DC/DC Railway Converter
EQX100 Series

* eXtremly wide input range 8:1
* Baseplate cooled
* I/O isolation of 3000 Vac
* Quarter brick size industrial standard
* Continuous short circuit proof
* Efficiency up to 91%
* Low no load input current
* Fully protected (OCP/OVP/OTP/UVLO)
* UL62368-1 3rd pending (reinforced insulation)
* EN50155 compliant with external circuits
* Shock & Vibration EN50155 (EN61373) Compliant
* Fire & Smoke EN45545-2 Compliant
* Operating altitude 5000m
* Operating case temperature -40 to +105°C
* Option -B: external capacitor on pin DC-Bus
  external resistor for adjustable UVLO



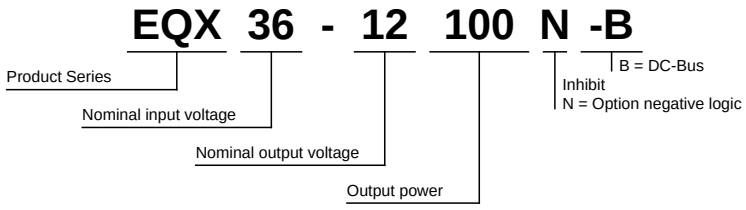
pending QQJQ2.E195564

Product Range

Model	Input		Iin @ Uin nom.		Output			Efficiency	Max.
	nominal	range	full load	no load	Uout	Iout max.	power	typ.	capacity
Single									
EQX36-05100	36Vdc	9...75Vdc	3.07A	25mA	5.0Vdc	20.0A	100W	90.5%	40'000uF
EQX36-12100	36Vdc	9...75Vdc	3.13A	25mA	12Vdc	8.30A	100W	88.5%	8'300uF
EQX36-15100	36Vdc	9...75Vdc	3.12A	25mA	15Vdc	6.70A	100W	90%	6'700uF
EQX36-24100	36Vdc	9...75Vdc	3.12A	25mA	24Vdc	4.20A	100W	90%	4'200uF
EQX36-28100	36Vdc	9...75Vdc	3.08A	30mA	28Vdc	3.60A	100W	91%	3'600uF
EQX36-48100	36Vdc	9...75Vdc	3.08A	30mA	48Vdc	2.10A	100W	91%	1'000uF
EQX36-54100	36Vdc	9...75Vdc	3.05A	30mA	54Vdc	1.85A	100W	91%	1'000uF

Notes:
Nominal input voltage 36 Vdc
Fabrimex recomends an external input capacitor of 470uF for all models to reduce input ripple voltage.

Nomenclature



Specifications

All values refer to an ambient temperature of 25°C and nominal rated values where nothing else is specified.

Input Specifications

Characteristic		Conditions	min	typ	max	unit
U_{IN}	Input voltage		9	36	75	Vdc
U_{UVLO}	Under voltage lockout		Off: 7.6 / 8.4, On: 8.2 / 9			Vdc
	Max. input current at full load		See	product	range	A
	No load input current		See	product	range	mA
	Inrush current	ETS300 132-2			0.1	A^2s
	Input surge voltage	Max. 100ms			100	Vdc

Output Specifications

Characteristic		Conditions	min	typ	max	unit
U_{ACC}	Output voltage accuracy			±1.0		%
	Output voltage adjust			-20 / +15		%
	Line regulation	Measured from high to low			±0.2	%
	Load regulation	Measured from full to no load			±0.2	%
	Cross regulation					%
	Load transient recovery time	75% / 100% step load change		< 250		us
	Load transient error band			±5.0		%
	Temperature coefficient				±0.02	%/K
	Ramp up time			10		ms
	Start up time			-		ms
	Ripple and noise	BW = 20MHz	12/15V:150, 24/28V:240, 48V:480			mVpp
	Current limit		110		210	% Inom
	Over voltage protection		115		140	% Unom
	Short circuit protection			continuous		% Inom
	Short circuit characteristic		Hiccup Mode, auto recovery			

