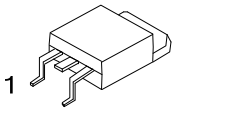
# 6A, 400V N-CHANNEL POWER MOSFET




TO-252

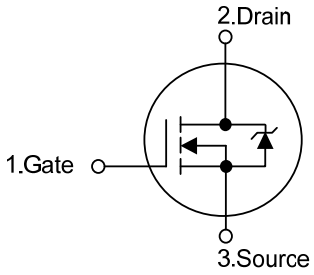
## ■ DESCRIPTION

The N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers, relay drivers.

## ■ FEATURES

* $R_{DS(ON)}$ < 1.1Ω @ $V_{GS}$=10V, $I_D$=3.0A
* Avalanche Energy Specified
* Fast Switching Capability
* Linear Transfer Characteristics
* High Input Impedance

## ■ SYMBOL



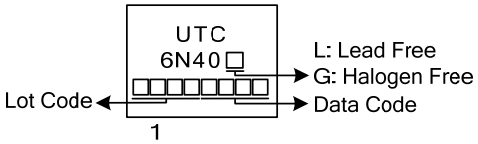

## ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 6N40L-TN3-R | 6N40G-TN3-R | TO-252 | G | D | S | Tape Reel |

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

| | |
|---|---|
| 6N40G-TN3-R<br>(1)Packing Type<br>(2)Package Type<br>(3)Green Package | (1) R: Tape Reel<br>(2) TN3: TO-252<br>(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 | | $V_{DSS}$ | 400 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Drain Current | Continuous | $I_D$ | 6.0 | A |
| | Pulsed (Note 2) | $I_{DM}$ | 24 | A |
| Avalanche Current (Note 2) | | $I_{AR}$ | 4.6 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 106 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 2.0 | V/ns |
| Power Dissipation | | $P_D$ | 48 | 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 = 10mH, $I_{AS}$ = 4.6A, $V_{DD}$ = 50V, $R_G$ = 25Ω, Starting $T_J$ = 25°C
4. $I_{SD}$ ≤5.5A, di/dt ≤ 200A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C

## ■ THERMAL DATA

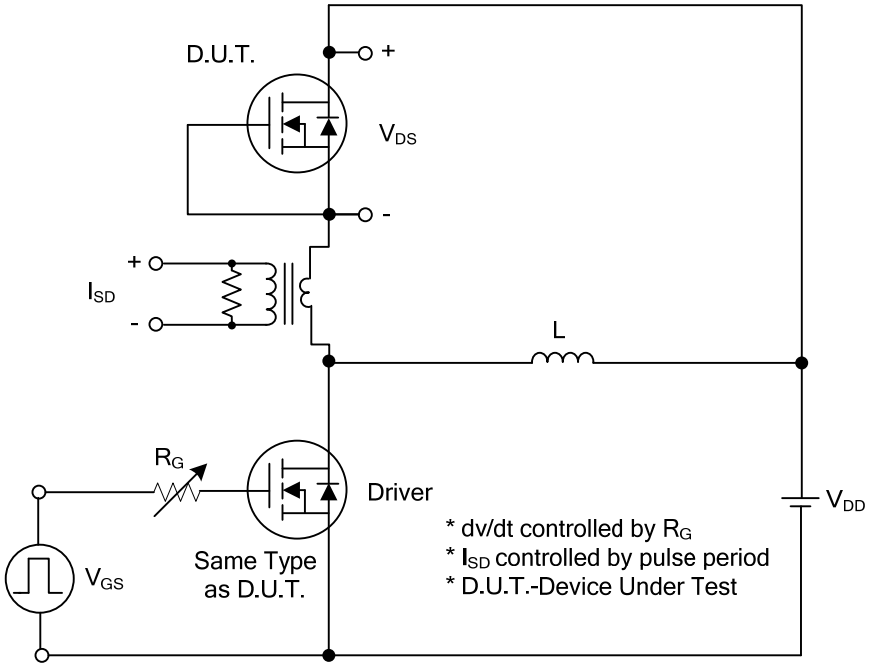
| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Junction to Ambient | $\theta_{JA}$ | 110 | °C/W |
| Junction to Case | $\theta_{JC}$ | 2.6 | °C/W |

