

| 工业型号                 | 公司型号             | 通俗命名 | H      | 封装标识                   | 包装方式       | 每管数量            | 每盒数量               | 每箱数量             |
|----------------------|------------------|------|--------|------------------------|------------|-----------------|--------------------|------------------|
| FQU2N60C<br>FQD2N60C | H2N60U<br>H2N60D | 2N60 | HAOHAI | U: TO-251<br>D: TO-252 | 条管装<br>卷盘装 | 80只/管<br>2.5K/卷 | 4Kpcs/盒<br>5Kpcs/盒 | 24Kpcs<br>25Kpcs |

### Features

Originative New Design  
 Superior Avalanche Rugged Technology  
 Robust Gate Oxide Technology  
 Very Low Intrinsic Capacitances  
 Excellent Switching Characteristics  
 Unrivalled Gate Charge: 5.5nC(Typ.)  
 Extended Safe Operating Area  
 Lower  $R_{DS(ON)}$ : 4.0Ω(Typ.) @  $V_{GS}=10V$   
 100% Avalanche Tested  
 Package: TO-251 & TO-252 (IPAK & DPAK)

$I_D=1.8A$   
 $BV_{DSS}=600V$   
 $R_{DS(on)}=4.0\Omega$

### 特点

导通电阻低,开关速度快,驱动简单,可并联使用,输入阻抗高,符合RoHS规范

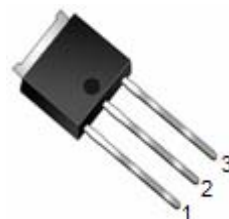
### 应用范围

开关电源、LCD电源、LED驱动电源、机箱电源、UPS电源、  
 各种充电器、电子整流器、电子变压器、逆变器、控制器、转换器、  
 风扇控制板、以及电源适配器、汽车稳压器等线性放大和功率开关电路

### 封装形式

TO-251 (IPAK)  
 TO-252 (DPAK)

### 2N60 Series Pin Assignment

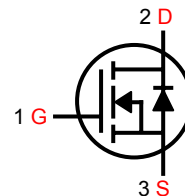


3-Lead Plastic TO-251  
 Package Code: U  
 Pin 1: Gate  
 Pin 2: Drain  
 Pin 3: Source



3-Lead Plastic TO-252  
 Package Code: D  
 Pin 1: Gate  
 Pin 2: Drain  
 Pin 3: Source

Series Symbol:



### Absolute Maximum Ratings ( $T_C=25^\circ C$ unless otherwise specified)

| Symbol         | Parameter   | Value      | Units |
|----------------|---|------------|-------|
| $V_{DSS}$      | Drain-Source Voltage  | 600        | V     |
| $I_D$          | Drain Current—Continuous ( $T_C=25^\circ C$ )                                 | 1.8        | A     |
|                | Drain Current—Continuous ( $T_C=100^\circ C$ )                                | 1.1        |       |
| $I_{DM}$       | Drain Current – Pulsed (Note 1)   | 7.2        |       |
| $V_{GS}$       | Gate-Source Voltage   | $\pm 30$   | V     |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                       | 116        | mJ    |
| $I_{AR}$       | Avalanche Current (Note 1)  | 1.8        | A     |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)  | 4.2        | mJ    |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)  | 4.5        | V/ns  |
| $P_D$          | Power Dissipation ( $T_A=25^\circ C$ ) *                                      | 2.5        | W     |
|                | Power Dissipation ( $T_C=25^\circ C$ )  | 42         |       |
|                | Power Dissipation - Derate above 25°C   | 0.34       | W/°C  |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                       | -50 ~ +150 | °C    |
| $T_L$          | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | 300        |       |

### Thermal Resistance Characteristics

| Symbol          | Parameter             | Typ. | Max. | Units |
|-----------------|-----------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case      | --   | 2.98 | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient * | --   | 50   |       |
| $R_{\theta JA}$ | Junction-to-Ambient   | --   | 110  |       |

\* When mounted on the minimum pad size recommended (PCB Mount)

