Shanghai Belling Co., Ltd.

Photo Smoke Detector Control IC with hush
BL59A65

DATASHEET

Introduction:

The BL59A65 is a low-current BiCMOS circuit providing all of the features for a photoelectric type smoke detector. BL59A65 can be used in conjunction with an infrared photoelectric chamber to sense scattered light from smoke particles. Special features are incorporated in the design to facilitate calibration and testing of the finished detector.

Features:

- 6 V to 12 V Operating Voltage Range
- Supply Voltage current：less than 10uA
- Internal Timer & Control for Reduced Sensitivity
- Operating Temperature Range：－25～75℃
- Power-ON Reset
- ESD and Latch-up Protection
- Piezoelectric Horn Driver
- Interconnect Up to 50 Detectors
- Continuous Modulated Tone Output For a Local or Remote Alarm Condition
- Package Type: DIP16; SOP16

Pin Configuration:

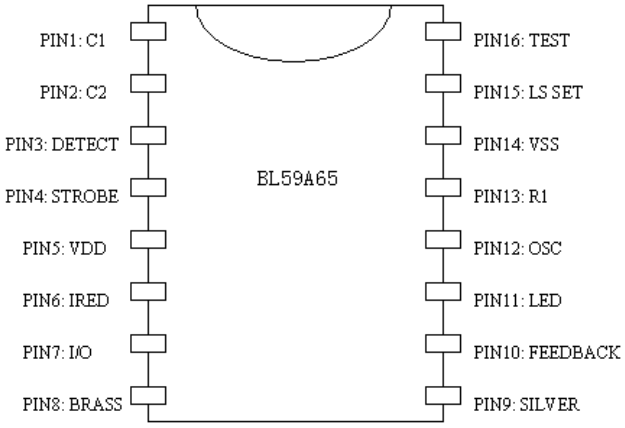


Fig.1 Pin Configuration

MAXIMUM RATINGS (Voltage referenced to Vss**)**

Symbol	Parameter	Range	Unit
VDD	Supply Voltage	-0.5～＋15	V
VIN	Input Voltage	-0.3～VDD＋0.3	V
IIN	Input Current	10	mA
T_A	Operating Temperature	-25 ～ +75	℃
Tstg	Storage Temperature	-55 ～ +125	℃
TL	Welding Temperature	260	℃

PIN FUNCTIONAL DESCRIPTION

Pin No.	Pin symbol	Input/Output	Function Description	
1 ,2	C1 , C2		External capacitor connected to the pins	A capacitor connected to the pins determines the gain of the photo amplifier.
3	DETECT	Input	Input to the photo amplifier	This pin connects the cathode of the photo diode. The photo diode is operated at zero bias.
4	STROBE	Output	Regulated voltage Output	The pin is the Regulated voltage Output. The value is Vdd-5V.
5 ,14	Vdd , V_{SS}		Power/Gnd	Power supply
6	IRED	Output	Signal output	This pin is a output, which provides a pulsed base current for the external npn transistor, which drives the IR emitter.
7	I/O			A connection at this pin allows multiple smoke detectors (less than 50) to be interconnected.
8 ,9	BRASS, SILVER	Output	Piezoelectric Transducer Output	These TWO pins are used in conjunction with a piezoelectric transducer.
10	FEEDBACK	Inuput	Piezoelectric Transducer Input	The pin is used in conjunction with a piezoelectric transducer feedback electrode.
11	LED	Output	Signal output	This open-drain NMOS output is used to directly drive a

				visible LED. The LED also indicates detector status as follows (with component values as in the typical application, all times nominal)
12	OSC	Input	OSC Input	The pin connects with external capacitor and resistor, sets the internal clock low time.
13	R1		External capacitor and resistor connected to the pins	The pin connects with external capacitor and resistor, sets the internal clock high time, which is also IRED pulse width.
15	LS SET	Intput	Low sensitive set	This input pin serves two purposes in normal operation: serves as an enable for the internal 10-minutes (nominal) timer and also as the reference (set by external resistor divider between VDD and STROBE) for the smoke comparator during the timer mode. This allows the detector to have a different sensitivity set point during the timer mode. If the timer mode is not used, this pin can be left open or connected to Vss, which disables this mode.
16	TEST	Input	Test Input	This pin has an internal pull-down device and is used to manually invoke Test Mode and Timer Mode. High logic level on this pin initiates Push-to-Test Mode (Av = 1 + (C1/10) where C1 is in pF.). When push-button is released, the input returns to Vss due to the pull down. This high-to-low transition on the pin also resets and starts the 10 minutes hush timer (Timer Mode).

