

4 Amps, 600Volts

N-CHANNEL MOSFET

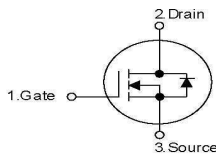
DESCRIPTION

The 4N60 is a high voltage MOSFET and 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 DC to DC converters and bridge circuits.

FEATURES

- $R_{DS(ON)}=2.5\ \Omega @V_{GS}=10V$
- Ultra Low gate charge(typical 15.0nC)
- Low reverse transfer capacitance(C_{RSS} =typical8.0pF)
- Fast switching capability
- Avalanche energy specified
- Improved dv/dt capability,high ruggedness

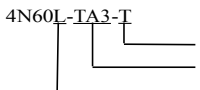
SYMBOL



ORDERING INFORMATION

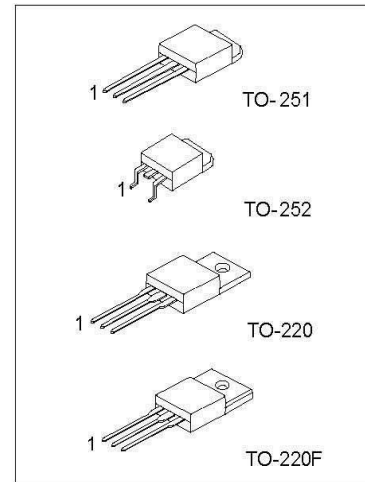
| Order Number | | Package | Pin Assignment | | | Packing |
|--------------|-------------------|---------|----------------|---|---|-----------|
| Normal | Lead Free Plating | | 1 | 2 | 3 | |
| 4N60-TA3-T | 4N60L-TA3-T | TO-220 | G | D | S | Tube |
| 4N60-TF3-T | 4N60L-TF3-T | TO-220F | G | D | S | Tube |
| 4N60-TM3-T | 4N60L-TM3-T | TO-251 | G | D | S | Tube |
| 4N60-TN3-R | 4N60L-TN3-R | TO-252 | G | D | S | Tape Reel |
| 4N60-TN3-T | 4N60L-TN3-T | TO-252 | G | D | S | Tube |

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

| | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|  <p>4N60L-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Plating</p> | <p>(1)T:Tube,R:Tape Reel (2)TA3:TO220,TF3:TO-220F,TM3:TO-251,TN3:TO-252 (3)L:Lead Free Plating Blank: Pb/Sn</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|

ABSOLUTE MAXIMUM RATINGS ($T_c=25^\circ C$, unless otherwise specified)

| PARAMETER | SYMBOL | PATINGS | UNIT |
|------------------------------|-----------|------------------|------|
| Drain-Source Voltage | V_{DSS} | 600 | V |
| Gate-Source Voltage | V_{GSS} | ± 30 | V |
| Avalanche Current(Note 2) | I_{AP} | 4.4 | A |
| Drain Currentet | I_D | $T_c=25^\circ C$ | 4.0 |
| | | Continuous | |
| Drain Current Pulsed(Note 2) | I_{DP} | 16 | A |



*Pb-free plating product number: 4N60

| | | | | |
|-----------------------------------|------------------------|-----------|----------|------|
| Avalanche Energy | Repetitive(Note 2) | E_{AR} | 260 | mJ |
| | Single Pulse(Note 3) | E_{AS} | 10.6 | mJ |
| Peak Diode Recovery dv/dt(Note 4) | | dv/dt | 4.5 | v/ns |
| Total Power Dissipation | $T_c=25^\circ\text{C}$ | P_D | 75 | W |
| | Derate above 25°C | | 0.59 | w/°C |
| Junction Temperature | | T_J | +150 | °C |
| Storage Temperature | | T_{STG} | -55~+150 | °C |

Note: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 bu maximum junction temperature

■ THERMAL DATA

| PARAMETER | PACKAGE | SYMBOL | RATINGS | UNIT |
|-------------------------------------|---------|---------------|---------|------|
| Thermal Resistance Junction-Ambient | TO-251 | θ_{JA} | 83 | °C/W |
| | TO-252 | | 83 | |
| | TO-220 | | 62.5 | |
| | TO-220F | | 62.5 | |
| Thermal Resistance Junction-Case | TO-251 | θ_{JC} | 2.5 | |
| | TO-252 | | 2.5 | |
| | TO-220 | | 1.18 | |
| | TO-220F | | 3.47 | |

