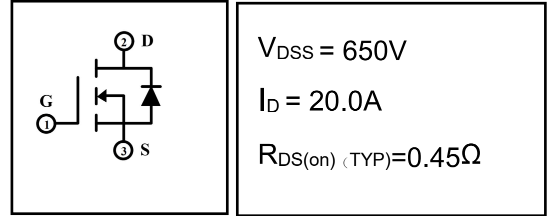
# 20A 650V N-channel Enhancement Mode Power MOSFET

## 1 Description

These N-channel enhanced vdmosfets, is obtained by the self-aligned planar technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. Which accords with the RoHS standard.

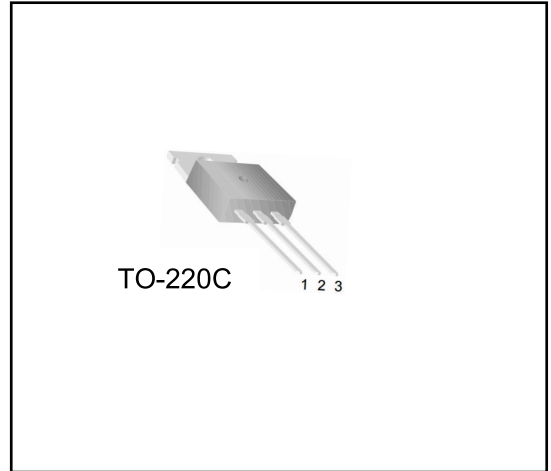



## 2 Features

- Fast switching
- ESD improved capability
- Low on resistance(Rdson≤0.56Ω)
- Low gate charge(Typ: 50.5nC)
- Low reverse transfer capacitances(Typ: 10.4pF)
- 100% single pulse avalanche energy test
- 100% ΔVDS test

## 3 Applications

- Used in various power switching circuit for system miniaturization and higher efficiency.
- Power switch circuit of electron ballast and adaptor.




## 4 Electrical Characteristics

### 4.1 Absolute Maximum Ratings (Tc=25℃,unless otherwise noted)

| PARAMETER | | SYMBOL | VALUE | UNIT |
|---|---|---|---|---|
| Drian-Source Voltage | | $V_{DS}$ | 650 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Drain Current(continuous)(Note 3) | | $I_D$ | 20 | A |
| Drain Current(continuous)(T=100℃)(Note 3) | | $I_D$ | 12.5 | A |
| Drain Current(Pulsed) | | $I_{DM}$ | 80 | A |
| Single Pulse Avalanche Energy(Note 4) | | $E_{AS}$ | 920 | mJ |
| Derating Factor above | $T_a$=25℃ | $P_D$ | 1.5 | W |
| Power Dissipation | $T_C$=25℃ | | 190 | W |
| Operating Junction Temperature Range | | $T_j$ | -55～150 | ℃ |
| Storage Temperature Range | | $T_{stg}$ | -55～150 | ℃ |
| High Temperature(tin solder) | | $T_L$ | 300 | ℃ |

### 4.2 Thermal Characteristics

| PARAMETER | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Thermal Resistance, Junction to Case-sink | $R_{thJC}$ | 0.66 | ℃/W |
| Thermal Resistance, Junction to Ambient | $R_{thJA}$ | 62.5 | ℃/W |

