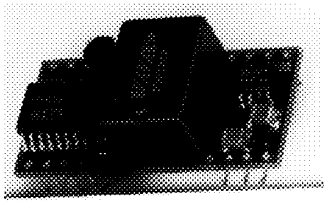
BURR-BROWN®



PWS727
PWS728

Isolated, Unregulated DC/DC CONVERTERS

FEATURES

- 100% TESTED FOR HIGH VOLTAGE BREAKDOWN
- COMPACT (28-pin DIP)
- 5V OR 15V INPUT OPTIONS
- SYNCHRONIZABLE (TTL)

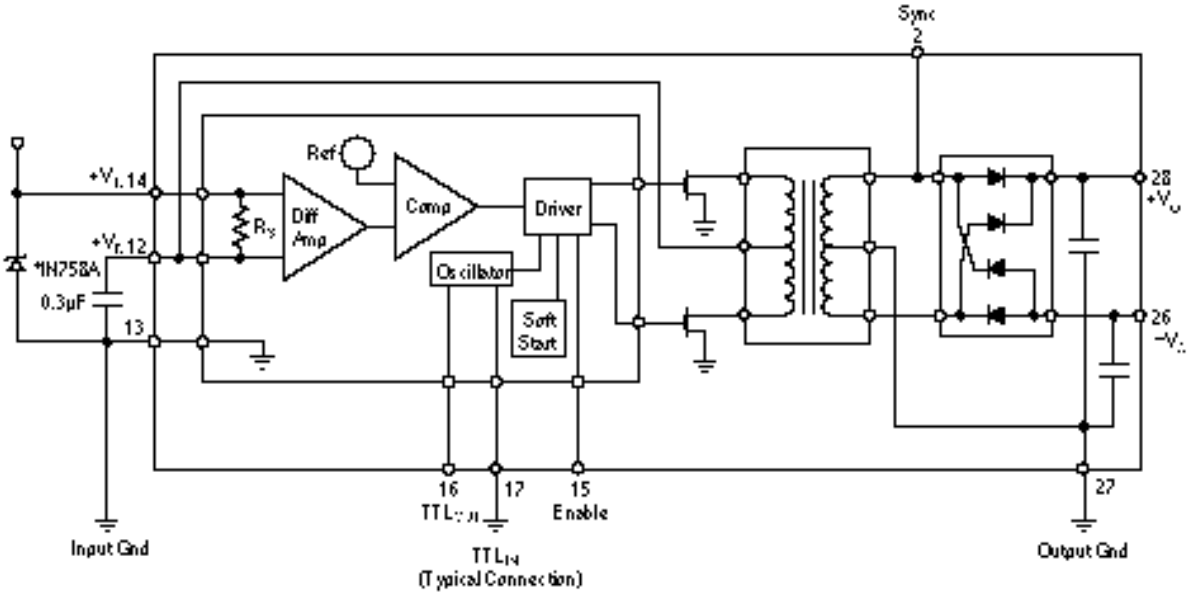
APPLICATIONS

- INDUSTRIAL PROCESS CONTROL
- GROUND LOOP ELIMINATION
- POINT-OF-USE ANALOG POWER

DESCRIPTION

The PWS727 is a DC/DC converter which uses minimal PC board space and converts a single input 10 to 18VDC to bipolar voltages of the same value as the input. The PWS728 converts a 4.7 to 6VDC to bipolar voltages three times the value of the input. The converters are capable of providing ±15mA (PWS727) or ±12mA (PWS728) at rated voltage and up to ±30mA.

The PWS727 and PWS728 use a high-frequency (800kHz nominal) surface mount oscillator that makes it possible to minimize the transformer size. The transformer is composed of a split bobbin isolation transformer using a ferrite core and is encapsulated in a plastic package, allowing a higher isolation voltage rating. The design minimizes high frequency radiated noise on the output by using a ground plane directly under the high frequency components.



input spikes overstressing the diode bridge.