**Electrical Characteristics** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|-------|

**On Characteristics**

|              |                                   |                                      |     |     |     |          |
|--------------|-----------------------------------|--------------------------------------|-----|-----|-----|----------|
| $V_{GS}$     | Gate Threshold Voltage            | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$  | 2.5 | --  | 4.5 | V        |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=10\text{V}, I_D=0.9\text{A}$ | --  | 4.0 | 5.0 | $\Omega$ |

**Off Characteristics**

|                              |   |   |     |     |           |                           |
|------------------------------|---|---|-----|-----|-----------|---------------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage            | $V_{GS}=0\text{V}, I_D=250\mu\text{A}$                  | 600 | --  | --        | V                         |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D=250\mu\text{A}$ , Referenced to $25^\circ\text{C}$ | --  | 0.6 | --        | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                    | Zero Gate Voltage Drain Current           | $V_{DS}=600\text{V}, V_{GS}=0\text{V}$                  | --  | --  | 1         | $\mu\text{A}$             |
|                              |   | $V_{DS}=480\text{V}, T_C=25^\circ\text{C}$              | --  | --  | 10        |                           |
| $I_{GSS}$                    | Gate-Body Leakage Current                 | $V_{GS}=\pm 30\text{V}, V_{DS}=0\text{V}$               | --  | --  | $\pm 100$ | nA                        |

**Dynamic Characteristics**

|           |                              |  |    |     |     |    |
|-----------|------------------------------|--|----|-----|-----|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS}=25\text{V}$<br>$V_{GS}=0\text{V}$<br>$f=1.0\text{MHz}$ | -- | 320 | 420 | pF |
| $C_{oss}$ | Output Capacitance           |  | -- | 38  | 50  |    |
| $C_{rss}$ | Reverse Transfer Capacitance |  | -- | 6.5 | 8.5 |    |

**Switching Characteristics**

|              |                     |   |    |     |     |    |
|--------------|---------------------|---|----|-----|-----|----|
| $t_{d(on)}$  | Turn-On Time        | $V_{DS}=300\text{V}$<br>$I_D=2\text{A}$<br>$R_G=25\Omega$<br>(Note 4,5) | -- | 20  | 50  | nS |
| $t_r$        | Turn-On Rise Time   |   | -- | 20  | 50  |    |
| $t_{d(off)}$ | Turn-Off Delay Time |   | -- | 30  | 70  |    |
| $t_f$        | Turn-Off Fall Time  |   | -- | 20  | 50  |    |
| $Q_g$        | Total Gate Charge   | $V_{DS}=480\text{V}, I_D=2.0\text{A}$<br>$V_{GS}=10\text{V}$ (Note 4,5) | -- | 5.5 | 7.5 | nC |
| $Q_{gs}$     | Gate-Source Charge  |   | -- | 1.8 | --  |    |
| $Q_{gd}$     | Gate-Drain Charge   |   | -- | 3.5 | --  |    |

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

|          |   |  |    |      |     |               |
|----------|---|--|----|------|-----|---------------|
| $I_S$    | Continuous Source-Drain Diode Forward Current | --   | -- | 1.8  | A   |               |
| $I_{SM}$ | Pulsed Source-Drain Diode Forward Current     | --   | -- | 7.2  |     |               |
| $V_{SD}$ | Source-Drain Diode Forward Voltage            | $I_S=1.8\text{A}, V_{GS}=0\text{V}$  | -- | --   | 1.4 | V             |
| $t_{rr}$ | Reverse Recovery Time                         | $I_S=2.0\text{A}, V_{GS}=0\text{V}$<br>$di_F/dt=100\mu\text{A}/\mu\text{s}$ (Note 4) | -- | 206  | --  | nS            |
| $Q_{rr}$ | Reverse Recovery Charge                       |  | -- | 0.76 | --  | $\mu\text{C}$ |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L=53\text{mH}, I_{AS}=2\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3.  $I_{SD} \leq 1.8\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature

