

P-Channel 20 V (D-S) MOSFET


Marking code: BP

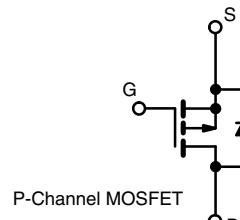
Thin PowerPAK® SC-70-6L Single
FEATURES

- TrenchFET® power MOSFET
- New thermally enhanced PowerPAK® SC-70 package
 - Small footprint area
 - Ultra-thin 0.6 mm height
 - Low on-resistance
- 100 % R_g tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Load switch and charger switch for portable devices
- DC/DC converter


PRODUCT SUMMARY

| | |
|---|--------|
| V_{DS} (V) | -20 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = -4.5$ V | 0.0205 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = -2.5$ V | 0.0270 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = -1.8$ V | 0.0360 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = -1.5$ V | 0.0600 |
| Q_g typ. (nC) | 24.5 |
| I_D (A) ^a | -12 |
| Configuration | Single |

ORDERING INFORMATION

| | |
|---------------------------------|---------------------|
| Package | Thin PowerPAK SC-70 |
| Lead (Pb)-free and halogen-free | SiA429DJT-T1-GE3 |

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

| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|----------------|-----------------------|------|
| Drain-source voltage | V_{DS} | -20 | V |
| Gate-source voltage | V_{GS} | ± 8 | |
| Continuous drain current ($T_J = 150$ °C) | I_D | -12 ^a | A |
| | | -12 ^a | |
| | | -10.6 ^{b, c} | |
| | | -8.5 ^{b, c} | |
| Pulsed drain current ($t = 300$ μ s) | I_{DM} | -30 | |
| Continuous source-drain diode current | I_S | -12 ^a | |
| | | -2.9 ^{b, c} | |
| Maximum power dissipation | P_D | 19 | W |
| | | 12 | |
| | | 3.5 ^{b, c} | |
| | | 2.2 ^{b, c} | |
| Operating junction and storage temperature range | T_J, T_{stg} | -55 to +150 | °C |
| Soldering recommendations (peak temperature) ^{d, e} | | 260 | |

THERMAL RESISTANCE RATINGS

| PARAMETER | SYMBOL | TYPICAL | MAXIMUM | UNIT |
|---|------------|---------|---------|------|
| Maximum junction-to-ambient ^{b, f} | R_{thJA} | 28 | 36 | °C/W |
| Maximum junction-to-case (drain) | R_{thJC} | 5.3 | 6.5 | |

