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9-18V Input, 10A DC-DC PWM Buck Controller + FET

Device	Application	Input Voltage	Output Voltage	Output Current	Topology
NCP3020	Test Equipment	9-18V	3.3V	0.01-10A	Buck

Table 1: Buck Power Supply

Characteristic	Min	Typ	Max	Unit
Input Voltage	9	12	18	V
Output Voltage	3.25	3.265	3.28	V
Output Current	.01	1	10	A
Oscillator Frequency	270	300	330	kHz
Output Voltage Ripple		86		mVpk-pk
Load Regulation				
I _{out} = 0.02-10A) Vin= 9V NCP3020		0.99		mV/A
I _{out} = 0.02-10A) Vin= 18V NCP3020		0.78		

Circuit Description

This circuit is proposed for a wide varying +12V input (9V-18V) where there is a need to step-down the voltage to +3.3V @ 10A. The requirement specified a large electrolytic input capacitance and also to utilize electrolytic capacitors on the output. Target efficiency is >85%.

The PCB for the NCP3020 is a 2-layer board for use in applications up to 50W. The synchronous buck converter uses voltage mode control, which can be compensated externally with a transconductance amplifier. The soft start time is fixed. The NCP3020 demonstration board is a flexible design allowing the use of electrolytic capacitors or ceramic capacitors. It also allows the use of SO8-FL or D-PAK MOSFETs.

Key Features

- High Efficiency
- Adjustable Current Limit
- Output Overvoltage and Output Undervoltage protection
- Short Circuit Protection
- Fixed Switching Frequency



Performance

The following figures show typical performance of the NCP3020 demonstration boards.

