



MT4435

30V P-Channel PowerTrench[®] MOSFET

General Description

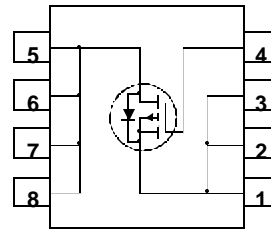
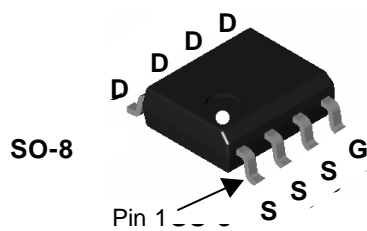
This PChannel MOSFET is a rugged gate version of MOS-TECH Semiconductor's advanced PowerTrench process. It has been optimized for power management applications requiring a wide range of gate drive voltage ratings (4.5V – 25V).

Applications

- Power management
- Load switch
- Battery protection

Features

- -8.8 A, -30 V $R_{DS(ON)} = 20\text{ m}\Omega @ V_{GS} = -10\text{ V}$
 $R_{DS(ON)} = 35\text{ m}\Omega @ V_{GS} = -4.5\text{ V}$
- Low gate charge (17nC typical)
- Fast switching speed
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability



Absolute Maximum Ratings T_A=25°C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|-----------------------------------|--|-------------|-------|
| V _{DSS} | Drain-Source Voltage | -30 | V |
| V _{GSS} | Gate-Source Voltage | ±25 | V |
| I _b | Drain Current – Continuous (Note 1a) – Pulsed | -8.8 | A |
| | | -50 | |
| P _D | Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c) | 2.5 | W |
| | | 1.2 | |
| | | 1 | |
| T _J , T _{STG} | Operating and Storage Junction Temperature Range | -55 to +175 | °C |

Thermal Characteristics

| | | | |
|------------------|---|-----|------|
| R _{θJA} | Thermal Resistance, Junction-to-Ambient (Note 1a) | 50 | °C/W |
| R _{θJA} | Thermal Resistance, Junction-to-Ambient (Note 1c) | 125 | °C/W |
| R _{θJC} | Thermal Resistance, Junction-to-Case (Note 1) | 25 | °C/W |

Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|----------------|--------|-----------|------------|------------|
| MT4435 | | 13" | 12mm | 2500 units |

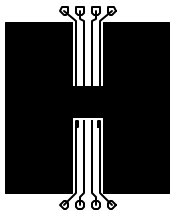
Electrical Characteristics

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

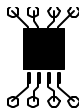
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|--|-----|----------------|----------------|----------------------------|
| Off Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_b = -250\ \mu\text{A}$ | -30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_b = -250\ \mu\text{A}$, Referenced to 25°C | | -21 | | $\text{mV}/^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -24\text{ V}, V_{GS} = 0\text{ V}$ | | | -1 | μA |
| I_{GSSF} | Gate-Body Leakage, Forward | $V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$ | | | 100 | nA |
| I_{GSSR} | Gate-Body Leakage, Reverse | $V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$ | | | -100 | nA |
| On Characteristics (Note 2) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_b = -250\ \mu\text{A}$ | -1 | -1.7 | -3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_b = -250\ \mu\text{A}$, Referenced to 25°C | | 5 | | $\text{mV}/^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = -10\text{ V}, I_b = -8.8\text{ A}$ $V_{GS} = -4.5\text{ V}, I_b = -6.7\text{ A}$ $V_{GS} = -10\text{ V}, I_b = -8.8\text{ A}, T_J = 125^\circ\text{C}$ | | 15 22 19 | 20 35 32 | $\text{m}\Omega$ |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$ | -50 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = -5\text{ V}, I_b = -8.8\text{ A}$ | | 24 | | S |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V},$ | | 1604 | | pF |
| C_{oss} | Output Capacitance | $f = 1.0\text{ MHz}$ | | 408 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 202 | | pF |
| Switching Characteristics (Note 2) | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = -15\text{ V}, I_b = -1\text{ A},$ | | 13 | 23 | ns |
| t_r | Turn-On Rise Time | $V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$ | | 13.5 | 24 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 42 | 68 | ns |
| t_f | Turn-Off Fall Time | | | 25 | 40 | ns |
| Q_g | Total Gate Charge | $V_{DS} = -15\text{ V}, I_b = -8.8\text{ A},$ | | 17 | 24 | nC |
| Q_{gs} | Gate-Source Charge | $V_{GS} = -5\text{ V}$ | | 5 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 6 | | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | | | -2.1 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = -2.1\text{ A}$ (Note 2) | | -0.73 | -1.2 | V |

