

# DATA SHEET

**EFD20/10/7**

**EFD cores and accessories**

Supersedes data of September 2004

2008 Sep 01

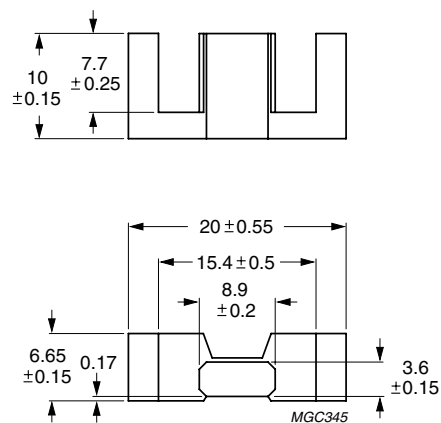
## EFD cores and accessories

## EFD20/10/7

## CORES

## Effective core parameters

| SYMBOL        | PARAMETER         | VALUE | UNIT             |
|---------------|-------------------|-------|------------------|
| $\Sigma(l/A)$ | core factor (C1)  | 1.52  | mm <sup>-1</sup> |
| $V_e$         | effective volume  | 1460  | mm <sup>3</sup>  |
| $l_e$         | effective length  | 47.0  | mm               |
| $A_e$         | effective area    | 31.0  | mm <sup>2</sup>  |
| $A_{min}$     | minimum area      | 29    | mm <sup>2</sup>  |
| m             | mass of core half | ≈ 3.5 | g                |



Dimensions in mm.

Fig.1 EFD20/10/7 core half.

## Core halves

$A_L$  measured in combination with a non-gapped core half, clamping force for  $A_L$  measurements  $20 \pm 10$  N, unless stated otherwise.

| GRADE                   | $A_L$<br>(nH)      | $\mu_e$ | TOTAL AIR GAP<br>( $\mu\text{m}$ ) | TYPE NUMBER          |
|-------------------------|--------------------|---------|------------------------------------|----------------------|
| 3C90                    | $63 \pm 3\%^{(1)}$ | ≈ 76    | ≈ 960                              | EFD20/10/7-3C90-E63  |
|                         | $100 \pm 3\%$      | ≈ 121   | ≈ 510                              | EFD20/10/7-3C90-A100 |
|                         | $160 \pm 5\%$      | ≈ 193   | ≈ 280                              | EFD20/10/7-3C90-A160 |
|                         | $250 \pm 8\%$      | ≈ 302   | ≈ 160                              | EFD20/10/7-3C90-A250 |
|                         | $315 \pm 10\%$     | ≈ 380   | ≈ 120                              | EFD20/10/7-3C90-A315 |
|                         | $1300 \pm 25\%$    | ≈ 1570  | ≈ 0                                | EFD20/10/7-3C90      |
| 3C94                    | $63 \pm 3\%^{(1)}$ | ≈ 76    | ≈ 960                              | EFD20/10/7-3C94-E63  |
|                         | $100 \pm 3\%$      | ≈ 121   | ≈ 510                              | EFD20/10/7-3C94-A100 |
|                         | $160 \pm 5\%$      | ≈ 193   | ≈ 280                              | EFD20/10/7-3C94-A160 |
|                         | $250 \pm 8\%$      | ≈ 302   | ≈ 160                              | EFD20/10/7-3C94-A250 |
|                         | $315 \pm 10\%$     | ≈ 380   | ≈ 120                              | EFD20/10/7-3C94-A315 |
|                         | $1300 \pm 25\%$    | ≈ 1570  | ≈ 0                                | EFD20/10/7-3C94      |
| 3C95 <small>des</small> | $1540 \pm 25\%$    | ≈ 1865  | ≈ 0                                | EFD20/10/7-3C95      |
| 3C96 <small>des</small> | $1200 \pm 25\%$    | ≈ 1450  | ≈ 0                                | EFD20/10/7-3C96      |
| 3F3                     | $63 \pm 3\%^{(1)}$ | ≈ 76    | ≈ 960                              | EFD20/10/7-3F3-E63   |
|                         | $100 \pm 3\%$      | ≈ 121   | ≈ 510                              | EFD20/10/7-3F3-A100  |
|                         | $160 \pm 5\%$      | ≈ 193   | ≈ 280                              | EFD20/10/7-3F3-A160  |
|                         | $250 \pm 8\%$      | ≈ 302   | ≈ 160                              | EFD20/10/7-3F3-A250  |
|                         | $315 \pm 10\%$     | ≈ 380   | ≈ 120                              | EFD20/10/7-3F3-A315  |
|                         | $1200 \pm 25\%$    | ≈ 1450  | ≈ 0                                | EFD20/10/7-3F3       |

