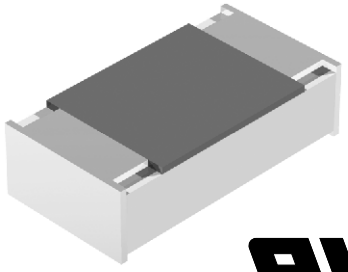
Thin Film Flat Chip Fuses



FEATURES

- Advanced thin film technology
- Very quick acting fuse characteristics
- Outstanding stability of fusing characteristics
- Standard metric SMD sizes
- Green product, supports lead (Pb)-free soldering

APPLICATIONS

- Information technology
- Industrial electronics
- Automotive electronics
- Telecommunication
- Medical equipment
- Audio/video electronics

MFU Thin Film Flat Chip Fuses are the perfect choice for the most fields of modern electronics. The highly controlled manufacturing thin film process guarantees an outstanding stability of fusing characteristics. Typical applications include information technology, telecommunication, medical equipment, industrial, audio/video, and automotive electronics.

METRIC SIZE				
INCH:	0402	0603	0805	1206
METRIC:	RR 1005M	RR 1608M	RR 2012M	RR 3216M

TECHNICAL SPECIFICATION					
DESCRIPTION		**MFU 0402**	**MFU 0603**	**MFU 0805**	**MFU 1206**
Metric size		RR 1005M	RR 1608M	RR 2012M	RR 3216M
Rated Current range I_R		0.5 A to 2.0 A	0.5 A to 5.0 A	0.5 A to 5.0 A	0.5 A to 6.3 A
Rated voltage, U_{max} DC		32 V	32 V	32 V	63 V
Breaking Capacity, I_{max} at U_{max} DC		50 A at 32 V	50 A at 32 V	50 A at 32 V	50 A at 63 V
Voltage drop at 1 x I_R		115 mV to 420 mV	85 mV to 361 mV	98 mV to 374 mV	116 mV to 433 mV
Cold resistance at 0.1 x I_R		44 mΩ to 640 mΩ	13 mΩ to 550 mΩ	15 mΩ to 570 mΩ	14 mΩ to 660 mΩ
Climatic category (LCT/UCT/days)		55/125/56	55/125/56	55/125/56	55/125/56
Permissible continuous current rating at $\vartheta_{amb.}$ = 23 °C		0.7 x I_R	0.7 x I_R	0.7 x I_R	0.7 x I_R
Approval	UL recognition file	E253806	E253806	E253806	E253806
	IEC 60127-4	n/a	Refer to Table: MFU 0603 RATING		Refer to Table: MFU 1206 RATING

PART NUMBER AND PRODUCT DESCRIPTION MFU SERIES[1)]

PART NUMBER[2)]: MFU0603FF01000PW00

M	F	U	0	6	0	3	F	F	0	1	0	0	0	P	W	0	0

MODEL/SIZE	FUSE CHARACTERISTIC	RATED CURRENT VALUE	PACKAGING[3)]	SPECIAL
MFU0402 **MFU0603** **MFU0805** **MFU1206**	**FF** = Very Quick Acting	**Rated current value in mA.** **Examples:** 00500 = 0.5 A 01000 = 1.0 A 06300 = 6.3 A	**E1** **E5** **E0** **P1** **P5** **PW**	up to 2 digits **00** = standard

PRODUCT DESCRIPTION[4)]: MFU 0603 -FF PW 1A0

MFU	0603	-FF	PW	1A0
MODEL	SIZE	FUSE CHARACTERISTIC	PACKAGING[3)]	RATED CURRENT VALUE
MFU	**0402** **0603** **0805** **1206**	**FF** = Very Quick Acting	**E1** **E5** **E0** **P1** **P5** **PW**	**See Rating Tables** **Examples:** **0A5** = 0.5 A **1A0** = 1.0 A **6A3** = 6.3 A

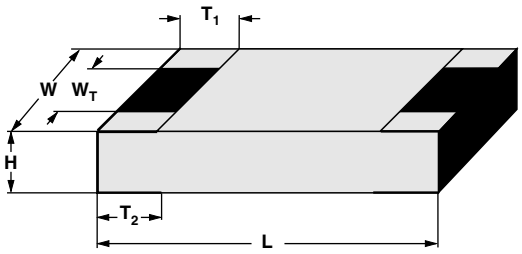
Notes

1. Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION.
2. The PART NUMBER is shown to facilitate the introduction of a unified part numbering system.
3. Please refer to table PACKAGING.
4. We recommend that the PRODUCT DESCRIPTION is used to minimize the possibility of errors in order handling.

