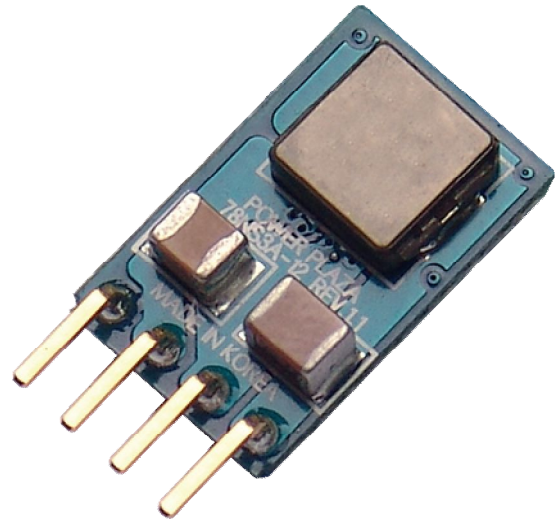


78NS3A-12(V) Series– Non-isolated DC/DC Converters
6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

Data Sheet

78NS3A-12 Series – 4-Terminal Non-isolated DC/DC converters**Features**

- Low Output Ripple and Noise
- Wide operating temperature range
(-40°C to +85°C)
- 6.5Vdc ~ 18Vdc input range(@ 3.3 Vout)
- Dimensions 10.4 x 16.5 x 4.9 (mm)
- Output Over Current Protection
- Over Temperature Protection
- UVLO (Typ. 4.3 Vin)
- Short Circuit Protection
- Remote On/Off
- Cost-efficiency open frame design
- RoHS directive

**Applications**

- Telecommunication equipment
- Network equipment
- Distributed power systems
- Industrial application

Description

78NS3A-12 Series is 3.0A 4-terminal non-isolated DC/DC converter offering low cost and space efficient solution. Features include precisely regulation, input under voltage lockout, output over current protection and over temperature protection.

The -40°C to +85°C operating temperature range makes the 78NS3A-12 series ideal for mixed analog/digital subsystems, data communication equipments, distributed power systems. It is an excellent choice for both new design-information network system and upgrading older systems.

78NS3A-12(V) Series– Non-isolated DC/DC Converters
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Absolute Maximum Ratings

Parameter	Min	Max	Unit	Notes
Input Voltage	-0.3	28	Vdc	
Operating Ambient Temperature	-40	85	°C	
Storage Temperature	-40	105	°C	

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device

Electrical Specifications

Input Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Operating Input voltage Range					
78NS3A-12-3R3V	V_{IN}	6.5		18	V
78NS3A-12-5R0V		10		18	V
Maximum Input Current (At nominal input voltage and maximum output current.)	$I_{IN,max}$		1.7@3.3V 1.7@5.0V		A
UVLO Threshold	$V_{IN,Rising}$	4.1	4.3	4.5	V
	Hysteresis	-	300	-	mV
No Load Input Current					
78NS3A-12-3R3V				28@12 V_{IN}	mA
78NS3A-12-5R0V				33@12 V_{IN}	mA
Input Reflected Ripple Current ($V_{IN} = 5.0V$, $V_{OUT} = 3.3V$, $I_{OUT} = 1.5A$)	$I_{reflect,ripple}$				mApp

Output Characteristics

$T_A = +25^\circ C$, $V_{in} = 6.5 \sim 18V$ unless otherwise specified

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage	V_{OUT}				
78NS3A-12-3R3V		-	3.3	-	V
78NS3A-12-5R0V		-	5.0	-	
Output Voltage Tolerance	$V_{OUT,Tol}$	-3.0	-	+3.0	%, V_{OUT}
Output Current	I_{OUT}			3.0	A
Output Regulation; - Line Regulation ($V_{IN} = 6.5 V$ to 18 V)		-0.2	-	+0.2	%, V_{OUT}

78NS3A-12(V) Series– Non-isolated DC/DC Converters
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Data Sheet

