



# STU/D5025NLS

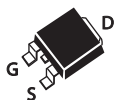
## N-Channel Logic Level Enhancement Mode Field Effect Transistor

### PRODUCT SUMMARY

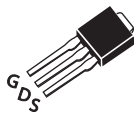
| V <sub>DSS</sub> | I <sub>D</sub> | R <sub>DS(ON)</sub> (m $\Omega$ ) Max |
|------------------|----------------|---------------------------------------|
| 25V              | 50A            | 8 @ V <sub>GS</sub> = 10V             |
|                  |                | 12 @ V <sub>GS</sub> = 4.5V           |

### FEATURES

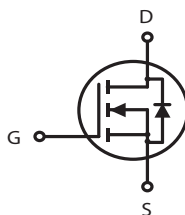
- Super high dense cell design for low R<sub>DS(ON)</sub>.
- Rugged and reliable.
- TO-252 and TO-251 Package.



STU SERIES  
TO-252AA(D-PAK)



STD SERIES  
TO-251(I-PAK)



### ABSOLUTE MAXIMUM RATINGS (T<sub>a</sub>=25°C unless otherwise noted)

| Parameter                                                               | Symbol                            | Limit      | Unit |
|-------------------------------------------------------------------------|-----------------------------------|------------|------|
| Drain-Source Voltage Rating                                             | V <sub>spike</sub> <sup>c</sup>   | 30         | V    |
| Drain-Source Voltage                                                    | V <sub>DS</sub>                   | 25         | V    |
| Gate-Source Voltage                                                     | V <sub>GS</sub>                   | ±20        | V    |
| Drain Current-Continuous @ T <sub>C</sub> =25°C<br>-Pulsed <sup>a</sup> | I <sub>D</sub>                    | 50         | A    |
|                                                                         | I <sub>DM</sub>                   | 200        | A    |
| Drain-Source Diode Forward Current                                      | I <sub>S</sub>                    | 20         | A    |
| Maximum Power Dissipation @ T <sub>C</sub> =25°C                        | P <sub>D</sub>                    | 50         | W    |
| Operating and Storage Temperature Range                                 | T <sub>J</sub> , T <sub>STG</sub> | -55 to 175 | °C   |

### THERMAL CHARACTERISTICS

|                                         |               |    |      |
|-----------------------------------------|---------------|----|------|
| Thermal Resistance, Junction-to-Case    | R $\theta$ JC | 3  | °C/W |
| Thermal Resistance, Junction-to-Ambient | R $\theta$ JA | 50 | °C/W |

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ELECTRICAL CHARACTERISTICS (Tc=25°C unless otherwise noted)

