## / Descriptions

TO-220 N

N-CHANNEL MOSFET in a TO-220 Plastic Package.

## / Features

$V_{DS}$=40V $I_D$=177A $V_{GS}$=±20V

$R_{DS(on)}$@10V 3.0m (Type.2.5m )

$R_{DS(on)}$@4.5V 5.0m (Type.3.5m )

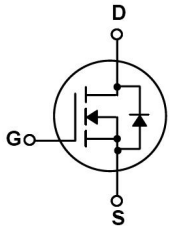
HF Product.

## / Applications

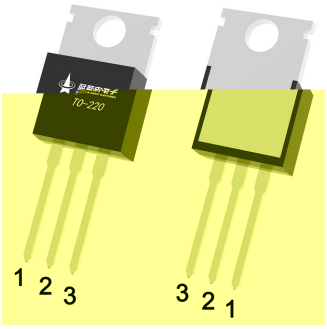
DC/DC

DC Motor Driver,Synchronous Rectification in DC/DC Converters.

## / Equivalent Circuit




## / Pinning




PIN1 G PIN 2 4 D PIN 3 S

## / Marking

See Marking Instructions.

## / Absolute Maximum Ratings(Ta=25 )

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 40 | V |
| Drain Current | | $I_D$(Tc=25 ) | 177 | A |
| Pulsed Drain Current | | $I_{DM}$ | 560 | A |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Single Pulsed Avalanche Energy L=0.5mH | | $E_{AS}$ | 435 | mJ |
| Avalanche Current | | $I_{AS}$ | 33 | A |
| Total Power Dissipation | | $P_D$(Tc=25 ) | 170 | W |
| Junction and Storage Temperature Range | | $T_J$,$T_{STG}$ | -55 to 150 | |
| Thermal Resistance-Junction to Ambient | t 10s | R JA | 15 | /W |
| | Steady-State | | 60 | |
| Thermal Resistance-Junction to Case | Steady-State | R JC | 0.74 | |

## / Electrical Characteristics(Ta=25 )

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250 A | 40 | 47 | | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=40V $V_{GS}$=0V | | | 1 | A |
| Gate-Body Leakage Current Forward | $I_{GSS}$ | $V_{GS}$=±20V $V_{DS}$=0V | | | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$ $I_D$=250 A | 1 | 1.7 | 3 | V |
| Static Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$=10V $I_D$=20A | | 2.5 | 3 | m |
| | | $V_{GS}$=4.5V $I_D$=10A | | 3.5 | 5 | |
| Forward On Voltage | $V_{SD}$ | $V_{GS}$=0V $I_S$=1A | | | 1.2 | V |
| Gate resistance | $R_g$ | $V_{GS}$=0V $V_{DS}$=0V, f=1MHz | | 1.3 | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=25V $V_{GS}$=0V f=1MHz | | 9600 | | pF |
| Output Capacitance | $C_{oss}$ | | | 740 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 650 | | |
| Total Gate Charge | $Q_{g(10V)}$ | $V_{GS}$=10V, $V_{DS}$=20V, $I_D$=20A | | 51 | | nC |
| Total Gate Charge | $Q_{g(4.5V)}$ | | | 23 | | |
| Gate Source Charge | $Q_{gs}$ | | | 13.2 | | |
| Gate Drain Charge | $Q_{gd}$ | | | 3.1 | | |

## / Electrical Characteristics(Ta=25 )

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS}$=10V $V_{DS}$=20V<br>$R_L$=1 $R_{GEN}$=3 | | 11 | | ns |
| Turn-On Rise Time | $t_r$ | | | 11 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 40 | | |
| Turn-Off Fall Time | $t_f$ | | | 10 | | |

