

# EXL1V0505

## High current molded inductor



### Product features

- High current carrying capacity
- Low DCR, high efficiency
- Magnetically shielded, low EMI
- Soft saturation
- Inductance range from 5.6  $\mu$ H to 10  $\mu$ H
- Current range from 5.0 A to 7.2 A
- 6.2 mm x 5.9 mm footprint surface mount package in a 5.0 mm height
- Alloy powder core material
- Moisture Sensitivity Level (MSL) 1

### Applications

- Voltage Regulator Module (VRM)
- Multi-phase regulators
- Point-of-load (POL) converters
- Desktop and server VRMs and EVRDs
- Base station equipment
- Laptop and notebook regulators
- Battery power systems
- Graphics cards
- Data networking and storage system

### Environmental compliance and general specifications

- Storage temperature range (Component): -40 °C to +125 °C
- Operating temperature range: -40 °C to +125 °C (ambient plus self-temperature rise)
- Solder reflow temperature: J-STD-020 (latest revision) compliant



## Product specifications

| Part number <sup>5</sup> | OCL <sup>1</sup><br>( $\mu\text{H}$ ) $\pm 20\%$ | FLL <sup>2</sup> ( $\mu\text{H}$ )<br>minimum | $I_{\text{rms}}$ <sup>3</sup> (A) typical |     | $I_{\text{sat}}$ <sup>4</sup><br>(A) | DCR (m $\Omega$ )<br>typical @ +25 °C | DCR (m $\Omega$ )<br>maximum @ +25 °C | SRF (MHz)<br>typical |
|--------------------------|--------------------------------------------------|-----------------------------------------------|-------------------------------------------|-----|--------------------------------------|---------------------------------------|---------------------------------------|----------------------|
| EXL1V0505-5R6-R          | 5.6                                              | 3.13                                          | 5.3                                       | 7.2 | 7.2                                  | 22                                    | 24.2                                  | 20                   |
| EXL1V0505-6R8-R          | 6.8                                              | 3.8                                           | 4.8                                       | 6.4 | 6.6                                  | 26                                    | 28.6                                  | 18                   |
| EXL1V0505-8R2-R          | 8.2                                              | 4.59                                          | 4.6                                       | 6.1 | 6.1                                  | 29.5                                  | 32.5                                  | 15                   |
| EXL1V0505-100-R          | 10                                               | 5.6                                           | 3.8                                       | 5.0 | 5.4                                  | 39                                    | 43                                    | 10                   |

1. Open circuit inductance (OCL) Test parameters: 100 kHz, 0.1 V<sub>rms</sub>, 0.0 Adc, +25 °C

2. Full load inductance (FLL) Test parameters: 100 kHz, 0.1 V<sub>rms</sub>,  $I_{\text{sat}}$ , +25 °C

3.  $I_{\text{rms}}$ : Heat rated current ( $I_{\text{rms}}$ ) will cause the part temperature rise approximately  $\Delta T$  of 40 °C. Circuit design, component, PCB trace size and thickness, airflow and other cooling provisions all affect the part temperature. Part temperature should be verified in the end application. The part temperature (ambient + temp rise) should not exceed +125 °C under worst case operating conditions.

4.  $I_{\text{sat}}$ : Peak current for approximately 30% rolloff @ +25 °C

5. Part Number Definition: EXL1V0505-xxx-R

EXL1V0505 = Product code and size

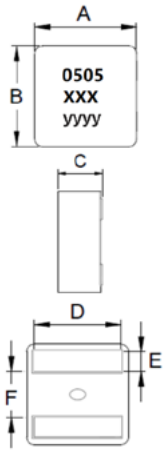
xxx= inductance value in  $\mu\text{H}$ , R= decimal point,

If no R is present then third digit equals the number of zeros

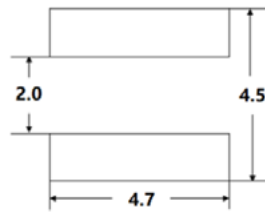
-R suffix = RoHS compliant

6. Rated operating voltage: 15 V typical

## Mechanical parameters, schematic, pad layout (mm)



### Recommended pad layout



### Schematic

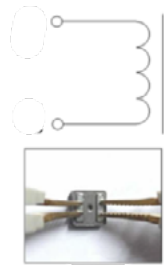


Figure 1. DCR test

| Part number     | A             | B             | C             | D             | E             | F              |
|-----------------|---------------|---------------|---------------|---------------|---------------|----------------|
| EXL1V0505-xxx-R | 6.0 $\pm$ 0.2 | 5.7 $\pm$ 0.2 | 4.8 $\pm$ 0.2 | 4.3 $\pm$ 0.3 | 1.1 $\pm$ 0.2 | 2.3 $\pm$ 0.25 |

Part marking: 0505, xxx= inductance value in  $\mu\text{H}$  (R= decimal point, if no R is present last digit equals number of zeros), yyyy= lot code

All soldering surfaces to be coplanar within 0.1 millimeters

Tolerances are  $\pm 0.3$  millimeters unless stated otherwise

Dimensions of recommended PCB layout are reference only.

