

FREE NOTES ON ELECTRONICS

b y d o k t o r p y t a [a t] g m a i l . c o m

Leakage current of some components

While designing high reliability electronic devices overvoltage clamping is a common need. On the market there is a great variety of semiconductor products (eg. transil) suitable for most typical applications. Unfortunately, some analog circuits need clamping diodes with extremely low leakage current. Such diodes are basically difficult to buy. There are some techniques to avoid leakage current. One of them is bootstrapping. Nevertheless it cannot be used everywhere and sometimes low leakage diode are beneficial. That is why I decided to measure reverse current of some commonly used components. According to Bob Pease, measuring leakage current using digital voltmeter (as an picoammeter) can introduce significant error due to rectifying voltage spikes at the voltmeter input by the diode's junction. That is why I've made simple I/U converter using good FET opamp and 100Meg resistor in the feedback loop. See Fig.1 for details.

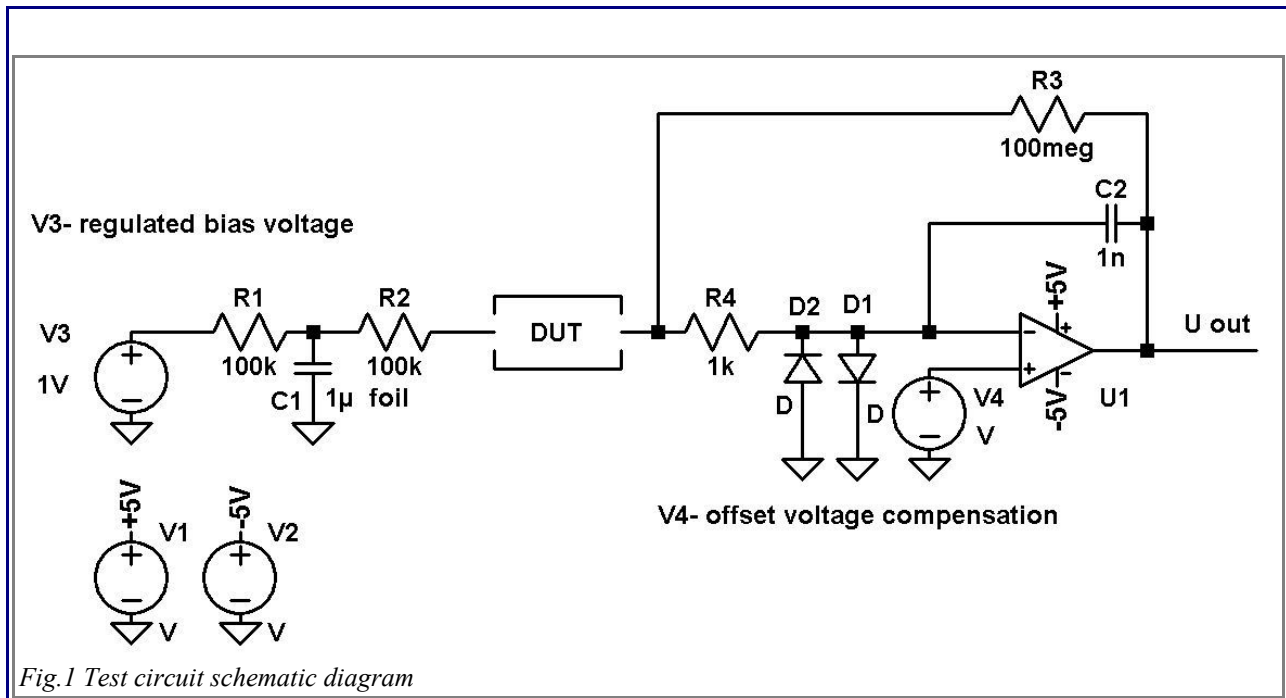
The measurements were proceeded for 1V and 10V reverse bias voltage. Please note the behavior of E-B diode when polarized at -10V. It acts like the about 6V Zener diode (precisely speaking, an avalanche breakdown occurs).

External light exposure of low leakage diodes can sometimes be a horror while running circuits. Influence of incandescent light (from 20cm distance) has also been checked.

Results have been collected in Tab.1.

FREE NOTES ON ELECTRONICS

b y d o k t o r p y t a [a t] g m a i l . c o m



type	(meas condition)	Irev @ 1V [pA]	Irev @ 10V [pA]	comments
BC547B	(be)	<= 0,1	18,6uA	good
+ light		<= 0,1	18,6uA	
BC547B	(bc)	<= 0,1	<= 0,1	good
+ light		<= 0,1	0,2	
BC847B	(bc)	0,2	0,3	good
light		0,2	0,3	
BC557C	(be)	0,3	16uA	good
+ light		0,3	16uA	
BC557C	(bc)	0,3	1	
+ light		0,3	1	
BF245C	(S+D)	0,5	1,6	
+ light		0,5	1,6	
1N4148 PH		2410	3782	poor
+ light		2785	4200	
LL4148		3380	4920	poor
+ light		3640	5420	
BAS81	(schottky)	2555	4200	poor
+ light		2640	4328	
1N5908	(transil 5V, 1,5kW)	4230	49uA	poor
+ light		4230	49uA	
1N4007		2310	3600	poor
+ light		2310	3600	
LED GREEN 5mm		28	54	poor
+ light		4630	4633	
Neon lamp, glass height 1cm		14,5	202	protect from light !
+ light		53	470	
glass reed switch L=30mm		<= 0,1	<= 0,1	good
+ light		<= 0,1	<= 0,1	

Tab.1 Results obtained

7TH JUNE 2010

FREE NOTES ON ELECTRONICS

b y d o k t o r p y t a [a t] g m a i l . c o m

B-C junction of BC547B and BC847B seem to be good candidates however they are not fast. About 10 of them have been checked and they have proven their reliability.

The 2N4117 N-JFET transistor is well known to have gate leakage far below 1pA, unfortunately I haven't got any to check.

Neon lamps are often used to protect inputs of high impedance voltmeter. Please remember to cover them from light as You can spend hours on tracking the cause of instability.

**ANY. COMMENTS.
AND. SUGGESTIONS.
ARE. WELCOMED.**