Features

- 2-stage operational amplifier as filter
- Built-in noise rejection circuit
- On-chip regulator
- Override function
- Synchronous with AC 220V/50Hz and 110V/60Hz
- Pulse output (PT8A261) for TRIAC drive or level output (PT8A262) for relay drive
- CDS to enable/disable output
- Adjustable output on time duration
- ON/AUTO/OFF selectable by MODE pin
- Auto-reset if the ZC signal disappears over 3 seconds
- 40 seconds warm-up
- Quick check mode for initial installation
- Operating voltage: 5V
- Stand-by current: 80μA

General Description

The PT8A261 and PT8A262 are low power mixed signal CMOS LSI designed for the automatic lamp control using PIR sensor as motion detector.

With on chip noise filter and voltage regulator, the IC provides stable operations throughout temperature range. CDS input to disable day time operation is desired.

Applications

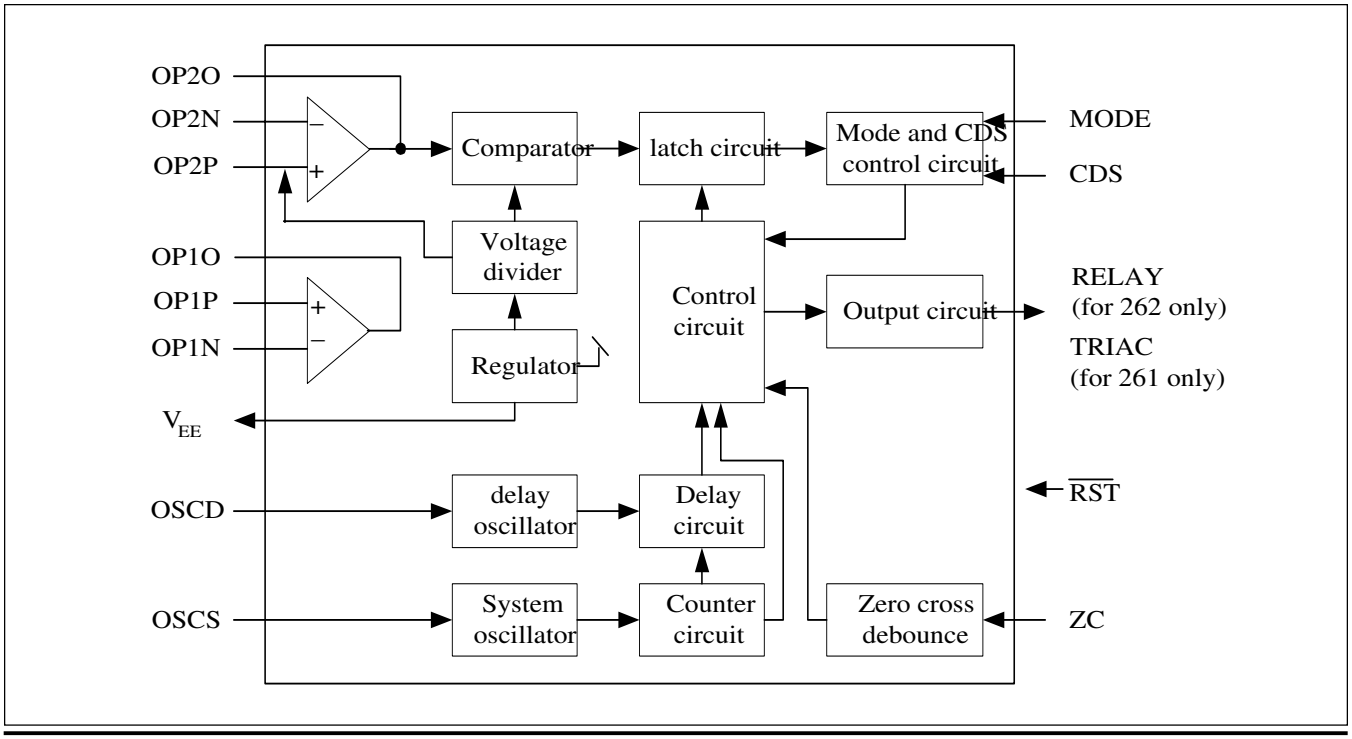
- Energy saving auto-switch in Garden, kitchen, bathroom, corridor, storage or yard
- Auto light in meeting room

