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A 36W Ballast Application with the NCP5104

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This document describes how the NCP5104 driver can be implemented in a ballast application. The scope of this application note is to highlight the NCP5104 driver and not to explain or detailed how to build electronic ballast.

The NCP5104 is a high voltage power MOSFET driver providing two outputs for direct drive of 2 N-channel power MOSFETs arranged in a half-bridge configuration with only one input.

It uses the bootstrap technique to insure a proper drive of the High-side power switch. The driver works with one input to accommodate half-bridge topology with a fixed dead time of 520 ns.

Demo Board Specification

- Input range : 85 Vac – 145 Vac OR 184 Vac – 265 Vac
- Ballast Output Power : 36 W (type PL-L 36W)
- Pre-Heating Current : 295 mA
- Pre-Heating Time : 1 second
- Nominal Current : 414 mA

NOTE: BEFORE PLUGGING IN THE DEMO BOARD, MAKE SURE THE JUMPER IS ON THE CORRECT POSITION: IF J2 IS USED, THEN V_{in} MUST BE LOWER THAN 145 Vac.

Detailed Operation

The lamp ballast is powered via a half bridge configuration. The 2 power MOSFETs are driven with the NCP5104 driver. The driver is supplied by the V_{CC} rail, and the high side driver is supplied by the bootstrap diode: when the low side power MOSFET (Q2) is switched ON, the BRIDGE pin is pulled down to the ground, thus the capacitor connected between BRIDGE pin and VBOOT pin is refuelled via the diode D3 and the resistor R5 connected to V_{CC} . When Q2 is switched OFF the bootstrap capacitor C6 supplies the high side driver with a voltage equal to V_{CC} level minus the D3 forward voltage diode. Given the NCP5104 architecture, the driver copies the input signal to the high side driver, then it generates a fixed dead time (520 ns) before toggling the low side driver when the input pin level changes.