### 4.3 Electrical Characteristics (Tc=25℃,unless otherwise noted)

| PARAMETER | SYMBOL | Test Condition | VALUE MIN | VALUE TYP | VALUE MAX | UNIT |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-source Breakdown Voltage | $BV_{DSS}$ | $I_D$=250μA,$V_{GS}$=0V | 650 | -- | -- | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=650V,$V_{GS}$=0V, $T_C$=25℃ | -- | -- | 1 | μA |
| | | $V_{DS}$=520V,$V_{GS}$=0V, $T_C$=125℃ | -- | -- | 100 | μA |
| Gate-to-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±30V,$V_{DS}$=0V | -- | -- | ±100 | nA |
| **On Characteristics**(Note 3) | | | | | | |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 2.0 | -- | 4.0 | V |
| Drain-source on Resistance | $R_{DS(on)}$ | $V_{GS}$=10V,$I_D$=10A | -- | 0.45 | 0.56 | Ω |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V,$V_{DS}$=25V, f=1.0MHz | -- | 2437 | -- | pF |
| Output Capacitance | $C_{oss}$ | | -- | 200 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 10.4 | -- | |
| Turn-on Delay Time | $T_{d(on)}$ | ID=16A, VDD=325V, VGS=10V, RG=10Ω | -- | 26 | -- | ns |
| Turn-on Rise Time | $t_r$ | | -- | 41.4 | -- | |
| Turn-off Delay Time | $T_{d(off)}$ | | -- | 65.6 | -- | |
| Turn-off Fall | $t_f$ | | -- | 42.3 | -- | |
| Total Gate Charge | $Q_g$ | ID=16A,VDD=520V, VGS=10V | -- | 50.5 | -- | nc |
| Gate-to-Source Charge | $Q_{gs}$ | | -- | 11.2 | -- | |
| Gate-to-Drain(“Miller”)C harge | $Q_{gd}$ | | -- | 20.7 | -- | |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage(Note 3) | $V_{FSD}$ | $V_{GS}$=0V,$I_S$=20A | -- | -- | 1.5 | V |
| Continuous Source Current (BodyDiode)(Note 3) | $I_S$ | | -- | -- | 20 | A |
| Reverse Recovery Time | trr | $T_J$=25℃ ,IF=16A, dIF/dt=100A/μS,VGS=0V | -- | 552 | -- | ns |
| Reverse Recovery Charge | Qrr | | -- | 5960 | -- | nc |

Notes：

1: Repetitive rating, pulse width limited by maximum junction temperature.

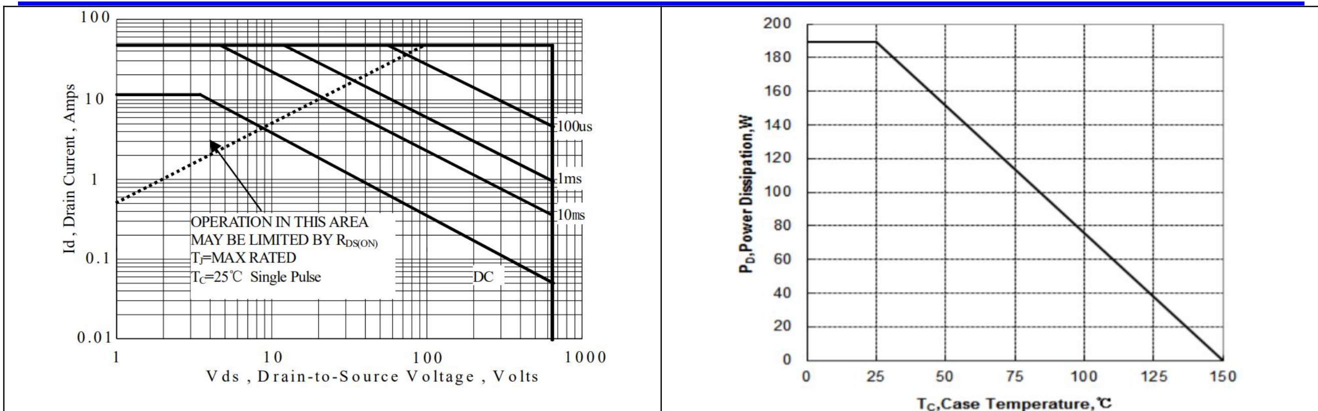
2: Surface mounted on FR4 Board, t≤10sec.

3: Pulse width ≤ 300μs, duty cycle ≤ 2%.

4: L=10mH,$I_D$=13.6A,$V_{DD}$=50V,,Start $T_J$=25℃.

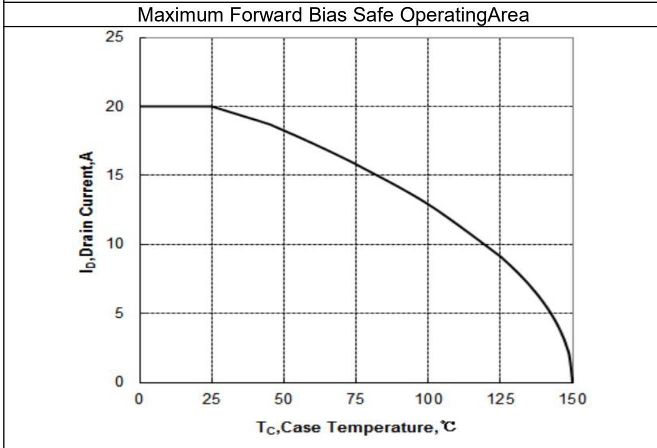
# 5 Typical Test Circuit and Waveform

| | |
|---|---|
| Gate Charge Test Circuit | Gate Charge Waveforms |
| Resistive Switching Test Circuit | Resistive Switching Waveforms |
| Diode Reverse Recovery Test Circuit | Diode Reverse Recovery Waveform |
| Unclamped Inductive Switching Test Circuit | Unclamped Inductive Switching Waveform |

