

**40V N-Channel Power MOSFET**

• **General Description**

It combines trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ .

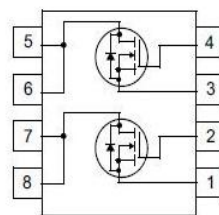
• **Features**

- AEC-Q101 Qualified
- Low  $R_{DS(ON)}$  to minimize conductive loss
- High GOX reliability
- Low Thermal resistance

• **Application**

- BLDC Motor driver
- DC-DC
- Battery protection

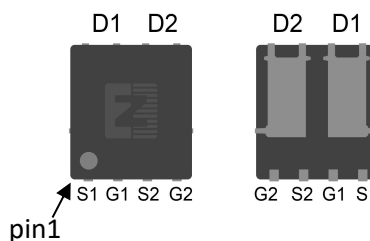
• **Product Summary**



$$V_{DS} = 40V$$

$$R_{DS(ON)} = 6.8m\Omega$$

$$I_D = 47A$$



DFN5\*6



• **Ordering Information:**

|                           |             |
|---------------------------|-------------|
| Part NO.                  | ZMDA68404HN |
| Marking                   | ZMD68404H   |
| Packing Information       | REEL TAPE   |
| Basic ordering unit (pcs) | 3000        |

• **Absolute Maximum Ratings** ( $T_C=25^\circ C$ )

| Parameter                        | Symbol    | Conditions                                            | Value       | Unit       |
|----------------------------------|-----------|-------------------------------------------------------|-------------|------------|
| Drain-Source Voltage             | $V_{DS}$  |                                                       | 40          | V          |
| Gate-Source Voltage <sup>①</sup> | $V_{GS}$  |                                                       | $\pm 20$    | V          |
| Continuous Drain Current         | $I_D$     | $T_C=25^\circ C$                                      | 47          | A          |
|                                  | $I_D$     | $T_C=75^\circ C$                                      | 47          | A          |
|                                  | $I_D$     | $T_C=100^\circ C$                                     | 47          | A          |
| Pulsed Drain Current             | $I_{DM}$  | Pulsed; $t_p \leq 10 \mu s$ ; $T_{mb} = 25^\circ C$ ; | 188         | A          |
| Total Power Dissipation          | $P_D$     | $T_C=25^\circ C$                                      | 42          | W          |
| Total Power Dissipation          | $P_D$     | $T_A=25^\circ C$                                      | 3.3         | W          |
| Operating Junction Temperature   | $T_J$     |                                                       | -55 to +175 | $^\circ C$ |
| Storage Temperature              | $T_{STG}$ |                                                       | -55 to +175 | $^\circ C$ |
| Single Pulse Avalanche Energy    | $E_{AS}$  | $L=0.1mH$ , $V_{GS}=10V$ , $R_g=25\Omega$ ,           | 100         | mJ         |
|                                  |           | $L=0.5mH$ , $V_{GS}=10V$ , $R_g=25\Omega$ ,           | 210         | mJ         |
| ESD Level (HBM)                  | CLASS 2   |                                                       |             |            |

**•Thermal resistance**

| Parameter                                         | Symbol     | Min. | Typ. | Max. | Unit |
|---------------------------------------------------|------------|------|------|------|------|
| Thermal resistance, junction - case               | $R_{thJC}$ |      | -    | 3.6  | °C/W |
| Thermal resistance, junction-ambient <sup>②</sup> | $R_{thJA}$ |      | -    | 45   | °C/W |
| Soldering temperature                             | $T_{sold}$ |      | -    | 260  | °C   |

**•Electronic Characteristics**

| Parameter                         | Symbol       | Condition                     | Min. | Typ. | Max. | Unit       |
|-----------------------------------|--------------|-------------------------------|------|------|------|------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$     | 40   |      |      | V          |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 2    | 3    | 4    | V          |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{GS}=0V, V_{DS}=40V$       |      |      | 1.0  | $\mu A$    |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   |      |      | 100  | nA         |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=18A$         |      | 6.8  | 9    | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS}=5V, I_{SD}=10A$       |      | 8    |      | S          |
| Diode Forward Voltage             | $V_{FSD}$    | $V_{GS}=0V, I_{SD}=18A$       |      |      | 1.3  | V          |

