



## Features

- Operational input voltage range is 100 – 600Vdc
- Maximum input voltage is 700Vdc
- 24Vdc Output voltage
- Up to 100W output
- High temperature – 177degC
- High efficiency design ~ 93%
- Short circuit output protection
- Input overvoltage protection
- CNC machined aluminum housing
- CANbus interface



## Product Description

The NSE 100W DCDC 24-4.2/600-38mm is a high performance, high temperature DCDC converter for demanding applications. It is targeted at downhole wireline and drilling tools in addition to other industrial applications where high temperature and large variation in input voltage may occur.

The NSE 100W DCDC 24-4.2/600-38mm has a specified input voltage range of 100 – 600Vdc. Output is 24Vdc and the converter can provide up to 4.2A output current over the entire operating temperature. Maximum operating voltage for short intervals is however 700Vdc. Voltages above this limit will cause it to shut down in protective mode. Maximum survival voltage is 900Vdc for one second.

The NSE 100W DCDC 24-4.2/600-38mm is equipped with output short circuit protection that will protect the converter from failing even though its outputs are directly short circuited.

In order to operate reliably at high temperature, the DCDC has high efficiency (~ 93%), reducing the dissipated power to a minimum.

The NSE 100W DCDC 24-4.2/600-38mm PCB layout is made with ruggedness in mind. A CNC machined aluminum chassis provides maximum mechanical support to allow the board to operate in a very high shock and vibration environment. The board has rugged power input and output connectors.

## Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	05.09.2017	Initial draft	TKK	GLK

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# 1 Product Specification

## 1.1 Electrical Specifications

Parameter	Conditions / Comments	Min	Typ	Max	Unit
<b>SUPPLY VOLTAGE</b>					
Input Voltage Range	<i>Specified operational range</i>	100		600	Vdc
	<i>Absolute maximum range</i>	100		700	Vdc
Overvoltage trig voltage	<i>Exceeding this voltage will enable overvoltage protection</i>	700	715	730	Vdc
Input Startup Voltage	<i>The converter will start when the input voltage is within this voltage.</i>	100		700	Vdc
Input High Voltage	<i>Survival, 1 sec pulse. Max pulse repetition frequency 1 minute</i>			900	Vdc
Negative Voltage protection	<i>No</i>				
<b>POWER OUTPUT SPECIFICATIONS</b>					
Output Voltage Set Point	<i>Vout measured internally at output terminals</i>		24		Vdc
Total Output Voltage Range	<i>Including thermal drift and load regulations</i>	23	24	25	Vdc
Operating Output Current Range	<i>Ambient temperature max 125°C</i>	0		4.2	A
Operating Output Current Range	<i>Ambient temperature max 177°C</i>	0		4.2	A
Operating Output Power Range	<i>@24Vdc output and max 125°C</i>	0		100	W
Operating Output Power Range	<i>@24Vdc output and max 177°C</i>	0		100	W
Current triggering limit	<i>Internally measured peak currents that will start disabling the output switch.</i>	4.2	4.5	4.8	A
Maximum Output Capacitance	<i>Maximum capacitance connected to the output in order to allow startup of the DCDC</i>			1000	uF

<b>DYNAMIC CHARACTERISTICS</b>					
Maximum Voltage Drop	<i>0 – 4.2A load change, 1msec recovery time</i>			3	V
Maximum Voltage Overshoot	<i>4.2 – 0A load change, 1msec recovery time</i>			3	V
<b>FEATURE CHARACTERISTICS</b>					
Converter switching frequency		120	140	180	kHz
<b>EFFICIENCY</b>					
Converter efficiency	<i>I<sub>out</sub> = 4.2A, Vin = 200V, Over full temperature range</i>	90	93		%
Converter efficiency	<i>I<sub>out</sub> = 4.2A, Vin = 600V, Over full temperature range</i>	90	91		%
<b>CANBUS INTERFACE</b>					
Baud Rate			125	250	kbits/s
<b>THERMAL</b>					
Ambient temperature	<i>Max Temperature on the surface of outer housing given that thermal resistance is within the specification</i>			177	°C
Thermal Resistance	<i>Surface of OUTER HOUSING to NSE UNIT</i>  <i>*Refer to the Section "Thermal properties" for further definition</i>			0.5	°C/W
<b>OPERATIONAL LIFETIME</b>					
Expected Lifetime	<i>&lt; 125°C Ambient Temperature</i>	2000			Hours
	<i>125 - 150°C (4 x acc. factor)</i>	500			Hours
	<i>150- 177°C (8 x acc. factor)</i>	250			Hours

## 1.2 Thermal properties

The NSE High Temperature DCDC is designed to operate in a 177°C environment.