General Specifications

Characteristic		Conditions	min	typ	max	unit
U_{ISO}	Isolation voltage	in/out, in/case & out/case=2.1kV		4.2k		Vdc
R_{ISO}	Isolation resistance			> 100M		Ohm
C_{ISO}	Isolation capacity			typ. 1000		pF
F_{SW}	Switching frequency			typ. 200		kHz
	Approvals					
	Safety Approvals			UL62368		
	MTBF	MIL-STD-217-F, GB, 25°C		663k (12V) - 780 (48V)		h
	Case material			Alu base plate, plastik DAP 94V-0		
	Compound material			UL 94V-0		
	PCB material					
	Weight			66		gr
	Dimensions			57.9 x 36.8 x 12.7mm		mm
	Soldering infos			275°C for 10		s

EMC Specifications

Characteristic		Conditions	
	EMC conducted	With external filter	EN55032 Class A / EN50121-3-2:2021 Conducted

Environmental Specifications

Characteristic		Conditions	min	typ	max	unit
T_{CASE}	Operation temperature	Case temperature		-40...+105		°C
T_{AMB}	Storage temperature			-55...+125		°C
T_{SD}	Thermal shutdown range	Case temperature		110		°C

Own notes

EMC information

No EMC graph available yet, please contact factory

No EMC filter available yet, please contact factory

Inhibit

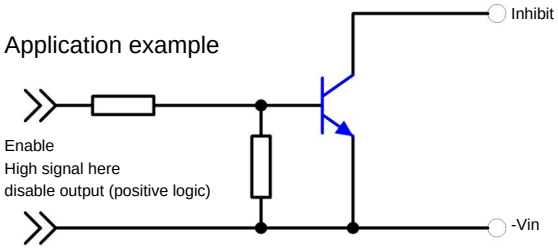
The EQX100 Series allows the user to switch the module on and off electronically by inhibit on/off feature. The converters are available in "positive logic" (standard) or "negative logic" (option) versions for inhibit on/off.

Logic table (inhibit pin)

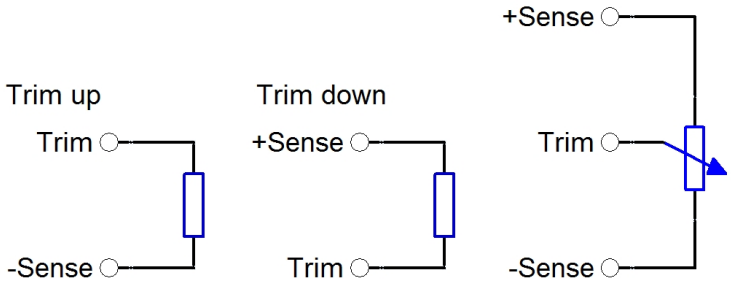
Logic state	Negative logic*	Positive logic
Logic low	Module on	Module off
Logic high	Module off	Module on

* Suffix "N" to the model number with active low inhibit on/off

Application example



Trimming

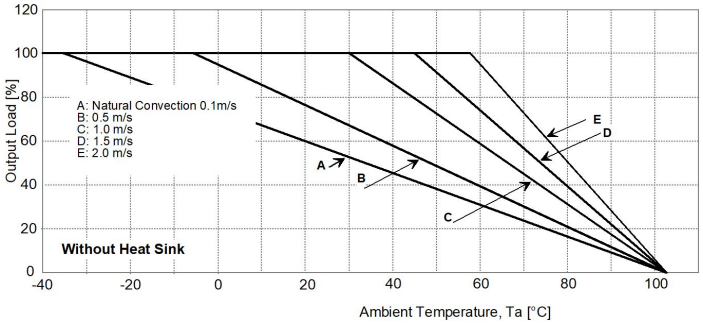


Own notes

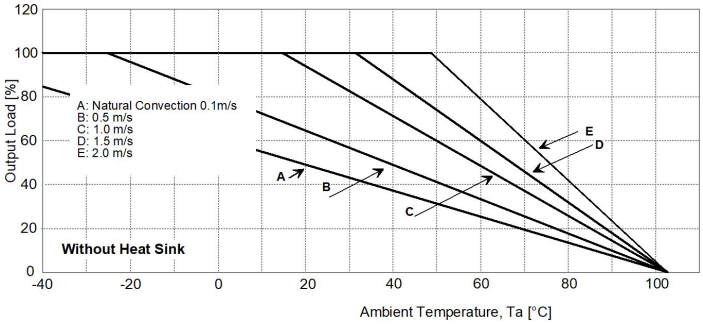
Derating Curves

The operating case temperature range of EQX100 series is -40...+105°C. When operating the EQX100 series, proper derating or cooling is needed. The following curves are the derating curves of EQX100. Please note that these are relative values in a test environment. Ambient temperature can not be exactly defined in an application, only the case temperature. Please ask the factory for a suitable heat sink.