Ordering Information

Part Number	Package
PT8A261PE/PT8A262PE	Lead free 16 - Pin PDIP
PT8A261WE/PT8A262WE	Lead free and Green 16 - Pin SOIC
PT8A261DE / PT8A262DE	Die Form

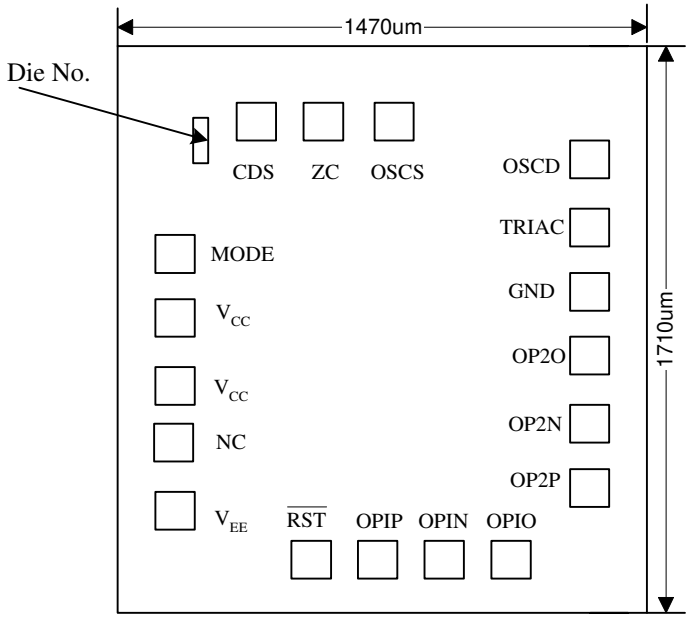
Note: Adding X suffix=Tape/Reel

Block Diagram



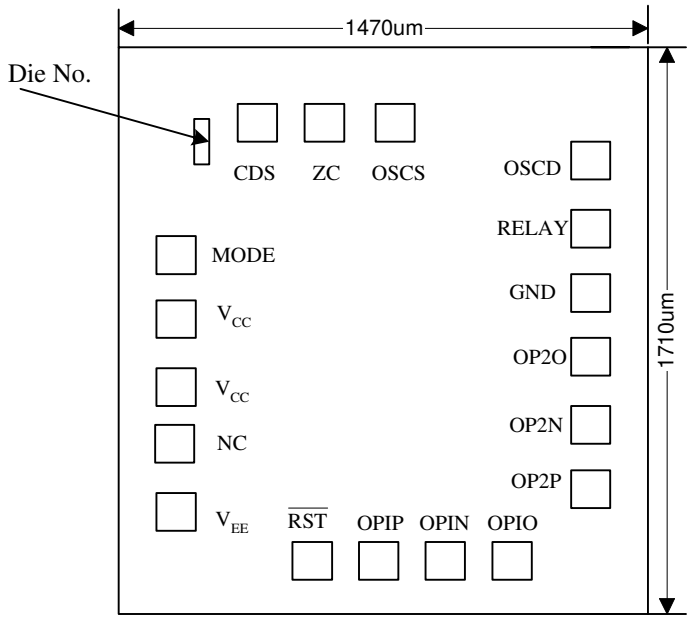
Pad Location

Pad Location of PT8A261DE



Pad Coordinate					
Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
GND	570	65.4	NC	570	-268.6
TRIAC	570	-101.6	V_{EE}	-570	232.4
OSCD	570	399.4	$\overline{RST}$	303.9	-687.2
OSCS	570	232.4	OP1P	-44.8	689.2
ZC	-378.8	689.2	OP1N	-211.8	689.2
CDS	-30.1	-687.2	OP1O	-570	-435.6
MODE	570	-435.6	OP2P	-570	-268.6
V_{CC}	-197.1	-687.2	OP2N	-570	-101.6
V_{CC}	136.9	-687.2	OP2O	-570	65.4
Note: Substrate is connected to GND					