In a typical assembly, the **NSE UNIT** is mounted to a **MOUNTING PROFILE** that is located inside an **OUTER HOUSING**.

The **OUTER HOUSING** surface temperature should not rise above the specified maximum ambient temperature, and the mechanical design and interface between the **OUTER HOUSING, MOUNTING PROFILE** and the **NSE UNIT** should be such that the thermal resistance specification is achieved.



## 1.3 Connectors

### 1.3.1 Input

DCDC connector: Harwin M80-5000000M5-02-333-00-000 2 pin connector.

Mating connector: Harwin M80-4000000F1-02-325-00-000

Pin	Signal name	Description / Function	Connector Pinout
A	GND	GROUND	
B	HVin	HV Input Voltage	

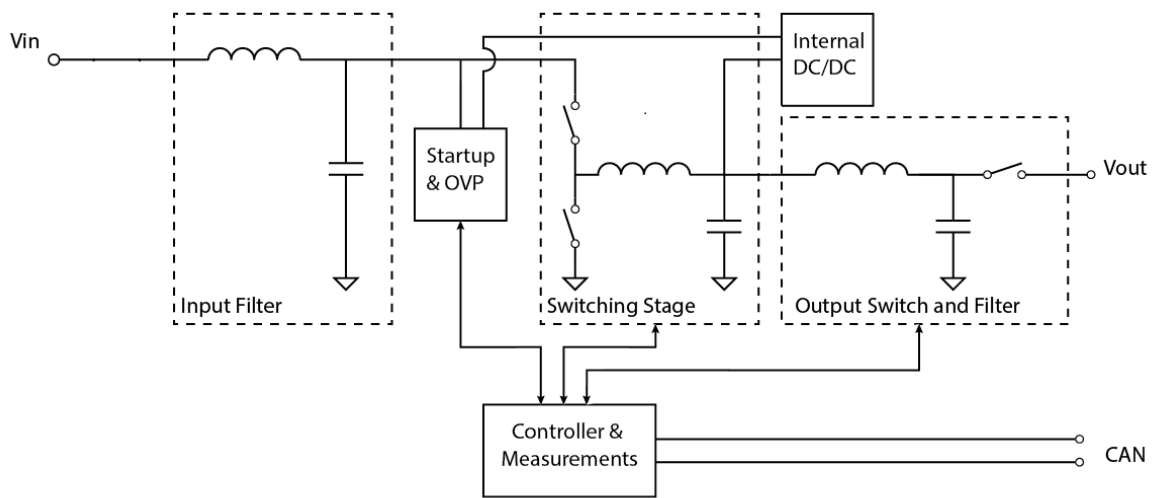
### 1.3.2 Output

DCDC connector: Harwin M80-5L10405M5-02-333-00-000 6 pin connector.

Mating connector: Harwin M80-4C10405F1-02-325-00-000

Pin	Signal name	Description / Function	Connector Pinout
A	VMAIN	Main Output Voltage	
B	GND	GROUND	
1	CANH	CAN High	
2	CANH	CAN High	
3	CANL	CAN Low	
4	CANL	CAN Low	

### 1.4 Functional Block Diagram



## 1.5 Typical Performance Characteristics

### 1.5.1 Step response

- Green plot is output voltage
- Yellow plot is supply (input) voltage
- Blue Plot is output Current

#### Room Temperature Test



Figure 1 – Step response with 100V input, 0 – 4.0 load. 500mV/div, 2A/div, 500us/div  
Result: 1140mV drop