**•Dynamic characteristics**

| Parameter                    | Symbol       | Condition                                        | Min. | Typ. | Max. | Unit     |
|------------------------------|--------------|--------------------------------------------------|------|------|------|----------|
| Input capacitance            | $C_{iss}$    | $f=1MHz, V_{DS}=25V$                             | -    | 3300 | -    | pF       |
| Output capacitance           | $C_{oss}$    |                                                  | -    | 232  | -    |          |
| Reverse transfer capacitance | $C_{rss}$    |                                                  | -    | 171  | -    |          |
| Gate Resistance              | $R_g$        | $f=1MHz$                                         | -    | 1.4  |      | $\Omega$ |
| Total gate charge            | $Q_g$        | $V_{DD}=15V, I_D=20A, V_{GS}=10V$                | -    | 51   | -    | nC       |
| Gate - Source charge         | $Q_{gs}$     |                                                  | -    | 9    | -    |          |
| Gate - Drain charge          | $Q_{gd}$     |                                                  | -    | 9.6  | -    |          |
| Turn-ON Delay time           | $t_{D(on)}$  | $V_{GS}=10V, V_{DS}=15V, R_G=3.3\Omega, I_D=20A$ | -    | 10   | -    | ns       |
| Turn-ON Rise time            | $t_r$        |                                                  | -    | 55   | -    | ns       |
| Turn-Off Delay time          | $t_{D(off)}$ |                                                  | -    | 25   | -    | ns       |
| Turn-Off Fall time           | $t_f$        |                                                  | -    | 42   | -    | ns       |
| Reverse Recovery Time        | $t_{RR}$     | $V_{DD}=20V, dI_S/dt=100A/\mu s, I_S=20A$        | -    | 23   | -    | ns       |
| Reverse Recovery Charge      | $Q_{RR}$     |                                                  | -    | 19   | -    | nC       |

