

## N-Ch 100V Fast Switching MOSFETs

### Features

- Split Gate Trench MOSFET technology
- Excellent package for heat dissipation
- High density cell design for low  $R_{DS(ON)}$

### Applications

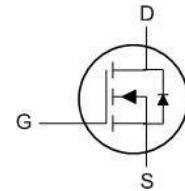
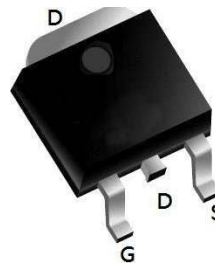
- DC-DC Converters
- Power management functions
- Synchronous-rectification applications

### Product Summary



| BVDSS | RDSON | ID  |
|-------|-------|-----|
| 100V  | 8.5mΩ | 70A |

### TO252 Pin Configuration



### Absolute Maximum Ratings:

| Symbol         | Parameter                                        |                                     | Value               | Units              |
|----------------|--------------------------------------------------|-------------------------------------|---------------------|--------------------|
| $V_{DSS}$      | Drain-to-Source Voltage                          |                                     | 100                 | V                  |
| $I_D$          | Continuous Drain Current                         | $T_C = 25\text{ }^{\circ}\text{C}$  | 70                  | A                  |
|                | Continuous Drain Current                         | $T_C = 100\text{ }^{\circ}\text{C}$ | 45                  | A                  |
| $I_{DM}^{a1}$  | Pulsed Drain Current                             |                                     | 280                 | A                  |
| $E_{AS}^{a2}$  | Single pulse avalanche energy                    |                                     | 110                 | mJ                 |
| $V_{GS}$       | Gate-to-Source Voltage                           |                                     | $\pm 20$            | V                  |
| $P_D$          | Power Dissipation                                |                                     | 100                 | W                  |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range |                                     | 150, $-55$ to $150$ | $^{\circ}\text{C}$ |
| $T_L$          | Maximum Temperature for Soldering                |                                     | 260                 | $^{\circ}\text{C}$ |

### Thermal Characteristics:

| Symbol          | Parameter                               | Value | Units                |
|-----------------|-----------------------------------------|-------|----------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | 1.25  | $^{\circ}\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 64    | $^{\circ}\text{C/W}$ |

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**Electrical Characteristics** (TA= 25°C unless otherwise specified) :

| Static Characteristics |                                   |                                                          |       |      |      |       |
|------------------------|-----------------------------------|----------------------------------------------------------|-------|------|------|-------|
| Symbol                 | Parameter                         | Test Conditions                                          | Value |      |      | Units |
|                        |                                   |                                                          | Min.  | Typ. | Max. |       |
| V <sub>DSS</sub>       | Drain to Source Breakdown Voltage | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA               | 100   | --   | --   | V     |
| I <sub>DSS</sub>       | Drain to Source Leakage Current   | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V               | --    | --   | 1    | μA    |
| I <sub>GSS(F)</sub>    | Gate to Source Forward Leakage    | V <sub>GS</sub> =+20V, V <sub>DS</sub> =0V               | --    | --   | 100  | nA    |
| I <sub>GSS(R)</sub>    | Gate to Source Reverse Leakage    | V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V               | --    | --   | -100 | nA    |
| V <sub>GS(TH)</sub>    | Gate Threshold Voltage            | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA | 1.3   | 1.8  | 2.3  | V     |
| R <sub>DS(ON)</sub>    | Drain-to-Source On-Resistance     | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                | --    | 8.5  | 10.5 | mΩ    |
|                        |                                   | V <sub>GS</sub> =4.5V, I <sub>D</sub> =15A               |       | 9.5  | 15   | mΩ    |

| Dynamic Characteristics |                              |                                                             |       |      |      |       |
|-------------------------|------------------------------|-------------------------------------------------------------|-------|------|------|-------|
| Symbol                  | Parameter                    | Test Conditions                                             | Value |      |      | Units |
|                         |                              |                                                             | Min.  | Typ. | Max. |       |
| C <sub>iss</sub>        | Input Capacitance            | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 50V<br>f = 1.0MHz | --    | 1368 | --   | pF    |
| C <sub>oss</sub>        | Output Capacitance           |                                                             | --    | 451  | --   |       |
| C <sub>rss</sub>        | Reverse Transfer Capacitance |                                                             | --    | 12.9 | --   |       |
| R <sub>g</sub>          | Gate resistance              | V <sub>GS</sub> =0V, V <sub>DS</sub> Open                   | --    | 0.48 | --   | Ω     |