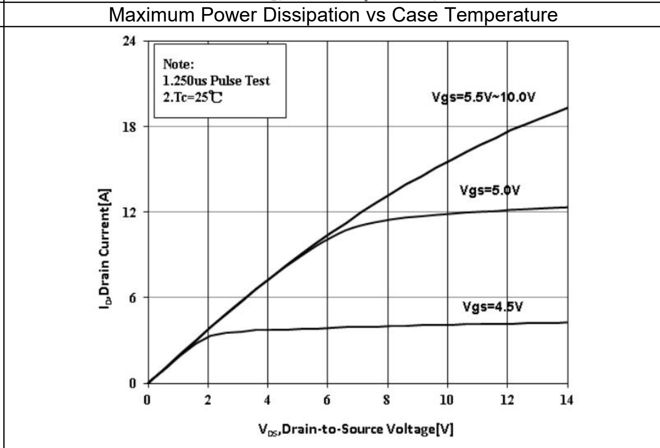



Maximum Forward Bias Safe OperatingArea

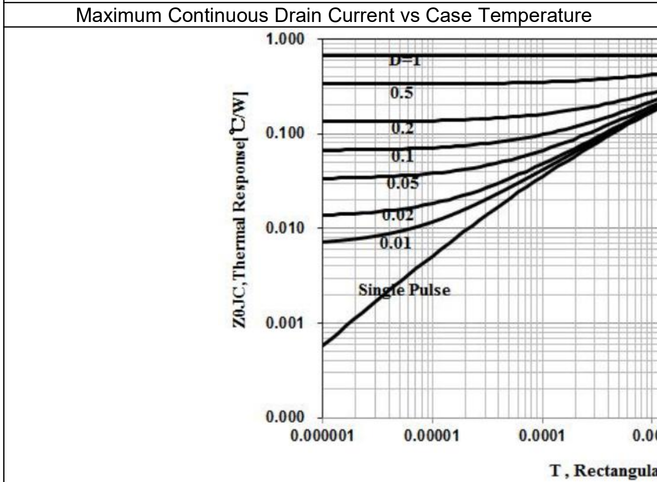
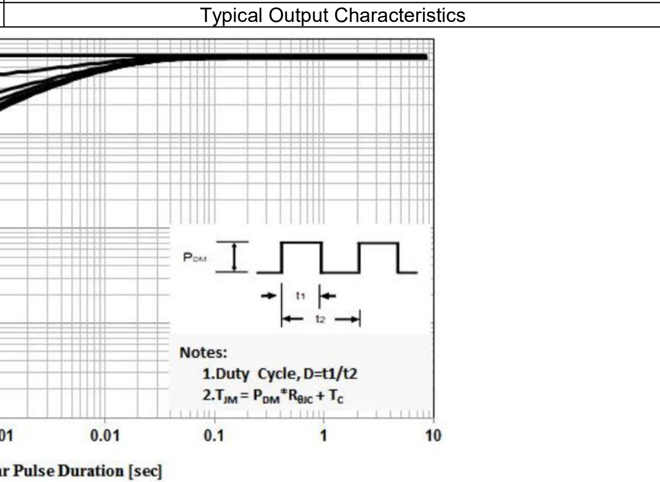
Maximum Power Dissipation vs Case Temperature



