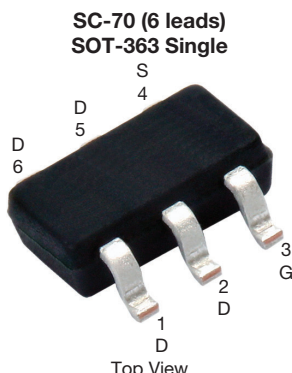


Dual P-Channel 12 V (D-S) MOSFET



Marking Code: DE

| PRODUCT SUMMARY | |
|---|-------|
| V_{DS} (V) | -12 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = -4.5$ V | 0.390 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = -2.5$ V | 0.535 |
| $R_{DS(on)}$ max. (Ω) at $V_{GS} = -1.8$ V | 0.710 |
| Q_g typ. (nC) | 1.7 |
| I_D (A) ^d | -1.3 |
| Configuration | Dual |

| ORDERING INFORMATION | |
|---------------------------------|-----------------|
| Package | SC70-6 |
| Lead (Pb)-free | Si1965DH-T1-E3 |
| Lead (Pb)-free and halogen-free | Si1965DH-T1-GE3 |

| ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted) | | | | |
|---|---------------|----------------|-----------------------|------|
| PARAMETER | | SYMBOL | LIMIT | UNIT |
| Drain-source voltage | | V_{DS} | -12 | V |
| Gate-source voltage | | V_{GS} | ± 8 | |
| Continuous drain current ($T_J = 150$ °C) | $T_C = 25$ °C | I_D | -1.3 ^a | A |
| | $T_C = 70$ °C | | -1.2 | |
| | $T_A = 25$ °C | | -1.14 ^{b, c} | |
| | $T_A = 70$ °C | | -0.9 ^{b, c} | |
| Pulsed drain current | | I_{DM} | -3 | A |
| Continuous source-drain diode current | $T_C = 25$ °C | I_S | -1 | |
| | $T_A = 25$ °C | | -0.6 ^{b, c} | |
| Maximum power dissipation | $T_C = 25$ °C | P_D | 1.25 | W |
| | $T_C = 70$ °C | | 0.8 | |
| | $T_A = 25$ °C | | 0.74 ^{b, c} | |
| | $T_A = 70$ °C | | 0.47 ^{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, d} | $t \leq 5$ s | R_{thJA} | 130 | 170 | °C/W |
| Maximum junction-to-foot (drain) | Steady state | R_{thJF} | 80 | 100 | |

Notes

- Package limited
- Surface mounted on 1" x 1" FR4 board
- $t = 5$ s
- Maximum under steady state conditions is 220 °C/W

FEATURES

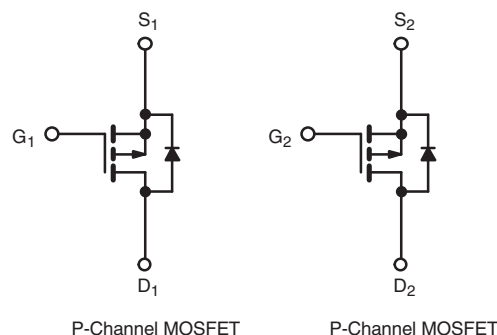
- TrenchFET® power MOSFET
- Material categorization:
for definitions of compliance please see
www.vishay.com/doc?99912

