

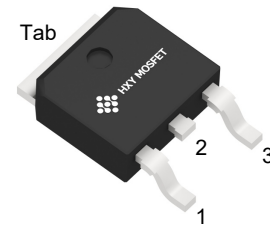


## Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Avalanche Ruggednes

## Applications

- Solar Inverters
- Switch Mode Power Supplies
- UPS
- Battery Chargers

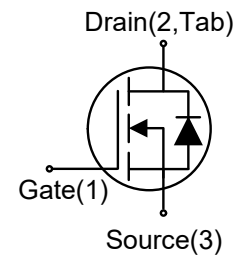


TO-252-2L



## Package Marking and Ordering Information

| Ordering Part Number | Package   | Brand      |
|----------------------|-----------|------------|
| STD11N65M5           | TO-252-2L | HXY MOSFET |



## Absolute Maximum Ratings

| Symbol         | Parameter                                       | Value       | Unit       | Test Conditions                         |
|----------------|-------------------------------------------------|-------------|------------|-----------------------------------------|
| $V_{DSmax}$    | Drain - Source Voltage                          | 650         | V          |                                         |
| $V_{GSmax}$    | Gate - Source Voltage (Absolute maximum values) | -8/+22      | V          |                                         |
| $V_{GS}$       | Gate - Source Voltage                           | -4/+18      | V          |                                         |
| $I_D$          | Continuous Drain Current                        | 6.8         | A          | $T_C = 25^\circ C$                      |
|                |                                                 | 4.8         |            | $T_C = 100^\circ C$                     |
| $I_{D(pulse)}$ | Pulsed Drain Current                            | 29          | A          | Pulse width $t_p$ limited by $T_{jmax}$ |
| $P_{TOT}$      | Power Dissipation                               | 41          | W          | $T_C = 25^\circ C$                      |
| $T_J, T_{stg}$ | Operating Junction and Storage Temperature      | -55 to +175 | $^\circ C$ |                                         |

