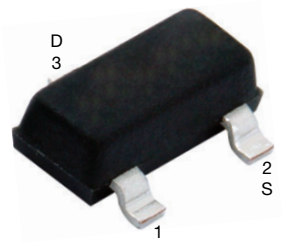
# P-Channel 40 V (D-S) MOSFET

SOT-23 (TO-236)




Top View

**Marking code:** G4

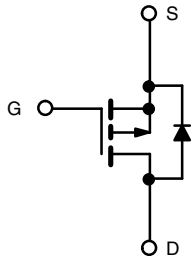
## FEATURES

- TrenchFET® Gen III p-channel power MOSFET
- 100 % $R_g$ and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE

## APPLICATIONS

- Battery switch
- Motor drive control
- Load switch




P-Channel MOSFET

| PRODUCT SUMMARY | |
|---|---|
| $V_{DS}$ (V) | -40 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS}$ = 10 V | 0.075 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS}$ = 4.5 V | 0.100 |
| $Q_g$ typ. (nC) | 6 |
| $I_D$ (A) | -3.6 [a] |
| Configuration | Single |

| ORDERING INFORMATION | |
|---|---|
| Package | SOT-23 |
| Lead (Pb)-free and halogen-free | Si2319DDS-T1-GE3 |

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

| PARAMETER | | SYMBOL | LIMIT | UNIT |
|---|---|---|---|---|
| Drain-source voltage | | $V_{DS}$ | -40 | V |
| Gate-source voltage | | $V_{GS}$ | ± 20 | |
| Continuous drain current ($T_J$ = 150 °C) | $T_C$ = 25 °C | $I_D$ | -3.6 | A |
| | $T_C$ = 70 °C | | -2.9 | |
| | $T_A$ = 25 °C | | -2.7 [b, c] | |
| | $T_A$ = 70 °C | | -2.2 [b, c] | |
| Pulsed drain current (t = 100 µs) | | $I_{DM}$ | -15 | |
| Continuous source-drain diode current | $T_C$ = 25 °C | $I_S$ | -1.4 | |
| | $T_A$ = 25 °C | | -0.8 [b, c] | |
| Single pulse avalanche current | L = 0.1 mH | $I_{AS}$ | -5 | |
| Single pulse avalanche energy | | $E_{AS}$ | 1.25 | mJ |
| Maximum power dissipation | $T_C$ = 25 °C | $I_P$ | 1.7 | W |
| | $T_C$ = 70 °C | | 1.1 | |
| | $T_A$ = 25 °C | | 1 [b, c] | |
| | $T_A$ = 70 °C | | 0.6 [b, c] | |
| Operating junction and storage temperature range | | $T_J$, $T_{stg}$ | -55 to +150 | °C |

**THERMAL RESISTANCE RATINGS**

| PARAMETER | | SYMBOL | TYPICAL | MAXIMUM | UNIT |
|---|---|---|---|---|---|
| Maximum junction-to-ambient [b] | t ≤ 5 s | $R_{thJA}$ | 100 | 130 | °C/W |
| Maximum junction-to-case (drain) | Steady state | $R_{thJF}$ | 60 | 75 | |

**Notes**

a. Based on $T_C$ = 25 °C
b. Surface mounted on 1" x 1" FR4 board
c. t = 5 s
d. Maximum under steady state conditions is 175 °C/W