- Load Regulation ($I_{OUT} = 0 \text{ A to } 3.0 \text{ A}$)		-1	-	+1	%, V_{OUT}
Output Over Current Protection (Automatic recovery)		3800	5000	-	mA
Output Ripple and Noise 78NS3A-12-3R3V 78NS3A-12-5R0V ($V_{IN} = 12\text{V}$, $I_{OUT} = 3.0 \text{ A}$, Bandwidth 20MHz, $C_{OUT,EXT} = 10\mu\text{F(Tantal)}$, $1\mu\text{F(Ceramic)}$)	Vripple&noise	-	-	40 60	mV _{PP} mV _{PP}
Efficiency 78NS3A-12-3R3 78NS3A-12-5R0 ($V_{IN} = 12\text{V}$, $I_{OUT} = 3.0\text{A}$)	η η		89 92		% %
Dynamic Load Response ($I_{OUT} = 50\% \text{ to } 100\% \text{ to } 50\%$)		-1.5		+1.5	%, V_{OUT}
Recovery Time (with in 1% Nominal V_o)			70		μs
Start – Up Time			400		μs
Turn – on overshoot			120		%
External Output Capacitance	$C_{OUT,EXT}$				μF
Switching frequency	f_{SW}	540	600	660	kHz

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Remote On/Off Unit On = 1.2V to 2V, Open Unit Off = 0 to 1.1V		1.2 -	1.35 -	2 1.1	V
MTBF		1.14 x 10 ⁶			hrs
Weight			1.72		Grams
Dimensions (W x H x L)		10.4 x 16.5 x 4.9			mm

Environmental

Parameter	Symbol	Min	Typ	Max	Unit
Operating Temperature		-40		85	°C
Operating Humidity (RH non-condensing)					%

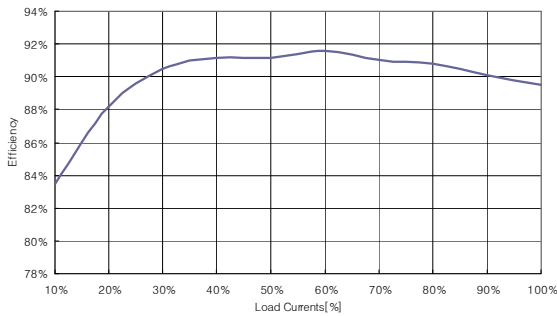
78NS3A-12(V) Series– Non-isolated DC/DC Converters
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Data Sheet

Storage Temperature		-40		105	°C
Lead Temperature (Soldering, 10 [sec])				300	°C