| Resistive Switching Characteristics |                     |                                                                                               |       |      |      |       |
|-------------------------------------|---------------------|-----------------------------------------------------------------------------------------------|-------|------|------|-------|
| Symbol                              | Parameter           | Test Conditions                                                                               | Value |      |      | Units |
|                                     |                     |                                                                                               | Min.  | Typ. | Max. |       |
| t <sub>d(ON)</sub>                  | Turn-on Delay Time  | I <sub>D</sub> = 10A<br>V <sub>DS</sub> = 50V<br>V <sub>GS</sub> = 10V<br>R <sub>G</sub> = 4Ω | --    | 16   | --   | ns    |
| t <sub>r</sub>                      | Rise Time           |                                                                                               | --    | 10   | --   |       |
| t <sub>d(OFF)</sub>                 | Turn-Off Delay Time |                                                                                               | --    | 40   | --   |       |
| t <sub>f</sub>                      | Fall Time           |                                                                                               | --    | 6    | --   |       |
| Q <sub>g</sub>                      | Total Gate Charge   | V <sub>GS</sub> = 10V<br>V <sub>DS</sub> = 50V<br>I <sub>D</sub> = 10A                        | --    | 31.3 | --   | nC    |
| Q <sub>gs</sub>                     | Gate Source Charge  |                                                                                               | --    | 3.49 | --   |       |
| Q <sub>gd</sub>                     | Gate Drain Charge   |                                                                                               | --    | 7.63 | --   |       |

| Source-Drain Diode Characteristics |                         |                                                            |       |      |      |       |
|------------------------------------|-------------------------|------------------------------------------------------------|-------|------|------|-------|
| Symbol                             | Parameter               | Test Conditions                                            | Value |      |      | Value |
|                                    |                         |                                                            | Min.  | Typ. | Max. |       |
| I <sub>S</sub>                     | Diode Forward Current   | T <sub>C</sub> = 25 °C                                     | --    | --   | 70   | A     |
| V <sub>SD</sub>                    | Diode Forward Voltage   | I <sub>S</sub> =10A, V <sub>GS</sub> =0V                   | --    | --   | 1.2  | V     |
| t <sub>rr</sub>                    | Reverse Recovery time   | I <sub>S</sub> =10A, V <sub>DD</sub> =50V<br>dI/dt=100A/μs | --    | 103  | --   | ns    |
| Q <sub>rr</sub>                    | Reverse Recovery Charge |                                                            | --    | 187  | --   | nC    |

a<sub>1</sub>: Repetitive rating; pulse width limited by maximum junction temperature

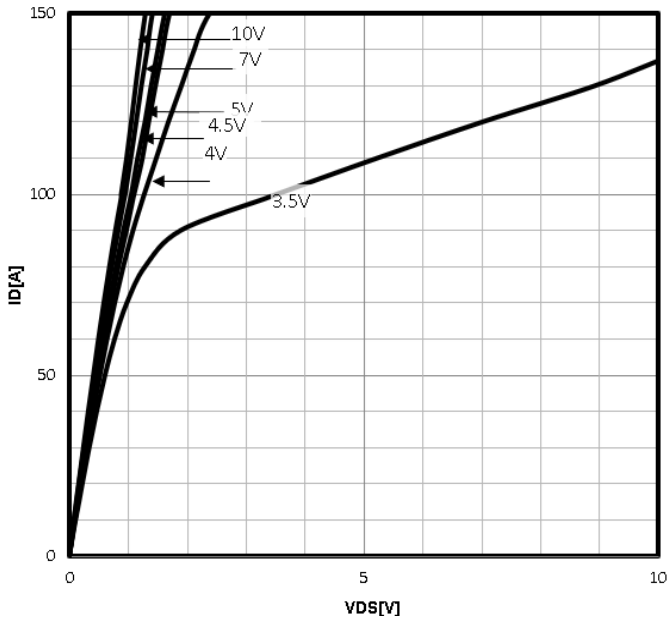
a<sub>2</sub>: VDD=50V, L=0.3mH, R<sub>g</sub>=25Ω, Starting T<sub>J</sub>=25 °C



