

N-Channel 60 V (D-S) MOSFET



| PRODUCT SUMMARY | |
|--|--------|
| V_{DS} (V) | 60 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = 10$ V | 0.0044 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = 4.5$ V | 0.0063 |
| Q_g typ. (nC) | 15.2 |
| I_D (A) | 80.3 |
| Configuration | Single |

FEATURES

- TrenchFET® Gen IV power MOSFET
- Very low R_{DS} - Q_g figure-of-merit (FOM)
- Tuned for the lowest R_{DS} - Q_{oss} FOM
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Synchronous rectification
- Primary side switch
- DC/DC converter
- Motor drive switch



N-Channel MOSFET

ORDERING INFORMATION

| | |
|---------------------------------|------------------|
| Package | PowerPAK SO-8 |
| Lead (Pb)-free and halogen-free | SiR186LDP-T1-RE3 |

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

| PARAMETER | SYMBOL | LIMIT | UNIT |
|---|----------------|----------------------|------|
| Drain-source voltage | V_{DS} | 60 | V |
| Gate-source voltage | V_{GS} | ± 20 | V |
| Continuous drain current ($T_J = 150$ °C) | $T_C = 25$ °C | 80.3 | A |
| | $T_C = 70$ °C | 64.2 | |
| | $T_A = 25$ °C | 23.8 ^{b, c} | |
| | $T_A = 70$ °C | 19 ^{b, c} | |
| Pulsed drain current ($t = 100$ μ s) | I_{DM} | 150 | A |
| Continuous source-drain diode current | $T_C = 25$ °C | 51.8 | A |
| | $T_A = 25$ °C | 4.5 ^{b, c} | |
| Single pulse avalanche current | $L = 0.1$ mH | 25 | mJ |
| Single pulse avalanche energy | E_{AS} | 31.25 | |
| Maximum power dissipation | $T_C = 25$ °C | 57 | W |
| | $T_C = 70$ °C | 36 | |
| | $T_A = 25$ °C | 5 ^{b, c} | |
| | $T_A = 70$ °C | 3.2 ^{b, c} | |
| Operating junction and storage temperature range | T_J, T_{stg} | -55 to +150 | °C |
| Soldering recommendations (peak temperature) ^c | | 260 | °C |

THERMAL RESISTANCE RATINGS

| PARAMETER | SYMBOL | TYPICAL | MAXIMUM | UNIT |
|--|------------|---------|---------|------|
| Maximum junction-to-ambient ^b | R_{thJA} | 20 | 25 | °C/W |
| Maximum junction-to-case (drain) | R_{thJC} | 1.7 | 2.2 | |

Notes

- Package limited
- Surface mounted on 1" x 1" FR4 board
- $t = 10$ s
- See solder profile (www.vishay.com/doc?73257). The PowerPAK SO-8 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 70 °C/W
- $T_C = 25$ °C



