



# EB Series

## 25W TO 30W SINGLE DC/DC CONVERTER

2"×1"×0.45"

### Key Features

- Efficiency up to 91%
- Six-sided shielding
- Output synchronous rectification
- 2:1 input voltage range
- Input-to-output isolation
- Soft start
- External synchronization
- Short circuit protection
- Thermal protection
- Industry standard pinout



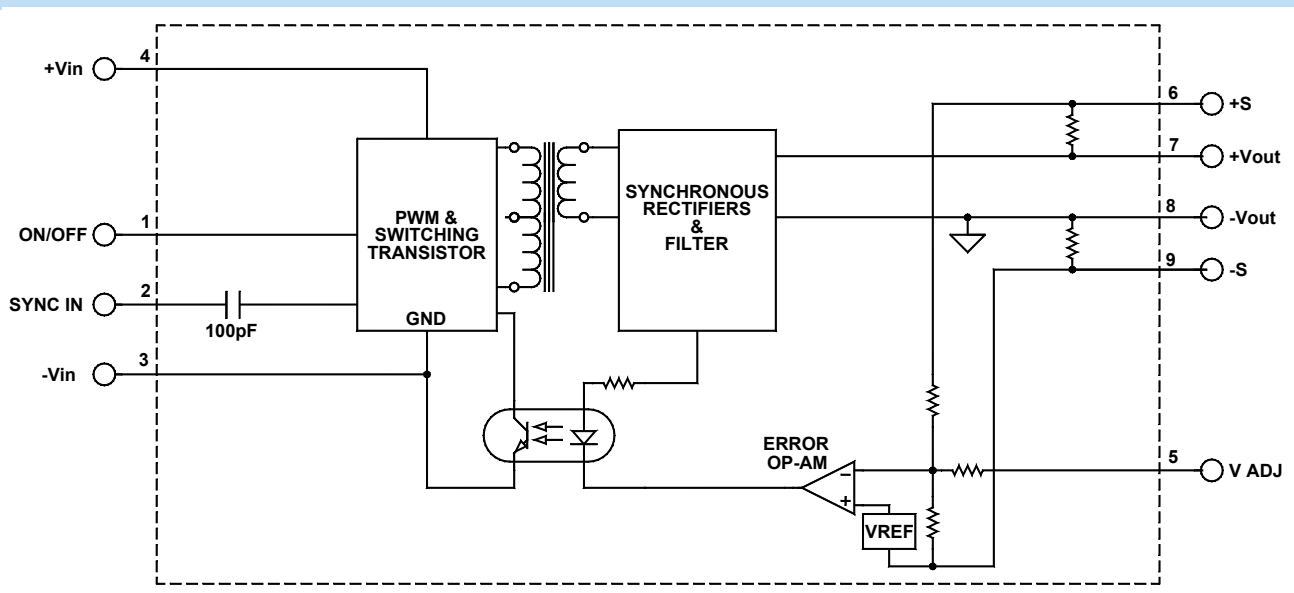
Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

### Applications

- Electronic Data Processing (EDP)
- Instrumentation/Industrial/Medical
- Communications
- Computers
- Fiber Optics

### Functional Description

The EB Series of isolated, single output DC/DC converters is based on patent-pending technology for synchronous rectification and noise reduction. The converters offer up to 30W of output power, a 2:1 input voltage range from  $9V_{IN}$  to  $72V_{IN}$  and an output voltage from  $2.5V_{OUT}$  to  $15V_{OUT}$ . Standard features include input undervoltage protection, output overvoltage protection, external synchronization, and six-sided shielding.



Typical Block Diagram

Unless otherwise specified, all parameters are given under typical ambient temperature of +25°C with an airflow rate = 400LFM. With the given power derating, the operating range is -40°C to +125°C. Specifications subject to change without notice.

