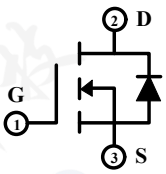
# 210A 30V N-channel Enhancement Mode Power MOSFET

## 1 Description

These N-channel enhanced vdmosfets used advanced trench technology design, provided excellent Rdson and low gate charge. Which accords with the RoHS standard.



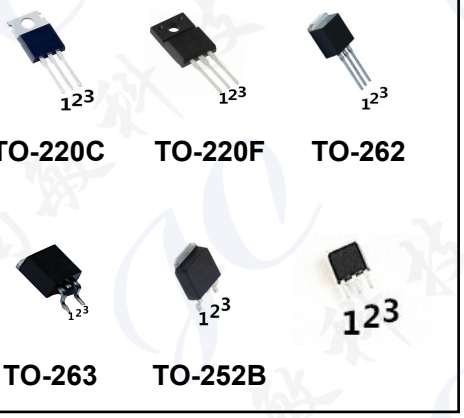

$V_{DSS}$ = 30V

$R_{DS(on)\ (TYP)}$= 1.5mΩ

$I_D$ = 210A

## 2 Features

- Fast switching
- Low on resistance(Rdson≤2.0mΩ)
- Low gate charge(Typ: 65nC)
- Low reverse transfer capacitances(Typ: 435pF)
- 100% single pulse avalanche energy test
- 100% $\Delta V_{DS}$ test




## 3 Applications

- SPMS applications
- Load switch
- Power management
- BMS System

## 4 Electrical Characteristics

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

| Parameter | | Symbol | Rating | | Units |
|---|---|---|---|---|---|
| | | | DH020N03/ DHI020N03/DHE020N03 /DHB020N03/DHD020N03 | DHF020 N03 | |
| Drian-to-Source Voltage | | $V_{DSS}$ | 30 | | V |
| Gate-to-Source Voltage | | $V_{GSS}$ | ±20 | | V |
| Continuous Drain Current | $T_C$=25℃ | $I_D$ | 210 | | A |
| | $T_C$=100℃ | | 133 | | A |
| Pulsed Drain Current(1) | | $I_{DM}$ | 630 | | A |
| Single Pulse Avalanche Energy(4) | | $E_{AS}$ | 1225 | | mJ |
| Avalanche Current(4) | | $I_{AS}$ | 70 | | A |
| Power Dissipation | $T_a$=25℃ | $P_{tot}$ | 2 | 2 | W |
| | $T_C$=25℃ | $P_{tot}$ | 166 | 50 | W |
| Isolation Voltage | | $V_{ISO}$ | / | 2500 | V |
| Junction Temperature Range | | $T_j$ | -55～175 | | ℃ |
| Storage Temperature Range | | $T_{stg}$ | -55～175 | | ℃ |
| Maximum Temperature for soldering | | $T_L$ | 300 | | ℃ |

### 4.2 Thermal Characteristics

| Parameter | Symbol | Rating | | Unit |
|---|---|---|---|---|
| | | DH020N03/ DHI020N03/DHE020N03 /DHB020N03/DHD020N03 | DHF020 N03 | |
| Thermal Resistance,Junction to Case-sink | $R_{thJC}$ | 0.90 | 3 | ℃/W |
| Thermal Resistance,Junction to Ambient | $R_{thJA}$ | 75 | 75 | ℃/W |

