



# FDS6680A

## Single N-Channel, Logic Level, PowerTrench® MOSFET

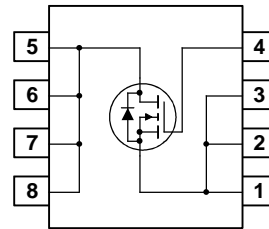
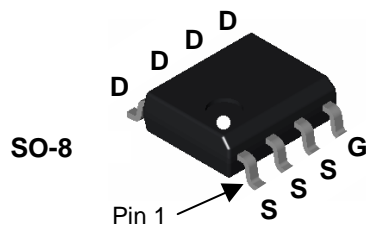
### General Description

This N-Channel Logic Level MOSFET is produced using T UÜB/OÖP Semiconductor's advanced Power Trench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

### Features

- 12.5 A, 30 V  $R_{DS(ON)} = 9.6 m\Omega @ V_{GS} = 10 V$   
 $R_{DS(ON)} = 13.5 m\Omega @ V_{GS} = 4.5 V$
- Ultra-low gate charge
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability



### Absolute Maximum Ratings

$T_A = 25^\circ C$  unless otherwise noted

| Symbol         | Parameter  | Ratings         | Units      |
|----------------|--|-----------------|------------|
| $V_{DSS}$      | Drain-Source Voltage   | 30              | V          |
| $V_{GSS}$      | Gate-Source Voltage  | $\pm 20$        |            |
| $I_D$          | Drain Current – Continuous (Note 1a)                                       | 12.5            | A          |
|                | – Pulsed   | 50              |            |
| $P_D$          | Power Dissipation for Single Operation (Note 1a)<br>(Note 1b)<br>(Note 1c) | 2.5             | W          |
|                |  | 1.2             |            |
|                |  | 1.0             |            |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                           | $-55$ to $+150$ | $^\circ C$ |

### Thermal Characteristics

|                 |   |    |              |
|-----------------|---|----|--------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 50 | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Ambient (Note 1)  | 25 |              |

### Package Marking and Ordering Information

| Device Marking | Device   | Reel Size | Tape width | Quantity   |
|----------------|----------|-----------|------------|------------|
| FDS6680A       | FDS6680A | 13"       | 12mm       | 2500 units |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**Off Characteristics**

|                                      |   |   |    |    |           |                      |
|--------------------------------------|---|---|----|----|-----------|----------------------|
| $BV_{DSS}$                           | Drain–Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                 | 30 |    |           | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$   |    | 25 |           | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$                         |    |    | 1         | $\mu\text{A}$        |
|                                      |   | $V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}, T_J = 55^\circ\text{C}$ |    |    | 10        | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate–Body Leakage                         | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$                     |    |    | $\pm 100$ | nA                   |

**On Characteristics (Note 2)**

|  |  |   |    |             |             |                      |
|--|--|---|----|-------------|-------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$   | 1  | 2           | 3           | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$   |    | –4.9        |             | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain–Source On–Resistance              | $V_{GS} = 10\text{ V}, I_D = 12.5\text{ A}$<br>$V_{GS} = 4.5\text{ V}, I_D = 10.5\text{ A}$<br>$V_{GS} = 10\text{ V}, I_D = 12.5\text{ A}, T_J = 125^\circ\text{C}$ |    | 9.1<br>11.0 | FE5<br>FE15 | m $\Omega$           |
| $I_{D(on)}$                            | On–State Drain Current                         | $V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$   | 25 |             |             | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 15\text{ V}, I_D = 12.5\text{ A}$   |    | 64          |             | S                    |

**Dynamic Characteristics**

|           |                              |  |  |      |  |          |
|-----------|------------------------------|--|--|------|--|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ |  | 1620 |  | pF       |
| $C_{oss}$ | Output Capacitance           |  |  | 380  |  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |  |  | 160  |  | pF       |
| $R_G$     | Gate Resistance              | $V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$                          |  | 1.3  |  | $\Omega$ |

