Features

- Superior circuit protection
- Overcurrent and overvoltage protection
- Blocks surges up to rated limits
- High speed performance
- Small SMT package
- Agency recognition:

Applications

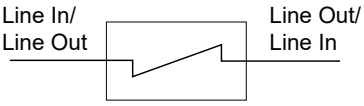
- Voice / VDSL cards
- Protection modules and dongles
- Process control equipment
- Test and measurement equipment
- General electronics

NIDEC COMPONENTS

C-FAP-CA Series - C-FAP Fast Acting Protectors

General Information

The C-FAP-CA Series of NIDEC COMPONENTS C-FAP products are low capacitance single bidirectional high speed protection components, constructed using MOSFET semiconductor technology, and designed to protect against faults caused by short circuits, AC power cross, induction and lightning surges.



C-FAP Device

The C-FAP high speed protector placed in the system circuit will monitor the current with the MOSFET detection circuit triggering to provide an effective barrier behind which sensitive electronics will not be exposed to large voltages or currents during surge events. The C-FAP device is provided in a surface mount DFN package and meets industry standard requirements such as RoHS and Pb Free solder reflow profiles.

Agency Approval

Description	
UL	File Number: E344793

Absolute Maximum Ratings (@ T_A = 25 °C Unless Otherwise Noted)

Symbol	Parameter	Part Number	Value	Unit
V_{imp}	Peak impulse voltage withstand with duration less than 10 ms	C-FAP-CA025-xxx-WH C-FAP-CA040-xxx-WH C-FAP-CA050-xxx-WH C-FAP-CA065-xxx-WH C-FAP-CA085-xxx-WH	250 400 500 650 850	V
V_{rms}	Continuous A.C. RMS voltage	C-FAP-CA025-xxx-WH C-FAP-CA040-xxx-WH C-FAP-CA050-xxx-WH C-FAP-CA065-xxx-WH C-FAP-CA085-xxx-WH	100 200 250 300 425	V
T_{op}	Operating temperature range		-40 to +125	°C
T_{stg}	Storage temperature range		-65 to +150	°C
T_{jmax}	Maximum Junction Temperature		+125	°C
ESD	HBM ESD protection per IEC 61000-4-2		±2	kV

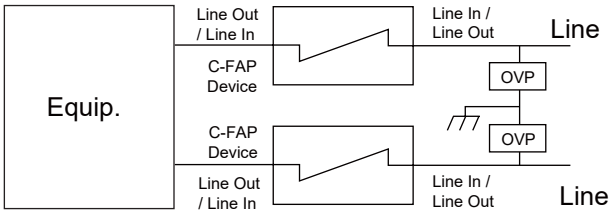
*RoHS Directive 2015/863, Mar. 31, 2015 and Annex.
Specifications are subject to change without notice.
Customers should verify actual device performance in their specific applications.

Electrical Characteristics (@ T_A = 25 °C Unless Otherwise Noted)

