

### • General Description

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

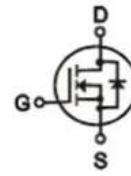
### • Features

- Advance device constructure
- Low  $R_{DS(ON)}$  to minimize conduction loss
- Low Gate Charge for fast switching
- Low Thermal resistance

### • Application

- Synchronous Rectification for AC-DC/DC-DC converter
- Power Tools

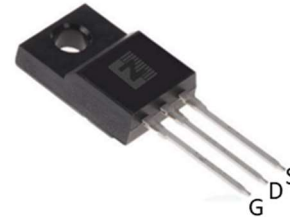
### • Product Summary



$$V_{DS} = 60V$$

$$R_{DS(ON)} = 5.2m\Omega$$

$$I_D = 52A$$



TO-220F

### • Ordering Information:

|                           |            |
|---------------------------|------------|
| Part NO.                  | ZMS052N06F |
| Marking                   | ZMS052N06  |
| Packing Information       | TUBE       |
| Basic ordering unit (pcs) | 1000       |

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

| Parameter                         | Symbol                 | Rating     | Unit       |
|-----------------------------------|------------------------|------------|------------|
| Drain-Source Voltage              | $V_{DS}$               | 60         | V          |
| Gate-Source Voltage               | $V_{GS}$               | $\pm 20$   | V          |
| Continuous Drain Current          | $I_{D@TC=25^\circ C}$  | 52         | A          |
|                                   | $I_{D@TC=75^\circ C}$  | 39         | A          |
|                                   | $I_{D@TC=100^\circ C}$ | 32         | A          |
| Pulsed Drain Current <sup>①</sup> | $I_{DM}$               | 156        | A          |
| Total Power Dissipation           | $P_{D@TC=25^\circ C}$  | 125        | W          |
| Total Power Dissipation           | $P_{D@TA=25^\circ C}$  | 3.4        | W          |
| Operating Junction Temperature    | $T_J$                  | -55 to 150 | $^\circ C$ |
| Storage Temperature               | $T_{STG}$              | -55 to 150 | $^\circ C$ |
| Single Pulse Avalanche Energy     | $E_{AS}$               | 280        | mJ         |

**•Thermal resistance**

| Parameter                                    | Symbol     | Min. | Typ. | Max. | Unit  |
|----------------------------------------------|------------|------|------|------|-------|
| Thermal resistance, junction - case          | $R_{thJC}$ |      |      | 1.0  | ° C/W |
| Thermal resistance, junction - ambient       | $R_{thJA}$ | -    | -    | 37   | ° C/W |
| Soldering temperature, wavesoldering for 10s | $T_{sold}$ | -    | -    | 265  | ° C   |

**•Electronic Characteristics**

| Parameter                         | Symbol       | Condition                         | Min. | Typ | Max.      | Unit       |
|-----------------------------------|--------------|-----------------------------------|------|-----|-----------|------------|
| Drain-Source Breakdown Voltage    | $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$     | 60   |     |           | V          |
| Gate Threshold Voltage            | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\mu A$ | 1.5  |     | 2.5       | V          |
| Drain-Source Leakage Current      | $I_{DSS}$    | $V_{DS} = 60V, V_{GS} = 0V$       |      |     | 1.0       | $\mu A$    |
| Gate- Source Leakage Current      | $I_{GSS}$    | $V_{GS} = \pm 20V, V_{DS} = 0V$   |      |     | $\pm 100$ | nA         |
| Static Drain-source On Resistance | $R_{DS(ON)}$ | $V_{GS} = 10V, I_D = 10A$         |      | 5.2 | 6.5       | m $\Omega$ |
|                                   |              | $V_{GS} = 4.5V, I_D = 5A$         |      | 6.8 | 8.5       | m $\Omega$ |
| Forward Transconductance          | $g_{FS}$     | $V_{DS} = 25V, I_D = 10A$         |      | 16  |           | S          |
| Source-drain voltage              | $V_{SD}$     | $I_S = 10A$                       |      |     | 1.28      | V          |