| Parameter                              | Symbol              | Condition                                                                                          | Min | Typ <sup>c</sup> | Max  | Unit  |
|----------------------------------------|---------------------|----------------------------------------------------------------------------------------------------|-----|------------------|------|-------|
| OFF CHARACTERISTICS                    |                     |                                                                                                    |     |                  |      |       |
| Drain-Source Breakdown Voltage         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA                                                         | 25  |                  |      | V     |
| Zero Gate Voltage Drain Current        | I <sub>DSS</sub>    | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V                                                          |     |                  | 1    | uA    |
| Gate-Body Leakage                      | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> = 0V                                                        |     |                  | ±100 | nA    |
| ON CHARACTERISTICS <sup>a</sup>        |                     |                                                                                                    |     |                  |      |       |
| Gate Threshold Voltage                 | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = 250uA                                          | 1   | 1.7              | 3    | V     |
| Drain-Source On-State Resistance       | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                                          |     | 6.5              | 8    | m ohm |
|                                        |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> = 10A                                                        |     | 9                | 12   | m ohm |
| On-State Drain Current                 | I <sub>D(ON)</sub>  | V <sub>DS</sub> = 10V, V <sub>GS</sub> = 10V                                                       | 50  |                  |      | A     |
| Forward Transconductance               | g <sub>FS</sub>     | V <sub>DS</sub> = 10V, I <sub>D</sub> = 10A                                                        |     | 22               |      | S     |
| DYNAMIC CHARACTERISTICS <sup>b</sup>   |                     |                                                                                                    |     |                  |      |       |
| Input Capacitance                      | C <sub>ISS</sub>    | V <sub>DS</sub> =15V, V <sub>GS</sub> = 0V<br>f=1.0MHz                                             |     | 1150             |      | pF    |
| Output Capacitance                     | C <sub>OSS</sub>    |                                                                                                    |     | 340              |      | pF    |
| Reverse Transfer Capacitance           | C <sub>RSS</sub>    |                                                                                                    |     | 185              |      | pF    |
| Gate resistance                        | R <sub>g</sub>      | V <sub>GS</sub> =0V, V <sub>DS</sub> = 0V, f=1.0MHz                                                |     | 0.33             |      | ohm   |
| SWITCHING CHARACTERISTICS <sup>b</sup> |                     |                                                                                                    |     |                  |      |       |
| Turn-On Delay Time                     | t <sub>D(ON)</sub>  | V <sub>DD</sub> = 15V<br>I <sub>D</sub> = 1 A<br>V <sub>GS</sub> = 10V<br>R <sub>GEN</sub> = 6 ohm |     | 22               |      | ns    |
| Rise Time                              | t <sub>r</sub>      |                                                                                                    |     | 27               |      | ns    |
| Turn-Off Delay Time                    | t <sub>D(OFF)</sub> |                                                                                                    |     | 42               |      | ns    |
| Fall Time                              | t <sub>f</sub>      |                                                                                                    |     | 20               |      | ns    |
| Total Gate Charge                      | Q <sub>g</sub>      | V <sub>DS</sub> =15V, I <sub>D</sub> =20A, V <sub>GS</sub> =10V                                    |     | 29               |      | nC    |
|                                        |                     | V <sub>DS</sub> =15V, I <sub>D</sub> =20A, V <sub>GS</sub> =4.5V                                   |     | 13               |      | nC    |
| Gate-Source Charge                     | Q <sub>gs</sub>     | V <sub>DS</sub> =15V, I <sub>D</sub> = 20A<br>V <sub>GS</sub> =10V                                 |     | 3.5              |      | nC    |
| Gate-Drain Charge                      | Q <sub>gd</sub>     |                                                                                                    |     | 8                |      | nC    |

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## ELECTRICAL CHARACTERISTICS (T<sub>c</sub>=25°C unless otherwise noted)

| Parameter                                       | Symbol          | Condition                                  | Min | Typ  | Max | Unit |
|-------------------------------------------------|-----------------|--------------------------------------------|-----|------|-----|------|
| DRAIN-SOURCE DIODE CHARACTERISTICS <sup>a</sup> |                 |                                            |     |      |     |      |
| Diode Forward Voltage                           | V <sub>SD</sub> | V <sub>GS</sub> = 0V, I <sub>s</sub> = 10A |     | 0.85 | 1.3 | V    |

### Notes

- a. Pulse Test: Pulse Width ≤ 300us, Duty Cycle ≤ 2%.
- b. Guaranteed by design, not subject to production testing.
- c. Guaranteed when external R<sub>g</sub>=6 ohm and t<sub>f</sub> < t<sub>f</sub> max

