



### Applications

- Intermediate Bus Architectures
- Telecommunications equipment
- LAN/WAN
- Data processing

### Features

- RoHS lead-free and lead-solder-exempt products are available
- Cost-effective, single board design
- Ultra-high efficiency 96.2% @ full load
- Low profile – 0.400" (10.16 mm)
- Narrow input range 42 – 53 VDC
- Input-to-output isolation: 2000 VDC
- Start-up into high capacitive load
- Low conducted and radiated EMI
- Output overcurrent protection
- Input undervoltage lockout
- Input overvoltage shutdown
- Overtemperature protection
- Approved to UL 60950/ CAN/CSA-C22.2 No. 60950-00, and TUV approved to EN 60950-1, IEC 60950-1

### Description

The QTS48T25120 bus converter provides an isolated step-down voltage from 48V to 12.0V nominal. The QTS is an unregulated converter; therefore output voltage is directly proportional to input voltage with a conversion ratio of 4:1. The converter provides ultra-high efficiency; as a result very little heat is dissipated and a heat sink is not required.

The QTS48T25120 is an excellent choice for intermediate bus application where multiple output voltages are required and a 12.0V rail will be used to power point-of-load devices.

Model Selection						
Model	Input Voltage VDC	Input Current, Max ADC	Output Voltage Vout, @ 48Vin VDC	Output Current ADC	Output Ripple/Noise, mV p-p (typ.)	Typical Efficiency @ 48Vi, 25A
QTS48T25120-NDA0	42-53	7.5	12.0	25	75	96.2
QTS48T25120-NCAS2	38-53	7.5	12.0	25	75	96.2

This product is intended for integration into end-use equipment. All the required procedures for CE marking of end-use equipment should be followed.

### Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings may cause performance degradation, adversely effect long-term reliability, and cause permanent damage to the converter.

Parameter	Conditions/Description	Min	Max	Units
Input Voltage	Continuous	0	53	VDC
Operating Temperature	PC Board Temperature	-40	120	°C
Storage Temperature		-40	125	°C

### Environmental and Mechanical Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Shock	(Half-sinewave, 6ms), 3 axes		50		g
Sinusoidal Vibration	GR-63-CORE, Section 5.4.2		1		g
Weight			1.2/35		Oz/g
Water Washing	Standard process		Yes		
MTBF	Per Bellcore TR-NWT-000332 @ 35°C		2,100		kHrs

### Isolation Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Insulation Safety Rating		Functional			
Isolation Voltage	Input to Output	2000			VDC
Isolation Resistance		10			MOhm
Isolation Capacitance			1100		pF

### Input Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Input Voltage	QTS48T25120-NDAX - Continuous	42	48	53	VDC
	QTS48T25120-NDAS2 - Continuous	38	48	53	
Turn-On Input Voltage	QTS48T25120-NDAX - Ramping Up	38	40.5	41.3	VDC
	QTS48T25120-NDAS2 – Ramping Up	36	36.5	37.3	
Turn-Off Input Voltage	QTS48T25120-NDAX - Ramping Down	36	37.5	40.5	VDC
	QTS48T25120-NDAS2 – Ramping Down	34	34.5	35.3	
Turn On Time	Within 1% of Vo nominal	3		20	ms
Input Reflected Ripple Current	Full Load, 12μH source inductance			50	mA p-p
Inrush Transient	Vin=Vin.max			1	A <sup>2</sup> s
Input Over-voltage Shutdown					
Turn-off voltage threshold	Vin	55	57	58	
Turn-on voltage threshold		52	54	55	

### Output Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Output Voltage over line load and temperature		9.7		13.5	VDC
Output Current	Over input voltage range	0		25	A
Load Regulation	Vo			500	mV
Turn-on overshoot	Vo			3	%
Transient response	25% load step change @ 1A/uS (% of Vo nominal)	Vo		+/-3	%
Admissible Load Capacitance	I <sub>rated</sub> , Nom Vin			3000	μF
Output Current Limit Threshold Auto Re-start	A	110%	125%	150%	
Switching Frequency			360		kHz

### Feature Specifications

All specifications apply over specified input voltage, output load, and temperature range, unless otherwise noted.

