

# GE04N70B

## N-CHANNEL ENHANCEMENT MODE POWER MOSFET

|         |          |
|---------|----------|
| BVDSS   | 650/700V |
| RDS(ON) | 2.4Ω     |
| ID      | 4A       |

### Description

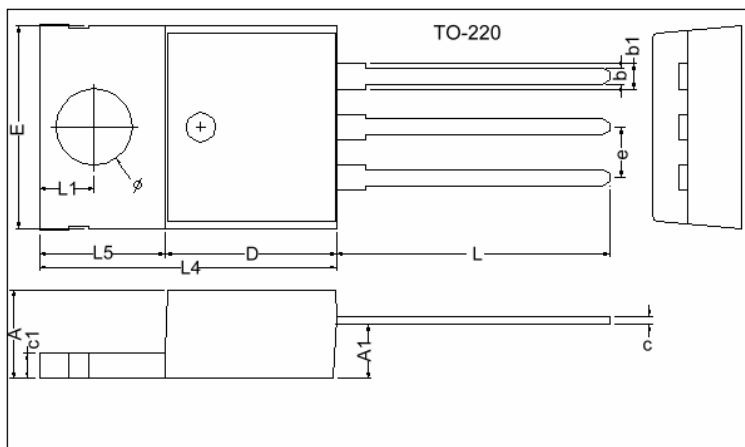
The GE04N70B series are specially designed as main switching devices for universal 90~265VAC off-line AC/DC converter applications. TO-220 type provide high blocking voltage to overcome voltage surge and sag in the toughest power system with the best combination of fast switching, ruggedized design and cost-effectiveness.

The TO-220 package is universally preferred for all commercial-industrial applications. The device is suited for switch mode power supplies, DC-AC converters and high current high speed switching circuits.

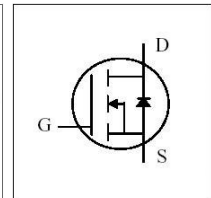
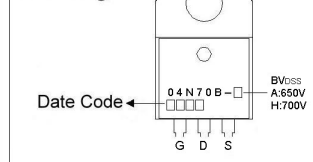
### Features

- \*Simple Drive Requirement
- \*Dynamic dv/dt Rating
- \*Repetitive Avalanche Rated
- \*Fast Switching

### Package Dimensions



#### Marking :



| REF. | Millimeter |      | REF. | Millimeter |       |
|------|------------|------|------|------------|-------|
|      | Min.       | Max. |      | Min.       | Max.  |
| A    | 4.40       | 4.80 | c1   | 1.25       | 1.45  |
| b    | 0.76       | 1.00 | b1   | 1.17       | 1.47  |
| c    | 0.36       | 0.50 | L    | 13.25      | 14.25 |
| D    | 8.60       | 9.00 | e    | 2.54 REF.  |       |
| E    | 9.80       | 10.4 | L1   | 2.60       | 2.89  |
| L4   | 14.7       | 15.3 | Ø    | 3.71       | 3.96  |
| L5   | 6.20       | 6.60 | A1   | 2.60       | 2.80  |

### Absolute Maximum Ratings

| Parameter                                        | Symbol                 | Ratings    | Unit          |
|--------------------------------------------------|------------------------|------------|---------------|
| Drain-Source Voltage                             | A/H $V_{DS}$           | 650/700    | V             |
| Gate-Source Voltage                              | $V_{GS}$               | $\pm 20$   | V             |
| Continuous Drain Current , $V_{GS}@10V$          | $I_D @T_C=25^\circ C$  | 4          | A             |
| Continuous Drain Current , $V_{GS}@10V$          | $I_D @T_C=100^\circ C$ | 2.5        | A             |
| Pulsed Drain Current <sup>1</sup>                | $I_{DM}$               | 15         | A             |
| Total Power Dissipation                          | $P_D @T_C=25^\circ C$  | 62.5       | W             |
| Linear Derating Factor                           |                        | 0.5        | W/ $^\circ C$ |
| Single Pulse Avalanche Energy <sup>2</sup>       | $E_{AS}$               | 100        | mJ            |
| Avalanche Current                                | $I_{AR}$               | 4          | A             |
| Repetitive Avalanche Energy                      | $E_{AR}$               | 4          | mJ            |
| Operating Junction and Storage Temperature Range | $T_j, T_{stg}$         | -55 ~ +150 | $^\circ C$    |