Typical Performance Characteristics

Fig-1. On Region Characteristics

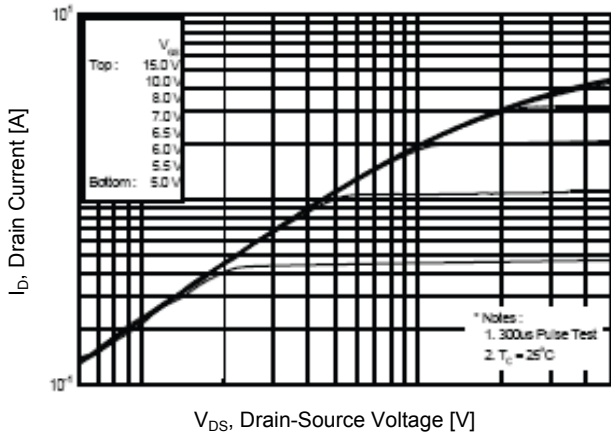


Fig-2. Transfer Characteristics

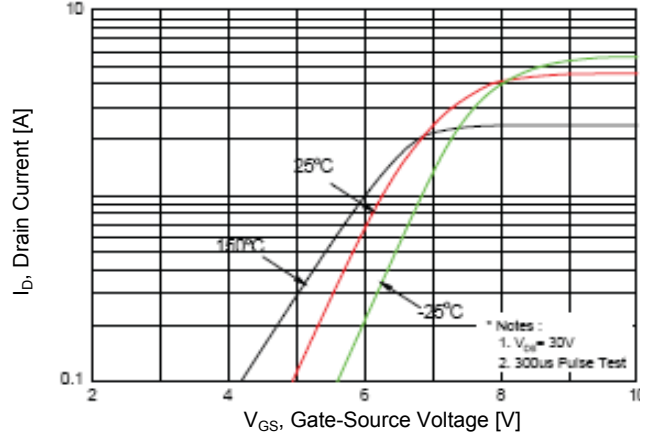


Fig-3. On Resistance Variation vs Drain Current and Gate Voltage

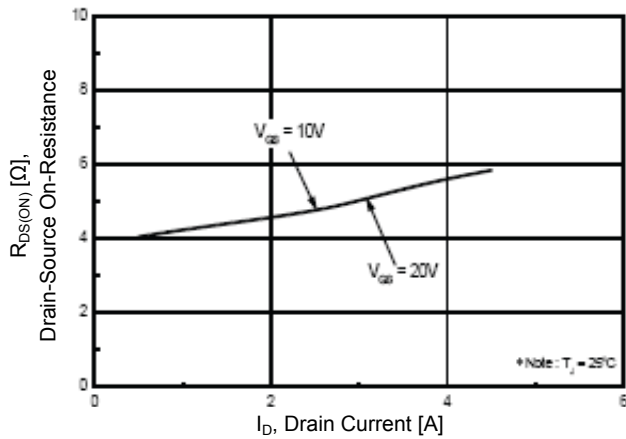


Fig-4. Body Diode Forward Voltage Variation with Source Current and Temperature

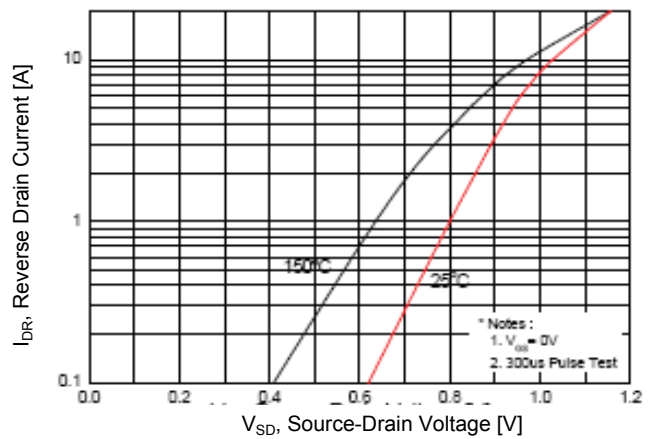


Fig-5. Capacitance Characteristics

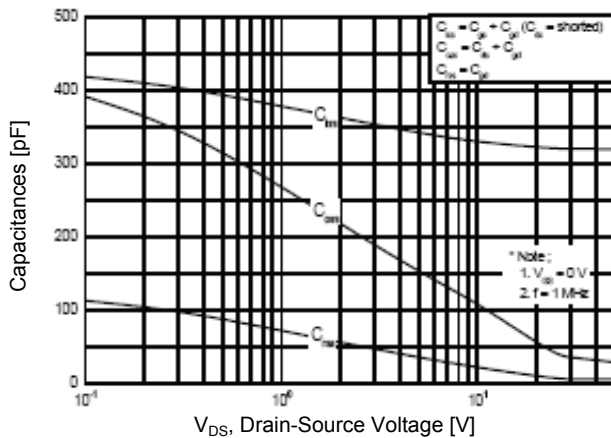
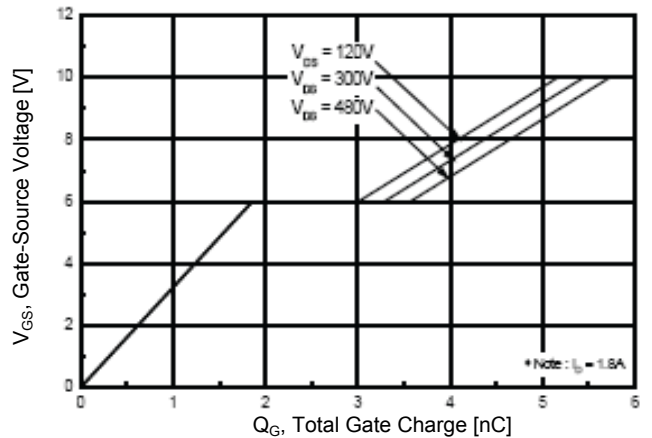


Fig-6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Fig-7. Breakdown Voltage Variation vs Temperature

