



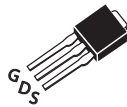
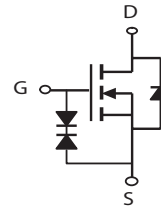
## N-Channel Logic Level Enhancement Mode Field Effect Transistor

## PRODUCT SUMMARY

| V <sub>DSS</sub> | I <sub>D</sub> | R <sub>DS(ON)</sub> (m $\Omega$ ) Max |
|------------------|----------------|---------------------------------------|
| 40V              | 30A            | 20 @ V <sub>GS</sub> = 10V            |
|                  |                | 30 @ V <sub>GS</sub> = 4.5V           |

## FEATURES

- Super high dense cell design for low R<sub>DS(ON)</sub>.
- Rugged and reliable.
- Surface Mount Package.
- ESD Protected.

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                                                                 | V <sub>DS</sub>                   | 40         | V    |
| Gate-Source Voltage                                                                  | V <sub>GS</sub>                   | ±20        | V    |
| Drain Current-Continuous <sup>a</sup> @ T <sub>C</sub> =25°C<br>-Pulsed <sup>b</sup> | I <sub>D</sub>                    | 30         | A    |
|                                                                                      | I <sub>DM</sub>                   | 100        | A    |
| Drain-Source Diode Forward Current                                                   | I <sub>S</sub>                    | 8          | 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 |

# STU/D410S

ELECTRICAL CHARACTERISTICS (T<sub>c</sub>=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                                                         | 40  |                  |     | V     |
| Zero Gate Voltage Drain Current        | I <sub>DSS</sub>    | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V                                                          |     |                  | 1   | uA    |
| Gate-Body Leakage                      | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> = 0V                                                        |     |                  | ±10 | uA    |
| 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   | 1.9              | 3   | V     |
| Drain-Source On-State Resistance       | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =10A                                                          |     | 16               | 20  | m ohm |
|                                        |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> = 8A                                                         |     | 23               | 30  | m ohm |
| On-State Drain Current                 | I <sub>D(ON)</sub>  | V <sub>DS</sub> = 10V, V <sub>GS</sub> = 10V                                                       | 30  |                  |     | A     |
| Forward Transconductance               | g <sub>FS</sub>     | V <sub>DS</sub> = 10V, I <sub>D</sub> = 10A                                                        |     | 17               |     | 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                                            |     | 690              |     | pF    |
| Output Capacitance                     | C <sub>OSS</sub>    |                                                                                                    |     | 140              |     | pF    |
| Reverse Transfer Capacitance           | C <sub>RSS</sub>    |                                                                                                    |     | 95               |     | pF    |
| 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> = 3 ohm |     | 13.1             |     | ns    |
| Rise Time                              | t <sub>r</sub>      |                                                                                                    |     | 13.5             |     | ns    |
| Turn-Off Delay Time                    | t <sub>D(OFF)</sub> |                                                                                                    |     | 45.7             |     | ns    |
| Fall Time                              | t <sub>f</sub>      |                                                                                                    |     | 11.8             |     | ns    |
| Total Gate Charge                      | Q <sub>g</sub>      | V <sub>DS</sub> =20V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V                                    |     | 13.5             |     | nC    |
|                                        |                     | V <sub>DS</sub> =20V, I <sub>D</sub> =10A, V <sub>GS</sub> =4.5V                                   |     | 6.7              |     | nC    |
| Gate-Source Charge                     | Q <sub>gs</sub>     | V <sub>DS</sub> =20V, I <sub>D</sub> = 10A<br>V <sub>GS</sub> =10V                                 |     | 1.65             |     | nC    |
| Gate-Drain Charge                      | Q <sub>gd</sub>     |                                                                                                    |     | 3.85             |     | nC    |

# STU/D410S

## ELECTRICAL CHARACTERISTICS ( $T_c=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                                       | Symbol   | Condition               | Min | Typ  | Max | Unit |
|-------------------------------------------------|----------|-------------------------|-----|------|-----|------|
| DRAIN-SOURCE DIODE CHARACTERISTICS <sup>a</sup> |          |                         |     |      |     |      |
| Diode Forward Voltage                           | $V_{SD}$ | $V_{GS} = 0V, I_S = 8A$ |     | 0.84 | 1.3 | V    |