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| **SPECIFICATIONS** ($T_J$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | |
| Drain-source breakdown voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = -250 µA | -40 | - | - | V |
| $V_{DS}$ temperature coefficient | $\Delta V_{DS}/T_J$ | $I_D$ = -250 µA | - | -27.5 | - | mV/°C |
| $V_{GS(th)}$ temperature coefficient | $\Delta V_{GS(th)}/T_J$ | $I_D$ = -250 µA | - | 3.2 | - | |
| Gate-source threshold voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | -1 | - | -2.5 | V |
| Gate-source leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | - | - | 100 | nA |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$ = -40 V, $V_{GS}$ = 0 V | - | - | -1 | µA |
| | | $V_{DS}$ = -40 V, $V_{GS}$ = 0 V, $T_J$ = 70 °C | - | - | -15 | |
| On-state drain current [a] | $I_{D(on)}$ | $V_{DS} \geq$ -10 V, $V_{GS}$ = -10 V | -10 | - | - | A |
| Drain-source on-state resistance [a] | $R_{DS(on)}$ | $V_{GS}$ = -10 V, $I_D$ = -2.7 A | - | 0.062 | 0.075 | Ω |
| | | $V_{GS}$ = -4.5 V, $I_D$ = -2.4 A | - | 0.081 | 0.100 | |
| Forward transconductance [a] | $g_{fs}$ | $V_{DS}$ = -15 V, $I_D$ = -2.7 A | - | 10 | - | S |
| **Dynamic [b]** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{DS}$ = -20 V, $V_{GS}$ = 0 V, f = 1 MHz | - | 650 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 54 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 43 | - | |
| Total gate charge | $Q_g$ | $V_{DS}$ = -20 V, $V_{GS}$ = -10 V, $I_D$ = -2.7 A | - | 12.5 | 19 | nC |
| | | $V_{DS}$ = -20 V, $V_{GS}$ = -4.5 V, $I_D$ =-2.7 A | - | 6 | 12 | |
| Gate-source charge | $Q_{gs}$ | | - | 1.8 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 2 | - | |
| Gate resistance | $R_g$ | f = 1 MHz | 2 | 10 | 20 | Ω |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = -20 V, $R_L$ = 9.1 Ω, $I_D \cong$ -2.2 A, $V_{GEN}$ = -10 V, $R_g$ = 1 Ω | - | 10 | 20 | ns |
| Rise time | $t_r$ | | - | 20 | 30 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 20 | 30 | |
| Fall time | $t_f$ | | - | 12 | 24 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = -20 V, $R_L$ = 9.1 Ω, $I_D \cong$ -2.2 A, $V_{GEN}$ = -4.5 V, $R_g$ = 1 Ω | - | 30 | 45 | |
| Rise time | $t_r$ | | - | 32 | 48 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 20 | 30 | |
| Fall time | $t_f$ | | - | 15 | 30 | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous source-drain diode current | $I_S$ | $T_C$ = 25 °C | - | - | -1.4 | A |
| Pulse diode forward current | $I_{SM}$ | | - | - | -15 | |
| Body diode voltage | $V_{SD}$ | $I_S$ = -2.2 A, $V_{GS}$ = 0 V | - | -0.8 | -1.2 | V |
| Body diode reverse recovery time | $t_{rr}$ | $I_F$ = -2.2 A, di/dt = 100 A/µs, $T_J$ = 25 °C | - | 15 | 30 | ns |
| Body diode reverse recovery charge | $Q_{rr}$ | | - | 9 | 18 | nC |
| Reverse recovery fall time | $t_a$ | | - | 10.5 | - | ns |
| Reverse recovery rise time | $t_b$ | | - | 4.5 | - | |

**Notes**

a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 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.*



