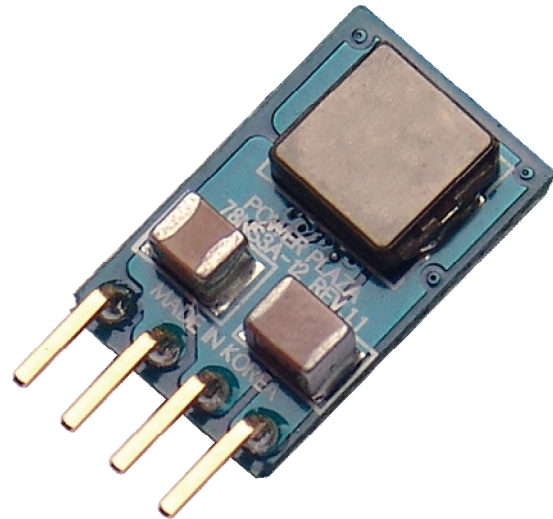


78NS3A-12(V) Series– Non-isolated DC/DC Converters
6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A OutputData Sheet
Oct. 15, 2009**78NS3A-12 Series – 4-Terminal Non-isolated DC/DC converters****Features**

- 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.

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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}

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- 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)					%

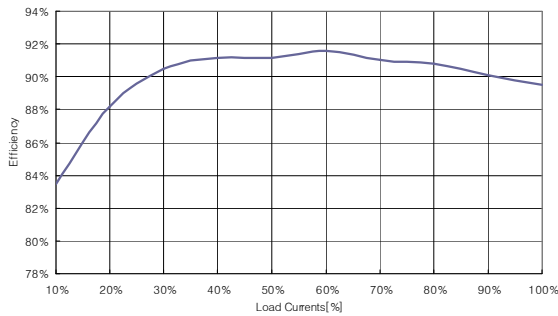
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Storage Temperature		-40		105	°C
Lead Temperature (Soldering, 10 [sec])				300	°C

