GOOD-ARK SEMICONDUCTOR

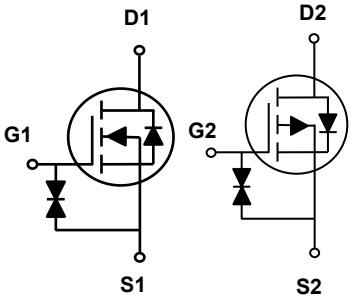
# SSF7120

**20V N-Channel + P-Channel Complementary MOSFET**

## Main Product Characteristics

| | | |
|---|---|---|
| $V_{(BR)DSS}$ | 20V | -20V |
| $R_{DS(ON)}$ | 300mΩ | 600mΩ |
| $I_D$ | 800mA | -400mA |


SOT-563




Schematic Diagram

## Features and Benefits

- Advanced MOSFET process technology
- Ideal for notebook, load switch, networking and hand-held devices
- Low on-resistance with low gate charge
- Fast switching and reverse body recovery

## Description

The SSF7120 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 supply and a wide variety of other applications.

## Absolute Maximum Ratings ($T_C$=25°C unless otherwise specified)

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 20 | -20 | V |
| Gate-Source Voltage[4] | $V_{GS}$ | ±12 | ±12 | V |
| Drain Current – Continuous ($T_C$=25°C) | $I_D$ | 800 | -400 | mA |
| Drain Current – Continuous ($T_C$=100°C) | | 510 | -250 | mA |
| Drain Current – Pulsed[1] | $I_{DM}$ | 3.2 | -1.6 | A |
| Power Dissipation ($T_C$=25°C) | $P_D$ | 312 | | mW |
| Power Dissipation – Derate above 25°C | $P_D$ | 2.5 | | mW/°C |
| Storage Temperature Range | $T_{STG}$ | -55 to +150 | | °C |
| Operating Junction Temperature Range | $T_J$ | -55 to +150 | | °C |

## Thermal Characteristics

| Parameter | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|
| Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | --- | 400 | °C/W |

## N-Channel Electrical Characteristics ($T_J$=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V , $I_D$=250uA | 20 | --- | --- | V |
| $BV_{DSS}$ Temperature Coefficient | $\triangle BV_{DSS}/\triangle T_J$ | Reference to 25°C , $I_D$=1mA | --- | -0.01 | --- | V/°C |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=20V , $V_{GS}$=0V , $T_J$=25°C | --- | --- | 1 | uA |
| | | $V_{DS}$=16V , $V_{GS}$=0V , $T_J$=125°C | --- | --- | 10 | uA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±8V , $V_{DS}$=0V | --- | --- | ±20 | uA |
| **On Characteristics** | | | | | | |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=4.5V , $I_D$=0.5A | --- | 200 | 300 | mΩ |
| | | $V_{GS}$=2.5V , $I_D$=0.4A | --- | 235 | 400 | |
| | | $V_{GS}$=1.8V , $I_D$=0.2A | --- | 295 | 550 | |
| | | $V_{GS}$=1.5V , $I_D$=0.1A | --- | 365 | 800 | |
| | | $V_{GS}$=1.2V , $I_D$=0.1A | --- | 600 | - | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 0.3 | 0.6 | 1.0 | V |
| $V_{GS(th)}$ Temperature Coefficient | $\triangle V_{GS(th)}$ | | --- | 3 | --- | mV/°C |
| **Dynamic and Switching Characteristics** | | | | | | |
| Total Gate Charge[2, 3] | $Q_g$ | $V_{DS}$=10V , $V_{GS}$=4.5V , $I_D$=0.5A | --- | 1 | 2 | nC |
| Gate-Source Charge[2, 3] | $Q_{gs}$ | | --- | 0.26 | 0.5 | |
| Gate-Drain Charge[2, 3] | $Q_{gd}$ | | --- | 0.2 | 0.4 | |
| Turn-On Delay Time[2, 3] | $T_{d(on)}$ | $V_{DD}$=10V , $V_{GS}$=4.5V , $R_G$=10Ω $I_D$=0.5A | --- | 5 | 10 | nS |
| Rise Time[2, 3] | $T_r$ | | --- | 3.5 | 7 | |
| Turn-Off Delay Time[2, 3] | $T_{d(off)}$ | | --- | 14 | 28 | |
| Fall Time[2, 3] | $T_f$ | | --- | 6 | 12 | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=10V , $V_{GS}$=0V , F=1MHz | --- | 38.2 | 75 | pF |
| Output Capacitance | $C_{oss}$ | | --- | 14.4 | 28 | |
| Reverse Transfer Capacitance | $C_{rss}$ | | --- | 6 | 12 | |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| Continuous Source Current | $I_S$ | $V_G$=$V_D$=0V , Force Current | --- | --- | 0.8 | A |
| Pulsed Source Current | $I_{SM}$ | | --- | --- | 1.6 | A |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V , $I_S$=-0.2A , $T_J$=25°C | --- | --- | 1 | V |