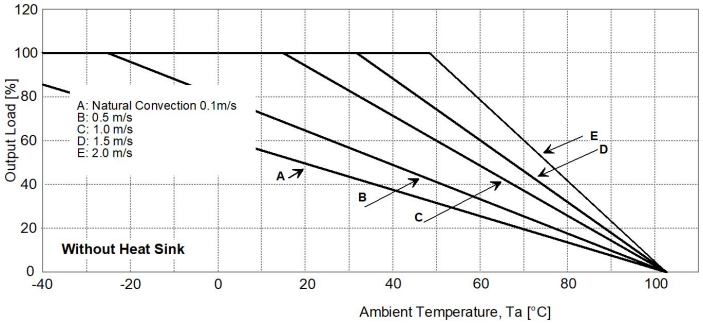
Derating Curve EQX100(Uin 36V) / 5V / 24V without heatsink



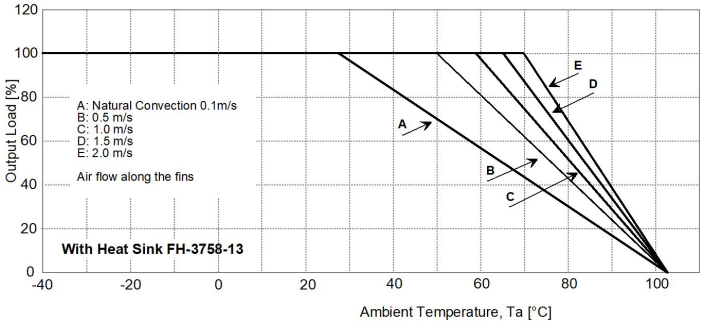
Derating Curve EQX100(Uin 36V) / 12V / 15V without heatsink



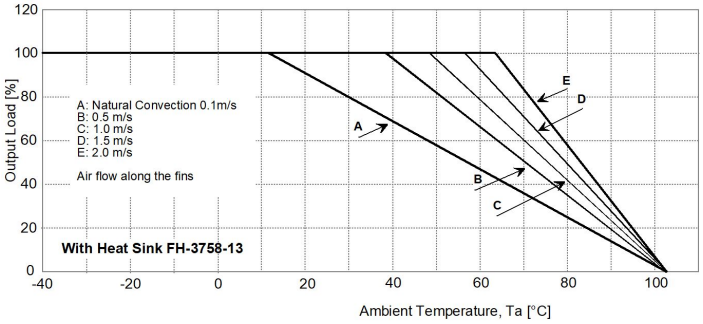
Derating Curve EQX100(Uin 36V) / 28V / 48V / 54V without heatsink



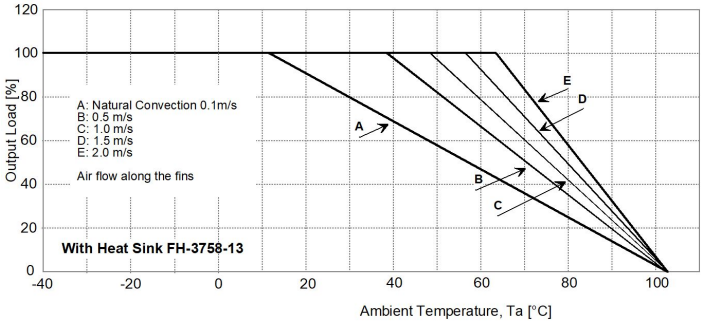
Derating Curve EQX100(Uin 36V) / 5V 24V FH-3758-13



