# P-Channel 1.8 V (G-S) MOSFET

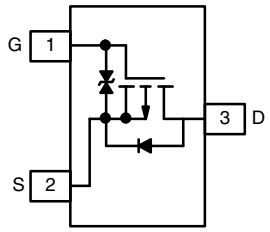
| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (mA) |
| - 20 | 1.2 at $V_{GS}$ = - 4.5 V | - 350 |
| | 1.6 at $V_{GS}$ = - 2.5 V | - 300 |
| | 2.7 at $V_{GS}$ = - 1.8 V | - 150 |

## FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- High-Side Switching
- Low On-Resistance: 1.2 Ω
- Low Threshold: 0.8 V (Typ.)
- Fast Switching Speed: 14 ns
- 1.8 V Operation
- TrenchFET® Power MOSFETs
- 2000 V ESD Protection
- Compliant to RoHS Directive 2002/95/EC

Pb-free
RoHS COMPLIANT
HALOGEN FREE

**SC-75A or SC-89**




Top View

**SC-75A (SOT-416):**
**Si1013R - Marking Code D**
**SC-89 (SOT-490):**
**Si1013X - Marking Code B**

**Ordering Information:**
Si1013R-T1-GE3 (SC-75A, Lead (Pb)-free and Halogen-free)
Si1013X-T1-GE3 (SC-89, Lead (Pb)-free and Halogen-free)

## APPLICATIONS

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits
- Load/Power Switching Cell Phones, Pagers

## BENEFITS

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Low Battery Voltage Operation

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

| Parameter | | Symbol | 5 s | Steady State | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | - 20 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 6 | | |
| Continuous Drain Current ($T_J$ = 150 °C)[b] | $T_A$ = 25 °C | $I_D$ | - 400 | - 350 | mA |
| | $T_A$ = 85 °C | | - 300 | - 275 | |
| Pulsed Drain Current[a] | | $I_{DM}$ | - 1000 | | |
| Continuous Source Current (Diode Conduction)[b] | | $I_S$ | - 275 | - 250 | |
| Maximum Power Dissipation[b] for SC-75 | $T_A$ = 25 °C | $P_D$ | 175 | 150 | mW |
| | $T_A$ = 85 °C | | 90 | 80 | |
| Maximum Power Dissipation[b] for SC-89 | $T_A$ = 25 °C | | 275 | 250 | |
| | $T_A$ = 85 °C | | 160 | 140 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 150 | | °C |
| Gate-Source ESD Rating (HBM, Method 3015) | | ESD | 2000 | | V |

Notes:
a. Pulse width limited by maximum junction temperature.
b. Surface mounted on FR4 board.

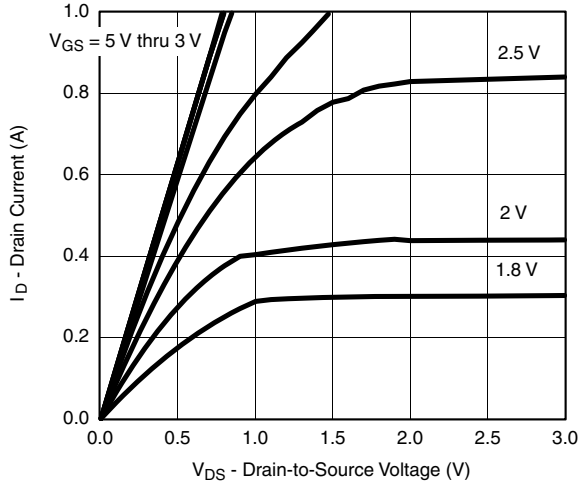
| **SPECIFICATIONS** ($T_A$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| **Static** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = - 250 µA | - 0.45 | | | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 4.5 V | | ± 1 | ± 2 | µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = - 16 V, $V_{GS}$ = 0 V | | - 0.3 | - 100 | nA |
| | | $V_{DS}$ = - 16 V, $V_{GS}$ = 0 V, $T_J$ = 85 °C | | | - 5 | µA |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ = - 5 V, $V_{GS}$ = - 4.5 V | - 700 | | | mA |
| Drain-Source On-State Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = - 4.5 V, $I_D$ = - 350 mA | | 0.8 | 1.2 | Ω |
| | | $V_{GS}$ = - 2.5 V, $I_D$ = - 300 mA | | 1.2 | 1.6 | |
| | | $V_{GS}$ = - 1.8 V, $I_D$ = - 150 mA | | 1.8 | 2.7 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$= - 10 V, $I_D$ = - 250 mA | | 0.4 | | S |
| Diode Forward Voltage[a] | $V_{SD}$ | $I_S$ = - 150 mA, $V_{GS}$ = 0 V | | - 0.8 | - 1.2 | V |
| **Dynamic**[b] | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = - 10 V, $V_{GS}$ = - 4.5 V, $I_D$ = - 250 mA | | 1500 | | pC |
| Gate-Source Charge | $Q_{gs}$ | | | 150 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 450 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = - 10 V, $R_L$ = 47 Ω<br>$I_D \cong$ - 200 mA, $V_{GEN}$ = - 4.5 V, $R_g$ = 10 Ω | | 5 | | ns |
| Rise Time | $t_r$ | | | 9 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 35 | | |
| Fall Time | $t_f$ | | | 11 | | |

Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

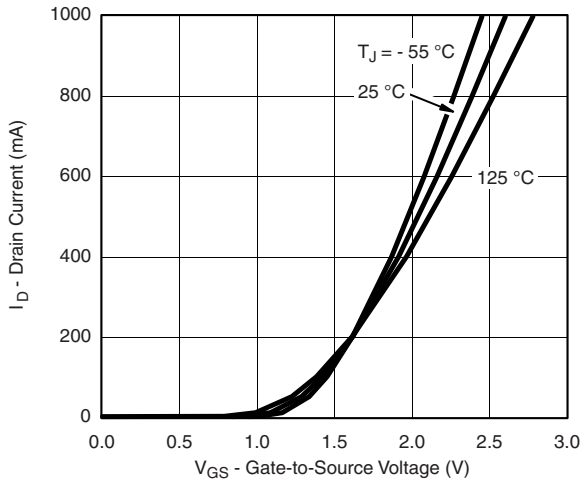
*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C, unless otherwise noted)

For the following graphs, P-Channel negative polarities for all voltage and current values are represented as positive values.

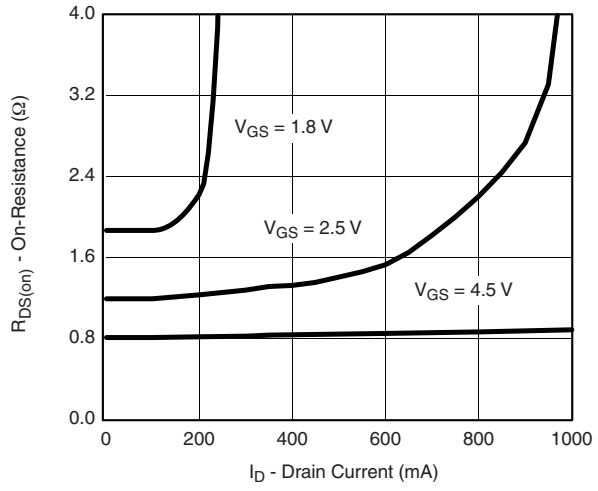



**Output Characteristics**

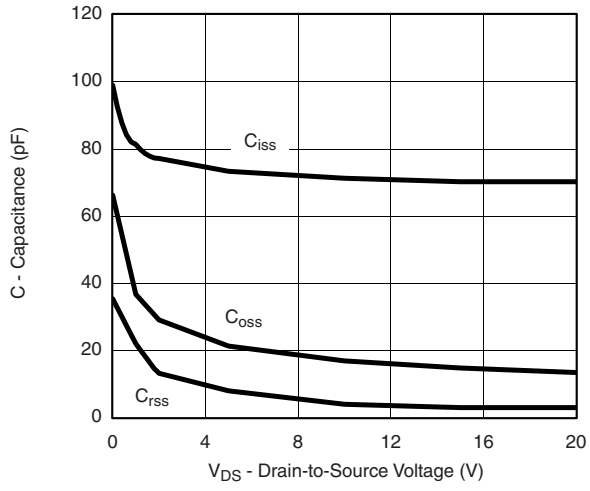



**Transfer Characteristics**

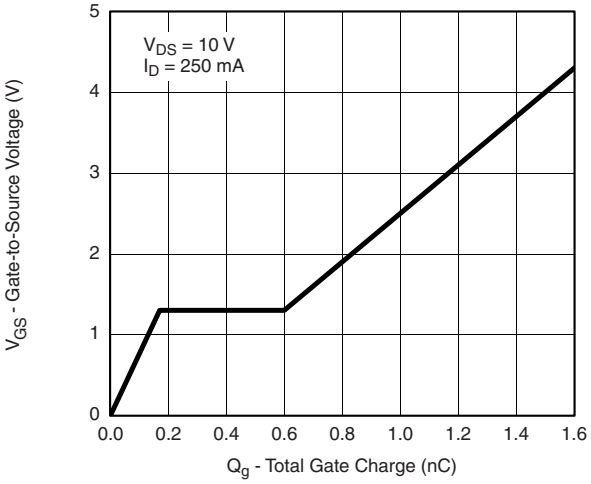
## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C, unless otherwise noted)



