78253 Series

MAX253 Compatible Converter Transformers

FEATURES

- Maxim MAX253 compatible
- 3.3V and 5V versions
- Isolation to 4kV$_{DC}$ 'Hi Pot Test'
- Frequency range to 500kHZ
- Toroidal construction
- Industry-standard pinout
- UL 94 V-0 package materials
- Fully encapsulated
- Low profile
- Surface mount option
- Industrial temperature range

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.

Surface-mount parts

The surface-mount (M suffix) products are not recommended for new designs.

For recommended alternatives please refer to the 78253J Series datasheet.

SELECTION GUIDE

Order Code	Input Voltage	Output Voltage	Max. Output Current	Turns Ratio	Package Style	Recommended Alternative
	V	V	mA			
		Recommended	In Production			
78253/35C	3.3	5.0	100	1:2.27	DIL	
78253/55C	5.0	5.0	200	1:1.31	DIL	
78253/35VC	3.3	5.0	100	1:2.14	DIL	
78253/55VC	5.0	5.0	200	1:1.33	DIL	
		NRND				
78253/35MC	3.3	5.0	100	1:2.27	SM	78253/3JC
78253/55MC	5.0	5.0	200	1:1.31	SM	78253/55JC
78253/35MVC	3.3	5.0	100	1:2.14	SM	78253/35JVC
78253/55MVC	5.0	5.0	200	1:1.33	SM	78253/55JVC

78253/35(M)C CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Primary Inductance, L_P	100kHz, 250mV	0.18	0.38	0.51	mH
Secondary Inductance, L_S	100kHz, 250mV	0.93	2.00	2.70	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, Et	Pins 1/2 or 2/3	30	35		Vµs

78253/55(M)C CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Primary Inductance, L_P	100kHz, 250mV	0.60	0.83	1.50	mH
Secondary Inductance, L_S	100kHz, 250mV	1.10	1.40	2.50	mH
Leakage Inductance, L_L	100kHz, 250mV		0.35	1.30	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, Et	Pins 1/2 or 2/3	40	50		Vµs

78253/35(M)VC CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
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, Et	Pins 1/2 or 2/3	18	22		Vµs

RoHS COMPLIANT

For full details go to
https://www.murata.com/en-global/products/power/rohs

1. Components are supplied in both tube and tape and reel packaging, please refer to package specification section. Orderable part numbers are 78253/XX(V)C and 78253/XXM(V)C (50 pieces per tube) and 78253/XXM(V)C-R (500 pieces per reel).

All specifications typical at T_A=25°C unless otherwise specified.

78253 Series

MAX253 Compatible Converter Transformers

78253/55(M)VC CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
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, Et	Pins 1/2 or 2/3	25	28		Vµs

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation voltage 78253/XX(M)C	Flash tested for 1 second	1500			VDC
Isolation voltage 78253/XX(M)VC	Flash tested for 1 second	4000			

TEMPERATURE CHARACTERISTICS

Operating free air temperature range	-40°C to 85°C
Storage temperature range	-50°C to 125°C

ABSOLUTE MAXIMUM RATINGS

Peak current I_{PK}	400mA

TECHNICAL NOTES

ISOLATION VOLTAGE

'Hi Pot Test', 'Flash Tested', 'Withstand Voltage', 'Proof Voltage', 'Dielectric Withstand Voltage' & 'Isolation Test Voltage' are all terms that relate to the same thing, a test voltage, applied for a specified time, across a component designed to provide electrical isolation, to verify the integrity of that isolation.

All products in this series are 100% production tested at their stated isolation voltage.

A question commonly asked is, "What is the continuous voltage that can be applied across the part in normal operation?"