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SPECIFICATIONS

ELECTRICAL

At V_{IN} =15VDC, Output Load = ±15mA (PWS727) and T_A = +25°C unless otherwise noted. Or V_{IN} = 5VDC, Output Load = ±12mA (PWS728) and T_A = +25°C unless otherwise noted

PARAMETER	CONDITIONS	PWS727			PWS728			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
ISOLATION								
Voltage Rated Continuous AC 60Hz		750			*			Vrms
100% Test[1]	60Hz, 1s, <5pC PD	1200			*			Vrms
Barrier Impedance			10^{12} || 8			*		Ω || pF
Leakage Current at 60Hz	V_{ISO} = 240Vrms, 60Hz		1	1.5		*	*	µArms
INPUT								
Rated Voltage			15			5		V
Voltage Range		10		18	4.5		6	V
Current			55	65		110	130	mA
Current Ripple			2.5			7.5		mAp-p
Current Limit				250			*	mAp-p
TTL_{IN}, I_{IH}				10			*	nA
I_{IL}			–1			*		µA
V_{IH}		2.0			*			V
V_{IL}				.8			*	V
Frequency Range		1	1.6	2.5	*	*	*	MHz
TTL_{OUT}, I_{OL}				15			15	mA
OUTPUT								
Rated Output Voltage		14.25	15.0	15.75	*	*	*	VDC
Current			15	30		12	30	mA
Regulation								
(single ended load change)	$+I_O$ = 7.5 –15mA, $–I_O$ = 15mA		45			135		mV/mA
Sensitivity	V_{IN} = 10 to 18 V		1.13			3.8		V/V
Balance				15			25	mV
Ripple Voltage	At Switching Frequency		10			*		mVpp
Output Switching Noise	>800kHz		20			*		mVpp
Output Voltage Temp Coefficient			.05			*		V/°C
Sync	Loading			20 || 40			*	kΩ || pF
Sync Frequency[2]		725	800	875	*	*	*	kHz
TEMPERATURE RANGE								
Specification		0		70	*		*	°C
Operation		–40		85	*		*	°C
Storage		–40		85	*		*	°C

* Specifications the same as PWS727.

NOTE: (1) Tested at 1.6 x rated, fail on 5pC partial discharge leakage current on 5 successive pulses. (2) Nominal with pin 17 grounded.

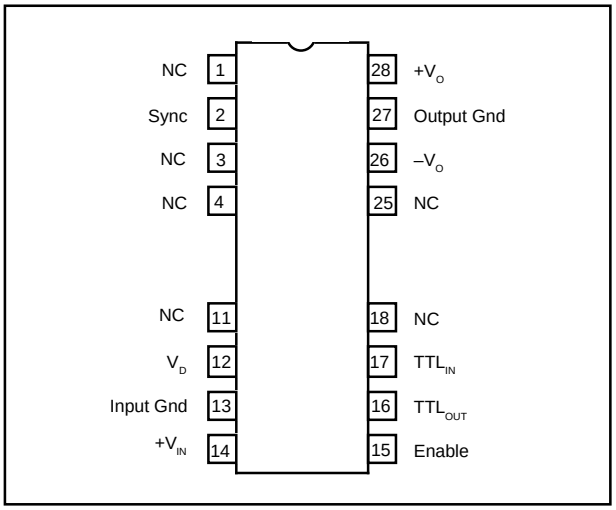
ORDERING INFORMATION

Basic Model Number	PWS727 PWS728

ABSOLUTE MAXIMUM RATINGS

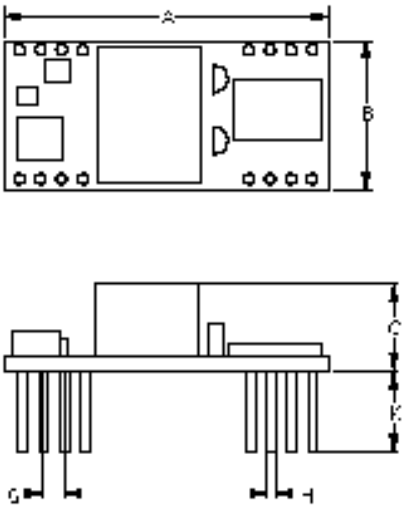
Supply Voltage	18V
Continuous Isolation Voltage	750Vrms
Junction Temperature	+150°C
Storage Temperature	85°C
Lead Temperature (Solder, 10s)	300°C
Output Short to Common	Continuous
Max Load, Sum of Both Outputs	60mA