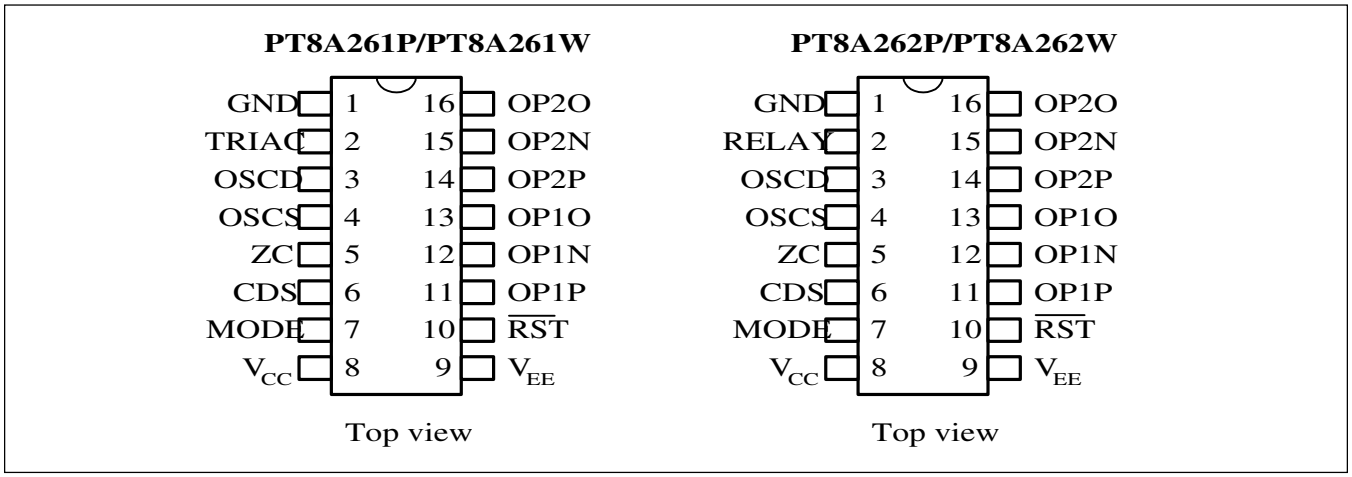
Pad Location of PT8A262DE



Pad Coordinate					
Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
GND	570	65.4	NC	570	-268.6
RELAY	570	-101.6	V_{EE}	-570	232.4
OSCD	570	399.4	$\overline{RST}$	303.9	-687.2
OSCS	570	232.4	OP1P	-44.8	689.2
ZC	-378.8	689.2	OP1N	-211.8	689.2
CDS	-30.1	-687.2	OP1O	-570	-435.6
MODE	570	-435.6	OP2P	-570	-268.6
V_{CC}	-197.1	-687.2	OP2N	-570	-101.6
V_{CC}	136.9	-687.2	OP2O	-570	65.4
Note: Substrate is connected to GND					

Pin Assignment

Figure 2



Pin Description

Table 1

Pin/Pad		Name	Type	Description
261	262			
1	1	GND	Ground	Ground
	2	RELAY	O	RELAY drive output through an external NPN transistor, active high
2		TRIAC	O	TRIAC drive two-pulse output, active negative pulse.
3	3	OSCD	I/O	Output timing oscillator I/O, connected to an external RC to adjust output duration.
4	4	OSCS	I/O	System oscillator I/O, connected to an external RC to set the system frequency. The system frequency = 16kHz for normal application.
5	5	ZC	I	Schmitt input for AC zero crossing detection.
6	6	CDS	I	Connected to a CDS voltage divider for daytime/night auto-detection. Low input to this pin can disable PIR input. CDS is a schmitt trigger input with 5-second input debounce time.
7	7	MODE	I	Mode select, connecting to V_{CC}- output always on, connection GND - output always off, open - auto detection
8	8	V_{CC}	Power	Power supply
9	9	V_{EE}	O	Internal voltage regulator output, 3.6V with respect to ground. Connected to the drain of PIR sensor
10	10	$\overline{RST}$	I	Chip reset input, active low, kept floating or connected an RC network
11	11	OP1P	I	Non-inverted input of first operational amplifier, connected directly to source of PIR sensor
12	12	OP1N	I	Inverted input of first operational amplifier
13	13	OP1O	O	Output of first operational amplifier
14	14	OP2P	I	Non-inverted input of second operational amplifier.
15	15	OP2N	I	Inverted input of second operational amplifier
16	16	OP2O	O	Output of second operational amplifier

Functional Descriptions

The PT8A261 and PT8A262 are CMOS LSI chips designed for automatic PIR lamp control. They can operate in 2-wire configuration for triac applications or in 3-wire configuration for relay applications.