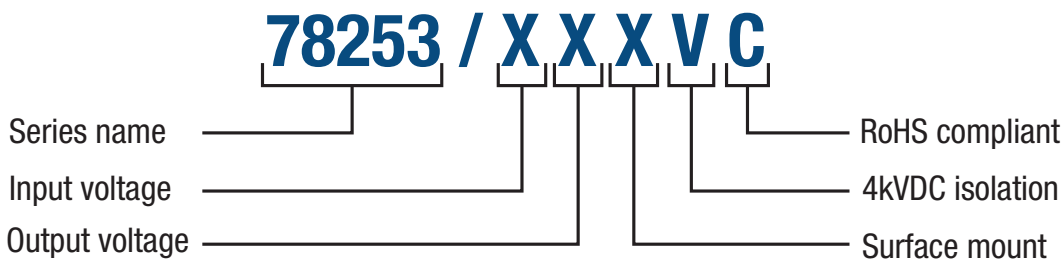
For a part holding no specific agency approvals both input and output should normally be maintained within SELV limits i.e. less than 42.4V peak, or 60VDC. The isolation test voltage represents a measure of immunity to transient voltages and the part should never be used as an element of a safety isolation system. The part could be expected to function correctly with several hundred volts offset applied continuously across the isolation barrier; but then the circuitry on both sides of the barrier must be regarded as operating at an unsafe voltage and further isolation/insulation systems must form a barrier between these circuits and any user-accessible circuitry according to safety standard requirements.

REPEATED HIGH-VOLTAGE ISOLATION TESTING

It is well known that repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment. This series has toroidal isolation transformers, with no additional insulation between primary and secondary windings of enamelled wire. While parts can be expected to withstand several times the stated test voltage, the isolation capability does depend on the wire insulation. Any material, including this enamel (typically polyurethane) is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage.

This consideration equally applies to agency recognised parts rated for better than functional isolation where the wire enamel insulation is always supplemented by a further insulation system of physical spacing or barriers.

PART NUMBER STRUCTURE



RoHS COMPLIANCE and MSL INFORMATION

The Through Hole parts in this series are compatible with RoHS soldering systems with a peak wave solder temperature of 260ºC for 10 seconds. Wave solder profile not to exceed the profile recommended in IEC 61760-1 Section 6.1.3. The pin termination finish on this product series is Matte Tin. The 78253 series is backward compatible with Sn/Pb soldering systems.

The Surface Mount parts in this series are compatible with Pb-Free soldering systems and is also backward compatible with Sn/Pb soldering systems. The 78253 series can be soldered in accordance with J-STD-020 and have a classification temperature of 220°C and moisture sensitivity level 1. The termination finish on this product is Matte Tin.[1]

Samples of the Surface Mount parts were tested in accordance with the conditioning described for MSL level 1 in IDC/J-STD-020. The products passed electrical tests and visual inspection criteria.

For further information, please visit www.murata.com/en-global/products/power/rohs

APPLICATION NOTES

Introduction

The 78253 series of isolated converter transformers are specifically designed for use with the MAX253 IC from Analog Devices Inc. (previously Maxim Integrated Circuits) to create an isolated power supply for low voltage, low power interface circuits. The 5V version (78253/55) can supply 1W and the 3.3V versions (78253/35) can supply 500mW; this is limited by the current switching capability of the MAX253 IC.

While the transformer has been specifically designed to complement the MAX253 IC, it would work equally well with any other push-pull driver configuration operating over a similar frequency range (e.g. 100kHz to 500kHz) and with similar voltage levels. The transformer can be operated at higher voltage levels, but the maximum switching frequency would change.

The transformers are centre tapped on the secondary side and hence can be used for full wave rectification, bipolar output or voltage doubling applications.

Rectification ciruits

The 78253 series are designed to provide a 5V output from either 3.3V or 5V supply to the MAX253 IC. Other output configurations can be derived to produce positive and negative 5V outputs or voltage doubled output. 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 and 500mW for a 3.3V input supply.

