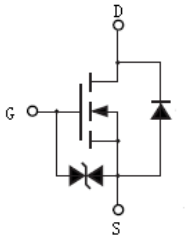
# N-Channel Enhancement Mode MOSFET

## BL1N60KR

## Features

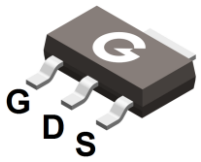
HF

- Fast switching
- ESD improved capability
- Low gate charge
- Low reverse transfer capacitances
- JESD22-A114-B ESD rating of class 1C per human body model




## Application

- Power switch circuit of adaptor and charger




SOT-223

## Mechanical Data

- Case: SOT-223
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208

## Ordering Information

| Part Number | Package | Shipping Quantity | Marking Code |
|---|---|---|---|
| BL1N60KR | SOT-223 | 4000 pcs / Tape & Reel | 1N60KR |

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

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-to-Source Voltage | $V_{DSS}$ | 600 | V |
| Gate-to-Source Voltage | $V_{GSS}$ | ±30 | V |
| Continuous Drain Current ($T_C$ = 25°C) | $I_D$ | 1 | A |
| Continuous Drain Current ($T_A$ = 25°C) *2 | | 0.35 | A |
| Continuous Drain Current ($T_A$ = 70°C) *2 | | 0.28 | A |
| Pulsed Drain Current ($t_p$ = 10μs, $T_C$ = 25°C) | $I_{DM}$ | 6 | A |
| Pulsed Drain Current ($t_p$ = 10μs, $T_A$ = 25°C) | | 3.5 | A |
| Single Pulse Avalanche Energy *4 | $E_{AS}$ | 60 | mJ |
| Power Dissipation ($T_C$ = 25°C) | $P_D$ | 20 | W |
| Power Dissipation ($T_A$ = 25°C) *2 | | 2.5 | W |
| Operating Junction Temperature Range | $T_J$ | -55 ~ +150 | °C |
| Storage Temperature Range | $T_{STG}$ | -55 ~ +150 | °C |

## Thermal Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Thermal Resistance Junction-to-Case | $R_{\theta JC}$ | - | - | 6.2 | °C/W |
| Thermal Resistance Junction-to-Air *1 | $R_{\theta JA}$ | - | - | 100 | °C/W |
| Thermal Resistance Junction-to-Air *2 | | - | 42 | 50 | °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 | 600 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 600V, $V_{GS}$ = 0V | - | - | 1 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | - | - | ±10 | μA |
| **On Characteristics** | | | | | | |
| $R_{DS(ON)}$ | Drain-Source On-resistance *3 | $V_{GS}$ = 10V,$I_D$ = 0.75A | - | 7 | 8 | Ω |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 2 | 3 | 4 | V |
| $R_G$ | Gate Resistance | $V_{GS}$ = 0V, f = 1MHz | - | 11 | - | Ω |
| **Dynamic Characteristics** | | | | | | |
| $C_{ISS}$ | Input Capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 25V<br>f = 1.0MHz | - | 178 | - | pF |
| $C_{OSS}$ | Output Capacitance | | - | 20 | - | |
| $C_{RSS}$ | Reverse Transfer Capacitance | | - | 3 | - | |
| **Switching Characteristics** | | | | | | |
| $t_{d(ON)}$ | Turn-on Delay Time *5 | $V_{DD}$ = 300V<br>$V_{GS}$ = 10V<br>$R_G$ = 4.7Ω<br>$I_D$ = 1.5A | - | 8 | - | ns |
| $t_r$ | Turn-on Rise Time *5 | | - | 30 | - | |
| $t_{d(OFF)}$ | Turn-Off Delay Time *5 | | - | 22 | - | |
| $t_f$ | Turn-Off Fall Time *5 | | - | 55 | - | |
| $Q_G$ | Total Gate-Charge | $V_{DD}$ = 480V<br>$V_{GS}$ = 10V<br>$I_D$ = 1.5A | - | 7.7 | - | nC |
| $Q_{GS}$ | Gate to Source Charge | | - | 0.9 | - | |
| $Q_{GD}$ | Gate to Drain (Miller) Charge | | - | 5.3 | - | |
| **Source-Drain Diode Characteristics** | | | | | | |
| $V_{SD}$ | Diode Forward Voltage *3 | $I_{SD}$ = 1.5A, $V_{GS}$ = 0V | - | 0.9 | 1.5 | V |
| trr | Reverse Recovery Time | $I_{SD}$ = 1.5A, $V_{GS}$ = 0V<br>$d_I/d_t$ = 100A/μs | - | 245 | - | ns |
| Qrr | Reverse Recovery Charge | | - | 795 | - | nC |

