# FIR2N60ALG

*Advanced N-Ch Power MOSFET*

## General Description

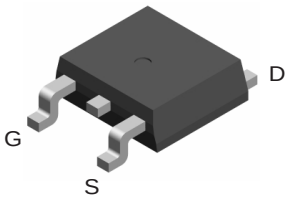
FIR2N60ALG is an N-channel enhancement mode power MOS field effect transistor which is produced using Silan proprietary F-Cell$^{TM}$ structure VDMOS technology. The improved planar stripe cell and the improved guard ring terminal have been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

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

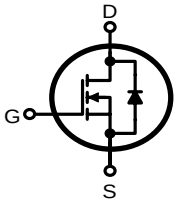
## Features

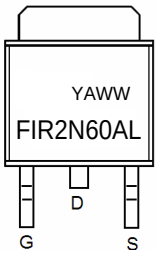
- 2A,600V,$R_{DS(on)}$（typ）=3.7Ω@$V_{GS}$=10V
- Low gate charge
- Low Crss
- Fast switching
- Improved dv/dt capability

## PIN Connection TO-252(D-PAK)




Schematic dia gram




**Marking Diagram**

Y = Year
A = Assembly Location
WW = Work Week
FIR2N60AL = Specific Device Code

## Absolute Maximum Ratings (Ta = 25°C unless otherwise noted )

| Characteristics | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 600 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Drain Current | $T_C$=25°C | $I_D$ | 2.0 | A |
| | $T_C$=100°C | | 1.3 | |
| Drain Current Pulsed | | $I_{DM}$ | 8 | A |
| Power Dissipation($T_C$=25°C) | | $P_D$ | 35 | W |
| -Derate above 25°C | | | 0.28 | W/°C |
| Single Pulsed Avalanche Energy(Note 1) | | $E_{AS}$ | 115 | mJ |
| Operation Junction Temperature Range | | $T_J$ | -55～+150 | °C |
| Storage Temperature Range | | $T_{stg}$ | -55～+150 | °C |

## Thermal Characteristics

| Characteristics | Symbol | Ratings | Unit |
|---|---|---|---|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 3.57 | °C/W |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 110 | °C/W |

## Electrical Characteristics (Ta = 25°C unless otherwise noted)

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain -Source Breakdown Voltage | $B_{VDSS}$ | 25 °C, $V_{GS}$=0V, $I_D$=250μA | 600 | -- | -- | V |
| | | 125°C, $V_{GS}$=0V, $I_D$=250μA | 600 | -- | -- | V |
| Drain-Source Leakage Current | $I_{DSS}$ | 25 °C, $V_{DS}$=600V, $V_{GS}$=0V | -- | -- | 10 | uA |
| | | 125°C, $V_{DS}$=600V, $V_{GS}$=0V | -- | -- | 50 | uA |
| | | 150°C, $V_{DS}$=600V, $V_{GS}$=0V | -- | -- | 100 | uA |
| 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 R esistance | $R_{DS(on)}$ | $V_{GS}$=10V, $I_D$=1.0A | -- | 3.7 | 4.2 | Ω |
| Forward Transconductance | Gfs | $V_{DS}$=10V, $I_D$=1.0A | -- | 1.3 | -- | S |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=25V,$V_{GS}$=0V, f=1.0MHZ | -- | 301.7 | -- | pF |
| Output Capacitance | $C^{oss}$ | | -- | 13 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 1.1 | -- | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=300V,$I_D$=2.0A, $R_G$=25Ω (Note 2,3) | -- | 9.2 | -- | ns |
| Turn-on Rise Time | $t_r$ | | -- | 23.4 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 15.3 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 20.1 | -- | |
| Total Gate Charge | $Q_g$ | $V_{DS}$=480V,$I_D$=2.0A, $V_{GS}$=10V (Note 2,3) | -- | 7.2 | -- | nC |
| Gate-Source Charge | $Q_{gs}$ | | -- | 1.57 | -- | |
| Gate-Drain Charge | $Q_{gd}$ | | -- | 2.1 | -- | |