Symbol	Parameter		Part Number	Min.	Typ.	Max.	Unit
$I_{trigger}$	Current required for the device to go from operating state to protected state		C-FAP-CAxxx-050-WH C-FAP-CAxxx-100-WH C-FAP-CAxxx-200-WH C-FAP-CAxxx-300-WH C-FAP-CAxxx-500-WH	50 100 200 300 500	75 150 300 450 750	100 200 400 600 1000	mA
$R_{C\text{-}FAP}$	Series resistance of the C-FAP device	V_{imp} = 250 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 500 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 500 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 500 mA V_{imp} = 650 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 650 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 650 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 650 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 650 V $I_{trigger}$ (min.) = 500 mA V_{imp} = 850 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 850 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 850 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 850 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 850 V $I_{trigger}$ (min.) = 500 mA	C-FAP-CA025-050-WH C-FAP-CA025-100-WH C-FAP-CA025-200-WH C-FAP-CA025-300-WH C-FAP-CA025-500-WH C-FAP-CA040-050-WH C-FAP-CA040-100-WH C-FAP-CA040-200-WH C-FAP-CA040-300-WH C-FAP-CA040-500-WH C-FAP-CA050-050-WH C-FAP-CA050-100-WH C-FAP-CA050-200-WH C-FAP-CA050-300-WH C-FAP-CA050-500-WH C-FAP-CA065-050-WH C-FAP-CA065-100-WH C-FAP-CA065-200-WH C-FAP-CA065-300-WH C-FAP-CA065-500-WH C-FAP-CA085-050-WH C-FAP-CA085-100-WH C-FAP-CA085-200-WH C-FAP-CA085-300-WH C-FAP-CA085-500-WH		13.3 7.1 4.2 3.2 2.6 14.3 8.1 5.2 4.3 3.6 15.7 9.5 6.6 5.6 5.0 17.7 11.5 8.6 7.6 7.0 21.4 15.2 12.3 11.3 10.7	15.3 8.2 4.8 3.8 3.0 16.5 9.4 6.0 5.0 4.2 18.0 10.9 7.5 6.5 5.7 20.3 13.2 9.8 8.8 8.0 24.5 17.4 14.0 13.0 12.2	Ω
t_{block}	Time for the device to go from normal operating state to protected state					1	µs
I_Q	Current through the triggered C-FAP device with 50 Vdc circuit voltage			0.25	0.50	1.00	mA
V_{reset}	Voltage below which the triggered C-FAP device will transition to normal operating state			12	16	20	V
$R_{th(j\text{-}l)}$	Junction to package pads - FR4 using recommended pad layout				98		°C/W
$R_{th(j\text{-}l)}$	Junction to package pads - FR4 using heat sink on board (6 cm ^{2}) (1 in^2)				40		°C/W

Reference Application

The C-FAP devices are general use protectors used in a wide variety of applications. The maximum voltage rating of the C-FAP device should never be exceeded. Where necessary, an OVP should be employed to limit the maximum voltage. A cost-effective protection solution combines NIDEC COMPONENTS C-FAP protection devices with a pair of Bourns® MOVs. For bandwidth sensitive applications, a Bourns® GDT may be substituted for the MOV.



Basic C-FAP Operation

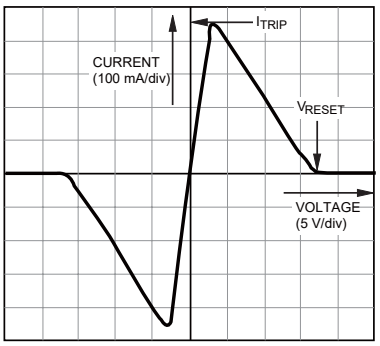
The C-FAP device, constructed using MOSFET semiconductor technology, placed in the system circuit will monitor the current with the MOSFET detection circuit triggering to provide an effective barrier behind which sensitive electronics are not exposed to large voltages or currents during surge events. The C-FAP device operates in approximately 1 µs - once line current exceeds the C-FAP device's trigger current Itrigger. When operated, the C-FAP device restricts line current to less than 1 mA typically. When operated, the C-FAP device will block all voltages including the surge up to rated limits.

After the surge, the C-FAP device resets when the voltage across the C-FAP device falls to the V_{reset} level. The C-FAP device will automatically reset on lines which have no DC bias or have DC bias below V_{reset} (such as unpowered signal lines).

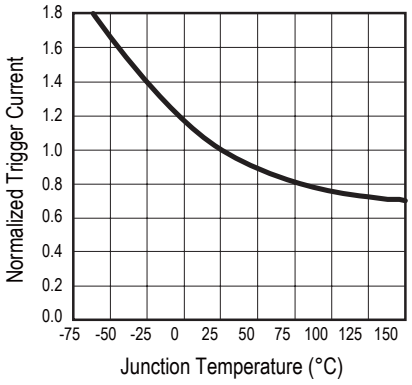
If the line has a normal DC bias above V_{reset}, the voltage across the C-FAP device may not fall below V_{reset} after the surge. In such cases, special care needs to be taken to ensure that the C-FAP device will reset, with software monitoring as one method used to accomplish this. NIDEC COMPONENTS application engineers can provide further assistance.