**Switching Characteristics (Note 2)**

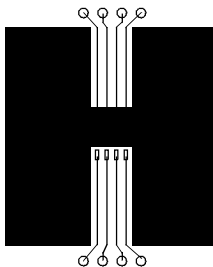
|              |                     |  |  |     |    |    |
|--------------|---------------------|--|--|-----|----|----|
| $t_{d(on)}$  | Turn–On Delay Time  | $V_{DD} = 15\text{ V}, I_D = 1\text{ A},$<br>$V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$ |  | 10  | 19 | ns |
| $t_r$        | Turn–On Rise Time   |  |  | 5   | 10 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time |  |  | 27  | 43 | ns |
| $t_f$        | Turn–Off Fall Time  |  |  | 15  | 27 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 15\text{ V}, I_D = 12.5\text{ A},$<br>$V_{GS} = 5\text{ V}$                          |  | 16  | 23 | nC |
| $Q_{gs}$     | Gate–Source Charge  |  |  | 5   |    | nC |
| $Q_{gd}$     | Gate–Drain Charge   |  |  | 5.8 |    | nC |

**Drain–Source Diode Characteristics and Maximum Ratings**

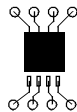
|                 |   |   |  |      |     |    |
|-----------------|---|---|--|------|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain–Source Diode Forward Current |   |  |      | 2.1 | A  |
| V <sub>SD</sub> | Drain–Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.1 A (Note 2)              |  | 0.73 | 1.2 | V  |
| t <sub>rr</sub> | Diode Reverse Recovery Time                           | I <sub>F</sub> = 12.5 A, d <sub>I</sub> F/d <sub>t</sub> = 100 A/μs |  | 28   |     | ns |
| Q <sub>rr</sub> | Diode Reverse Recovery Charge                         |   |  | 18   |     | nC |

**Notes:**

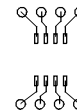
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $105^\circ\text{C/W}$  when mounted on a  $.04\text{ in}^2$  pad of 2 oz copper



c)  $125^\circ\text{C/W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%

## Typical Characteristics

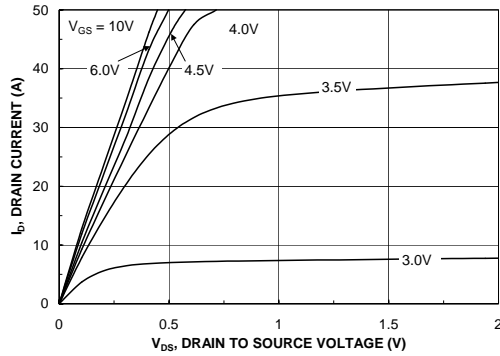


Figure 1. On-Region Characteristics.

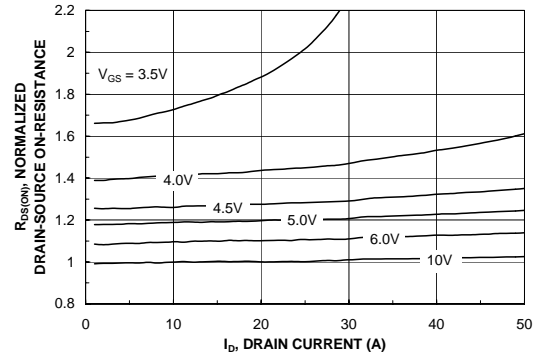


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

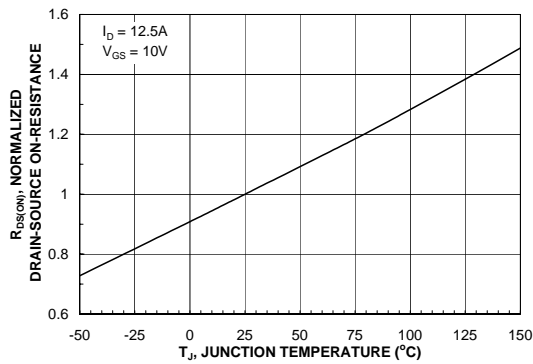


Figure 3. On-Resistance Variation with Temperature.