#### 177 °C Temperature Test

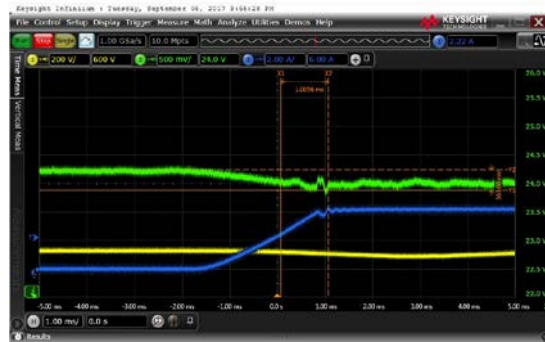


Figure 3 – Step response with 100V input, 0 – 4.0 load. 500mV/div, 2A/div, 1ms/div  
Result: 360mV drop

#### Room Temperature Test

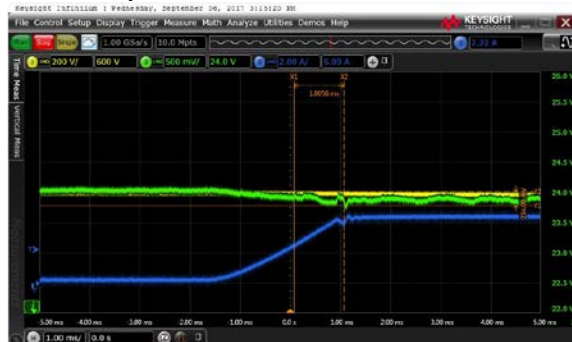


Figure 2– Step response with 600V input, 0 – 4.0 load. 500mV/div, 2A/div, 1ms/div  
Result:

#### 177 °C Temperature Test

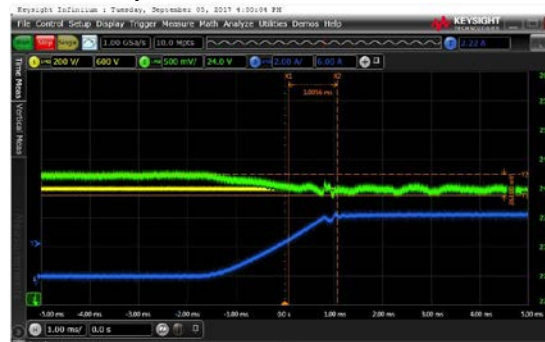


Figure 4 – Step response with 600V input, 0 – 4.0A load. 500mV/div, 2A/div, 1ms/div  
Result: 360mV drop



### 1.5.2 Efficiency at 100W load

Efficiency is measured at 25°C Room temperature and 125°C at 177°C at full load (4.2A).

