

# CA3059

## Zero Voltage Switch

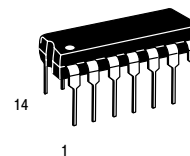
This series is designed for thyristor control in a variety of AC power switching applications for AC input voltages of 24 V, 120 V, 208/230 V, and 277 V @ 50/60 Hz.

**Applications:**

- Relay Control
- Valve Control
- Heater Control
- Lamp Control
- On–Off Motor Switching
- Differential Comparator with Self–Contained Power Supply for Industrial Applications
- Synchronous Switching of Flashing Lights

### ZERO VOLTAGE SWITCH

#### SEMICONDUCTOR TECHNICAL DATA



PLASTIC PACKAGE  
CASE 646

#### ORDERING INFORMATION

Device	Operating Temperature Range	Package
CA3059	T <sub>A</sub> = -40° to +85°C	Plastic DIP

#### FUNCTIONAL BLOCK DESCRIPTION

- 1. Limiter–Power Supply** — Allows operation of the CA3059 directly from an AC line. Suggested dropping resistor (R<sub>S</sub>) values are given in the table below.
- 2. Differential On/Off Sensing Amplifier** — Tests for condition of external sensors or input command signals. Proportional control capability or hysteresis may be implemented using this block.
- 3. Zero–Crossing Detector** — Synchronizes the output pulses to the zero voltage point of the AC cycle. This synchronization eliminates RFI when used with resistive loads.
- 4. Triac Drive** — Supplies high–current pulses to the external power controlling thyristor.
- 5. Protection Circuit** — A built–in circuit may be actuated, if the sensor opens or shorts, to remove the drive current from the external triac.
- 6. Inhibit Capability** — Thyristor firing may be inhibited by the action of an internal diode gate at Pin 1.
- 7. High Power DC Comparator Operation** — Operation in this mode is accomplished by connecting Pin 7 to Pin 12 (thus overriding the action of the zero–crossing detector). When Pin 13 is positive with respect to Pin 9, current to the thyristor is continuous.

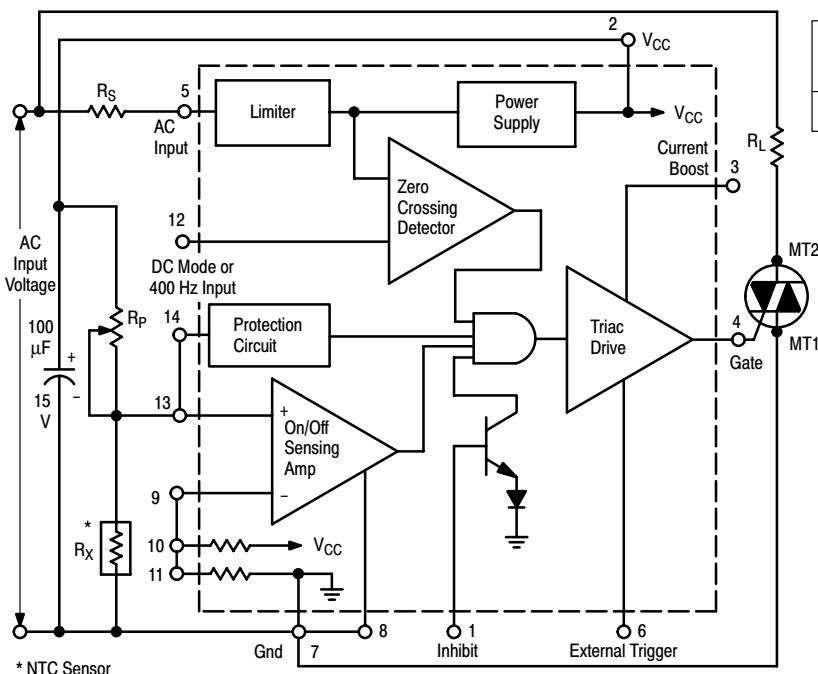


Figure 1. Representative Block Diagram

AC Input Voltage (50/60 Hz) V <sub>ac</sub>	Input Series Resistor (R <sub>S</sub> ) kΩ	Dissipation Rating for R <sub>S</sub> W
24	2.0	0.5
120	10	2.0
208/230	20	4.0
277	25	5.0

