

## P-Channel 20 V (D-S) MOSFET

| PRODUCT SUMMARY     |                                 |                     |
|---------------------|---------------------------------|---------------------|
| V <sub>DS</sub> (V) | R <sub>DS(on)</sub> (Ω)         | I <sub>D</sub> (mA) |
| - 20                | 8 at V <sub>GS</sub> = - 4.5 V  | - 150               |
|                     | 12 at V <sub>GS</sub> = - 2.5 V | - 125               |
|                     | 15 at V <sub>GS</sub> = - 1.8 V | - 100               |
|                     | 20 at V <sub>GS</sub> = - 1.5 V | - 30                |

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- High-Side Switching
- Low On-Resistance: 8 Ω
- Low Threshold: 0.9 V (typ.)
- Fast Switching Speed: 45 ns
- TrenchFET® Power MOSFETs: 1.5 V Rated
- ESD Protected: 2000 V
- Compliant to RoHS Directive 2002/95/EC



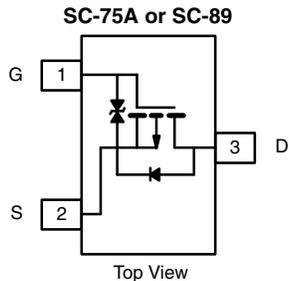
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### 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



SC-75A (SOT-416): Si1031R  
SC-89 (SOT-490): Si1031X

Marking Code: H

#### Ordering Information:

Si1031R-T1-GE3 (SC-75A, Lead (Pb)-free and Halogen-free)  
Si1031X-T1-GE3 (SC-89, Lead (Pb)-free and Halogen-free)

| ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted) |                                   |                        |              |         |              |       |    |
|---|-----------------------------------|------------------------|--------------|---------|--------------|-------|----|
| Parameter   | Symbol                            | Si1031R                |              | Si1031X |              | Unit  |    |
|   |                                   | 5 s                    | Steady State | 5 s     | Steady State |       |    |
| Drain-Source Voltage  | V <sub>DS</sub>                   | - 20                   |              |         |              | V     |    |
| Gate-Source Voltage   | V <sub>GS</sub>                   | ± 6                    |              |         |              |       |    |
| Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>           | I <sub>D</sub>                    | T <sub>A</sub> = 25 °C | - 150        | - 140   | - 165        | - 155 | mA |
|   |                                   | T <sub>A</sub> = 85 °C | - 110        | - 100   | - 150        | - 125 |    |
| Pulsed Drain Current <sup>a</sup>   | I <sub>DM</sub>                   | - 500                  |              | - 600   |              | mW    |    |
| Continuous Source Current (Diode Conduction) <sup>a</sup>                 | I <sub>S</sub>                    | - 250                  | - 200        | - 340   | - 240        |       |    |
| Maximum Power Dissipation <sup>a</sup>                                    | P <sub>D</sub>                    | T <sub>A</sub> = 25 °C | 280          | 250     | 340          | 300   | mW |
|   |                                   | T <sub>A</sub> = 85 °C | 145          | 130     | 170          | 150   |    |
| Operating Junction and Storage Temperature Range                          | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150            |              |         |              | °C    |    |
| Gate-Source ESD Rating (HBM, Method 3015)                                 | ESD                               | 2000                   |              |         |              | V     |    |

Notes:

a. Surface mounted on FR4 board.