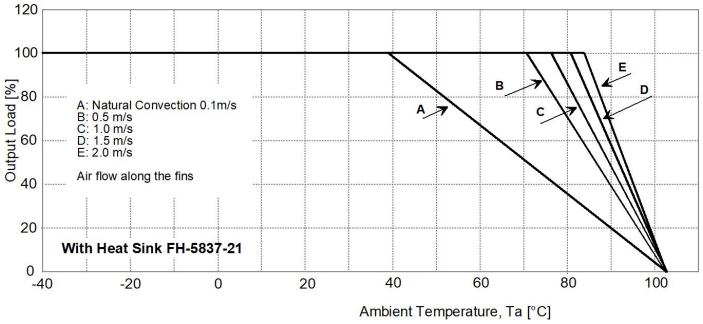
Derating Curve EQX100(Uin 36V) / 12V 15V FH-3758-13



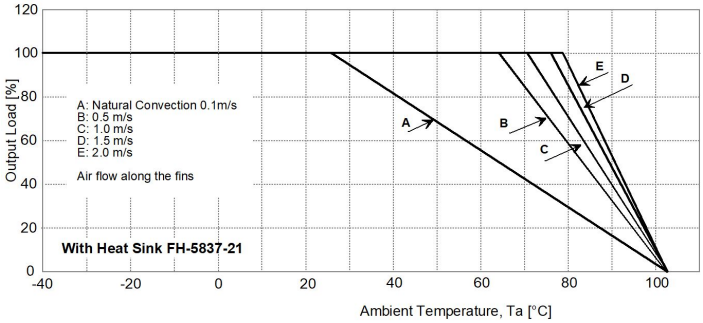
Derating Curve EQX100(Uin 36V) / 28V / 48V 54V FH-3758-13



Derating Curve EQX100(Uin 36V) / 5V 24V FH-5837-21

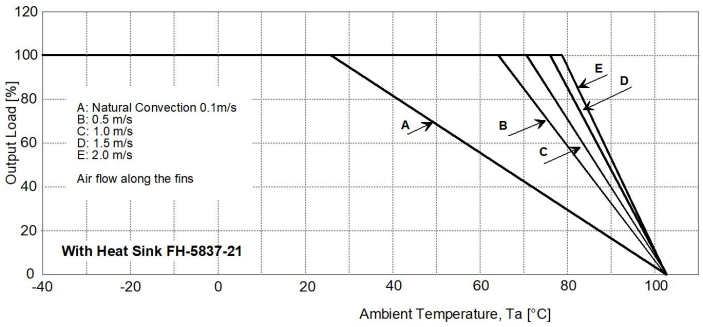


Derating Curve EQX100(Uin 36V) / 12V 15V FH-5837-21

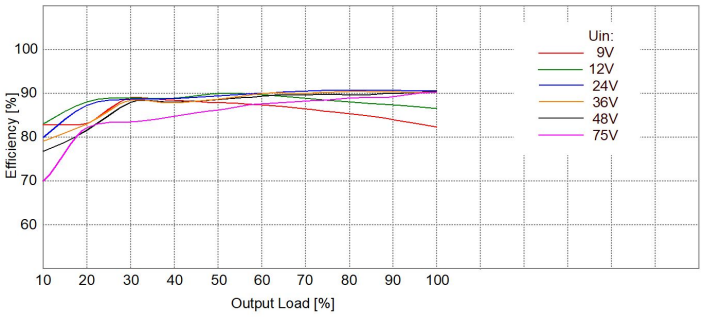


Derating Curves

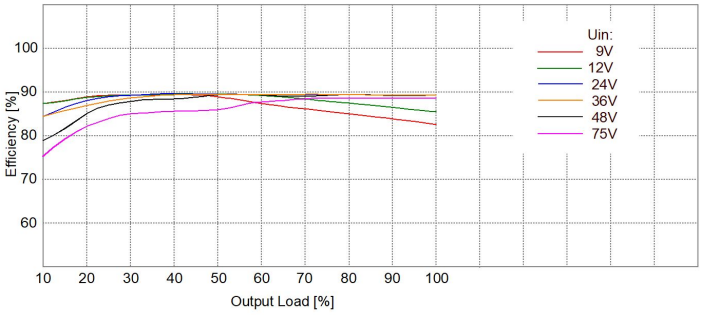
Derating Curve EQX100(Uin 36V) / 28V / 48V 54V FH-5837-21