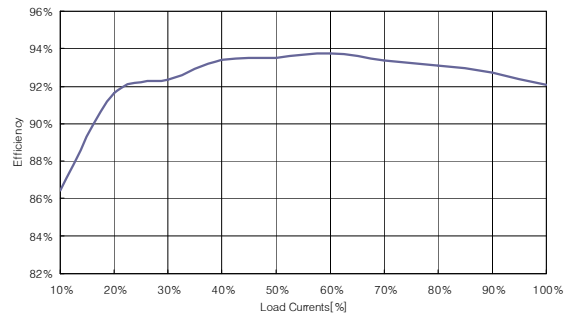
Characteristic Curves
Efficiency Curves

- 78NS3A-12-3R3-



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

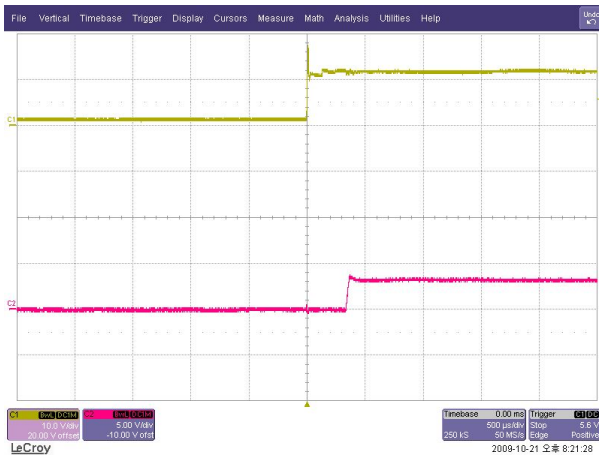
- 78NS3A-12-5R0-



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

Start-up from Vin

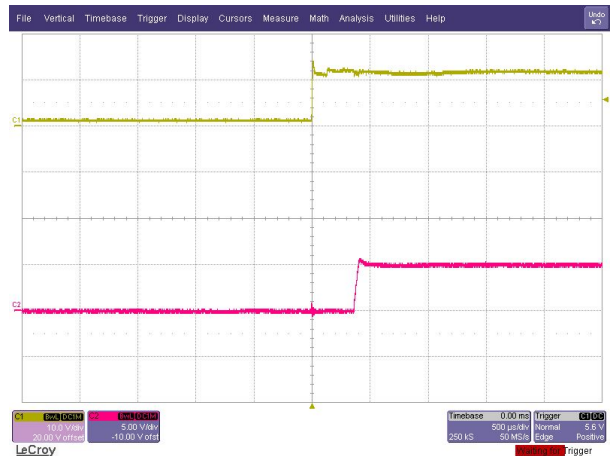
- 78NS3A-12-3R3-



-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

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

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Falling time

- 78NS3A-12-3R3-

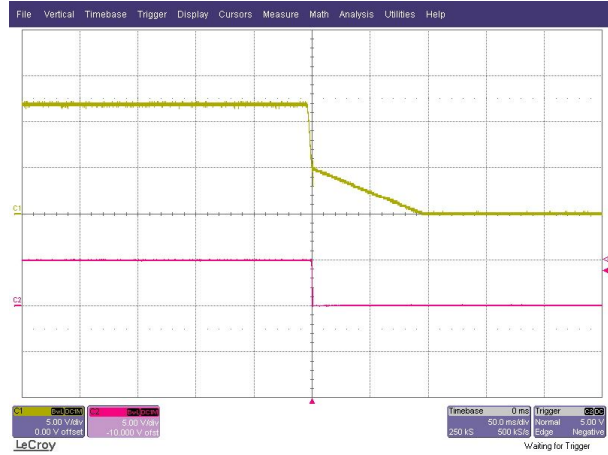


-Ch1 : Input voltage, 5V/div, 50ms/div

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

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

- 78NS3A-12-5R0-



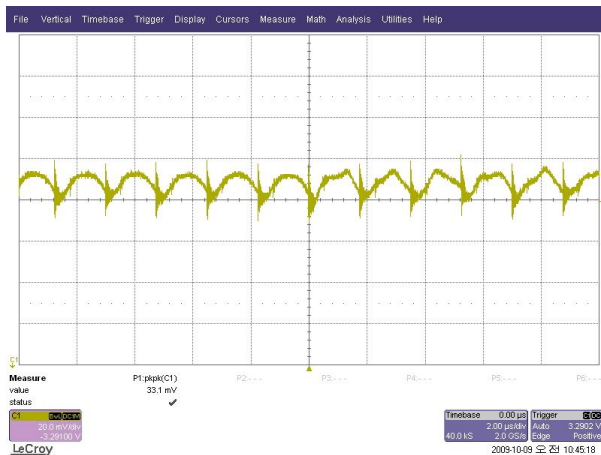
-Ch1 : Input voltage, 5V/div, 50ms/div

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

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

Output Ripple/Noise

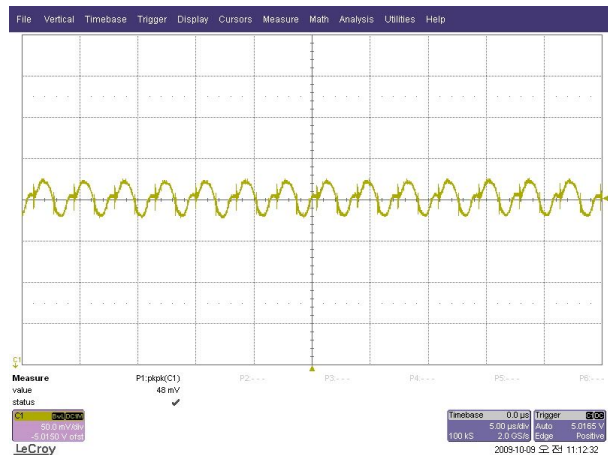
- 78NS3A-12-3R3-



-20mV/div, 2μs/div

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

- 78NS3A-12-5R0-



-50mV/div, 5μs/div

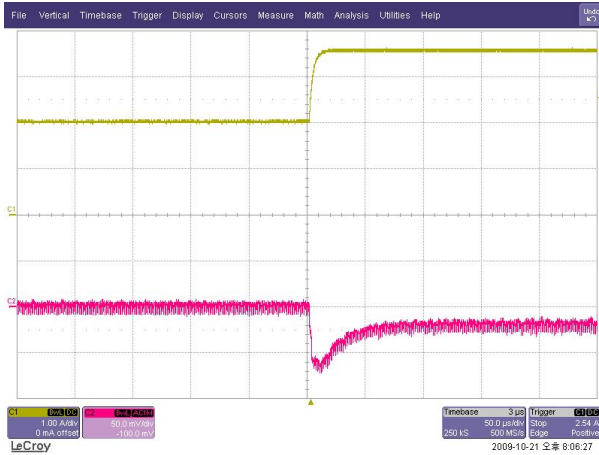
[Fig. 8] Vin=12V, Vo=5.0V@3A , At 25°C

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

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Output Load Transient Response