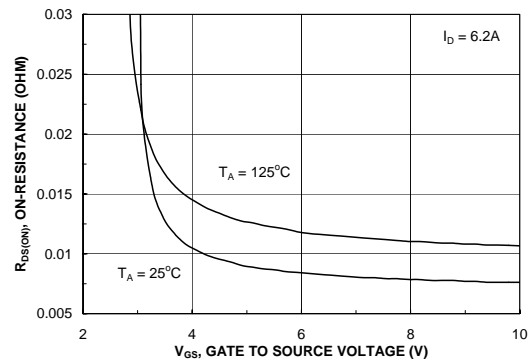


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

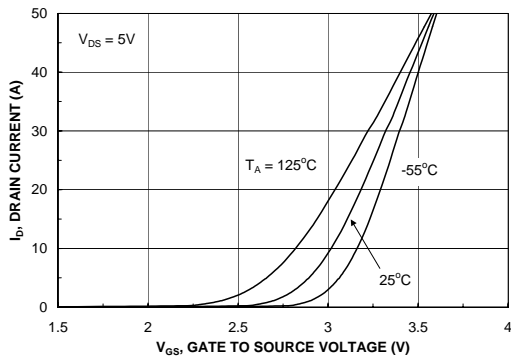


Figure 5. Transfer Characteristics.

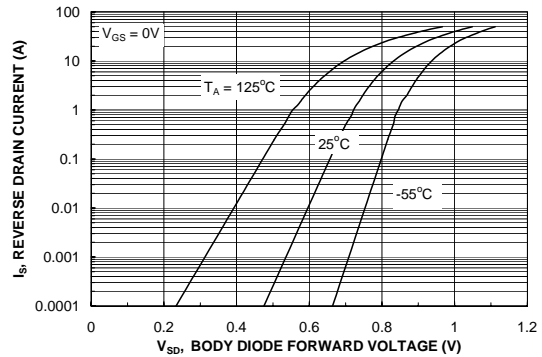


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

# Typical Characteristics

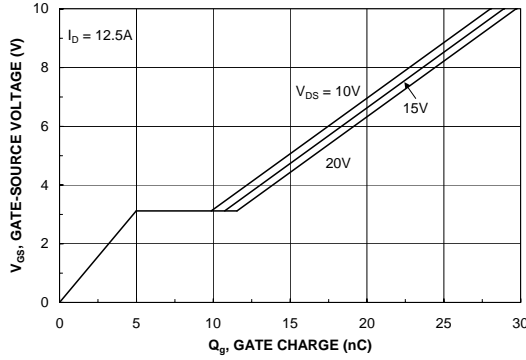


Figure 7. Gate Charge Characteristics.

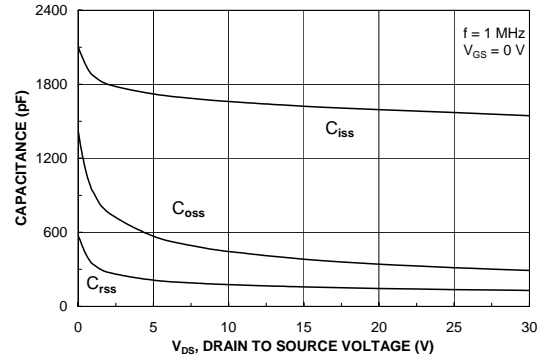


Figure 8. Capacitance Characteristics.

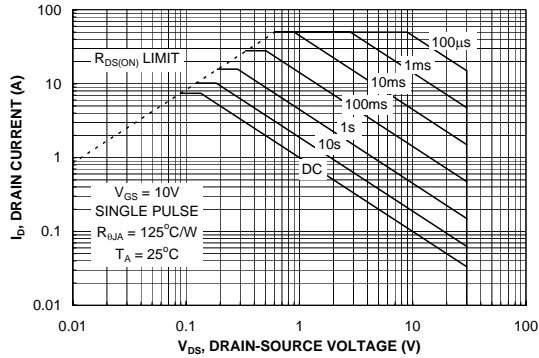


Figure 9. Maximum Safe Operating Area.

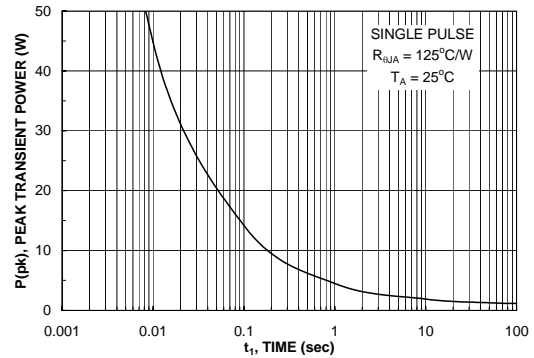


Figure 10. Single Pulse Maximum Power Dissipation.

