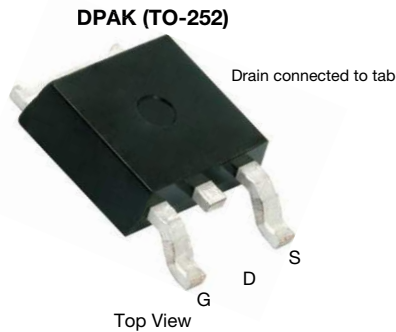
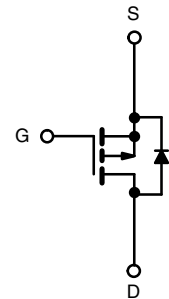


## P-Channel 40 V (D-S), 175 °C MOSFET



### FEATURES

- TrenchFET® power MOSFETs
- 175 °C junction temperature
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT


P-Channel MOSFET

### PRODUCT SUMMARY

|   |        |
|---|--------|
| $V_{DS}$ (V)  | -40    |
| $R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -10$ V  | 0.0094 |
| $R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -4.5$ V | 0.0145 |
| $I_D$ (A) <sup>d</sup>                              | -50    |
| Configuration                                       | Single |

### ORDERING INFORMATION

|                |                 |
|----------------|-----------------|
| Package        | DPAK (TO-252)   |
| Lead (Pb)-free | SUD50P04-09L-E3 |

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

| PARAMETER  | SYMBOL         | LIMIT          | UNIT              |
|--|----------------|----------------|-------------------|
| Drain-source voltage                             | $V_{DS}$       | -40            | V                 |
| Gate-source voltage                              | $V_{GS}$       | $\pm 20$       |                   |
| Continuous drain current ( $T_J = 175$ °C)       | $I_D$          | $T_C = 25$ °C  | -50 <sup>d</sup>  |
|  |                | $T_C = 125$ °C | -50 <sup>d</sup>  |
| Pulsed drain current                             | $I_{DM}$       | -100           | A                 |
| Avalanche current                                | $I_{AS}$       | -50            |                   |
| Single avalanche energy <sup>a</sup>             | $E_{AS}$       | 125            | mJ                |
| Power dissipation                                | $P_D$          | $T_C = 25$ °C  |                   |
|  |                | $T_A = 25$ °C  | 3 <sup>b, c</sup> |
| Operating junction and storage temperature range | $T_J, T_{stg}$ | -55 to +175    | °C                |

### THERMAL RESISTANCE RATINGS

| PARAMETER                        | SYMBOL     | TYPICAL       | MAXIMUM | UNIT |
|----------------------------------|------------|---------------|---------|------|
| Junction-to-ambient <sup>b</sup> | $R_{thJA}$ | $t \leq 10$ s | 15      | °C/W |
|                                  |            | Steady state  | 40      |      |
| Junction-to-case                 | $R_{thJC}$ | 0.82          | 1.1     |      |

#### Notes

- Duty cycle  $\leq 1\%$
- When mounted on 1" square PCB (FR4 material)
- See SOA curve for voltage derating
- Package limited



| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)                                      |              |  |      |        |           |               |
|--|--------------|--|------|--------|-----------|---------------|
| PARAMETER  | SYMBOL       | TEST CONDITIONS  | MIN. | TYP.   | MAX.      | UNIT          |
| <b>Static</b>  |              |  |      |        |           |               |
| Drain-source breakdown voltage   | $V_{DS}$     | $V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$  | -40  | -      | -         | V             |
| Gate threshold voltage   | $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$  | -1   | -      | -3        |               |
| Gate-body leakage  | $I_{GSS}$    | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$   | -    | -      | $\pm 100$ | nA            |
| Zero gate voltage drain current  | $I_{DSS}$    | $V_{DS} = -32\text{ V}$ , $V_{GS} = 0\text{ V}$  | -    | -      | -1        | $\mu\text{A}$ |
|  |              | $V_{DS} = -32\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$  | -    | -      | -50       |               |
|  |              | $V_{DS} = -32\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$  | -    | -      | -150      |               |
| On-state drain current <sup>a</sup>  | $I_{D(on)}$  | $V_{DS} = -5\text{ V}$ , $V_{GS} = -10\text{ V}$   | -50  | -      | -         | A             |
| Drain-source on-state resistance <sup>a</sup>  | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}$ , $I_D = -24\text{ A}$   | -    | 0.0075 | 0.0094    | $\Omega$      |
|  |              | $V_{GS} = -10\text{ V}$ , $I_D = -50\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$   | -    | -      | 0.0140    |               |
|  |              | $V_{GS} = -10\text{ V}$ , $I_D = -50\text{ A}$ , $T_J = 175\text{ }^\circ\text{C}$   | -    | -      | 0.0170    |               |
|  |              | $V_{GS} = -4.5\text{ V}$ , $I_D = -18\text{ A}$  | -    | 0.0115 | 0.0145    |               |
| Forward transconductance <sup>a</sup>  | $g_{fs}$     | $V_{DS} = -5\text{ V}$ , $I_D = -24\text{ A}$  | -    | 73     | -         | S             |
| <b>Dynamic <sup>b</sup></b>  |              |  |      |        |           |               |
| Input capacitance  | $C_{ISS}$    | $V_{GS} = 0\text{ V}$ , $V_{DS} = -25\text{ V}$ , $f = 1\text{ MHz}$   | -    | 4800   | -         | $\mu\text{F}$ |
| Output capacitance   | $C_{OSS}$    |  | -    | 700    | -         |               |
| Reverse transfer capacitance   | $C_{RSS}$    |  | -    | 550    | -         |               |
| Total gate charge <sup>c</sup>   | $Q_g$        | $V_{DS} = -20\text{ V}$ , $V_{GS} = -10\text{ V}$ , $I_D = -50\text{ A}$   | -    | 102    | 150       | nC            |
| Gate-source charge <sup>c</sup>  | $Q_{gs}$     |  | -    | 18.5   | -         |               |
| Gate-drain charge <sup>c</sup>   | $Q_{gd}$     |  | -    | 27     | -         |               |
| Turn-on delay time <sup>c</sup>  | $t_{d(on)}$  | $V_{DD} = -20\text{ V}$ , $R_L = 0.4\text{ }\Omega$<br>$I_D \cong -50\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 6\text{ }\Omega$ | -    | 10     | 15        | ns            |
| Rise time <sup>c</sup>   | $t_r$        |  | -    | 60     | 90        |               |
| Turn-off delay time <sup>c</sup>   | $t_{d(off)}$ |  | -    | 145    | 220       |               |
| Fall time <sup>c</sup>   | $t_f$        |  | -    | 140    | 220       |               |
| <b>Source Drain-Diode Ratings and Characteristics <sup>b</sup> (<math>T_C = 25\text{ }^\circ\text{C}</math>)</b> |              |  |      |        |           |               |
| Continuous current   | $I_S$        |  | -    | -      | -50       | A             |
| Pulsed current   | $I_{SM}$     |  | -    | -      | -100      |               |
| Forward voltage <sup>a</sup>   | $V_{SD}$     | $I_F = -50\text{ A}$ , $V_{GS} = 0\text{ V}$   | -    | -1     | -1.5      | V             |
| Reverse recovery time  | $t_{rr}$     | $I_F = -50\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$  | -    | 55     | 85        | ns            |

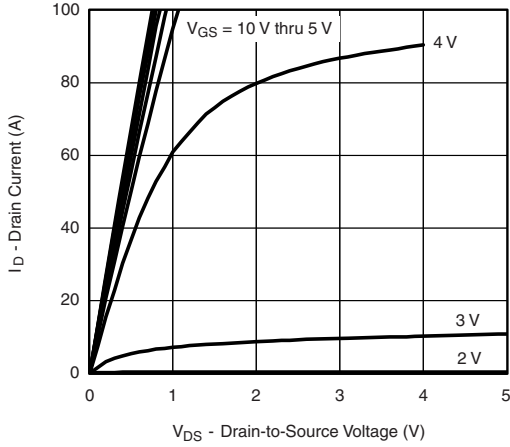
**Notes**

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

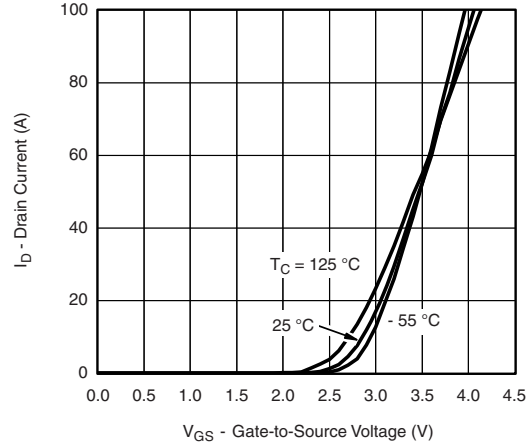
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