## / Electrical Characteristic Curve

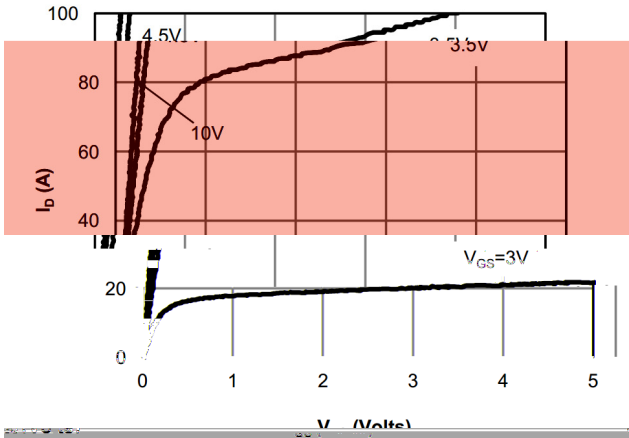



Figure 2: Transfer Characteristics

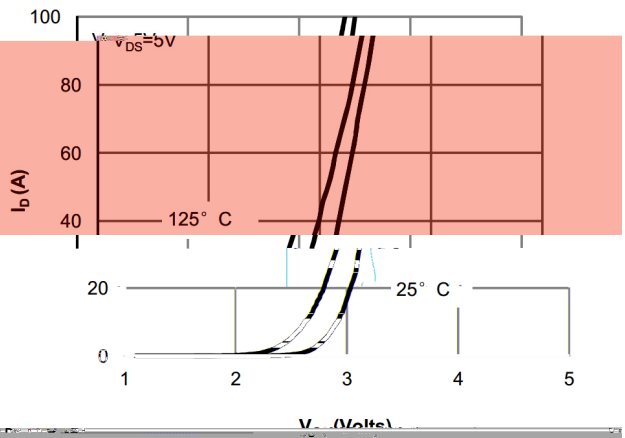
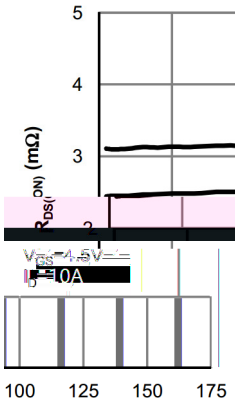
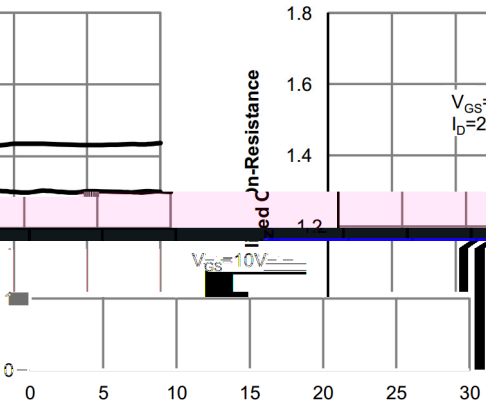


