

High-voltage contactor

Gas-filled contactor for high-voltage DC switching

Series/Type: HVC45
Ordering code: B88269X*
Date: 2023-06-09
Version: 01

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Values in this document are preliminary and may be subject to change

General

HVC45 series has a robust design for high-voltage DC switching requirements in harsh environments. Our customers deploy HVC45 series in a wide range of applications such as automotive traction battery systems and DC fast charging stations.

Features

- Main terminals without polarity (bi-directional)
- High short circuit handling capability up to 12 kA
- RoHS compatible

Characteristics

Contact arrangement	1A	
Inner contact material	Cu alloy	
Internal contact gap (full disconnection)	2.2 (2 × 1.1)	mm
Recommended connection conductor cross section ¹		
- for I _{th} = 250 A _{DC}	≥ 60	mm ²
- for I _{th} = 300 A _{DC}	≥ 100	mm ²
Vibration in closed state, xyz-axis ²		
Shock, 6 ms ½ sine, peak ³	588	m/s ²
Vibration, sine 100 ... 2000 Hz, peak ⁴	98	m/s ²
Wideband random vibration, 10 ... 1000 Hz ⁵	49	m/s ² _{RMS}
Operation and storage ⁶		
Temperature	-40 ... +85	°C
Humidity	5 ... 85	%
Air pressure	50 ... 106	kPa
Utilization category	IEC 60947-4-1	DC-1
Pollution degree	IEC 60947-1	2
IP level	IEC 60529	IP 40
Climatic category	IEC 60068-1	40/085/21
Certifications	UKCA	pending
	CE	pending
	UL 60947-4-1 (E491412)	pending
Weight ⁷	~ 390	g

See "Notes" on page 9

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Specifications ⁸

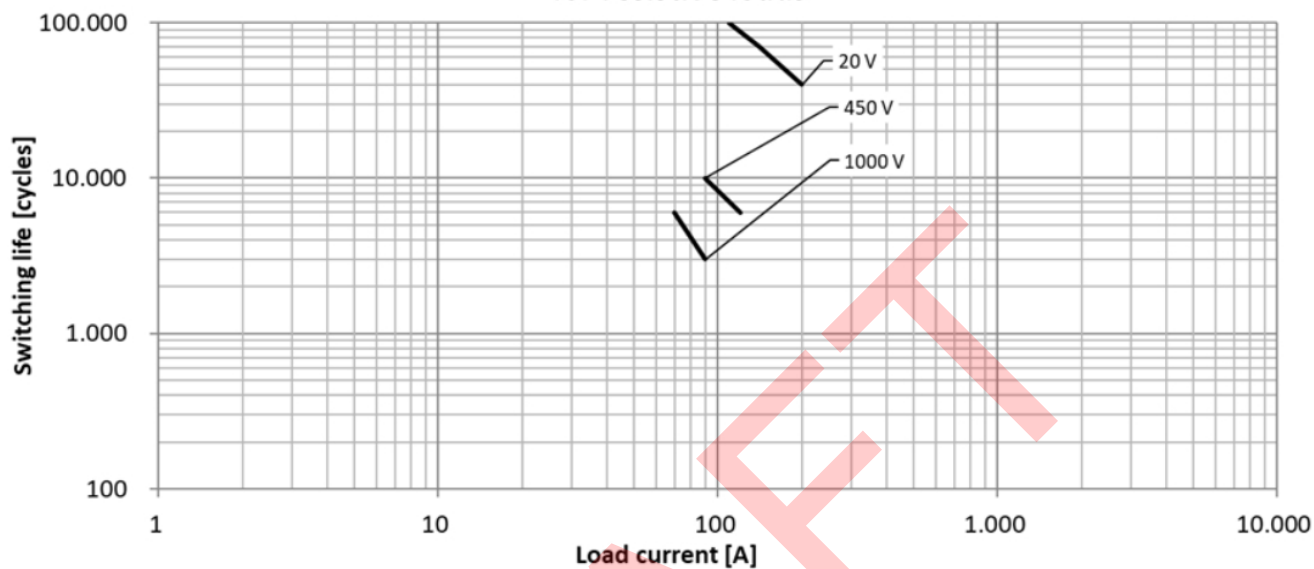
Type HVC45-...		250A	300A	
Contact				
Maximum operating voltage		1000		V _{DC}
Continuous current	I _{th}	250	300	A _{DC}
Temporary overcurrent (10 min)	I _{cw1}	340	400	A _{DC}
Temporary overcurrent (1 min)	I _{cw2}	600	730	A _{DC}
Short circuit handling capability (5 ms) ⁹		12		kA
Rated operational voltage ^{10, 11}	U _e	1000		V _{DC}
Rated operational current ^{10, 11}	I _e	100		A _{DC}
Contact resistance at 100 A _{DC}				
- typical		0.15		mΩ
- max.		0.35		mΩ
Insulation resistance at 1000 V _{DC}				
- contact to contact / contact to coil		≥ 1		GΩ
Dielectric strength ¹²				
- contact to contact / contact to coil		≥ 4400		V _{AC}
Rated impulse withstand voltage ¹³	U _{imp}	8		kV
Operating time ¹⁴				
- make		≤ 30		ms
- break		≤ 10		ms
Electrical endurance ^{11, 15, 16}				
Mechanical ¹⁷				
- max. 1 V, 1 A _{DC} (make & break)		350000		operations
Capacitive				
- at 20 V _{DC} , 140 A _{DC} (make)		75000		operations
Resistive ¹⁸				
- at 450 V _{DC} , 300 A _{DC} (break)		1000		operations
- at 1000 V _{DC} , 300 A _{DC} (break)		40		operations
Maximum cut-off ¹⁹				
- at 450 V _{DC} , 2200 A _{DC} (break) ²⁰		1		operation
- at 1000 V _{DC} , 900 A _{DC} (break)		1		operation
Coil type ¹⁵		12 V	24 V	
Rated control voltage (nominal)	U _c	12	24	V _{DC}
Operating voltage range	U ₁ ... U ₂	9 ... 16	18 ... 32	V _{DC}
Pick-up voltage (max.)	U ₁	9	18	V _{DC}
Drop-out voltage (min.)		1	2	V _{DC}
Minimum holding current		0.16	0.08	A _{DC}
Power at nominal voltage ²¹		6	6	W
Nominal resistance		24	96	Ω