Notes:

1. The data tested by surface mounted on a minimum recommended FR-4 board
2. The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper
3. The data tested by pulsed, pulse width ≤ 300μs, duty cycle ≤ 2%
4. The $E_{AS}$ data shows Max. rating. The test condition is $V_{DD}$ = 100V, $V_{GS}$ = 10V, L = 50mH
5. Guaranteed by design, not subject to production

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

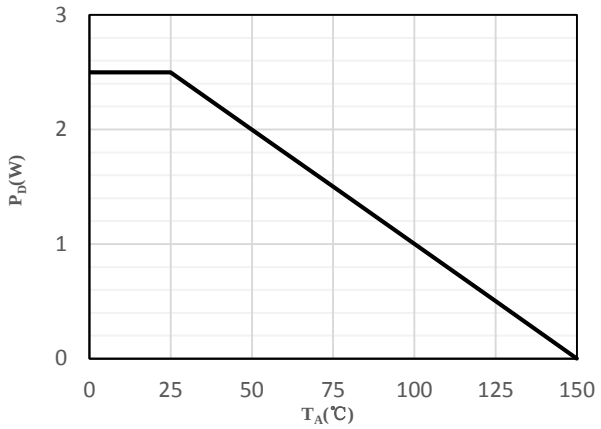



Fig 1 Power Dissipation

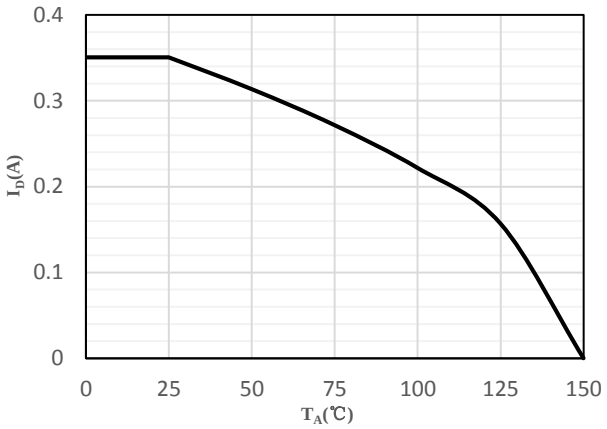



