Negative Voltage Hot Swap Controller with Active Power Filter

Hot Swap Controller Evaluation Board with Predetection Pins

A hot swap operation involves insertion or removal of a device or a printed circuit board from a live backplan/ platform, while the system is operational. However, a hot swap operation could cause external capacitors to draw currents high enough to disturb system operations or even cause permanent damage to both the device and the system.

IXYS Corporation has introduced a live insertion and removal, Negative Voltage Hot Swap Controller with built-in power noise filter that prevents such occurrences.Capable of operating under several different modes, the IXHQ100 also acts as a power active noise filter and incorporates a patented sensorless board insertion/removal detection circuit, Auto-Detect. These widely sought features reduces downtime, which is critical in many telecommunication applications.

The new IXHQ100 not only meets all industry requirements for a Hot Swap Power Line Controller, but also provides extra features designers often seek.

The minimum requirements from a Hot Swap Power Lines Controllers are usually the following:

1. Pre detection (insertion mode).
2. Current ramping up from zero (insertion mode).
3. Overcurrent protection (in both insertion and normal operation modes).
4. Removal pre-detection.

The IXHQ100 meets all the above requirements and provides these additional features:

5. Eliminates the need for extra pins during insertion/removal pre-detection.
6. Provides insertion/removal pre-detection output for resetting a microprocessor.
7. Includes an active filter for noise reduction and thus reduces space taken by (otherwise needed) capacitors.
8. Electronic circuit breaker.

Telecommunications Hot Swap Application with Positive Ground Detection

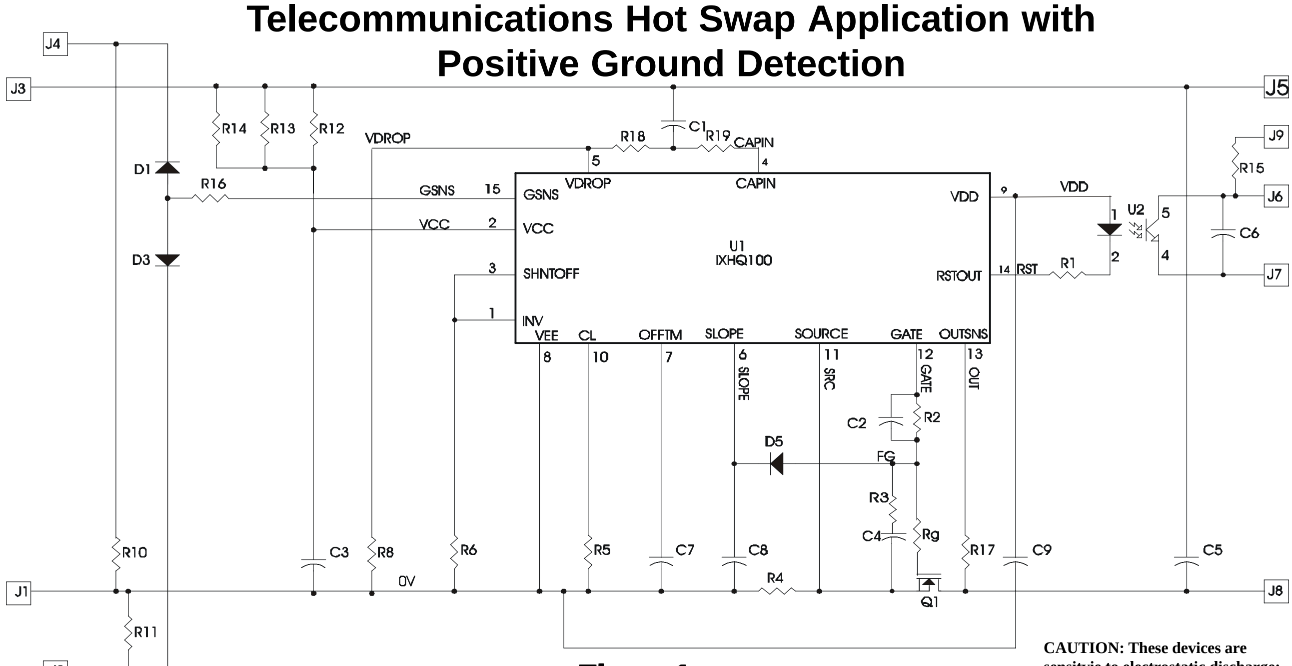

Figure1

CAUTION: These devices are sensitvie to electrostatic discharge; take caution when handling and assembling this component.

