

Aerovox Corp.®

Type RBPS IGBT Snubber Capacitor Modules

Direct Mount and Board Level IGBT Capacitor Modules **RoHS Compliant**



Type RBPS IGBT snubber capacitor modules for power electronics can be mounted directly onto the IGBT or mounted as a board level product for protection against transient voltages caused by the high di/dt that occurs at gate turn off.

Highlights

- Low inductance to 12 nH
- High DV/DT
- Low ESR
- UL 94 V-0 flame retardant case & resin
- Wide selection of terminal options
- Low loss polypropylene dielectric

Specifications

Capacitance Range: 0.1 to 3.0 μF

Voltage Range: 630, 1000, 1250, 1600 Vdc

Capacitance Tolerance: $\pm 10\%$

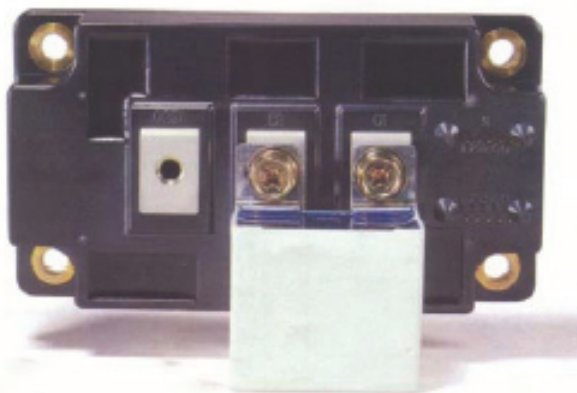
Operating Temperature Range: $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

Dissipation Factor (DF): $< 0.1\%$ at 1 kHz @ $25\text{ }^{\circ}\text{C}$

Insulation Resistance (IR): $> 100,000\text{ m}\Omega \times \mu\text{F}$ @ 100 Vdc after 2 minutes

Dielectric Strength: 1.6 x rated for 60 sec.

Equivalent Series Inductance (ESL):



Equivalent Series Inductance (ESL)

| Terminal Description | Terminal Style | Maximum Inductance (nH) |
|-------------------------------------|----------------|-------------------------|
| Radial Lead | A | 30 |
| Circuit Mounted, 2 pins per side | B | 15 |
| Circuit Mounted, 3 pins per side | C | 15 |
| Circuit Mounted, 4 pins per side | D | 15 |
| Direct Mounted, 22 to 31 mm Centers | G, I, J | 20 |
| Direct Mounted, 39 to 48 mm Centers | H | 20 |

Resistance to Solder Heat:

Test Conditions

| | |
|--------------------|-----------------|
| Solder Temperature | 260°C ±5.0°C |
| Test Duration | 10 seconds ±1 s |

Performance Requirements:

| | |
|-------------|-----------------|
| Capacitance | Delta of < 2.0% |
|-------------|-----------------|

Accelerated Pulse Handling Capability:

Test Conditions:

A capacitor under test will be charged through an impedance of a magnitude greater than the discharging impedance. The capacitor under test will be charged to the rated DC voltage and discharged through an impedance capable of producing a minimum voltage gradient with time (DV/DT). The test will be performed in accordance with the requirements for the voltage gradient multiplier and charge and discharge cycles as listed below.

| Voltage Gradient Multiplier | Test Cycles |
|-----------------------------|-------------|
| 6x | 100 |
| 4x | 1000 |
| 2x | 1 million |

Example:

An RBPS part rated 1.0 uF 1,000 VDC has a DV/DT rating of 600 volts per microsecond. This part would be capable of withstanding 100 cycles at a minimum of 3,600 volts/microsecond, 1000 cycles at 2,400 volts/microsecond, or 1 million cycles at 1,200 volts/microsecond.

Performance Criteria After Testing

| | |
|-------------|--|
| Capacitance | Delta < 3% |
| ESR | Absolute value < 150% of original measured value |

General Description

Dielectric: Polypropylene film with self-healing dual metallized electrodes.