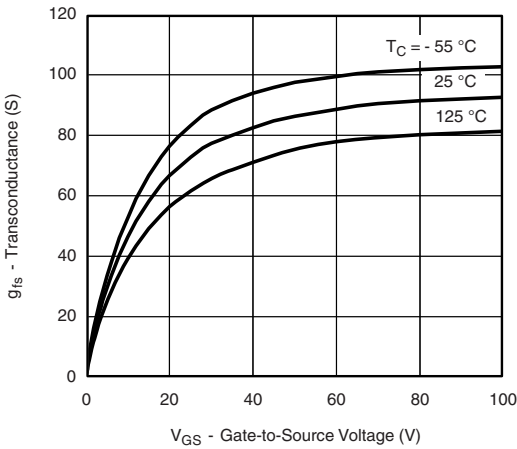
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



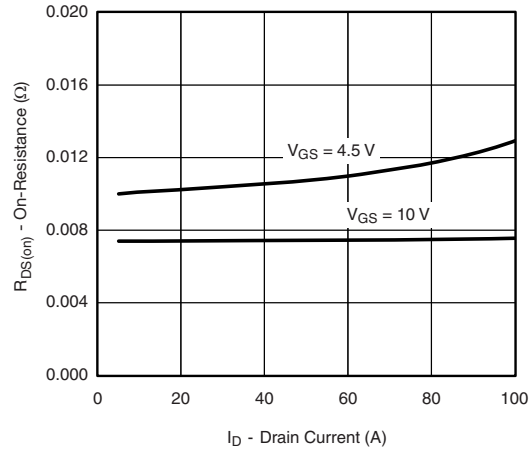
Output Characteristics



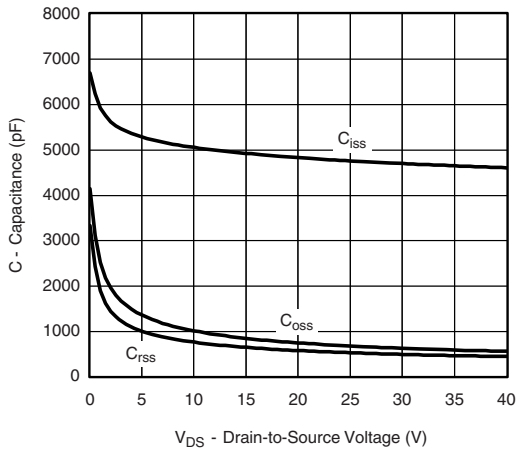
Transfer Characteristics



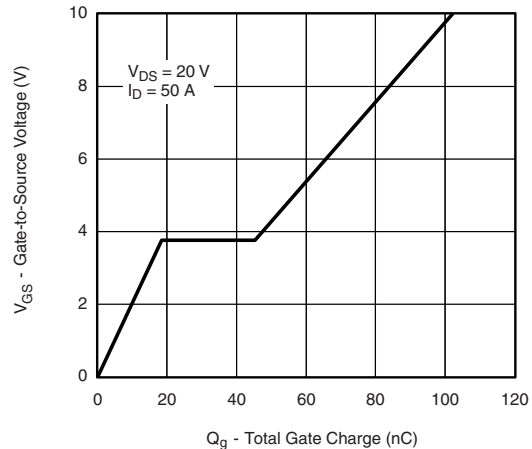
Transconductance



On-Resistance vs. Drain Current



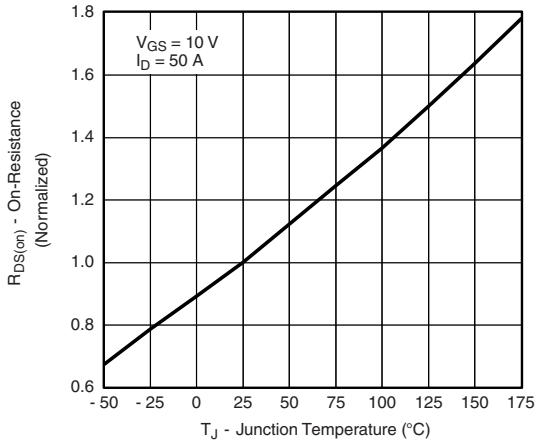
Capacitance



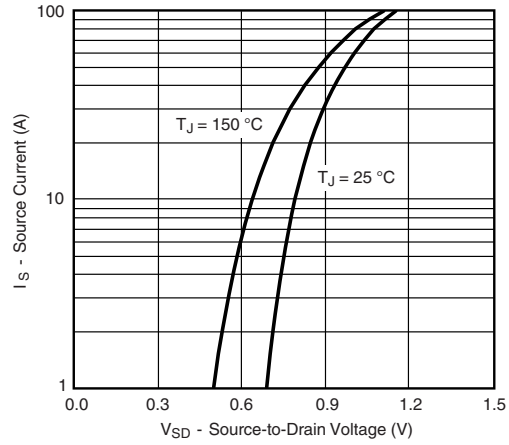
Gate Charge



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

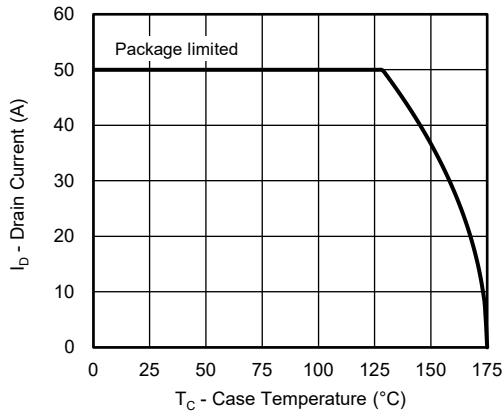


On-Resistance vs. Junction Temperature