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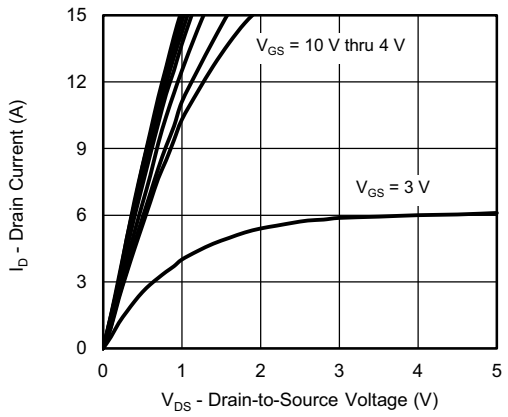
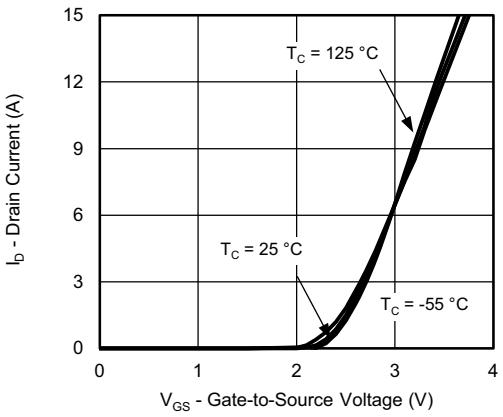
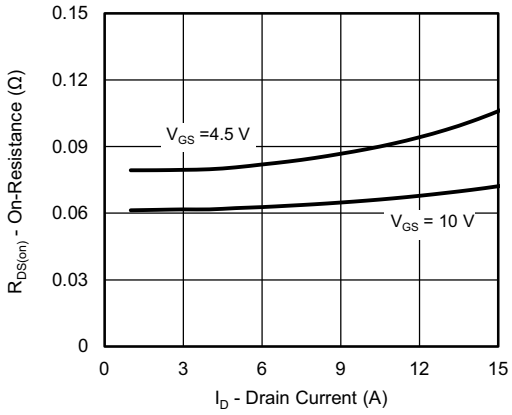
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



