# N-Channel 40V(D-S) MOSFET

| Product summary | | |
|---|---|---|
| $V_{DS}$ | 40 | V |
| $R_{DS(ON)}$(at $V_{GS}$=10V) Typ. | 4.2 | mΩ |
| $R_{DS(ON)}$(at $V_{GS}$=4.5V) Typ. | 6.0 | mΩ |
| $I_D$(Tc=25℃) | 80 | A |

## Features

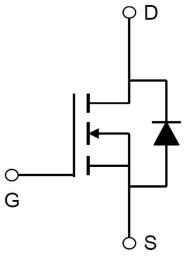
- High density cell design for low $R_{DS(ON)}$
- Excellent package for heat dissipation

## Applications

- PWM Application
- Load switching
- Power management

## Pin Configuration


TO-252




## Packing Information

| Device | Package | Reel Size | Quantity(Min. Package) |
|---|---|---|---|
| ECFA80N04B | TO-252 | 13″ | 2500pcs |

## Absolute Maximum Ratings (at $T_A$=25℃ Unless Otherwise Noted)

| Symbol | Parameter | | Rating | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | | ±20 | V |
| $I_D$ | Continuous Drain Current | $T_C$=25℃ | 80 | A |
| | | $T_C$=100℃ | 51 | A |
| $I_{DM}$ | Pulse Drain Current Tested [A] | | 320 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy [B] | | 104 | mJ |
| $P_D$ | Power Dissipation | $T_C$=25℃ | 77 | W |
| $T_J$,$T_{STG}$ | Junciton and Storage Temperature Range | | -55 to +150 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Typical | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance-Junction to case | 1.95 | ℃/W |

## Electrical Characteristics (at $T_J$ =25℃ Unless Otherwise Noted)

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Static Parameters | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V,$I_D$=250uA | 40 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=40V,$V_{GS}$=0V | -- | -- | 1 | uA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{DS}$=0V,$V_{GS}$=±20V | -- | -- | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=250uA | 1.0 | 1.5 | 2.5 | V |
| $R_{DS(ON)}$ | Drain-Source On-State Resistance [C] | $V_{GS}$=10V,$I_D$=30A | -- | 4.2 | 5.5 | mΩ |
| | | $V_{GS}$=4.5V,$I_D$=20A | -- | 6.0 | 7.5 | mΩ |
| $V_{SD}$ | Forward Voltage | $I_S$=30A,$V_{GS}$=0V | -- | -- | 1.2 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | -- | -- | 80 | A |
| Dynamic Parameters [D] | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V,$V_{DS}$=20V f=1MHZ | -- | 3040 | -- | pF |
| $C_{oss}$ | Output Capacitance | | -- | 385 | -- | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 230 | -- | pF |
| $Q_g$ | Total Gate Charge | $V_{DS}$=20V,$I_D$=30A $V_{GS}$=10V | -- | 57 | -- | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 9 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 11 | -- | nC |
| $t_{D(on)}$ | Turn-on Delay Time | $V_{DS}$=20V， $I_D$=30A,$R_G$=3Ω, $V_{GS}$=10V | -- | 8 | -- | ns |
| $t_r$ | Turn-on Rise Time | | -- | 18 | -- | ns |
| $t_{D(off)}$ | Turn-off Delay Time | | -- | 24 | -- | ns |
| $t_f$ | Turn-off Fall Time | | -- | 14 | -- | ns |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=20A di/dt=100A/us | -- | 22 | -- | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | -- | 11 | -- | uC |

A. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.

