

# FP1012V

## High frequency, high current power inductors



### Product features

- Vertical design utilizes less board space
- High current carrying capacity
- Operating frequency up to 3 MHz
- Inductance range from 70 nH to 470 nH
- Current range 22 A to 130 A
- 10.0 mm x 6.2 mm footprint surface mount package in 12 mm height
- Moisture sensitivity level (MSL): 1
- Ferrite core material
- Weight: 3.1 grams typical

### Applications

- Multi-phase and Vcore regulators
- Voltage regulator modules (VRMs) and high power density VRMs
  - Server and desktop
  - Central processing unit (CPU)
  - Graphics processing unit (GPU)
  - Application specific integrated circuit (ASIC)
- Data networking and storage systems
- Graphics cards and battery power systems
- Point-of-Load modules

### 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>(nH) ±10% | FLL <sup>2</sup><br>(nH) minimum | I <sub>avg</sub> <sup>3</sup><br>(A) | I <sub>avg1</sub> <sup>4</sup><br>(A) | I <sub>avg2</sub> <sup>5</sup><br>(A) | I <sub>avg3</sub> <sup>6</sup><br>(A) | DCR (mΩ)<br>@ +20 °C<br>±10% | K-factor <sup>7</sup> | Dimension B<br>(mm)<br>maximum |
|--------------------------|-------------------------------|----------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|------------------------------|-----------------------|--------------------------------|
| FP1012V2-R070-R          | 70                            | 50                               | 84                                   | 130+                                  | 130+                                  | 130+                                  | 0.125                        | 305                   | 6.2                            |
| FP1012V2-R080-R          | 80                            | 57                               | 84                                   | 130+                                  | 130+                                  | 125                                   | 0.125                        | 305                   | 6.1                            |
| FP1012V2-R090-R          | 90                            | 64                               | 84                                   | 130+                                  | 117                                   | 110                                   | 0.125                        | 305                   | 6.1                            |
| FP1012V2-R100-R          | 100                           | 72                               | 84                                   | 125                                   | 105                                   | 100                                   | 0.125                        | 305                   | 6.0                            |
| FP1012V2-R120-R          | 120                           | 86                               | 84                                   | 105                                   | 88                                    | 81                                    | 0.125                        | 305                   | 6.0                            |
| FP1012V2-R150-R          | 150                           | 108                              | 84                                   | 83                                    | 70                                    | 66                                    | 0.125                        | 305                   | 6.0                            |
| FP1012V2-R330-R          | 330                           | 231                              | 84                                   | 36                                    | 28                                    | 26                                    | 0.125                        | 305                   | 6.0                            |
| FP1012V2-R470-R          | 470 (±15%)                    | 329                              | 84                                   | 22                                    | 19                                    | 18                                    | 0.125                        | 305                   | 6.0                            |

1. Open circuit inductance (OCL) test parameters: 100 kHz, 0.1 Vrms, 0.0 Adc, +25 °C

2. Full load inductance (FLL) test parameters: 100 kHz, 0.1 Vrms, I<sub>avg1</sub>, +25 °C

3. I<sub>avg</sub>: DC current for an approximate temperature rise of 40 °C without core loss. Derating is necessary for AC currents.

PCB layout, trace thickness and width, air-flow, and proximity of other heat generating components will affect the temperature rise. It is recommended that the temperature of the part not exceed +125 °C under worst case operating conditions verified in the end application.

4. I<sub>avg1</sub>: Peak current for approximately 20% rolloff @ +25 °C

5. I<sub>avg2</sub>: Peak current for approximately 20% rolloff @ +100 °C

6. I<sub>avg3</sub>: Peak current for approximately 20% rolloff @ +125 °C

7. K-factor: Used to determine Bp-p for core loss (see graph). Bp-p = K \* L \* ΔI \* 10<sup>-3</sup>. Bp-p[Gauss], K: (K-factor from table), L: (Inductance in nH), ΔI (Peak to peak ripple current in Amps).