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| GRADE            | $A_L$<br>(nH)               | $\mu_e$        | TOTAL AIR GAP<br>( $\mu\text{m}$ ) | TYPE NUMBER         |
|------------------|-----------------------------|----------------|------------------------------------|---------------------|
| 3F35 <b>des</b>  | 920 $\pm 25\%$              | $\approx 1110$ | $\approx 0$                        | EFD20/10/7-3F35     |
| 3F4 <b>des</b>   | 63 $\pm 3\%$ <sup>(1)</sup> | $\approx 76$   | $\approx 900$                      | EFD20/10/7-3F4-E63  |
|                  | 100 $\pm 3\%$               | $\approx 121$  | $\approx 450$                      | EFD20/10/7-3F4-A100 |
|                  | 160 $\pm 5\%$               | $\approx 193$  | $\approx 230$                      | EFD20/10/7-3F4-A160 |
|                  | 250 $\pm 8\%$               | $\approx 302$  | $\approx 120$                      | EFD20/10/7-3F4-A250 |
|                  | 315 $\pm 10\%$              | $\approx 380$  | $\approx 80$                       | EFD20/10/7-3F4-A315 |
|                  | 650 $\pm 25\%$              | $\approx 780$  | $\approx 0$                        | EFD20/10/7-3F4      |
| 3F45 <b>prot</b> | 650 $\pm 25\%$              | $\approx 780$  | $\approx 0$                        | EFD20/10/7-3F45     |