Parameter	Conditions/Description	Min	Nom	Max	Units
Shutdown (ON/OFF)					
Negative Logic Converter ON	On/Off signal is low – converter is ON	-0.5		0.8	VDC
Source Current Converter OFF	ON/OFF pin is connected to -Vin	2.5		1 Vin	mADC VDC
Positive Logic Converter ON	On/Off signal is low–converter is OFF	2.5		Vin	VDC
Open Circuit Voltage Converter OFF	ON/OFF pin is floating	-0.5		5 0.8	VDC VDC
Overtemperature Protection	Average board temperature	+120		+130	°C

**Characteristic Curves**

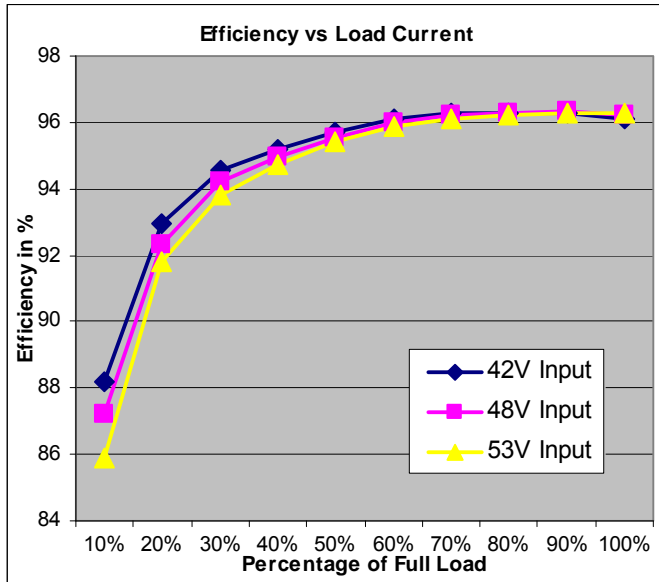


Figure 1. QTS48T25120 Efficiency vs. Output Load

**Typical Application**

Figure 2 shows the recommended connections for the QTS48T25120 converter.



Figure 2. Typical Application of QTS48T25120

The QTS48T25120 converter does not require any external components for proper operation. However, if the distribution of the input voltage to the converter contains significant inductance, the capacitor C1 may be required to enhance performance of the converter. A minimum of a 100  $\mu$ F electrolytic capacitor (with  $ESR < 0.5\Omega @ 100 \text{ kHz}$ ) mounted close to the input side of the power module will ensure stability of the unit.

Refer to the “Inrush Current Control Application Note” on [www.power-one.com](http://www.power-one.com) for suggestions on how to limit the magnitude of the inrush current.

For output decoupling we recommend using a 10  $\mu$ F low ESR tantalum (AVX TPSC106M025R0500 is used in our test setup) capacitor and a 1  $\mu$ F ceramic capacitor. Note, that the capacitors do not substitute the filtering required by the load.

**Shutdown Feature Description**

The ON/OFF pin in the QTS48T25120 converter functions as a normal soft shutdown. It is referenced to the  $-V_{in}$  pin (see Figure 2). With the positive logic, when the ON/OFF pin is pulled low, the output is turned off and the unit goes into a very low input power mode.

With negative logic, when the ON/OFF pin is pulled low, the unit is turned on.

An open collector switch is recommended to control the voltage between the ON/OFF pin and the  $-V_{in}$  pin of the converter. The ON/OFF pin is pulled up internally, so no external voltage source is required. The user should avoid connecting a resistor between the ON/OFF pin and the  $+V_{in}$  pin.

When the ON/OFF pin is used to achieve remote control, the user must take care to insure that the pin reference for the control is really the  $-V_{in}$  pin. The control signal must not be referenced ahead of EMI filtering, or remotely from the unit. Optically coupling the information and locating the optical coupler directly at the module will solve any of these problems.

**Note:**

If the ON/OFF pin is not used, it can be left floating (positive logic), or connected to the  $-V_{in}$  pin (negative logic).

### Safety Considerations

The QTS48T25120 converter features 2000 Volt DC isolation from input to output. The input-to-output resistance is greater than 10 MΩ. This converter is provided with functional insulation between input and output circuits according to all IEC60950 based standards. Nevertheless, if the system using the converter needs to receive safety agency approval, certain rules must be followed in the design of the system. In particular, all of the creepage and clearance requirements of the end-use safety requirements must be observed. These documents include UL60950 - CSA60950-00 and EN60950, although other or additional requirements may be needed for specific applications.

The QTS48T25120 converter has no internal fuse. The external fuse must be provided to protect the system from catastrophic failure as shown in Figure 2. The fuse with a rating not greater than 10 A is recommended. The user can select a lower rating fuse based upon the highest inrush transient at the maximum input voltage and the maximum input current of the converter, which occurs at the minimum input voltage. Both input traces and the chassis ground trace (if applicable) must be capable of conducting a current of 1.5 times the value of the fuse without opening. The fuse must not be placed in the grounded input line, if any.

