# N-Channel Enhancement Mode MOSFET

## BL4N1K5 BL4N1K5B BL4N1K5F

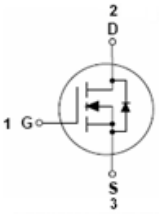
## Features

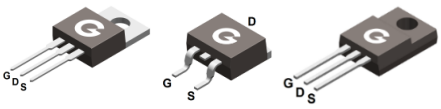
- Planar technology
- Low on-resistance
- Low gate charge
- Low reverse transfer capacitances
- HBM: JESD22-A114-B: 1C

HF

## Mechanical Data

- Case: TO-220AB, TO-263, ITO-220AB
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte Tin-Plated Leads, Solderability-per MIL-STD-202, Method 208



TO-220AB TO-263 ITO-220AB

## Ordering Information

| Part Number | Package | Shipping Quantity | Marking Code |
|---|---|---|---|
| BL4N1K5 | TO-220AB | 50 pcs / Tube | 4N1K5 |
| BL4N1K5B | TO-263 | 50 pcs / Tube or 800 pcs / Tape & Reel | 4N1K5B |
| BL4N1K5F | ITO-220AB | 50 pcs / Tube | 4N1K5F |

## Maximum Ratings (@ $T_C$ = 25°C unless otherwise specified)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-to-Source Voltage | $V_{DSS}$ | 1500 | V |
| Gate-to-Source Voltage | $V_{GSS}$ | ±30 | V |
| Continuous Drain Current ($T_C$ = 25°C) | $I_D$ | 4 | A |
| Continuous Drain Current ($T_C$ = 100°C) | | 2.5 | |
| Pulsed Drain Current ($t_p$ =10μs, $T_C$ = 25°C) | $I_{DM}$ | 16 | A |
| Single Pulse Avalanche Energy *2 | $E_{AS}$ | 30 | mJ |
| Power Dissipation (TO-220AB, $T_C$ = 25°C) | $P_D$ | 278 | W |
| Power Dissipation (TO-263, $T_C$ = 25°C) | | 278 | |
| Power Dissipation (ITO-220AB, $T_C$ = 25°C) | | 36 | |
| Operating Junction Temperature Range | $T_J$ | -55 ~ +150 | °C |
| Storage Temperature Range | $T_{STG}$ | -55 ~ +150 | °C |

## Thermal Characteristics

| Parameter | Symbol | TO-220AB/TO-263 | ITO-220AB | Unit |
|---|---|---|---|---|
| Thermal Resistance Junction-to-Case | $R_{\theta JC}$ | 0.45 | 3.5 | °C/W |
| Thermal Resistance Junction-to-Air | $R_{\theta JA}$ | 50 | 62.5 | °C/W |

## Electrical Characteristics (@ $T_A$ = 25°C unless otherwise specified)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | |
| $V_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 250μA | 1500 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 1500V, $V_{GS}$ = 0V | - | - | 25 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$ = ±30V, $V_{DS}$ = 0V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $R_{DS(ON)}$ | Drain-Source On-resistance *1 | $V_{GS}$ = 10V, $I_D$ = 2A | - | 5.5 | 7 | Ω |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 2.5 | 3.5 | 5 | V |
| $R_G$ | Gate Resistance | $V_{GS}$ = 0V, f = 1MHz | - | 2 | - | Ω |
| **Dynamic Characteristics** | | | | | | |
| $C_{ISS}$ | Input Capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 25V<br>f = 1.0MHz | - | 1728 | - | pF |
| $C_{OSS}$ | Output Capacitance | | - | 101 | - | |
| $C_{RSS}$ | Reverse Transfer Capacitance | | - | 8.9 | - | |
| **Switching Characteristics** | | | | | | |
| $t_{d(ON)}$ | Turn-on Delay Time *3 | $V_{DD}$ = 750V<br>$V_{GS}$ = 10V<br>$I_D$ = 4A<br>$R_G$ = 4.7Ω | - | 25 | - | ns |
| $t_r$ | Turn-on Rise Time *3 | | - | 48 | - | |
| $t_{d(OFF)}$ | Turn-Off Delay Time *3 | | - | 57 | - | |
| $t_f$ | Turn-Off Fall Time *3 | | - | 52 | - | |
| $Q_G$ | Total Gate-Charge | $V_{DD}$ = 960V<br>$V_{GS}$ = 10V<br>$I_D$ = 4A | - | 45 | - | nC |
| $Q_{GS}$ | Gate to Source Charge | | - | 7.5 | - | |
| $Q_{GD}$ | Gate to Drain ( “Miller” ) Charge | | - | 21.2 | - | |
| **Source-Drain Diode Characteristics** | | | | | | |
| $V_{SD}$ | Diode Forward Voltage *1 | $I_{SD}$ = 4A, $V_{GS}$ = 0V | - | 0.85 | 1.5 | V |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$ = 2A, $V_R$=100V<br>$d_I$ / $d_t$ = 100A/μs | - | 1 | - | us |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | | - | 6.6 | - | uC |