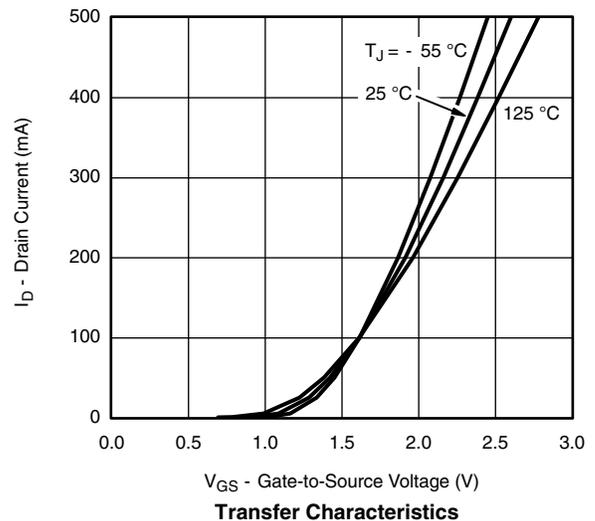
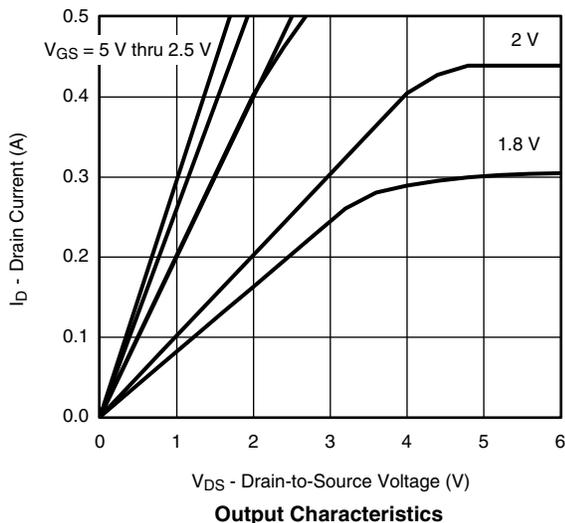
| <b>SPECIFICATIONS</b> ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |              |  |       |                   |           |               |
|--|--------------|--|-------|-------------------|-----------|---------------|
| Parameter  | Symbol       | Test Conditions  | Min.  | Typ. <sup>a</sup> | Max.      | Unit          |
| <b>Static</b>  |              |  |       |                   |           |               |
| Gate Threshold Voltage   | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$   | -0.40 |                   | -1.2      | V             |
| Gate-Body Leakage  | $I_{GSS}$    | $V_{DS} = 0\text{ V}, V_{GS} = \pm 2.8\text{ V}$   |       | $\pm 0.5$         | $\pm 1.0$ | $\mu\text{A}$ |
|  |              | $V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$   |       | $\pm 1.0$         | $\pm 2.0$ |               |
| Zero Gate Voltage Drain Current  | $I_{DSS}$    | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$   |       | -1                | -500      | nA            |
|  |              | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$   |       |                   | -10       | $\mu\text{A}$ |
| On-State Drain Current <sup>a</sup>  | $I_{D(on)}$  | $V_{DS} = -5\text{ V}, V_{GS} = -4.5\text{ V}$   | -200  |                   |           | mA            |
| Drain-Source On-State Resistance <sup>a</sup>                                      | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}, I_D = -150\text{ mA}$   |       |                   | 8         | $\Omega$      |
|  |              | $V_{GS} = -2.5\text{ V}, I_D = -125\text{ mA}$   |       |                   | 12        |               |
|  |              | $V_{GS} = -1.8\text{ V}, I_D = -100\text{ mA}$   |       |                   | 15        |               |
|  |              | $V_{GS} = -1.5\text{ V}, I_D = -30\text{ mA}$  |       |                   | 20        |               |
| Forward Transconductance <sup>a</sup>  | $g_{fs}$     | $V_{DS} = -10\text{ V}, I_D = 150\text{ mA}$   |       | 0.4               |           | S             |
| Diode Forward Voltage <sup>a</sup>   | $V_{SD}$     | $I_S = -150\text{ mA}, V_{GS} = 0\text{ V}$  |       |                   | -1.2      | V             |
| <b>Dynamic<sup>b</sup></b>   |              |  |       |                   |           |               |
| Total Gate Charge  | $Q_g$        | $V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -150\text{ mA}$  |       | 1500              |           | $\mu\text{C}$ |
| Gate-Source Charge   | $Q_{gs}$     |  |       | 150               |           |               |
| Gate-Drain Charge  | $Q_{gd}$     |  |       | 450               |           |               |
| Turn-On Delay Time   | $t_{d(on)}$  | $V_{DD} = -10\text{ V}, R_L = 65\text{ }\Omega$<br>$I_D \cong -150\text{ mA}, V_{GEN} = -4.5\text{ V}, R_g = 10\text{ }\Omega$ |       |                   | 55        | ns            |
| Rise Time  | $t_r$        |  |       |                   | 30        |               |
| Turn-Off Delay Time  | $t_{d(off)}$ |  |       |                   | 60        |               |
| Fall Time  | $t_f$        |  |       |                   | 30        |               |