## Electrical Specifications

### INPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range	See Model Selection Guide				
Input Startup Voltage, 12V <sub>IN</sub>		8		9	Vdc
Input Startup Voltage, 24V <sub>IN</sub>				17	Vdc
Input Startup Voltage, 48V <sub>IN</sub>				35	Vdc
Undervoltage Shutdown, 12V <sub>IN</sub>		7		9	Vdc
Undervoltage Shutdown, 24V <sub>IN</sub>		16			Vdc
Undervoltage Shutdown, 48V <sub>IN</sub>		32			Vdc
Input Filter	Capacitor				
No Load Input Current	See Model Selection Guide				
Input Surge Current (20µs Spike)				10	A
Short Circuit Current Limit			125	150	% I <sub>IN</sub> Max
Off State Current			150		µA
Remote ON/OFF Control					
Supply ON	Pin 3 Open (Open circuit voltage: 10V Max.)				
Supply OFF		0		0.6	Vdc
Logic Input Reference					
Logic Compatibility	TTL Open Collector or CMOS Open Drain				

### OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Voltage and Current Ratings	See Model Selection Guide				
Output Voltage Accuracy			0.5	1	%
Output Voltage Adjustment			±5		%
Ripple & Noise	Without external capacitor		1	2	%V <sub>PP</sub> of V <sub>OUT</sub>
Line Regulation	Minimum V <sub>IN</sub> to maximum V <sub>IN</sub>		±0.04	±0.1	%
Load Regulation	NL to FL		0.05	0.1	%
Temperature Coefficient @ FL			0.02		%/°C
Transient Response Time	50% FL to FL to 50% FL, See Figure 3B		25	100	µS
Short Circuit Protection	By input current limiting				
Turn On Delay with Soft Start	See Figure 2B		30	40	mS
Output Overvoltage Protection	None,				

### GENERAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency (at full power)	See Model Selection Guide				
Isolation Voltage (1 min.), Input to Output	All models		1500		Vdc
Isolation Resistance			10 <sup>9</sup>		Ω
Isolation Capacitance			300		pF
Switching Frequency (F <sub>c</sub> )		160	180	200	kHz
External Sync Frequency (F <sub>e</sub> )	F <sub>e</sub> < F <sub>c</sub> See <b>External Synchronization</b> , Figure 5	320	380	420	kHz

### ENVIRONMENTAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature Range (Ambient)	Industrial, See Figure 1	-40		+71	°C
Storage Temperature Range		-55		+125	°C
Maximum Operating Case Temperature <sup>1</sup>				110	°C
Derating	See Figure 1				
Cooling	See Figure 1				
MTBF	per MIL-HNBK-217 (Ground benign, +25°C)				
Shielding Connection	-Vin for 12Vin, 24Vin				
Shielding Connection	+Vin for 48Vin				

## PHYSICAL CHARACTERISTICS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (L×W×H)	2.00×1.00×0.450 in. (50.80×25.40×11.43mm)				
Weight	1.3 oz. (37g)				

## Model Selection Guide

MODEL NUMBER	INPUT				Reflected Ripple <sup>3</sup> (mA <sub>pp</sub> )	OUTPUT		
	Voltage (Vdc)		Current (mA)			Voltage (Vdc)	Current (A)	Efficiency (% at 100% FL)
	Nominal	Range	No Load	Full Load <sup>2</sup>				
EB30S2.5/12	12	9.5–18	80	2314	100	2.5	10	91
EB30S3.3/12	12	9.5–18	80	2266	100	3.3	7.5	91
EB30S5/12	12	9.5–18	80	2314	100	5	5	90
EB30S12/12	12	9.5–18	80	2222	100	12	2	90
EB30S15/12	12	9.5–18	80	2305	100	15	1.66	90
EB30S2.5/24	24	18–36	40	1350	40	2.5	12	91
EB30S3.3/24	24	18–36	40	1350	40	3.3	9	91
EB30S5/24	24	18–36	40	1400	40	5	6	90
EB30S6/24	24	18.5–36	80	1400	40	6	5	90
EB30S12/24	24	18–36	40	1400	40	12	2.5	90
EB30S15/24	24	18–36	40	1400	40	15	2	90
EB30S2.5/48	48	36–72	40	685	40	2.5	12	91
EB30S3.3/48	48	36–72	40	685	40	3.3	9	91
EB30S5/48	48	36–72	40	694	40	5	6	90
EB30S12/48	48	36–72	40	685	40	12	2.5	91
EB30S15/48	48	36–72	40	700	40	15	2	89

Contact factory for custom input and output voltage combinations

<sup>1</sup> When the converter enters thermal protection mode, its duty cycle is reduced momentarily and will resume after its internal temperature (PWM) drops a few degrees (°C). The converter's output behaves similar to a hiccup short circuit mode.

