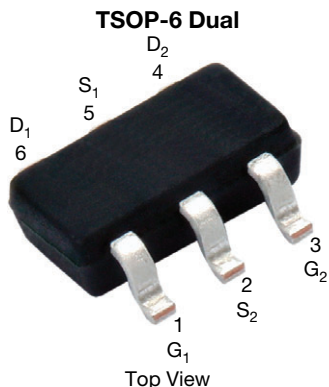


# Automotive Dual P-Channel 30 V (D-S) 175 °C MOSFET



Marking code: 9B

| PRODUCT SUMMARY                                |        |
|------------------------------------------------|--------|
| $V_{DS}$ (V)                                   | -30    |
| $R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -10$ V  | -0.155 |
| $R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -4.5$ V | -0.300 |
| $I_D$ (A)                                      | -2.32  |
| Configuration                                  | Dual   |

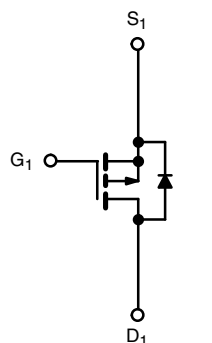
## FEATURES

- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 %  $R_g$  and UIS tested
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

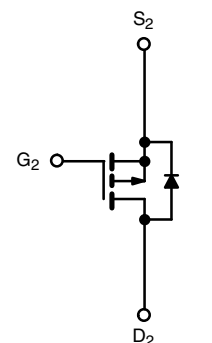
AUTOMOTIVE  
GRADE



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**



P-Channel MOSFET



P-Channel MOSFET

| ORDERING INFORMATION            |                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Package                         | TSOP-6                                                                                                                     |
| Lead (Pb)-free and halogen-free | SQ3989EV<br>(for detailed order number please see <a href="http://www.vishay.com/doc?79771">www.vishay.com/doc?79771</a> ) |

| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted) |                |                |             |      |
|-------------------------------------------------------------------|----------------|----------------|-------------|------|
| PARAMETER                                                         |                | SYMBOL         | LIMIT       | UNIT |
| Drain-source voltage                                              |                | $V_{DS}$       | -30         | V    |
| Gate-source voltage                                               |                | $V_{GS}$       | $\pm 20$    |      |
| Continuous drain current ( $T_J = 150$ °C) <sup>a</sup>           | $T_C = 25$ °C  | $I_D$          | -2.5        | A    |
|                                                                   | $T_C = 125$ °C |                | -1.5        |      |
| Pulsed drain current                                              |                | $I_{DM}$       | -10.2       |      |
| Continuous source current (diode conduction) <sup>a</sup>         |                | $I_S$          | -2.1        | W    |
| Maximum power dissipation <sup>a</sup>                            | $T_C = 25$ °C  | $P_D$          | 1.67        |      |
|                                                                   | $T_C = 125$ °C |                | 0.56        |      |
| Unclamped inductive surge UIS                                     |                | $I_{AV}$       | -7          | A    |
| Operating junction and storage temperature range                  |                | $T_J, T_{stg}$ | -55 to +175 | °C   |

| THERMAL RESISTANCE RATINGS               |              |            |       |      |
|------------------------------------------|--------------|------------|-------|------|
| PARAMETER                                |              | SYMBOL     | LIMIT | UNIT |
| Maximum junction-to-ambient <sup>a</sup> | Steady state | $R_{thJA}$ | 150   | °C/W |
| Maximum junction-to-foot (drain)         | Steady state | $R_{thJF}$ | 90    |      |

