

## N-Channel Power MOSFET

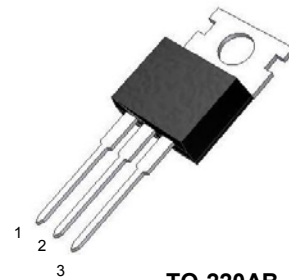
4.5A, 500V, 1.50Ω

### General Description

The N-Channel MOSFET is used an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance. This device is well suited for high efficiency switched mode power suppliers, active power factor correction, electronic lamp ballasts based half bridge topology.

### Features

- Robust high voltage termination
- Avalanche energy specified
- Diode is characterized for use in bridge circuits
- Source to Drain diode recovery time comparable to a discrete fast recovery diode.



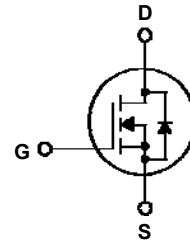
1 = Gate  
2 = Drain  
3 = Source

TO-220AB

### DEVICE MARKING DIAGRAM



L = Tak Cheong Logo  
xxyy = Monthly Date Code  
TFPXXXX = Device Type



### ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C, unless otherwise noted)

| Symbol           | Parameter                               | Value        | Units |
|------------------|---|--------------|-------|
| V <sub>DSS</sub> | Drain- Source Voltage                   | 500          | V     |
| V <sub>GSS</sub> | Gate-Source Voltage                     | ±30          | V     |
| I <sub>D</sub>   | Drain Current                           | 4.5          | A     |
| I <sub>DM</sub>  | Drain Current Pulsed                    | 18           | A     |
| P <sub>D</sub>   | Power Dissipation (Note 2)              | 87.5         | W     |
|                  | Derating factor above 25°C              | 0.7          | W/°C  |
| E <sub>AS</sub>  | Single Pulsed Avalanche Energy (Note 1) | 311          | mJ    |
| E <sub>AR</sub>  | Repetitive Avalanche Energy (Note 2)    | 7.3          | mJ    |
| T <sub>J</sub>   | Operating Junction Temperature          | 150          | °C    |
| T <sub>stg</sub> | Storage Temperature Range               | - 55 to +150 | °C    |

### Notes:

1. L=26.5mH, I<sub>AS</sub>=4.5A, V<sub>DD</sub>=82V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C
2. Repetitive Rating: Pulse width limited by maximum junction temperature.

### THERMAL CHARACTERISTICS

| Symbol           | Parameter                               | Value | Unit |
|------------------|---|-------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction-to-Case    | 1.43  | °C/W |
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | 62.5  | °C/W |

**ELECTRICAL CHARACTERISTICS**
**Off Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| Symbol                       | Parameter                                 | Test Conditions               | Min. | Typ. | Max. | Unit         |
|------------------------------|---|-------------------------------|------|------|------|--------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage            | $V_{GS} = 0V, I_D = 250\mu A$ | 500  | --   | --   | V            |
| $I_{DSS}$                    | Zero Gate Voltage Drain Current           | $V_{DS} = 500V, V_{GS} = 0V$  | --   | --   | 10   | $\mu A$      |
| $I_{GSSF}$                   | Gate-Body Leakage Current, Forward        | $V_{GS} = 30V, V_{DS} = 0V$   | --   | --   | 100  | nA           |
| $I_{GSSR}$                   | Gate-Body Leakage Current, Reverse        | $V_{GS} = -30V, V_{DS} = 0V$  | --   | --   | -100 | nA           |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu A$              | --   | 0.6  | --   | $V/^\circ C$ |

**On Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| Symbol       | Parameter              | Test Conditions                   | Min. | Typ. | Max. | Unit     |
|--------------|------------------------|-----------------------------------|------|------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 2.0  | --   | 4.0  | V        |
| $R_{DS(on)}$ | On-Resistance          | $V_{GS} = 10V, I_D = 2.5A$        | --   | 1.3  | 1.5  | $\Omega$ |

**Dynamic Characteristics**

| Symbol    | Parameter                    | Test Conditions                                     | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25V, V_{GS} = 0V,$<br>$f = 1.0\text{MHz}$ | --   | 548  | --   | pF   |
| $C_{oss}$ | Output Capacitance           |   | --   | 63   | --   | pF   |
| $C_{rss}$ | Reverse Transfer Capacitance |   | --   | 5    | --   | pF   |