Performance Graphs

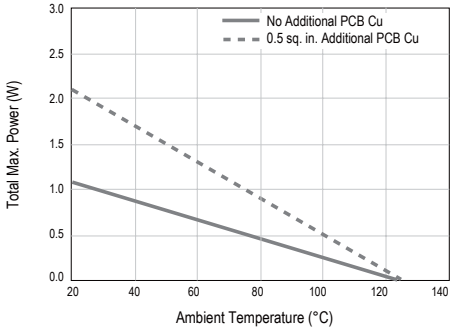
Typical V-I Characteristics (C-FAP-CA050-300-WH)



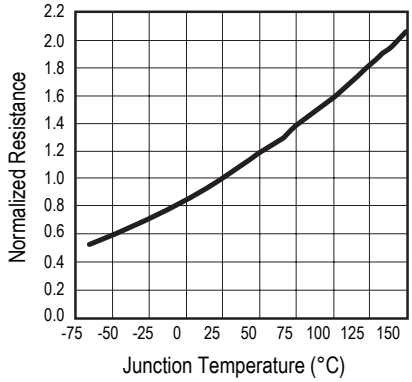
Typical Trigger Current vs. Temperature



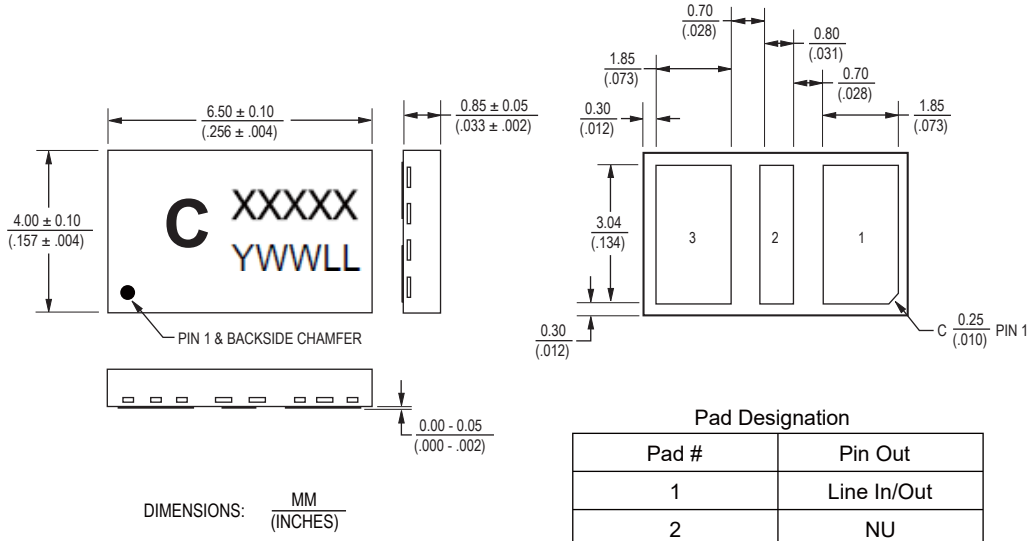
Power Derating Curve



Typical Resistance vs. Temperature



Product Dimensions



DIMENSIONS: MM / (INCHES)

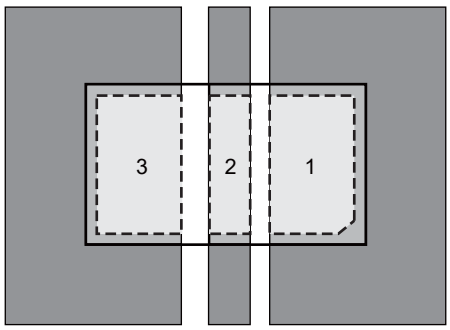
Note. Unless otherwise specified, tolerance ; ±0.10 (unit : mm)