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
DC Supply Voltage (Between Pins 2 and 7)	$V_{CC}$	12	Vdc
DC Supply Voltage (Between Pins 2 and 8)	$V_{CC}$	12	Vdc
Peak Supply Current (Pins 5 and 7)	$I_{5,7}$	$\pm 50$	mA
Fail-Safe Input Current (Pin 14)	$I_{14}$	2.0	mA
Output Pulse Current (Pin 4) (Note 1)	$I_{out}$	150	mA
Junction Temperature	$T_J$	150	$^{\circ}C$
Operating Temperature Range	$T_A$	- 40 to + 85	$^{\circ}C$
Storage Temperature Range	$T_{stg}$	- 65 to + 150	$^{\circ}C$

ELECTRICAL CHARACTERISTICS (Operation @ 120 Vrms, 50–60 Hz,  $T_A = 25^{\circ}C$  [Note 2])

Characteristic	Figure	Symbol	Min	Typ	Max	Unit
DC Supply Voltage Inhibit Mode $R_S = 10\text{ k}$ , $I_L = 0$ $R_S = 5.0\text{ k}$ , $I_L = 2.0\text{ mA}$ Pulse Mode $R_S = 10\text{ k}$ , $I_L = 0$ $R_S = 5.0\text{ k}$ , $R_L = 2.0\text{ mA}$	2	$V_S$	6.1 —	6.5 6.1	7.0 —	Vdc
Gate Trigger Current ( $V_{GT} = 1.0\text{ V}$ , Pins 3 and 2 connected)	3	$I_{GT}$	—	160	—	mA
Peak Output Current, Pulsed With Internal Power Supply, $V_{GT} = 0$ Pin 3 Open Pins 3 and 2 Connected With External Power Supply, $V_{CC} = 12\text{ V}$ , $V_{GT} = 0$ Pin 3 Open Pins 3 and 2 Connected	3 4	$I_{OM}$	50 90 — —	125 190 230 300	— — — —	mA
Inhibit Input Ratio (Ratio of Voltage @ Pin 9 to Pin 2)	5	$V_9/V_2$	0.465	0.485	0.520	—
Total Gate Pulse Duration ( $C_{Ext} = 0$ ) Positive dv/dt Negative dv/dt	6	$t_p$ $t_n$	70 70	100 100	140 140	$\mu s$
Pulse Duration After Zero Crossing ( $C_{Ext} = 0$ , $R_{Ext} = \infty$ ) Positive dv/dt Negative dv/dt	6	$t_{p1}$ $t_{n1}$	— —	50 60	— —	$\mu s$
Output Leakage Current Inhibit Mode (Note 3)	3	$I_4$	—	0.001	10	$\mu A$
Input Bias Current	7	$I_{IB}$	—	0.15	1.0	$\mu A$
Common Mode Input Voltage Range (Pins 9 and 13 Connected)	—	$V_{CMR}$	—	1.4 to 5.0	—	Vdc
Inhibit Input Voltage	8	$V_1$	—	1.4	1.6	Vdc
External Trigger Voltage	—	$V_6-V_4$	—	1.4	—	Vdc

**NOTES:** 1. Care must be taken, especially when using an external power supply, that total package dissipation is not exceeded.

2. The values given in the Electrical Characteristics Table at 120 V also apply for operation at input voltages of 24 V, 208/230 V, and 277 V, except for Pulse Duration test. However, the series resistor ( $R_S$ ) must have the indicated value, shown in Table A for the specified input voltage.

3.  $I_4$  out of Pin 4, 2.0 V on Pin 1,  $S_1$  position 2.