Notes

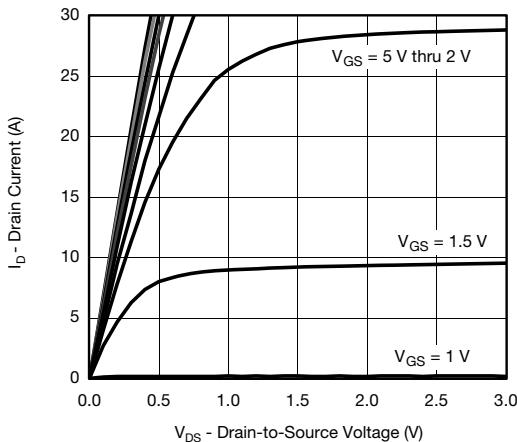
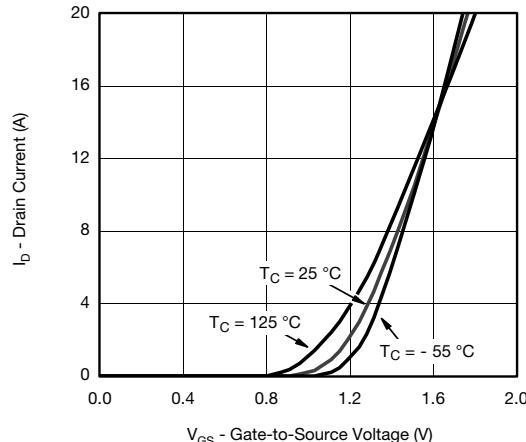
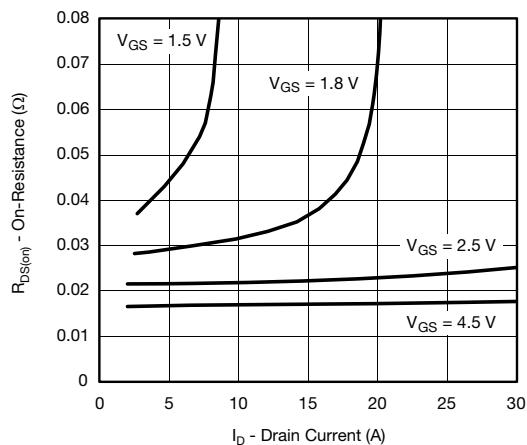
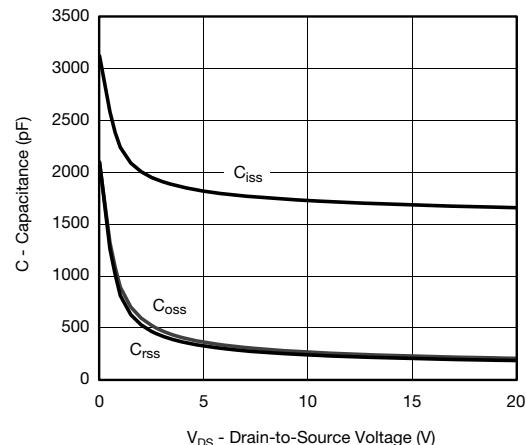
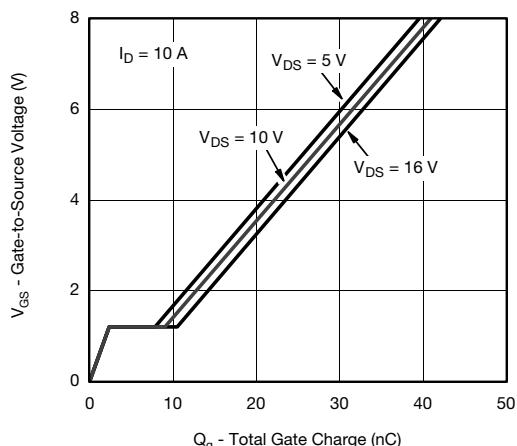
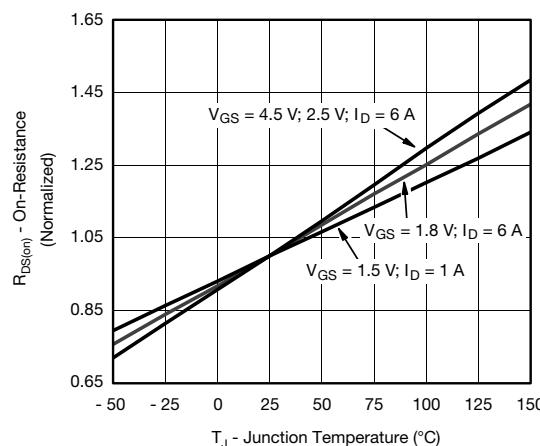
- Package limited
- Surface mounted on 1" x 1" FR4 board
- $t = 5$ s
- See solder profile (www.vishay.com/doc?73257). The PowerPAK SC-70 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components
- Maximum under steady state conditions is 80 °C/W

