## Features

- Super Low Gate Charge
- Green Device Available
- Excellent Cdv/dt effect decline
- Advanced high cell density Trench technology

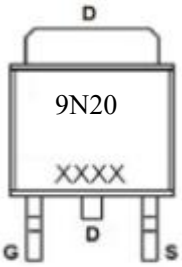
| Bvdss | Rdson | ID |
|---|---|---|
| 200V | 225mΩ | 9A |

RoHS

## Application

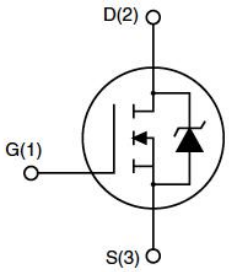
- DC Motor Control and Class D Amplifier
- Uninterruptible Power Supply (UPS)
- Automotive

## Package




Marking and pin assignment

TO-252 top view




Schematic diagram

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Quantity |
|---|---|---|---|
| | 9N20 | TO-252 | 2500 |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise specified)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 200 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current | $T_C$ = 25℃ | $I_D$ | 9 | A |
| Pulsed Drain Current | | $I_{DM}$note1 | 38 | A |
| Power Dissipation | | $P_D$ | 30 | W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | ℃ |
| Maximum Temperature for Soldering | | $T_L$ | 260 | ℃ |

## Thermal Resistance Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance Junction-Ambient | $R_{\theta JA}$ | 4.17 | ℃/W |

## Ordering Information

| Ordering Number | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|
| Halogen Free | | G | D | S | |
| HL9N20 | TO-252 | 1 | 2 | 3 | Tape Reel |

## Electrical Characteristics ($T_A$=25℃unless otherwise specified )

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V , $I_D$=250uA | 200 | --- | --- | V |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V , $I_D$=2A | --- | 225 | 280 | mΩ |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1 | 2 | 3 | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=200V, $V_{GS}$=0V | --- | --- | 1 | uA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| Gate Resistance | $R_g$ | $V_{DS}$=Open, $V_{GS}$=0V | --- | 1.35 | --- | Ω |
| Total Gate Charge | $Q_g$ | $V_{GS}$=10, $V_{DS}$=100V, $I_D$=2A | --- | 22.8 | --- | nC |
| Gate-Source Charge | $Q_{gs}$ | | --- | 3.5 | --- | |
| Gate-Drain Charge | $Q_{gd}$ | | --- | 5.8 | --- | |
| Turn-On Delay Time | $T_{d(on)}$ | $V_{GS}$=10V, $V_{DS}$=100V, $I_D$=2A, $R_G$=4Ω | --- | 12 | --- | ns |
| Rise Time | $T_r$ | | --- | 14 | --- | |
| Turn-Off Delay Time | $T_{d(off)}$ | | --- | 34 | --- | |
| Fall Time | $T_f$ | | --- | 16 | --- | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=100V , $V_{GS}$=0V , f=1MHz | --- | 922 | --- | pF |
| Output Capacitance | $C_{oss}$ | | --- | 23.2 | --- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | --- | 27 | --- | |

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Maximum Continuous Drain to Source Diode Forward Current | $I_S$ | Tc=25℃ | - | - | 9 | A |
| Drain to Source Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=2A | - | - | 1.2 | V |
| Reverse Recovery time | $t_{rr}$ | $I_S$=2A, $V_{DD}$=100V dI/dt=100A/μs | - | 150 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 396 | - | nC |

Notes:

1.Repetitive rating; pulse width limited by maximum junction temperature

## Characteristics Curve：

**Fig1: Typ. output characteristics**

$I_D=f(V_{DS})$

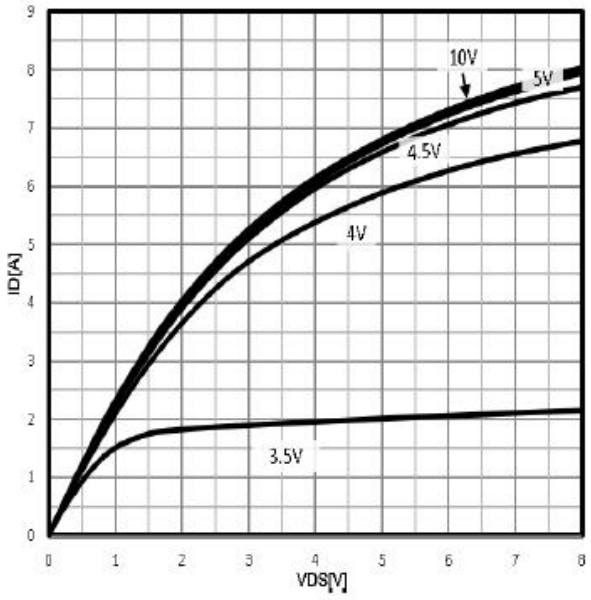



**Fig2:Power Dissipation**

$Ptot=f(T_C)$

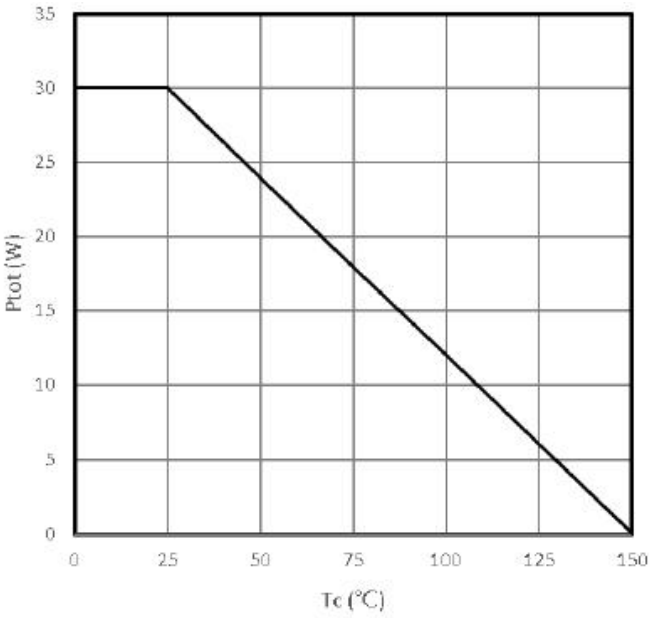



**Fig3:Typ. transfer characteristics**

$I_D=f(V_{GS})$

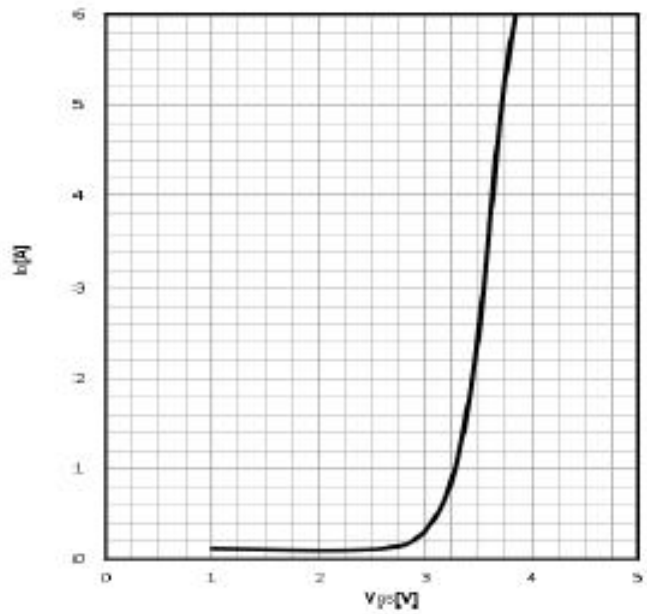