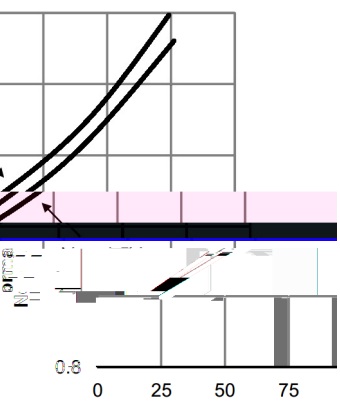

Figure 1: On-Region Characteristics



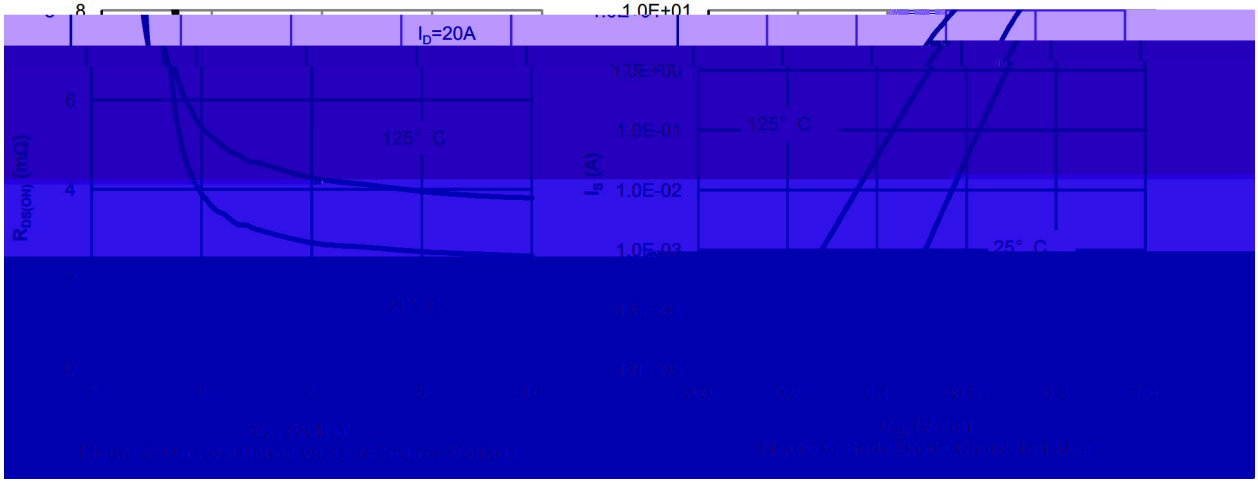

ure (°C)
s. Junction Temperature




$I_D$ (A)
Figure 3: On-Resistance vs. Drain Current and Gate Voltage




Temperat
Figure 4: On-Resistance v



