Design Idea DI-78
LinkSwitch®-HF Low Cost 1.6 W CV/CC Charger/Adapter

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
Charger/Adapter	LNK353	1.6 W	85-265 VAC	5.2 V	Flyback

Design Highlights

- Low cost, low component count solution
- No-load power consumption <300 mW – meets worldwide energy efficiency requirements
- Low leakage current design, <10 µA
- Universal AC input range – single design worldwide
- Secondary-side feedback gives accurate voltage and constant current output
- Small size and weight
- Meets EN55022 B EMI limits

Operation

The AC input is rectified and filtered and applied to one side of the primary winding. The other end of the primary is connected to the DRAIN pin of U1. During the on-time of U1, energy is stored in the transformer and delivered to the load when U1 switches off. A simple RCD clamp (D5, R2, C3 and R3) limits the peak drain voltage.

A simple pi (π) filter formed by C1, L1 and C2 together with RF1 are sufficient to attenuate differential conducted EMI. Common mode and radiated EMI generation is minimized through the use of transformer shield windings, a snubber (R4 and C9) across the output diode, and by the internal switching frequency jitter of *LinkSwitch-HF*.

LinkSwitch-HF uses ON/OFF control to regulate the output. Current >49 µA fed from the BYPASS pin capacitor C5 into the FEEDBACK pin disables the MOSFET for that switching cycle.

To maximize efficiency, a Schottky diode (D7) is used to rectify the secondary. Filtering is provided by a low ESR capacitor C6 and for most battery chargers, no additional filtering is required.

During CV operation the output voltage is determined by the sum of the Q1 V_{BE} voltage and VR1. As the voltage increases above this level, Q1 is biased on and current is fed through the optocoupler LED, thus inhibiting switching cycles to maintain regulation. The transition to CC operation occurs when the voltage developed across R9 and R8 exceeds the LED forward voltage of U2 (~1 V). Resistors R7 and R8 limit the optocoupler current during transients. Resistor R5 limits the base current of Q1 and R6 provides a bias current through VR1 (~0.5 mA).

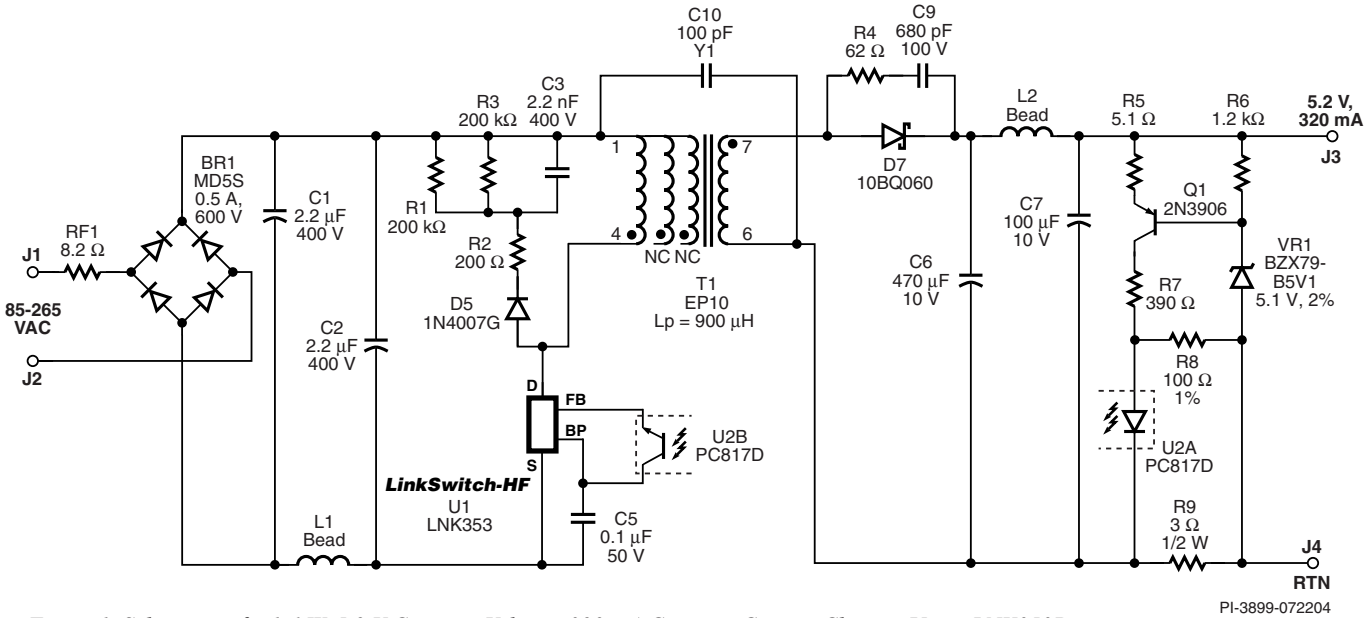

Figure 1. Schematic of a 1.6 W, 5.2 V Constant Voltage, 320 mA Constant Current Charger Using LNK353P.

