

MC34025, MC33025



The MC34025 series are high speed, fixed frequency, double-ended pulse width modulator controllers optimized for high frequency operation. They are specifically designed for Off-Line and DC-to-DC converter applications offering the designer a cost effective solution with minimal external components. These integrated circuits feature an oscillator, a temperature compensated reference, a wide bandwidth error amplifier, a high speed current sensing comparator, steering flip-flop, and dual high current totem pole outputs ideally suited for driving power MOSFETs.

Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle-by-cycle current limiting, and a latch for single pulse metering.

The flexibility of this series allows it to be easily configured for either current mode or voltage mode control.

Features

- 50 ns Propagation Delay to Outputs
- Dual High Current Totem Pole Outputs
- Wide Bandwidth Error Amplifier
- Fully-Latched Logic with Double Pulse Suppression
- Latching PWM for Cycle-By-Cycle Current Limiting
- Soft-Start Control with Latched Overcurrent Reset
- Input Undervoltage Lockout with Hysteresis
- Low Startup Current (500 μ A Typ)
- Internally Trimmed Reference with Undervoltage Lockout
- 45% Maximum Duty Cycle (Externally Adjustable)
- Precision Trimmed Oscillator
- Voltage or Current Mode Operation to 1.0 MHz
- Functionally Similar to the UC3825
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

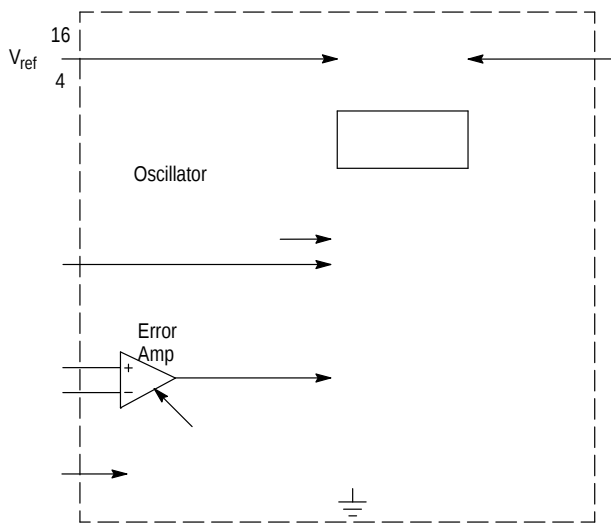


Figure 1. Simplified Application

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	30	V
Output Driver Supply Voltage	V_C	25	V
Output Current, Source or Sink (Note 1)	I_O	0.5 2.0	A
DC Pulsed (0.5 μ s)			
Current Sense, Soft-Start, Ramp, and Error Amp Inputs	V_{in}	-0.3 to +7.0	V
Error Amp Output and Soft-Start Sink Current	I_O	10	mA
Clock and R_T Output Current	I_{CO}	5.0	mA
Power Dissipation and Thermal Characteristics			
SO-16 Package (Case 751G)			
Maximum Power Dissipation @ $T_A = +25^\circ\text{C}$	P_D	862	mW
Thermal Resistance, Junction-to-Air	$R_{\theta JA}$	145	$^\circ\text{C/W}$
DIP Package (Case 648)			
Maximum Power Dissipation @ $T_A = +25^\circ\text{C}$	P_D	1.25	W
Thermal Resistance, Junction-to-Air	$R_{\theta JA}$	100	$^\circ\text{C/W}$
Operating Junction Temperature	T_J	+150	$^\circ\text{C}$
Operating Ambient Temperature (Note 2)	T_A	0 to +70 -40 to +105	$^\circ\text{C}$
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Storage Temperature Range	T_{stg}	-55 to +150	

