

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



High Efficiency, <30mW Standby QR Adapter

ON Semiconductor

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1340B1 NCP43080D NCP431A	Adapter	85 to 265 Vac	45 W Nominal	Quasi-Resonant Flyback	Isolated

Output Specification	
Output Voltage	19 Vdc nominal
Nominal Current	2.37 A
No Load Standby	< 30 mW
Min Current	zero

Circuit Description

The NCP1340 is a highly-integrated quasi-resonant flyback controller suitable for designing high-performance off-line power converters. With an integrated active X2 capacitor discharge feature, the NCP1340 enables no-load power consumption below 30 mW.

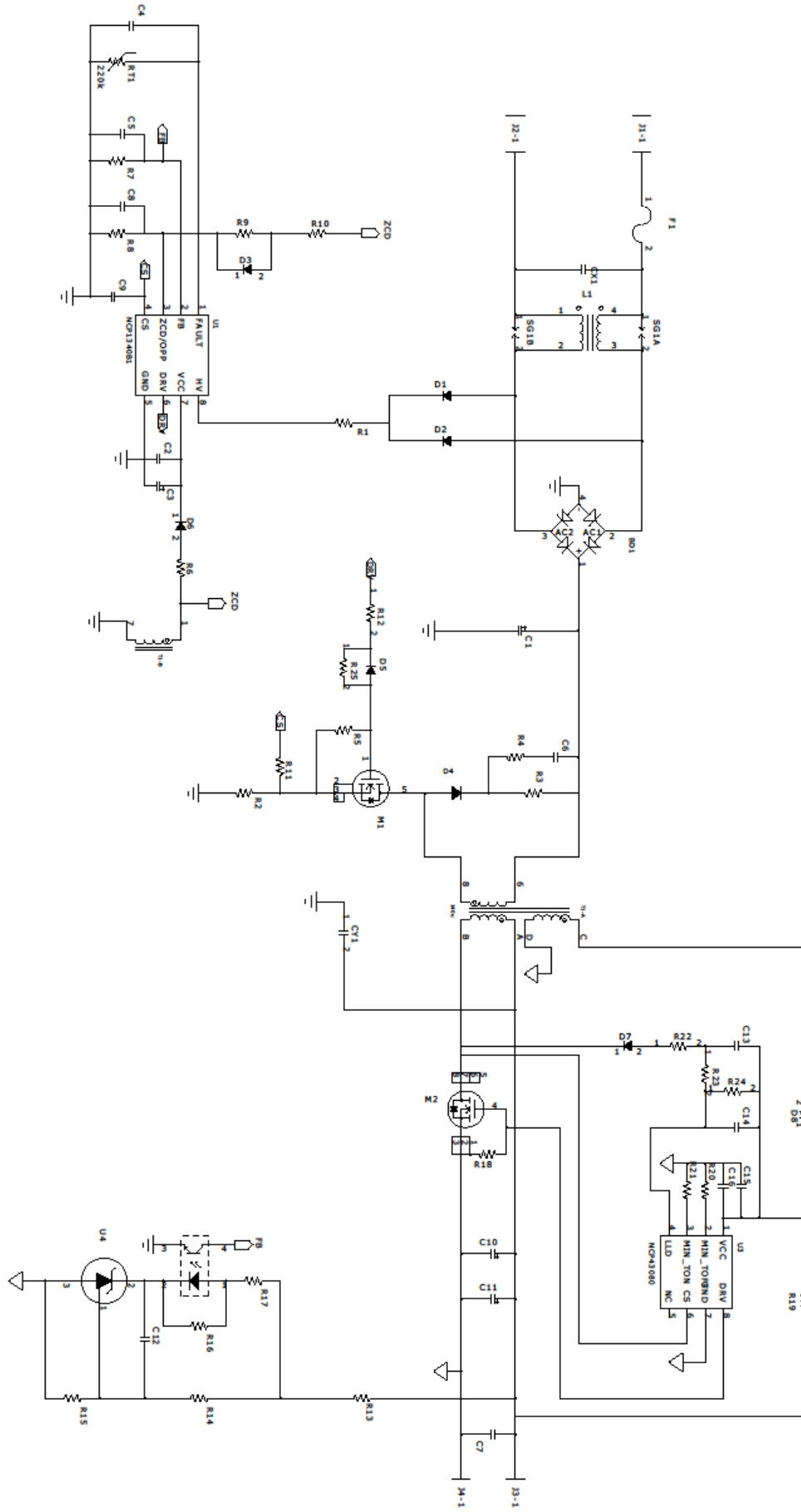
The quasi-resonant operating mode features a proprietary valley-lockout circuitry ensuring stable valley switching down the 6th valley. After the 6th valley the controller transitions to a frequency foldback mode to reduce switching losses in lighter load conditions. As the load continues to decrease the NCP1340 will enter a Quiet-Skip™ mode to efficiently manage power delivery while minimizing acoustic noise.