PACKAGING

MODEL	REEL		
	DIAMETER	PIECES/REEL	CODE
MFU0402	180 mm/7"	1000	E1
	180 mm/7"	5000	E5
	180 mm/7"	10 000	E0
MFU0603	180 mm/7"	1000	P1
	180 mm/7"	5000	P5
	330 mm/13"	20 000	PW
MFU0805	180 mm/7"	1000	P1
	180 mm/7"	5000	P5
	330 mm/13"	20 000	PW
MFU1206	180 mm/7"	1000	P1
	180 mm/7"	5000	P5
	330 mm/13"	20 000	PW

DIMENSIONS



DIMENSIONS - Chip Fuse types, mass and relevant physical dimensions							
TYPE	**H (mm)**	**L (mm)**	**W (mm)**	**W_T (mm)**	**T_1 (mm)**	**T_2 (mm)**	**MASS (mg)**
MFU 0402	0.32 ± 0.05	1.0 ± 0.05	0.5 ± 0.05	> 75 % of W	0.2 + 0.1/- 0.15	0.2 ± 0.1	0.65
MFU 0603	0.45 + 0.1/- 0.05	1.55 ± 0.05	0.85 ± 0.1	> 75 % of W	0.3 + 0.15/- 0.2	0.3 + 0.15/- 0.2	1.9
MFU 0805	0.45 + 0.1/- 0.05	2.0 ± 0.1	1.25 ± 0.15	> 75 % of W	0.4 + 0.1/- 0.2	0.4 + 0.1/- 0.2	4.7
MFU 1206	0.55 ± 0.1	3.2 + 0.1/- 0.2	1.6 ± 0.15	> 75 % of W	0.5 ± 0.25	0.5 ± 0.25	9.5

MFU 0402 RATING - very quick acting (FF)										
SIZE	**FUSE CHAR.**	**RATED CURRENT[1)]**	**RATED VOLTAGE**	**PRE-ARCING[2)] I^2t at 10 x I_R**	**VOLT. DROP[2)] at 1 x I_R**	**COLD RESIS.[2)] at 0.1 x I_R**	**BREAKING CAPACITY DC**	**MARK.**	**APPROVAL**	**ORDERING CODE[3)4)]**
0402	FF	500 mA[5)]	32 V	0.0009 A^2s	420 mV	640 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 0A5
		630 mA[5)]	32 V	0.0014 A^2s	331 mV	400 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 0A63
		750 mA[5)]	32 V	0.0020 A^2s	275 mV	280 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 0A75
		800 mA	32 V	0.0023 A^2s	231 mV	220 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 0A8
		1.0 A	32 V	0.0028 A^2s	184 mV	140 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 1A0
		1.25 A	32 V	0.0039 A^2s	159 mV	97 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 1A25
		1.5 A	32 V	0.0059 A^2s	146 mV	74 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 1A5
		1.6 A	32 V	0.0065 A^2s	136 mV	65 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 1A6
		1.75 A	32 V	0.0077 A^2s	124 mV	54 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 1A75
		2.0 A	32 V	0.0101 A^2s	115 mV	44 mΩ	50 A at 32 V	-	UL	MFU 0402-FF E0 2A0

Notes

1. Other values of rated current are available on request
2. Typical values
3. For packages with 1000 pieces, please use for packaging E1 instead of E0
4. For packages with 5000 pieces, please use for packaging E5 instead of E0
5. Available on request

MFU 0603 RATING - very quick acting (FF)										
SIZE	**FUSE CHAR.**	**RATED CURRENT[1)]**	**RATED VOLTAGE**	**PRE-ARCING[2)] I^2t at 10 x I_R**	**VOLT. DROP[2)] at 1 x I_R**	**COLD RESIS.[2)] at 0.1 x I_R**	**BREAKING CAPACITY DC**	**MARK.**	**APPROVAL**	**ORDERING CODE[3)4)]**
0603	FF	500 mA	32 V	0.0009 A^2s	361 mV	550 mΩ	50 A at 32 V	F	UL/IEC	MFU 0603-FF PW 0A5
		630 mA	32 V	0.0014 A^2s	331 mV	400 mΩ	50 A at 32 V	CT	UL	MFU 0603-FF PW 0A63
		750 mA	32 V	0.0020 A^2s	258 mV	262 mΩ	50 A at 32 V	G	UL	MFU 0603-FF PW 0A75
		800 mA	32 V	0.0023 A^2s	249 mV	237 mΩ	50 A at 32 V	CV	UL	MFU 0603-FF PW 0A8
		1.0 A	32 V	0.0028 A^2s	223 mV	170 mΩ	50 A at 32 V	H	UL/IEC	MFU 0603-FF PW 1A0
		1.25 A	32 V	0.0039 A^2s	180 mV	110 mΩ	50 A at 32 V	J	UL	MFU 0603-FF PW 1A25
		1.5 A	32 V	0.0059 A^2s	155 mV	79 mΩ	50 A at 32 V	K	UL	MFU 0603-FF PW 1A5
		1.6 A	32 V	0.0065 A^2s	159 mV	76 mΩ	50 A at 32 V	EF	UL/IEC	MFU 0603-FF PW 1A6
		1.75 A	32 V	0.0077 A^2s	138 mV	60 mΩ	50 A at 32 V	L	UL	MFU 0603-FF PW 1A75
		2.0 A	32 V	0.0101 A^2s	150 mV	57 mΩ	50 A at 32 V	N	UL/IEC	MFU 0603-FF PW 2A0
		2.5 A	32 V	0.0157 A^2s	121 mV	37 mΩ	50 A at 32 V	O	UL	MFU 0603-FF PW 2A5
		3.0 A	32 V	0.0227 A^2s	126 mV	32 mΩ	50 A at 32 V	P	UL	MFU 0603-FF PW 3A0
		3.15 A	32 V	0.0250 A^2s	120 mV	29 mΩ	50 A at 32 V	EL	UL/IEC	MFU 0603-FF PW 3A15
		3.5 A	32 V	0.0308 A^2s	106 mV	23 mΩ	50 A at 32 V	R	UL	MFU 0603-FF PW 3A5
		4.0 A	32 V	0.0403 A^2s	100 mV	19 mΩ	50 A at 32 V	S	UL	MFU 0603-FF PW 4A0
		5.0 A	32 V	0.2275 A^2s	85 mV	13 mΩ	50 A at 32 V	T	UL	MFU 0603-FF PW 5A0

