## ● General Description

The ZMC88601S combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. It combine one N Channel MOSFET and one P channel MOSFET.

## ● Features

■ Advance high cell density Trench technology

■ Low $R_{DS(ON)}$ to minimize conductive loss

■ Low Gate Charge for fast switching

■ Dual DIE in one package

## ● Application

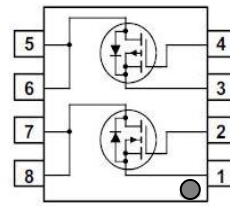■ Power Management in Notebook Computer

■ BLDC Motor driver

## ● Product Summary

$V_{DS1} = 60V$
$V_{DS2} = -60V$
$R_{DS(ON)1} = 43m\Omega$
$R_{DS(ON)2} = 57m\Omega$
$I_{D1} = 4.5A$
$I_{D2} = -4.0A$

SOP8

## ● Ordering Information:

| Part NO. | ZMC88601S |
|---|---|
| Marking | ZMC88601 |
| Packing Information | REEL TAPE |
| Basic ordering unit (pcs) | 4000 |

## ● N Channel Absolute Maximum Ratings ($T_C = 25°C$)

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 60 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Continuous Drain Current[2] | $I_D$ | 4.5 | A |
| Pulsed Drain Current [1] | $I_{DM}$ | 13 | A |
| Total Power Dissipation[2] | $P_D$@TC=25°C | 3.4 | W |
| Total Power Dissipation | $P_D$@TA=25°C | 0.69 | W |
| Operating Junction Temperature | $T_J$ | -55 to 150 | ℃ |
| Storage Temperature | $T_{STG}$ | -55 to 150 | ℃ |

●**P Channel Absolute Maximum Ratings  (T$_C$ =25℃)**

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Drain-Source Voltage | V$_{DS}$ | -60 | V |
| Gate-Source Voltage | V$_{GS}$ | ±20 | V |
| Continuous Drain Current(TC=25℃) | I$_D$ | -4.0 | A |
| Pulsed Drain Current [1] | I$_{DM}$ | -12 | A |
| Total Power Dissipation[2] | P$_D$@TC=25℃ | 3.6 | W |
| Total Power Dissipation | P$_D$@TA=25℃ | 0.69 | W |
| Operating Junction Temperature | T$_J$ | -55 to 150 | ℃ |
| Storage Temperature | T$_{STG}$ | -55 to 150 | ℃ |

●**Thermal resistance**

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Thermal resistance, junction - case | R$_{thJC}$ | - | - | 56 | ° C/W |
| Thermal resistance, junction - ambient | R$_{thJA}$ | - | - | 180 | ° C/W |
| Soldering temperature, wavesoldering for 10s | T$_{sold}$ | - | - | 265 | ° C |

●**N Channel Electronic Characteristics**

| Parameter | Symbol | Condition | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | BV$_{DSS}$ | V$_{GS}$ =0V,I$_D$ =250uA | 60 | | | V |
| Gate Threshold Voltage | V$_{GS(TH)}$ | V$_{GS}$ =V$_{DS}$, I$_D$ =250uA | 1.2 | | 2.5 | V |
| Drain-Source Leakage Current | I$_{DSS}$ | V$_{DS}$=60V, V$_{GS}$ =0V | | | 1.0 | uA |
| Gate- Source Leakage Current | I$_{GSS}$ | V$_{GS}$=±20V ,V$_{DS}$ =0V | | | ±100 | nA |
| Static Drain-source On Resistance | R$_{DS(ON)}$ | V$_{GS}$=10V, I$_D$=4A | | 43 | 50 | mΩ |
| | | V$_{GS}$=4.5V, I$_D$=3A | | 75 | 85 | mΩ |
| Forward Transconductance | g$_{FS}$ | V$_{DS}$ =10V, I$_D$=4A | | 10 | | s |
| Diode Forward Voltage | V$_{FSD}$ | I$_{SD}$=4A | | | 1.28 | V |

