



# Power Conversion Solutions



*Providing a diverse portfolio of power management solutions to meet the needs of designers worldwide from ON Semiconductor.*



## Power Conversion Solutions from ON Semiconductor

### ON Your Way to Designing Efficient Power Supplies. . .

Designing world-class power supplies is getting harder. Every year, your customers demand more power from a smaller space at a lower cost. In addition, new regulations are imposing increasingly stringent requirements on power conversion efficiency, quality, and standby consumption.

ON Semiconductor provides a diverse portfolio of power management solutions to meet the needs of designers worldwide. Our products help you produce more power in a smaller footprint while meeting power consumption specifications such as Energy Star® and Blue Angel\*, and PFC requirements such as IEC1000-3-2.

ON Semiconductor covers the complete power chain, from industrial power supplies to consumer applications such as DVD players, set top boxes, computers, laptops and cell phones.



### SPICE Models Available

ON Semiconductor offers full power solutions with dedicated SPICE models implemented in a working template. Both transient simulations and small-signal analysis help you test your design quickly and safely - before you get out the soldering iron. In partnership with Intusoft®, our free demonstration kit lets you simulate working applications from wall adapters to multi-output power supplies.

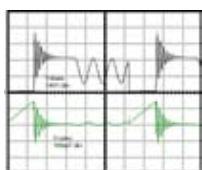


Individual models are available online at:

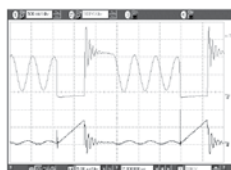
<http://www.onsemi.com/support/models/powermanagement>

Or order the SPICE Simulation CDROM at:

<http://www.onsemi.com/orderlit>



Simulated



Measured

### Winning Feature Set

ON Semiconductor offers a wide variety of controllers with features to fit your application:

- ✓ Fixed frequency current or voltage mode topologies
- ✓ Variable-frequency Quasi-Resonant (QR) and resonant mode architectures for higher efficiency and better EMI
- ✓ Skip cycle, Soft-Skip™ or frequency foldback circuits for excellent standby performance
- ✓ Fixed on-time/variable off-time switching for low power applications
- ✓ Hysteretic-type control for ease of implementation
- ✓ Comprehensive protection and safety options

### Reach the Minimum. . .

Complying with existing and future energy conversion regulations can be challenging. Power controllers and switching regulators from ON Semiconductor minimize standby power consumption and maximize power conversion efficiency. **For example, a 70 W power supply reference design built with the NCP1203 has been shown to consume only 86 mW at no-load conditions – the best performance in its class.**

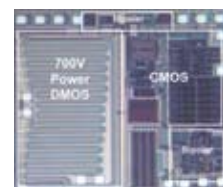


For two consecutive years, ON Semiconductor has been the only chip manufacturer recognized by the China Standard Certification Center (CSC, formerly the CECP) to support China's drive for standby power reduction and energy conservation. We are participating in European Commission (EC) work groups developing a Code of Conduct to help reduce standby losses in a wide range of consumer equipment.

### High Voltage Technology

Very High Voltage Integrated Circuit Technology (VHVIC):

- ✓ High speed and high accuracy control with high voltage switching on a single die
- ✓ Power switching devices scalable from 200 Volts to over 1000 Volts
- ✓ High density logic for intelligent feature-set products
- ✓ Medium voltage analog from 10 Volts to 60 Volts for off-line connection and direct power switch drive



If you want to design  
a Power Supply. . .

CTRL + MOS  
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REGULATOR  
Go to page 6