•Example of acceptable  $V_{GS}$  waveform





**Electrical Characteristics** ( $T_C = 25^\circ\text{C}$  unless other wise specified)

| Symbol                     | Parameter                          | Value  |            |         | Unit | Test Condition                                                                                      |  |
|----------------------------|------------------------------------|--------|------------|---------|------|-----------------------------------------------------------------------------------------------------|--|
|                            |                                    | min.   | typ.       | max.    |      |                                                                                                     |  |
| Static Characteristics     |                                    |        |            |         |      |                                                                                                     |  |
| V <sub>DSS</sub>           | Drain-source breakdown voltage     | 750    | -          | -       | V    | V <sub>GS</sub> =0V, I <sub>D</sub> =100uA                                                          |  |
| V <sub>GS(th)</sub>        | Gate threshold voltage             | 2      | 2.8        | 4       | V    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =0.43mA                                           |  |
| I <sub>DSS</sub>           | Zero gate voltage drain current    | -<br>- | 1<br>5     | 10<br>- | μA   | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V<br>T <sub>C</sub> =25°C<br>T <sub>C</sub> =175°C         |  |
| I <sub>GSS</sub>           | Gate-source leakage current        | -      |            | 100     | nA   | V <sub>GS</sub> =18V, V <sub>DS</sub> =0V                                                           |  |
| R <sub>DS(on)</sub>        | Drain-source on-state resistance   | -      | 460<br>540 | 610     | mΩ   | V <sub>GS</sub> =18V, I <sub>D</sub> =2A,<br>T <sub>J</sub> =25°C<br>T <sub>J</sub> =175°C          |  |
| R <sub>DS(on)</sub>        | Drain-source on-state resistance   | -      | 580        | -       | mΩ   | V <sub>GS</sub> =15V, I <sub>D</sub> =2A, T <sub>J</sub> =25°C                                      |  |
| g <sub>fs</sub>            | Transconductance                   | -      | 1.3        | -       | S    | V <sub>DS</sub> =20V, I <sub>D</sub> =2A                                                            |  |
| Dynamic Characteristics    |                                    |        |            |         |      |                                                                                                     |  |
| C <sub>iss</sub>           | Input Capacitance                  | -      | 176        | -       | pF   | V <sub>DS</sub> = 400V<br>V <sub>GS</sub> = 0V<br>T <sub>J</sub> = 25°C                             |  |
| C <sub>oss</sub>           | Output Capacitance                 | -      | 17         | -       |      | V <sub>AC</sub> = 25mV<br>f = 1MHz                                                                  |  |
| C <sub>rss</sub>           | Reverse Transfer Capacitance       | -      | 2          | -       |      |                                                                                                     |  |
| Q <sub>G</sub>             | Gate Total Charge                  | -      | 8.5        | -       | nC   | V <sub>DS</sub> = 400V<br>V <sub>GS</sub> = -4/18V<br>I <sub>D</sub> = 1.6A                         |  |
| Q <sub>gs</sub>            | Gate-Source charge                 | -      | 2.6        | -       |      |                                                                                                     |  |
| Q <sub>gd</sub>            | Gate-Drain charge                  | -      | 2.6        | -       |      |                                                                                                     |  |
| E <sub>ON</sub>            | Turn-On Switching Energy           | -      | 32.5       | -       | μJ   | V <sub>DD</sub> = 400V<br>V <sub>GS</sub> = -4/+18V<br>I <sub>D</sub> = 1.6A<br>R <sub>G</sub> = 5Ω |  |
| E <sub>OFF</sub>           | Turn-Off Switching Energy          | -      | 0.53       | -       |      |                                                                                                     |  |
| t <sub>d(on)</sub>         | Turn-on delay time                 | -      | 40         | -       | ns   |                                                                                                     |  |
| t <sub>r</sub>             | Rise time                          | -      | 33.5       | -       |      |                                                                                                     |  |
| t <sub>d(off)</sub>        | Turn-off delay time                | -      | 49         | -       |      |                                                                                                     |  |
| t <sub>f</sub>             | Fall time                          | -      | 54         | -       |      |                                                                                                     |  |
| R <sub>G</sub>             | Gate resistance                    | -      | 3.7        | -       | Ω    | V <sub>AC</sub> = 25mV, f=1MHz                                                                      |  |
| Body Diode Characteristics |                                    |        |            |         |      |                                                                                                     |  |
| V <sub>SD</sub>            | Body Diode Forward Voltage         |        | 3          |         | V    | V <sub>GS</sub> = 0V, I <sub>SD</sub> =1A,<br>T <sub>J</sub> =25°C                                  |  |
|                            |                                    |        | 2.7        |         |      | V <sub>GS</sub> = 0V, I <sub>SD</sub> =1A,<br>T <sub>J</sub> =175°C                                 |  |
| t <sub>rr</sub>            | Body Diode Reverse Recovery Time   | -      | 52         | -       | ns   | V <sub>R</sub> = 400V, V <sub>GS</sub> = 0V<br>I <sub>D</sub> = 1.6A                                |  |
| Q <sub>rr</sub>            | Body Diode Reverse Recovery Charge | -      | 21.8       | -       | nC   | di/dt = 800A/μS<br>T <sub>J</sub> = 175°C                                                           |  |



## Thermal Characteristics

| Symbol     | Parameter                                   | Typ. | Unit                 | Test Conditions |
|------------|---------------------------------------------|------|----------------------|-----------------|
| $R_{thJC}$ | Thermal Resistance from Junction to Case    | 3.7  | $^{\circ}\text{C/W}$ |                 |
| $R_{thJA}$ | Thermal Resistance From Junction to Ambient | 40   |                      |                 |

## Typical Performance

Fig 1. Output Characteristics ( $T_J = -55^{\circ}\text{C}$ )

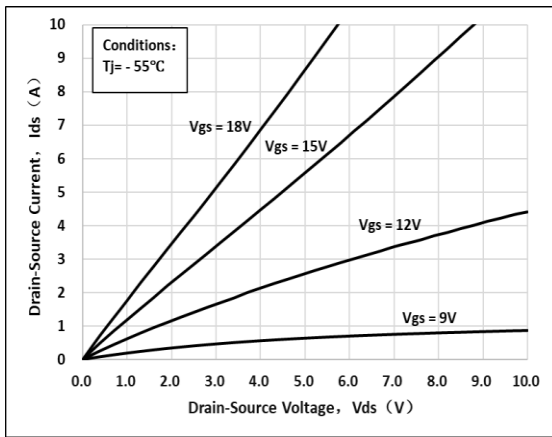


Fig 2. Output Characteristics ( $T_J = 25^{\circ}\text{C}$ )