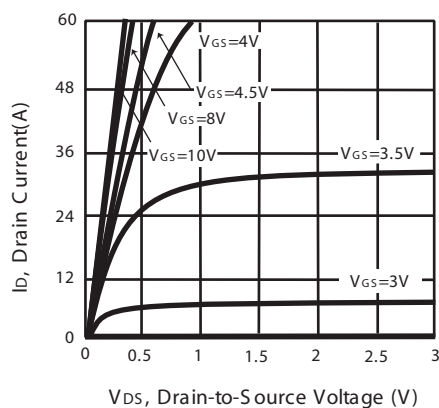


Figure 1. Output Characteristics

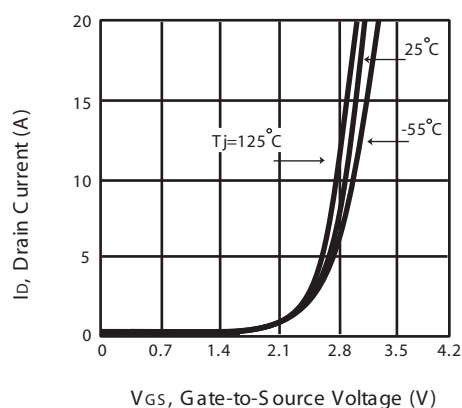


Figure 2. Transfer Characteristics

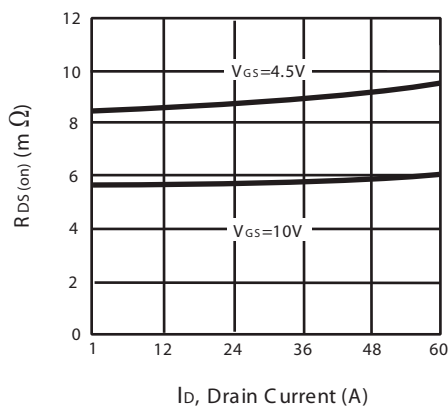


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

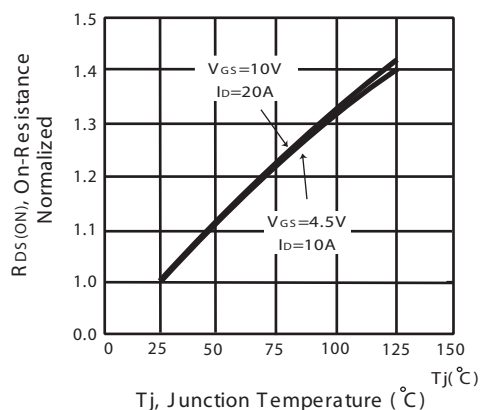


Figure 4. On-Resistance Variation with Drain Current and Temperature

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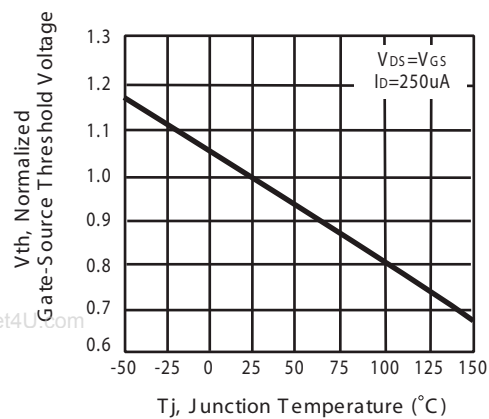