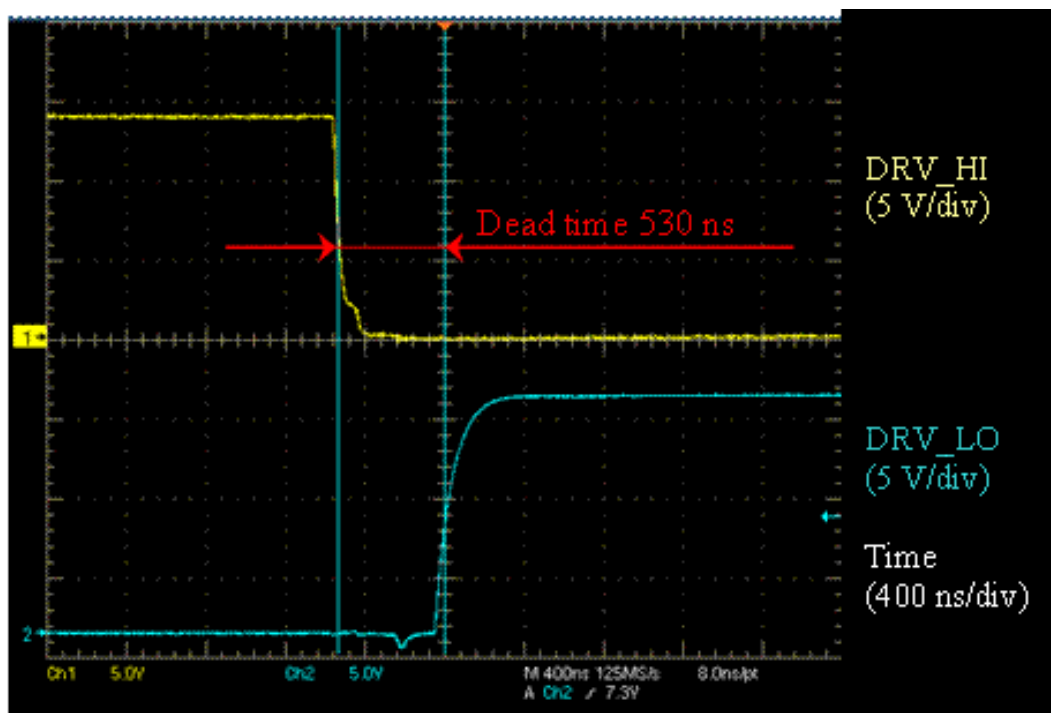


Figure 1. Dead Time Between the High and Low-Side Driver

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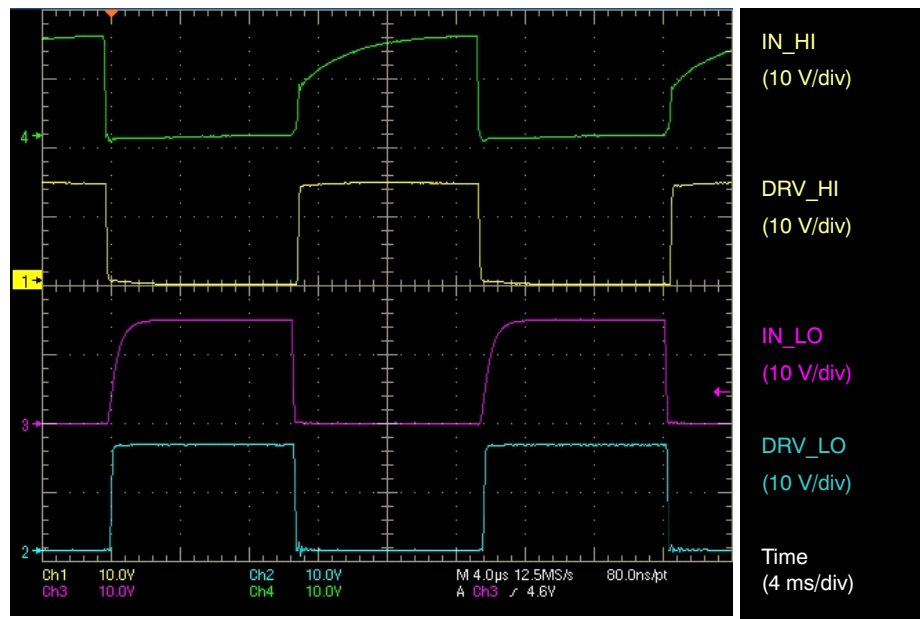


