Thick Film Chip Fuse

TFU 0603 Thick Film Chip Fuse is the best choice for the most fields of modern electronics. The controlled manufacturing process guarantees stable fusing characteristics in standard applications of information technology, telecommunication, and audio/video electronics.

FEATURES

- Proven thick film technology
- Very quick acting fuse characteristics
- Standard SMD size
- Lead (Pb)-free solder contacts
- Halogen-free according to IEC 61249-2-21 definition
- Compliant to RoHS Directive 2002/95/EC

RoHS COMPLIANT HALOGEN FREE

APPLICATIONS

- Information technology
- Telecommunication
- Audio/video electronics

SIZE	
INCH	0603
METRIC	1608M

TECHNICAL SPECIFICATIONS	
DESCRIPTION	**TFU 0603**
Metric size	1608M
Rated current range I_R	1.5 A to 4.0 A
Rated voltage, $U_{max.}$ DC	32 V; 24 V
Interrupting rating, $I_{max.}$ at $U_{max.}$ DC	35 A
Cold resistance at 0.1 x I_R	19 mΩ to 97 mΩ
Permissible film temperature, $\vartheta_{F\ max.}$	125 °C
Operating temperature range	- 55 °C to 125 °C
Permissible continuous current rating at ϑ_{amb} = 23 °C	0.7 x I_R
UL recognition file	E335924

For technical questions, contact: fuse@vishay.com

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PART NUMBER AND PRODUCT DESCRIPTION (1)

Part Number: TFU0603FF04000P500

T	F	U	0	6	0	3	F	F	0	4	0	0	0	P	5	0	0

MODEL/SIZE	FUSING CHARACTERISTIC	RATED CURRENT	PACKAGING (2)	SPECIAL
TFU0603	**FF** = Very quick acting	Example: 4.0 A = **04000**	**P1** **P5** **PW**	Up to 2 digits **00** = Standard

Product Description: TFU 0603-FF P5 4A0

TFU	0603	-FF	P5	4A0
MODEL	SIZE	FUSING CHARACTERISTIC	PACKAGING (2)	RATED CURRENT
TFU	**0603**	**FF** = Very quick acting	**P1** **P5** **PW**	Example: 4.0 A = **4A0**

Notes

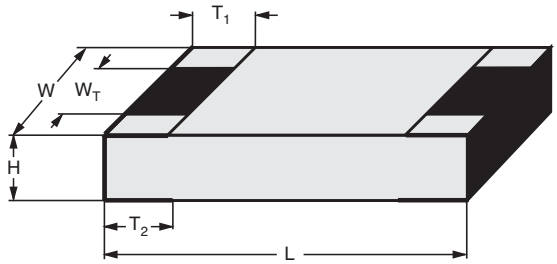
(1) Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION

(2) Please refer to table PACKAGING

PACKAGING

TYPE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
TFU 0603	P1	1000	Card board tape acc. IEC 60286-3 Type I	8.0	4.0	180 mm/7"
	P5	5000				
	PW	20 000				330 mm/13"

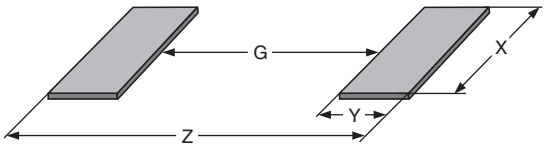
DIMENSIONS



DIMENSIONS - Mass and relevant physical dimensions

TYPE	H (mm)	L (mm)	W (mm)	W_T (mm)	T_1 (mm)	T_2 (mm)	MASS (mg)
TFU 0603	0.45 + 0.1/- 0.05	1.55 ± 0.1	0.85 ± 0.1	> 0.55	0.3 + 0.15/- 0.2	0.45 + 0.15/- 0.2	2.3

SOLDER PAD DIMENSIONS



RECOMMENDED SOLDER PAD DIMENSIONS

TYPE	WAVE SOLDERING				REFLOW SOLDERING			
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)
TFU 0603	0.55	1.10	1.10	2.75	0.65	0.75	0.95	2.15

Note

- The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g. in standards IEC 61188-5-x, or in publication IPC-7351. They do not guarantee any supposed thermal properties, particularly as these are also strongly influenced by many other parameters.

