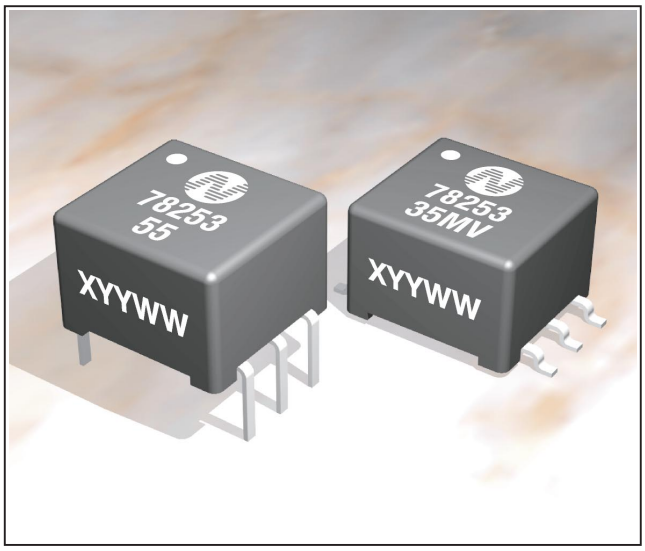
78253 SERIES
MAX253 Compatible Converter Transformers

features

- Maxim Compatible
- 3.3V and 5V Versions
- Isolation to 4kV
- Frequency Range to 500kHz
- Toroidal Construction
- Industrial Standard Pinout
- UL 94V-0 Package Material
- Fully Encapsulated
- Low Profile
- Surface Mount Available

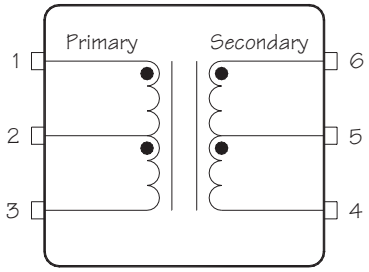


description

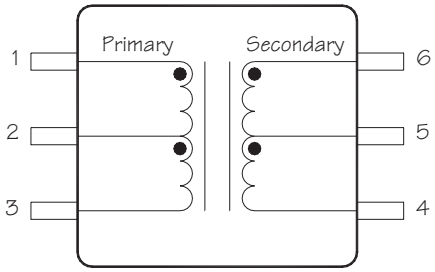
The 78253 series of converter transformers are specifically designed for use with the MAX253 chip set to provide isolated power supplies. The 5V version can supply 1W and the 3.3V version can supply 500mW. A centre tapped secondary winding allows for full bridge, half bridge or voltage doubling.

The surface mount devices are fully compatible with CECC00802 to 280°C which allows them to be placed and reflowed with IC's thus reducing time and cost in production.

6 Pin DIP (top view)



6 Pin SM (top view)



PRELIMINARY

Notice : This is not a final specification.
Some parametric limits may be subject to change.

absolute maximum ratings

Operating free air temperature range · –40°C to 85°C

Storage temperature range· –50°C to 125°C

Lead Temperature 1.5mm from case for 10 seconds · 300°C

Peak current I_{PK}· 400mA

Isolation voltage 78253/XX(M) (flash tested for 1 second) · · · · · · · · · · · · · · · · 1500VDC

Isolation voltage 78253/XX(M)V (flash tested for 1 second) · · · · · · · · · · · · · · · 4000VDC

electrical specifications over operating free air temperature range[1]

78253/35(M)

Parameter	Conditions	MIN	NOM	MAX	Units
Turns Ratio	$N_P : N_S$		1:√5		
Primary Inductance, L_P	100kHz, 250mV	0.30	0.38	0.46	mH
Secondary Inductance, L_S	100kHz, 250mV	1.60	2.00	2.40	mH
Leakage Inductance, L_L	100kHz, 250mV		0.30	1.00	µH
Interwinding Capacitance, C_{WW}	100kHz, 250mV		30	50	pF
Primary D.C. Resistance, R_{DC}	>0.1VDC		0.40	1.00	Ω
Volt-time Product, E_T	5kHz, 5V	50	80		Vµs

electrical specifications over operating free air temperature range[1]

78253/55(M)

Parameter	Conditions	MIN	NOM	MAX	Units
Turns Ratio	$N_P : N_S$		1:1.31		
Primary Inductance, L_P	100kHz, 250mV	0.60	0.83	1.10	mH
Secondary Inductance, L_S	100kHz, 250mV	1.10	1.40	1.70	mH
Leakage Inductance, L_L	100kHz, 250mV		0.35	1.00	µH
Interwinding Capacitance, C_{WW}	100kHz, 250mV		30	50	pF
Primary D.C. Resistance, R_{DC}	>0.1VDC		0.70	1.50	Ω
Volt-time Product, E_T	5kHz, 5V	50	65		Vµs

1 All data taken at T_A=25°C.

electrical specifications over operating free air temperature range[1]

78253/35(M)V

Parameter	Conditions	MIN	NOM	MAX	Units
Turns Ratio	$N_P : N_S$		1:√5		
Primary Inductance, L_P	100kHz, 20mV	110	142	185	µH
Secondary Inductance, L_S	100kHz, 20mV	550	710	850	µH
Leakage Inductance, L_L	100kHz, 250mV		3.00	5.00	µH
Interwinding Capacitance, C_{WW}	100kHz, 250mV		4.20	8.00	pF
Primary D.C. Resistance, R_{DC}	>0.1VDC		0.30	0.50	Ω
Volt-time Product, E_T	5kHz, 5V	30	42		Vµs

electrical specifications over operating free air temperature range[1]

78253/55(M)V

Parameter	Conditions	MIN	NOM	MAX	Units
Turns Ratio	$N_P : N_S$		1:1.36		
Primary Inductance, L_P	100kHz, 20mV	190	240	310	µH
Secondary Inductance, L_S	100kHz, 20mV	350	444	540	µH
Leakage Inductance, L_L	100kHz, 250mV		5.20	8.00	µH
Interwinding Capacitance, C_{WW}	100kHz, 250mV		4.20	8.00	pF
Primary D.C. Resistance, R_{DC}	>0.1VDC		0.40	0.60	Ω
Volt-time Product, E_T	5kHz, 5V	25	32		Vµs

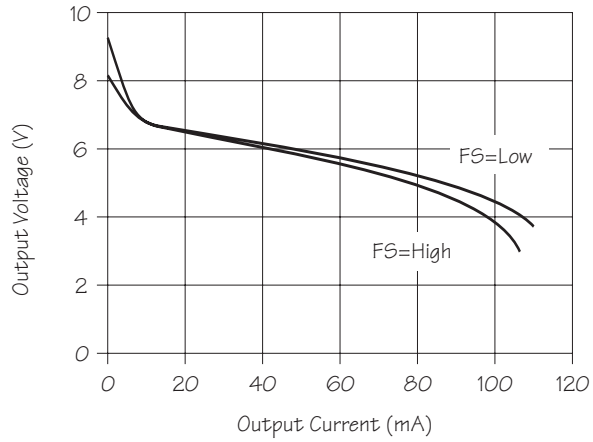
1 All data taken at T_A=25°C.

ordering information

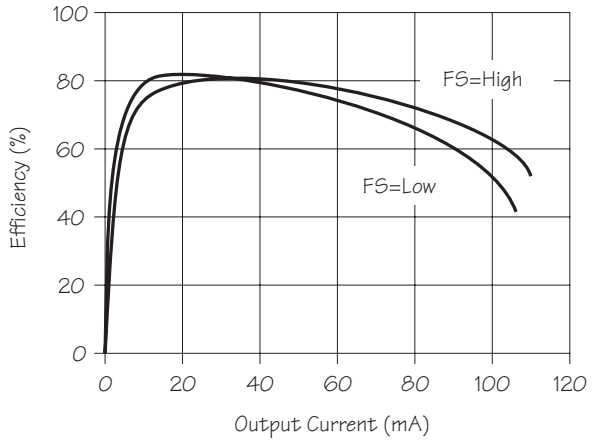
Part Number	Input Voltage (V)	Output Voltage (V)	Output Current (mA MAX)	Isolation Voltage (VDC)	Turns Ratio	Package Style
78253/35	3.3	5.0	100	1500	1:√5	1
78253/35M						2
78253/55	5.0	5.0	200	1500	1:1.31	1
78253/55M						2
78253/35V	3.3	5.0	100	4000	1:√5	1
78253/35MV						2
78253/55V	5.0	5.0	200	4000	1:1.36	1
78253/55MV						2

typical test circuit characteristics - 78253/35(M)