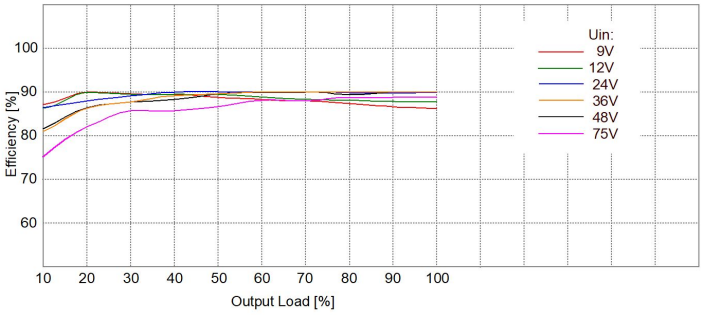
Efficiency Curves EQX36-05100



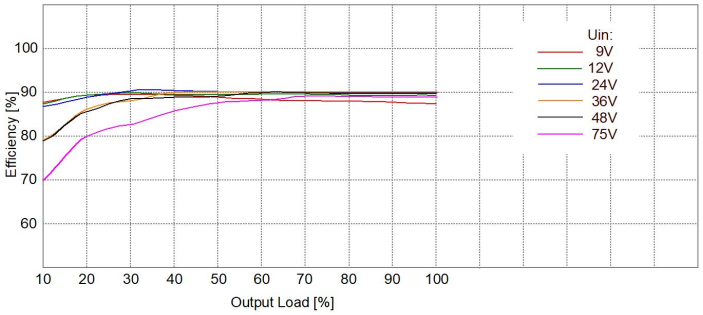
Efficiency Curves EQX36-12100



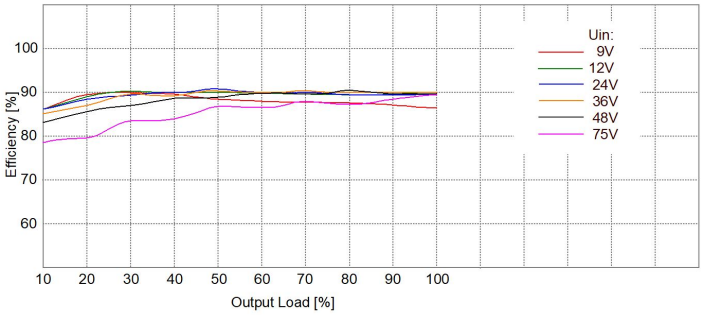
Efficiency Curves EQX36-15100



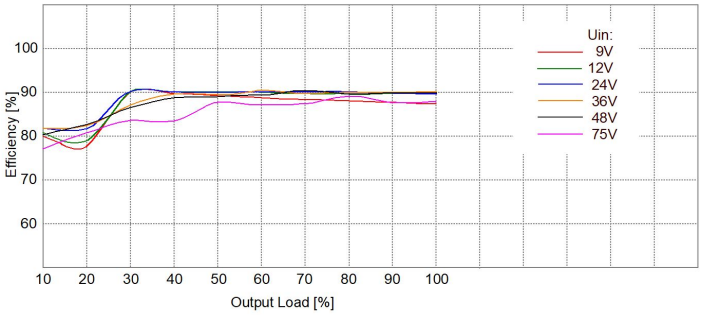
Efficiency Curves EQX36-24100



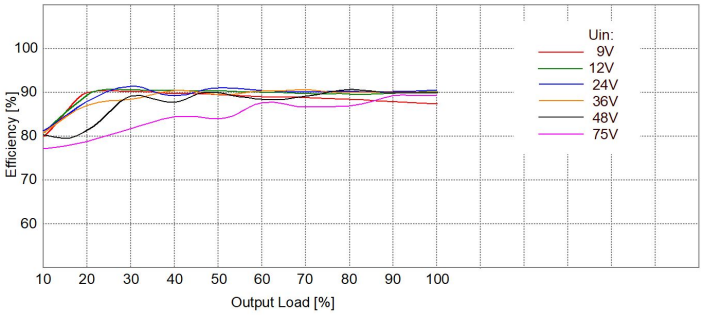
Efficiency Curves EQX36-28100



Efficiency Curves EQX36-48100

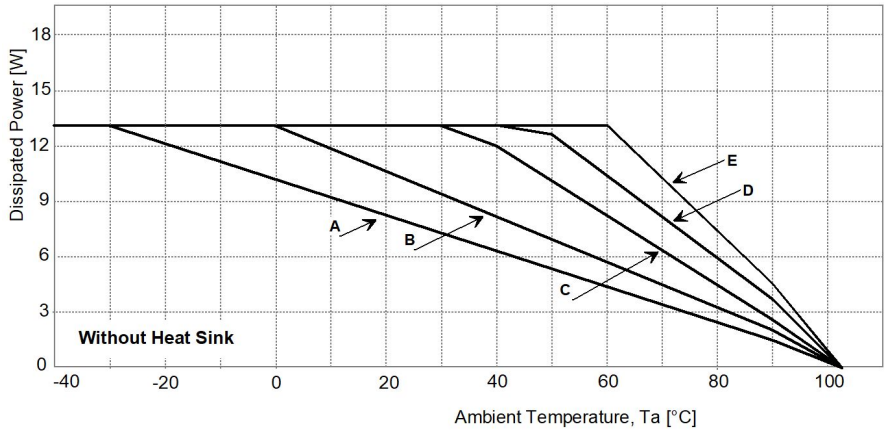


Efficiency Curves EQX36-54100



Derating Formulas

Without Heat Sink: Power Dissipation vs Ambient Temperature and Air Flow