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

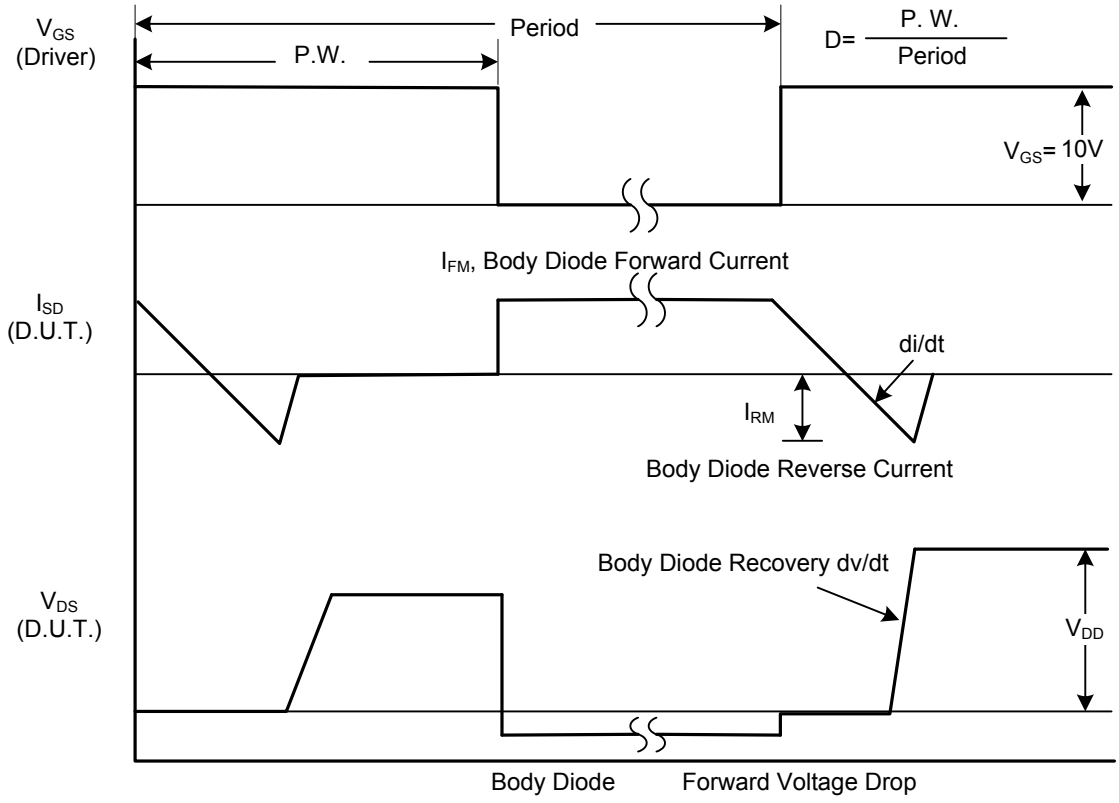
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250μA | 400 | | | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=Rated $BV_{DSS}$, $V_{GS}$=0V | | | 25 | μA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V | | | ±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, $I_D$=3.0A | | | 1.1 | Ω |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$=0V,$V_{DS}$=25V, f=1.0MHz | | 485 | | pF |
| Output Capacitance | $C_{OSS}$ | | | 70 | | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | 7 | | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Total Gate Charge (Note 1) | $Q_G$ | $V_{DS}$=50V, $V_{GS}$=10V, $I_D$=1.3A $I_G$=100μA (Note1, 2) | | 35.4 | | nC |
| Gate to Source Charge | $Q_{GS}$ | | | 3.6 | | nC |
| Gate to Drain Charge | $Q_{GD}$ | | | 5.8 | | nC |
| Turn-ON Delay Time (Note 1) | $t_{D(ON)}$ | $V_{DS}$=30V, $V_{GS}$=10V, $I_D$=0.5A, $R_G$=25Ω (Note1, 2) | | 31 | | ns |
| Rise Time | $t_R$ | | | 40 | | ns |
| Turn-OFF Delay Time | $t_{D(OFF)}$ | | | 117 | | ns |
| Fall-Time | $t_F$ | | | 38 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Maximum Body-Diode Continuous Current | $I_S$ | | | | 6 | A |
| Maximum Body-Diode Pulsed Current | $I_{SM}$ | | | | 24 | A |
| Drain-Source Diode Forward Voltage (Note 1) | $V_{SD}$ | $I_S$ =6.0A, $V_{GS}$=0V | | | 1.6 | V |
| Body Diode Reverse Recovery Time (Note 1) | $t_{rr}$ | $I_S$ =6.0A, $V_{GS}$=0V $dI_F$/dt=100A/μs | | 220 | | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | | 1.0 | | 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