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

| Parameter | Symbol | Test Condition | Value | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **Off Characteristics** | | | | | | |
| Drain-to-Source Breakdown Voltage | $BV_{DSS}$ | $I_D$=250μA,$V_{GS}$=0V | 30 | -- | -- | V |
| $BV_{DSS}$ Temperature Coefficient | $\Delta BV_{DSS}/\Delta T_J$ | $I_D$=250μA,reference 25℃ | -- | 0.02 | -- | V/℃ |
| Drain-to-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=30V,$V_{GS}$=0V,$T_C$=25℃ | -- | -- | 1 | μA |
| | | $V_{DS}$=24V,$V_{GS}$=0V,$T_C$=125℃ | -- | -- | 100 | μA |
| Gate-to-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 | 1.0 | 1.6 | 2.5 | V |
| Drain-to-Source on-state Resistance | $R_{DS(on)}$ | $V_{GS}$=10V,$I_D$=50A | -- | 1.5 | 2.0 | mΩ |
| | | $V_{GS}$=4.5V,$I_D$=40A | -- | 1.5 | 2.5 | |
| Forward Transfer Conductance | $g_{fs}$ | $V_{DS}$=5V,$I_D$=20A | -- | 70 | -- | S |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V,$V_{DS}$=25V,f=1.0MHz | -- | 7720 | 11000 | pF |
| Output Capacitance | $C_{oss}$ | | -- | 945 | 1400 | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 435 | 650 | |
| Gate Resisitance | $R_G$ | $V_{DD}$=0V,$V_{GS}$=0V,f=1MHz | -- | 1.2 | 2.4 | Ω |
| **Switching Characteristics** | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DS}$=15V, $I_D$=1A, $V_{GS}$=10V, $R_{GEN}$=3.3Ω | -- | 28 | -- | nS |
| Turn-on Rise Time | $t_r$ | | -- | 45 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 105 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 40 | -- | |
| Total Gate Charge | $Q_g$ | $I_D$=10A,$V_{DS}$=15V,$V_{GS}$=4.5V | -- | 65 | 120 | nC |
| Gate-to-Source Charge | $Q_{gs}$ | | -- | 16 | 30 | |
| Gate-to-Drain(“Miller”) Charge | $Q_{gd}$ | | -- | 21 | 40 | |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage(3) | $V_{FSD}$ | $V_{GS}$=0V,$I_S$=50A | -- | 0.82 | 1.2 | V |
| Diode Forward Current | $I_S$ | | -- | -- | 210 | A |
| Reverse Recovery Time(3) | $t_{rr}$ | $T_J$=25℃,$I_F$=50A, $dI_F/dt$=100A/μS,$V_{GS}$=0V | -- | -- | -- | nS |
| Reverse Recovery Charge(3) | $Q_{rr}$ | | -- | -- | -- | 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=0.5mH,$I_D$=70A,$V_{DD}$=25V,$V_{GATE}$=30V,Start $T_J$=25℃.