IXYS reserves the right to change limits, test conditions and dimensions.

 www.ixys.com 98716 (08/21/00)

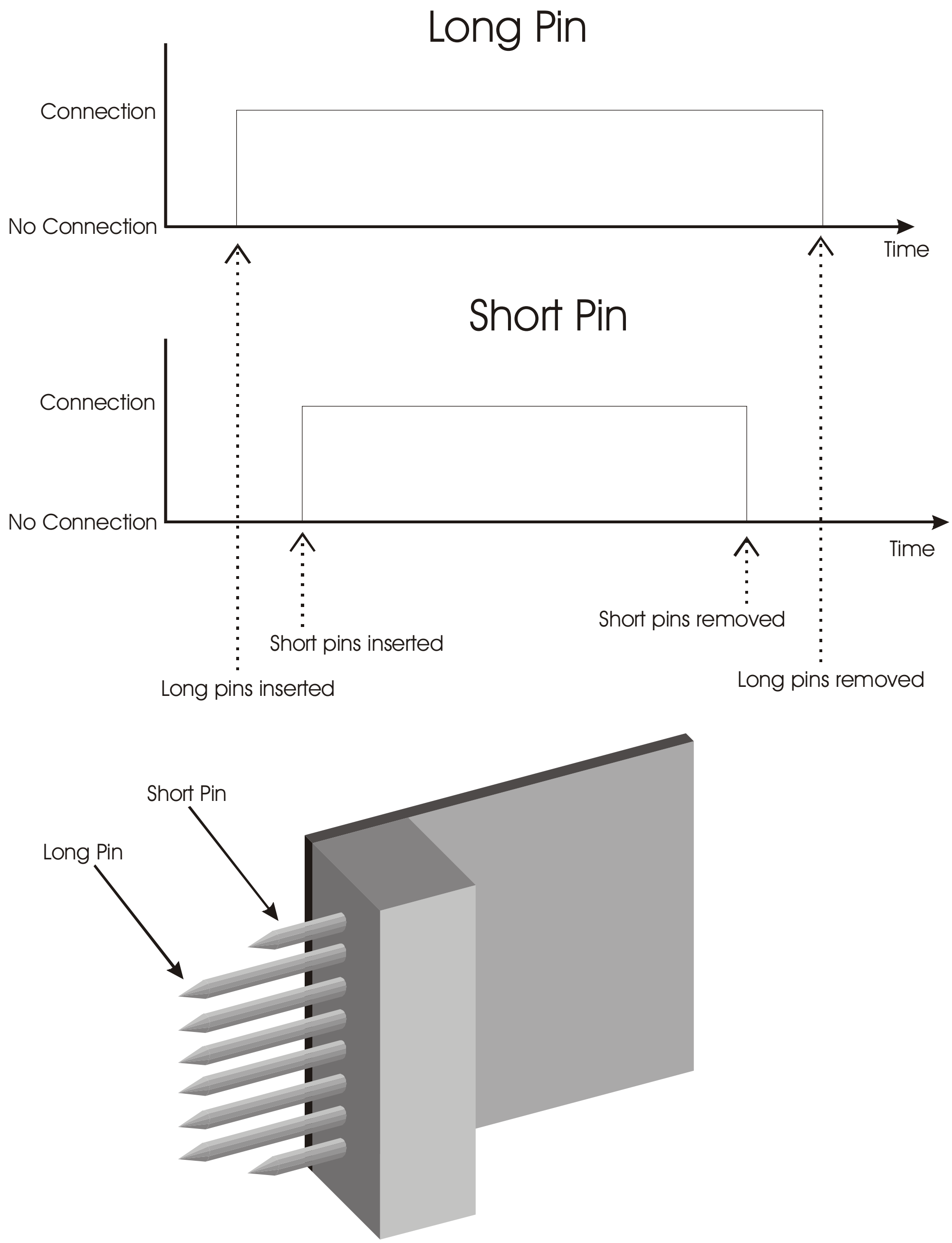

Figure 2

Figure 2 above shows the application with staggered pins.