**Switching Characteristics**

| Symbol       | Parameter           | Test Conditions  | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 250V, I_D = 4.5A,$<br>$R_G = 25\Omega$<br>(Note 3 & 4) | --   | 18   | --   | nS   |
| $t_r$        | Turn-On Rise Time   |  | --   | 13   | --   | nS   |
| $t_{d(off)}$ | Turn-Off Delay Time |  | --   | 108  | --   | nS   |
| $t_f$        | Turn-Off Fall Time  |  | --   | 16   | --   | nS   |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 400V, I_D = 4.5A,$                                     | --   | 16   | --   | nC   |
| $Q_{gs}$     | Gate-Source Charge  | $V_{GS} = 10V$   | --   | 2.7  | --   | nC   |
| $Q_{gd}$     | Gate-Drain Charge   | (Note 3 & 4)   | --   | 6.1  | --   | nC   |

**Drain-Source Diode Characteristics and Maximum Ratings**

| Symbol   | Parameter   | Test Conditions  | Min. | Typ. | Max. | Unit    |
|----------|---|--|------|------|------|---------|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current |  | --   | --   | 4.5  | A       |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current     |  | --   | --   | 18   | A       |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0V, I_S = 4.5A$  | --   | --   | 1.5  | V       |
| $T_{rr}$ | Reverse Recovery Time                                 | $V_{GS} = 0V, I_S = 4.5A,$<br>$dI_F / dt = 100A/\mu S$<br>(Note 3) | --   | 250  | --   | nS      |
| $Q_{rr}$ | Reverse Recovery Charge                               |  | --   | 2.2  | --   | $\mu C$ |

**Notes:**

- Pulse Test : Pulse width < 300 $\mu s$ , Duty cycle  $\leq 2\%$ .
- Basically not affected by working temperature.