Secondary side synchronous rectification (SR) is implemented with the NCP43080 for optimized efficiency across all operating modes. The NCP43080 features precise zero current turn off and 12 ns turn-off delay from current sense to the driver allowing for the optimal SR conduction period in quasi-resonant mode. The light load detection (LLD) feature modulates the drive voltage as the load decreases and shuts down the driver for optimal light and no-load performance.

Key Features

- High-Voltage Startup Circuit with Active Input Filter Capacitor Discharge and Brownout Detection for Reduced Standby Power
- Valley Switching Operation to 6th valley with Valley-Lockout for Stable Operation
- Frequency Foldback with 25 kHz Minimum Frequency Clamp
- Quiet-Skip™ Operation for Highest Performance in Light and No-Load
- Minimized Current Consumption for No Load Power Below 30 mW.
- Frequency Jitter for Reduced EMI Signature
- Adjustable Maximum Frequency Clamp
- Fault Input for Severe Fault Conditions, NTC Compatible (Latch and Auto-Recovery Options)

DN05089/D Circuit Schematic



DN05089/D Magnetics Design – Flyback Transformer NCP1340

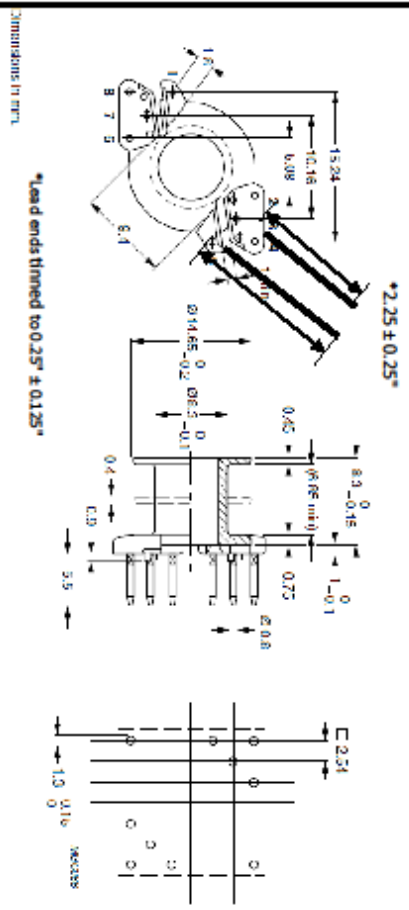
CUSTOMER TERMINAL	ROHS	LEAD(Pb)-FREE
Sn 96%, Ag 4%	Yes	Yes