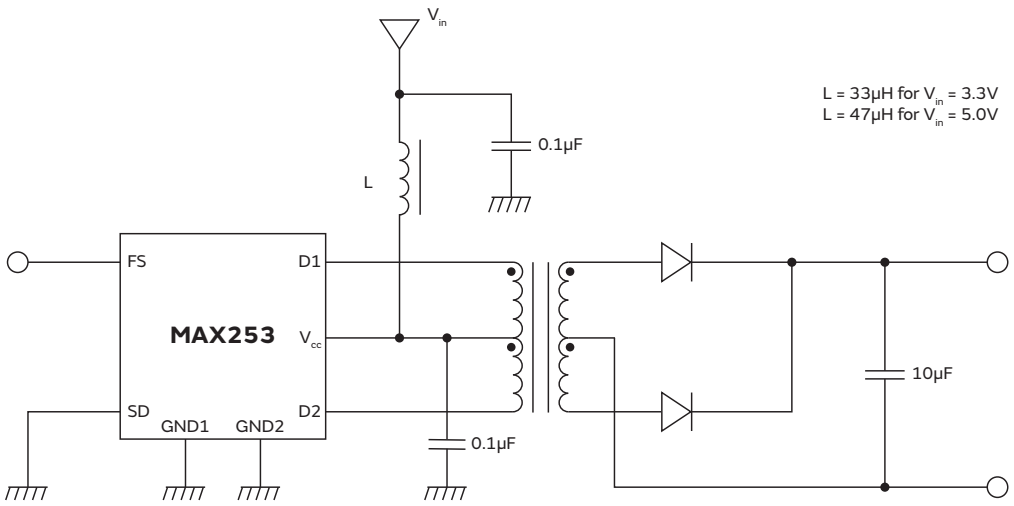
Diode selection

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 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 characteristics curves to those seen in this datasheet.

Input filtering

The MAX253 IC driver and 78253 series transformers 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 Murata Power Solutions we recommend filtering this supply locally via a capacitor and inductor filter at the MAX253 to reduce noise introduced to other circuits operating from the same supply rail (see Figure 1).

Figure 1: Input filtering



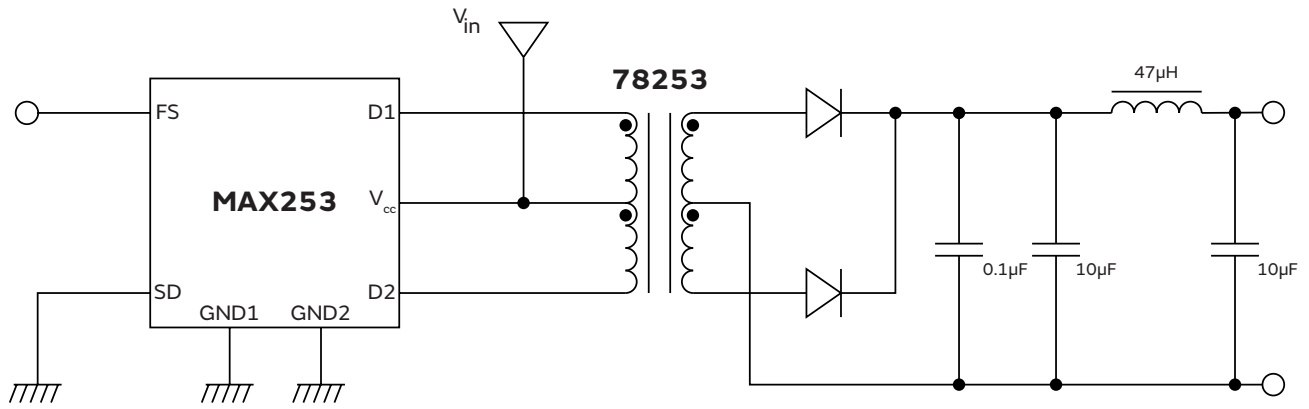
Output filtering

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 2). 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 22µF, up to 47µF 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.

APPLICATION NOTES (Continued)