Notes:

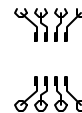
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 50°C/W when mounted on a 1 in^2 pad of 2 oz copper



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



c) 125°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

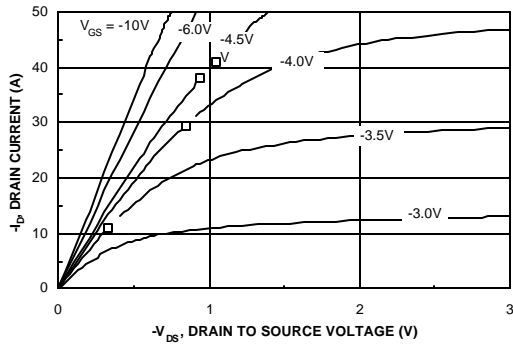


Figure 1. On-Region Characteristics.

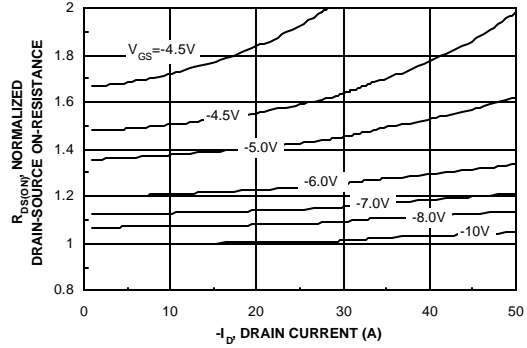


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

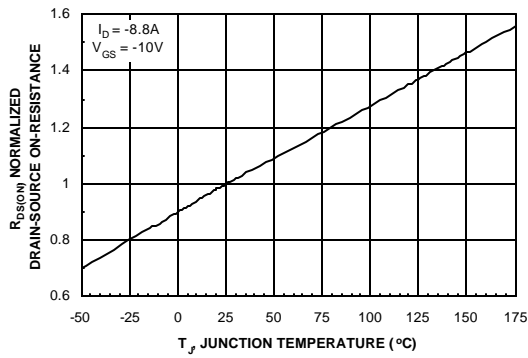


Figure 3. On-Resistance Variation with Temperature.

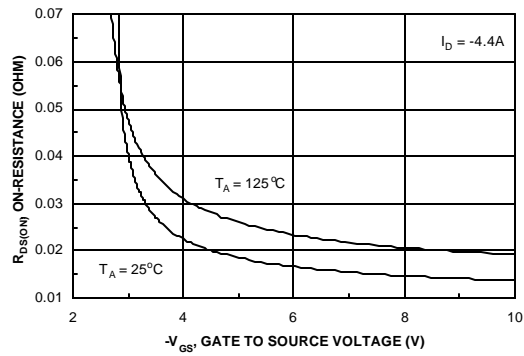


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

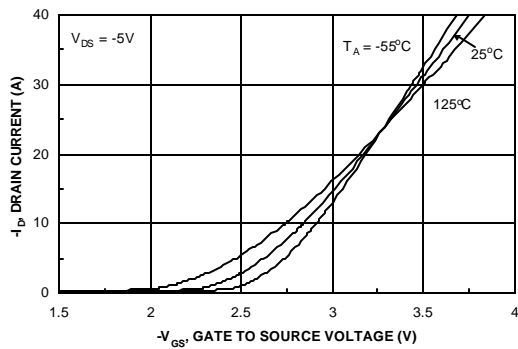


Figure 5. Transfer Characteristics.

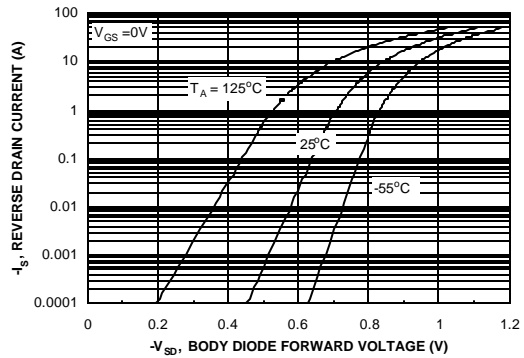


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

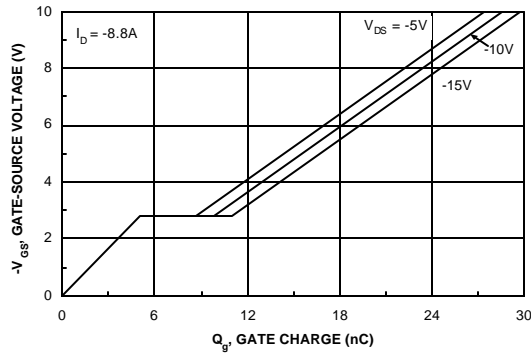


Figure 7. Gate Charge Characteristics.

