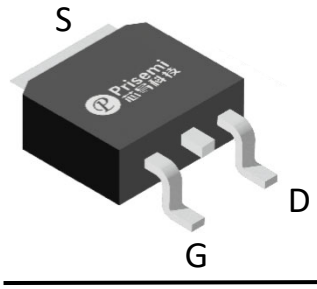
Prisemi®

# PGCDP70R180B

## 700V GaN Power Transistor

## Description

| Product Summary | | |
|---|---|---|
| $V_{DS}$(V) | $R_{DS(on)}$(mΩ)(Typ) | $I_D$(A) |
| 700 | 180 | 12.8 |



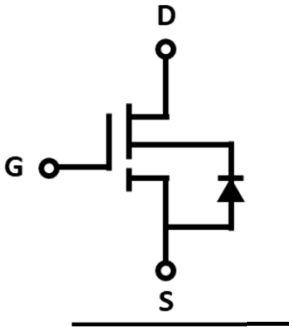

TO-252 (Top View)

## Feature

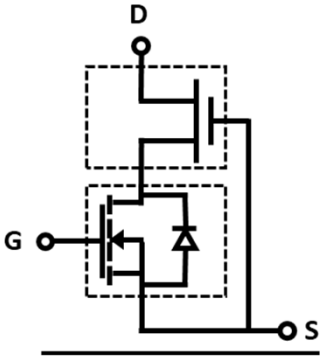
- Easy to use, compatible with standard gate drivers
- Excellent $Q_G$ x $R_{DS(on)}$ figure of merit (FOM)
- Low $Q_{RR}$, no free-wheeling diode required
- Low switching loss
- RoHS compliant and Halogen-free

## Applications

- High efficiency power supplies
- Telecom and datacom
- Automotive
- Servo motors




Schematic Symbol




Cascode
Device Structure

## Absolute maximum rating@25℃

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 700 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Transient Drain-Source Voltage[1)] | | $V_{TDS}$ | 800 | V |
| Continuous Drain Current | $T_C$=25℃ | $I_D$ | 12.8 | A |
| | $T_C$=100℃ | | 8.5 | |
| Pulsed Drain Current (Pulse Width: 100μs) | $T_C$=25℃ | $I_{DM}$ | 28 | A |
| | $T_C$=150℃ | | 20 | |
| Power Dissipation | | $P_D$ | 54 | W |
| Soldering Peak Temperature | | $T_{CSOLD}$ | 260 | ℃ |
| Operating Junction and Storage Temperature | | $T_J$, $T_{STG}$ | -55 to 150 | ℃ |

## Thermal Resistance

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Thermal Resistance, Junction-to-Case | $R_{θJC}$ | - | 2.3 | - | ℃/W |
| Thermal Resistance, Junction-to-Ambient[2)] | $R_{θJA}$ | - | 50 | - | ℃/W |

