NCP1200

PWM Current-Mode Controller for Low-Power Universal Off-Line Supplies

Housed in SOIC−8 or PDIP−8 package, the NCP1200 represents a major leap toward ultra−compact Switchmode Power Supplies. Due to a novel concept, the circuit allows the implementation of a complete offline battery charger or a standby SMPS with few external components. Furthermore, an integrated output short−circuit protection lets the designer build an extremely low−cost AC−DC wall adapter associated with a simplified feedback scheme.

With an internal structure operating at a fixed 40 kHz, 60 kHz or 100 kHz, the controller drives low gate−charge switching devices like an IGBT or a MOSFET thus requiring a very small operating power. Due to current−mode control, the NCP1200 drastically simplifies the design of reliable and cheap offline converters with extremely low acoustic generation and inherent pulse−by−pulse control.

When the current setpoint falls below a given value, e.g. the output power demand diminishes, the IC automatically enters the skip cycle mode and provides excellent efficiency at light loads. Because this occurs at low peak current, no acoustic noise takes place.

Finally, the IC is self−supplied from the DC rail, eliminating the need of an auxiliary winding. This feature ensures operation in presence of low output voltage or shorts.

Features

- No Auxiliary Winding Operation
- Internal Output Short−Circuit Protection
- Extremely Low No−Load Standby Power
- Current−Mode with Skip−Cycle Capability
- Internal Leading Edge Blanking
- 250 mA Peak Current Source/Sink Capability
- Internally Fixed Frequency at 40 kHz, 60 kHz and 100 kHz
- Direct Optocoupler Connection
- Built−in Frequency Jittering for Lower EMI
- SPICE Models Available for TRANsient and AC Analysis
- Internal Temperature Shutdown
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- AC−DC Adapters
- Offline Battery Chargers
- Auxiliary/Ancillary Power Supplies (USB, Appliances, TVs, etc.)

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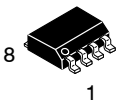
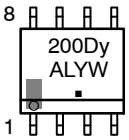
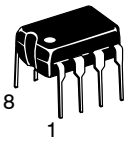
MARKING DIAGRAMS

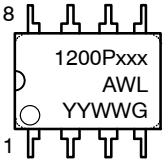


SOIC−8
D SUFFIX
CASE 751



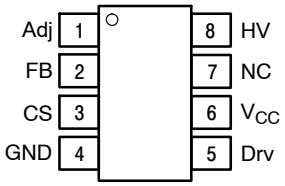


PDIP−8
P SUFFIX
CASE 626



xxx	= Device Code: 40, 60 or 100
y	= Device Code:
	4 for 40
	6 for 60
	1 for 100
A	= Assembly Location
L	= Wafer Lot
Y, YY	= Year
W, WW	= Work Week
G, ▪	= Pb−Free Package

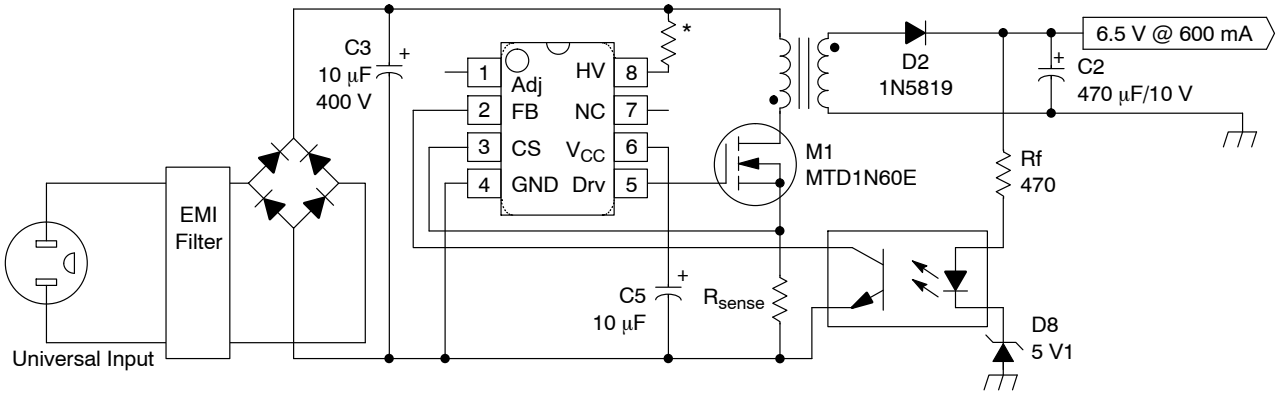
PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

See detailed ordering and shipping information on page 14 of this data sheet.