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ELECTRICAL CHARACTERISTICS ($V_{CC} = 15\text{ V}$, $R_T = 3.65\text{ k}\Omega$, $C_T = 1.0\text{ nF}$, for typical values $T_A = +25^\circ\text{C}$, for min/max values T_A is the operating ambient temperature range that applies [Note 4], unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
ERROR AMPLIFIER SECTION					
Input Offset Voltage	V_{IO}	–	–	15	mV
Input Bias Current	I_{IB}	–	0.6	3.0	μA
Input Offset Current	I_{IO}	–	0.1	1.0	μA
Open-Loop Voltage Gain ($V_O = 1.0\text{ V to }4.0\text{ V}$)	A_{VOL}	60	95	–	dB
Gain Bandwidth Product ($T_J = +25^\circ\text{C}$)	GBW	4.0	8.3	–	MHz
Common Mode Rejection Ratio ($V_{CM} = 1.5\text{ V to }5.5\text{ V}$)	CMRR	75	95	–	dB
Power Supply Rejection Ratio ($V_{CC} = 10\text{ V to }30\text{ V}$)	PSRR	85	110	–	dB
Output Current, Source ($V_O = 4.0\text{ V}$) Sink ($V_O = 1.0\text{ V}$)	I_{Source} I_{Sink}	0.5 1.0	3.0 3.6	– –	mA
Output Voltage Swing, High State ($I_O = -0.5\text{ mA}$) Low State ($I_O = 1.0\text{ mA}$)	V_{OH} V_{OL}	1.5 0	2.7 0.4	3.8 1.0	V
Slew Rate					V/ μs

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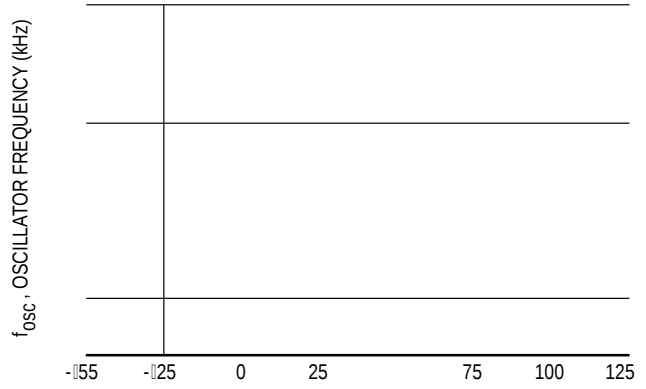
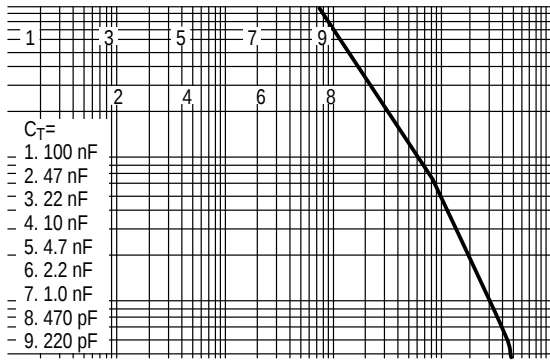
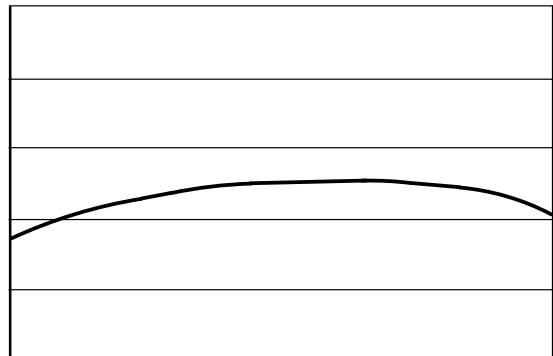
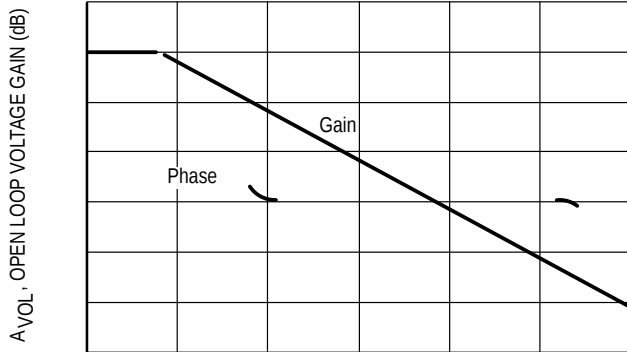