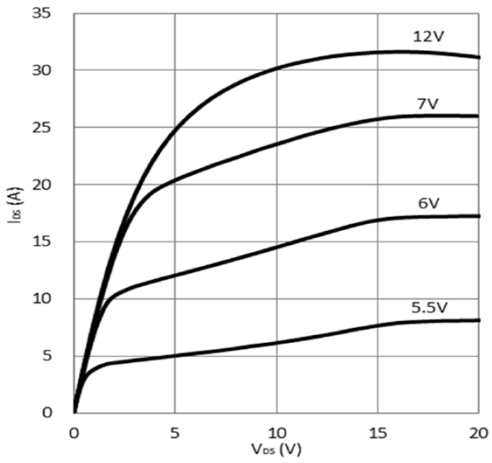
## Electrical characteristics per line@25℃ (unless otherwise specified)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| **Statistic Characteristics** | | | | | | | |
| Maximum Drain-Source Voltage | $V_{DS-Max}$ | $V_{GS}$ = 0V | | 700 | - | - | V |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ = 0V,$I_D$ = 250μA | | - | 1000 | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=700V, $V_{GS}$=0V | $T_J$=25℃ | - | 8 | 20 | μA |
| | | | $T_J$=150℃ | - | 50 | - | |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±20V,$V_{DS}$ = 0V | | - | - | ±150 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$,$I_D$ = 500μA | | 3 | 4 | 5 | V |
| Gate threshold voltage temperature coefficient | $\triangle V_{GS(th)}/T_J$ | | | - | -10.7 | - | mV/℃ |
| Drain-Source On-State Resistance[3)] | $R_{DS(ON)}$ | $V_{GS}$=12V, $I_D$=4A | $T_J$=25℃ | - | 180 | 225 | mΩ |
| | | | $T_J$=150℃ | - | 360 | - | |
| **Dynamic Characteristics** | | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$ = 400V,$V_{GS}$ = 0V, f = 1MHz | | - | 502 | - | pF |
| Output Capacitance | $C_{oss}$ | | | - | 21 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | - | 1.5 | - | |
| Effective Output Capacitance, Energy Related | $C_{o(er)}$ | $V_{GS}$ = 0V, $V_{DS}$ = 0-400V | | - | 31 | - | pF |
| Effective Output Capacitance, Time Related | $C_{o(tr)}$ | | | - | 65 | - | |
| Output Charge | $Q_{oss}$ | | | - | 26 | - | nC |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DS}$ = 400V,$I_D$ = 8A, $V_{GS}$ =0-12V,$R_G$=47Ω | | - | 37 | - | ns |
| Turn-on Rise Time | $t_r$ | | | - | 13 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 73 | - | |
| Turn-Off Fall Time | $t_f$ | | | - | 8 | - | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = 400V,$I_D$ = 8A, $V_{GS}$ =0-12V | | - | 15.8 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | | - | 3.8 | - | |
| Gate-Drain Charge | $Q_{gd}$ | | | - | 5.5 | - | |
| **Reverse Diode Characteristics** | | | | | | | |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=4A | | - | 1.4 | - | V |
| | | $V_{GS}$=0V, $I_S$=6A | $T_J$=25℃ | - | 2.1 | - | |
| | | | $T_J$=150℃ | - | 3.2 | - | |
| Reverse Recovery Time | $t_{rr}$ | $V_{GS}$=0V, $I_S$=8A, $V_{DD}$=400V, di/dt=1000A/μs | | - | 18 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | - | 26 | - | nC |

Notes:
1. Off-state spike duty cycle < 0.01, spike duration < 2μs
2. Device on one layer epoxy PCB for drain connection (vertical and without air stream cooling, with 6cm²copper area and 70μm thickness)
3. Dynamic on-resistance; see Figure 19 and 20 for test circuit and configurations