See "Notes" on page 9

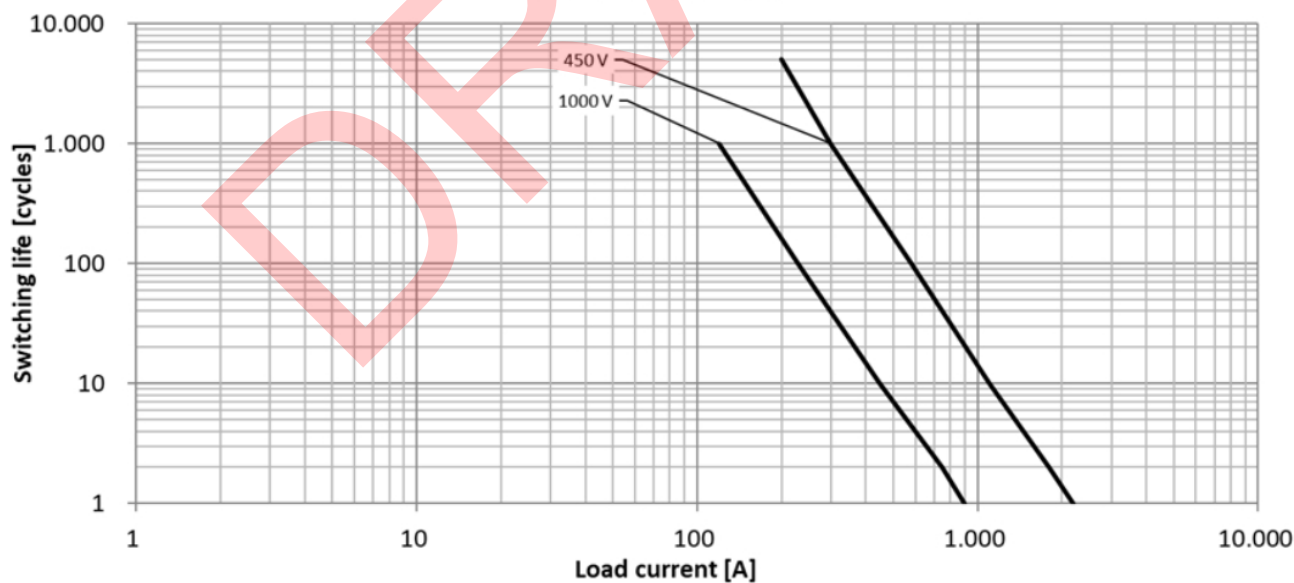
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Characteristics (TBD) ^{11, 15, 16, 22}