Pad layout tolerances are  $\pm 0.1$  millimeters unless stated otherwise

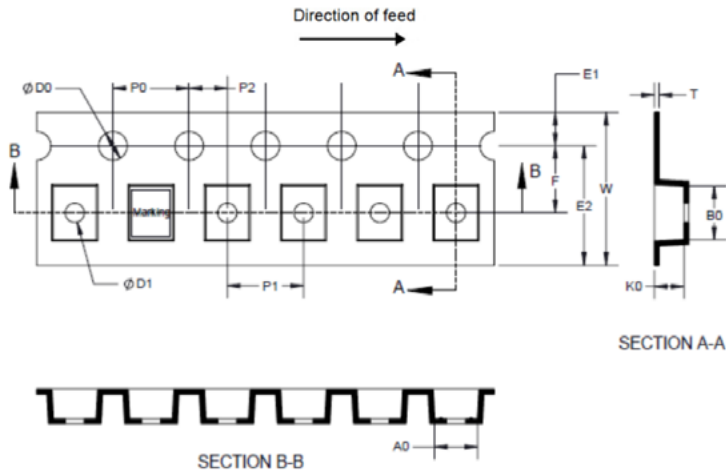
Four terminal kelvin-clip recommended for DCR testing as shown in Figure 1.

Traces or vias underneath the inductor is not recommended.

## Packaging information (mm)

Drawing not to scale

Supplied in tape and reel packaging, 1500 parts per 13" diameter reel (EIA-481 compliant)

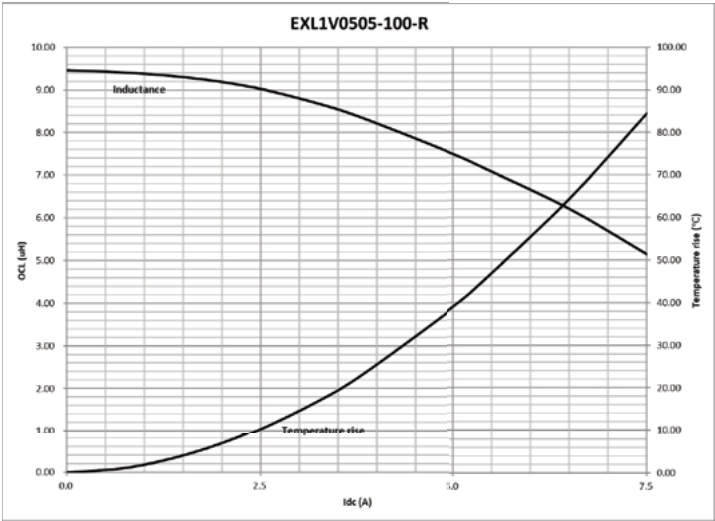
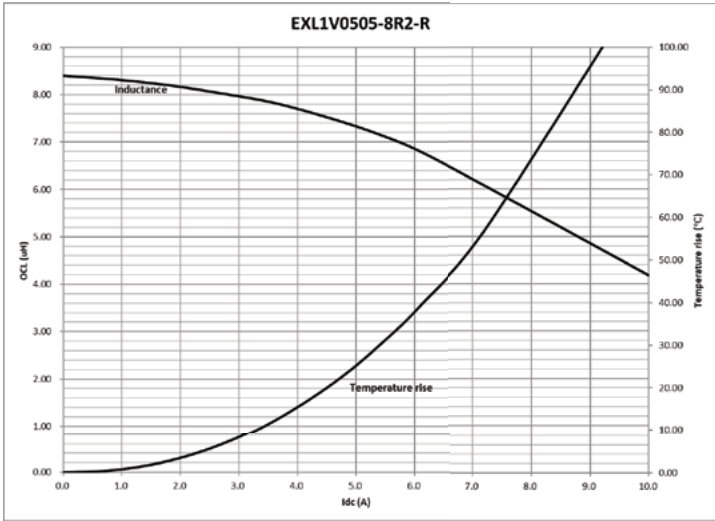
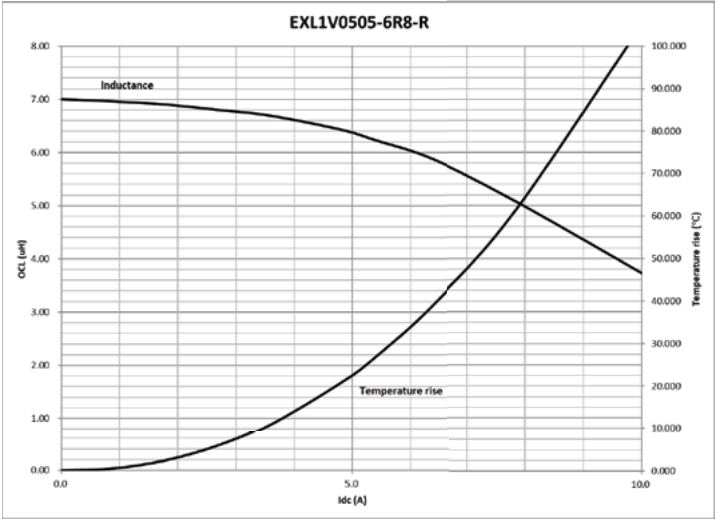
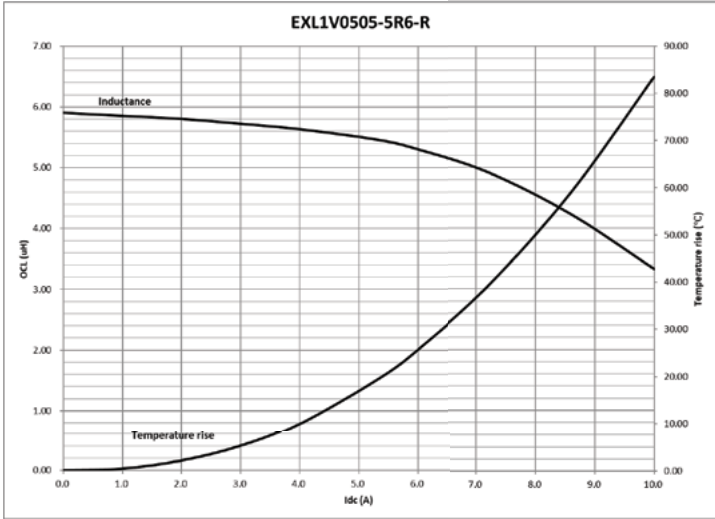