Notes:

1. The data tested by pulsed, pulse width ≤ 300μs, duty cycle ≤ 2%
2. The $E_{AS}$ data shows Max. rating. The test condition is $V_{DD}$ = 50V, $V_{GS}$ = 15V, L = 10mH
3. Guaranteed by design, not subject to production

## Ratings and Characteristic Curves (@ $T_A$ = 25°C unless otherwise specified)

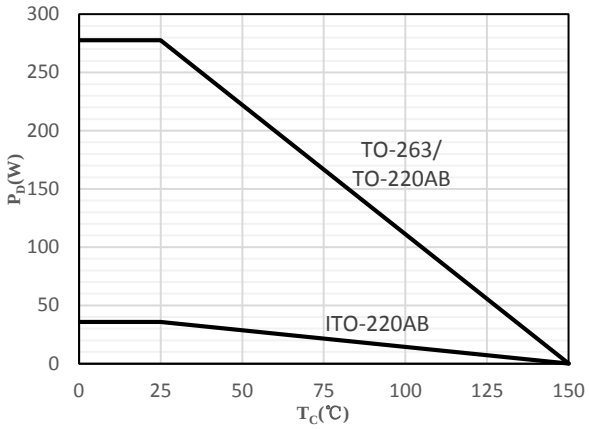



Fig 1 Power Dissipation