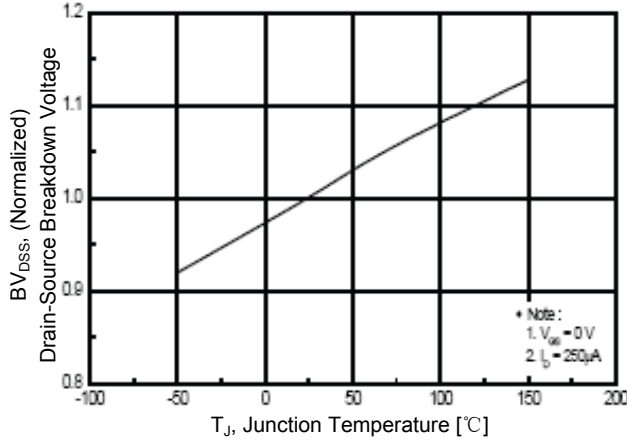


Fig-8. On-Resistance Variation vs Temperature

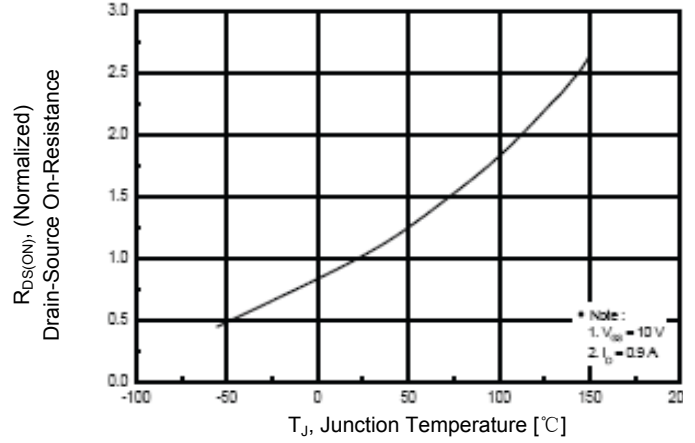


Fig-9. Maximum Safe Operating Area

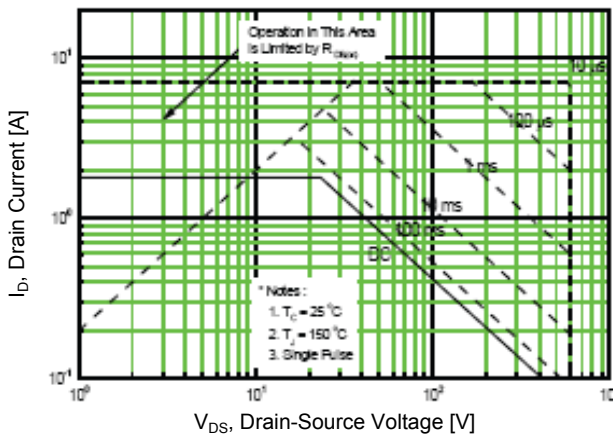


Fig-10. Maximum Drain Current vs Case Temperature