Figure 5. Gate Threshold Variation with Temperature

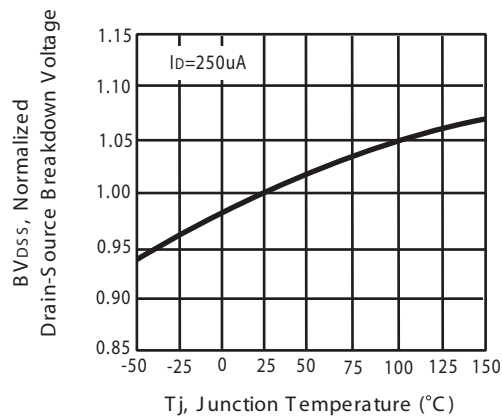


Figure 6. Breakdown Voltage Variation with Temperature

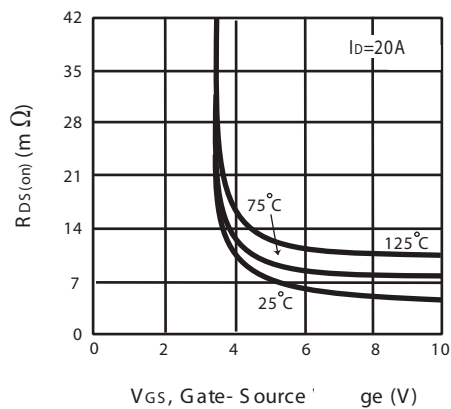


Figure 7. On-Resistance vs. Gate-Source Voltage

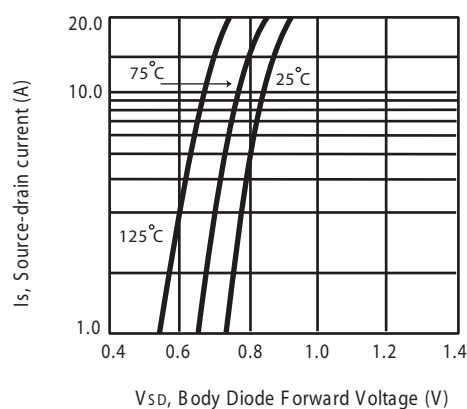


Figure 8. Body Diode Forward Voltage Variation with Source Current

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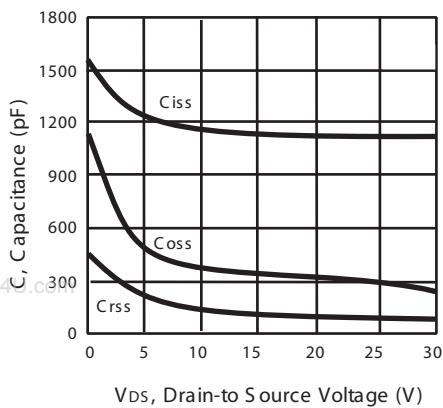


Figure 9. Capacitance

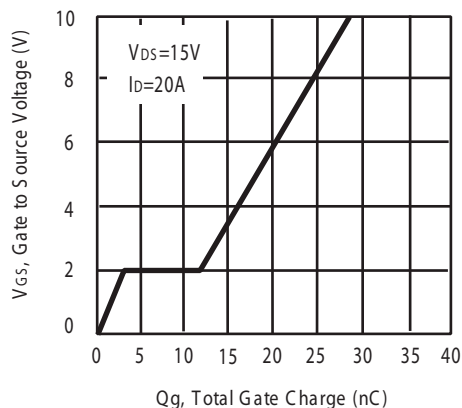


Figure 10. Gate Charge

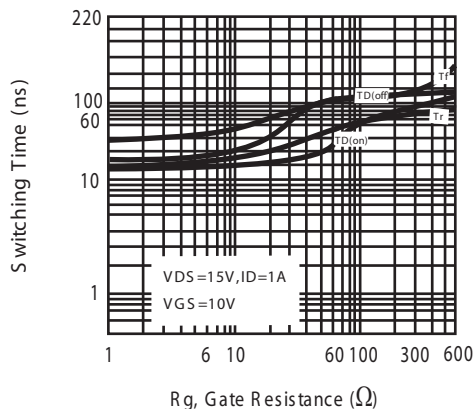


Figure 11. switching characteristics

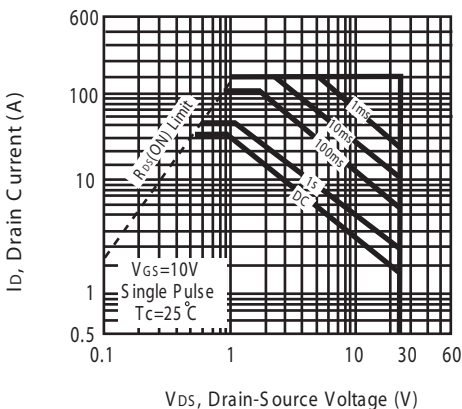


Figure 12. Maximum Safe Operating Area

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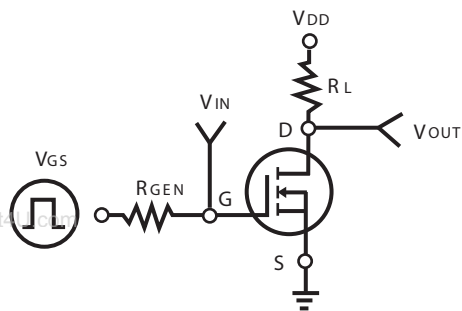