## Power Factor Controllers

### Minimize THD and Maximize PF and Efficiency. . .

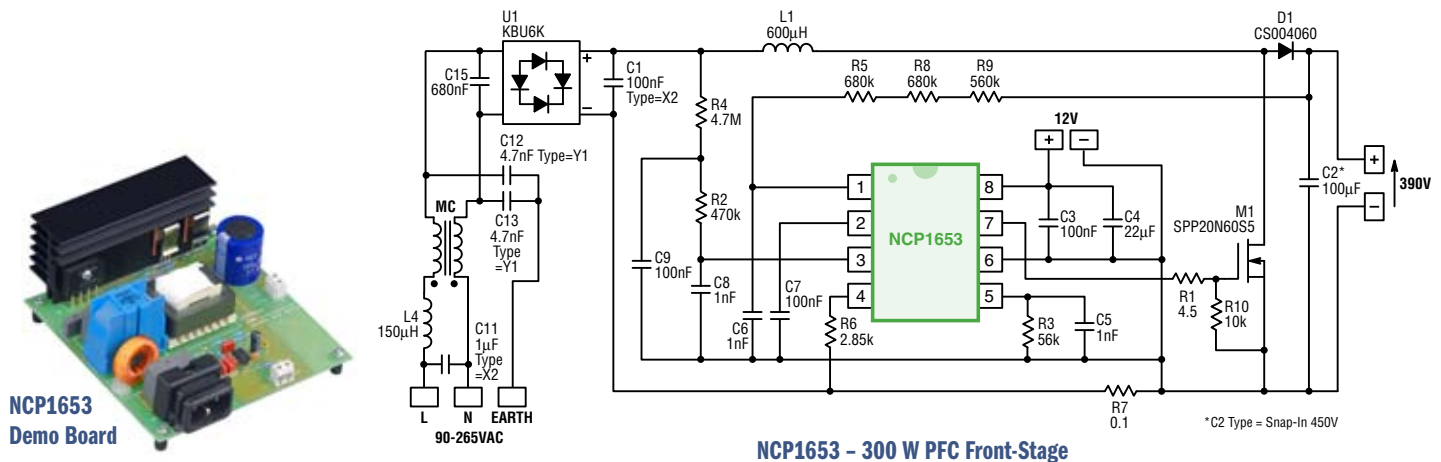
IEC 1000-3-2 standards set regulations to limit the harmonics injected into the AC line by any equipment drawing more than 75 W of input power for class D equipment (TV sets, PC monitors, desktop PCs) and 25 W for class C equipment (lighting). A front-end Power Factor Controller is then required in these power supplies. Adding such a stage can lead to difficulties in meeting other regulatory requirements (standby and active power) unless you make judicious design choices.



Above challenges have been fully understood by ON Semiconductor which steadily releases innovative PFC controllers matching designers' wishes of simple, compact and robust solutions. These new PFCs represent perfect solutions in various applications such as Flat TVs, ATX Power supply & Servers, Telecom and Industrial SMPS where cost will, of course, always be a primary factor, but where you can also base differentiation on performance.

## Key Features & Benefits

- ✓ Solutions for both Critical Conduction Mode and Continuous Conduction Mode
  - ① Design flexibility and better applications coverage
- ✓ Follower Boost Mode Capability
  - ① Flexibility & Compactness as well as Cost reduction
- ✓ Fixed frequency & Synchronization capability
  - ① Smoother EMI & Flexibility
- ✓ Low consumption during start-up and shutdown mode
  - ① Help Meet Low Stand-by Power Requirements
- ✓ Several Integrated protections such as
  - Over Current and Voltage Limitations
  - In-rush Current Detection
  - Feed-back loop Failure Detection
  - ① Design flexibility and rugged design

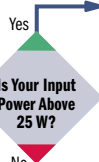


NCP1653  
Demo Board

NCP1653 - 300 W PFC Front-Stage

POWER FACTOR CONTROLLERS	Device	Max Output Power (W)	Topology	Mode	Operation Mode	HV Start-Up	OVP <sup>3</sup>	UVP <sup>4</sup>	Current Limit	Power Limit	Brown-Out	In-Rush Detect	Shutdown	Package(s)
LIGHTING	MC33260	300	Boost	CRM <sup>6</sup>	Voltage	✓	✓	✓	✓			✓		SOIC-8, PDIP-8
	MC33262	200	Boost	CRM <sup>6</sup>	Current		✓	✓	✓					SOIC-8, PDIP-8
	MC33368	300	Boost	CRM <sup>6</sup>	Current	✓	✓	✓	✓					SOIC-16, PDIP-16
	NCP1601	400	Boost	CRM <sup>6</sup> /DCM <sup>2</sup>	Fixed Freq Voltage	✓	✓	✓	✓			✓	✓	SOIC-8, PDIP-8
	NCP1606	200	Boost	CRM <sup>6</sup>	Voltage		✓	✓	✓				✓	SOIC-8, PDIP-8
	NCP1603	250	Combo Flyback <sup>5</sup>	CRM <sup>6</sup> /DCM <sup>2</sup>	Current	✓	✓	✓	✓			✓	✓	SOIC-16
	NCP1651	250	1-Stage Flyback	CCM <sup>1</sup> /DCM <sup>2</sup>	Average Current	✓		✓	✓				✓	SOIC-16
	NCP1652	250	1-Stage Flyback	CCM <sup>1</sup> /DCM <sup>2</sup>	Average Current	✓		✓	✓		✓			SOIC-16
	NCP1653	1000	Boost	CCM <sup>1</sup> /DCM <sup>2</sup>	Average Current		✓	✓	✓	✓	✓	✓	✓	SOIC-8, PDIP-8
	NCP1650	5000	Boost	CCM <sup>1</sup> /DCM <sup>2</sup>	Average Current		✓	✓	✓	✓	✓	✓	✓	SOIC-16