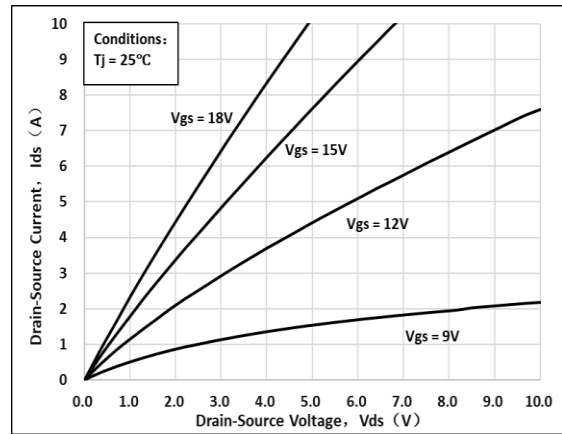


Fig 3. Output Characteristics ( $T_J = 175^{\circ}\text{C}$ )

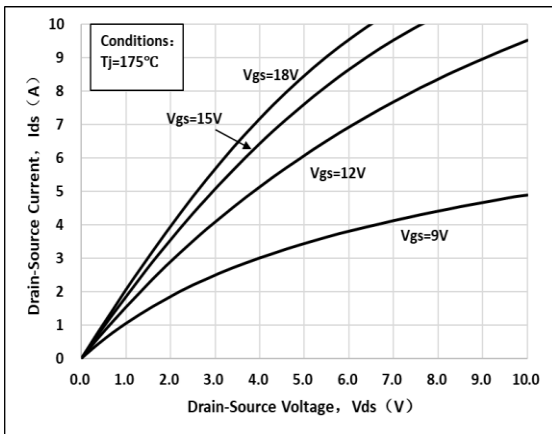


Fig 4:  $R_{ds(on)}$  Vs  $I_{ds}$  Characteristics

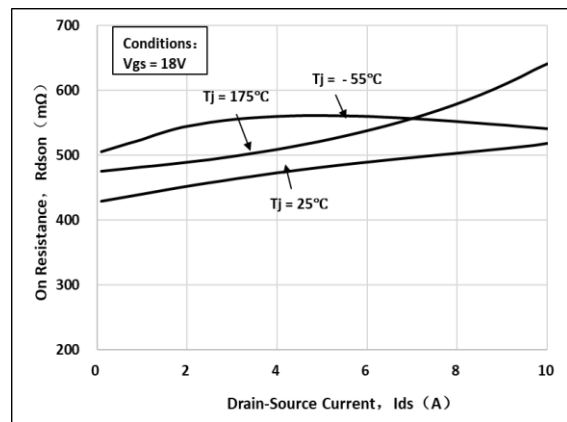




Fig 5:  $R_{ds(on)}$  vs. Temperature

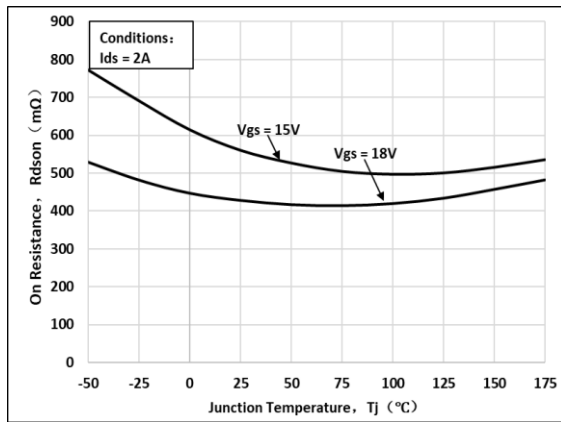


Fig 5: Transfer Characteristics

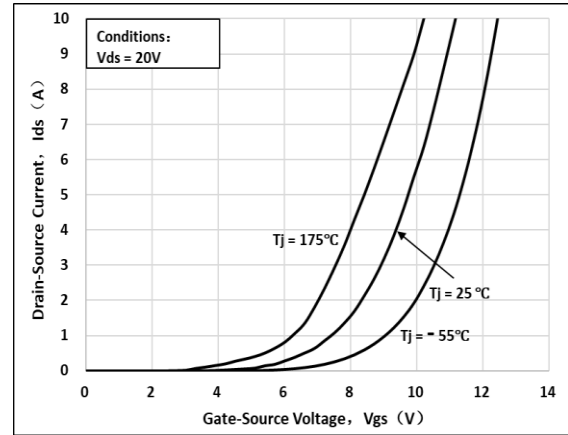


Fig 7: Body-diode Characteristics ( $T_J = -55^{\circ}C$ )