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TFU 0603 RATING - Very quick acting (FF)								
SIZE	**FUSE CHAR.**	**RATED CURRENT**	**RATED VOLTAGE $U_{max.}$ DC**	**COLD RESISTANCE (1) AT 0.1 x I_R**	**INTERRUPTING RATING DC**	**MARKING**	**APPROVAL**	**PART NUMBER (2)(3)**
0603	FF	1.5 A	32 V	97 mΩ	35 A at 32 V	K	UL	TFU0603FF01500P500
		2.0 A	32 V	61 mΩ	35 A at 32 V	N	UL	TFU0603FF02000P500
		2.5 A	32 V	44 mΩ	35 A at 32 V	O	UL	TFU0603FF02500P500
		3.0 A	24 V	32 mΩ	35 A at 24 V	P	UL	TFU0603FF03000P500
		3.5 A	24 V	26 mΩ	35 A at 24 V	R	UL	TFU0603FF03500P500
		4.0 A	24 V	19 mΩ	35 A at 24 V	S	UL	TFU0603FF04000P500

Notes

(1) Typical values

(2) For packages with 1000 pieces, please use for packing P1 instead of P5

(3) For packages with 20 000 pieces, please use for packing PW instead of P5

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A mixed film of highly conductive particles 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 layer.

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**.

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 lead (Pb)-free (category **e3**), the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes.
Solderability is specified for 2 years after production or requalification. The permitted storage time is 5 years.

All products comply with the **CEFIC-EECA-EICTA** list of legal restrictions on hazardous substances.

This includes full compatibility with the following directives.

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

APPROVALS

The fuses are tested in accordance with the following standards:

- UL/CSA 248-14
- IEC 60127-1
- IEC 60127-4
- IEC 60068 series

Recognition by Underwriter Laboratories Inc. is indicated by the UL logo on the package label.

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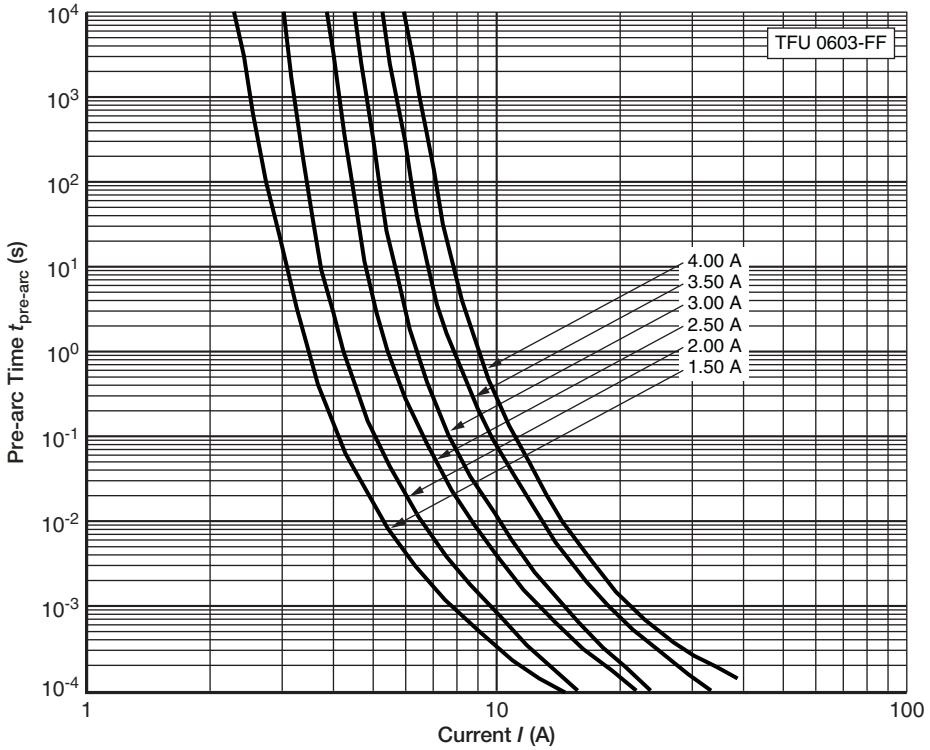
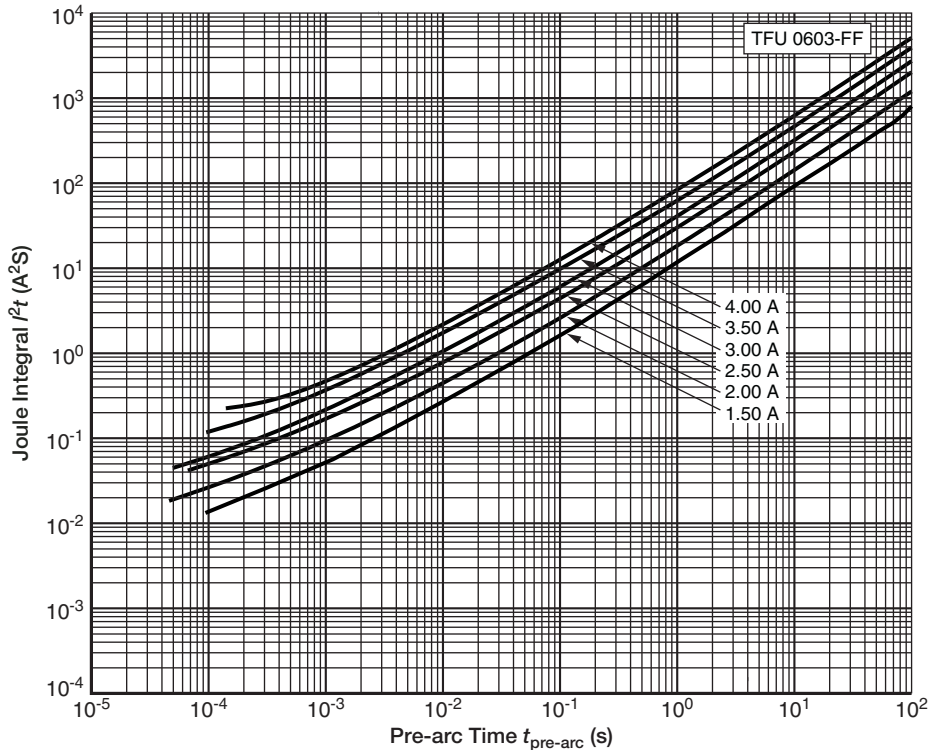
FUNCTIONAL PERFORMANCE



