

## Silicon N-Channel Planar Power MOSFET

### Description

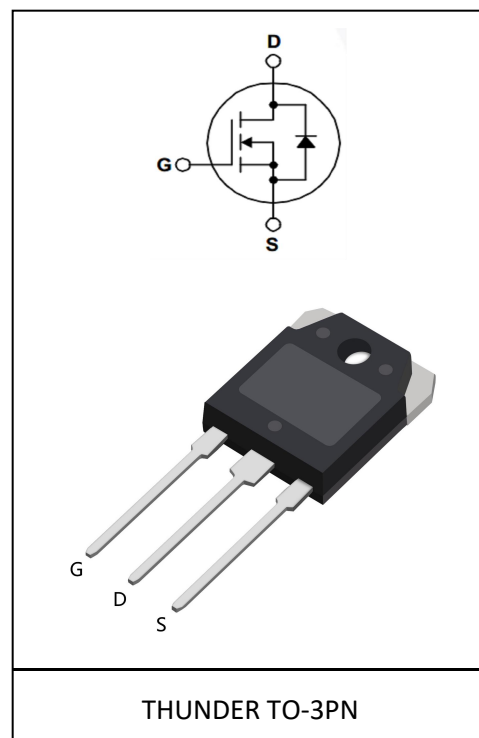
The TH28N50PB utilizes the latest processing techniques to achieve low on-resistance per silicon area. Additional features of this MOSFET are 150°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for PDP driving applications. It can be used in a wide variety of applications.

### General Features

- $V_{DS}=500V, I_D=28A$
- Low ON Resistance,  $R_{DS(ON)}=130m\Omega @ V_{GS}=10V, I_D=14A$
- Low reverse transfer capacitance
- Low Qg for fast response
- Short fall & rise times for fast switching
- 100% single pulse avalanche energy Test

### Application

- Power switching application
- Digital amplifier
- Adapter and charger



### Product Summary

|              |               |
|--------------|---------------|
| $V_{DS}$     | 500V          |
| $R_{DS(on)}$ | 130m $\Omega$ |
| $I_D$        | 28A           |

### Absolute Maximum Ratings

| Parameter                                                                 | Symbol         | Value      | Unit       |
|---------------------------------------------------------------------------|----------------|------------|------------|
| Drain-source voltage                                                      | $V_{DS}$       | 500        | V          |
| Continuous drain current<br>$T_C = 25^\circ C$ (Silicon limit)            | $I_D$          | 28         | A          |
| Pulsed drain current ( $T_C = 25^\circ C$ , $t_p$ limited by $T_{jmax}$ ) | $I_{DM}$       | 112        | A          |
| Avalanche energy, single pulse ( $L=10mH$ , $R_g=25\Omega$ )              | $E_{AS}$       | 2680       | mJ         |
| Gate-Source voltage                                                       | $V_{GS}$       | $\pm 30$   | V          |
| Power dissipation ( $T_C = 25^\circ C$ )                                  | $P_D$          | 313        | W          |
| Operating junction and storage temperature                                | $T_j, T_{stg}$ | -55...+150 | $^\circ C$ |

## Thermal Resistance

| Parameter                                              | Symbol     | Max | Unit |
|--------------------------------------------------------|------------|-----|------|
| Thermal resistance, junction – case.                   | $R_{thJC}$ | 0.4 | °C/W |
| Thermal resistance, junction – ambient(min. footprint) | $R_{thJA}$ | 40  |      |

## Electrical Characteristic (at $T_j = 25^\circ\text{C}$ , unless otherwise specified)

| Parameter | Symbol | Value |      |      | Unit | Test Condition |
|-----------|--------|-------|------|------|------|----------------|
|           |        | min.  | typ. | max. |      |                |