Fig 2 Drain Current

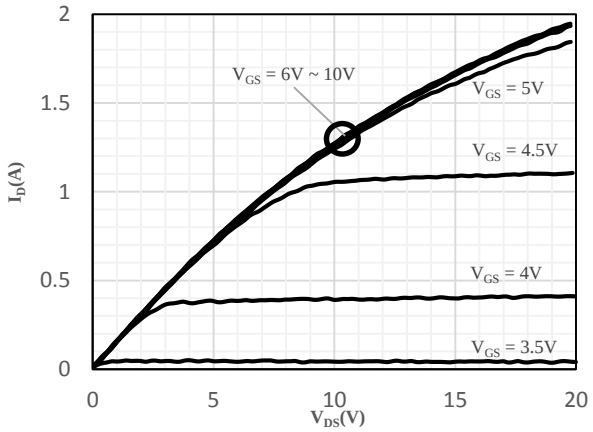



Fig 3 Typical Output Characteristics

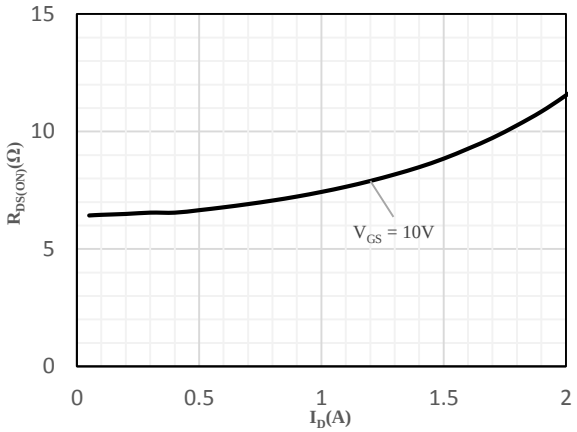



Fig 4 On-Resistance vs. Drain Current and Gate Voltage

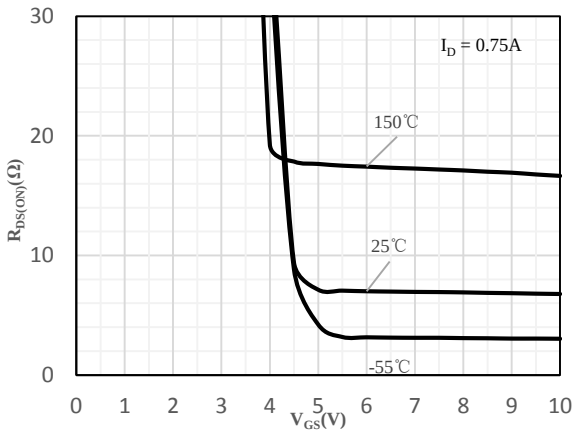



Fig 5 On-Resistance vs. Gate-Source Voltage

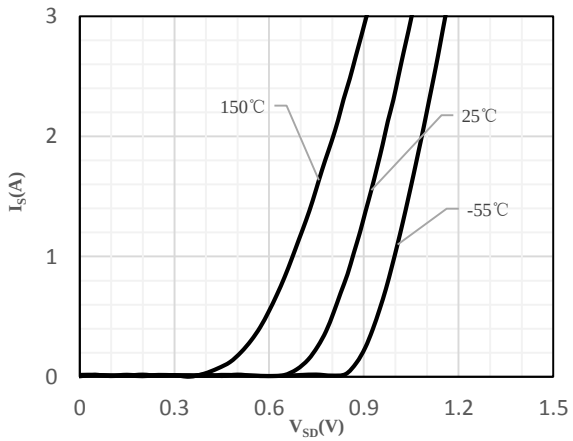



Fig 6 Body-Diode Characteristics

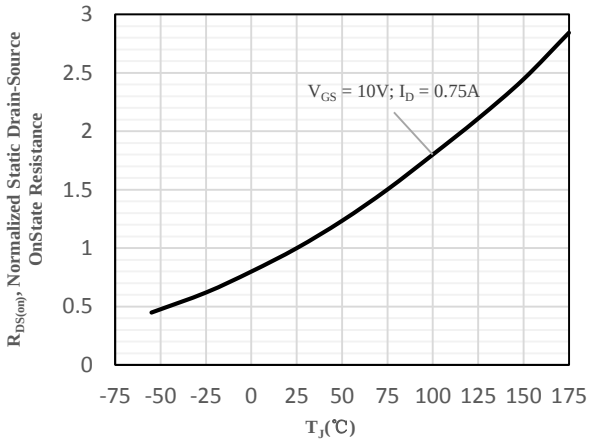



Fig 7 Normalized On-Resistance vs. Junction Temperature

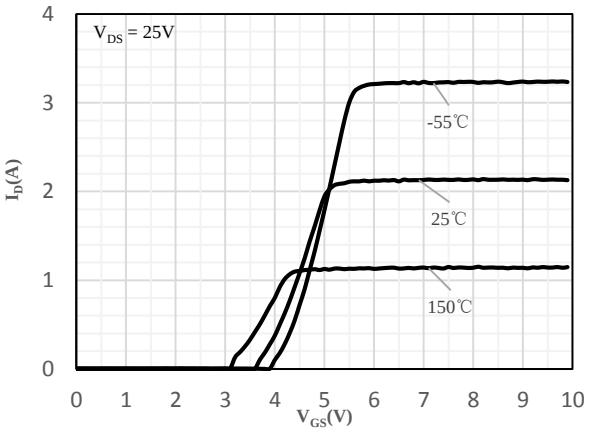