## P-Channel Electrical Characteristics ($T_J$=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V , $I_D$=-250uA | -20 | --- | --- | V |
| $BV_{DSS}$ Temperature Coefficient | $\triangle BV_{DSS}/\triangle T_J$ | Reference to 25°C , $I_D$=-1mA | --- | -0.01 | --- | V/°C |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=-20V , $V_{GS}$=0V , $T_J$=25°C | --- | --- | -1 | uA |
| | | $V_{DS}$=-16V , $V_{GS}$=0V , $T_J$=125°C | --- | --- | -10 | uA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±8V , $V_{DS}$=0V | --- | --- | ±20 | uA |
| **On Characteristics** | | | | | | |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=-4.5V , $I_D$=-0.3A | --- | 440 | 600 | mΩ |
| | | $V_{GS}$=-2.5V , $I_D$=-0.2A | --- | 610 | 850 | |
| | | $V_{GS}$=-1.8V , $I_D$=-0.1A | --- | 810 | 1200 | |
| | | $V_{GS}$=-1.5V , $I_D$=-0.1A | --- | 1020 | 1600 | |
| | | $V_{GS}$=-1.2V , $I_D$=-0.1A | --- | 1800 | --- | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -0.3 | -0.6 | -1.0 | V |
| $V_{GS(th)}$ Temperature Coefficient | $\triangle V_{GS(th)}$ | | --- | 3 | --- | mV/°C |
| **Dynamic and Switching Characteristics** | | | | | | |
| Total Gate Charge[2, 3] | $Q_g$ | $V_{DS}$=-10V , $V_{GS}$=-4.5V , $I_D$=-0.2A | --- | 1 | 2 | nC |
| Gate-Source Charge[2, 3] | $Q_{gs}$ | | --- | 0.28 | 0.5 | |
| Gate-Drain Charge[2, 3] | $Q_{gd}$ | | --- | 0.18 | 0.4 | |
| Turn-On Delay Time[2, 3] | $T_{d(on)}$ | $V_{DD}$=-10V , $V_{GS}$=-4.5V , $R_G$=10Ω $I_D$=-0.2A | --- | 8 | 16 | nS |
| Rise Time[2, 3] | $T_r$ | | --- | 5.2 | 10 | |
| Turn-Off Delay Time[2, 3] | $T_{d(off)}$ | | --- | 30 | 60 | |
| Fall Time[2, 3] | $T_f$ | | --- | 18 | 36 | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=-10V , $V_{GS}$=0V , F=1MHz | --- | 40 | 78 | pF |
| Output Capacitance | $C_{oss}$ | | --- | 15 | 30 | |
| Reverse Transfer Capacitance | $C_{rss}$ | | --- | 6.5 | 13 | |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| Continuous Source Current | $I_S$ | $V_G$=$V_D$=0V , Force Current | --- | --- | -0.4 | A |
| Pulsed Source Current | $I_{SM}$ | | --- | --- | -0.8 | A |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V , $I_S$=-0.2A , $T_J$=25°C | --- | --- | -1 | V |

**Notes:**

1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed, pulse width ≦ 300uS, duty cycle ≦ 2 % .
3. Essentially independent of operating temperature.
4. HTGB Reliability conditions follow up $I_{GSS}$ spec.