### Thermal Data

| Parameter                           | Symbol           | Value | Unit         |
|-------------------------------------|------------------|-------|--------------|
| Thermal Resistance Junction-case    | Max. $R_{thj-c}$ | 2.0   | $^\circ C/W$ |
| Thermal Resistance Junction-ambient | Max. $R_{thj-a}$ | 62    | $^\circ C/W$ |

**Electrical Characteristics(T<sub>j</sub> = 25°C Unless otherwise specified)**

| Parameter                                           | Symbol                         | Min. | Typ. | Max. | Unit | Test Conditions                                                                                                   |
|-----------------------------------------------------|--------------------------------|------|------|------|------|-------------------------------------------------------------------------------------------------------------------|
| Drain-Source Breakdown Voltage                      | BV <sub>DSS</sub>              | 650  | -    | -    | V    | V <sub>GS</sub> =0, I <sub>D</sub> =250uA A                                                                       |
|                                                     |                                | 700  | -    | -    | V    | V <sub>GS</sub> =0, I <sub>D</sub> =250uA H                                                                       |
| Breakdown Voltage Temperature Coefficient           | $\Delta BV_{DSS} / \Delta T_j$ | -    | 0.6  | -    | V/°C | Reference to 25°C, I <sub>D</sub> =1mA                                                                            |
| Gate Threshold Voltage                              | V <sub>GS(th)</sub>            | 2.0  | -    | 4.0  | V    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA                                                          |
| Forward Transconductance                            | g <sub>fs</sub>                | -    | 2.5  | -    | S    | V <sub>DS</sub> =50V, I <sub>D</sub> =2A                                                                          |
| Gate-Source Leakage Current                         | I <sub>GSS</sub>               | -    | -    | ±100 | nA   | V <sub>GS</sub> = ±20V                                                                                            |
| Drain-Source Leakage Current(T <sub>j</sub> =25°C)  | I <sub>DSS</sub>               | -    | -    | 100  | uA   | V <sub>DS</sub> =600V, V <sub>GS</sub> =0                                                                         |
| Drain-Source Leakage Current(T <sub>j</sub> =150°C) |                                | -    | -    | 500  | uA   | V <sub>DS</sub> =480V, V <sub>GS</sub> =0                                                                         |
| Static Drain-Source On-Resistance                   | R <sub>DS(ON)</sub>            | -    | -    | 2.4  | Ω    | V <sub>GS</sub> =10V, I <sub>D</sub> =2A                                                                          |
| Total Gate Charge <sup>3</sup>                      | Q <sub>g</sub>                 | -    | 16.7 | -    | nC   | I <sub>D</sub> =4A<br>V <sub>DS</sub> =480V<br>V <sub>GS</sub> =10V                                               |
| Gate-Source Charge                                  | Q <sub>gs</sub>                | -    | 4.1  | -    |      |                                                                                                                   |
| Gate-Drain ("Miller") Charge                        | Q <sub>gd</sub>                | -    | 4.9  | -    |      |                                                                                                                   |
| Turn-on Delay Time <sup>3</sup>                     | T <sub>d(on)</sub>             | -    | 11   | -    | ns   | V <sub>DD</sub> =300V<br>I <sub>D</sub> =4A<br>V <sub>GS</sub> =10V<br>R <sub>G</sub> =10Ω<br>R <sub>D</sub> =75Ω |
| Rise Time                                           | T <sub>r</sub>                 | -    | 8.3  | -    |      |                                                                                                                   |
| Turn-off Delay Time                                 | T <sub>d(off)</sub>            | -    | 23.8 | -    |      |                                                                                                                   |
| Fall Time                                           | T <sub>f</sub>                 | -    | 8.2  | -    |      |                                                                                                                   |
| Input Capacitance                                   | C <sub>iss</sub>               | -    | 950  | -    | pF   | V <sub>GS</sub> =0V<br>V <sub>DS</sub> =25V<br>f=1.0MHz                                                           |
| Output Capacitance                                  | C <sub>oss</sub>               | -    | 65   | -    |      |                                                                                                                   |
| Reverse Transfer Capacitance                        | C <sub>rss</sub>               | -    | 6    | -    |      |                                                                                                                   |