Notes
1. Other values of rated current are available on request
2. Typical values
3. For packages with 1000 pieces, please use for packaging P1 instead of PW
4. For packages with 5000 pieces, please use for packaging P5 instead of PW

MFU 0805 RATING - very quick acting (FF)										
SIZE	**FUSE CHAR.**	**RATED CURRENT[1)]**	**RATED VOLTAGE**	**PRE-ARCING[2)] I^2t at 10 x I_R**	**VOLT. DROP[2)] at 1 x I_R**	**COLD RESIS.[2)] at 0.1 x I_R**	**BREAKING CAPACITY DC**	**MARK.**	**APPROVAL**	**ORDERING CODE[3)4)]**
0805	FF	500 mA	32 V	0.0009 A^2s	374 mV	570 mΩ	50 A at 32 V	F	UL	MFU 0805-FF PW 0A5
		630 mA	32 V	0.0014 A^2s	347 mV	420 mΩ	50 A at 32 V	CT	UL	MFU 0805-FF PW 0A63
		750 mA	32 V	0.0021 A^2s	280 mV	285 mΩ	50 A at 32 V	G	UL	MFU 0805-FF PW 0A75
		800 mA	32 V	0.0023 A^2s	262 mV	250 mΩ	50 A at 32 V	CV	UL	MFU 0805-FF PW 0A8
		1.0 A	32 V	0.0028 A^2s	243 mV	185 mΩ	50 A at 32 V	H	UL	MFU 0805-FF PW 1A0
		1.25 A	32 V	0.0040 A^2s	205 mV	125 mΩ	50 A at 32 V	J	UL	MFU 0805-FF PW 1A25
		1.5 A	32 V	0.0059 A^2s	171 mV	87 mΩ	50 A at 32 V	K	UL	MFU 0805-FF PW 1A5
		1.6 A	32 V	0.0065 A^2s	164 mV	78 mΩ	50 A at 32 V	EF	UL	MFU 0805-FF PW 1A6
		1.75 A	32 V	0.0077 A^2s	161 mV	70 mΩ	50 A at 32 V	L	UL	MFU 0805-FF PW 1A75
		2.0 A	32 V	0.0101 A^2s	176 mV	67 mΩ	50 A at 32 V	N	UL	MFU 0805-FF PW 2A0
		2.5 A	32 V	0.0157 A^2s	131 mV	40 mΩ	50 A at 32 V	O	UL	MFU 0805-FF PW 2A5
		3.0 A	32 V	0.0227 A^2s	134 mV	34 mΩ	50 A at 32 V	P	UL	MFU 0805-FF PW 3A0
		3.15 A	32 V	0.0250 A^2s	128 mV	31 mΩ	50 A at 32 V	EL	UL	MFU 0805-FF PW 3A15
		3.5 A	32 V	0.0308 A^2s	119 mV	26 mΩ	50 A at 32 V	R	UL	MFU 0805-FF PW 3A5
		4.0 A	32 V	0.0403 A^2s	105 mV	20 mΩ	50 A at 32 V	S	UL	MFU 0805-FF PW 4A0
		5.0 A	32 V	0.2275 A^2s	98 mV	15 mΩ	50 A at 32 V	T	UL	MFU 0805-FF PW 5A0

Notes
1. Other values of rated current are available on request
2. Typical values
3. For packages with 1000 pieces, please use for packaging P1 instead of PW
4. For packages with 5000 pieces, please use for packaging P5 instead of PW