## Note

1. Measured in combination with an equal gapped core half, clamping force for  $A_L$  measurements, 20  $\pm 10$  N.

## Properties of core sets under power conditions

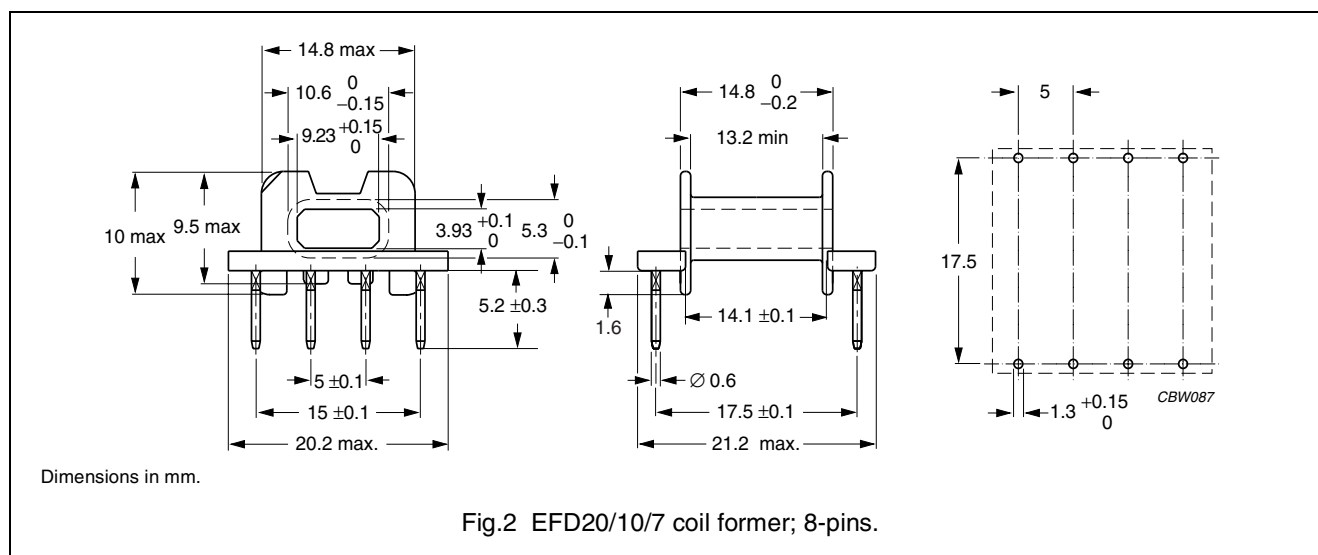
| GRADE | B (mT) at                           | CORE LOSS (W) at                           |                                             |                                            |                                             |                                            |
|-------|-------------------------------------|--------------------------------------------|---------------------------------------------|--------------------------------------------|---------------------------------------------|--------------------------------------------|
|       | H = 250 A/m; f = 25 kHz; T = 100 °C | f = 25 kHz; $\hat{B} = 200$ mT; T = 100 °C | f = 100 kHz; $\hat{B} = 100$ mT; T = 100 °C | f = 100 kHz; $\hat{B} = 200$ mT; T = 25 °C | f = 100 kHz; $\hat{B} = 200$ mT; T = 100 °C | f = 400 kHz; $\hat{B} = 50$ mT; T = 100 °C |
| 3C90  | $\geq 330$                          | $\leq 0.16$                                | $\leq 0.17$                                 | –                                          | –                                           | –                                          |
| 3C94  | $\geq 330$                          | –                                          | $\leq 0.13$                                 | –                                          | $\leq 0.8$                                  | –                                          |
| 3C95  | $\geq 330$                          | –                                          | –                                           | $\leq 0.86$                                | $\leq 0.82$                                 | –                                          |
| 3C96  | $\geq 330$                          | –                                          | $\leq 0.1$                                  | –                                          | $\leq 0.6$                                  | $\leq 0.26$                                |
| 3F35  | $\geq 300$                          | –                                          | –                                           | –                                          | –                                           | $\leq 0.13$                                |
| 3F3   | $\geq 315$                          | –                                          | $\leq 0.17$                                 | –                                          | –                                           | $\leq 0.28$                                |
| 3F4   | $\geq 300$                          | –                                          | –                                           | –                                          | –                                           | –                                          |

## Properties of core sets under power conditions (continued)

| GRADE | B (mT) at                           | CORE LOSS (W) at                           |                                             |                                          |                                          |                                          |
|-------|-------------------------------------|--------------------------------------------|---------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
|       | H = 250 A/m; f = 25 kHz; T = 100 °C | f = 500 kHz; $\hat{B} = 50$ mT; T = 100 °C | f = 500 kHz; $\hat{B} = 100$ mT; T = 100 °C | f = 1 MHz; $\hat{B} = 30$ mT; T = 100 °C | f = 1 MHz; $\hat{B} = 50$ mT; T = 100 °C | f = 3 MHz; $\hat{B} = 10$ mT; T = 100 °C |
| 3C90  | $\geq 330$                          | –                                          | –                                           | –                                        | –                                        | –                                        |
| 3C94  | $\geq 330$                          | –                                          | –                                           | –                                        | –                                        | –                                        |
| 3C95  | $\geq 330$                          | –                                          | –                                           | –                                        | –                                        | –                                        |
| 3C96  | $\geq 330$                          | $\leq 0.5$                                 | –                                           | –                                        | –                                        | –                                        |
| 3F35  | $\geq 300$                          | $\leq 0.2$                                 | $\leq 1.5$                                  | –                                        | –                                        | –                                        |
| 3F3   | $\geq 315$                          | –                                          | –                                           | –                                        | –                                        | –                                        |
| 3F4   | $\geq 300$                          | –                                          | –                                           | $\leq 0.43$                              | –                                        | $\leq 0.7$                               |
| 3F45  | $\geq 300$                          | –                                          | –                                           | $\leq 0.34$                              | $\leq 1.25$                              | $\leq 0.55$                              |

