

DC-DC Converter Qone LEC / HEC



Output Power up to 160 Watt

Isolated

Single Output

For standard euro rack size 19''

Qone comes with luxury as a standard.

It is generously equipped, leaving any competitors behind.



Its merits are:

- High power density
- Fully integrated heatsink (or mounting surface) provides extremely low thermal stress to temperature sensitive components
- Coated and partial encapsulated assembly for better vibration resistance
- Overtemperature and overvoltage shutdown
- Short circuit protection
- Remote on/off
- Yellow LED indicates operating mode
- CE certified
- Fixed switching frequency 300 kHz
- Reverse polarity protection by internal protector
- Voltage Control (VC)
- Thermal Warning (TW)
- Synchronization (Sy)
- Voltage in Fail (ViF)
- Voltage out Fail (VoF)

Order Numbers and Specific Characteristics

The standard euro rack size 19" LEC and HEC are available. You have the choice of different mechanical case options (compare drawing page 4):
 LEC-C/-CS (CS=cut): Cassette for chassis mounting without front plate, without LED, for mounting on power loss dissipating metal surface (heatsink).
 HEC-F/-FS (FS=cut): Cassette for chassis mounting without front plate, without LED, on no power loss dissipating surface. (See datasheet mechanical "accessories")
 The order numbers consist of eleven digits (eight for the basis number and three for the mechanical Version).
 Other type on request

Order number											Derating (see diagram 1)					
I _{out} ¹²⁾ nom (A)	P _{out} max (W)	η _{typ} (%) ¹⁾	I _{in} ¹²⁾ max (A)	Pro- tector 2)	LEC	-C	-CS	HEC	-F	-FS	LEC (Diagram1)			LEC-C and LEC-CS P _{out} max at 70 °C		
											Pd (W)	Td (°C)	DF (W/K)	R _{thCA} ⁵⁾ (K/W)	DF _{70 °C} ⁹⁾ (W/K)	
V_{in} nom = 12 V – see table 1																
V _{in} operating = 8 to 15 V, V _{in} range = 7 to 18 V ^{3b) 6)}																
3,3 ⁷⁾	17,6	60	76	16,0	T15							56	70	1,49	1,9	1,71
5 ⁷⁾	15,6	80	79	16,0	T15							67	70	1,84	1,7	2,29
12	7,5	90	78	16,0	T15							73	65	1,86	1,4	2,57
15	6,7	100	80	16,0	T15							82	65	2,10	1,4	2,86
24	4,2	100	79	16,0	T15							77	65	1,99	1,3	2,86
V_{in} nom = 24 V																
V _{in} operating = 16 to 30 V, V _{in} range = 14,4 to 36 V ^{3b) 6)}																
3,3 ⁷⁾	17,6	60	76	7,1	T15							56	70	1,49	1,9	1,71
5 ⁷⁾¹¹⁾	15,6	80	80	8,5	T15							71	70	1,93	1,8	2,29
12	8,3	100	81	10,7	T15							94	65	2,45	1,5	2,86
15	7,7	115	82	12,3	T15							100	65	2,56	1,4	3,29
24 ¹¹⁾	5,4	130	84	13,2	T15							116	65	3,04	1,4	3,71
V_{in} nom = 12/24 V																
V _{in} operating = 10 to 30 V, V _{in} range = 10 to 40 V ^{3b) 4) 6)}																
3,3 ⁷⁾	17,6	60	76	11,2	T15							56	70	1,49	1,9	1,71
5 ⁷⁾	15,6	80	79	13,5	T15							67	70	1,84	1,7	2,29
12	7,9	95	79	16,0	T15							77	65	1,99	1,4	2,71
15	7,0	105	80	16,0	T15							82	65	2,10	1,3	3,00
24 ⁸⁾	4,8	115 ⁸⁾	81	16,0	T15							88	65	2,28	1,3	3,29
V_{in} nom = 36 V																
V _{in} operating = 24 to 45 V, V _{in} range = 21,6 to 51 V ^{3b) 6)}																
24 ⁸⁾	5,4	130	84	9,8	T15							116	65	3,04	1,4	3,71
V_{in} nom = 48 V																
V _{in} operating = 33 to 60 V, V _{in} range = 32,5 to 80 V ^{3a) 6)}																
3,3 ⁷⁾⁹⁾	17,6	60	76	3,0	T6,3							56	70	1,49	1,9	1,71
5 ⁷⁾	15,6	80	80	3,9	T6,3							71	70	1,66	1,8	2,29
12 ⁹⁾	8,3	100	83	4,7	T6,3							88	65	2,28	1,5	2,86
15 ⁹⁾	7,7	115	84	5,3	T15							94	65	2,45	1,4	3,29
24 ⁹⁾	5,4	130	86	5,8	T15							108	65	2,80	1,4	3,71
V_{in} nom = 72 V																
V _{in} operating = 48 to 90 V, V _{in} range = 43,2 to 101 V ^{3b) 6)}																
24	5,4	130	84	4,5	T6,3							108	65	2,80	1,4	3,71
V_{in} nom = 110 V																
V _{in} operating = 77 to 138 V, V _{in} range = 66 to 160 V ^{3b) 6)}																
3,3 ⁷⁾	17,6	60	76	1,5	T6,3							56	70	1,49	1,9	1,71
5 ⁷⁾	15,6	80	80	1,9	T6,3							71	70	1,93	1,8	2,29
12	9,6	115	81	2,6	T6,3							88	65	2,28	1,3	3,29
15	8,7	130	82	3,3	T6,3							94	65	2,45	1,2	3,71
24 ⁹⁾	6,7	160	84	3,6	T6,3							108	65	2,80	1,1	4,57