B. EAS condition: $T_J$=25℃, $V_{DD}$=20V, $R_G$=25Ω，L=0.5mH, $I_{AS}$=20.4A.

C. Pulse Test: Pulse Width≤300us,Duty cycle ≤2%.

D. Guaranteed by design, not subject to production testing.

## Typical Characteristics

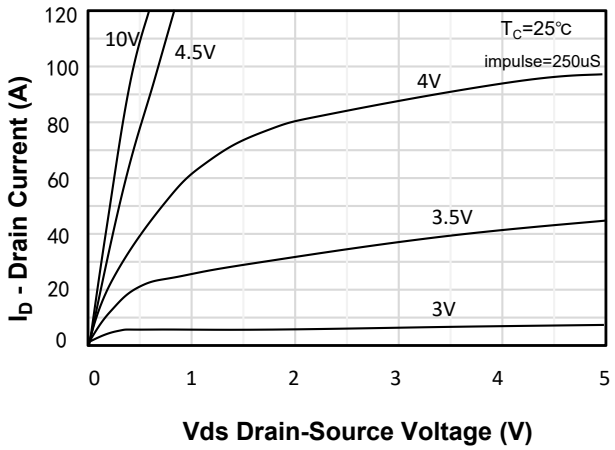



Figure 1. On-Region Characteristics

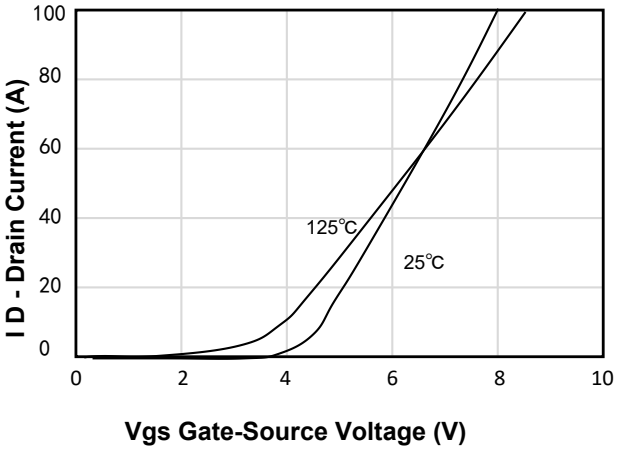



Figure 2. Transfer Characteristics

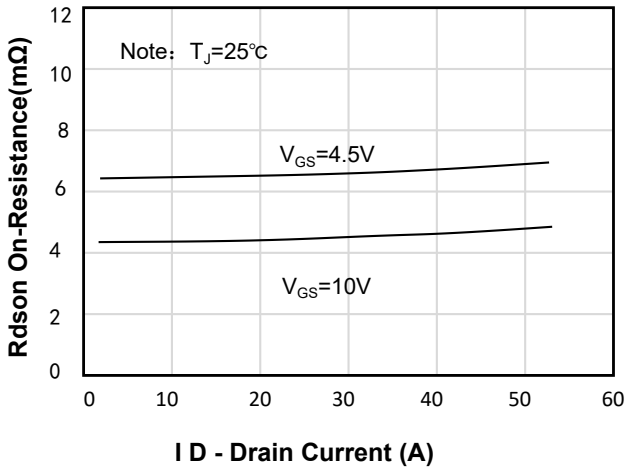



Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

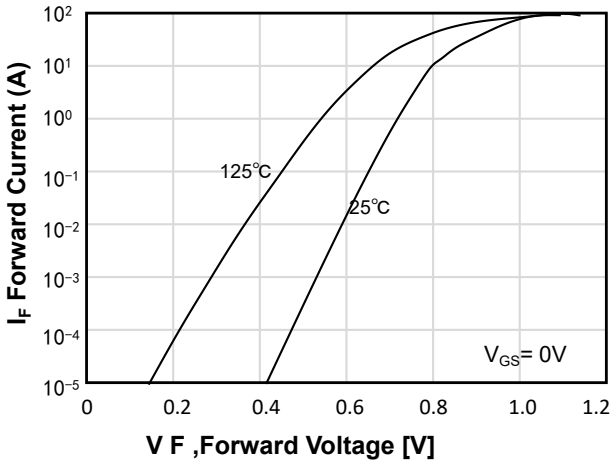



Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

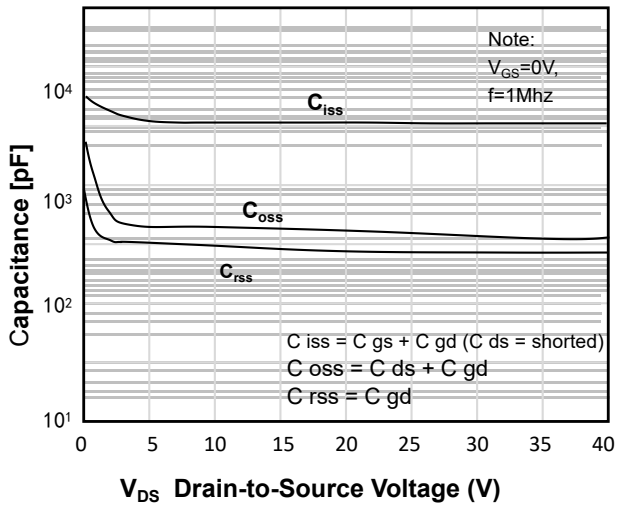



Figure 5. Capacitance Characteristics

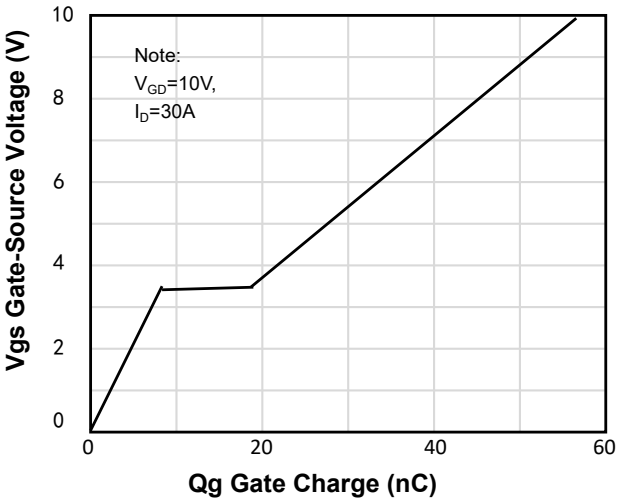



Figure 6. Gate Charge Characteristics

## Typical Characteristics

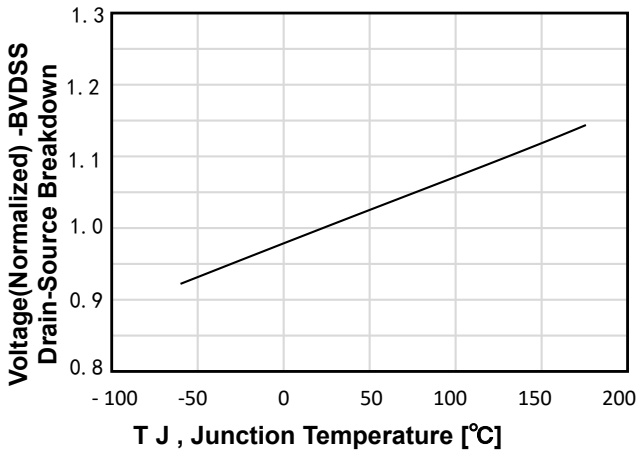