| 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 | 60 | - | - | V |
| V _{DS} temperature coefficient | ΔV _{DS} /T _J | I _D = 10 mA | - | 32 | - | mV/°C |
| V _{GS(th)} temperature coefficient | ΔV _{GS(th)} /T _J | I _D = 250 μA | - | -5 | - | |
| 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} = 60 V, V _{GS} = 0 V | - | - | 1 | μA |
| | | V _{DS} = 60 V, V _{GS} = 0 V, T _J = 70 °C | - | - | 15 | |
| On-state drain current ^a | I _{D(on)} | V _{DS} ≥ 10 V, V _{GS} = 10 V | 40 | - | - | A |
| Drain-source on-state resistance ^a | R _{DS(on)} | V _{GS} = 10 V, I _D = 15 A | - | 0.0035 | 0.0044 | Ω |
| | | V _{GS} = 4.5 V, I _D = 10 A | - | 0.0049 | 0.0063 | |
| Forward transconductance ^a | g _{fs} | V _{DS} = 15 V, I _D = 15 A | - | 54 | - | S |
| Dynamic ^b | | | | | | |
| Input capacitance | C _{iss} | V _{DS} = 30 V, V _{GS} = 0 V, f = 1 MHz | - | 1980 | - | pF |
| Output capacitance | C _{oss} | | - | 447 | - | |
| Reverse transfer capacitance | C _{rss} | | - | 24 | - | |
| Total gate charge | Q _g | V _{DS} = 30 V, V _{GS} = 10 V, I _D = 10 A | - | 31.5 | 48 | nC |
| | | V _{DS} = 30 V, V _{GS} = 4.5 V, I _D = 10 A | - | 15.2 | 23 | |
| Q _{gs} | - | | 6.2 | - | | |
| Q _{gd} | - | | 4.5 | - | | |
| Output charge | Q _{oss} | V _{DS} = 30 V, V _{GS} = 0 V | - | 28.3 | - | |
| Gate resistance | R _g | f = 1 MHz | 0.3 | 0.85 | 1.5 | Ω |
| Turn-on delay time | t _{d(on)} | V _{DD} = 30 V, R _L = 3 Ω, I _D ≅ 10 A, V _{GEN} = 10 V, R _g = 1 Ω | - | 11 | 22 | ns |
| Rise time | t _r | | - | 6 | 12 | |
| Turn-off delay time | t _{d(off)} | | - | 26 | 52 | |
| Fall time | t _f | | - | 6 | 12 | |
| Turn-on delay time | t _{d(on)} | V _{DD} = 30 V, R _L = 3 Ω, I _D ≅ 10 A, V _{GEN} = 4.5 V, R _g = 1 Ω | - | 21 | 42 | |
| Rise time | t _r | | - | 73 | 146 | |
| Turn-off delay time | t _{d(off)} | | - | 24 | 48 | |
| Fall time | t _f | | - | 10 | 20 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous source-drain diode current | I _S | T _C = 25 °C | - | - | 51.8 | A |
| Pulse diode forward current | I _{SM} | | - | - | 150 | |
| Body diode voltage | V _{SD} | I _S = 5 A, V _{GS} = 0 V | - | 0.75 | 1.1 | V |
| Body diode reverse recovery time | t _{rr} | I _F = 10 A, di/dt = 100 A/μs, T _J = 25 °C | - | 30 | 60 | ns |
| Body diode reverse recovery charge | Q _{rr} | | - | 20 | 40 | nC |
| Reverse recovery fall time | t _a | | - | 13 | - | ns |
| Reverse recovery rise time | t _b | | - | 17 | - | |

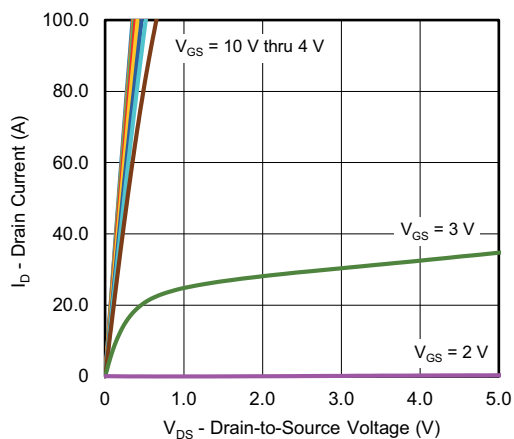
Notes

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

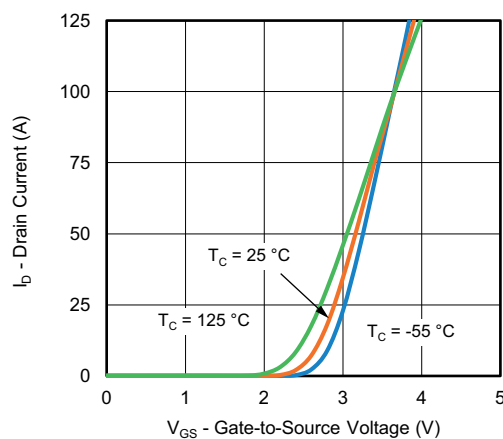
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