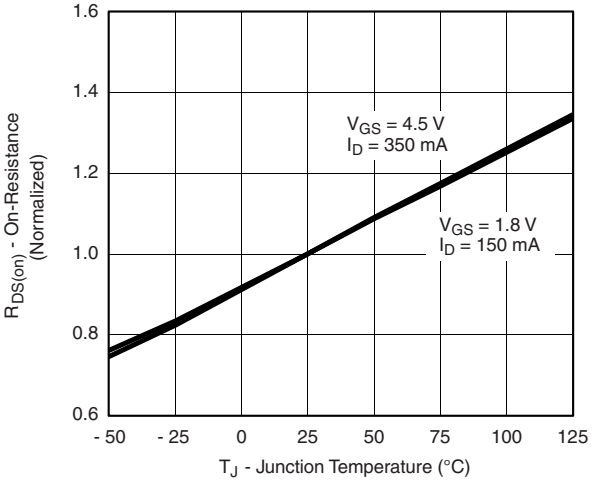

**On-Resistance vs. Drain Current**



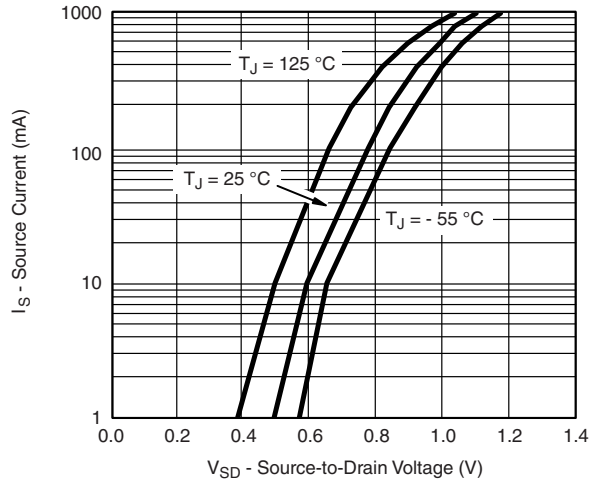

**Capacitance**



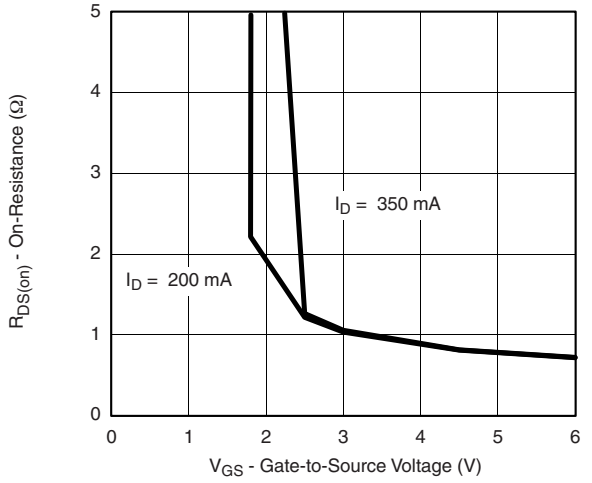

**Gate Charge**




**On-Resistance vs. Junction Temperature**

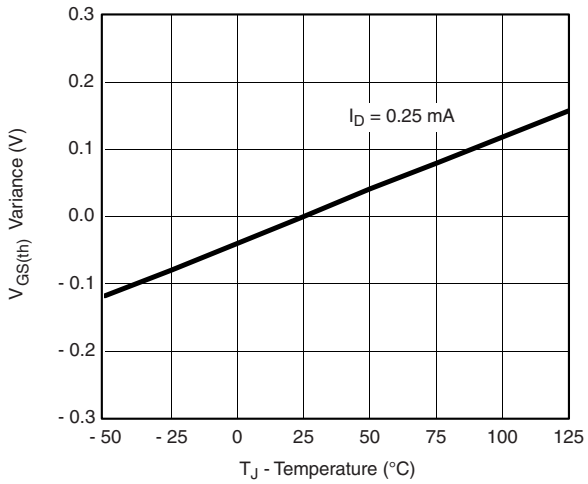



**Surge-Drain Diode Forward Voltage**

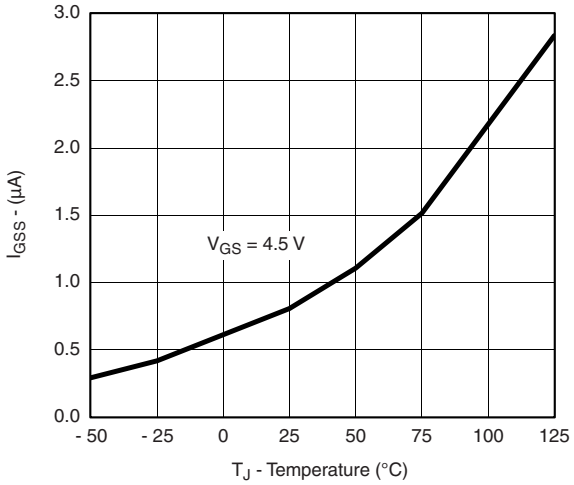



**On-Resistance vs. Gate-to-Source Voltage**

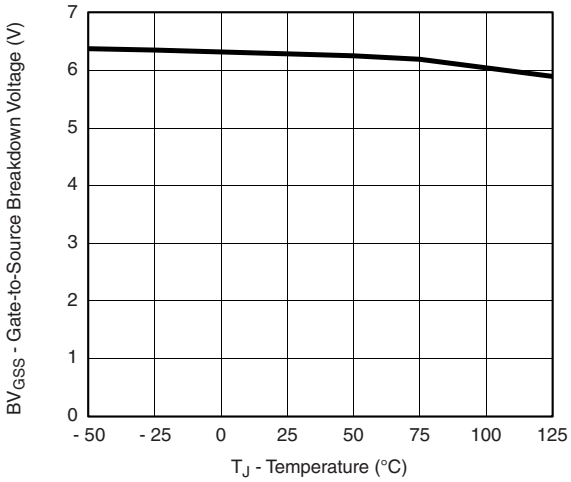
## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C, unless otherwise noted)