TYPICAL CHARACTERISTICS

图1、导通特性

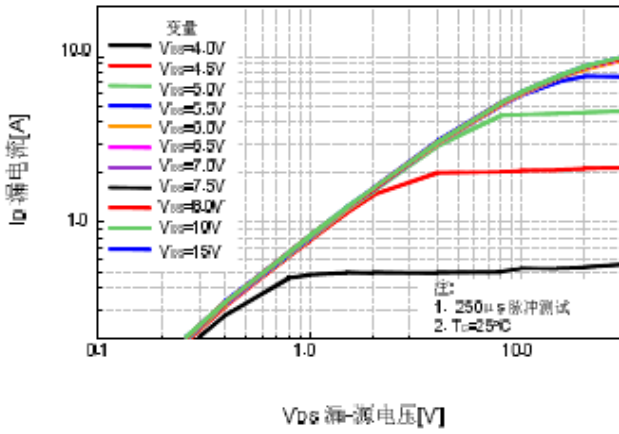


图2、传输特性

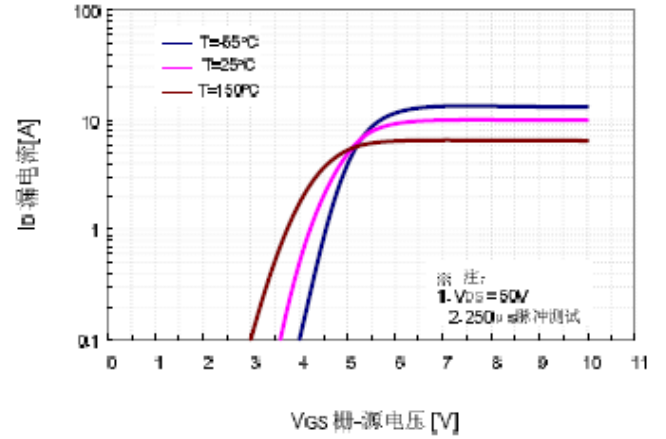


图3、导通电阻 vs. 漏电流和栅极电压

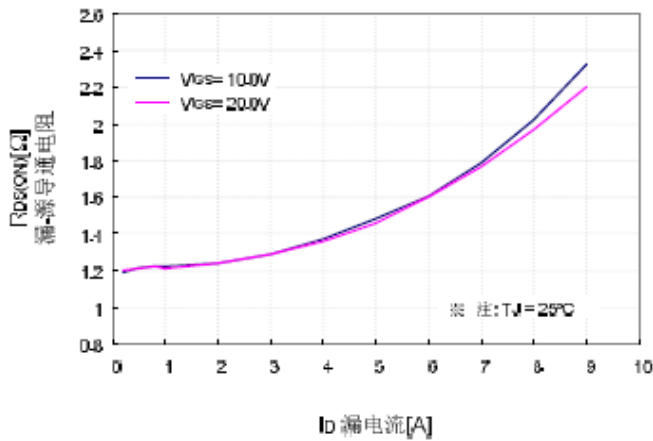


图4、体二极管正向压降 vs. 源电流和温度

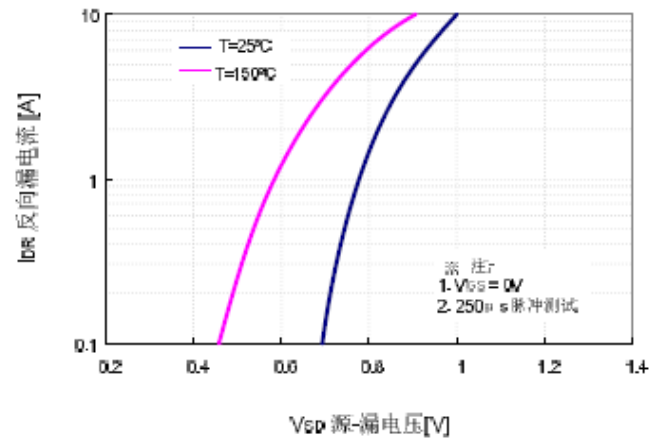