8. Part number definition: FP1012Vx-Rxxx-R

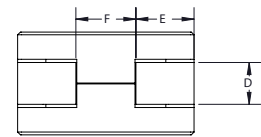
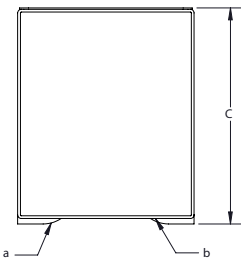
FP1012 = Product code and size

Vx= Version indicator

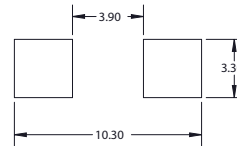
Rxxx=Inductance value in μH, R=decimal point

-R suffix = RoHS compliant

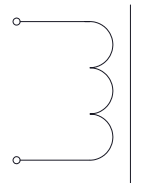
## Dimensions-mm



## Recommended pad layout



## Schematic



## Dimension

|   |                                  |
|---|----------------------------------|
| A | 10 maximum                       |
| B | See product specifications table |
| C | 12 maximum                       |
| D | 2.3 nominal                      |
| E | 3.2 nominal                      |
| F | 3.3 nominal                      |

Part marking: FP1012=Product code and size, Vx=Version indicator, Rxxx= inductance value in uH,

R=decimal point, xxxx= lot code

Tolerances are ±0.15 millimeters unless stated otherwise

All soldering surfaces to be coplanar within 0.1 millimeters

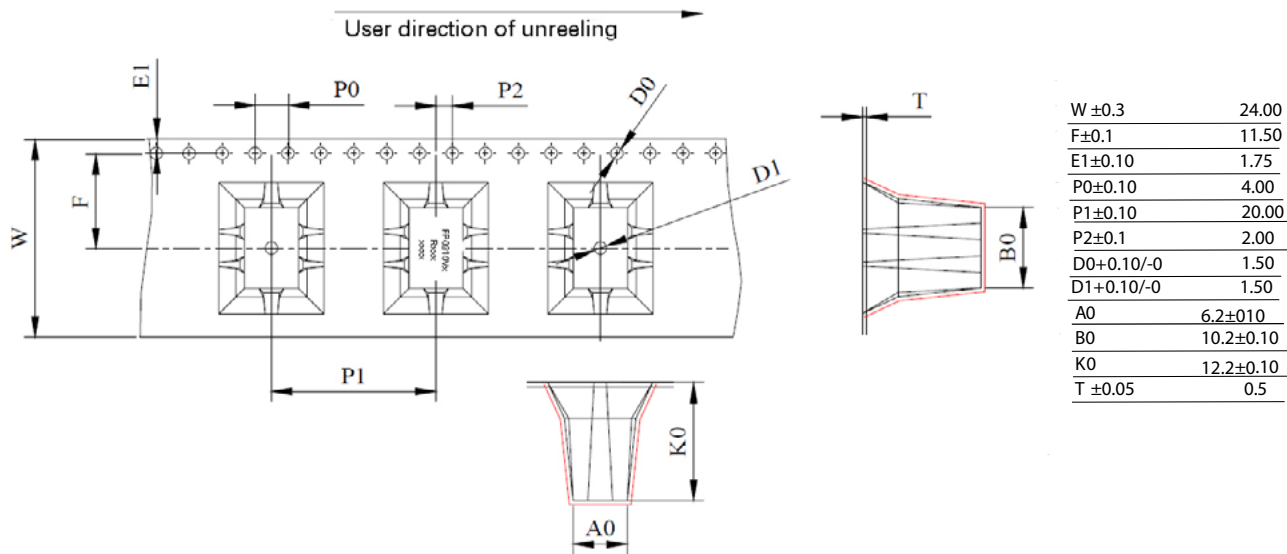
Pad layout tolerances are ±0.1 millimeters unless stated otherwise

DCR is measured from point "a" to point "b"

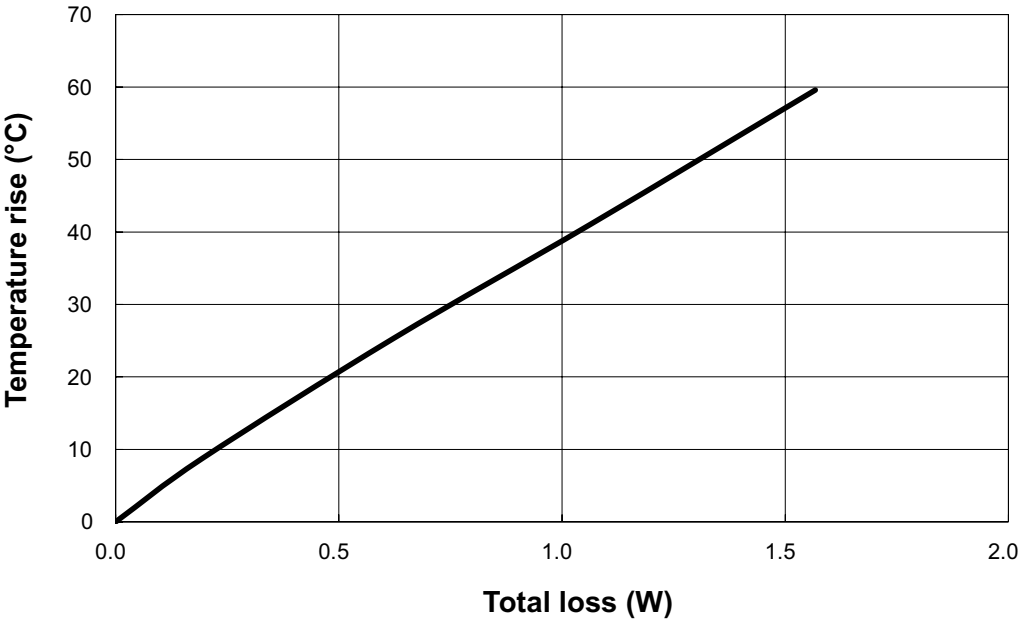
Traces or vias underneath the inductor is not recommended