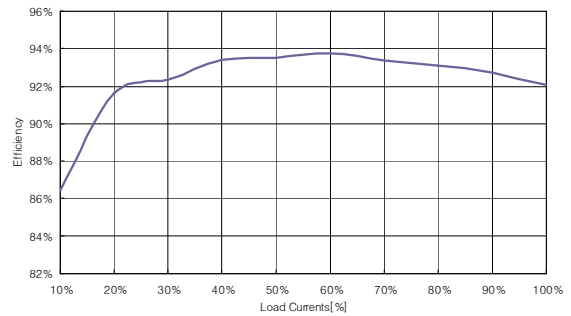
Characteristic Curves
Efficiency Curves

- 78NS3A-12-3R3-



[Fig. 1] Vin=12V, Vo=3.3V@3A , At 25°C

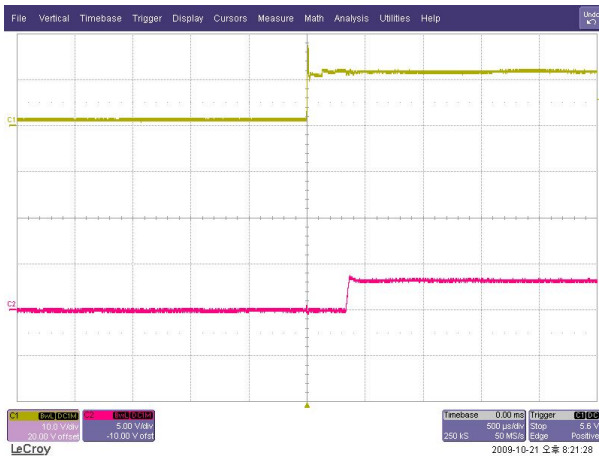
- 78NS3A-12-5R0-



[Fig. 2] Vin=12V, Vo=5.0V@3A , At 25°C

Start-up from Vin

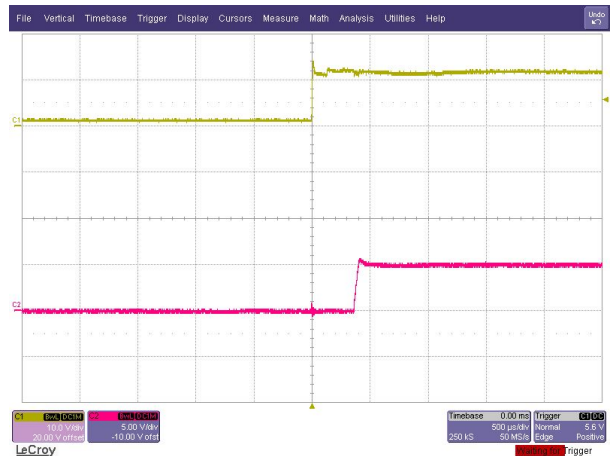
- 78NS3A-12-3R3-



-Ch1 : Input voltage, 10V/div, 500 µs /div
 -Ch2 : Output voltage, 5V/div, 500 µs /div

[Fig. 3] Vin=12V, Vo=3.3V@3A , At 25°C

- 78NS3A-12-5R0-



-Ch1 : Input voltage, 10V/div, 500 µs /div
 -Ch2 : Output voltage, 5V/div, 500 µs /div

[Fig. 4] Vin=12V, Vo=5.0V@3A , At 25°C

78NS3A-12(V) Series– Non-isolated DC/DC Converters
6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