## Static Characteristic

|                                  |              |     |     |           |            |                                                     |
|----------------------------------|--------------|-----|-----|-----------|------------|-----------------------------------------------------|
| Drain-source breakdown voltage   | $BV_{DSS}$   | 500 | -   | -         | V          | $V_{GS}=0V, I_D=250\mu A$                           |
| Gate threshold voltage           | $V_{GS(th)}$ | 2.0 | -   | 4.0       | V          | $V_{DS}=V_{GS}, I_D=250\mu A$                       |
| Zero gate voltage drain current  | $I_{DSS}$    | -   | -   | 1         | $\mu A$    | $V_{DS}=500V, V_{GS}=0V$<br>$T_j=25^\circ\text{C}$  |
|                                  |              | -   | -   | 10        | $\mu A$    | $V_{DS}=400V, V_{GS}=0V$<br>$T_j=125^\circ\text{C}$ |
| Gate-source leakage current      | $I_{GSS}$    | -   | -   | $\pm 100$ | nA         | $V_{GS}=\pm 30V, V_{DS}=0V$                         |
| Drain-source on-state resistance | $R_{DS(on)}$ | -   | 130 | 153       | m $\Omega$ | $V_{GS}=10V, I_D=14A$                               |
| Transconductance                 | $g_{fs}$     | -   | 28  | -         | S          | $V_{DS}=20V, I_D=14A$                               |

## Dynamic Characteristic

|                              |              |   |      |   |          |                                             |
|------------------------------|--------------|---|------|---|----------|---------------------------------------------|
| Input Capacitance            | $C_{iss}$    | - | 5680 | - | pF       | $V_{GS}=0V, V_{DS}=25V,$<br>$f=1\text{MHz}$ |
| Output Capacitance           | $C_{oss}$    | - | 420  | - |          |                                             |
| Reverse Transfer Capacitance | $C_{rss}$    | - | 4.0  | - |          |                                             |
| Gate Total Charge            | $Q_g$        | - | 65   | - | nC       | $V_{GS}=10V, V_{DS}=400V,$<br>$I_D=28A$     |
| Gate-Source charge           | $Q_{gs}$     | - | 18   | - |          |                                             |
| Gate-Drain charge            | $Q_{gd}$     | - | 26   | - |          |                                             |
| Turn-on delay time           | $t_{d(on)}$  | - | 44   | - | ns       | $V_{DD}=250V, I_D=28A,$<br>$R_G=25\Omega$   |
| Rise time                    | $t_r$        | - | 105  | - |          |                                             |
| Turn-off delay time          | $t_{d(off)}$ | - | 155  | - |          |                                             |
| Fall time                    | $t_f$        | - | 92   | - |          |                                             |
| Gate resistance              | $R_G$        | - | 0.4  | - | $\Omega$ | $V_{GS}=0V, V_{DS}=0V,$<br>$f=1\text{MHz}$  |

## Body Diode Characteristic

| Parameter                             | Symbol   | Value |      |      | Unit    | Test Condition                            |
|---------------------------------------|----------|-------|------|------|---------|-------------------------------------------|
|                                       |          | min.  | typ. | max. |         |                                           |
| Body Diode Forward Voltage            | $V_{SD}$ | -     | -    | 1.4  | V       | $V_{GS}=0V, I_{DS}=28A$                   |
| Body Diode Continuous Forward Current | $I_S$    | -     | -    | 28   | A       | $T_C=25^{\circ}C$                         |
| Body Diode Reverse Recovery Time      | $t_{rr}$ | -     | 540  | -    | ns      | $T_C=25^{\circ}C, I_S=28A, di/dt=100A/us$ |
| Body Diode Reverse Recovery Charge    | $Q_{rr}$ | -     | 8.0  | -    | $\mu C$ |                                           |