Packaging information- mm

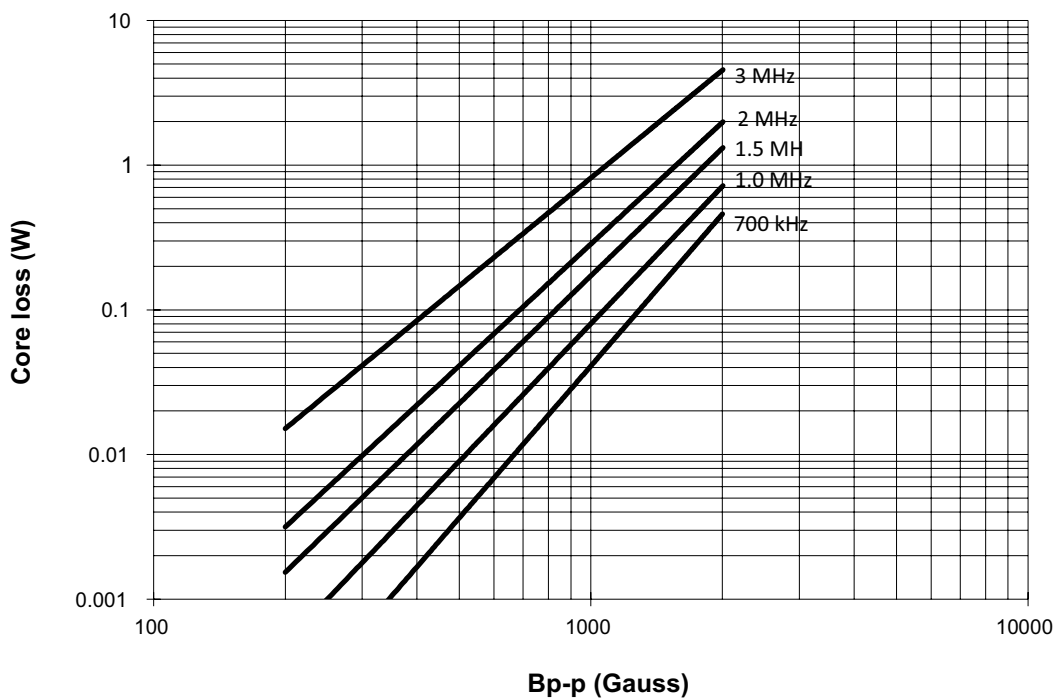
Supplied in tape and reel packaging, 250 parts per 13" diameter reel