**COIL FORMERS****General data**

| PARAMETER                     | SPECIFICATION                                                                                                       |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Coil former material          | phenolformaldehyde (PF), glass-reinforced, flame retardant in accordance with "UL94 V-0"; UL file number E167521(M) |
| Pin material                  | copper-tin alloy (CuSn), Ni flash, tin (Sn) plated, see note 1                                                      |
| Maximum operating temperature | 180 °C, "IEC 60085", class H                                                                                        |
| Resistance to soldering heat  | "IEC 60068-2-20", Part 2, Test Tb, method 1B, 350 °C, 3.5 s                                                         |
| Solderability                 | "IEC 60068-2-20", Part 2, Test Ta, method 1: 235 °C, 2 s                                                            |

**Winding data and area product for EFD20 coil former with 8-pins**

| NUMBER OF SECTIONS | WINDING AREA (mm <sup>2</sup> ) | MINIMUM WINDING WIDTH (mm) | AVERAGE LENGTH OF TURN (mm) | AREA PRODUCT Ae x Aw (mm <sup>4</sup> ) | TYPE NUMBER                    |
|--------------------|---------------------------------|----------------------------|-----------------------------|-----------------------------------------|--------------------------------|
| 1                  | 26.4                            | 13.2                       | 36.5                        | 818                                     | CSH-EFD20-1S-8P <sup>(1)</sup> |

**Note**

- Also available with post-inserted pins.

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## COIL FORMERS

## General data

| PARAMETER                     | SPECIFICATION                                                                                                            |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Coil former material          | liquid crystal polymer (LCP), glass reinforced, flame retardant in accordance with "UL94 V-0"; UL file number E54705 (M) |
| Pin material                  | copper-tin alloy (CuSn), Ni flash, tin (Sn) plated                                                                       |
| Maximum operating temperature | 155 °C, "IEC 60085", class F                                                                                             |
| Resistance to soldering heat  | "IEC 60068-2-20", Part 2, Test Tb, method 1B, 350 °C, 3.5 s                                                              |
| Solderability                 | "IEC 60068-2-20", Part 2, Test Ta, method 1: 235 °C, 2 s                                                                 |

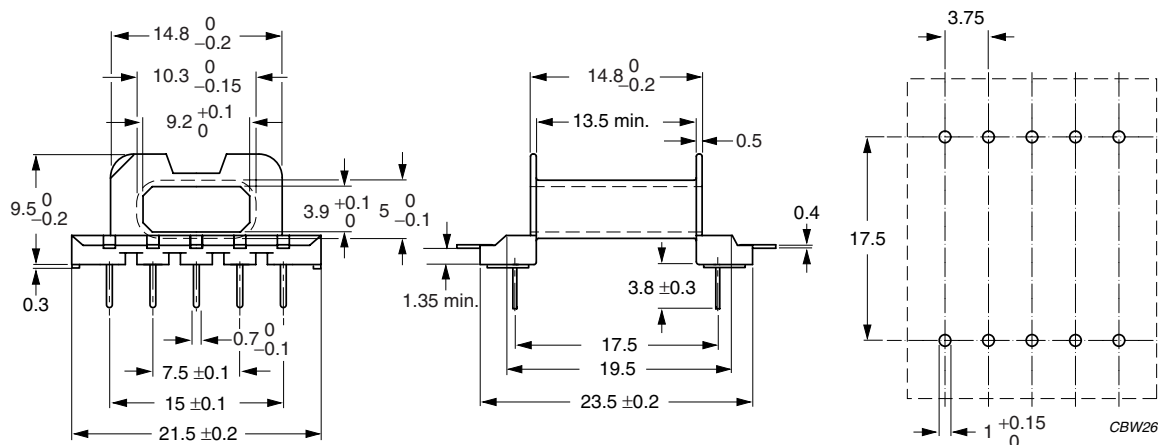


Fig.3 EFD20/10/7 coil former (PCB); 10-pins.