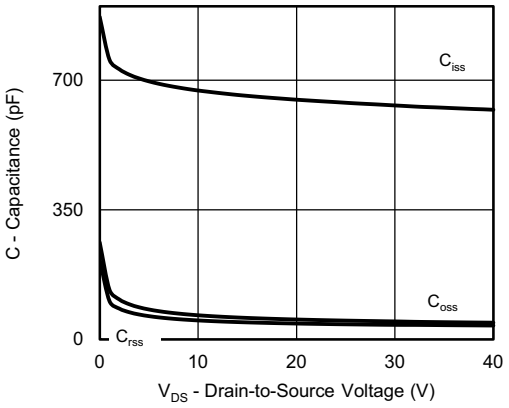

**Output Characteristics**



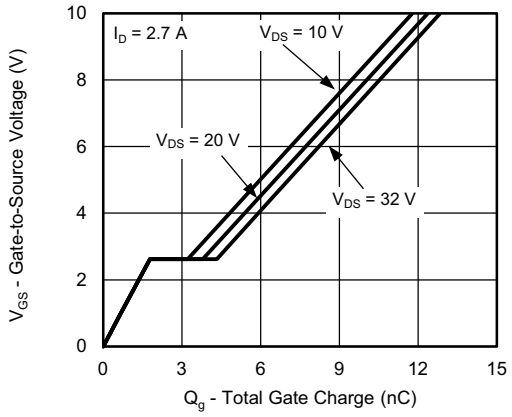

**Transfer Characteristics**



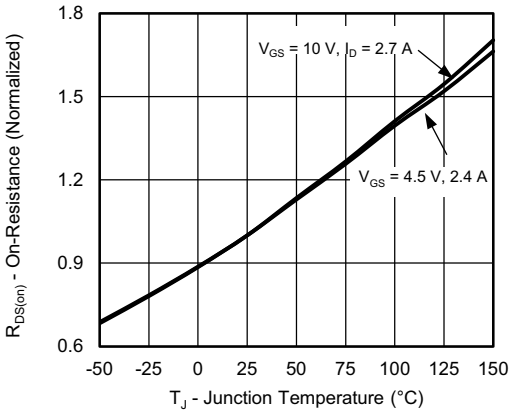

**On-Resistance vs. Drain Current and Gate Voltage**




**Capacitance**




**Gate Charge**




**On-Resistance vs. Junction Temperature**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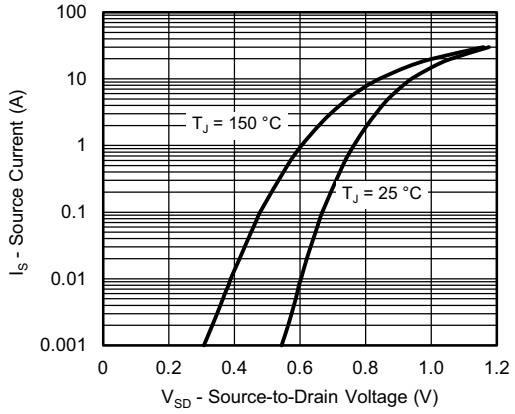
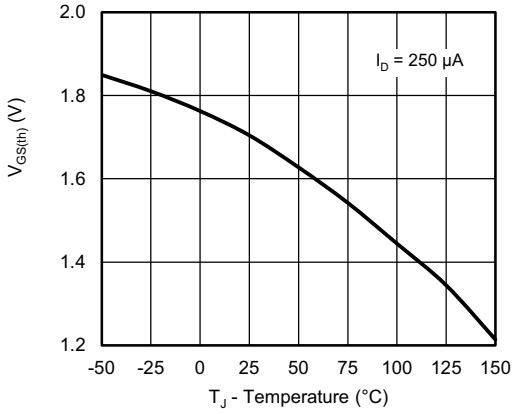
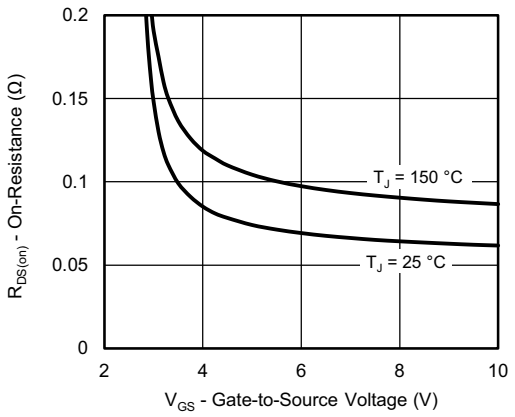