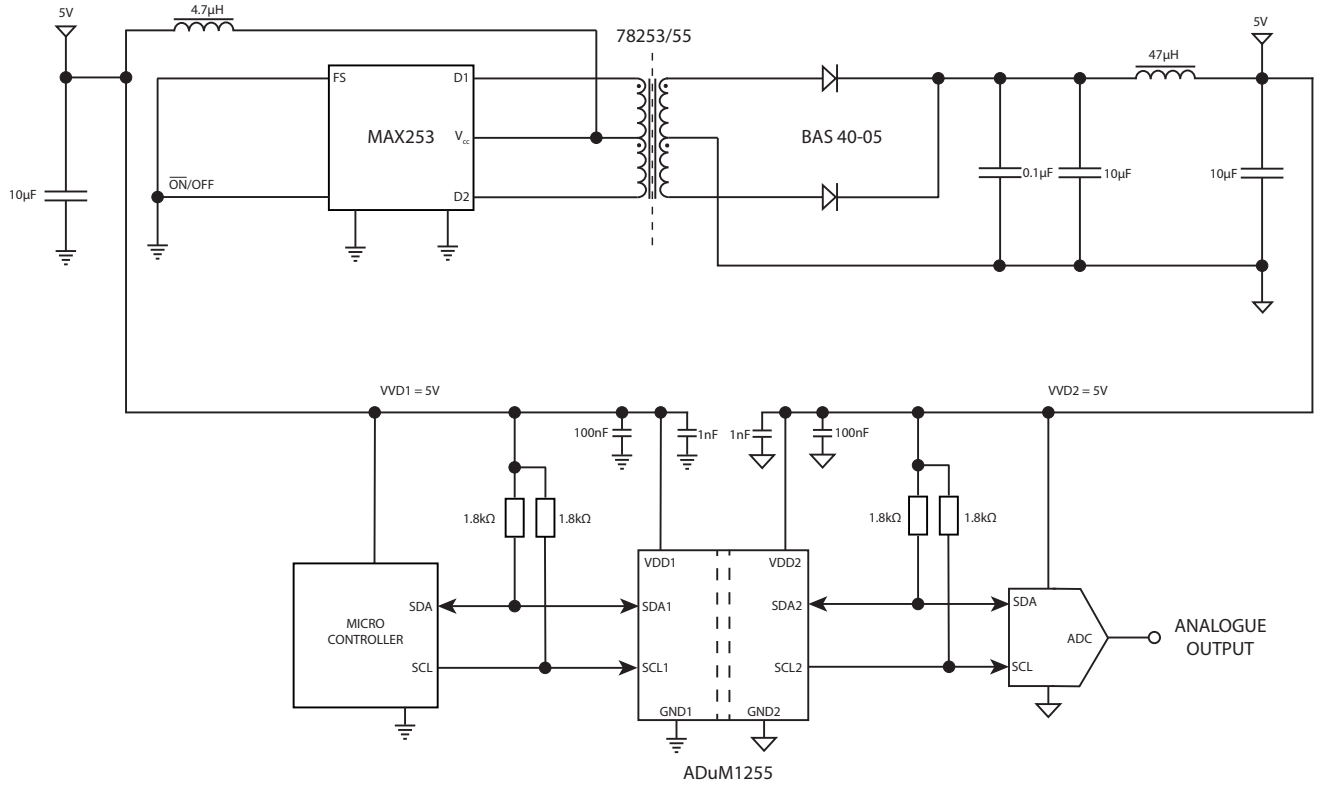
Figure 2: Output filtering



I2C digital isolator

The circuit below shows an Inter-Integrated Circuit (I2C) isolated interface to an analogue output, using the Analog Devices ADuM1255 isolator, the MAX253 driver and 78253/55 transformer. This effectively allows any I2C digital interface to be isolated from any functional input or output (a DAC could replace the ADC shown in Figure 3).

Figure 3: Isolated analogue output over 12C bus

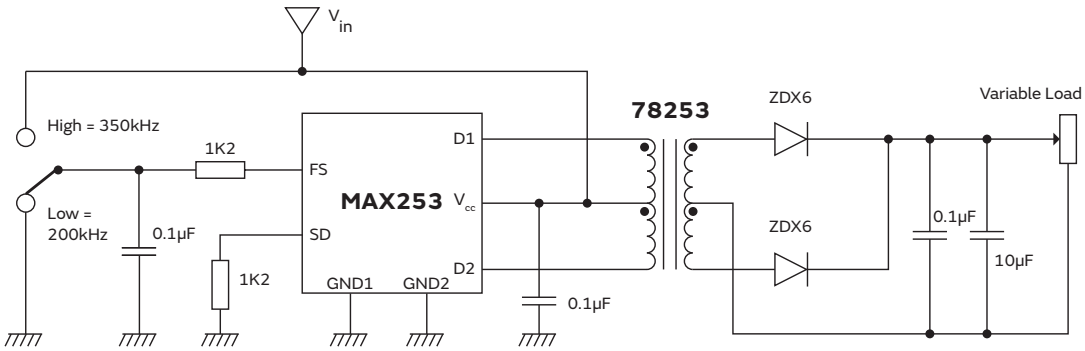


APPLICATION NOTES (Continued)