**Fig4: Drain-source on-state resistance**

$R_{DS(on)}=f(Tj);I_D=2A;\ V_{GS}=10V$

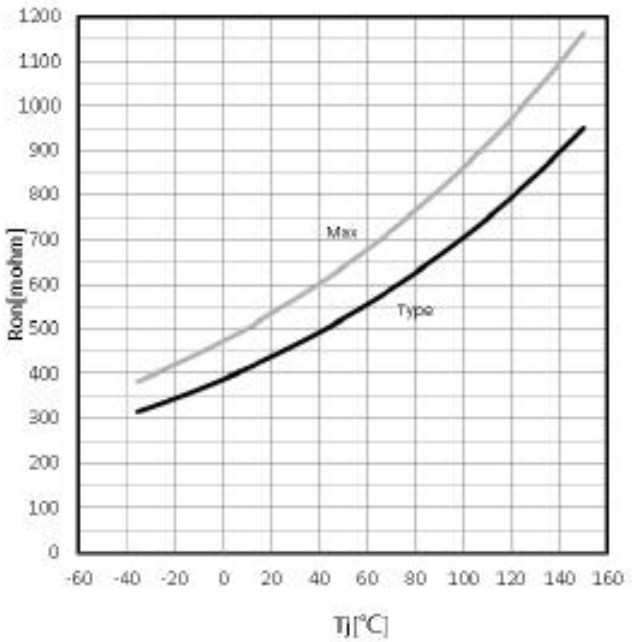


**Fig5:Gate Threshold Voltage**

$V_{TH}$=f(Tj); $I_D$=250uA

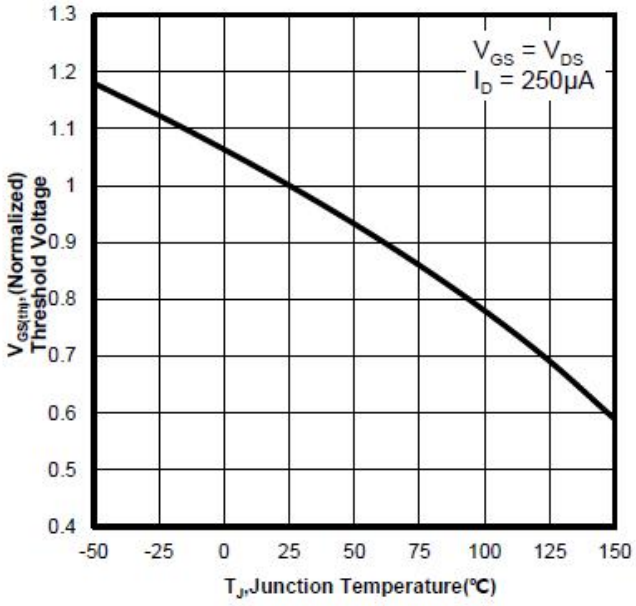



**Fig6:Drain-source breakdown voltage**

$V_{BR(DSS)}$=f(Tj); $I_D$=250uA

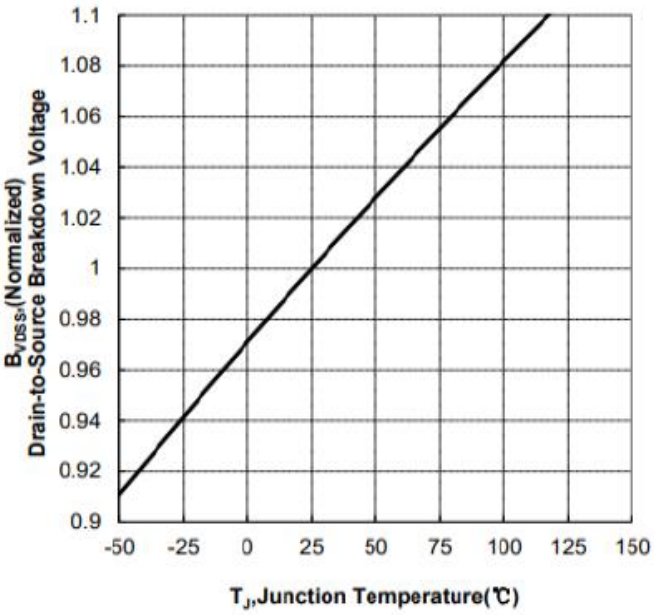



**Fig7:Typ. Gate charge**

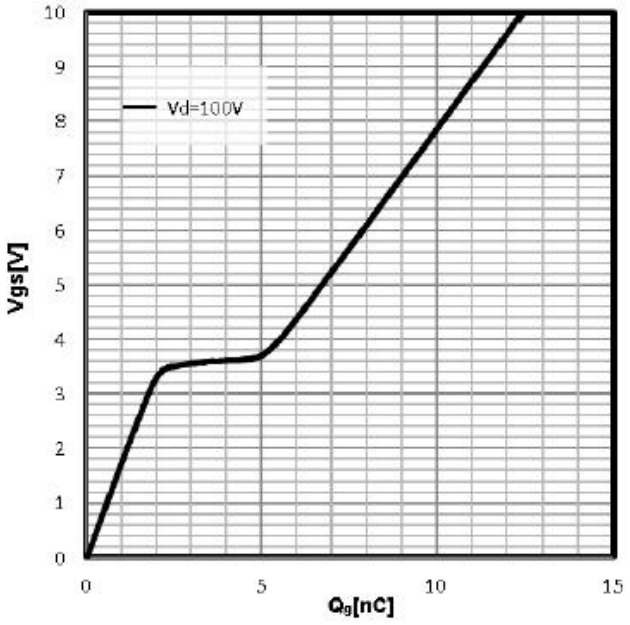



**Fig8: Maximum Drain Current**

$I_D$=f($T_C$)