## 5 Typical characteristics diagrams

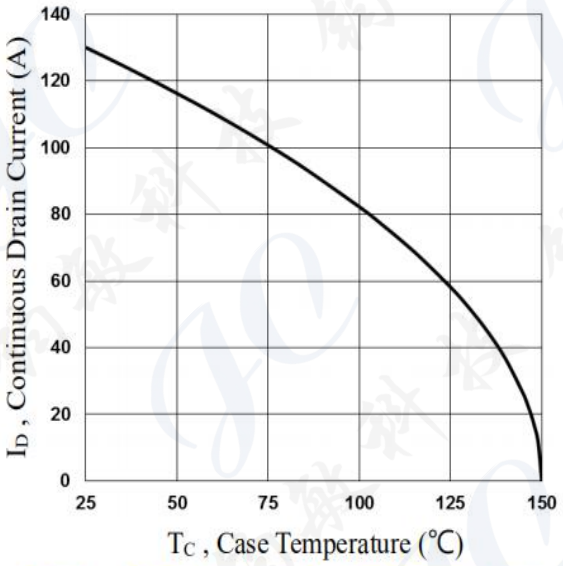



**Fig.1 Continuous Drain Current vs. $T_C$**

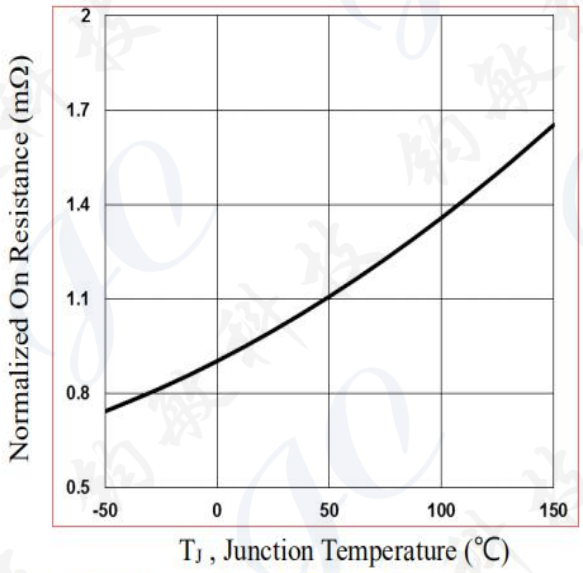



**Fig.2 Normalized RDSON vs. $T_J$**

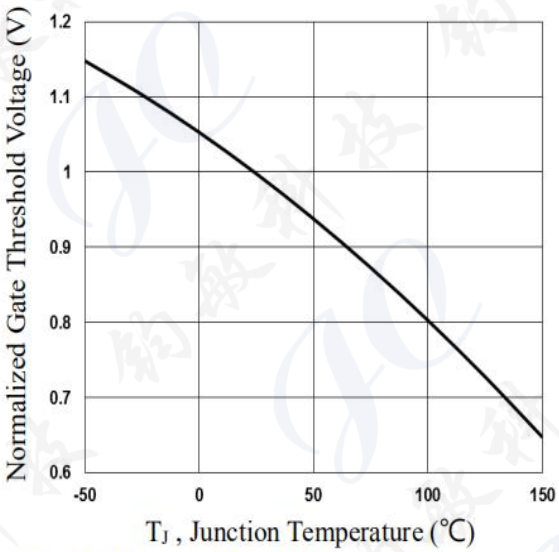



**Fig.3 Normalized $V_{th}$ vs. $T_J$**

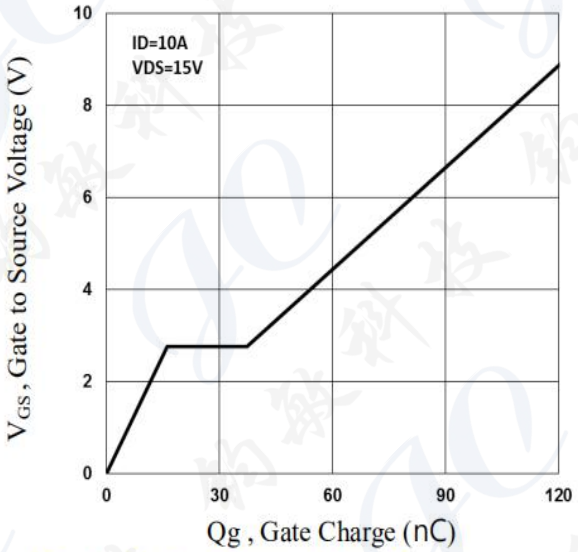