**Figure 7. Breakdown Voltage Variation vs Temperature**

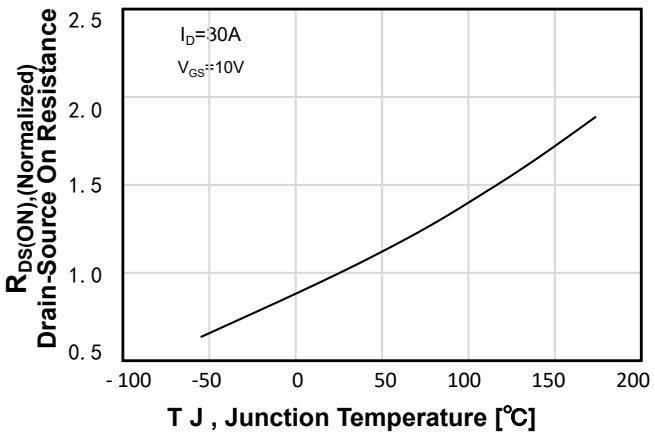



**Figure 8. On-Resistance Variation vs Temperature**

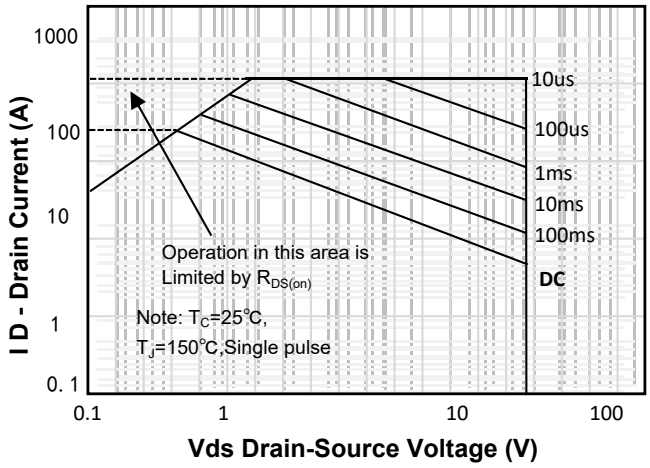



**Figure 9. Maximum Safe Operating Area**

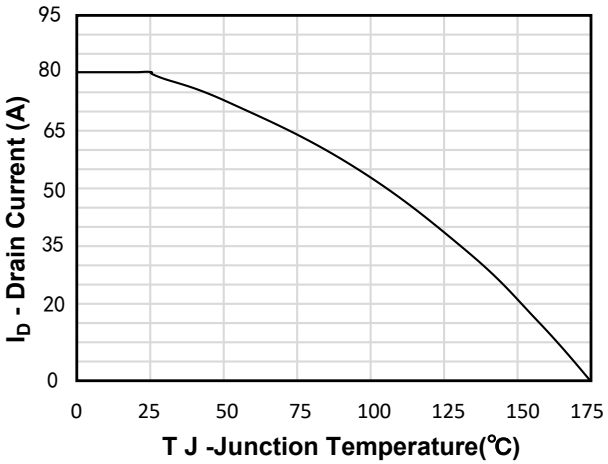



**Figure 10. Vds Drain VS Junction Temperature**

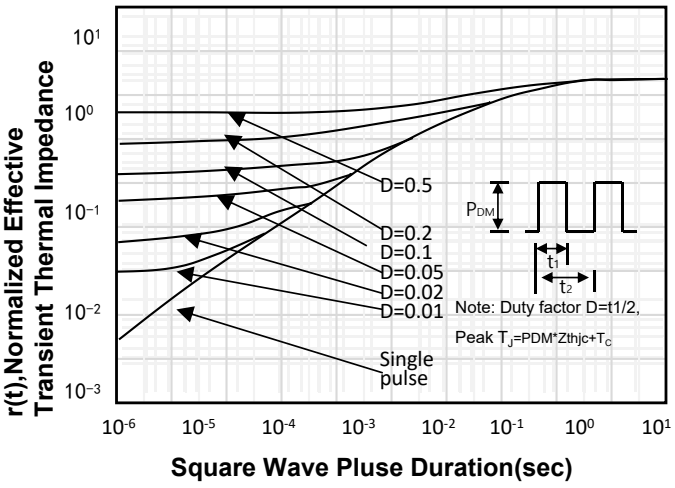
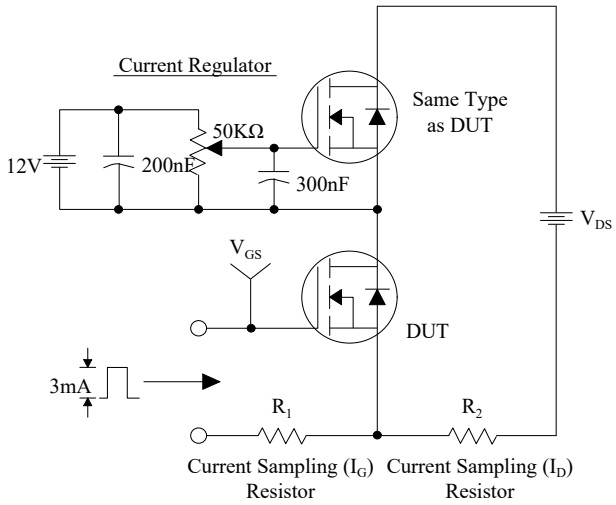
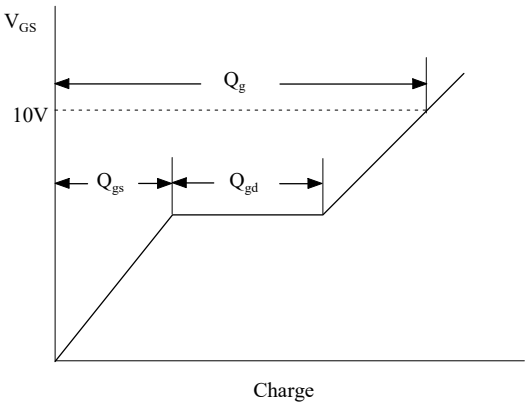