Figure 2. Input Output Timing Diagram

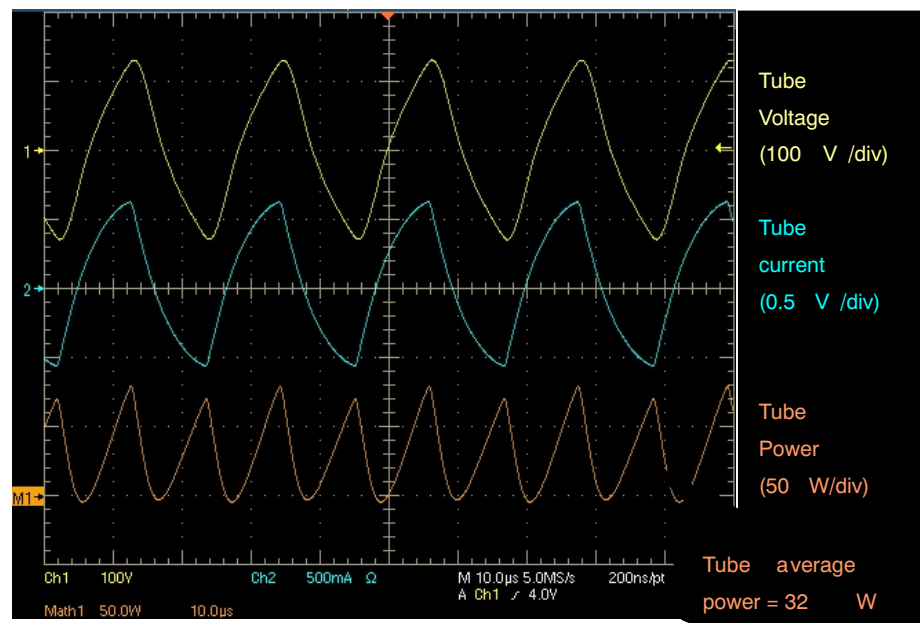


Figure 3. Tube Signals

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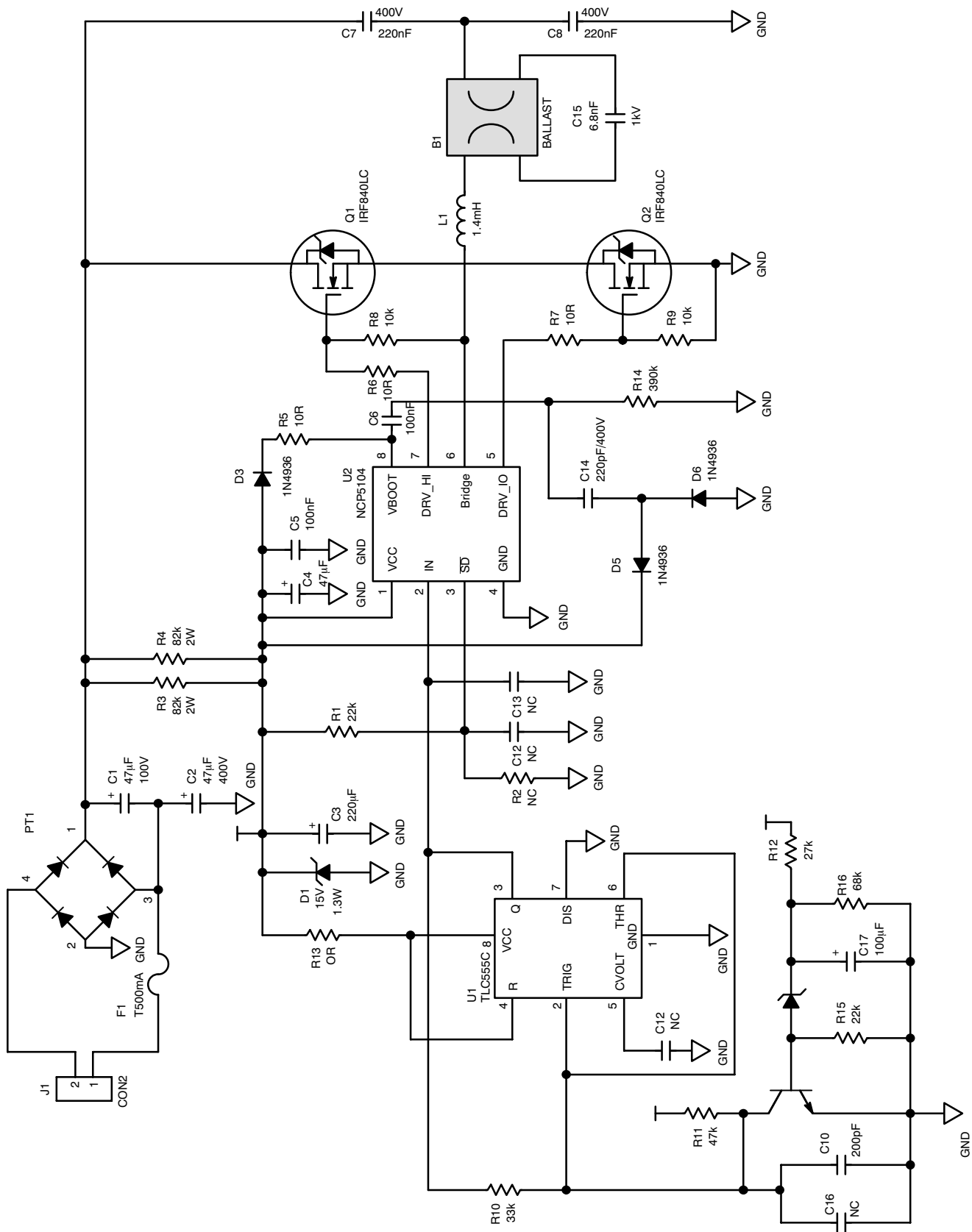