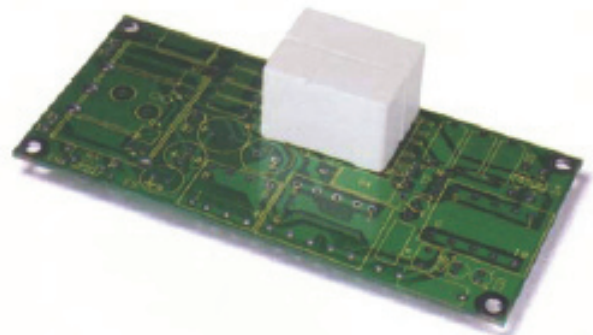
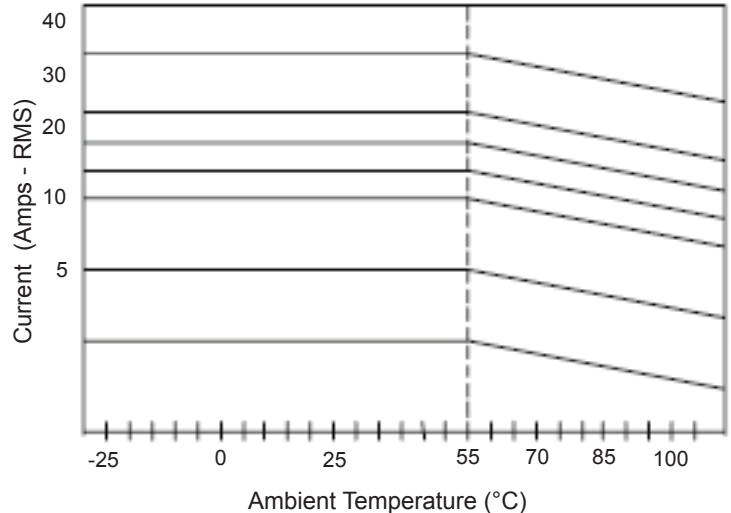
Enclosure: UL 94V-0 flame-retardant plastic case and resin.

Marking: Ink stamped with Aerovox, part number, capacitance value, nominal DC voltage, and date code, at a minimum.

Terminals: Tinned copper, terminal sizes and styles are specified in outline drawings on page 4.

Ripple Current: The Maximum Rms current is the maximum current flowing through the capacitor at

Rated RMS Current vs Temperature



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Why Use Snubber Capacitors?

RoHS Compliant

With the evolution of power technology, new higher speed Insulated Gate Bipolar Transistors (IGBTs) make it possible for high power converters to operate up to 10 kHz or more. IGBTs are replacing the slower Darling-ton transistors, simplifying circuit design and reducing cost. IGBT power modules are now being designed into AC and DC motor drive inverters, uninterruptible power systems, electric vehicles and alternate energy production systems.

Power systems containing IGBTs must be designed so the transient voltages caused by the hi di/dt that occurs at gate turn off is minimized. Left uncontrolled, this transient voltage can exceed the blocking voltage rating of the IGBT and cause it to fail. To reduce the tran-sient voltage, either di/dt or the parasitic DC bus induc-tance of the power circuit must be reduced. This is best achieved by decoupling the parasitic bus inductance us-ing a non-inductive wound film capacitor mounted as near as possible to the IGBT module terminals.

Snubber capacitors, constructed of polypropylene film dielectric and dual metallized film electrodes, are the optimal capacitor design for IGBT applications. While film/foil capacitors are often used because of their su-perior current carrying capability, they fail in a short circuit mode, which may cause damage to the IGBT module. Aerovox's snubber capacitors combine high current carrying capability with low inductance, low dielectric losses and capacitance stability across a wide frequency range. They offer the self-healing property of metallized film (not failing in a short circuit mode) with the high peak current carrying capability (dv/dt) of film/foil construction.

Aerovox's snubber capacitors, manufactured with poly-propylene fim and dual metallized electrodes, available with direct IGBT module terminals, radial wire leads, or a unique printed circuit board dual in-line pin mount, provide the highest electrical performance of any snub-ber capacitors currently available.