Figure 2. Timing Resistor versus Oscillator Frequency



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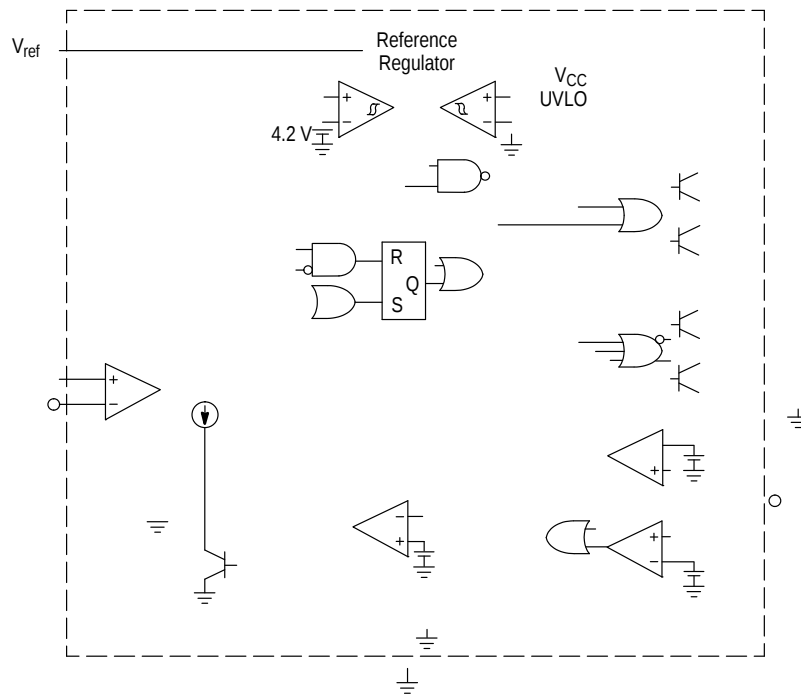


Figure 19. Representative Block Diagram

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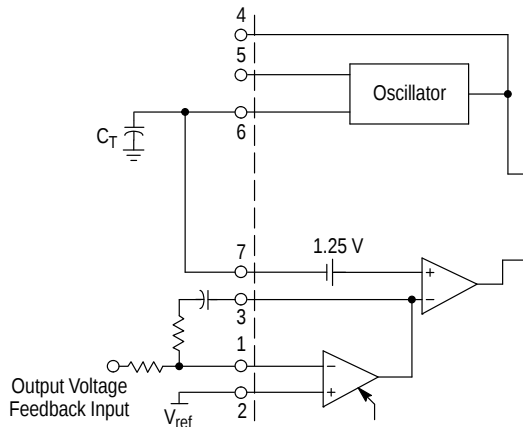
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If the voltage at this pin exceeds 1.4 V, the second comparator is activated. This comparator sets a latch which, in turn, causes the Soft-

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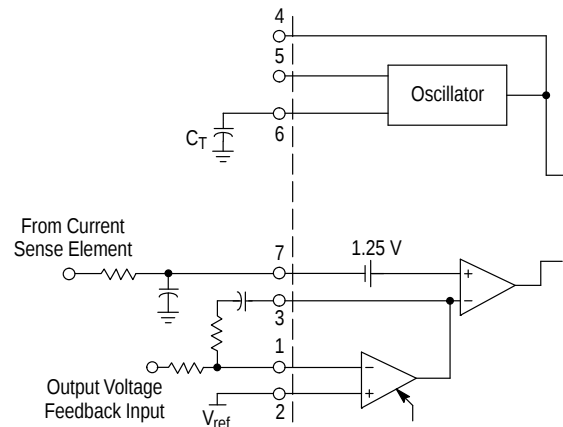
PIN FUNCTION DESCRIPTION