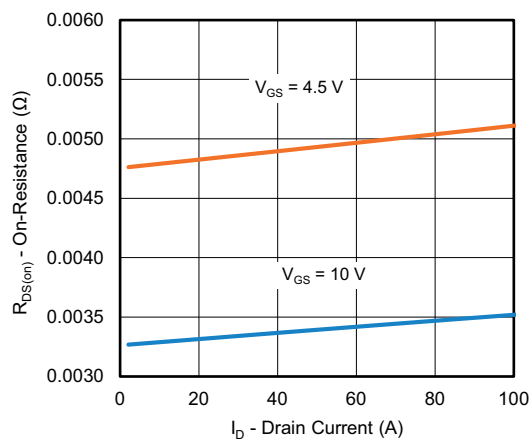
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



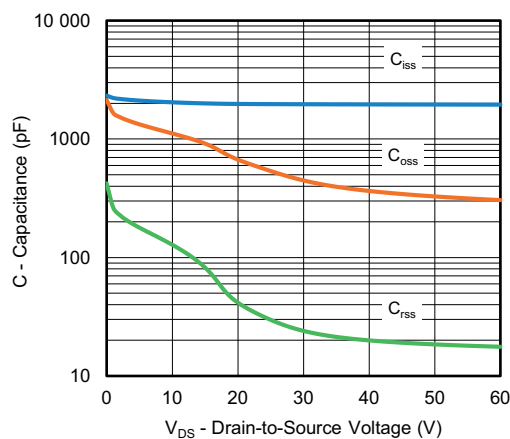
Output Characteristics



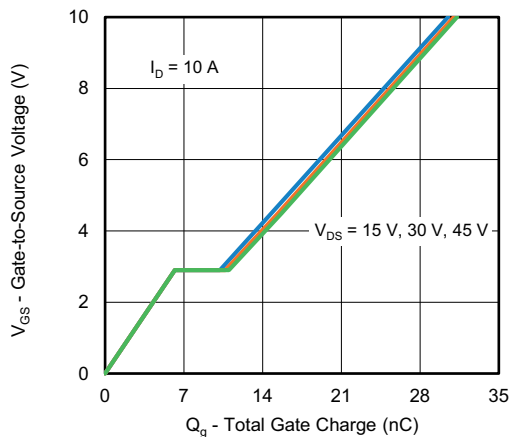
Transfer Characteristics



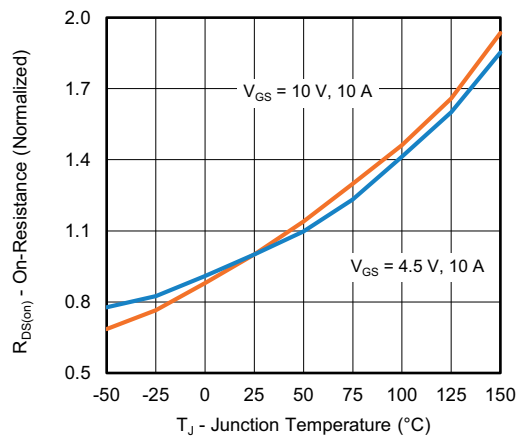
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