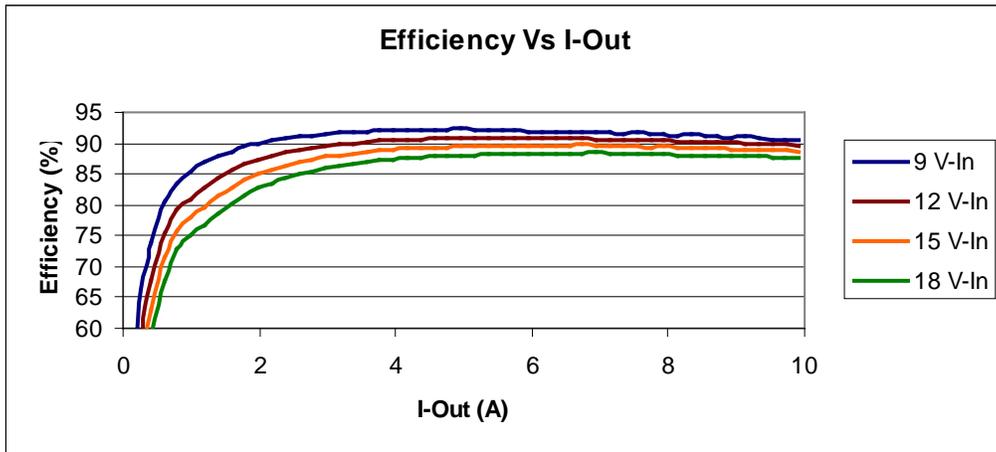


Figure 1: NCP3020 Efficiency at 9V-18.0V with a 3.3V Output Voltage

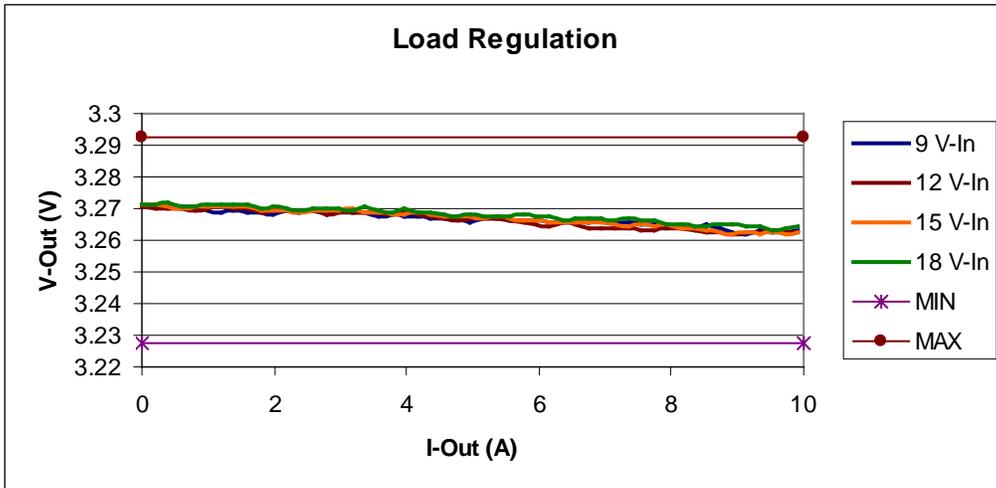


Figure 2: NCP3020 Load Regulation

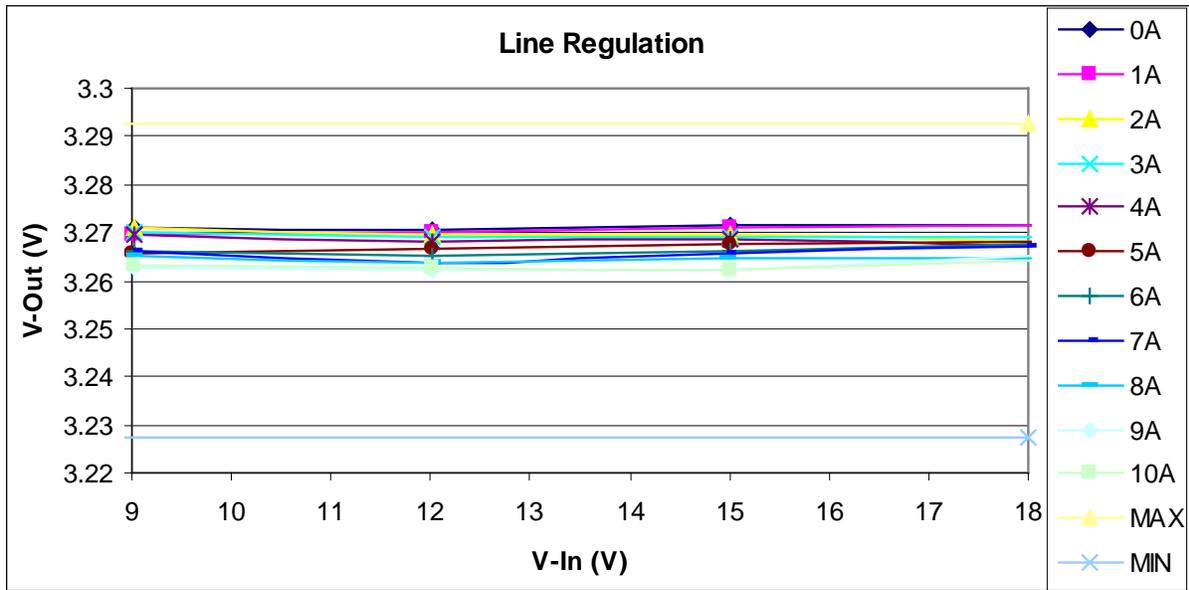


Figure 3: NCP3020 Line Regulation

Schematics

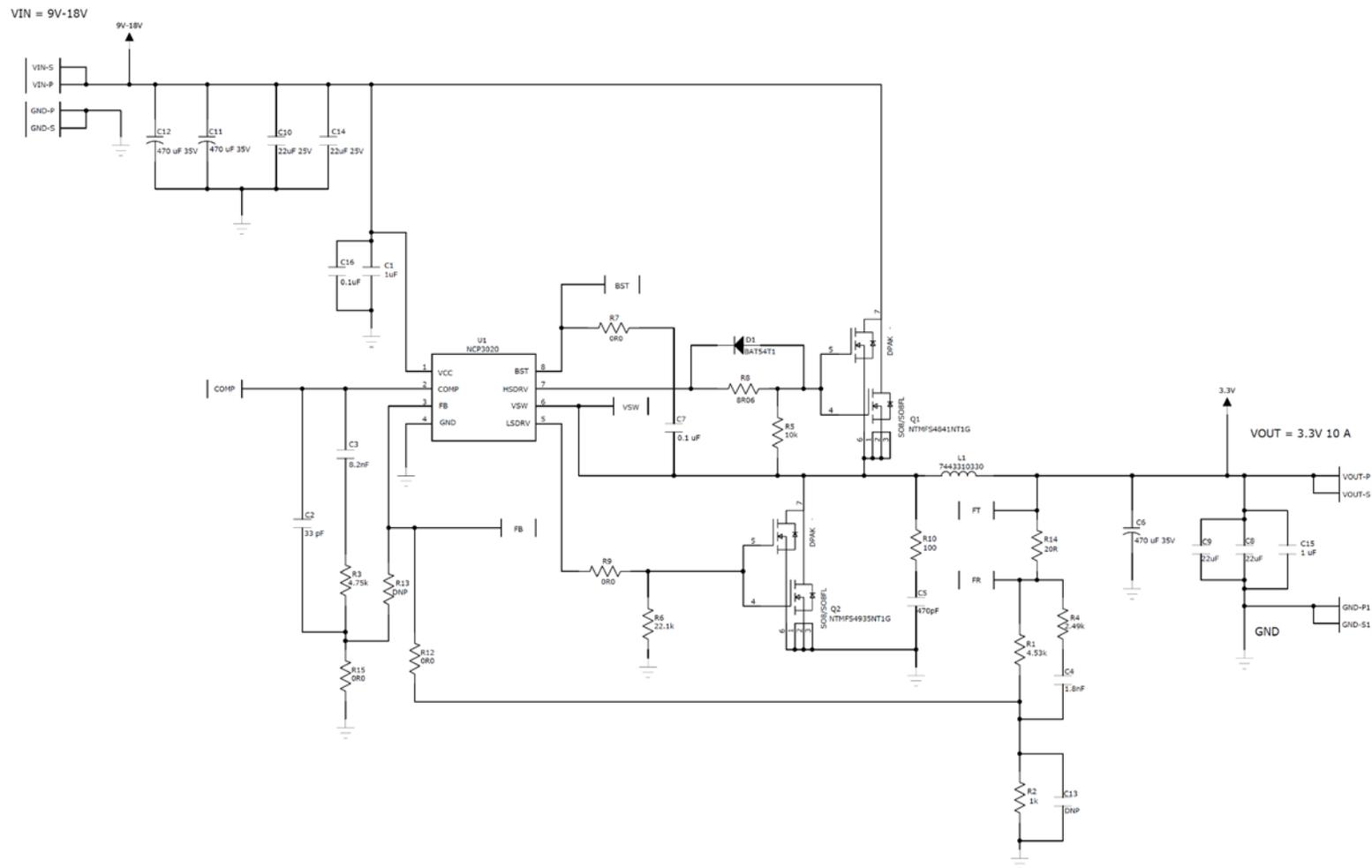


Figure 4: NCP3020 Schematic

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Designator	Quantity	Description	Value	Tolerance	FootPrint	Manufacturer	Manufacturer Part Name	Substitution Allowed	Lead Free
C1	1	Ceramic Chip Capacitor	1uF 25V	+/- 10%	1208	TDK	C3216X7R1E105K	Yes	Yes
C2	1	Ceramic Chip Capacitor	33 pF	+/- 5%	0803	TDK	C1608C0G1H330J	Yes	Yes
C3	1	Ceramic Chip Capacitor	8.2nF	+/- 5%	0803	TDK	C1608C0G1E822J	Yes	Yes
C4	1	Ceramic Chip Capacitor	1.8nF	+/- 5%	0803	TDK	C1608C0G1H182J	Yes	Yes
C5	1	Ceramic Chip Capacitor	470pF	+/- 10%	0805	Kemet	C0805C471K5RACTU	Yes	Yes
C6 C11 C12	3	Electrolytic Capacitor	470 uF 35V	+/- 20%	SMT	United Chemi-Con	EMVH350ARA471MKG5S	No	Yes