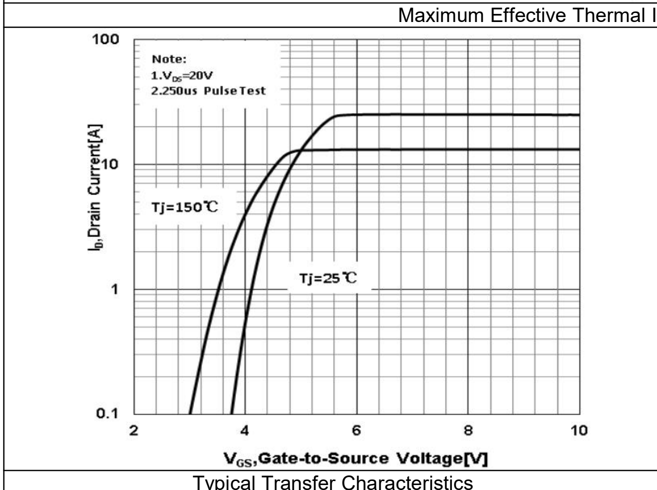

Maximum Continuous Drain Current vs Case Temperature



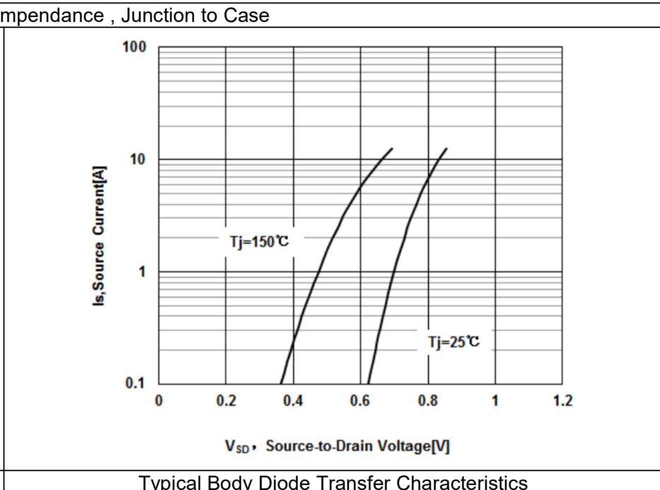

Typical Output Characteristics

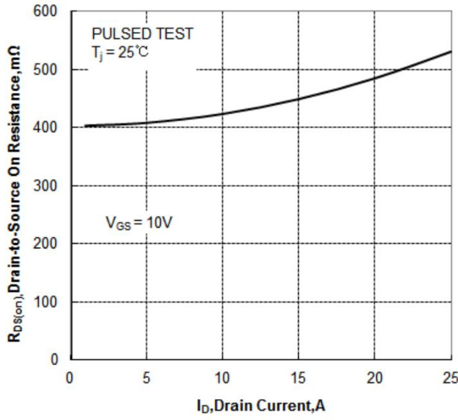
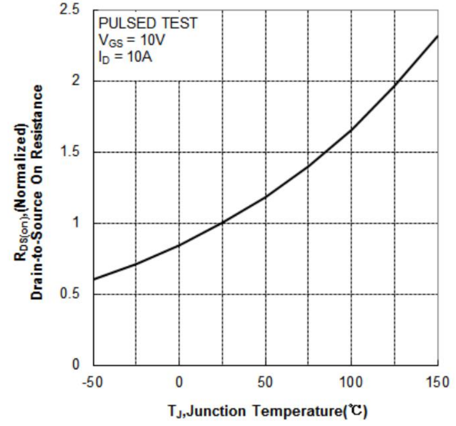
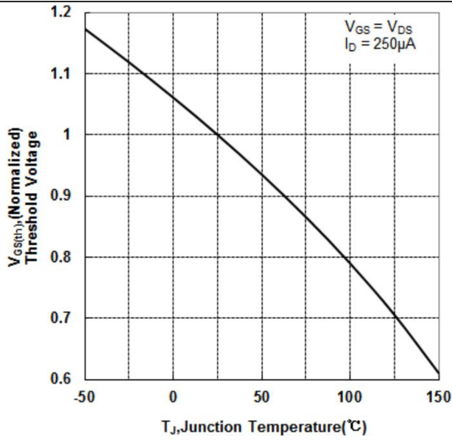
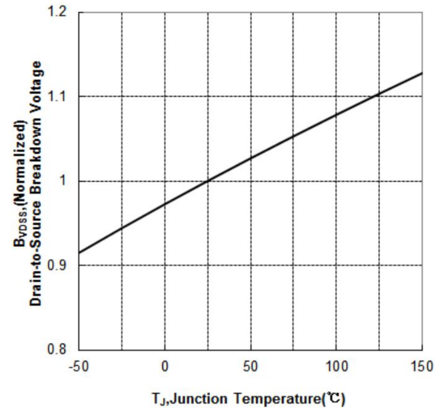
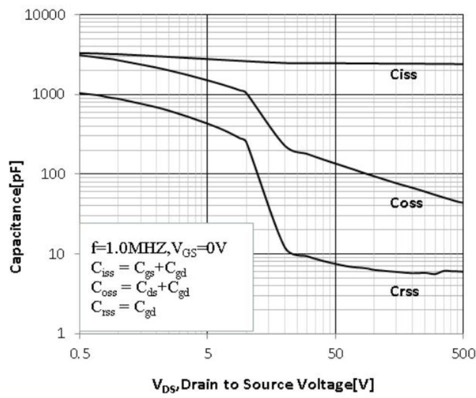
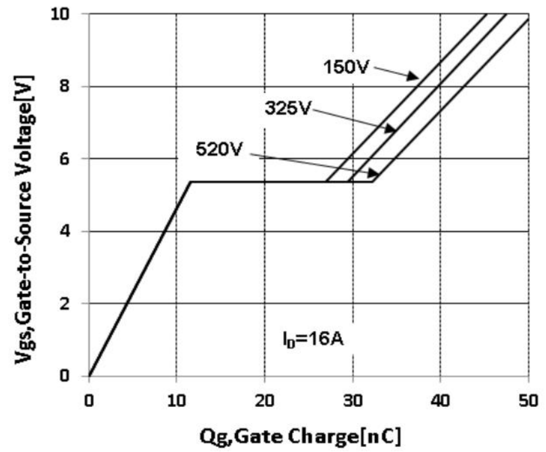