- 78NS3A-12-3R3-



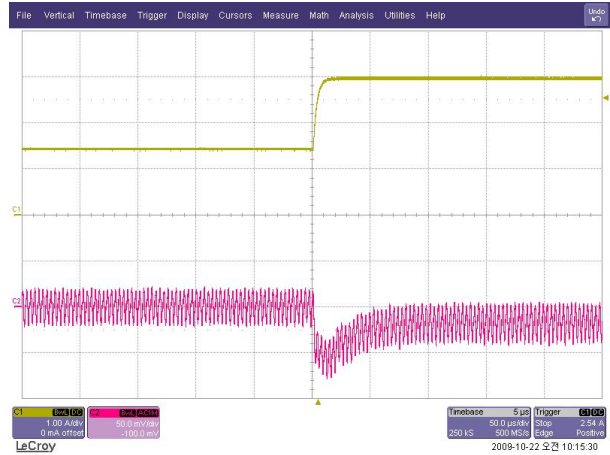
50% to 100% Max load, Slew rate: 3A/μs

-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-



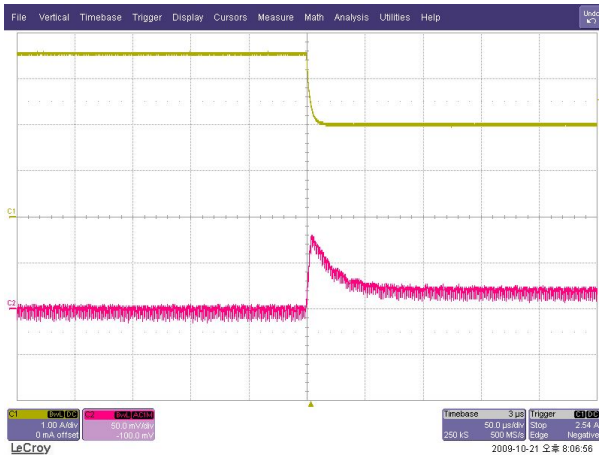
50% to 100% Max load, Slew rate: 3A/μs

-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-



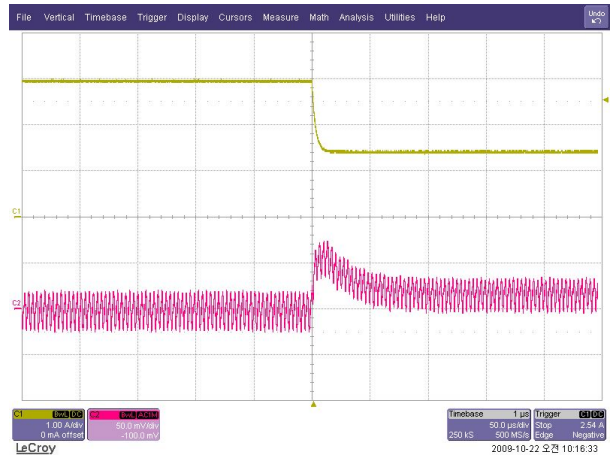
50% to 100% Max load, Slew rate: 3A/μs

-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

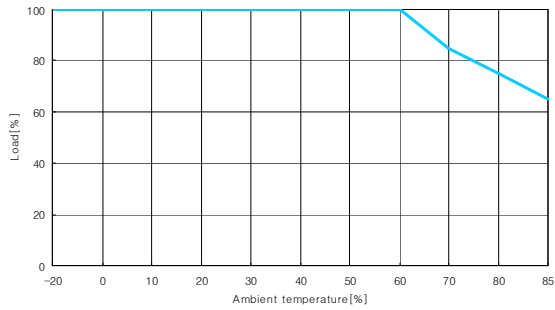
[Fig. 12] Vin=12V, Vo=5.0V@3A , At 25°C

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

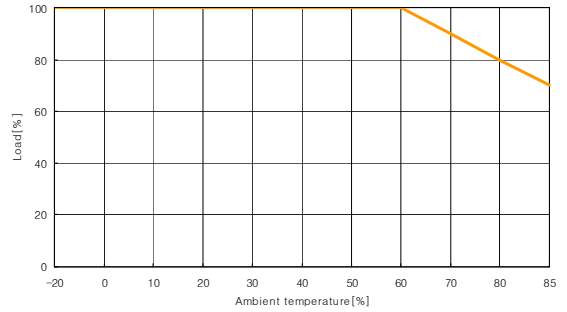
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Derating curve

-78NS3A-12-3R3-



-78NS3A-12-5R0-

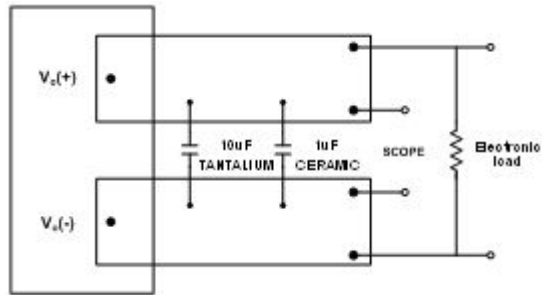