## Typical Performance Characteristics

Fig 1: Output Characteristics

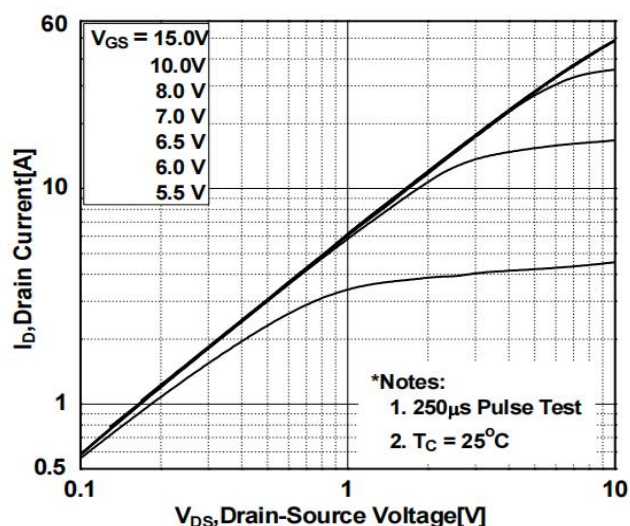


Fig 2: Transfer Characteristics

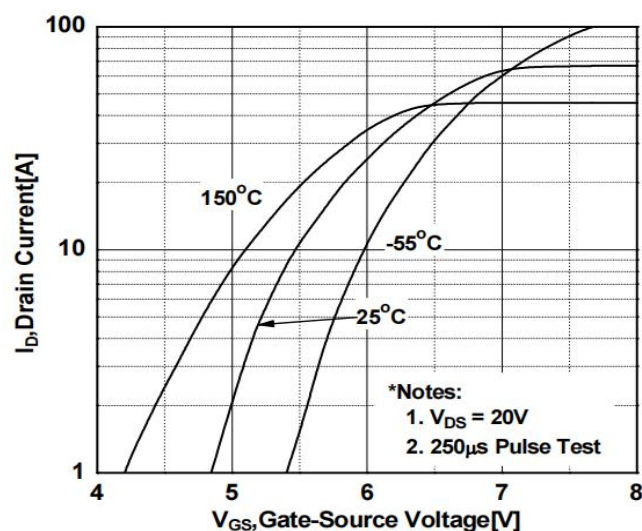


Fig 3:  $R_{DS(on)}$  vs Drain Current and Gate Voltage

