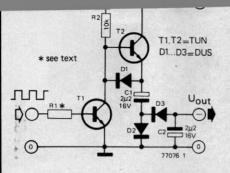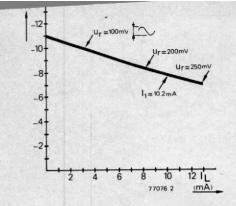# negative supply from positive supply

It is sometimes necessary to provide a negative supply voltage in a circuit that otherwise uses all positive supply voltages, for example to provide a symmetrical supply for an op-amp in a circuit that is otherwise all logic ICs. Providing such a supply can be a problem, especially in battery operated equipment.

In the circuit shown here T1 is turned on and off by a squarewave signal of 50% duty-cycle at approximately 10 kHz. In logic circuits it is quite conceivable that such a signal may already be available as clock pulses. Otherwise an oscillator using two NAND gates may be constructed to provide it.

When T1 is turned off, T2 is turned on and C1 charges through T2 and D2 to about 11 V. When T1 turns on, T2 turns off and the positive end of C1 is pulled down to about +0.8 V via D1. The negative end of C1 is now about 10.2 V negative so C1 discharges through D3 into C2, thus charging it. If no current is drawn from C2 it will eventually charge to around −10 V. Of course, if a significant amount of current is drawn, the voltage across C2 will drop as shown in the graph and a 10 kHz ripple will appear on the output.