78NS3A-12(V) Series– Non-isolated DC/DC Converters
6.5 – 18Vdc Input, 3.3Vdc to 5Vdc Output, 3A Output

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TEST Configurations

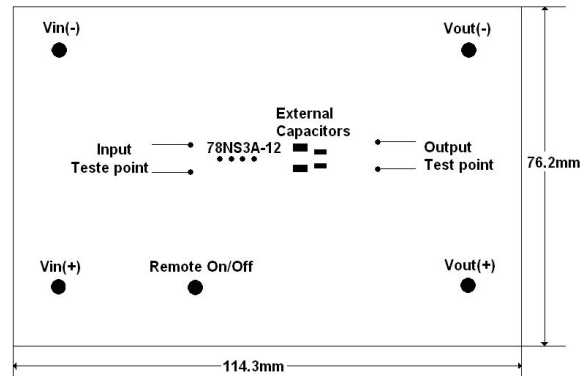
Output ripple and noise Test



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

[Fig. 13]

Test board description

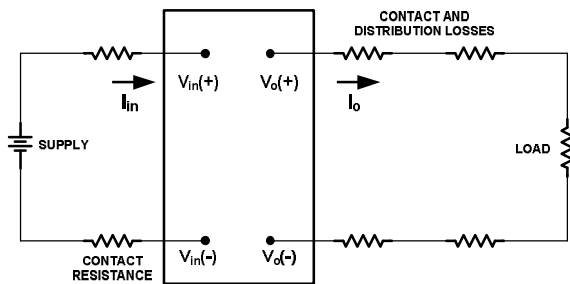


[Fig. 15]

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

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

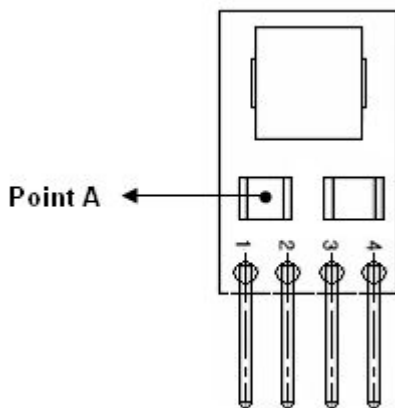
Thermal Considerations

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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[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 $-V_{in}$	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