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

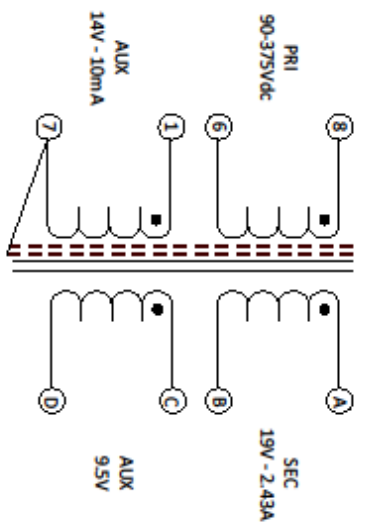


more than you expect

PARAMETER	TEST CONDITIONS	VALUE
D.C. RESISTANCE	8-6 @20°C	0.070 ohms ±10%
D.C. RESISTANCE	A-B @20°C	0.020 ohms max.
D.C. RESISTANCE	1-7 @20°C	0.150 ohms ±10%
D.C. RESISTANCE	C-D @20°C	0.120 ohms ±10%
INDUCTANCE	8-6 10kHz, 100mV, 1s	140µH ±10%
SATURATION CURRENT	8-6 20% roll-off from initial	2.75A
LEAKAGE INDUCTANCE	8-6 5µ(A+B), 100kHz, 100mV, 1s	4.0µH typ., 7.0µH max.
DIELECTRIC	8-A 1µ(6+7, A+C), 3750VAC, 1 second	3000VAC, 1 minute
DIELECTRIC	1-8 625VAC, 1 second	
TURN RATIO	A-C (1-7)/(8-6)	8:1, ±2%
TURN RATIO	(A-B)/(8-6)	6:1, ±1%
TURN RATIO	(C-D)/(8-6)	12:1, ±1%



Flying leads are labeled as "A", "B", "C", & "D" as specified below.



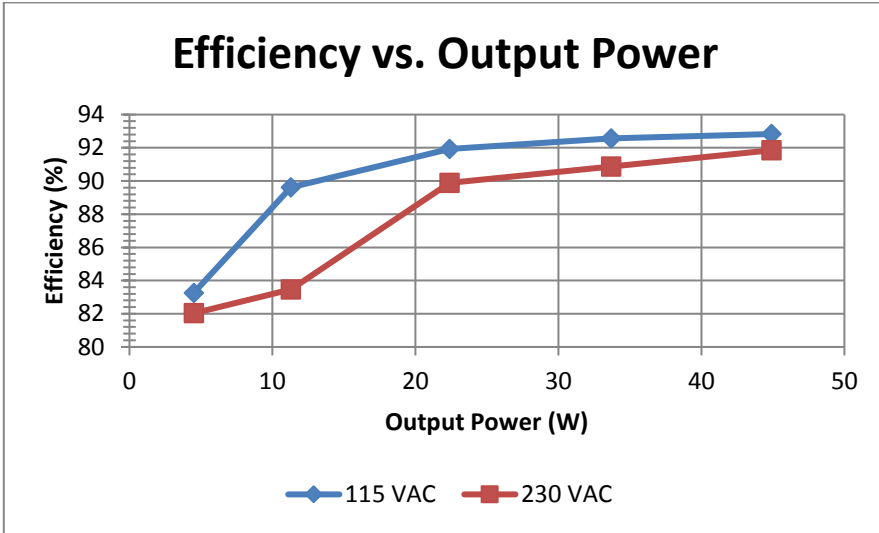
GENERAL SPECIFICATIONS:

OPERATING TEMPERATURE RANGE: -40°C to +125°C including temp rise.
 Designed to comply with the following requirements as defined by IEC60950-1, EN60950-1, UL60950-1/CSA60950-1 and AS/NZS60950.1:
 - Reinforced insulation for a primary circuit at a working voltage of 2650Vrms, 400Vpeak, Overvoltage Category III.

Wire insulation & RoHS status not affected by wire color. Wire insulation color may vary depending on availability.

DFM	Packaging Specifications	Tolerances unless otherwise specified:	DRAWING TITLE	PART NO.
DATE	Method: Tray	Angles: ±1°	TRANSFORMER	7508112428
ENG	PKG-0936	Decimals: ±.005 [.13]		
REV.	06	Fractions: ±1/64 Footprint ±.001 [.03]		
DATE	6/24/2016	This drawing is dual dimensioned. Dimensions in brackets are in millimeters.	SPECIFICATION SHEET 1 OF 1	

