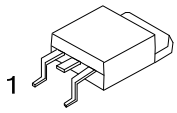
F2N60-LC1 **Preliminary** ***Power MOSFET***

# 2.0A, 600V N-CHANNEL POWER MOSFET




TO-252

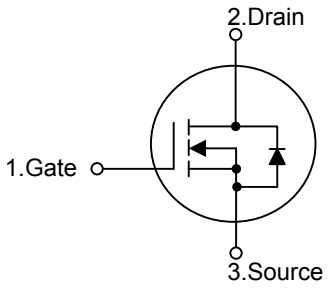
## ■ DESCRIPTION

The UTC **F2N60-LC1** is a N-Channel enhancement mode silicon gate power MOSFET with Fast Body Diode, is designed high voltage, high speed power switching applications such, is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.

## ■ FEATURES

* $R_{DS(ON)} \leq 5.5\ \Omega$ @ $V_{GS}$=10V, $I_D$=1.0A
* Fast body diode MOSFET technology
* High Switching Speed
* 100% Avalanche Tested

## ■ SYMBOL




## ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| F2N60L-TN3-R | F2N60G-TN3-R | TO-252 | G | D | S | Tape Reel |

Note: Pin Assignment: G: Gate D: Drain S: Source

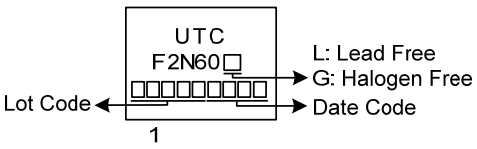
F2N60G-TN3-R

(1)Packing Type — (1) R: Tape Reel

(2)Package Type — (2) TN3: TO-252

(3)Green Package — (3) G: Halogen Free and Lead Free, L: Lead Free

## ■ MARKING



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

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 600 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | V |
| Drain Current | Continuous | $I_D$ | 2 | A |
| | Pulsed (Note 2) | $I_{DM}$ | 4 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 49 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 6 | V/ns |
| Power Dissipation | | $P_D$ | 45 | W |
| Junction Temperature | | $T_J$ | +150 | °C |
| Storage Temperature | | $T_{STG}$ | -55 ~ +150 | °C |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature.
3. L = 30mH, $I_{AS}$ = 1.8A, $V_{DD}$ = 50V, $R_G$ = 25Ω, Starting $T_J$ = 25°C
4. $I_{SD}$ ≤ 2.0A, di/dt ≤ 200A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C

## ■ THERMAL CHARACTERISTICS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Junction to Ambient | $\theta_{JA}$ | 100 | °C/W |
| Junction to Case | $\theta_{JC}$ | 2.77 (Note) | °C/W |

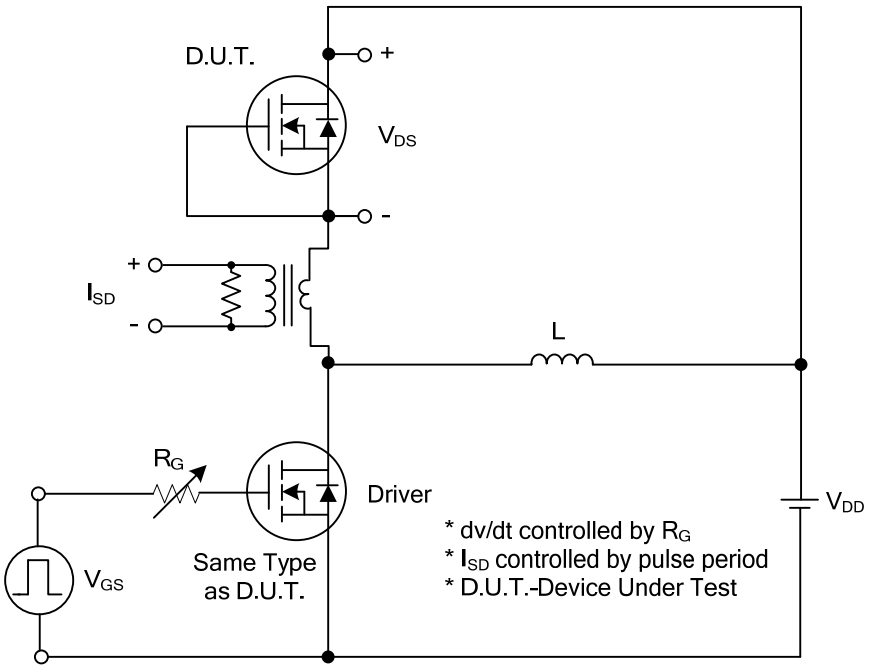
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