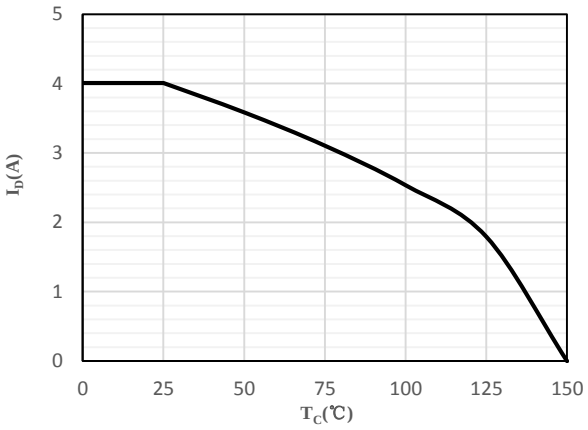



Fig 2 Drain Current

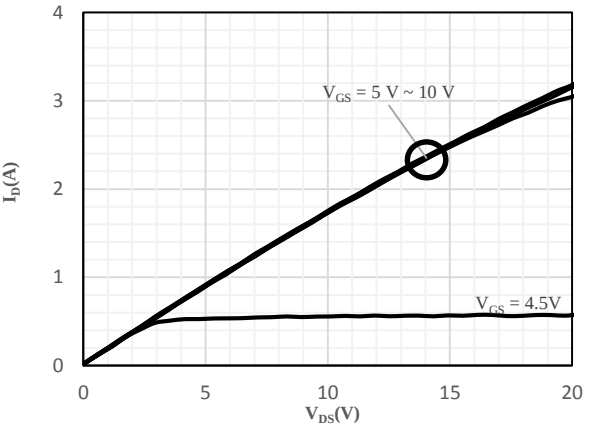



Fig 3 Typical Output Characteristics

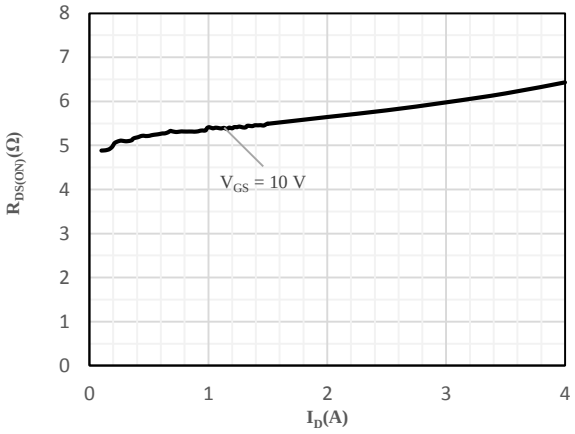



Fig 4 On-Resistance vs. Drain Current and Gate Voltage

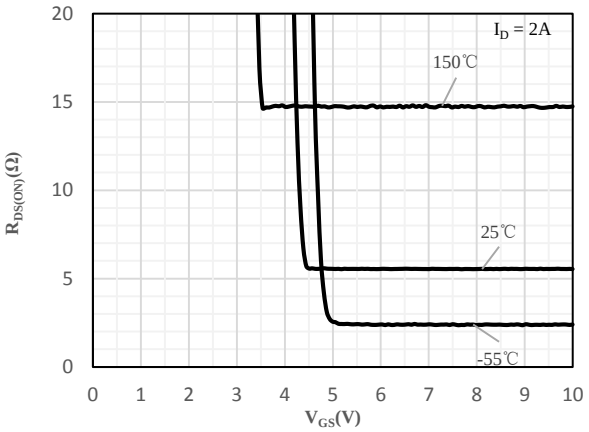



Fig 5 On-Resistance vs. Gate-Source Voltage

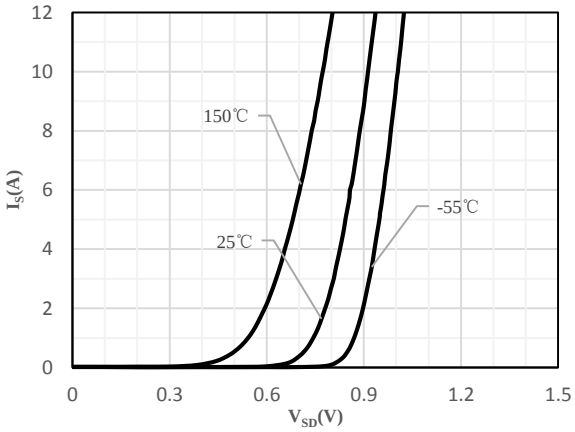