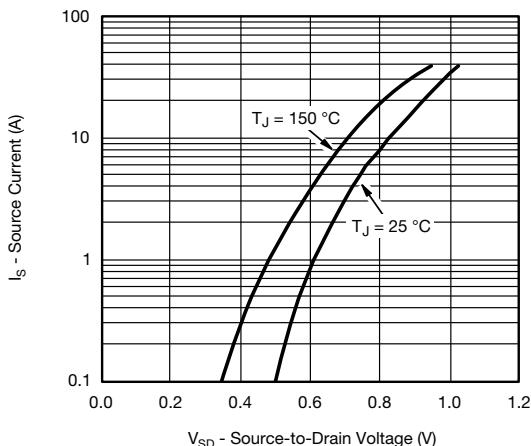
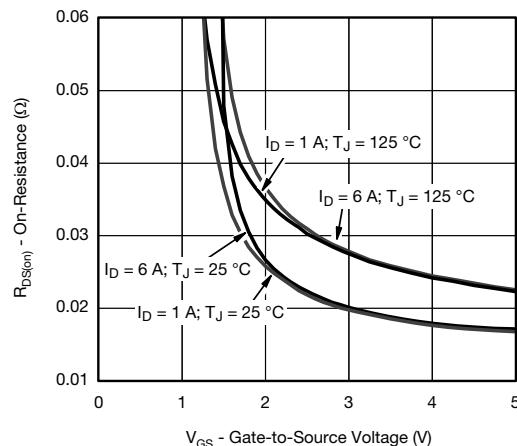
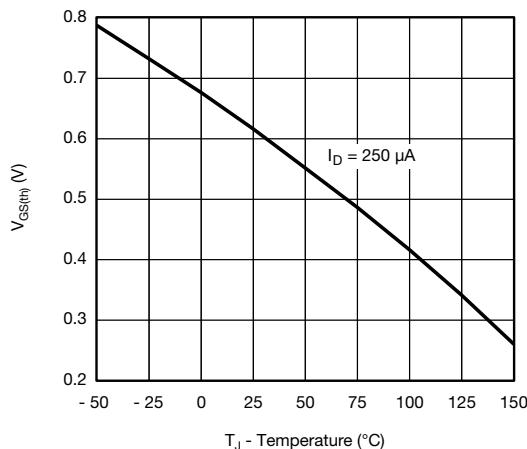
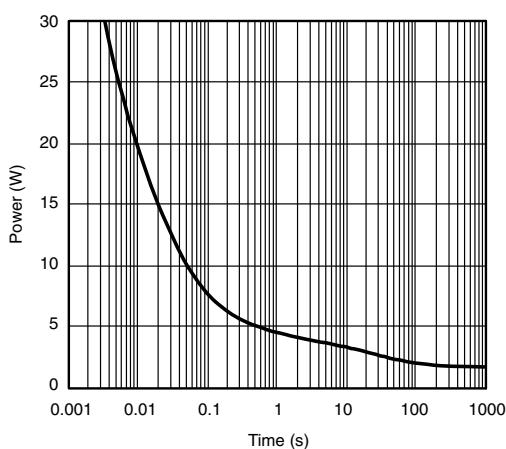
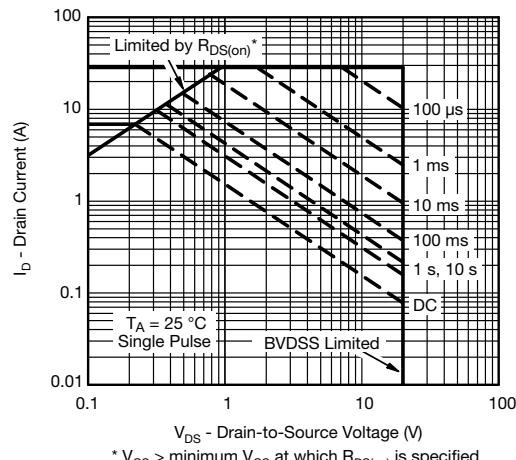
| SPECIFICATIONS ($T_J = 25^\circ\text{C}$, unless otherwise noted) | | | | | | |
|--|--------------------------------|--|------|--------|-----------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | |
| Drain-source breakdown voltage | V_{DS} | $V_{GS} = 0 \text{ V}$, $I_D = -250 \mu\text{A}$ | -20 | - | - | V |
| V_{DS} temperature coefficient | $\Delta V_{DS}/T_J$ | $I_D = -250 \mu\text{A}$ | - | -12 | - | mV/°C |
| $V_{GS(\text{th})}$ temperature coefficient | $\Delta V_{GS(\text{th})}/T_J$ | | - | 2.7 | - | |
| Gate-source threshold voltage | $V_{GS(\text{th})}$ | $V_{DS} = V_{GS}$, $I_D = -250 \mu\text{A}$ | -0.4 | - | -1 | V |
| Gate-source leakage | I_{GSS} | $V_{DS} = 0 \text{ V}$, $V_{GS} = \pm 8 \text{ V}$ | - | - | ± 100 | nA |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = -20 \text{ V}$, $V_{GS} = 0 \text{ V}$ | - | - | -1 | μA |
| | | $V_{DS} = -20 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_J = 55^\circ\text{C}$ | - | - | -10 | |
| On-state drain current ^a | $I_{D(\text{on})}$ | $V_{DS} \leq -5 \text{ V}$, $V_{GS} = -4.5 \text{ V}$ | -20 | - | - | A |
| Drain-source on-state resistance ^a | $R_{DS(\text{on})}$ | $V_{GS} = -4.5 \text{ V}$, $I_D = -6 \text{ A}$ | - | 0.0170 | 0.0205 | Ω |
| | | $V_{GS} = -2.5 \text{ V}$, $I_D = -2 \text{ A}$ | - | 0.0220 | 0.0270 | |
| | | $V_{GS} = -1.8 \text{ V}$, $I_D = -2 \text{ A}$ | - | 0.0290 | 0.0360 | |
| | | $V_{GS} = -1.5 \text{ V}$, $I_D = -1 \text{ A}$ | - | 0.0380 | 0.0600 | |
| Forward transconductance ^a | g_{fs} | $V_{DS} = -10 \text{ V}$, $I_D = -6 \text{ A}$ | - | 30 | - | S |
| Dynamic ^b | | | | | | |
| Input capacitance | C_{iss} | $V_{DS} = -10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | - | 1750 | - | pF |
| Output capacitance | C_{oss} | | - | 270 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 240 | - | |
| Total gate charge | Q_g | $V_{DS} = -10 \text{ V}$, $V_{GS} = -8 \text{ V}$, $I_D = -10 \text{ A}$ | - | 41 | 62 | nC |
| Gate-source charge | Q_{gs} | $V_{DS} = -10 \text{ V}$, $V_{GS} = -4.5 \text{ V}$, $I_D = -10 \text{ A}$ | - | 24.5 | 37 | |
| Gate-drain charge | Q_{gd} | | - | 2.4 | - | |
| Gate resistance | R_g | | - | 6.7 | - | |
| Turn-on delay time | $t_{d(\text{on})}$ | $V_{DD} = -10 \text{ V}$, $R_L = 1.2 \Omega$ $I_D \geq -8.5 \text{ A}$, $V_{GEN} = -4.5 \text{ V}$, $R_g = 1 \Omega$ | - | 22 | 35 | ns |
| Rise time | t_r | | - | 25 | 40 | |
| Turn-off delay time | $t_{d(\text{off})}$ | | - | 70 | 105 | |
| Fall time | t_f | | - | 25 | 40 | |
| Turn-on delay time | $t_{d(\text{on})}$ | | - | 10 | 15 | |
| Rise time | t_r | | - | 10 | 15 | |
| Turn-off delay time | $t_{d(\text{off})}$ | | - | 80 | 120 | |
| Fall time | t_f | | - | 25 | 40 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous source-drain diode current | I_S | $T_C = 25^\circ\text{C}$ | - | - | -12 | A |
| Pulse diode forward current | I_{SM} | | - | - | -30 | |
| Body diode voltage | V_{SD} | $I_S = -8.5 \text{ A}$, $V_{GS} = 0 \text{ V}$ | - | -0.8 | -1.2 | V |
| Body diode reverse recovery time | t_{rr} | $I_F = -8.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$ | - | 35 | 60 | ns |
| Body diode reverse recovery charge | Q_{rr} | | - | 18 | 30 | |
| Reverse recovery fall time | t_a | | - | 13 | - | |
| Reverse recovery rise time | t_b | | - | 22 | - | |

