



Explanation of 100V Input Transient Protection

Application Note 01-07-00 Rev. 01

Summary:

This application note provides an overview of SynQor's input transient protection features. It explains the differences in protection ratings across our dc/dc converter product lines and answers some frequently asked questions concerning these features.

Introduction

Some recently introduced SynQor dc/dc converters incorporate an enhancement to the input voltage transient protection feature. This document is intended to explain this issue in depth and answer questions concerning the change and any resulting effects on customers using both the existing and the enhanced dc/dc converter products.

100V Input Transient Protection

All isolated dc/dc converters specify a rated maximum input voltage. Most 48V input converters specify a maximum input voltage rating of about 75-80V, which is slightly above the typical operating range of 36-72V (+5%). This difference guarantees sufficient margin between the normal operating range of the application and the input voltage specification of the converter. An under-voltage lockout feature assures that the maximum input current is not exceeded, as per the ETSI 300 132-2 specification. In some models, an over-voltage shutdown feature assures that the semiconductor devices in the converter are not damaged by excessive voltage stresses. Hysteresis is typically added to both the over and under voltage shutdown levels to prevent the converter from turning on and off repeatedly when the voltage is near either voltage extreme.

Until recently, SynQor's converters have been designed to provide a maximum input voltage transient protection up to 100V for $< 10\mu\text{s}$. The half-brick family of converters has additionally offered an input over-voltage shutdown feature, which assures that the unit will shut down when the input voltage exceeds the nominal maximum of 75V.

SynQor's new product introductions will provide additional input voltage transient protection of 100V for 100ms. In conjunction with this change, the input over-voltage shutdown feature has been removed from newly introduced half-brick modules. The changes are summarized in Table 1 below.

Converter Series	Input Voltage Absolute Maximum Ratings			Input Over-Voltage Shutdown
	Non-Operating	Operating	Transient	
Existing Products (PQ48 series)	100V continuous	80V continuous	100V for $\leq 10\mu\text{s}$	Yes (half-bricks)
New Products (PQ60 series)	100V continuous	80V continuous	100V for 100ms	No

Table 1: Absolute maximum ratings and protection features for Input Voltage specifications from SynQor dc/dc converter product lines.

It is important to note that the change to our newly introduced products does not indicate any fault or limitation with our existing 48V input modules. In fact, the existing product line typically provides more input voltage protection than most competing products.

Common Questions about the 100V Input Transient Protection

Why was this change implemented?

The impetus for the change to 100V for 100ms input voltage transient protection is primarily due to a particular interpretation of the ETSI ETS300 132-2 specification. A number of SynQor customers have uniquely interpreted this document to indicate that a 100V input transient for 100ms is a necessary requirement of all dc/dc converters to meet this specification. SynQor feels that this interpretation of the ETSI spec will become more widespread and eventually could become an industry standard for dc/dc converters. The specific requirement states that all dc/dc converters must have the ability to withstand a transient that lasts between 10ms and 100ms of 100V amplitude without shutting down or being damaged. The actual ETSI specification is admittedly very vague and does not even mention the amplitude of the voltage step. Many companies have interpreted the exact same document differently and indicate that 100V for 10 μ s input voltage transient capability is acceptable. In fact, nearly all dc/dc converters available on the market today provide a lower level of protection. SynQor has decided to implement this design change on new products so that we can satisfy both sets of customers, regardless of how they interpret this ETSI specification. Therefore, SynQor is providing protection above and beyond what is expected and required in the marketplace. Meeting the demanding requirements of our global customers will result in increased worldwide compliance for SynQor's product line.

Do I need to transition to the 100V input FET converters?

No. Assuming you have no issues with our present input voltage transient protection, then you can continue to use those products without reservation. Only customers that need to meet very specific input voltage transient requirements will require a transition to the new products.

How does this change affect the input over-voltage shutdown feature?

The input over-voltage shutdown feature protects the converter in cases where the input voltage exceeds the maximum specification range of 75V. Specifically, the converter shuts down when the input voltage reaches 78.3V and turns back on again when the converter reaches a normal input voltage. Typically a user would not need or even desire this protection feature since they would provide a separate circuit on the input, which would clamp the voltage when it reached an undesirable level. In fact, the input over-voltage shutdown feature is not present on SynQor's Quarter-brick units because many customers do not want the converter to shut down before their input clamp circuit becomes active. The input over-voltage shutdown feature is not present on the new converter series (PQ60) with 100V for 100ms input transient protection. The converter will continue to operate as the input voltage exceeds 100V but continued operation is not guaranteed since this is beyond the operating specification of the input FETs.

What are the impacts on manufacturing, performance, reliability and part sourcing as a result of this change?

The only functional change required to implement this new feature is to increase the voltage rating of the input FETs. This requires only a simple part number change on the BOM. No manufacturing processes are changed. The performance and reliability of the unit are not degraded in any way. In fact, efficiency and derating performance may increase marginally due to the availability of slightly better performing FETs. These new FETs are widely available from multiple sources and will not effect the sourcing of parts or finished product lead times.

Will I need to re-qualify any products that have the new input voltage transient protection?

No, there is no need to re-qualify these units since they have identical electrical performance and carry the same safety certifications as the PQ48 series converters. However, if you are relying on the input over-voltage shut-down feature to protect against abnormally high input voltage conditions, you will likely want to design in a protection circuit to clamp the input voltage under abnormal conditions.

How does this feature change affect the part numbering system?

All units with the new 100V for 100ms input voltage transient protection will use a 60 instead of a 48 in the part number scheme to indicate input voltage. For example, the part number below would change as follows:

PQ48033HMA30xxx **→** PQ60033HMA30xxx

Keep in mind that the nominal input voltage range of both units is 35 - 75V. However, the PQ60 unit provides additional input transient protection of 100V for 100ms.

Exactly which products have the 100V for 100ms input transient protection?

The 100V for 100ms input transient enhancement will be added to the new *DualQor* dual output quarter-bricks. This feature is also being added to some previously released units in the *PowerQor* half-brick and quarter-brick families based on specific customer demands. Future standard products will incorporate the 100V for 100ms input transient protection unless specific requirements dictate otherwise.



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