TEST CIRCUITS

(All resistor values are in ohms)

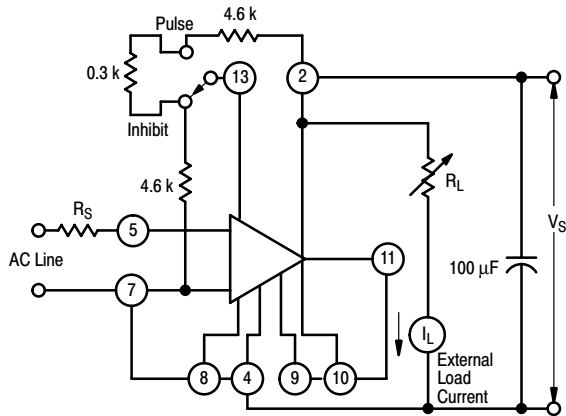


Figure 2. DC Supply Voltage

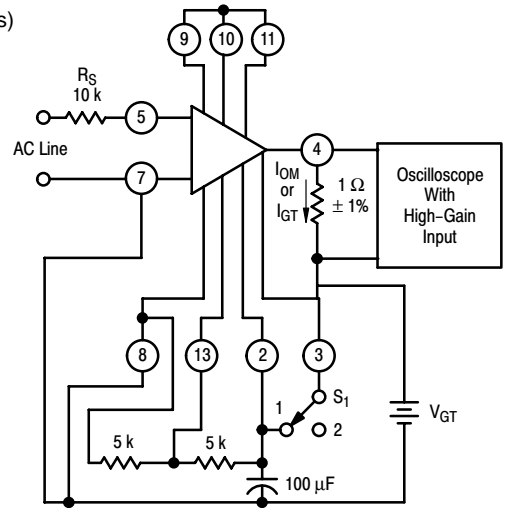


Figure 3. Peak Output (Pulsed) and Gate Trigger Current with Internal Power Supply