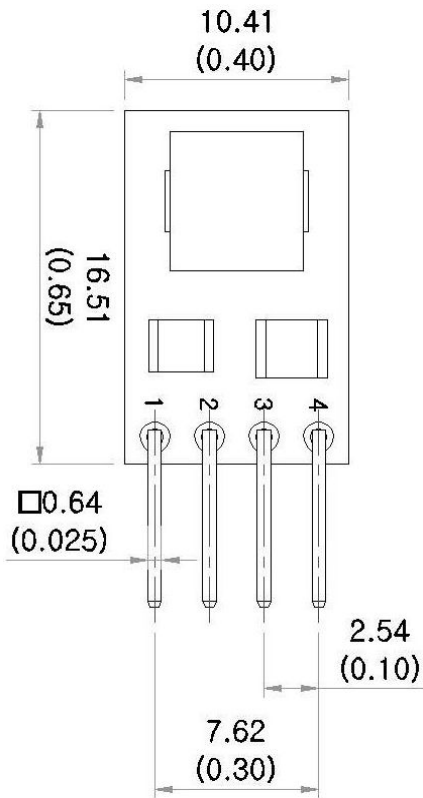
Under Voltage Lock Out(UVLO)

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

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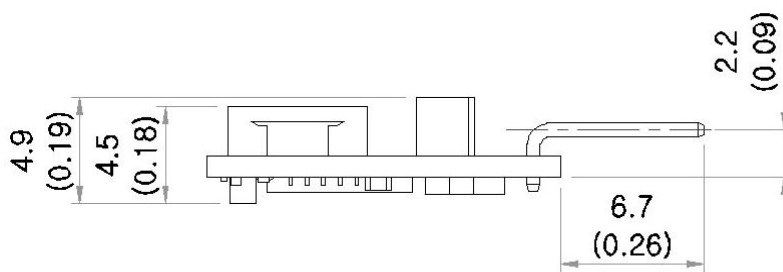
Pin assignments



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



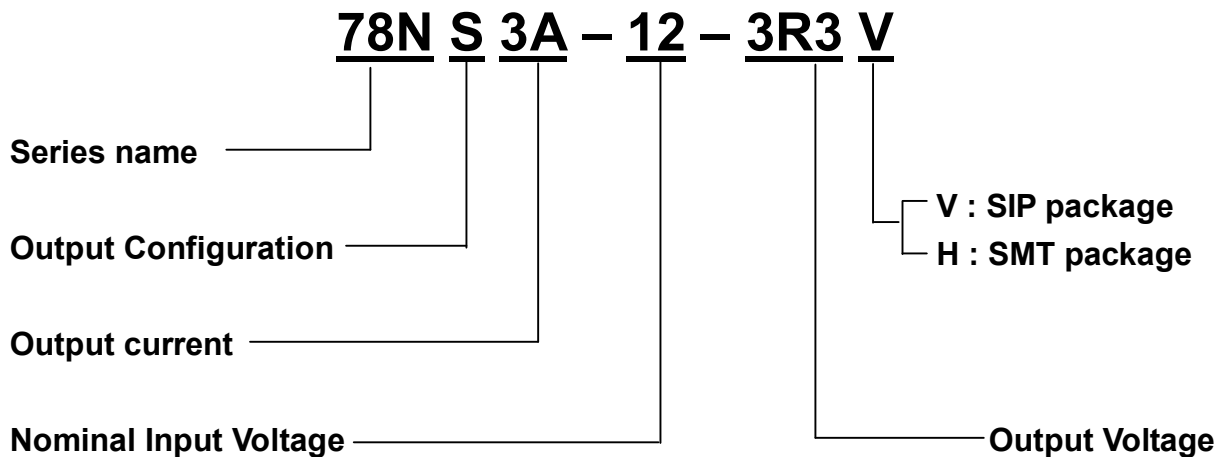
All dimensions are mm(inches)

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

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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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