**Estimated make & break life curves
for resistive loads**



**Estimated break-only life curves
for resistive loads**

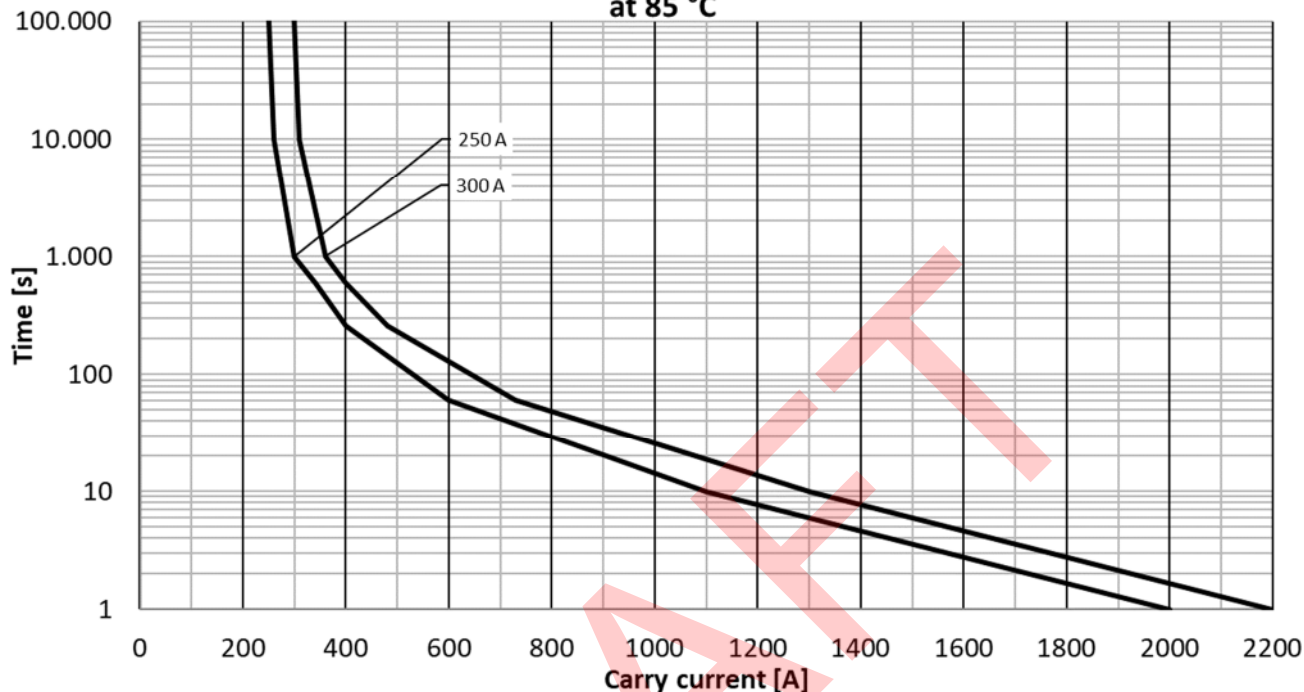


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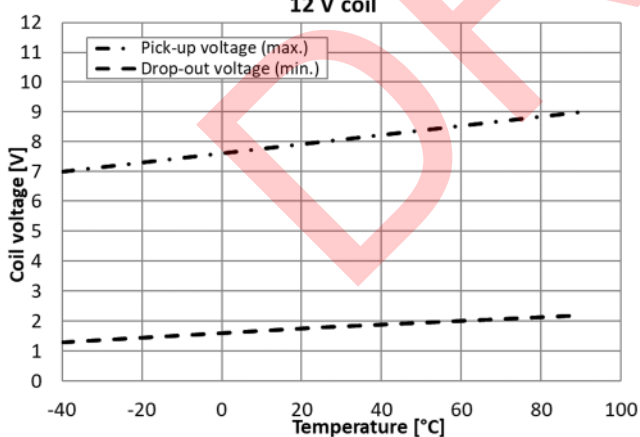
Current handling capability

at 85 °C



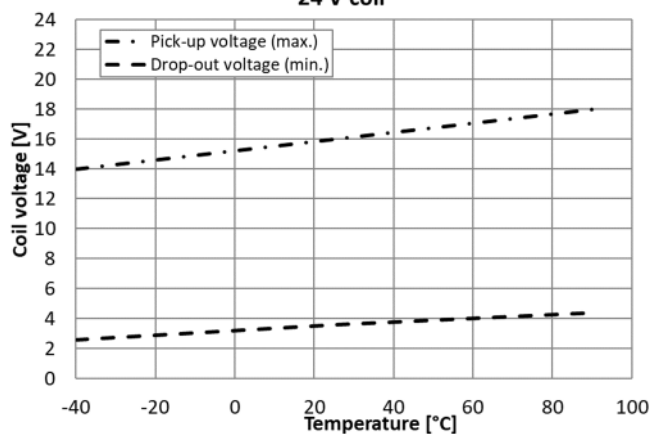
Typical operating voltage characteristics