●**Electronic Characteristics**

| Parameter | Symbol | Condition | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|---|
| Input capacitance | Ciss | V$_{DS}$=25V f = 1MHz | - | 1050 | - | pF |
| Output capacitance | Coss | | - | 255 | - | |
| Reverse transfer capacitance | Crss | | - | 185 | - | |

●**Gate Charge characteristics(T$_a$ = 25℃)**

| Parameter | Symbol | Condition | Min. | Typ | Max. | Unit |
|-----------|--------|-----------|------|-----|------|------|
| Total gate charge | Qg | VDD =25V | - | 12 | - | |
| Gate - Source charge | Qgs | ID = 4A | - | 5 | - | nC |
| Gate - Drain charge | Qgd | VGS = 10V | - | 4 | - | |

●**P Channel Electronic Characteristics**

| Parameter | Symbol | Condition | Min. | Typ | Max. | Unit |
|-----------|--------|-----------|------|-----|------|------|
| Drain-Source Breakdown Voltage | BV$_{DSS}$ | $V_{GS}$ =0V,I$_D$ =-250uA | -60 | | | V |
| Gate Threshold Voltage | V$_{GS(TH)}$ | $V_{GS}$ =V$_{DS}$, I$_D$ =-250uA | -1.0 | | -2.5 | V |
| Drain-Source Leakage Current | I$_{DSS}$ | $V_{DS}$=-60V, V$_{GS}$ =0V | | | -1.0 | uA |
| Gate- Source Leakage Current | I$_{GSS}$ | $V_{GS}$=±20V ,V$_{DS}$ =0V | | | ±100 | nA |
| Static Drain-source On Resistance | R$_{DS(ON)}$ | $V_{GS}$=-10V, I$_D$=-4A | | 57 | 74 | mΩ |
| | | $V_{GS}$=-4.5V, I$_D$=-3A | | 76 | 100 | mΩ |
| Forward Transconductance | g$_{FS}$ | $V_{DS}$ =-10V, I$_D$=-3A | | 9 | | s |
| Diode Forward Voltage | V$_{FSD}$ | I$_{SD}$=-4A | | | -1.28 | V |

●**Electronic Characteristics**

| Parameter | Symbol | Condition | Min. | Typ | Max. | Unit |
|-----------|--------|-----------|------|-----|------|------|
| Input capacitance | Ciss | V$_{DS}$=25V f = 1MHz | - | 1550 | - | |
| Output capacitance | Coss | | - | 160 | - | pF |
| Reverse transfer capacitance | Crss | | - | 140 | - | |

●**Gate Charge characteristics(T$_a$ = 25℃)**

| Parameter | Symbol | Condition | Min. | Typ | Max. | Unit |
|-----------|--------|-----------|------|-----|------|------|
| Total gate charge | Qg | VDD = -25V | - | 23 | - | |
| Gate - Source charge | Qgs | ID = -4A | - | 4 | - | nC |
| Gate - Drain charge | Qgd | VGS = -10V | - | 9 | - | |

●N Channel characteristics curve
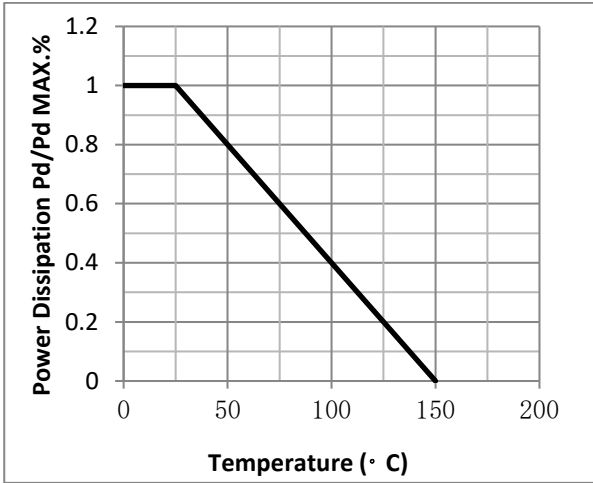
Fig.1 Power Dissipation Derating Curve
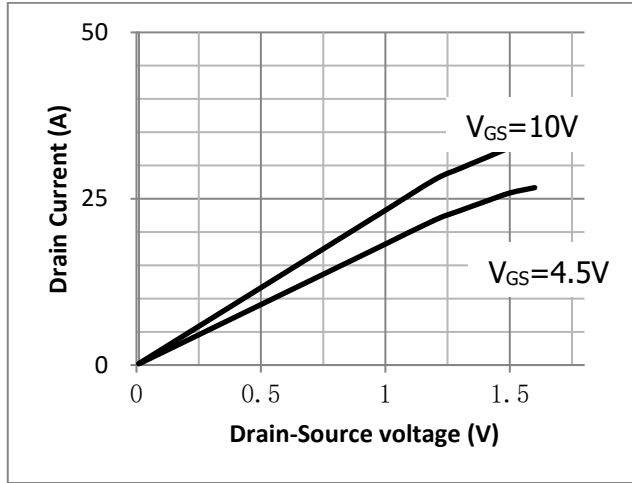
Fig.2 Typical output Characteristics