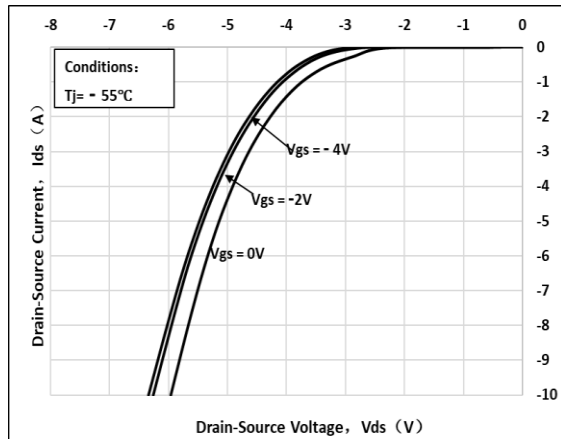


Fig 8: Body-diode Characteristics ( $T_J = 25^{\circ}C$ )

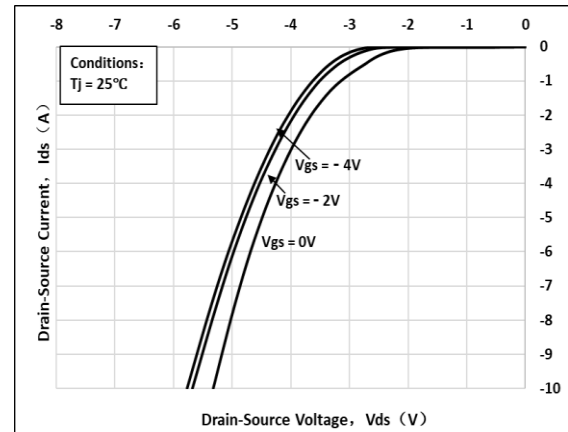


Fig 9: Body-diode Characteristics ( $T_J = 175^{\circ}C$ )

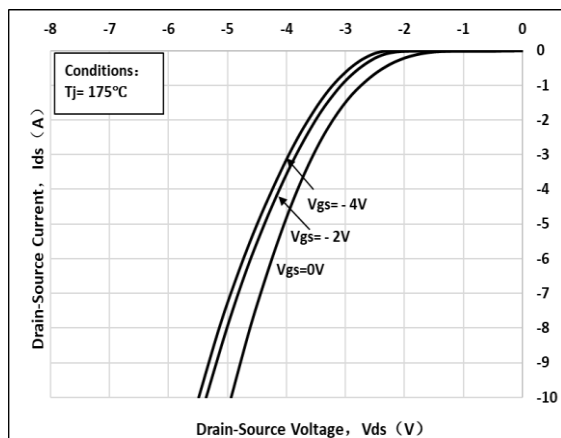


Fig 10:  $V_{th}$  Vs  $T_J$  Temperature Characteristics

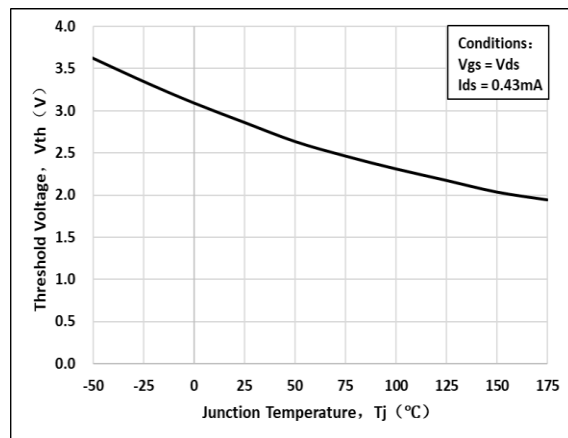




Fig 11: 3rd Quadrant Characteristics( $T_J = -55^\circ\text{C}$ )