PIN CONFIGURATION



MECHANICAL

28-Pin Double — Wide DIP

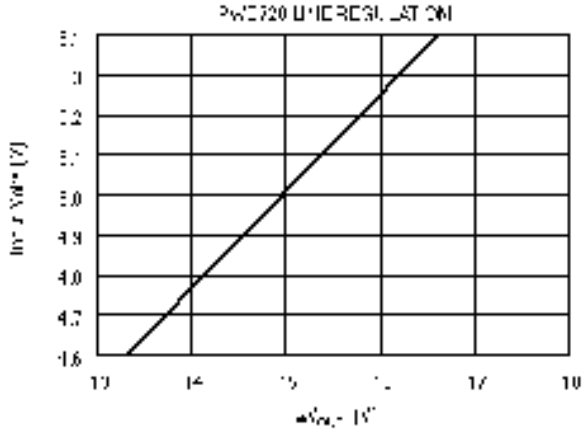


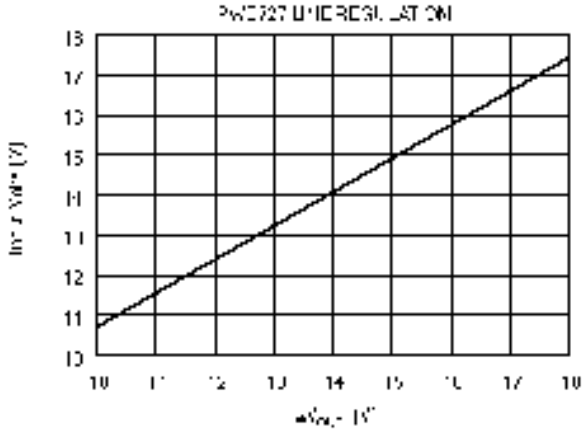
	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.440	1.460	36.58	37.08
B	.690	.710	17.53	18.03
C	.390	.410	9.91	10.41
G	.100 BASIC		2.54 BASIC	
H	.020 BASIC		0.51 BASIC	
K	.190	.210	4.83	5.33
L	.600 BASIC		15.24 BASIC	

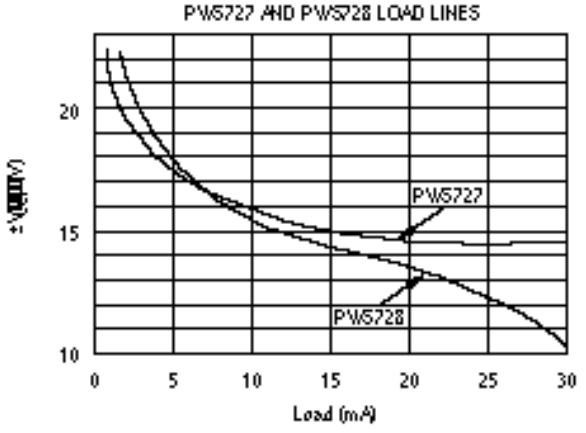
NOTE: Leads in true position within 0.01" (0.25mm) R at MMC at seating plane.