Typical $t_{pre-arc}$ vs. *I* characteristic of TFU 0603 (1)



Typical I^2t vs. $t_{pre-arc}$ characteristic of TFU 0603 (1)

Note

(1) Fuses mounted on a test board according to IEC 60127-4

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TEST AND REQUIREMENTS

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

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

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)

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 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 UL 248-14 and IEC 60127-4 respectively. However, some additional tests and a number of improvments against those minimum requirements have been included.

TEST PROCEDURES AND REQUIREMENTS

UL/CSA 248-14	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE
-	21 (Ue_1)	Substrate bending	Depth 3 mm; rate 1 mm/s 1 time	No visible damage; $\Delta R/R \leq 15$ %
-	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	
		Resistance to soldering heat	Solder bath method; (260 ± 5) °C; (10 ± 1) s	No visible damage; $\Delta R/R \leq 15$ %
			Reflow method 2 (I_R/forced gas convection); (260 ± 5) °C; (10 ± 1) s	
-	-	Time/current characteristics at nominal temperature	Destructive testing under overcurrent conditions (DC-current)	At 2.0 x I_R, $t_{pre\text{-}arc} < 60$ s At 2.5 x I_R, $t_{pre\text{-}arc} < 5$ s
5.5	-	Interrupting rating (DC)	35 A at rated voltage	Optical inspection with naked eye; no visible damage to the fuse body
-	-	Endurance test acc. to IEC 60127-4, clause 9.4	a) $I = 1.0 \times I_R$ (DC) 1.0 h on; 0.25 h off; 23 °C; 100 times b) $I = 1.25 \times I_R$ (DC) 1.0 h on 23 °C; 1 time	No visible damage; $\Delta R/R \leq 15$ %
8.2.3	-	Verification of temp.-rise and current-carrying capacity	$I = 1.0 \times I_R$ (DC)	Temperature rise of hot spot ≤ 75 K acc. to UL 248-14, clause 8.2.4
-	-	Time/current characteristics at elevated temperature. IEC 60127-1, clause 9.2.2	$I = 1.1 \times I_R$ (DC) at 70 °C; 1.0 h	No visible damage; $\Delta R/R \leq 15$ %

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