**Fig.4 Gate Charge Waveform**

## 5 Typical characteristics diagrams(continues)

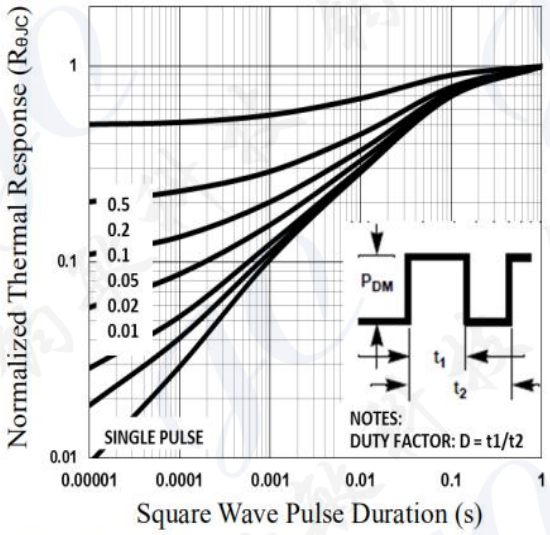



**Fig.5 Normalized Transient Impedance**

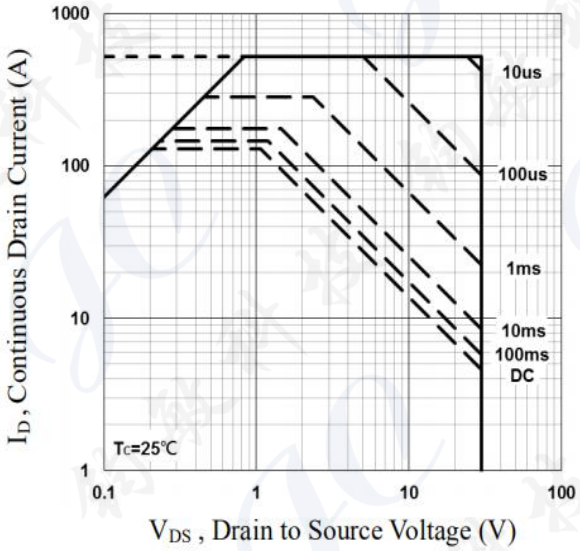
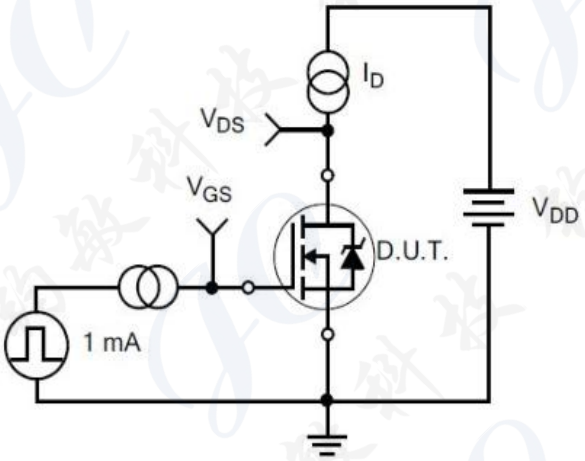
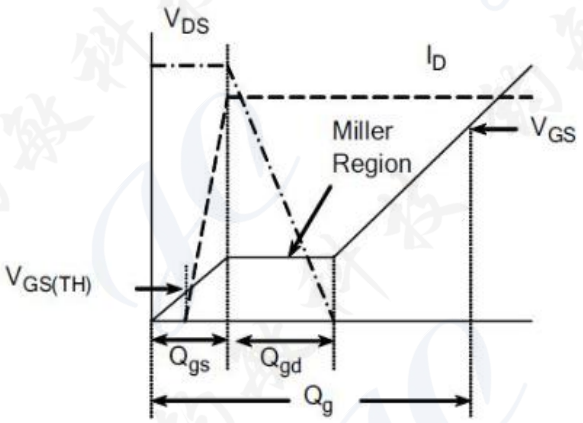