## Note

a. Surface mounted on 1" x 1" FR4 board



| SPECIFICATIONS (T <sub>J</sub> = 25°C, unless otherwise noted) |                     |                                                                                                                         |                                                 |      |       |       |      |
|----------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------|-------|-------|------|
| PARAMETER                                                      | SYMBOL              | TEST CONDITIONS                                                                                                         |                                                 | MIN. | TYP.  | MAX.  | UNIT |
| Static                                                         |                     |                                                                                                                         |                                                 |      |       |       |      |
| Gate threshold voltage                                         | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA                                                            |                                                 | -0.6 | -     | -1.5  | V    |
| Gate-body leakage                                              | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                                                         |                                                 | -    | -     | ± 100 | nA   |
| Zero gate voltage drain current                                | I <sub>DSS</sub>    | V <sub>GS</sub> = 0 V                                                                                                   | V <sub>DS</sub> = -30 V                         | -    | -     | -1    | μA   |
|                                                                |                     | V <sub>GS</sub> = 0 V                                                                                                   | V <sub>DS</sub> = -30 V, T <sub>J</sub> = 55 °C | -    | -     | -5    |      |
| On-state drain current <sup>a</sup>                            | I <sub>D(on)</sub>  | V <sub>GS</sub> = -10 V                                                                                                 | V <sub>DS</sub> ≤ -5 V                          | -4   | -     | -     | A    |
| Drain-source on-state resistance <sup>a</sup>                  | R <sub>DS(on)</sub> | V <sub>GS</sub> = -10 V                                                                                                 | I <sub>D</sub> = -0.4 A                         | -    | 0.140 | 0.155 | Ω    |
|                                                                |                     | V <sub>GS</sub> = -4.5 V                                                                                                | I <sub>D</sub> = -0.2 A                         | -    | 0.265 | 0.300 |      |
| Forward transconductance <sup>a</sup>                          | g <sub>fs</sub>     | V <sub>DS</sub> = -5 V, I <sub>D</sub> = -1 A                                                                           |                                                 | -    | 2.2   | -     | S    |
| Diode forward voltage <sup>a</sup>                             | V <sub>SD</sub>     | I <sub>S</sub> = -0.5 A, V <sub>GS</sub> = 0 V                                                                          |                                                 | -    | -0.83 | -1.1  | V    |
| Dynamic <sup>b</sup>                                           |                     |                                                                                                                         |                                                 |      |       |       |      |
| Total gate charge                                              | Q <sub>g</sub>      | V <sub>GS</sub> = -10 V                                                                                                 | V <sub>DS</sub> = -15 V, I <sub>D</sub> = -3 A  | -    | 8.6   | 11.1  | nC   |
| Gate-source charge                                             | Q <sub>gs</sub>     |                                                                                                                         |                                                 | -    | 1.2   | -     |      |
| Gate-drain charge                                              | Q <sub>gd</sub>     |                                                                                                                         |                                                 | -    | 3     | -     |      |
| Gate resistance                                                | R <sub>g</sub>      | f = 1 MHz                                                                                                               |                                                 | 2.5  | -     | 7.2   | Ω    |
| Turn-on delay time                                             | t <sub>d(on)</sub>  | V <sub>DD</sub> = -10 V, R <sub>L</sub> = 10 Ω<br>I <sub>D</sub> ≅ -1 A, V <sub>GEN</sub> = -10 V, R <sub>g</sub> = 1 Ω |                                                 | -    | 5.7   | 8     | ns   |
| Rise time                                                      | t <sub>r</sub>      |                                                                                                                         |                                                 | -    | 3     | 4     |      |
| Turn-off delay time                                            | t <sub>d(off)</sub> |                                                                                                                         |                                                 | -    | 13.8  | 18    |      |
| Fall time                                                      | t <sub>f</sub>      |                                                                                                                         |                                                 | -    | 2     | 3     |      |

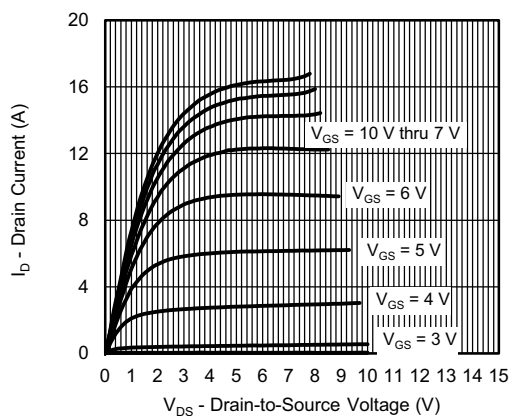
**Notes**

- a. Pulse test; pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\ \%$   
b. Guaranteed by design, not subject to production testing