Maximum Effective Thermal Impendance , Junction to Case



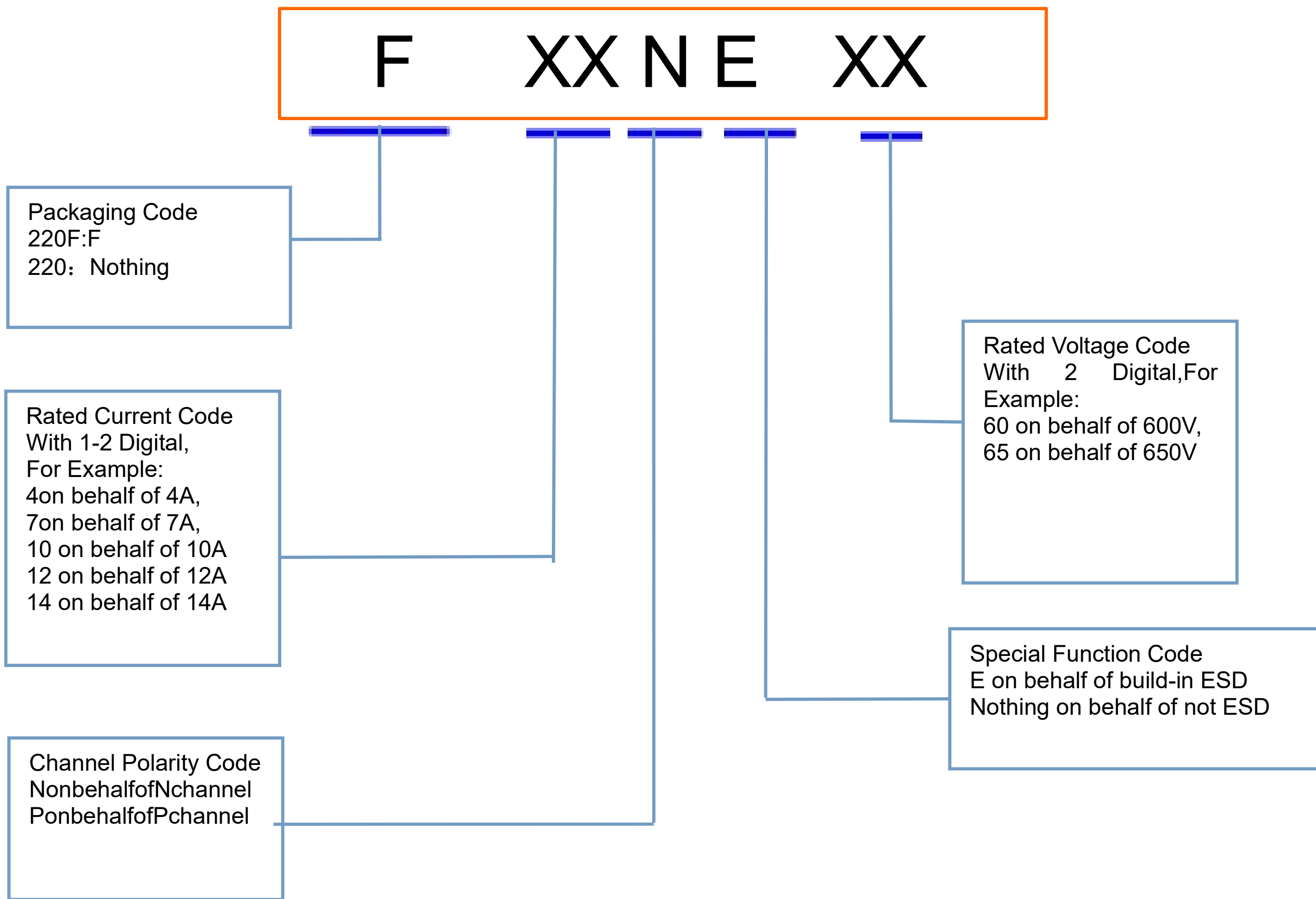

Typical Transfer Characteristics




Typical Body Diode Transfer Characteristics

| | |
|---|---|
|  |  |
| Typical Drain to Source ON Resistance vs Drain Curren | Typical Drian to Source on Resistance vs Junction Temperature |
|  |  |
| Typical Theshold Voltage vs Junction Temperature | Typical Breakdown Voltage vs Junction Temperature |
|  |  |
| Typical Capacitance vs Drain to Source Voltage | Typical Gate Charge vs Gate to Source Voltage |

## 7 Product Names Rules

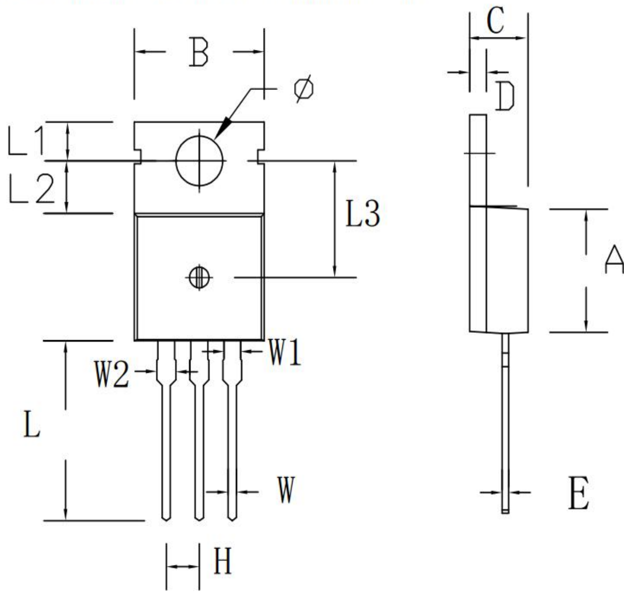



## 8 Product Specifications and Packaging Models

| Product Model | Package Type | Mark Name | RoHS | Package | Quantity |
|---|---|---|---|---|---|
| 20N65 | TO-220 | 20N65 | Pb-free | Tube | 1000/box |

## 9 Dimensions

TO-220C PACKAGE OUTLINE DIMENSIONS




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | min. | max. | min. | max. |
| A | 8.80 | 9.30 | 0.346 | 0.366 |
| B | 9.70 | 10.30 | 0.382 | 0.406 |
| C | 4.25 | 4.75 | 0.167 | 0.187 |
| D | 1.20 | 1.45 | 0.047 | 0.057 |
| E | 0.40 | 0.60 | 0.016 | 0.024 |
| H | 2.54 TYP | | 0.100 TYP | |