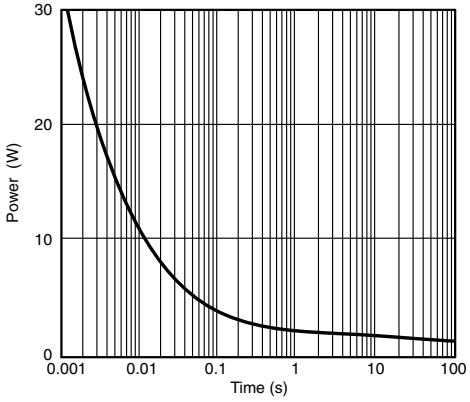

**Source-Drain Diode Forward Voltage**



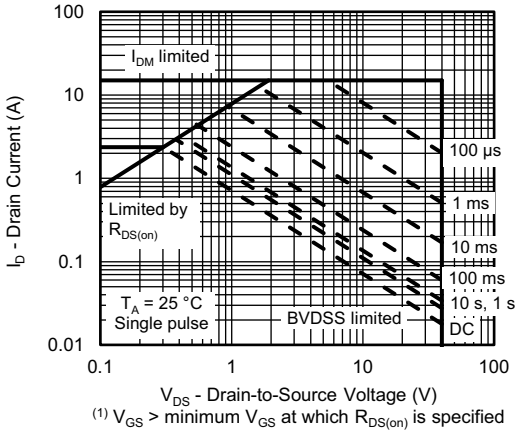

**Threshold Voltage**




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




**Single Pulse Power, Junction-to-Ambient**




(1) $V_{GS}$ > minimum $V_{GS}$ at which $R_{DS(on)}$ is specified

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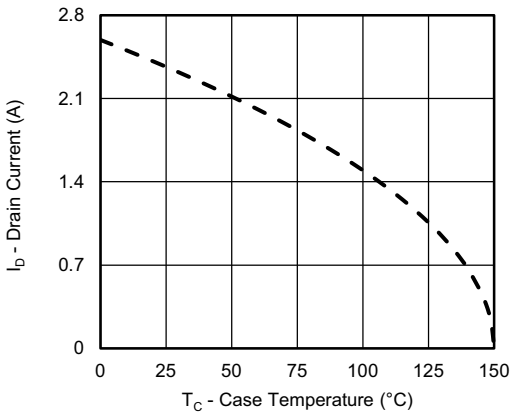
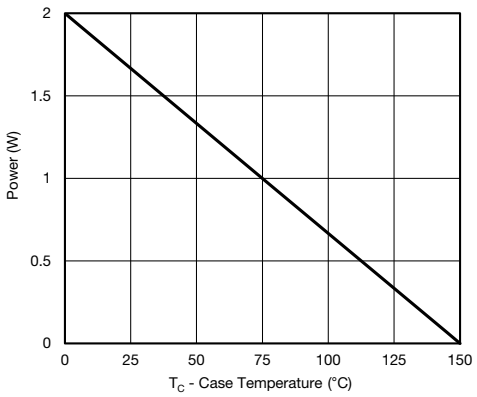
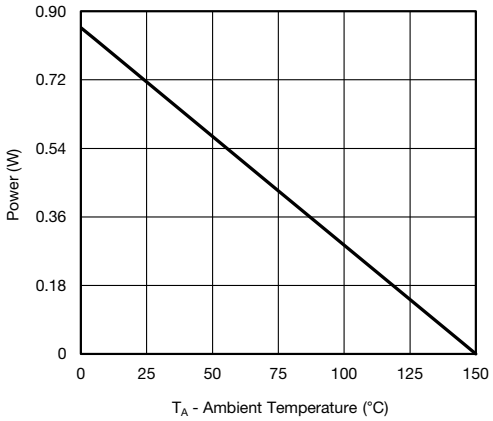



**Current Derating** [a]




**Power, Junction-to-Case**




**Power, Junction-to-Ambient**

**Note**

a. The power dissipation $P_D$ is based on $T_J$ max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit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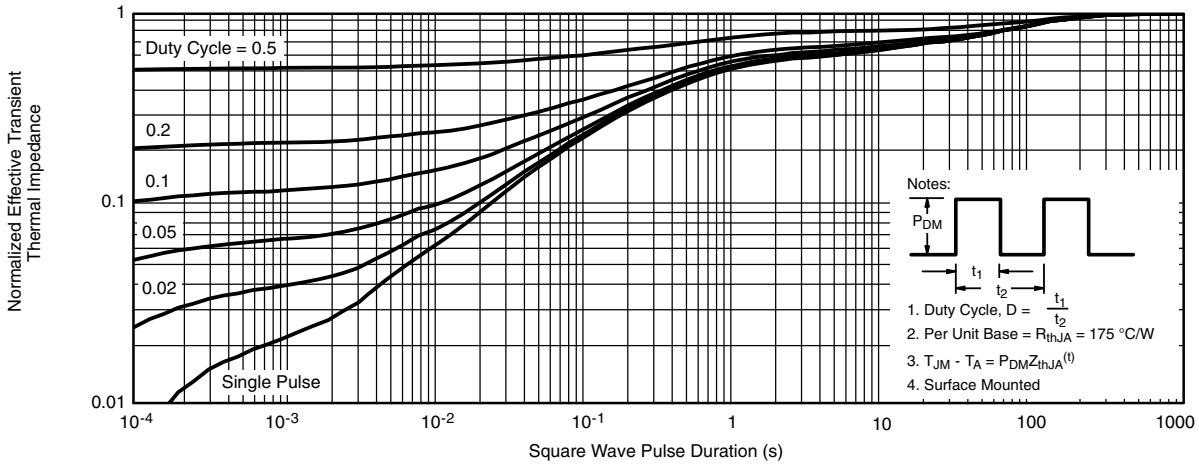
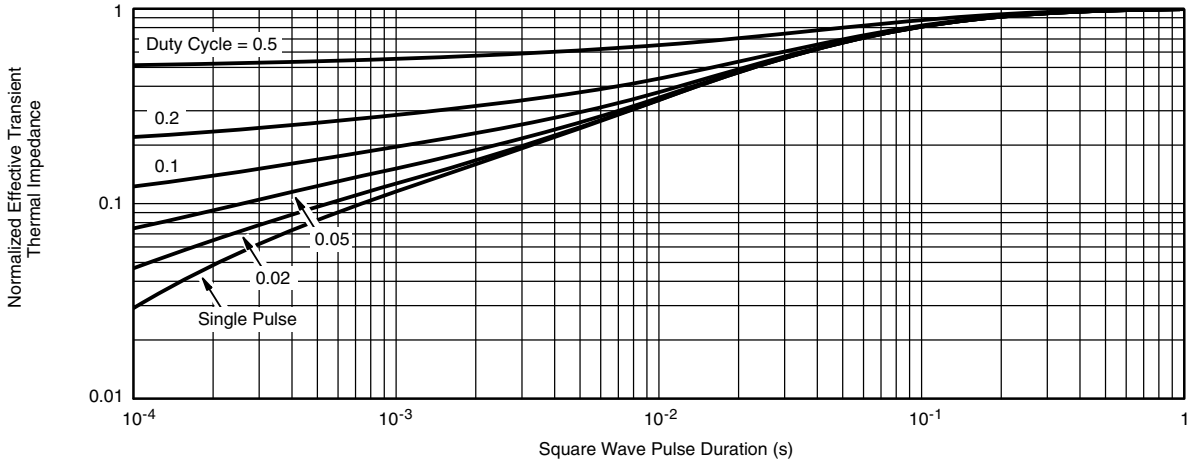