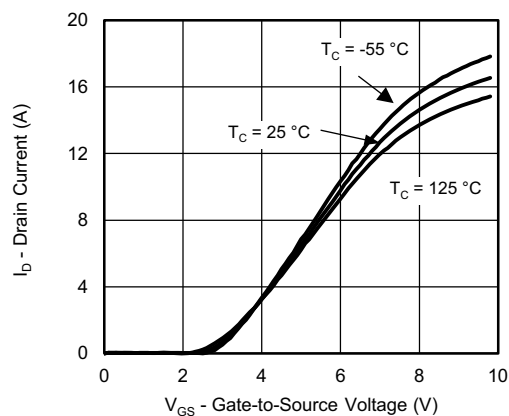
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



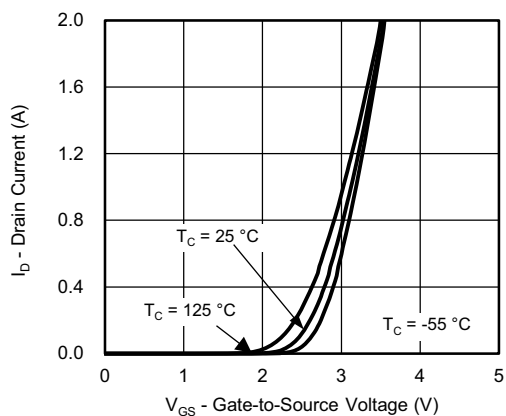
**TYPICAL CHARACTERISTICS** (25 °C unless otherwise noted)