| W | 0.60 | 0.95 | 0.024 | 0.037 |
| W1 | 1.05 | 1.45 | 0.041 | 0.057 |
| W2 | 1.20 | 1.60 | 0.047 | 0.063 |
| L | 12.60 | 13.40 | 0.496 | 0.528 |
| L1 | 2.45 | 2.95 | 0.096 | 0.116 |
| L2 | 3.45 | 3.95 | 0.136 | 0.156 |
| L3 | 8.15 | 8.65 | 0.321 | 0.341 |
| Φ | 3.50 | 3.90 | 0.138 | 0.154 |
| | | | | |

## 10 Attentions

- Jiangsu Donghai Semiconductor Technology Co., Ltd. reserves the right to change the specification without prior notice! The customer should obtain the latest version of the information before making the order and verify that the information is complete and up to date.
- It is the responsibility of the purchaser for any failure or failure of any semiconductor product under certain conditions. It is the responsibility of the purchaser to comply with safety standards and to take safety measures in the system design and machine manufacturing of WXDH products in order to avoid potential risk of failure. Injury or property damage.
- Product promotion is endless, our company will be dedicated to provide customers with better products.

## 11 Appendix

Revision history:

| Date | REV. | Description | Page |
|---|---|---|---|
| 2020.03.09 | 1.0 | Original | |