Pad Designation

Pad #	Pin Out
1	Line In/Out
2	NU
3	Line Out/In

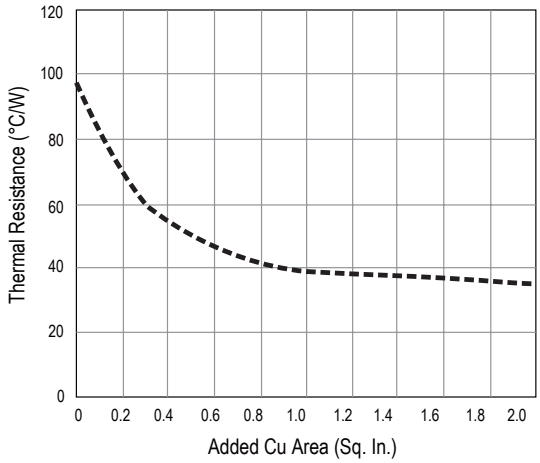
Recommended Pad Layout

C-FAP protectors have matte-tin termination finish. The suggested layout should use Non-Solder Mask Define (NSMD). The recommended stencil thickness is 0.10-0.12 mm (.004-.005 in.) with a stencil opening size 0.025 mm (.0010 in.) less than the device pad size. As when heat sinking any power device, it is recommended that wherever possible, extra PCB copper area is allowed. For minimum parasitic capacitance, do not allow any signal, ground or power signals beneath any of the pads of the device.



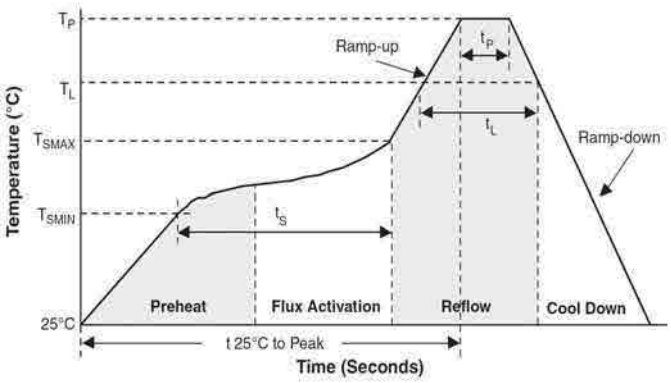
Dark grey areas show added PCB copper area for better thermal resistance.

Thermal Resistance vs Additional PCB Cu Area



Reflow Profile

Reflow Profile	Pb-Free Assembly
Average Ramp-Up Rate (Tsmax to Tp)	3 °C/sec. max.
Preheat - Temperature Min. (Tsmin) - Temperature Max. (Tsmax) - Time (tsmin to tsmax)	 150 °C 200 °C 60-180 sec.
Time maintained above: - Temperature (TL) - Time (tL)	 217 °C 60-150 sec.
Peak/Classification Temperature (Tp)	260 °C
Time within 5 °C of Actual Peak Temp. (tp)	20-40 sec.
Ramp-Down Rate	6 ℃/sec. max.
Time 25 °C to Peak Temperature	8 min. max.



How to Order

C-FAP - CA 085 - 500 - WH

C-FAP Product

Series
CA = Bi-Series

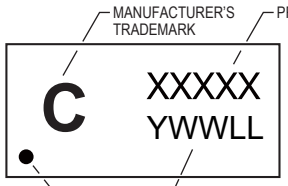
Impulse Voltage Rating
025 = 250 V
040 = 400 V
050 = 500 V
065 = 650 V
085 = 850 V