## / Electrical Characteristic Curve

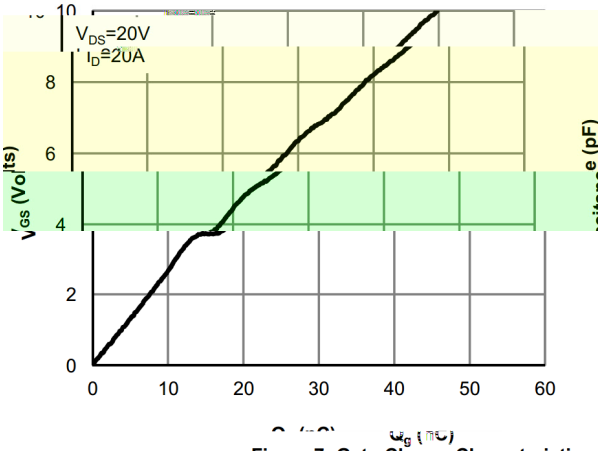



Figure 7: Gate-Charge Characteristics

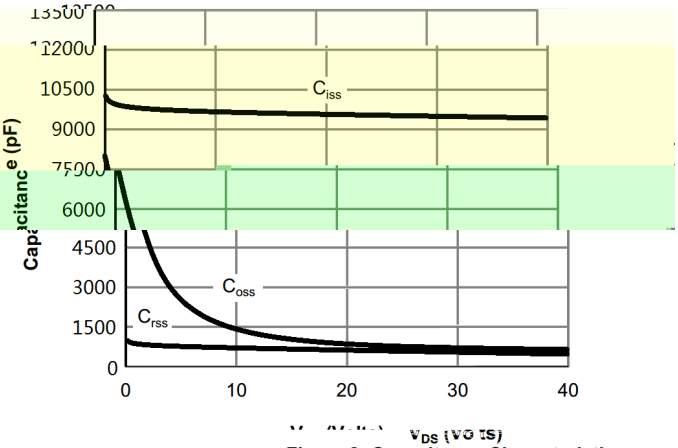



Figure 8: Capacitance Characteristics

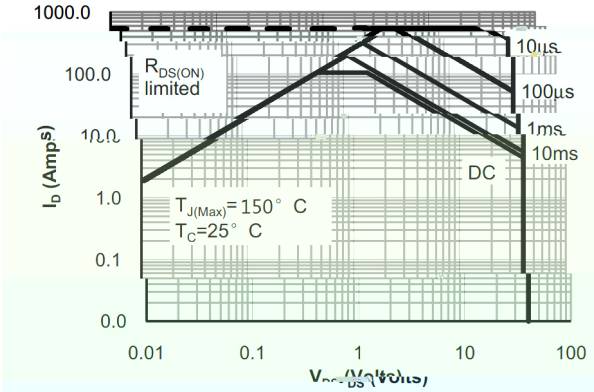
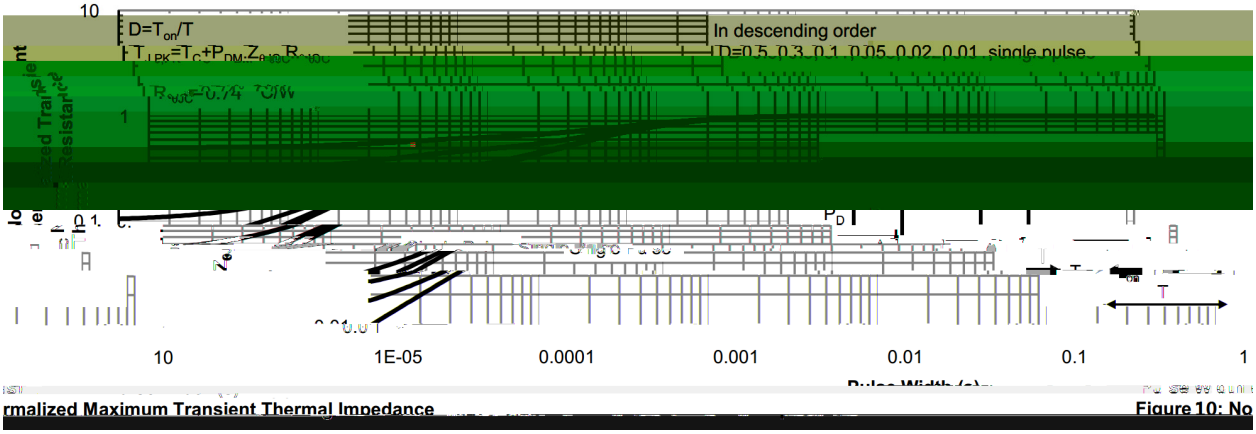