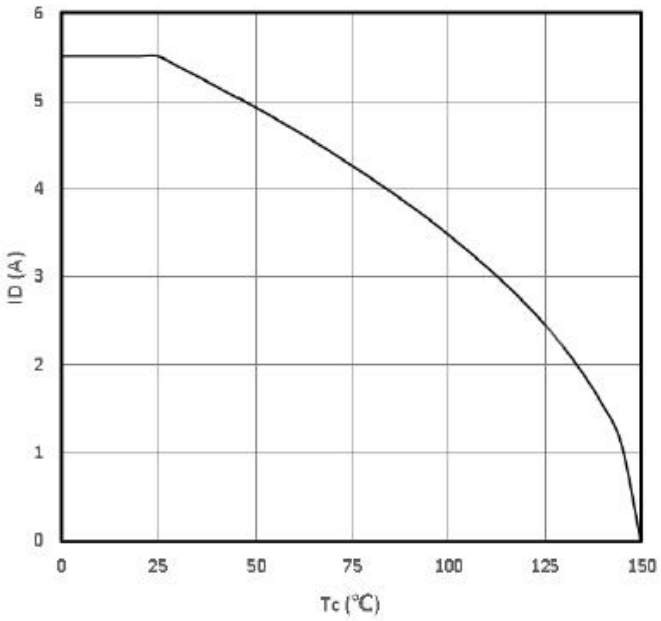


**Fig9:Safe operating area**

$I_D=f(V_{DS})$

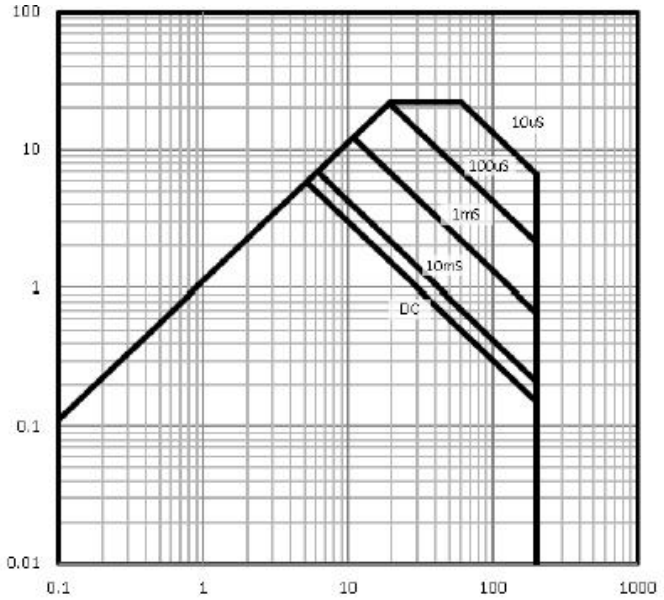



**Fig10: Body Diode Forward