## Winding data and area product for EFD20/10/7 coil former (PCB) with 10-pins

| NUMBER OF SECTIONS | WINDING AREA (mm <sup>2</sup> ) | MINIMUM WINDING WIDTH (mm) | AVERAGE LENGTH OF TURN (mm) | AREA PRODUCT Ae x Aw (mm <sup>4</sup> ) | TYPE NUMBER         |
|--------------------|---------------------------------|----------------------------|-----------------------------|-----------------------------------------|---------------------|
| 1                  | 27.7                            | 13.5                       | 34.1                        | 859                                     | CPH-EFD20-1S-10PD-Z |

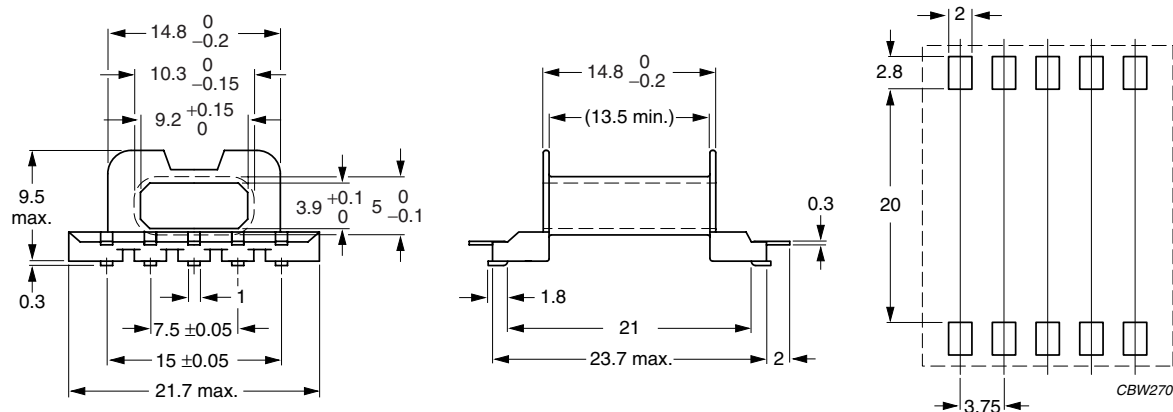
## EFD cores and accessories

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## COIL FORMERS

## General data

| PARAMETER                     | SPECIFICATION                                                                                                            |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Coil former material          | liquid crystal polymer (LCP), glass reinforced, flame retardant in accordance with "UL94 V-0"; UL file number E83005 (M) |
| Pin material                  | copper-tin alloy (CuSn), tin (Sn) plated                                                                                 |
| Maximum operating temperature | 155 °C, "IEC 60085", class F                                                                                             |
| Resistance to soldering heat  | "IEC 60068-2-20", Part 2, Test Tb, method 1B, 350 °C, 3.5 s                                                              |
| Solderability                 | "IEC 60068-2-20", Part 2, Test Ta, method 1: 235 °C, 2 s                                                                 |



Dimensions in mm.

Fig.4 EFD20/10/7 coil former (SMD); 10-solder pads.