Figure 9: Maximum Forward Biased Safe Operating Area

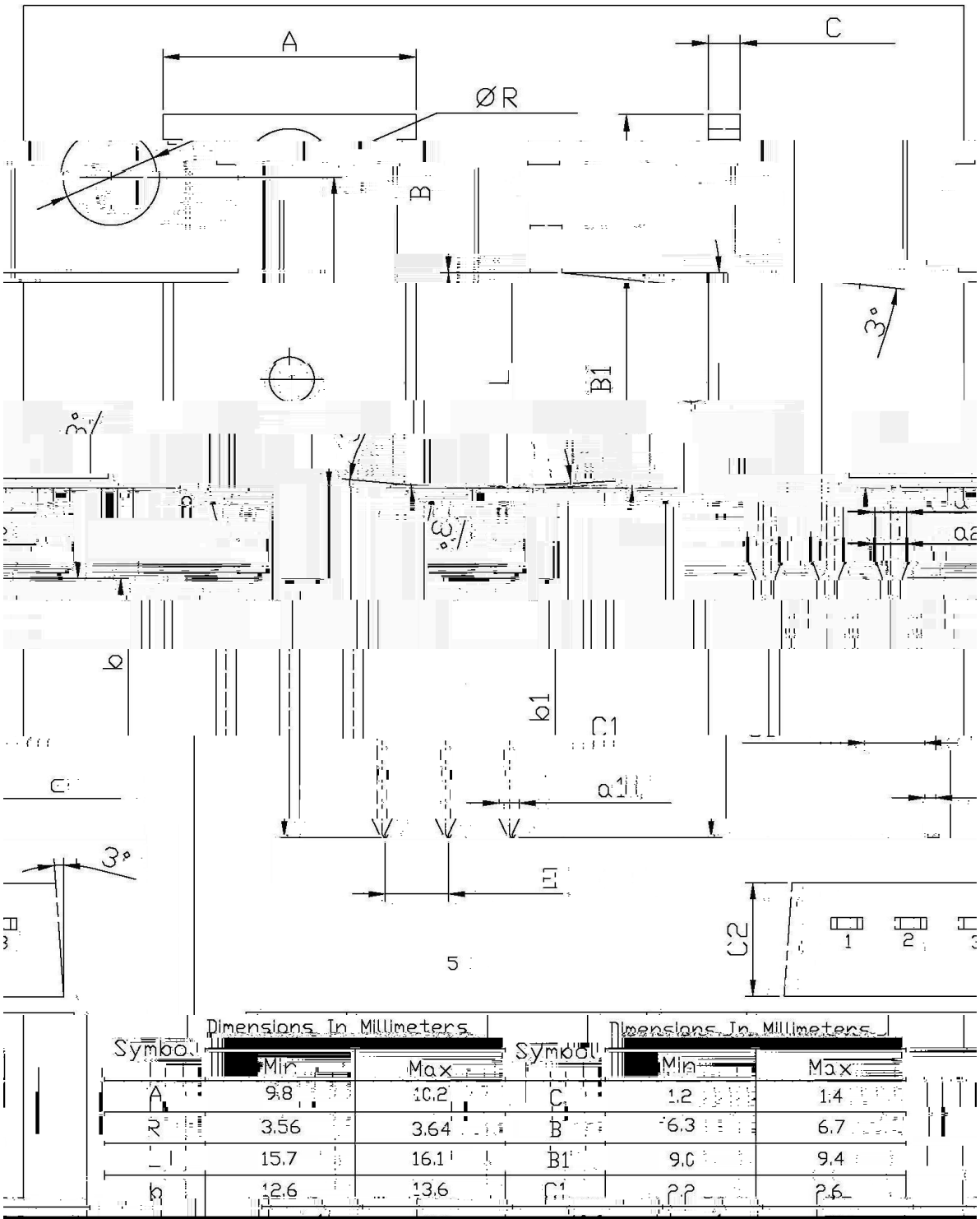



rmalized Maximum Transient Thermal Impedance

Figure 10: No

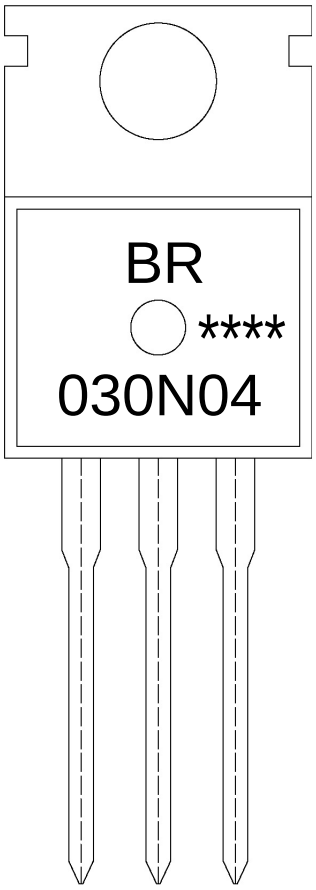
## / Package Dimensions

TO-220 单位：mm




| Symbol | Dimensions In Millimeters Min | Max | Symbol | Dimensions In Millimeters Min | Max |
|---|---|---|---|---|---|
| A | 9.8 | 10.2 | C | 1.2 | 1.4 |
| R | 3.56 | 3.64 | B | 6.3 | 6.7 |
| L | 15.7 | 16.1 | B1 | 9.0 | 9.4 |
| b | 12.6 | 13.6 | C1 | 2.2 | 2.6 |

## / Marking Instructions




BR

030N04

****

Note:

| | |
|---|---|
| BR: | Company Code |
| 030N04: | Product Type |
| ****: | Lot No. Code, code change with Lot No |

## ( ) / Temperature Profile for Dip Soldering(Pb-Free)

| | | | | |
|---|---|---|---|---|
| | | | | Note: |
| 1 | 25 150 | | 60 90sec; | 1.Preheating:25~150 , Time:60~90sec. |
| 2 | 255±5 | | 5±0.5sec; | 2.Peak Temp.:255±5 , Duration:5±0.5sec. |
| 3 | | 2 10 | /sec. | 3. Cooling Speed: 2~10 /sec. |

## / Resistance to Soldering Heat Test Conditions

| | | | |
|---|---|---|---|
| 270±5 | 10±1 sec. | Temp.:270±5 | Time:10±1 sec |

## / Packaging SPEC.

/ BULK

| Package Type | Units | | | | | Dimension | | (unit mm³) |
|---|---|---|---|---|---|---|---|---|
| | Units/Bag / | Bags/Inner Box / | Units/Inner Box / Units | Inner Boxes/Outer Box / | Units/Outer Box / | Bag | Dimension Box | Outer Box # |
| TO-220/F | 200 | 10 | 2,000 | 5 | 10,000 | 135×190 | 237×172×102 | 560×245×195 |