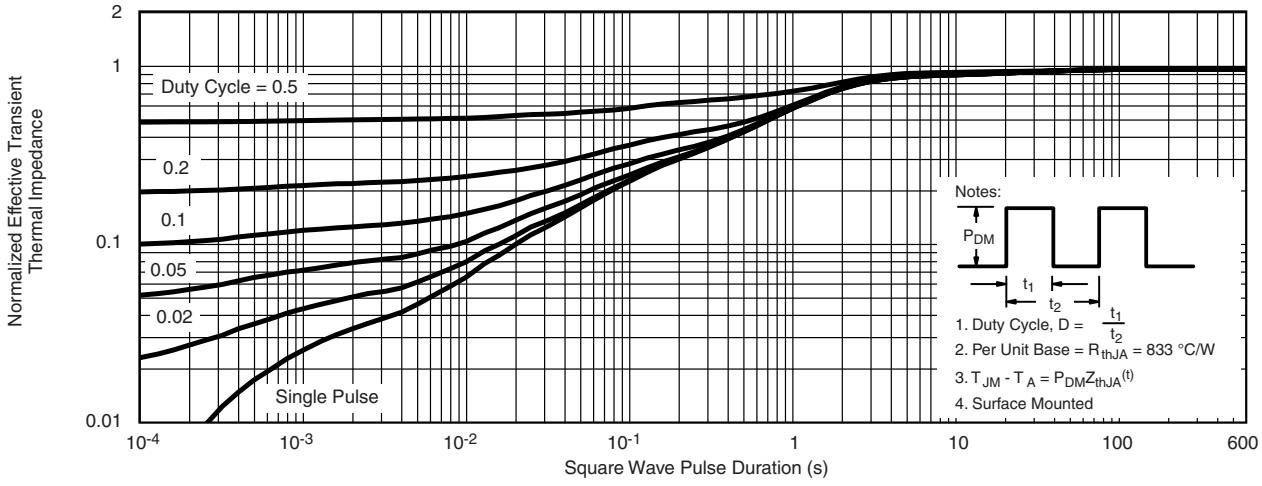

**Threshold Voltage Variance vs. Temperature**




**$I_{GSS}$ vs. Temperature**

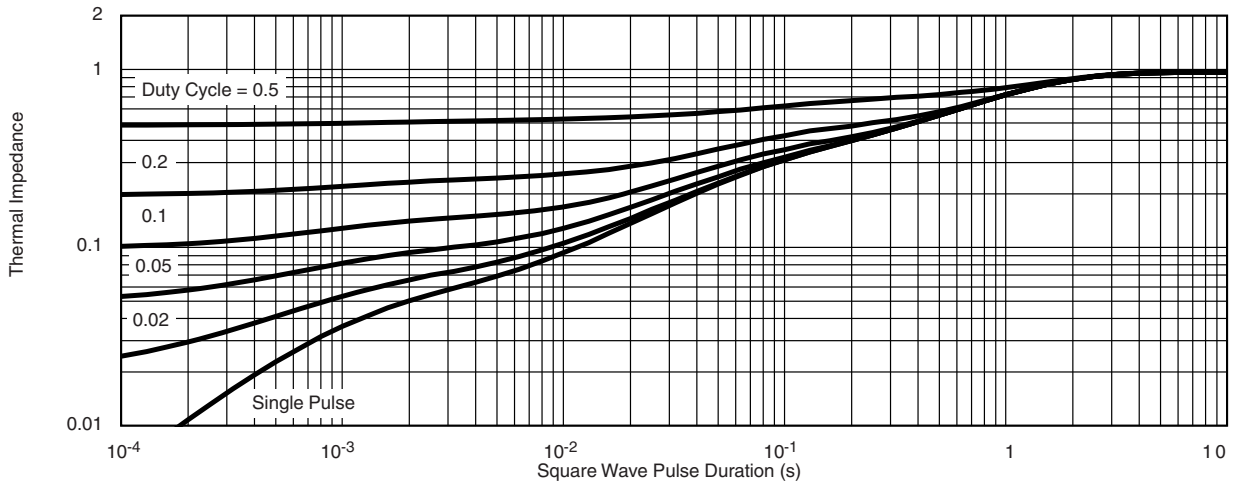



**$BV_{GSS}$ vs. Temperature**




**Normalized Thermal Transient Impedance, Junction-to-Ambient (SC-75A)**

## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C, unless otherwise noted)




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

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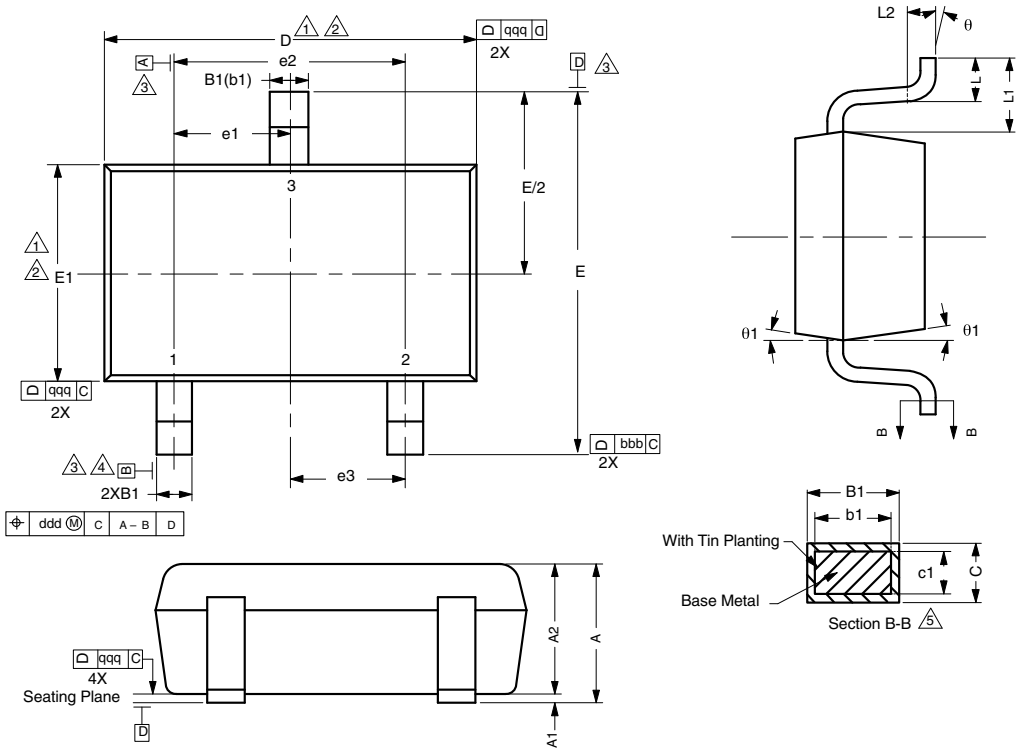
# SC-75A: 3 Leads