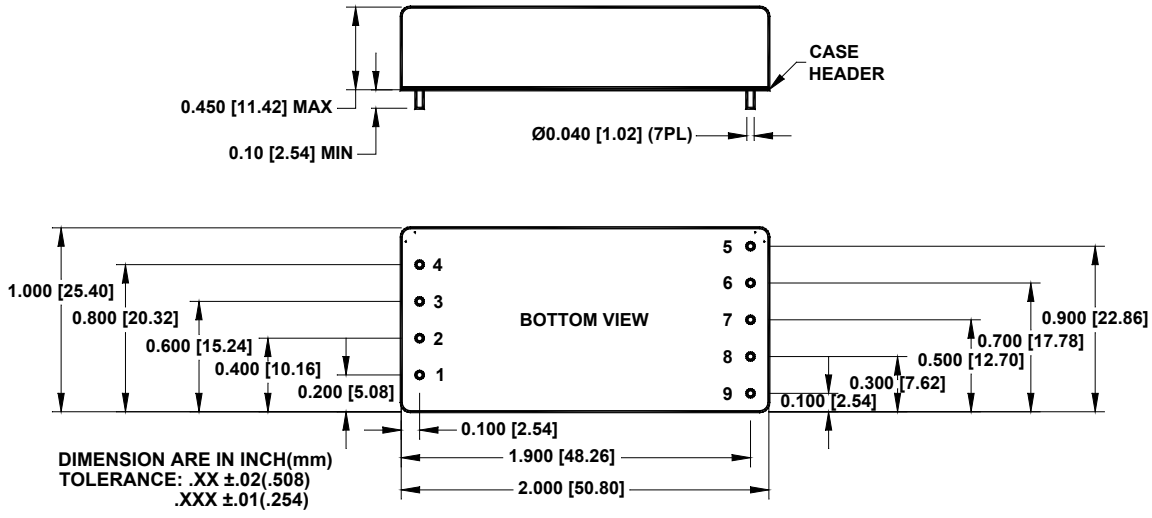
<sup>2</sup> The maximum input current at any given input range measured at minimum input voltage is given as  $1.6 \cdot I_{\text{NOMINAL}}$ . Nominal input current is the typical value measured at the input of the converter under full-load room temperature and nominal input voltage (12, 24 and 48Vdc).

<sup>3</sup> See Application Note DC-004: Thermal Considerations for DC/DC Converters.

### ORDERING GUIDE

EB 30 S 12/48 \_\_\_\_\_  
 Power \_\_\_\_\_ Input Voltage \_\_\_\_\_  
 Number of Outputs (S = Single) \_\_\_\_\_ Output Voltage \_\_\_\_\_

### MECHANICAL SPECIFICATIONS



Pin	Function
INPUTS	
1	ON/OFF
2	SYNC IN*
3	-V <sub>IN</sub>
4	+V <sub>IN</sub>
OUTPUTS	
5	V <sub>ADJ</sub>
6	+S
7	+V <sub>OUT</sub>
8	-V <sub>OUT</sub>
9	-S