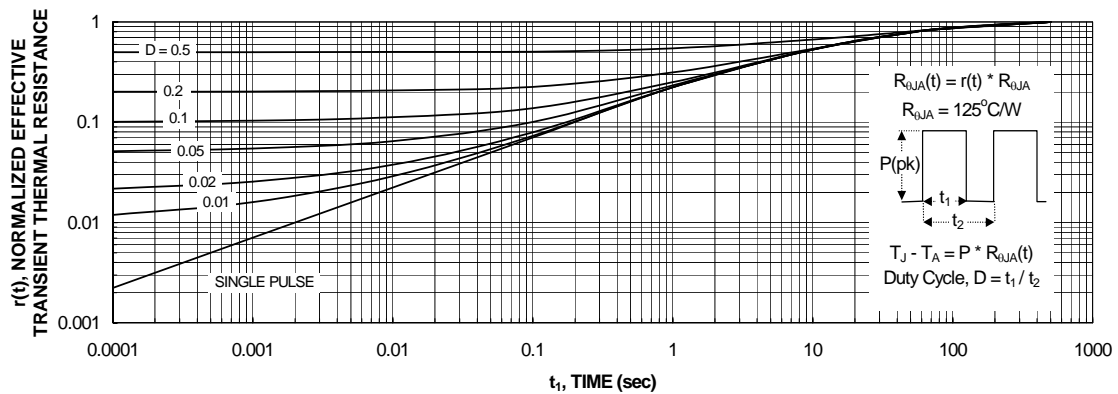
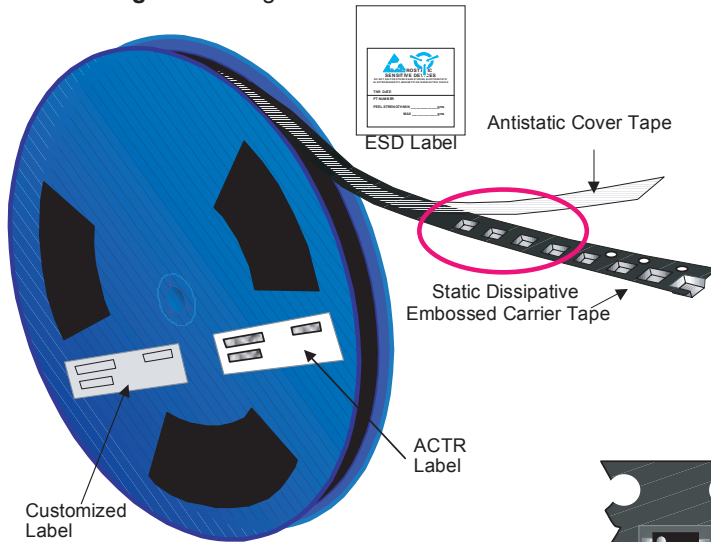


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c.  
Transient thermal response will change depending on the circuit board design.

## SOIC-8 Tape and Reel Data

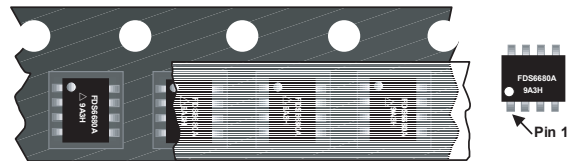
### SOIC(8lds) Packaging Configuration: Figure 1.0



#### Packaging Description:

SOIC-8 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 2,500 units per 13" or 330cm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 500 units per 7" or 177cm diameter reel. This and some other options are further described in the Packaging Information table.