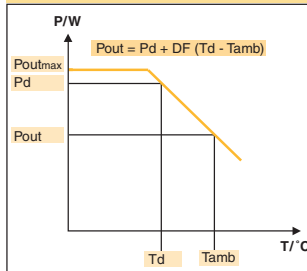
Models in blue are not recommended for new designs

In case of V_{in} = V_{in} nom and free convection. Available up to +85°C. Typical course of Characteristic, detailed Data on request.

Table 1: Max. Output Power P_{out} (W) at Permanent Operation

V _{out} nom \ V _{in}	7 V	7,5 V	8 V	9 V	10-18 V	12 V
3,3 V	60	60	60	60	60	60
5 V	77	80	80	80	80	80
12 V	80	85	87	87	87	90
15 V	82	87	92	98	100	100
24 V	80	85	90	95	95	100

Diagram 1: Output Power P_{out} (W) / Ambient Temperature T_{amb} (°C)



T_d = Reference Temperature of Derating
 P_d = Output Power at T_d
 DF = Derating-Factor

- P_{out} = 0,8 P_{out} max; V_{in} = V_{in} nom
- For disconnecting from the pretending supply, sufficient current of the supply point to trigger the fuse in case of short circuit has to be made sure (<300 ms).
- Converter input according to Railway Standard EN 50155 (V_{in} operating).
- Converter input and critical input according to Railway Standard EN 50155 (V_{in} operating and V_{in} range; not at V_{in} nom=12 V).
- Adjust V_{out}, at V_{in} nom = 24 V
- Necessary thermal resistance of mounting surface (chassis) to ambient for P_{out} max, up to T_{amb}=70°C. Typical value at free convection
- If the operating voltage is exceeded, the converters may be operated only with restricted load.
- 3,3 V adjusted to 3,4 V and 5 V adjusted to 5,1 V
- P_{out} max = 108 W permanent, 115 W for 1 min. ED 50%
- Switching frequency 200 kHz
- Derating factor. Valid up to T_{amb}=85°C
- 40V_{in} for 100ms permissible
- Permissible continuous current depends on the used type of contact and ambient temperature.

Technical Data

At $T_{amb}=25\text{ }^{\circ}\text{C}$, $V_{in\ nom}$, $I_{out\ nom}$, unless otherwise specified.