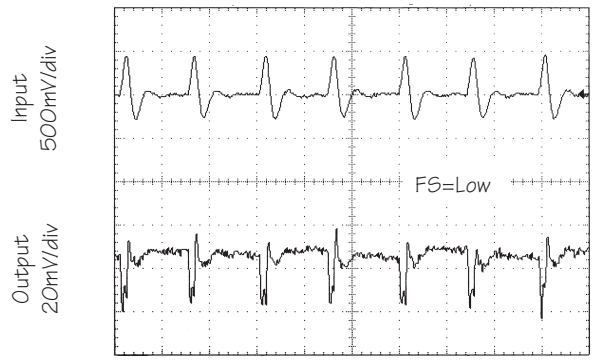
voltage curves



efficiency curves



input/output voltage ripple



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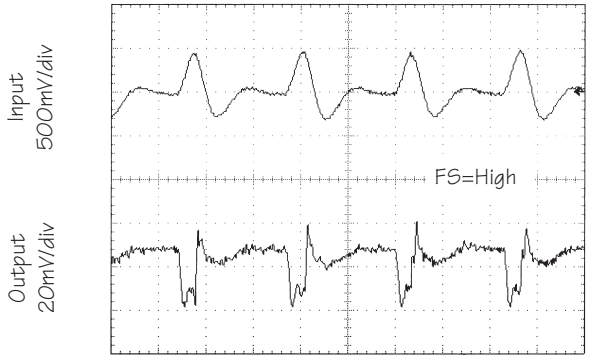

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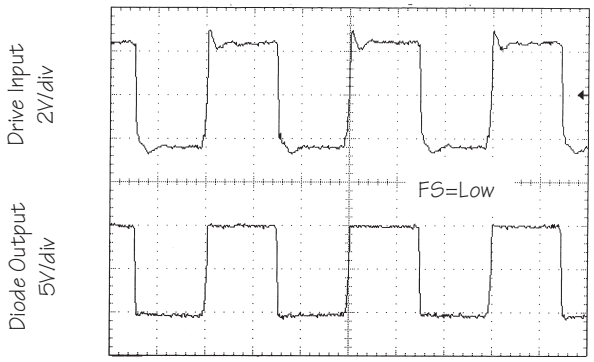
transformer voltage waveforms



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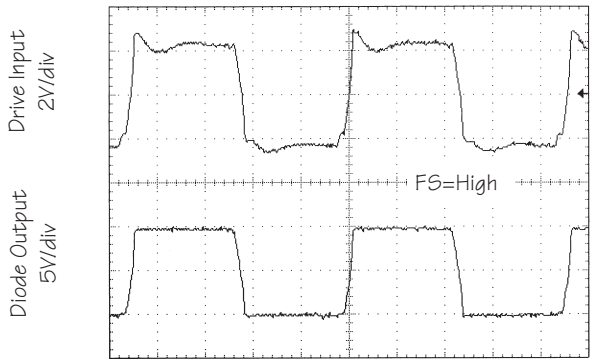

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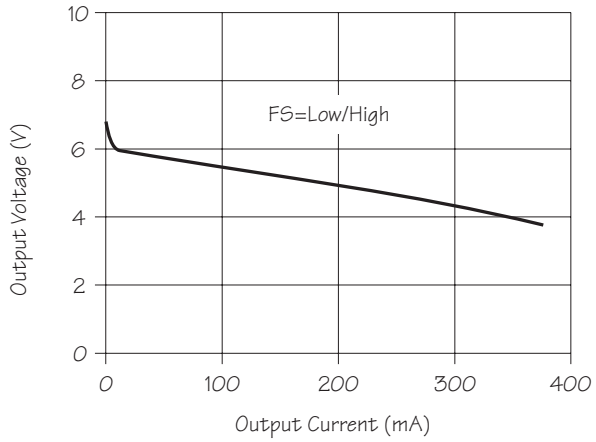
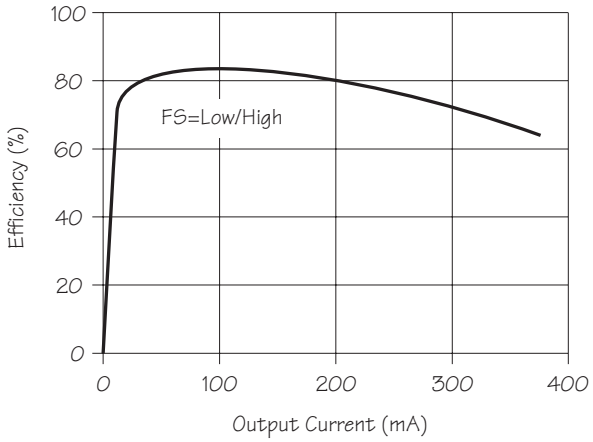
typical test circuit characteristics - 78253/55(M)

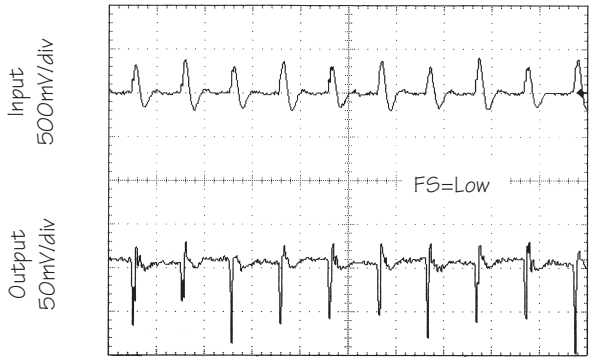
voltage curves



efficiency curves



input/output voltage ripple



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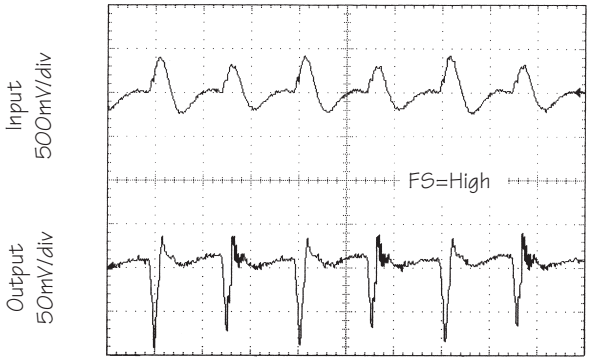
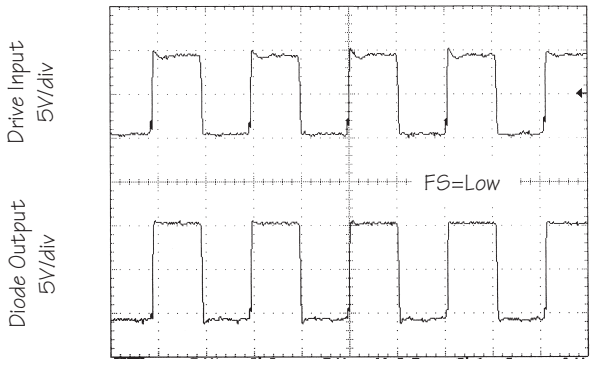


1.0ms/div

transformer voltage waveforms



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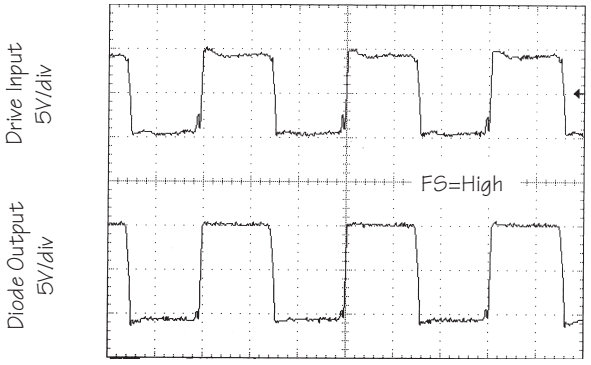

