

**CURRENT SENSE/LOW OHM
CERAMIC ENCASED TYPE**

HCAL SERIES

VERY LOW RESISTANCE
Negligible Inductance
Power Ceramic Resistors

- 1 W to 20 W
- R 002 to R 20
- Any resistance value possible within resistance range given

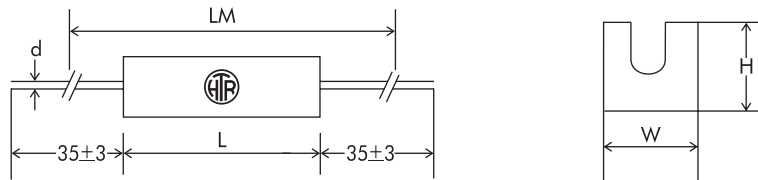




HCAL

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PHYSICAL CONFIGURATION

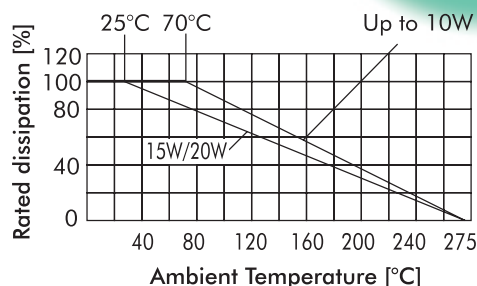


| HTR TYPE | POWER RATING at 70°C | DIMENSIONS (mm) | | | | | RESISTANCE RANGE | | TYPICAL WEIGHT PER PC (gms) |
|----------|----------------------|-------------------------------|----------|---------|---------|------------|------------------|------|-----------------------------|
| | | \blacktriangle L ±1.5 | LM ±1 | W ±1 | H ±1 | d ±0.05 | min | max | |
| C-1AL | 1W | 13.0 | 35 | 5.5 | 5.5 | 0.8 | R002 | R04 | 1.4 |
| C-1L | 1W | 15.0 | 40 | 7.5 | 6.5 | 0.8 | R0025 | R045 | 1.9 |
| C-2L | 2W | 17.5 | 40 | 7.5 | 7.0 | 0.8 | R002 | R081 | 3.0 |
| C-3L | 3W | 22.0 | 45 | 8.0 | 8.0 | 0.8 | R002 | R10 | 4.0 |
| C-5L | 5W | 22.0 | 45 | 9.5 | 9.5 | 0.8/1.0 | R002 | R10 | 5.0 |
| C-7L | 7W | 35.0 | 60 | 9.5 | 9.5 | 0.8/1.0 | R003 | R15 | 7.0 |
| C-10L | 10W | 48.0 | 65 | 9.5 | 9.5 | 0.8/1.0 | R004 | R20 | 9.5 |
| C-15L | 15W (25°C) | 48.0 | 65 | 12.5 | 12.5 | 1.0 | R004 | R20 | 16.5 |
| C-20L | 20W (25°C) | 63.5 | 85 | 12.5 | 12.5 | 1.0 | R005 | R20 | 21.0 |

- ▲ A Bead of Potting compound may be observed at the point where the termination emerges out of the ceramic case.
- Resistance values above the maximum range are possible on special request.
- Resistance values must be checked using 4½ digit micro ohm meter with four wire system and insulated clips. The resistance values must be checked at dimension LM as given in the table above.
- C5L / C7L / C10L are also available with 1.0mmØ terminations which contributes to lowering the TCR of the resistor.