FUNCTIONAL BLOCK DIAGRAM

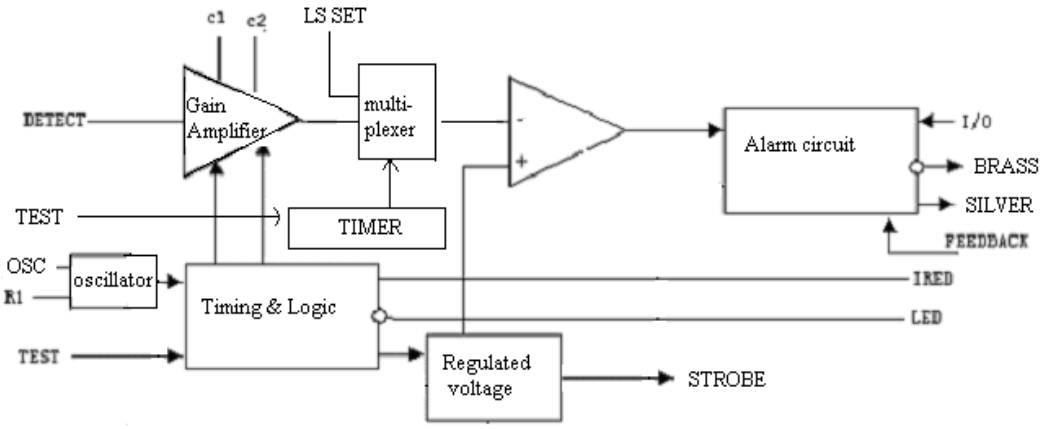


Fig.2 Functional Block Diagram

Circuit Characteristic

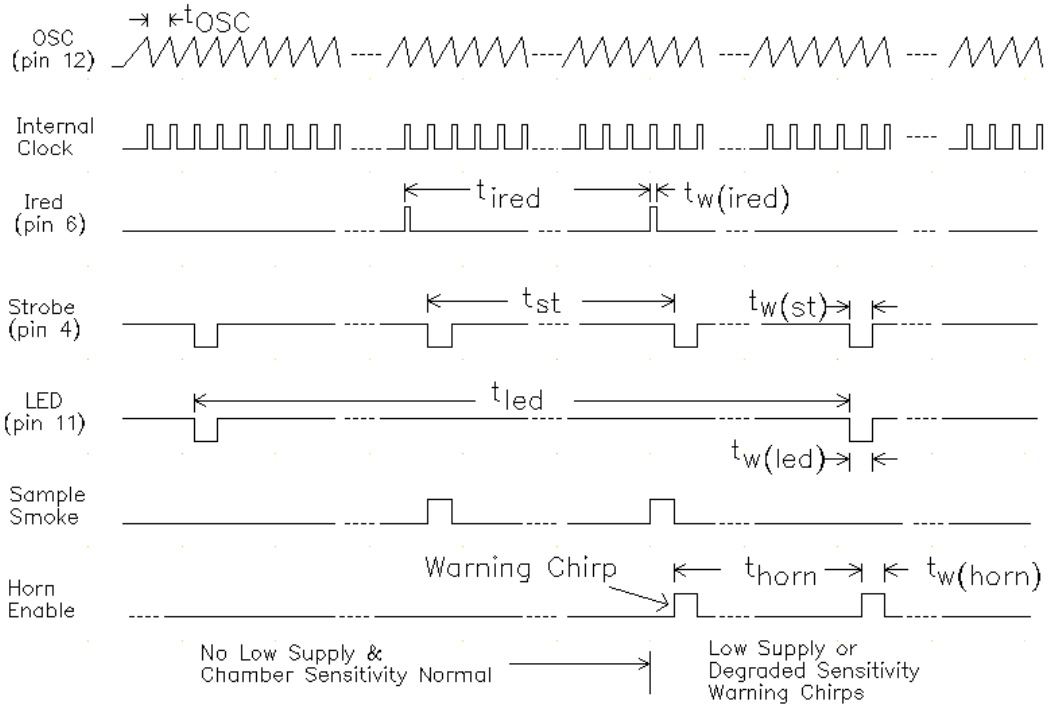
The gain is determined by external capacitor C1 and C2. A capacitor connected to C2 determines the gain of the photo amplifier during standby. A typical value for this low-gain mode is 4700 pF but should be selected based on a specific photo chamber and the desired level of sensitivity to smoke.
AV≅ 1+(C2/10) where C2 is in pF. This gain increases by a nominal 10% after a local alarm is detected (three consecutive detections).