Input Characteristics

	Symbol	Unit	min	typ	max	Notes
Input voltage	V_{in}					
Nominal input voltage	$V_{in\ nom}$	V				1)
Input voltage range						
– Min. input voltage	$V_{in\ min}$	V	1)			
– Max. input voltage	$V_{in\ max}$	V			1)	
Threshold						
– Voltage on threshold	$V_{in\ on}$	V		$1,05 V_{in\ min}$		
– Voltage off threshold	$V_{in\ off}$	V		$V_{in\ min}$		
Input current	I_{in}					
Max. input current	$I_{in\ max}$	A				1)
No load input current	$I_{in\ off}$	mA		10 ⁸⁾		Switched off by En, $V_{in} = V_{in\ nom}$
Polarity and short circuit protection						Integrated Protection 1)
Remote on/off						"on" = En open, "off" = En to GND (EA, Sync)

Output Characteristic

	Symbol	Unit	min	typ	max	Notes
Output voltage	V_{out}					Short circuit protected and zero load operation
Nominal output voltage	$V_{out\ nom}$	V				1)
Accuracy		%		$\pm 0,2$ ⁴⁾		$V_{in\ nom}$; 50 % I_{out} ; T_{amb} 25 °C
Regulation						
– Line regulation		%		$\pm 0,6$		70 % – 130 % $V_{in\ nom}$; 50 % $I_{out\ nom}$; T_{amb} 25 °C
– Static load regulation		%		$\pm 0,6$ ⁹⁾		10 % – 100 % $I_{out\ nom}$; $V_{in\ nom}$; T_{amb} 25 °C
– Temperature coefficient		%/K		$\pm 0,01$		-25 bis +85 °C (heat sink); $V_{in\ nom}$; 50 % $I_{out\ nom}$
– Dynamic load change		A				25 % – 100 % – 25 % $I_{out\ nom}$
– Voltage deviation		%		4 ⁶⁾		with load capacity (I_{out}/A) * 300 μF ²⁾
– Recovery time		ms		0,5	2,0	
Rising characteristics						
– Rise time		ms		60		$V_{in\ nom}$; 50 % $I_{out\ nom}$; Resistive load
– Overshoot				5)		
Ripple and noise		%		3		according to EN 61204; V_{ss} / 20 MHz bandwidth
Trim range		%	-30		+10	External voltage; adjustment by VC ³⁾
Overvoltage protection		V		$1,2 V_{out}$		The converter switches off. Restart after ca. 1,5 s.
Output current	I_{out}					
Nominal output current	$I_{out\ nom}$	A				1)
Overcurrent protection		A	$1,08 I_{out\ nom}$		$1,15 I_{out\ nom}$	The converter switches off. Restart after ca. 1,5 s
Output power	P_{out}					
Max. output power	$P_{out\ max}$	W			1)	1)
Derating						
Efficiency		%		1)		80 % $P_{out\ max}$; $V_{in\ nom}$
Overtemperature shutdown		°C	101	105	107	Case temperature The converter switches off. Restart after ca. 1,5 s
Parallel connection	I_{out}	A				Parallel connection is possible. More information on request.
Series connection						max. 2 converters

Thermal Protection TW (Thermal Warning)

Operating criteria (Transistor is conducting)	Overtemperature shutdown -5K Risk of overtemperature exists.
Output TW	Output with npn-transistor, emitter connected with S-; max. current 30 mA

MTBF

1.000.000 h; T_{amb} 25 °C

Ambient Temperature Range

Operating	-40 to +85 °C
Storage/Transport	-40 to +105 °C

Isolation

Input/Output	1.500 V_{eff}
Input/Case	1.500 V_{eff}
Output/Case	500 V_{eff}

1) See table "Order Numbers and Specific Characteristics" (page 2).

2) It is recommended that an electrolytic capacitor (low ESR type required) is installed at the output (V_{out+} , V_{out-}), if the load itself does not have adequate capacity.