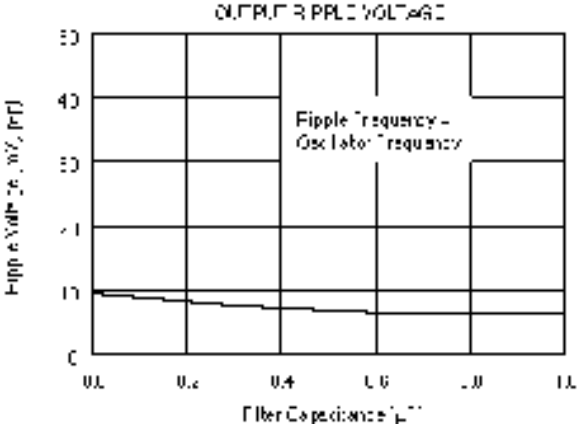
TYPICAL PERFORMANCE CURVES

T_A = +25°C, V_{IN} = 15VDC, I_{LOAD} = ±15mA (PWS727), or V_{IN} = 5VDC, output load = ±12mA (PWS728) unless otherwise noted.



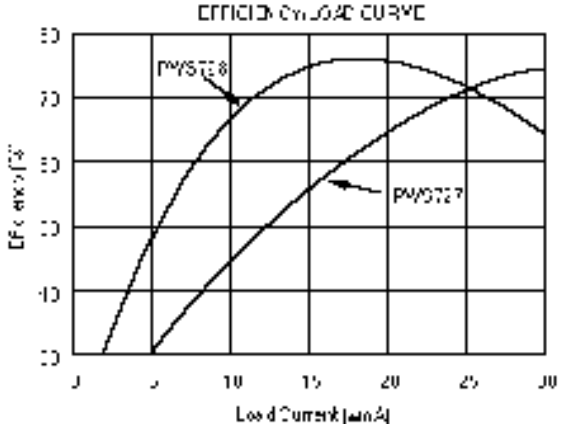


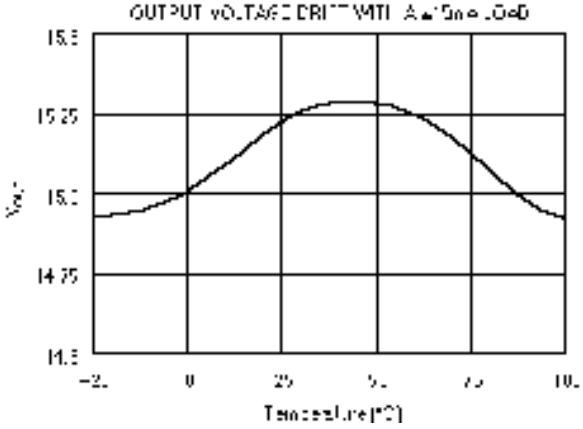


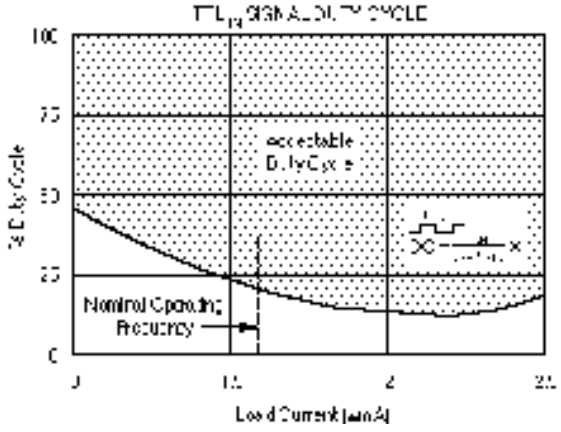


TYPICAL PERFORMANCE CURVES (CONT)

T_A = +25°C, V_{IN} = 15VDC, I_{LOAD} = ±15mA (PWS727), or V_{IN} = 5VDC, output load = ±12mA (PWS728) unless otherwise noted.







THEORY OF OPERATION

The PWS727 and PWS728 are composed of the PWS750 building blocks which are assembled along with some standard components to build an isolated push pull DC/DC converter.