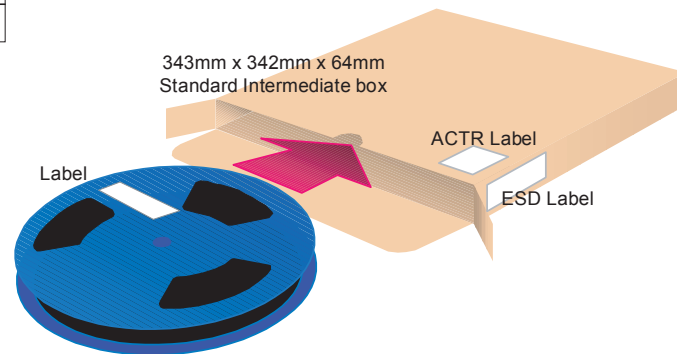
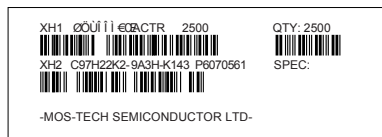
These full reels are in individually barcode labeled and placed inside a standard intermediate box (illustrated in figure 1.0) made of recyclable corrugated brown paper. One box contains two reels maximum. And these boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.



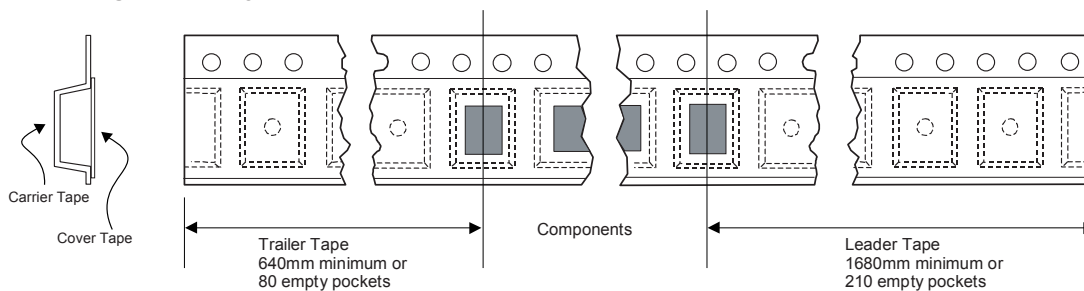
#### SOIC-8 Unit Orientation

| SOIC (8lds) Packaging Information |                         |            |            |            |
|-----------------------------------|-------------------------|------------|------------|------------|
| Packaging Option                  | Standard (no flow code) | L86Z       | F011       | D84Z       |
| Packaging type                    | ACTR                    | Rail/Tube  | TNR        | TNR        |
| Qty per Reel/Tube/Bag             | 2,500                   | 95         | 4,000      | 500        |
| Reel Size                         | 13" Dia                 | -          | 13" Dia    | 7" Dia     |
| Box Dimension (mm)                | 343x64x343              | 530x130x83 | 343x64x343 | 184x187x47 |
| Max qty per Box                   | 5,000                   | 30,000     | 8,000      | 1,000      |
| Weight per unit (gm)              | 0.0774                  | 0.0774     | 0.0774     | 0.0774     |
| Weight per Reel (kg)              | 0.6060                  | -          | 0.9696     | 0.1182     |
| Note/Comments                     |                         |            |            |            |

#### ACTR Label sample



### SOIC(8lds) Tape Leader and Trailer Configuration: Figure 2.0

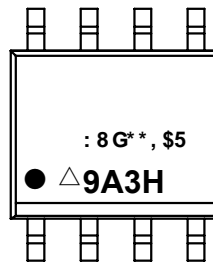


## Part Marking Information



### SO-8 (PMG Code )

SO-8 Devices



FDS6680A = Example Base Part Number

- = Pin 1 Indicator
- △ = ESD Symbol (⚡)
- 9 = Year Code
- A = Month Code
- 3 = Week Code
- H = Assembly Factory Code

**NOTE:**

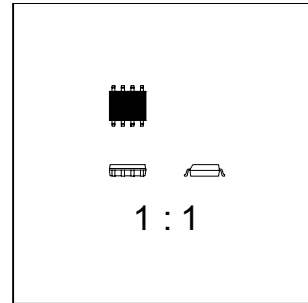
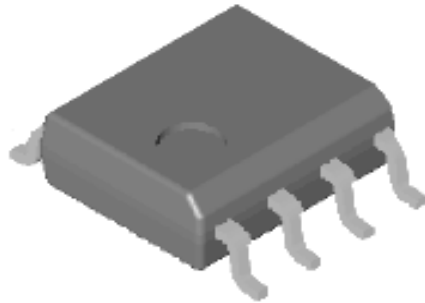
1. For analog switches base part includes DG prefix. Package suffix may or may not be present, depending on room available.