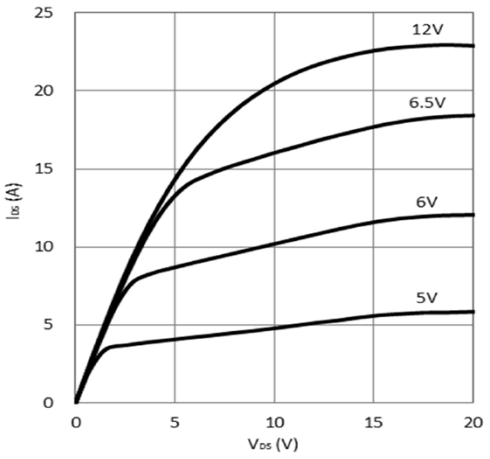
## Typical Characteristics

**Figure 1. Typical Output Characteristics $T_J$=25℃**



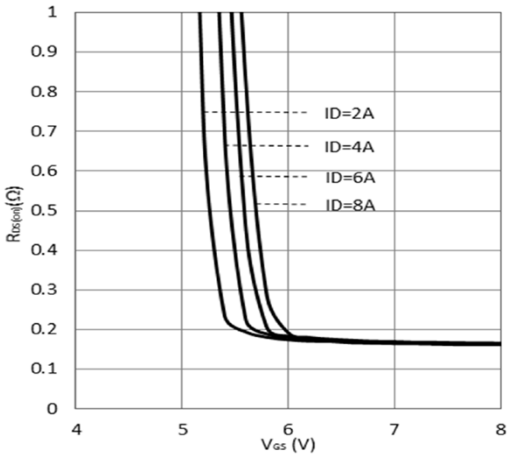

Parameter: $V_{GS}$

**Figure 2. Typical Output Characteristics $T_J$=150℃**



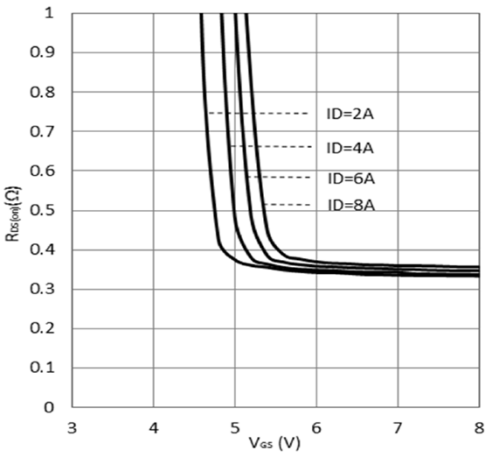

Parameter: $V_{GS}$

**Figure 3.Typical Drain to Source On-resistance $T_J$= 25°C**



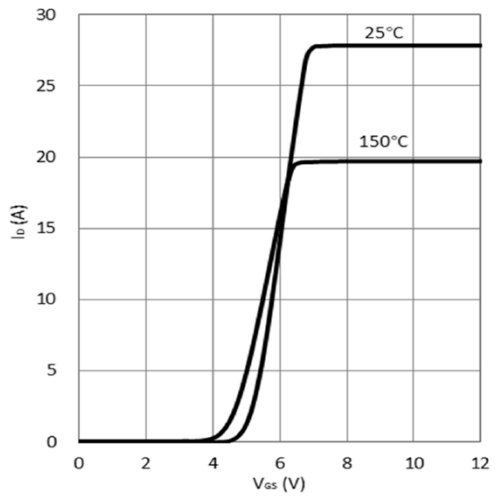

Parameter: $I_D$

**Figure 4. Typical Drain to Source On-resistance $T_J$= 150°C**



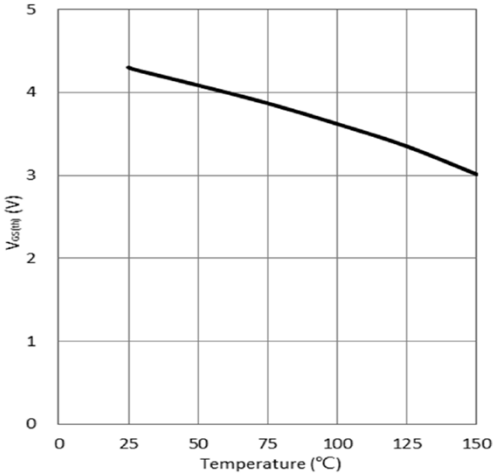

Parameter: $I_D$