\* Optional pins,  
See Ordering Guide

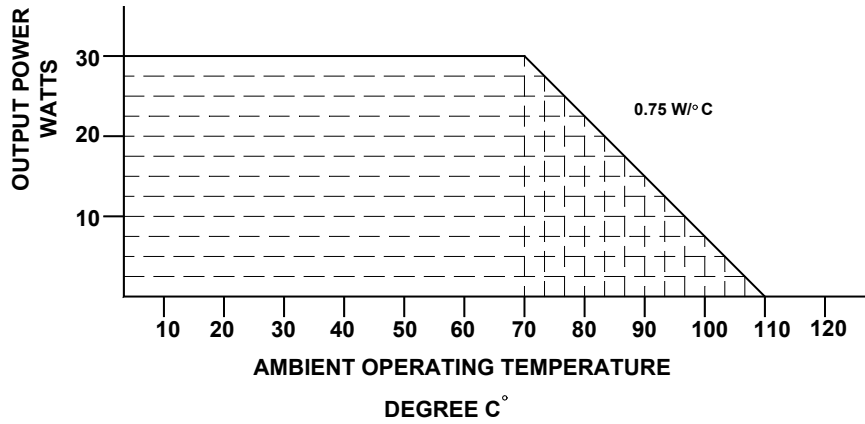


FIGURE 1. Worst case derating for the EB series

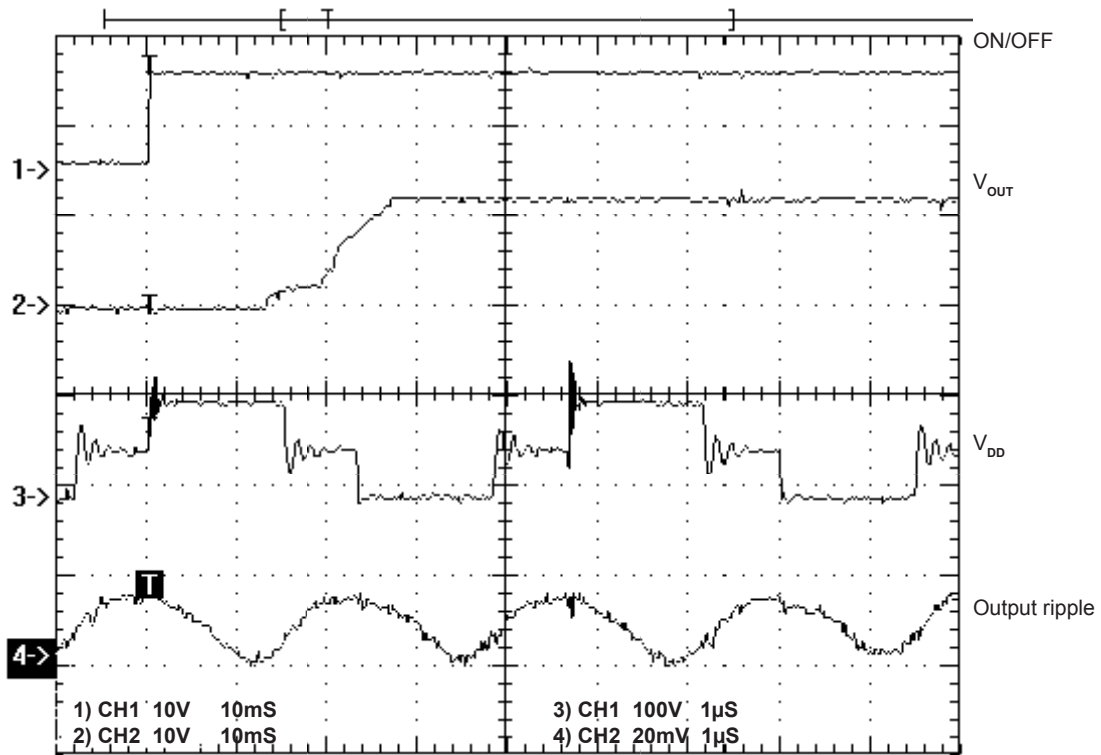
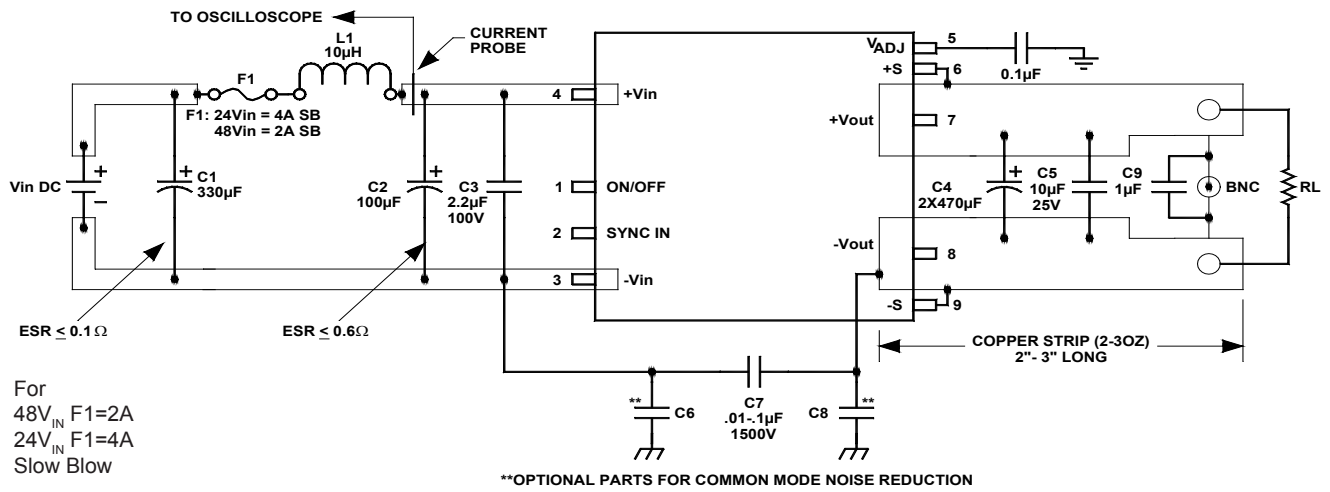