The current marking strategy is reflected. Contact your local sales representative for historical marking strategies for these packages.

## SOIC-8 Package Dimensions



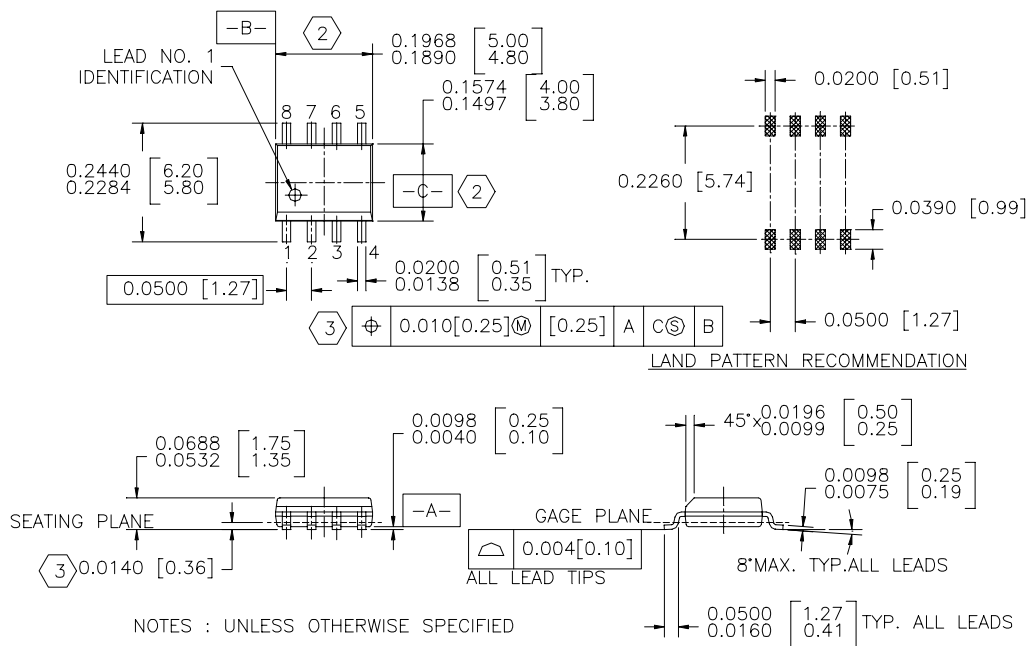
### SOIC-8 (PKG Code S1)



Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

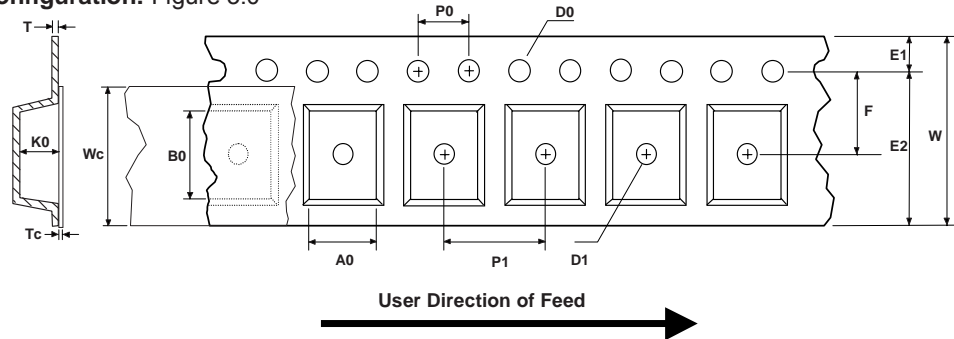
Part Weight per unit (gram): 0.0774



## SOIC-8 Tape and Reel Data, continued

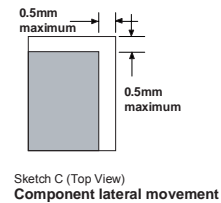
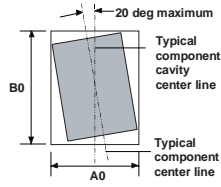
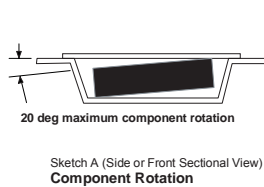