**Source-Drain Diode**

| Parameter                                       | Symbol          | Min. | Typ. | Max. | Unit | Test Conditions                                               |
|-------------------------------------------------|-----------------|------|------|------|------|---------------------------------------------------------------|
| Forward On Voltage <sup>3</sup>                 | V <sub>SD</sub> | -    | -    | 1.5  | V    | I <sub>S</sub> =4A, V <sub>GS</sub> =0V, T <sub>j</sub> =25°C |
| Continuous Source Current(Body Diode)           | I <sub>S</sub>  | -    | -    | 4    | A    | V <sub>D</sub> = V <sub>G</sub> =0V, V <sub>S</sub> =1.5V     |
| Pulsed Source Current (Body Diode) <sup>1</sup> | I <sub>SM</sub> | -    | -    | 15   | A    |                                                               |

Notes: 1. Pulse width limited by safe operating area.

2. Staring T<sub>j</sub>=25°C, V<sub>DD</sub>=50V, L=25mH, R<sub>G</sub>=25Ω, I<sub>AS</sub>=4A.

3. Pulse width ≤ 300us, duty cycle ≤ 2%.

## Characteristics Curve

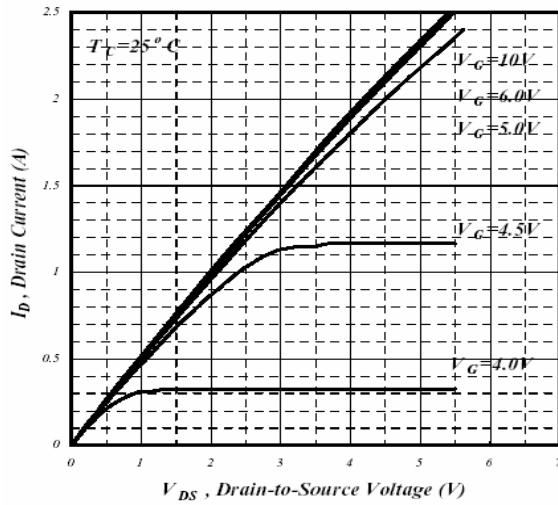


Fig 1. Typical Output Characteristics

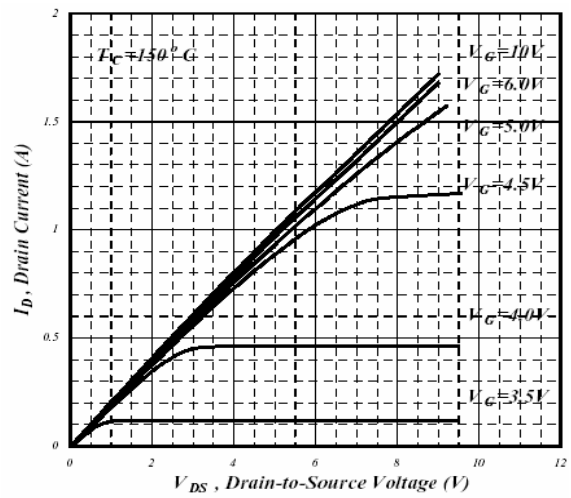


