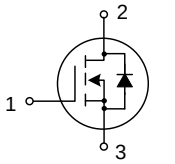
# 12A, 650V N-CHANNEL MOSFET

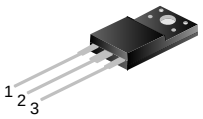
## GENERAL DESCRIPTION

SVF12N65FQ is an N-channel enhancement mode power MOS field effect transistor which is produced using Silan proprietary F-Cell™ high-voltage planar VDMOS technology. The improved process and cell structure have been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

These devices are widely used in AC-DC power supplies, DC-DC converters and H-bridge PWM motor drivers.




1.Gate 2.Drain 3.Source




TO-220FQ-3L

## FEATURES

- 12A,650V,$R_{DS(on)(typ.)}$=0.64Ω@$V_{GS}$=10V
- Low gate charge
- Low Crss
- Fast switching
- Improved dv/dt capability

## NOMENCLATURE

S V F X N E X X X

Silan VDMOS Code of F-Cell process

Nominal current,using 1 or 2 digits:
Example:4 denotes 4A,
10 denotes 10A,
08 denotes 0.8A

N denotes N Channel

Package information.Example:
FQ:TO-220FQ.

Nominal Voltage,using 2 digits
Example: 60 denotes 600V,
65 denotes 650V.

Special Features indication, May be omitted.
Example: E denotes embeded ESD structure

## ORDERING INFORMATION

| Part No. | Package | Marking | Hazardous Substance Control | Packing |
|---|---|---|---|---|
| SVF12N65FQ | TO-220FQ-3L | SVF12N65FQ | Pb free | Tube |

## ABSOLUTE MAXIMUM RATINGS ($T_C$=25°C, unless otherwise noted)

| Characteristics | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| | | | SVF12N65FQ | |
| Drain-Source Voltage | | $V_{DS}$ | 650 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Drain Current | $T_C$=25°C | $I_D$ | 12 | A |
| | $T_C$=100°C | | 9 | |
| Drain Current Pulsed | | $I_{DM}$ | 48 | A |
| Power Dissipation($T_C$=25°C) | | $P_D$ | 51 | W |
| -Derate above 25°C | | | 0.41 | W/°C |
| Single Pulsed Avalanche Energy (Note 1) | | $E_{AS}$ | 786 | mJ |
| Operation Junction Temperature Range | | $T_J$ | -55～+150 | °C |
| Storage Temperature Range | | $T_{stg}$ | -55～+150 | °C |

## THERMAL CHARACTERISTICS

| Characteristics | Symbol | Ratings | Unit |
|---|---|---|---|
| | | SVF12N65FQ | |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 2.44 | °C/W |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_C$=25°C unless otherwise noted)

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain -Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250μA | 650 | -- | -- | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=650V, $V_{GS}$=0V | -- | -- | 1.0 | μA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±30V, $V_{DS}$=0V | -- | -- | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$= $V_{DS}$, $I_D$=250μA | 2.0 | -- | 4.0 | V |
| Static Drain- Source On State Resistance | $R_{DS(on)}$ | $V_{GS}$=10V, $I_D$=6.0A | -- | 0.64 | 0.8 | Ω |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=25V,$V_{GS}$=0V, f=1.0MHZ | -- | 1476 | -- | pF |
| Output Capacitance | $C_{oss}$ | | -- | 152 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 4.5 | -- | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=325V,$I_D$=12A, $R_G$=25Ω (Note 2,3) | -- | 37.67 | -- | ns |
| Turn-on Rise Time | $t_r$ | | -- | 61.67 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 80.33 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 46.67 | -- | |
| Total Gate Charge | $Q_g$ | $V_{DS}$=520V,$I_D$=12A, $V_{GS}$=10V (Note 2,3) | -- | 24.15 | -- | nC |
| Gate-Source Charge | $Q_{gs}$ | | -- | 7.86 | -- | |
| Gate-Drain Charge | $Q_{gd}$ | | -- | 7.47 | -- | |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Continuous Source Current | $I_S$ | Integral Reverse p-n Junction | -- | -- | 12 | A |
| Pulsed Source Current | $I_{SM}$ | Diode in the MOSFET | -- | -- | 48 | |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=12A,$V_{GS}$=0V | -- | -- | 1.4 | V |
| Reverse Recovery Time | $T_{rr}$ | $I_S$=12A,$V_{GS}$=0V, | -- | 590.61 | -- | ns |
| Reverse Recovery Charge | $Q_{rr}$ | $dI_F/dt$=100A/μS (Note 2) | -- | 5.62 | -- | μC |