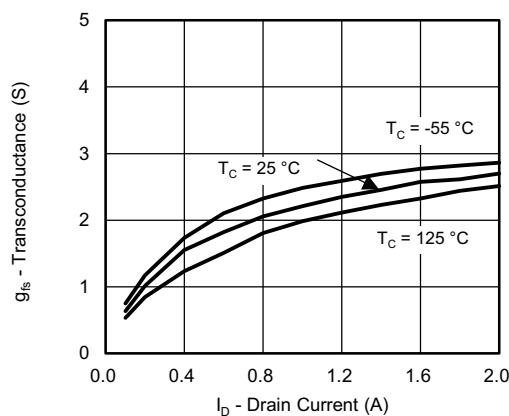
**Output Characteristics**



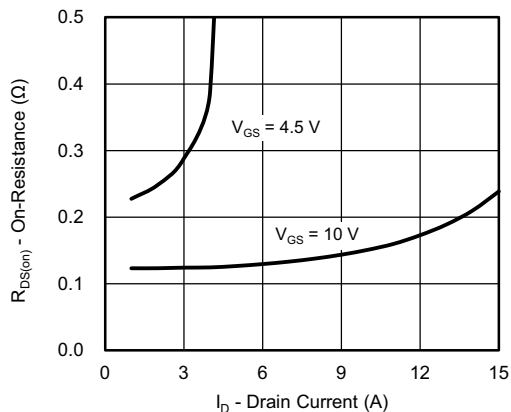
**Transfer Characteristics**



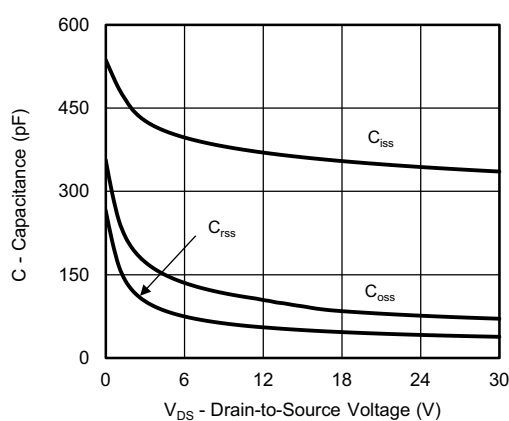
**Transfer Characteristics**



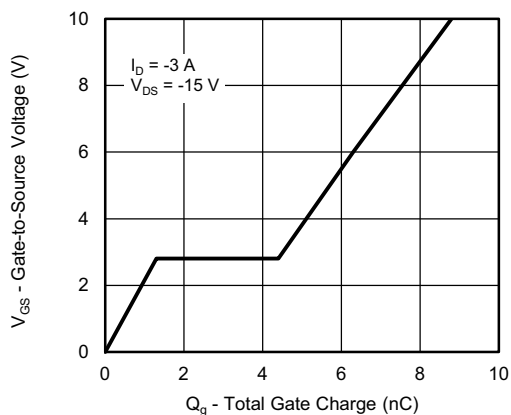
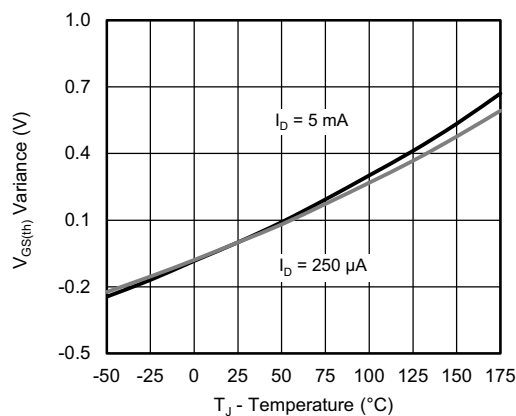
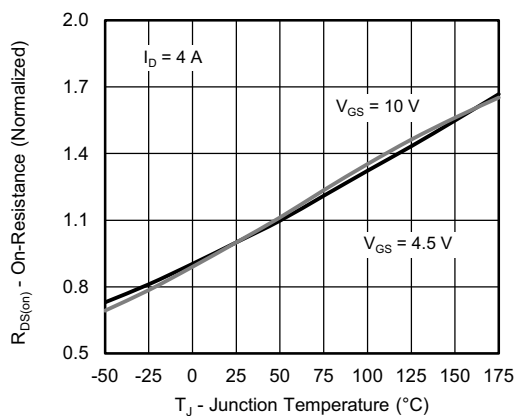
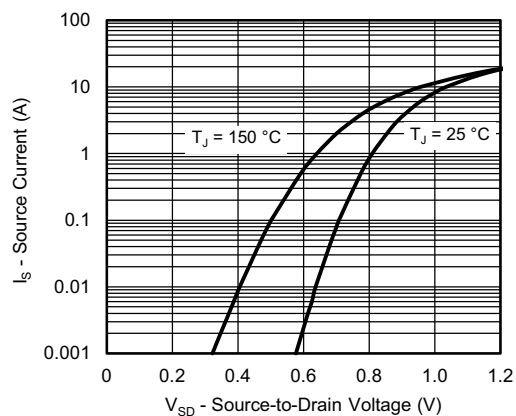
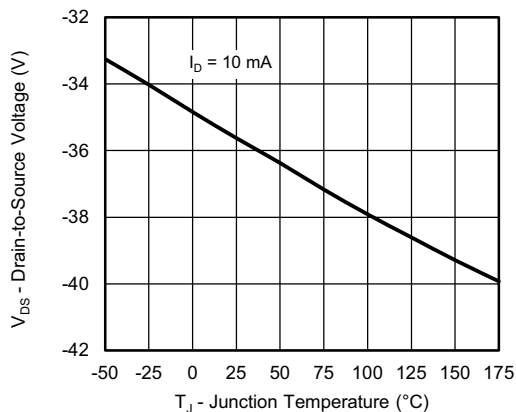
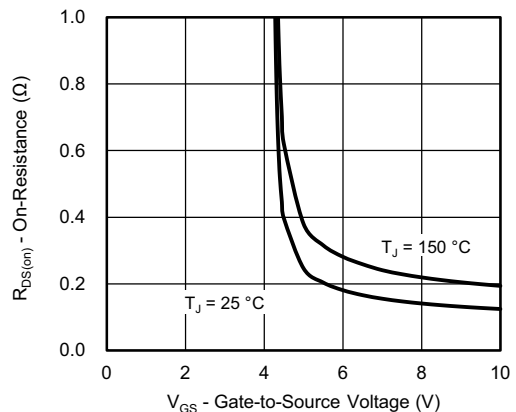
**Transconductance**