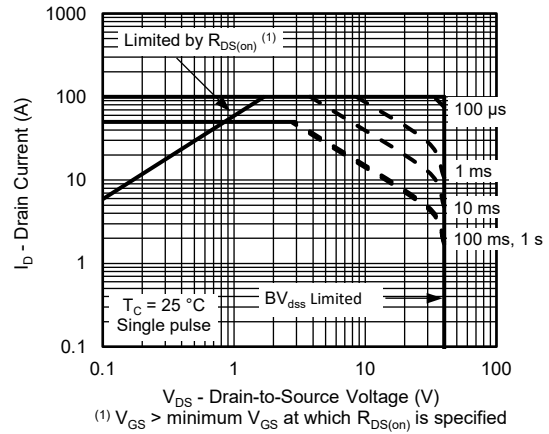


Source-Drain Diode Forward Voltage

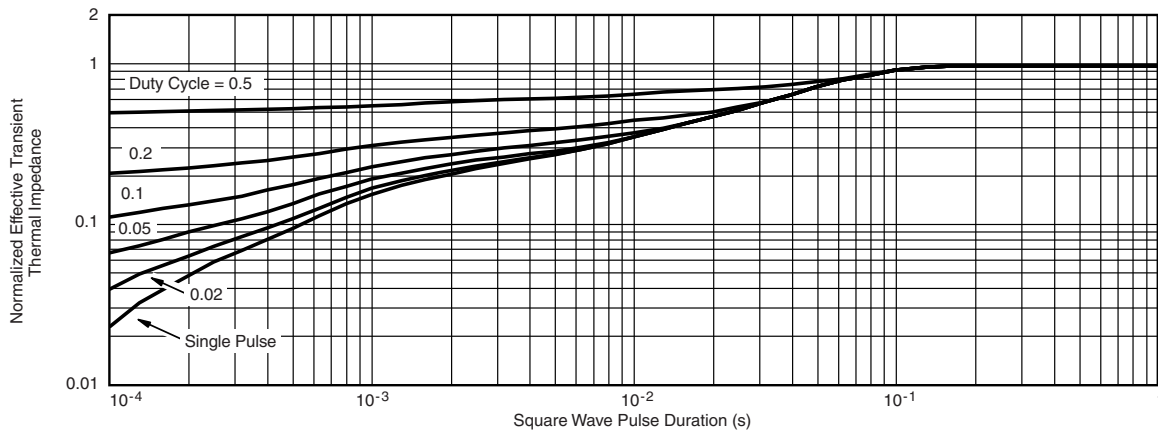
THERMAL RATINGS



Max. Avalanche and Drain Current vs. Case Temperature



Safe Operating Area



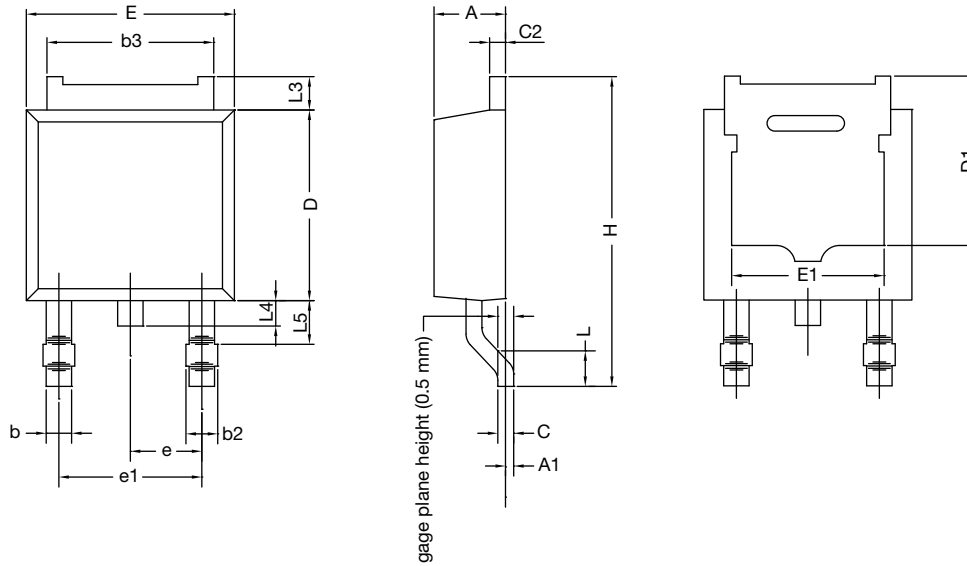
Normalized Thermal Transient Impedance, Junction-to-Case

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# TO-252AA Case Outline

## VERSION 1: FACILITY CODE = Y



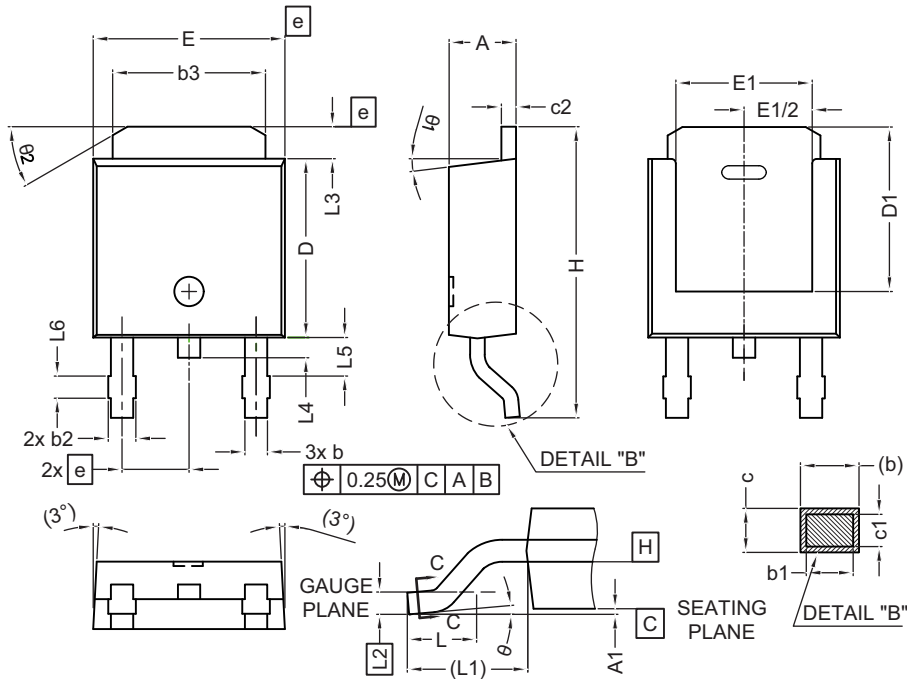
| DIM. | MILLIMETERS |       |
|------|-------------|-------|
|      | MIN.        | MAX.  |
| A    | 2.18        | 2.38  |
| A1   | -           | 0.127 |
| b    | 0.64        | 0.88  |
| b2   | 0.76        | 1.14  |
| b3   | 4.95        | 5.46  |
| C    | 0.46        | 0.61  |
| C2   | 0.46        | 0.89  |
| D    | 5.97        | 6.22  |
| D1   | 4.10        | -     |
| E    | 6.35        | 6.73  |
| E1   | 4.32        | -     |
| H    | 9.40        | 10.41 |
| e    | 2.28 BSC    |       |
| e1   | 4.56 BSC    |       |
| L    | 1.40        | 1.78  |
| L3   | 0.89        | 1.27  |
| L4   | -           | 1.02  |
| L5   | 1.01        | 1.52  |