Figure 1 and its BOM in Figure 3 is an example for a circuit for hot-swap telecommunication application. This circuit includes a staggered pin input at both sides of the circuit board to detect an insertion/removal event. The sense pins detect ground connection (positive ground).

The reason for the three resistors in parallel R12, R13, R14 is for high power using standard SMD resistors. If resistor R8 and R5 are removed, then the voltage of the active filter will be the maximum voltage drop and maximum current limit. The values of R8 (voltage drop) and R5 (current limit) are given in the following equations:

$$I_{\text{Current Limit}}[A] = \frac{V_{CL}[V]}{R4[\Omega]} = \frac{0.12V}{\left(\frac{10K\Omega}{R5[K\Omega]}+1\right)\cdot 0.005\Omega}$$

$$V_{DROP}[V] = 0.75V \bullet \frac{1}{\frac{50K\Omega}{R8[\Omega]}+1}$$

Bill of Materials

Item	Reference Number			Part Value	
1	C1		10uF/100V		TH
2	C2		3.3nF	25V	0805
3	C3		10uF/25V		TH
4	C4		10uF/16V		TH
5	C5		100uF/100V		TH
6	C6		100nF	25V	0805
7	C7		100nF	25V	0805
8	C8		100nF	25V	0805
9	C9		100nF	25V	0805
10	D1		BAS16		SOT23
11	D3		BAS16		SOT23
12	D5		BAS16		SOT23
13	Q1		IRF2807S		D2
14	R1		3.6 Kohm	0.1Watt	0805
15	R2		10 Kohm	0.1Watt	0805
16	R3		3 Kohm	0.1Watt	0805
17	R4		0.005 ohm	2Watt	1206
18	R5		See Text	0.1 Watt	0805
19	R6		Jumper	N/A	0805
20	R10		100 Kohm	0.1Watt	0805
21	R11		100 Kohm	0.1Watt	0805
22	R12		16 Kohm	0.1Watt	0805
23	R13		16 Kohm	0.1Watt	0805
24	R14		16 Kohm	0.1Watt	0805
25	R15		100 Kohm	0.1Watt	0805
26	R16		10 Kohm	0.1Watt	0805
27	R17		10 Kohm	0.1Watt	0805
28	R18		10 Kohm	0.1Watt	0805
29	R19		100 kohm	0.1Watt	0805
30	Rg		10 ohm	0.1Watt	0805
31	U1		IXHQ100		
32	U2		4N25		DIP6

Figure 3

The circuit in Figure 4 differs from the circuit in Figure 1 in its sense pin polarity. In Figure 4, the circuit detects –Vin at the insertion/removal pin whereas in Figure 1, the circuit detects positive ground. A wire is needed to connect U1 pin No. 1 to the -Vin input (to change the GSNS polarity).