PWS727 AND PWS728 PIN FUNCTIONS

TTL_{IN} is used to optionally control the frequency of the oscillator with an external TTL level frequency source. The input frequency must be twice the desired driver frequency, since there is an internal divide by 2 circuit to produce a 50% duty cycle output. The input duty cycle can vary from 12% to 95%, (see the Typical Performance Curves). **When in the free running mode the TTL_{IN} pin must be tied to ground.**

TTL_{OUT} is used to synchronize the outputs of multiple PWS727s and/or PWS728s to minimize beat frequency problems if desired. A standard open collector output is provided, therefore a 330 to 3.3kΩ resistor will be necessary, depending on the amount of stray capacitance on the TTL_{IN} line. A maximum of 8 PWS727s or PWS728s can be connected without the use of an external TTL buffer. Connect the TTL_{OUT} of a master unit to the TTL_{IN} of the slave units.

An Enable pin is provided so that the driver can be shut down to minimize power use if required. A TTL low applied to the pin will shut down the driver within one cycle (1.25µs). A TTL high will enable driver outputs within one cycle. The TTL_{OUT} will still have an 800kHz signal when a master driver is disabled, so other synchronized drivers will not be shut down. The pin can be left open for normal operation.

The $+V_{IN}$ pin supplies power to the converter. The V_D pin connects the power to the transformer through the internal overcurrent sense resister. The other end of the overcurrent sense resister is tied to $+V_{IN}$. A 0.3µF bypass capacitor must be connected to the V_D pin to reduce the ripple current through the shunt resistor, otherwise false current limit conditions can occur due to ripple voltage peaks. During overload conditions the output drive shuts off for approximately 80µs, then turns back on for 20µs, resulting in a 25% power up duty cycle. If the overload condition still exists, then the output will shut off again. When the fault or the excessive load is removed, the converter resumes normal operation.

The Sync pin can be used to synchronize the internal oscillator of an ISO120 to the operating frequency of the converter. The Sync pin is connected directly to the secondary of the transformer, so an 800kHz square wave of twice the output magnitude is present. Minimum pc board trace length should be used to minimize loading the transformer. When making the connection to the ISO120, a simple frequency divider circuit (see Figure 3) is necessary to match the 400kHz nominal frequency required by the ISO120. If this function is not used, leave the pin disconnected.