*Please refer to the application information section

Figure 1. Typical Application

PIN FUNCTION DESCRIPTION

Pin No.	Pin Name	Function	Description
1	Adj	Adjust the Skipping Peak Current	This pin lets you adjust the level at which the cycle skipping process takes place.
2	FB	Sets the Peak Current Setpoint	By connecting an Optocoupler to this pin, the peak current setpoint is adjusted accordingly to the output power demand.
3	CS	Current Sense Input	This pin senses the primary current and routes it to the internal comparator via an L.E.B.
4	GND	The IC Ground	
5	Drv	Driving Pulses	The driver's output to an external MOSFET.
6	V_{CC}	Supplies the IC	This pin is connected to an external bulk capacitor of typically 10 μF.
7	NC	No Connection	This un−connected pin ensures adequate creepage distance.
8	HV	Generates the V_{CC} from the Line	Connected to the high−voltage rail, this pin injects a constant current into the V_{CC} bulk capacitor.

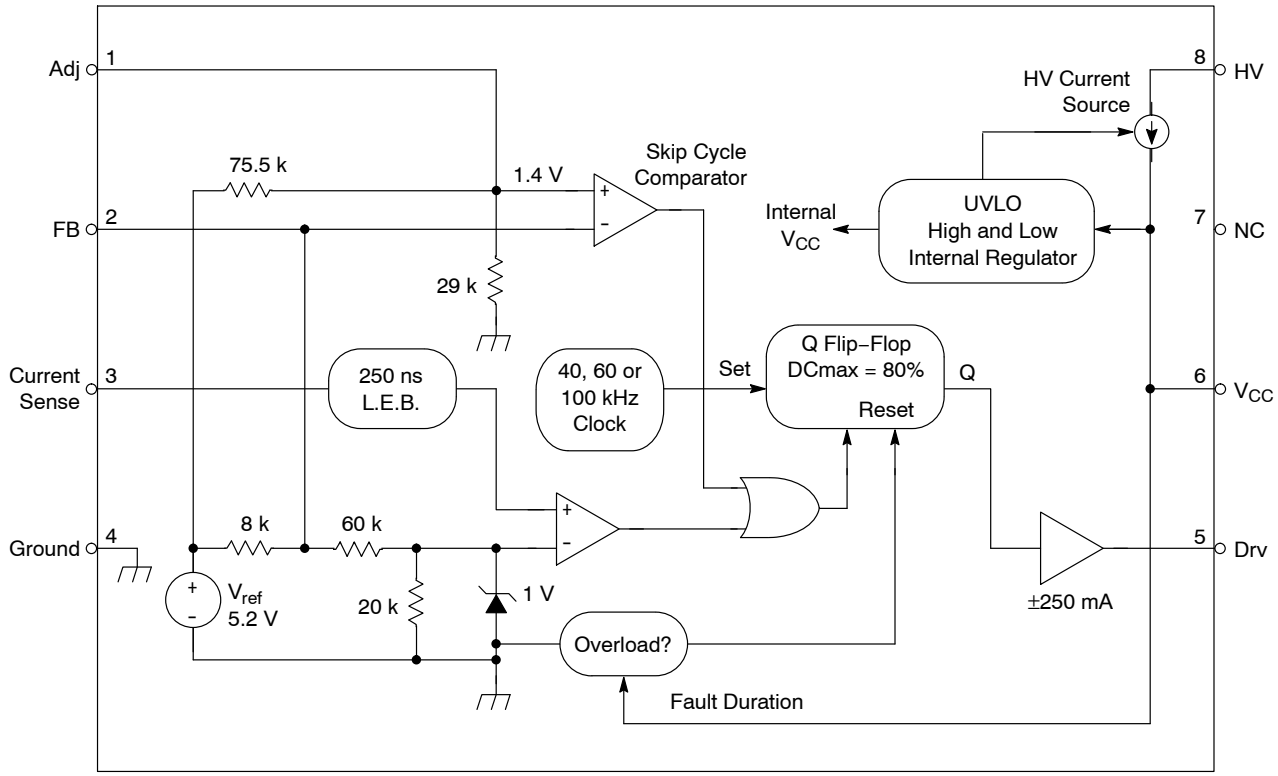


Figure 2. Internal Circuit Architecture

MAXIMUM RATINGS

Rating	Symbol	Value	Units
Power Supply Voltage	V_{CC}	16	V
Thermal Resistance Junction−to−Air, PDIP−8 version Thermal Resistance Junction−to−Air, SOIC version Thermal Resistance Junction−to−Case	$R_{\theta JA}$ $R_{\theta JA}$ $R_{\theta JC}$	100 178 57	°C/W
Maximum Junction Temperature Typical Temperature Shutdown	T_{Jmax} –	150 140	°C
Storage Temperature Range	T_{stg}	−60 to +150	°C
ESD Capability, HBM Model (All Pins except V_{CC} and HV)	–	2.0	kV
ESD Capability, Machine Model	–	200	V
Maximum Voltage on Pin 8 (HV), pin 6 (V_{CC}) Grounded	–	450	V
Maximum Voltage on Pin 8 (HV), Pin 6 (V_{CC}) Decoupled to Ground with 10 μF	–	500	V
Minimum Operating Voltage on Pin 8 (HV)	–	30	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. This device series contains ESD protection rated using the following tests:
   Human Body Model (HBM) 2000 V per JEDEC Standard JESD22, Method A114E.
   Machine Model (MM) 200 V per JEDEC Standard JESD22, Method A115A.