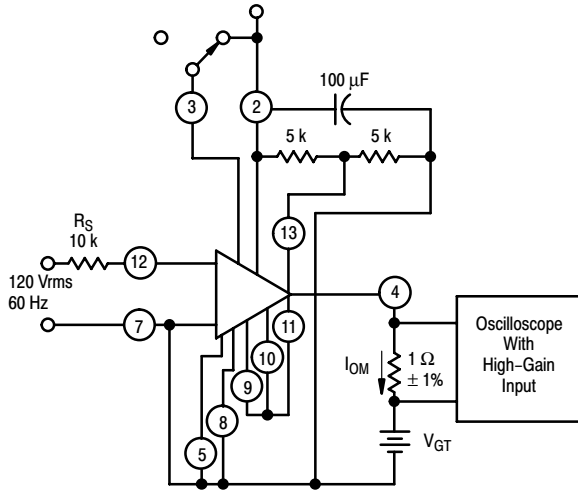


Figure 4. Peak Output Current (Pulsed) with External Power Supply

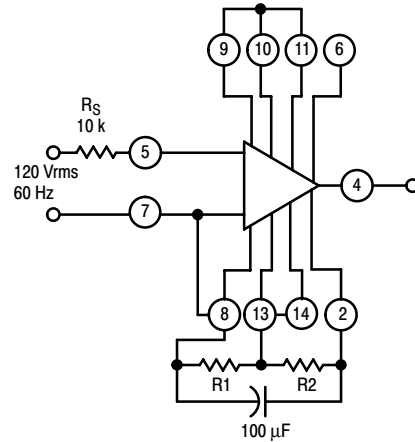


Figure 5. Input Inhibit Ratio

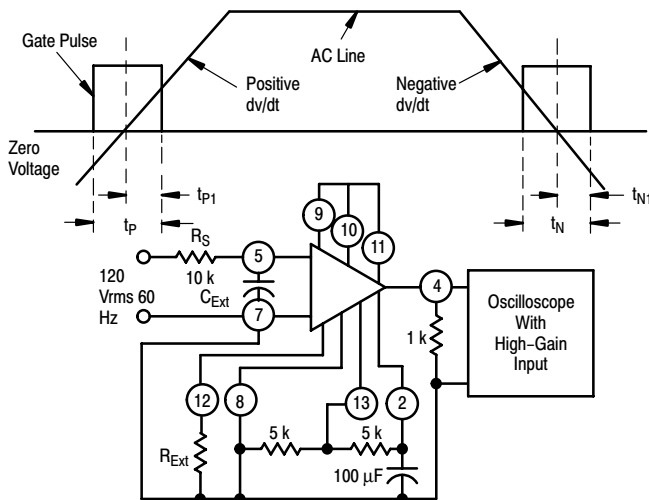


Figure 6. Gate Pulse Duration Test Circuit with Associated Waveform

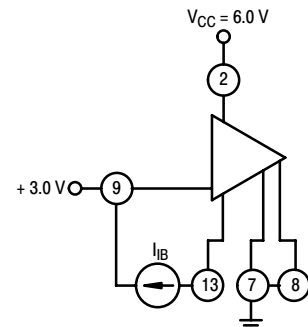


Figure 7. Input Bias Current Test Circuit

TYPICAL CHARACTERISTICS

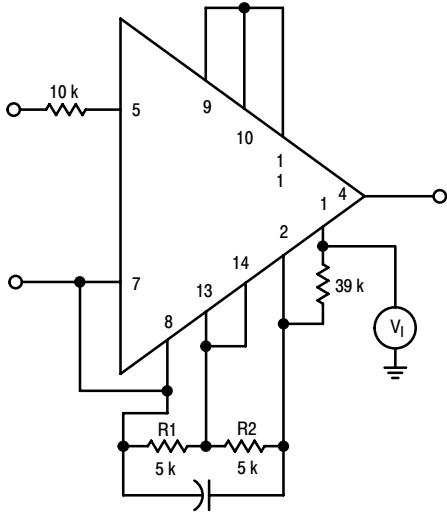


Figure 8. Inhibit Input Voltage Test

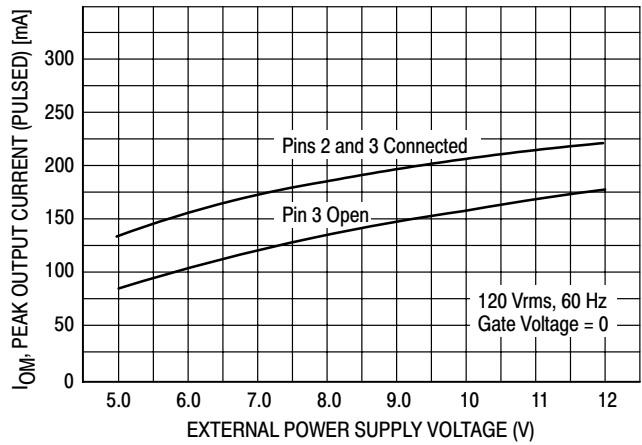


Figure 9. Peak Output Current (Pulsed) versus External Power Supply Voltage

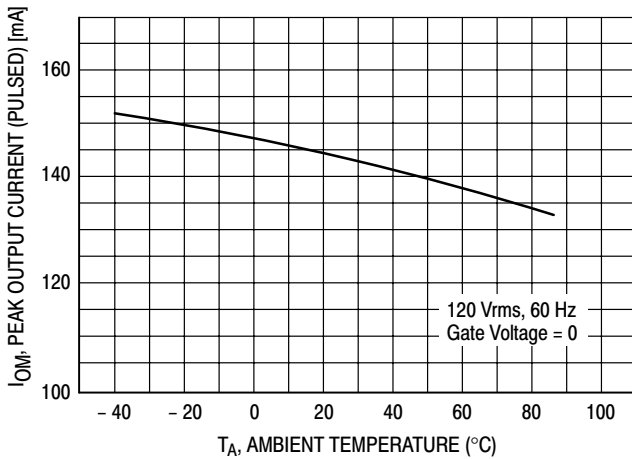


Figure 10. Peak Output Current (Pulsed) versus Ambient Temperature