**Figure 5. Typical Transfer Characteristics**



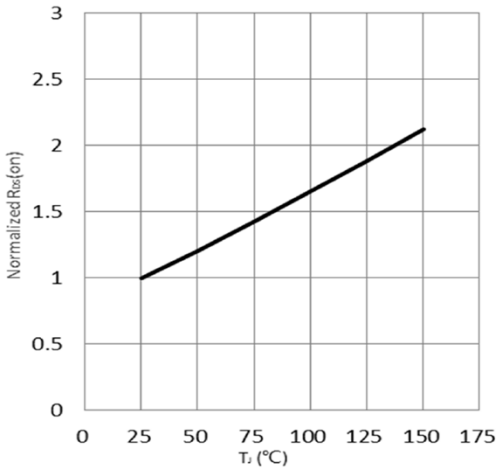

$V_{DS}$=10V, Parameter: $T_J$

**Figure 6. $V_{GS(th)}$ Vs Temperature Characteristics**



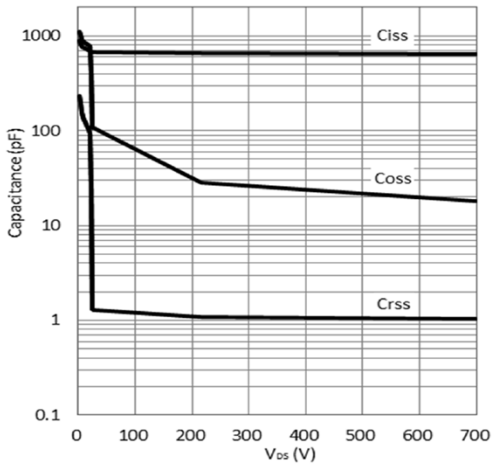

$I_D$=500uA

**Figure 7. Normalized On-resistance**



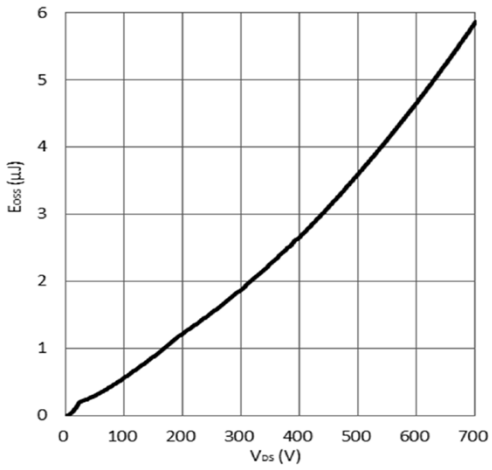

$I_D$=4A, $V_{GS}$=12V

**Figure 8. Typical Capacitance**



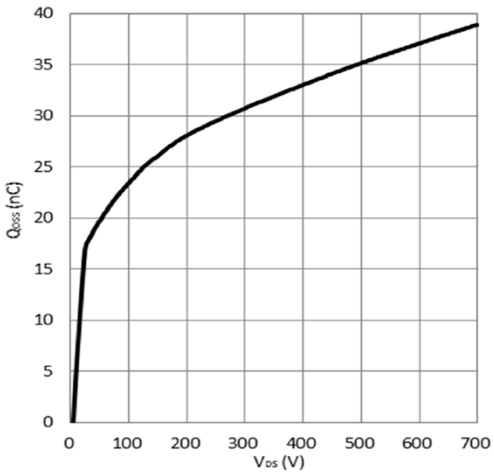

$V_{GS}$=0V, f=1MHz

**Figure 9. Typical Coss Stored Energy**



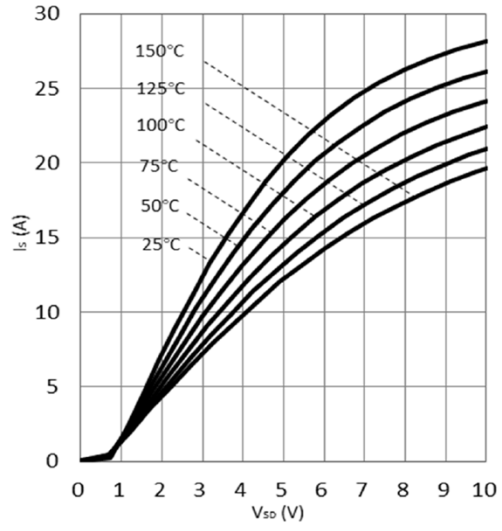

$V_{GS}$=0V, f=1MHz