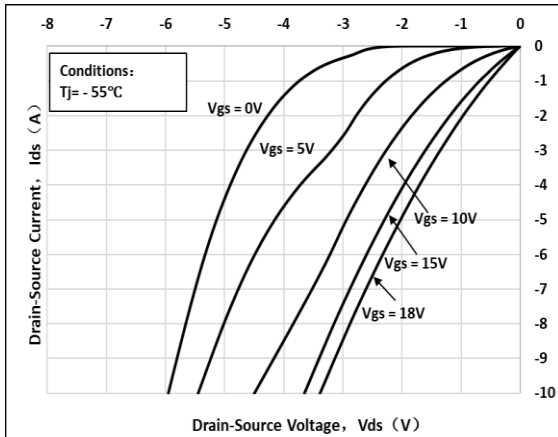


Fig 12: 3rd Quadrant Characteristics( $T_J = 25^\circ\text{C}$ )

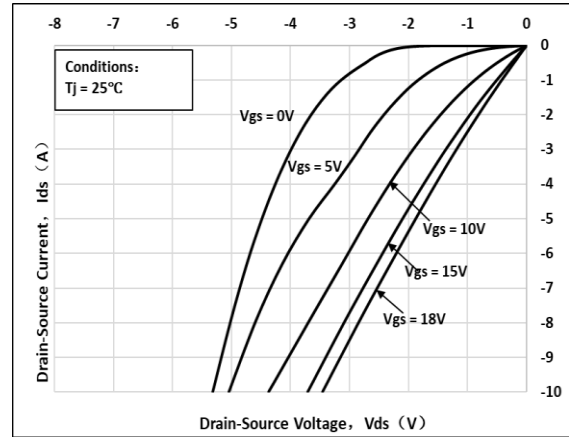


Fig 13: 3rd Quadrant Characteristics( $T_J = 175^\circ\text{C}$ )