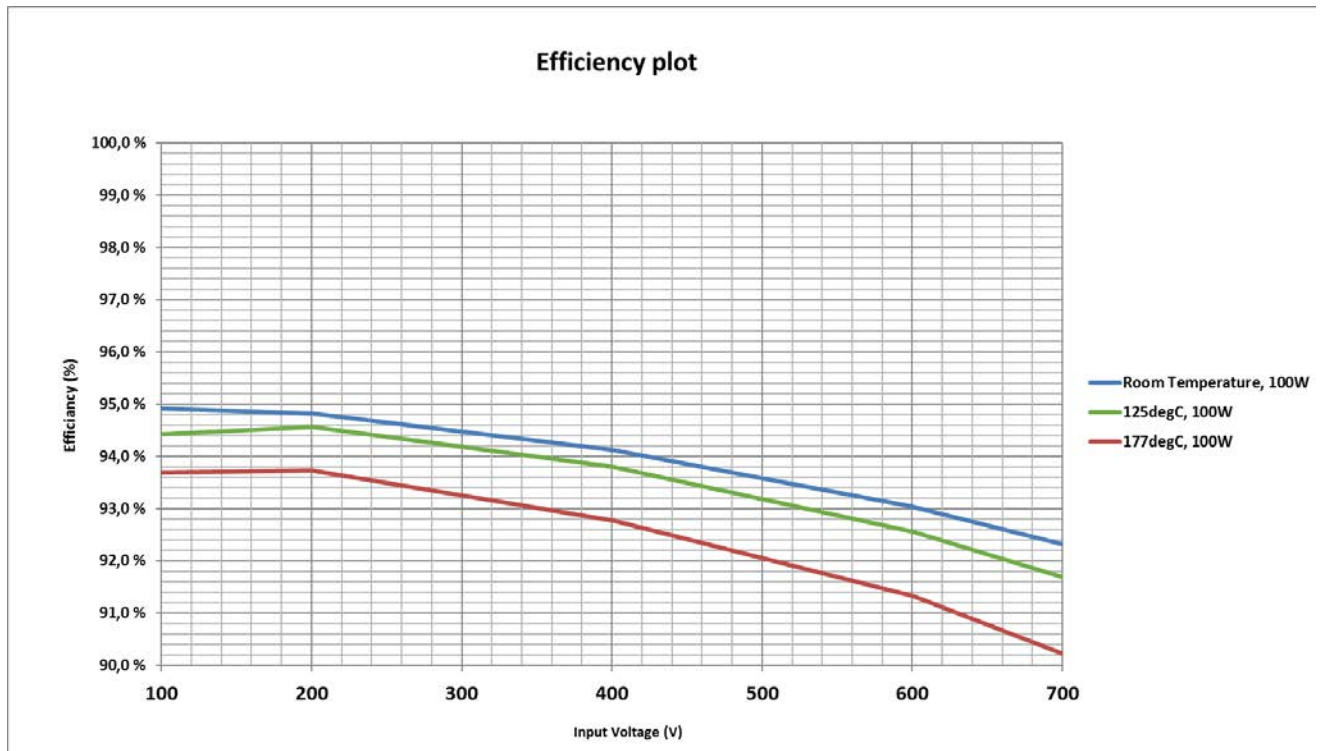


Figure 5 - Measured efficiency (typical numbers) for different input voltages in room temperature and high temperatures

## 2 Functional Description

### 2.1 Integrated Sensors

The NSE 100W DCDC 24-4.2/600-38mm has the following integrated sensors that are continuously sampled and can be distributed over CANbus:

1. Temperature Sensor
2. Input Voltage Measurement
3. Output Voltage Measurement
4. Output Current Measurement

### 2.2 Over Voltage Protection

The over-voltage protection will activate if the input voltage goes above the threshold voltage of the over-voltage circuit. When the over voltage is activated the circuit will cut off the power to the board and thereby shut it down.

When the board has been shut down by the over-voltage circuit, the input voltage has to decrease into the valid operational voltage range before the unit will attempt restart.

After re-start the unit will resume normal operation.

### 2.3 Output Power Switch

The NSE 100W DCDC 24-4.2/600-38mm has an output switch that will disconnect the output in the case of the following event:

1. Output over-current
2. Output short circuit
3. Input over voltage range
4. Input under voltage range

During startup the switch is off until the converter is within the valid input voltage range.

### 2.4 CANbus

The NSE 100W DCDC 24-4.2/600-38mm has a CANbus interface for communications with CANbus nodes. Typically the DCDC converter will act like a slave on a CANbus network. It has a defined protocol for reading its internal registers. The CANbus is available as long as internal start-up is activated. Internal start-up will occur typically when approximately 30V is applied on the input.

### 2.5 Startup circuit

The NSE 100W DCDC 24-4.2/600-38mm has a dedicated start up circuit in order to allow proper powering and protection during startup of the unit.

The unit will start up as long as it is within the specified voltage range.

## 2.6 Output Short Circuit Protection

The unit is protected against overload and short circuits with a current limiting feature and a short circuit detect.

If the current rises above the current triggering limit, the converter will turn off its output switch in order to protect its circuitry.

If a short circuit is detected (output voltage drop below the short circuit triggering level) the output switch will be turned off.

In both cases (current protection and short circuit detection), the unit will try to restart and resume to normal operation when the short circuit or overload is removed.

## 2.7 Bootloader

The NSE 100W DCDC 24-4.2/600-38mm can be firmware upgraded through its CANbus interface using the NSE bootloader software. Bootloader is activated during startup when a low voltage, typically 50Vdc is applied on the input terminals.

Consult NSE for further information.

## 3 Mechanical Dimensions