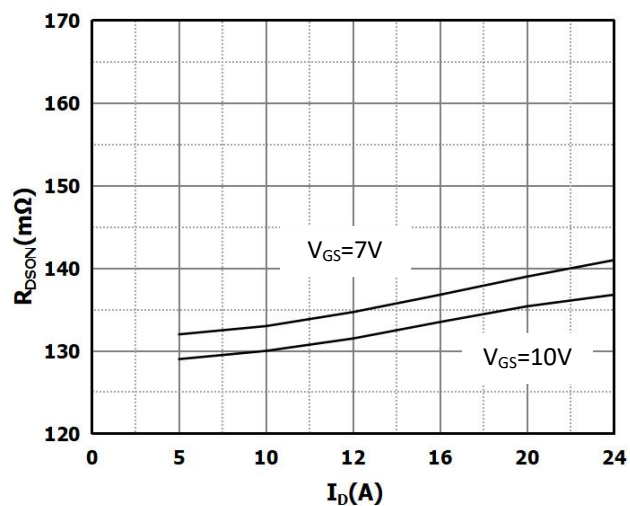


Fig 4:  $R_{DS(on)}$  vs Gate Voltage

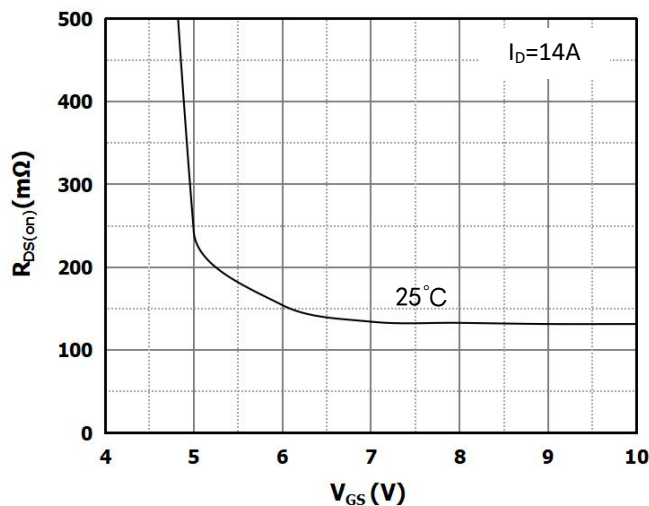


Fig 5:  $R_{DS(on)}$  vs. Temperature

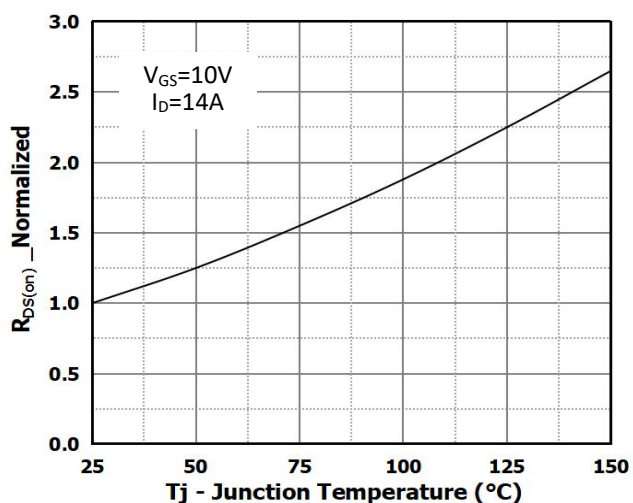


Fig 6: Capacitance Characteristics

