

## MOSFET Silicon N-Channel MOS



### 1. Applications

Single-ended flyback.  
PD Adaptor, LCD & PDP TV and LED lighting.

### 2. Features

Low drain-source on-resistance:  $R_{DS(ON)} = 0.870\Omega$  (typ.)  
Easy to control Gate switching  
Enhancement mode:  $V_{th} = 2.8$  to  $4.2$  V



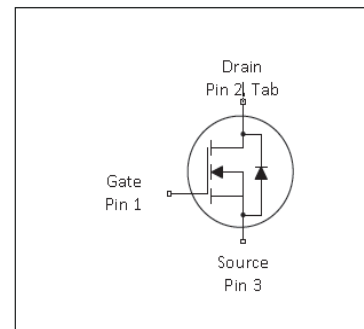
**Table 1 Key Performance Parameters**

| Parameter            | Value | Unit       |
|----------------------|-------|------------|
| $V_{DS} @ T_{j,max}$ | 750   | V          |
| $R_{DS(on),max}$     | 950   | m $\Omega$ |
| $Q_{g,typ}$          | 10.3  | nC         |
| $I_{D,pulse}$        | 18    | A          |

### 3. Packaging and Internal Circuit

| Part Name  | Package   | Marking    |
|------------|-----------|------------|
| ASA70R950E | TO220F    | ASA70R950E |
| ASD70R950E | TO252     | ASD70R950E |
| ASE70R950E | SOT223-2L | ASE70R950E |

| TO220F | SOT223 | TO252 |
|--------|--------|-------|
|        |        |       |



**1 Maximum ratings**  
at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

**Table 2 Maximum ratings**

| Parameter  | Symbol        | Values |      |      | Unit             | Note / Test Condition  |
|--|---------------|--------|------|------|------------------|--|
|  |               | Min.   | Typ. | Max. |                  |  |
| Continuous drain current <sup>1)</sup>                       | $I_D$         |        | -    | 6    | A                | $T_C=25^\circ\text{C}$   |
| Pulsed drain current <sup>2)</sup>                           | $I_{D,pulse}$ | -      | -    | 18   | A                | $T_C=25^\circ\text{C}$   |
| Avalanche energy, single pulse                               | $E_{AS}$      | -      | -    | 180  | mJ               | $T_C=25^\circ\text{C}, V_{DD}=50\text{V}, L=10\text{mH}, R_G=25\Omega$                 |
| Avalanche current, single pulse                              | $I_{AS}$      | -      | -    | 6    | A                | $T_C=25^\circ\text{C}, V_{DD}=50\text{V}, L=10\text{mH}, R_G=25\Omega$                 |
| MOSFET dv/dt ruggedness                                      | dv/dt         | -      | -    | 36   | V/ns             | $V_{DS}=0\dots400\text{V}$   |
| Gate source voltage (static)                                 | $V_{GS}$      | -20    | -    | 20   | V                | static;  |
| Gate source voltage (dynamic)                                | $V_{GS}$      | -30    | -    | 30   | V                | AC ( $f>1\text{ Hz}$ )   |
| Power dissipation (TO220F)                                   | $P_{tot}$     | -      | -    | 26   | W                | $T_C=25^\circ\text{C}$   |
| Power dissipation (TO252/SOT223)                             | $P_{tot}$     | -      | -    | 37   | W                | $T_C=25^\circ\text{C}$   |
| Storage temperature  | $T_{stg}$     | -55    | -    | 150  | $^\circ\text{C}$ |  |
| Operating junction temperature                               | $T_j$         | -55    | -    | 150  | $^\circ\text{C}$ |  |
| Soldering Temperature<br>Distance of 1.6mm from case for 10s | $T_L$         |        |      | 260  | $^\circ\text{C}$ |  |
| Continuous diode forward current                             | $I_S$         | -      | -    | 6    | A                | $T_C=25^\circ\text{C}$   |
| Reverse diode dv/dt <sup>3)</sup>                            | dv/dt         | -      | -    | 15   | V/ns             | $V_{DS}=0\dots400\text{V}, I_{SD}\leq 48\text{A}, T_j=25^\circ\text{C}$<br>see table 8 |