Figure 11. Switching Test Circuit

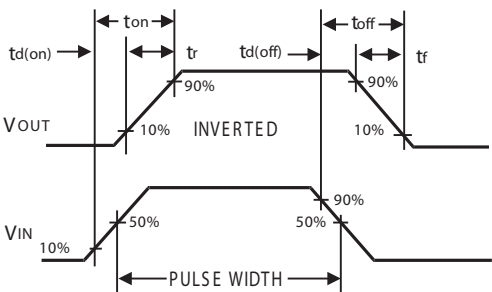


Figure 12. Switching Waveforms

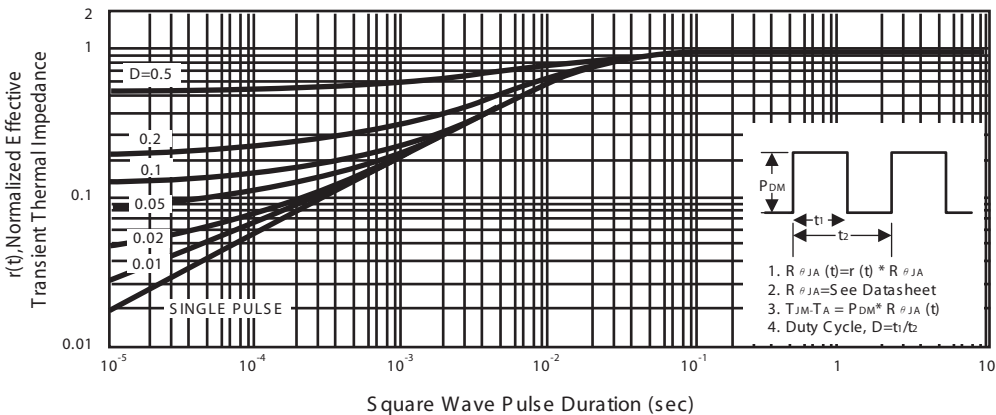
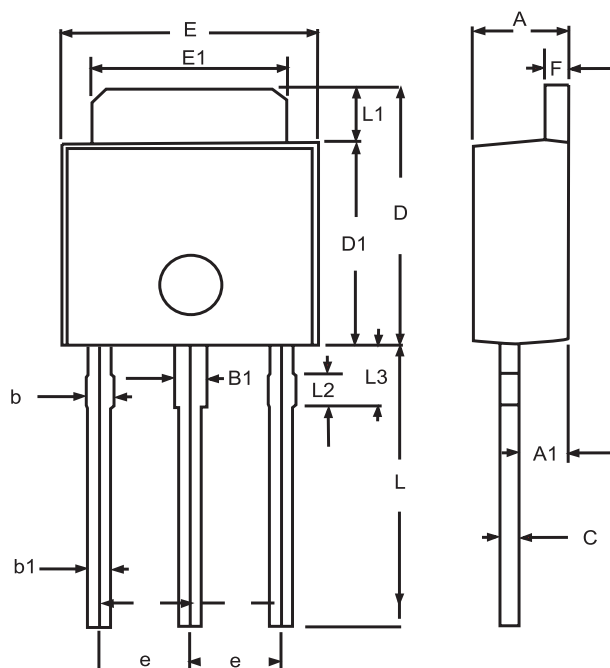


Figure 13. Normalized Thermal Transient Impedance Curve

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## PACKAGE OUTLINE DIMENSIONS