**Figure 11. Transient Thermal Response Curve**

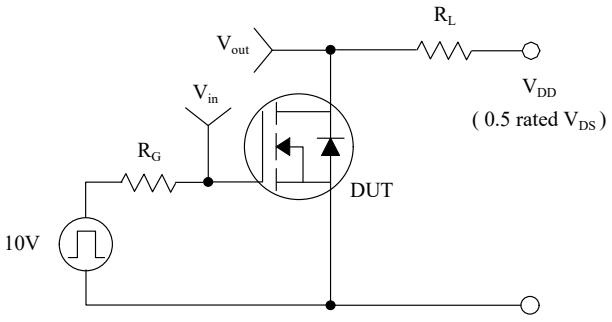
## Test Circuit

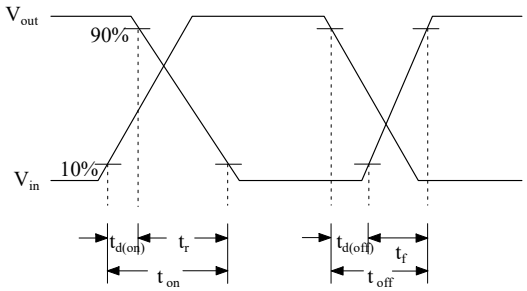
### Gate Charge Test Circuit & Waveform



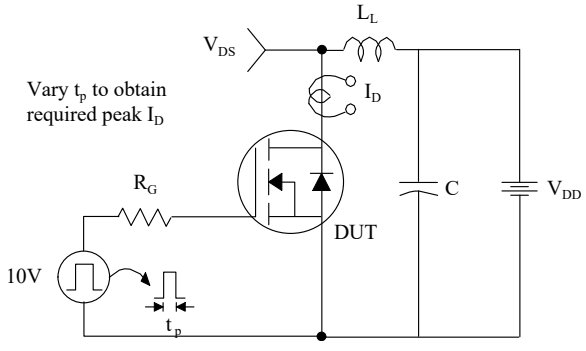




### Resistive Switching Test Circuit & Waveforms

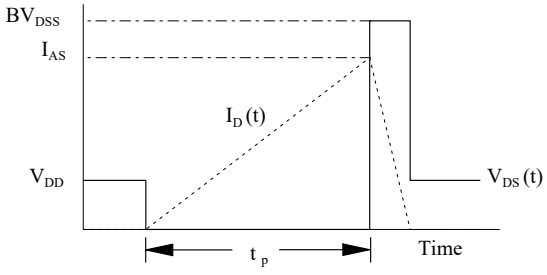



### Unclamped Inductive Switching Test Circuit & Waveforms

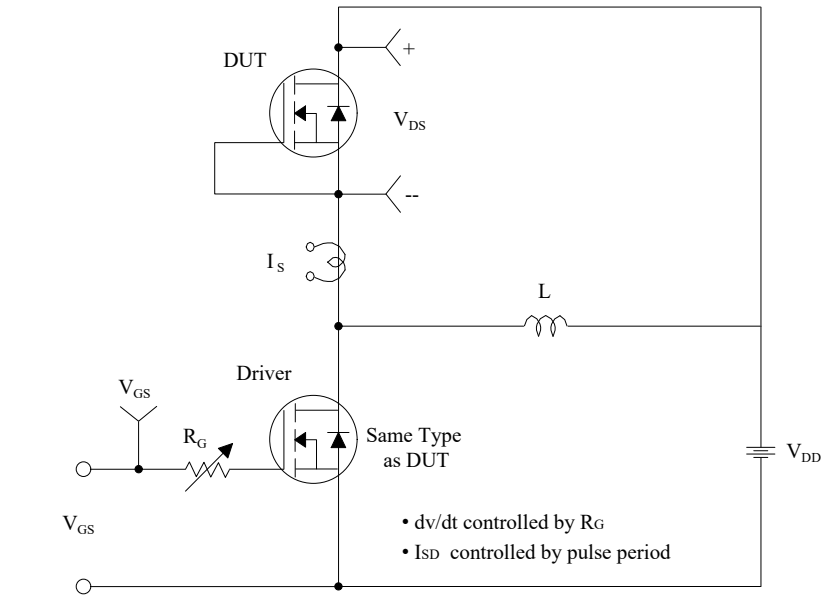