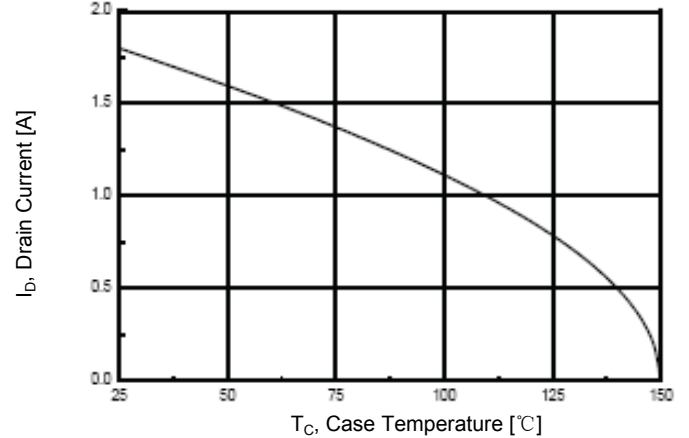


Fig-11. Transient Thermal Response Curve

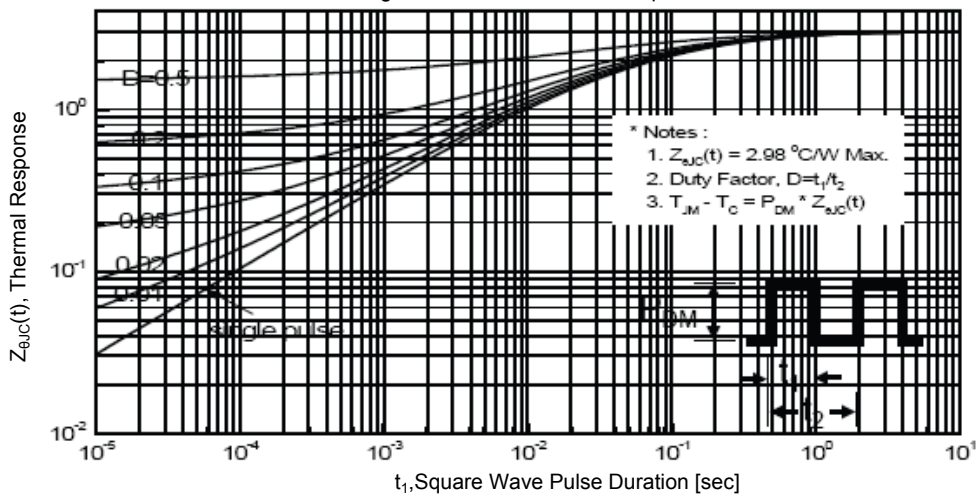


Fig-12. Gate Charge Test Circuit & Waveform

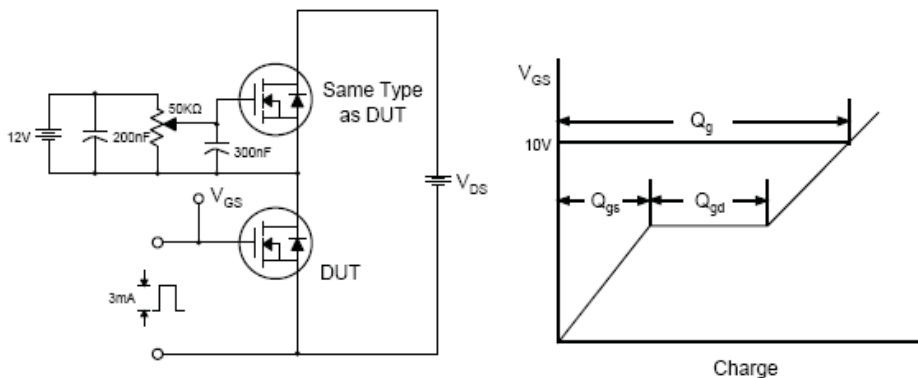


Fig-13. Resistive Switching Test Circuit & Waveforms