C7	1	Ceramic Chip Capacitor	0.1 uF	+/- 10%	0805	TDK	C2012X7R1H104K	Yes	Yes
C8 C9	2	Ceramic Chip Capacitor	22uF	+/- 10%	1210	TDK	C3225X5R1A226M	Yes	Yes
C10 C14	2	Ceramic Chip Capacitor	22uF 25V	+/- 20%	1812	TDK	C4532X7R1E226M	No	Yes
C13	1	Ceramic Chip Capacitor	DNP	-	0803	-	-	-	-
C15	1	Ceramic Chip Capacitor	1 uF	+/- 10%	0805	TDK	C2012X7R1A105K	Yes	Yes
C16	1	Ceramic Chip Capacitor	0.1uF	+/- 10%	0803	TDK	C1608X7R1E104K	Yes	Yes
U1	1	300 kHz PWM Controller	300kHz	-	SOIC-8	ON Semiconductor	NCP3020A	No	Yes
D1	1	Schottky Barrier Diodes	0.35 Vf	-	SOD_123_BAT54T1	ON Semiconductor	BAT54T1G	No	Yes
L1	1	SMT Inductor	3.3 uH	+/- 20%	12X11X9.5 mm	Würth	7443310330	No	Yes
Q1	1	Triple Use Footprint: SO8/SO8FL/DPAK MOSFET	30V, SO8FL	-	DPAK/SO8FL	ON Semiconductor	NTMFS4841T1G	No	Yes
Q2	1	Triple Use Footprint: SO8/SO8FL/DPAK MOSFET	30V, SO8FL	-	DPAK/SO8FL	ON Semiconductor	NTMFS4935NT1G	No	Yes
R1	1	SMT Resistor	4.53k	+/- 1%	0803	Vishay/Dale	CRCW08034K53FKEA	Yes	Yes