In order for the output of the QTS48T25120 converter to be considered as SELV (Safety Extra Low Voltage) or TNV-1, according to all IEC60950

based standards, one of the following requirements must be met in the system design:

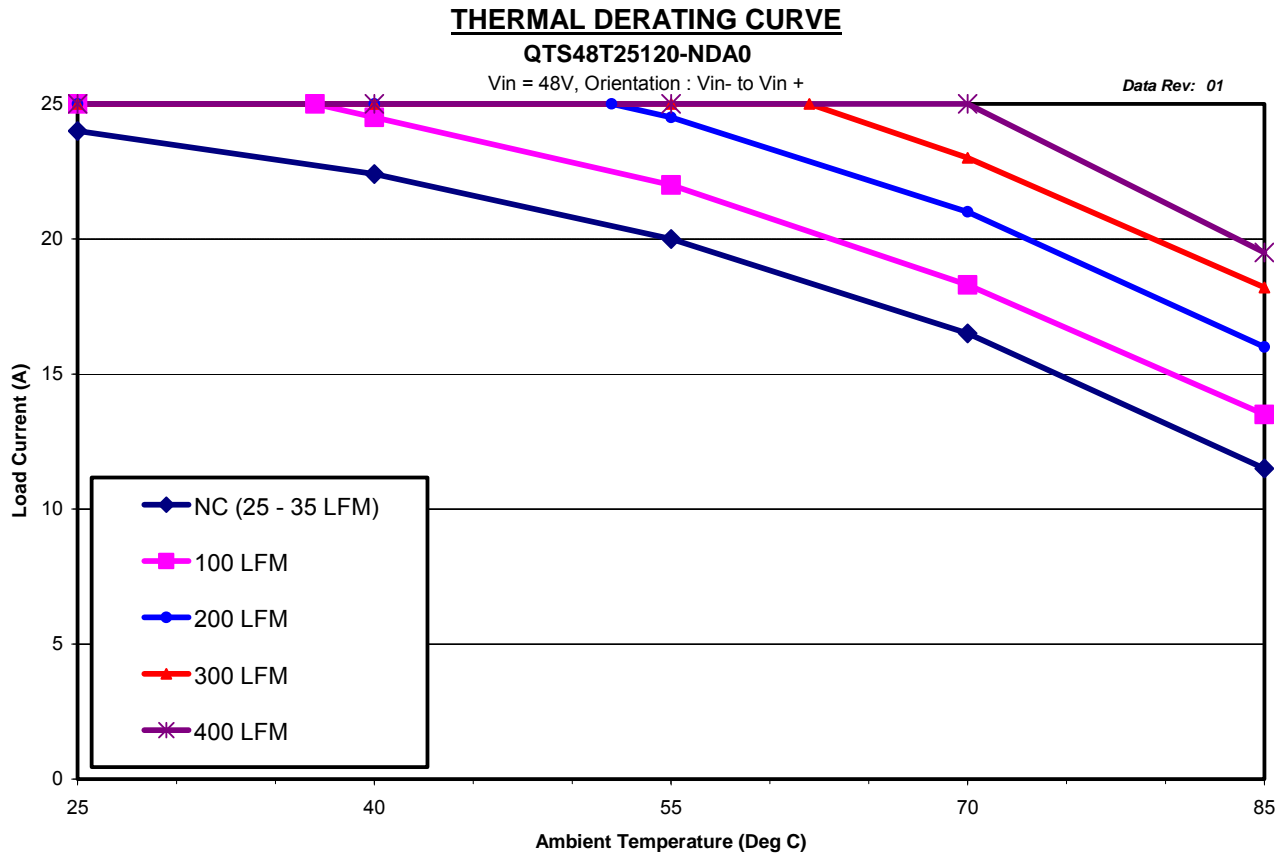
- If the voltage source feeding the module is SELV or TNV, the output of the converter may be grounded or ungrounded.
- If the voltage source feeding the module is ELV, the output of the converter may be considered SELV only if the output is grounded per the requirements of the standard.
- This information is provided for guidance only and the user is responsible for any design considerations regarding safety.