Notes:

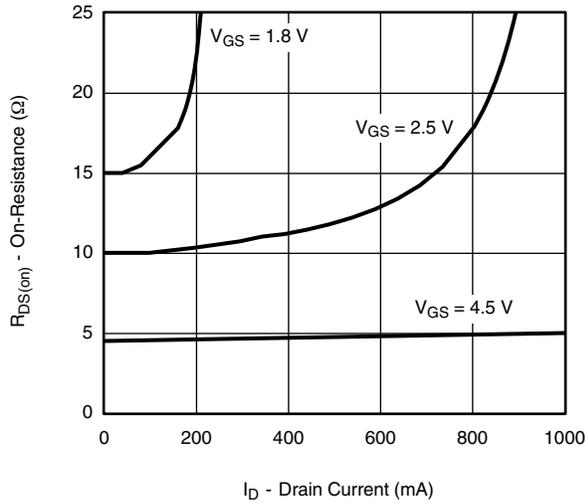
a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

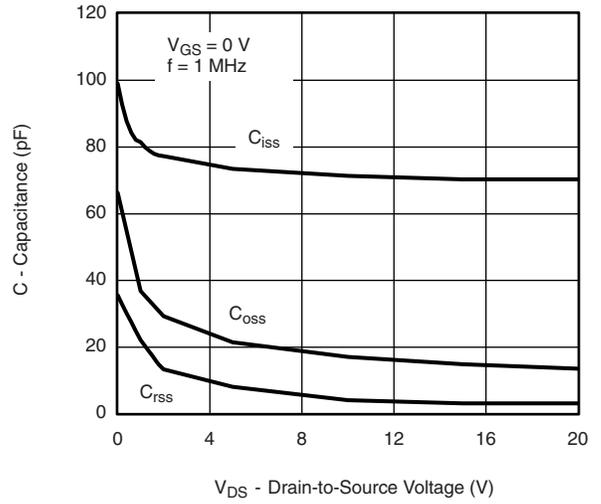
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

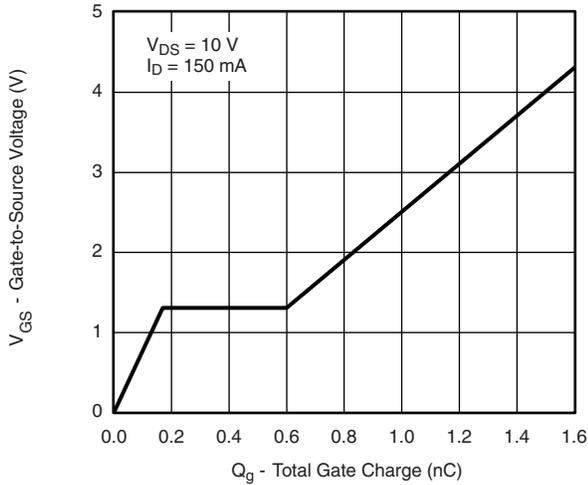
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