## Characteristics Curve:

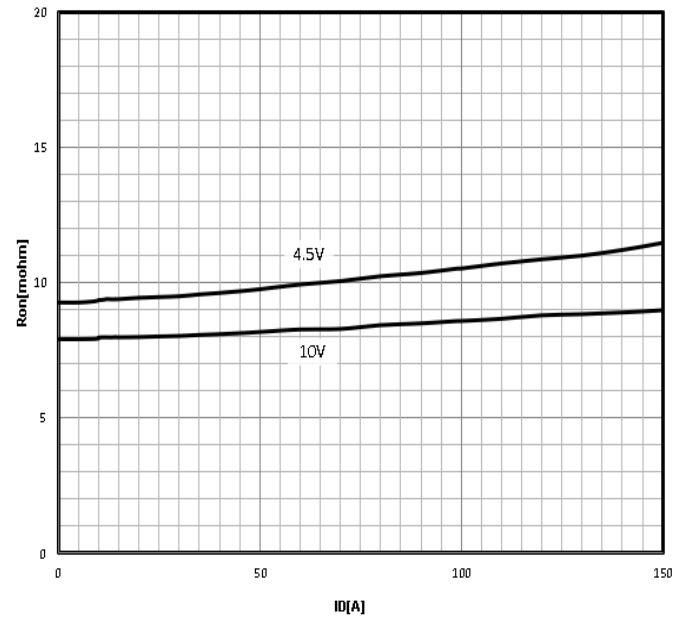
Typ. output characteristics

$$I_D = f(V_{DS})$$



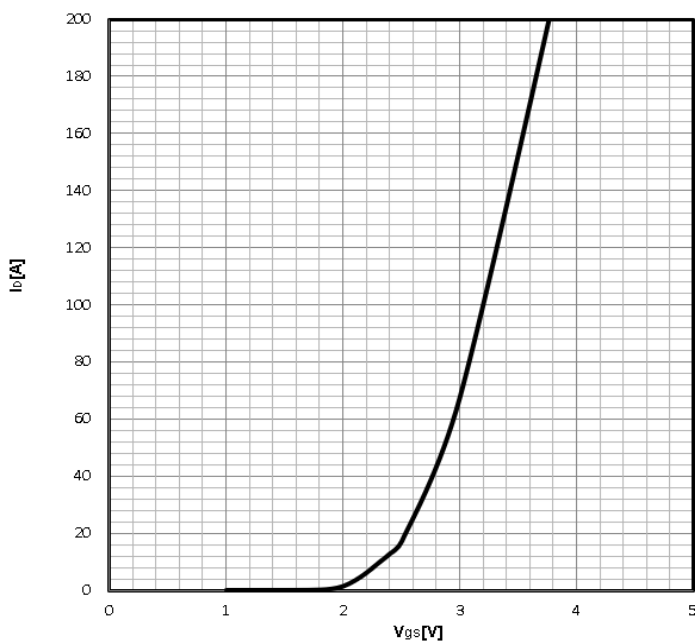
Typ. drain-source on resistance

$$R_{DS(on)} = f(I_D)$$



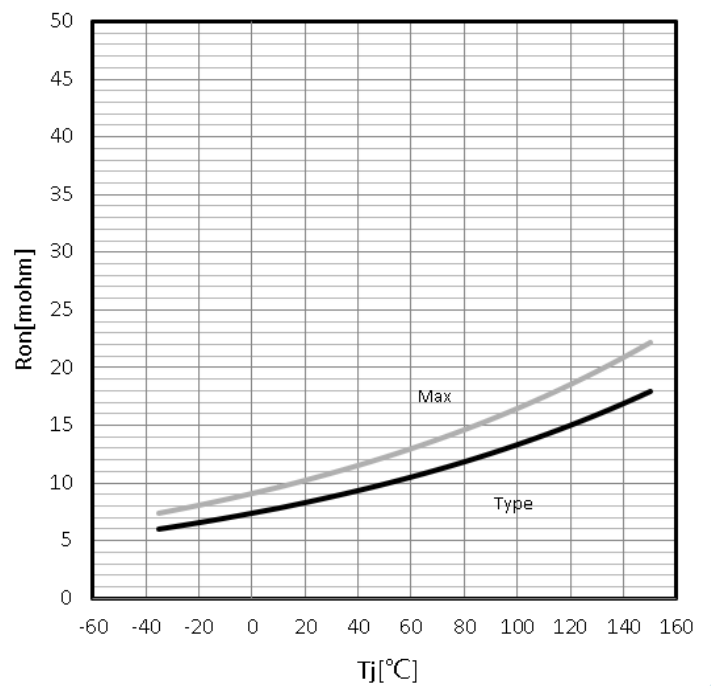
Typ. transfer characteristics

