

NR-2.0 Series



2A Output Current, Non-Isolated DC-DC converter

Features

- SIP3, Full SMD Technology
- Non-Isolated Regulator with Very Low Standby Current
- Wide Input Range , Step-down switching DC-DC converter
- High Voltage Input Range, up to 36V
- Continuous Short Circuit Protection
- Pin-out compatible with LM78XX three terminals positive Regulator
- Efficiency up to 96%



PART NUMBER STRUCTURE

NR - **24** **05** - **2.0**
(1) (2) (3) (4)

(1) Series

(2) Input Voltage Range

05 - 3-5.5 V

24 - 4.6-36 V

***See Table**

(4) Output Current

2.0 - 2.0 A

(3) Output Voltage

1R2 - 1.2 V

1R5 - 1.5 V

1R8 - 1.8 V

2R5 - 2.5 V

3R3 - 3.3 V

05 - 5.0 V

6R5 - 6.5 V

09 - 9.0 V

12 - 12 V

15 - 15 V

ALL SPECIFICATIONS ARE TYPICAL AT 25°C, NOMINAL INPUT AND FULL LOAD UNLESS OTHERWISE NOTED

Model Number	Input Voltage Range (VDC)	Input Current			Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency Full Load (% , typ.)		Capacitive Load @FL (µF, max.)
		No-Load (mA, typ.)	Full Load (mA, typ.)				@Min. Vin	@Max. Vin	
			@Min. Vin	@Max. Vin					
NR-051R2-2.0	3-5.5	0.5	889	507	1.2	2000	90	86	4200
NR-051R5-2.0	3-5.5	0.5	1099	613	1.5	2000	91	89	3700
NR-051R8-2.0	3-5.5	0.5	1304	727	1.8	2000	92	90	3300
NR-052R5-2.0	3.8-5.5	0.5	1385	978	2.5	2000	95	93	1800
NR-241R2-2.0	4.6-36	1.5	614	88	1.2	2000	85	76	2500
NR-241R5-2.0	4.6-36	1.5	758	108	1.5	2000	86	77	2000
NR-241R8-2.0	4.6-36	1.5	889	125	1.8	2000	88	80	1600
NR-242R5-2.0	4.6-36	1.5	1208	165	2.5	2000	90	84	1200
NR-243R3-2.0	4.75-36	1.5	1527	213	3.3	2000	91	86	900
NR-2405-2.0	6.5-36	1.5	1637	312	5.0	2000	94	89	600
NR-246R5-2.0	9-36	1.5	1520	393	6.5	2000	95	92	470
NR-2409-2.0	12-36	1.5	153	538	9.0	2000	96	93	330
NR-2412-2.0	15-36	1.5	1684	725	12.0	2000	95	92	270
NR-2415-2.0	18-36	1.5	1736	887	15.0	2000	96	94	200

INPUT SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Filter		Capacitor			
Input Reflected Ripple Current (1)			35		mApk-pk
Start up Time	Nominal Vin and constant resistive load		5		ms
Recommended input fuse (slow blow)	NR-051R2-2.0 & NR-051R5-2.0 NR-051R8-2.0 & NR-052R5-2.0	2.0			A
	NR-241R2-2.0 & NR-241R5-2.0 NR-241R8-2.0	1.6			
	NR-242R5-2.0 & NR-243R3-2.0 NR-2405-2.0 & NR-246R5-2.0	2.5			
	NR-2409-2.0 & NR-2412-2.0 NR-2415-2.0	3.15			
Note :					
1. Measured with a simulated source inductance of 12μH and a source capacitor Cin (10μF, ESR<1.0Ω at 100kHz).					

OUTPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy			-2.0		+2.0	%
Maximum Output Current					2000	mA
Line Regulation			-0.5		+0.5	%
Load Regulation	From 0% to 100% Load	All 5 V Input	-1.0		+1.0	%
		24 Vin & Vo ≥ 5 V	-1.0		+1.0	
		24 Vin & Vo ≤ 3.3 V	-1.5		+1.5	
	From 10% to 100% Load	All 24V Input	-1.0		+1.0	
Ripple & Noise (1)	20MHz bandwidth	Vo ≤ 6.5 V			50	mVpk-pk
		Vo ≥ 9.0 V			75	
Over Current Protection	Hiccup mode	5 V Input		8.5		A
		24V Input		3.5		
Short Circuit Protection			Continuous (Automatic Recovery)			
Temperature Coefficient			-0.02		+0.02	%/°C
Maximum Capacitive Load	Minimum Vin and constant resistive load		See Table			
Transient Recovery Time	Nominal Vin and 25% load step change (75%-50%-25% of Io)			150		μs
Transient Response Deviation			-3		+3	%
Note :						
1. Ripple & Noise measured with a 0.1μF MLCC.						

ABSOLUTE MAXIMUM RATINGS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Surge Voltage (100 ms)	5V Input			6	VDC
	24V Input			40	
Soldering Temperature	1.5mm from case 10sec max.			260	°C
Note : These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability.					

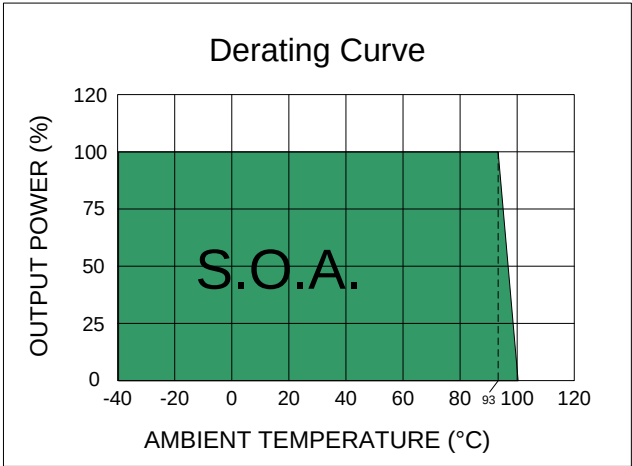
GENERAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Switching Frequency	5 V Input			1200		kHz
	24 V Input			410		
MTBF	MIL-HDBK-217 F @ 25°C	5 V Input	16			M hours
		24 V Input	2.6			
Safety Approval	IEC / EN / UL 62368-1		Design to meet			
Environmental compliance			RoHS			

ENVIRONMENT SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating Ambient Temperature	See the Derating Curve	-40		100	°C
Maximum Case Temperature				105	°C
Thermal Impedance	Mounting at FR4 (1.18*1.18 inch) PCB	34			°C/W
Storage Humidity				95	% rel. H
Storage Temperature		-55		125	°C
Cooling	Natural Convection	30-65 LFM			

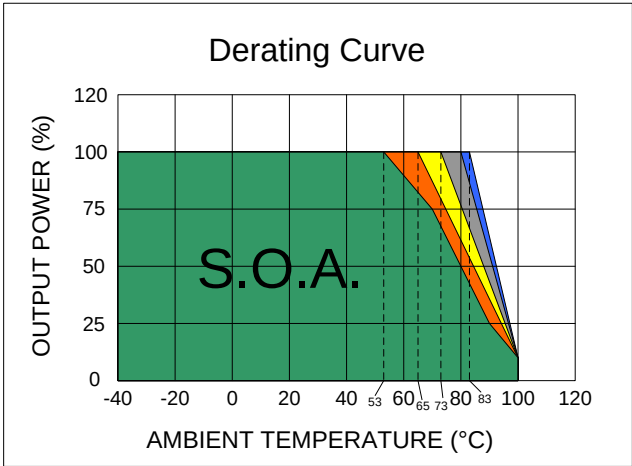
EMC SPECIFICATIONS			
Parameter	Standard	Condition	Criterion
Conducted Emissions	EN55032	with external components	B
Radiated Emissions	EN55032	with external components	B
ESD	IEC 61000-4-2	Air: ± 8kV / Indirect: ± 6kV	A
RS	IEC 61000-4-3	10V/m	A
EFT	IEC 61000-4-4	±2kV with external components	A
Surge	IEC 61000-4-5	±0.5kV with external components	A
CS	IEC 61000-4-6	10Vrms	A
PFMF	IEC 61000-4-8	100A/m	A