Pin No.	Function	Description
1	Error Amp Inverting Input	This pin is usually used for feedback from the output of the power supply.
2	Error Amp Noninverting Input	This pin is used to provide a reference in which an error signal can be produced on the output of the error amp. Usually this is connected to V_{ref} , however an external reference can also be used.
3	Error Amp Output	This pin is provided for compensating the error amp for poles and zeros encountered in the power supply system, mostly the output LC filter.
4	Clock	This is a bidirectional pin used for synchronization.
5	R_T	The value of R_T sets the charge current through timing Capacitor, C_T .
6	C_T	In conjunction with R_T , the timing Capacitor sets the switching frequency. Because this part is a push-pull output, each output runs at one-half the frequency set at this pin.
7	Ramp Input	For voltage mode operation this pin is connected to C_T . For current mode operation this pin is connected through a filter to the current sensing element.
8	Soft-Start	A capacitor at this pin sets the Soft-Start time.
9	Current Limit/Shutdown	This pin has two functions. First, it provides cycle-by-cycle current limiting. Second, if the current is excessive, this pin will reinitiate a Soft-Start cycle.
10	Ground	This pin is the ground for the control circuitry.
11	Output A	This is a high current totem pole output.
12	Power Ground	This is a separate power ground return that is connected back to the power source. It is used to reduce the effects of switching transient noise on the control circuitry.
13	V_C	This is a separate power source connection for the outputs that is connected back to the power source input. With a separate power source connection, it can reduce the effects of switching transient noise on the control circuitry.
14	Output B	This is a high current totem pole output.
15	V_{CC}	This pin is the positive supply of the control IC.
16	V_{ref}	This is a 5.1 V reference. It is usually connected to the noninverting input of the error amplifier.



In voltage mode operation, the control range on the output of the Error Amplifier from 0% to 90% duty cycle is from 2.25 V to 4.05 V.

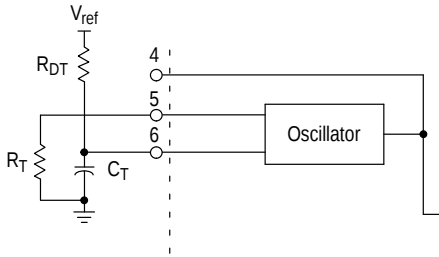
Figure 22. Voltage Mode Operation



In current mode control, an RC filter should be placed at the ramp input to filter the leading edge spike caused by turn-on of a power MOSFET.

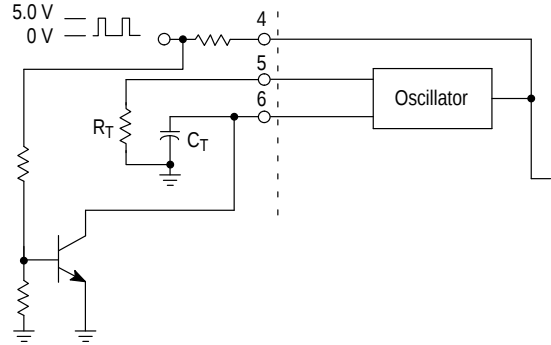
Figure 23. Current Mode Operation

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Additional dead time can be added by the addition of a dead time resistor from V_{ref} to C_T . See text on oscillator section for more information.

Figure 24. Dead Time Addition



The sync pulse fed into the clock pin must be at least 3.9 V. R_T and C_T need to be set 10% slower than the sync frequency. This circuit is also used in voltage mode operation for master/slave operation. The clock signal would be coming from the master which is set at the desired operating frequency, while the slave is set 10% slower.