### Notes

a. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

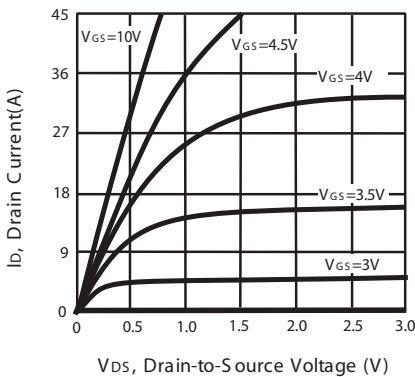


Figure 1. Output Characteristics

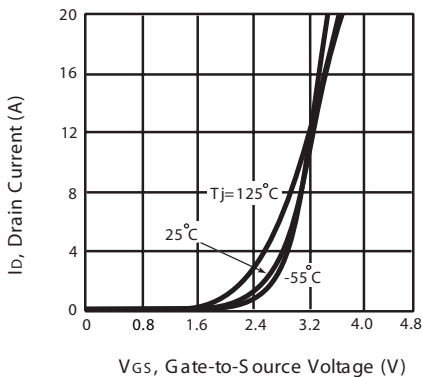


Figure 2. Transfer Characteristics

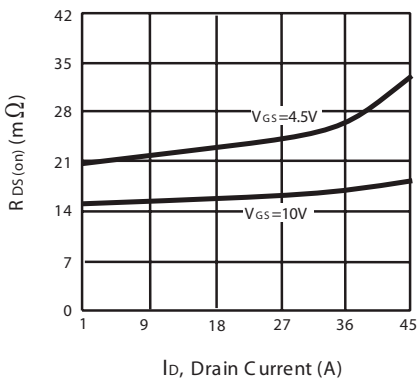


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

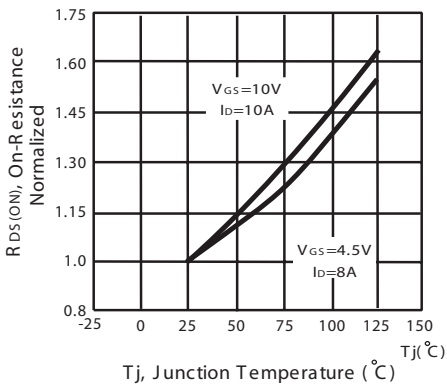


Figure 4. On-Resistance Variation with Drain Current and Temperature

# STU/D410S

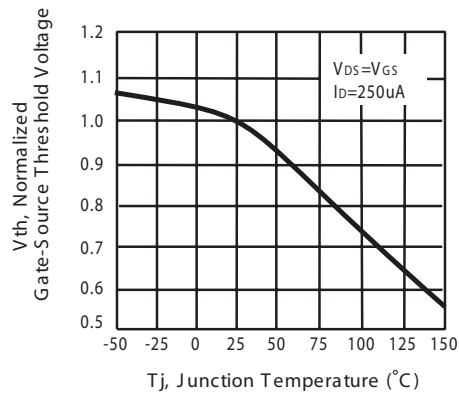


Figure 5. Gate Threshold Variation with Temperature

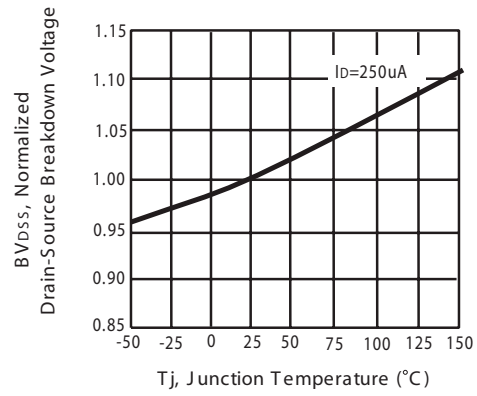


Figure 6. Breakdown Voltage Variation with Temperature