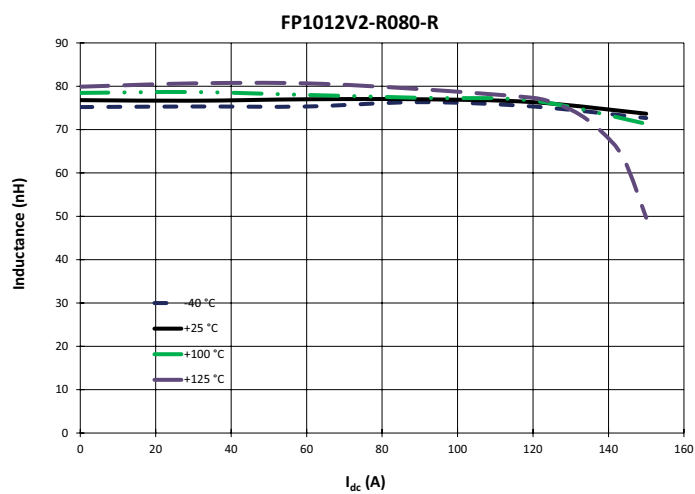
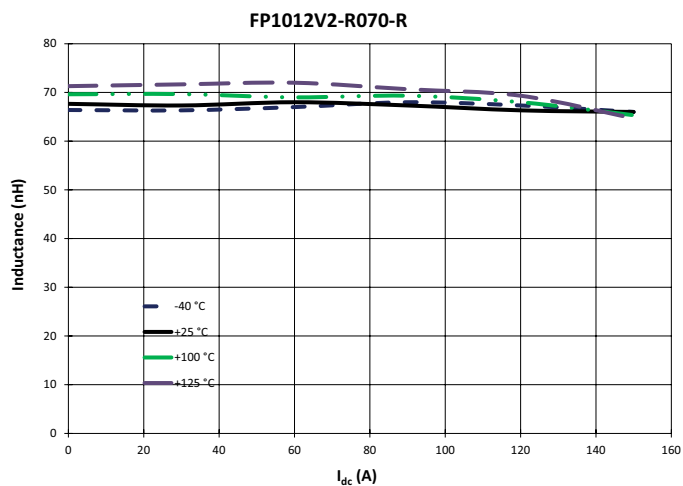
Temperature rise vs. total loss



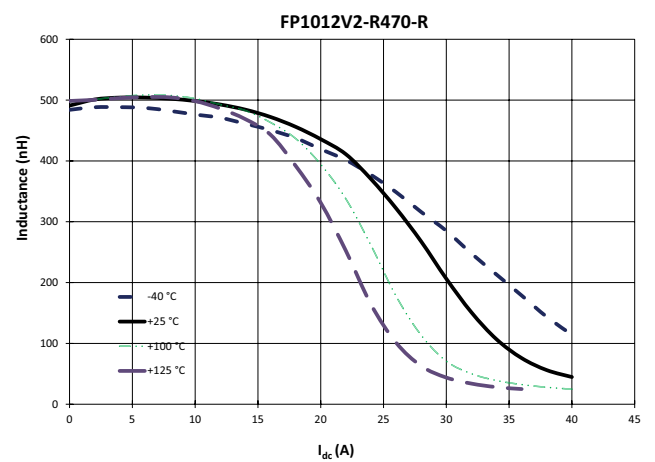
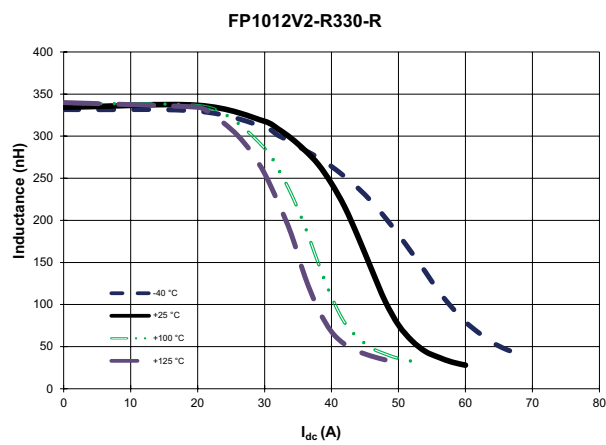
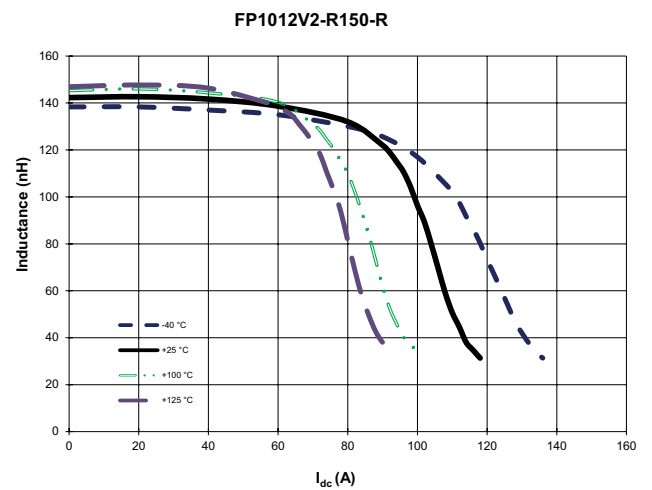
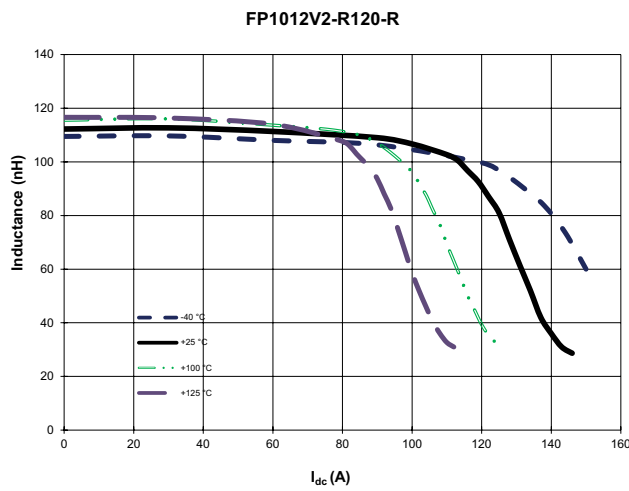
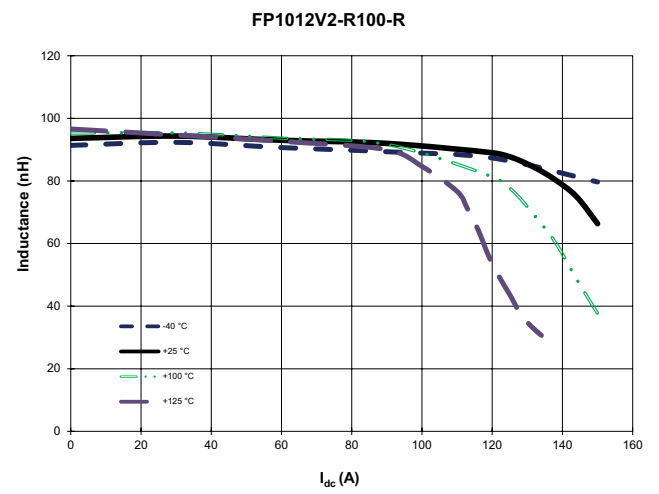
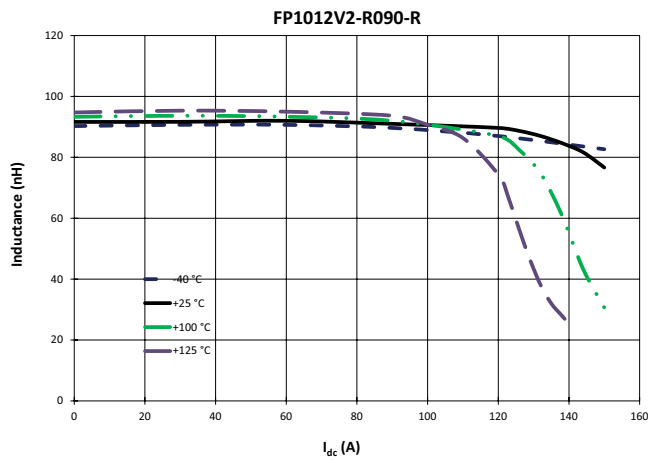
## Core loss vs Bp-p