$$I_D = f(V_{GS})$$



Drain-source on-state resistance

$$R_{DS(on)} = f(T_J); I_D = 20A; V_{GS} = 10V$$

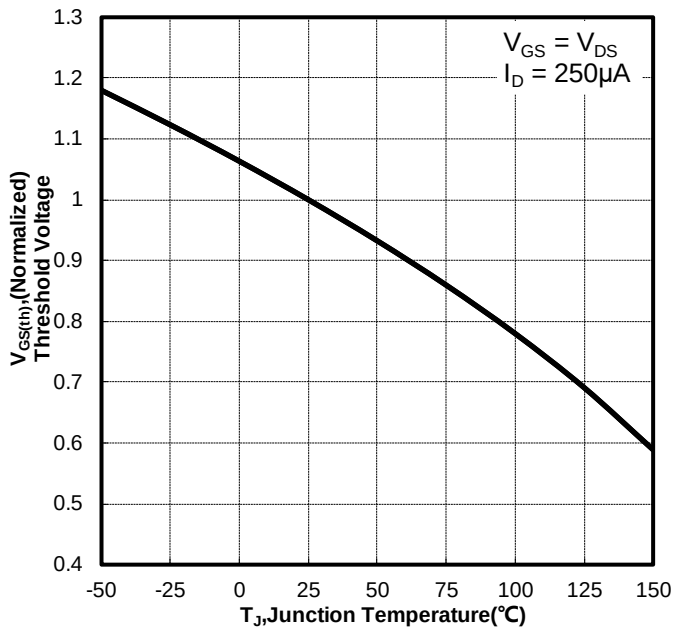




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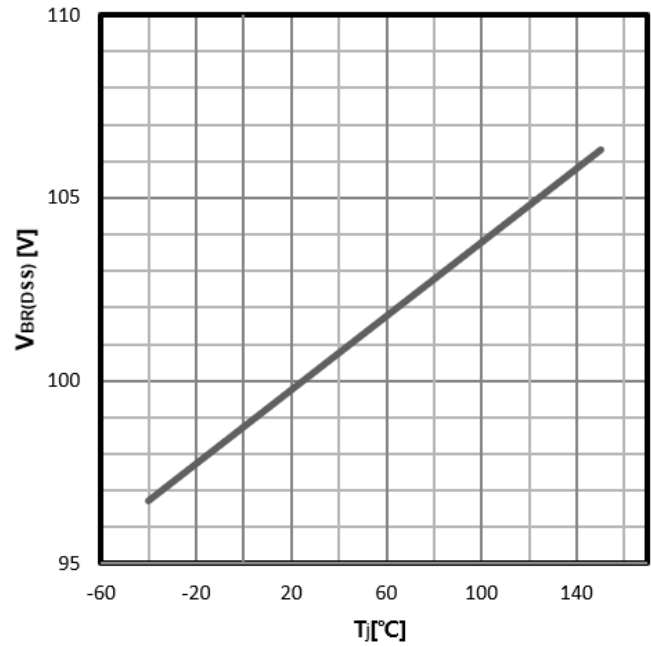
Gate Threshold Voltage