DERATING CURVE



ELECTRICAL & ENVIRONMENTAL CHARACTERISTICS / DATA

| PARAMETER/PERFORMANCE TEST & TEST METHOD | PERFORMANCE REQUIREMENTS |
|---|---|
| Power Rating (Rated Ambient Temperature) | Upto 10W, full power dissipation at 70 °C and 15W / 20W, full power dissipation at 25 °C and linearly derated to zero at +275 °C (Refer derating curve above) |
| Resistance Tolerances Available | ±10% (K); ±5% (J); ±3%(H); ±2%(G); ±1%(F) ± 0.5% (D) |
| Temperature Range | -55°C to +275°C with suitable derating as per derating curve. |
| Voltage Rating / Limiting Voltage / Max Working Voltage | $V = \sqrt{P \times R}$ |
| Voltage Proof / Dielectric Withstanding Voltage (Based on 1000V rms for 60 secs) | $\Delta R \pm (1\% + R0005)$ Average - No flashover or mechanical damage |
| Insulation Resistance [MIL STD 202F - Test Method 302] | > 1000M (min) |
| Short Time Overload (5 x Rated power upto 2 watts and 10 x Rated Power 3 watts and above for 5 secs) | $\Delta R \pm (1\% + R0005)$ - Average $\Delta R \pm (2\% + R0005)$ - for resistance values near maximum range |
| Temperature Co-efficient of Resistance [Measured from -55°C to +125°C referenced to +25°C] | ± 60 to 400 ppm/°C (Depending on resistance value) |
| Thermal Shock [-65°C to +125°C, 5 cycles, 15 min. at each extreme temperature] | $\Delta R \pm (1.5\% + R0005)$ - Average |
| Mechanical Shock (Specified Pulse) [MIL STD 202F - Test Method 213B condition 'C'] | $\Delta R \pm (0.75\% + R0005)$ - Typical |
| Moisture Resistance [MIL STD 202F - Test Method 106E with step 7b eliminated] | $\Delta R \pm (1.25\% + R0005)$ - Average |
| Damp Heat (Steady State) / Humidity (70°C at 95% R.H for 250 hours) | $\Delta R \pm (1.5\% + R0005)$ - Typical |
| Endurance - Load Life (70°C with limiting voltage - 1.5 hours on / 0.5 hours off) | $\Delta R \pm (2.5\% + R0005)$ Average - 2000 hours duration $\Delta R \pm (\leq 2.0\% + R0005)$ Typical - 1000 hours duration |
| Solvent Resistance [IPA for 60 secs ± 10 secs] | No effect on case filling / marking |



MECHANICAL SPECIFICATIONS

| PARAMETER/PERFORMANCE TEST & TEST METHOD | PERFORMANCE REQUIREMENTS |
|---|---|
| Pull Test / Robustness of Terminations [Direct load 2 to 4.5 kgs depending on size for 15 secs] | No effect |
| Resistance to Soldering Heat (260°C - 270°C for 4 secs) | $\Delta R \pm (0.1\% + R0005)$ Typical |
| Solderability [MIL STD 202F - Test method 208F] | Must meet the requirements laid down (95% satisfactory coverage) |
| Marking | As per IEC Pub. 60062 |

TYPICAL APPLICATIONS

HCAL series was evolved in order to overcome the phenomena of inductance inherent in wound resistors. These resistors are finding widespread acceptance where pulse and current sensing are required. E.g. Switching and linear power supplies and instrumentation.

For the effective utilization of these resistors, please refer "Application / Design notes for current sense resistors".

Note : Due to recent technological advances, the ceramic cases used may be steatite ceramic or cordierite ceramic or high alumina ceramic depending on the nature of the application. Hence, the ceramic cases may be off-white or variations of brown and variations of gray; colours which are inherent to these ceramic materials.

PREFORMED LEADS

The resistor terminations can be bent and cut as per requirements for quick PCB mounting. Please send detailed drawing of the type of preforming required.

ORDERING INFORMATION

| Series | RoHS Compliance | Type | Resistance Value | Tolerance |
|--------|-----------------|------|------------------|-----------|
| HCAL | * | C-5L | R047 | J |

1. For RoHS version - C-5L *
2. For 1.0mm terminations - C-5L (1)
3. If current required during normal operation exceeds 31 amps on a continuous basis, it is advisable to opt for 2mm terminations. For this - C-5L (2)
4. C5L / C7L and C10L can be supplied with 0.8mm terminations, though for superior performance, 1.0mm terminations are advised.