### Thermal Considerations

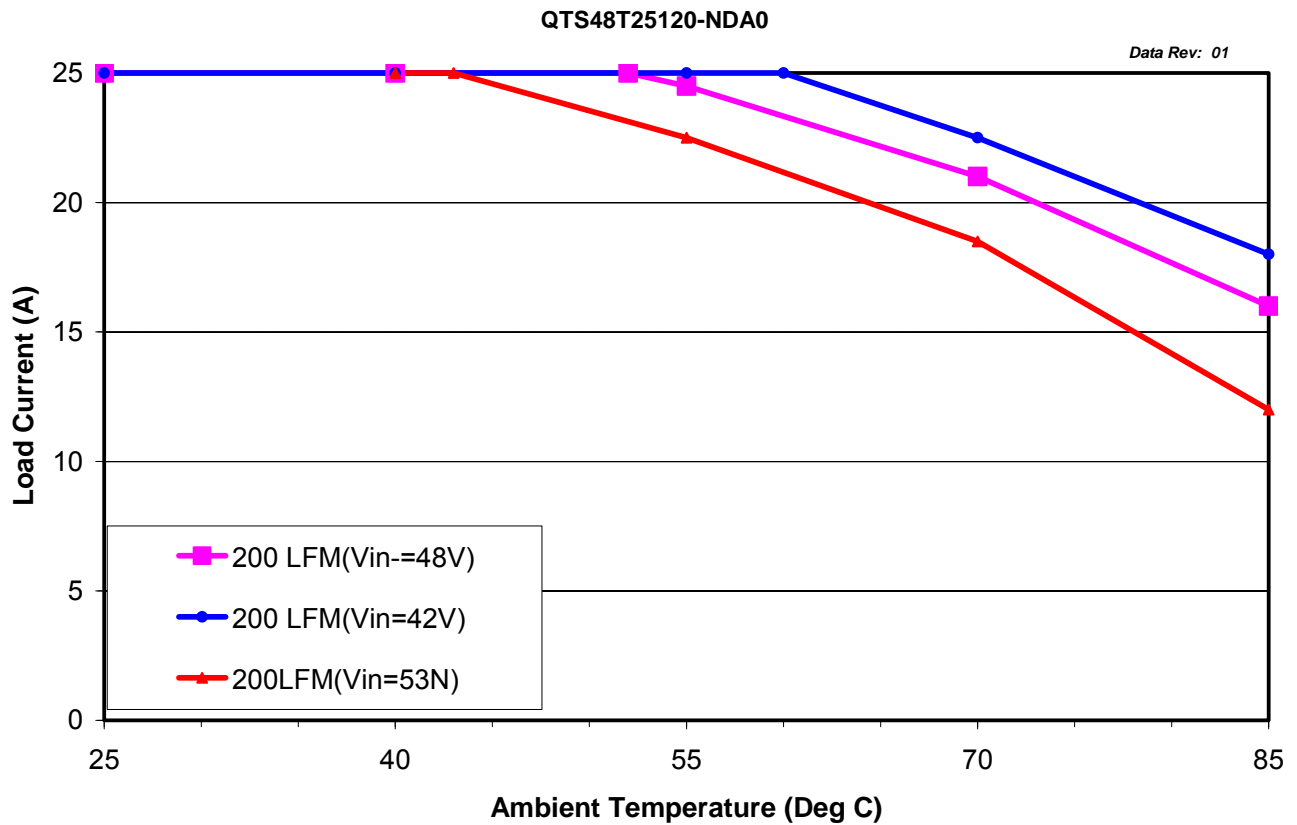
The QTS48T25120 converter is designed for natural or forced convection cooling. The maximum allowable output current of the converter is determined by meeting the derating criteria for all components used in the converter. For example, the maximum semiconductor junction temperature is not allowed to exceed 125 °C to ensure reliable long-term operation of the converter. Contact Power-One for the complete list of the derating criteria.

The graph in figure 3 shows the maximum output current of the QTS48T25120 converter at different ambient temperatures under both natural and forced (transverse airflow direction, from pin 1 to pin 3) convection.

For example, the QTS48T25120 operating at 48Vin, 70 °C can deliver up to 21 A reliably with 200 LFM forced air.



**Figure 3. Thermal Derating Curve Varying Airflow (Input Voltage Constant)**



**Figure 5: Thermal Derating Curve Varying Input Voltage (Airflow Constant at 200 LFM)**

NUCLEAR AND MEDICAL APPLICATIONS - Power-One products are not designed, intended for use in, or authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of the respective divisional president of Power-One, Inc.

TECHNICAL REVISIONS - The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

**Mechanical Drawing**



**Ordering Information**

Options	Suffixes to add to part number
Remote ON/OFF (1 <sup>st</sup> digit of option extension)	Positive- Standard, -P suffix Negative-Standard, -N suffix
Overall Height (2nd digit of option extension)	0.400" – Standard add "D" suffix 0.500" – Add "C" suffix
Pin Length (3rd digit of option extension)	0.18"- Standard, add "A" suffix 0.145"- Add "B" suffix 0.110"- Add "C" suffix
(4 <sup>th</sup> digit of option extension)	Standard add "0" suffix Extended Input Range (38 – 52 VDC) add "-S2" suffix

RoHS	Add to Part Number
RoHS lead solder exempt <sup>1</sup>	No RoHS character required.
RoHS compliant for all six substances	Add "G" as the last character of the part number.

<sup>1</sup> The solder exemption refers to all the restricted materials except lead in solder.

Example: QTS with negative logic, 0.400" height, and 0.145 pin length, the resulting part number is  
QTS48T25120-NDB0