|                        |      |
|------------------------|------|
| $W \pm 0.30$           | 16   |
| $F \pm 0.1$            | 7.5  |
| $E1 \pm 0.1$           | 1.75 |
| $P0 \pm 0.1$           | 4.0  |
| $P1 \pm 0.1$           | 8.0  |
| $P2 \pm 0.1$           | 2.0  |
| $D0 + 0.1/-0$          | 1.5  |
| $D1 + 0.1/-0$          | 1.5  |
| $A0 \pm 0.1$           | 6.4  |
| $B0 \pm 0.1$           | 6.1  |
| $K0 \pm 0.1$           | 5.3  |
| $T \pm 0.05$           | 0.35 |
| $P0 \times 10 \pm 0.2$ | 40   |

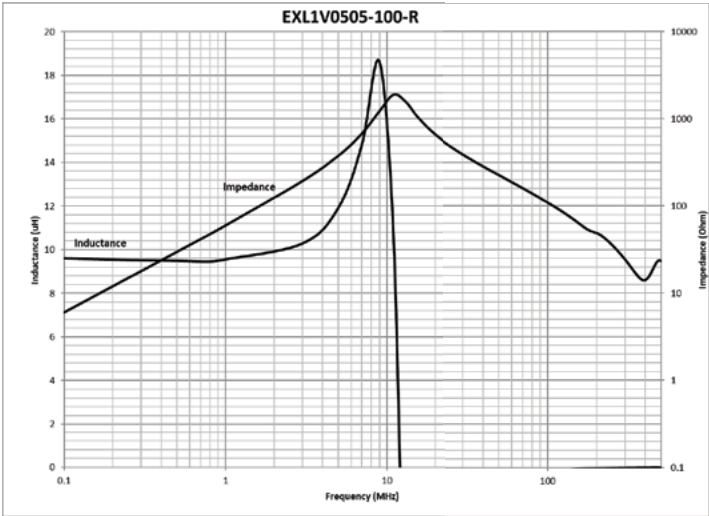
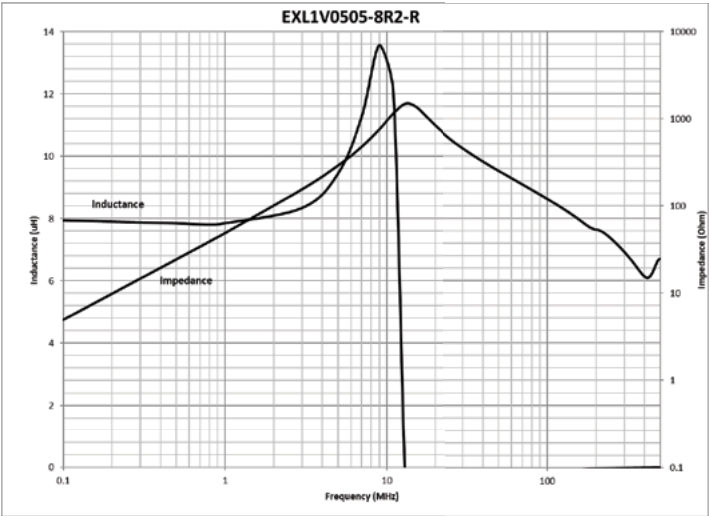
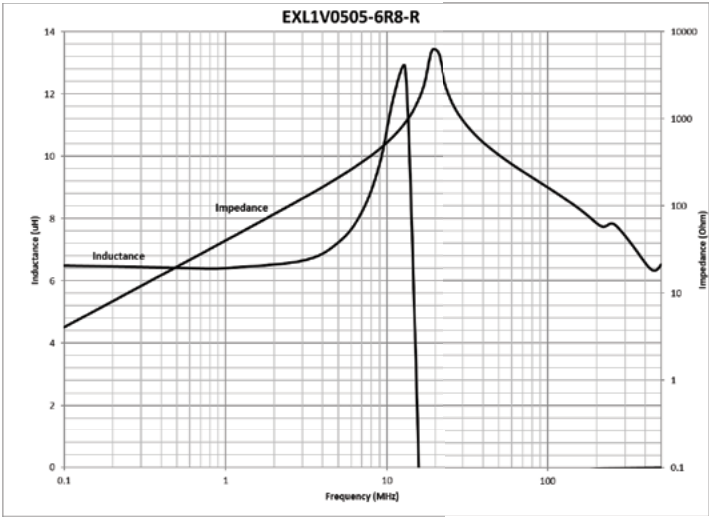
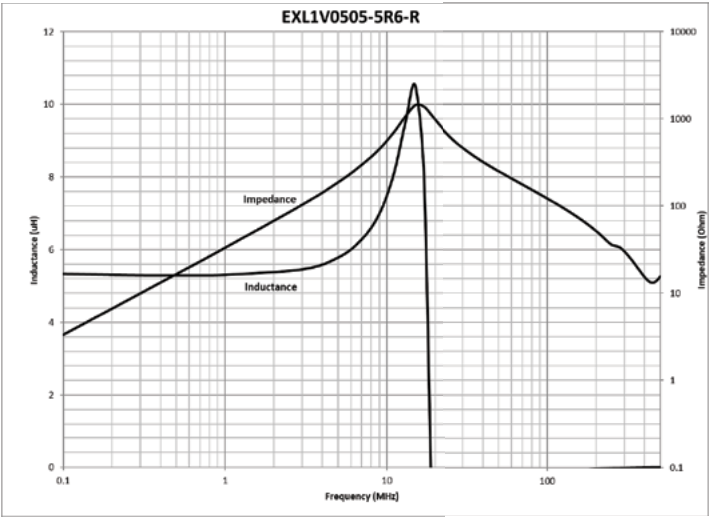
## Qualification testing

| No. | Test item                    | Reference standards       | Test condition                                                                                                                     | Acceptable value/range                                                          |
|-----|------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| 1   | Life                         | MIL-STD-202<br>Method 108 | +125 °C + $I_{rms}$ for 1000 hours                                                                                                 | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 2   | Load humidity                | MIL-STD-202<br>Method 103 | +85 °C/85% RH + $I_{rms}$ for 1000 hours                                                                                           | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 3   | Moisture resistance          | MIL-STD-202<br>Method 106 | 7a & 7b included                                                                                                                   | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 4   | Thermal shock                | MIL-STD-202<br>Method 107 | Step 1: -40 ± 2 °C 30 ± 5 minutes<br>Step 2: 25 ± 2 °C ≤ 0.5 minutes<br>Step 3: 125 ± 2 °C 30 ± 5 minutes<br>Number of cycles: 500 | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 5   | Vibration                    | MIL-STD-202<br>Method 204 | 10 g, 12 hours (10 Hz ~ 2 kHz ~ 10 Hz for 20 minutes, 12 cycles each of 3 orientations)                                            | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 6   | Shock                        | MIL-STD-202<br>Method 213 | Half-sine<br>50 g's, 11 ms                                                                                                         | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 7   | Bending                      | IEC 68-2-21               | 1.2 mm for 10 s                                                                                                                    | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 8   | Solderability                | J-STD-002D<br>Method B    | Preheat: +150 °C, 60 sec.<br>245 ± 5, Dip time: 4 ± 1 sec.<br>Depth: completely cover the termination                              | ≥ 95% of the terminal covered with solder                                       |
| 9   | Resistance to soldering heat | MIL-STD-202<br>Method 210 | +260 ± 5 °C; 10 ± 1 s                                                                                                              | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |
| 10  | Terminal strength            | AEC-Q200-006              | 1 kg for 60 ± 1 s                                                                                                                  | a. Appearance<br>b. $\Delta L/L \leq \pm 10\%$<br>d. $\Delta R/R \leq \pm 15\%$ |