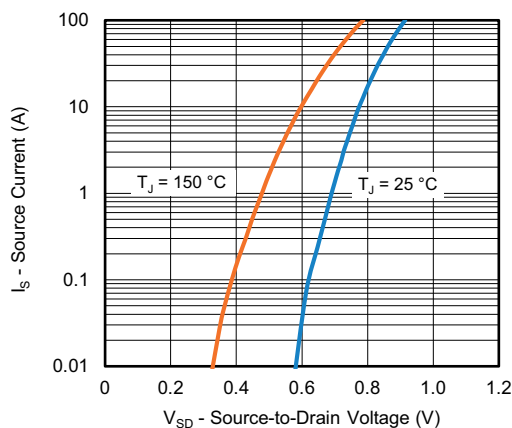
Gate Charge



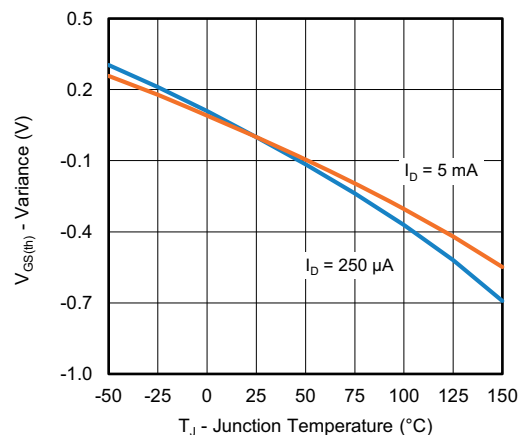
On-Resistance vs. Junction Temperature



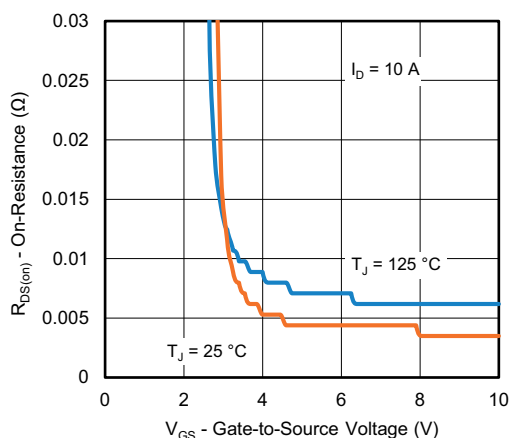
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