Voltage Variation**

$IF=f(V_{GS})$

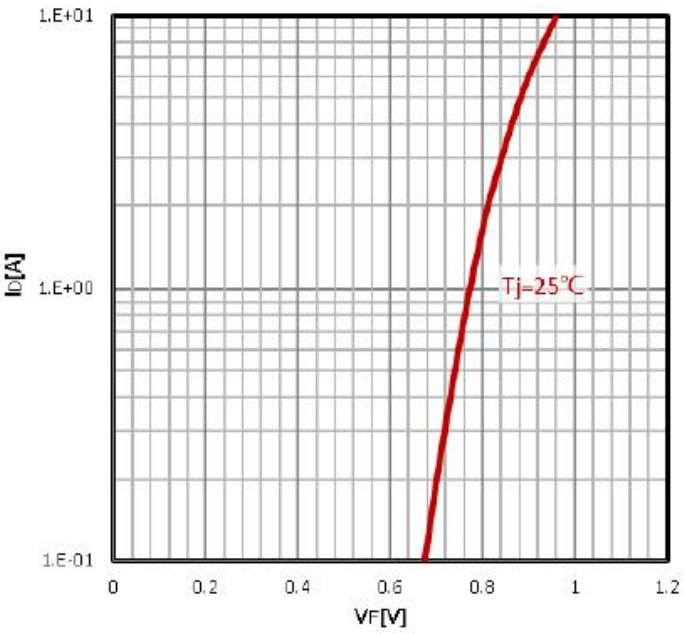
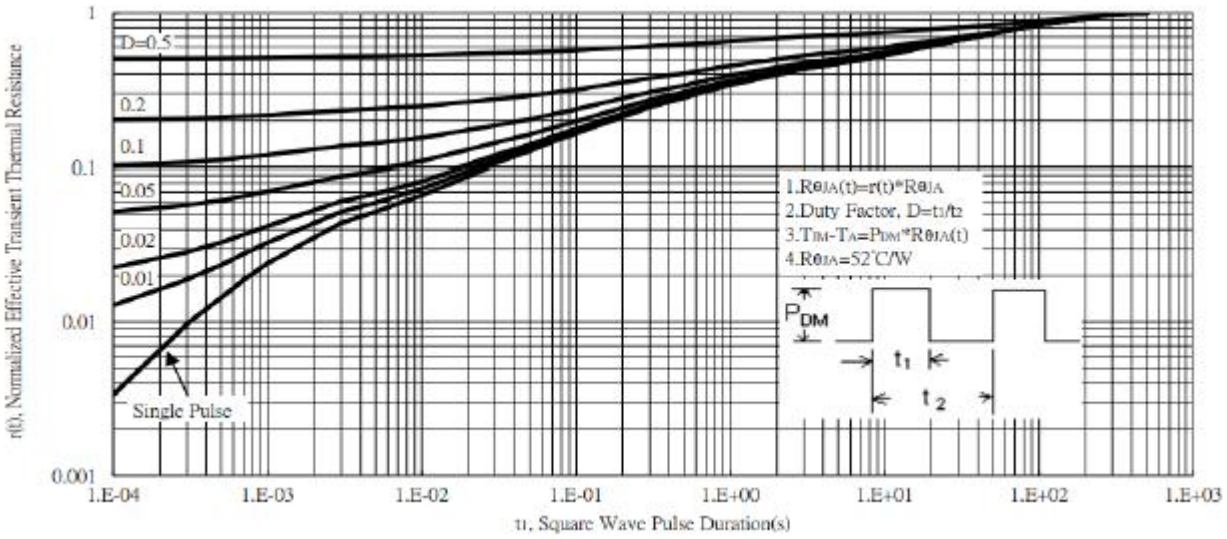
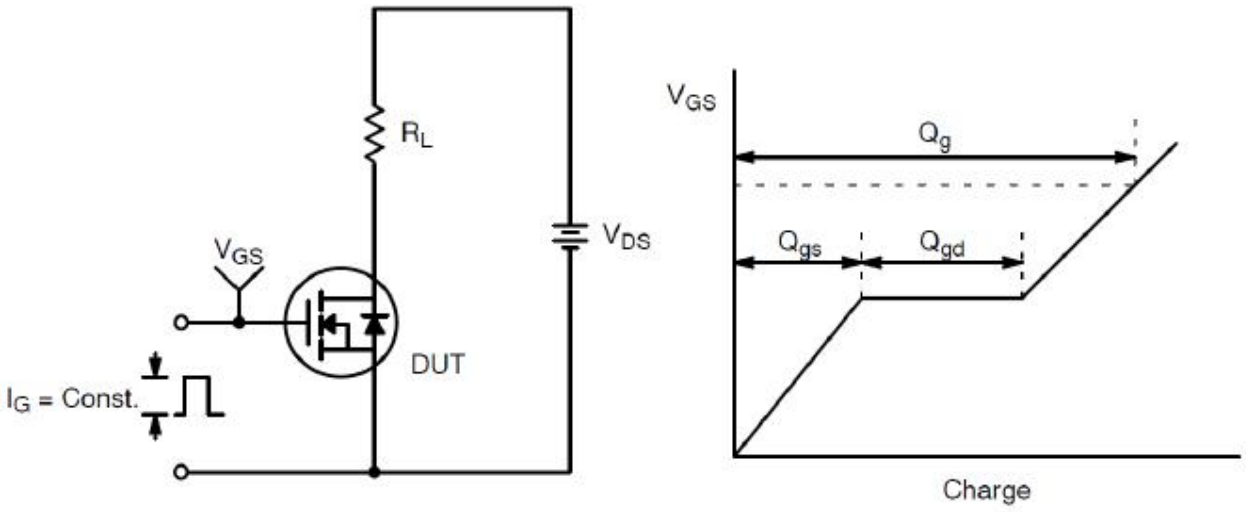