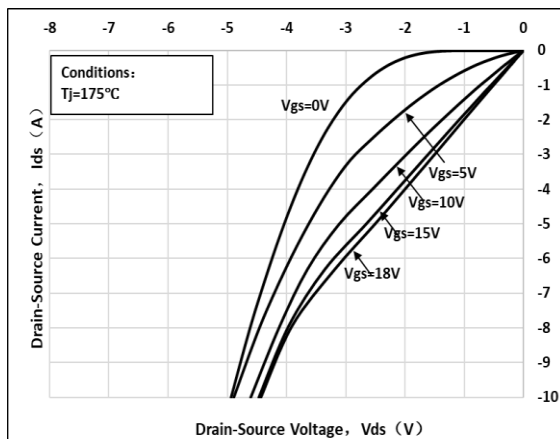


Fig 14: Gate Charge Characteristics

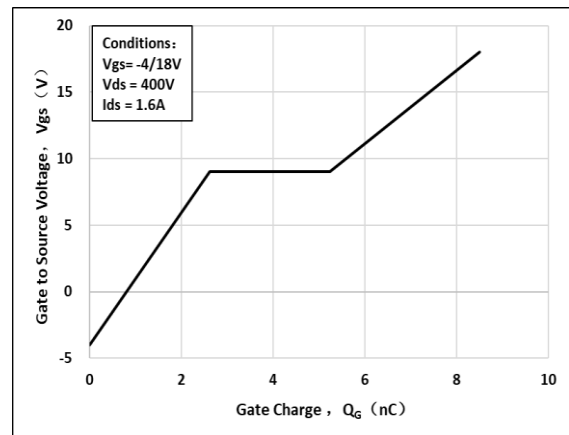


Fig 15: Continuous Drain Current vs. Case Temperature

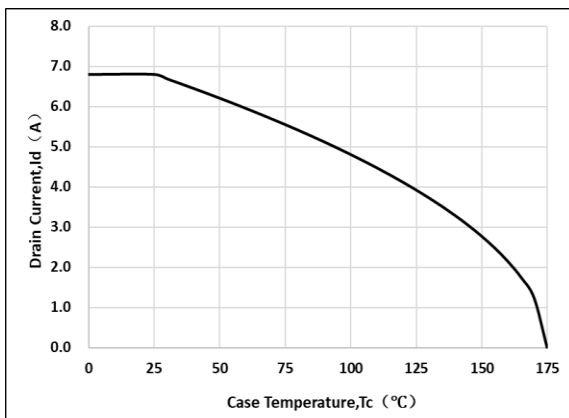
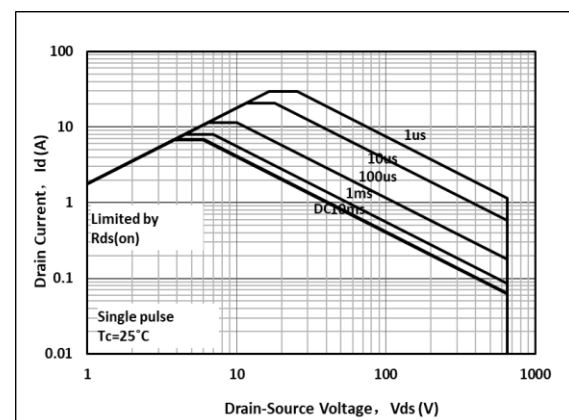
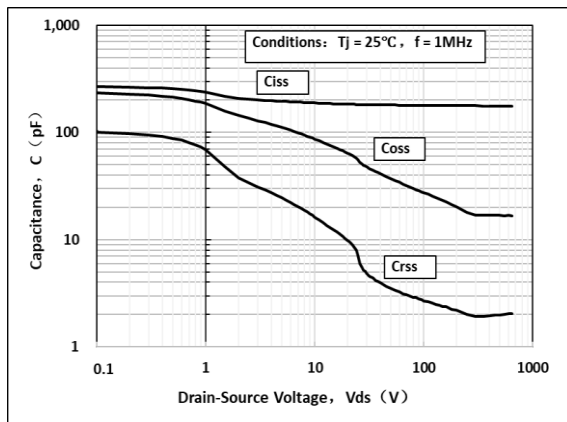