Ratings

| Cap (μ F) | Cap Code | Case Code | DV/DT (V/ μ sec) | I _{peak} (A) | I _{rms} @ 55 °C (A max) | ESR Max @ 100 kHz (m Ω) | Terminal Codes |
|--|-------------|--------------|-------------------------|--------------------------|--|---------------------------------------|-------------------|
| Voltage Code 63 - 630 Vdc (400 Vac @ 60 Hz) | | | | | | | |
| .33 | 334 | C7 | 600 | 200 | 10.9 | 9 | B,G,I,J |
| .39 | 394 | C7 | 600 | 235 | 11.5 | 9 | B,G,I,J |
| .47 | 474 | C7 | 550 | 235 | 12.2 | 8 | B,G,I,J |
| .56 | 564 | C7 | 500 | 280 | 13.0 | 8 | B,G,I,J |
| .68 | 684 | C7 | 450 | 300 | 14.0 | 8 | B,G,I,J |
| .75 | 754 | C7 | 400 | 300 | 15.0 | 8 | B,G,I,J |
| .82 | 824 | B7 | 400 | 330 | 16.0 | 8 | B,G,I,J |
| 1.00 | 105 | B7 | 400 | 400 | 18.0 | 7 | B,G,I,J |
| 1.20 | 125 | A7 | 400 | 480 | 19.0 | 7 | C,G,I,J |
| 1.50 | 155 | A7 | 400 | 600 | 20.0 | 7 | C,G,I,J |
| 1.75 | 175 | A7 | 400 | 700 | 21.0 | 7 | C,G,I,J |
| 2.00 | 205 | A7 | 400 | 800 | 22.0 | 7 | C,G,I,J |
| 2.20 | 225 | R4 | 280 | 615 | 24.0 | 7 | C,G,H |
| 2.50 | 255 | R4 | 250 | 625 | 26.0 | 7 | C,G,H |
| 3.00 | 305 | R4 | 250 | 750 | 28.0 | 7 | C,G,H |
| 4.00 | 405 | R5 | 250 | 1000 | 30.0 | 6 | D,G,H |
| 5.00 | 505 | R5 | 250 | 1250 | 35.0 | 6 | D,G,H |

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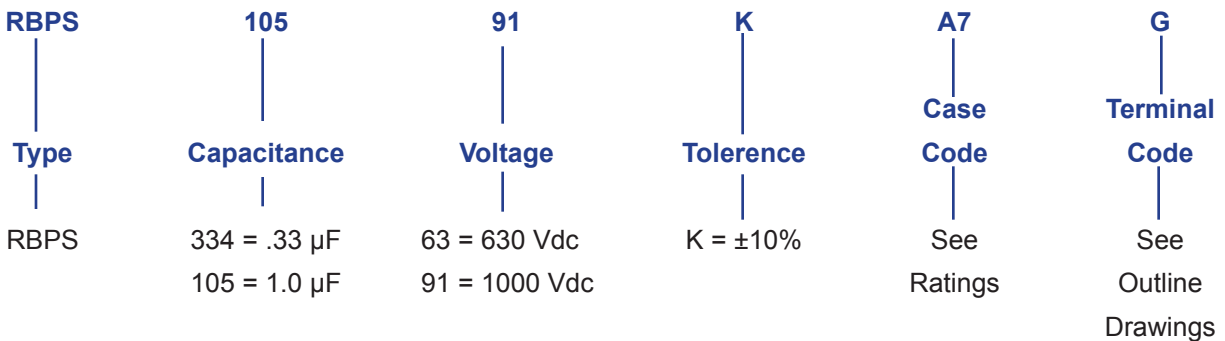
Type RBPS IGBT Snubber Capacitor Modules

Ratings

RoHS Compliant

| Cap (μ F) | Cap Code | Case Code | DV/DT (V/ μ sec) | I _{peak} (A) | I _{rms} @ 55 °C (A max) | ESR Max @ 100 kHz (m Ω) | Terminal Codes |
|---|-------------|--------------|-------------------------|--------------------------|--|---------------------------------------|-------------------|
| Voltage Code 91 - 1000 Vdc (530 Vac @ 60 Hz) | | | | | | | |
| .22 | 224 | W0 | 1000 | 220 | 6.6 | 12 | A |
| .27 | 274 | C7 | 700 | 245 | 10.0 | 12 | B,G |
| .33 | 334 | C7 | 700 | 300 | 10.9 | 10 | B,G |
| .39 | 394 | C7 | 700 | 310 | 11.5 | 9 | B,G |
| .47 | 474 | C7 | 700 | 375 | 12.2 | 8 | B,G |
| .56 | 564 | B7 | 700 | 450 | 14.0 | 8 | B,G |
| .68 | 684 | B7 | 700 | 450 | 15.0 | 8 | B,G |
| .75 | 754 | B7 | 700 | 525 | 15.0 | 8 | B,G |
| .82 | 824 | A7 | 600 | 490 | 17.2 | 8 | C,G |
| 1.00 | 105 | A7 | 600 | 600 | 18.4 | 7 | C,G |
| 1.20 | 125 | A7 | 500 | 600 | 18.5 | 7 | C,G |
| 1.50 | 155 | R4 | 500 | 750 | 21.7 | 7 | C,G,H |
| 1.75 | 175 | R4 | 500 | 875 | 22.0 | 7 | C,G,H |
| 2.00 | 205 | R4 | 450 | 900 | 22.5 | 7 | C,G,H |
| 2.20 | 225 | R5 | 450 | 990 | 26.0 | 7 | D,G,H |
| 2.50 | 255 | R5 | 400 | 1000 | 27.0 | 7 | D,G,H |
| 3.00 | 305 | R5 | 400 | 1200 | 30.0 | 6 | D,G,H |