Key Design Points

- Diode D5 should be a glass passivated type to guarantee a specified recovery time and should be used with R2 fitted to limit reverse pull-out current.
- Select the value of C1 and C2 to meet differential line surge withstand requirements.
- Select the initial value of R9 using: R9 = $V_{F(U2)}/I_O$. Small adjustments may be made by changing the value of R8.
- Use an optocoupler with a high CTR (300% to 600%) to improve CC linearity and variability.
- For VR1 select a Zener series with a low test current.
- Inductor L2 and C7 are typically not required for battery loads.

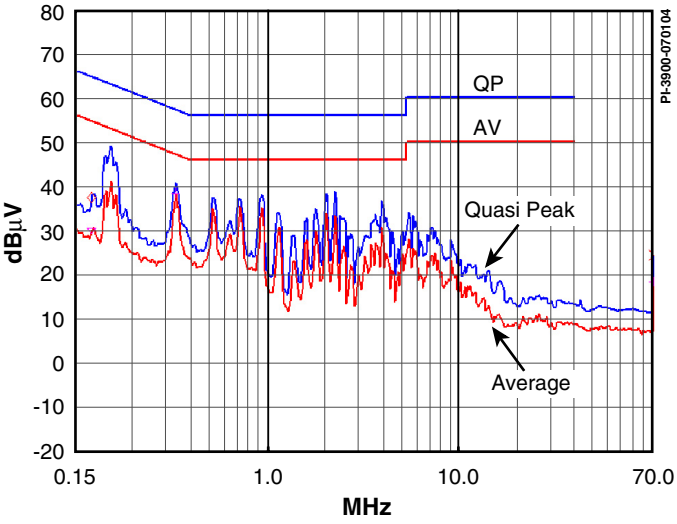

Figure 2. Conducted EMI Plot, 230 VAC Input, Maximum Load and Output Return Connected to Artificial Hand Input of LISN.

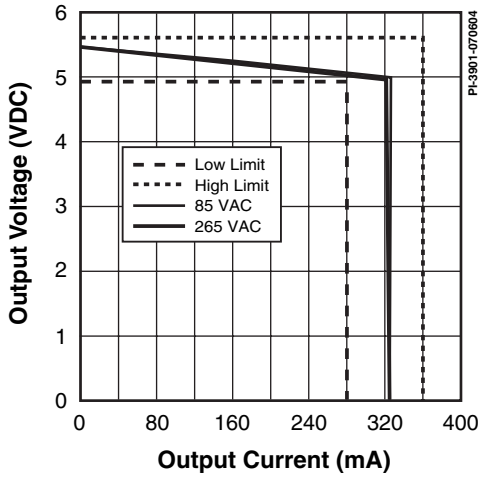

Figure 3. V-I Output Characteristic.

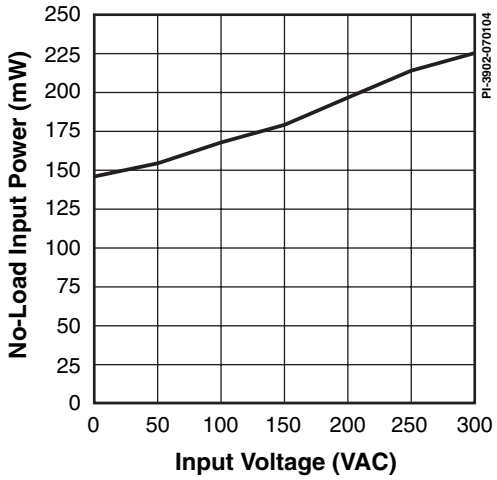

Figure 4. No-Load Input Power vs. Line Voltage.

TRANSFORMER PARAMETERS	
Core Material	EP10 (TDK PC40), gapped for A_L of 54.1 nH/T²
Bobbin	EP10 Horizontal, 8-pin
Winding Details	Shield 1: 23T, 38 AWG x 2, tape, Primary: 129T, 38 AWG, tape, Shield 2: 10T, 31 AWG x 2, tape, Secondary: 11T, 32 AWG triple insulated, tape
Primary Inductance	900 µH ±5%
Primary Resonant Frequency	900 kHz (minimum)
Leakage Inductance	70 µH (maximum)

Table 1. Transformer Design Parameters.

Power Integrations **5245 Hellyer Avenue** **San Jose, California 95138**

MAIN PHONE NUMBER
+1 408-414-9200

APPLICATIONS HOTLINE
+1 408-414-9660

APPLICATIONS FAX
+1 408-414-9760

For a complete listing of worldwide sales offices, please visit ***www.powerint.com***