**Normalized Thermal Transient Impedance, Junction-to-Ambient**




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

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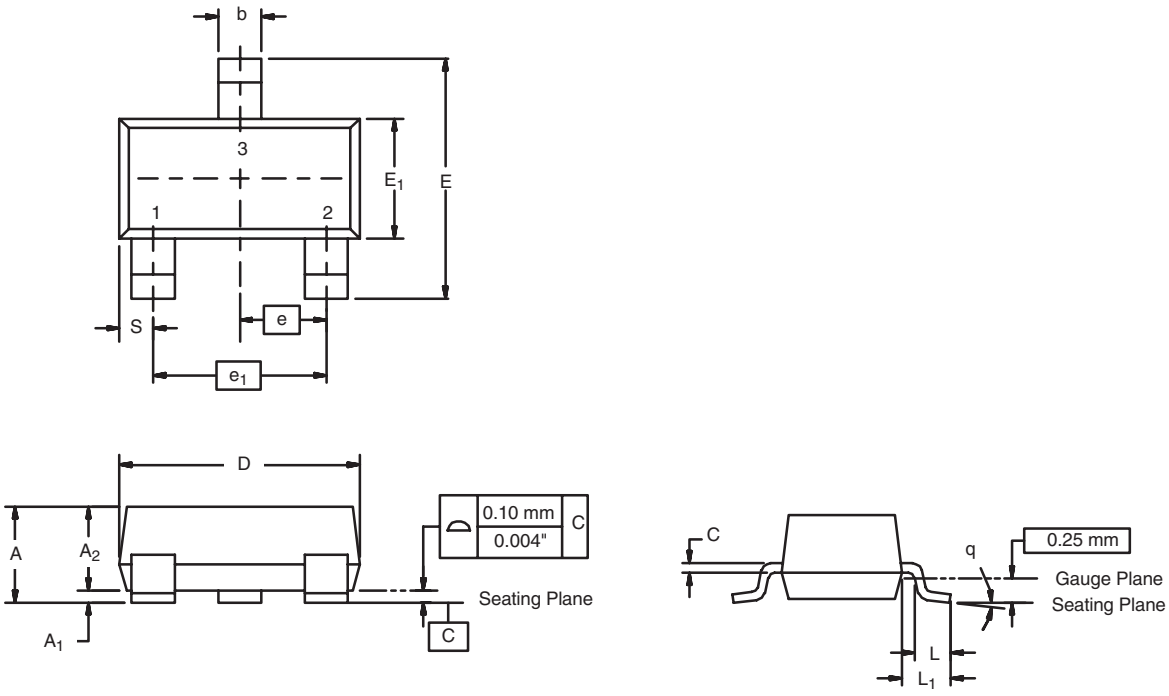
## SOT-23 (TO-236): 3-LEAD