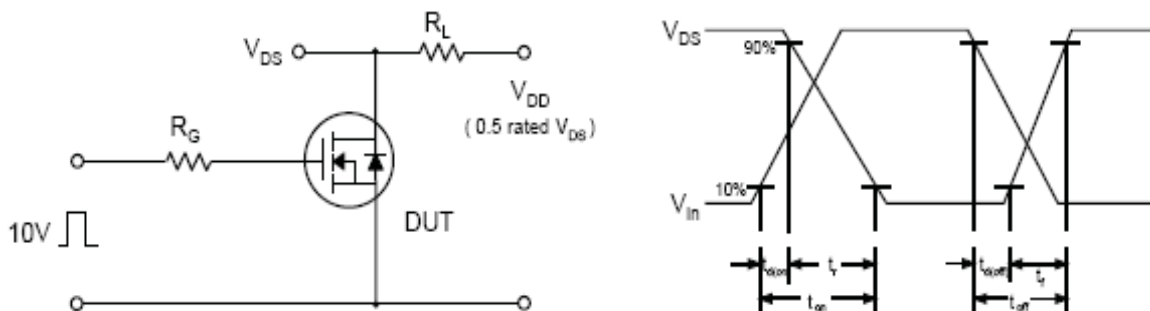


Fig-14. Unclamped Inductive Switching Test Circuit & Waveforms

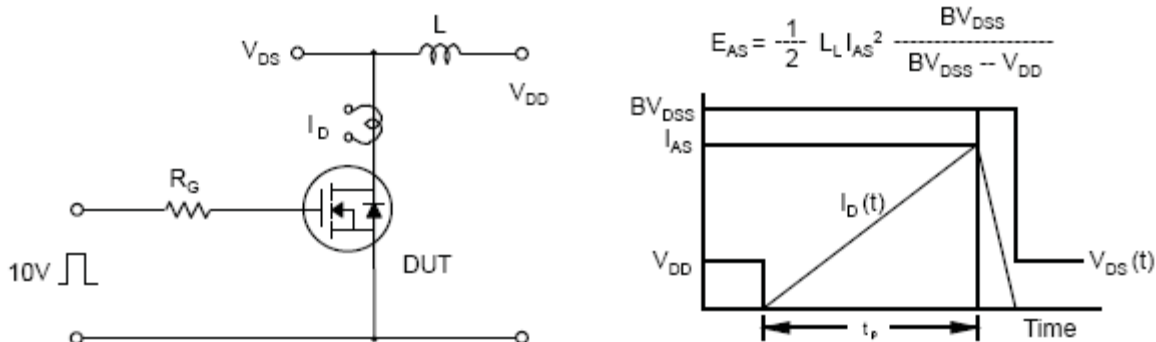
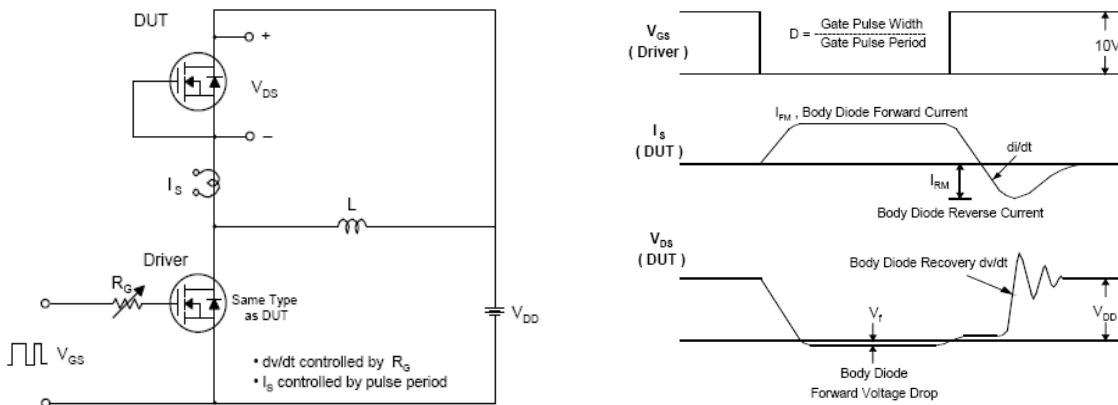
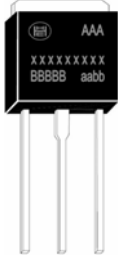