The device consists of operational amplifiers, a comparator, timer, a zero crossing detector, control circuit, a voltage regulator, a system oscillator, and an output timing oscillator.

The PIR sensor detects infrared power variations caused by motion of a human body and transfer to a voltage variation. If the PIR output voltage variation conforms to criteria, the lamp is turned on for an adjustable duration. The PT8A261 (or 262) offers three operating modes (ON, AUTO, OFF) which can be set through a MODE pin. When the device is working in AUTO mode, the user can override the mode to switch it to TEST mode or manual ON mode, or return to the AUTO mode by switching power switch.

OSCS and OSCD Pins

OSCS is a system oscillator I/O pin connected to an external RC to generate system frequency of 16kHz.

OSCD is an output timing oscillator I/O pin. It's connected to an external RC to obtain the desired turn-on duration by selecting various values of RC or using a variable resistor. F_{OSCD} is the frequency of OSCD pin, output timing can be caculated as the formula: $T_D = 21504/F_{OSCD}$

CDS Input Circuit

CDS is a CMOS schmitt trigger input pin. It is used to distinguish between day time and night time. When the input voltage of CDS is high the PIR input is enabled, when CDS low the PIR input disabled. The input disable-to-enable debounce time is 5 seconds. Connect this pin to V_{CC} when not using it. The CDS input is ignored when the TRIAC or RELAY output is active.