### TO-251

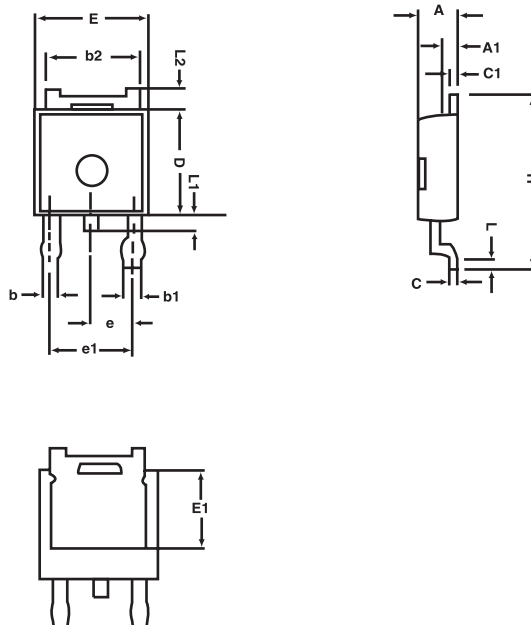


| SYMBOLS | MILLIMETERS |       | INCHES |       |
|---------|-------------|-------|--------|-------|
|         | MIN         | MAX   | MIN    | MAX   |
| A       | 2.20        | 2.40  | 0.087  | 0.095 |
| A1      | 1.100       | 1.300 | 0.043  | 0.051 |
| B1      | 0.650       | 1.050 | 0.026  | 0.041 |
| b       | 0.500       | 0.900 | 0.020  | 0.035 |
| b1      | 0.400       | 0.800 | 0.016  | 0.32  |
| C       | 0.400       | 0.600 | 0.016  | 0.024 |
| D       | 6.700       | 7.300 | 0.264  | 0.287 |
| D1      | 5.400       | 5.650 | 0.213  | 0.222 |
| E       | 6.40        | 6.650 | 0.252  | 0.262 |
| e       | 2.100       | 2.500 | 0.083  | 0.098 |
| F       | 0.400       | 0.600 | 0.016  | 0.024 |
| L       | 7.000       | 8.000 | 0.276  | 0.315 |
| L1      | 1.300       | 1.700 | 0.051  | 0.067 |
| L2      | 0.700       | 0.900 | 0.028  | 0.035 |
| L3      | 1.400       | 1.800 | 0.055  | 0.071 |

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## PACKAGE OUTLINE DIMENSIONS

### TO-252



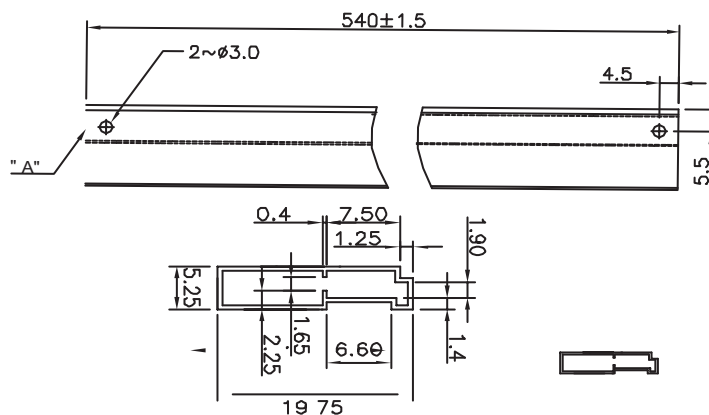
| SYMBOLS | MILLIMETERS |       | INCHES |       |
|---------|-------------|-------|--------|-------|
|         | MIN         | MAX   | MIN    | MAX   |
| A       | 2.25        | 2.35  | 0.089  | 0.093 |
| A1      | 0.95        | 1.05  | 0.037  | 0.041 |
| b       | 0.77        | 0.85  | 0.030  | 0.033 |
| b1      | 0.84        | 0.94  | 0.033  | 0.037 |
| b2      | 5.30        | 5.45  | 0.209  | 0.215 |
| C       | 0.49        | 0.53  | 0.019  | 0.021 |
| D       | 6.00        | 6.20  | 0.236  | 0.244 |
| E       | 6.40        | 6.60  | 0.252  | 0.260 |
| E1      | 3.18        | 3.67  | 0.125  | 0.145 |
| e       | 2.29        | BSC   | 0.090  | BSC   |
| H       | 9.70        | 10.10 | 0.382  | 0.398 |
| L       | 1.425       | 1.625 | 0.056  | 0.064 |
| L1      | 0.650       | 0.850 | 0.026  | 0.033 |
| L2      | 0.600       | REF.  | 0.024  | REF.  |