**Figure 10. Typical Qoss**



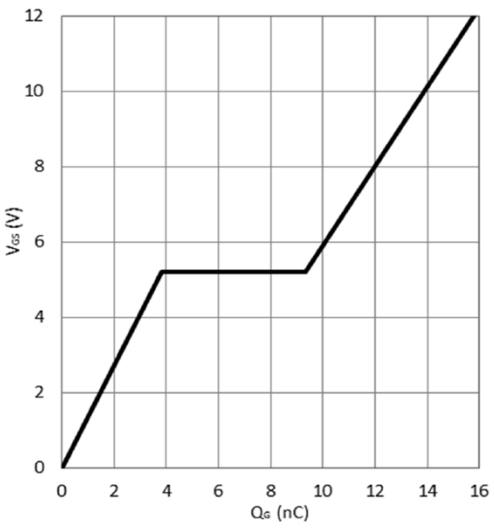

$V_{GS}$=0V, f=1MHz

**Figure 11. Forward Characteristic of Rev. Diode**




$I_S=f(V_{SD})$, Parameter $T_J$

**Figure 12. Typical Gate Charge**




$I_{DS}$=6A, $V_{DS}$=400V

**Figure 13. Power Dissipation**

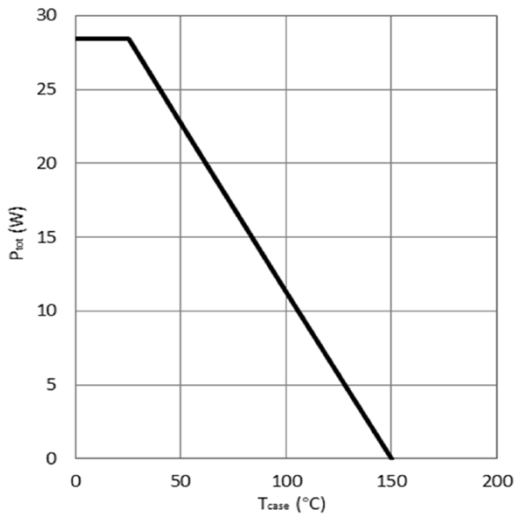



**Figure 14. Current Derating**

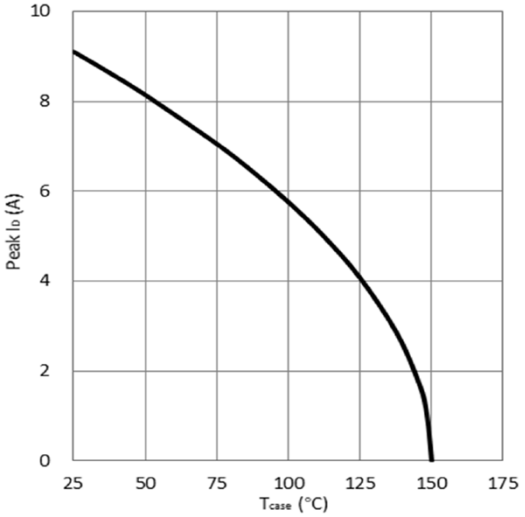



**Figure 15. Transient Thermal Resistance**

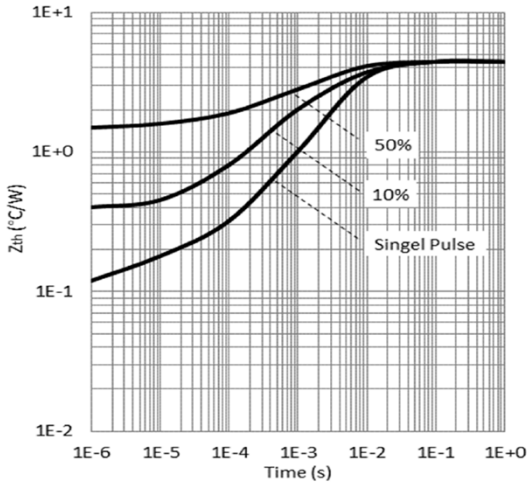
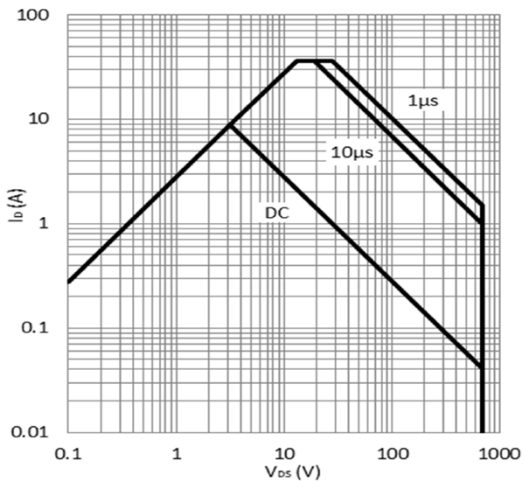
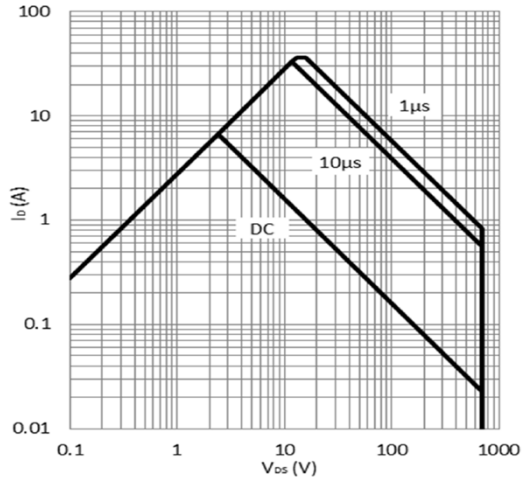