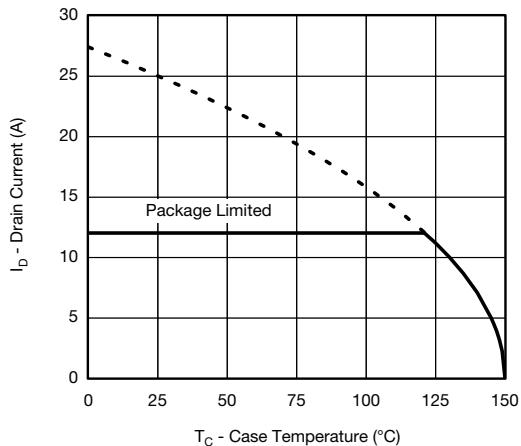
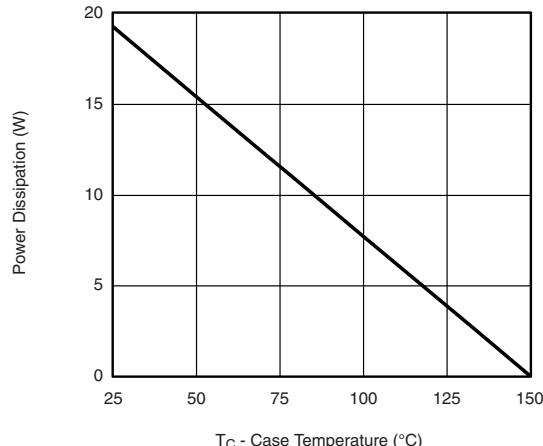
Notes