Test circuit

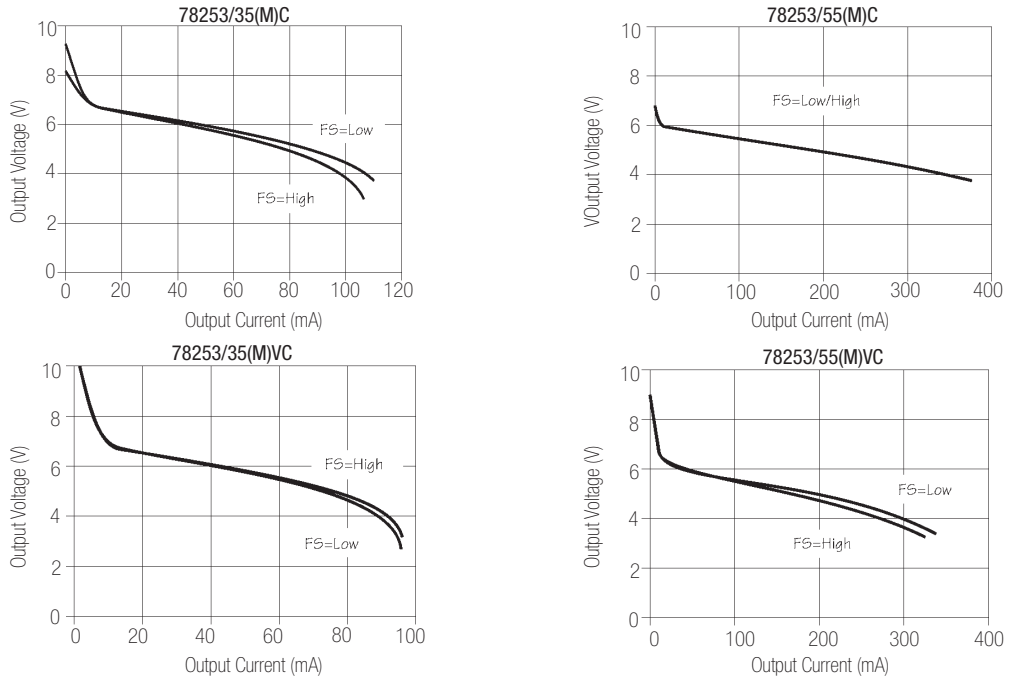
All characterisation curves presented in this data sheet were derived from the test circuit shown in Figure 4. This features the MAX253 IC and a pair of ZDX6 rectifier diodes with a 10uF output capacitor. Since the tests were conducted the ZDX6 diode had become obsolete, however, the results will be similar for any rectifier diode with a forward voltage of around 1.1V at 200mA.

Figure 4: Test circuit



TYPICAL CHARACTERISTICS (VOLTAGE CURVES)

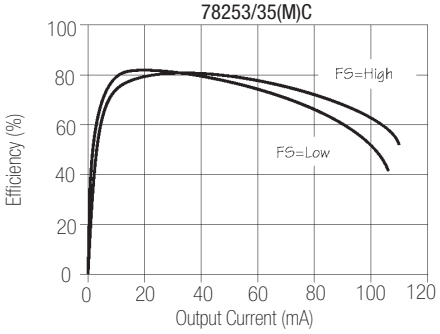
VOLTAGE CURVES



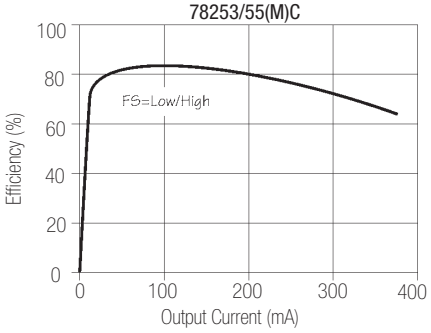
TYPICAL CHARACTERISTICS (VOLTAGE CURVES) (Continued)