## Source-Drain Diode Ratings And Characteristics

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Continuous Source Current | $I_S$ | Integral Reverse P-N Junction Diode in the MOSFET | -- | -- | 2.0 | A |
| Pulsed Source Current | $I_{SM}$ | | -- | -- | 8.0 | |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=2.0A,$V_{GS}$=0V | -- | -- | 1.4 | V |
| Reverse Recovery Time | $T_{rr}$ | $I_S$=2.0A,$V_{GS}$=0V, $dI_F/dt$=100A/μS | -- | 356.75 | -- | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | -- | 1.03 | -- | μC |

**Notes:**

1. L=30mH, $I_{AS}$=2.52A, $V_{DD}$=145V, $R_G$=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

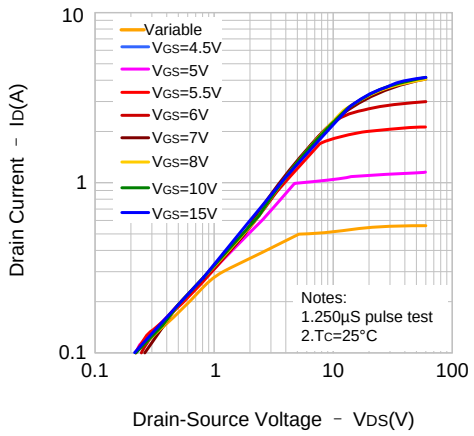



Figure 2. Transfer Characteristics

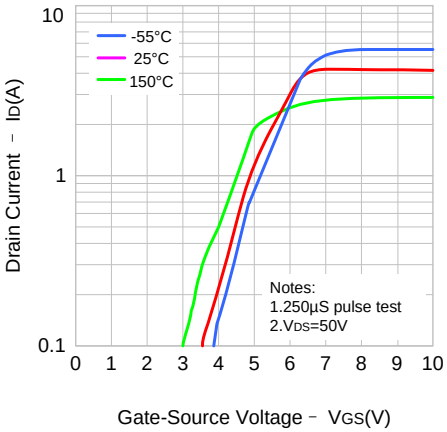



Figure 3. On-Resitance Variation vs. Drain Current and Gate Voltage

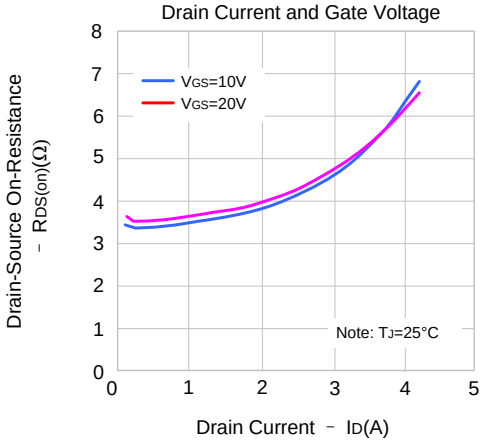



Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

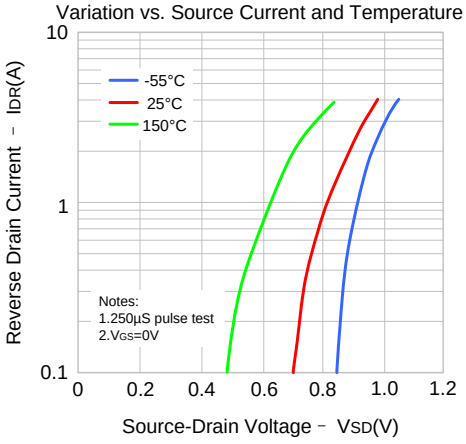



Figure 5. Capacitance Characteristics

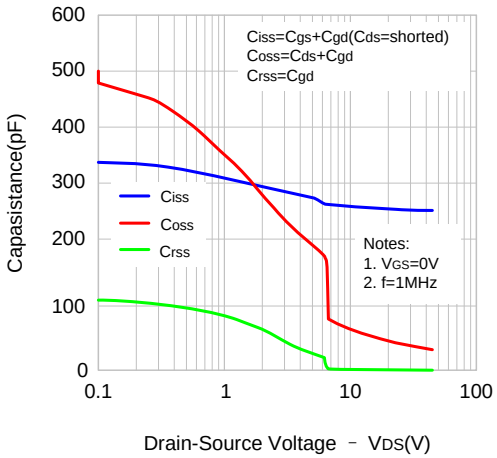
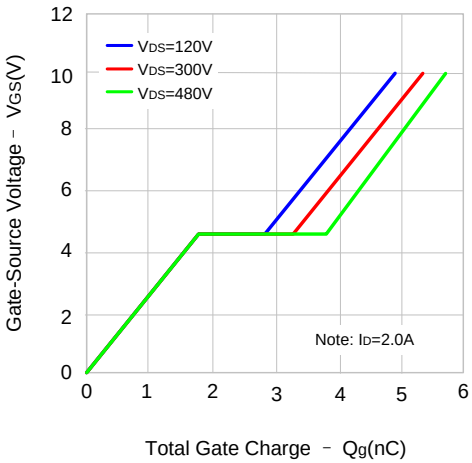