Fig 2. Typical Output Characteristics

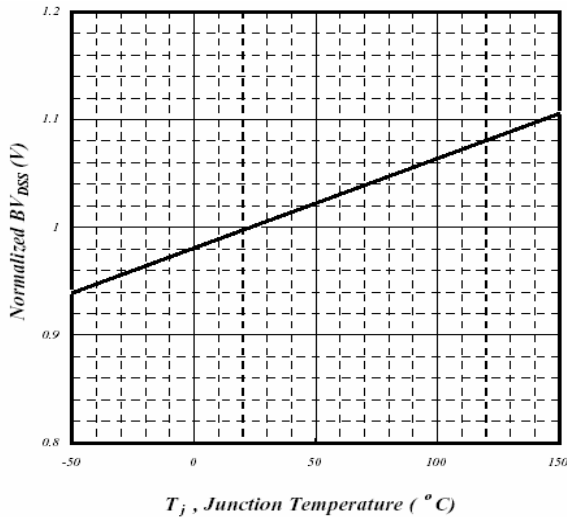


Fig 3. Normalized BV\_DS v.s. Junction Temperature

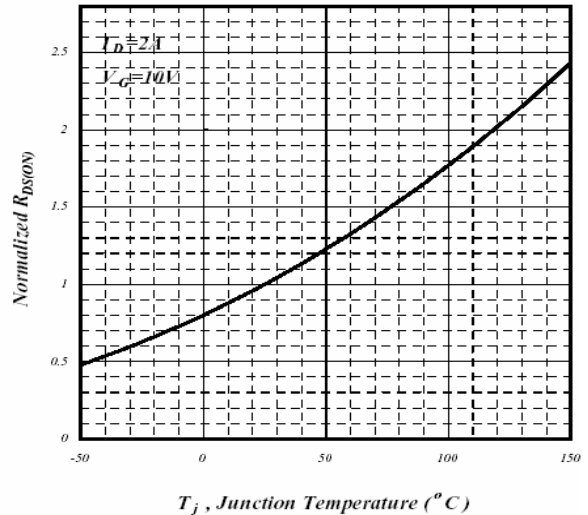


Fig 4. Normalized On-Resistance v.s. Junction Temperature

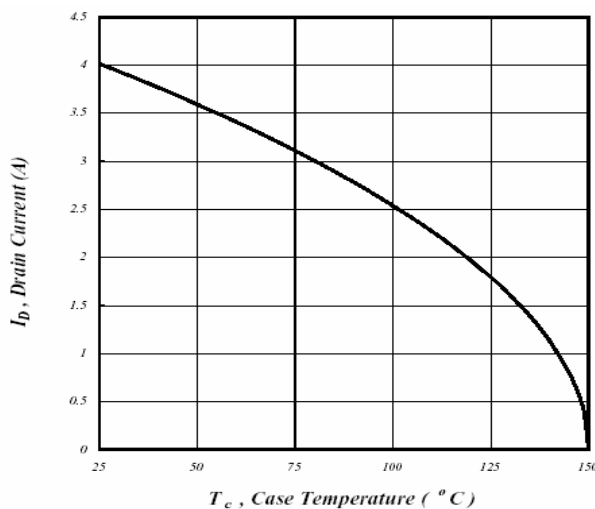


Fig 5. Maximum Drain Current v.s. Case Temperature

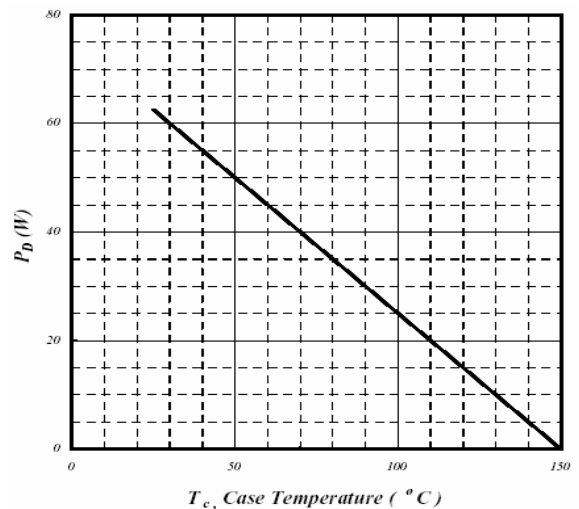


Fig 6. Typical Power Dissipation

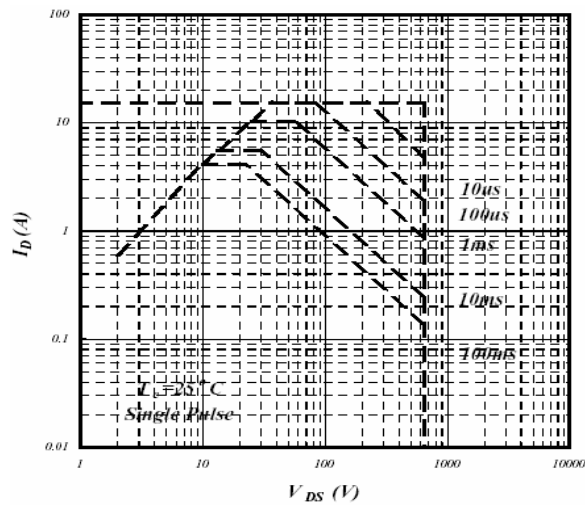


Fig 7. Maximum Safe Operating Area

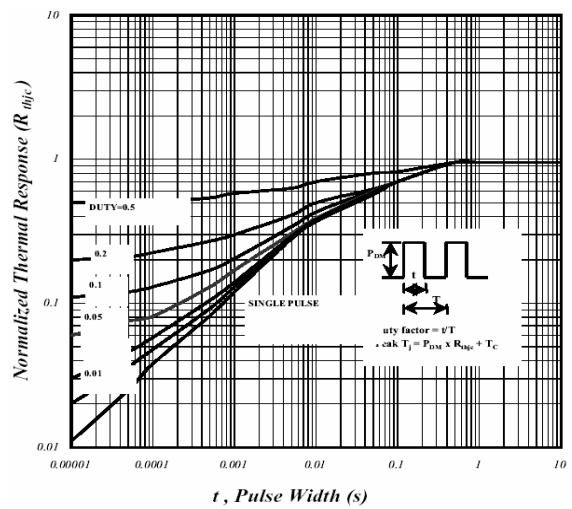


Fig 8. Effective Transient Thermal Impedance

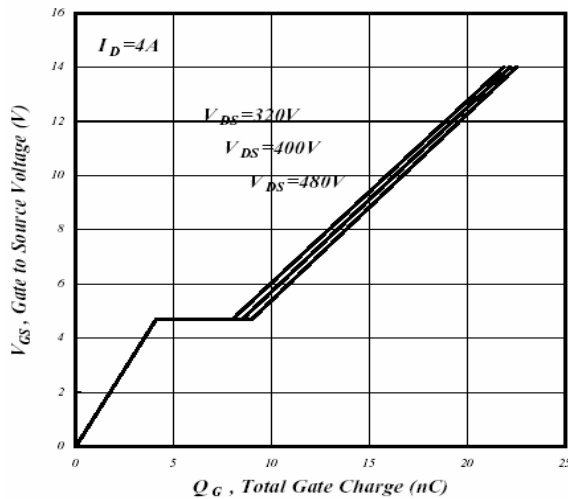