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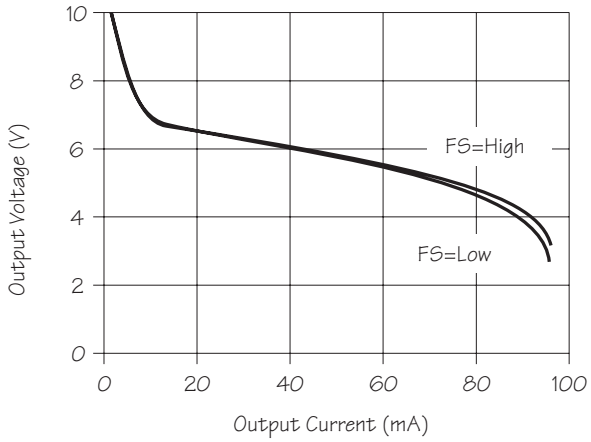
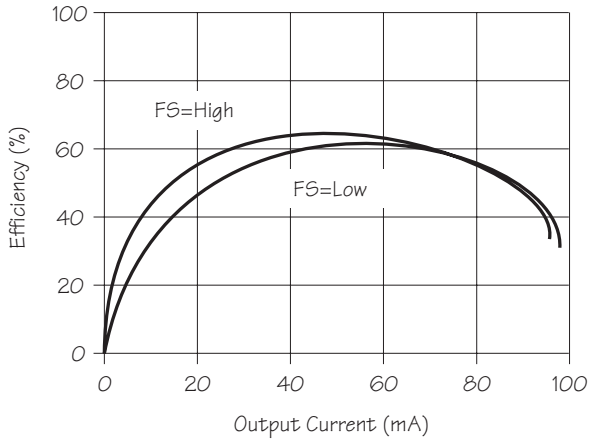
typical test circuit characteristics - 78253/35(M)V

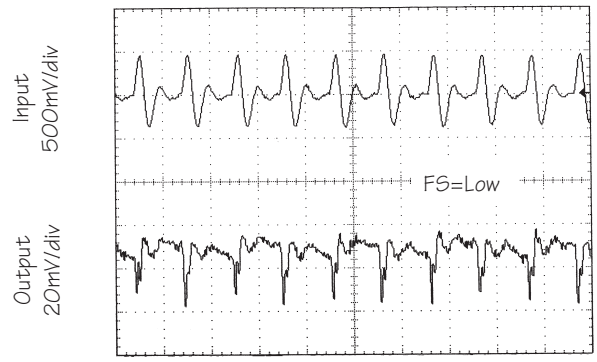
voltage curves



efficiency curves



input/output voltage ripple



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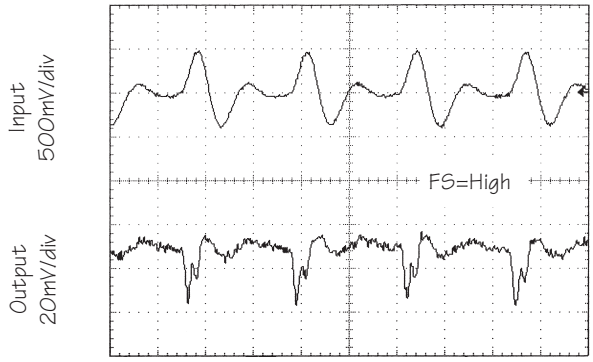

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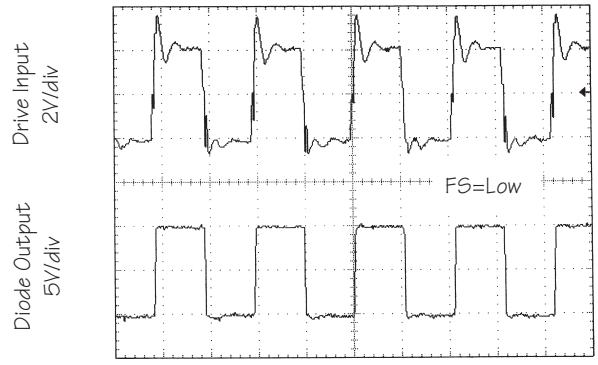
transformer voltage waveforms



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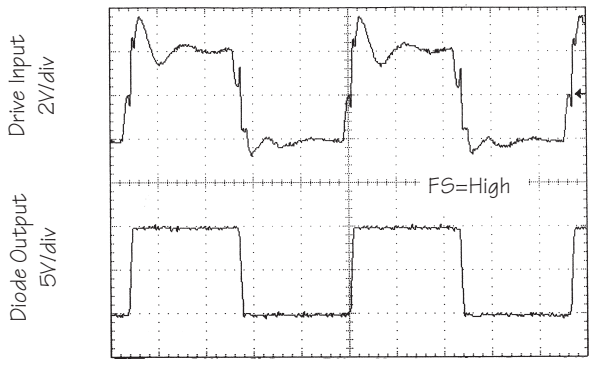

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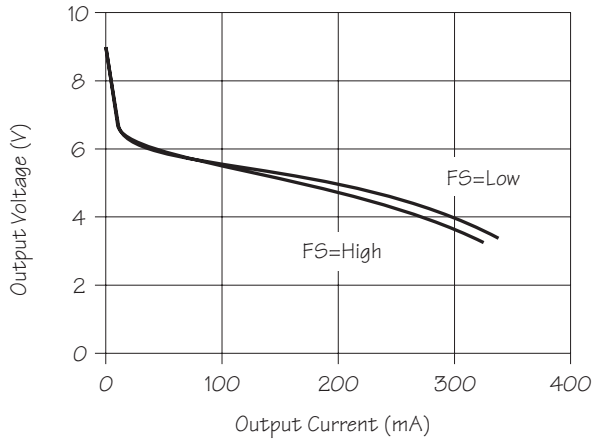
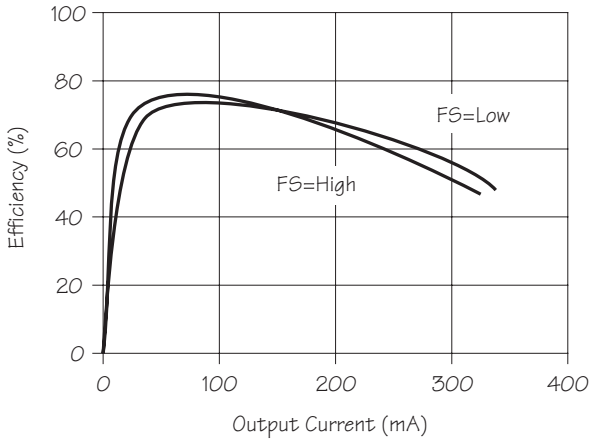
typical test circuit characteristics - 78253/55(M)V

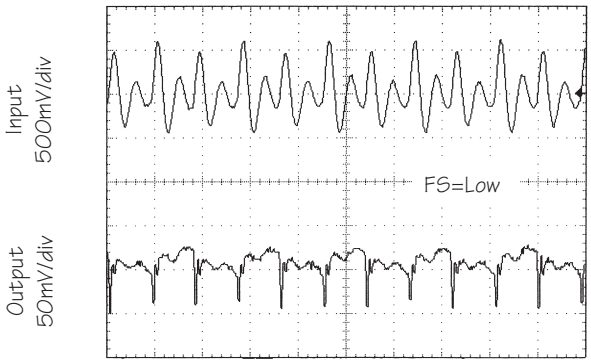
voltage curves



efficiency curves



input/output voltage ripple



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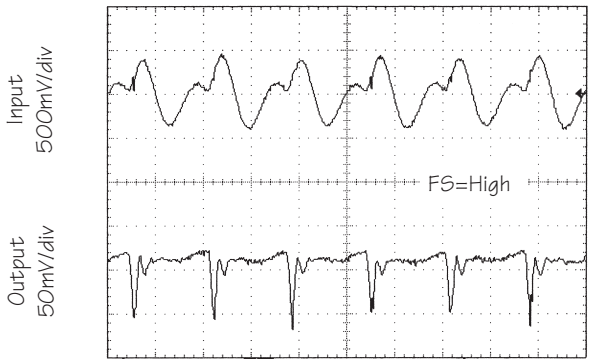

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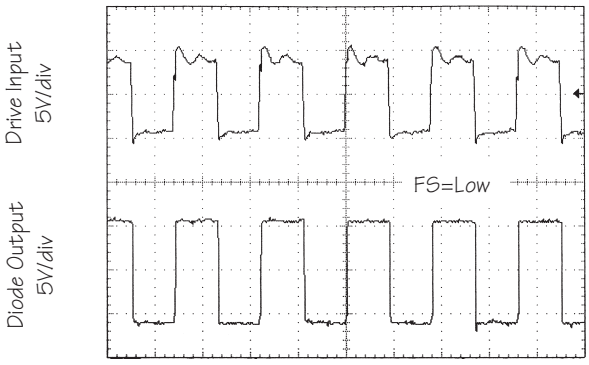
transformer voltage waveforms