**On-Resistance vs. Drain Current**

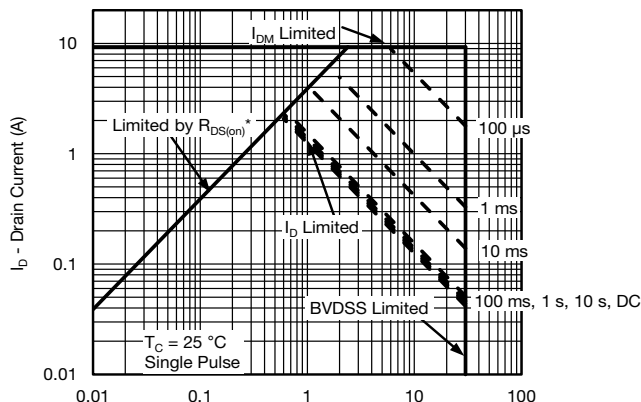


**Capacitance**

**TYPICAL CHARACTERISTICS** (25 °C unless otherwise noted)

**Gate Charge**

**Threshold Voltage**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

**Drain Source Breakdown vs. Junction Temperature**

**On-Resistance vs. Gate-to-Source Voltage**

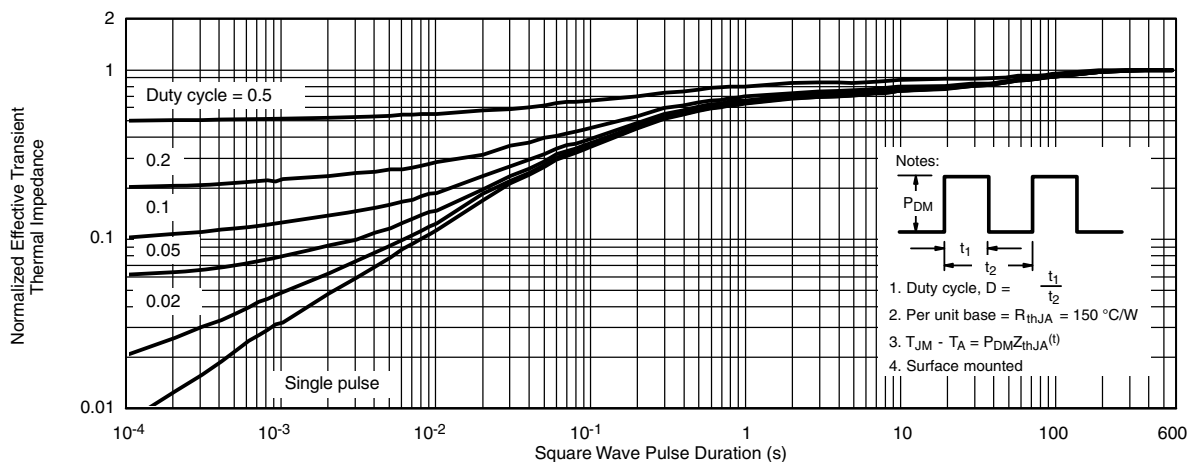


**TYPICAL CHARACTERISTICS** (25 °C unless otherwise noted)

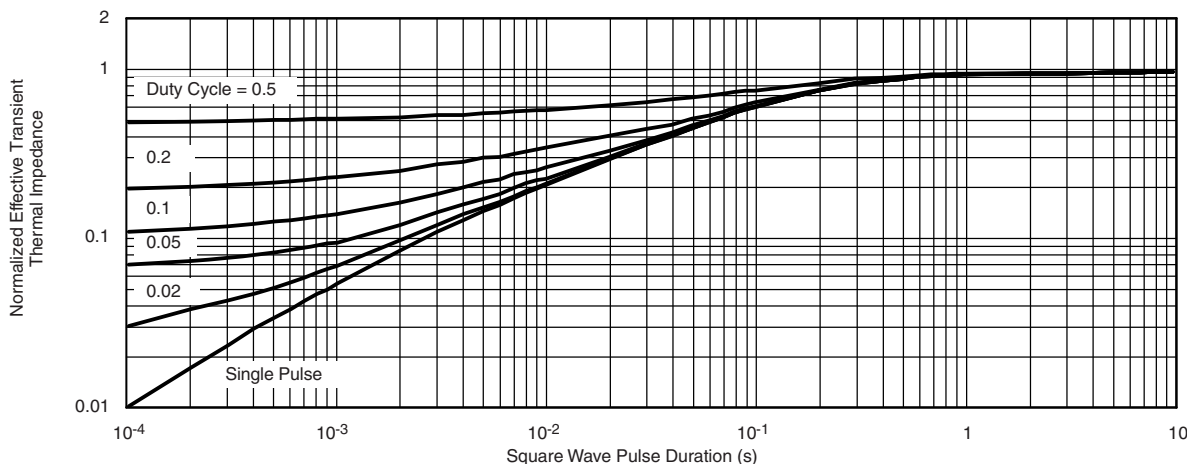


$V_{DS}$  - Drain-to-Source Voltage (V)  
\*  $V_{GS}$  > minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