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

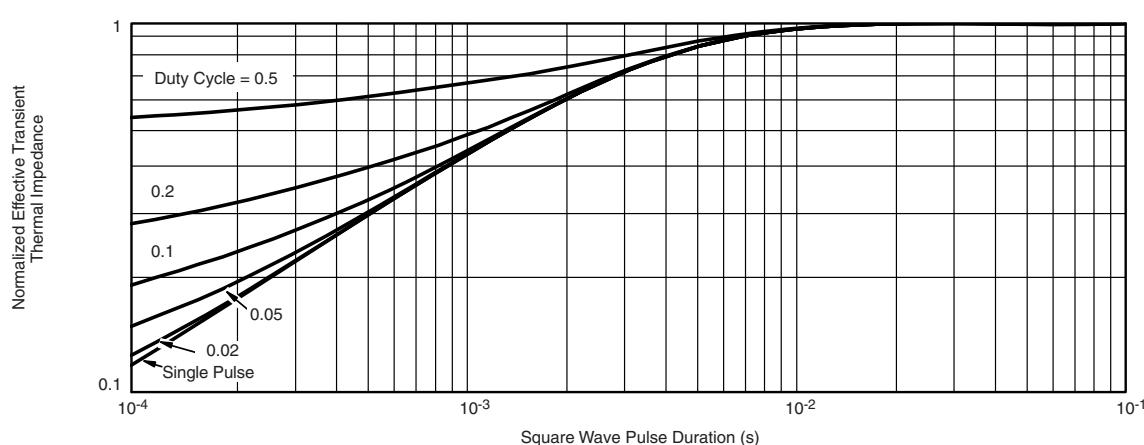
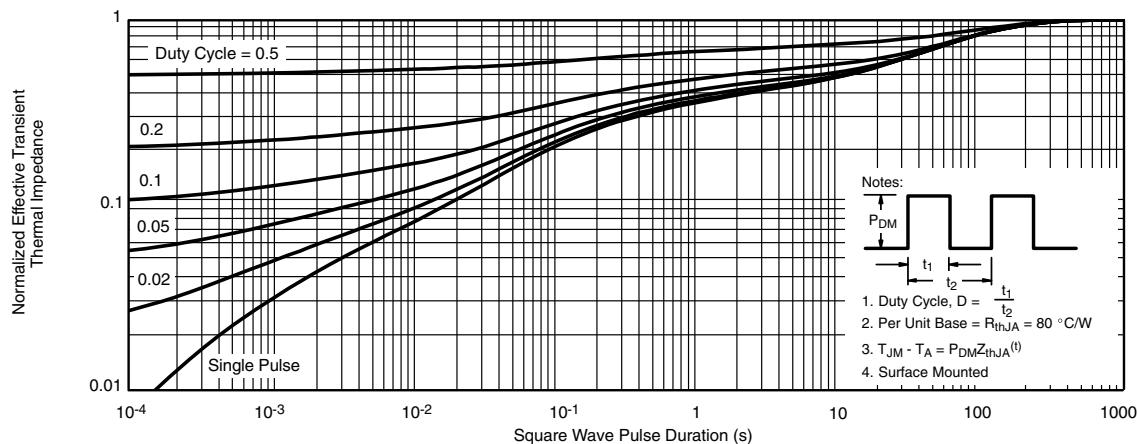
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Output Characteristics