I/O pin allows multiple smoke detectors to be interconnected. If a local smoke condition occurs, this pin is driven high. As an input, this pin is sampled nominally every 1.35 seconds during standby. Any local alarm condition causes I/O to be ignored as an input. An internal nmos device acts as a charge dump to aid in applications involving a large (distributed) capacitance. The charge dump is activated at the end of local or test mode.

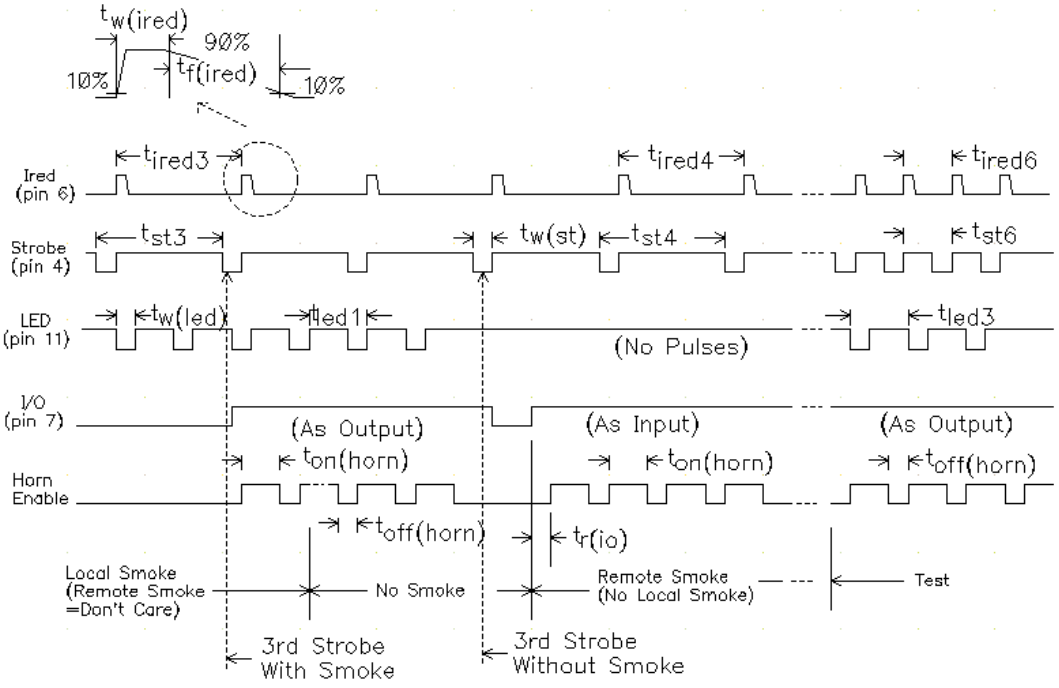
LED pin is an output pin, which is used to directly drive a visible LED. The load for the low-battery test is applied to this output. The low-battery test does not occur coincident with any other test or alarm signal. The LED also indicates detector status as follows (with component values as in the typical application, all times nominal):

Standby - Pulses every 43 seconds.
Local Smoke - Pulses every 0.67 second.
Remote Alarm - No pulses.
Test Mode - Pulses every 0.67 second.
Timer Mode - Pulses every 10 seconds

Timing Diagram



Standby Timing Diagram



Local Alarm Timing Diagram

DC ELECTRICAL CHARACTERISTICS (Voltages referenced to Vss. TA = 25 ℃)