Fig.1 Gate-Charge Characteristics

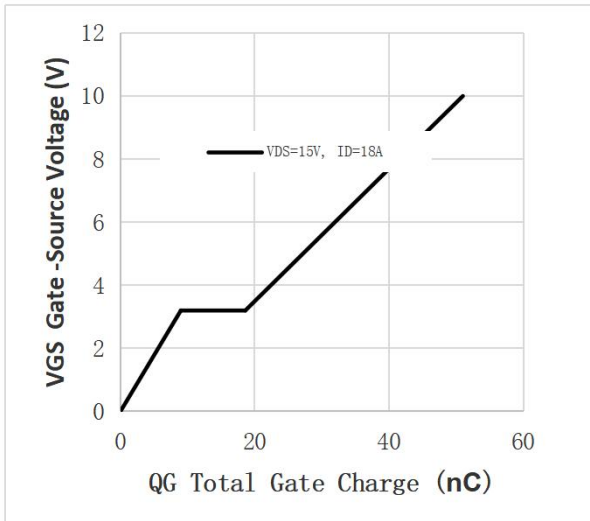


Fig.2 Capacitance Characteristics

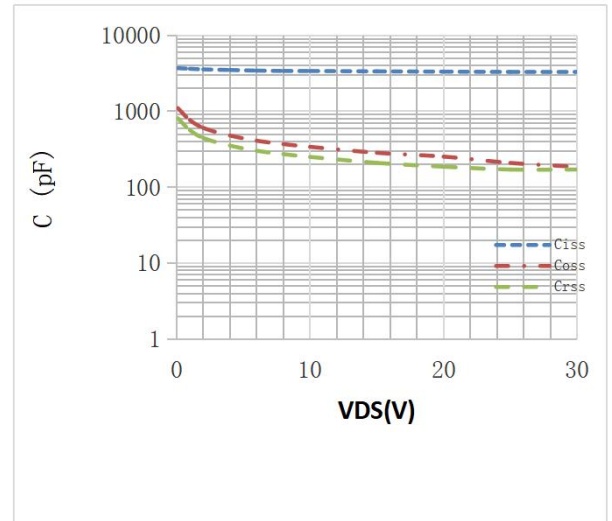


Fig.3 Power Dissipation

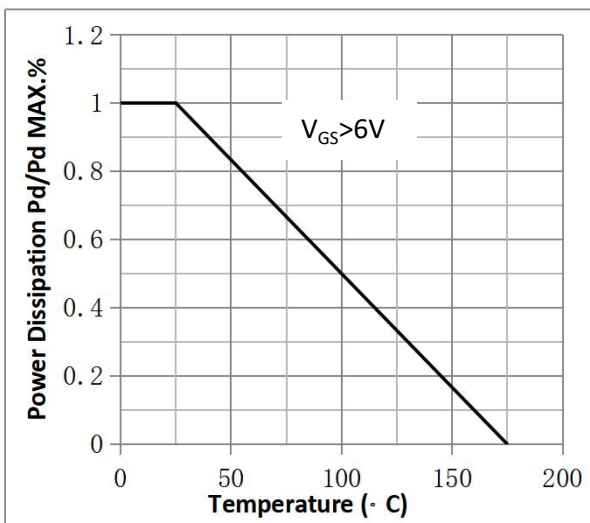


Fig.4 Typical output Characteristics

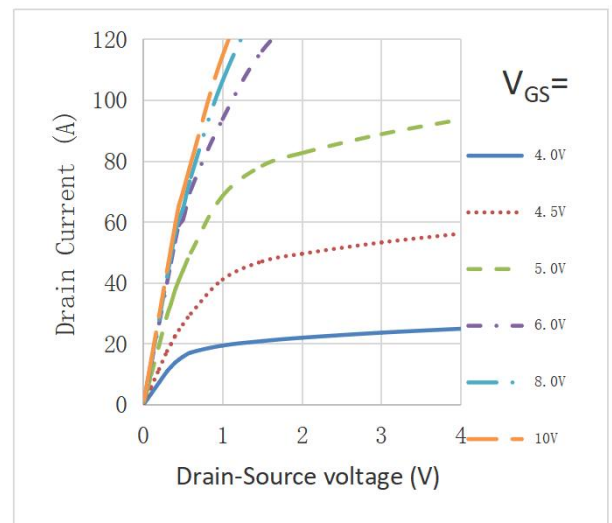