**Notes:**

1. L=30mH, $I_{AS}$=6.66A, $V_{DD}$=140V, $R_G$=25Ω, starting $T_J$=25°C;
2. Pulse Test: Pulse width ≤300μs,Duty cycle≤2%;
3. Essentially independent of operating temperature.

## TYPICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

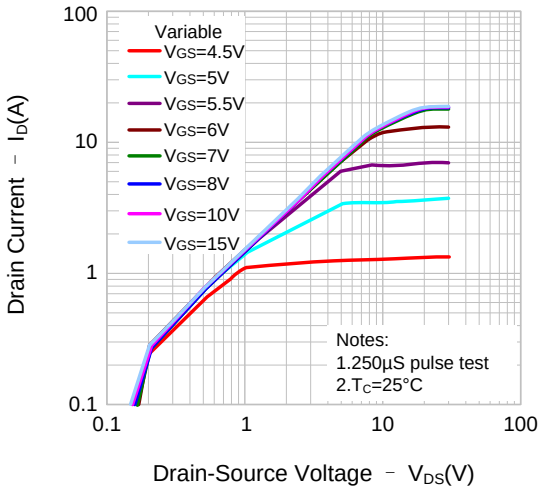



Figure 2. Transfer Characteristics

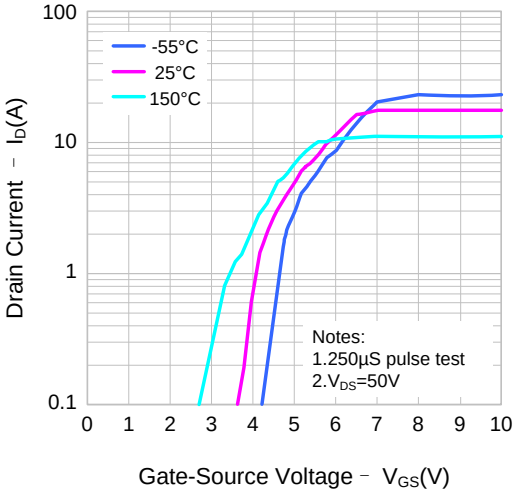



Figure 3. On-Resitance Variation vs. Drain Current and Gate Voltage

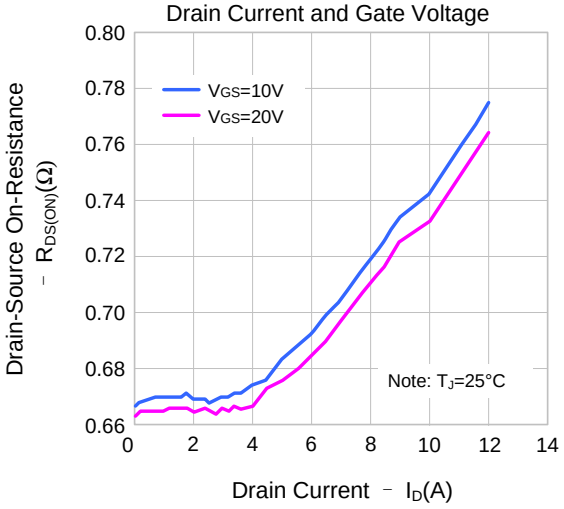
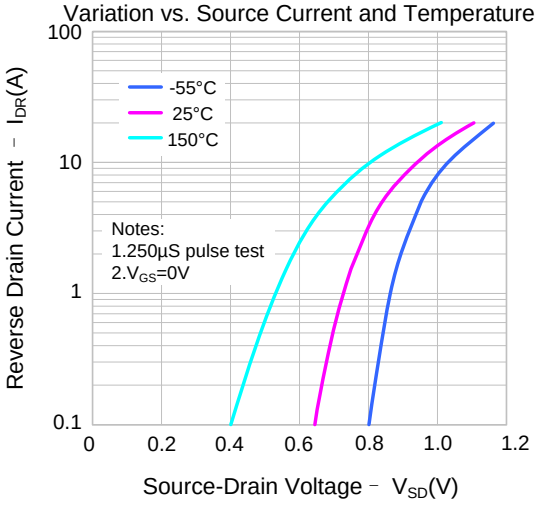



Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature



## TYPICAL CHARACTERISTICS(continued)

Figure 5. Capacitance Characteristics

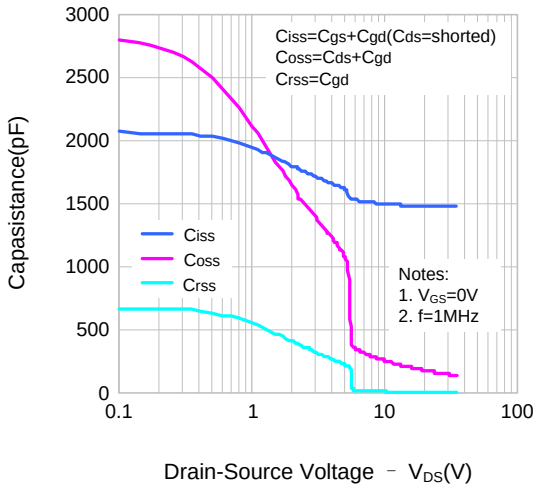



Figure 6. Gate Charge Characteristics

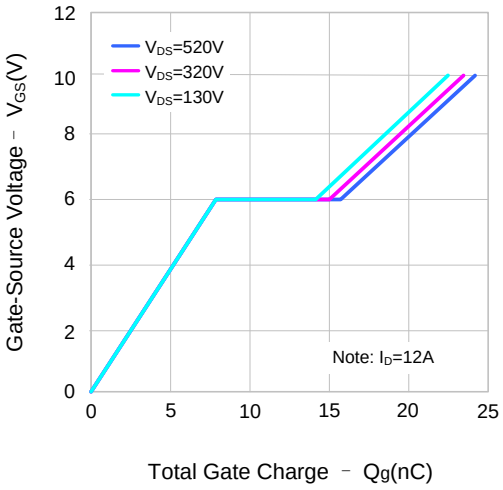



Figure 7. Breakdown Voltage Variation vs. Temperature