**Figure 16. Safe Operating Area $T_C$=25℃**




calculated based on thermal limit

**Figure 17. Safe Operating Area $T_C$=80℃**




calculated based on thermal limit

## Test Circuits and Waveforms

Figure 18. Switching Time Test Circuit

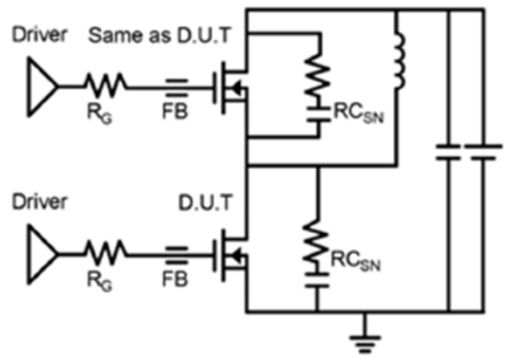



Figure 19. Switching Time Waveform

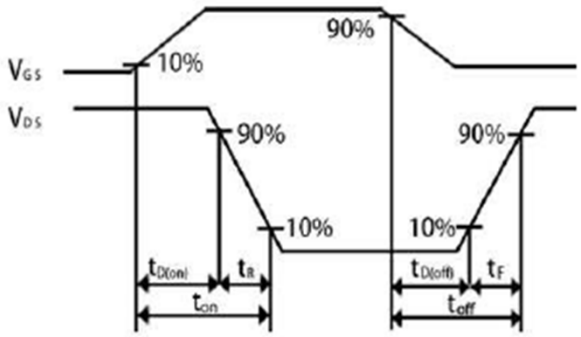



Figure 20. Dynamic $R_{DS(on)}$ Test Circuit

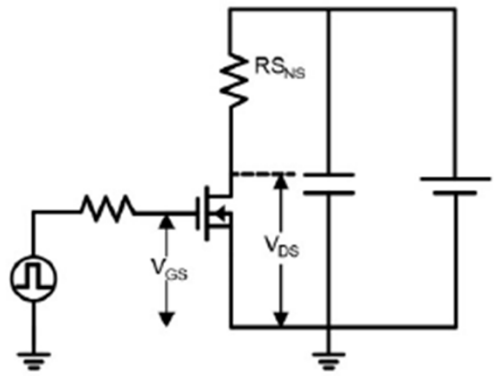



Figure 21. Dynamic $R_{DS(on)}$ Waveform

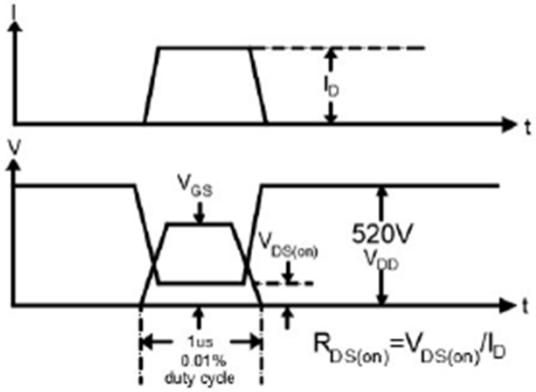



Figure 22. Diode Characteristic Test Circuits

