

# ULTRA QUICK

## FUSES FOR PROTECTION OF SEMICONDUCTORS



# FUSES FOR SEMICONDUCTOR DEVICES PROTECTION

## General information

Fuses are the oldest protective devices in the electrical industry. Because of the advantageous features, fuses have been and are used in an extensive fields of applications – one of them is protection of semiconductor devices (diodes, thyristors, power transistors, GTO) in current and frequency converters. Semiconductor devices are being produced with high maximum continuous currents and peak inverse voltages. Unfortunately, that devices still have poor overload capacities and continue to need sensitive and fast-acting protection.

ETI fuses for semiconductor protection series ULTRA-QUICK are optimal solution for the protection of power semiconductors.

General informations about fuse marking

Fuse marking consists of two letters, where the first letter describes the breaking ranges

### a - partial range

Operates by all currents between the lowest current indicated on its operating time current characteristic and its rated breaking capacity.

### g - full range

Operates by all currents which cause the melting of the fuse element up to its rated breaking capacity

The second letter describes the applications (characteristics or utilization category).

- L** – mainly for conductor protection
- B** – mining equipment
- M** – motor circuit and switching devices protection
- R** – semiconductor protection
- Tr** – transformers protection

The combination of “breaking ranges” and “applications” indicate many combinations describes in standards and technical report IEC TR 61818 “Application-guide for low voltage fuses”

- gL:** Full range - general application, mainly for conductor protection
- aM:** Partial range (back-up) - short-circuit protection of motor circuit
- gR, gS:** Full range - semiconductor protection
- aR:** Partial range (back-up) - semiconductor protection
- gB:** Full range - mining equipment protection
- gTr:** Full range - transformer protection

ETI fuses for semiconductor protection series “ULTRA-QUICK” comply with the IEC 60269 and VDE 0636 series standard. A list of the standards for characteristics and dimensions is included below:

- IEC 60269-4: Supplementary requirements for fuselinks for the protection of semiconductor devices
- IEC 60269-4-1: Examples of standardized fuses
- IEC 60269-3-1: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications)
- IEC 60269-2-1: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) for the protection of semiconductor devices
- DIN 43 620, DIN 43 653
- VDE 0636-201 Niederspannungssicherungen (NH-System)
- DIN EN 60269-4, VDE 0636 Teil 40 Niederspannungssicherungen Teil 4: Zusätzliche Anforderung an
- BS 88 Part 4

Fuse-links as protective equipment for semiconductors should ensure that the following conditions are met:

- Interruption should be effected quickly enough to prevent damage to other devices
- Interruption should take place before damage to semiconductor devices – quick action
- High rated breaking capacity
- High d.c. switching capacity
- High current limitation
- Operation of the protective equipment should not cause unacceptably high over-voltages to be impressed on any of the semiconductor devices – low arc voltage

## Selecting the fuses for semiconductor protection (FSP)

What the user should know about FSP to be able to select the best FSP for his special purpose?

In practice, there exist no common regulations covering FSPs, except IEC60146-6 „Applications guide for the protection of semiconductor convertors against overcurrent by fuses”. The object of this report is to advise on the specific fuse features and on the specific convertor features which are to be observed to ensure correct application of FSP in convertors, and to give specific recommendations for trouble-free operation of convertors protected by fuses.

Before the fuse selection the user must be fully aware of the conditions under which the FSP is to function. This applies to normal service conditions as well as to conditions during fault. Here is few basic suggestions for FSP selection:

**A:** The load current through the semiconductor ( $I_{sem}$ ) should be lower or equal as the rated current of the selected fuse-link ( $I_{nv}$ ). For continuous duty the FSP can withstand this current indefinitely. In case of pulsed current, the user should consult ETI.

$$I_{sem} \leq I_{nv}$$

**B:** The operating voltage on the semiconductor ( $U_{sem}$ ) should be lower or equal as the rated voltage of the fuse-link ( $U_{nv}$ ). Consult ETI with respect to a.c. and d.c. applied voltage, time constant and power factor.

$$U_{sem} \leq U_{nv}$$

**C:** The operating (pre-arcing + arcing)  $I^2t$  values of the selected fuse-link ( $I^2t_{opv}$ ) should be lower than  $I^2t$  of the semiconductor ( $I^2t_{sem}$ ). Consult ETI with respect to parallel operation, discrimination and loss of coordination at higher fault levels

$$I^2t_{opv} < I^2t_{sem}$$

**D:** For other current rating, which are not included in this catalogue, please consult ETI R&D department.

Short product range review of fuses for semiconductor protection series ULTRA-QUICK