Data Sheet

Falling time

- 78NS3A-12-3R3-

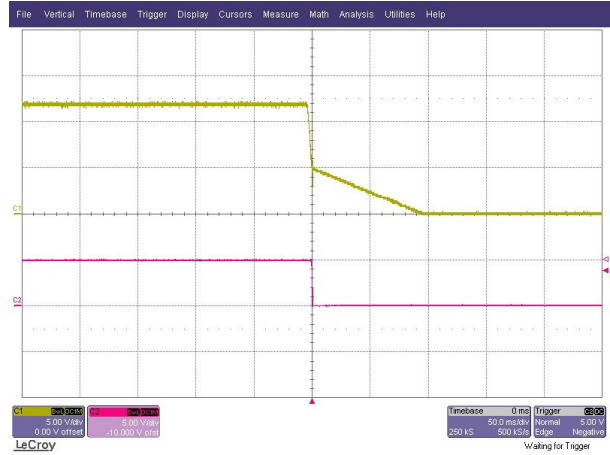


-Ch1 : Input voltage, 5V/div, 50ms/div

-Ch2 : Output voltage, 5V/div, 50ms/div

[Fig. 5] Vin=12V, Vo=3.3V@3A , At 25°C

- 78NS3A-12-5R0-



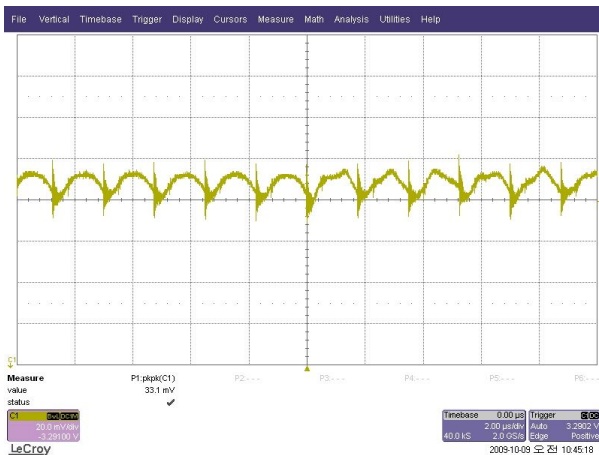
-Ch1 : Input voltage, 5V/div, 50ms/div

-Ch2 : Output voltage, 5V/div, 50ms/div

[Fig. 6] Vin=12V, Vo=5.0V@3A , At 25°C

Output Ripple/Noise

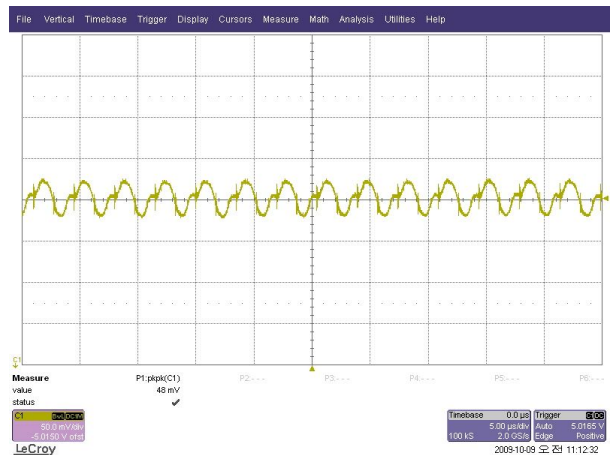
- 78NS3A-12-3R3-



-20mV/div, 2μs/div

[Fig. 7] Vin=12V, Vo=3.3V@3A , At 25°C

- 78NS3A-12-5R0-



-50mV/div, 5μs/div

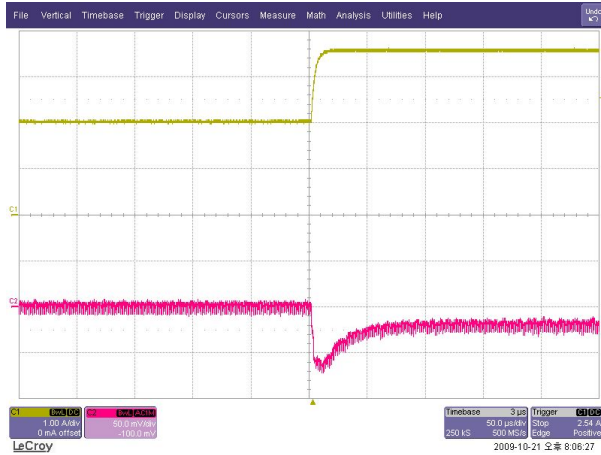
[Fig. 8] Vin=12V, Vo=5.0V@3A , At 25°C

78NS3A-12(V) Series– Non-isolated DC/DC Converters
6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