<sup>1)</sup> Limited by  $T_{j,max}$ . Maximum Duty Cycle  $D = 0.50$

<sup>2)</sup> Pulse width  $t_p$  limited by  $T_{j,max}$

<sup>3)</sup> Identical low side and high side switch with identical  $R_G$

## 2 Thermal characteristics

**Table 3 Thermal characteristics (T0220 FullPAK)**

| Parameter                    |           | Symbol     | Values |      |      | Unit | Note / Test Condition            |
|------------------------------|-----------|------------|--------|------|------|------|----------------------------------|
|                              |           |            | Min.   | Typ. | Max. |      |                                  |
| Thermal resistance, junction | - case    | $R_{thJC}$ | -      | -    | 4.9  | °C/W | -                                |
| Thermal resistance, junction | - ambient | $R_{thJA}$ | -      | -    | 80   | °C/W | device on PCB, minimal footprint |

**Thermal characteristics (T0252/SOT223)**

| Parameter                    |           | Symbol     | Values |      |      | Unit | Note / Test Condition            |
|------------------------------|-----------|------------|--------|------|------|------|----------------------------------|
|                              |           |            | Min.   | Typ. | Max. |      |                                  |
| Thermal resistance, junction | - case    | $R_{thJC}$ | -      | -    | 3.41 | °C/W | -                                |
| Thermal resistance, junction | - ambient | $R_{thJA}$ | -      | -    | 62   | °C/W | device on PCB, minimal footprint |

### 3 Electrical characteristics

at  $T_j=25^{\circ}\text{C}$ , unless otherwise specified

**Table 4 Static characteristics**

| Parameter                        | Symbol        | Values |      |      | Unit     | Note / Test Condition                            |
|----------------------------------|---------------|--------|------|------|----------|--|
|                                  |               | Min.   | Typ. | Max. |          |  |
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | 705    | -    | -    | V        | $V_{GS}=0V, I_D=250\mu A$                        |
| Gate threshold voltage           | $V_{(GS)th}$  | 2.8    |      | 4.2  | V        | $V_{DS}=V_{GS}, I_D=250\mu A$                    |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | -    | 1    | $\mu A$  | $V_{DS}=700V, V_{GS}=0V, T_j=25^{\circ}\text{C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | -    | 100  | nA       | $V_{GS}=30V, V_{DS}=0V$                          |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 0.87 | 0.95 | $\Omega$ | $V_{GS}=10V, I_D=2A, T_j=25^{\circ}\text{C}$     |
| Gate resistance (Intrinsic)      | $R_G$         | -      | 32   | -    |          | $f=1\text{MHz}$ , open drain                     |

**Table 5 Dynamic characteristics**

| Parameter                    | Symbol       | Values |      |      | Unit | Note / Test Condition  |
|------------------------------|--------------|--------|------|------|------|--|
|                              |              | Min.   | Typ. | Max. |      |  |
| Input capacitance            | $C_{iss}$    | -      | 377  | -    | pF   | $V_{GS}=0V, V_{DS}=50V, f=10\text{kHz}$                          |
| Output capacitance           | $C_{oss}$    | -      | 33   | -    | pF   | $V_{GS}=0V, V_{DS}=50V, f=10\text{kHz}$                          |
| Reverse transfer capacitance | $C_{rss}$    | -      | 4.55 | -    | pF   | $V_{GS}=0V, V_{DS}=50V, f=10\text{kHz}$                          |
| Turn-on delay time           | $t_{d(on)}$  | -      | 8.4  | -    | ns   | $V_{DD}=400V, V_{GS}=13V, I_D=2.5A, R_G=6.8\Omega$ ; see table 9 |
| Rise time                    | $t_r$        | -      | 21.6 | -    | ns   | $V_{DD}=400V, V_{GS}=13V, I_D=2.5A, R_G=6.8\Omega$ ; see table 9 |
| Turn-off delay time          | $t_{d(off)}$ | -      | 45.2 | -    | ns   | $V_{DD}=400V, V_{GS}=13V, I_D=2.5A, R_G=6.8\Omega$ ; see table 9 |
| Fall time                    | $t_f$        | -      | 24.4 | -    | ns   | $V_{DD}=400V, V_{GS}=13V, I_D=2.5A, R_G=6.8\Omega$ ; see table 9 |

**Table 6 Gate charge characteristics**

| Parameter             | Symbol        | Values |       |      | Unit | Note / Test Condition                    |
|-----------------------|---------------|--------|-------|------|------|--|
|                       |               | Min.   | Typ.  | Max. |      |  |
| Gate to source charge | $Q_{gs}$      | -      | 1.845 | -    | nC   | $V_{DD}=400V, I_D=2.5A, V_{GS}=0$ to 10V |
| Gate to drain charge  | $Q_{gd}$      | -      | 2.723 | -    | nC   | $V_{DD}=400V, I_D=2.5A, V_{GS}=0$ to 10V |
| Gate charge total     | $Q_g$         | -      | 10.3  | -    | nC   | $V_{DD}=400V, I_D=2.5A, V_{GS}=0$ to 10V |
| Gate plateau voltage  | $V_{plateau}$ | -      | 6.4   | -    | V    | $V_{DD}=400V, I_D=2.5A, V_{GS}=0$ to 10V |