Fig 6 Body-Diode Characteristics

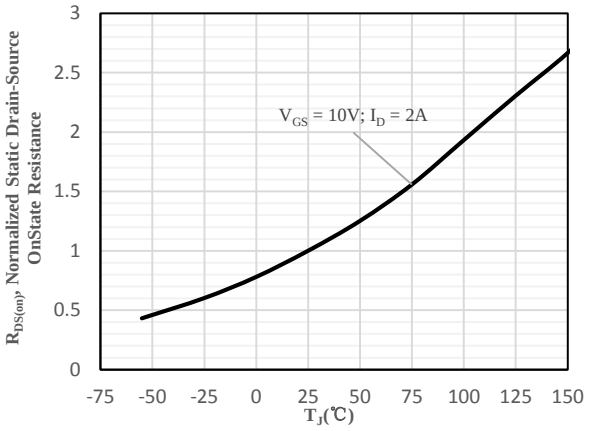



Fig 7 Normalized On-Resistance vs. Junction Temperature

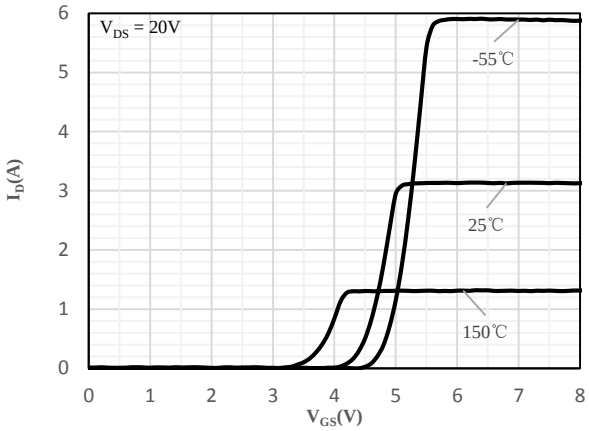



Fig 8 Transfer Characteristics

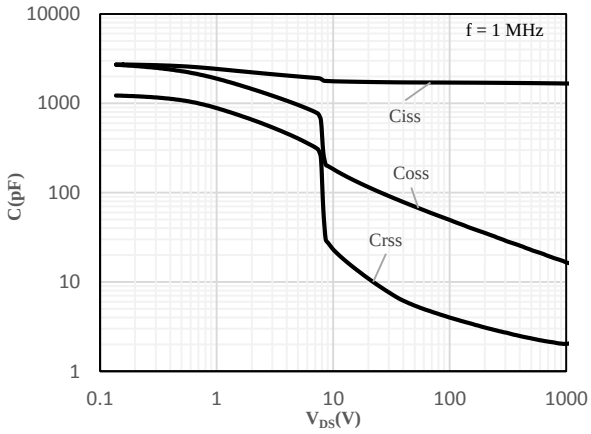



Fig 9 Capacitance Characteristics

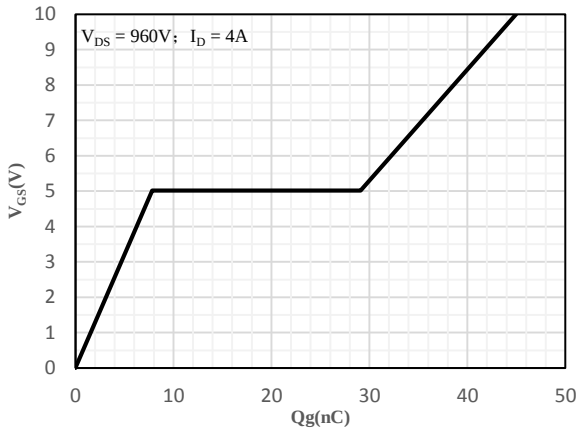



Fig 10 Gate-Charge Characteristics

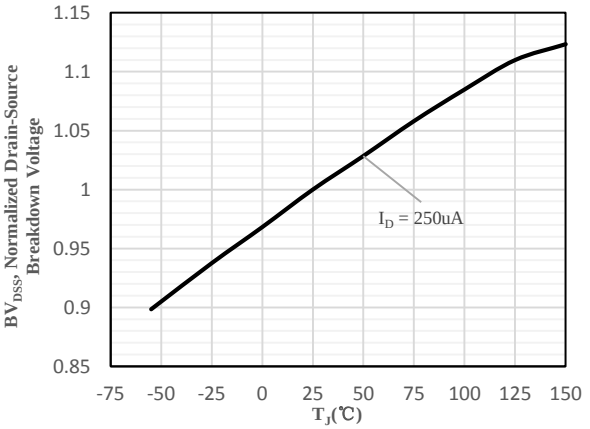



Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

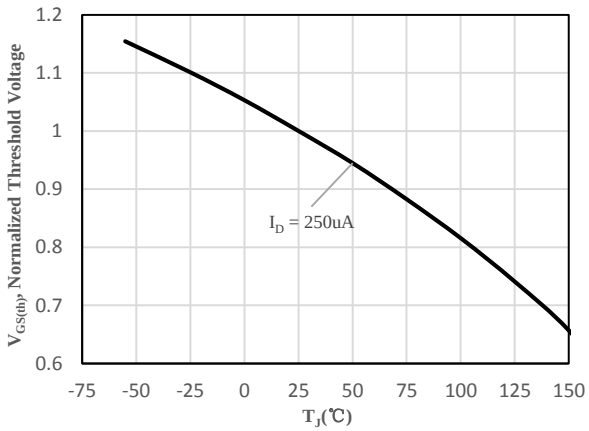



Fig 12 Normalized $V_{GS(th)}$ vs. Junction Temperature

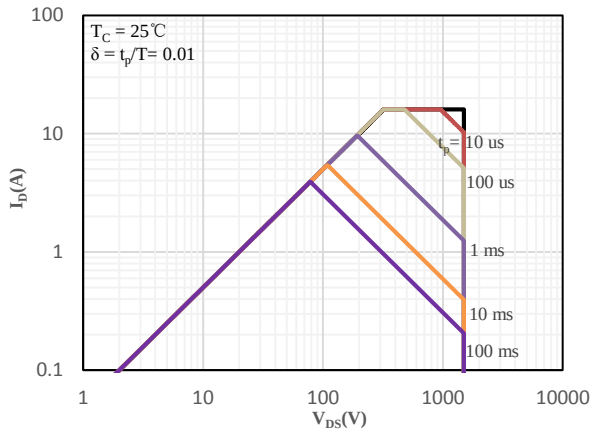



Fig 13 Safe Operating Area (TO-220AB / TO-263)

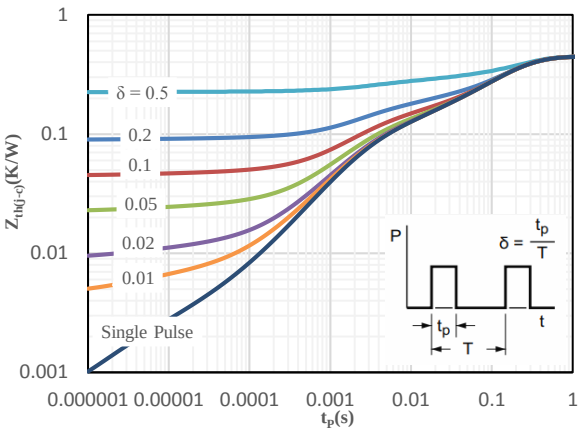
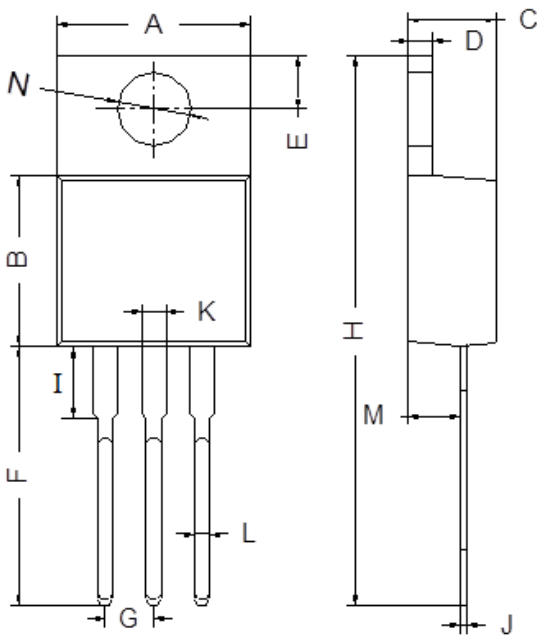
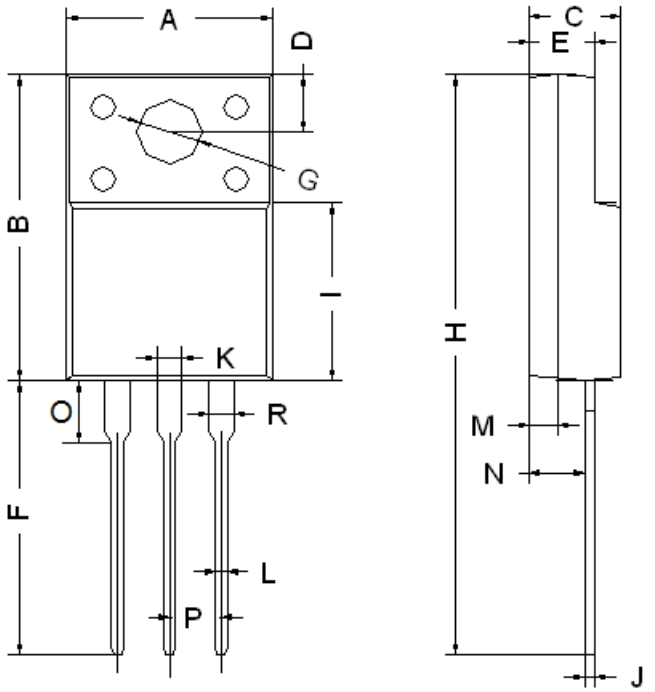