MFU 1206 RATING - very quick acting (FF)										
SIZE	**FUSE CHAR.**	**RATED CURRENT[1)]**	**RATED VOLTAGE**	**PRE-ARCING[2)] I^2t at 10 x I_R**	**VOLT. DROP[2)] at 1 x I_R**	**COLD RESIS.[2)] at 0.1 x I_R**	**BREAKING CAPACITY DC**	**MARK.**	**APPROVAL**	**ORDERING CODE[3)4)]**
1206	FF	500 mA	63 V	0.0009 A^2s	433 mV	660 mΩ	50 A at 63 V	F	UL/IEC	MFU 1206-FF PW 0A5
		630 mA	63 V	0.0014 A^2s	372 mV	450 mΩ	50 A at 63 V	CT	UL	MFU 1206-FF PW 0A63
		750 mA	63 V	0.0022 A^2s	325 mV	330 mΩ	50 A at 63 V	G	UL	MFU 1206-FF PW 0A75
		800 mA	63 V	0.0023 A^2s	273 mV	260 mΩ	50 A at 63 V	CV	UL	MFU 1206-FF PW 0A8
		1.0 A	63 V	0.0028 A^2s	262 mV	200 mΩ	50 A at 63 V	H	UL/IEC	MFU 1206-FF PW 1A0
		1.25 A	63 V	0.0041 A^2s	230 mV	140 mΩ	50 A at 63 V	J	UL	MFU 1206-FF PW 1A25
		1.5 A	63 V	0.0059 A^2s	207 mV	105 mΩ	50 A at 63 V	K	UL	MFU 1206-FF PW 1A5
		1.6 A	63 V	0.0066 A^2s	168 mV	80 mΩ	50 A at 63 V	EF	UL/IEC	MFU 1206-FF PW 1A6
		1.75 A	63 V	0.0077 A^2s	174 mV	76 mΩ	50 A at 63 V	L	UL	MFU 1206-FF PW 1A75
		2.0 A	63 V	0.0102 A^2s	181 mV	69 mΩ	50 A at 63 V	N	UL/IEC	MFU 1206-FF PW 2A0
		2.5 A	63 V	0.0159 A^2s	161 mV	49 mΩ	50 A at 63 V	O	UL	MFU 1206-FF PW 2A5
		3.0 A	63 V	0.0229 A^2s	173 mV	44 mΩ	50 A at 63 V	P	UL	MFU 1206-FF PW 3A0
		3.15 A	63 V	0.0251 A^2s	153 mV	37 mΩ	50 A at 63 V	EL	UL/IEC	MFU 1206-FF PW 3A15
		3.5 A	63 V	0.0310 A^2s	161 mV	35 mΩ	50 A at 63 V	R	UL	MFU 1206-FF PW 3A5
		4.0 A	63 V	0.0404 A^2s	147 mV	28 mΩ	50 A at 63 V	S	UL	MFU 1206-FF PW 4A0
		5.0 A	63 V	0.2275 A^2s	131 mV	20 mΩ	50 A at 63 V	T	UL	MFU 1206-FF PW 5A0
		6.3 A	63 V	0.5160 A^2s	116 mV	14 mΩ	50 A at 63 V	ET	UL	MFU 1206-FF PW 6A3

Notes

1. Other values of rated current are available on request
2. Typical values
3. For packages with 1000 pieces, please use for packaging P1 instead of PW
4. For packages with 5000 pieces, please use for packaging P5 instead of PW

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade ceramic body. The fuse elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure tin on nickel plating.

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual fuses. Only accepted products are laid directly into the paper tape in accordance with **IEC 60286-3**.

APPROVALS

The fuses are tested in accordance with **IEC 60127-4** and UL 248-14 which refers to **UL 248-1, IEC 60127-1** and **IEC 60068** series. VDE-approval of conformity is indicated by the **UMF** Logo on the package label. Recognition by Underwriter Laboratories Inc. is indicated by the **UL** logo on the package label.

Pb-free Identification on the Package Label

ASSEMBLY

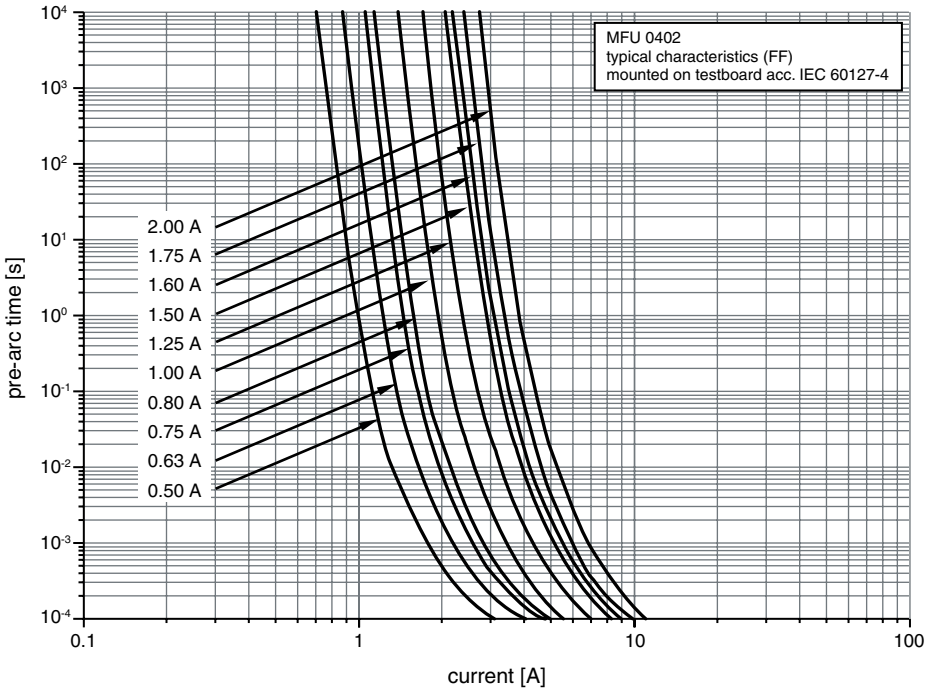
The fuses are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The fuses are RoHS copmliant, the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing. All products comply with the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances.