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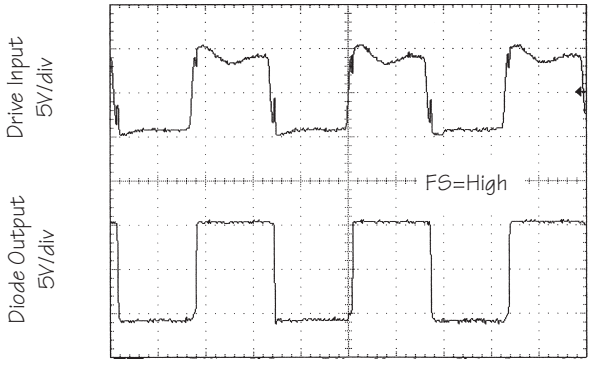

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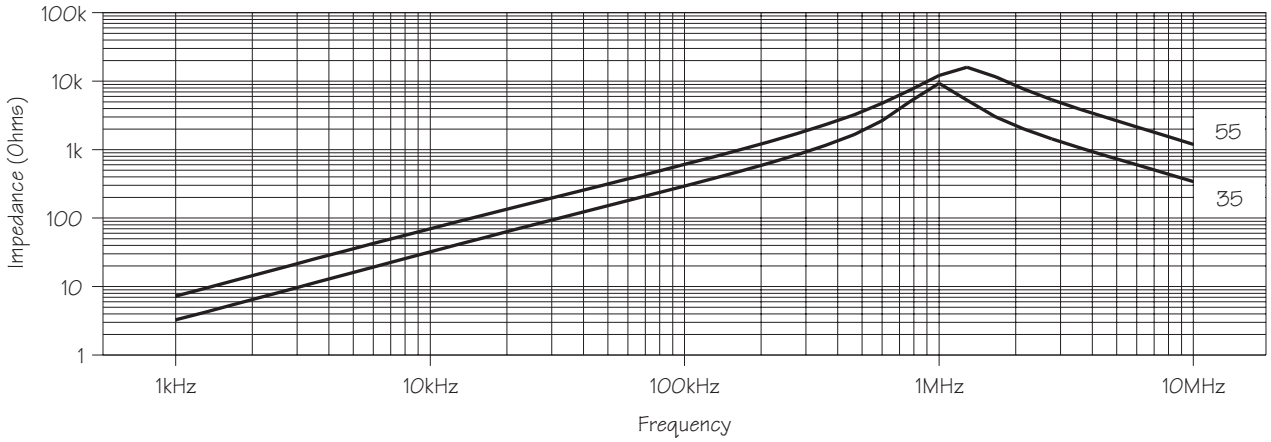
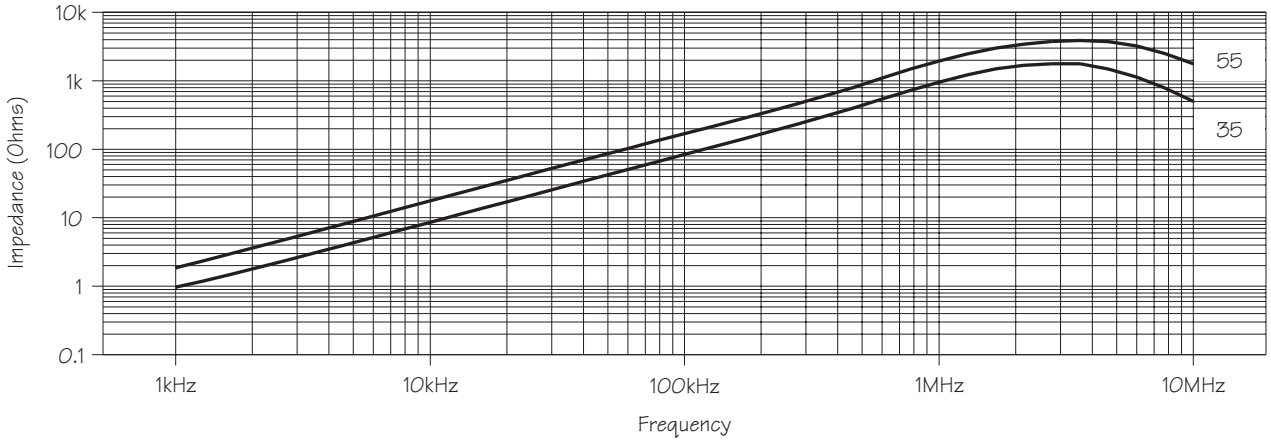
typical test circuit characteristics

78253/XX(M) impedance analysis

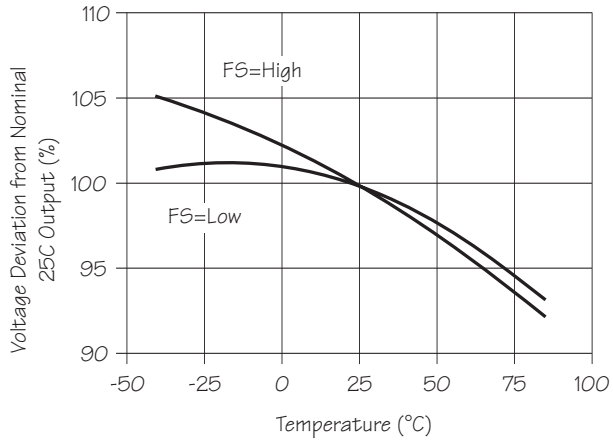


78253/XX(M)V impedance anaylsis



application circuit - high temperature performance characteristics

78253/35(M)



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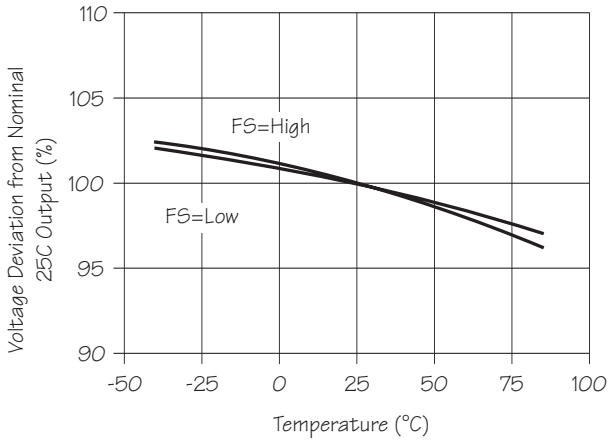

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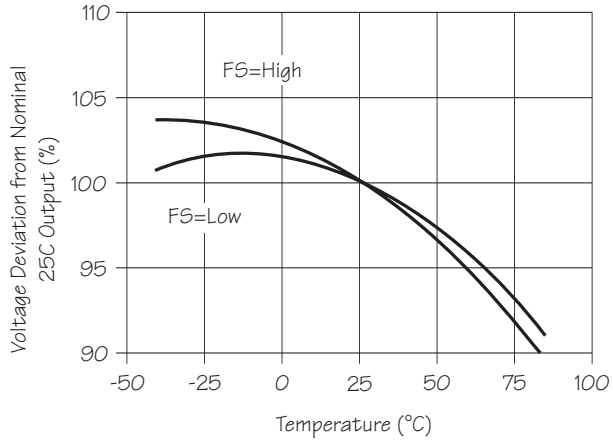
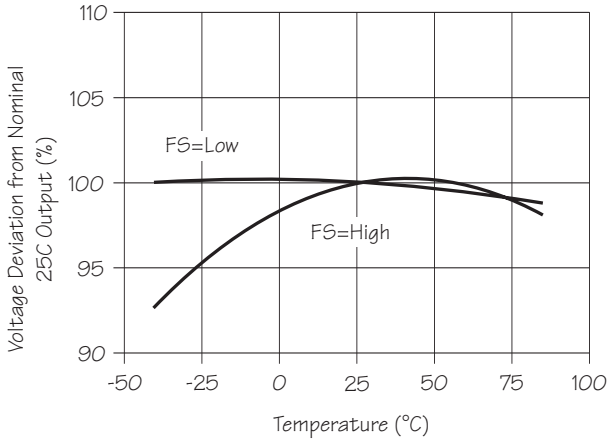