$$V_{TH}=f(T_j); I_D=250\mu A$$



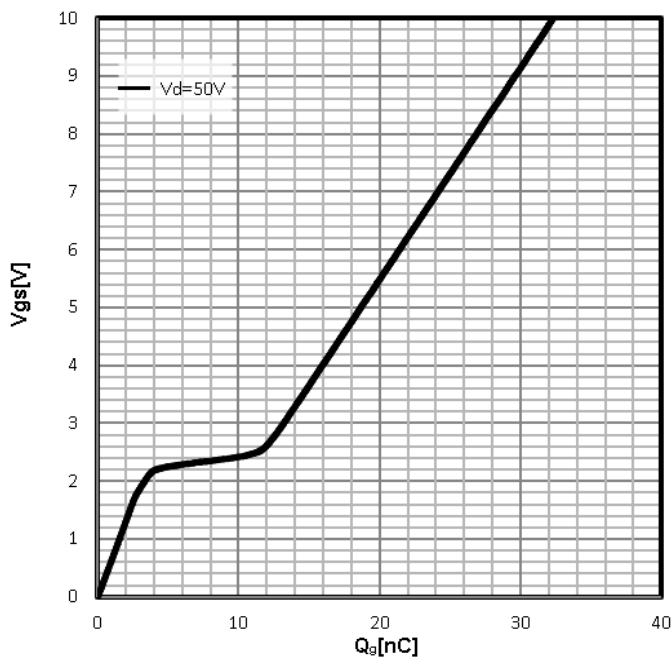
Drain-source breakdown voltage

$$V_{BR(DSS)}=f(T_j); I_D=250\mu A$$



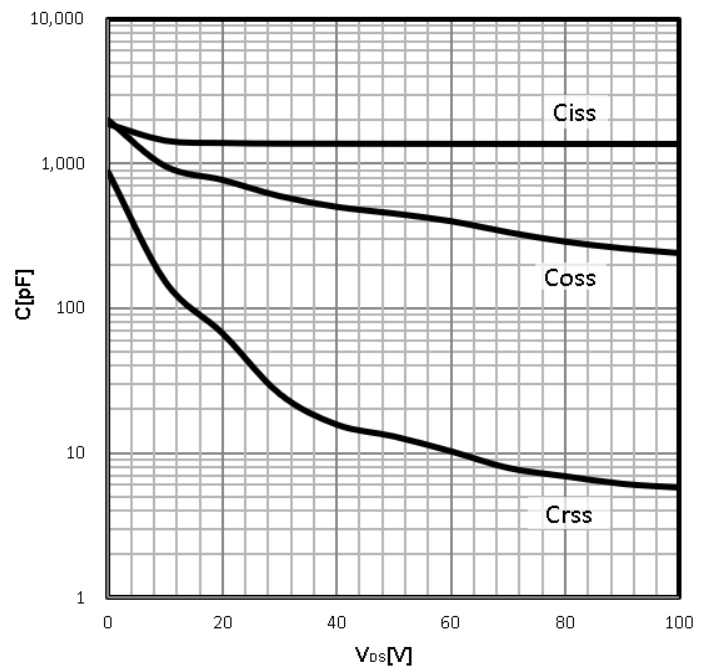
Typ. gate charge

$$V_{GS}=f(Q_g); I_D=10A$$



Typ. capacitances

$$C=f(V_{DS}); V_{GS}=0V; f=1MHz$$

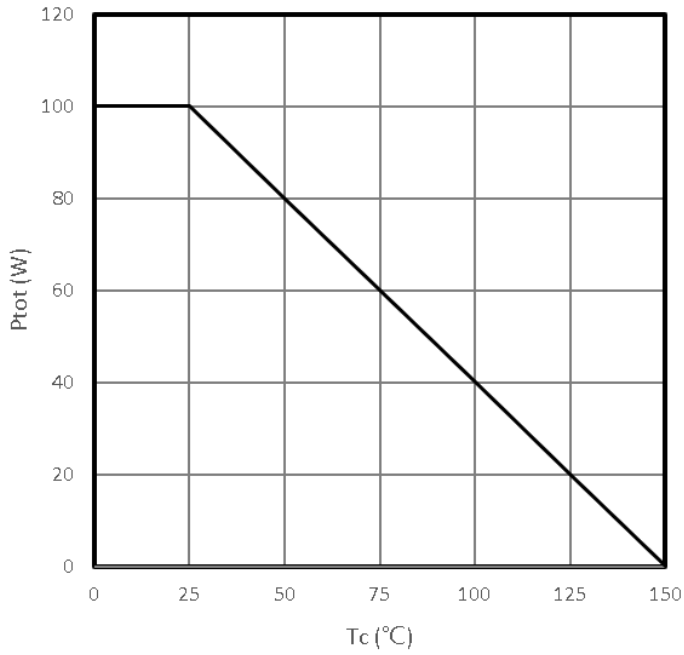




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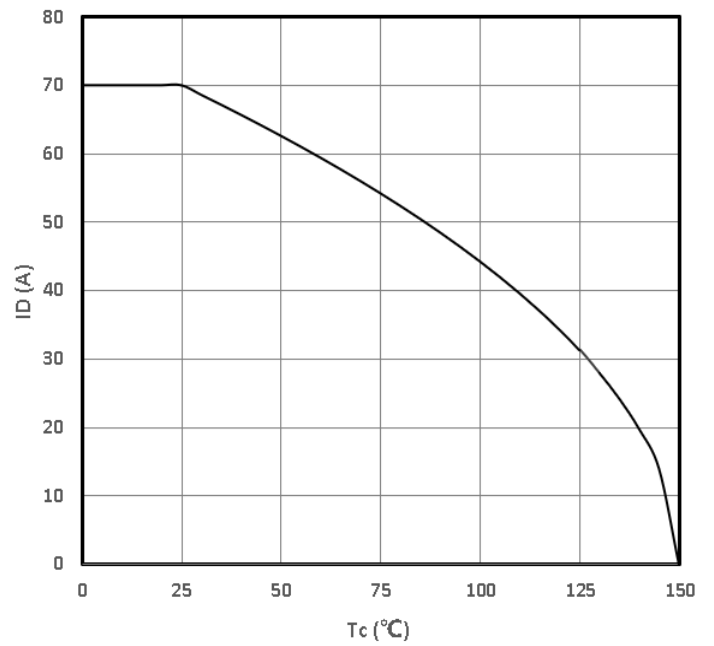
Power Dissipation