**Safe Operating Area, Junction-to-Case**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

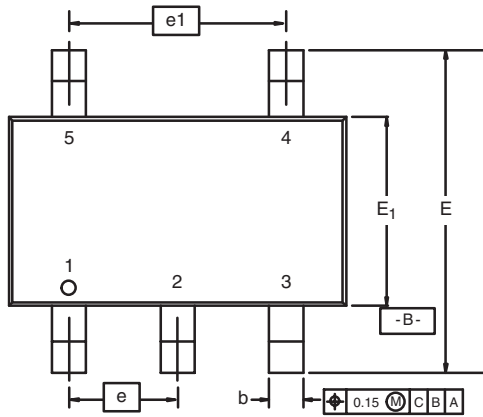


**Normalized Thermal Transient Impedance, Junction-to-Foot**

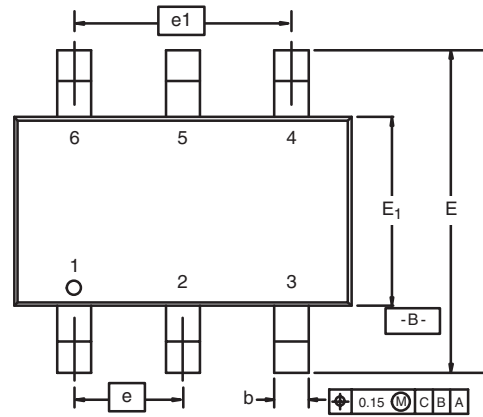
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## TSOP: 5/6-LEAD

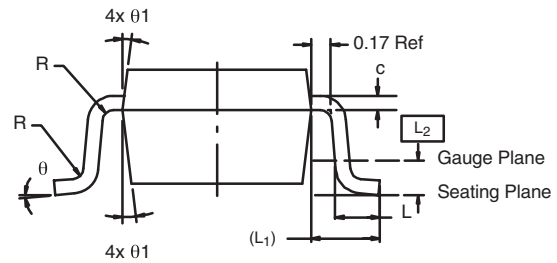
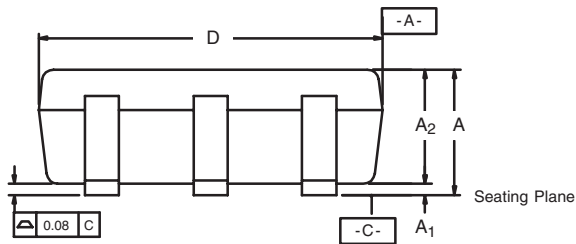
JEDEC Part Number: MO-193C