Figure 3. System Oscillator

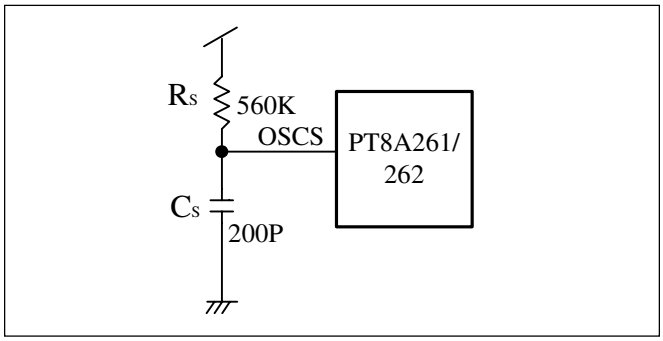


Figure 4. Output Timing Oscillator

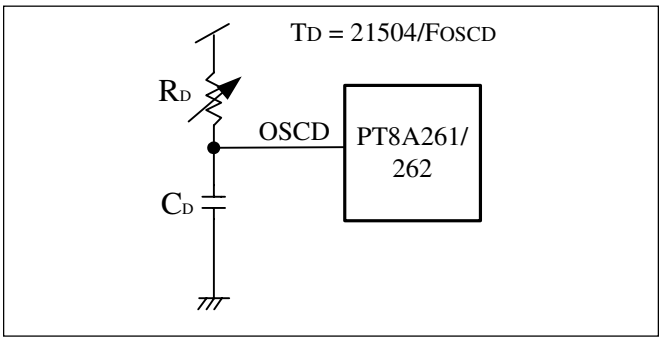


Figure 5. CDS Input Circuit

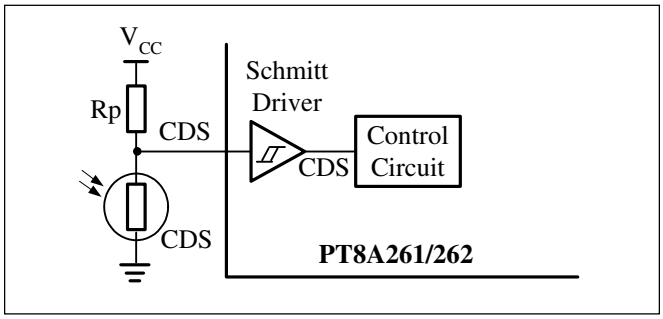
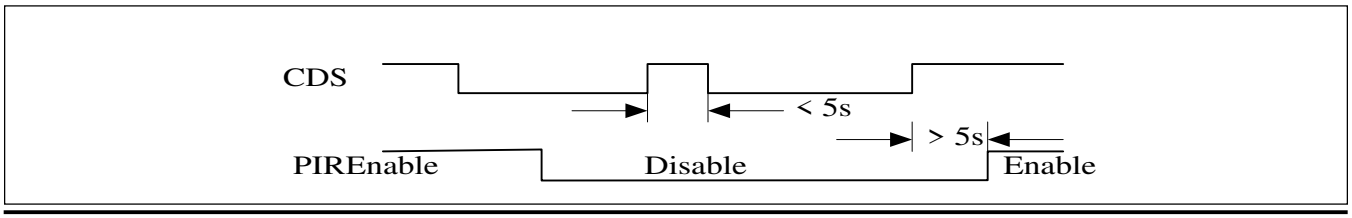


Table 2. CDS Pin Function

CDS	Status	PIR
LOW	Day Time	Disabled
HIGH	Night	Enabled

Figure 6. CDS Enable Debounce



MODE

MODE is a tri-state input pin for operation mode selection. See the following table 3.

Override Control: The term override refers to the change of operating mode by switching the power switch twice within 3 seconds. When the chip is working in the AUTO mode (MODE pin openned), the output is activated by a valid PIR trigger signal and the output active duration is controlled by the OSCD oscillation period. The lamp can be switched to ON from the AUTO mode by either switching the MODE pin to V_{CC} or switching the power switch twice within 3 seconds. The device can be toggled from ON to AUTO by switching the power switch twice within 3 seconds again (override operation).

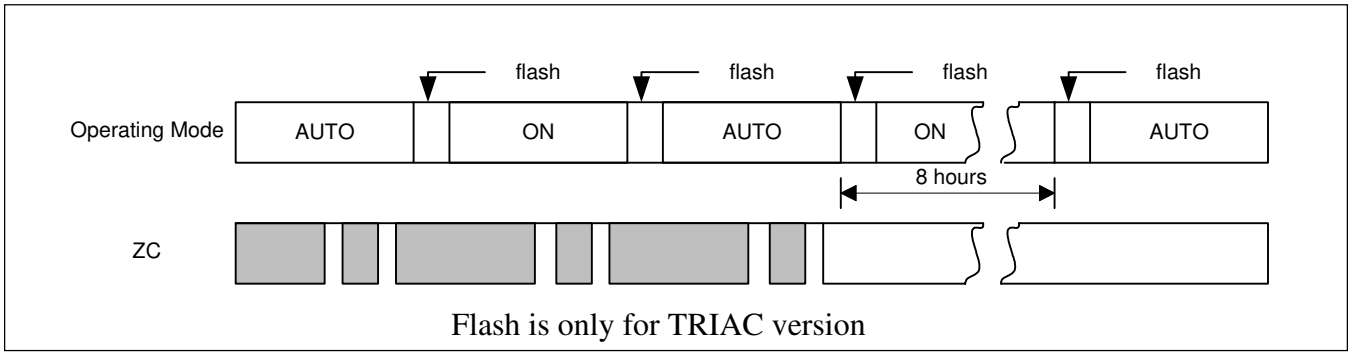
If the chip is overridden to ON and there is no further override operation, it will return to AUTO automatically after an internal preset ON time duration (8 hours).

The override operation will cause the lamp flash (for TRIAC version only). It will flash 3 times at 1Hz rate when changing AUTO mode to other mode, and flash 3 times at 2Hz rate when returning to AUTO mode. But no flash if mode is changed by switching the MODE switch. See Figure 7 for override timing.

Table 3. Operation Modes by MODE Pin

MODE Status	Operation Mode	Description
V_{CC}	ON	Output is always ON: RELAY pin sends high level for relay driving; TRIAC pulse train output is synchronized by ZC for triac driving.
GND	OFF	Output is always OFF: RELAY pin sends low level for relay driving; TRIAC pin sends high level for triac driving.
Open	AUTO	Outputs remain in the OFF state until activated by a valid PIR trigger input signal. When working in the AUTO mode, the device allows override control by switching the ZC signal.