PHYSICAL SPECIFICATIONS	
Parameter	Value
Case Material	Nonconductive Black Plastic (UL94V-0 rated)
Pin Material	0.46 x 0.46mm Copper Matte tin-coated
Potting Material	Silicone (UL94V-0 rated)
Weight	2.4 g, typ.
Dimensions	0.55" x 0.30" x 0.40"

ELECTRICAL CHARACTERISTIC CURVES



5 V Input



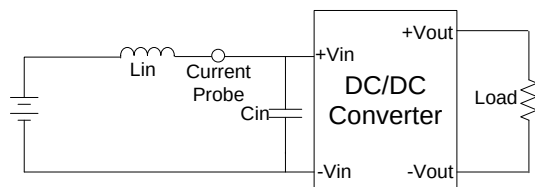
24 V Input

Blue Zone – Vout 1.2 ~ 1.8 VDC models
Gray Zone – Vout 2.5 ~ 3.3 VDC models
Yellow Zone – Vout 5 ~ 6.5 VDC models
Orange Zone – Vout 9 VDC model
Green Zone – Vout 12 ~ 15 VDC models

TEST CONFIGURATIONS

Input Reflected Ripple Current Test Step

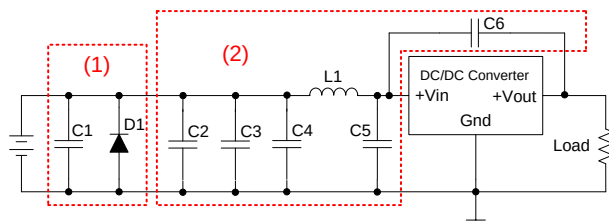
Input reflected ripple current is measured with a source inductor L_{in} (12 μ H) and a source capacitor C_{in} (10 μ F, ESR<1.0 Ω at 100kHz) at nominal input and full load.



DESIGN & FEATURE CONFIGURATIONS

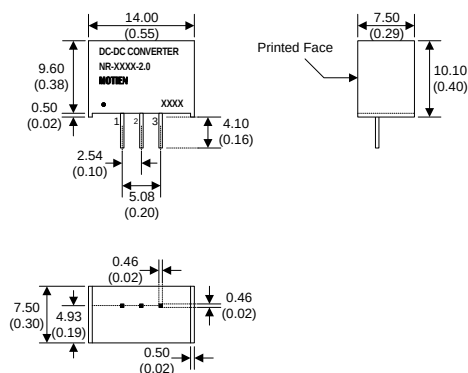
EMC Filter

The part (1) Circuit is used to meet Surge & EFT test, and the part (2) Circuit is used to meet EMI test.



	C1	D1	C2, C3	C4	L1	C5	C6
NR-05XX-2.0	NIPPON Chemi-con KY series 3300 μ F, 10V	SMDJ6.0A		MLCC 10 μ F, 50V	22 μ H	MLCC 10 μ F, 50V	MLCC 1nF, 50V
NR-24XX-2.0	NIPPON Chemi-con KY series 220 μ F, 100V	SMDJ36A	MLCC 10 μ F, 50V				

MECHANICAL SPECIFICATIONS



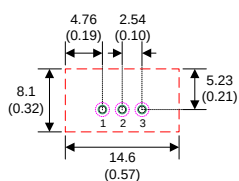
Notes : All dimensions are typical in millimeters (inches).

1. Pin dimension tolerance: ± 0.05 (± 0.002)
2. Pin pitch and length tolerance: ± 0.35 (± 0.014)
3. Pin to case tolerance: ± 0.5 (± 0.02)
4. Case Tolerance: ± 0.5 (± 0.02)

PIN CONNECTIONS

PIN NUMBER	SINGLE
1	+Vin
2	GND
3	+Vout

RECOMMEND FOOTPRINT DETAILS



Notes : 1. All dimensions are typical in millimeters (inches).

- Through hole (black) 1~3: $\varnothing 0.90$ (0.035)
 Top view pad (green) 1~3: $\varnothing 1.10$ (0.043)
 Bottom view pad (pink) 1~3: $\varnothing 1.80$ (0.071)