■ ELECTRICAL CHARACTERISTICS($T_J=25^\circ\text{C}$, unless otherwise specified.)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNI |
|-----------------------------------|------------------------------|----------------------------------|--------------------------|-----|------|----------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 600 | | | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=600V, V_{GS}=0V$ | | | 10 | μA |
| Gate-Body Leakage Current | Forward | I_{GSS} | $V_{GS}=30V, V_{DS}=0V$ | | 100 | nA |
| | Reverse | | $V_{GS}=-30V, V_{DS}=0V$ | | -100 | nA |
| Breakdown Voltage Temperature | $\Delta BV_{DSS}/\Delta T_J$ | $I_D=250\mu A$ | | 0.6 | | V/°C |
| On Characteristics | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2.0 | | 4.0 | V |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{DS}=10V, I_D=2.0A$ | | | 2.5 | Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=100V, I_D=2.4A$ (Note 1) | 2.9 | | | S |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=25V, V_{GS}=0V, f=1MHz$ | | 520 | 670 | pF |
| Output Capacitance | C_{OSS} | | | 70 | 90 | pF |
| Reverse Transfer Capacitance | C_{RSS} | | | 8 | 11 | pF |

■ ELECTRICAL CHARACTERISTICS(Cont.)

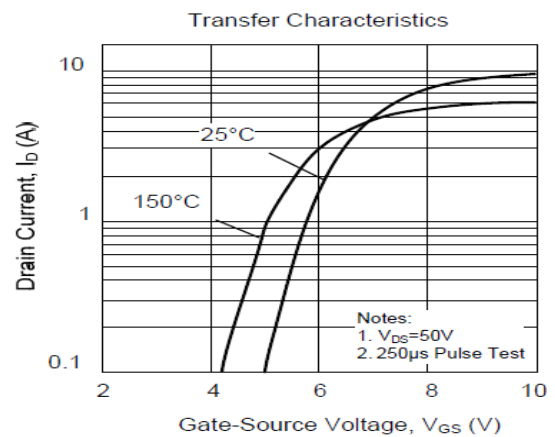
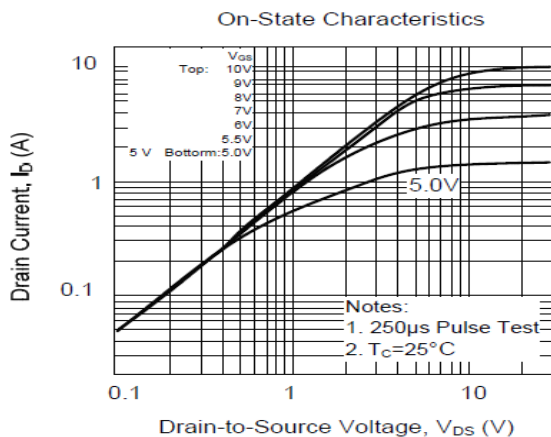
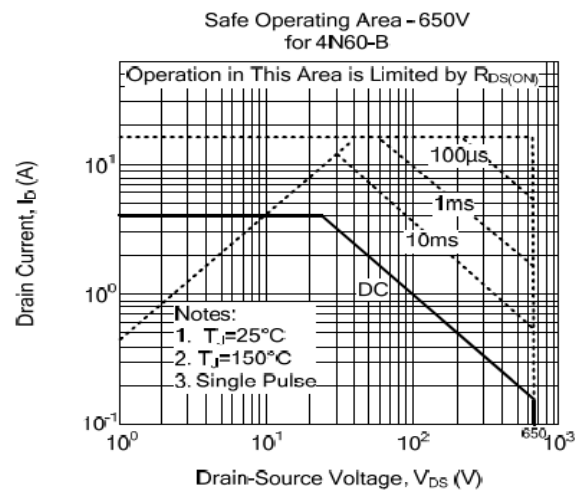
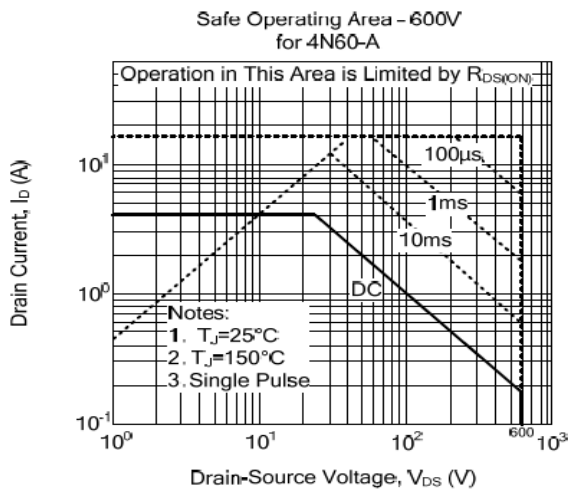
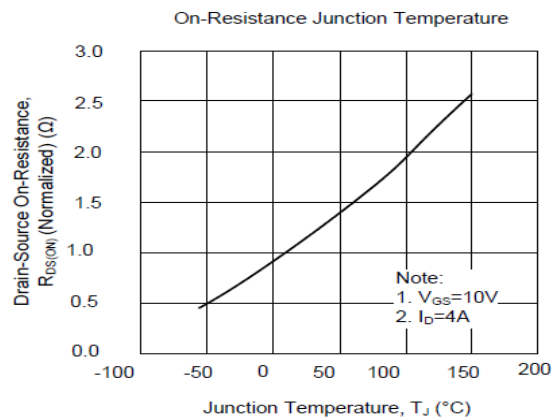
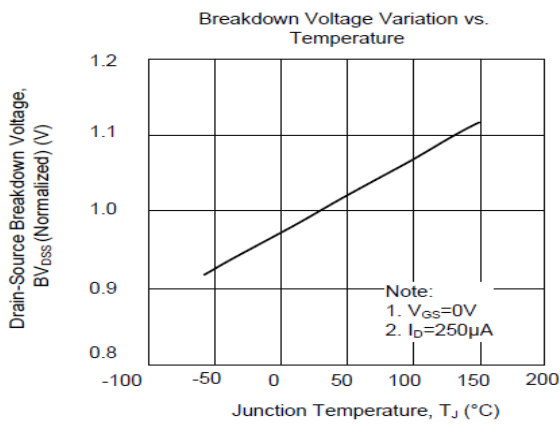
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|----------------------------------|--------------|------------------------------------------------------|-----|-----|-----|------|
| Switching Characteristics | | | | | | |
| Turn-On Delay Time | $t_{D(ON)}$ | $V_{DD}=300V, I_D=4.0A, R_G=25\Omega$ (Note 1, 2) | | 13 | 35 | ns |
| Rise Time | t_R | | | 45 | 100 | ns |
| Turn-Off Delay Time | $t_{D(OFF)}$ | | | 25 | 60 | ns |
| Fall Time | t_F | | | 35 | 80 | ns |
| Total Gate Charge | Q_G | $V_{DS}=480V, V_{GS}=10V, I_D=4.0A$ | | 15 | 20 | nC |