## Winding data and area product for EFD20/10/7 coil former (SMD) with 10-solder pads

| NUMBER OF SECTIONS | WINDING AREA (mm <sup>2</sup> ) | MINIMUM WINDING WIDTH (mm) | AVERAGE LENGTH OF TURN (mm) | AREA PRODUCT Ae x Aw (mm <sup>4</sup> ) | TYPE NUMBER       |
|--------------------|---------------------------------|----------------------------|-----------------------------|-----------------------------------------|-------------------|
| 1                  | 27.7                            | 13.5                       | 34.1                        | 859                                     | CPHS-EFD20-1S-10P |

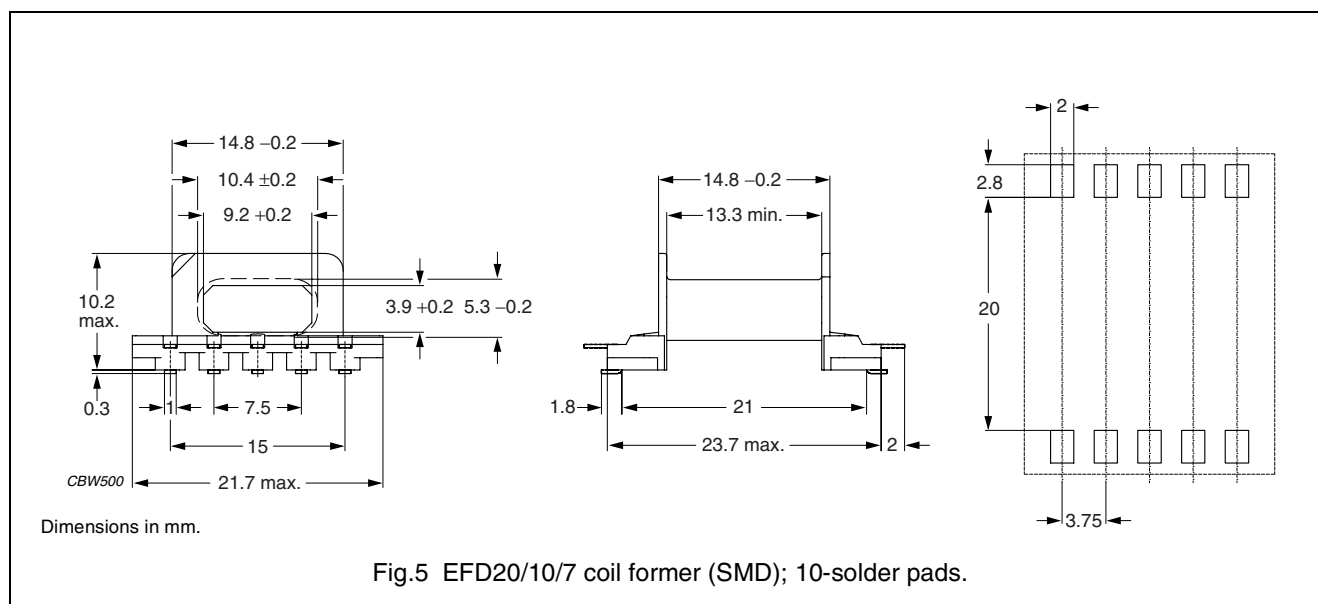
## EFD cores and accessories

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## COIL FORMERS

## General data

| PARAMETER                     | SPECIFICATION                                                                                                       |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Coil former material          | phenolformaldehyde (PF), glass reinforced, flame retardant in accordance with "UL94 V-0"; UL file number E41429 (M) |
| Solder pad material           | copper-tin alloy (CuSn), tin (Sn) plated                                                                            |
| Maximum operating temperature | 180 °C, "IEC 60085", class H                                                                                        |
| Resistance to soldering heat  | "IEC 60068-2-20", Part 2, Test Tb, method 1B, 350 °C, 3.5 s                                                         |
| Solderability                 | "IEC 60068-2-20", Part 2, Test Ta, method 1: 235 °C, 2 s                                                            |



## Winding data and area product for EFD20/10/7 coil former (SMD) with 10-solder pads

| NUMBER OF SECTIONS | NUMBER OF SOLDER PADS | WINDING AREA (mm <sup>2</sup> ) | MINIMUM WINDING WIDTH (mm) | AVERAGE LENGTH OF TURN (mm) | AREA PRODUCT Ae x Aw (mm <sup>4</sup> ) | TYPE NUMBER         |
|--------------------|-----------------------|---------------------------------|----------------------------|-----------------------------|-----------------------------------------|---------------------|
| 1                  | 10                    | 27.2                            | 13.3                       | 34.9                        | 843                                     | CSHS-EFD20-1S-10P-Z |