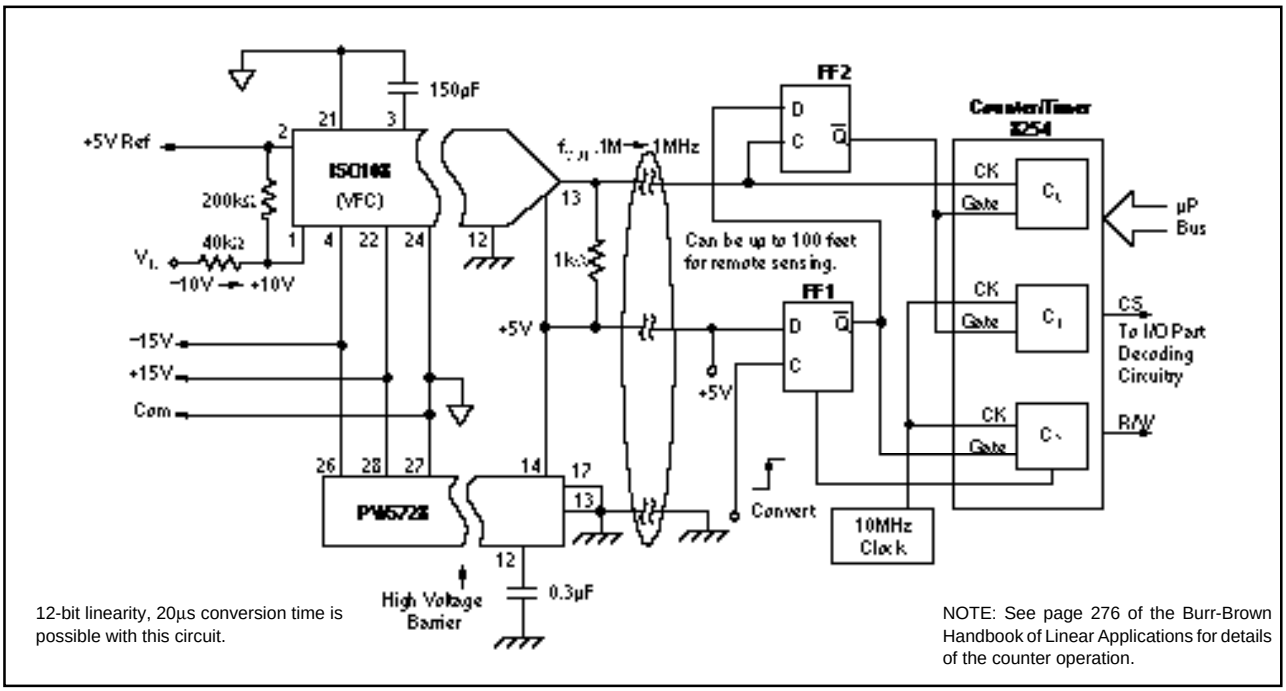


FIGURE 1. Isolated Integrated A/D Conversion System Using Ratiometric Counting and Microprocessor Interface, Operating from a Single 5V Supply.