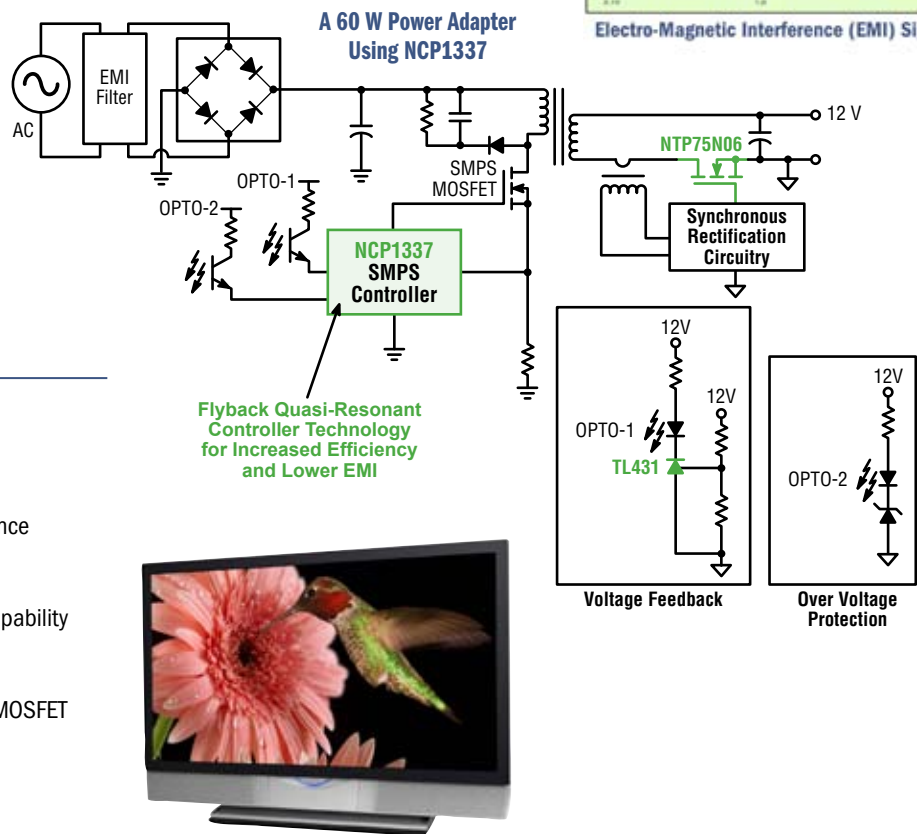
1. Continuous Conduction Mode 2. Discontinuous Conduction Mode 3. Overvoltage Protection 4. Undervoltage Protection 5. NCP1603 - combination of NCP1601 & NCP1203 6. Critical Conduction Mode



## Variable Frequency Controllers

### Minimum EMI, Maximum Efficiency. . .

ON Semiconductor's variable frequency controllers include quasi-resonant and resonant controllers. These controllers are used respectively in critical conduction mode quasi-resonant flyback converters and half bridge resonant LLC converters. These topologies minimize EMI radiation, provide better magnetic utilization and offer excellent power conversion efficiency - up to 90%. Our variable frequency controllers combine the advantages of working directly off-line (with our proprietary VHVIC technology) with the ability to drive an external high-voltage MOSFET of your choice, and offer you more design flexibility than our competitors.