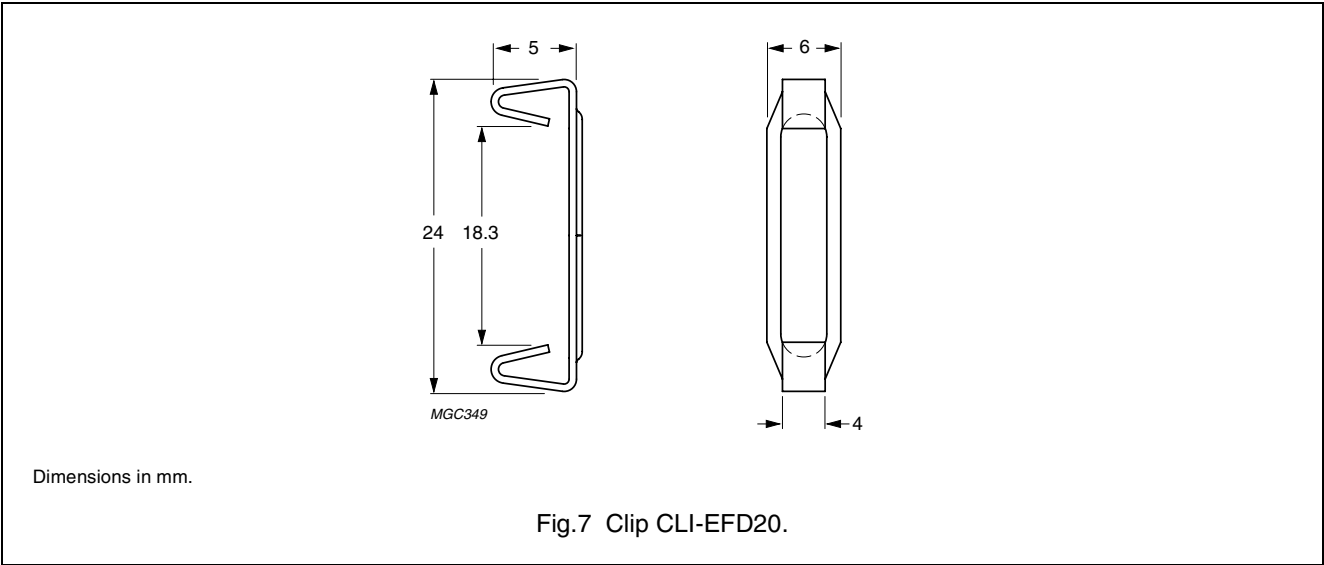
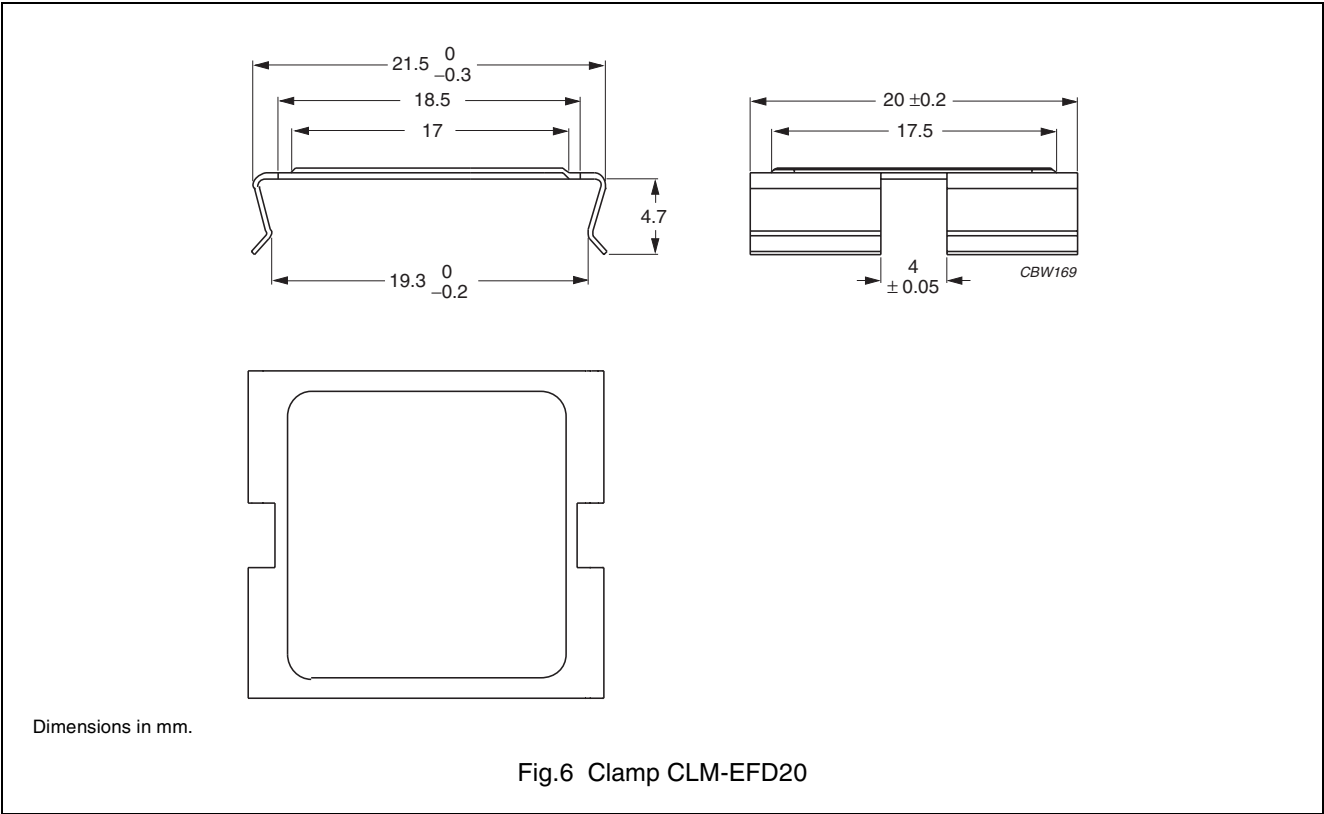
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MOUNTING PARTS