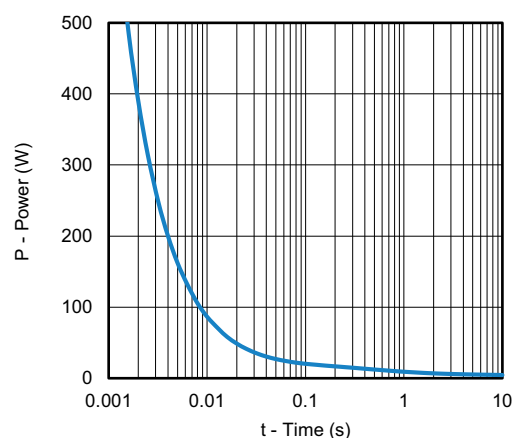
Source-Drain Diode Forward Voltage



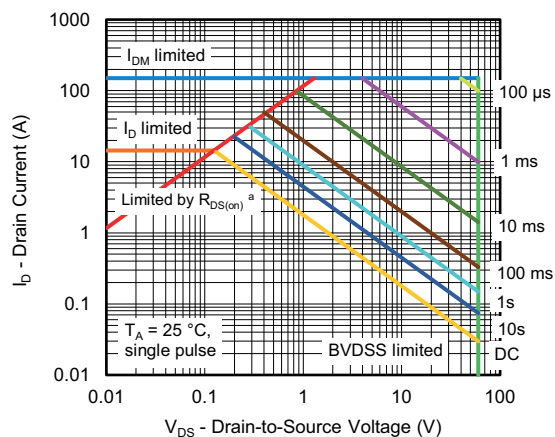
Threshold Voltage



On-Resistance vs. Gate-to-Source Voltage



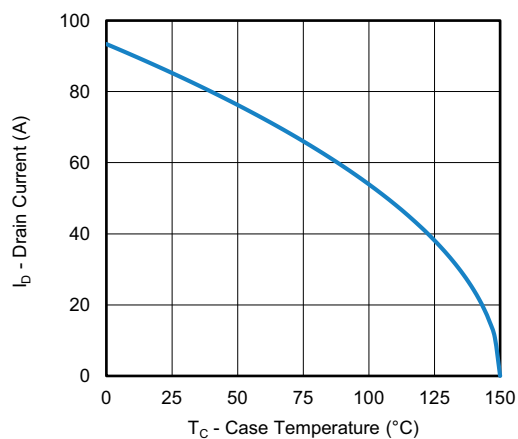
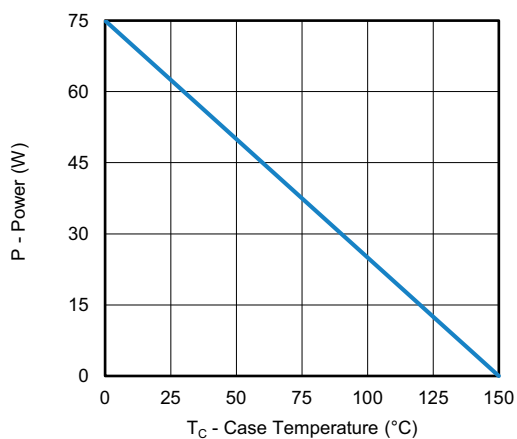
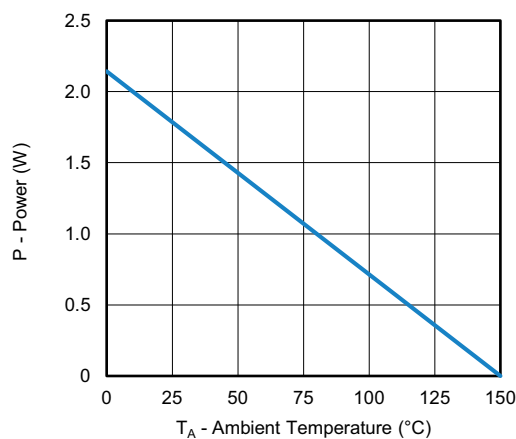
Single Pulse Power, Junction-to-Ambient



Safe Operating Area, Junction-to-Ambient

Note

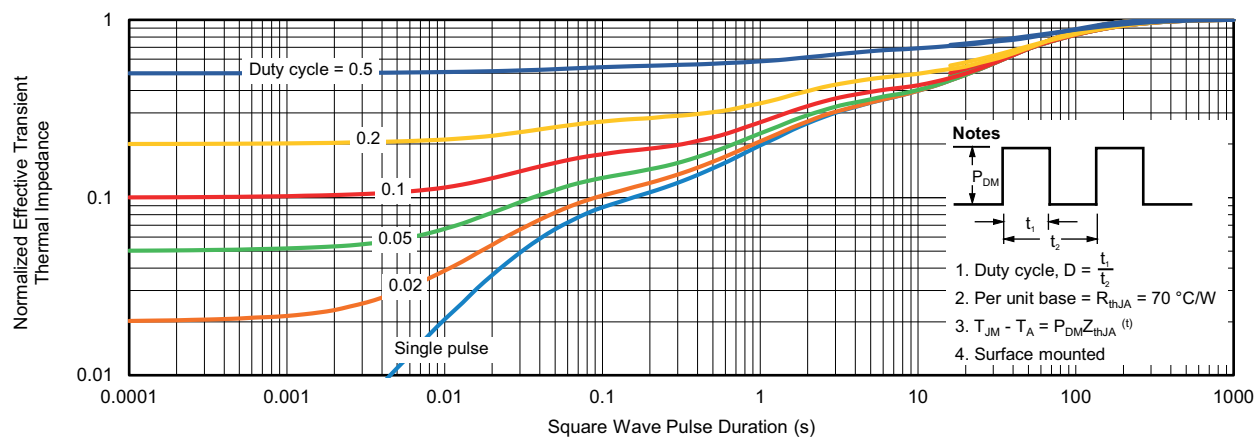
a. $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating ^a