EFFICIENCY CURVES

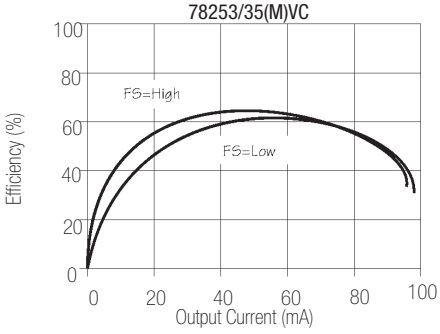
78253/35(M)C



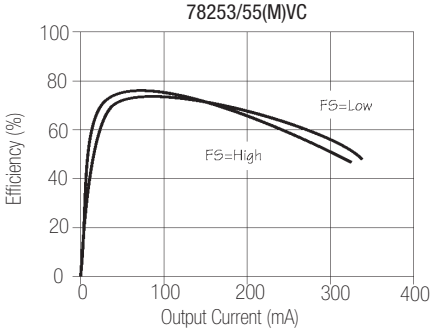
78253/55(M)C



78253/35(M)VC

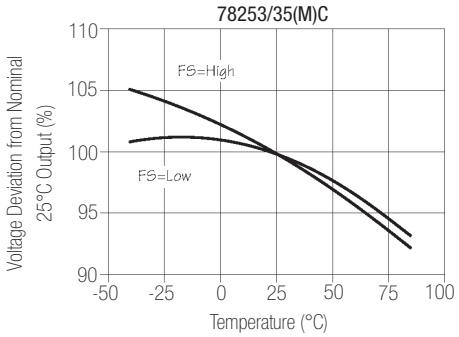


78253/55(M)VC

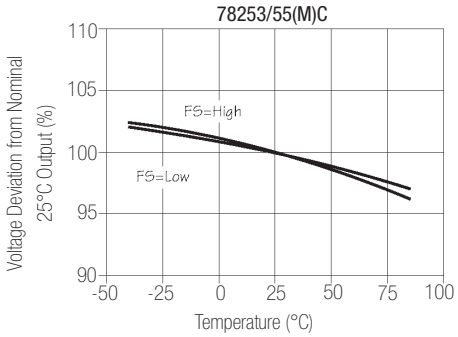


VOLTAGE DEVIATION

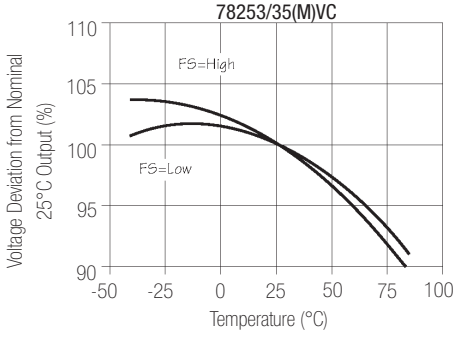
78253/35(M)C



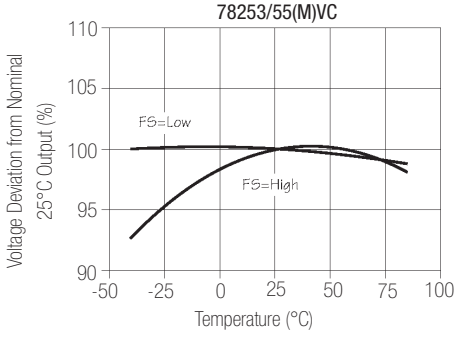
78253/55(M)C



78253/35(M)VC



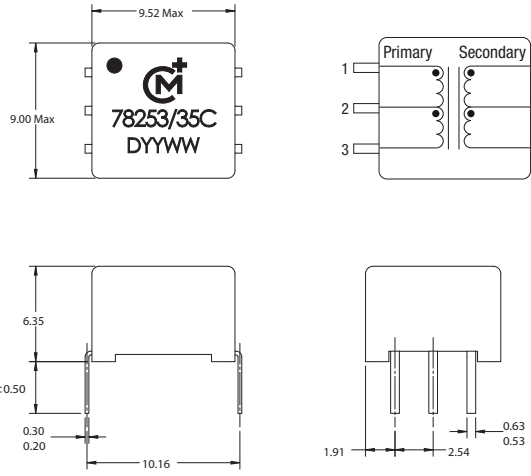
78253/55(M)VC



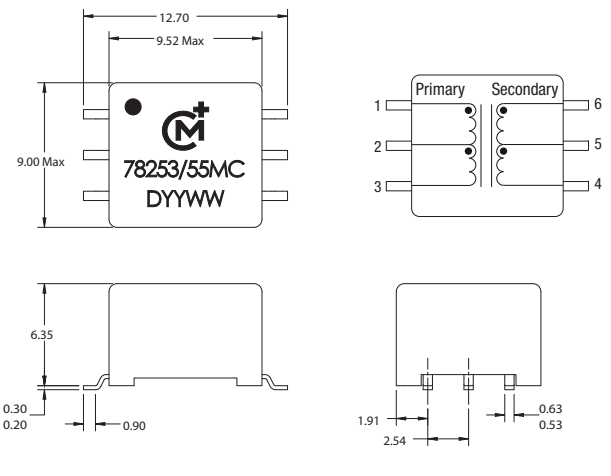
PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

6 Pin DIL



6 Pin SM

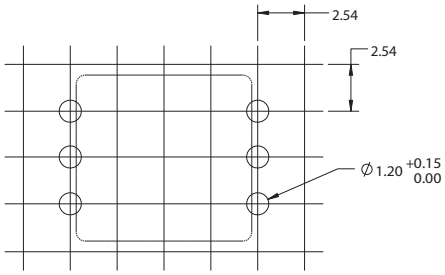


Unless otherwise stated all dimensions in mm ±(0.25.
All pins on a 2.54 pitch and within ±0.25 of true position.

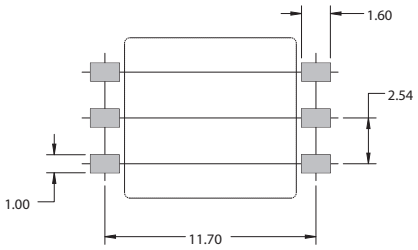
Package weight 1.0g Typ.

RECOMMENDED FOOTPRINT DETAILS

6 Pin DIL

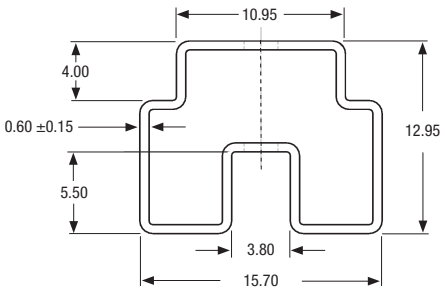


6 Pin SM



All pins on a (2.54 pitch and within ±0.25 of true position.