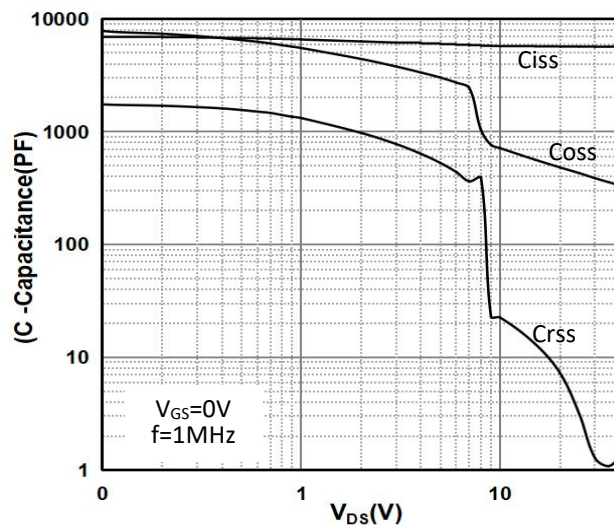


Fig 7: Gate Charge Characteristics

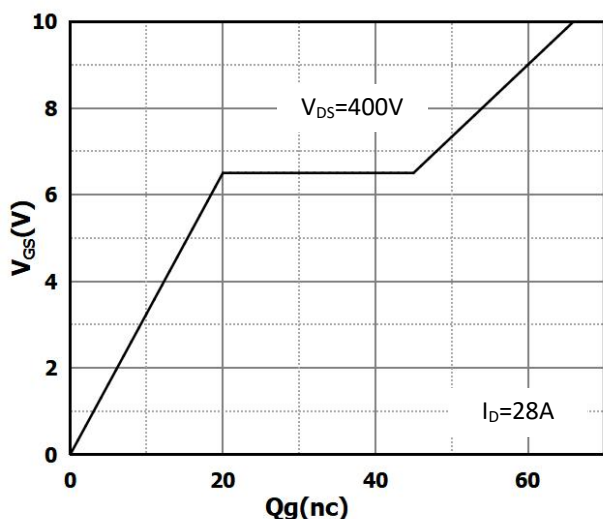


Fig 8: Body-diode Forward Characteristics

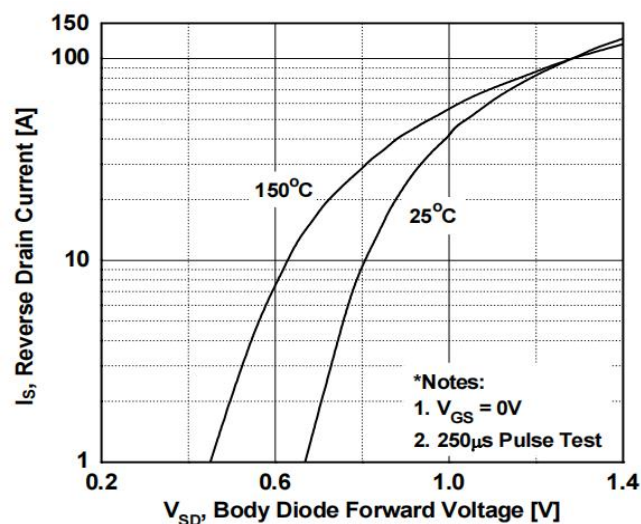


Fig 9: Power Dissipation

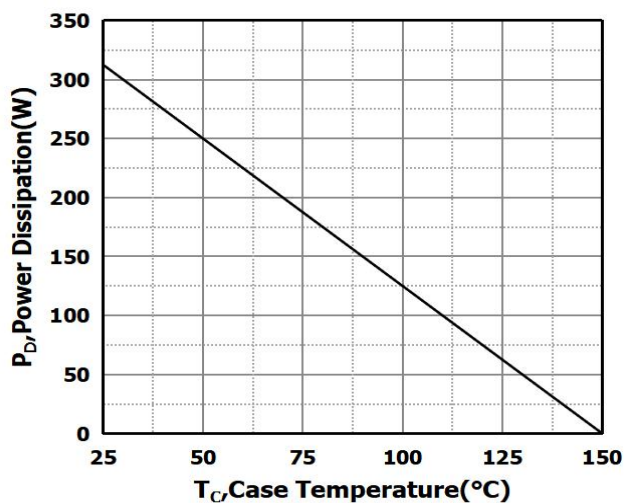