Symbol	Parameter	Conditions	VDD	Pin	Min.	Max.	Unit
VDD	Supply Voltage Range		-	-	6.0	12	V
VTH	Low VDD(th) threshold		-	-	6.9	7.6	V
IDD	Operating Supply Current	Standby	12	5	-	10	uA
iDD	Operating Supply Current	Strobe on IRED off	12	5	-	2.0	mA
VIL	Low-Level Input Voltage						V
	I/O		9.0	7	-	1.5	
	Feedback		9.0	10	-	2.7	
	Test		9.0	16	-	7.0	
	LS SET		9.0	15	-	0.5	
VIH	High-Level Input Voltage					-	V
	I/O		9.0	7	3.2		
	Feedback		9.0	19	6.3		
	Test		9.0	16	8.5		
	LS SET		9.0	15	1.6		
IIH	Input Leakage High						nA
	C1，C2	Vin=VDD，Strobe active Pin 12=Vdd	12	1,2	-	100	
	Detect, Feedback, OSC	Vin=VDD	12	3,10,12	-	100	
IIL	Input Leakage Low						
	C1, C2, Detect	Vin=VST，Strobe active, Pin 12=Vdd	12	1,2,3	-	-100	nA
	Feedback, OSC	Vin=VSS	12	10,12	-	-100	nA
	LS SET, TEST	Vin=VSS	12	15,16	-	-1.0	uA
IIN	Input Pull-Down Current						uA
	Test, LS SET	Vin=VDD	9.0	15,16	0.25	10	
	I/O	No Local Alarm， Vin=VDD	9	7	20	80	
	I/O	No Local Alarm， Vin=17V	12	7	-	160	
VOL	Low-Level Output Voltage						V
	LED	Io=10mA	6.5	11	-	0.6	
	BRASS,SILVER	Io=16mA	6.5	8,9	-	1.0	
	R1	Io=5mA	6.5	13	-	0.5(typ)	
VOH	High-Level Output Voltage BRASS, SILVER	Io=-16mA	6.5	8,9	5.5	-	V
VST	Strobe Output Voltage						V
	Strobe	Inactive, Iout=-1uA	12	4	VDD-0.1	-	

		active, I out=100uA to 500uA	9.0	4	VDD-5.25	Vdd-4.75	
Vired	Ired Output Voltage						V
		Inactive, Io=1uA, TA=25°C	12	6		0.1	
		active, Io=6mA, TA=25°C	9	6	2.85	3.35	
IOH	High-Level Output Current I/O	Any Alarm Condition , Vo=VDD-2V	9.0	7	-4	-	mA
IOZ	OFF Leakage Current High LED,R1	Vout=VDD	12	11,13	-	1	uA
IOZ	OFF Leakage Current Low LED,R1	Vout=Vss	12	11,13	-	-1	uA
VIC	Common Mode Voltage C1，C2，Detect	Any Alarm Condition	—	1,2,3	VDD-4	VDD-2	V
Vref	Smoke Comparator Ref. Volt.	Any Alarm Condition	—	internal	VDD-3.7	VDD-3.3	V

AC ELECTRICAL CHARACTERISTICS (Voltages referenced to Vss. TA = 25 ℃**)**

Symbol	Parameter	Conditions	VDD	Pin	clocks	Min.	Typ.	Max.	Unit
Tosc	OSC Period		9	12	1	9.4	10.5	11.5	ms
Tled1	Led Pulse Period	No Local or Remote Smoke	9	11	4096	39	-	48	s
Tled2		Remote Smoke Only	9	11		None	-	-	-
Tled3		Local Smoke or Test	9	11	64	0.60	0.67	0.74	s
Tled4		Timer Mode, No Alarm	9	11	1024	9.67	10.75	11.83	s
Tw(led)	Led Pulse Width		9	11	1	9.5	-	11.5	ms
Tst1	Strobe Pulse Period	No Local or Remote Smoke	9	4	1024	9.6	-	11.9	s
Tst2		After 1 of 3 Vaild Samples	9	4	256	2.42	2.70	2.96	s
Tst3		After 2 of 3 Vaild Samples and During Local Alarm	9	4	128	1.21	1.34	1.47	s
Tst4		Remote Alarm	9	4	1024	9.67	10.8	11.8	s
Tst5		Chamber Test or Low Supply Test,No Local Alarm	9	4	4096	38.9	-	47.1	s
Tst6		Pushbutton Test,No Alarm	9	4	32	330	336	370	ms
Tw(st)	Strobe Pulse Width		9	4	1	9.5		11.5	ms
Tired1	Ired Pulse Period	No Local or Remote Smoke	9	6	1024	9.6	-	11.9	s
Tired2		After 1 of 3 Vaild Samples	9	6	256	2.42	2.70	2.96	s
Tired3		After 2 of 3 Vaild Samples and During Local Alarm	9	6	128	1.21	1.34	1.47	s
Tired4		Remote Alarm	9	6	1024	9.67	10.8	11.8	s
Tired5		Chamber Test or Low Supply Test,No Local Alarm	9	6	4096	38.9	-	47.1	s
Tired6		Pushbutton Test,No Alarm	9	6	32	330	336	370	ms
Tw(ired)	Ired Pulse Width		9	6		94		116	us