Efficiency



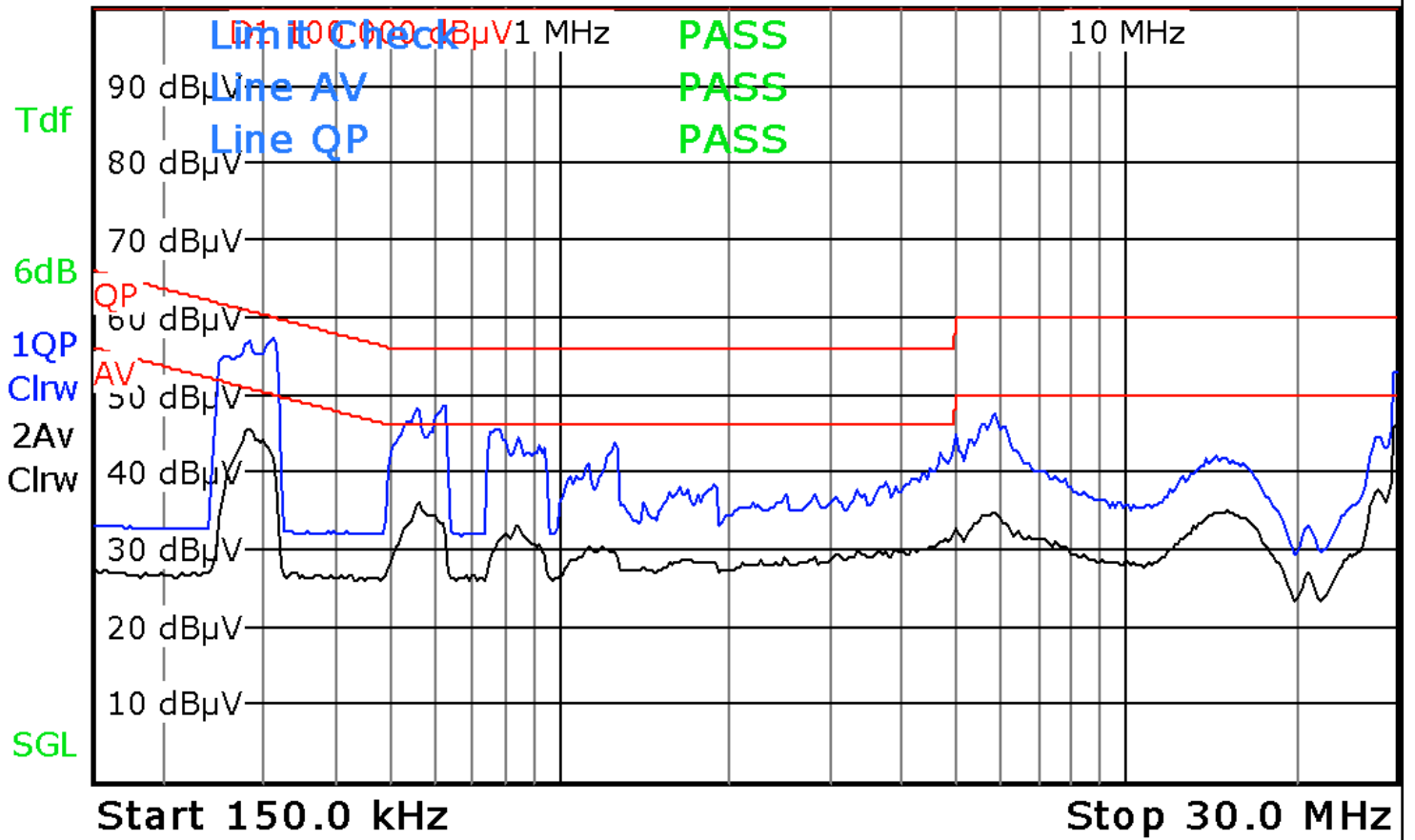
VAC	Load	Efficiency (%)
115	100%	92.83
	75%	92.57
	50%	91.92
	25%	89.62
	10%	83.26
230	100%	91.85
	75%	90.86
	50%	89.88
	25%	83.46
	10%	82.03