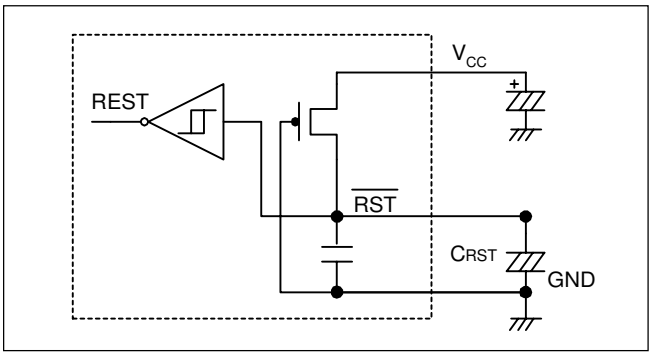
Figure 7. Override Timing



$\overline{RST}$ Pin

$\overline{RST}$ is used to reset the device. It is internal pull-high and active low. The use of C_{RST} can extend the power-on initial time. If the $\overline{RST}$ pin is openned (without CRST), the initial time is 40 seconds. See Figure 8.

Figure 8. $\overline{RST}$ Application Example



Power On Initial

The PIR signal amplifier requires a warm up period after power-on. The input should be disabled during this period.

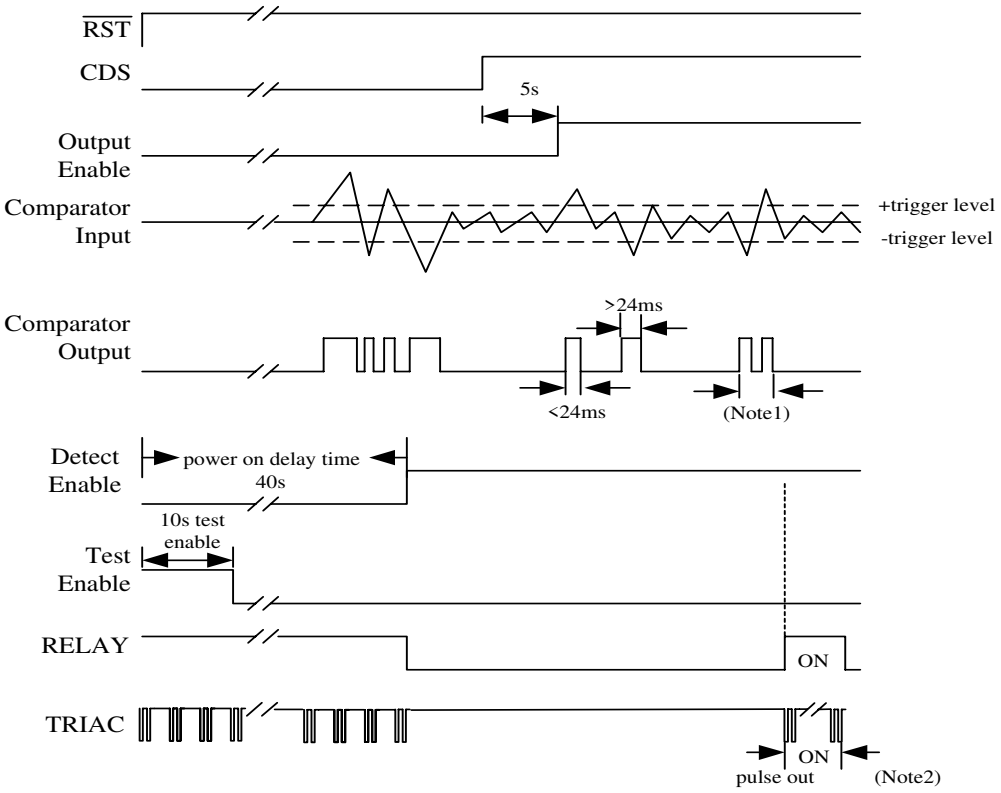
In the AUTO mode within the first 10 seconds of the initial time the chip allows override control to enter the quickly install mode.After 40s of the initial time the chip allows override control between ON and AUTO. It will remain in the warm up period if the total initial time has not elapsed after returning to AUTO.