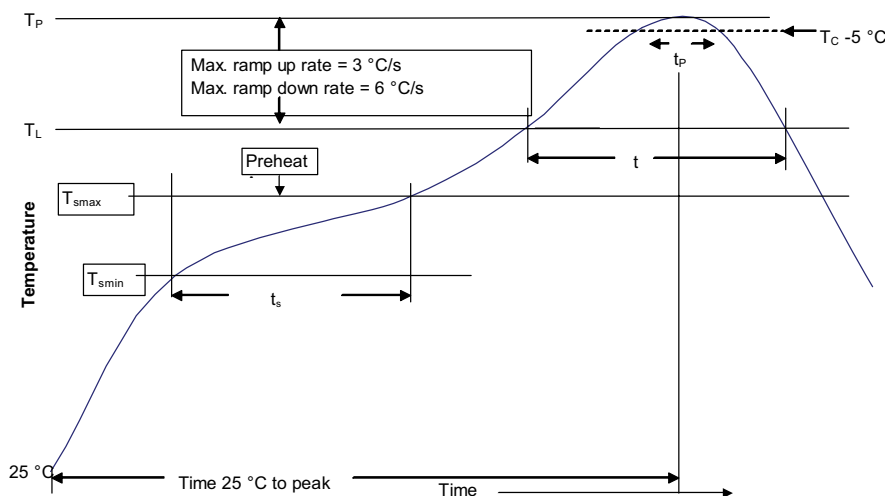
Inductance and temperature rise vs. current



Inductance and impedance vs. frequency curve



## Solder reflow profile



**Table 1 - Standard SnPb solder ( $T_c$ )**

| Package thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm           | 235 °C                      | 220 °C                      |
| ≥2.5 mm           | 220 °C                      | 220 °C                      |

**Table 2 - Lead (Pb) free solder ( $T_c$ )**

| Package thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> 350 - 2000 | Volume mm <sup>3</sup> >2000 |
|-------------------|-----------------------------|-----------------------------------|------------------------------|
| <1.6 mm           | 260 °C                      | 260 °C                            | 260 °C                       |
| 1.6 – 2.5 mm      | 260 °C                      | 250 °C                            | 245 °C                       |
| >2.5 mm           | 250 °C                      | 245 °C                            | 245 °C                       |

## Reference J-STD-020

| Profile feature                                                                   | Standard SnPb solder | Lead (Pb) free solder |
|-----------------------------------------------------------------------------------|----------------------|-----------------------|
| Preheat and soak                                                                  |                      |                       |
| • Temperature min. ( $T_{smin}$ )                                                 | 100 °C               | 150 °C                |
| • Temperature max. ( $T_{smax}$ )                                                 | 150 °C               | 200 °C                |
| • Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )                                     | 60-120 seconds       | 60-120 seconds        |
| Ramp up rate $T_L$ to $T_p$                                                       | 3 °C/ second max.    | 3 °C/ second max.     |
| Liquidous temperature ( $T_L$ )                                                   | 183 °C               | 217 °C                |
| Time ( $t_L$ ) maintained above $T_L$                                             | 60-150 seconds       | 60-150 seconds        |
| Peak package body temperature ( $T_p$ )*                                          | Table 1              | Table 2               |
| Time ( $t_p$ )* within 5 °C of the specified classification temperature ( $T_c$ ) | 20 seconds*          | 30 seconds*           |
| Ramp-down rate ( $T_p$ to $T_L$ )                                                 | 6 °C/ second max.    | 6 °C/ second max.     |
| Time 25 °C to peak temperature                                                    | 6 minutes max.       | 8 minutes max.        |

\* Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

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