Average efficiency = 91.74%@115Vac, 89.02%@230Vac

No Load Standby Power

VAC	Power Dissipation (mW)
90	20.5
115	21.5
230	25.7
265	27.1

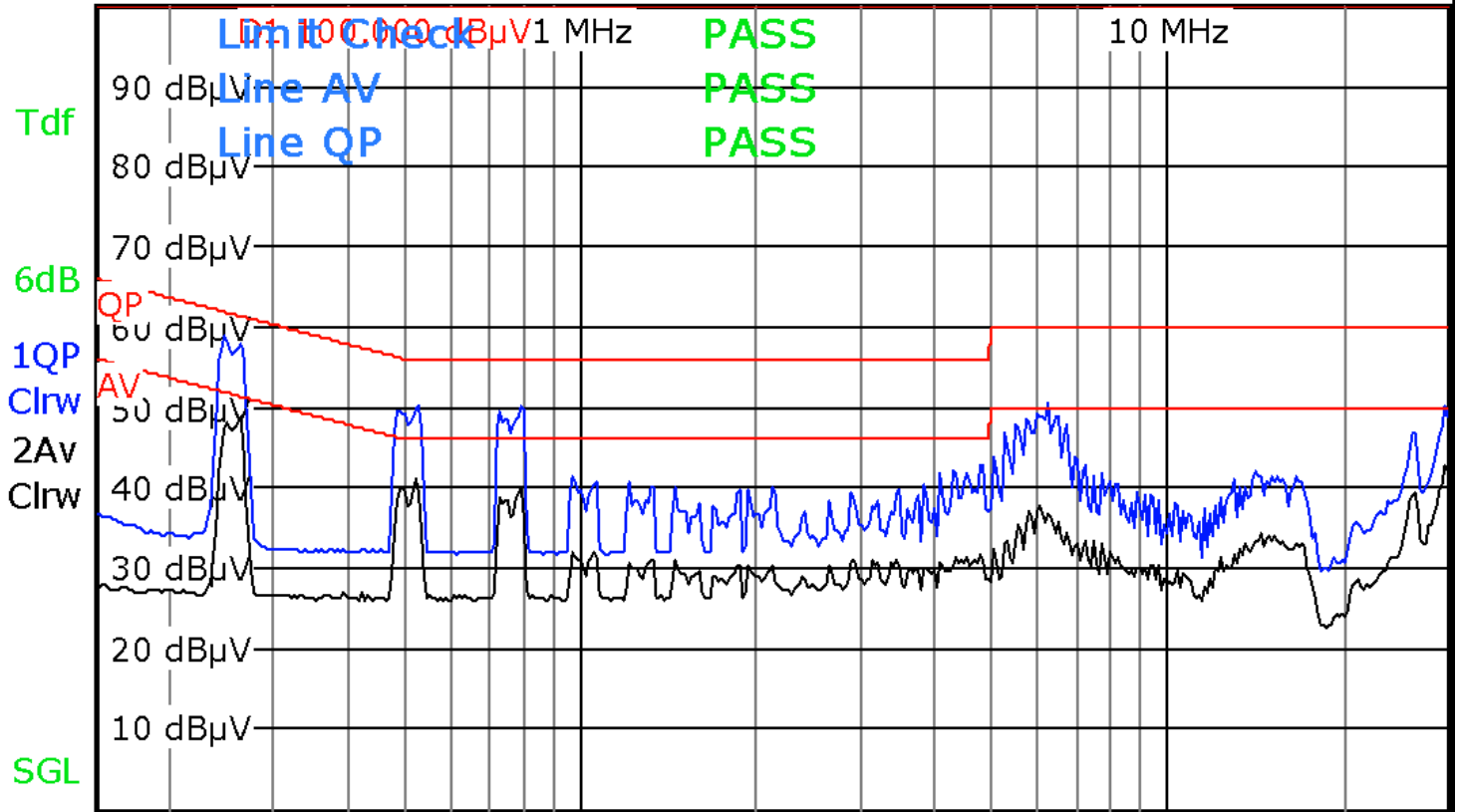
EMI Performance



120 VAC – 45W LOAD

Scan	Freq (MHz)	dBµV	Margin
QP	0.31	57.13	-2.84
Avg	0.282	45.43	-5.33
Avg	29.852	46.01	-3.99