78253/55(M)V



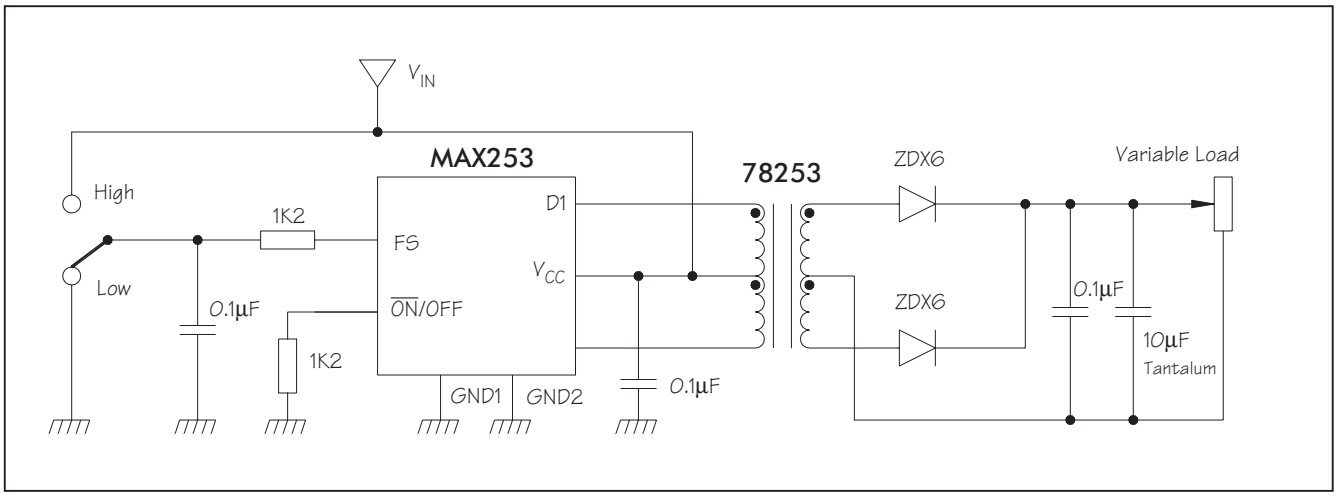


Figure 1 : Test Circuit

test circuit

All characterisation curves are derived from tests using the test circuit shown in figure 1 featuring a MAX253 driver IC, a pair of ZDX6 fast rectifier diodes and a 10mF tantalum output capacitor.

applications

rectification circuits

The 78253 series are designed to provide a 5V output from either 3.3V or 5V supply to the MAX253 IC (see figure 2). Other output configurations can be derived to produce positive and negative 5V outputs (see figure 3) or voltage doubled output (see figures 4 & 5). Under rectification schemes other than the standard single rail 5V output, the total power drawn from the circuit must not exceed 1W for a 5V input supply and 500mW for a 3.3V input supply.

diode selection

The switching circuit can operate at a relatively high frequency (maximum 500kHz), hence, high speed rectifiers are recommended. If operating at low load levels (less than 50% maximum output current) low cost parts can be used even though they exhibit a high voltage drop. This is