**Table 7 Reverse diode characteristics**

| Parameter                     | Symbol    | Values |      |      | Unit    | Note / Test Condition                                      |
|-------------------------------|-----------|--------|------|------|---------|--|
|                               |           | Min.   | Typ. | Max. |         |  |
| Diode forward voltage         | $V_{SD}$  | -      | 0.77 | -    | V       | $V_{GS}=0V, I_F=1A, T_J=25^{\circ}C$                       |
| Reverse recovery time         | $t_{rr}$  | -      | 124  | -    | ns      | $V_R=400V, I_F=2.5 A, di_F/dt=100A/\mu s$ ;<br>see table 8 |
| Reverse recovery charge       | $Q_{rr}$  | -      | 0.88 | -    | $\mu C$ | $V_R=400V, I_F=2.5 A, di_F/dt=100A/\mu s$ ;<br>see table 8 |
| Peak reverse recovery current | $I_{rrm}$ | -      | 10   | -    | A       | $V_R=400V, I_F=2.5 A, di_F/dt=100A/\mu s$ ;<br>see table 8 |

## 4 Electrical characteristics diagram

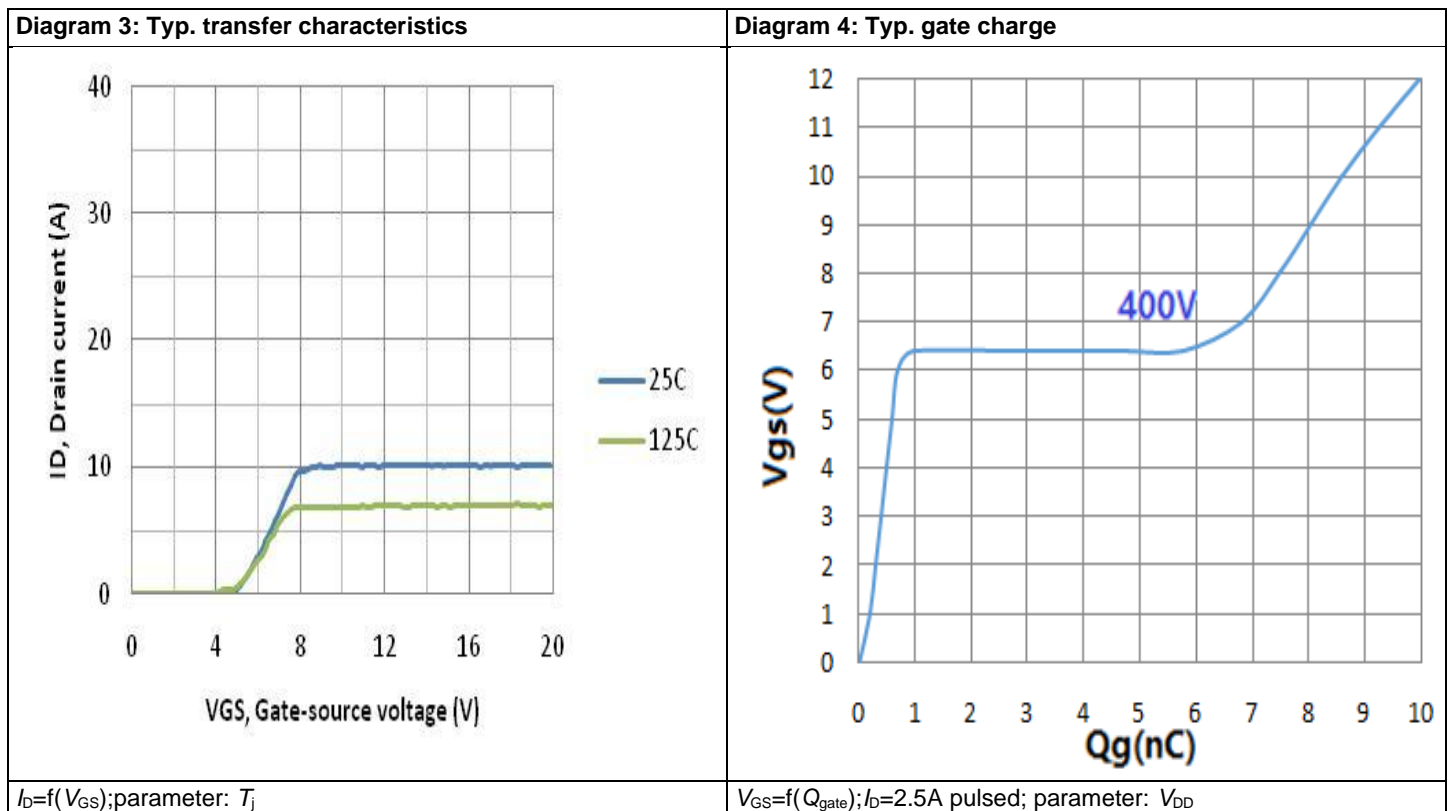
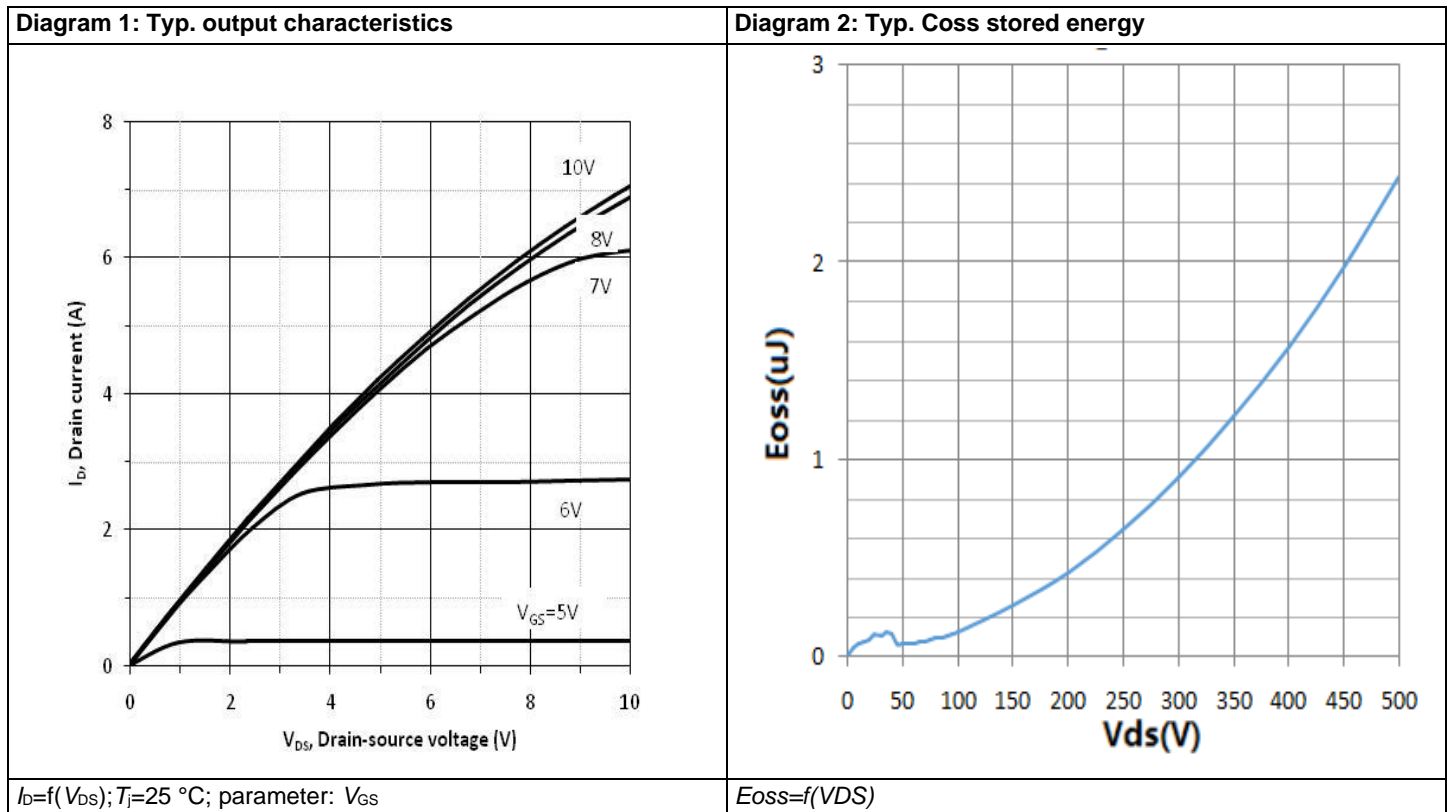
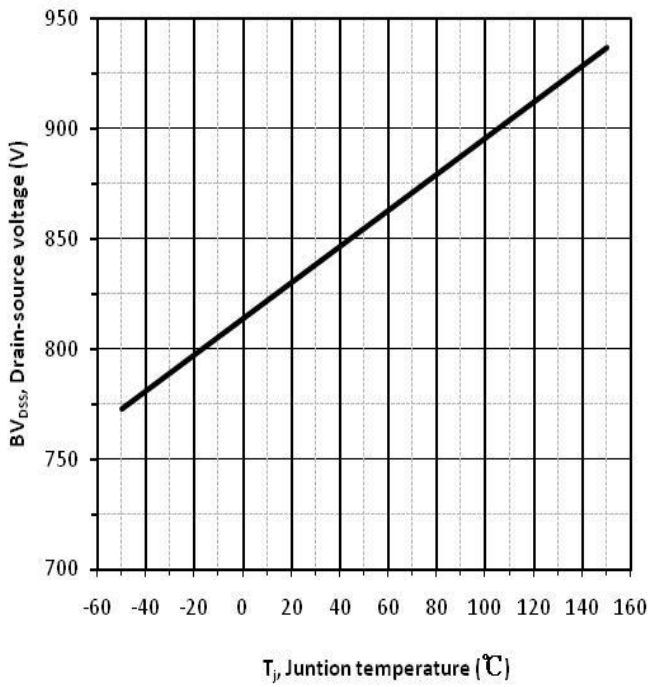
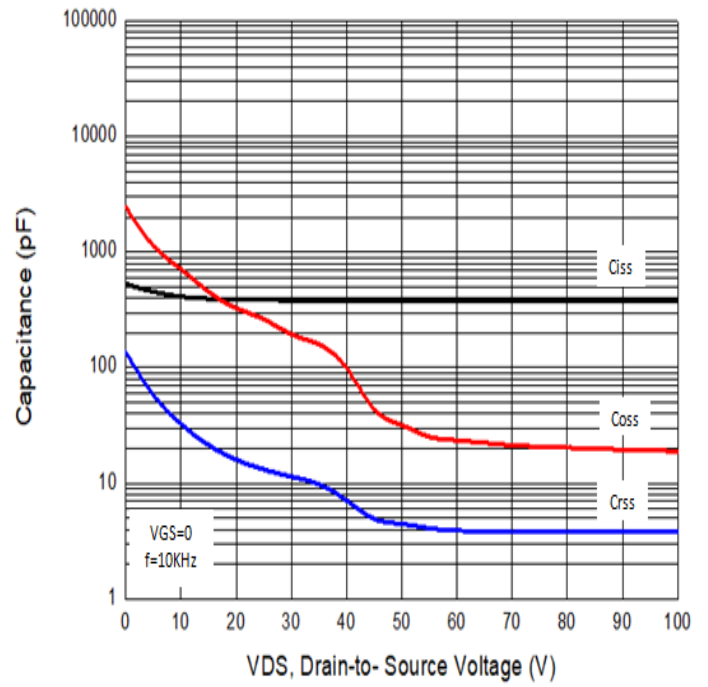