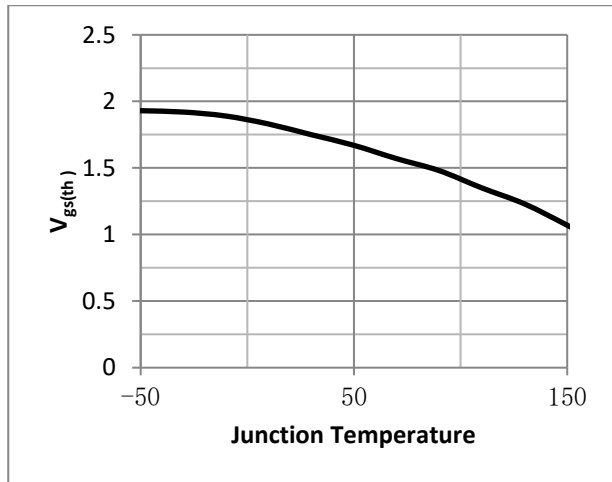Fig.3 Threshold Voltage V.S Junction Temperature
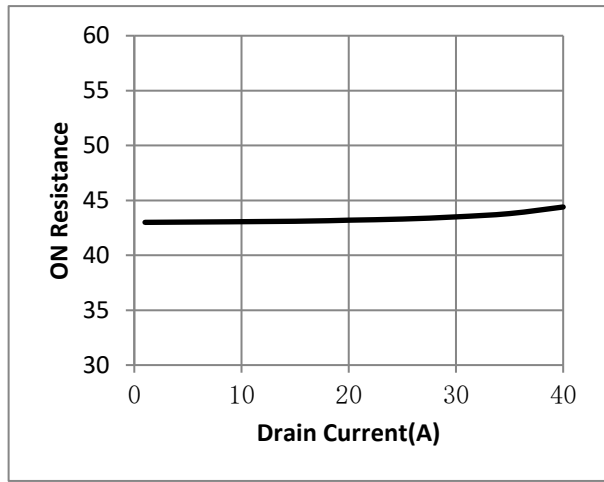
Fig.4 Resistance V.S Drain Current