APPLICATIONS

- Load switch for portable devices



RoHS
COMPLIANT
HALOGEN
FREE
Available





| 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 | -12 | - | - | V | |
| V _{DS} temperature coefficient | ΔV _{DS} /T _J | I _D = -250 μA | - | -14 | - | mV/°C | |
| V _{GS(th)} temperature coefficient | ΔV _{GS(th)} /T _J | | - | 2 | | | |
| Gate-source threshold voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = -250 μA | -0.4 | - | -1.0 | V | |
| Gate-source leakage | I _{GSS} | V _{DS} = 0 V, V _{GS} = ± 8 V | - | - | ± 100 | nA | |
| Zero gate voltage drain current | I _{DSS} | V _{DS} = -12 V, V _{GS} = 0 V | - | - | -1 | μA | |
| | | V _{DS} = -12 V, V _{GS} = 0 V, T _J = 85 °C | - | - | -10 | | |
| On-state drain current ^a | I _{D(on)} | V _{DS} ≤ -5 V, V _{GS} = -4.5 V | -3 | - | - | A | |
| Drain-source on-state resistance ^a | R _{DS(on)} | V _{GS} = -4.5 V, I _D = -1.0 A | - | 0.315 | 0.390 | Ω | |
| | | V _{GS} = -2.5 V, I _D = -0.86 A | - | 0.425 | 0.535 | | |
| | | V _{GS} = -1.8 V, I _D = -0.25 A | - | 0.550 | 0.710 | | |
| Forward transconductance ^a | g _{fs} | V _{DS} = -6 V, I _D = -1.0 A | - | 2.5 | - | S | |
| Dynamic ^b | | | | | | | |
| Input capacitance | C _{iss} | V _{DS} = -6 V, V _{GS} = 0 V, f = 1 MHz | - | 120 | - | pF | |
| Output capacitance | C _{oss} | | - | 41 | - | | |
| Reverse transfer capacitance | C _{rss} | | - | 25 | - | | |
| Total gate charge | Q _g | V _{DS} = -6 V, V _{GS} = -8 V, I _D = -1.1 A | - | 2.8 | 4.2 | nC | |
| | | V _{DS} = -6 V, V _{GS} = -4.5 V, I _D = -1.1 A | - | 1.7 | 2.6 | | |
| Gate-source charge | Q _{gs} | | - | 0.3 | - | | |
| Gate-drain charge | Q _{gd} | | - | 0.4 | - | | |
| Gate resistance | R _g | f = 1 MHz | - | 7.5 | - | Ω | |
| Turn-on delay time | t _{d(on)} | V _{DD} = -6 V, R _L = 6.7 Ω I _D ≅ -0.9 A, V _{GEN} = -4.5 V, R _g = 1 Ω | - | 12 | 20 | ns | |
| Rise time | t _r | | - | 27 | 40 | | |
| Turn-off delay time | t _{d(off)} | | - | 15 | 25 | | |
| Fall time | t _f | | - | 10 | 15 | | |
| Turn-on delay time | t _{d(on)} | V _{DD} = -6 V, R _L = 6.7 Ω I _D ≅ -0.9 A, V _{GEN} = -8 V, R _g = 1 Ω | - | 2 | 5 | | |
| Rise time | t _r | | - | 12 | 20 | | |
| Turn-off delay time | t _{d(off)} | | - | 12 | 20 | | |
| Fall time | t _f | | - | 10 | 15 | | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous source-drain diode current | I _S | T _C = 25 °C | - | - | -1.0 | A | |
| Pulse diode forward current ^a | I _{SM} | | - | - | -3.0 | | |
| Body diode voltage | V _{SD} | I _S = -0.9 A | - | -0.8 | -1.2 | V | |
| Body diode reverse recovery time | t _{rr} | I _F = -0.9 A, dI/dt = 100 A/μs, T _J = 25 °C | - | 20 | 40 | ns | |
| Body diode reverse recovery charge | Q _{rr} | | - | 10 | 20 | nC | |
| Reverse recovery fall time | t _a | | - | 9.5 | - | ns | |
| Reverse recovery rise time | t _b | | - | 11.5 | - | | |