FIGURE 2B. Turn-on delay and output ripple of EB30S12/48

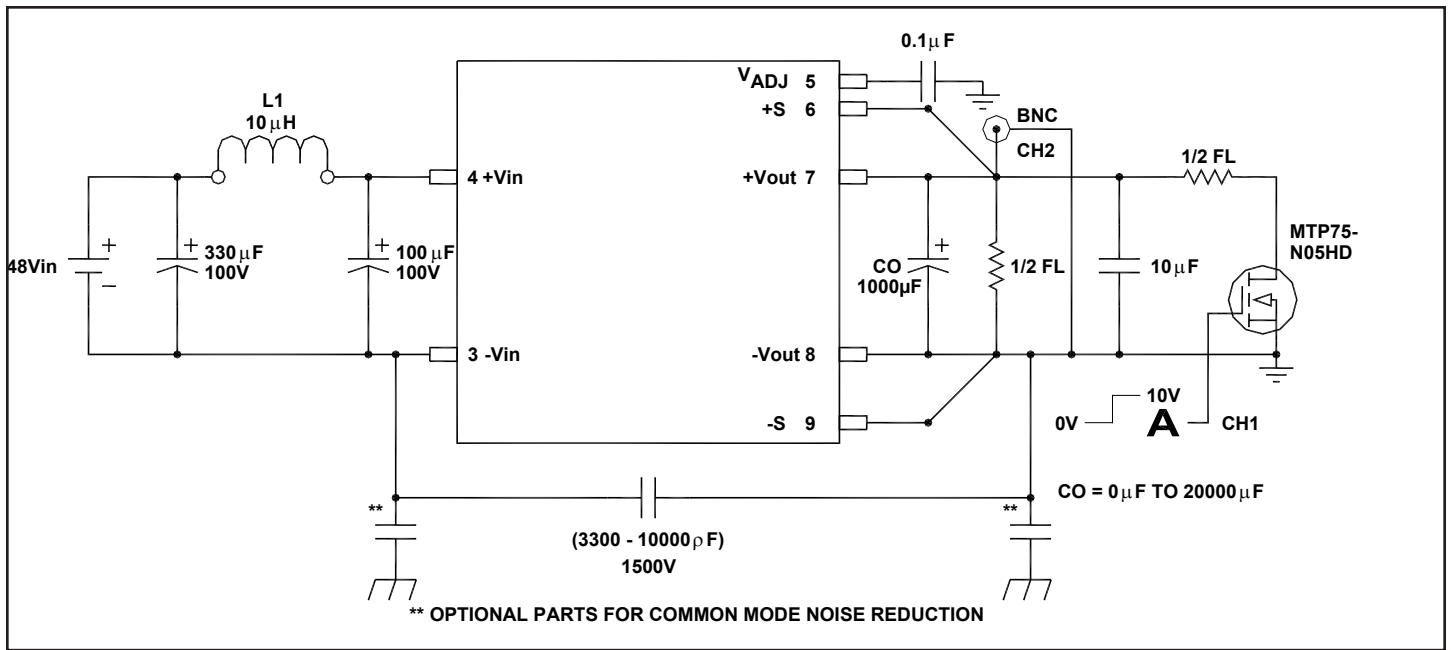


FIGURE 3A. Setup for transient response measurements

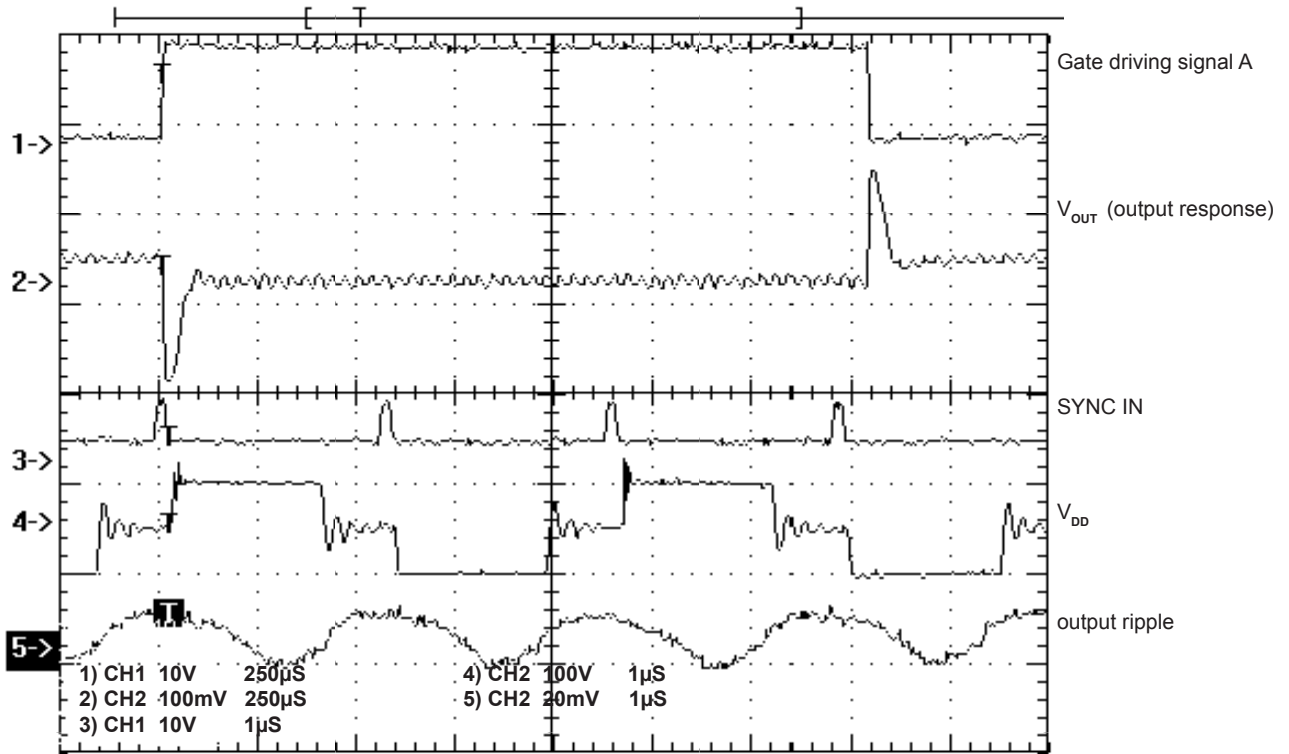


FIGURE 3B. Transient response 50% full load to full load to 50% full load output ripple of EB30S12/48

### EXTERNAL SYNCHRONIZATION

The converter can be synchronized to an external clock. The external clock MUST have a higher frequency than that of the converter's switching frequency. The amplitude of the external clock pulse must be 3.7 volts or greater and its duration between 15nS to 150nS for sync pulse detection.