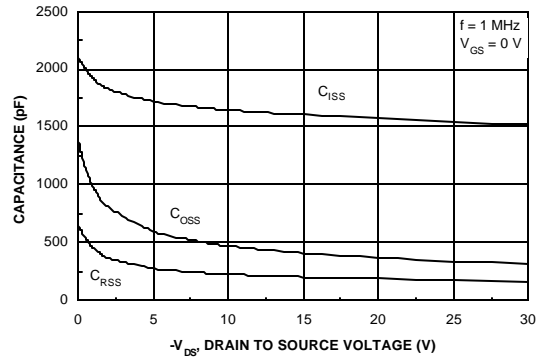


Figure 8. Capacitance Characteristics.

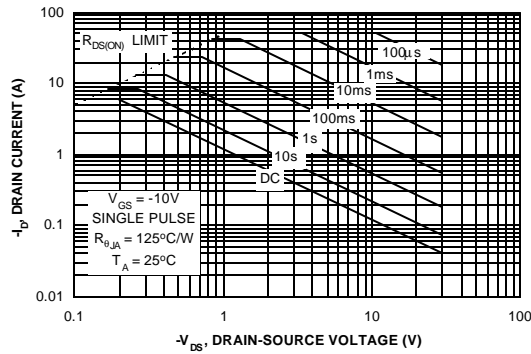


Figure 9. Maximum Safe Operating Area.

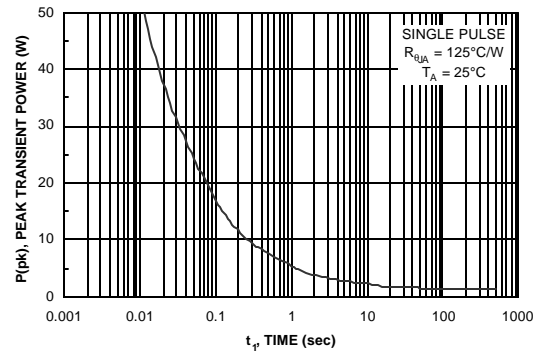


Figure 10. Single Pulse Maximum Power Dissipation.