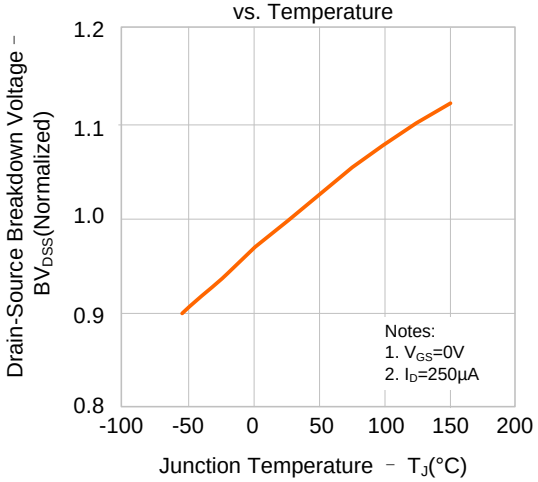



Figure 8. On-resistance Variation vs. Temperature

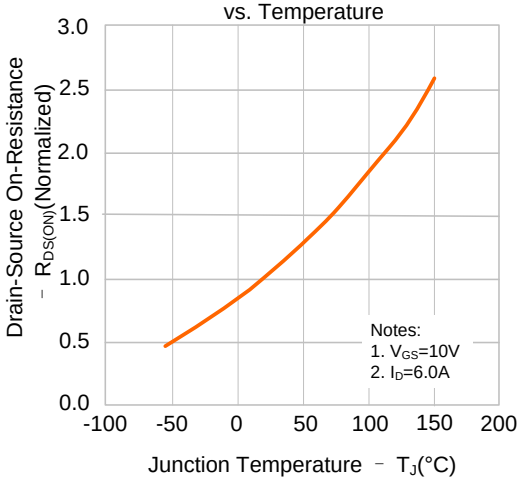



Figure 9. Max. Safe Operating Area

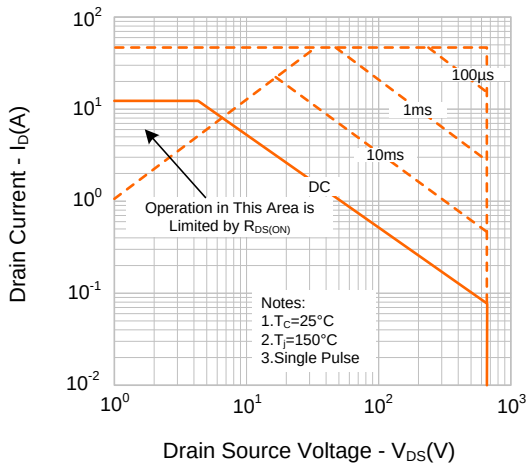
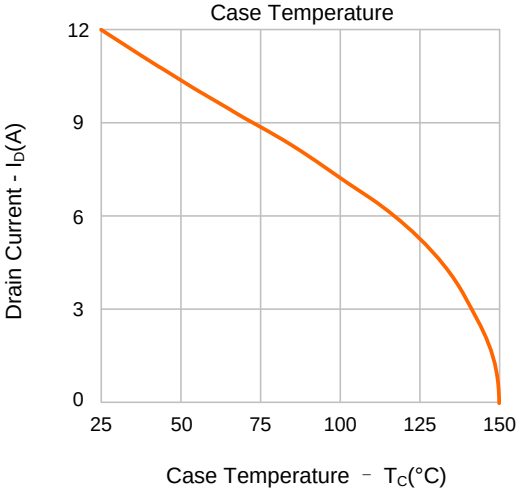
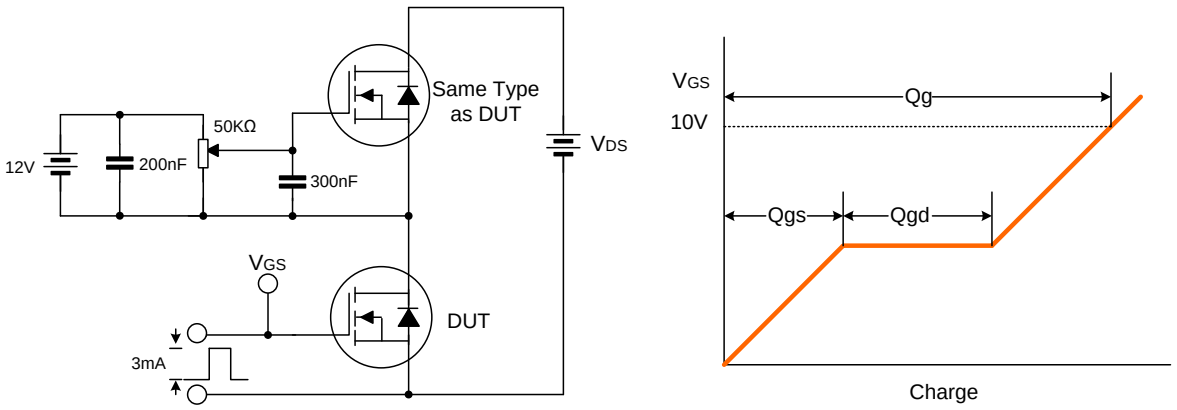