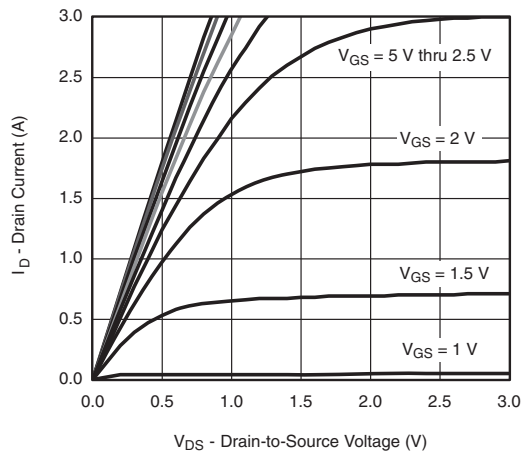
Notes

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

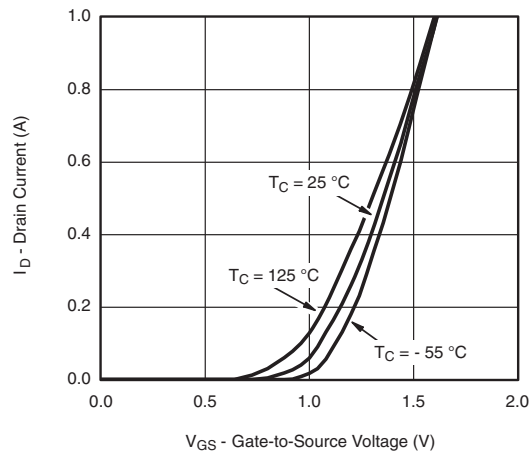
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



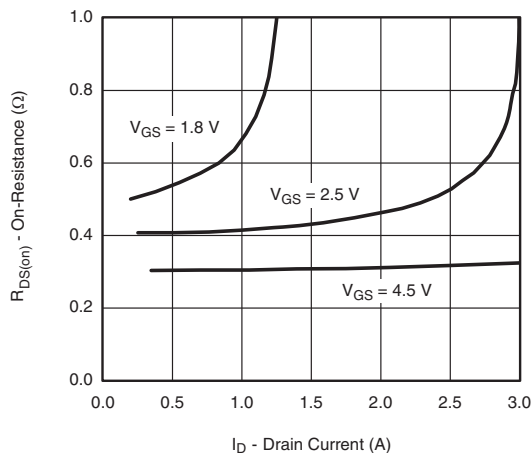
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



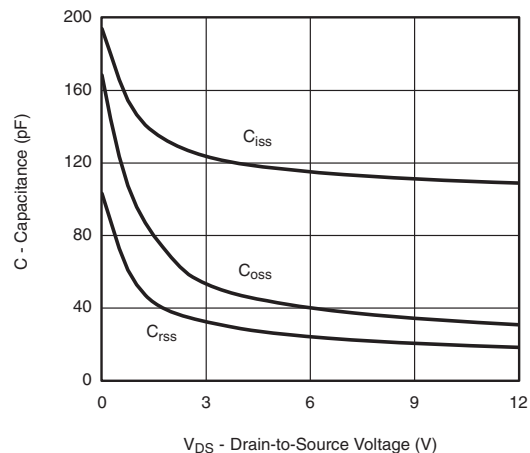
Output Characteristics



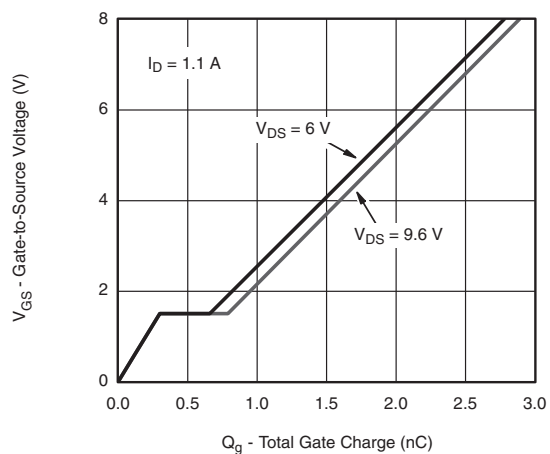
Transfer Characteristics



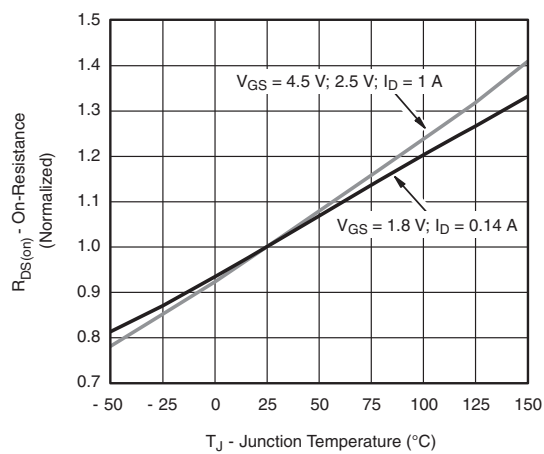
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