Tr(ired)	Ired Rise Time	10%to 90%		6		-	-	30	us
Tf(ired)	Ired Fall Time	90% to 10%		6		-	-	200	us
Td(io)	I/O to Active Delay	Local Alarm	9	7		-	0		s
Tdump	I/O Charge Dump Duration	End of Local Alarm or Test	9	7	128	1.21	1.35	1.45	s
Tr(io)	Rising Edge on I/O to Alarm	No Local Alarm	9	7		-	-	1.34	s
Thorn	Horn warning Pulse Period	Local Supply and Degraded Chamber Sensitivity	9	8,9	4096	38.9	-	47.1	s
Tw(horn)	Horn warning Pulse Width	Local Supply and Degraded Chamber Sensitivity	9	8,9	1	9.5		11.5	ms
Ton(horn)	Horn on time	Local or Remote Alarm	9	8,9	24		252		ms
Toff(horn)	Horn off Time	Local or Remote Alarm	9	8,9	8		84		ms
T_{HUSH}	Silence Time	V_{pin15} >1.6V and V_{pin16} jumps from Vdd to float	9		61440± 2048	9.30	10.75	12.17	min

Note: T_{OSC} is determined by the external R1, R2 and R3. T_{OSC} = Tr + Tf, Tr = R2*C3*(ln2) = 0.6931*R2*C3; Tf = R1*C3*(ln2) = 0.6931*R1*C3.