General data

| ITEM  | REMARKS                                                      | FIGURE | TYPE NUMBER |
|-------|--------------------------------------------------------------|--------|-------------|
| Clamp | stainless steel (CrNi); clamping force $\approx 30\text{ N}$ | 6      | CLM-EFD20   |
| Clip  | stainless steel (CrNi); clamping force $\approx 20\text{ N}$ | 7      | CLI-EFD20   |



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## DATA SHEET STATUS DEFINITIONS

| DATA SHEET STATUS         | PRODUCT STATUS | DEFINITIONS                                                                                                                                                                              |
|---------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preliminary specification | Development    | This data sheet contains preliminary data. Ferroxcube reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.     |
| Product specification     | Production     | This data sheet contains final specifications. Ferroxcube reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |

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## PRODUCT STATUS DEFINITIONS

| STATUS           | INDICATION                                                                          | DEFINITION                                                                                                                                                                     |
|------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Prototype</b> |  | These are products that have been made as development samples for the purposes of technical evaluation only. The data for these types is provisional and is subject to change. |
| <b>Design-in</b> |  | These products are recommended for new designs.                                                                                                                                |
| <b>Preferred</b> |                                                                                     | These products are recommended for use in current designs and are available via our sales channels.                                                                            |
| <b>Support</b>   |  | These products are <b>not</b> recommended for new designs and may not be available through all of our sales channels. Customers are advised to check for availability.         |