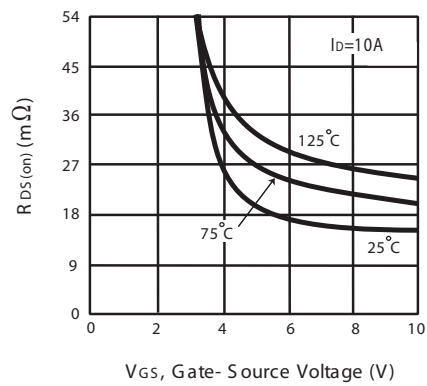


Figure 7. On-Resistance vs. Gate-Source Voltage

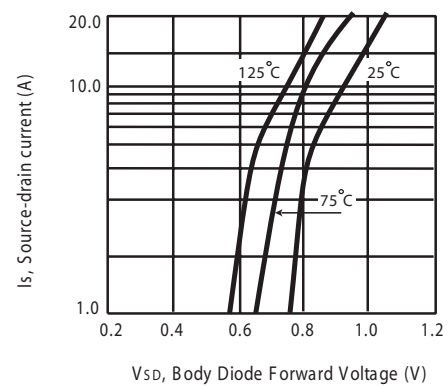


Figure 8. Body Diode Forward Voltage Variation with Source Current

# STU/D410S

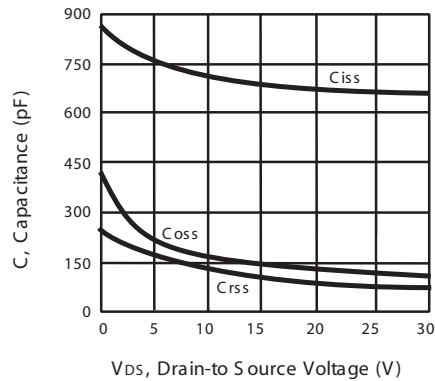


Figure 9. Capacitance

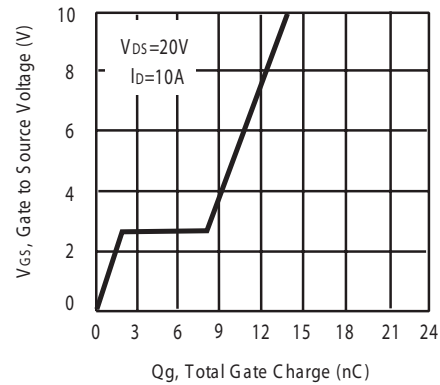


Figure 10. Gate Charge

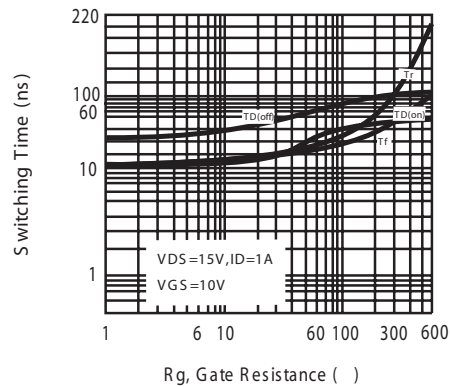


Figure 11. switching characteristics

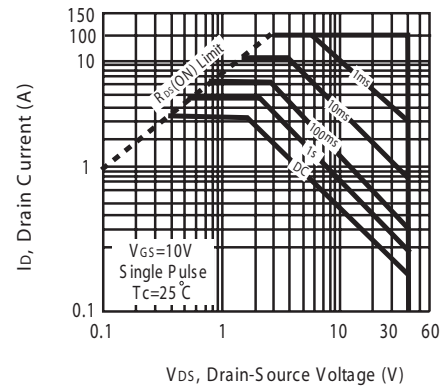


Figure 12. Maximum Safe Operating Area

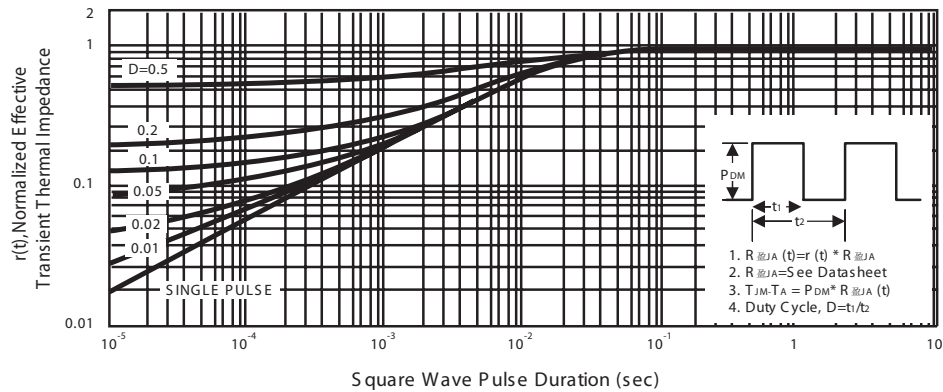
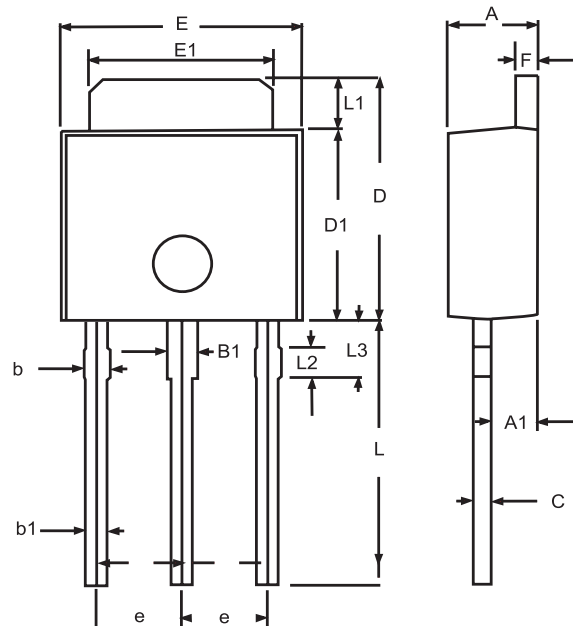