Diagram 5: Drain-source breakdown voltage



$V_{BR(DSS)} = f(T_j); I_D = 10\text{mA}$

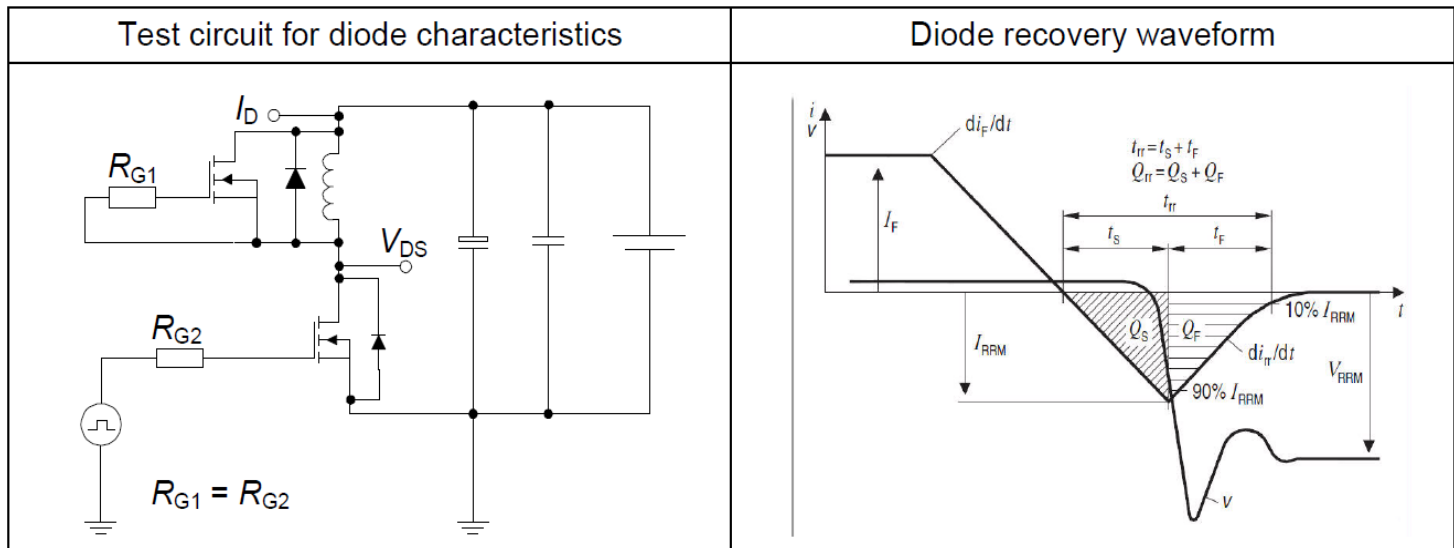
Diagram 6: Typ. capacitances



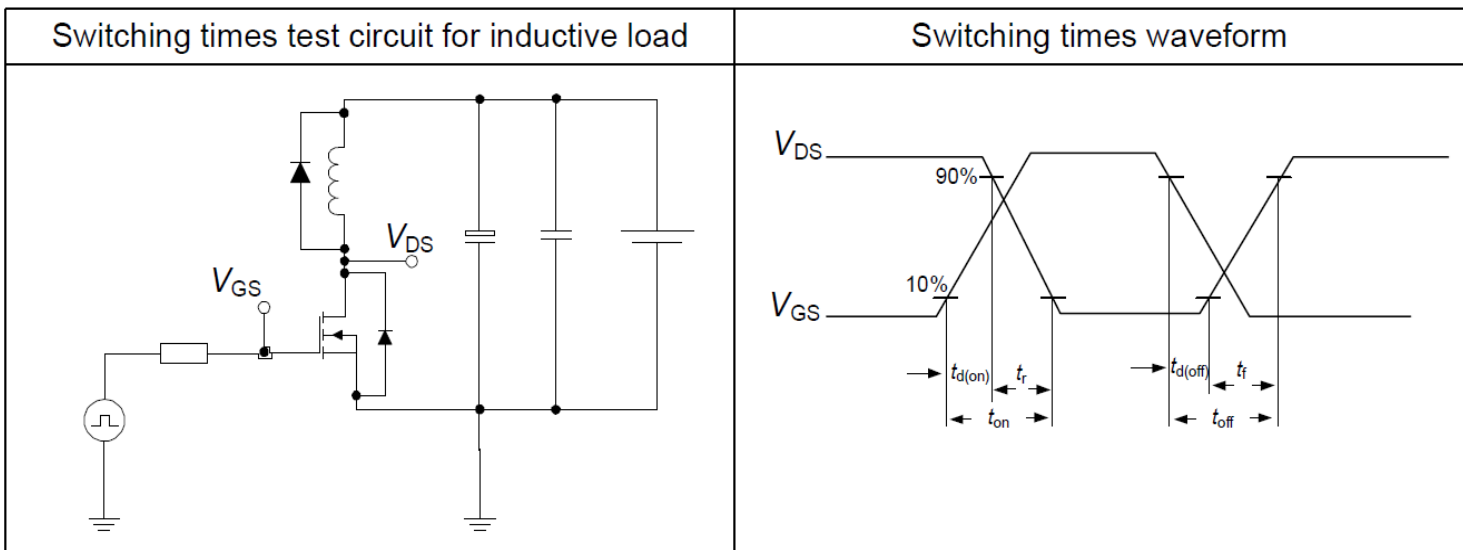
$C = f(V_{DS}); V_{GS} = 0\text{V}; f = 10\text{ kHz}$

