

## Wire Common Mode Choke Rating Voltage

### 1. Scope

The purpose of this document is to explain how Laird defines and verifies rating voltage of wire common mode chokes.

### 2. General Definition

**Rating Voltage:** The maximum voltage to be applied in service.

**Breakdown Voltage:** The failure line-to-line voltage.

**Withstand Voltage:** 75% of the breakdown voltage. It is the non-destructive voltage that the coils should be tested at.

### 3. Rating Voltage Determination

- 3.1. Collect minimum line-to-line breakdown voltage value by sampling test, and use 90% of this value as a safety breakdown voltage spec.
- 3.2. Multiply the breakdown voltage spec by 75% to get withstand voltage spec.
- 3.3. Refer to UL1283 standard to calculate a maximum constant line-to-line voltage the parts can be applied to. If withstand voltage spec is between 1000V and 1500V, maximum constant voltage is 250V. If withstand voltage spec is more than 1500V,  $V_{\text{constant}} = 250V + (V_{\text{withstand}} - 1500V) / 2$ .
- 3.4. As all parts will be soldered on customer's PCBA, rating voltage must comply with IPC2221 standard which specify maximum constant voltage applied to the parts base on different termination spacing. Termination spacing multiplied with related grads can get related maximum constant voltage according to below table.

| Termination spacing(mm) | Maximum Constant Voltage(V)<br>DC or AC peak | Grads(V/mm) |
|-------------------------|--|-------------|
| 0.13                    | 0-15   | 115         |
| 0.25                    | 16-30  | 120         |
| 0.40                    | 31-50  | 125         |
| 0.50                    | 51-100                                       | 200         |
| 0.80                    | 101-300                                      | 375         |
| 1.50                    | 301-500                                      | 333         |
| >1.50                   | -  | 328         |

Note: Use line-to-line spacing in Land Pattern specified in product prints as termination spacing.

- 3.5. When  $V_{\text{constant}}$  is less than the voltage IPC2221 permits we use  $V_{\text{constant}}$  as rating voltage spec, otherwise rating voltage should be specified as the maximum voltage IPC2221 permits. Rating voltage is specified as the minimum value of maximum constant voltage IPC2221 and UL1283 permit.

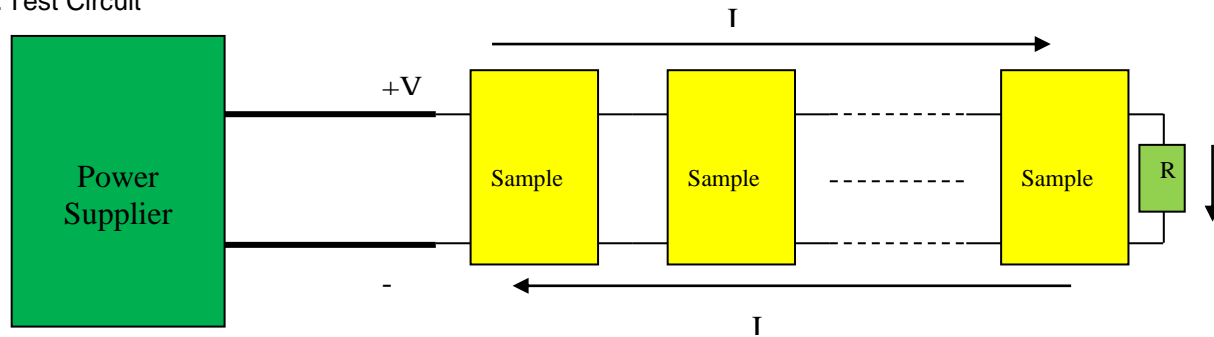
## 4. Rating Voltage Testing Methods

### 4.1. Test Methods

| Test Item      | Test Methods   | Test Requirement   | Test Equipment  |
|----------------|--|--|---|
| Rating Voltage | 1. 1000hr at 85°C ambient.<br>2. Load both rating voltage and rating current.<br>3. Measurement at 24±2 hours after test conclusion. | 1. No visible mechanical damage.<br>2. Impedance Change < ±10%.<br>3. IR @75V Change < ±30%. | 1. Temperature Chamber.<br>2. DC power supplier (500V /100A /2.4KW) |

Note: If testing power is out of rating power of the power supplier, keep test voltage as rated voltage and decrease current to ensure testing power meets test equipment capability.