Figure 25. External Clock Synchronization

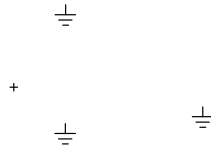


Figure 26. Resistive Current Sensing

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▷

7
0
0
3

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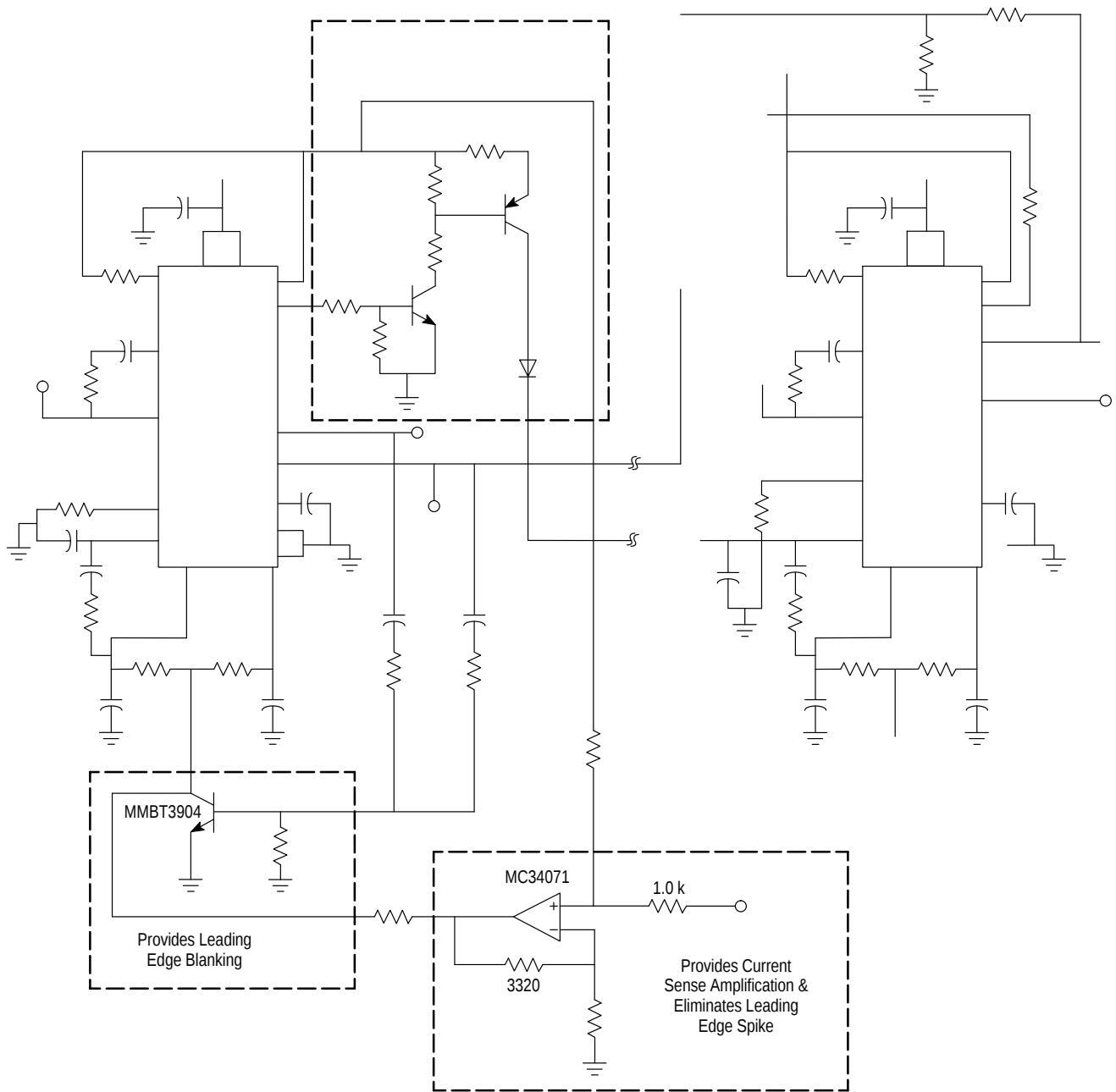
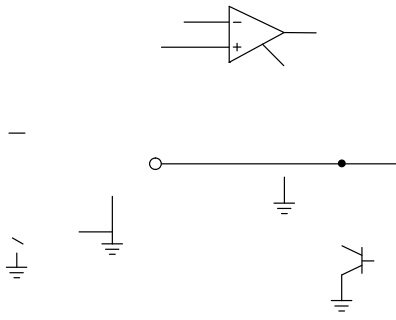
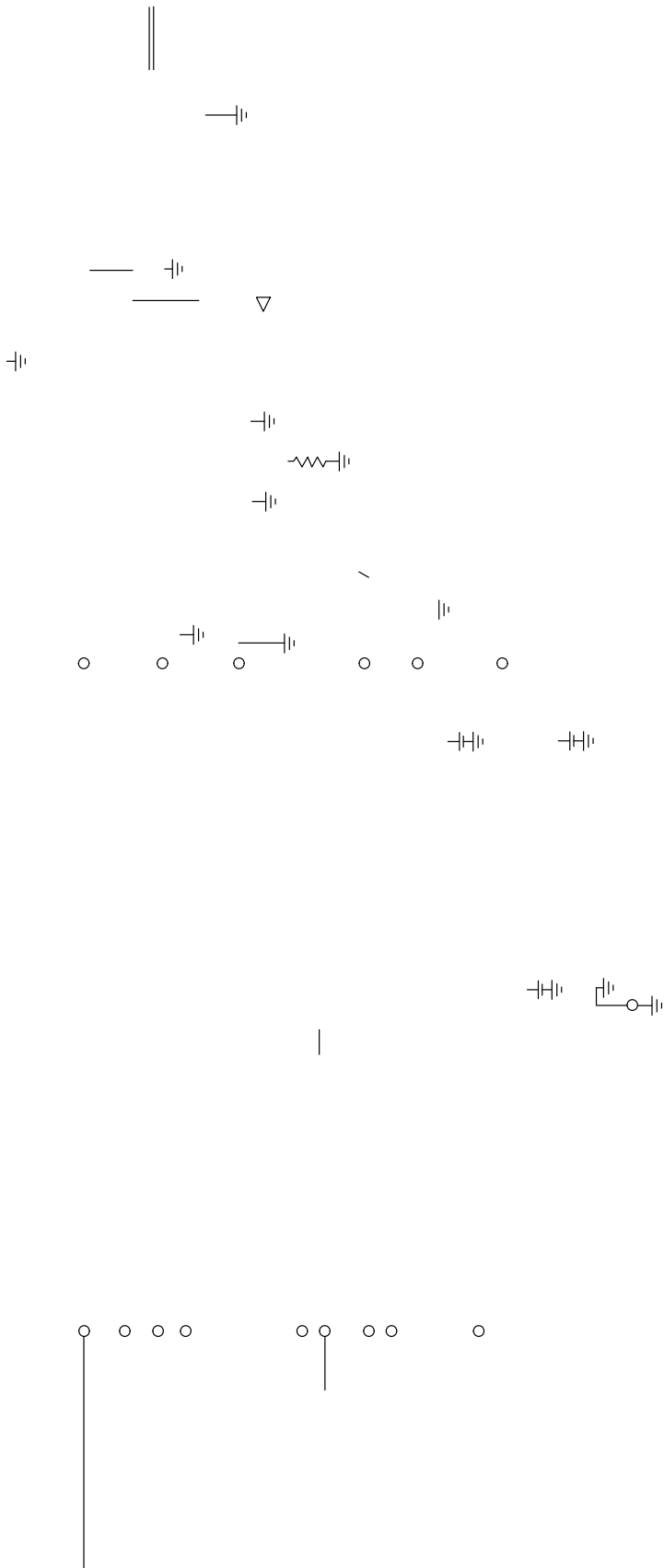