**Fig11:Max. transient thermal impedance**

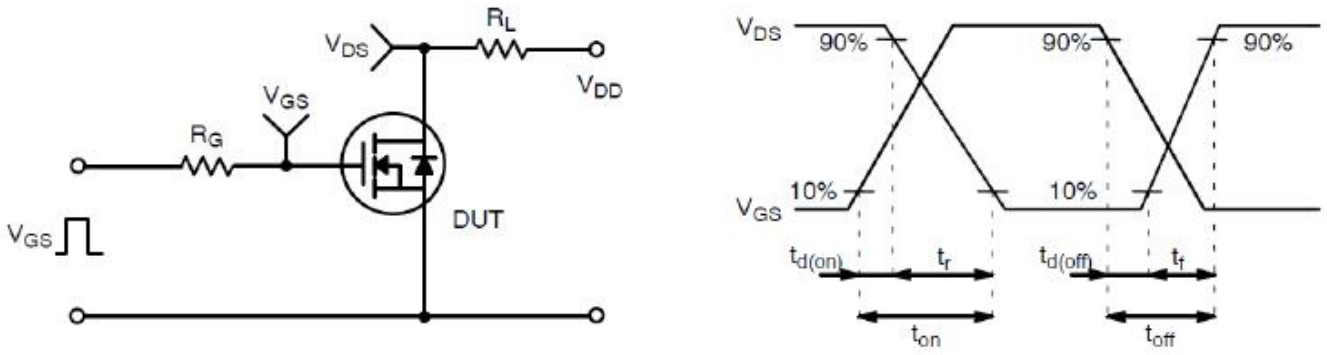
$Z_{thJC}=f(t_p)$



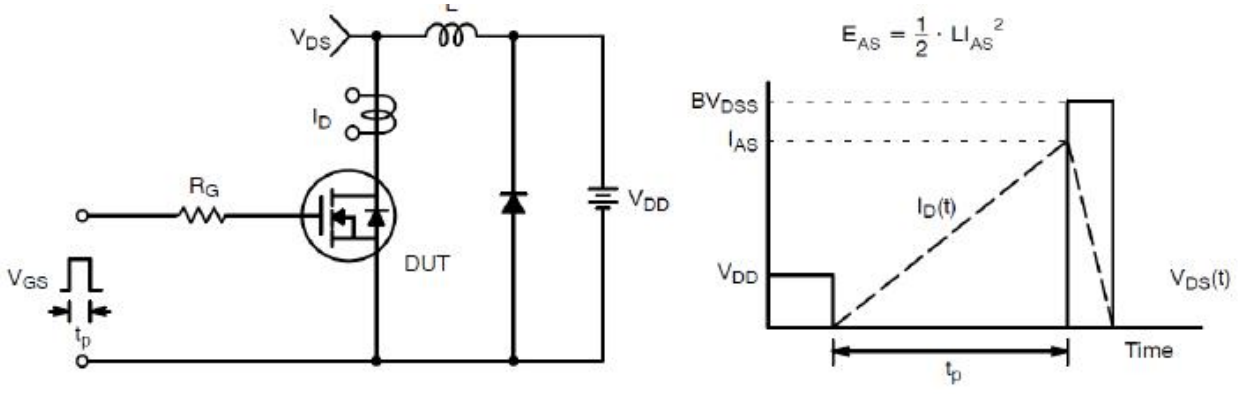
## Test Circuit and Waveform:




**Gate Charge Test Circuit & Waveform**



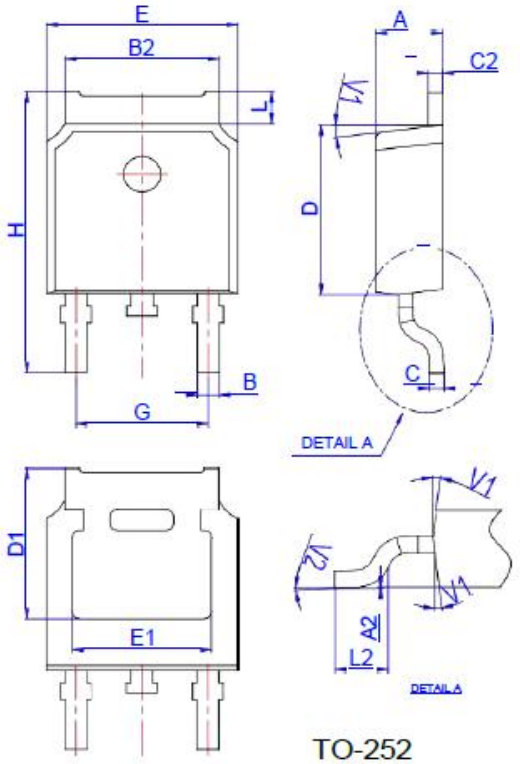

**Resistive Switching Test Circuit & Waveforms**




**Unclamped Inductive Switching Test Circuit & Waveforms**

## Package Dimensions TO-252

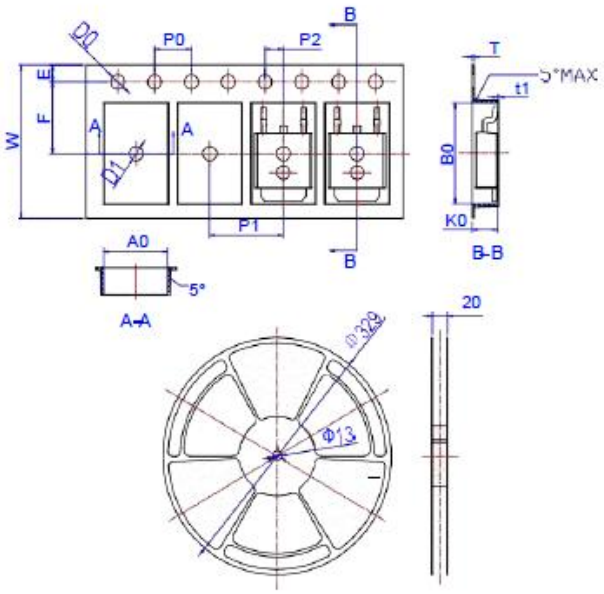
### Package Mechanical Data TO 252




TO-252

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.10 | | 2.50 | 0.083 | | 0.098 |
| A2 | 0 | | 0.10 | 0 | | 0.004 |
| B | 0.66 | | 0.86 | 0.026 | | 0.034 |
| B2 | 5.18 | | 5.48 | 0.202 | | 0.216 |
| C | 0.40 | | 0.60 | 0.016 | | 0.024 |
| C2 | 0.44 | | 0.58 | 0.017 | | 0.023 |
| D | 5.90 | | 6.30 | 0.232 | | 0.248 |
| D1 | 5.30REF | | | 0.209REF | | |
| E | 6.40 | | 6.80 | 0.252 | | 0.268 |
| E1 | 4.63 | | | 0.182 | | |
| G | 4.47 | | 4.67 | 0.176 | | 0.184 |
| H | 9.50 | | 10.70 | 0.374 | | 0.421 |
| L | 1.09 | | 1.21 | 0.043 | | 0.048 |
| L2 | 1.35 | | 1.65 | 0.053 | | 0.065 |
| V1 | | 7° | | | 7° | |
| V2 | 0° | | 6° | 0° | | 6° |

### Reel Specification-TO-252




| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| W | 15.90 | 16.00 | 16.10 | 0.626 | 0.630 | 0.634 |
| E | 1.65 | 1.75 | 1.85 | 0.065 | 0.069 | 0.073 |
| F | 7.40 | 7.50 | 7.60 | 0.291 | 0.295 | 0.299 |
| D0 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| D1 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| P0 | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| P1 | 7.90 | 8.00 | 8.10 | 0.311 | 0.315 | 0.319 |
| P2 | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| A0 | 6.85 | 6.90 | 7.00 | 0.270 | 0.271 | 0.276 |
| B0 | 10.45 | 10.50 | 10.60 | 0.411 | 0.413 | 0.417 |
| K0 | 2.68 | 2.78 | 2.88 | 0.105 | 0.109 | 0.113 |
| T | 0.24 | | 0.27 | 0.009 | | 0.011 |
| t1 | 0.10 | | | 0.004 | | |
| 10P0 | 39.80 | 40.00 | 40.20 | 1.567 | 1.575 | 1.583 |

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