The circuit in Figure 4 can be used to produce a 50nS to 150nS pulse from a square wave. The circuit will be turned on by the negative edge of the square wave and will stay on for approximately 50nS (depending on the  $R2 \cdot C1$  time constant) (See Figure 5).

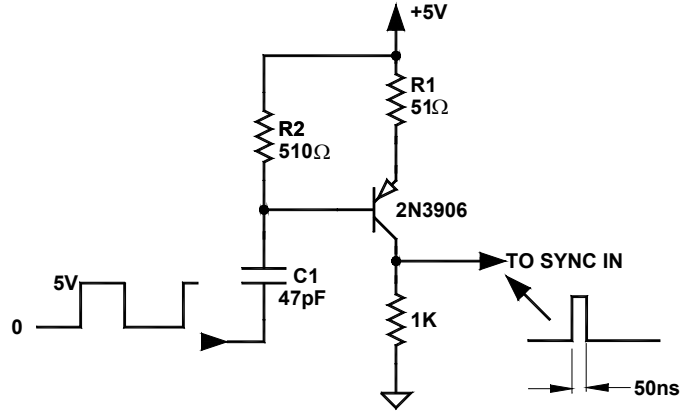


FIGURE 4. 50nS pulse generator from a square wave TTL/5V CMOS clock

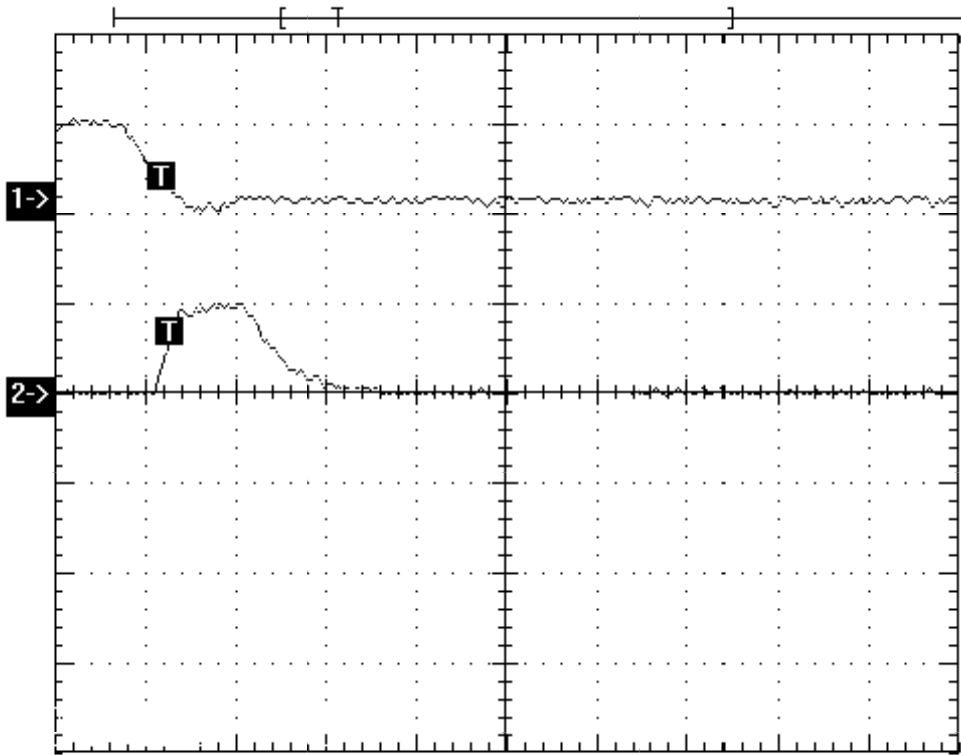


FIGURE 5. Waveforms generated from circuit in Figure 4