### Key Features & Benefits

- ✓ Quasi-resonant mode valley switching
  - ① Minimizes EMI
  - ① Reduces switching losses
- ✓ High-voltage start-up-current source
  - ① Offers clean loss-less start-up sequence
- ✓ Dynamic Self Supply (DSS) capability
  - ① Simplifies transformer design
- ✓ Adjustable skip-mode and Soft-Skip™ capability
  - ① No acoustic noise generation
- ✓ Gate drive capability up to 500 mA
  - ① Gives flexibility in choosing external MOSFET
- ✓ Over-current and over-voltage protection
  - ① Protects circuitry
- ✓ Over-power compensation

VARIABLE FREQUENCY CONTROLLERS	Device	Max Output Power <sup>1</sup> (W)	Mode	Standby Power Method	Output Gate Drive (mA) @ V <sub>CC</sub> = 11V	Max Switching Frequency (kHz)	500V Off-Line Startup FET	Dynamic Self Supply	OVP <sup>2</sup>	Latch	Soft-Start	Enable	OPC <sup>3</sup>	Brown-Out	Package(s)
Variable toff	NCP1215A	10	Current, Var toff	Freq Foldback	30	Adjustable	✓				✓	✓			SO-8, TSOP-6
	NCP1351	50	Current, Var toff	Freq Foldback	150	65	✓			✓	✓	✓	✓		SO-8
	NCP1205	150	Current	Freq Foldback	300	Adj., Default 125	✓		✓						SO-16, PDIP-8, PDIP-14
	NCP1207A	150/100 <sup>1</sup>	Current	Adj Skip Cycle	500	Set by Min, Toff = 8µs	✓	✓	✓	✓	✓	✓			SO-8, PDIP-8
	NCP1308	150	Current	Adj Skip Cycle	500	Set by Min, Toff = 10µs	✓	✓	✓	✓	✓	✓			SO-8
	NCP1337	200	Current	Adj Skip Cycle	500	130	✓	✓	✓	✓	✓	✓	✓	✓	SO-7, PDIP-7
	NCP1377/B	150	Current	Adj Skip Cycle	500	Set by Min, Toff = 3 or 8µs	✓	✓	✓	✓	✓	✓	✓		SO-7, PDIP-7
	NCP1378	150	Current	Adj Skip Cycle	500	Set by Min, Toff = 8µs	✓		✓	✓	✓	✓	✓		SO-7, PDIP-7
	NCP1381	200	Current	Adj Skip Cycle	500	125	✓		✓	✓	✓	✓	✓		SO-14
	NCP1395	500	Voltage	Adj Skip Cycle	180	1000	✓		✓	✓	✓	✓		✓	SOIC-16, PDIP-16

1. Maximum Power Output with DSS 2. Overvoltage Protection 3. Over Power Compensation

## Fixed Frequency Controllers

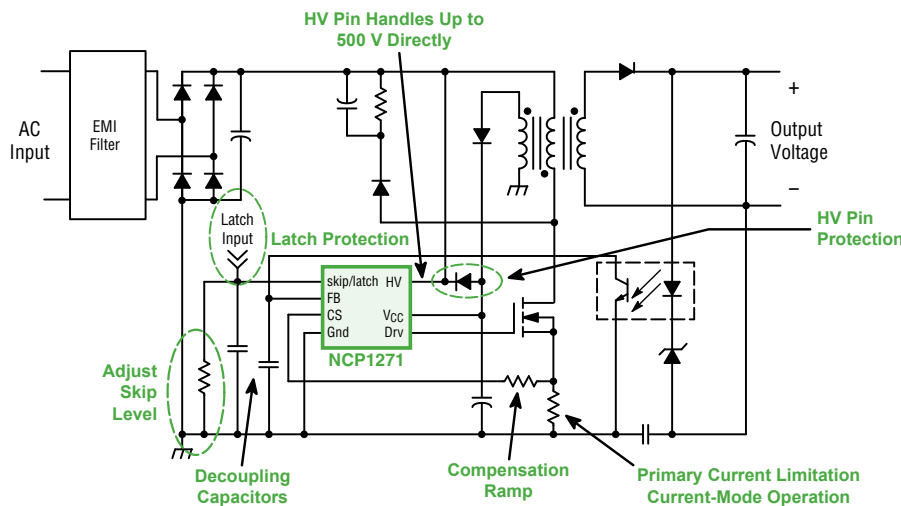
### Low Cost and Low Power Consumption. . .