Fig 8 Transfer Characteristics

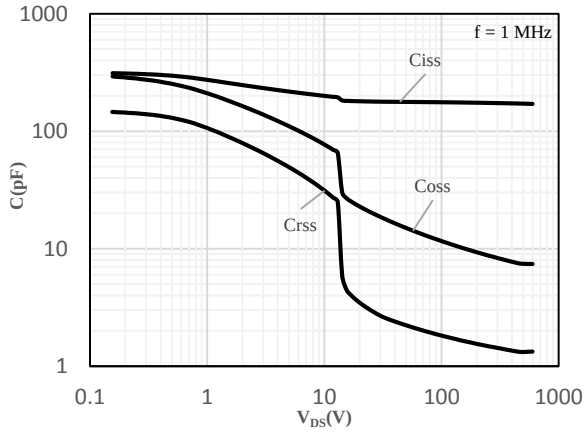



Fig 9 Capacitance Characteristics

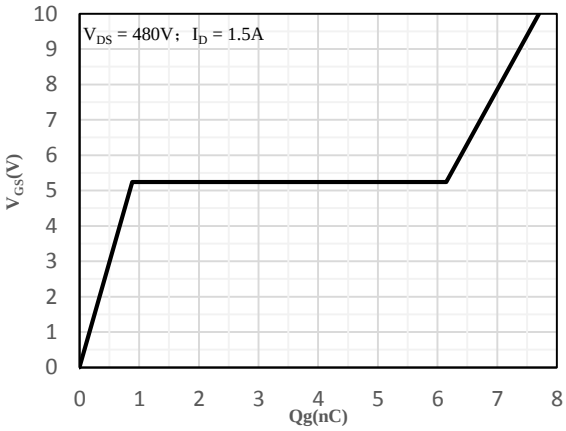



Fig 10 Gate-Charge Characteristics

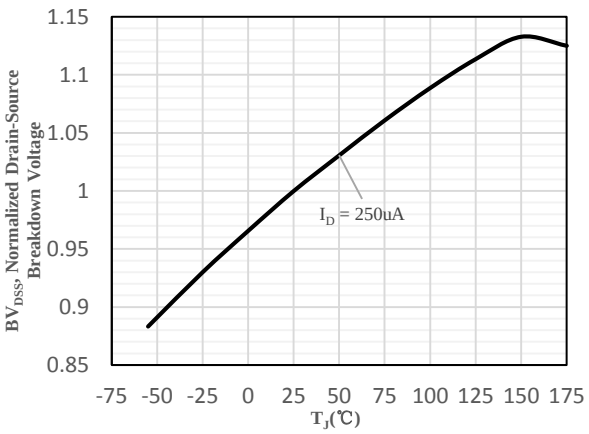



Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

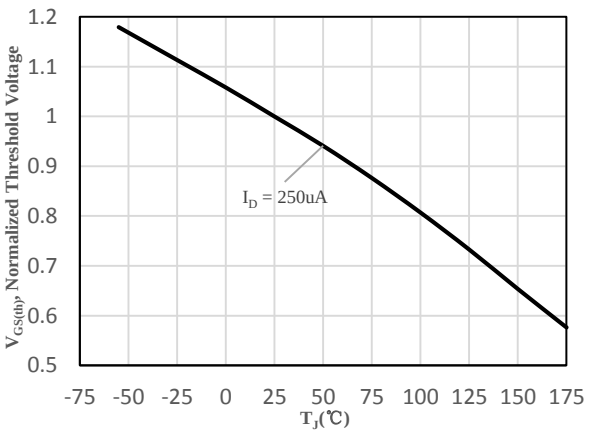



Fig 12 Normalized $V_{GS(th)}$ vs. Junction Temperature

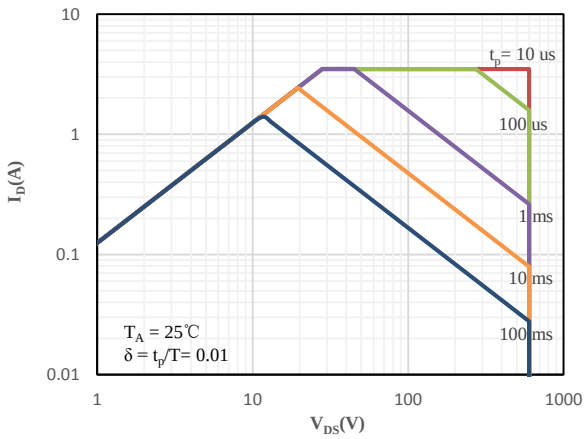



Fig 13 Safe Operation Area

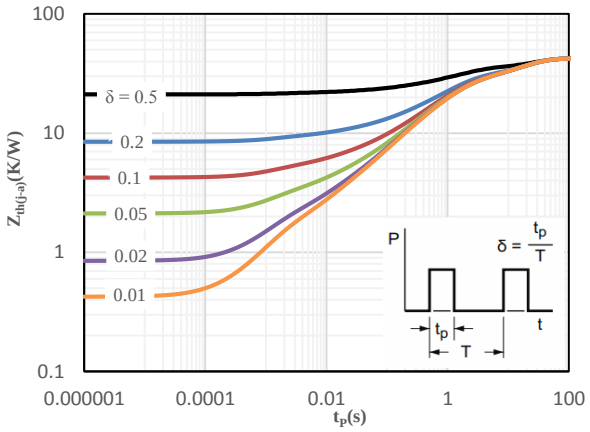
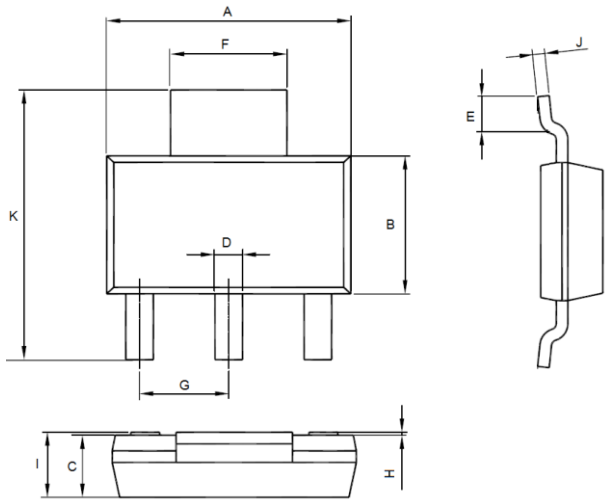