图5、电容特性

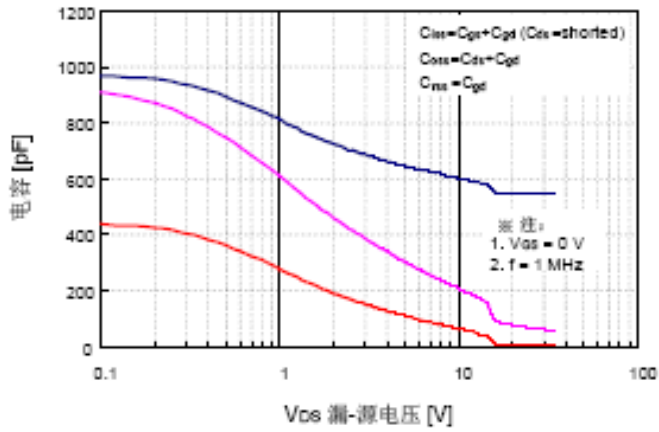


图6、栅极电荷特性

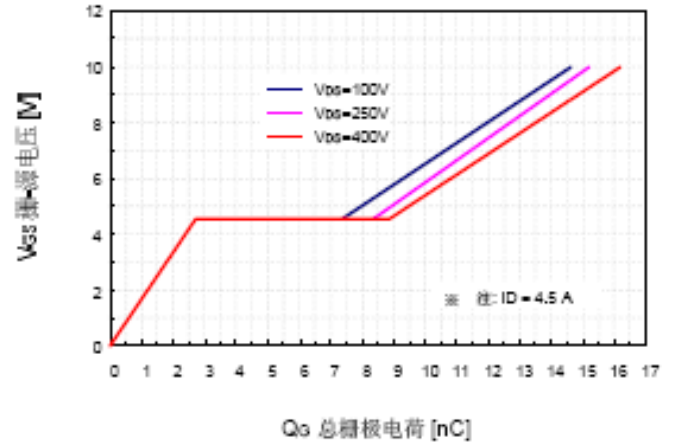


图7、击穿电压vs.温度

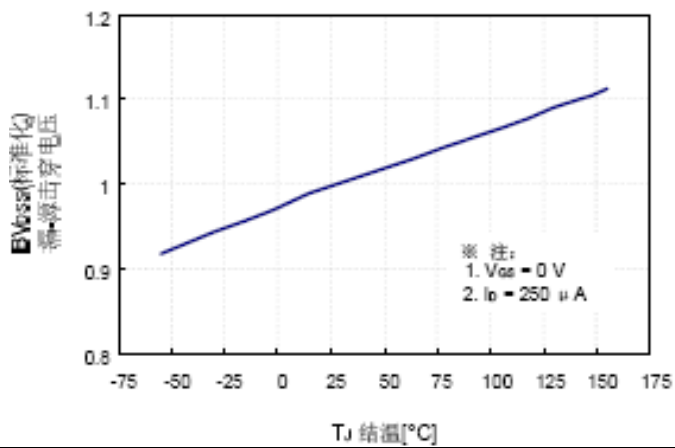
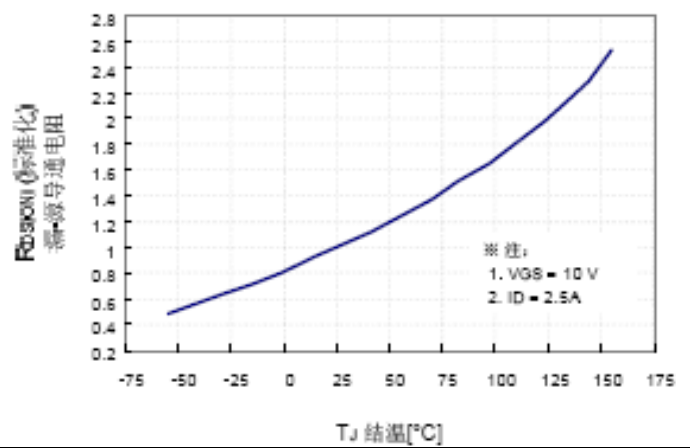
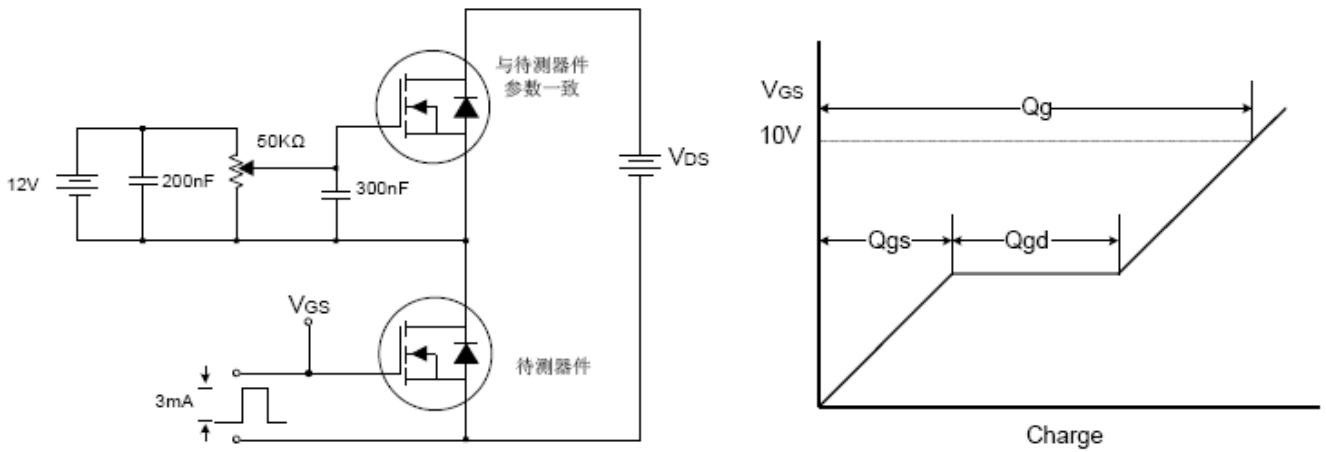