Figure 6. Gate Charge Characteristics



## Typical Characteristics(Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

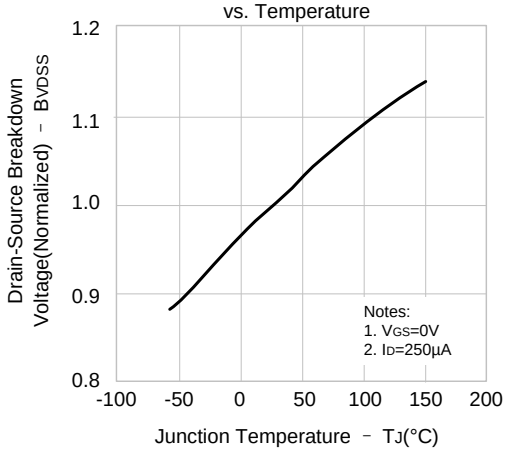



Figure 8. On-resistance Variation vs. Temperature

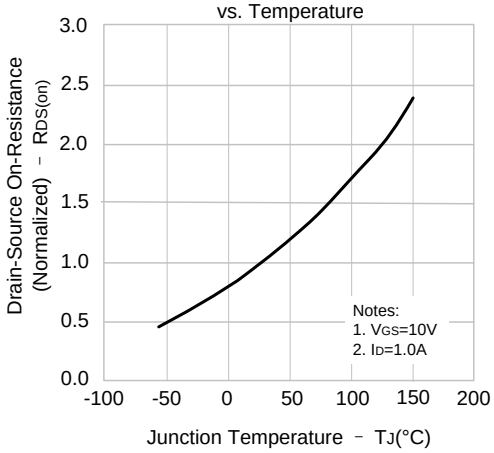



Figure 9. Max. Safe Operating Area(FIR2N60ALG)

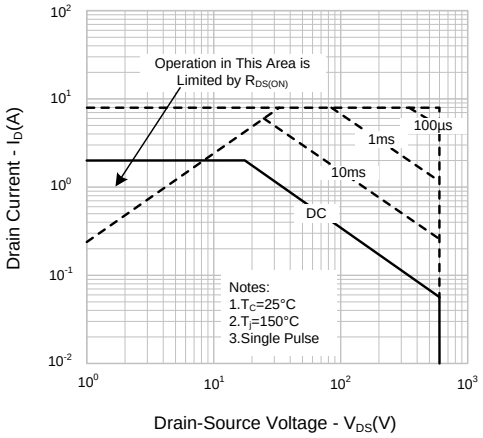
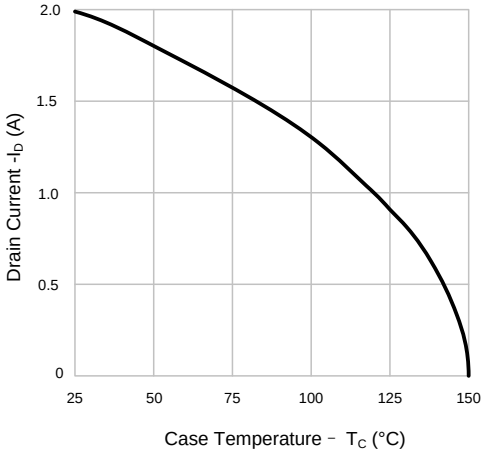
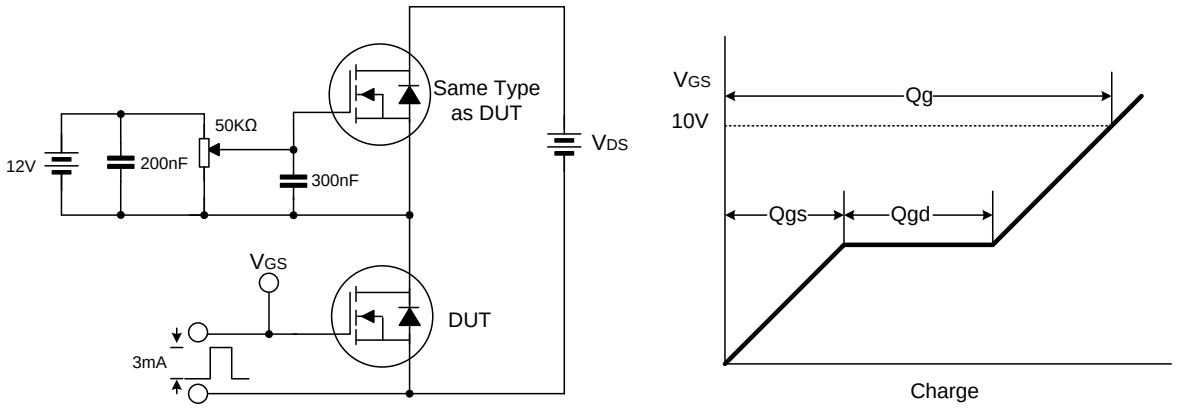