Hot Swap with -Vin Input Detection

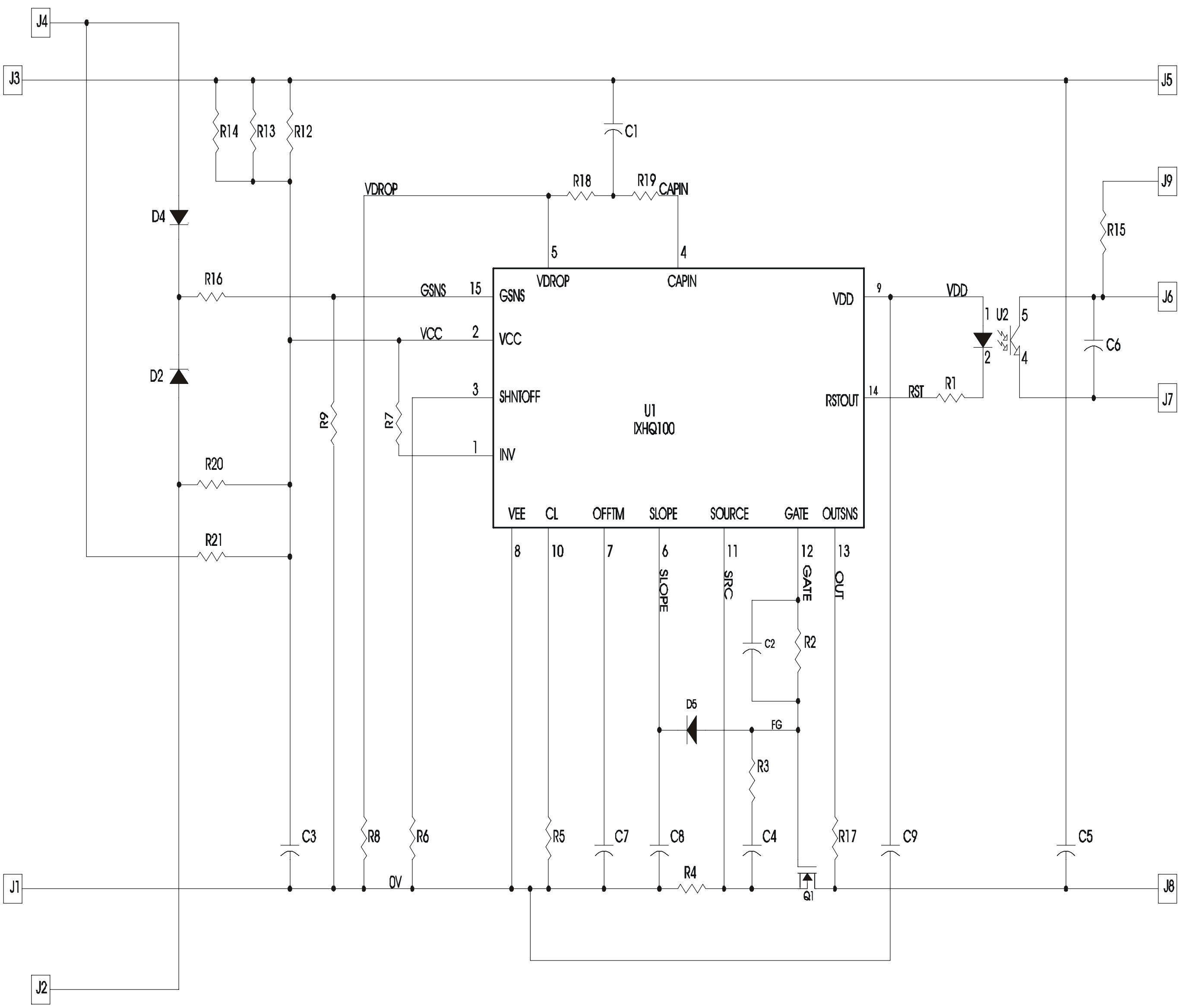

Figure 4

Bill of Materials

Item	Reference Number		Part Value	
1	C1	10uF/100V		TH
2	C2	3.3nF	25V	0805
3	C3	10uF/25V		TH
4	C4	10uF/16V		TH
5	C5	100uF/100V		TH
6	C6	100nF	25V	0805
7	C7	100nF	25V	0805
8	C8	100nF	25V	0805
9	C9	100nF	25V	0805
10	D2	BAS16		SOT23
11	D4	BAS16		SOT23
13	D5	BAS16		SOT23
14	Q1	IRF2807S		D2
15	R1	3.6 Kohm	0.1Watt	0805
16	R2	10 Kohm	0.1Watt	0805
17	R3	3 Kohm	0.1Watt	0805
18	R4	0.005 ohm	2Watt	1206
19	R5	See Text	0.1 watt	0805
20	R6	Jumper	N/A	0805
21	R7	10 Kohm	0.1 Watt	0805
22	R9	100 Kohm	0.1 Watt	0805
23	R12	16 Kohm	0.1Watt	0805
24	R13	16 Kohm	0.1Watt	0805
25	R14	16 Kohm	0.1Watt	0805
26	R15	100 Kohm	0.1Watt	0805
27	R16	10 Kohm	0.1Watt	0805
28	R17	10 Kohm	0.1Watt	0805
29	R18	10 Kohm	0.1Watt	0805
30	R19	100 Kohm	0.1Watt	0805
31	R20	100 Kohm	0.1Watt	0805
32	R21	100 Kohm	0.1Watt	0805
33	Rg	10 ohm	0.1Watt	0805
34	U1	IXHQ100		
35	U2	4N25		DIP6

Figure 5

Using the IXHQ100 active filter minimizes the number of extra de-coupling capacitors. This improves noise immunity of the circuit board. Additionaly, low output impedance of the filter also improves the performance of noise cancellation on power lines. An extra advantage of using the IXHQ100 over capacitors is the amount of space one can save. Figure 6 gives an example of cross talk noise cancellation by the IXHQ100 and an comparison of the size difference between an IXHQ100 chip and a capacitor (to scale).