Data Sheet

Output Load Transient Response

- 78NS3A-12-3R3-



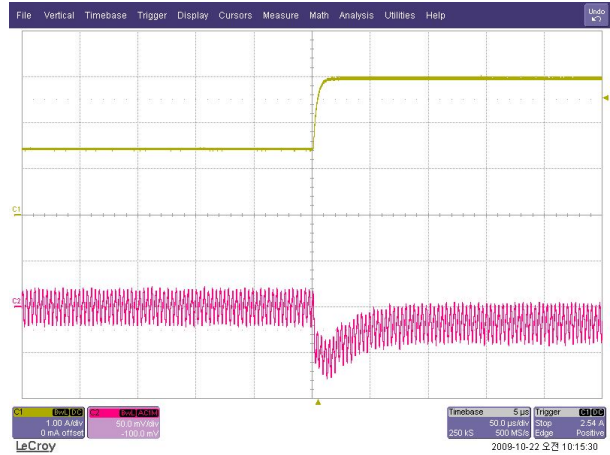
50% to 100% Max load, Slew rate: 3A/μs

-Ch1 : Output Current, 50mV/div, 50μs/div

-Ch2: Output Current, 1A/div, 50μs/div

[Fig. 9] Vin=12V, Vo=3.3V@3A , At 25°C

- 78NS3A-12-5R0-



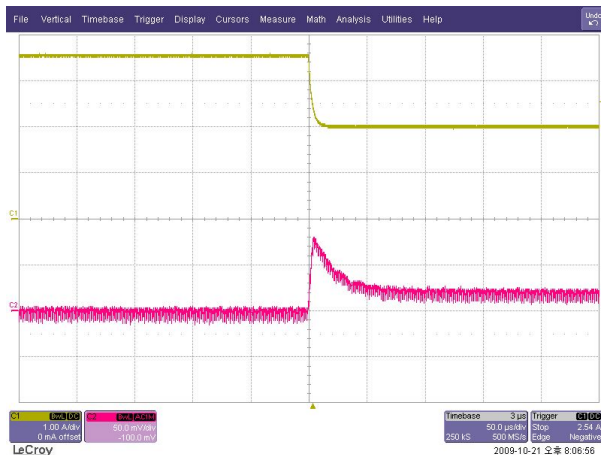
50% to 100% Max load, Slew rate: 3A/μs

-Ch1 : Output Voltage, 50mV/div, 50μs/div

-Ch2: Output Current, 1A/div, 50μs/div

[Fig. 10] Vin=12V, Vo=5.0V@3A , At 25°C

- 78NS3A-12-3R3-



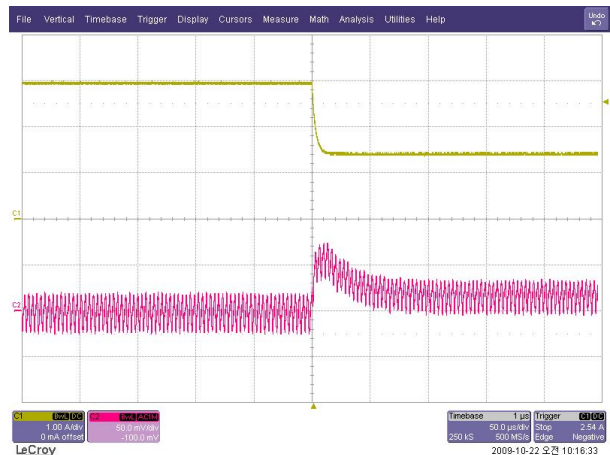
50% to 100% Max load, Slew rate: 3A/μs

-Ch1 : Output Current, 50mV/div, 50μs/div

-Ch2: Output Current, 1A/div, 50μs/div

[Fig. 11] Vin=12V, Vo=3.3V@3A , At 25°C

- 78NS3A-12-3R3-



50% to 100% Max load, Slew rate: 3A/μs

-Ch1 : Output Voltage, 50mV/div, 50μs/div

-Ch2: Output Current, 1A/div, 50μs/div

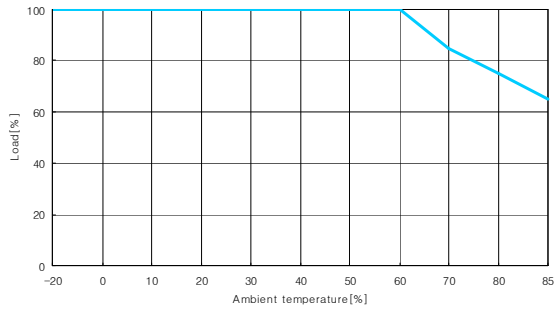
[Fig. 12] Vin=12V, Vo=5.0V@3A , At 25°C

78NS3A-12(V) Series– Non-isolated DC/DC Converters
6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

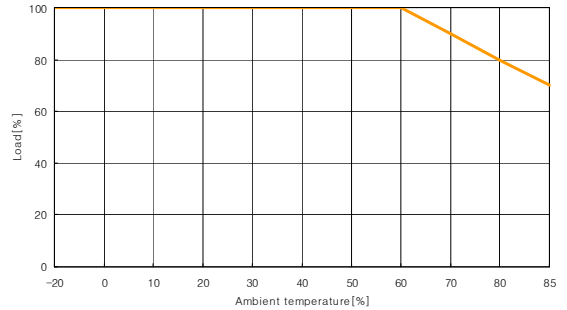
Data Sheet

Derating curve

-78NS3A-12-3R3-



-78NS3A-12-5R0-

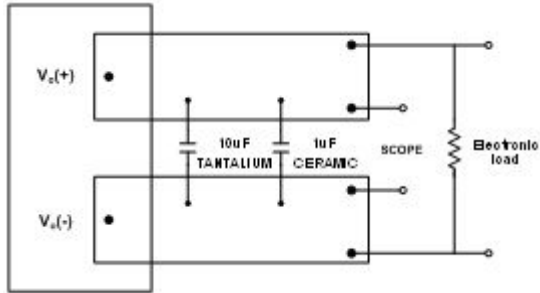


78NS3A-12(V) Series– Non-isolated DC/DC Converters
6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