Part Numbering System



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Ratings

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| Cap (μ F) | Cap Code | Case Code | DV/DT (V/ μ sec) | I _{peak} (A) | Irms @ 55 °C (A max) | ESR Max @ 100 kHz (m Ω) | Terminal Codes |
|---|-------------|--------------|-------------------------|--------------------------|----------------------------|---------------------------------------|-------------------|
| Voltage Code 92 - 1250 Vdc (550 Vac @ 60 Hz) | | | | | | | |
| .10 | 104 | W0 | 1200 | 120 | 5.7 | 16 | A |
| .15 | 154 | C7 | 1000 | 150 | 8.9 | 15 | B,G,I,J |
| .22 | 224 | C7 | 1000 | 220 | 10.0 | 12 | B,G,I,J |
| .27 | 274 | C7 | 900 | 245 | 11.0 | 12 | B,G,I,J |
| .33 | 334 | C7 | 800 | 265 | 12.0 | 10 | B,G,I,J |
| .39 | 394 | B7 | 770 | 300 | 14.0 | 9 | B,G,I,J |
| .47 | 474 | B7 | 650 | 305 | 17.0 | 8 | B,G,I,J |
| .56 | 564 | A7 | 650 | 365 | 17.5 | 8 | C,G,I,J |
| .68 | 684 | A7 | 650 | 440 | 20.0 | 8 | C,G,I,J |
| .75 | 754 | A7 | 650 | 490 | 20.0 | 8 | C,G,I,J |
| .82 | 824 | A7 | 650 | 530 | 21.0 | 8 | C,G,I,J |
| 1.00 | 105 | A7 | 650 | 650 | 22.0 | 7 | C,G,I,J |
| 1.20 | 125 | R4 | 550 | 660 | 25.0 | 7 | C,G,H |
| 1.50 | 155 | R4 | 500 | 750 | 26.0 | 7 | C,G,H |
| 1.75 | 175 | R5 | 500 | 875 | 27.0 | 7 | D,G,H |
| 2.00 | 205 | R5 | 475 | 950 | 28.0 | 7 | D,G,H |
| 2.20 | 225 | R5 | 475 | 1045 | 30.0 | 6 | D,G,H |
| Voltage Code 96 - 1600 Vdc (550 Vac @ 60 Hz) | | | | | | | |
| .10 | 104 | W0 | 1200 | 120 | 5.7 | 16 | A |
| .15 | 154 | C7 | 1000 | 150 | 8.9 | 15 | B,G |
| .22 | 224 | C7 | 1000 | 220 | 10.0 | 12 | B,G |
| .27 | 274 | B7 | 850 | 230 | 12.0 | 12 | B,G |
| .33 | 334 | B7 | 850 | 280 | 13.4 | 10 | B,G |
| .39 | 394 | A7 | 850 | 330 | 16.0 | 9 | C,G |
| .47 | 474 | A7 | 850 | 400 | 17.2 | 8 | C,G |
| .56 | 564 | A7 | 850 | 475 | 17.5 | 8 | C,G |
| .68 | 684 | R4 | 700 | 475 | 20.0 | 8 | C,G,H |
| .75 | 754 | R4 | 600 | 450 | 20.5 | 8 | C,G,H |
| .82 | 824 | R4 | 600 | 490 | 21.0 | 8 | C,G,H |
| 1.00 | 105 | R4 | 600 | 600 | 21.7 | 7 | C,G,H |
| 1.20 | 125 | R4 | 600 | 720 | 26.0 | 7 | D,G,H |
| 1.50 | 155 | R5 | 600 | 900 | 28.0 | 7 | D,G,H |