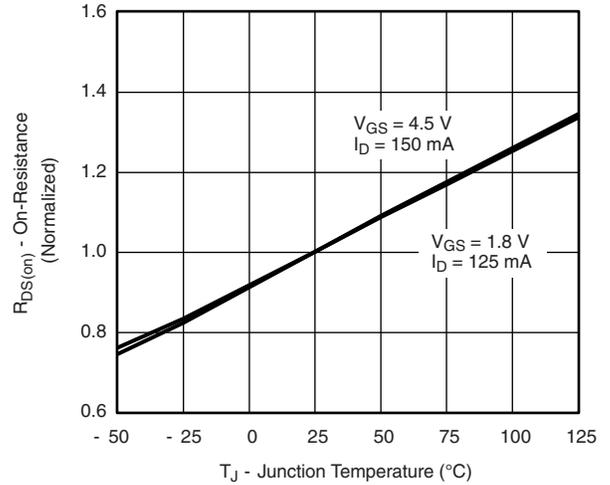
**On-Resistance vs. Drain Current**



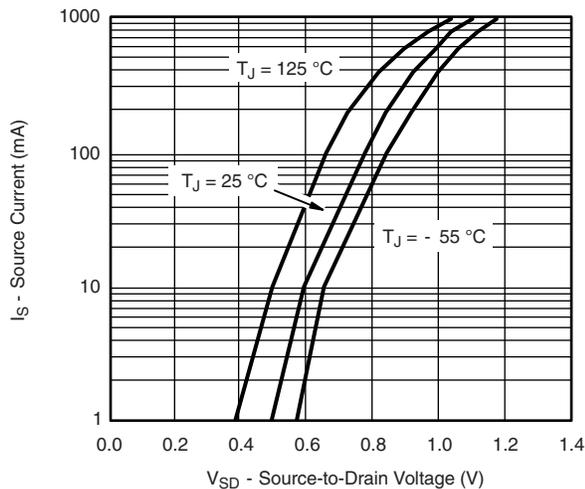
**Capacitance**



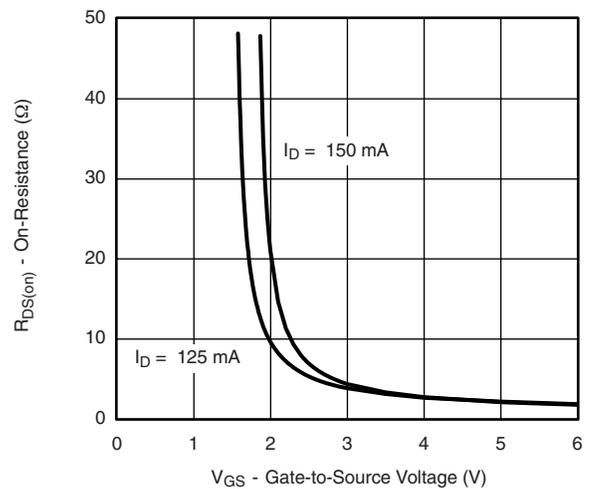
**Gate Charge**



**On-Resistance vs. Junction Temperature**

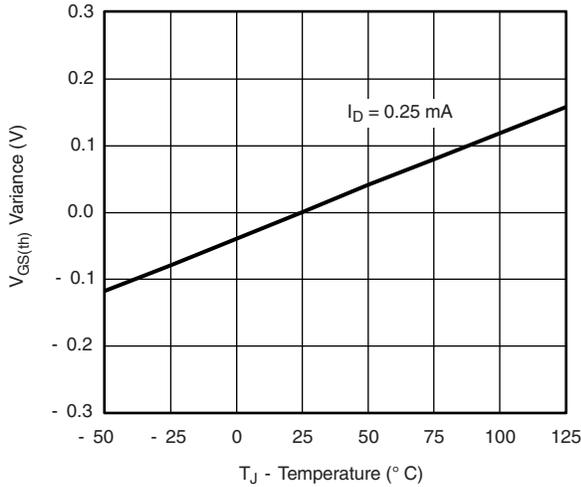


**Surge-Drain Diode Forward Voltage**

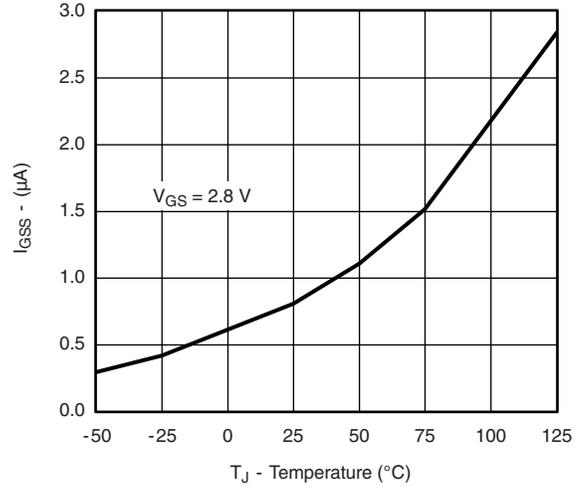


**On-Resistance vs. Gate-to-Source Voltage**

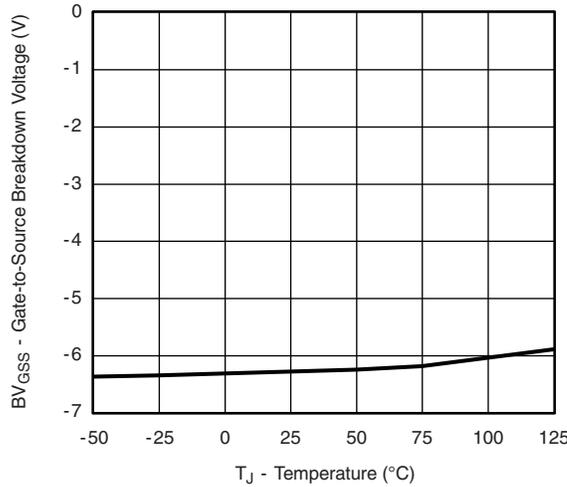
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