| | | | | |
|-------------------------------------------|----------|---------------------------|------|---------|
| Gate-Source Charge | Q_{GS} | (Note1,2) | 3.4 | nC |
| Gate-Drain Charge | Q_{GD} | | 7.1 | nC |
| Drain-Source Diode Characteristics | | | | |
| Drain-Source Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_{SD}=4.4A$ | 1.4 | V |
| Continuous Drain-Source Current | I_{SD} | | 4.4 | A |
| Pulsed Drain-Source Current | I_{SM} | | 17.6 | A |
| Reverse Recovery Time | t_{RR} | $V_{GS}=0V, I_{SD}=4.4A,$ | 250 | ns |
| Reverse Recovery Charge | Q_{RR} | $di/dt=100A/\mu A$ | 1.5 | μC |

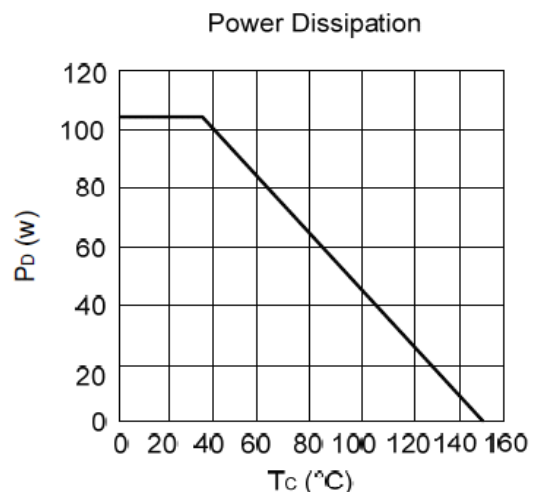
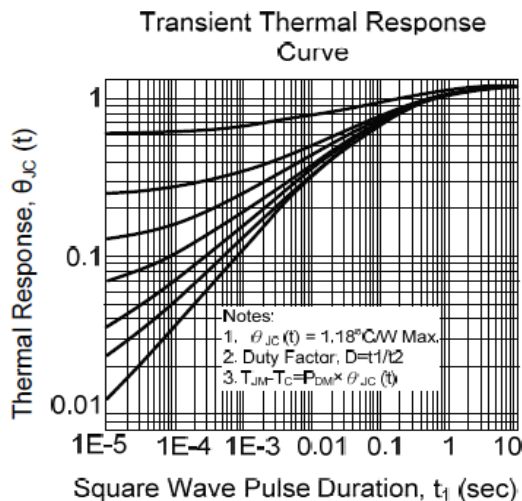
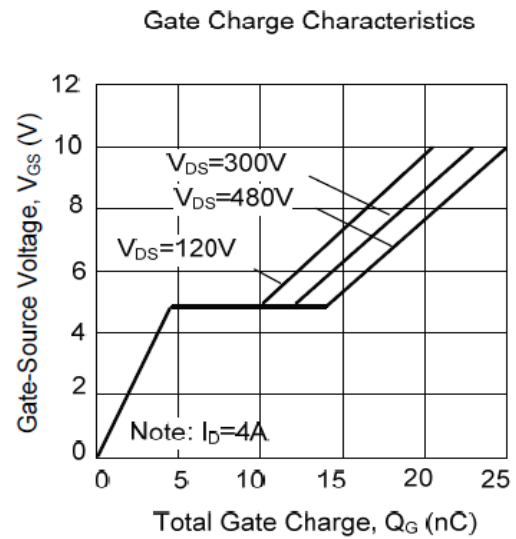
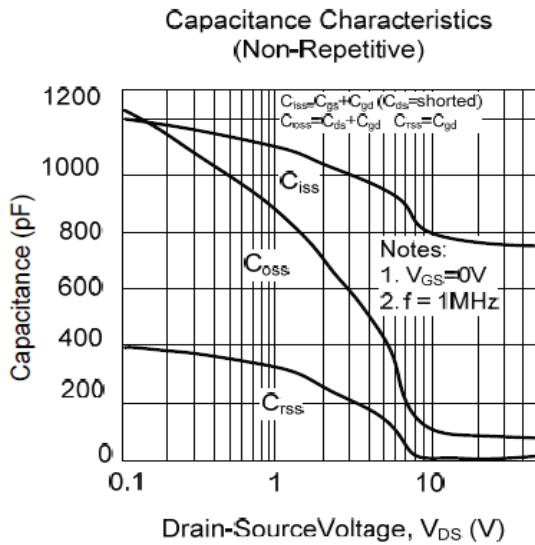
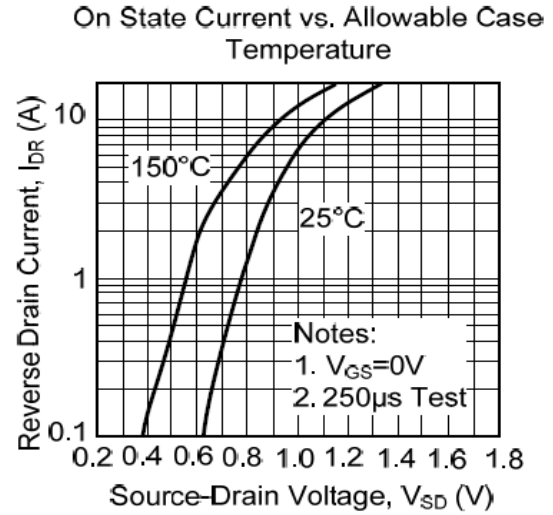
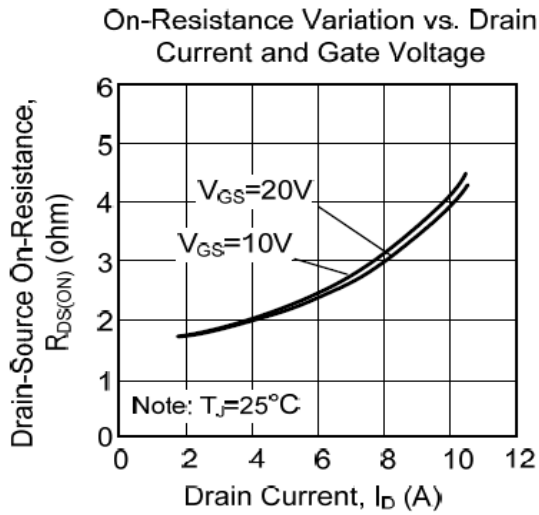
Note:1. Pulse Test: Pulse Width $\leq 300 \mu s$, Duty Cycle $\leq 2\%$

2. Essentially Independent of Operating Temperature

TYPICAL CHARACTERISTICS



TYPICAL PERFORMANCE CHARACTERISTICS(cont)



■ TYPICAL CHARACTERISTICS(cont)