## ■ ELECTRICAL CHARACTERISTICS ($T_J$ =25°C, unless otherwise specified)

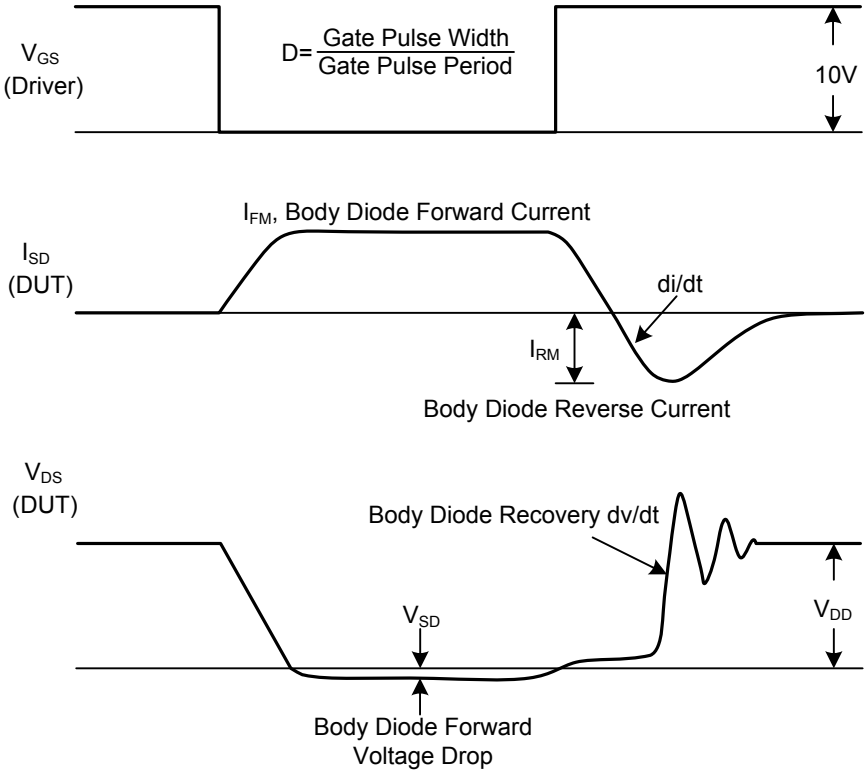
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $I_D$=250μA, $V_{GS}$=0V | 600 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=600V, $V_{GS}$=0V | | | 10 | μA |
| Gate- Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$=+30V, $V_{DS}$=0V | | | +100 | nA |
| | Reverse | | $V_{GS}$=-30V, $V_{DS}$=0V | | | -100 | nA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.0 | | 4.0 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=1.0A | | | 5.5 | Ω |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=25V, f=1.0MHz | | 265 | | pF |
| Output Capacitance | | $C_{OSS}$ | | | 31 | | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 3 | | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge (Note 1) | | $Q_G$ | $V_{DS}$=480V, $V_{GS}$=10V, $I_D$=2A $I_G$=1mA (Note 1, 2) | | 7.5 | | nC |
| Gate to Source Charge | | $Q_{GS}$ | | | 2.6 | | nC |
| Gate to Drain Charge | | $Q_{GD}$ | | | 1 | | nC |
| Turn-ON Delay Time (Note 1) | | $t_{D(ON)}$ | $V_{DD}$=100V, $V_{GS}$=10V, $I_D$=2A, $R_G$ =25Ω (Note 1, 2) | | 5 | | ns |
| Rise Time | | $t_R$ | | | 16 | | ns |
| Turn-OFF Delay Time | | $t_{D(OFF)}$ | | | 24 | | ns |
| Fall-Time | | $t_F$ | | | 24 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 2 | A |
| Maximum Body-Diode Pulsed Current (Note 1) | | $I_{SM}$ | | | | 4 | A |
| Drain-Source Diode Forward Voltage (Note 1) | | $V_{SD}$ | $I_S$=2A, $V_{GS}$=0V | | | 1.4 | V |
| Body Diode Reverse Recovery Time | | $t_{rr}$ | $I_S$=2A, $V_{GS}$=0V, $dI_F/dt$=100A/μs | | 87 | | ns |
| Body Diode Reverse Recovery Charge | | $Q_{rr}$ | | | 0.3 | | μC |

