The Single Ended Primary Inductance Converter (SEPIC) can convert an input voltage to an output voltage that is higher, lower or equal to the input. Conversion is performed without the use of expensive transformers, making this a good choice for low cost, non-isolated applications. The UC2577 provides the switch and control to take advantage of this topology with a minimum of additional parts.

The circuit shown in Figure 1 was designed to provide a 5V or 12V output from an input voltage ranging between 3V and 40V. The coupling capacitor is chosen to handle the high ripple current seen in this topology, with a peak-to-peak current of approximately $I_{IN} + I_{OUT}$. The converter switches at 52kHz and operates in both continuous inductor current mode (CCM) and discontinuous inductor current mode (DCM). Note that both the diode and the switch have a peak voltage stress of approximately $V_{IN} + V_{OUT}$, and peak current stress of approximately $I_{IN} + I_{OUT}$. Note that when the converter is in CCM, the ratio of $V_{OUT}/V_{IN} = D/(1-D)$ where D is the duty ratio. To calculate components for other inputs and outputs, assume CCM as a starting point and use about 1/2 max output current as a min value. For further details, consult Unitrode Design Note DN-48.
Parts List:

U1   UC2577
D1   UC3612 Dual Schottky
L1,L2 100μH ECI # M1088
phone (413) 562-7684
C1   47μF/50V Sprague 515D476M050AA6A
     phone (207) 324-4140
C2   0.1μF ceramic
C3   0.47μF ceramic
C4   220μF/50V Sprague 515D227M050CD6A
C5   220μF/6V Sprague 595D227X9006D7
     (5V output)
* C5 12V output only, use four 68μF/16V
     Sprague 293D686X0016D2T
R1   100 ohm 1/8W
R2   3.01k 1/8W
R3   1k 1/8W (5V output)
* R3 330 ohms 1/8W (12V output)
* D2,3 UC3612 Dual Schottky
     (Extended Operating Range)

Efficiency was measured for the 5V (Figure 2) and
12V (Figure 3) output at two power levels for the full
range of Automotive input voltages.

As seen in Figure one, a simple design is used to
convert power for automotive applications. If longer
hold up times are needed or operation at low input
voltages demanded, the circuit in Figure 4 may be-
come useful. By adding two diodes, the output volt-
age bootstraps the IC and allows operation even af-
ter the input voltage drops below the operating
range of the IC.

Figure 2: 5V Converter Efficiency vs Input Voltage

Figure 3: 12V Converter Efficiency vs Input Voltage

Figure 4: Extending Operation Range
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