Trigger Current
050 = 50 mA
100 = 100 mA
200 = 200 mA
300 = 300 mA
500 = 500 mA

Hold to Trip Ratio Suffix
W = Hold to Trip Ratio

Package Suffix
H = DFN Package

Typical Part Marking

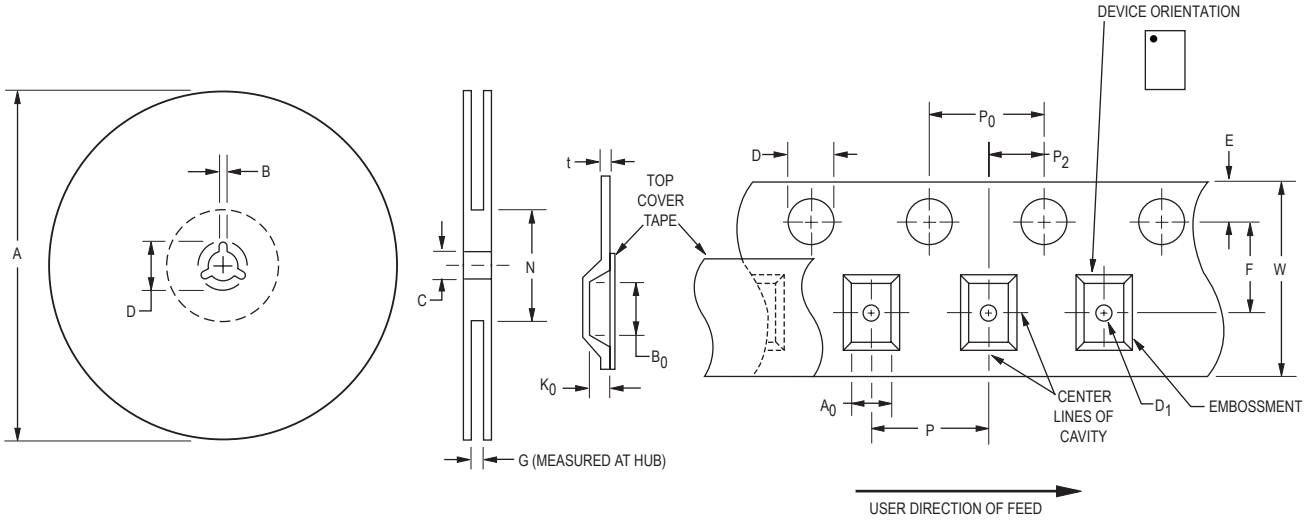


MANUFACTURER'S TRADEMARK

PRODUCT CODE
- 1ST DIGIT INDICATES PRODUCT FAMILY:
A = C-FAP-CA SERIES
- 2ND & 3RD DIGITS INDICATE IMPULSE VOLTAGE:
25 = 250 V 40 = 400 V 50 = 500 V
65 = 650 V 85 = 850 V
- 4TH & 5TH DIGITS INDICATE TRIGGER CURRENT:
05 = 50 mA 10 = 100 mA 20 = 200 mA
30 = 300 mA 50 = 500 mA

MANUFACTURING DATE CODE
• 1ST DIGIT INDICATES THE YEAR.
• 2ND & 3RD DIGITS INDICATE THE WEEK NUMBER.
• 4TH & 5TH DIGITS INDICATE THE LOT CODE

Packaging Specifications



QUANTITY: 3000 PIECES PER REEL

A		B		C		D		G	N
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Ref.	Ref.
326 (12.835)	330 (13.002)	1.5 (.059)	2.5 (.098)	12.8 (.504)	13.5 (.531)	20.2 (.795)	-	16.5 (.650)	102 (4.016)

A_0		B_0		D		D_1		E		F	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	max.
4.3 (.169)	4.5 (.177)	6.7 (.264)	6.9 (.272)	1.5 (.059)	1.6 (.063)	1.5 (.059)	-	1.65 (.065)	1.85 (.073)	7.4 (.291)	7.6 (.299)
K_0		P		P_0		P_2		t		W	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1.0 (.039)	1.2 (.047)	7.9 (.311)	8.1 (.319)	3.9 (.159)	4.1 (.161)	1.9 (.075)	2.1 (.083)	0.25 (.010)	0.35 (.014)	15.7 (.618)	16.3 (.642)

DIMENSIONS: MM (INCHES)

Revision History

Date	Rev.	Reason
10/12/2010	A	Initial issue
05/15/2012	A1	Updated Performance Graphs and Packaging Specifications
07/16/2014	A2	Tolerance was added to the product size.
02/13/2017	B	Change marking.
04/03/2023	C	Change our company name.