ELECTRICAL CHARACTERISTICS (For typical values T_J = +25°C, for min/max values T_J = −25°C to +125°C, Max T_J = 150°C, V_{CC}= 11 V unless otherwise noted)

Rating	Pin	Symbol	Min	Typ	Max	Unit
DYNAMIC SELF−SUPPLY (All Frequency Versions, Otherwise Noted)						
V_{CC} Increasing Level at Which the Current Source Turns−off	6	V_{CCOFF}	10.3	11.4	12.5	V
V_{CC} Decreasing Level at Which the Current Source Turns−on	6	V_{CCON}	8.8	9.8	11	V
V_{CC} Decreasing Level at Which the Latchoff Phase Ends	6	$V_{CClatch}$	−	6.3	−	V
Internal IC Consumption, No Output Load on Pin 5	6	I_{CC1}	−	710	880 Note 1	μA
Internal IC Consumption, 1 nF Output Load on Pin 5, F_{SW} = 40 kHz	6	I_{CC2}	−	1.2	1.4 Note 2	mA
Internal IC Consumption, 1 nF Output Load on Pin 5, F_{SW} = 60 kHz	6	I_{CC2}	−	1.4	1.6 Note 2	mA
Internal IC Consumption, 1 nF Output Load on Pin 5, F_{SW} = 100 kHz	6	I_{CC2}	−	1.9	2.2 Note 2	mA
Internal IC Consumption, Latchoff Phase	6	I_{CC3}	−	350	−	μA
INTERNAL CURRENT SOURCE						
High−voltage Current Source, V_{CC} = 10 V	8	I_{C1}	2.8	4.0	−	mA
High−voltage Current Source, V_{CC} = 0 V	8	I_{C2}	−	4.9	−	mA
DRIVE OUTPUT						
Output Voltage Rise−time @ CL = 1 nF, 10−90% of Output Signal	5	T_r	−	67	−	ns
Output Voltage Fall−time @ CL = 1 nF, 10−90% of Output Signal	5	T_f	−	28	−	ns
Source Resistance (drive = 0, Vgate = V_{CCHMAX} − 1 V)	5	R_{OH}	27	40	61	Ω
Sink Resistance (drive = 11 V, Vgate = 1 V)	5	R_{OL}	5	12	25	Ω
CURRENT COMPARATOR (Pin 5 Un−loaded)						
Input Bias Current @ 1 V Input Level on Pin 3	3	I_{IB}	−	0.02	−	μA
Maximum internal Current Setpoint	3	I_{Limit}	0.8	0.9	1.0	V
Default Internal Current Setpoint for Skip Cycle Operation	3	I_{Lskip}	−	350	−	mV
Propagation Delay from Current Detection to Gate OFF State	3	T_{DEL}	−	100	160	ns
Leading Edge Blanking Duration	3	T_{LEB}	−	230	−	ns
INTERNAL OSCILLATOR (V_{CC} = 11 V, Pin 5 Loaded by 1 kΩ)						
Oscillation Frequency, 40 kHz Version	−	f_{OSC}	36	42	48	kHz
Oscillation Frequency, 60 kHz Version	−	f_{OSC}	52	61	70	kHz
Oscillation Frequency, 100 kHz Version	−	f_{OSC}	86	103	116	kHz
Built−in Frequency Jittering, F_{SW} = 40 kHz	−	f_{jitter}	−	300	−	Hz/V
Built−in Frequency Jittering, F_{SW} = 60 kHz	−	f_{jitter}	−	450	−	Hz/V
Built−in Frequency Jittering, F_{SW} = 100 kHz	−	f_{jitter}	−	620	−	Hz/V
Maximum Duty Cycle	−	Dmax	74	80	87	%
FEEDBACK SECTION (V_{CC} = 11 V, Pin 5 Loaded by 1 kΩ)						
Internal Pullup Resistor	2	Rup	−	8.0	−	kΩ
Pin 3 to Current Setpoint Division Ratio	−	Iratio	−	4.0	−	−
SKIP CYCLE GENERATION						
Default skip mode level	1	Vskip	1.1	1.4	1.6	V
Pin 1 internal output impedance	1	Zout	−	25	−	kΩ

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Max value @ T_J = −25°C.
2. Max value @ T_J = 25°C, please see characterization curves.