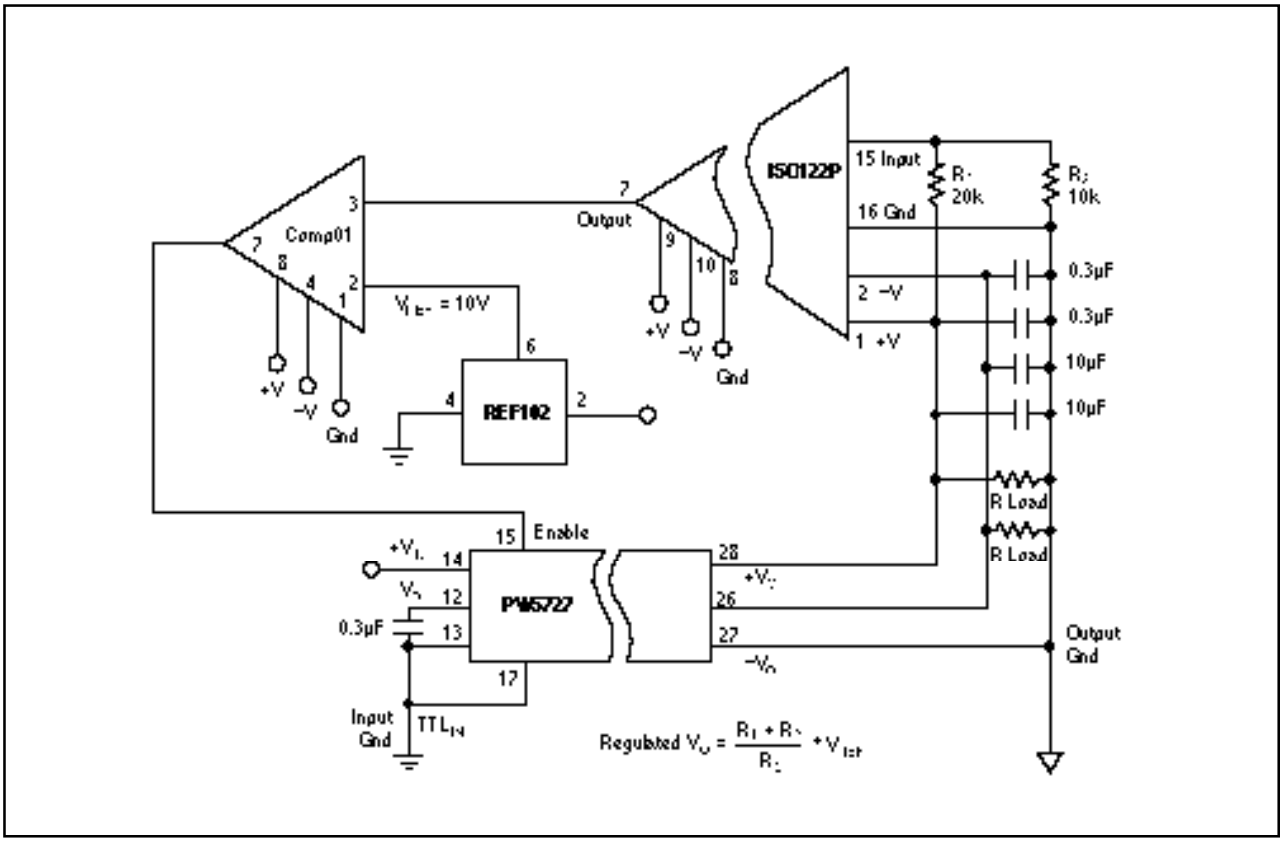


FIGURE 2. Regulated Output Using the Enable Pin to Cycle the Converter Output On and Off.