Figure 10. Max. Drain Current vs. Case Temperature

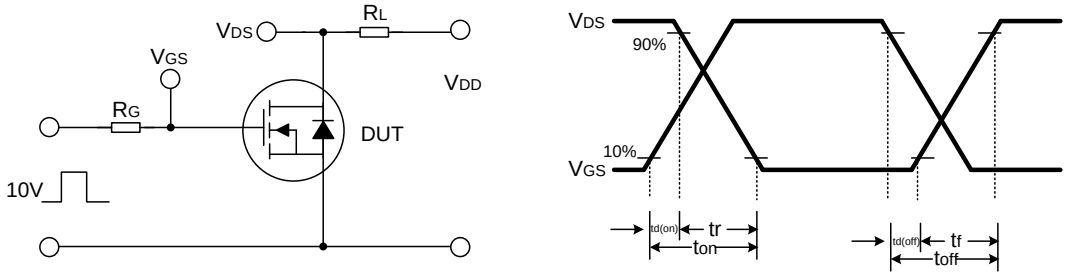


## Typical Test Circuit

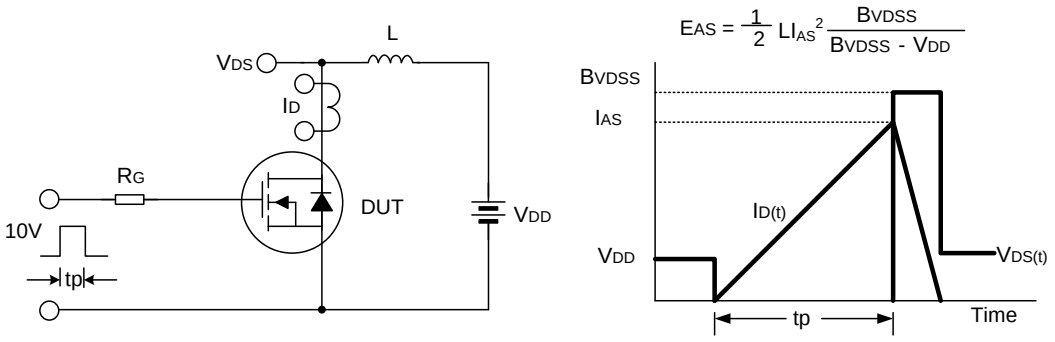
Gate Charge Test Circuit & Waveform




Resistive Switching Test Circuit & Waveform

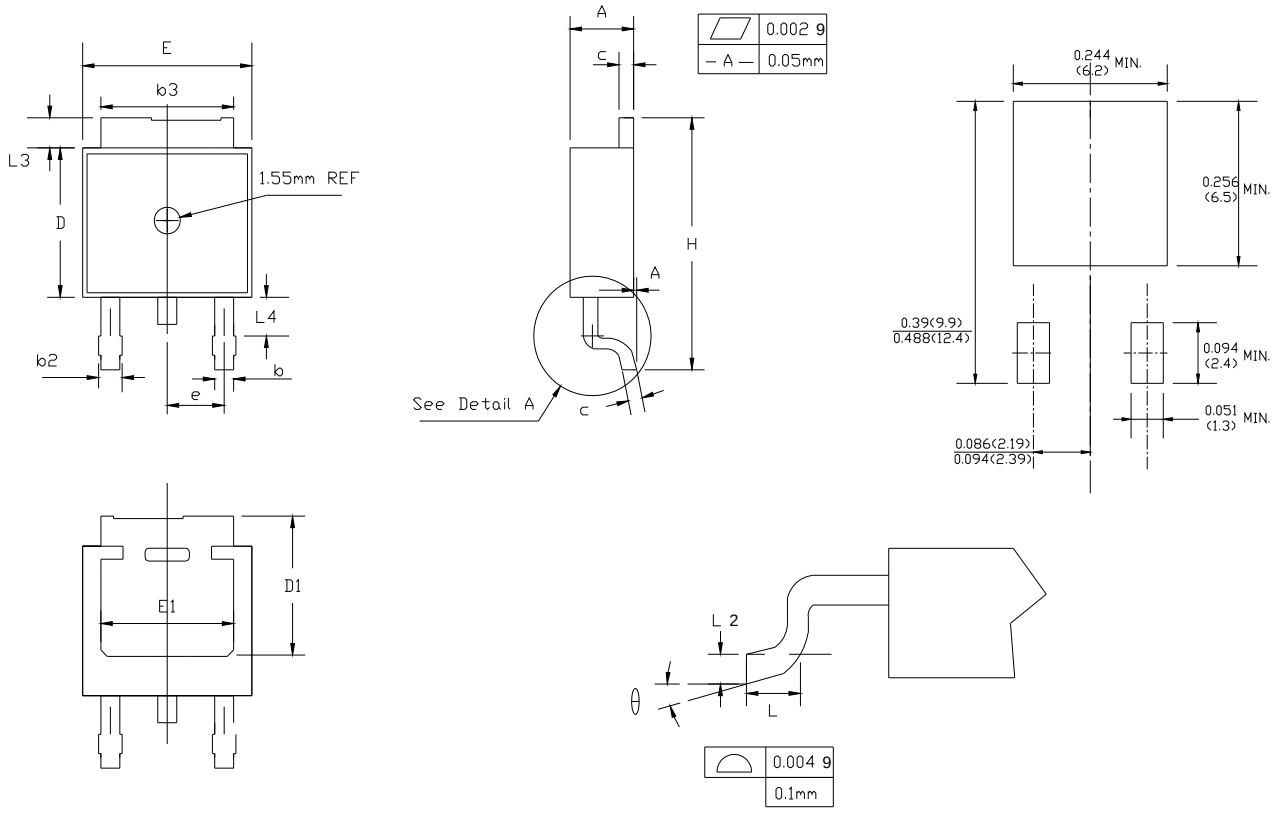



Unclamped Inductive Switching Test Circuit & Waveform



## Package Dimensions

8 Q L WPVP




| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | ! | " | " # | |
| | $ | | $ | # | |
| % | " | # | ! | | |
| % " | # # | ! | ! | ! | |
| % # | " | " | " | ! | |
| & | | "! | ! | | |
| | "! | "! | " | # " | |
| | " | $ | " | $ | |
| | " | " | # | ' # | |
| | | $ | ! # | $ | |
| | | | " " | | |
| | # | ! | | ! | |
| | | ' | ! | ' | |
| " | " | | | | |
| # | # | | | " ' | |
| ! | " | ! | ! | | |
| | ( | ( | ( | ( | |

| Revision History | |
|---|---|
| Date | Revison Changes |
| 2017/7/3 | 1.Adding Mininum Ciss Value:297pF<br>2.Adding Maximum Ciss Value:306.1pF<br>3.Adding Mininum Coss Value:11pF<br>4.Adding Maximum Coss Value:17pF<br>5.Adding Mininum Crss Value:0.9pF<br>6.Adding Maximum Crss Value:1.3pF<br>7.Change Typical Ciss value from 250.1pF to 301.7pF<br>8.Change Typical Coss value from 35.7pF to 13pF<br>9.Change Typical Qg value from 5.67nC to 7.2nC<br>10.Change Typical Qgs value from 1.74nC to 1.57nC<br>11.Change Typical Qgs value from 1.99nC to 2.1nC |