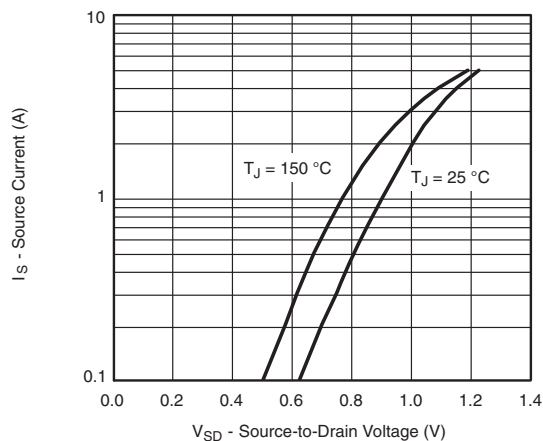
Gate Charge



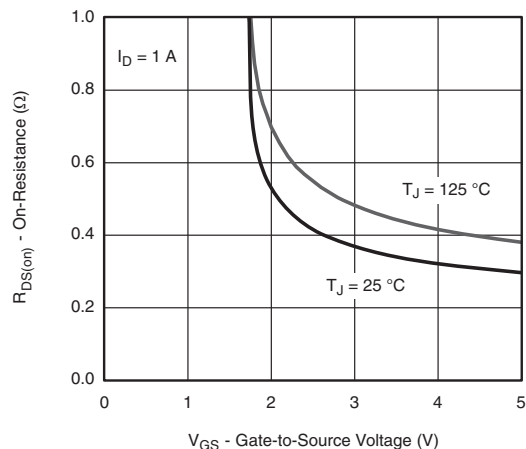
On-Resistance vs. Junction Temperature



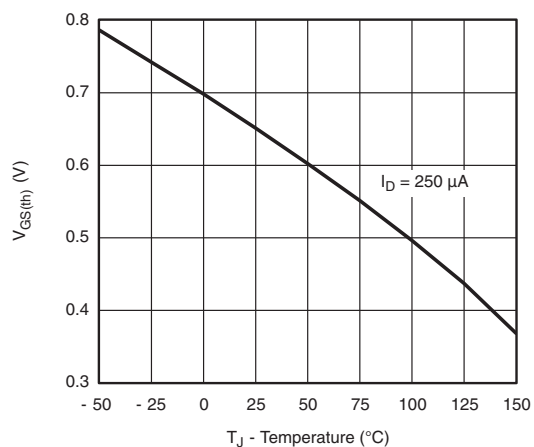
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



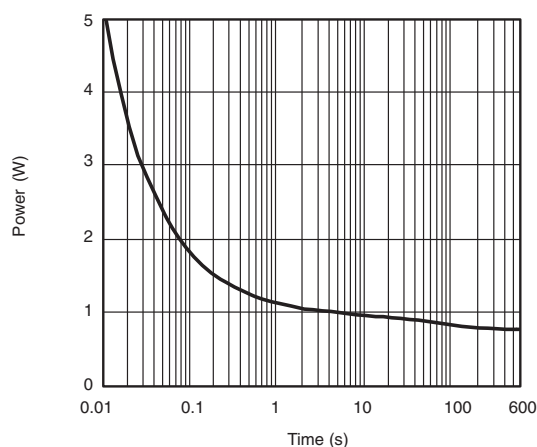
Source-Drain Diode Forward Voltage



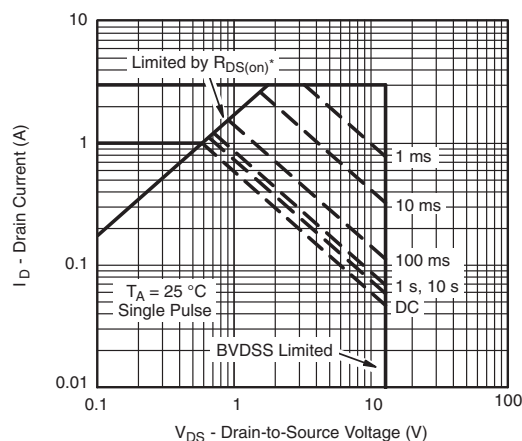
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