12 V coil



Typical operating voltage characteristics

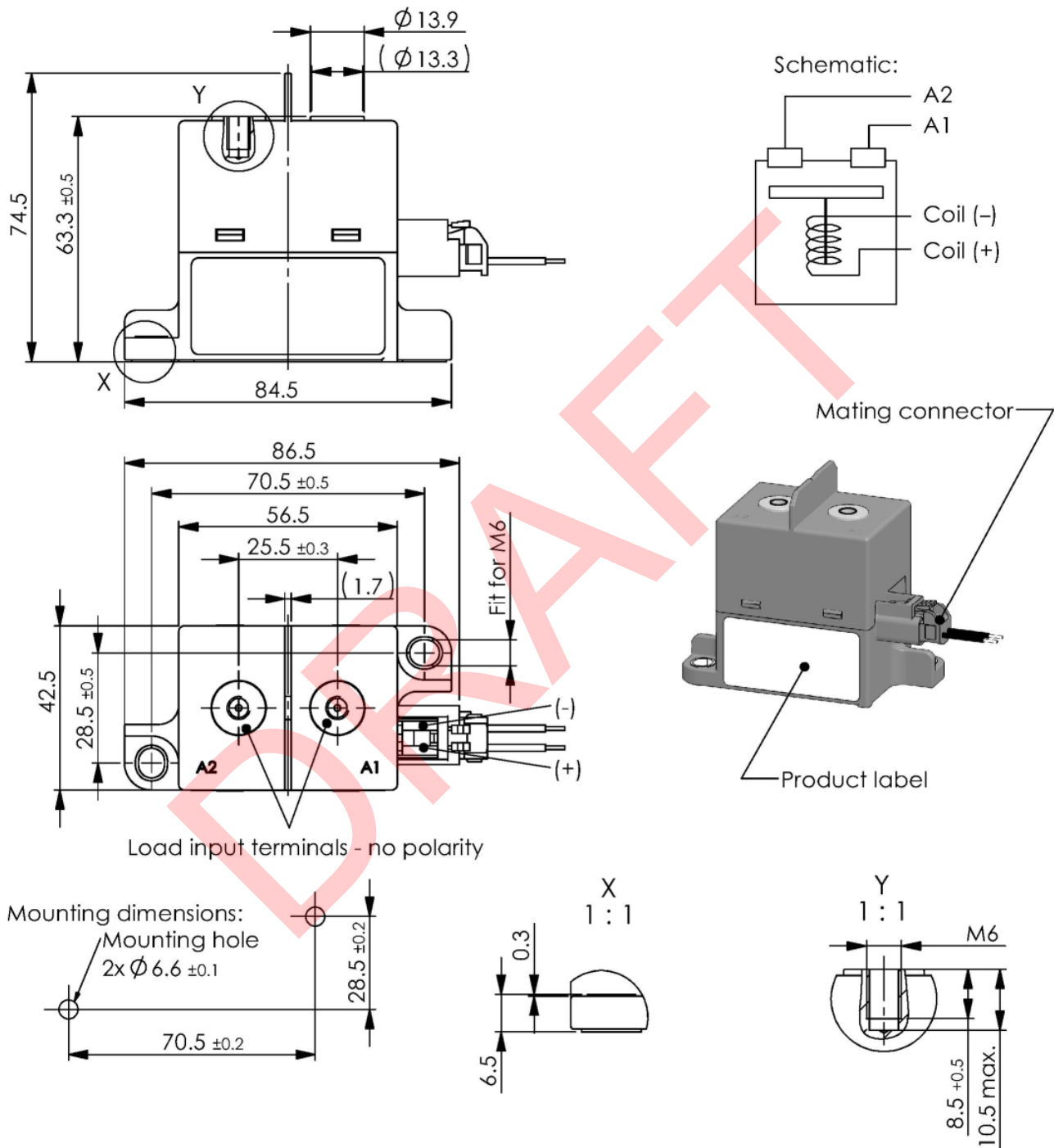
24 V coil



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Dimensional drawing

in mm



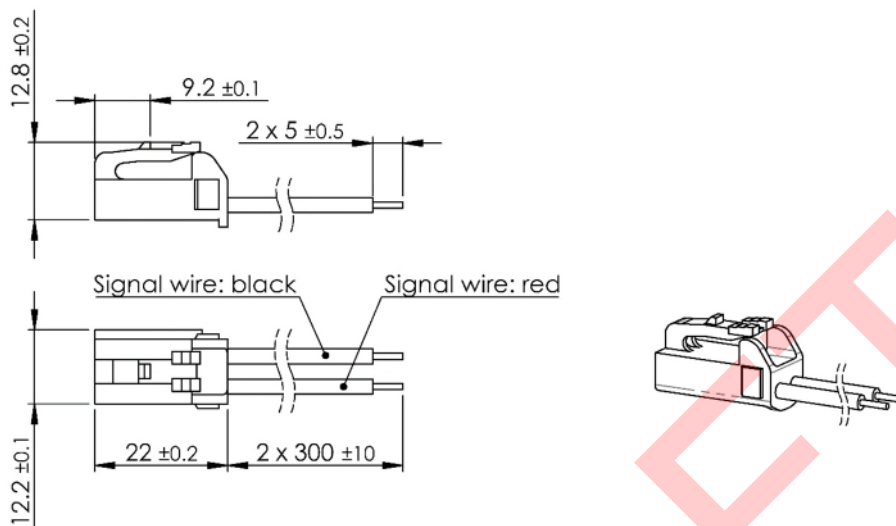
In case of no tolerance shown in dimensional drawing, general tolerances apply:
 dimension ≤ 10 mm: ± 0.3 mm; dimension 10 to 50 mm: ± 0.6 mm; dimension > 50 mm: ± 1 mm

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Accessory

Mating connector plug (corresponding to Yazaki 7283-1020)

To order if required with order code **B88269X9990C101** (10 pcs. in a box).



Installation information

Connection name	Type	Marking	Finishing	Remarks
A1	Main terminal M6	A1	Copper contact surface	Tightening torque 6...8 Nm
A2	Main terminal M6	A2		
Optional: Mating connector plug	Plug with wire (AWG 20)	Red (+)	Stripped and tinned	Connector plug
	Plug with wire (AWG 20)	Black (-)		
Case mounting	Relay mounting M5	None	Stainless steel insert	Tightening torque 4...6 Nm

Important:

Coil terminations should be suppressed with a surge protection device. Preferably a varistor (e.g. S10K30, B72210S0300K101 or equivalent) should be installed in parallel, see "Cautions and warnings".