Where:
Example: Vin = 48V, Vout = 12V, Iout = 8.3A, Ta = 40°C, Air Flow = 1m/s

The power dissipation Pd:

$$Pd = Pi - Po = \frac{Po \cdot (1- \eta)}{\eta}$$

Leads to:

$$Pd = \frac{12V \cdot 8.3A \cdot (1- 0.885)}{0.885} = \mathbf{13.0W}$$

The temperature rise Delta T:

$$\Delta T = Pd \cdot R_{thca}$$

And this leads to:

$$\Delta T = 13W \cdot 5.4K/W = \mathbf{70.2K}$$

And:

$$Tc = Ta + \Delta T = 25°C + 70.2K = \mathbf{95.2°C}$$

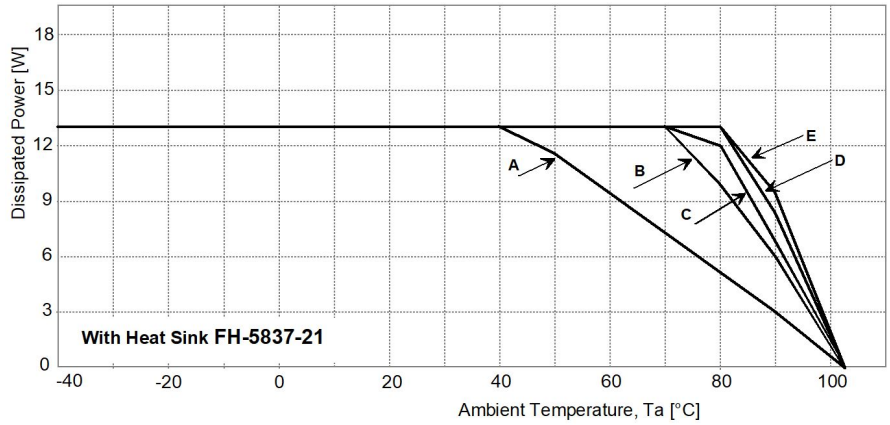
Which is below the max. Tc of 105°C.