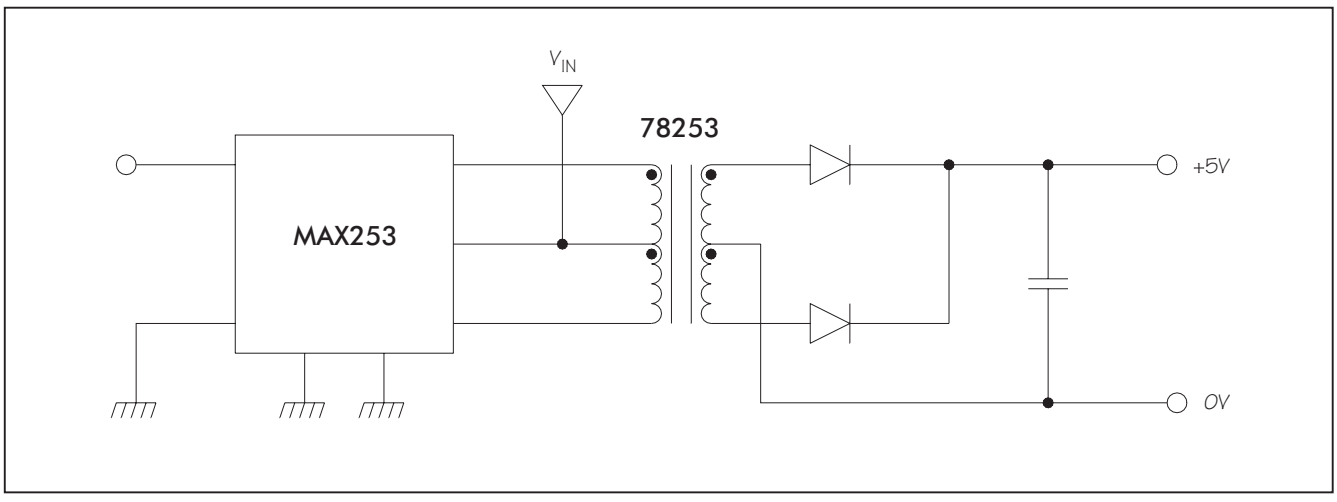


Figure 2 : Full Wave Unipolar

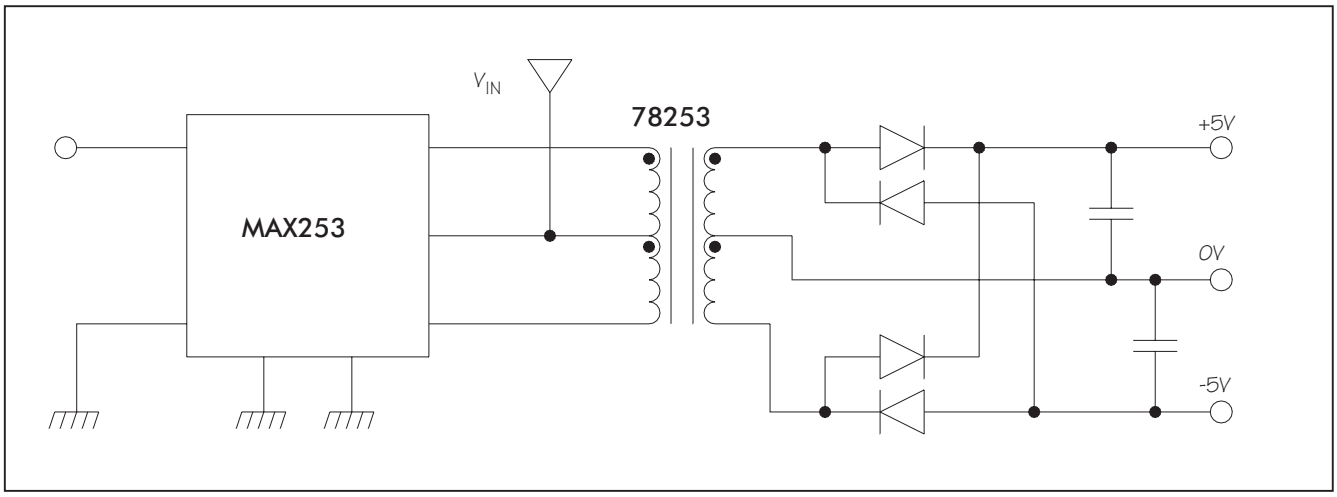


Figure 3 : Full Wave Bipolar

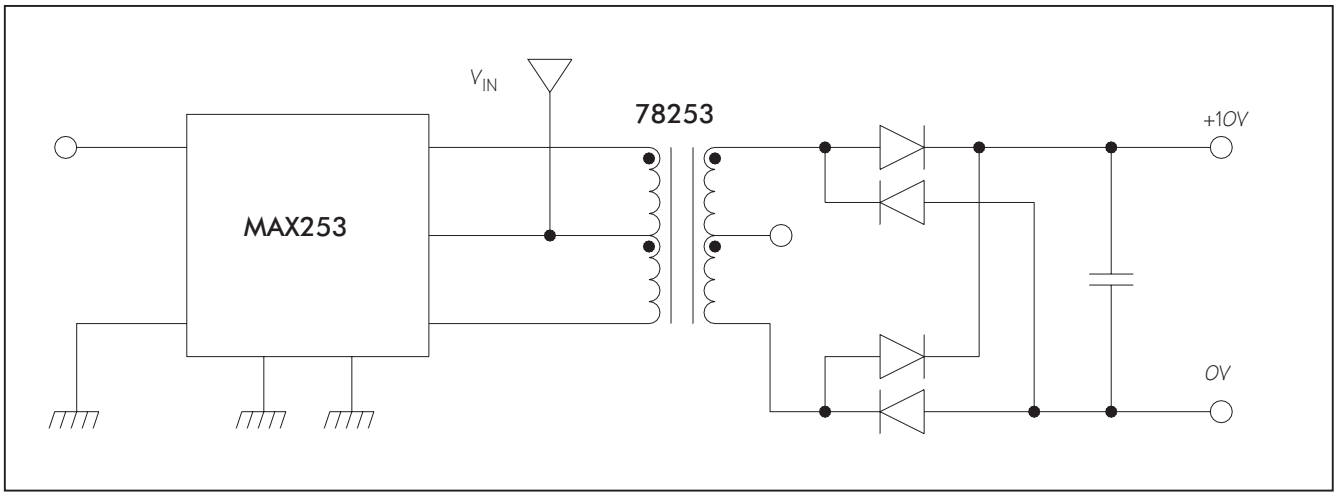


Figure 4 : Full Wave Voltage Doubled Unipolar

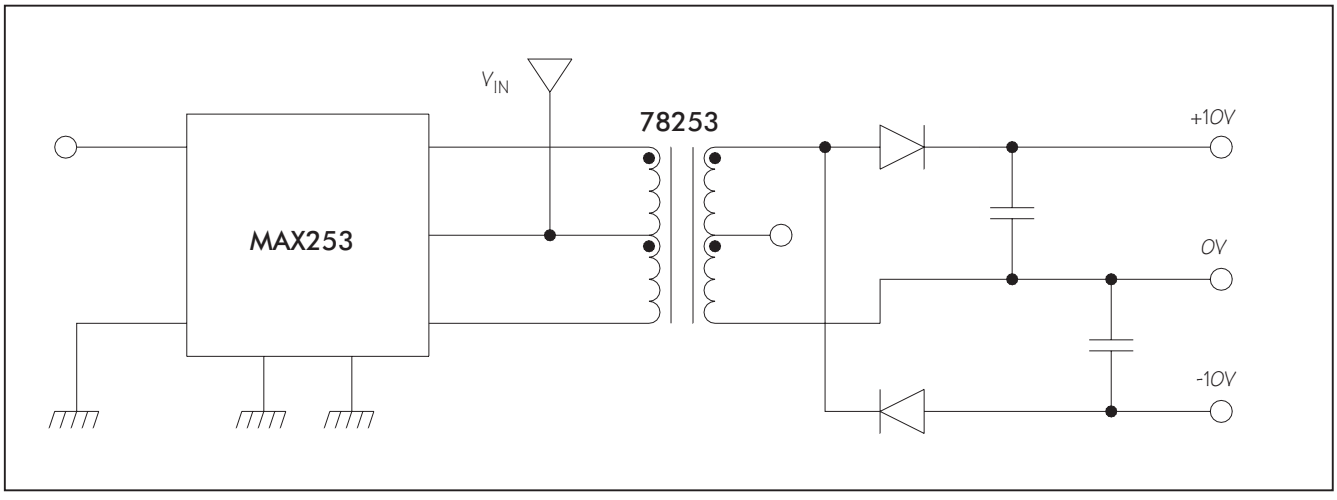
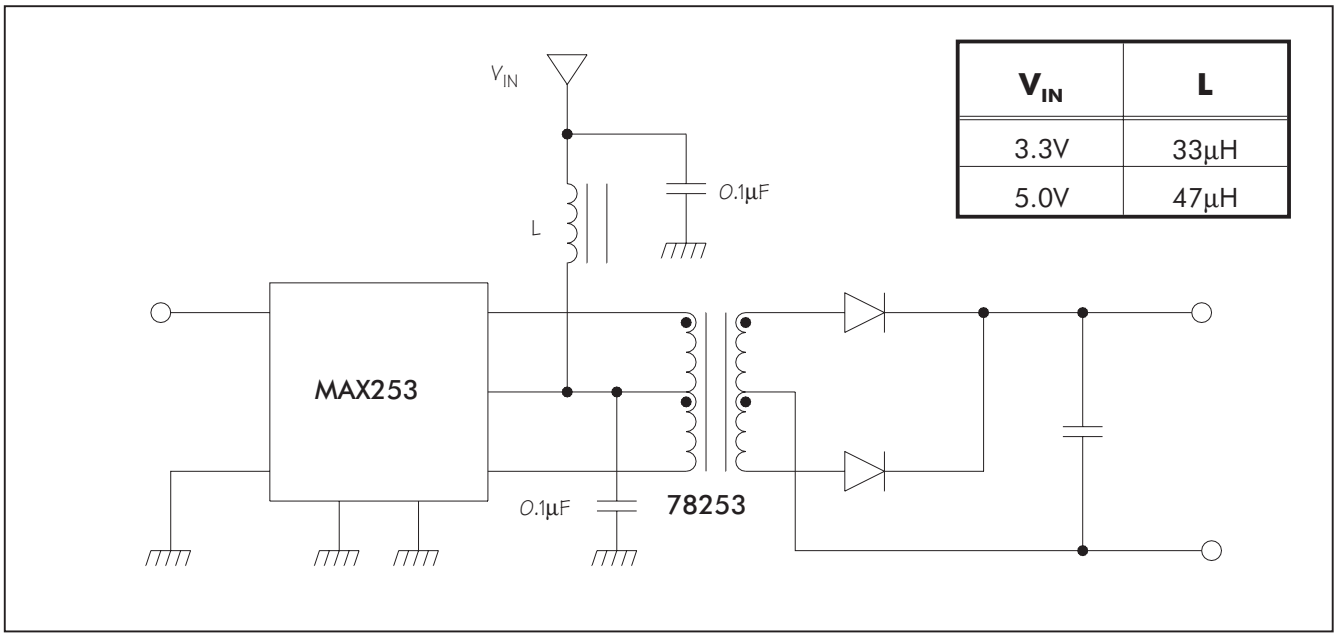


Figure 5 : Half Wave Voltage Doubled Bipolar



V_{IN}	L
3.3V	33µH
5.0V	47µH

Figure 6 : Input Filtering

because at low output load the transformer output voltage is quite high and these lower cost parts will bring the voltage into regulation.

When operating at high load demands, high efficiency, low drop Schottky diodes are recommended, the final choice is left to the designer. It must be noted that different component combinations will produce different characteristic curves to those shown in this data sheet.

input filtering

The MAX253 IC driver and 78253 series transformer form a switching converter typically operating at either 200kHz (FS = LOW) or 350kHz (FS = HIGH). The circuit can therefore introduce some switching noise into the supply line feeding the MAX253. At Newport Components we recommend filtering this supply locally via a capacitor and inductor filter at the MAX253 to reduce the noise introduced to other circuits operating from the same supply rail (see figure 6).