Fig.5 Threshold Voltage V.S Junction Temperature

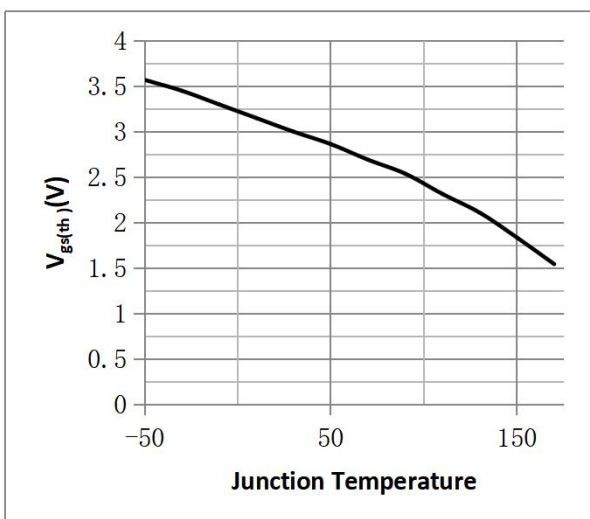


Fig.6 Resistance V.S Drain Current

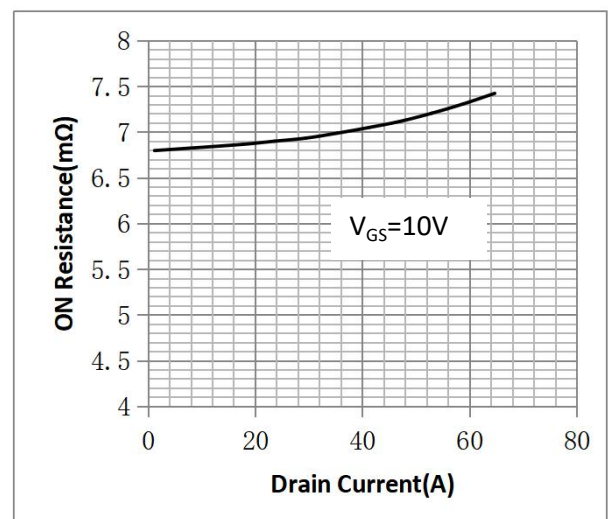


Fig.7 On-Resistance VS Gate Source Voltage

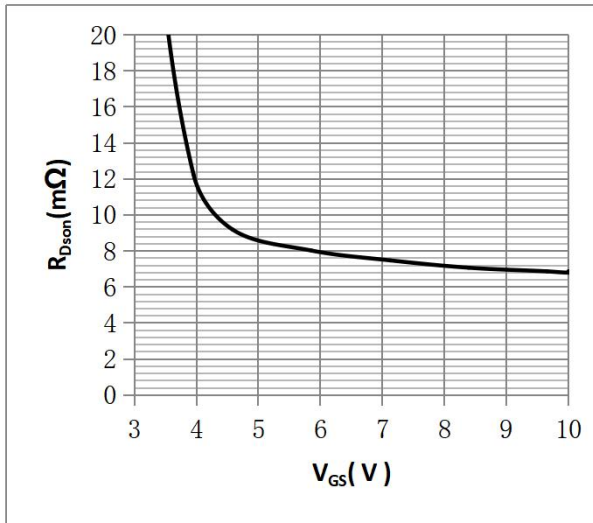


Fig.8 On-Resistance V.S Junction Temperature

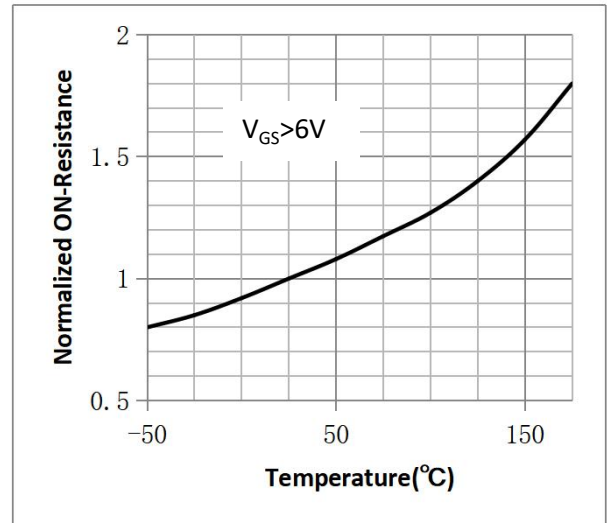