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Case Codes and Dimensions

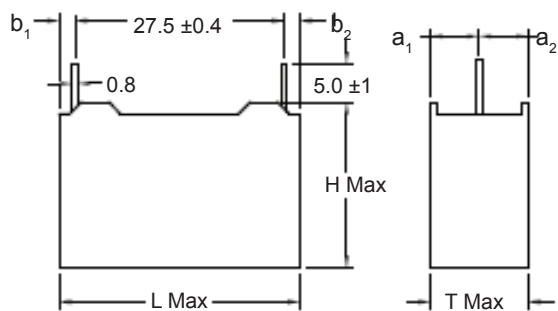
RoHS Compliant

| Case Code | T | H | L | P | Case Code | T | H | L | P |
|-----------|------|------|------|------|-----------|------|------|------|------|
| W0 | 13.0 | 22.0 | 32.1 | 27.5 | A7 | 28.2 | 37.3 | 42.7 | 35.0 |
| C7 | 17.0 | 28.0 | 42.7 | 35.0 | R4 | 29.2 | 41.2 | 58.5 | 52.0 |
| B7 | 22.1 | 30.1 | 42.7 | 35.0 | R5 | 46.0 | 36.0 | 58.7 | 52.0 |

Dimensions in mm

Outline Drawings

Case Code W0
Terminal Code A (Radial Leads)

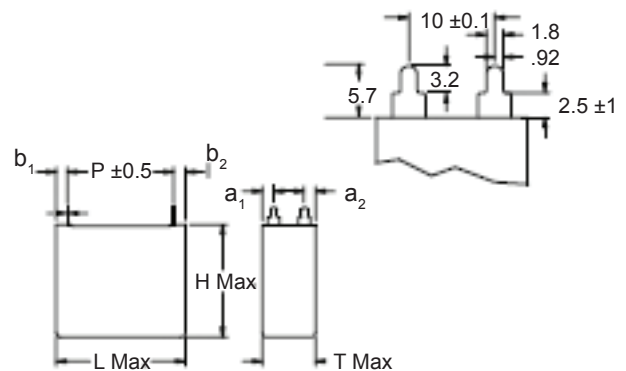


Dimensions in mm

$$|a_1 - a_2| < 0.4$$

$$|b_1 - b_2| < 0.6$$

Case Codes C7, B7
Terminal Code B (2-Pin)

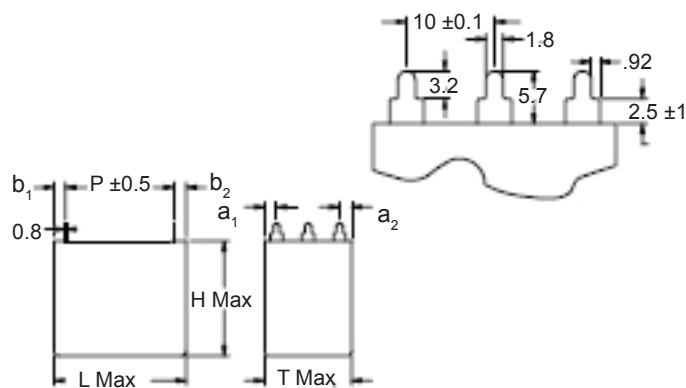


Dimensions in mm

$$|a_1 - a_2| < 0.4$$

$$|b_1 - b_2| < 0.6$$

Case Codes A7, P = 35
R4, P = 52
Terminal Code C (3-Pin)

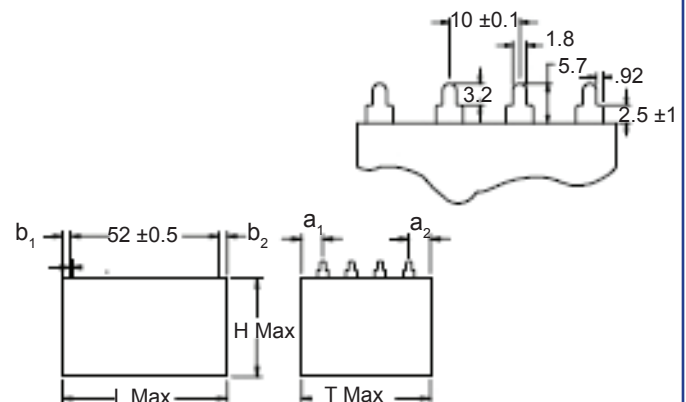


Dimensions in mm

$$|a_1 - a_2| < 0.4$$

$$|b_1 - b_2| < 0.6$$

Case Code R5
Terminal Code D (4-Pin)