Transfer Characteristics

On-Resistance vs. Drain Current and Gate Voltage

Capacitance

Gate Charge

On-Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage

Single Pulse Power, Junction-to-Ambient

Safe Operating Area, Junction-to-Ambient

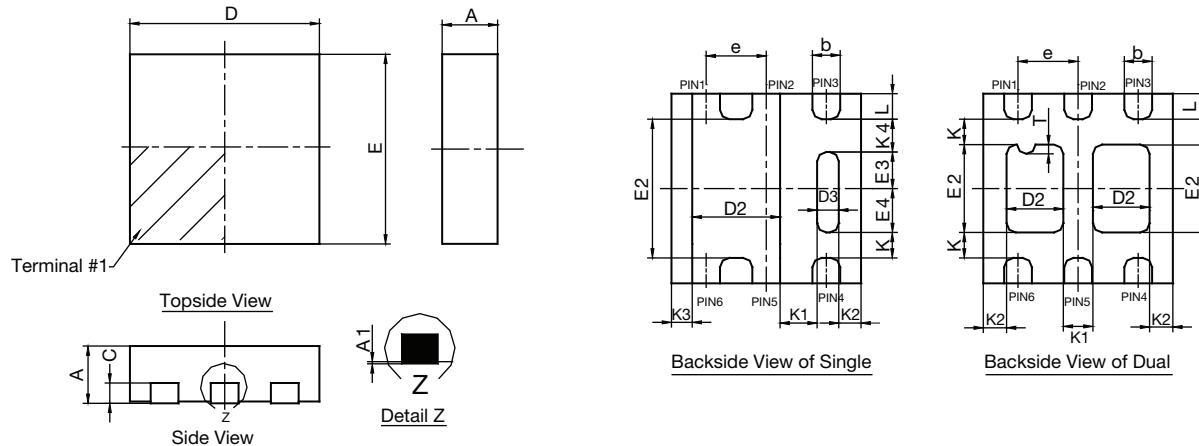
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating ^a

Power Derating
Note

- 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

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for silicon technology and package reliability represent a composite of all qualified locations. For related documents such as package / tape drawings, part marking, and reliability data, see www.vishay.com/ppg?67038.

Case Outline for PowerPAK® SC70T



| DIM. | SINGLE PAD | | | | | | DUAL PAD | | | | | |
|------|-------------|-------|-------|------------|-------|-------|-------------|-------|-------|------------|-------|-------|
| | MILLIMETERS | | | INCHES | | | MILLIMETERS | | | INCHES | | |
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.525 | 0.60 | 0.65 | 0.0206 | 0.024 | 0.026 | 0.525 | 0.60 | 0.65 | 0.0206 | 0.024 | 0.026 |
| A1 | 0 | - | 0.05 | 0 | - | 0.002 | 0 | - | 0.05 | 0 | - | 0.002 |
| b | 0.23 | 0.30 | 0.38 | 0.009 | 0.012 | 0.015 | 0.23 | 0.30 | 0.38 | 0.009 | 0.012 | 0.015 |
| C | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 |
| D2 | 0.85 | 0.95 | 1.05 | 0.033 | 0.037 | 0.041 | 0.513 | 0.613 | 0.713 | 0.020 | 0.024 | 0.028 |
| D3 | 0.135 | 0.235 | 0.335 | 0.005 | 0.009 | 0.013 | | | | | | |
| E | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 |
| E2 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 | 0.85 | 0.95 | 1.05 | 0.033 | 0.037 | 0.041 |
| E3 | 0.345 | 0.395 | 0.445 | 0.014 | 0.016 | 0.018 | | | | | | |
| E4 | 0.425 | 0.475 | 0.525 | 0.017 | 0.019 | 0.021 | | | | | | |
| e | 0.65 BSC | | | 0.026 BSC | | | 0.65 BSC | | | 0.026 BSC | | |
| K | 0.275 TYP. | | | 0.011 TYP. | | | 0.275 TYP. | | | 0.011 TYP. | | |
| K1 | 0.400 TYP. | | | 0.016 TYP. | | | 0.320 TYP. | | | 0.013 TYP. | | |
| K2 | 0.240 TYP. | | | 0.009 TYP. | | | 0.252 TYP. | | | 0.010 TYP. | | |
| K3 | 0.225 TYP. | | | 0.009 TYP. | | | | | | | | |
| K4 | 0.355 TYP. | | | 0.014 TYP. | | | | | | | | |
| L | 0.175 | 0.275 | 0.375 | 0.007 | 0.011 | 0.015 | 0.175 | 0.275 | 0.375 | 0.007 | 0.011 | 0.015 |
| T | | | | | | | 0.05 | 0.10 | 0.15 | 0.002 | 0.004 | 0.006 |

ECN: C12-0160-Rev. B, 05-Mar-12

DWG: 5994

Notes

1. All dimensions are in millimeter. Millimeters will govern.
2. Package outline exclusive of mold flash and metal burr.
3. Package outline inclusive of plating

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