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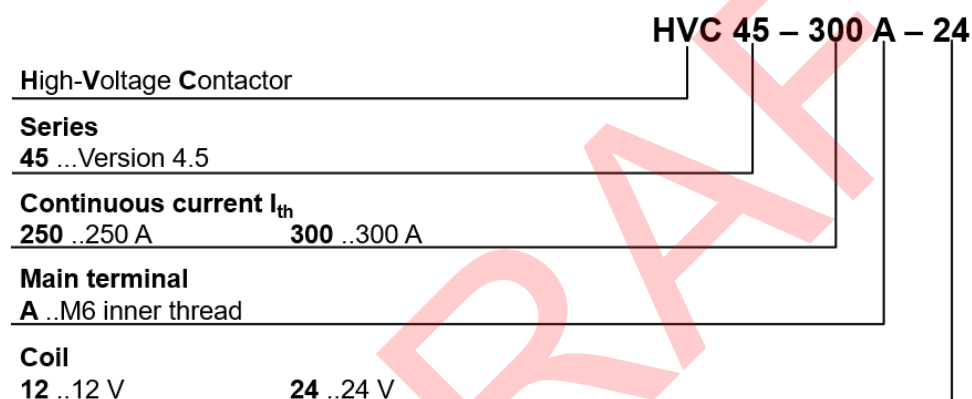
Packing unit

 B88269X...**C011** = 1 pc. in cardboard box

Delivery unit

10 pcs. in cardboard box

Drawing TBD

Nomenclature of type name
Example (other digits may indicate customized version or special option)

Ordering codes (TBD)

Continuous current A_{DC}	Coil voltage V_{DC}	Type name	Ordering code *
250	12	HVC45-250A-12	TBD
	24	HVC45-250A-24	TBD
300	12	HVC45-300A-12	TBD
	24	HVC45-300A-24	TBD

* The ordering code can be followed by a three-digit internal suffix.

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Notes:

- ¹ The recommended cross section refers to pure copper. In other cases it must be matched to actual current, conductor material properties and operation temperature (see: Cautions and warnings).
- ² Detection time 10 μ s: micro-openings \leq 10 μ s may occur between main contacts
- ³ Referring to IEC 60068-2-27
- ⁴ Referring to IEC 60068-2-6
- ⁵ Referring to IEC 60068-2-64
- ⁶ Freezing or condensing must be avoided.
- ⁷ Valid for base-model without accessory, other configurations will lead to deviations.
- ⁸ The specified values apply to unused contactors acc. to IEC 61810-1.
- ⁹ No thermal expansion and no ignition after short circuit. However, the contactor may be welded and must be exchanged.
- ¹⁰ Referring to IEC 60947-4-1, 6000 operations make & break
- ¹¹ Referring to IEC 60947-4-1, 50 % of operations in positive and 50 % in negative direction (see: Cautions and warnings)
- ¹² Detection limit 10 mA
- ¹³ Referring to IEC 60947-4-1
- ¹⁴ Measured at rated control voltage U_c including contact bouncing time.
- ¹⁵ Specified referring to JIS C 5442 (temperature 15 °C to 35 °C, humidity 25 % to 85 % RH).
- ¹⁶ End of life is reached when insulation resistance is $<$ 50 M Ω at 1000 V.
- ¹⁷ Duty cycle 50%, cycle duration 1 s, value represents B10 life time acc. to Weibull analysis.
- ¹⁸ Duty cycle 1%, cycle duration 600 s.
- ¹⁹ No thermal expansion and no ignition will occur after this break
- ²⁰ Tested with resistive loads with $\tau \leq$ 1 ms
- ²¹ Tolerance \pm 10 % at thermal equilibrium
- ²² For „make & break life curves“ duty cycle is 10 % and cycle duration is 6 s. For “break-only life curves” duty cycle is 1 % and cycle duration is 600 s.