## N-Channel Typical Electrical and Thermal Characteristic Curves

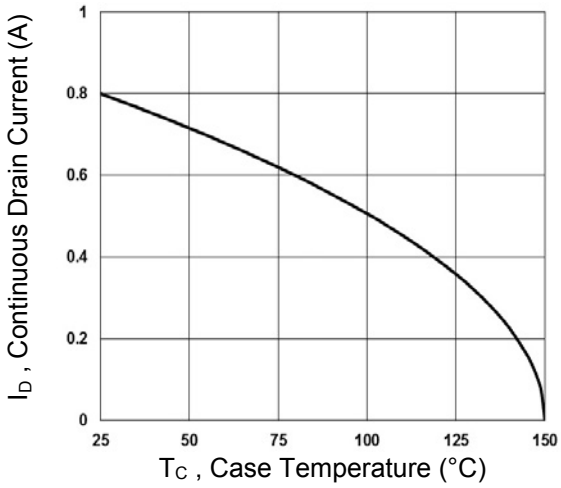



**Fig.1 Continuous Drain Current vs. $T_C$**

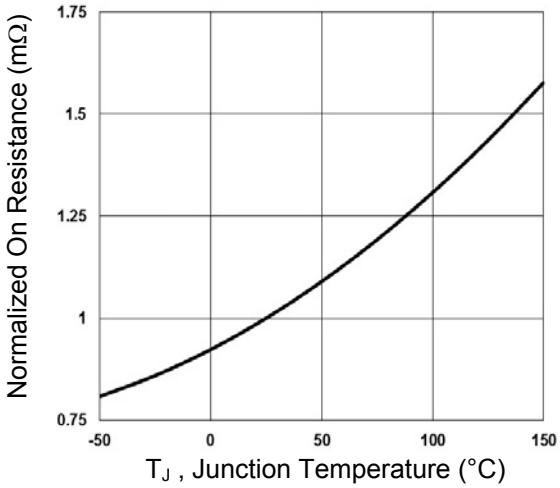



**Fig.2 Normalized $R_{DS(ON)}$ vs. $T_J$**

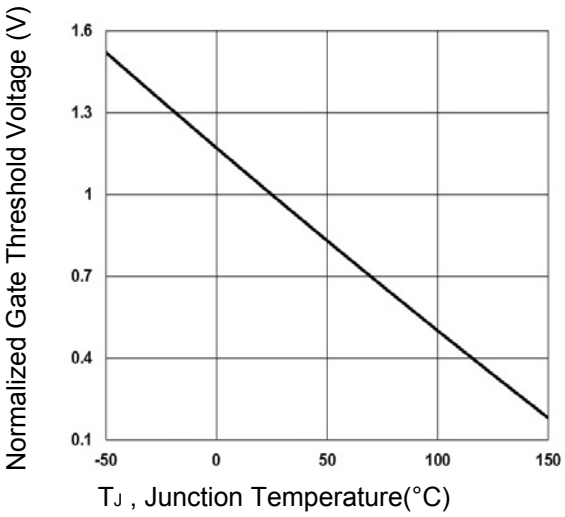



**Fig.3 Normalized $V_{th}$ vs $T_J$**

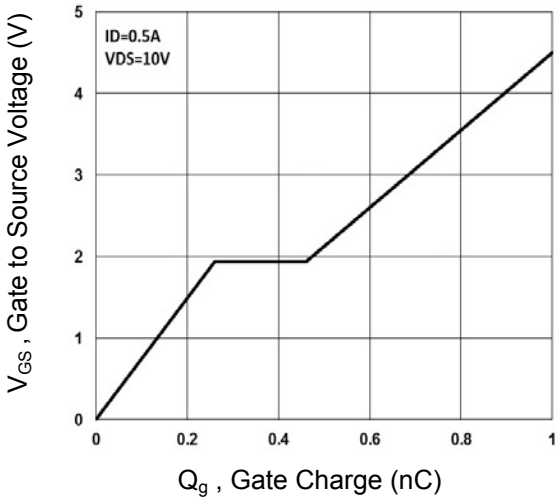



**Fig.4 Gate Charge Waveform**

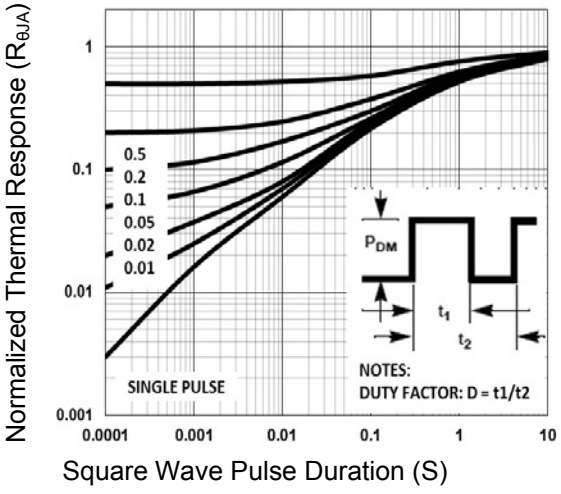



**Fig.5 Normalized Transient Impedance**

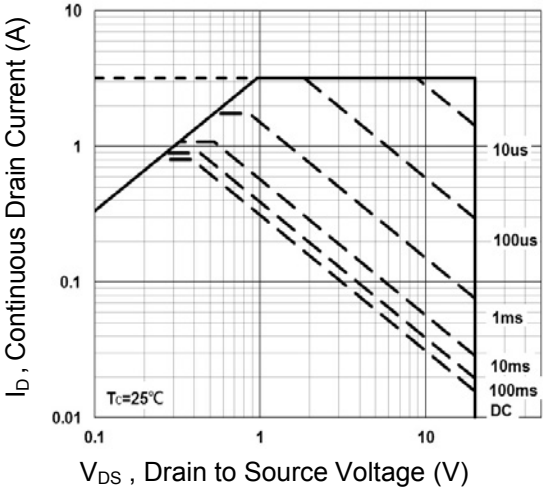