DN05089/D



Start 150.0 kHz

Stop 30.0 MHz

240 VAC – 45W LOAD

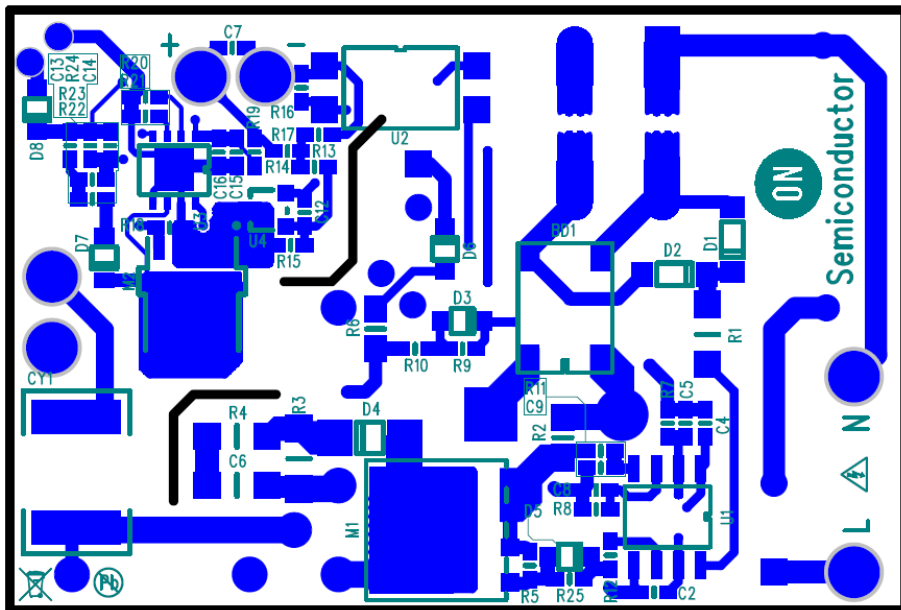
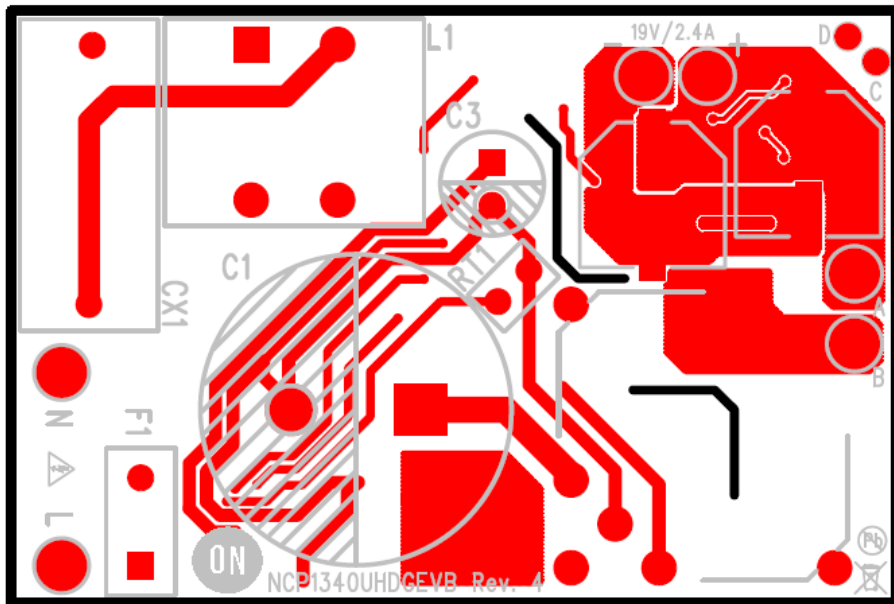
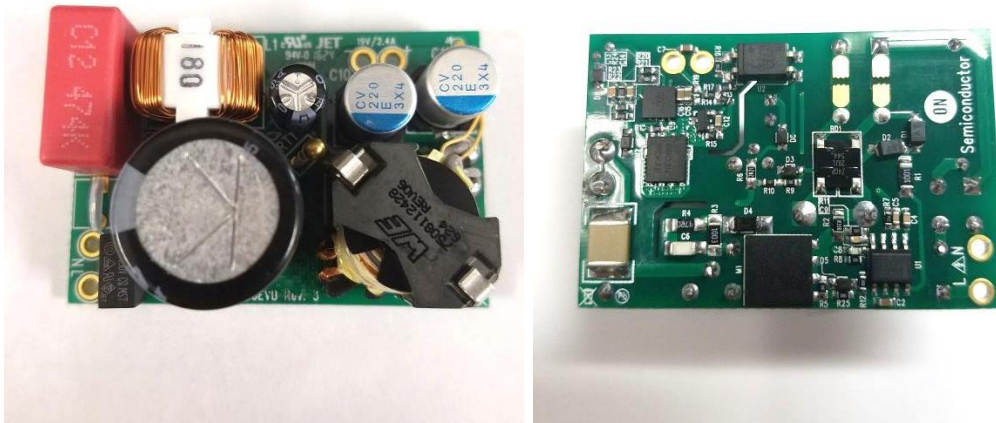
Scan	Freq (MHz)	dB	Margin
QP	0.246	58.77	-3.12
QP	0.53	50.12	-5.88
QP	0.794	50.19	-5.81
Avg	0.262	48.69	-2.68
Avg	0.526	41.24	-4.76