**Fig.6 Maximum Safe Operation Area**

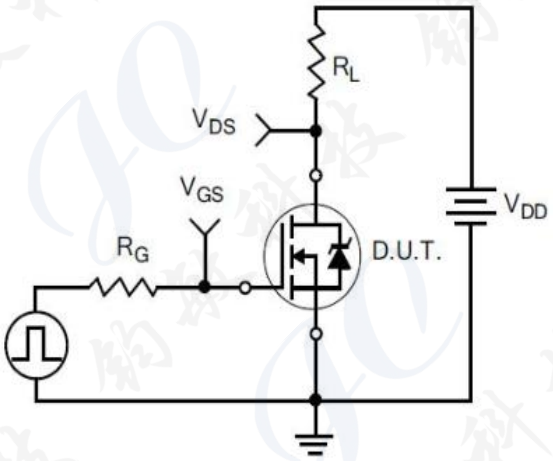
## 6 Typical Test Circuit and Waveform



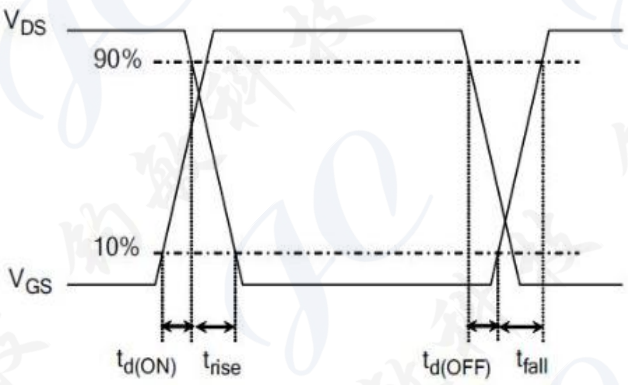

1) Gate Charge Test Circuit




2) . Gate Charge Waveform

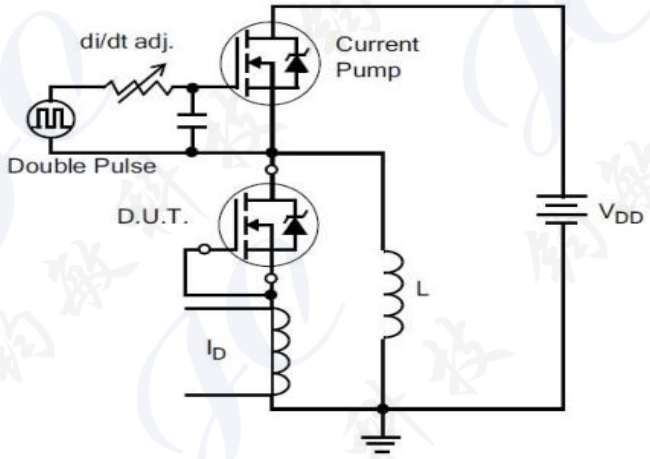



3) Resistive Switching Test Circuit

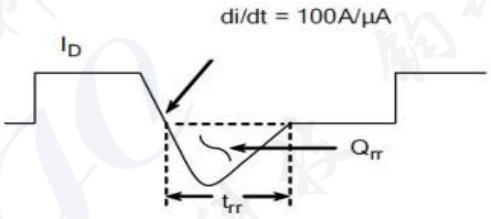



4) Resistive Switching Waveforms

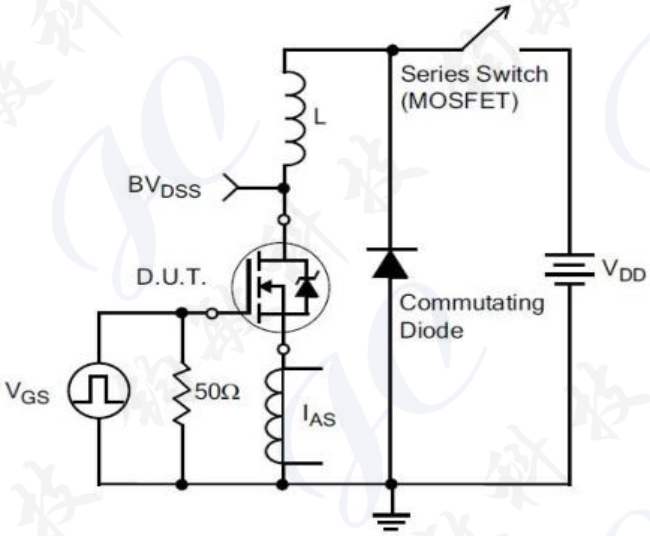
## 6 Typical Test Circuit and Waveform(continues)