Figure 9. Diode Forward Voltage vs. Current

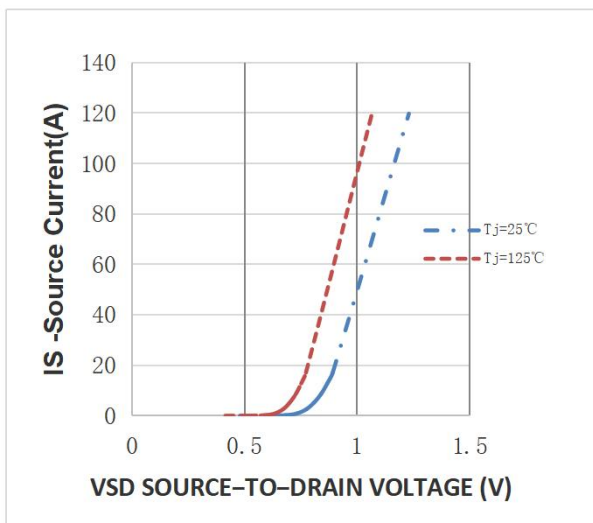


Figure 10. Transfer Characteristics

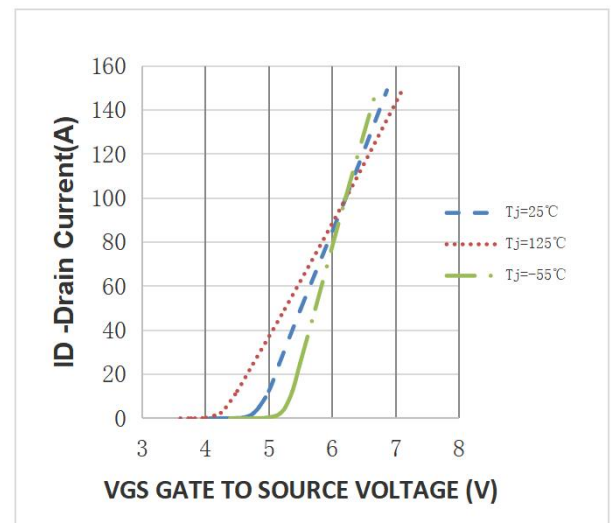


Fig.11 Safe Operating Area

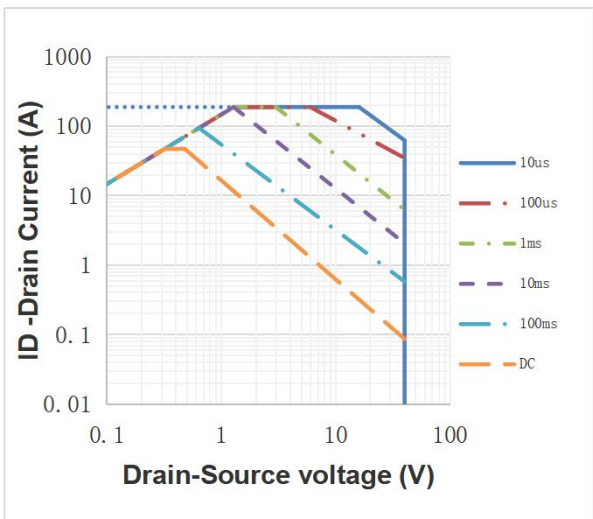
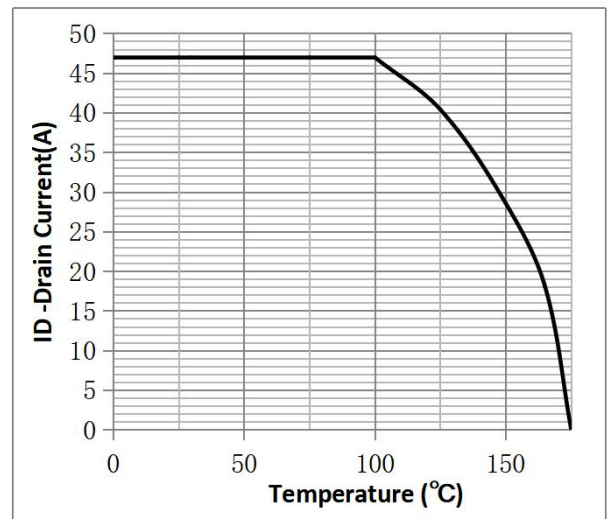
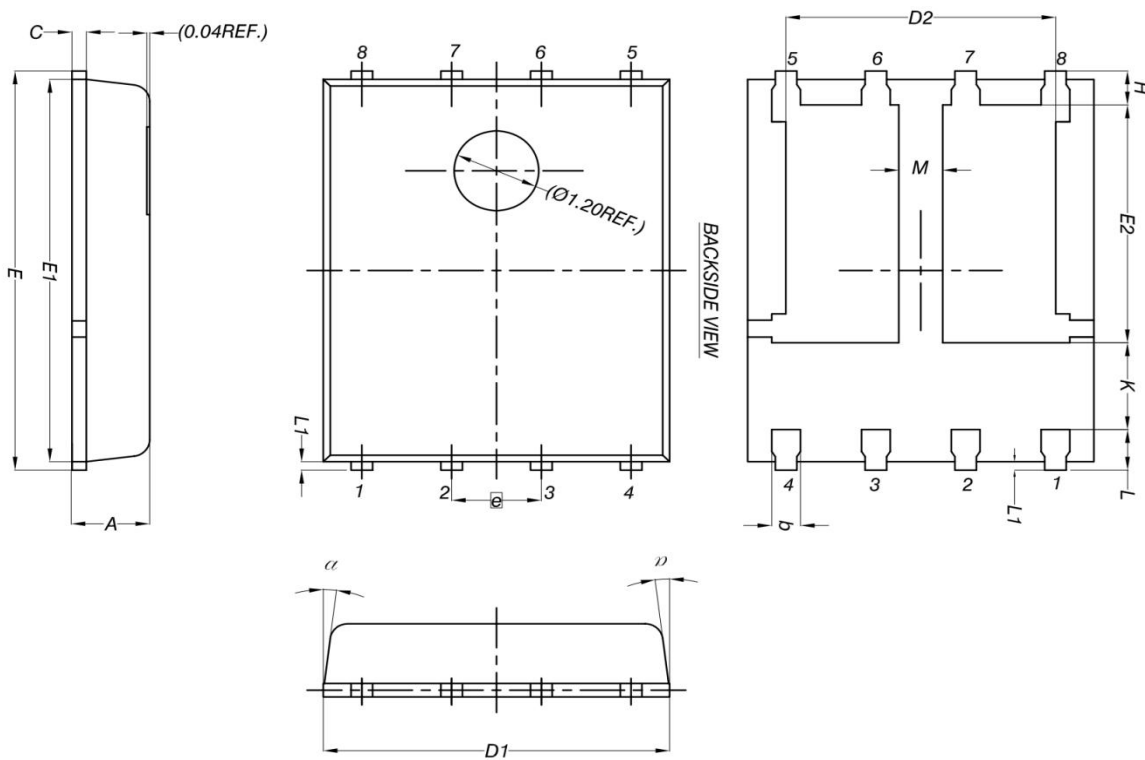