This includes full compliance with the following directives:

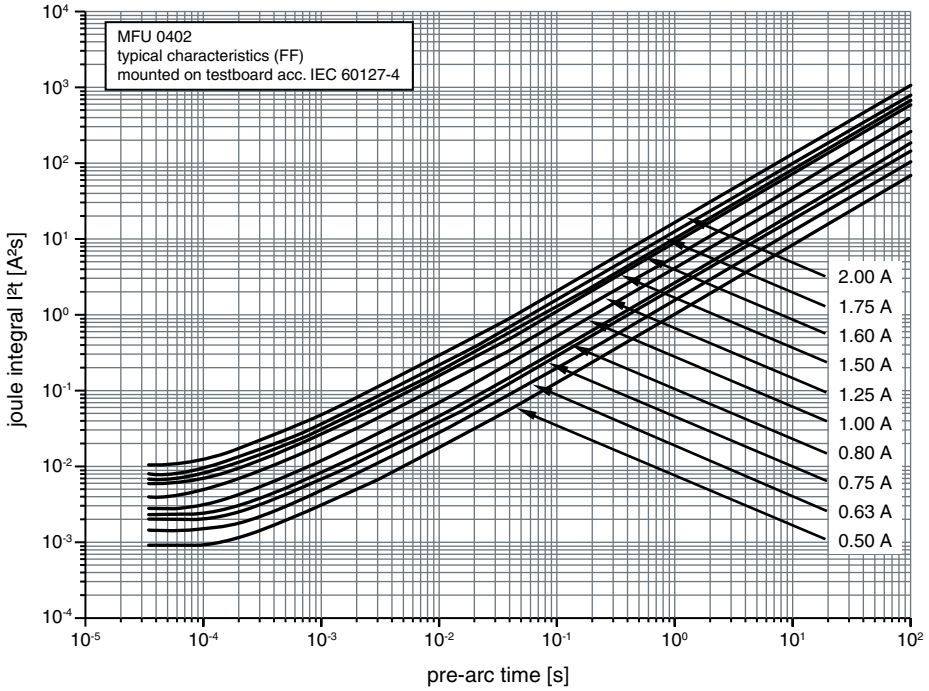
- 2000/53/EC End of Vehicle life Directive (ELV)
- 2000/53/EC Annex II to End of Vehicle Life Directive (ELV II)
- 2002/95/EC Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

Solderability is specified for 2 years after production or requalification. The permitted storage time is 20 years.