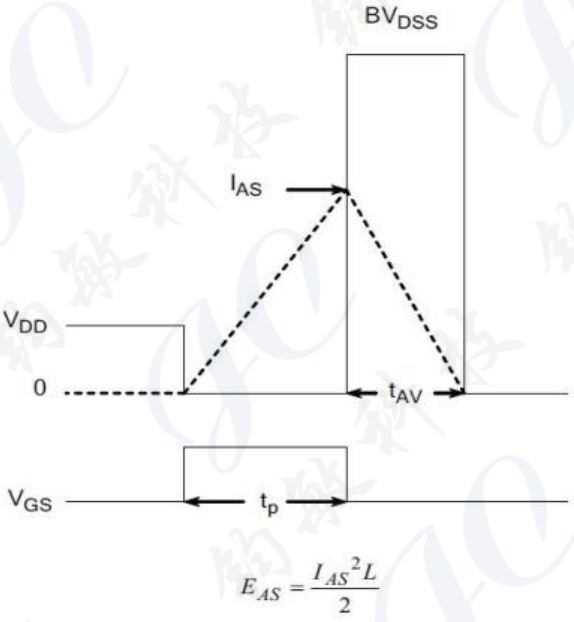

5) Diode Reverse Recovery Test Circuit




6) Diode Reverse Recovery Waveform

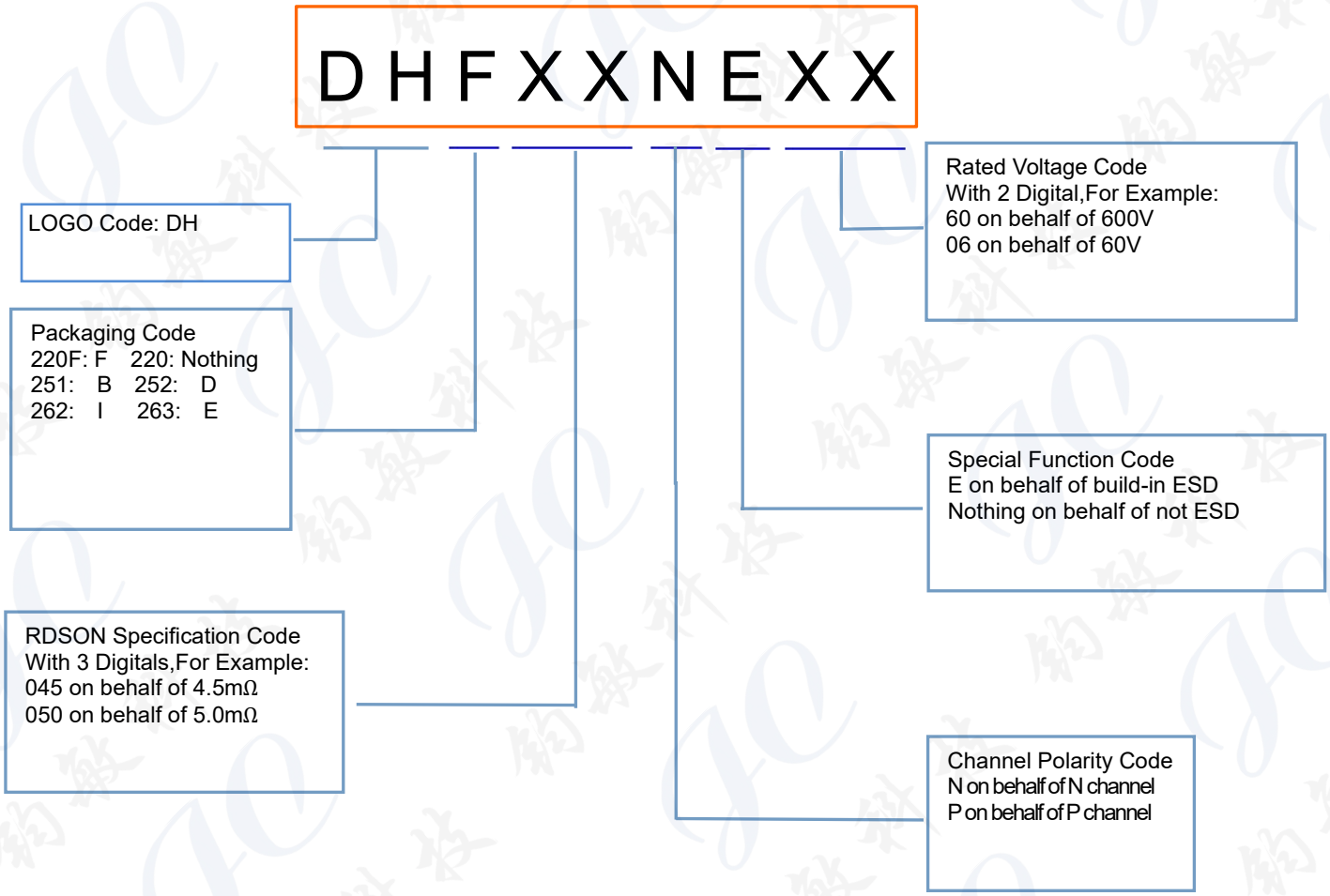



7) . Unclamped Inductive Switching Test Circuit




8) Unclamped Inductive Switching Waveforms

## 7 Product Names Rules

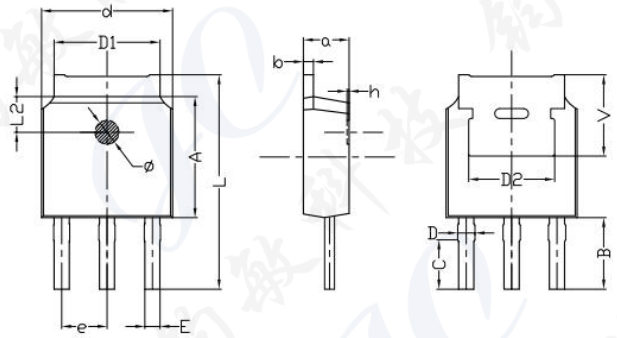



## 8 Product Specifications and Packaging Models

| Product Model | Package Type | Mark Name | RoHS | Package | Quantity |
|---|---|---|---|---|---|
| DH020N03 | TO-220 | DH020N03 | Pb-free | Tube | 1000/box |
| DHF020N03 | TO-220F | DHF020N03 | Pb-free | Tube | 1000/box |
| DHB020N03 | TO-251 | DHB020N03 | Pb-free | Tube | 3000/box |
| DHD020N03 | TO-252 | DHD020N03 | Pb-free | Tape & Reel | 2500/box |
| DHI020N03 | TO-262 | DHI020N03 | Pb-free | Tube | 1000/box |
| DHE020N03 | TO-263 | DHE020N03 | Pb-free | Tape & Reel | 800/box |