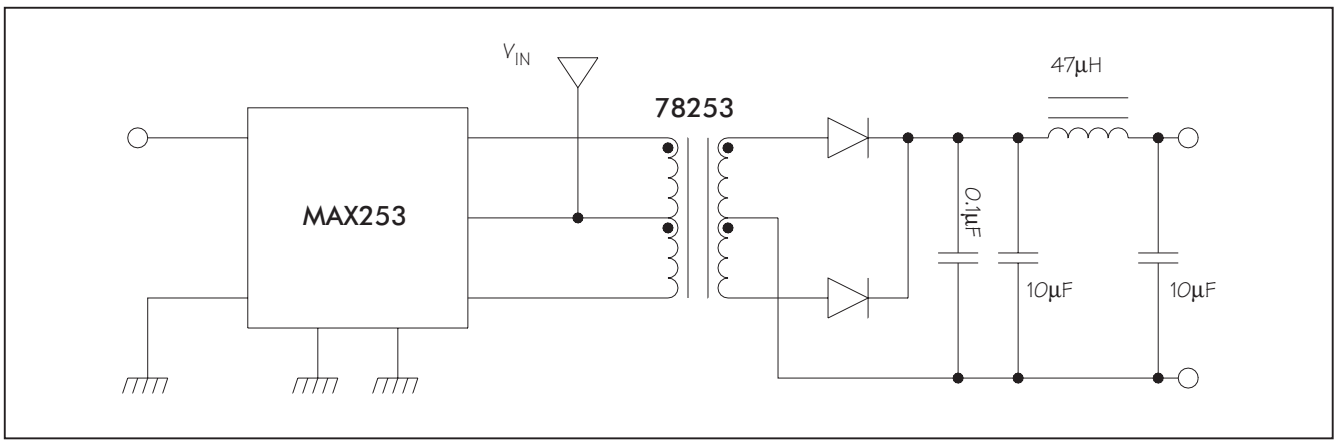


Figure 7 : Output Filtering

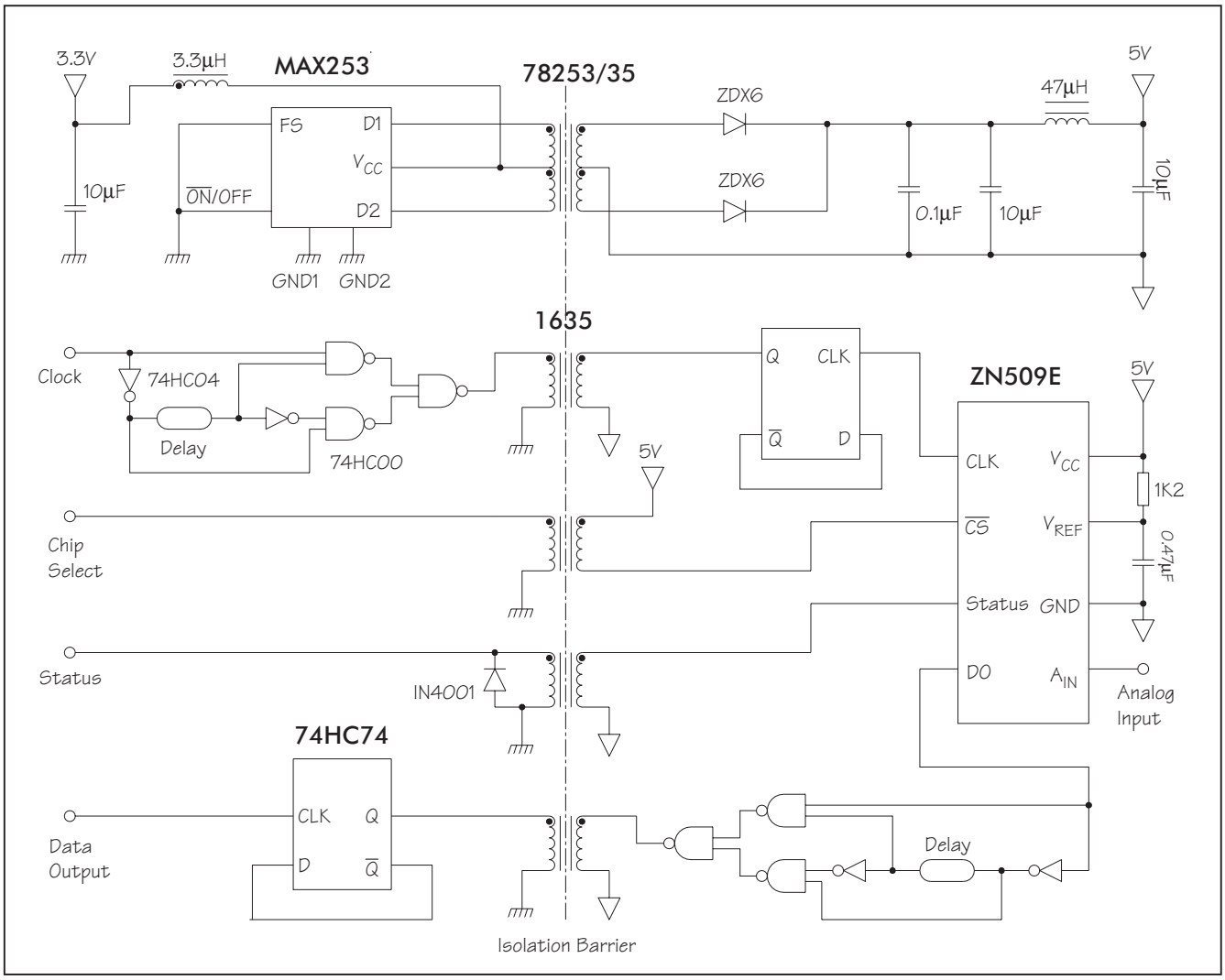


Figure 8 : Transformer Isolated ADC

output filtering

The output ripple from the rectifier circuit can be reduced further by a series inductor and second filter capacitor forming a pi-filter with the original smoothing capacitor (see figure 7). The values shown reduce ripple to less than 10mV at full load, further reductions can be achieved by using larger capacitor values. The largest recommended capacitor for the first stage smoothing is 22mF, up to 47mF can be used if required after the series inductor.

The output filter capacitors should exhibit low effective equivalent series resistance (ESR) at the switching frequency. Tantalum or ceramic capacitors are the recommended choice of dielectric.

transformer isolated ADC

The circuit in figure 8 offers a very low quiescent current for an isolated interface by using logic compatible tranfomer isolator/translator devices (1635). The isolators require some additional logic to interface with the ADC and a 3.3V logic controller, a few 74HC IC's and two delay lines are all that is required to implement full control over the ADC and its output.