$$P_{tot}=f(T_C)$$



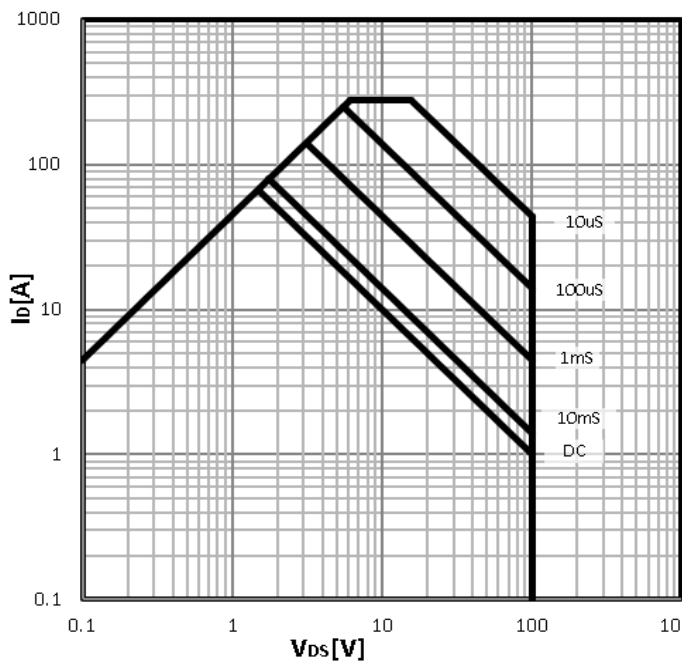
Maximum Drain Current

$$I_D=f(T_C)$$



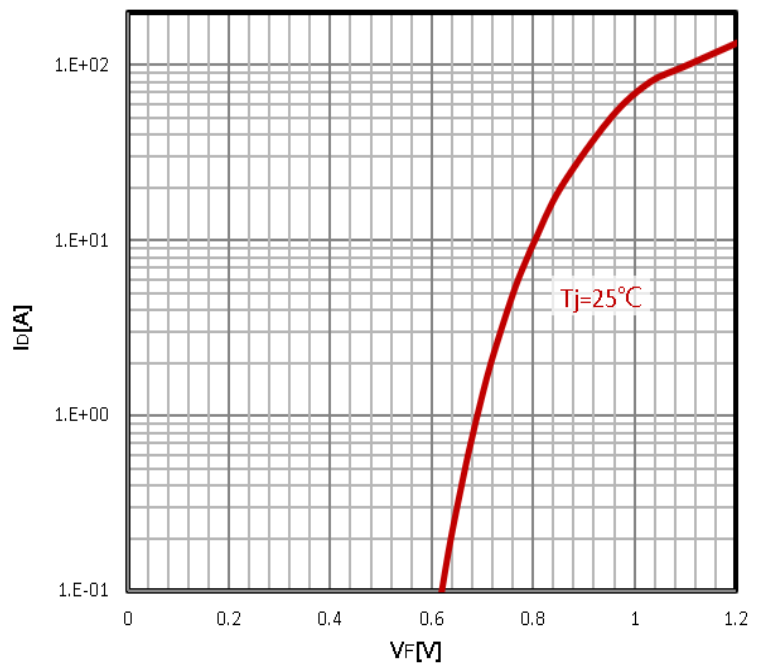
Safe operating area

$$I_D=f(V_{DS})$$



Body Diode Forward Voltage Variation

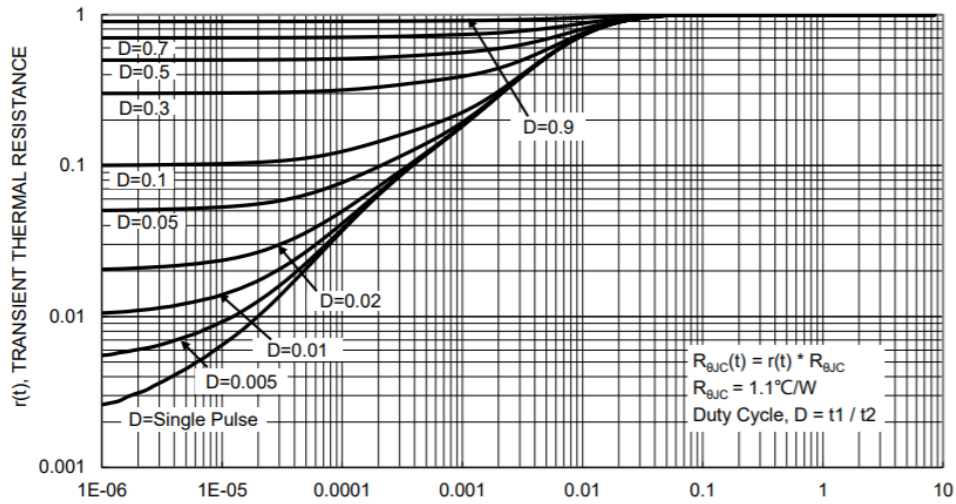
$$I_F=f(V_{GS})$$