Fig 14 Maximum transient thermal impedance

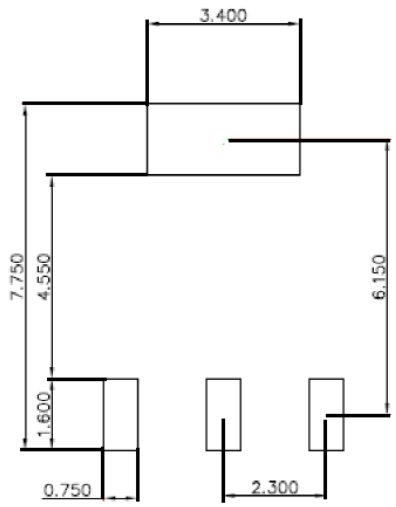
## Package Outline Dimensions (Unit: mm)




| SOT-223 | | |
|---|---|---|
| **Dimension** | **Min.** | **Max.** |
| A | 6.10 | 6.50 |
| B | 3.30 | 3.70 |
| C | 1.50 | 1.70 |
| D | 0.66 | 0.82 |
| E | 0.90 | 1.15 |
| F | 2.90 | 3.10 |
| G | 2.20 | 2.40 |
| H | 0.02 | 0.10 |
| I | 1.52 | 1.80 |
| J | 0.20 | 0.40 |
| K | 6.70 | 7.30 |

## Mounting Pad Layout (Unit: mm)

### SOT-223

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