Fig-15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



**PACKAGE DIMENSIONS**

| ■ TO-251 (IPAK) Dimension (封装尺寸数据, 单位: mm) |          |      | MILLIMETERS |  | 元件打印标识  |
|--|----------|------|-------------|--|---|
| DIM  | Min.     | Max. |             |  |   |
| A  | 5.97     | 6.35 |             |  |  <p>左上角:公司LOGO<br/>AAA:芯片代码<br/>XXXXXXXXXX:器件型号<br/>BBBBBB:批次代码<br/>aabb:出厂批号<br/>其中:<br/>aa:出厂年份<br/>bb:出厂自然周 (01-53)</p> |
| B  | 6.35     | 6.73 |             |  |   |
| C  | 2.19     | 2.38 |             |  |   |
| D  | 0.69     | 0.88 |             |  |   |
| E  | 0.84     | 1.01 |             |  |   |
| F  | 0.94     | 1.19 |             |  |   |
| G  | 2.29 BSC |      |             |  |   |
| H  | 0.87     | 1.01 |             |  |   |
| J  | 0.46     | 0.58 |             |  |   |
| K  | 8.89     | 9.65 |             |  |   |
| R  | 4.45     | 5.46 |             |  |   |
| S  | 1.27     | 2.28 |             |  |   |
| V  | 0.77     | 1.27 |             |  |   |

| ■ TO-252 (DPAK) Dimension (封装尺寸数据, 单位: mm) |          |      | MILLIMETERS |  | 元件打印标识  |
|--|----------|------|-------------|--|---|
| DIM  | Min.     | Max. |             |  |   |
| A  | 5.97     | 6.35 |             |  |  <p>左上角:公司LOGO<br/>AAA:芯片代码<br/>XXXXXXXXXX:器件型号<br/>BBBBBB:批次代码<br/>aabb:出厂批号<br/>其中:<br/>aa:出厂年份<br/>bb:出厂自然周 (01-53)</p> |
| B  | 6.35     | 6.73 |             |  |   |
| C  | 2.19     | 2.38 |             |  |   |
| D  | 0.69     | 0.88 |             |  |   |
| E  | 0.84     | 1.01 |             |  |   |
| F  | 0.94     | 1.19 |             |  |   |
| G  | 4.58 BSC |      |             |  |   |
| H  | 0.87     | 1.01 |             |  |   |
| J  | 0.46     | 0.58 |             |  |   |
| K  | 2.60     | 2.89 |             |  |   |
| L  | 2.29 BSC |      |             |  |   |
| R  | 4.45     | 5.46 |             |  |   |
| S  | 0.51     | 1.27 |             |  |   |
| Z  | 3.51     | --   |             |  |   |

Manufacturers version information

2007-03-11, HAOHAI™ Product Data-U1.0

2010-04-10, HAOHAI™ Product Data-U1.1

2014-07-11, HAOHAI™ Product Data-U1.2



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