The thermal resistances without heatsink are listed below:

Air flow rate	**Typical Rthca**
natural convection 0.1m/s	10.1 K/W
0.5 m/s	8.0 K/W
1.0 m/s	5.4 K/W
1.5 m/s	4.4 K/W
2.0 m/s	3.4 K/W

Derating Formulas

With Heat Sink FH-5837-21: Power Dissipation vs Ambient Temperature and Air Flow; Height: 21mm



Where:
Example: Vin = 48V, Vout = 12V, Iout = 8.33A, Ta = 70°C, Air Flow = 1m/s

The power dissipation Pd:

$$Pd = Pi - Po = \frac{Po \cdot (1- \eta)}{\eta}$$

Leads to:

$$Pd = \frac{12V \cdot 8.33A \cdot (1- 0.885)}{0.885} = \mathbf{13.0W}$$

The temperature rise Delta T:

$$\Delta T = Pd \cdot R_{thca}$$

And this leads to:

$$\Delta T = 13.0W \cdot 2.06K/W = \mathbf{26.8K}$$

And:

$$Tc = Ta + \Delta T = 70°C + 26.8K = \mathbf{96.8°C}$$

Which is below the max. Tc of 105°C.

The thermal resistances with heat sink FH-5837-21 are listed below:

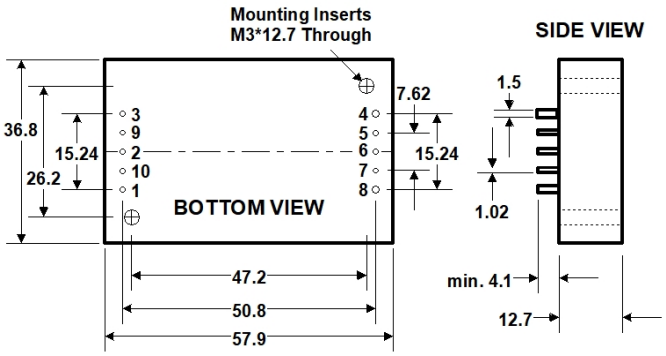
Air flow rate	**Typical Rthca**
natural convection 0.1m/s	4.78 K/W
0.5 m/s	2.44 K/W
1.0 m/s	2.06 K/W
1.5 m/s	1.76 K/W
2.0 m/s	1.58 K/W

Case

Normal tolerance 1/10 ±0.5 mm, 1/100 ±0.25 mm; Pin tolerance ±0.05 mm diameter

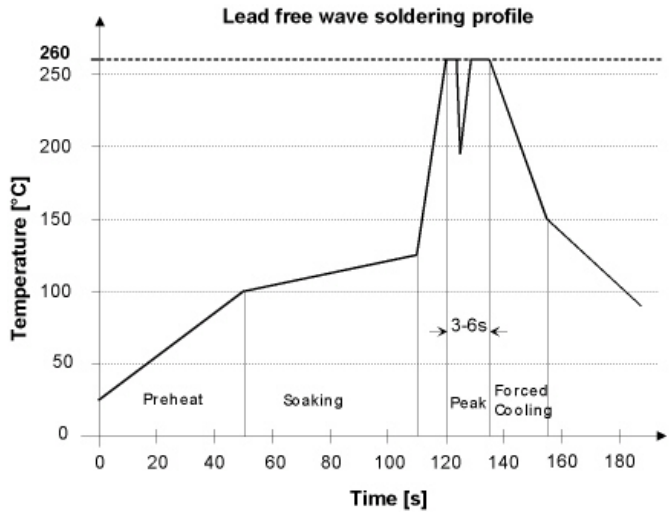
NP = No pin, NC = Not connected, NA = Not available for electrical contact, do not connect, (opt) = optional

Quarterbrick



Pin	Single
1	+Vin
2	on/off
3	-Vin
4	-Vout
5	-Sense
6	Trim
7	+Sense
8	+Vout
9	Bus (opt)
10	UVLO (opt)

Soldering



1. Soldering Materials: Sn/Cu/Ni
2. Preheat: 1.4 °C/s (From 30°C to 100°C)
3. Soaking: 0.5 °C/s (From 100°C to 130°C), 60 ±20s
4. Peak temperature: 260°C, above 250°C 3~6s
5. Forced cooling: -10.0 °C/s (From 260°C to 150°C)

Cleaning

The modules are cleanable with the today's known and in the electronics industry usually used products. Due to the different cleaning processes and new available products, we highly recommend to do a compatibility test when using the converters the first time.

Own notes

Notice: All statements, technical information, and recommendations related to FABRIMEX's products are based on information believed to be reliable, but the accuracy or completeness thereof is not guaranteed. Before utlizing the product, the user should determine the suitability of the product for its intended use.

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