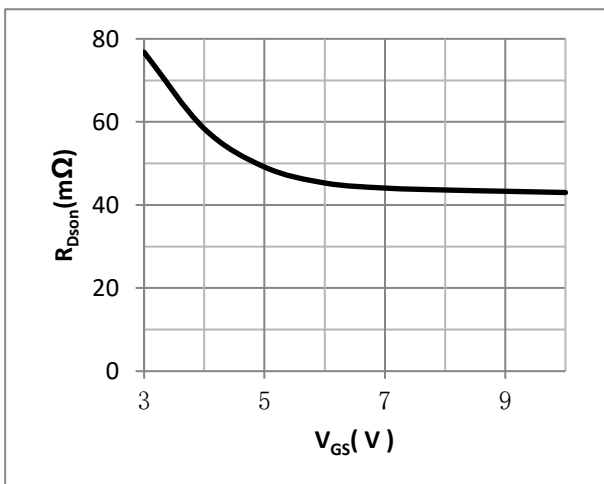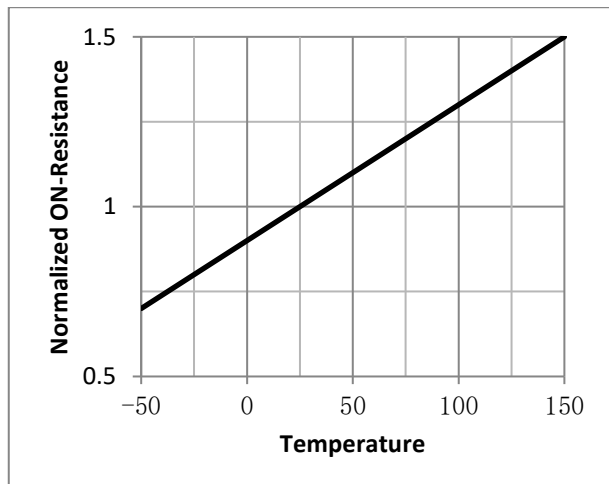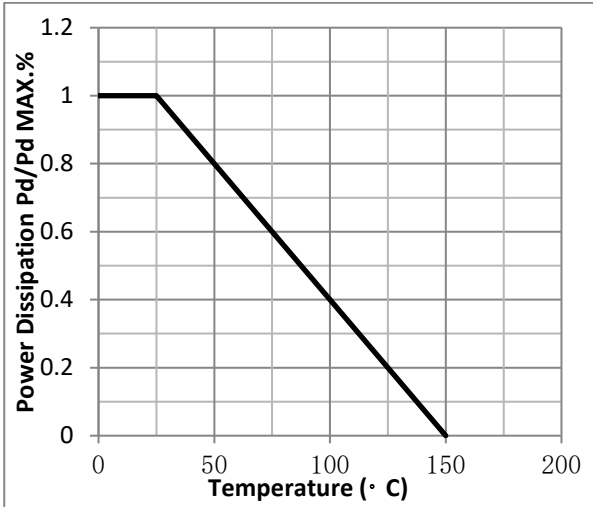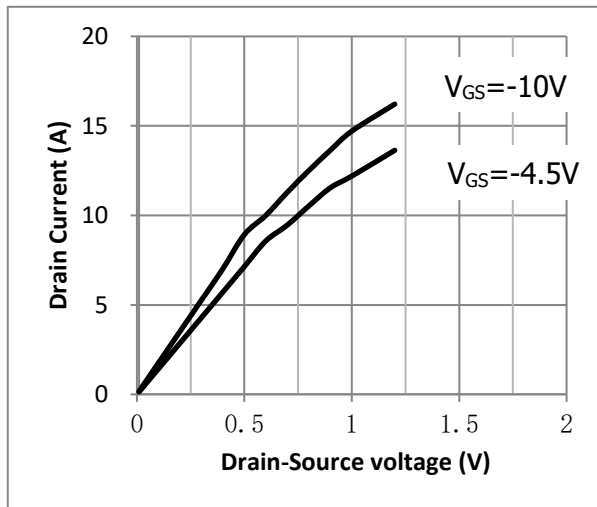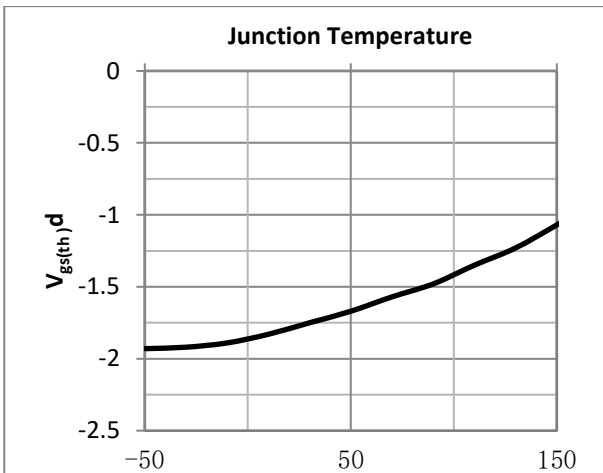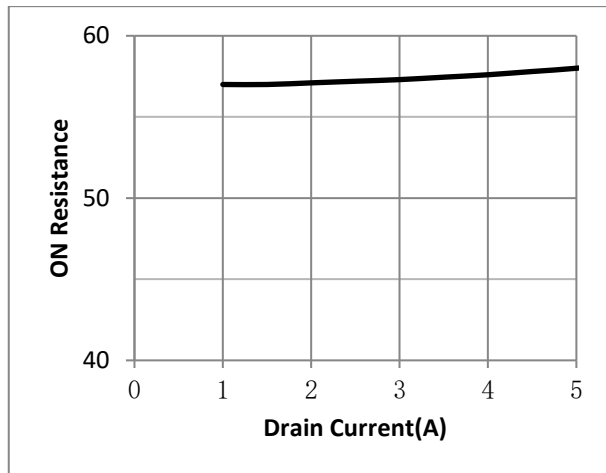Fig.5 On-Resistance VS Gate Source Voltage