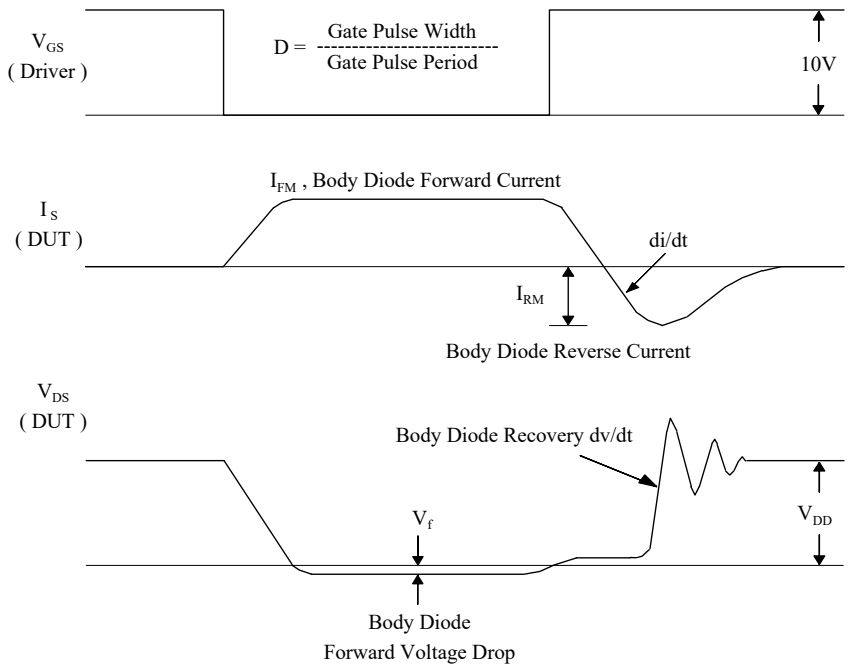

$$E_{AS} = \frac{1}{2} L_L I_{AS}^2$$



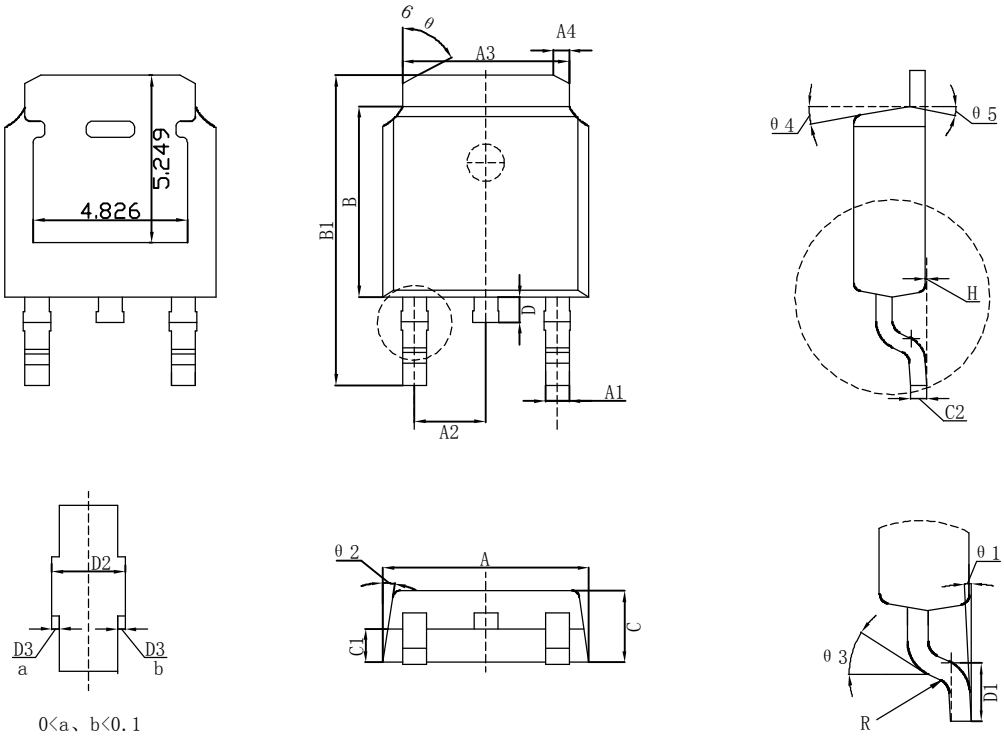
## Test Circuit

### Peak Diode Recovery dv/dt Test Circuit & Waveforms



# TO-252 Package Information




| 尺寸 / 标注 | 最小(mm) | 最大(mm) | 尺寸 / 标注 | 最小(mm) | 最大(mm) |
|---|---|---|---|---|---|
| A | 6.50 | 6.70 | D1 | 1.40 | 1.60 |
| A1 | 0.71 | 0.81 | D2 | 0.81 | 0.91 |
| A2 | 2.236 | 2.336 | D3 | 0.05TYP | |
| A3 | 5.284 | 5.384 | H | 0.00 | 0.10 |
| A4 | 0.75 | 0.85 | R | 0.40TYP | |
| B | 6.00 | 6.20 | θ1 | 0° ━ 8° | |
| B1 | 9.80 | 10.10 | θ2 | 8.5° TYP4 | |
| C | 2.20 | 2.40 | θ3 | 25° TYP | |
| C1 | 0.967 | 1.087 | θ4 | 10° TYP2 | |
| C2 | 0.498 | 0.518 | θ5 | 10° TYP | |
| D | 0.70 | 0.90 | θ6 | 70° TYP | |