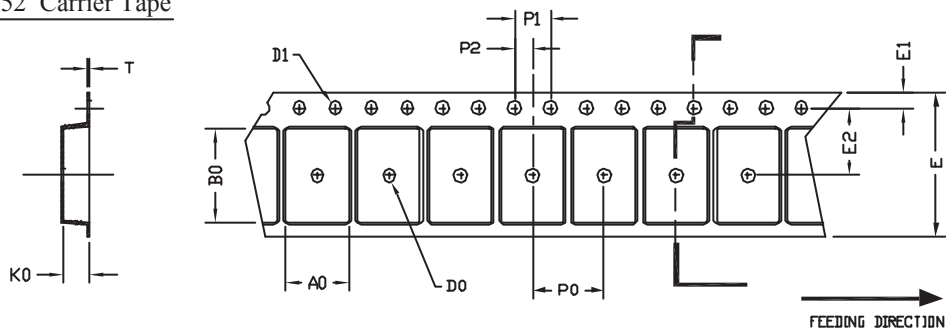
# STU/D5025NLS

## TO251 Tube/TO-252 Tape and Reel Data

### TO-251 Tube



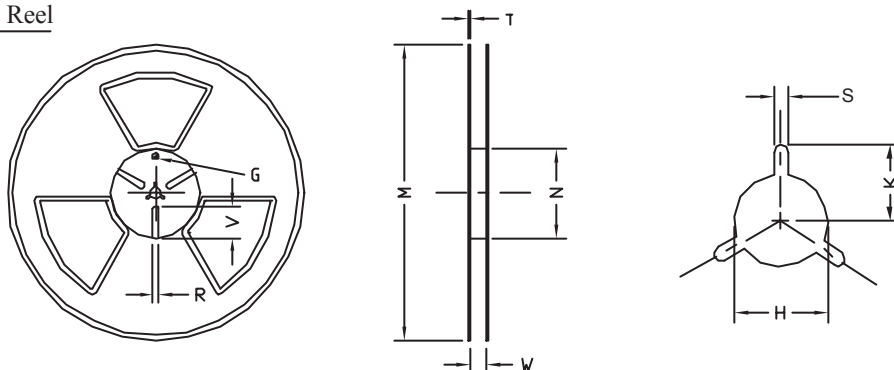
### TO-252 Carrier Tape



UNIT:mm

| PACKAGE           | A0                | B0                | K0                | D0       | D1                             | E                 | E1                | E2                | P0               | P1               | P2                | T                 |
|-------------------|-------------------|-------------------|-------------------|----------|--------------------------------|-------------------|-------------------|-------------------|------------------|------------------|-------------------|-------------------|
| TO-252<br>(16 mm) | 6.80<br>$\pm 0.1$ | 10.3<br>$\pm 0.1$ | 2.50<br>$\pm 0.1$ | $\phi 2$ | $\phi 1.5$<br>$+ 0.1$<br>$- 0$ | 16.0<br>$0.3 \pm$ | 1.75<br>$0.1 \pm$ | 7.5<br>$\pm 0.15$ | 8.0<br>$\pm 0.1$ | 4.0<br>$\pm 0.1$ | 2.0<br>$\pm 0.15$ | 0.3<br>$\pm 0.05$ |

### TO-252 Reel



UNIT:mm

| TAPE SIZE | REEL SIZE  | M                       | N                      | W                        | T   | H                                 | K    | S                | G   | R   | V   |
|-----------|------------|-------------------------|------------------------|--------------------------|-----|-----------------------------------|------|------------------|-----|-----|-----|
| 16 mm     | $\phi 330$ | $\phi 330$<br>$\pm 0.5$ | $\phi 97$<br>$\pm 1.0$ | 17.0<br>$+ 1.5$<br>$- 0$ | 2.2 | $\phi 13.0$<br>$+ 0.5$<br>$- 0.2$ | 10.6 | 2.0<br>$\pm 0.5$ | --- | --- | --- |