TUBE OUTLINE DIMENSIONS

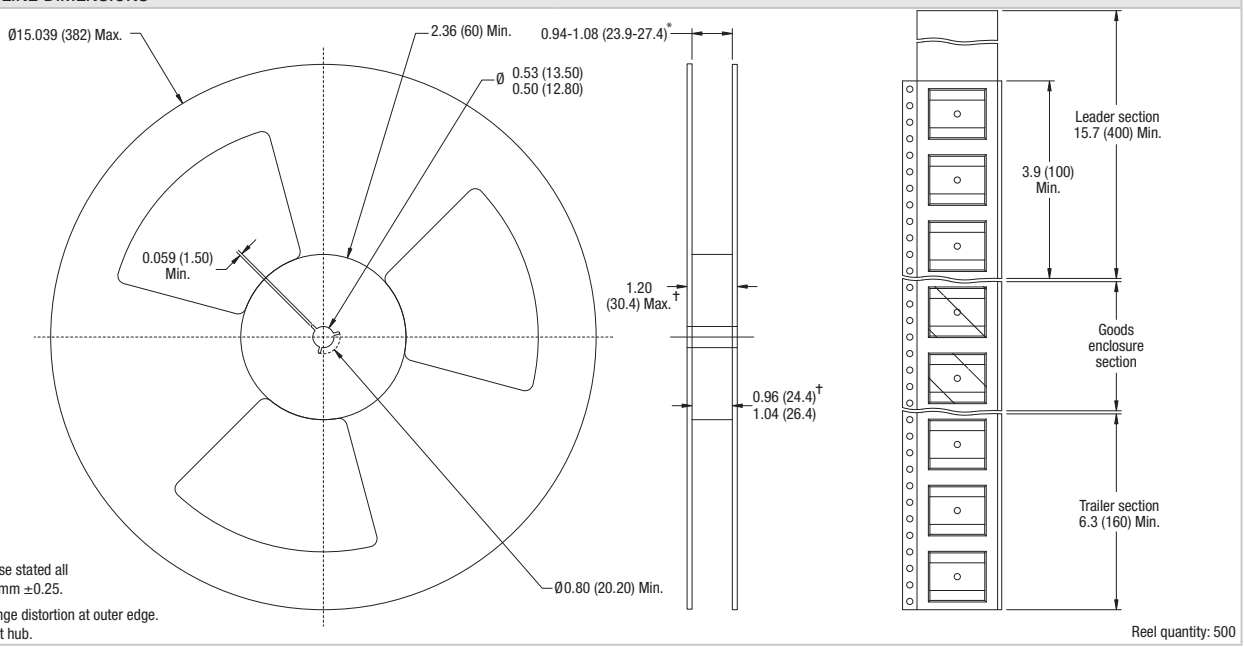


Tube length: 465 ±2.
Tube material: Antistatic coated clear pvc.

Tube quantity: 50

TAPE & REEL SPECIFICATIONS

REEL OUTLINE DIMENSIONS

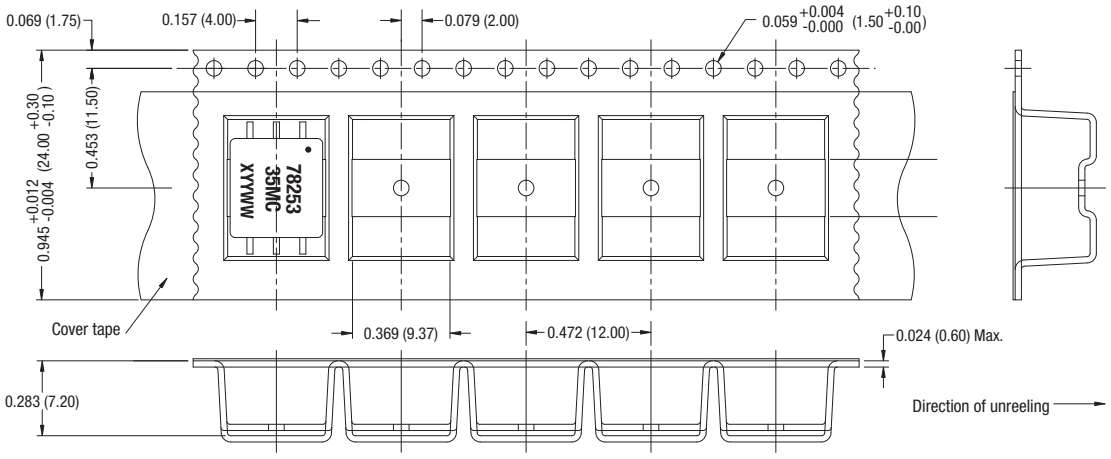


Unless otherwise stated all dimensions in mm ±0.25.

* Includes flange distortion at outer edge.
† Measured at hub.

Reel quantity: 500

TAPE OUTLINE DIMENSIONS



Unless otherwise stated all dimensions in mm ±0.25.

DISCLAIMER

Unless otherwise stated in the datasheet, all products are designed for standard commercial and industrial applications and NOT for safety-critical and/or life-critical applications.

Particularly for safety-critical and/or life-critical applications, i.e. applications that may directly endanger or cause the loss of life, inflict bodily harm and/or loss or severe damage to equipment/property, and severely harm the environment, a prior explicit written approval from Murata is strictly required. Any use of Murata standard products for any safety-critical, life-critical or any related applications without any prior explicit written approval from Murata shall be deemed unauthorised use.

These applications include but are not limited to:

- Aircraft equipment
- Aerospace equipment
- Undersea equipment
- Power plant control equipment
- Medical equipment
- Transportation equipment (automobiles, trains, ships, etc.)
- Traffic signal equipment
- Disaster prevention / crime prevention equipment
- Data Processing equipment

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