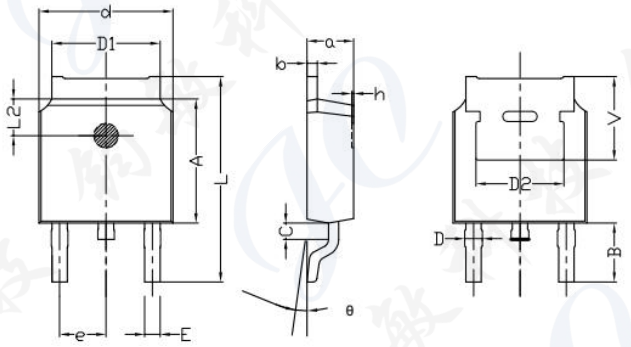
## 9 Dimensions

TO-251B PACKAGE OUTLINE DIMENSIONS




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | min. | max. | min. | max. |
| a | 2.20 | 2.40 | 0.087 | 0.0946 |
| b | 0.46 | 0.58 | 0.018 | 0.023 |
| C | 2.45 | 2.65 | 0.097 | 0.104 |
| D | 0.80 | 0.90 | 0.032 | 0.035 |
| d | 6.30 | 6.70 | 0.248 | 0.264 |
| D1 | 5.00 | 5.50 | 0.197 | 0.217 |
| D2 | TYP 4.83 | | TYP 0.190 | |
| A | 5.80 | 6.20 | 0.228 | 0.244 |
| e | 2.19 | 2.39 | 0.086 | 0.094 |
| L | 10.40 | 11.00 | 0.4098 | 0.4334 |
| B | 3.50 | 3.70 | 0.1379 | 0.1458 |
| L2 | 1.5 | 1.8 | 0.059 | 0.071 |
| Φ | 1.10 | 1.30 | 0.0433 | 0.0512 |
| h | 0.00 | 0.30 | 0.000 | 0.012 |
| V | 5.25 | 5.85 | 0.207 | 0.230 |
| E | 0.60 | 0.80 | 0.0236 | 0.0315 |

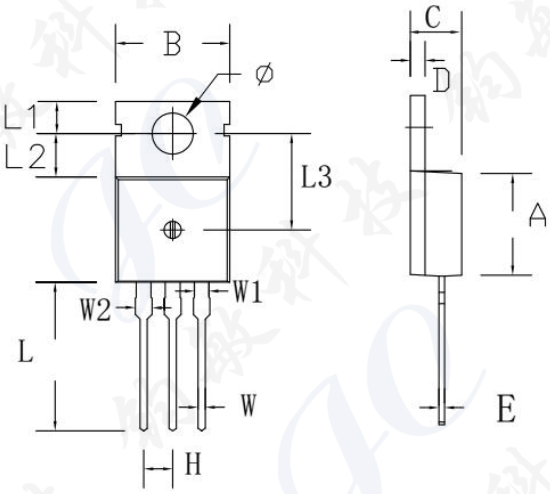
TO-252B PACKAGE OUTLINE DIMENSIONS




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | min. | max. | min. | max. |
| a | 2.20 | 2.40 | 0.087 | 0.095 |
| b | 0.46 | 0.58 | 0.018 | 0.023 |
| c | 0.70 | 0.90 | 0.028 | 0.035 |
| D | 0.80 | 1.00 | 0.032 | 0.039 |
| d | 6.30 | 6.70 | 0.248 | 0.264 |
| D1 | 5.00 | 5.50 | 0.197 | 0.217 |
| D2 | TYP 4.83 | | TYP 0.190 | |
| A | 5.80 | 6.20 | 0.228 | 0.244 |
| e | 2.19 | 2.39 | 0.086 | 0.094 |
| L | 9.40 | 10.40 | 0.370 | 0.409 |
| B | 2.6 | 3.2 | 0.102 | 0.126 |
| L2 | 1.5 | 1.8 | 0.059 | 0.071 |
| θ | 0 | 8 | 0 | 8 |
| h | 0 | 0.3 | 0 | 0.012 |
| V | 5.25 | 5.85 | 0.207 | 0.230 |
| E | 0.6 | 0.8 | 0.024 | 0.032 |

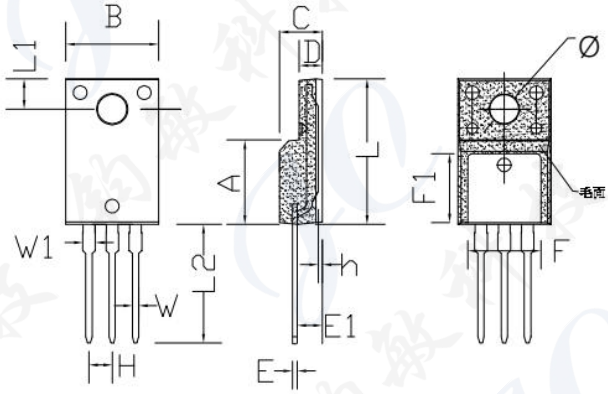
## 9 Dimensions(continues)