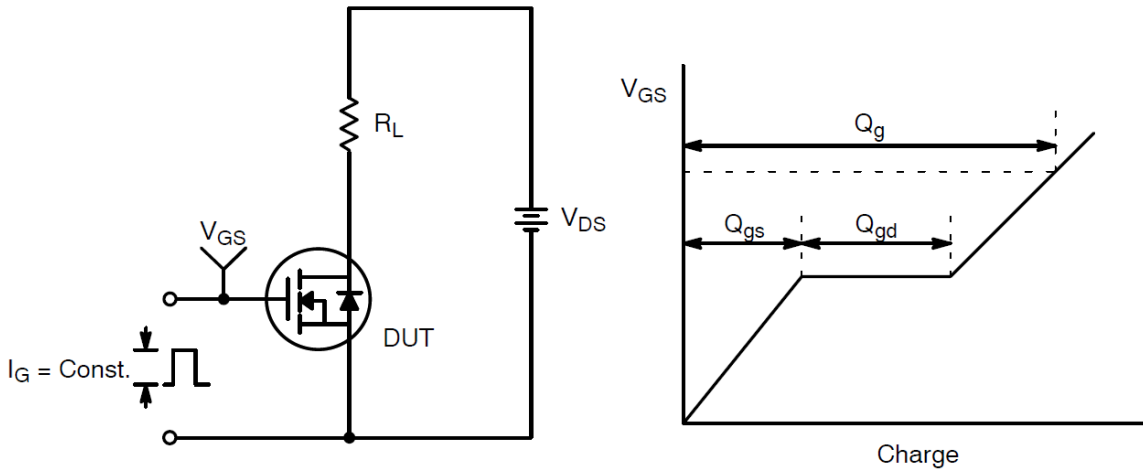
Max. transient thermal impedance

$$Z_{thJC} = f(t_p)$$

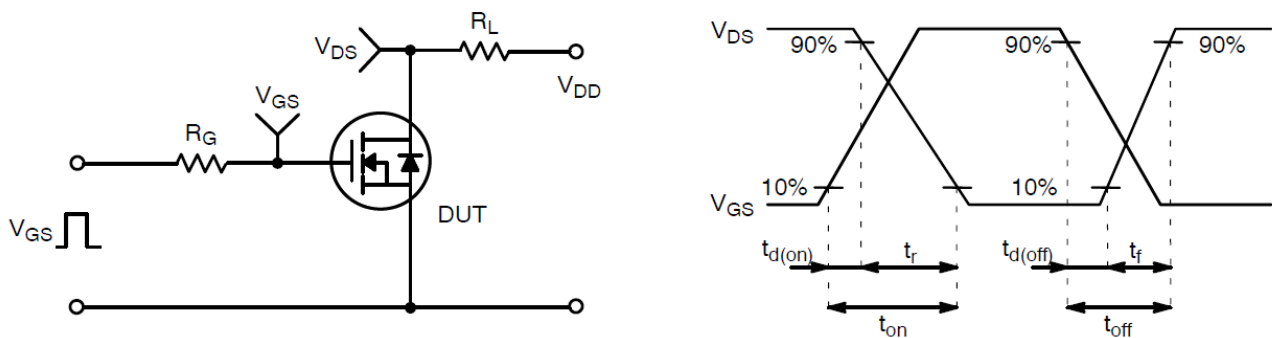




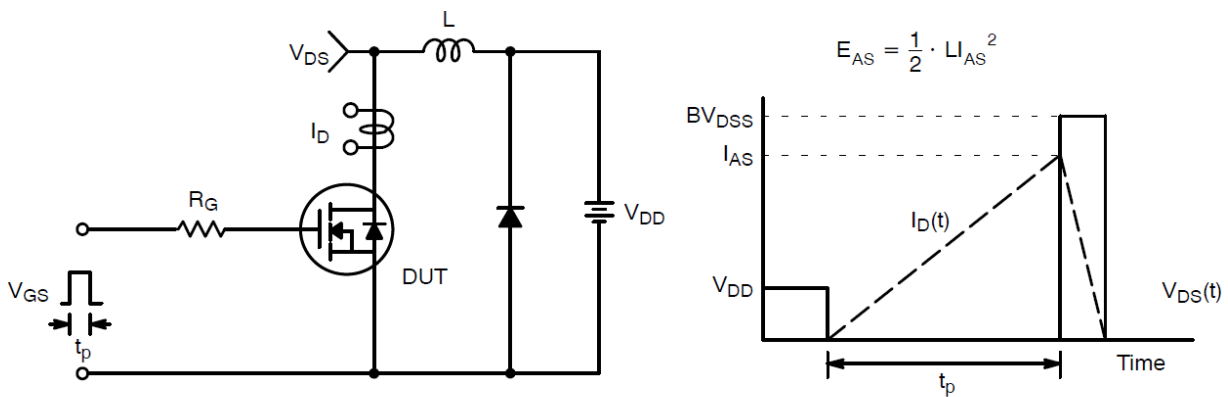
### Test Circuit and Waveform:



Gate Charge Test Circuit & Waveform



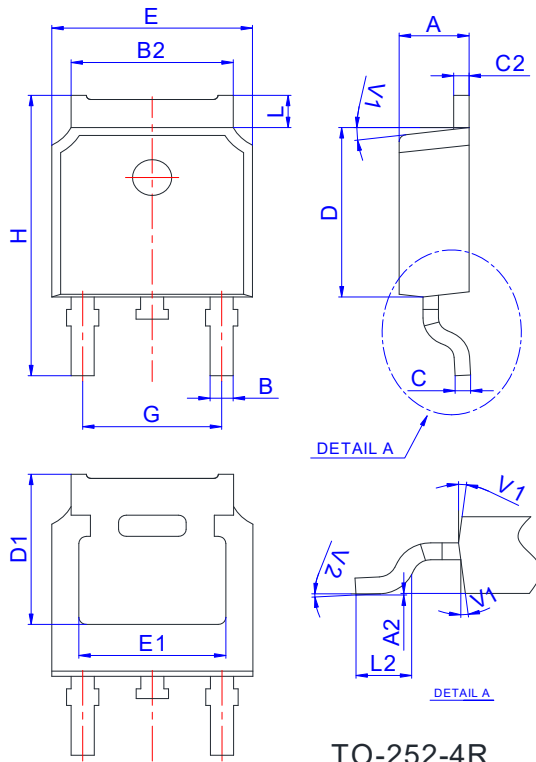
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

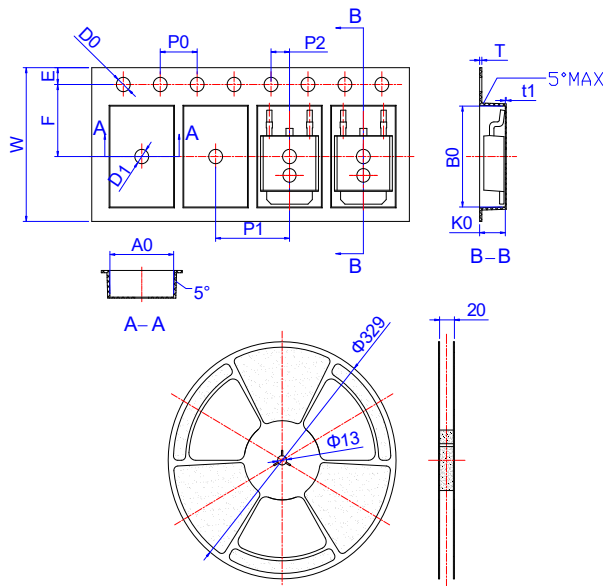
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Package Mechanical Data-TO-252-4R



| 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-252-4R



| 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 |