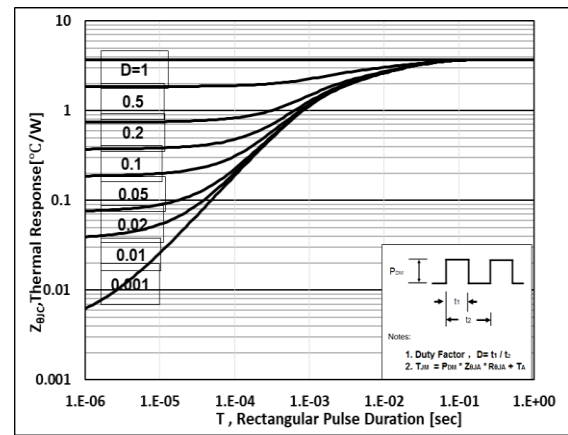
Fig 16: Safe Operating Area



**Fig 17: Capacitance Characteristics**

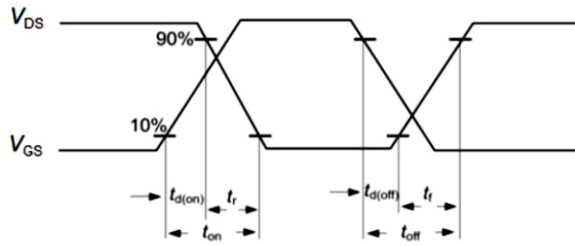


**Fig 18: Transient Thermal Impedance**

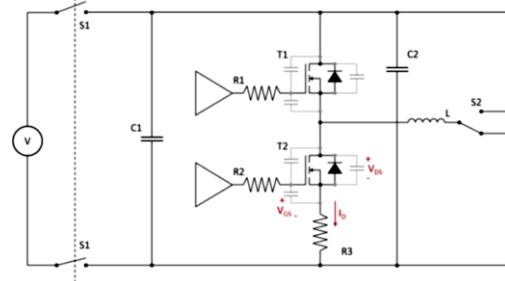


## Test Circuit & Waveform

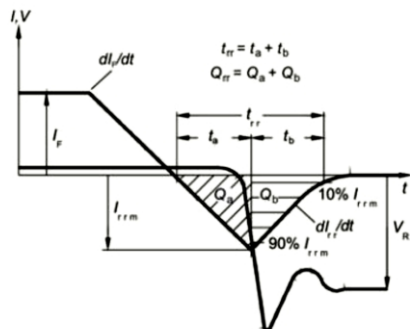
### Figure A. Definition of switching times



**Figure B. Dynamic test circuit**



### Figure C. Definition of body diodeswitching characteristics

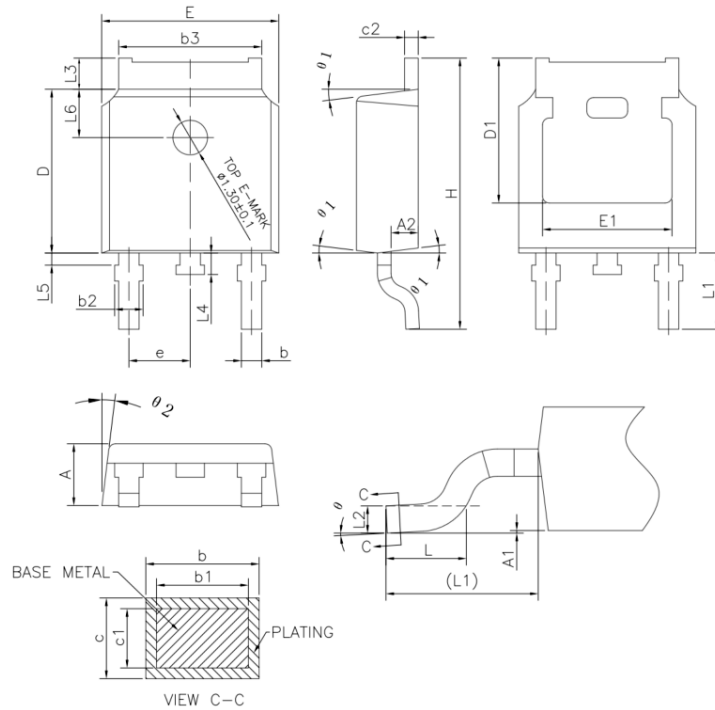


**Figure C. Definition of diode switching characteristics**



## Package Dimensions

Package TO-252-2L



| SYMBOL | Unit: mm  |       |       |
|--------|-----------|-------|-------|
|        | MIN       | NOM   | MAX   |
| A      | 2.20      | 2.30  | 2.38  |
| A1     | 0         | -     | 0.10  |
| A2     | 0.90      | 1.01  | 1.10  |
| b      | 0.72      | -     | 0.85  |
| b1     | 0.71      | 0.76  | 0.81  |
| b2     | 0.72      | -     | 0.90  |
| b3     | 5.13      | 5.33  | 5.46  |
| c      | 0.47      | -     | 0.60  |
| c1     | 0.46      | 0.51  | 0.56  |
| c2     | 0.47      | -     | 0.60  |
| D      | 6.00      | 6.10  | 6.20  |
| D1     | 5.25      | -     | -     |
| E      | 6.50      | 6.60  | 6.70  |
| E1     | 4.70      | -     | -     |
| e      | 2.186     | 2.286 | 2.386 |
| H      | 9.80      | 10.10 | 10.40 |
| L      | 1.40      | 1.50  | 1.70  |
| L1     | 2.90 REF  |       |       |
| L2     | 0.508 BSC |       |       |
| L3     | 0.90      | -     | 1.25  |
| L4     | 0.60      | 0.80  | 1.00  |
| L5     | 0.15      | -     | 0.75  |
| L6     | 1.80 REF  |       |       |
| θ      | 0°        | -     | 8°    |
| θ1     | 5°        | 7°    | 9°    |
| θ2     | 5°        | 7°    | 9°    |



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