**•Electronic Characteristics**

| Parameter                    | Symbol    | Condition                    | Min. | Typ  | Max. | Unit |
|------------------------------|-----------|------------------------------|------|------|------|------|
| Input capacitance            | $C_{iss}$ | $f = 1MHz$<br>$V_{DS} = 25V$ | -    | 1910 | -    | pF   |
| Output capacitance           | $C_{oss}$ |                              | -    | 1070 | -    |      |
| Reverse transfer capacitance | $C_{rss}$ |                              | -    | 22   | -    |      |

**•Gate Charge characteristics( $T_a = 25^\circ C$ )**

| Parameter            | Symbol   | Condition      | Min. | Typ | Max. | Unit |
|----------------------|----------|----------------|------|-----|------|------|
| Total gate charge    | $Q_g$    | $V_{DD} = 25V$ | -    | 24  | -    | nC   |
| Gate - Source charge | $Q_{gs}$ | $I_D = 8A$     | -    | 5   | -    |      |
| Gate - Drain charge  | $Q_{gd}$ | $V_{GS} = 10V$ | -    | 3.3 | -    |      |

Note: ① Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$  ;

Fig.1 Gate-Charge Characteristics

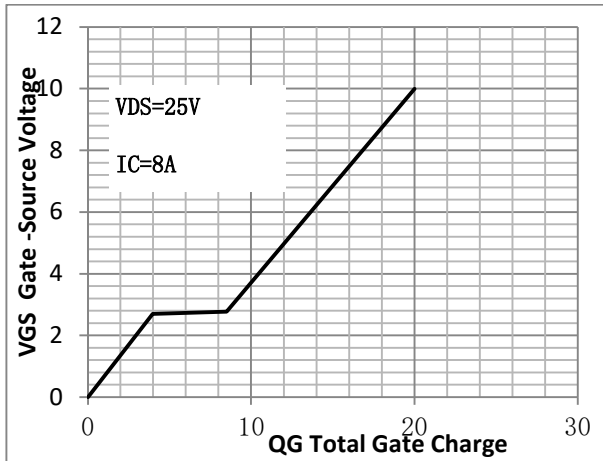


Fig.2 Capacitance Characteristics

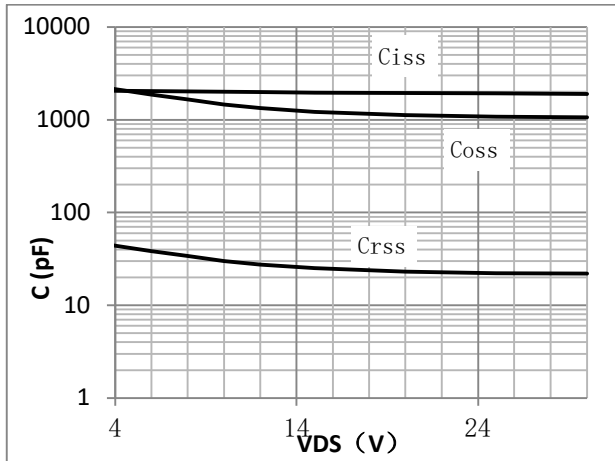


Fig.3 Power Dissipation

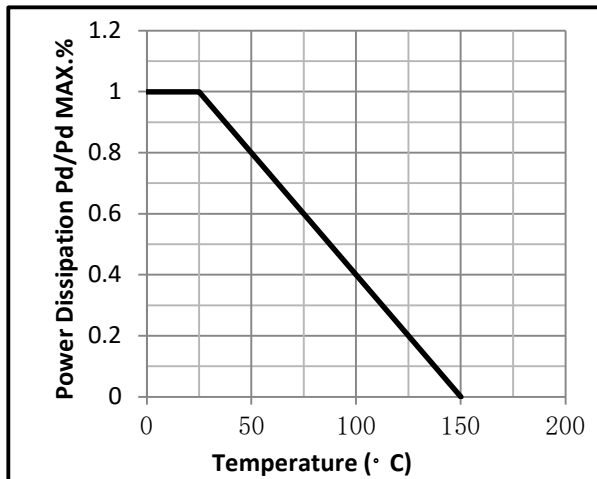


Fig.4 Typical output Characteristics

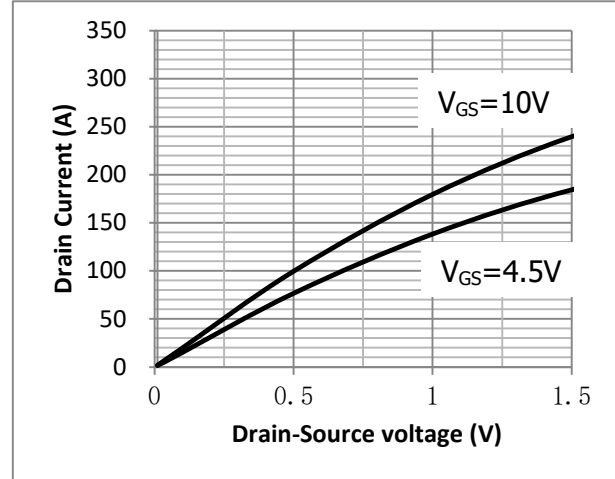


Fig.5 Threshold Voltage V.S Junction Temperature