DN05089/D

Bill of Materials

Ref	Qty	Description	Value	Tol	Footprint	Manufacturer	Manufacturer P/N
C1	1	Capacitor, Electrolytic	68uF/400V	20%	18mm x 7.5mm(LS)	Rubycon	400BXW68MEFC18X20
C3	1	Capacitor, Electrolytic	100uF/35V	20%	6mm x 2.5mm(LS)	Kemet	ESH107M035AE3AA
C2, C7, C16	3	Capacitor, Ceramic	0.1uF/50V	10%	0603	Yageo	CC0603KRX7R9BB104
C4, C13	2	Capacitor, Ceramic	10nF/50V	10%	0603	Vishay Vitramon	VJ0603Y103KXAAC31
C5	1	Capacitor, Ceramic	470pF/50V	10%	0603	Yageo	CC0603KRX7R9BB471
C8	1	Capacitor, Ceramic	56pF/50V	10%	0603	Yageo	CC0603JRNPO9BN560
C9	1	Capacitor, Ceramic	100pF/50V	10%	0603	Vishay Vitramon	VJ0603Y101KXACW1BC
C12	1	Capacitor, Ceramic	6.8nF/50V	10%	0603	Kemet	C0603C682K5RACTU
C14	1	Capacitor, Ceramic	33nF/50V	10%	0603	Yageo	CC0603KRX7R9BB333
C15	1	Capacitor, Ceramic	1uF/50V	10%	0603	Taiyo Yuden	UMK107AB7105KA-T
C6	1	Capacitor, Ceramic	220pF/1kV	10%	1206	Kemet	C1206C221KDRACTU
C10-11	2	Capacitor, Polymer	270uF/25V	20%	8mm x 8mm	Nichicon	PCR1E271MCL1GS
CX1	1	Capacitor, X2	470nF/310Vac	10%	7mm x 18mm x 15mm(LS)	Würth	890324025039CS
CY1	1	Capacitor, X1Y2	2200pF/250VAC	10%	2220	Murata	GA355QR7GF222KW01L
R5, R16, R18	3	Resistor, SMD	10k	1%	0603	Vishay Dale	CRCW06031002F
R7	1	Resistor, SMD	44.2k	1%	0603	Vishay Dale	CRCW06034422F
R8, R10	2	Resistor, SMD	1k	1%	0603	Vishay Dale	CRCW06031001F
R9	1	Resistor, SMD	301k	1%	0603	Vishay Dale	CRCW06033013F
R11	1	Resistor, SMD	100 Ohm	1%	0603	Vishay Dale	CRCW0603100RF
R12	1	Resistor, SMD	1 Ohm	1%	0603	Vishay Dale	CRCW06031R00F
R13	1	Resistor, SMD	0 Ohm	1%	0603	Vishay Dale	CRCW06030000Z0EA
R14	1	Resistor, SMD	169k	1%	0603	Vishay Dale	CRCW06031693F
R15	1	Resistor, SMD	25.5k	1%	0603	Vishay Dale	CRCW06032552F
R17	1	Resistor, SMD	4.75k	1%	0603	Vishay Dale	CRCW06034751F
R20	1	Resistor, SMD	11.0k	1%	0603	Vishay Dale	CRCW06031102F
R21	1	Resistor, SMD	4.99k	1%	0603	Vishay Dale	CRCW06034991F
R22	1	Resistor, SMD	9.09k	1%	0603	Vishay Dale	CRCW06039091F
R23-24	2	Resistor, SMD	39.2k	1%	0603	Vishay Dale	CRCW06033922F
R25	1	Resistor, SMD	10.0 Ohm	1%	0603	Vishay Dale	CRCW060310R0F