Fig.6 On-Resistance V.S Junction Temperature

●**P Channel characteristics curve**

Fig.1 Power Dissipation Derating Curve



Fig.2 Typical output Characteristics



Fig.3 Threshold Voltage V.S Junction Temperature



Fig.4 Resistance V.S Drain Current



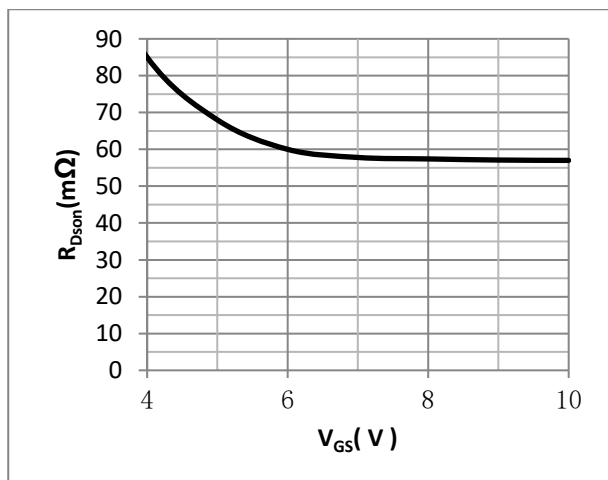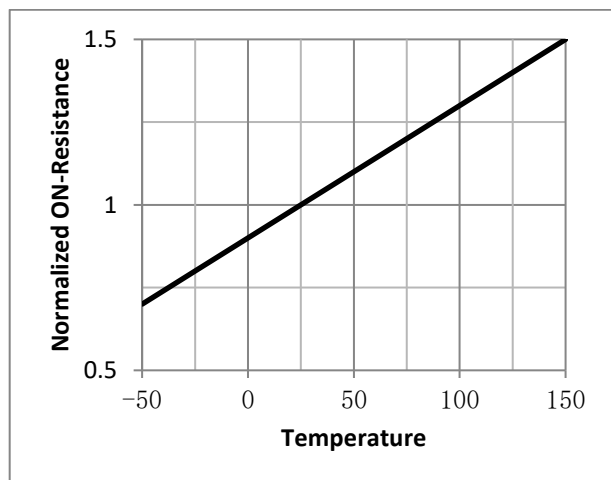Fig.5 On-Resistance VS Gate Source Voltage