Dimensions in mm

$$|a_1 - a_2| < 0.4$$

$$|b_1 - b_2| < 0.6$$

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Case Codes and Dimensions

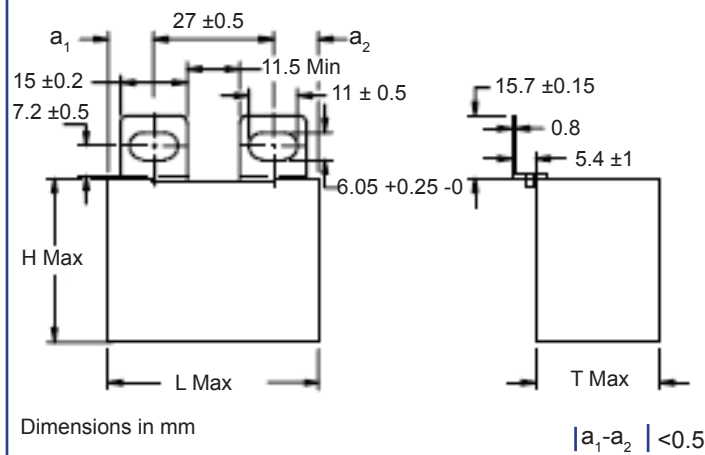
RoHS Compliant

| Case Code | T | H | L | P | Case Code | T | H | L | P |
|-----------|------|------|------|------|-----------|------|------|------|------|
| W0 | 13.0 | 22.0 | 32.1 | 27.5 | A7 | 28.2 | 37.3 | 42.7 | 35.0 |
| C7 | 17.0 | 28.0 | 42.7 | 35.0 | R4 | 29.2 | 41.2 | 58.5 | 52.0 |
| B7 | 22.1 | 30.1 | 42.7 | 35.0 | R5 | 46.0 | 36.0 | 58.7 | 52.0 |

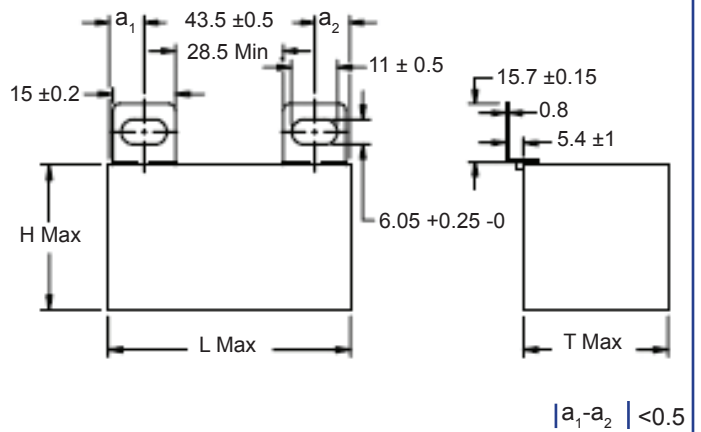
Dimensions in mm

Outline Drawings

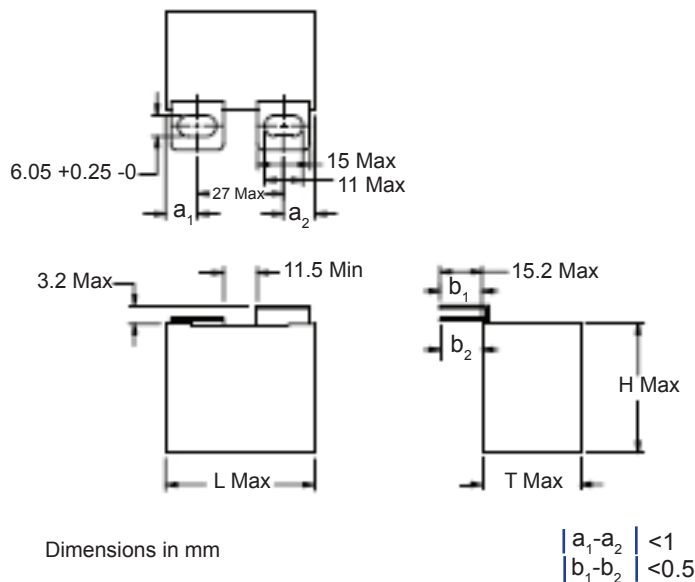
Case Codes A7, B7, C7, R4, R5
Terminal Code G (Old B1)



Cases Codes R4, R5
Terminal Code H (Old B2)



Case Codes A7, B7
Terminal Code I (Old B3)



Case Codes A7, B7
Terminal Code J (Old B4)