Fixed frequency controllers from ON Semiconductor are the perfect solution for many applications. DVD players, set-top boxes, notebook power adapters, printers, scanners, LCD monitors, and a wealth of other end products use our controllers. Extremely low standby power helps you easily meet applicable regulations. The Dynamic Self-Supply (DSS) feature of our devices saves cost by avoiding the use of an auxiliary transformer winding, and current-mode topologies give tighter control of output voltage. Our fixed frequency controllers can help you meet your toughest design challenges while still keeping cost to a minimum.



## Key Features & Benefits

- ✓ Dynamic Self Supply (DSS) capability
  - ① No auxiliary transformer winding
- ✓ Current-mode control with adjustable skip-cycle and Soft-Skip™ capability
  - ① Provides excellent efficiency at light loads
  - ① No acoustic noise generation
- ✓ Fixed frequencies up to 200 kHz
  - ① Offers suitable solution for all applications
- ✓ High-voltage start-up-current source
  - ① Clean loss less start-up sequence
- ✓ Frequency jittering
  - ① Reduces EMI signature
- ✓ Go-to-standby for PFC front stage
  - ① Minimizes standby losses
- ✓ Internal short-circuit protection independent of auxiliary voltage
  - ① Reliable short-circuit protection, immediately reducing the output power
- ✓ Under-voltage lockout at 7.6 V typical
  - ① Suitable for applications already using UC3843



NCP1271 Typical Schematic for Fixed Frequency Controller with Soft-Skip™

FIXED FREQUENCY CONTROLLERS	Device	Max Output Power (W)	Mode	Standby Power Method	Output Gate Drive (mA) @ V <sub>CC</sub> = 11V	Frequency Options (kHz)	500V Off-Line Startup FET	Dynamic Self Supply	Freq Jittering	OVP <sup>4</sup>	Latch	Soft-Start	Ramp Compensation	Brown-Out	Enable	Package(s)
<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>Do you need low Standby power?</p> <p>Yes</p> <p>No</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>What features do you need?</p> <p>Low End</p> <p>High End</p> </div> </div>	NCP1200	150/40 <sup>1</sup>	Current	Adj Skip	250	40,60,100	✓	✓					EXT		✓	SO-8, PDIP-8
	NCP1201	150	Current	Adj Skip	250	60,100	✓		✓		✓		EXT	✓	✓	SO-8, PDIP-8
	NCP1203	150	Current	Adj Skip	250	40,60,100	✓		✓				EXT		✓	SO-8, PDIP-8
	NCP1216/A <sup>2</sup>	150/100 <sup>1</sup>	Current	Adj Skip	500	65,100,133	✓	✓	✓		✓	✓ <sup>3</sup>	INT		✓	SO-8, PDIP-7
	NCP1217/A <sup>2</sup>	150	Current	Adj Skip	500	65,100,133	✓		✓	✓	✓	✓ <sup>3</sup>	INT		✓	SO-7, PDIP-7
	NCP1212	150	Current	Adj Skip	500	Adj Up to 150			✓				EXT		✓	SO-8, PDIP-8
	NCP1230	150	Current	Adj Skip	500	65,100,133	✓		✓	✓	✓	✓	INT		✓	SO-8, PDIP-8
	NCP1271	150	Current	Adj Skip w/ TLD <sup>5</sup>	500	65,100	✓		✓	✓	✓	✓	INT	✓	✓	SO-7
	NCP1282/1562*	400	Voltage	Skip Cycle	200	Adj Up to 1000	✓*	✓	✓	✓	✓	✓	EXT		✓	SO-16

1. Maximum power output with DSS 2. "A" Versions Have a 50% Max Duty Cycle for Forward Topologies 3. Only Available on "A" Versions 4. Overvoltage Protection 5. Transient Load Detection \* NCP1562 has 100 V startup FET

Please visit our website at [www.onsemi.com](http://www.onsemi.com) for additional options.