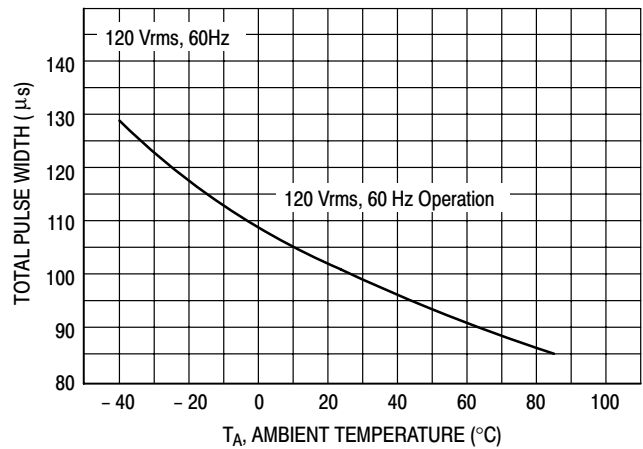


Figure 11. Total Pulse Width versus Ambient Temperature

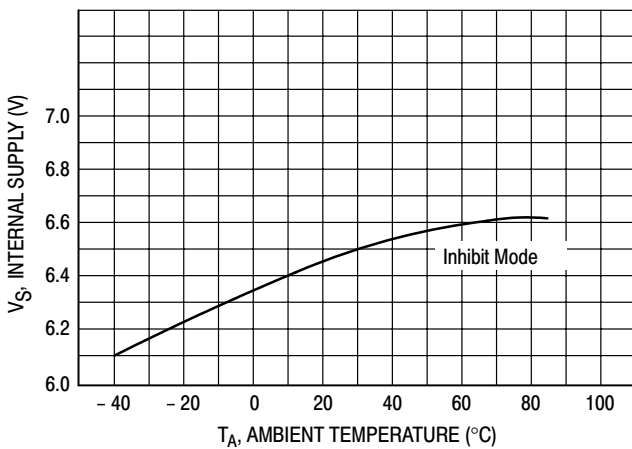


Figure 12. Internal Supply versus Ambient Temperature

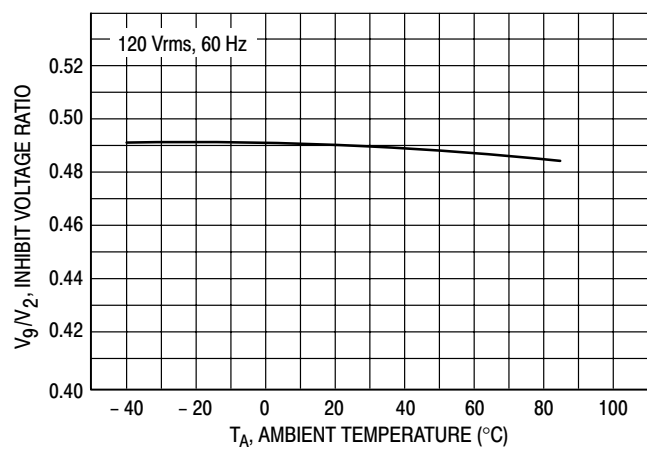


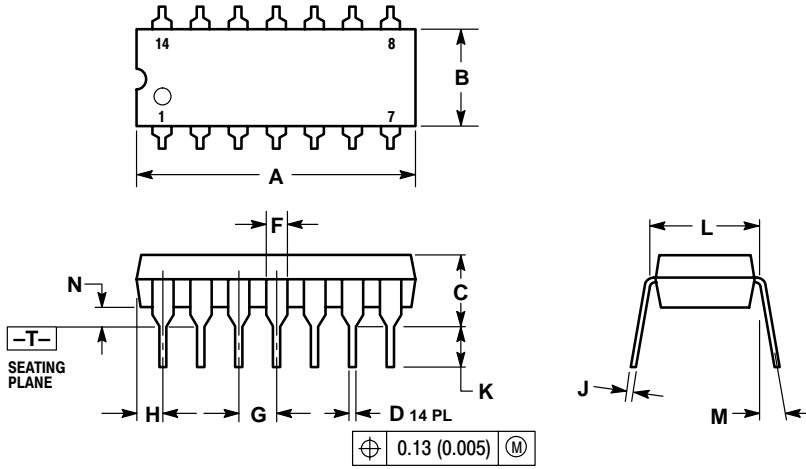
Figure 13. Inhibit Voltage Ratio versus Ambient Temperature



# CA3059

## PACKAGE DIMENSIONS

PLASTIC PACKAGE  
CASE 646-06  
ISSUE M




### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	18.80
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.290	0.310	7.37	7.87
M	---	10°	---	10°
N	0.015	0.039	0.38	1.01

**Notes**

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