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

## ■ TEST CIRCUITS AND WAVEFORMS

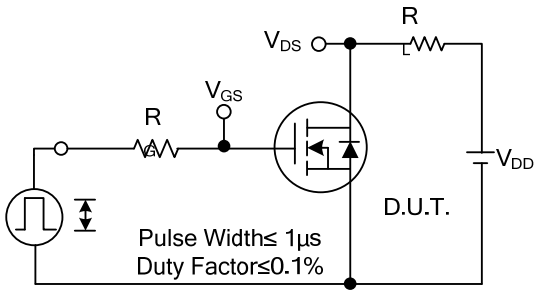



**Peak Diode Recovery dv/dt Test Circuit**

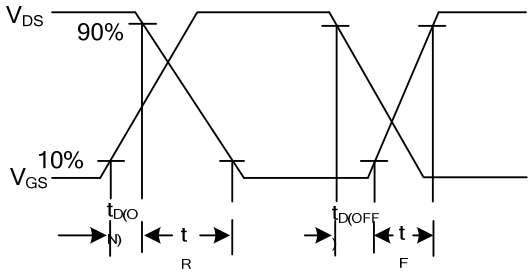



**Peak Diode Recovery dv/dt Waveforms**

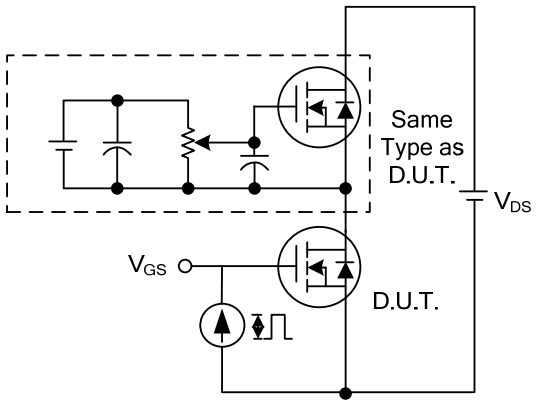
## ■ TEST CIRCUITS AND WAVEFORMS



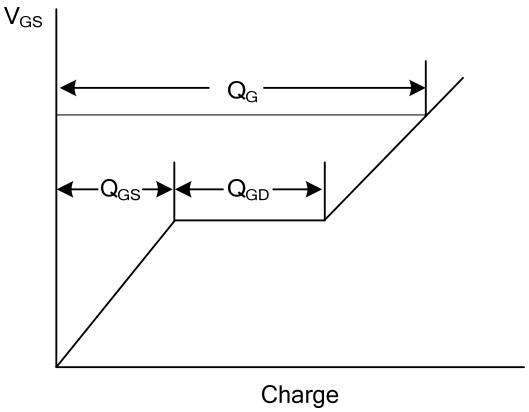

Switching Test Circuit



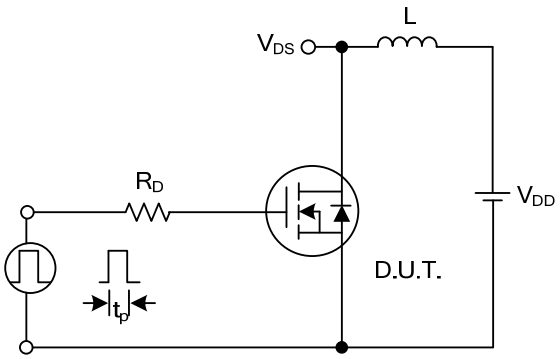

Switching Waveforms



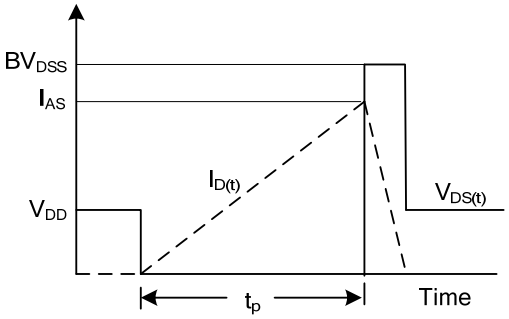

Gate Charge Test Circuit




Gate Charge Waveform




Unclamped Inductive Switching Test Circuit




Unclamped Inductive Switching Waveforms