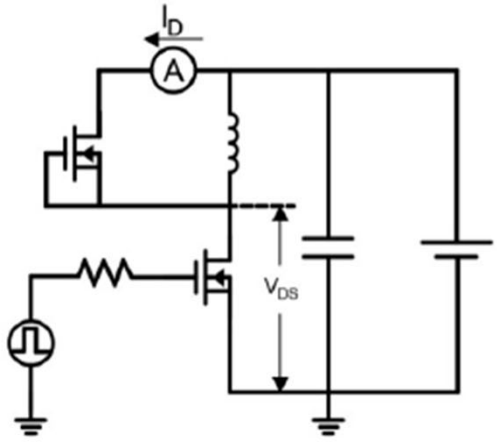
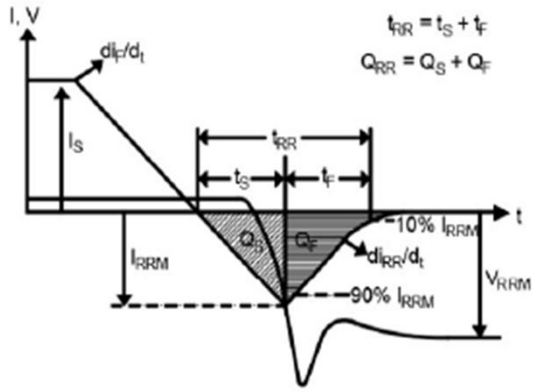
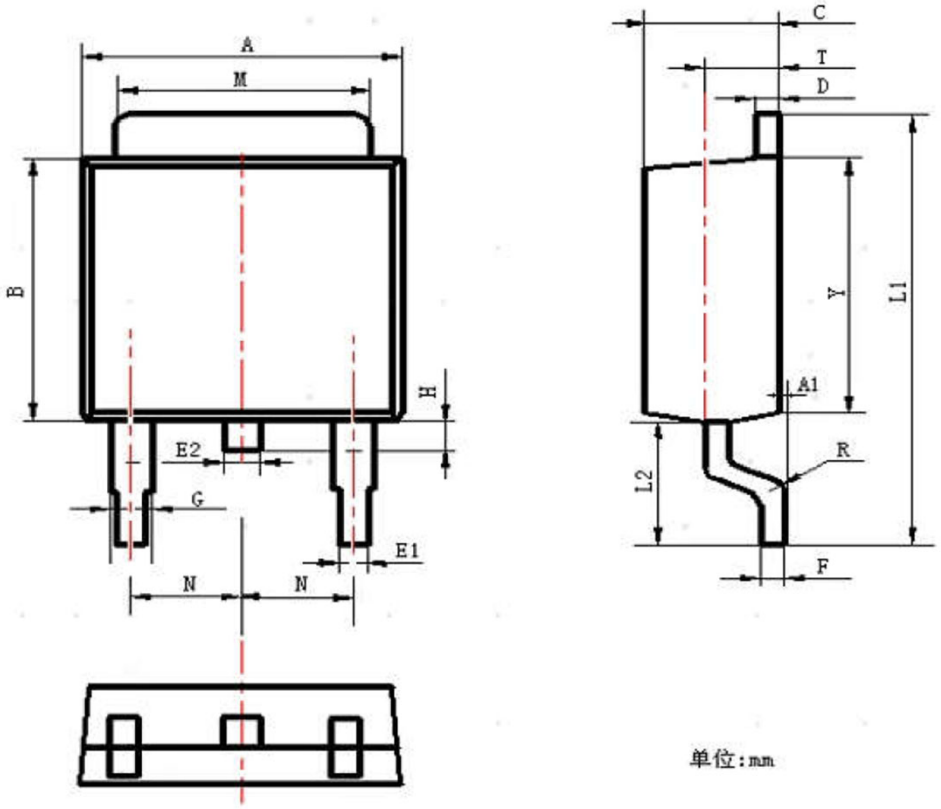



Figure 23. Diode Recovery Waveform



## Product Dimension (TO-252)




| SYMBOL | Millimeter | |
|---|---|---|
| | Min | Max |
| A | 6.30 | 6.90 |
| A1 | 0 | 0.16 |
| B | 5.70 | 6.30 |
| C | 2.10 | 2.50 |
| D | 0.30 | 0.90 |
| E1 | 0.60 | 0.90 |
| F | 0.30 | 0.60 |
| G | 0.70 | 1.20 |
| L1 | 9.30 | 10.50 |
| L2 | 2.50 | 3.10 |
| H | 0.40 | 1.05 |
| M | 4.90 | 5.60 |
| N | 2.09 | 2.49 |

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