Systems	Series	Types	Sizes	Rated current	Rated voltage	Application	Pages:	
<b>DO</b>			D01, D02	2A - 63A	400V	gR	6	
<b>D</b>			DI, DII, DIII, DIV, DV	2A - 200A	500V	gR	7	
<b>BS</b>	-	-	BS8, BS17, BS38, BS38T	6A - 800A	240V	aR	8	
	-	-	BS8, BS17, BS17D, BS38, BS38T	6A - 700A	690V	aR	9	
<b>NV/NH</b>	UQU-N	M	00C, 00, 0, 1, 2, 3	6A - 630A	690V	aR/gR	10, 11	
	UQ U	S80mm	00C, 00	6A - 160A	690V	aR/gR	12	
		S97mm	0	6A - 160A	690V	aR/gR	12	
		S110mm	1, 2, 3	35A - 630A	690V	aR/gR	13	
	UQ01 hyper quick acting	M	00	10A - 160A	690V	aR	23	
			S80mm	00, 00C	10A - 400A	690V	aR	24
				00	32A - 315A	1000V	aR	28
		S110mm	1, 2, 3	80A - 1250A	690V	aR	25	
			1, 2, 3	80A - 1250A	690V	aR	26	
			1, 2, 3	63A - 1000A	1000V	aR	29	
		G	1, 2, 3	80A - 1250A	690V	aR	27	
			1, 2, 3	63A - 1000A	1000V	aR	30	
	UQ1 super quick acting	M	00C, 1,2,3	10A - 630A	690V	aR	14, 15	
			0	32A - 160A	1000V	aR	20	
		S80mm	00C, 00, 1, 2, 3	10A - 1250A	690V	aR	16, 17	
		S110mm	1, 2, 3	32A - 1250A	690V	aR	18	
			1, 2, 3	100A - 800A	1000V	aR	21	
		G	1, 2, 3	32A - 1250A	690V	aR	19	
	UQ2 quick acting	M	00C, 1, 2, 3, 4, 4a	6A - 1500A	500V	gR	31, 32	
			00C, 1, 2, 3	10A - 630A	690V	gR	36, 37	
			1, 2, 3	80A - 630A	1200V	aR	41	
		S80mm	00C	16A - 160A	500V	gR	33	
			00C	10A - 160A	690V	gR	38	
		S110mm	1, 2, 3	35A - 630A	500V	gR	34	
			1, 2, 3	80A - 630A	690V	gR	39	
		S170mm	1, 2, 3	80A - 630A	1200V	aR	42	
		G	1, 2, 3	35A - 630A	500V	gR	35	
			1, 2, 3	80A - 630A	690V	gR	40	
1, 2, 3			80A - 630A	1200V	aR	43		

Marking of fuses for semiconductor protection series ULTRA-QUICK:

1. System D and DO

D0-fuse links

D01	UQ	2A
D02		max. 63A
size	trade mark	current

D-fuse links

DI	UQ	2A
DII		max. 200A
DIII		
DIV		
DV		
size	trade mark	current

2. System BS and NV/NH

BS - fuse links

BS	8	UQ	38	2A	240V
	17		41	max. 800A	
	17D		59		
	38		63		690V
	38T		64		
			70		
			83		
case	diameter (T-twin, D-double)	trade mark	length	current	voltage

NV/NH - fuse links

S	00	M	UQ	01	/80	/10A	/690V
M	0	*		1	110	max. 1500A	500V
G	00C			2	97		1000V
	1			U	170		1200V
	2			U-N			
	3						
	4						
	4a						
case	size	micro-switch	trade mark	curve	distance	current	voltage

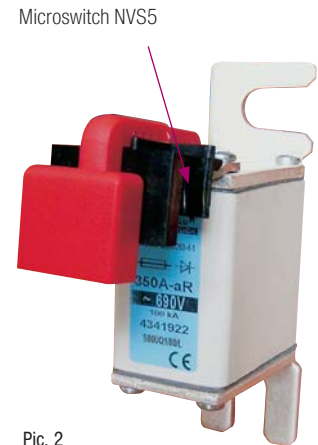
## Operation indicators of ULTRA-QUICK fuse links

The operation-sensing device is a fine wire which is connected in parallel with the fuse melting element. This wire is used to hold in a flag (made of thin metal band) usually placed on the upper cover. When the wire breaks because of fuse operate, the flag is pushed out and in this way an indication of operation is given.

The indicator on pic.1 is a visual indication of fuse operating. When only indication is not enough, we offering possibility to add a microswitch NVS5 on the upper cover for remote signalling of fuse operating (Pic.2).

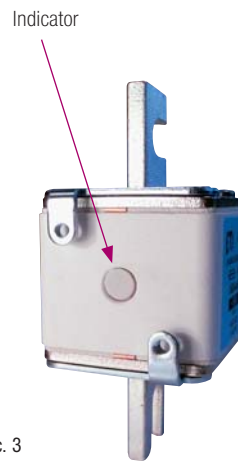


Pic. 1



Pic. 2

Another type of signalling of fuse operating is indicator, called "middle". It is located in the center of the ceramic body in front of the fuse link. After fuse operation, the particular plastic striker is pushed out from the ceramic body (Pic.3).

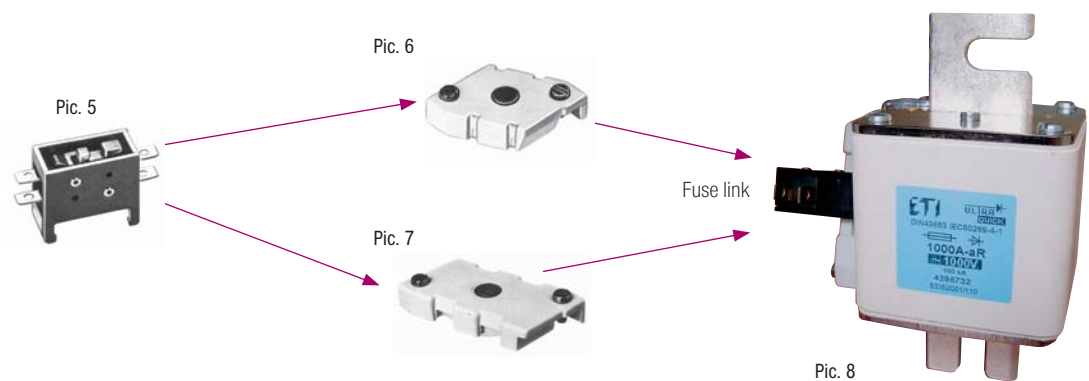


Pic. 3



Pic. 4

For remote signaling we offering microswitch MK (Pic.4 and Pic.5) mounted on additional adapters AMK (Pic.6 and Pic. 7)



The purpose of adapters AMK1 and AMK2 are microswitch type MK setting up on the fuse link body of sizes for 690V and 1000V.