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 |

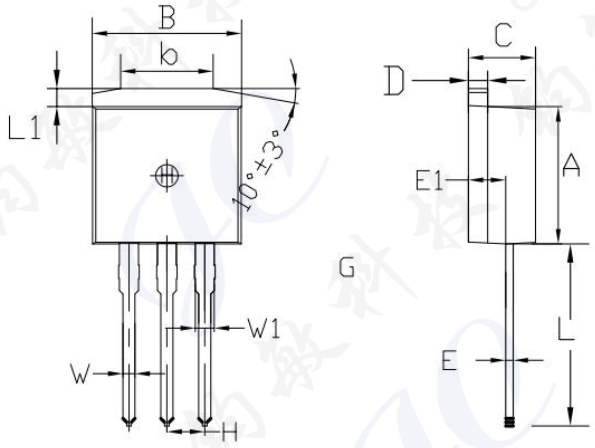
TO-220F PACKAGE OUTLINE DIMENSIONS




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | min. | max. | min. | max. |
| A | 8.80 | 9.30 | 0.346 | 0.366 |
| B | 10.00 | 10.50 | 0.394 | 0.413 |
| C | 4.30 | 4.90 | 0.169 | 0.193 |
| D | 2.30 | 2.70 | 0.091 | 0.106 |
| L | 15.55 | 16.15 | 0.612 | 0.636 |
| h | 0.40 | 0.60 | 0.016 | 0.024 |
| L1 | 3.15 | 3.55 | 0.124 | 0.140 |
| L2 | 12.65 | 13.35 | 0.498 | 0.526 |
| W | 0.70 | 0.90 | 0.028 | 0.035 |
| W1 | 1.15 | 1.55 | 0.045 | 0.061 |
| H | 2.54 TYP | | 0.100 TYP | |
| E | 0.48 | 0.53 | 0.019 | 0.021 |
| Φ | 2.90 | 3.40 | 0.114 | 0.134 |
| E1 | 2.40 | 2.90 | 0.094 | 0.114 |
| F | 7.75 | 8.25 | 0.305 | 0.325 |
| F1 | 7.35 | 7.85 | 0.289 | 0.309 |

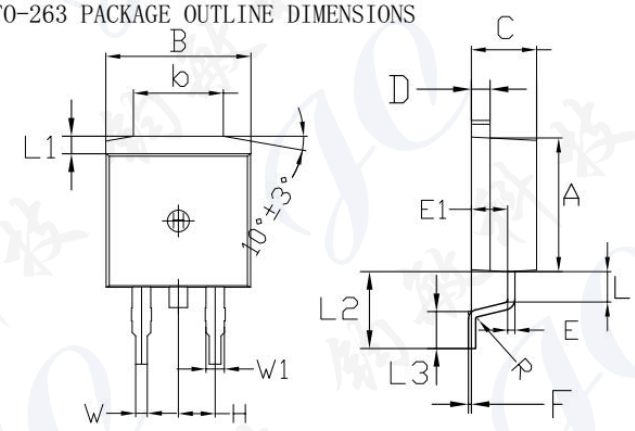
## 9 Dimensions(continues)

TO-262 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 |
| L | 12.25 | 13.75 | 0.482 | 0.541 |
| L1 | 1.15 | 1.45 | 0.045 | 0.057 |
| E1 | 2.4 | 2.6 | 0.0945 | 0.1024 |
| W | 0.80 | 0.82 | 0.0315 | 0.034 |
| W1 | 1.20 | 1.30 | 0.047 | 0.051 |
| H | 2.54 TYP | | 0.200 TYP | |
| b | 5.50 | 6.50 | 0.216 | 0.256 |

TO-263 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 |
| L | 1.90 | 2.30 | 0.075 | 0.091 |
| L1 | 1.15 | 1.45 | 0.045 | 0.057 |
| R | 0.24 | 0.26 | 0.0095 | 0.0102 |
| W | 0.80 | 0.82 | 0.0315 | 0.0323 |
| W1 | 1.20 | 1.30 | 0.047 | 0.051 |
| H | 2.54 TYP | | 0.200 TYP | |
| b | 5.50 | 6.50 | 0.216 | 0.256 |
| E1 | 2.4 | 2.6 | 0.0946 | 0.1024 |
| L2 | 5.20 | 5.80 | 0.205 | 0.228 |
| L3 | 2.20 | 3.20 | 0.087 | 0.126 |
| F | 0.03 | 0.23 | 0.0012 | 0.0091 |

## 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 Donghai 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 |
|---|---|---|---|
| 2018.11.08 | 1.0 | Original | |