## 5 Test Circuits

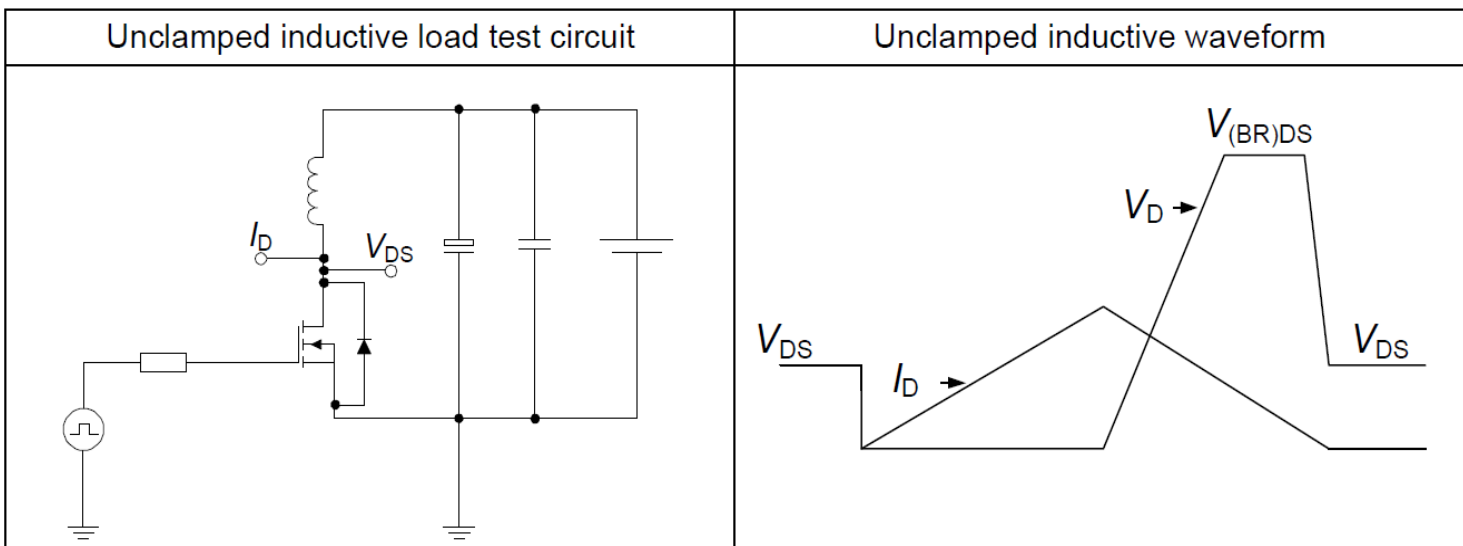
**Table 8 Diode characteristics**



**Table 9 Switching times**

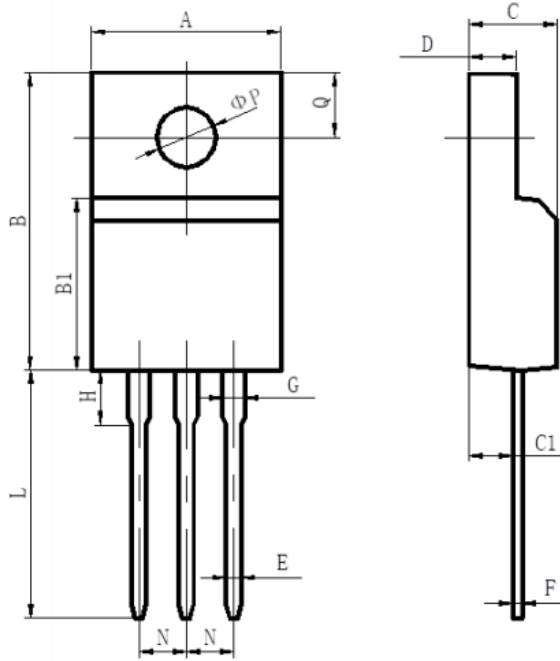


**Table10 Unclamped inductive load**



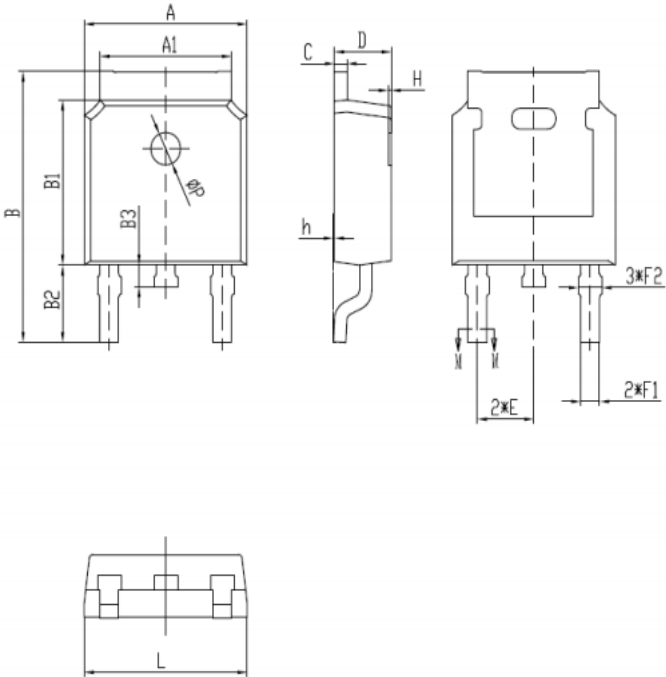


## 6 Package Outlines



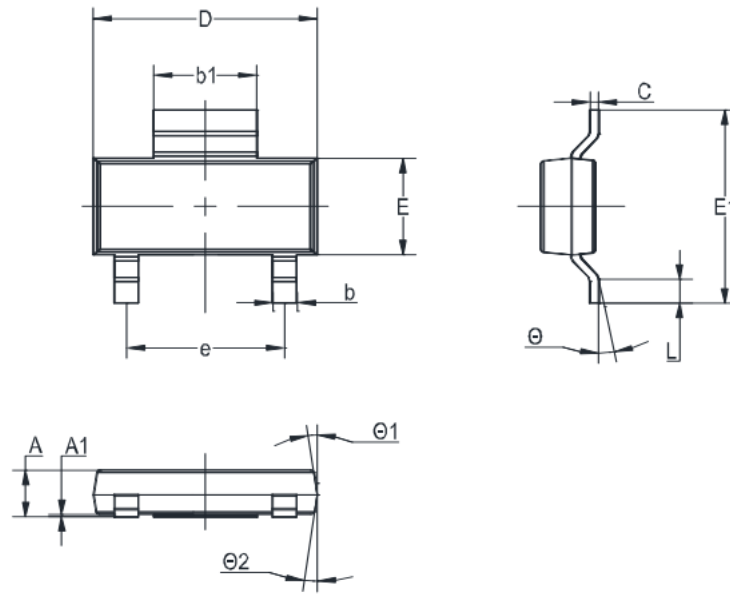
| 项目       | 规范(mm) |       |
|----------|--------|-------|
|          | MIN    | MAX   |
| A        | 9.70   | 10.30 |
| B        | 15.50  | 16.10 |
| B1       | 8.99   | 9.39  |
| C        | 4.40   | 4.80  |
| C1       | 2.15   | 2.55  |
| D        | 2.50   | 2.90  |
| E        | 0.70   | 0.90  |
| F        | 0.40   | 0.60  |
| G        | 1.12   | 1.42  |
| H        | 3.40   | 3.80  |
| L        | 12.6   | 13.6  |
| N        | 2.34   | 2.74  |
| Q        | 3.15   | 3.55  |
| $\phi P$ | 3.00   | 3.30  |

Figure1: Outline PG-T0220F(HT)



| 项目       | 规范(mm) |       |
|----------|--------|-------|
|          | MIN    | MAX   |
| A        | 6.50   | 6.70  |
| A1       | 5.16   | 5.46  |
| B        | 9.77   | 10.17 |
| B1       | 6.00   | 6.20  |
| B2       | 2.60   | 3.00  |
| B3       | 0.70   | 0.90  |
| C        | 0.45   | 0.61  |
| D        | 2.20   | 2.40  |