Figure 4. Demo Board Schematic

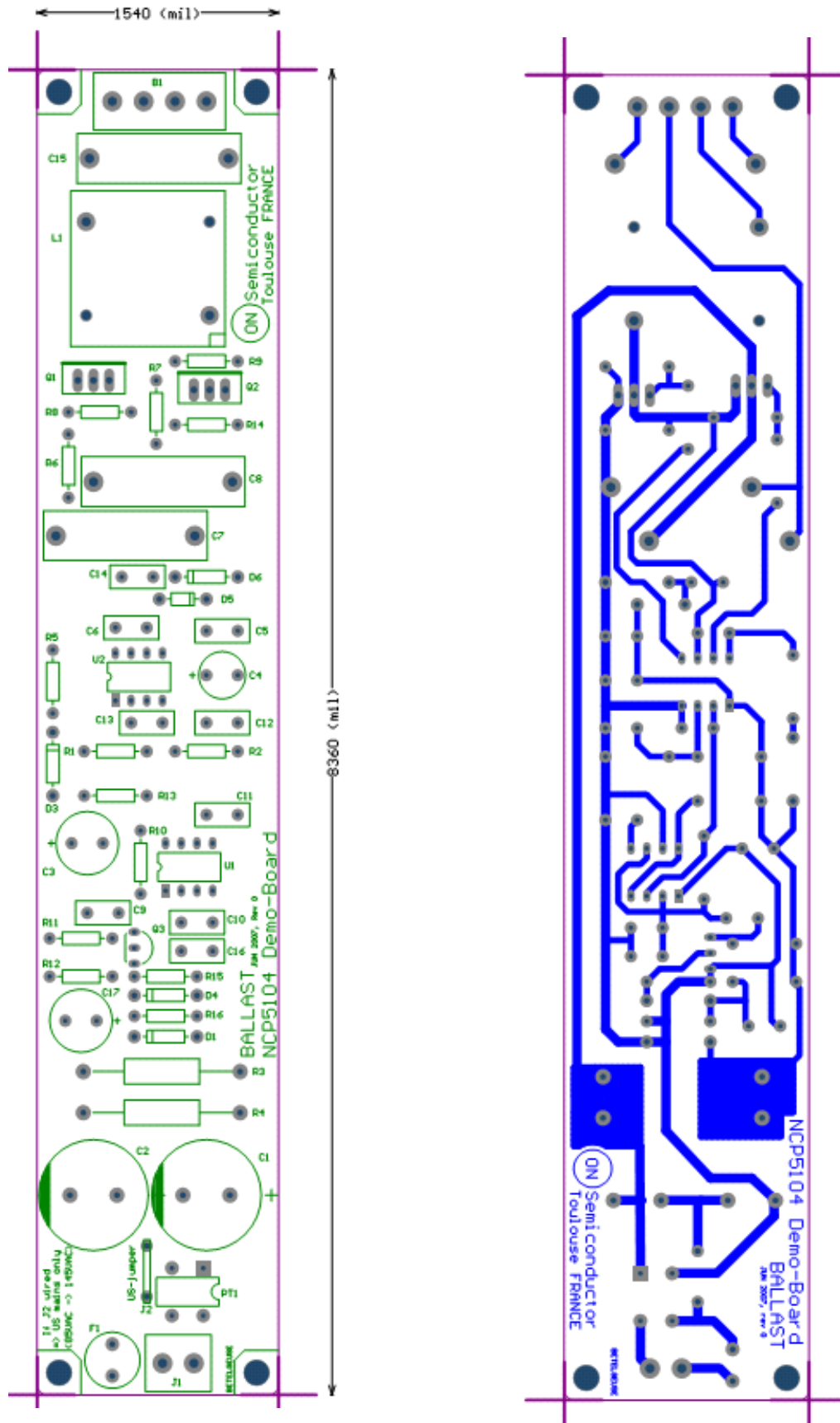



Figure 5. PCB Printout: Top and Bottom View

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BILL OF MATERIAL

Part Type	Designator	Manufacturer	Description
Connector	B1, J1	-	Connector
47uF/400V	C1, C2	Panasonic	M Series
220pF	C10	Generic	Capacitor
10nF	C11	Generic	Capacitor
NC	C12, C13	-	Capacitor
220pF /400V	C14	Generic	Capacitor
6.8nF/1kV	C15	Generic	Capacitor
NC	C16	-	Capacitor
100uF	C17	Generic	Capacitor
220uF	C3	Generic	Capacitor
4.7uF/50V	C4	Generic	Capacitor
100nF	C5	Generic	Capacitor
100nF	C6	Generic	Capacitor
220nF/400V	C7, C8	Generic	Capacitor
220pF	C9	Generic	Capacitor
BZX85C15V	D1	Generic	15V Zener diode
1N4936	D3, D5, D6	ON Semiconductor	Fast Recovery rectifier
BZX85C5V1	D4	Generic	5V1 Zener diode
T500mA	F1	Generic	Fuse
US-jumper	J2	-	Jumper for US main supply only
1.4mH	L1	VOGT	VOGT 53-044
DF06M	PT1	-	600V Diode Bridge
IRF840LC	Q1, Q2	IRF	Low Charge N-Channel MOSFET
BC547B	Q3	Generic	NPN transistor
22k	R1	Generic	Resistor
33k	R10	Generic	Resistor
47k	R11	Generic	Resistor
27k	R12	Generic	Resistor
15k	R13	Generic	Resistor
390k	R14	Generic	Resistor
22k	R15	Generic	Resistor
68k	R16	Generic	Resistor
NC	R2	-	Resistor
82k/2W	R3, R4	Generic	Resistor 2W power type
10R	R5, R6, R7	Generic	Resistor
10k	R8, R9	Generic	Resistor
TLC555C	U1	Texas Instrument	CMOS 555 timer
NCP5104	U2	ON Semiconductor	NCP5104

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