Figure 10. Maximum Drain Current vs. Case Temperature

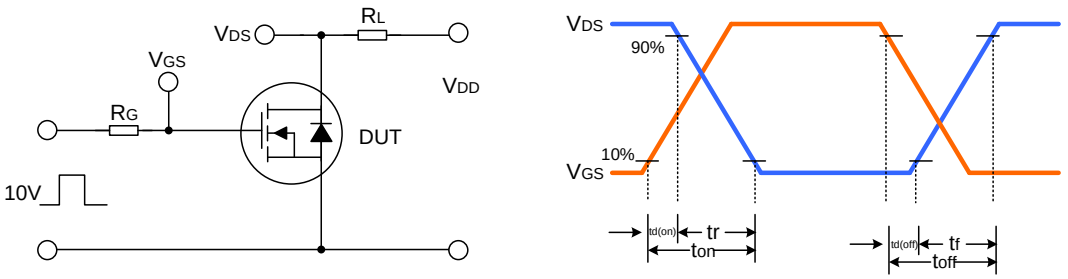


## TYPICAL TEST CIRCUIT

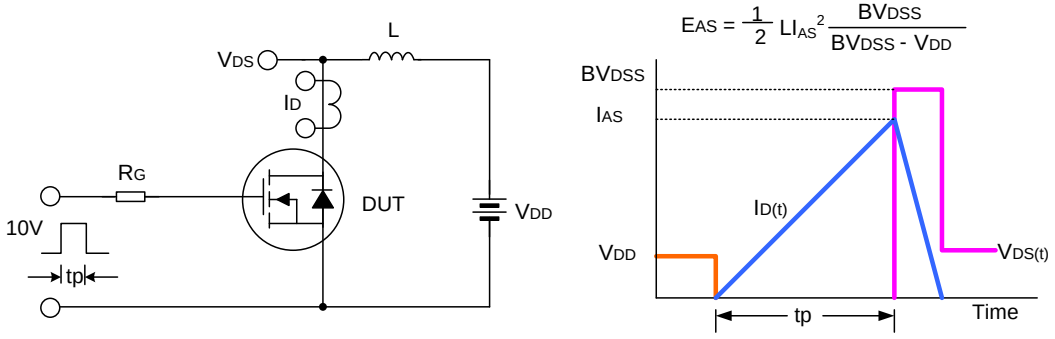
Gate Charge Test Circuit & Waveform




Resistive Switching Test Circuit & Waveform

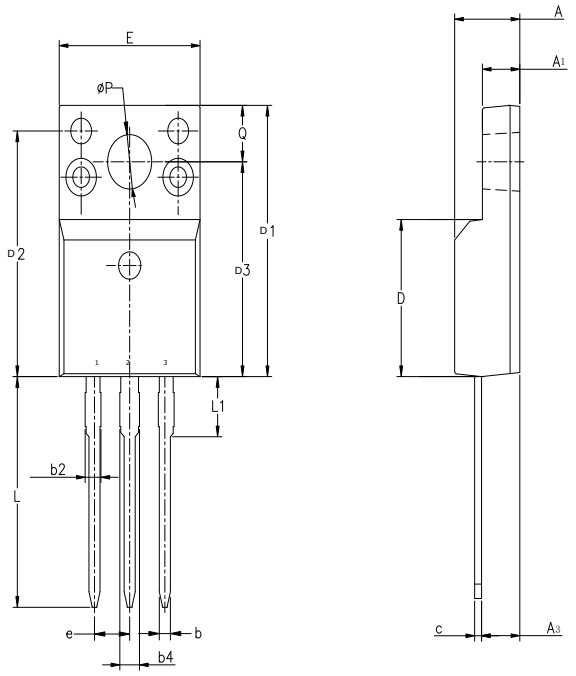



Unclamped Inductive Switching Test Circuit & Waveform



## PACKAGE OUTLINE

**TO-220FQ-3L** **Unit: mm**




| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 4.57 | 4.70 | 4.83 |
| A1 | 2.57 | 2.70 | 2.83 |
| A3 | 2.56 | 2.76 | 2.93 |
| b | 0.76 | – | 0.90 |
| b2 | 0.96 | – | 1.19 |
| b4 | 1.24 | – | 1.47 |
| c | 0.46 | – | 0.60 |
| D | 8.99 | 9.19 | 9.39 |
| D1 | 15.80 | 15.87 | 16.13 |
| D2 | 14.17 | 14.37 | 14.57 |
| D3 | 12.30 | 12.57 | 12.87 |
| E | 9.96 | 10.16 | 10.36 |
| e | 2.54BSC | | |
| L | 13.20 | 13.50 | 13.70 |
| L1 | 3.37 | 3.52 | 3.67 |
| øP | 3.08 | 3.18 | 3.28 |
| Q | 3.20 | 3.30 | 3.40 |

| | | | |
|---|---|---|---|
| Part No.: | SVF12N65FQ | Document Type: | Datasheet |
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Rev.: 1.0

Revision History:

1. First release