Recommended values V_{out} / Capacity: 3,3 V / 1000 μF ; 5 V / 470 μF ; 12 V, 15 V / 220 μF ; 24 V / 100 μF

3) Use of V_{out} : higher V_{out} VC via resistor at S- lower V_{out} VC via resistor at S+

Restricted trim range at 3,3 V (-0% / +10%) and 5 V (-15% / +10%)

Use of an external voltage: higher V_{out} VC < 2,6 V with reference to S- lower V_{out} VC > 2,6 V with reference to S-

4) At 3,3 V and 5 V $\pm 0,4$ %⁸⁾ At $V_{in\ nom} = 12/24$ V and $V_{in\ nom} = 12$ V 20mA

5) See ripple and noise⁹⁾ At 3,3 V ± 3 % and 5 V ± 2 %

6) At 3,3 V and 5 V 8 %

7) See "Installation Instructions" (page 4)

EMC

Product Standard	EN 61204-3:2000
Emission (conducted)	conducted emission acc. to EN 55022 ⁷⁾
Immunity	
Electrostatic discharge (ESD)	EN 61000-4-2, class B
Electric field	EN 61000-4-3, class B
	EN 61000-4-6, class B
Fast transient (Burst)	EN 61000-4-4, class B
Transient (Surge)	EN 61000-4-5, class B

Mechanical Stress

Shock	IEC 68-2-27
Continuous shock	IEC 68-2-29
Vibration	IEC 68-2-6

Special Features

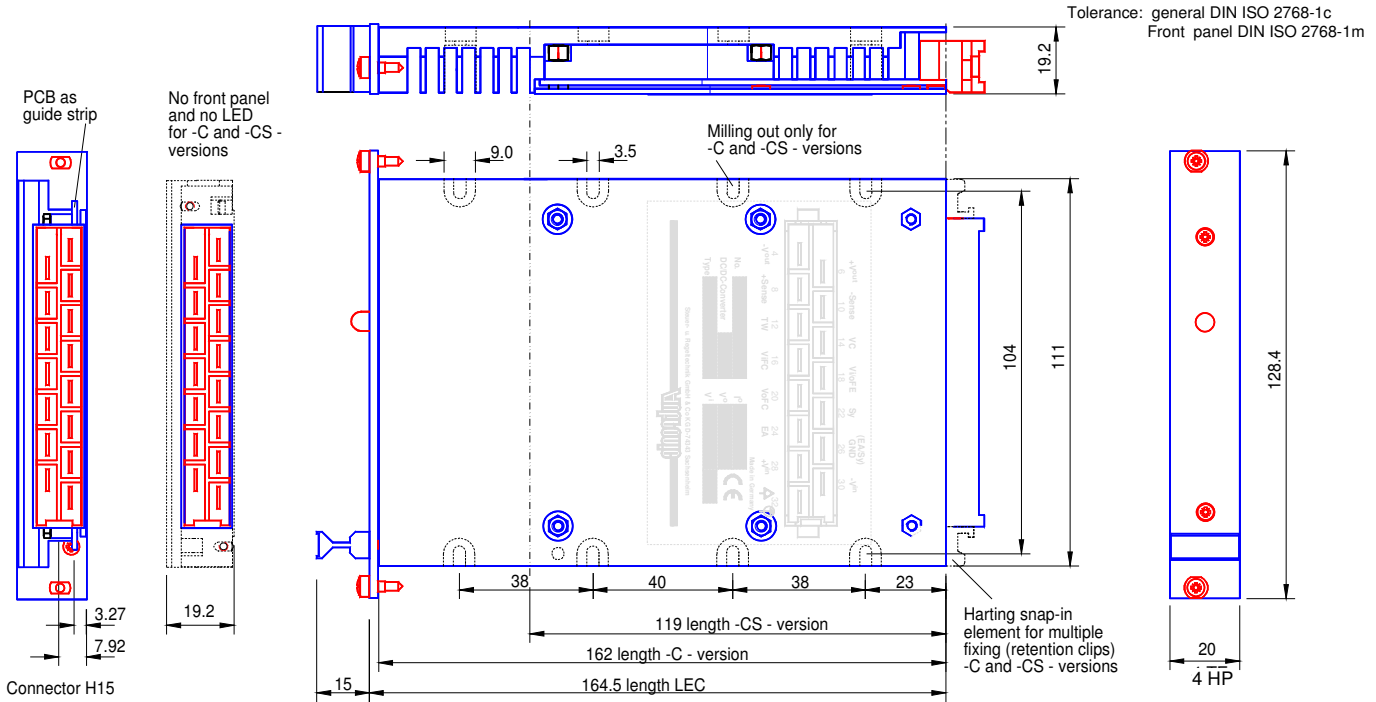
Input Monitoring ViF (Voltage in Fail), Output Monitoring (Voltage out Fail)