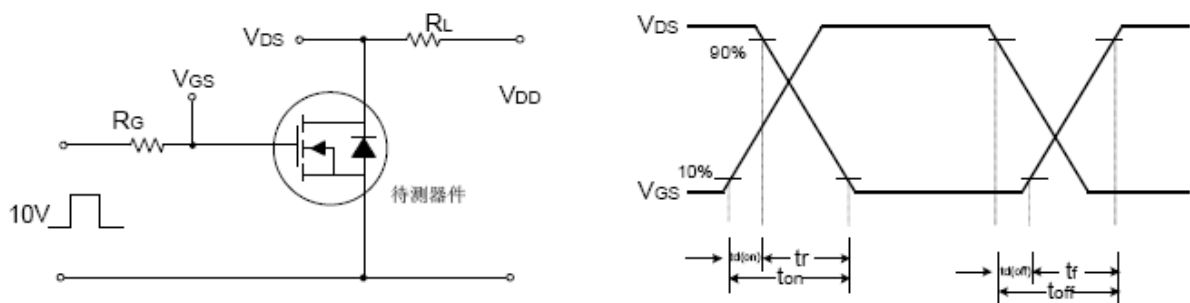
图8、导通电阻vs.温度



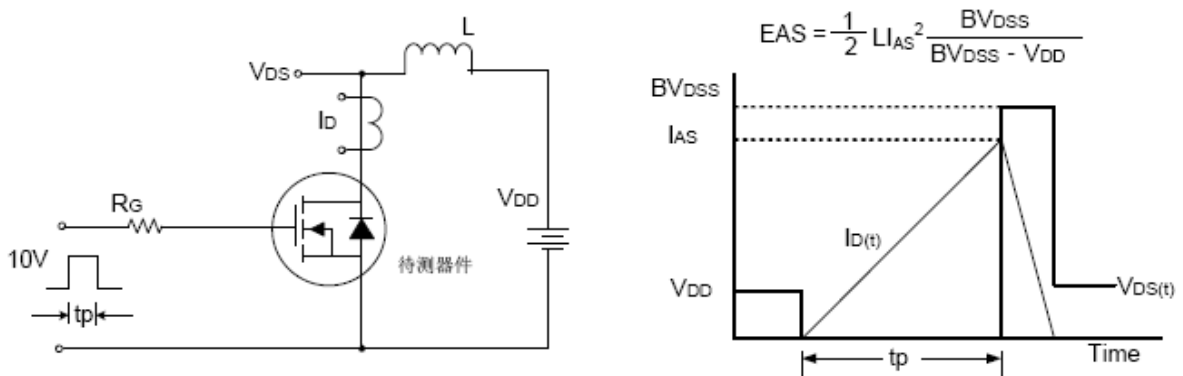
栅极电荷量测试电路及波形图



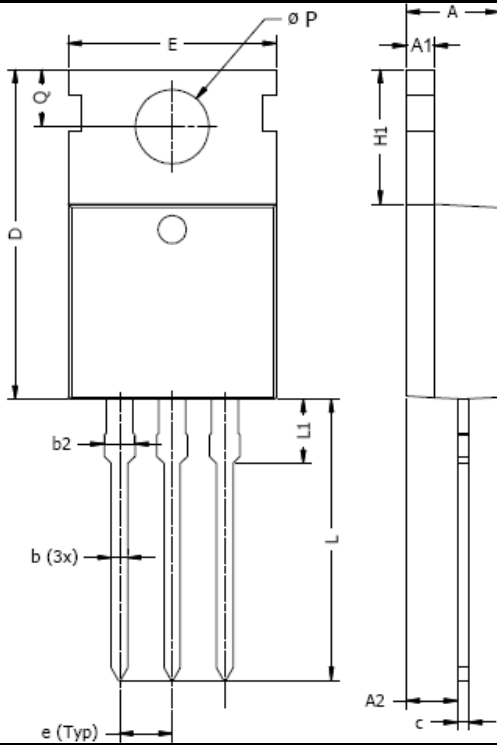
开关时间测试电路及波形图



EAS测试电路及波形图



TO220AB PACKAGE OUTLINE



| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 3.60        | 4.80  | 0.142  | 0.189 |
| A1  | 1.20        | 1.40  | 0.047  | 0.055 |
| A2  | 2.03        | 2.90  | 0.080  | 0.114 |
| b   | 0.40        | 1.00  | 0.016  | 0.039 |
| b2  | 1.20        | 1.78  | 0.047  | 0.070 |
| c   | 0.36        | 0.60  | 0.014  | 0.024 |
| D   | 14.22       | 16.50 | 0.560  | 0.650 |
| e   | 2.34        | 2.74  | 0.092  | 0.108 |
| E   | 9.70        | 10.60 | 0.382  | 0.417 |
| H1  | 5.84        | 6.85  | 0.230  | 0.270 |
| L   | 12.70       | 14.70 | 0.500  | 0.579 |
| L1  | 2.70        | 3.30  | 0.106  | 0.130 |
| ØP  | 3.50        | 4.00  | 0.138  | 0.157 |
| Q   | 2.54        | 3.40  | 0.100  | 0.134 |

NOTE: Above package outline conforms to JEDEC TO-220AB

## **NOTICE**

The information presented in this document is for reference only. Tak Cheong reserves the right to make changes without notice for the specification of the products displayed herein.

The product listed herein is designed to be used with ordinary electronic equipment or devices, and not designed to be used with equipment or devices which require high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), Tak Cheong Semiconductor Co., Ltd., or anyone on its behalf, assumes no responsibility or liability for any damages resulting from such improper use of sale.

This publication supersedes & replaces all information previously supplied. For additional information, please visit our website <http://www.takcheong.com>, or consult your nearest Tak Cheong's sales office for further assistance.