| Dim | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.89 | 1.12 | 0.035 | 0.044 |
| $A_1$ | 0.01 | 0.10 | 0.0004 | 0.004 |
| $A_2$ | 0.88 | 1.02 | 0.0346 | 0.040 |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 0.085 | 0.18 | 0.003 | 0.007 |
| D | 2.80 | 3.04 | 0.110 | 0.120 |
| E | 2.10 | 2.64 | 0.083 | 0.104 |
| $E_1$ | 1.20 | 1.40 | 0.047 | 0.055 |
| e | 0.95 BSC | | 0.0374 Ref | |
| $e_1$ | 1.90 BSC | | 0.0748 Ref | |
| L | 0.40 | 0.60 | 0.016 | 0.024 |
| $L_1$ | 0.64 Ref | | 0.025 Ref | |
| S | 0.50 Ref | | 0.020 Ref | |
| q | 3° | 8° | 3° | 8° |
| ECN: S-03946-Rev. K, 09-Jul-01<br>DWG: 5479 | | | | |



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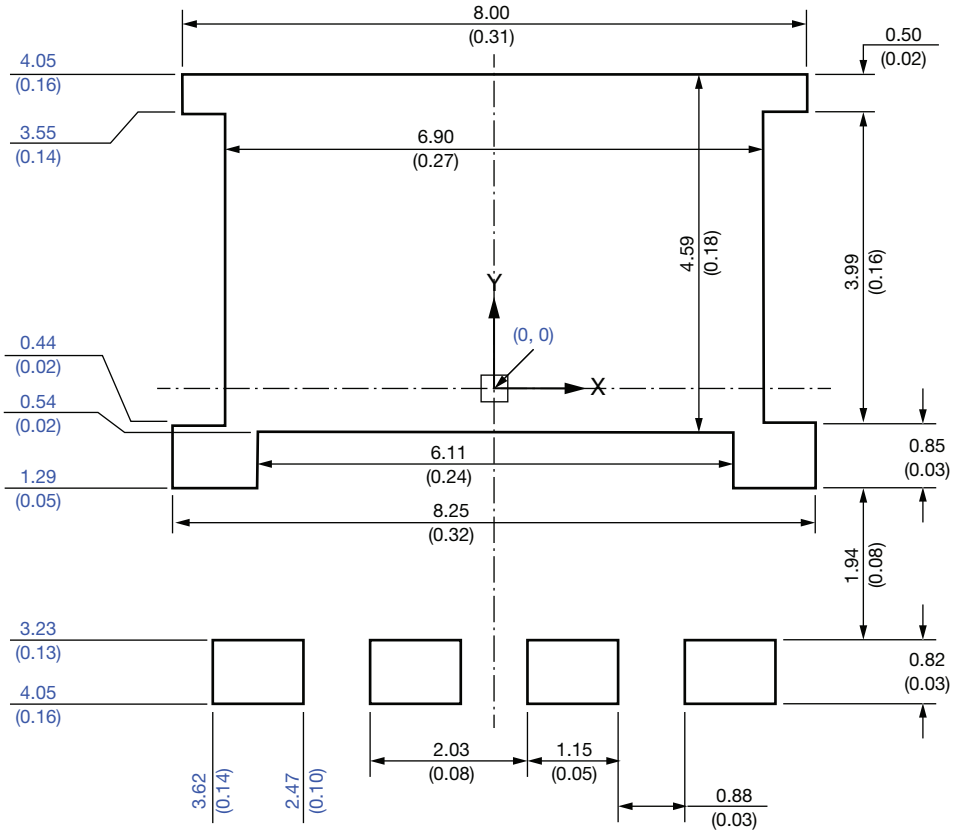
# Recommended Minimum PADs for PowerPAK® 8 x 8L Single




Dimensions in millimeters (inches)

**Note**

- Linear dimensions are in black, the same information is provided in ordinate dimensions which are in blue.



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