Fig.6 On-Resistance V.S Junction Temperature

●Test Circuit

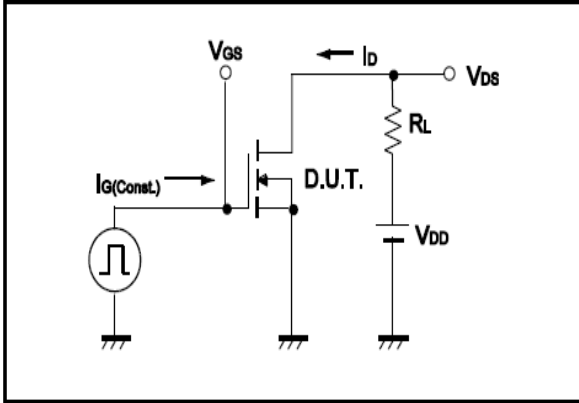Fig.1 Gate Charge Measurement Circuit
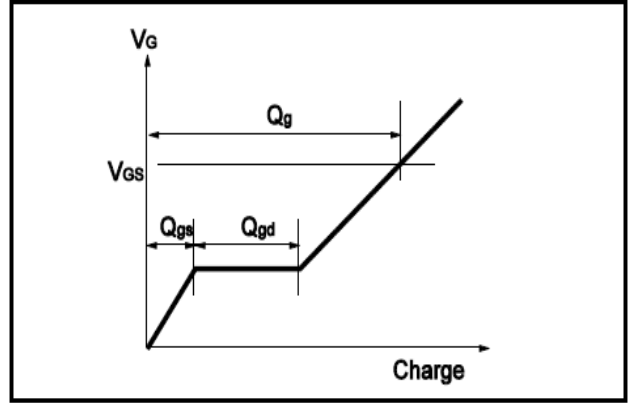
Fig.2 Gate Charge Waveform
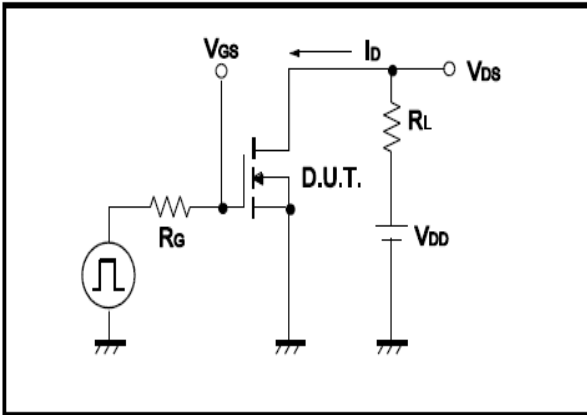
Fig.3 Switching Time Measurement Circuit

Fig.4 Switching Time Waveform

Fig.5  Avalanche Measurement Circuit

Fig.6  Avalanche Waveform

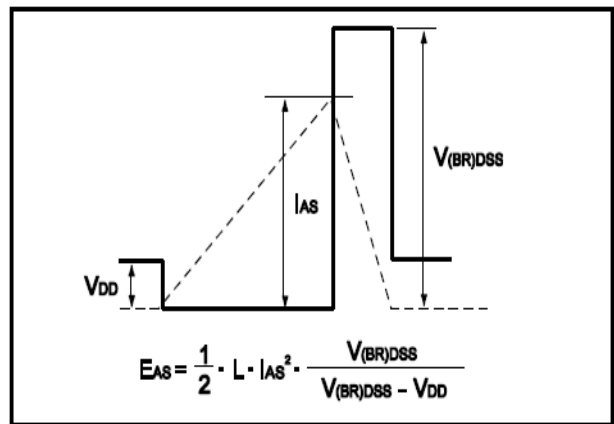$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AS}^2 \cdot \frac{V_{(BR)DSS}}{V_{(BR)DSS} - V_{DD}}$$

●**Dimensions(SOP8)**

Unit: mm

| SYMBOL | min | TYP | max | SYMBOL | min | | max |
|--------|-----|-----|-----|--------|-----|-----|-----|
| A | 4.80 | | 5.00 | C | 1.30 | | 1.50 |
| A1 | 0.37 | | 0.47 | C1 | 0.55 | | 0.75 |
| A2 | | 1.27 | | C2 | 0.55 | | 0.65 |
| A3 | | 0.41 | | C3 | 0.05 | | 0.20 |
| B | 5.80 | | 6.20 | C4 | 0.19 | 0.20 | 0.23 |
| B1 | 3.80 | | 4.00 | D | | 1.05 | |
| B2 | | 5.00 | | D1 | 0.40 | | 0.62 |