DWG: 5868

**Notes**

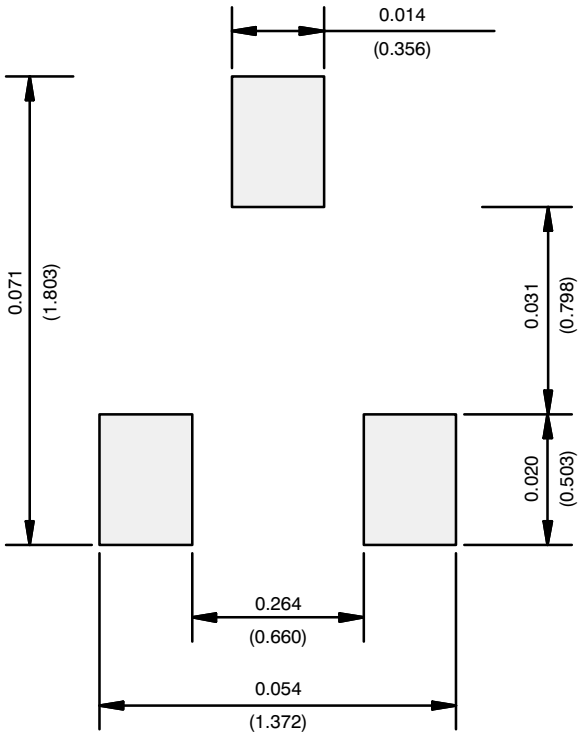
Dimensions in millimeters will govern.

1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash protrusions or gate burrs shall not exceed 0.10 mm per end. Dimension E1 does not include Interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.10 mm per side.
2. Dimensions D and E1 are determined at the outmost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
3. Datums A, B and D to be determined 0.10 mm from the lead tip.
4. Terminal positions are shown for reference only.
5. These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.

| DIMENSIONS | TOLERANCES |
|---|---|
| aaa | 0.10 |
| bbb | 0.10 |
| ccc | 0.10 |
| ddd | 0.10 |

| DIM. | MILLIMETERS | | | NOTE |
|---|---|---|---|---|
| | MIN. | NOM. | MAX. | |
| A | - | - | 0.80 | |
| A1 | 0.00 | - | 0.10 | |
| A2 | 0.65 | 0.70 | 0.80 | |
| B1 | 0.19 | - | 0.24 | 5 |
| b1 | 0.17 | - | 0.21 | |
| c | 0.13 | - | 0.15 | 5 |
| c1 | 0.10 | - | 0.12 | 5 |
| D | 1.48 | 1.575 | 1.68 | 1, 2 |
| E | 1.50 | 1.60 | 1.70 | |
| E1 | 0.66 | 0.76 | 0.86 | 1, 2 |
| e1 | 0.50 BSC | | | |
| e2 | 1.00 BSC | | | |
| e3 | 0.50 BSC | | | |
| L | 0.15 | 0.205 | 0.30 | |
| L1 | 0.40 ref. | | | |
| L2 | 0.15 BSC | | | |
| q | 0° | - | 8° | |
| q1 | 4° | - | 10° | |

**RECOMMENDED MINIMUM PADS FOR SC-75A: 3-Lead**




Recommended Minimum Pads
Dimensions in Inches/(mm)

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