R2	1	Resistor, SMD	0.33 Ohm	1%	0805	Vishay Dale	RCWE0805R330FKEA
R6	1	Resistor, SMD	2.2 Ohm	1%	0805	Vishay Dale	CRCW08052R20FKEA
R1	1	Resistor, SMD	1k	1%	1206	Vishay Dale	CRCW12061001F
R3	1	Resistor, SMD	100k	1%	1206	Vishay Dale	CRCW12061003F
R4	1	Resistor, SMD	47 Ohm	1%	1206	Vishay Dale	CRCW120647R0FKEA
R19	1	Resistor, SMD	NI	-	0603	-	-
RT1	1	Thermistor, NTC	220k	1%	2.5mm	Vishay BC	NTCLE100E3224JB0
F1	1	Fuse, Slow Blow	2A/250VAC	1%	8.35mm x 7.7mm	MULTICOMP	MST 2A 250V
L1	1	Choke, Common Mode	5 mH	1%	17.5mm x 14mm	Kemet	SC-01-50G
T1	1	Transformer, Flyback	140uH	1%	RM7	Würth	7508112428 Rev 06
BD1	1	Diode, Bridge	600V/2A	1%	ABS(Z4)	Comchip	Z4GP206L-HF
D1-2	2	Diode, Rectifier	1000V/1A	-	SOD-123	Comchip	CGRM4007-G
D3, D5-8	5	Diode, General Purpose	200V/200mA	-	SOD-323	ON Semiconductor	BAS20HT1G
D4	1	Diode, Fast Recovery	600V/1A	-	SMA	Taiwan Semiconductor	RSFJL
M1	1	MOSFET, High Voltage	600V/385mOhm	-	THINPAK8X8	Infineon	IPL6R385CP
M2	1	MOSFET, SR	100V/4.8mOhm	-	SO-8FL	ON Semiconductor	NTMFS6B03N
U1	1	Flyback Controller	NCP1340B1	-	SOIC-8	ON Semiconductor	NCP1340B1DR2G
U2	1	Optocoupler	CTR 50%-200%	-	SMD-4	CEL	PS2513L-1-F3-A
U3	1	SR Controller	NCP43080D	-	DFN-8	ON Semiconductor	NCP43080DMNTWG
U4	1	Shunt Regulator	NCP431A	1%	SOT-23	ON Semiconductor	NCP431ACSNT1G

DN05089/D Demo Board



References

NCP1340-D Datasheet
NCP43080-D Datasheet
NCP431-D Datasheet

Disclaimer: ON Semiconductor is providing this design note "AS IS" and does not assume any liability arising from its use; nor does ON Semiconductor convey any license to its or any third party's intellectual property rights. This document is provided only to assist customers in evaluation of the referenced circuit implementation and the recipient assumes all liability and risk associated with its use, including, but not limited to, compliance with all regulatory standards. ON Semiconductor may change any of its products at any time, without notice.

Design note created by Alan Finkel: e-mail: Alan.Finkel@onsemi.com