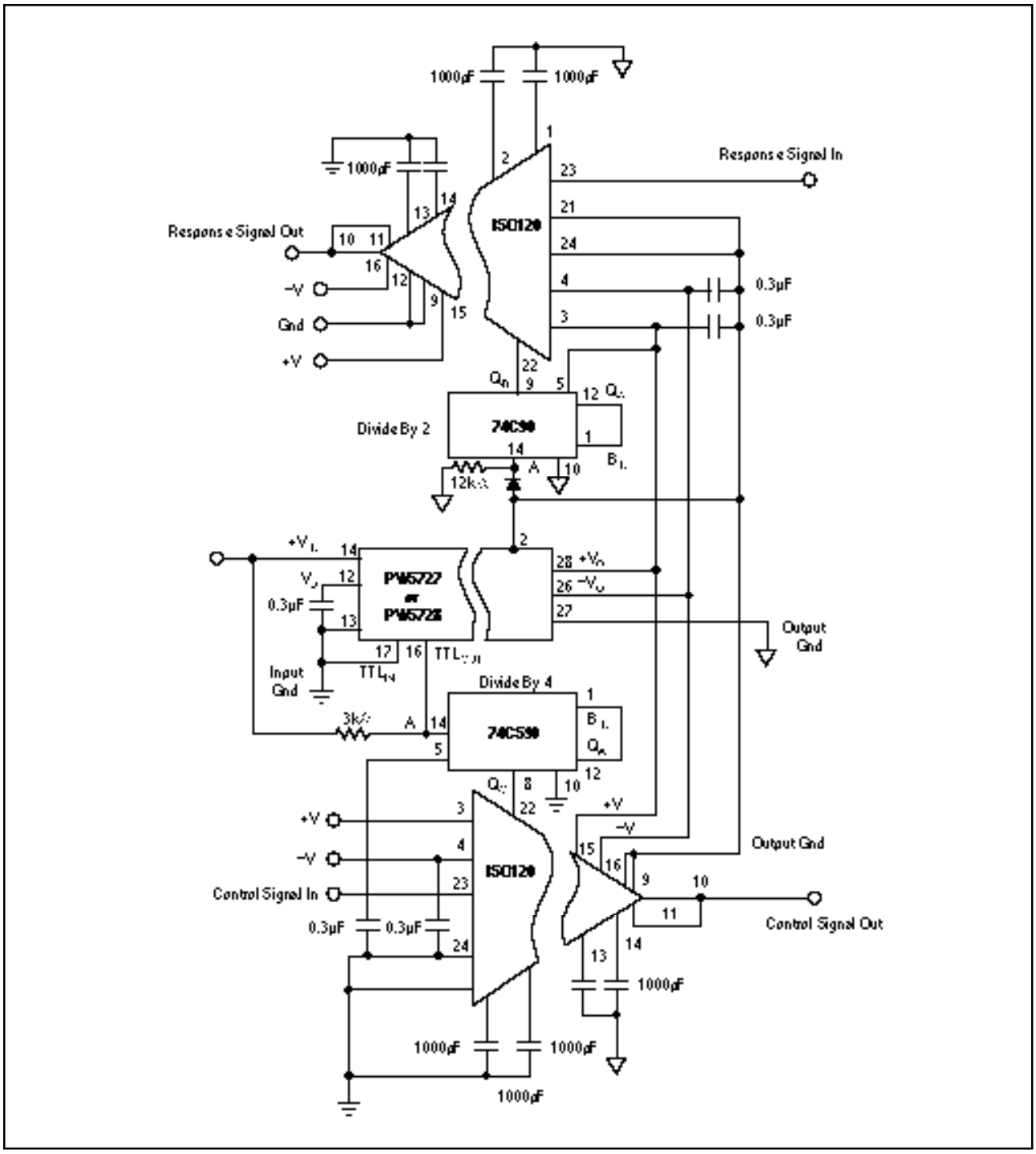


FIGURE 3. The PWS727 or PWS728 Can Be Used to Synchronize the ISO120. The Output Sync Must be Divided by 2 and the TTL_{OUT} Must Be Divided by 4.

BASIC OPERATION

PC BOARD LAYOUT CONSIDERATIONS

These converters have low output ripple so that standard layout methods are all that is necessary for good circuit performance. Bypass capacitors should be placed close to each device powered by the converters. To minimize the noise pickup by sensitive (12 bit resolution) circuits, a 10Ω resistor can be placed in series with the isolated power traces. The resistor in conjunction with the bypass capacitor acts as a low pass filter, to minimize isolation amplifier PSRR related ripple voltage feedthrough. A π filter can also be used at the input ($+V_{IN}$) to minimize input supply ripple current.

5V OPERATION

With 5V operation (PWS728) the transformer winding ratio is 3:1, therefore generating much greater currents in the primary. The input ripple will be larger, so an input π filter will be necessary to isolate the supply noise from the rest of the circuit. For example, when the output load is ± 15mA the input current will be approximately 120mA.

OUTPUT CURRENT RATING

The PWS727 and PWS728 contain soft start circuitry to protect the FETs from high inrush currents during turn on. The internal input current limit is 250mA peak to prevent thermal overload of the MOSFETs. The maximum output current rating is ±30mA. Total current, which can be drawn from each isolation channel, is the total of the of the power being drawn from both the +V and –V outputs. For example, if one output is not used, then maximum current can be drawn from the other output. In all cases the maximum current that can be drawn from any individual channel is:

$$(+I_{OUT}) + (-I_{OUT}) < 60mA$$

It should be noted that many analog circuit functions do not simultaneously draw equal current from both the positive and negative supplies.

HIGH VOLTAGE TESTING

Burr Brown Corporation has adopted a partial discharge test criterion that is similar to the German VDE0884 optocoupler standard. This method requires that less than 5pC partial discharge across the isolation barrier with 1200 Vrms 60Hz applied. This criterion confirms transient overvoltage (1.6 x 750 Vrms) protection without damage to the PWS727 or PWS728. Lifetest results verify the absence of high-voltage breakdown under continuous rated voltage and maximum temperature.

The minimum AC barrier voltage that initiates partial discharge above 5pC is defined as the “inception voltage”. Decreasing the barrier voltage to a lower level is required before partial discharge ceases and is known as “extinction voltage”. We have developed a package insulation system to yield an inception voltage greater than 1200 Vrms so that transient voltages below this level will not damage the isolation barrier. The extinction voltage is above 750 Vrms so that even overvoltage-induced partial discharge will cease once the barrier voltage is reduced to the rated value. Previous high voltage test methods relied on applying a large enough overvoltage (above rating) to break down marginal devices, but not so high as to damage good ones. Our partial discharge testing gives us more confidence in barrier reliability than breakdown/no breakdown criteria.