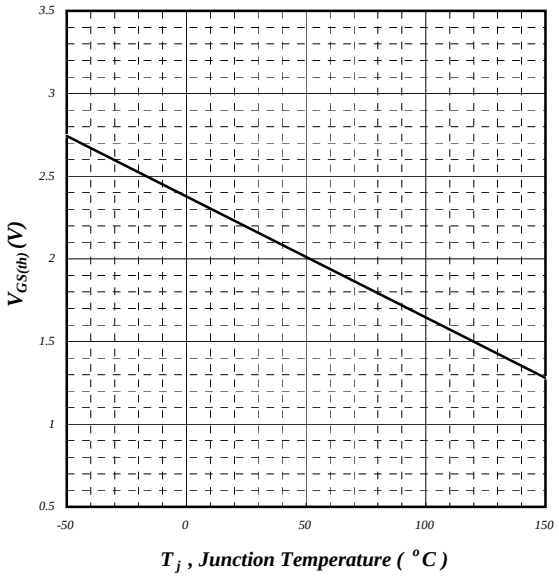



Fig 12. Gate Threshold Voltage vs. **Junction Temperature**

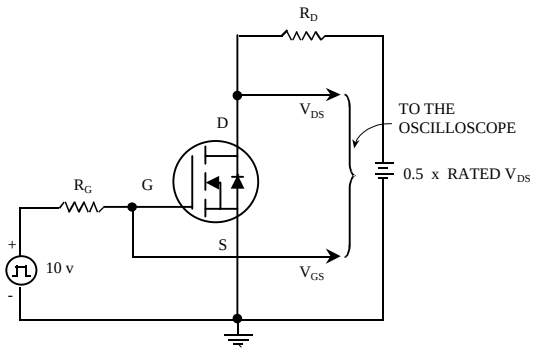



**Fig 13. Switching Time Circuit**

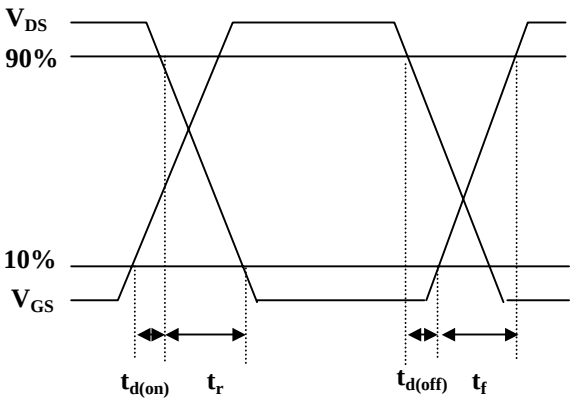



**Fig 14. Switching Time Waveform**

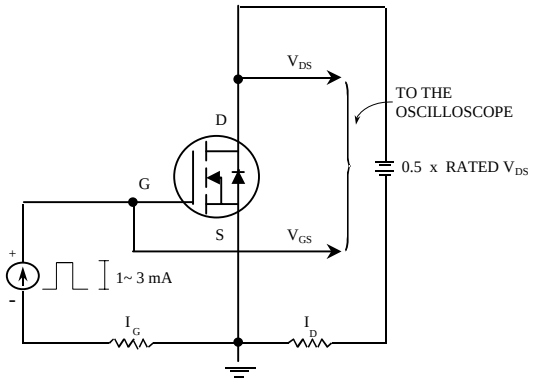



**Fig 15. Gate Charge Circuit**

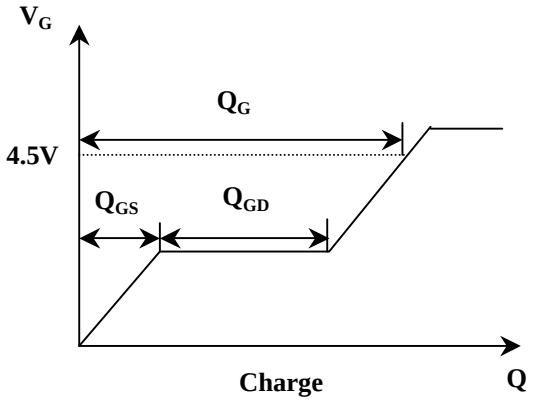



**Fig 16. Gate Charge Waveform**