**Fig.6 Maximum Safe Operation Area**

## P-Channel Typical Electrical and Thermal Characteristic Curves

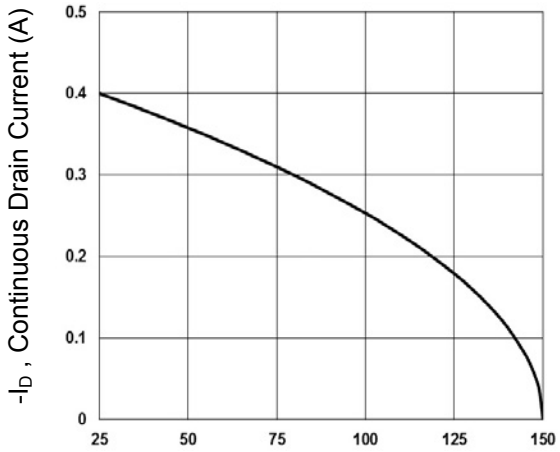



**Fig.7 Continuous Drain Current vs. $T_C$**

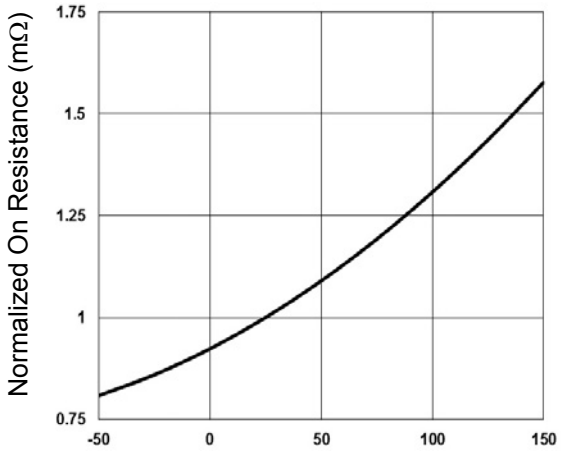



**Fig.8 Normalized $R_{DS(ON)}$ vs. $T_J$**

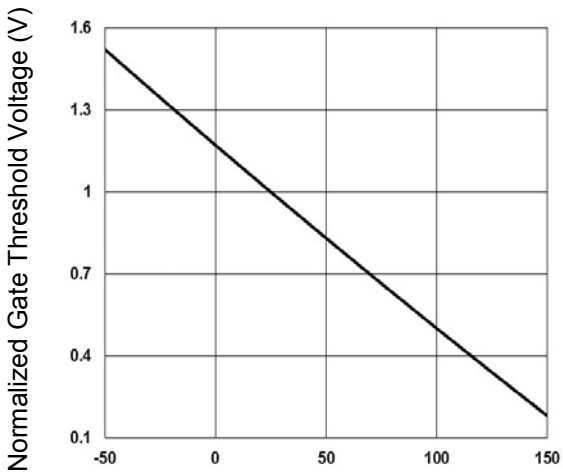



**Fig.9 Normalized $V_{th}$ vs $T_J$**

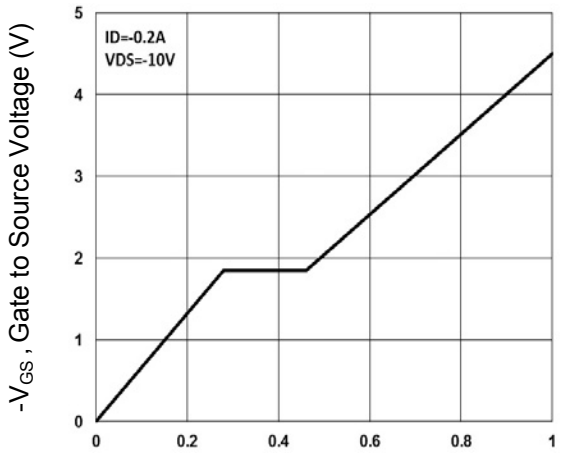



**Fig.10 Gate Charge Waveform**

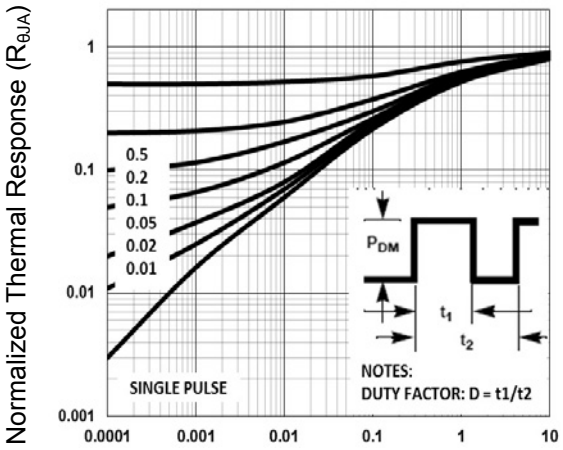



**Fig.11 Normalized Transient Impedance**

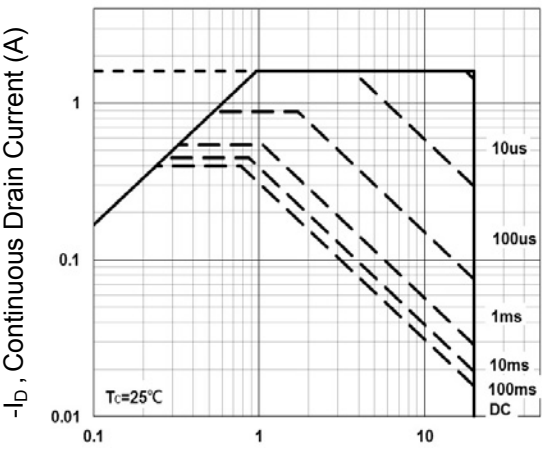
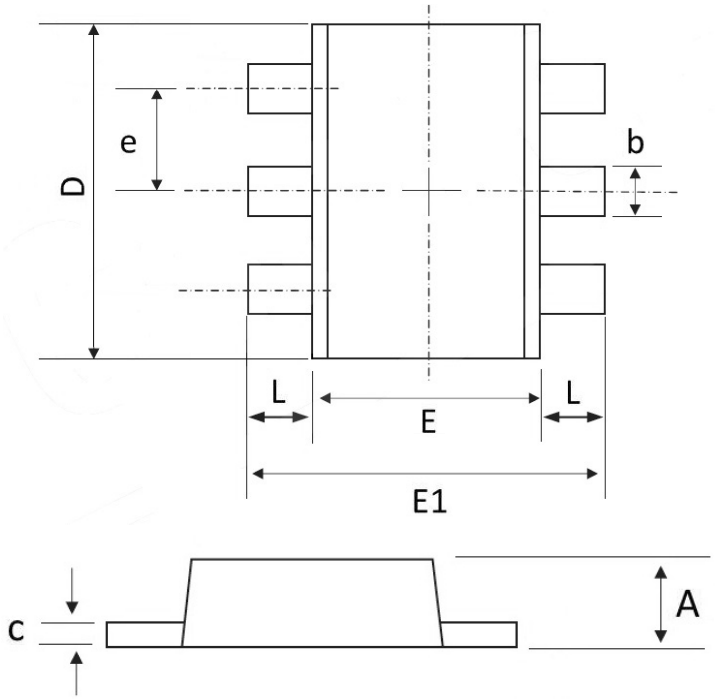



**Fig.12 Maximum Safe Operation Area**

## Package Outline Dimensions SOT-563




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MAX | MIN | MAX | MIN |
| A | 0.600 | 0.500 | 0.024 | 0.020 |
| b | 0.300 | 0.150 | 0.012 | 0.006 |
| c | 0.180 | 0.100 | 0.007 | 0.004 |
| D | 1.700 | 1.500 | 0.067 | 0.059 |
| E | 1.250 | 1.100 | 0.049 | 0.043 |
| E1 | 1.700 | 1.550 | 0.067 | 0.061 |
| e | 0.5BSC | | 0.02BSC | |
| L | 0.300 | 0.100 | 0.012 | 0.004 |

## Order Information

| Device | Package | Marking | Carrier | Reel Quantity |
|---|---|---|---|---|
| SSF7120 | SOT-563 | DXY( X=Year, Y=Lot) | Tape & Reel | 3,000pcs |