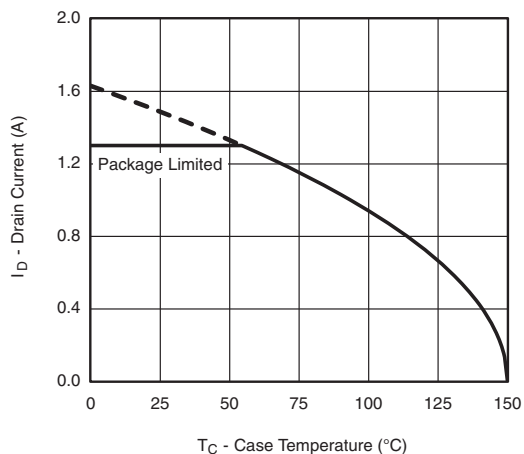
Single Pulse Power



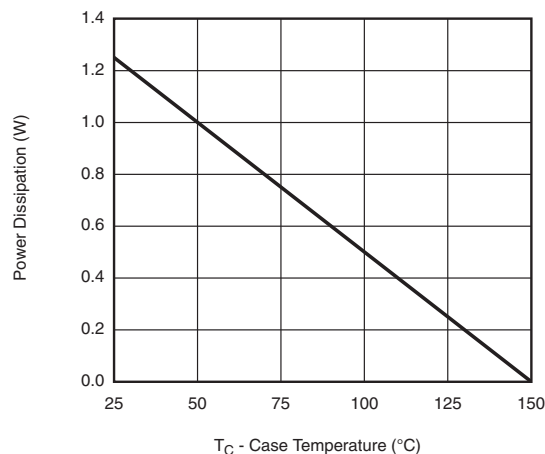
Safe Operating Area, Junction-to-Ambient