Fig 10: Drain Current Derating

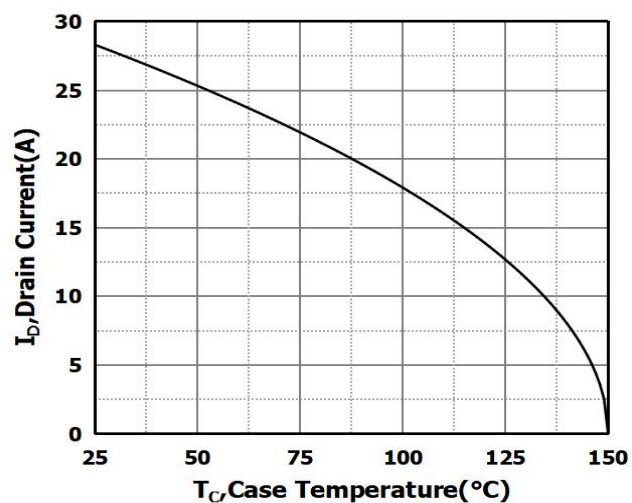




Fig 11: Safe Operating Area

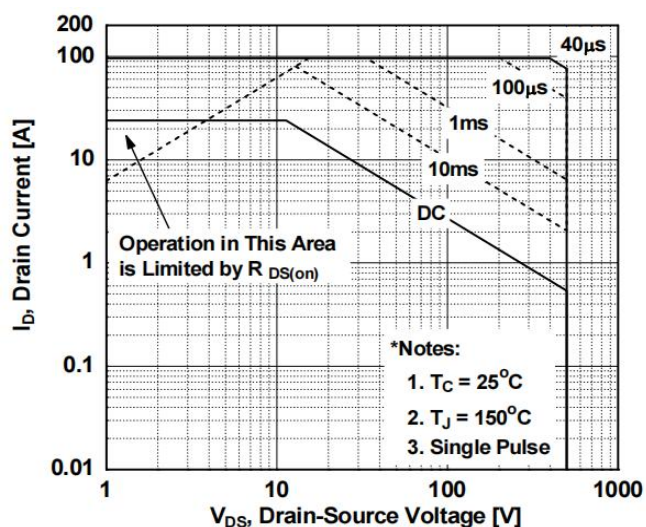
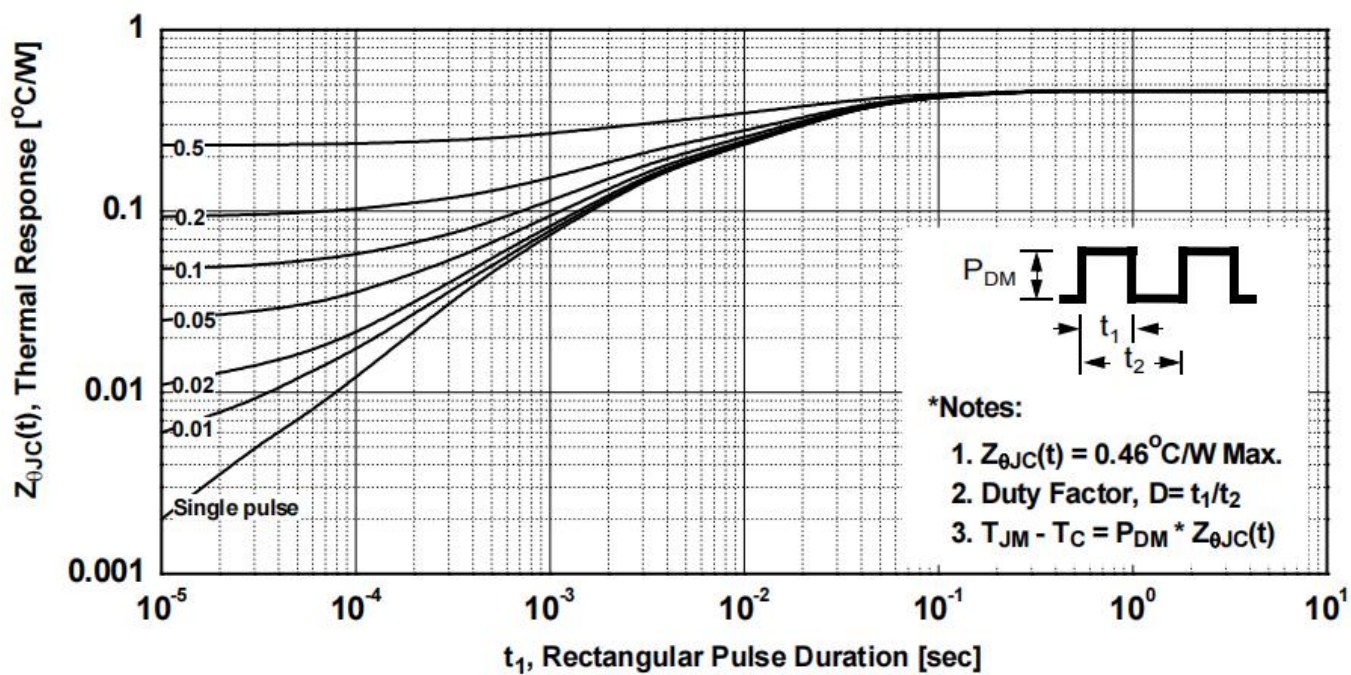
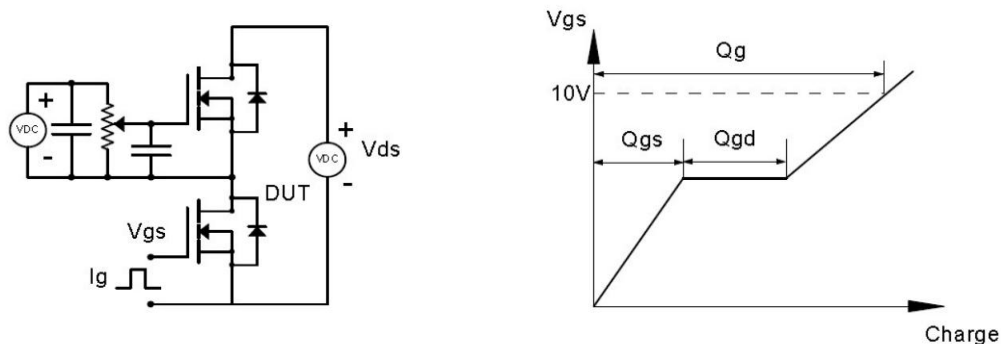