### SOIC(8lds) Embossed Carrier Tape Configuration: Figure 3.0

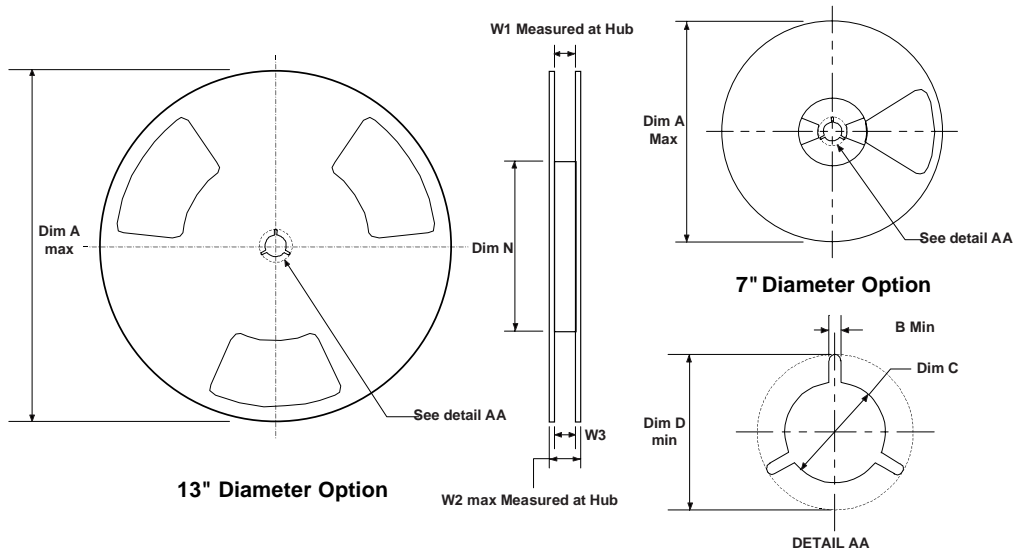


| Dimensions are in millimeter |                 |                 |                |                 |                 |                 |              |                 |               |               |                |                       |               |                 |
|------------------------------|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|--------------|-----------------|---------------|---------------|----------------|-----------------------|---------------|-----------------|
| Pkg type                     | A0              | B0              | W              | D0              | D1              | E1              | E2           | F               | P1            | P0            | K0             | T                     | Wc            | Tc              |
| SOIC(8lds)<br>(12mm)         | 6.50<br>+/-0.10 | 5.30<br>+/-0.10 | 12.0<br>+/-0.3 | 1.55<br>+/-0.05 | 1.60<br>+/-0.10 | 1.75<br>+/-0.10 | 10.25<br>min | 5.50<br>+/-0.05 | 8.0<br>+/-0.1 | 4.0<br>+/-0.1 | 2.1<br>+/-0.10 | 0.450<br>+/-<br>0.150 | 9.2<br>+/-0.3 | 0.06<br>+/-0.02 |

Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



### SOIC(8lds) Reel Configuration: Figure 4.0



| Dimensions are in inches and millimeters |             |               |              |                                   |               |             |                                  |               |                              |
|--|-------------|---------------|--------------|-----------------------------------|---------------|-------------|----------------------------------|---------------|------------------------------|
| Tape Size                                | Reel Option | Dim A         | Dim B        | Dim C                             | Dim D         | Dim N       | Dim W1                           | Dim W2        | Dim W3 (LSL-USL)             |
| 12mm                                     | 7" Dia      | 7.00<br>177.8 | 0.059<br>1.5 | 512 +0.020/-0.008<br>13 +0.5/-0.2 | 0.795<br>20.2 | 2.165<br>55 | 0.488 +0.078/-0.000<br>12.4 +2/0 | 0.724<br>18.4 | 0.469 - 0.606<br>11.9 - 15.4 |
| 12mm                                     | 13" Dia     | 13.00<br>330  | 0.059<br>1.5 | 512 +0.020/-0.008<br>13 +0.5/-0.2 | 0.795<br>20.2 | 7.00<br>178 | 0.488 +0.078/-0.000<br>12.4 +2/0 | 0.724<br>18.4 | 0.469 - 0.606<br>11.9 - 15.4 |