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating ^a



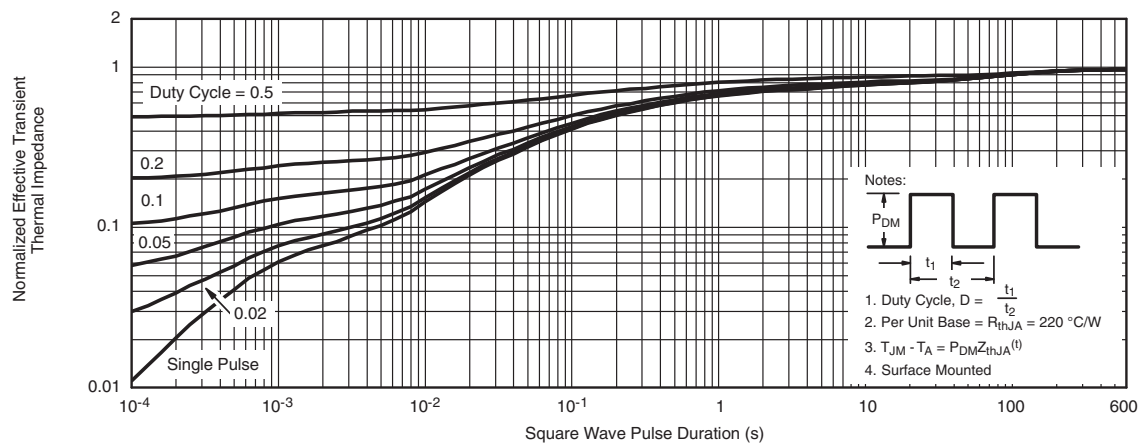
Power, Junction-to-Foot

Note

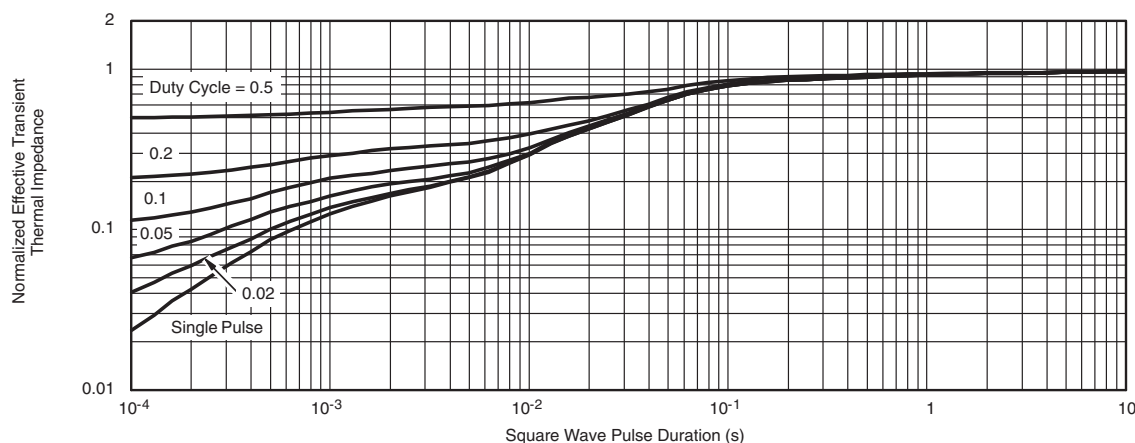
- a. The power dissipation P_D is based on T_J max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient

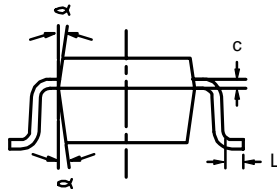


Normalized Thermal Transient Impedance, Junction-to-Foot

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SC-70: 6-LEADS

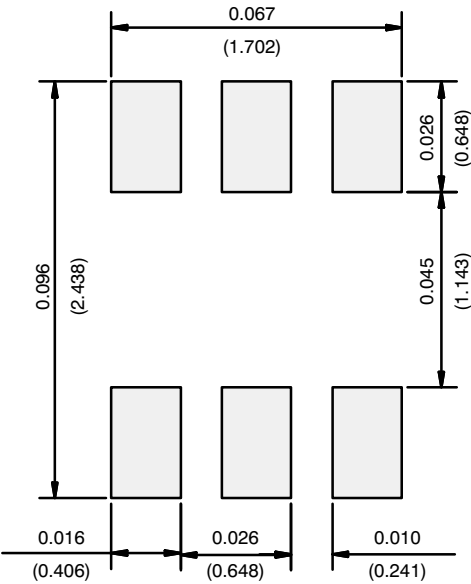


| Dim | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|----------|-------|-------|
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.90 | — | 1.10 | 0.035 | — | 0.043 |
| A ₁ | — | — | 0.10 | — | — | 0.004 |
| A ₂ | 0.80 | — | 1.00 | 0.031 | — | 0.039 |
| b | 0.15 | — | 0.30 | 0.006 | — | 0.012 |
| c | 0.10 | — | 0.25 | 0.004 | — | 0.010 |
| D | 1.80 | 2.00 | 2.20 | 0.071 | 0.079 | 0.087 |
| E | 1.80 | 2.10 | 2.40 | 0.071 | 0.083 | 0.094 |
| E ₁ | 1.15 | 1.25 | 1.35 | 0.045 | 0.049 | 0.053 |
| e | 0.65BSC | | | 0.026BSC | | |
| e ₁ | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| L | 0.10 | 0.20 | 0.30 | 0.004 | 0.008 | 0.012 |
| α | 7°Nom | | | 7°Nom | | |

ECN: S-03946—Rev. B, 09-Jul-01
DWG: 5550



RECOMMENDED MINIMUM PADS FOR SC-70: 6-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)



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