R2	1	SMT Resistor	1k	+/- 1%	0803	Vishay/Dale	CRCW08031K00FKEA	Yes	Yes
R3	1	SMT Resistor	4.75k	+/- 1%	0803	Vishay/Dale	CRCW08034K75FKEA	Yes	Yes
R4	1	SMT Resistor	2.49k	+/- 1%	0803	Vishay/Dale	CRCW08032K49FKEA	Yes	Yes
R5	1	SMT Resistor	10k	+/- 5%	0803	Vishay/Dale	CRCW080310K0JNEA	Yes	Yes
R6	1	SMT Resistor	22.1k	+/- 1%	0803	Vishay/Dale	CRCW080322K1FKEA	Yes	Yes
R7 R12 R15	3	SMT Resistor	0R0	Jumper	0803	Vishay/Dale	CRCW08030000Z0EA	Yes	Yes
R8	1	Resistor	8R08	+/- 1%	1208	Vishay/Dale	CRCW12088R08FNEA	Yes	Yes
R9	1	Resistor	0R0	Jumper	1208	Vishay/Dale	CRCW12080000Z0EA	Yes	Yes
R10	1	Resistor	100	+/- 1%	1208	Vishay/Dale	CRCW1208100RFKEA	Yes	Yes
R13	1	SMT Resistor	DNP	-	0803	-	-	-	-
R14	1	SMT Resistor	20R	-	0803	Vishay/Dale	CRCW080320R0FKEA	Yes	Yes
VIN-P VIN-S VOUT-P VOUT-S VSW BST COMP FB FR FT GND- P GND-P1 GND-S GND-S1	14	Printed Circuit Pins	-	-	0.040 DIA	Mill-Max	6821-0-00-15-00-00-08-0	Yes	Yes

Table 2: NCP3020 BOM

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