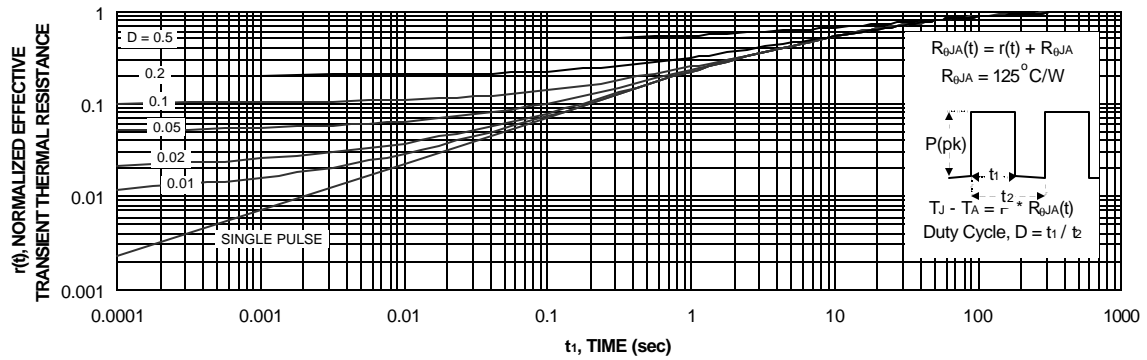


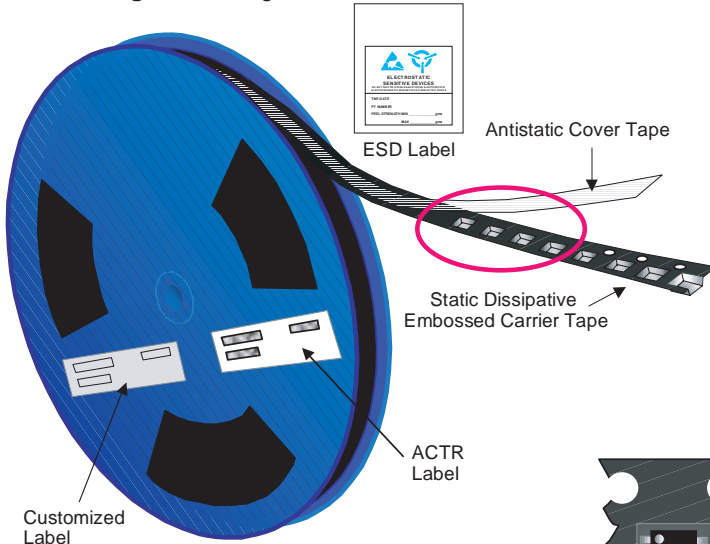
Figure 11. Transient Thermal Response Curve.

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

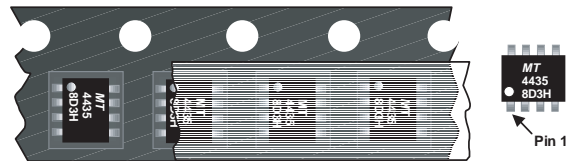
SOIC-8 Tape and Reel Data



SOIC(8lds) Packaging Configuration: Figure 1.0



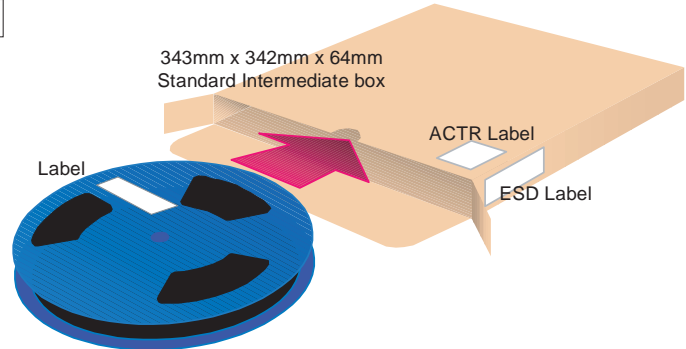
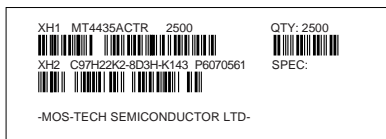
Packaging Description:
 SOIC-8 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. 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 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.



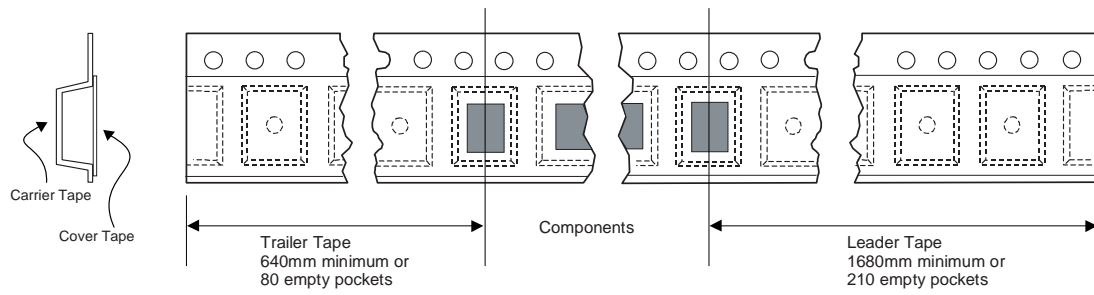
| SOIC (8lds) Packaging Information | | | | |
|-----------------------------------|-------------------------|------------|------------|------------|
| Packaging Option | Standard (no flow code) | L86Z | F011 | D84Z |
| Packaging type | ACTR | Rail/Tube | TNR | TNR |
| Qty per Reel/Tube/Bag | 2,500 | 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 | | | | |