5-LEAD TSOP

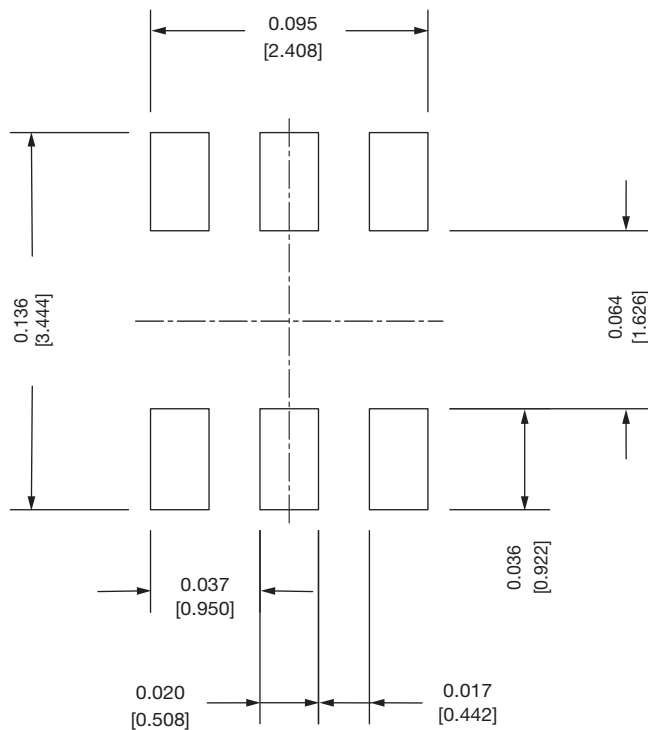
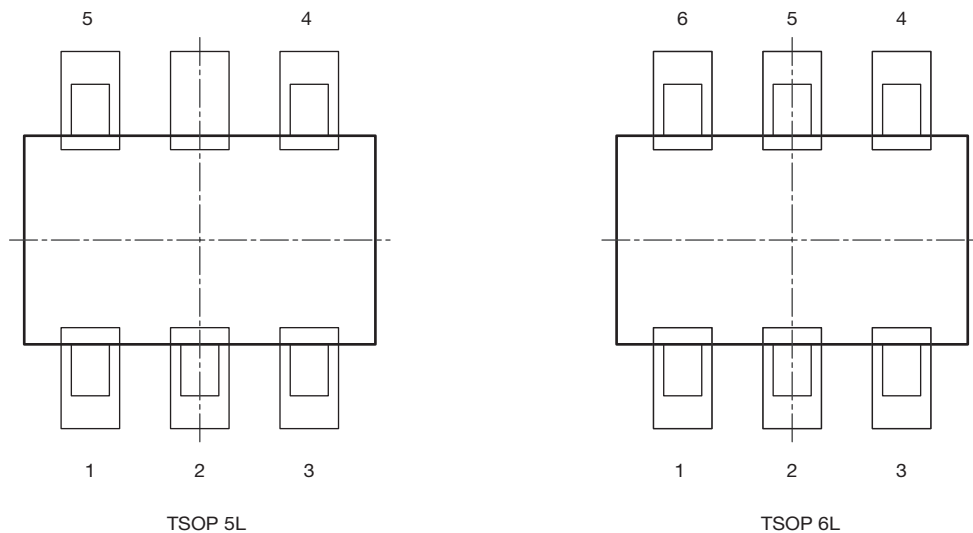


6-LEAD TSOP



| Dim                            | MILLIMETERS |      |      | INCHES     |       |       |
|--------------------------------|-------------|------|------|------------|-------|-------|
|                                | Min         | Nom  | Max  | Min        | Nom   | Max   |
| A                              | 0.91        | -    | 1.10 | 0.036      | -     | 0.043 |
| A <sub>1</sub>                 | 0.01        | -    | 0.10 | 0.0004     | -     | 0.004 |
| A <sub>2</sub>                 | 0.90        | -    | 1.00 | 0.035      | 0.038 | 0.039 |
| b                              | 0.30        | 0.32 | 0.45 | 0.012      | 0.013 | 0.018 |
| c                              | 0.10        | 0.15 | 0.20 | 0.004      | 0.006 | 0.008 |
| D                              | 2.95        | 3.05 | 3.10 | 0.116      | 0.120 | 0.122 |
| E                              | 2.70        | 2.85 | 2.98 | 0.106      | 0.112 | 0.117 |
| E <sub>1</sub>                 | 1.55        | 1.65 | 1.70 | 0.061      | 0.065 | 0.067 |
| e                              | 0.95 BSC    |      |      | 0.0374 BSC |       |       |
| e <sub>1</sub>                 | 1.80        | 1.90 | 2.00 | 0.071      | 0.075 | 0.079 |
| L                              | 0.32        | -    | 0.50 | 0.012      | -     | 0.020 |
| L <sub>1</sub>                 | 0.60 Ref    |      |      | 0.024 Ref  |       |       |
| L <sub>2</sub>                 | 0.25 BSC    |      |      | 0.010 BSC  |       |       |
| R                              | 0.10        | -    | -    | 0.004      | -     | -     |
| θ                              | 0°          | 4°   | 8°   | 0°         | 4°    | 8°    |
| θ <sub>1</sub>                 | 7° Nom      |      |      | 7° Nom     |       |       |
| ECN: C-06593-Rev. I, 18-Dec-06 |             |      |      |            |       |       |
| DWG: 5540                      |             |      |      |            |       |       |

## Recommended Land Pattern For TSOP-5L / TSOP-6L


**Note**

- All dimensions are in inches (millimeter)

ECN: C22-0860-Rev. B, 24-Oct-2022  
DWG: 3010



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