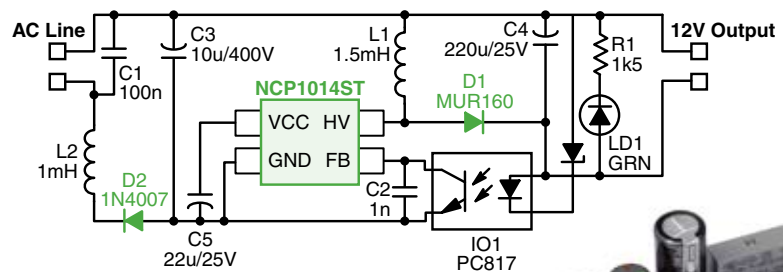
## Power Switching Regulators

### Easier, Faster Power Designs and Fewer External Components. . .

Power Regulators from ON Semiconductor offer the simplest, most economical way to design a power supply compliant with stringent requirements on standby power. These highly integrated solutions reduce system size and external component count to a minimum. The Dynamic Self Supply feature can even eliminate the auxiliary winding of the transformer. The design of your power supply can be done in minutes – drastically reducing your time-to-market.

### Key Features & Benefits

- ✓ Highly integrated solution
  - ① Reduces system size and cost
- ✓ Dynamic Self Supply (DSS) capability
  - ① No need for an auxiliary transformer winding
- ✓ On-chip 700V power switch circuit
  - ① Compact and easy system design
- ✓ Frequency jittering
  - ① Reduces EMI signature
- ✓ Skip-cycle operation
  - ① No acoustic noise
- ✓ Low power consumption
  - ① Allows energy ECO regulations compliance
- ✓ Output overload and open loop protection
  - ① Protects your application
- ✓ Over-power and brown-out protection
- ✓ Ramp Compensation



NCP1014 - 12 V, 200 mA Buck Application



POWER SWITCHING REGULATORS	Device	Max Output Power <sup>1</sup> (W)	Mode	Power Switch Voltage (V)	Peak Current Limit (mA)	Typ <sup>2</sup> R <sub>DS(on)</sub> (Ω)	Min HV Startup	Frequency Options (kHz)	Dynamic Self Supply	Freq Jittering	Soft-Start	Enable	Package(s)
	NCP1030	3	Voltage	200	515	4.1	16.8	Up to 1000	✓			✓	SOIC-8, Micro8
	NCP1031	6	Voltage	200	1050	2.1	16.8	Up to 1000	✓			✓	SOIC-8, Micro8
	NCP1050	10	Gated Osc	700	100	22	20	44, 100, 136	✓	✓		✓	PDIP-7, SOT-223
	NCP1051	10	Gated Osc	700	200	22	20	44, 100, 136	✓	✓		✓	PDIP-7, SOT-223
	NCP1052	10	Gated Osc	700	300	22	20	44, 100, 136	✓	✓		✓	PDIP-7, SOT-223
	NCP1053	20	Gated Osc	700	400	10	20	44, 100, 136	✓	✓		✓	PDIP-7, SOT-223
	NCP1054	20	Gated Osc	700	530	10	20	44, 100, 136	✓	✓		✓	PDIP-7, SOT-223
	NCP1055	20	Gated Osc	700	680	10	20	44, 100, 136	✓	✓		✓	PDIP-7, SOT-223
	NCP1010	4	Current	700	100	22	30	65, 100, 130	✓	✓	✓	✓	PDIP-7, SOT-223 <sup>3</sup>
	NCP1011	11	Current	700	250	22	30	65, 100, 130	✓	✓	✓	✓	PDIP-7, SOT-223, GullWing <sup>4</sup>
	NCP1012	11	Current	700	250	11	30	65, 100, 130	✓	✓	✓	✓	PDIP-7, SOT-223 <sup>3</sup>
	NCP1013	15	Current	700	350	11	30	65, 100, 130	✓	✓	✓	✓	PDIP-7, SOT-223 <sup>3</sup>
	NCP1014	19 / 171	Current	700	450	11	30	65, 100	✓	✓	✓	✓	PDIP-7, SOT-223, GullWing <sup>4</sup>
	NCP1027/28	20	Current	700	800	5.6	30	65, 100		✓	✓	✓	PDIP-7 <sup>3</sup>
	NCP1000	20	Voltage	700	0.5	18	100	100				✓	PDIP-8
	NCP1001	30	Voltage	700	1	9	100	100				✓	PDIP-8
	NCP1002	50	Voltage	700	1.5	6	100	100				✓	PDIP-8

1. Maximum Power Output with DSS 2. Typical at 25°C 3. Gullwing package available on Demand 4. Gullwing SMD DIP-7

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