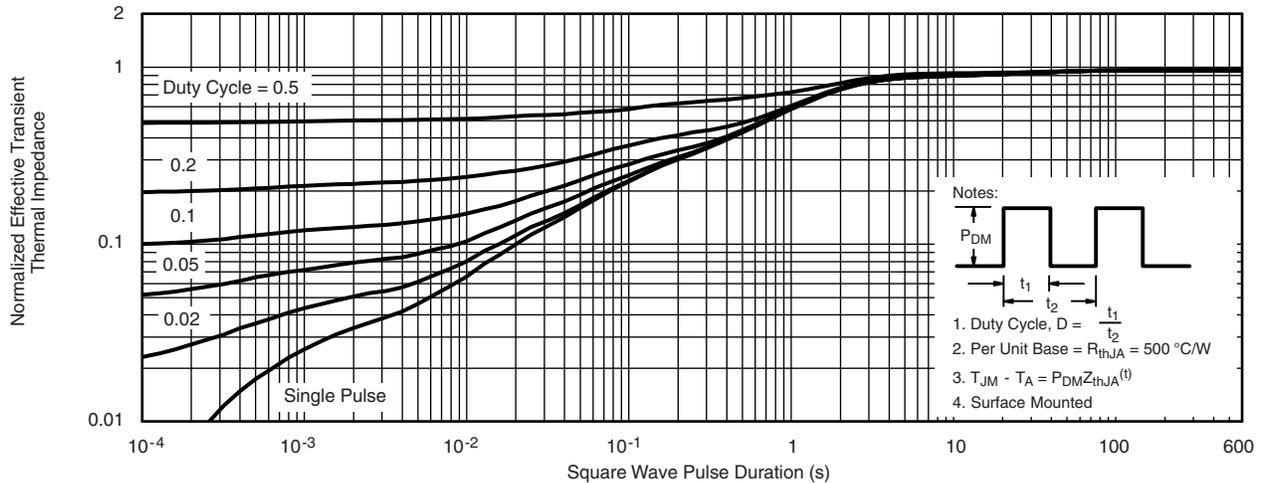
**Threshold Voltage Variance vs. Temperature**