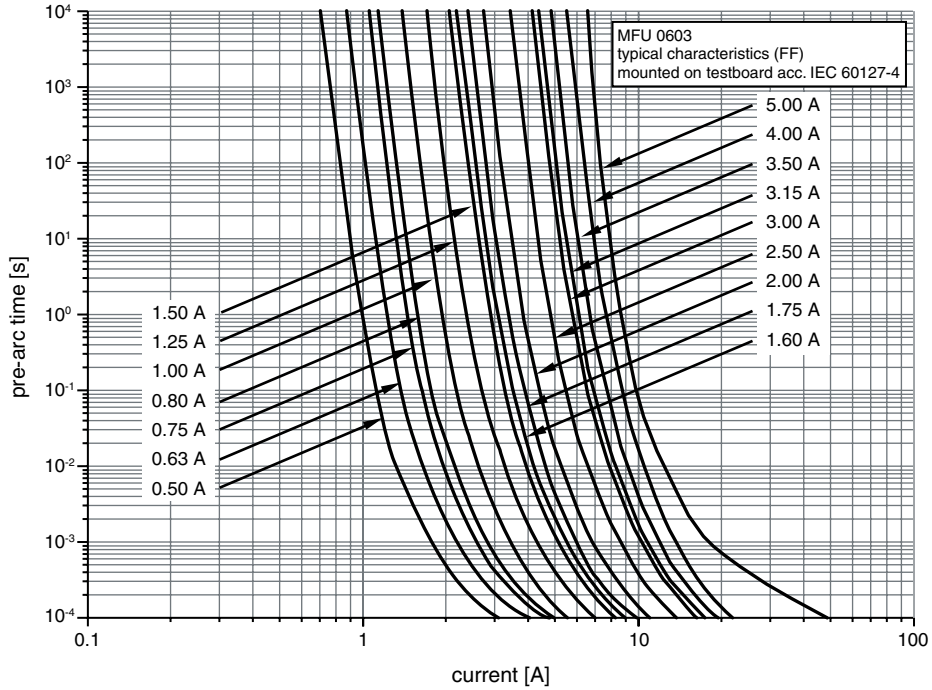
FUNCTIONAL PERFORMANCE



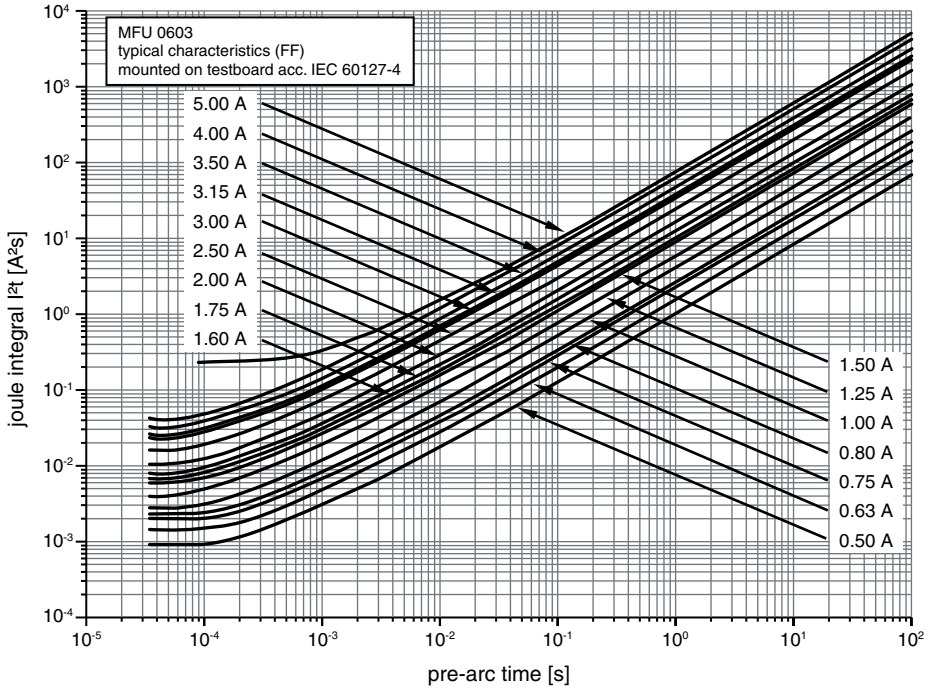
Typical I-t Characteristic of MFU 0402



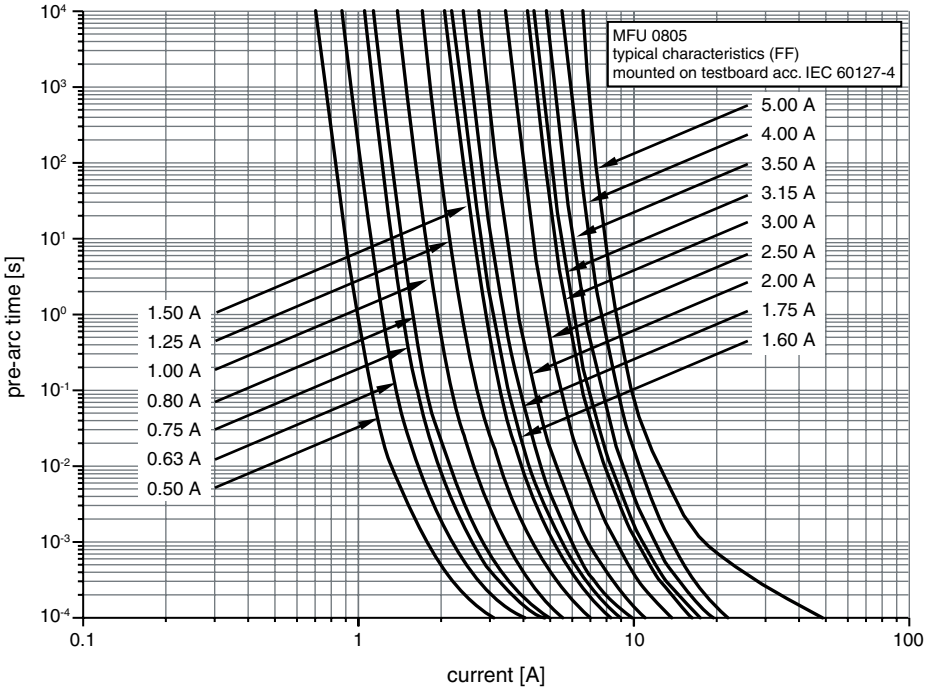
Typical I^2t vs. t Characteristic of MFU 0402