Figure 31. Synchronization Over Long Distances

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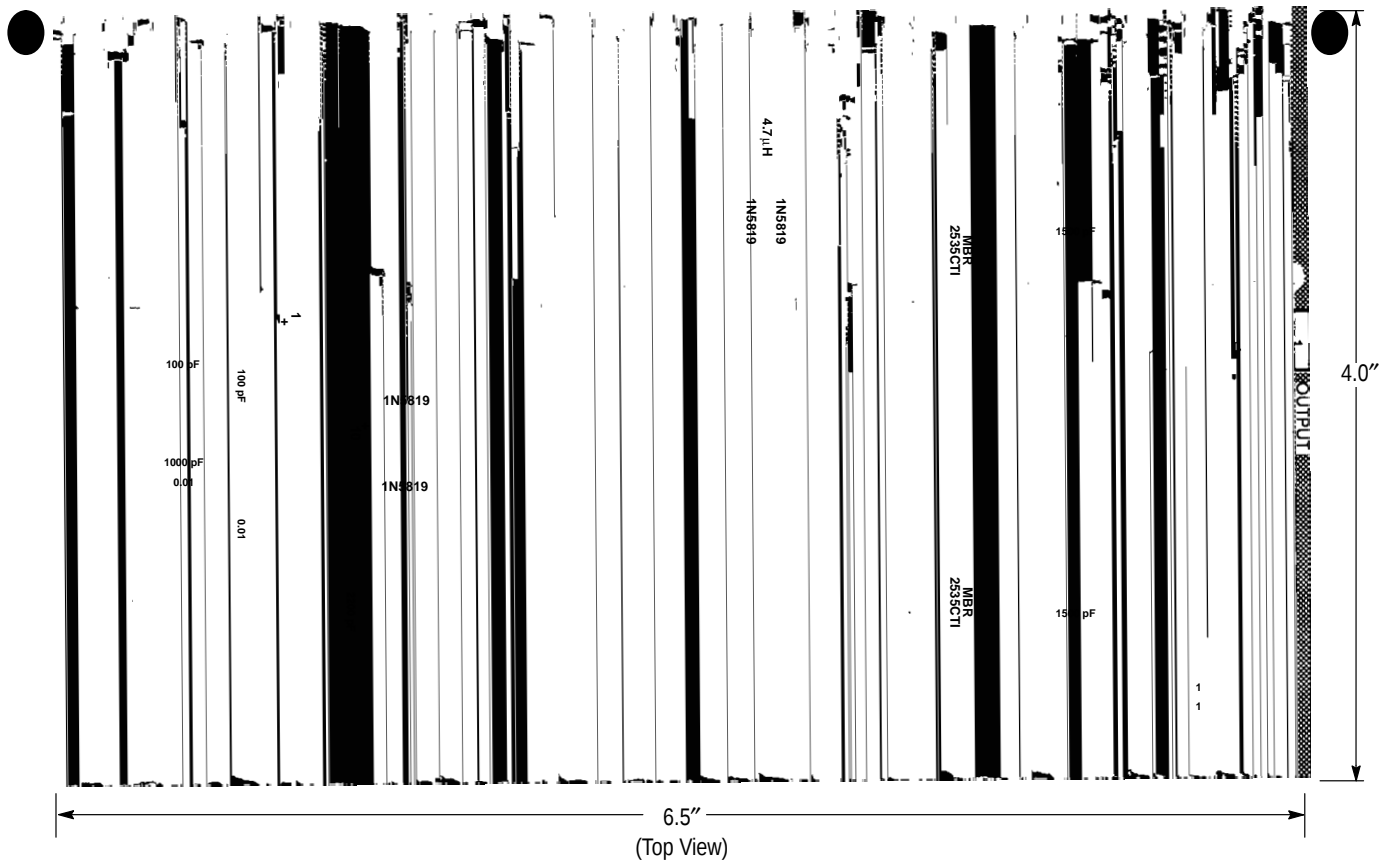


Figure 38. PC Board With Components



(Top View)