Data Sheet

TEST Configurations

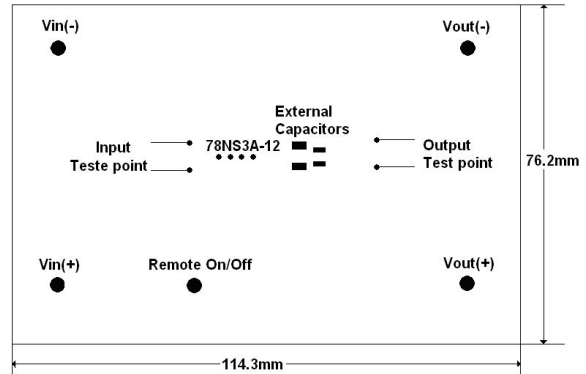
Output ripple and noise Test



* Conductor from Test point to capacitors = 17mm (0.67in)

[Fig. 13]

Test board description

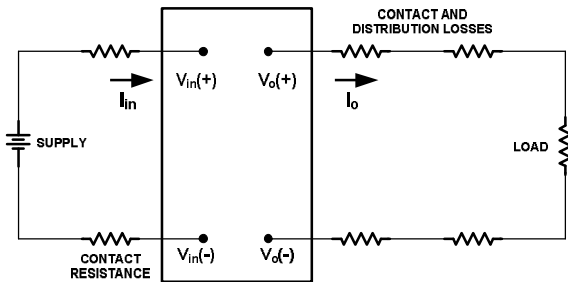


[Fig. 15]

Size:76.2mm x114.3mm x1.6mm(1Oz)

Both electrical characteristic test and thermal test are treated on the above board.

Output Voltage and Efficiency Test



[Fig. 14]

*All measurements are taken at the module terminals when socketing, place Kelvin connections at module terminals to avoid measurement errors due to socket contact resistance

Efficiency

$$\eta = \left(\frac{[V_o(+)-V_o(-)] \times I_o}{[V_{in}(+)-V_{in}(-)] \times I_{in}} \right) \times 100\%$$

Thermal Considerations

78NS3A-12 has wide operating temperature range from -40°C to +85°C.

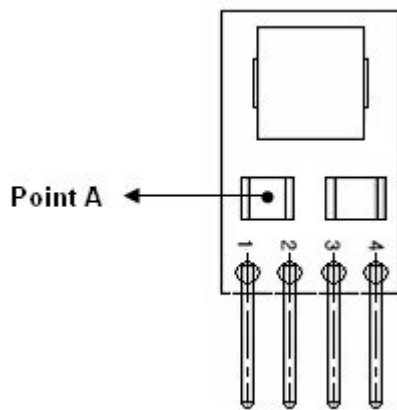
Output derating curve provide designers with a quantity of a current under the desired ambient temperature.

If the device is installed in a system, the device's temperature of point A at Fig. 17 should be checked if it does not exceed specified temperature as below.

Please make sure that the temperature of point A does not exceed 100°C. If the temperature of point A exceed a 100°C over temperature protection circuit will operate and output shunt down. As the temperature goes down the output will recover automatically. As shown in point A.

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6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

Data Sheet



[Fig. 16]

Soldering Information

The product is intended for through hole mounting in a PCB, When wave soldering is used, the temperature on the pins is specified to maximum 300°C for maximum 10 seconds when hand soldering, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

Feature Description

Remote ON/OFF Control (CNT)

By using CNT pin you can control the output without turning the input power on or off. If you need not this function open this pin

CNT Level for –Vin	OUTPUT
Open	ON
Short	OFF

Over current Protection(OCP)

78NS3A-12 built in over current protection circuit which operates when the output current is over 166% of rating and automatically recovers when over current condition is removed

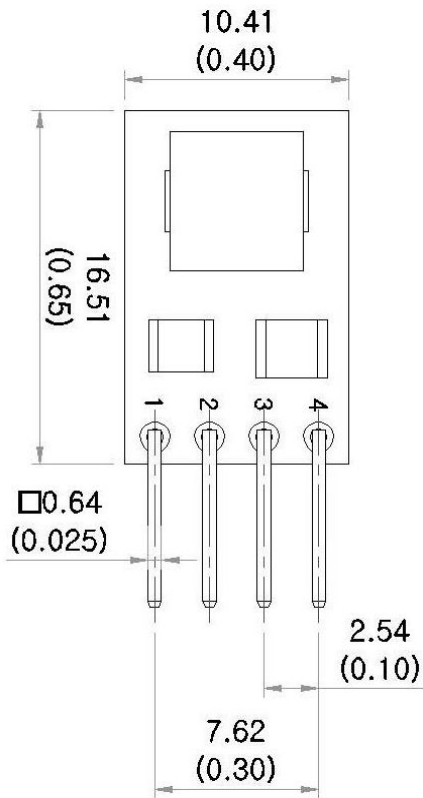
Under Voltage Lock Out(UVLO)