| E        | 2.186  | 2.386 |
| F1       | 0.67   | 0.87  |
| F2       | 0.76   | 0.96  |
| H        | 0.00   | 0.30  |
| h        | 0.00   | 0.127 |
| L        | 6.50   | 6.70  |
| $\phi P$ | 1.10   | 1.30  |

Figure2: Outline PG-T0252(HT)



| Unit | A   | A1  | b   | b1  | C    | D   | E   | E1  | e   | L   | Θ   | Θ1 | Θ2 |
|------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|----|----|
| mm   | 1.8 | 0.1 | 0.8 | 3.1 | 0.32 | 6.7 | 3.7 | 7.3 | 4.6 | 1.1 | 10° | 7° | 7° |
|      | 1.5 | MAX | 0.6 | 2.9 | 0.22 | 6.3 | 3.3 | 6.7 | TYP | 0.7 | 0°  | 0° | 0° |

Figure3: Outline PG-SOT223-2L(HC)

## Revision History

| Revision | Date       | Subjects (major changes since last revision)                                      |
|----------|------------|---|
| 1.0      | 2019-07-15 | Preliminary version   |
| 1.1      | 2020-03-27 | Fine tune outline and add Crss test data etc.Add Electrical characteristics Curve |
| 1.2      | 2020-04-18 | Add avalanche energy test condition, avalanche current data and test condition    |
| 1.3      | 2022-06-14 | Updated TO220F &TO252 POD for HT  |
| 1.4      | 2022-11-15 | Added SOT223-2L package   |

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