Figure 13. Normalized Thermal Transient Impedance Curve

# STU/D410S

## PACKAGE OUTLINE DIMENSIONS

### TO-251

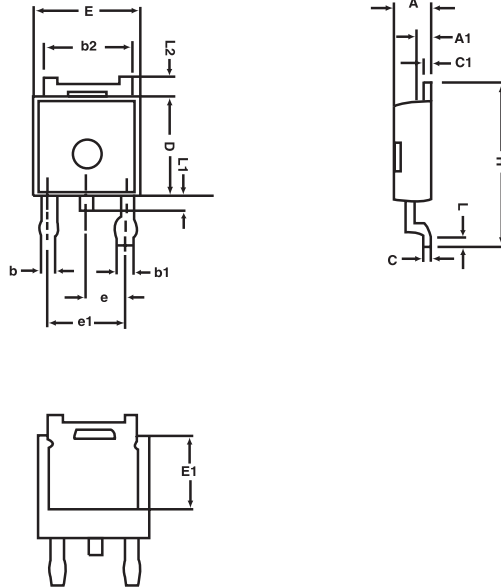


| SYMBOLS | MILLIMETERS |       | INCHES |       |
|---------|-------------|-------|--------|-------|
|         | MIN         | MAX   | MIN    | MAX   |
| A       | 2.20        | 2.40  | 0.087  | 0.095 |
| A1      | 1.100       | 1.300 | 0.043  | 0.051 |
| B1      | 0.650       | 1.050 | 0.026  | 0.041 |
| 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 |

# STU/D410S

## PACKAGE OUTLINE DIMENSIONS

### TO-252

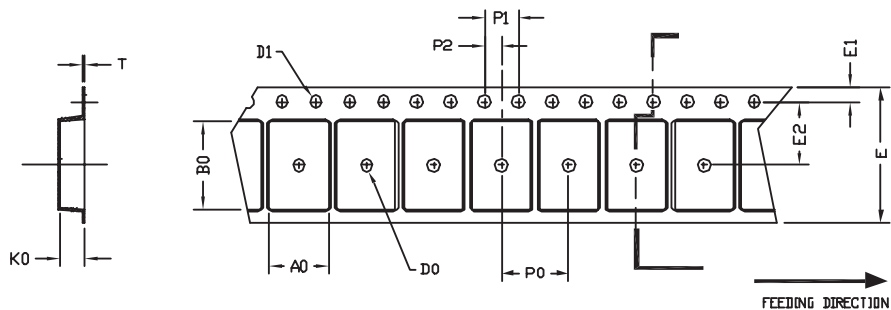


| SYMBOLS | MILLIMETERS |       | INCHES |       |
|---------|-------------|-------|--------|-------|
|         | MIN         | MAX   | MIN    | MAX   |
| A       | 2.25        | 2.35  | 0.089  | 0.093 |
| A1      | 0.95        | 1.05  | 0.037  | 0.041 |
| b       | 0.77        | 0.85  | 0.030  | 0.033 |
| 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/D410S

## TO-252 Tape and Reel Data

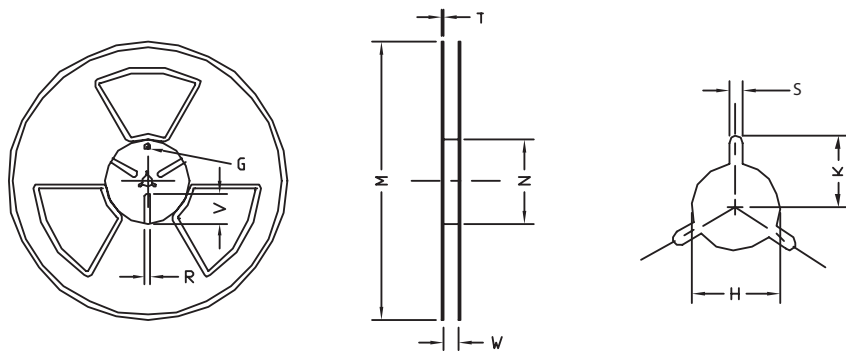
### TO-252 Carrier Tape



UNIT: mm

| PACKAGE             | A0          | B0          | K0          | D0   | D1                | E           | E 1         | E 2         | P0         | P1         | P2          | T           |
|---------------------|-------------|-------------|-------------|------|-------------------|-------------|-------------|-------------|------------|------------|-------------|-------------|
| TO-252<br>(16 pins) | 6.80<br>0.1 | 10.3<br>0.1 | 2.50<br>0.1 | 1.27 | 1.5<br>+0.1<br>-0 | 16.0<br>0.3 | 1.75<br>0.1 | 7.5<br>0.15 | 8.0<br>0.1 | 4.0<br>0.1 | 2.0<br>0.15 | 0.3<br>0.05 |

### TO-252 Reel



UNIT: mm

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