Operating criteria for "good"-Signal (Transistor is conducting). Input voltage over $V_{in\ min}$ and converter is switched on. Output voltage in the range of $V_{out\ nom} \pm 5\ %$

Output ViF, VoF	Isolated Optocoupler-Output with npn-Transistor		
Current	5 mA		
Pins	Collector ViFC, Collector VoFC, Emitter Vi/oFE		
Isolation	ViF-Case: 1.500 V _{rms} ;	ViF-V _{in} : 1.500 V _{rms} ;	ViF-V _{out} : 500 V _{rms} ;
	VoF-Case: 1.500 V _{rms} ;	VoF-V _{out} : 500 V _{rms} ;	VoF-V _{in} : 1.500 V _{rms}

Additional Technical Data

Drawing (dimensions in mm)



Packaging

Standard Euro rack size 19" and chassis mounting

Class of protection

Class I EN 60950

Degree of protection

IP20 (inserted in rack) DIN 40050 (IEC 529)
IP10 (other Versions)

Pollution degree

2 EN 60950

Weight

LEC ca. 565 g -C - Version ca. 550 g -CS - Version ca. 415 g

Installation Instructions

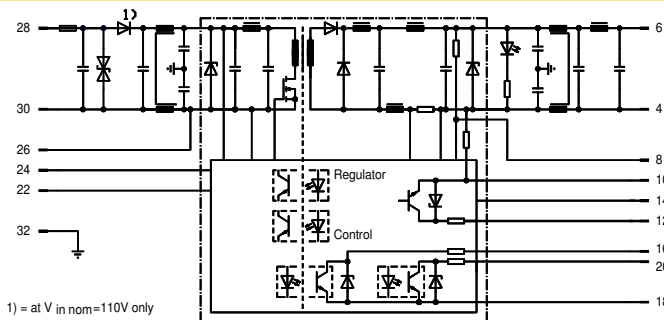
The converters have to be installed according to the guidelines currently in force, like other open electronic component assemblies. Plug in not under voltage if converter connected parallel or in series. Attention must be paid to sufficient ventilation, carry off heat, fastening and protection against accidental contact.

Attention! At $P_{out\ max}$ (constantly) a warming up of the front plate up to 45°C over the ambient temperature is possible.

The pin 32, Case/PE: (/), has to be properly connected in order to assure operation.

In built-in condition our devices may show different EMC properties. Measures of improvement on request.

Block Diagram



1) = at $V_{in\ nom} = 110V$ only

Pin Allocation

4	V_{out-}	- Output Voltage
6	V_{out+}	+ Output Voltage
8	S+	Page 3 ³⁺
10	S-	**
12	TW	Thermal Warning
14	VC	Voltage Control
16	ViFC	Voltage in Fail
18	Vi/oFE	Voltage in/out Fail
20	VoFC	Voltage out Fail
22	Sy	Synchronization
24	En	Enable
26	GND (EA, Sy)	Ground (EA, Sy)
28	V_{in+}	+ Input Voltage
30	V_{in-}	- Input Voltage
32	/	Case

* Positive reference for VC
** Negative reference for VC