Fig 14 Maximum transient thermal impedance (TO-220AB / TO-263)

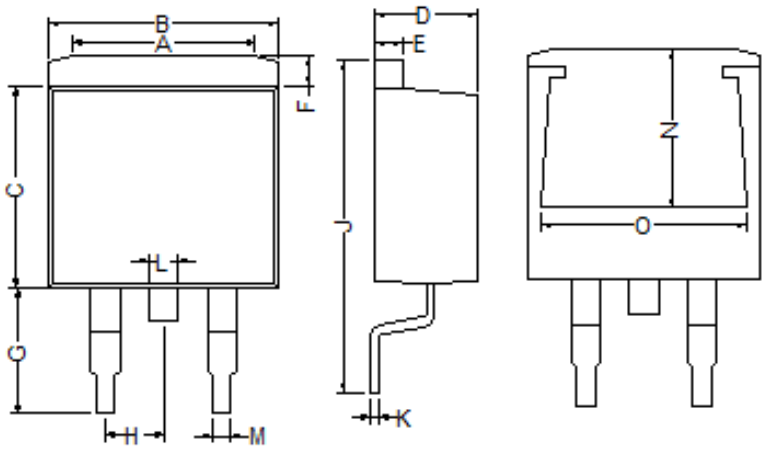
## Package Outline Dimensions (Unit: mm)




| TO-220AB | | |
|---|---|---|
| **Dimension** | **Min.** | **Max.** |
| A | 9.80 | 10.30 |
| B | 8.70 | 9.10 |
| C | 4.37 | 4.77 |
| D | 1.07 | 1.47 |
| E | 2.64 | 2.84 |
| F | 13.14 | 13.74 |
| G | 2.44 | 2.64 |
| H | 28.03 | 28.83 |
| I | 3.50 | 4.00 |
| J | 0.28 | 0.48 |
| K | 1.22 | 1.32 |
| L | 0.71 | 0.91 |
| M | 2.40 | 2.60 |
| N | 3.76 | 3.96 |




| ITO-220AB | | |
|---|---|---|
| **Dimension** | **Min.** | **Max.** |
| A | 9.90 | 10.30 |
| B | 14.80 | 15.20 |
| C | 4.30 | 4.70 |
| D | 2.50 | 2.90 |
| E | 2.80 | 3.30 |
| F | 13.00 | 13.60 |
| G | 3.10 | 3.30 |
| H | 28.00 | 28.60 |
| I | 7.90 | 8.90 |
| J | 0.40 | 0.60 |
| L | 0.70 | 0.90 |
| M | 1.30 | 1.50 |
| N | 2.60 | 2.80 |
| O | 2.60 | 3.10 |
| P | 2.45 | 2.65 |
| K/R | 1.10 | 1.30 |




| TO-263 | | |
|---|---|---|
| **Dimension** | **Min.** | **Max.** |
| A | 6.00 | 8.00 |
| B | 9.90 | 10.30 |
| C | 8.50 | 9.10 |
| D | 4.37 | 4.77 |
| E | 1.07 | 1.47 |
| F | 1.07 | 1.47 |
| G | 5.05 | 5.74 |
| H | 2.44 | 2.66 |
| J | 15.15 | 15.80 |
| K | 0.28 | 0.48 |
| L | 1.17 | 1.37 |
| M | 0.71 | 0.91 |
| N | 6.55 | 7.68 |
| O | 7.70 | 8.10 |

## Mounting Pad Layout (Unit: mm)

### TO-263