### Note

- Dimension L3 is for reference only



VERSION 2: FACILITY CODE = N



| DIM. | MILLIMETERS |       |
|------|-------------|-------|
|      | MIN.        | MAX.  |
| A    | 2.18        | 2.39  |
| A1   | -           | 0.13  |
| b    | 0.65        | 0.89  |
| b1   | 0.64        | 0.79  |
| b2   | 0.76        | 1.13  |
| b3   | 4.95        | 5.46  |
| c    | 0.46        | 0.61  |
| c1   | 0.41        | 0.56  |
| c2   | 0.46        | 0.60  |
| D    | 5.97        | 6.22  |
| D1   | 5.21        | -     |
| E    | 6.35        | 6.73  |
| E1   | 4.32        | -     |
| e    | 2.29 BSC    |       |
| H    | 9.94        | 10.34 |

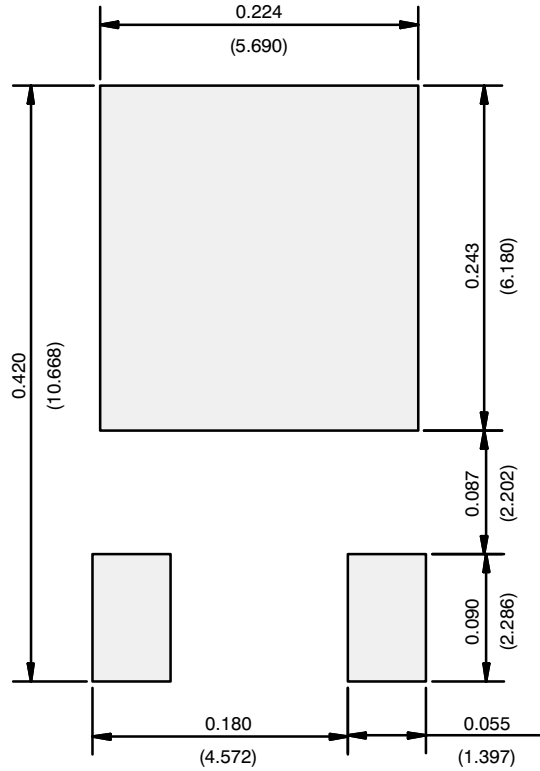
| DIM. | MILLIMETERS |      |
|------|-------------|------|
|      | MIN.        | MAX. |
| L    | 1.50        | 1.78 |
| L1   | 2.74 ref.   |      |
| L2   | 0.51 BSC    |      |
| L3   | 0.89        | 1.27 |
| L4   | -           | 1.02 |
| L5   | 1.14        | 1.49 |
| L6   | 0.65        | 0.85 |
| θ    | 0°          | 10°  |
| θ1   | 0°          | 15°  |
| θ2   | 25°         | 35°  |

Notes

- Dimensioning and tolerance confirm to ASME Y14.5M-1994
- All dimensions are in millimeters. Angles are in degrees
- Heat sink side flash is max. 0.8 mm
- Radius on terminal is optional

ECN: E22-0399-Rev. R, 03-Oct-2022  
 DWG: 5347

## RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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