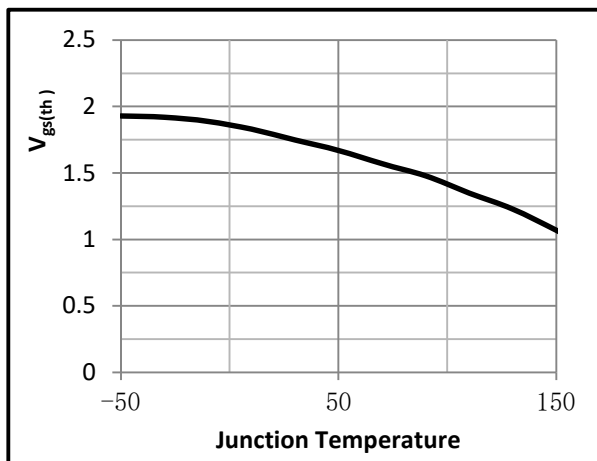


Fig.6 Resistance V.S Drain Current

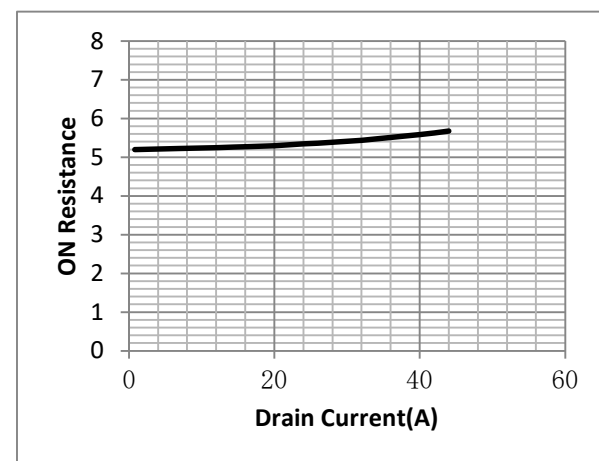


Fig.7 On-Resistance VS Gate Source Voltage

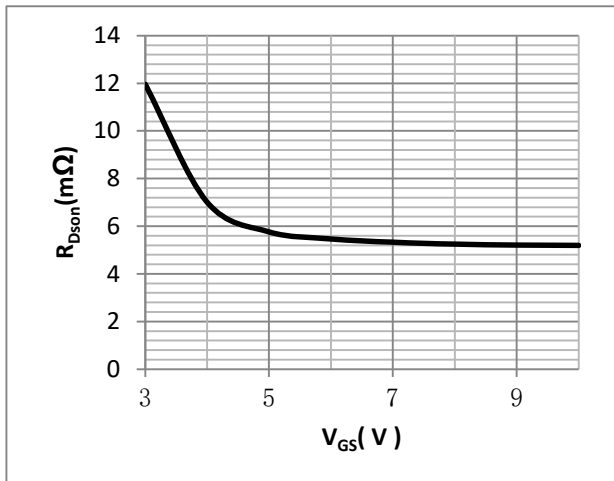


Fig.8 On-Resistance V.S Junction Temperature

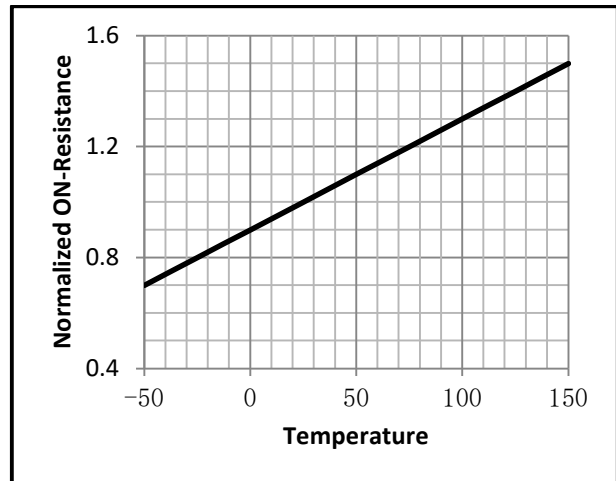


Fig.9 SOA Maximum Safe Operating Area

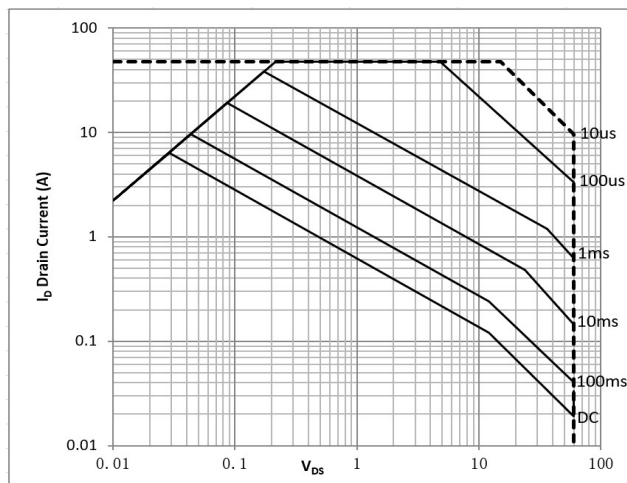


Fig.10  $I_D$ -Junction Temperature

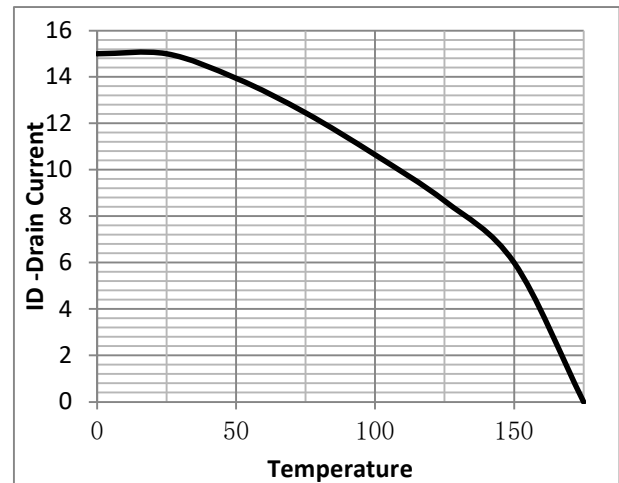


Fig.11 Switching Time Measurement Circuit

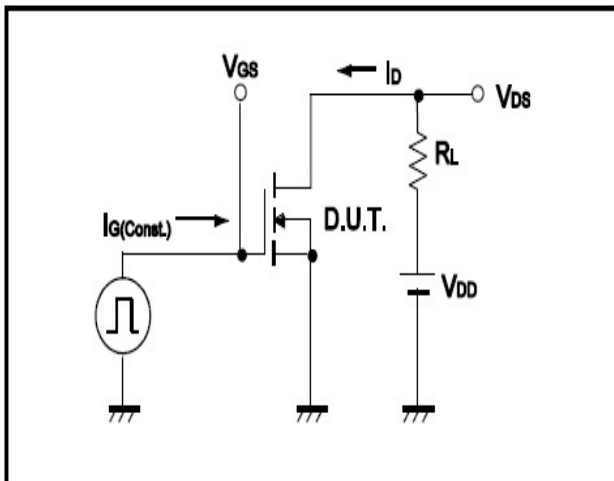


Fig.12 Gate Charge Waveform

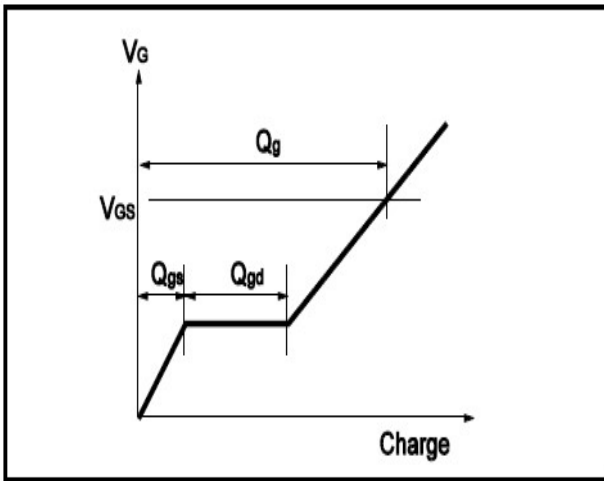


Fig.13 Switching Time Measurement Circuit

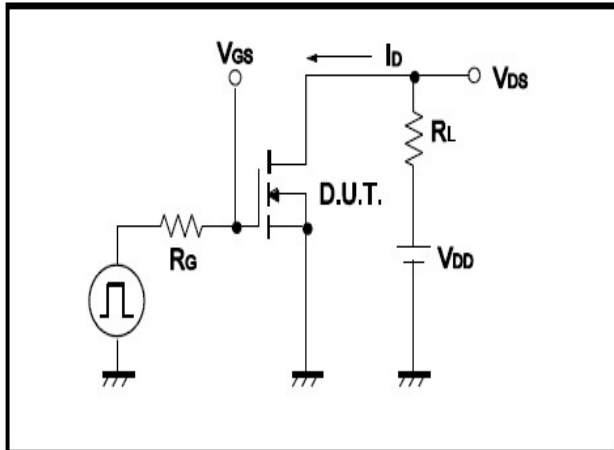
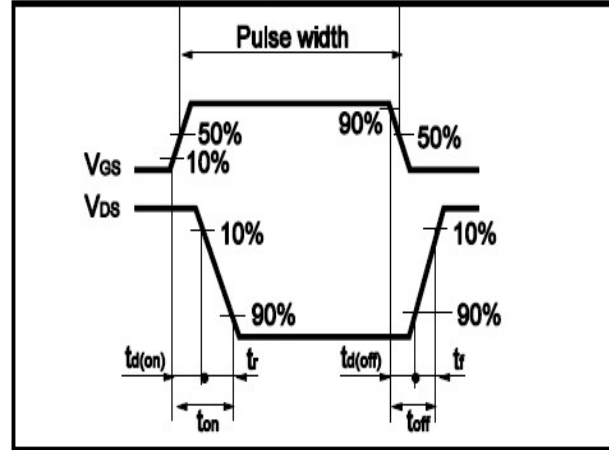


Fig.14 Gate Charge Waveform



**Dimensions (TO-220F)**

Unit: mm

| SYMBOL | min   | nom   | max   | SYMBOL | min  | nom  | max  |
|--------|-------|-------|-------|--------|------|------|------|
| C      | 4.50  | 4.70  | 4.90  | b1     | 2.90 | 3.40 | 3.90 |
| c      | 0.40  | 0.50  | 0.6   | a      | 1.08 | 1.28 | 1.48 |
| A      | 9.96  | 10.16 | 10.36 | a1     | 0.70 | 0.80 | 0.9  |
| B      | 15.67 | 15.87 | 16.07 | E      | 2.34 | 2.54 | 2.74 |
| B1     | 3.30  | 3.40  | 3.50  | E1     | 2.34 | 2.54 | 2.74 |
| R      | 3.08  | 3.18  | 3.28  | C1     | 2.34 | 2.54 | 2.74 |
| b      | 12.48 | 12.98 | 13.48 | C2     | 2.56 | 2.76 | 2.96 |
|        |       |       |       |        |      |      |      |