**I<sub>GSS</sub> vs. Temperature**



**BV<sub>GSS</sub> vs. Temperature**

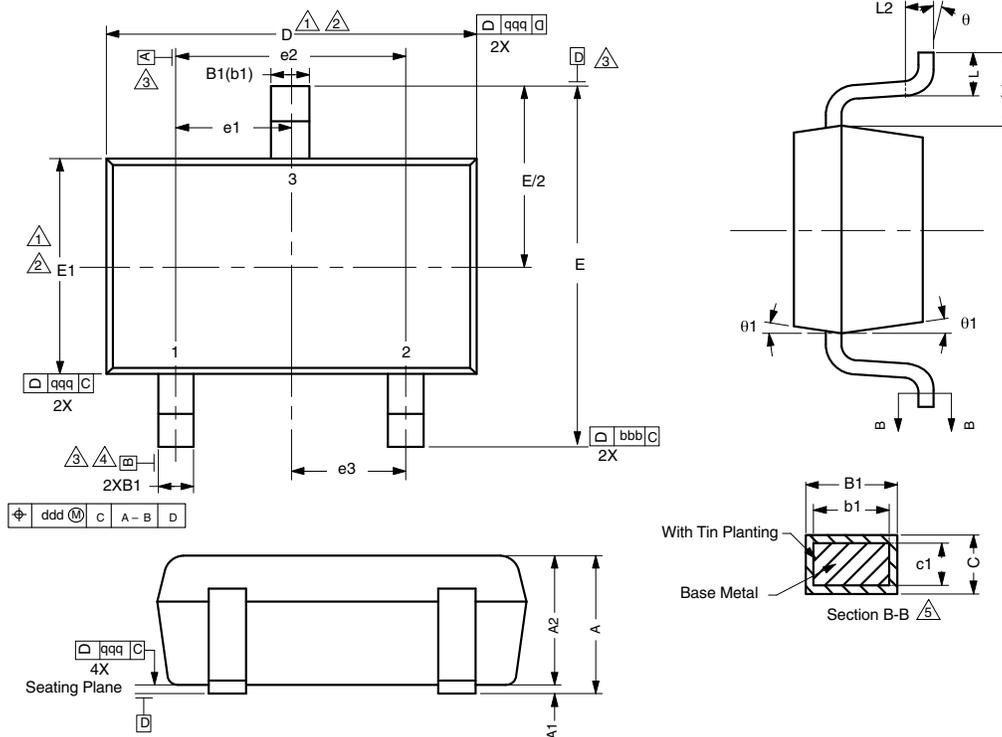


**Normalized Thermal Transient Impedance, Junction-to-Ambient (SC-75A, Si1031R Only)**

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SC-75A: 3-LEADS



Notes

Dimensions in millimeters will govern.

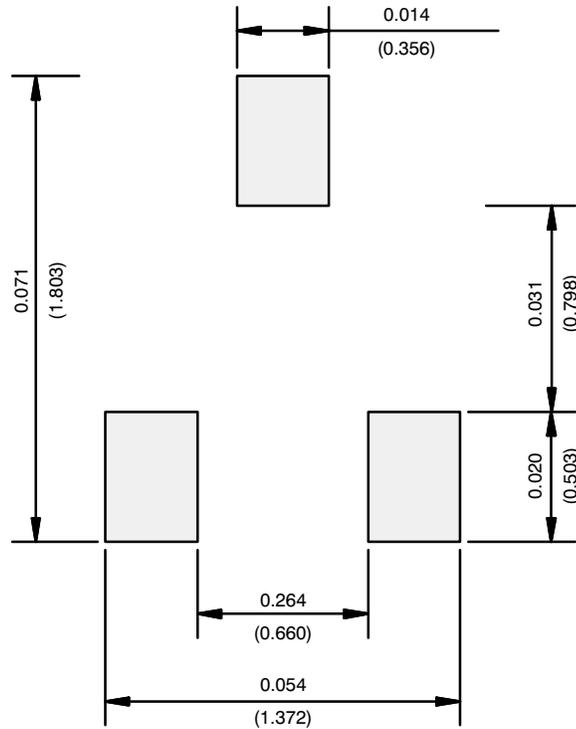
1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash protrusions or gate burrs shall not exceed 0.10 mm per end. Dimension E<sub>1</sub> does not include Interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.10 mm per side.
2. Dimensions D and E<sub>1</sub> 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 |      |
| A <sub>1</sub> | 0.00        | -     | 0.10 |      |
| A <sub>2</sub> | 0.65        | 0.70  | 0.80 |      |
| B <sub>1</sub> | 0.19        | -     | 0.24 | 5    |
| b <sub>1</sub> | 0.17        | -     | 0.21 |      |
| c              | 0.13        | -     | 0.15 | 5    |
| c <sub>1</sub> | 0.10        | -     | 0.12 | 5    |
| D              | 1.48        | 1.575 | 1.68 | 1, 2 |
| E              | 1.50        | 1.60  | 1.70 |      |
| E <sub>1</sub> | 0.66        | 0.76  | 0.86 | 1, 2 |
| e <sub>1</sub> | 0.50 BSC    |       |      |      |
| e <sub>2</sub> | 1.00 BSC    |       |      |      |
| e <sub>3</sub> | 0.50 BSC    |       |      |      |
| L              | 0.15        | 0.205 | 0.30 |      |
| L <sub>1</sub> | 0.40 REF    |       |      |      |
| L <sub>2</sub> | 0.15 BSC    |       |      |      |
| θ              | 0°          | -     | 8°   |      |
| θ <sub>1</sub> | 4°          | -     | 10°  |      |

ECN: E11-2210-Rev. D, 08-Aug-11  
DWG: 5868

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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

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