SOIC-8 Unit Orientation

MT4435ACTR Label sample



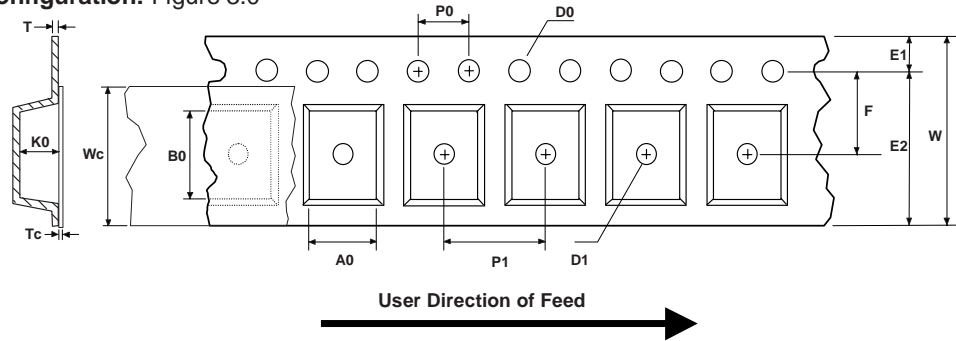
SOIC(8lds) Tape Leader and Trailer Configuration: Figure 2.0



SOIC-8 Tape and Reel Data, continued

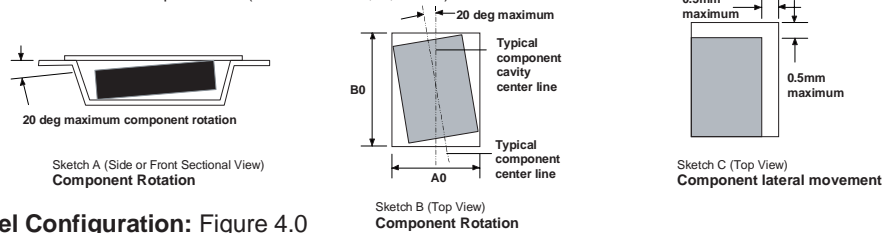


SOIC(8lds) Embossed Carrier Tape Configuration: Figure 3.0

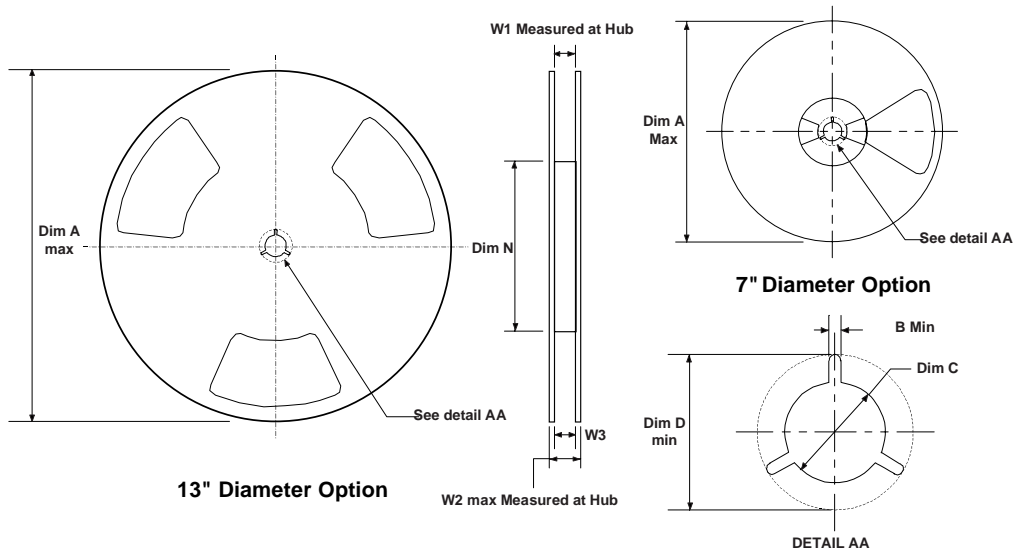


| Dimensions are in millimeter | | | | | | | | | | | | | | |
|------------------------------|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|--------------|-----------------|---------------|---------------|----------------|-----------------------|---------------|-----------------|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

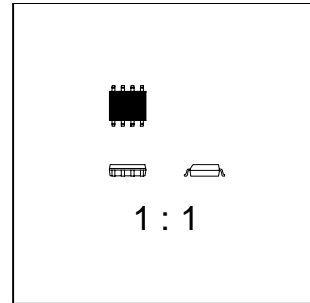
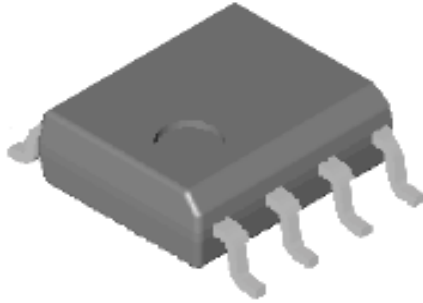


| Dimensions are in inches and millimeters | | | | | | | | | |
|--|-------------|---------------|--------------|-----------------------------------|---------------|-------------|----------------------------------|---------------|------------------------------|
| Tape Size | Reel Option | Dim A | Dim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