### 4.2. Test Circuit



## 5. Parts list with Rating Voltage Specification

| Part Number    | Breakdown Voltage (VDC) | Withstand Voltage (VDC) | V <sub>constant</sub> by UL1283 (VDC) | Land Pattern spacing (mm) | V <sub>constant</sub> by ICP2221 (VDC) | Rating Voltage (VDC) |
|----------------|-------------------------|-------------------------|---------------------------------------|---------------------------|--|----------------------|
| CM2021Y330R-10 | 2490                    | 1681                    | 340                                   | 0.76                      | 285                                    | 285                  |
| CM2545X171B-10 | 2490                    | 1681                    | 340                                   | 1.27                      | 423                                    | 340                  |
| CM2545X171B-15 | 2490                    | 1681                    | 340                                   | 1.27                      | 423                                    | 340                  |
| CM2545X171R-10 | 2490                    | 1681                    | 340                                   | 0.76                      | 285                                    | 285                  |
| CM2722R151R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                   |
| CM2722R201R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                   |
| CM2722R800R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                   |
| CM2722R800R-15 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                   |
| CM3032V121R-10 | 1690                    | 1141                    | 250                                   | 0.25                      | 30                                     | 30                   |
| CM3032V201R-10 | 1690                    | 1141                    | 250                                   | 0.25                      | 30                                     | 30                   |
| CM3032V301R-10 | 1690                    | 1141                    | 250                                   | 0.25                      | 30                                     | 30                   |
| CM3421Y600R-10 | 2490                    | 1681                    | 340                                   | 0.76                      | 285                                    | 285                  |
| CM3440Z171B-10 | 1720                    | 1161                    | 250                                   | 1.00                      | 333                                    | 250                  |
| CM3440Z171R-10 | 1800                    | 1215                    | 250                                   | 0.51                      | 100                                    | 100                  |
| CM3440Z171R-15 | 1800                    | 1215                    | 250                                   | 0.51                      | 100                                    | 100                  |
| CM3822R151R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                   |
| CM3822R201R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                   |
| CM3822R800R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                   |
| CM4440Z121R-10 | 1800                    | 1215                    | 250                                   | 0.51                      | 100                                    | 100                  |
| CM4545Z131B-10 | 2490                    | 1681                    | 340                                   | 1.27                      | 423                                    | 340                  |
| CM4545Z131R-10 | 2490                    | 1681                    | 340                                   | 0.76                      | 285                                    | 285                  |
| CM4732V201R-10 | 1690                    | 1141                    | 250                                   | 0.25                      | 30                                     | 30                   |

| Part Number    | Breakdown Voltage (VDC) | Withstand Voltage (VDC) | V <sub>constant</sub> by UL1283 (VDC) | Land Pattern spacing (mm) | V <sub>constant</sub> by ICP2221 (VDC) | Rating Voltage ( VDC) |
|----------------|-------------------------|-------------------------|---------------------------------------|---------------------------|--|-----------------------|
| CM4732V301R-10 | 1690                    | 1141                    | 250                                   | 0.25                      | 30                                     | 30                    |
| CM5022R151R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                    |
| CM5022R201R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                    |
| CM5022R800R-10 | 1290                    | 871                     | 145                                   | 0.25                      | 30                                     | 30                    |
| CM5441Z101B-10 | 2500                    | 1688                    | 344                                   | 2.03                      | 665                                    | 340                   |
| CM5441Z101B-13 | 2500                    | 1688                    | 344                                   | 2.03                      | 665                                    | 340                   |
| CM5441Z161B-10 | 2500                    | 1688                    | 344                                   | 2.03                      | 665                                    | 340                   |
| CM5441Z161B-13 | 2500                    | 1688                    | 344                                   | 2.03                      | 665                                    | 340                   |
| CM5441Z161B-15 | 2500                    | 1688                    | 344                                   | 2.03                      | 665                                    | 340                   |
| CM5441Z161R-10 | 2500                    | 1688                    | 344                                   | 2.03                      | 665                                    | 340                   |
| CM5441Z161R-13 | 2500                    | 1688                    | 344                                   | 2.03                      | 665                                    | 340                   |
| CM5740Z171B-10 | 1720                    | 1161                    | 250                                   | 1.00                      | 333                                    | 250                   |
| CM5740Z241B-10 | 1720                    | 1161                    | 250                                   | 1.00                      | 333                                    | 250                   |
| CM5740Z171R-10 | 1800                    | 1215                    | 250                                   | 0.51                      | 100                                    | 100                   |
| CM5942V301B-15 | 1900                    | 1283                    | 250                                   | 0.60                      | 225                                    | 225                   |
| CM6032V201R-10 | 1690                    | 1141                    | 250                                   | 0.25                      | 30                                     | 30                    |
| CM6032V301R-10 | 1690                    | 1141                    | 250                                   | 0.25                      | 30                                     | 30                    |
| CM8663Z161B-10 | 3000                    | 2025                    | 512                                   | 3.00                      | 984                                    | 512                   |