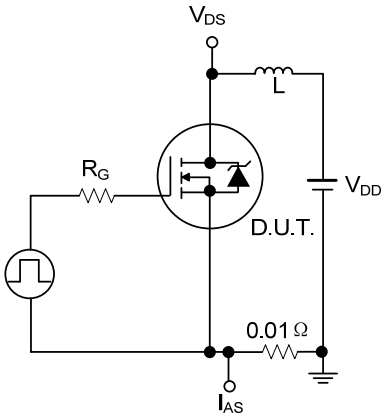



Figure 1A. Unclamped Energy Test Circuit

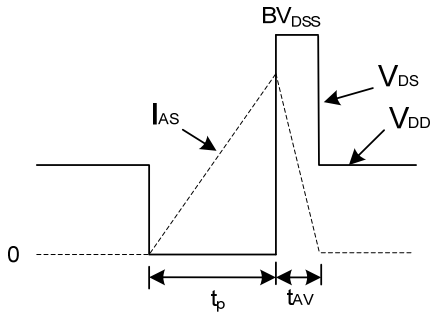



Figure 1B. Unclamped Energy Waveforms

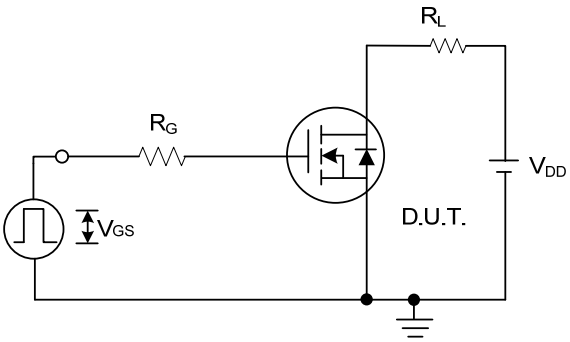



Figure 2A. Switching Time Test Circuit

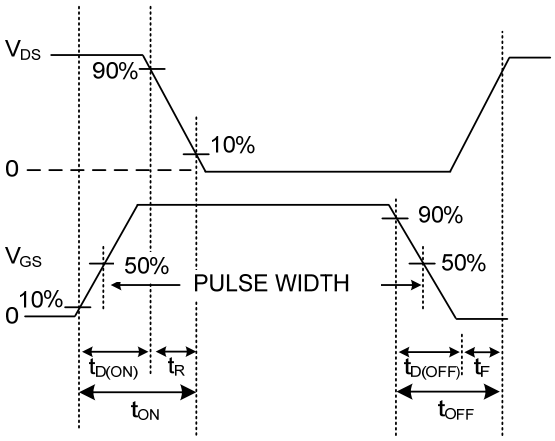



Figure 2B. Resistive Switching Waveforms

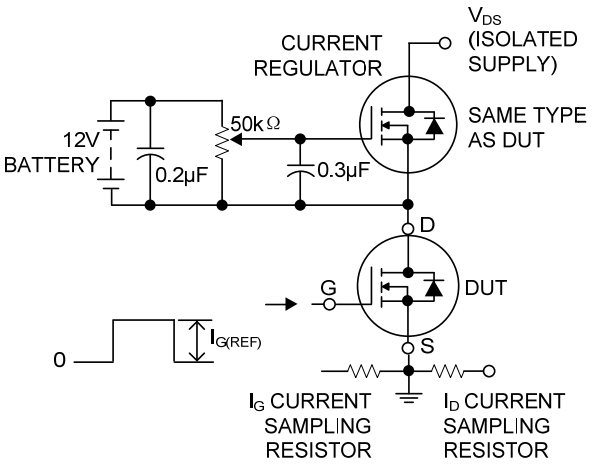



Figure 3A. Gate Charge Test Circuit

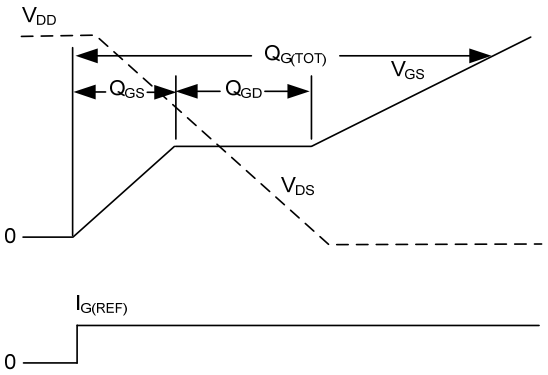



Figure 3B. Gate Charge Waveforms