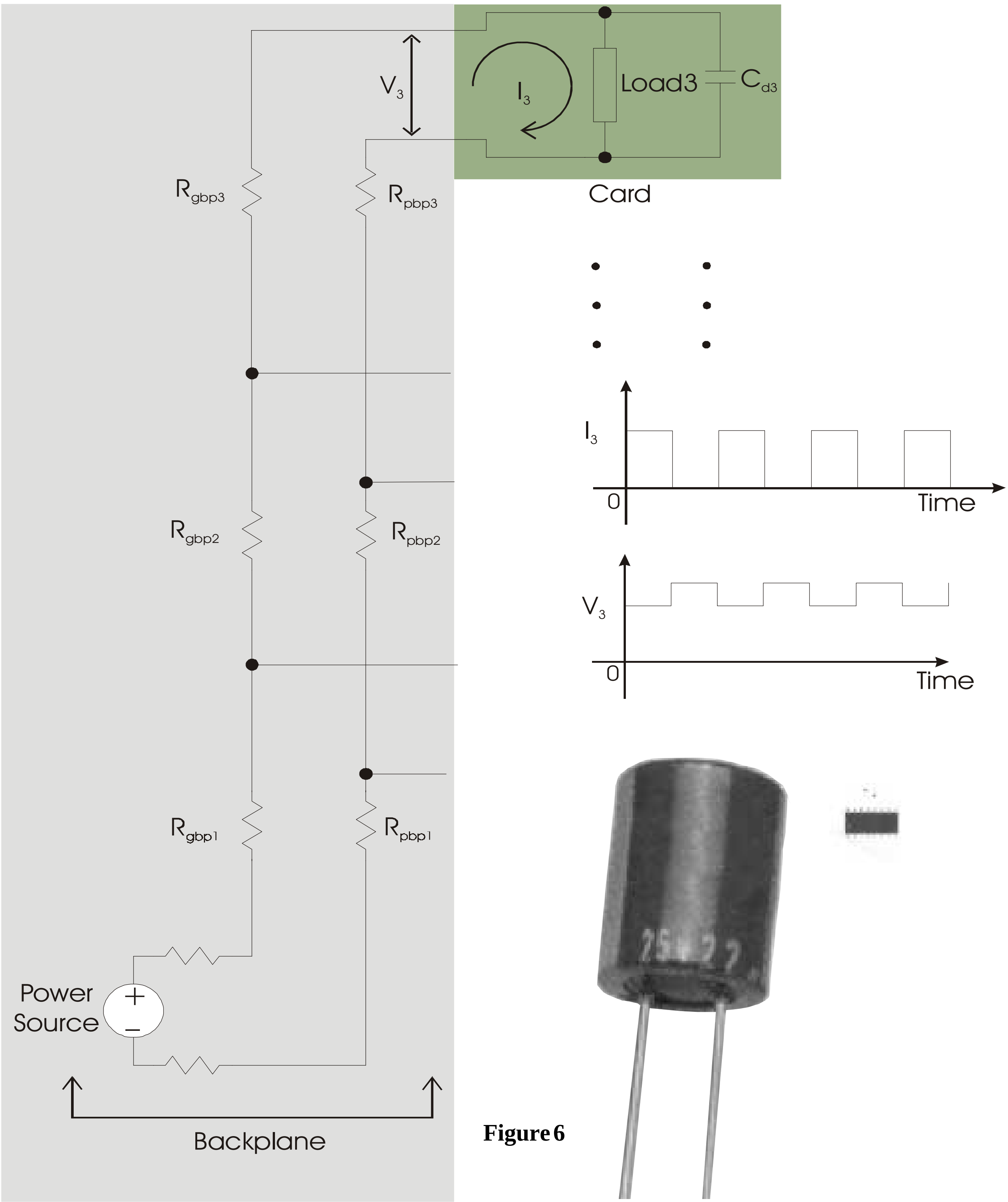

Figure 6