Cautions and warnings

- We strongly recommend to implement redundancy, take measures to prevent the spread of fire, take the possibilities of malfunction into account, and perform regular maintenance.
- It is also required to always use a suitable backup fuse for the contactor.
- It is not allowed to use the contactor outside of the parameter range specified in this datasheet. This also includes temperature and humidity. Overloading the contactor may destroy the component.
- The lifetime is dependent on several factors: e.g. load type, driving circuit and ambient conditions. We recommend checking the performance of the part under actual conditions.
- For capacitive loads, the inrush current through the contactor should not exceed the specified limit of the estimated make & break life curves, otherwise tack welding and permanent failure will occur.
- Break of inductive loads with time constant $\tau >$ 1 ms will shorten the lifetime and failure may occur.
- In the event of a break under inductive load, the voltage at the connection terminals of the contactor must not exceed the nominal operating voltage by more than 10 %.
- For continuous high current operation, make sure that the temperatures of the connection terminals do not exceed 130 °C by selecting an appropriate connection cable cross section or active cooling.
- The main connections of the contactor also act as a heat sink. Please ensure that the connection surface area is fully covered with a matched cable lug or busbar and that the connection hole in

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the busbar is according to DIN ISO 20273 (middle clearance).

- The contactor must be mounted onto a flat surface using the designated fixation holes, in addition to the busbars attached to the main connections. It is not allowed to mount the contactor using only the busbars.
- The leads to the contactor must be securely tightened to the terminals (check torque specification in data sheet) otherwise current stress may generate sparks and heating. Use only fitting screws for all mechanical connections to the contactor and verify their functionality in the application.
- After long-term operation the contactor coil resistance is increased due to the temperature rise. If the contactor is switched on immediately afterwards, the coil characteristics may be deteriorated.
- The coil contacts need to be protected from overvoltage when switching off. Therefore, a protection device needs to be installed in parallel.
- For successful pick-up, the voltage cannot be ramped up slowly. The voltage needs to be applied instantly to at least the maximum pick-up voltage.
- The contactor is not intended to be used with pulse width modulation (PWM) controllers. Please contact TDK for details.
- Simultaneously applied maximum operation parameters for e.g. coil voltage, over currents, temperature, vibration etc. may lead to reduced lifetime. We recommend applying rated settings to achieve optimum life performance.
- For parts without plus or minus marking at the main HV contacts (e.g. no polarity of main contacts), the service life curves are estimated based on the requirements of IEC60947-4-1; Chapter 8.2.4 where 50 % of the required operations are performed in positive direction and 50 % in negative direction.
- We recommend to separate or shield the low voltage side from the high voltage side.
- The contactor must be mounted in a way that the vertical axis of the part (Z-axis) is not in line with the main shock axis inside the application. Still, it must be mounted either upright standing or horizontal lying on either side. Upside down mounting must be avoided and only the original mounting holes are allowed to be used to mount the part.
- Contactors radiate magnetic and electromagnetic fields. Please ensure that other components mounted in close proximity are not affected.
- In case two contactors are mounted in close proximity, a clearance distance of 10 mm has to be kept.
- The operating life of the contactor can be affected by strong magnetic fields. Please ensure that there are no magnetic field sources in close proximity and avoid nearby installed heat sources.
- The contactor must not be operated without any load. This may increase the contact resistance.
- Contactors may become hot during extended periods of current overload (burn hazard).
- Contactors must be handled with care and must not be dropped.
- If a current occurred that exceeded the maximum breaking current by more than 50 % or triggered a series fuse, the contactor is considered damaged and must be replaced.
- The manufacturer cannot be held liable for failures caused by condensation or icing. The customer has to apply suitable measures to avoid these circumstances.
- This contactor is not waterproof.
- It must be ensured that during usage, storage, or transportation direct sunlight is avoided. The ambient temperature during usage must not exceed the value specified in this data sheet.
- It is forbidden to use this contactor in atmospheres loaded with organic solvents (alcohol,

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- petroleum, etc.) or strong alkaline substances (ammoniac, acids in general, etc.).
- It must be ensured that during installation and operation no kind of foreign matter adheres to the main contact. Especially oils and silicones must be avoided.
- It is forbidden to attach any kind of additional construction to or on the contactor.

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

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Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard**. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements ("CSR") TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System**. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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