Fig 9. Gate Charge Characteristics

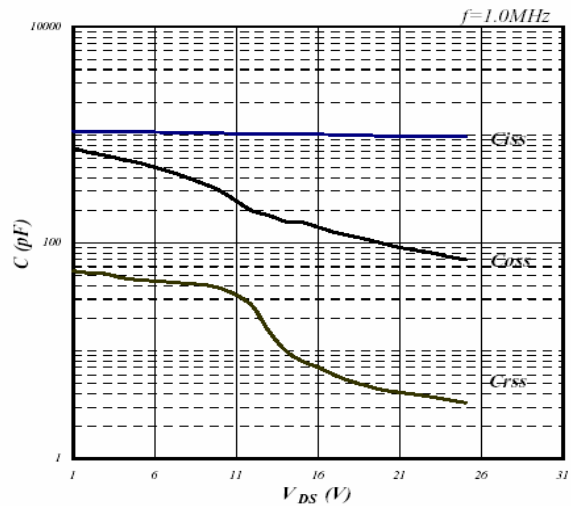


Fig 10. Typical Capacitance Characteristics

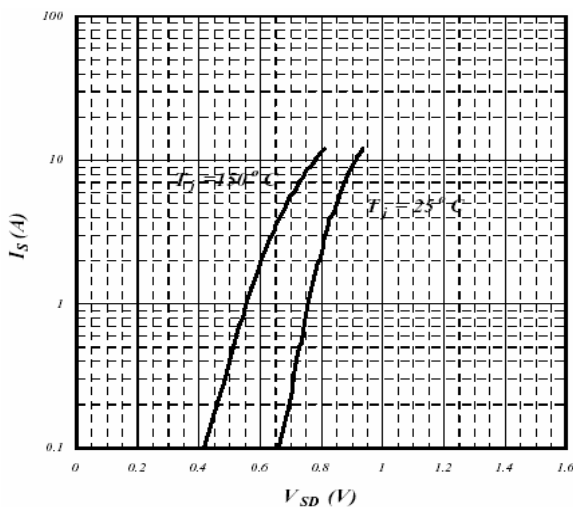


Fig 11. Forward Characteristics of Reverse Diode

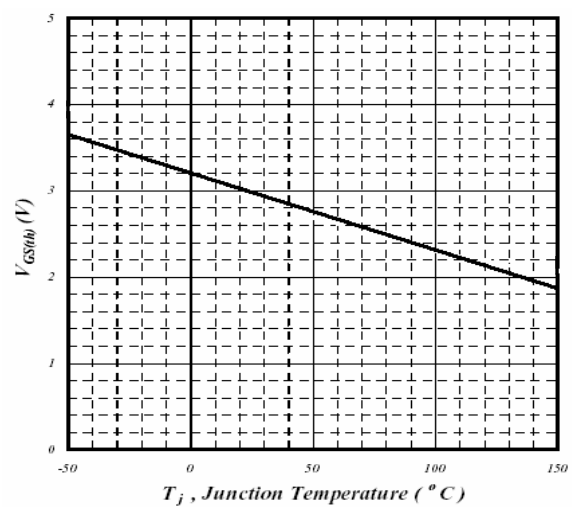
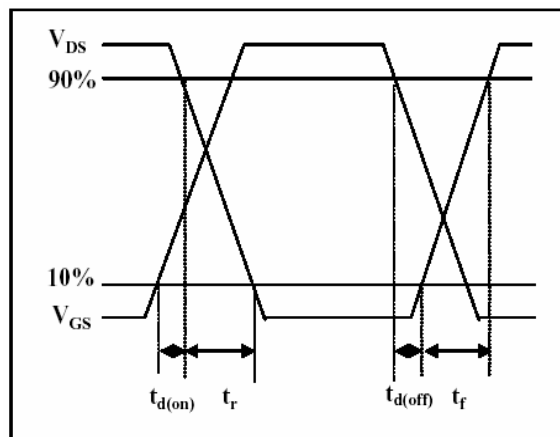


Fig 12. Gate Threshold Voltage v.s. Junction Temperature



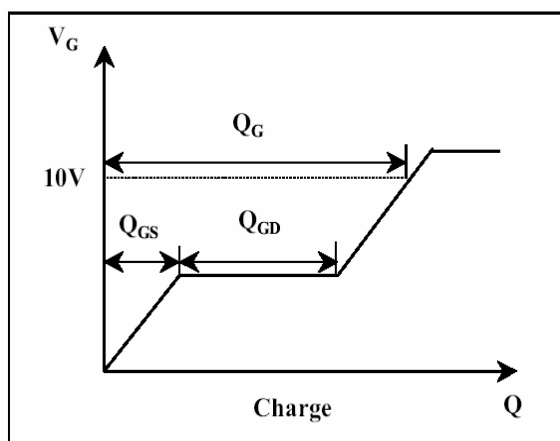
**Fig 13. Switching Time Circuit**



**Fig 14. Switching Time Waveform**



**Fig 15. Gate Charge Circuit**



**Fig 16. Gate Charge Waveform**

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