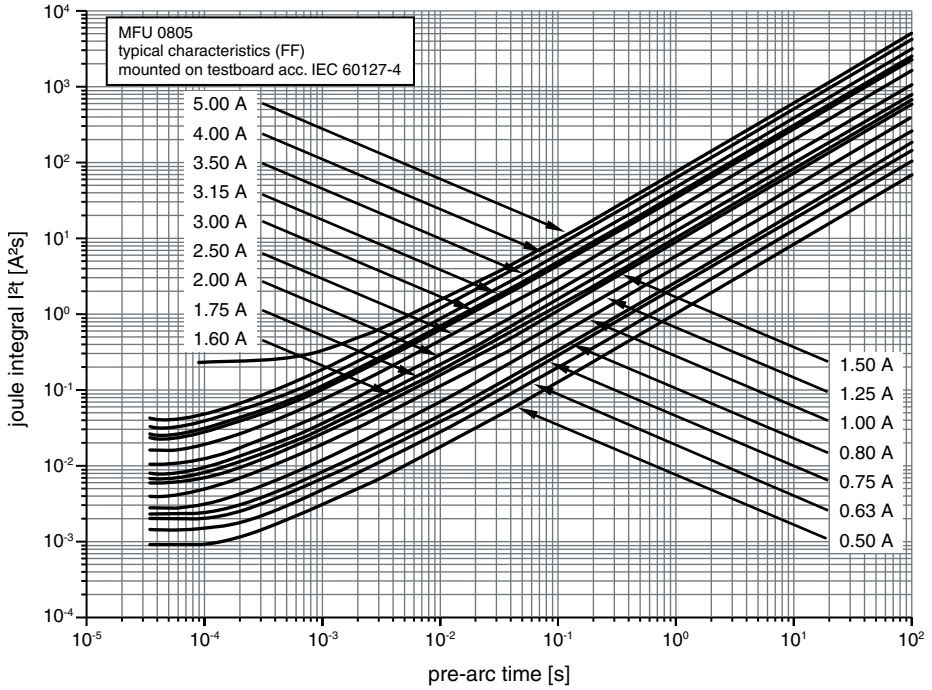
Typical I-t Characteristic of MFU 0603



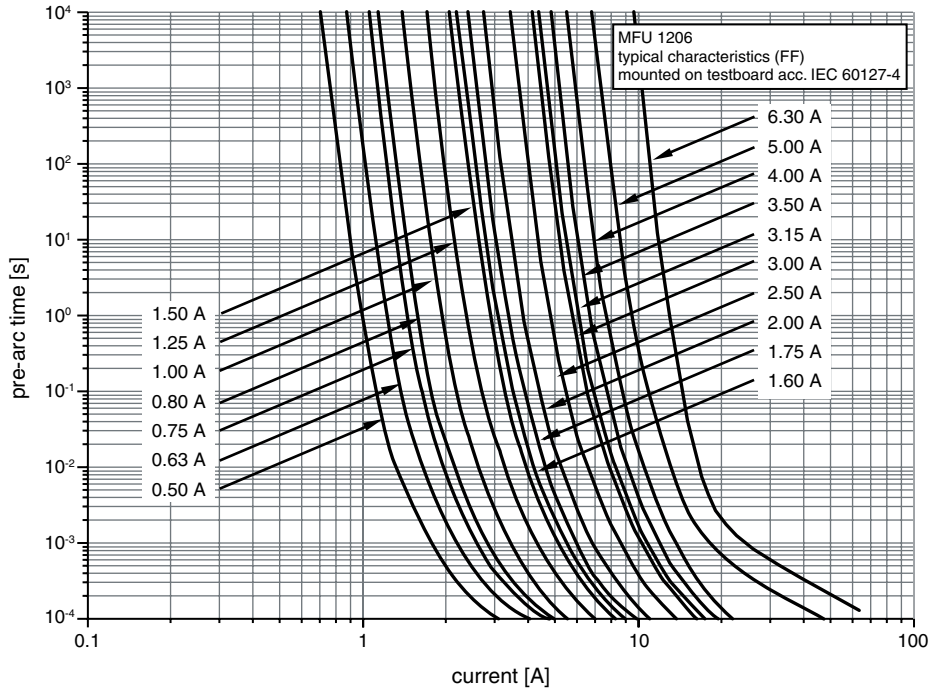
Typical I^2t vs. t Characteristic of MFU 0603



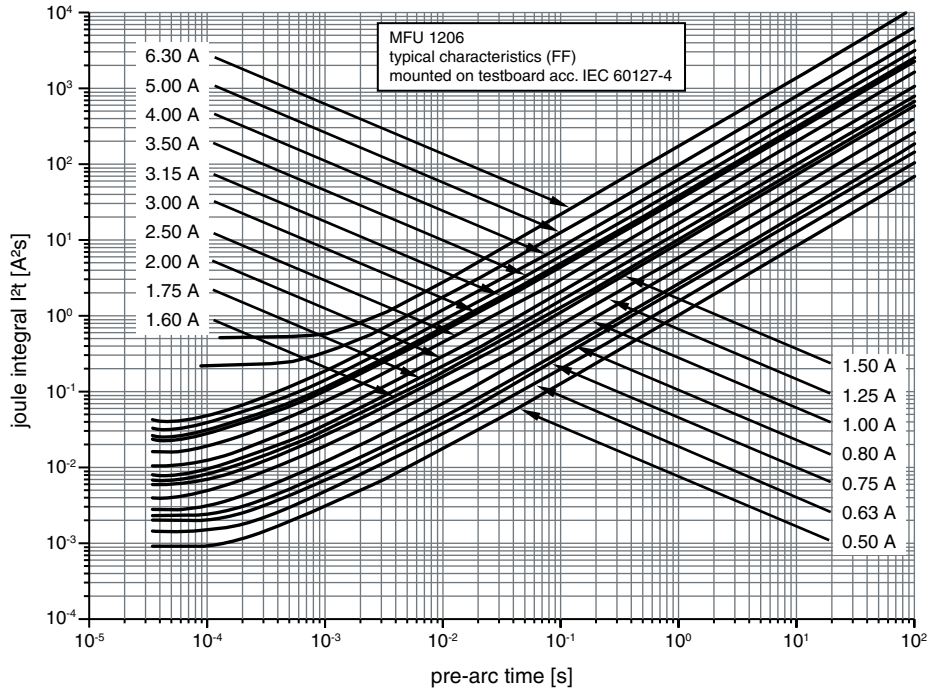
Typical I-t Characteristic of MFU 0805



Typical I^2t vs. t Characteristic of MFU 0805



Typical I-t Characteristic of MFU 1206



Typical I^2t vs. t Characteristic of MFU 1206

TEST AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

IEC 60127-1, Miniature fuse - Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links

IEC 60127-4, Universal Modular Fuse Links (UMF)

UL 248-1, Low voltage fuses - Part 1: General Requirements

UL 248-14, Low voltage fuses - Part 14: Supplemental Fuses

For the full test schedule refer to the documents listed above. The testing also covers most of the requirements specified by METI and CCC.