SOIC-8 Package Dimensions



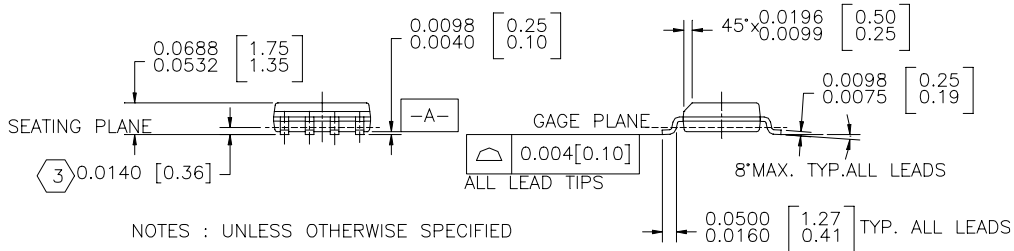
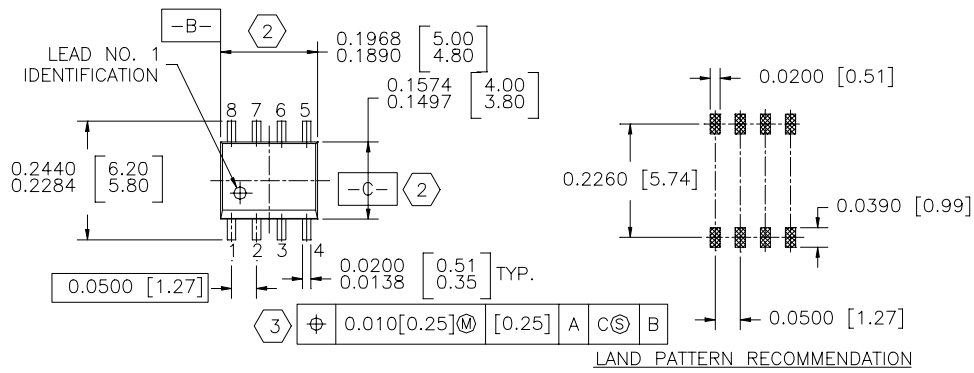
SOIC-8 (PKG Code S1)



Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0774



NOTES : UNLESS OTHERWISE SPECIFIED

- STANDARD LEAD FINISH:
200 MICROINCHES / 5.08 MICRONS MINIMUM
LEAD / TIN (SOLDER) ON COPPER.

SO 0.150 WIDE 8 LEADS

- THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH
- MAXIMUM LEAD 0.024 [0.609]



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 - 1) 生命维持装置。
 - 2) 植埋于人体使用的装置。
 - 3) 用于治疗(切除患处、给药等)的装置。
 - 4) 其他直接影响到人的生命的装置。
9. 在使用本资料所记载的产品时,对于最大额定值、工作电源电压的范围、放热特性、安装条件及其他条件请在本公司规定的保证范围内使用。如果超出了本公司规定的保证范围使用时,对于由此而造成的故障和出现的事,本公司将不承担任何责任。
10. 本公司一直致力于提高产品的质量和可靠性,但一般来说,半导体产品总会以一定的概率发生故障、或者由于使用条件不同而出现错误运行等。为了避免因本公司的产品发生故障或者错误运行而导致人身事故和火灾或造成社会性的损失,希望客户能自行负责进行冗余设计、采取延烧对策及进行防止错误运行等的安全设计(包括硬件和软件两方面的设计)以及老化处理等,这是作为机器和系统的出厂保证。特别是单片机的软件,由于单独进行验证很困难,所以要求在顾客制造的最终的机器及系统上进行安全检验工作。
11. 如果把本资料所记载的产品从其载体设备上卸下,有可能造成婴儿误吞的危险。顾客在将本公司产品安装到顾客的设备上时,请顾客自行负责将本公司产品设置为不容易剥落的安全设计。如果从顾客的设备上剥落而造成事故时,本公司将不承担任何责任。
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Keep safety first in your circuit designs!

1. MOS-TECH Semiconductor Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.