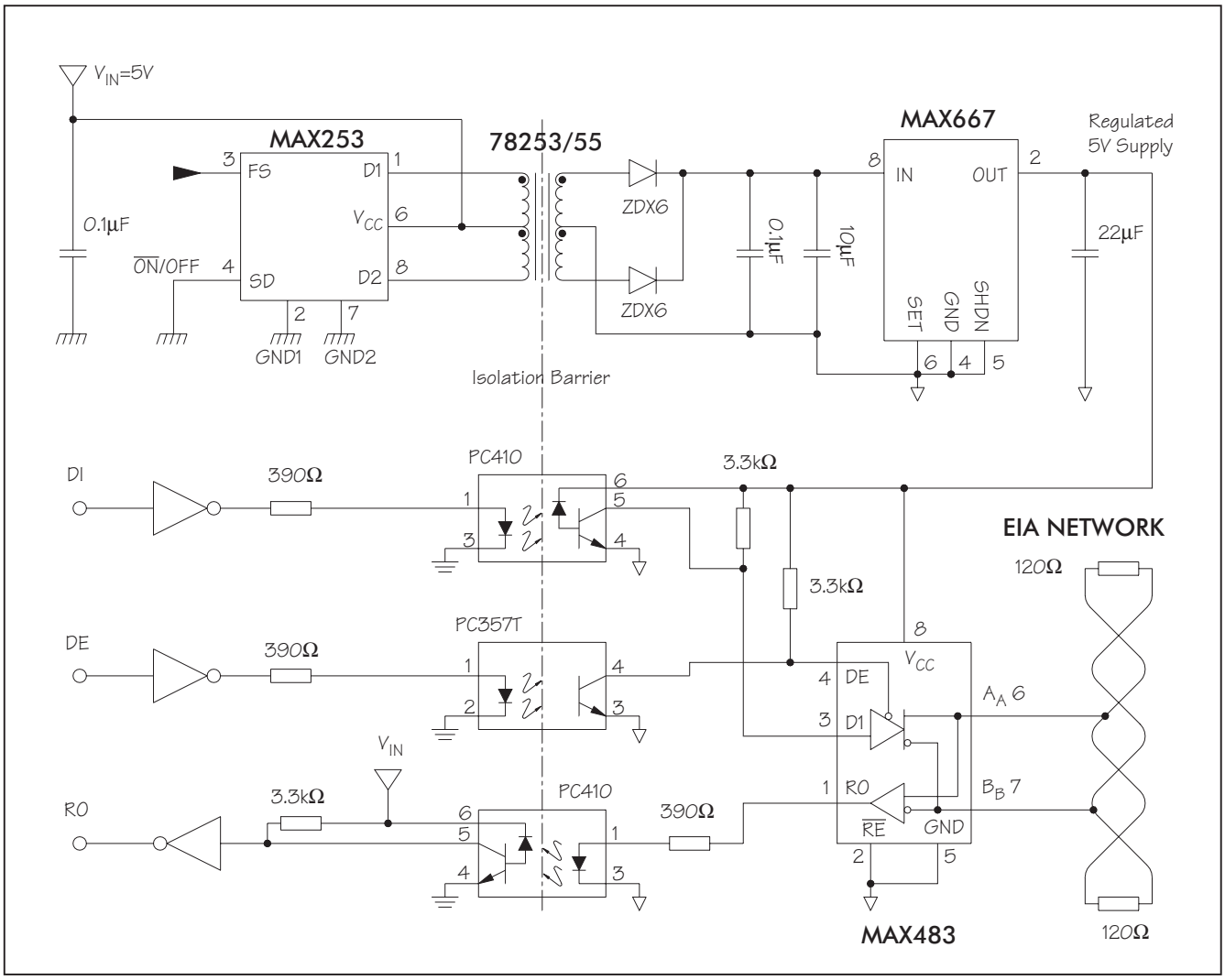


Figure 9 : Isolated EIA485 Interface

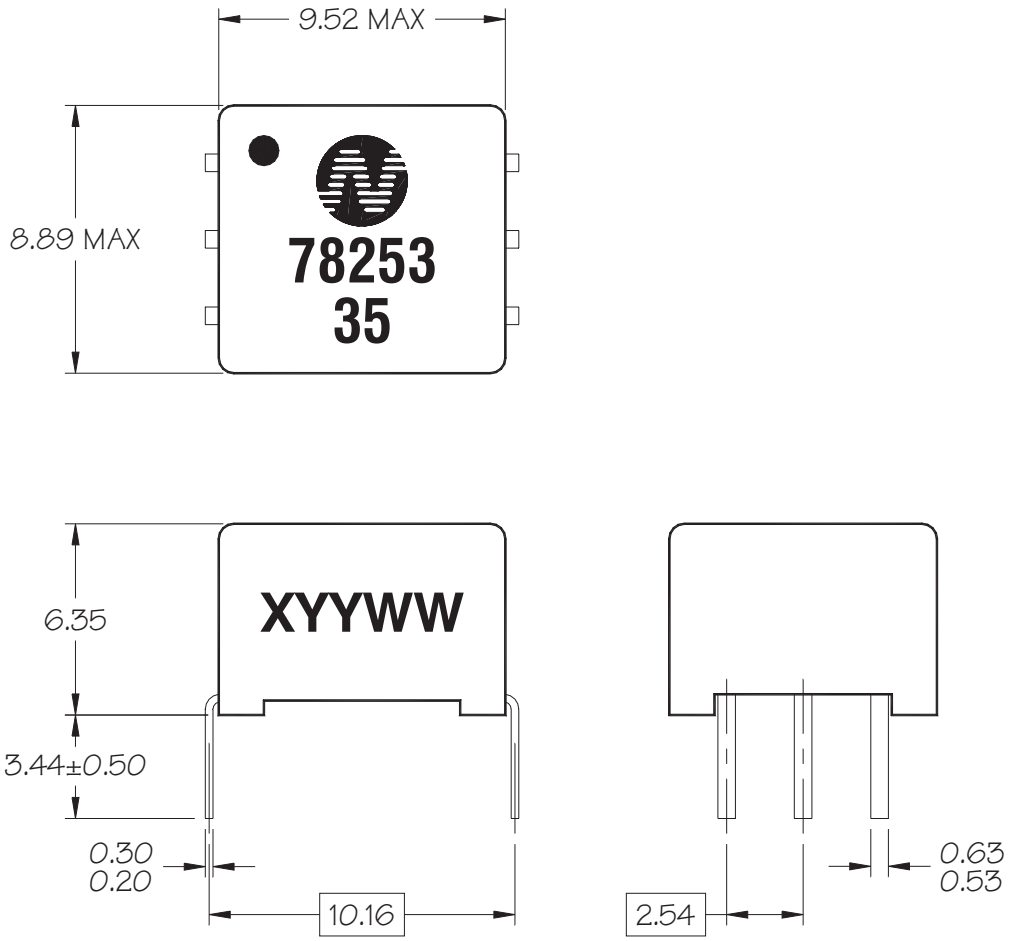
isolated EIA485 interface

In circuits which have a low output current demand, such as the above isolated EIA485 interface (see figure 9), a low drop-out linear regulator can be used on the output of the rectifier circuit to further reduce output ripple and noise.

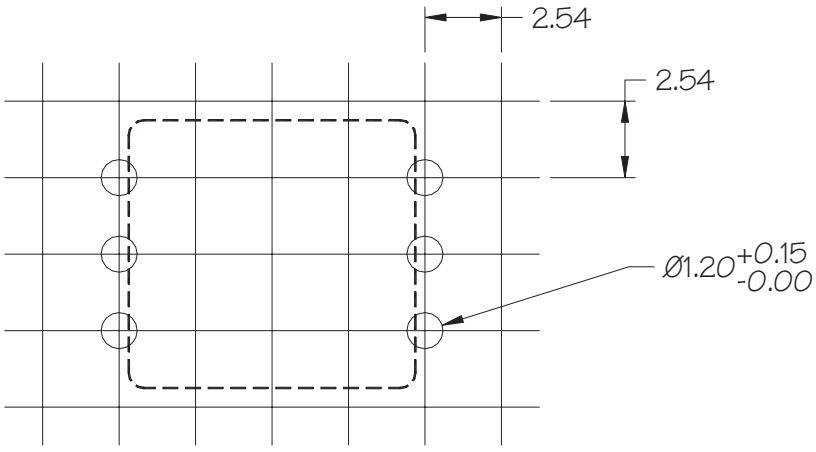
outline dimensions[1]

6 Pin DIP package style

1



recommended footprint details

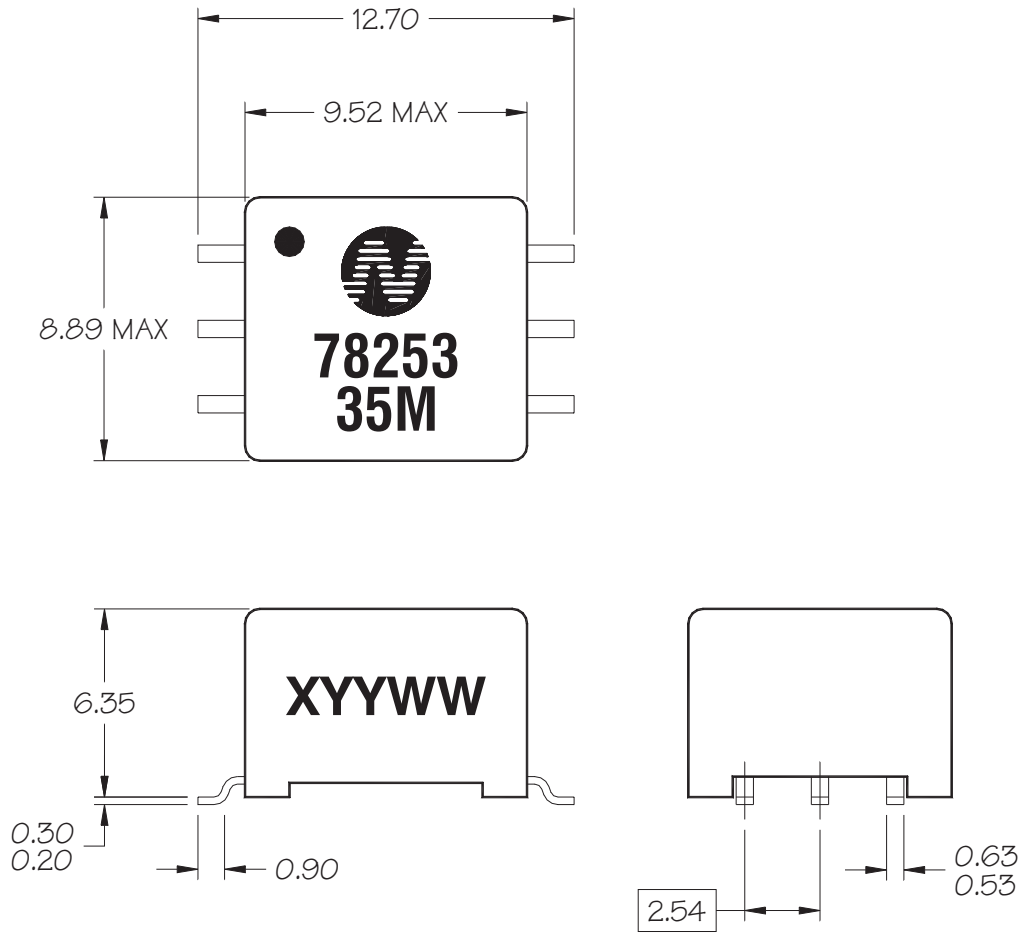


1 All pins on a 2.54mm pitch.
All dimensions in mm XX.XX ± 0.25mm.

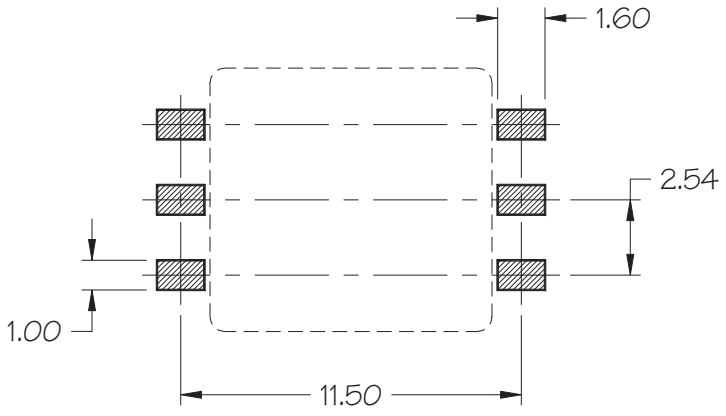
outline dimensions[1]

6 Pin SM package style

2



recommended footprint details



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All dimensions in mm XX.XX ± 0.25mm.