The tests are carried out in accordance with IEC 60068 and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3. Climatic category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days) is valid.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar).

The components are mounted for testing on printed-circuit boards in accordance with IEC 60127-4, unless otherwise specified.

The requirements stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of IEC 60127-1 and IEC 60127-4 respectively. However, some additional tests and a number of improvements against those minimum requirements have been included.

TEST PROCEDURES AND REQUIREMENTS

IEC 60127-4 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)
8.3.2	21 (U_{e1})	substrate bending	depth 1 mm; rate 1 mm/s 1 times	no visible damage $\Delta R/R \leq \pm 10$ %
8.6.2	58 (Td)	solderability	solder bath method; SnPb40; non-activated flux; (215 ± 3) °C; (3 ± 0.3) s	good tinning (≥ 95 % covered); no visible damage
			solder bath method; SnAg3Cu0.5 or SnAg3.5; non-activated flux; (235 ± 3) °C; (2 ± 0.2) s	good tinning (≥ 95 % covered); no visible damage
8.7.2	58 (Td)	resistance to soldering heat	solder bath method; (260 ± 5) °C; (10 ± 1) s	no visible damage $\Delta R/R \leq \pm 10$ %
			reflow method 2 (IR/forced gas convection); (260 ± 5) °C; (10 ± 1) s	no visible damage $\Delta R/R \leq \pm 10$ %
9.2.1	-	time/current characteristics at nominal temperature	cold resistance at 0.1 x I_R; destructive testing under overcurrent conditions (DC-Current)	at 1.25 x I_R, $t_{pre\text{-}arc} > 1$ h at 2.0 x I_R, $t_{pre\text{-}arc} < 5$ s at 10 x I_R, $t_{pre\text{-}arc} < 0.001$ s
9.3.2	-	breaking capacity	50 A at rated voltage acc. to UL 248-14	optical inspection with naked eye no visible damage
9.3.3	-	residual resistance	50 A at rated voltage acc. to UL 248-14	insulation resistance at 2.0 x U_R (DC) higher than 0.1 MΩ

TEST PROCEDURES AND REQUIREMENTS

IEC 60127-4 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
9.4	-	endurance test acc. to IEC 60127-1	a) I = 1.0 x I_R (DC) 1.0 h on; 0.25 h off; 23 °C; 100 times b) I = 1.25 x I_R (DC) 1.0 h on 23 °C; 1 time	**MFU 0603**	$I_R \leq 3.15$ A	no visible damage $\Delta R/R \leq \pm 10$ %
				MFU 0805	$I_R \leq 3.15$ A	
				MFU 1206	$I_R \leq 3.15$ A	
-	-	verification of temp.-rise and current- carrying capacity acc. to UL 248-14 clause 8.2.3	I = 1.0 x I_R (DC)	**MFU 0603**	$I_R \leq 5.0$ A	temperature rise of hot spot ≤ 75 K acc. to UL 248-14 Clause 8.2.4
				MFU 0805	$I_R \leq 5.0$ A	
				MFU 1206	$I_R \leq 6.3$ A	
9.5	-	maximum sustained dissipation acc. to IEC 60127-1	calculation in accordance with results of clause 9.4 b)	dissipation ≤ acc. to IEC 60127-4 table 2		
9.7	-	fuse-link temperature	the test is performed during the final 5 min. of clause 9.4 b)	**MFU 0603**	$I_R \leq 3.15$ A	temperature rise of terminals ≤ 85 K
				MFU 0805	$I_R \leq 3.15$ A	
				MFU 1206	$I_R \leq 3.15$ A	
-	78 (Cab)	damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	$\Delta R/R \leq \pm 10$ % I-t characteristic		
-	14 (Na)	rapid change of temperature	30 min. at LCT; 30 min. at UCT; LCT = - 55 °C; UCT = 125 °C; 5 cycles	$\Delta R/R \leq \pm 10$ %		
-	6 (Fc)	vibration	endurance by sweeping; 10 to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s^2; 6 h	$\Delta R/R \leq \pm 10$ %		
-	45 (XA)	component solvent resistance	isopropyl alcohol; 50 °C; method 2	no visible damage		
-	45 (XA)	solvent resistance of marking	isopropyl alcohol; 50 °C; method 1, toothbrush	marking legible, no visible damage		
-	21 (Ue_3)	shear (adhesion)	RR 1608M; 9 N	no visible damage		
			RR 2012M and RR 3216M; 45 N			
-	-	flammability	IEC 60695-2-2, needle flame test; 10 s	no burning after 30 s		

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