Fig 12: Max. Transient Thermal Impedance

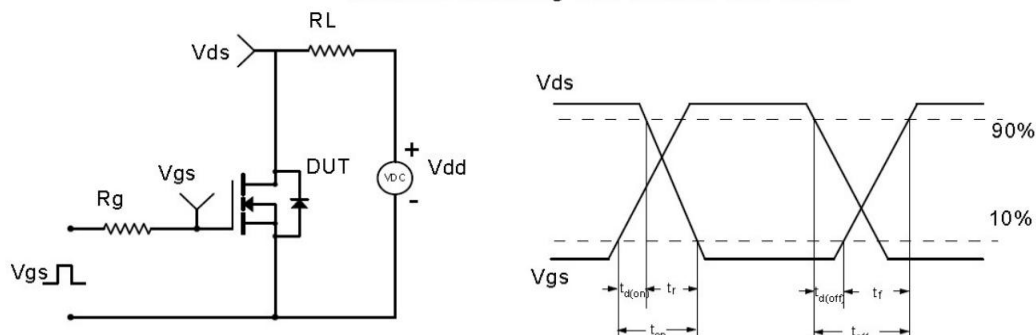


## Test Circuit & Waveform

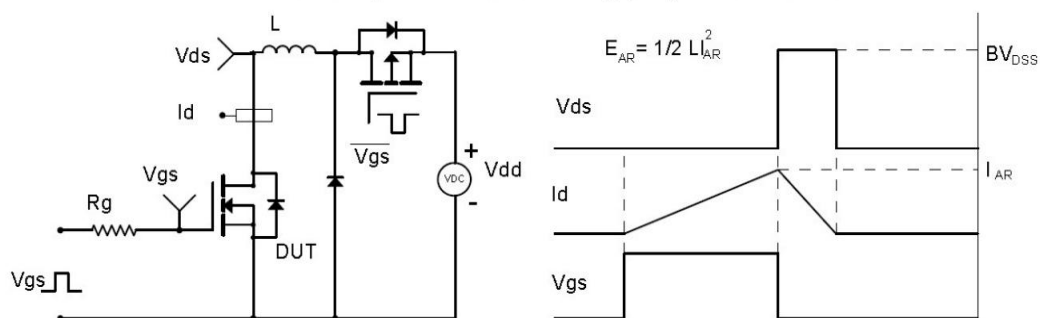
Gate Charge Test Circuit & Waveform



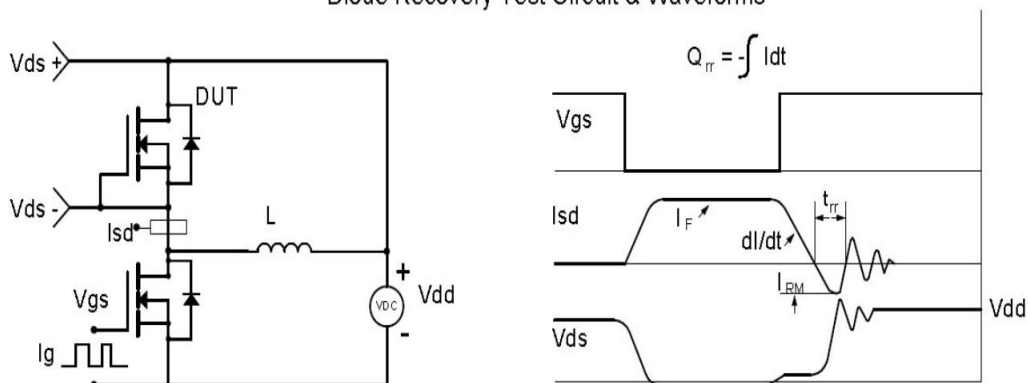
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



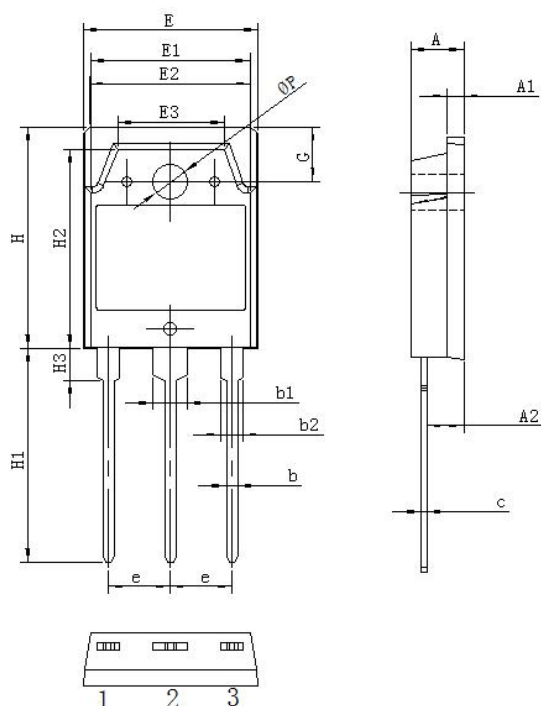
Diode Recovery Test Circuit & Waveforms



## Package Information

### TO-3PN PACKAGE

基本尺寸



| Symbol | 单位 mm |      |      |
|--------|-------|------|------|
|        | Min   | Nom  | Max  |
| A      | 4.60  | 4.80 | 5.00 |
| A1     | 1.3   | 1.5  | 1.7  |
| A2     | 2.20  | 2.40 | 2.60 |
| b      | 0.80  | 1.0  | 1.20 |
| b1     | 2.90  | 3.10 | 3.30 |
| b2     | 1.90  | 2.10 | 2.30 |
| c      | 0.50  | 0.60 | 0.70 |
| e      | 5.25  | 5.45 | 5.65 |
| E      | 15.2  | 15.6 | 16.0 |
| E1     | 13.2  | 13.4 | 13.6 |
| E2     | 13.1  | 13.3 | 13.5 |
| E3     | 9.1   | 9.3  | 9.5  |
| H      | 19.8  | 20.0 | 20.2 |
| H1     | 19.4  | 19.8 | 20.2 |
| H2     | 18.5  | 18.7 | 18.9 |
| H3     | 2.9   | 3.1  | 3.3  |
| G      | 4.8   | 5.0  | 5.2  |
| ΦP     | 3.00  | 3.20 | 3.40 |

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### -Headquarters

WuXi Thunder Microelectronics Incorporated Limited

Building E1-9, No.200 LingHu Road, XinWu district,WuXi,China 214135

Tel:+86-510-85160109

Fax:+86-510-85160109