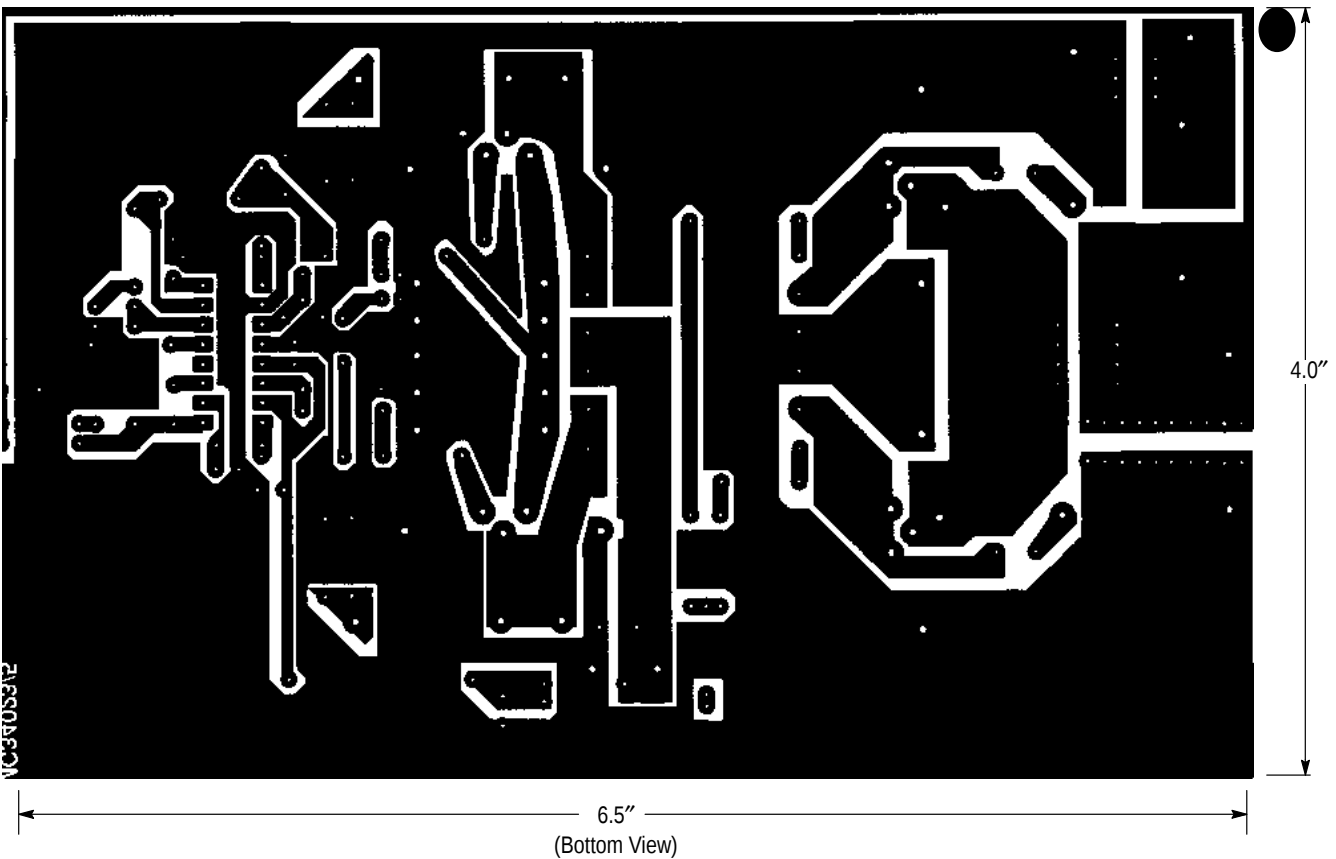


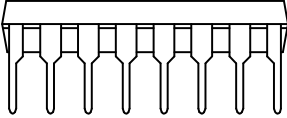
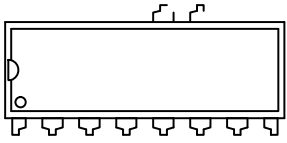
Figure 39. PC Board Without Components

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ORDERING INFORMATION

Device	Package	Shipping†
MC33025DWG	SOIC-16WB (Pb-Free)	47 Units / Rail
MC33025DWR2G	SOIC-16WB (Pb-Free)	1000 Units / Tape & Reel
MC33025PG	PDIP-16 (Pb-Free)	25 Units / Rail
MC34025DWG	SOIC-16WB (Pb-Free)	47 Units / Rail
MC34025DWR2G	SOIC-16WB (Pb-Free)	1000 Units / Tape & Reel
MC34025PG	PDIP-16 (Pb-Free)	25 Units / Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



SOIC

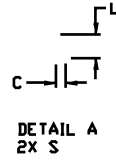
16

9



1

8



-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

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