Power, Junction-to-Case

Power, Junction-to-Ambient
Note

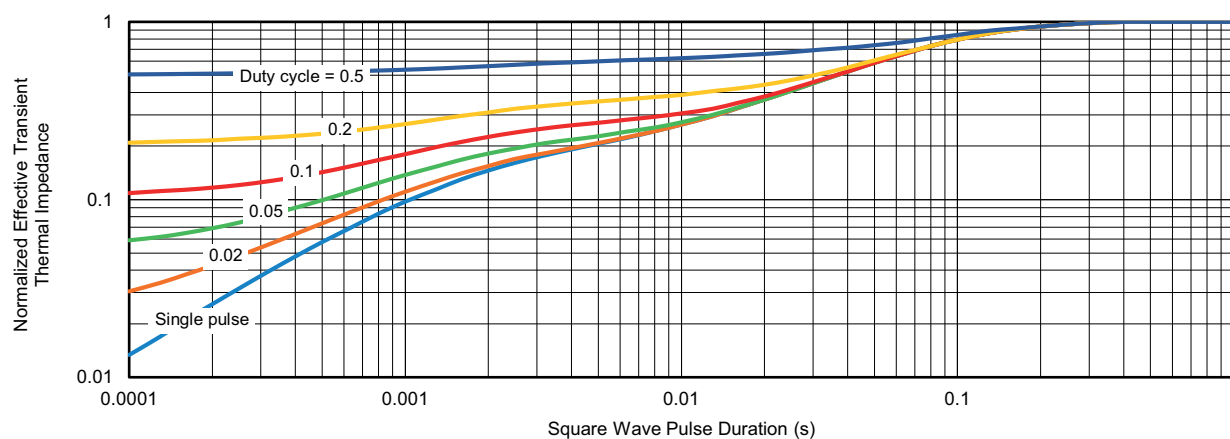
- a. The power dissipation P_D is based on T_J max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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PowerPAK® SO-8, (Single/Dual)



Notes

1. Inch will govern.
2. Dimensions exclusive of mold gate burrs.
3. Dimensions exclusive of mold flash and cutting burrs.

| DIM. | MILLIMETERS | | | INCHES | | |
|---------------------------------|-------------|------|------|-------------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.97 | 1.04 | 1.12 | 0.038 | 0.041 | 0.044 |
| A1 | | - | 0.05 | 0 | - | 0.002 |
| b | 0.33 | 0.41 | 0.51 | 0.013 | 0.016 | 0.020 |
| c | 0.23 | 0.28 | 0.33 | 0.009 | 0.011 | 0.013 |
| D | 5.05 | 5.15 | 5.26 | 0.199 | 0.203 | 0.207 |
| D1 | 4.80 | 4.90 | 5.00 | 0.189 | 0.193 | 0.197 |
| D2 | 3.56 | 3.76 | 3.91 | 0.140 | 0.148 | 0.154 |
| D3 | 1.32 | 1.50 | 1.68 | 0.052 | 0.059 | 0.066 |
| D4 | 0.57 typ. | | | 0.0225 typ. | | |
| D5 | 3.98 typ. | | | 0.157 typ. | | |
| E | 6.05 | 6.15 | 6.25 | 0.238 | 0.242 | 0.246 |
| E1 | 5.79 | 5.89 | 5.99 | 0.228 | 0.232 | 0.236 |
| E2 | 3.48 | 3.66 | 3.84 | 0.137 | 0.144 | 0.151 |
| E3 | 3.68 | 3.78 | 3.91 | 0.145 | 0.149 | 0.154 |
| E4 | 0.75 typ. | | | 0.030 typ. | | |
| e | 1.27 BSC | | | 0.050 BSC | | |
| K | 1.27 typ. | | | 0.050 typ. | | |
| K1 | 0.56 | - | - | 0.022 | - | - |
| H | 0.51 | 0.61 | 0.71 | 0.020 | 0.024 | 0.028 |
| L | 0.51 | 0.61 | 0.71 | 0.020 | 0.024 | 0.028 |
| L1 | 0.06 | 0.13 | 0.20 | 0.002 | 0.005 | 0.008 |
| θ | 0° | - | 12° | 0° | - | 12° |
| W | 0.15 | 0.25 | 0.36 | 0.006 | 0.010 | 0.014 |
| M | 0.125 typ. | | | 0.005 typ. | | |
| ECN: S17-0173-Rev. L, 13-Feb-17 | | | | | | |
| DWG: 5881 | | | | | | |

RECOMMENDED MINIMUM PADS FOR PowerPAK® SO-8 Single



Recommended Minimum Pads
Dimensions in Inches/(mm)

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