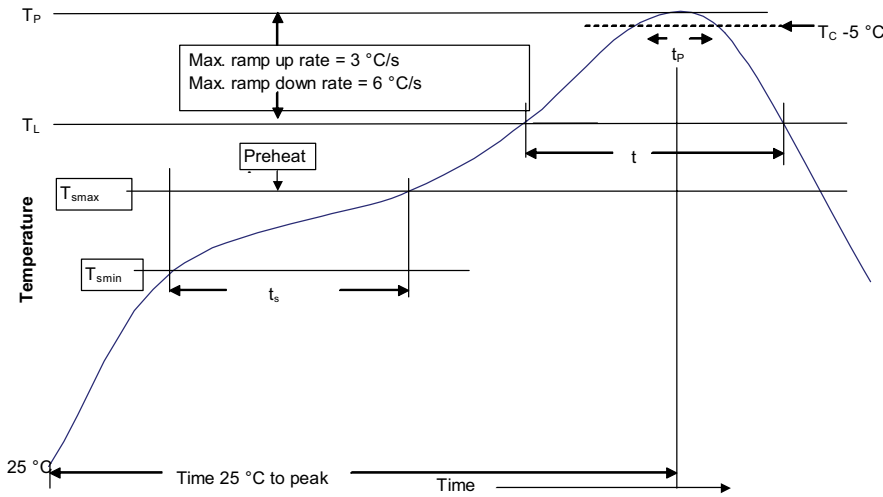
## Inductance characteristics



## Inductance characteristics



## 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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**Eaton**  
**Electronics Division**  
1000 Eaton Boulevard  
Cleveland, OH 44122  
United States  
Eaton.com/electronics

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