TYPICAL APPLICATION

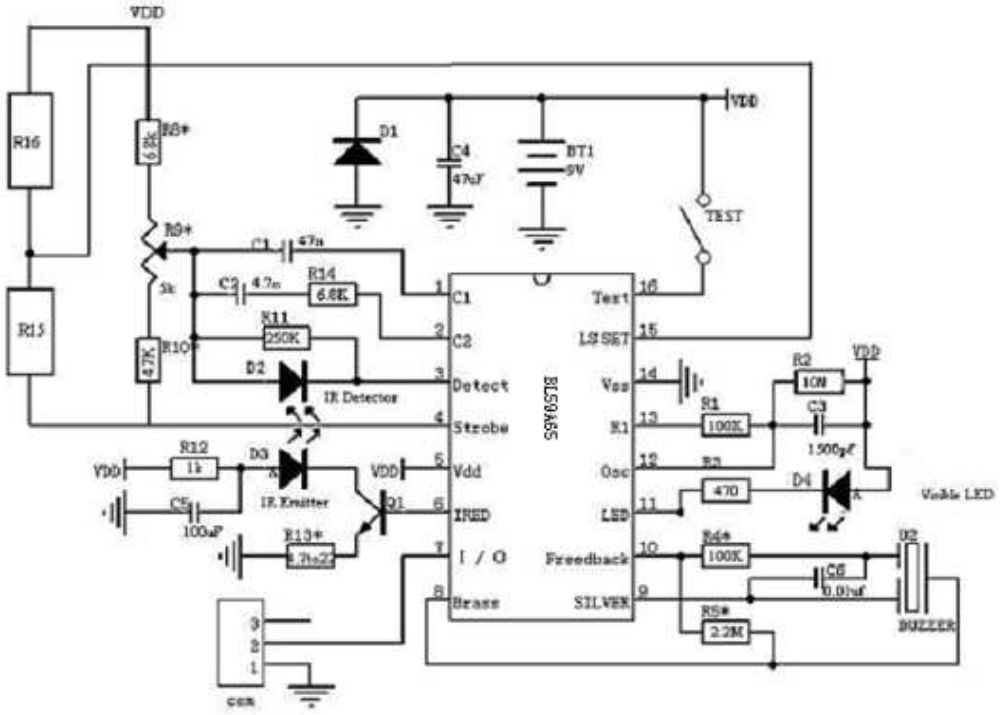


Fig.3 Typical Application

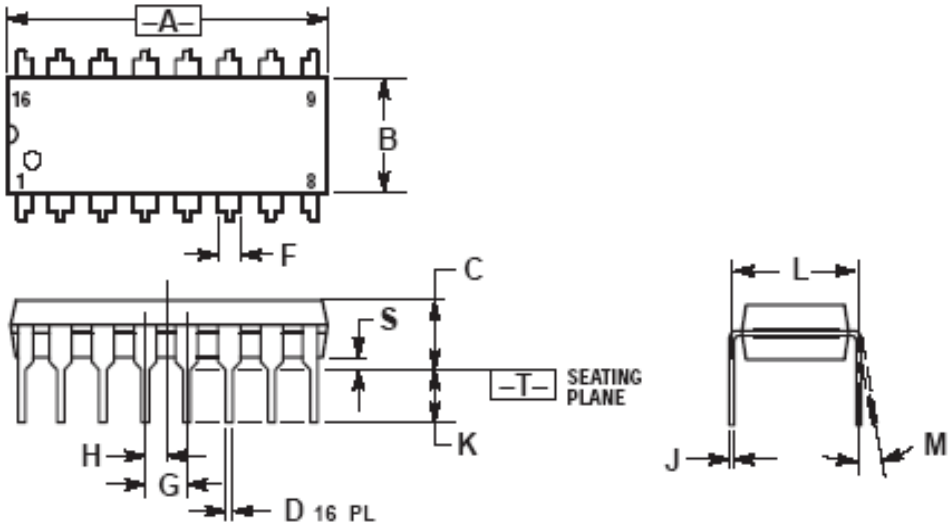
Calibration Mode Description

For sensitive detecting and calibrating smoke system, BL59A65 could set calibration Mode. If TEST=V_{SS}-0.9V, and draining 100uA current from the pin. After one period, BL59A65 is in calibration Mode。To exit this mode, TEST pin is floated for at least one OSC cycle.

PIN Symbol	Function
7:I/O	This pin is disabled as an output. A logic high on this pin places the photo amplifier output on pin 1 or pin 2 as determined by pin 15. The amplifier output appears as pulses.
15:LS SET	If the I/O pin is high, this pin controls the amplifier gain capacitor. If pin 15 is low, normal gain is selected and the amplifier output is on pin 1. If pin 15 is high, supervisory gain is selected and the amplifier output is on pin 2.
10:FEEDBACK	If pin 7 is high and pin 15 is low (normal gain), taking this pin to a high logic level increases the amplifier gain by ~10% (hysteresis).
12:OSC	This pin may be driven by an external clock source.
8:BRASS	This pin is reconfigured as the smoke integrator output. Three consecutive smoke detections will cause this pin to go high and three consecutive no smoke detections cause this pin to go low.
11:LED	This pin becomes a low-battery indicator. The open-drain NMOS output is normally OFF. If VDD falls below the low battery threshold, the output

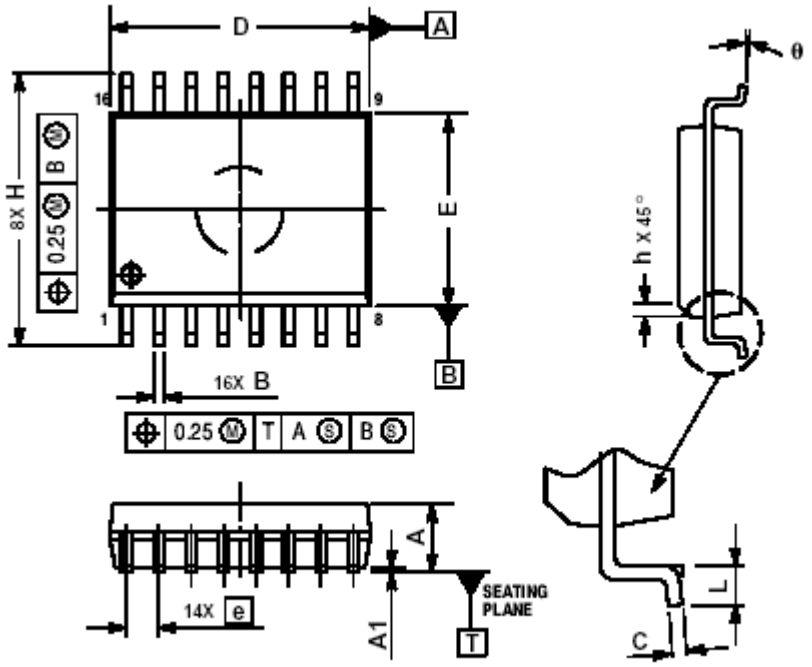
	turns on.

PACKAGE
DIP16



	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

SOP16



DIM	MILLIMETERS	
	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
B	0.35	0.49
C	0.23	0.32
D	10.15	10.45
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0°	7°