78NS3A-12 built in under voltage lock out circuit which operates when the output voltage under 4.1V-4.5V. When UVLO is triggerd, the input must be taken out for second and then reinputed manually.

78NS3A-12(V) Series– Non-isolated DC/DC Converters
 6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

Data Sheet

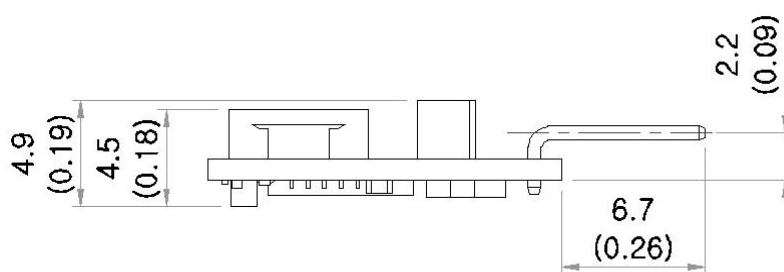
Pin assignments



PIN NO.	NAME	FUNCTION
1	Remote On/Off	Remote On/Off
2	+Vin	Positive terminal for input
3	COM	Ground
4	+Vout	Positive terminal for output

Mechanical Specification

SIDE VIEW



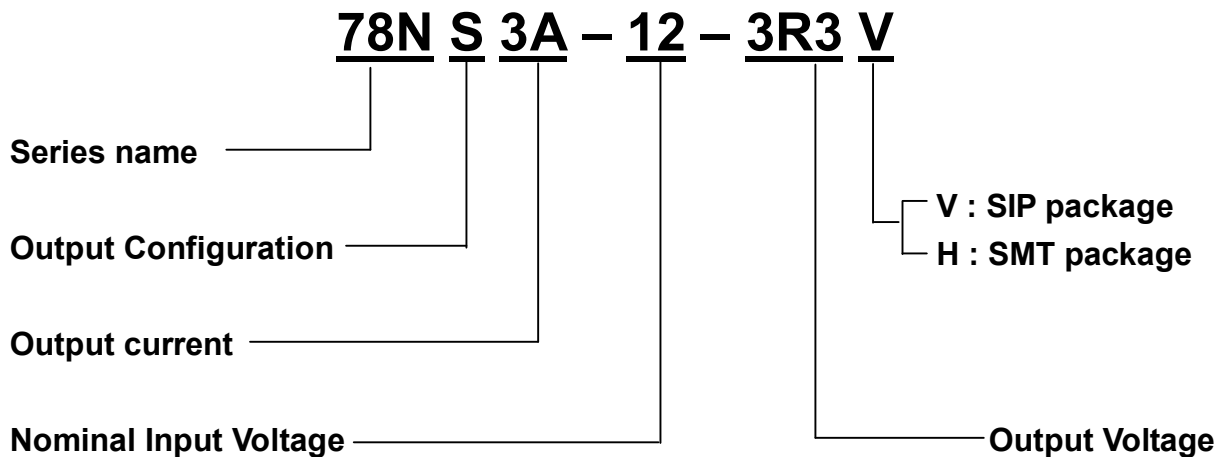
All dimensions are mm(inches)

78NS3A-12(V) Series– Non-isolated DC/DC Converters
 6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

Data Sheet

Ordering Information

Input	Output	Maximum Power[W]	Ripple & Noise Max.[mV _{PP}]	Efficiency Typ.[%]	Model Number
6.5 – 18V	3.3V@3.0A	9.9	40	89	78NS3A-12-3R3V
10 – 18V	5.0V@3.0A	15	60	92	78NS3A-12-5R0V

Part Number Structure


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