Fig.12 ID vs. Case Temperature<sup>③</sup>

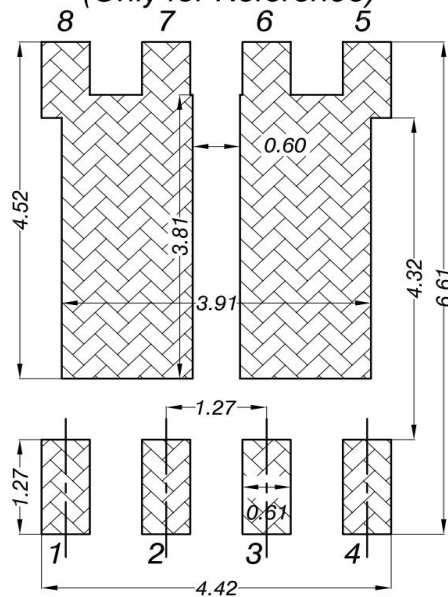




## •DFN5\*6 Package Outline



| DIM.     | MILLIMETERS |      |      |
|----------|-------------|------|------|
|          | MIN.        | NOM. | MAX. |
| A        | 0.90        | 1.00 | 1.10 |
| b        | 0.33        | 0.41 | 0.51 |
| C        | 0.20        | 0.25 | 0.30 |
| D1       | 4.80        | 4.90 | 5.00 |
| D2       | 3.61        | 3.81 | 3.96 |
| E        | 5.90        | 6.00 | 6.10 |
| E1       | 5.70        | 5.75 | 5.80 |
| E2       | 3.38        | 3.58 | 3.78 |
| e        | 1.27 BSC    |      |      |
| H        | 0.41        | 0.51 | 0.61 |
| K        | 1.10        | -    | -    |
| L        | 0.51        | 0.61 | 0.71 |
| L1       | 0.06        | 0.13 | 0.20 |
| M        | 0.50        | -    | -    |
| $\alpha$ | 0°          | -    | 12°  |

Land Pattern  
(Only for Reference)

**Note:**

- ① Pulse :  $V_{GS}=+20V/-20V$ , Duty cycle=50%,  $T_j=175^{\circ}C$ ,  $t=1000$  hours; For DC , the following test conditions can be passed:  $V_{GS}=+20V/-10V$ ,  $T_j=175^{\circ}C$ ,  $t=1000$  hours;
- ② Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;
- ③ Practically the current will be limited by PCB, thermal design and operating temperature.  $V_{GS}=10V$ .

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## Revision History

| Version | Date       | Change |
|---------|------------|--------|
| A       | 2022.12.20 | New    |
|         |            |        |
|         |            |        |
|         |            |        |
|         |            |        |
|         |            |        |
|         |            |        |
|         |            |        |