In case that the ZC signal disappears more than 3 seconds, the chip will restart the initialization operation. However, the restart initial time is always 40 seconds and cannot be extended by adding C_{RST} to the $\overline{RST}$ pin as shown in Figure 6.

Trigger

The trigger timing is shown in Figure 9.
Retrigger -- If another signal is attained in trigger hold time, the circuit will be retriggered, and the trigger hold time will be restarted from this time.

Figure 9. Trigger Timing



Notes: 1. The output is activated if the trigger signal conforms to the following criteria:
- More than 3 triggers within 2 seconds,
- A trigger signal sustain duration ≥ 0.34 seconds, and
- 2 triggers within 2 seconds with pulse duration of one ≥ 0.16 seconds.
- The effective comparator output width is 24ms.(Fosc=16KHz)

2. The output duration is set by an external RC connected to the OSCD pin.

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested)

Storage Temperature ..... -40°C to +125°C
Supply Voltage to Ground Potential (Inputs & V_{CC} Only) .... -0.3 to +6.0V
Supply Voltage to Ground Potential (Outputs & D/O Only) -0.3 to +6.0V
DC Input Voltage ..... -0.3 to +6.0V
DC Output Current 20mA
Power Dissipation 500mW

Note:
Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Operation Conditions

Sym	Description	Min	Typ	Max	Units
V_{CC}	Supply Voltage	4.75	5.0	6.0	V
V_{IH}	Input HIGH Voltage (MODE,$\overline{RST}$)	$0.8V_{CC}$	-	-	V
V_{IL}	Input LOW Voltage (MODE,$\overline{RST}$)	-	-	$0.2V_{CC}$	V
f_{SYS}	System Oscillator Frequency	12.8	16	19.2	kHz
f_{DOSC}	Delay Oscillator Frequency	12.8	16	19.2	kHz
T_A	Operation Temperature	-25	25	70	°C

DC Electrical Characteristics

Sym	Description	Test Conditions	Min	Typ	Max	Units
I_{IH}	Input high level leakage current(ZC,CDS)	V_{IH} = 4.5V	-0.1	-	0.1	µA
I_{IL}	Input low level leakage current(ZC,CDS)	V_{IL} = 0.5V	-0.1	-	0.1	µA
I_{OH}	Output Source Current (RELAY, TRIAC)	V_{OH} = 4.5V	-6	-	-	mA
I_{OL}	Output Sink Current (RELAY, TRIAC)	V_{OL} = 0.5V	15	-	-	mA
V_{TH1}	CDS Transfer High Voltage		3.0	3.2	3.6	V
V_{TL1}	CDS Transfer Low Voltage		1.5	1.7	2.1	V
V_{TH2}	ZC Transfer High Voltage		2.6	2.9	3.2	V
V_{TL2}	ZC Transfer Low Voltage		1.0	1.4	1.6	V
V_{TH3}	OSCS Transfer High Voltage		2.2	2.4	2.8	V
V_{TL3}	OSCS Transfer Low Voltage		1.0	1.4	1.6	V
V_{TH4}	OSCD Transfer High Voltage		2.2	2.4	2.8	V
V_{TL4}	OSCD Transfer Low Voltage		0.4	0.6	0.8	V

Note: These specifications apply for V_{CC} = 5.0V and -25°C ≤ T_A ≤ 70°C, unless otherwise specified.

AC Electrical Characteristics

Voltage Regulator

Sym	Description	Test Conditions	Min	Typ	Max	Units
V_{EE}	Output Voltage	No load	3.2	3.6	4.0	V
V_{OP2P}	Noninverting input of OP2	No load	1.6	1.8	2.0	V
ΔV_O	Line Regulation	$4.5V \le V_{CC} \le 5.5V$, I_L = 1mA	-	30	50	mV
ΔV_{LDR}	Load Regulation	V_{CC} = 5V, $0.5mA \le I_L \le 2mA$	-	60	100	mV
I_L	Regulator Output Current	V_{CC} = 5V	4	-	-	mA

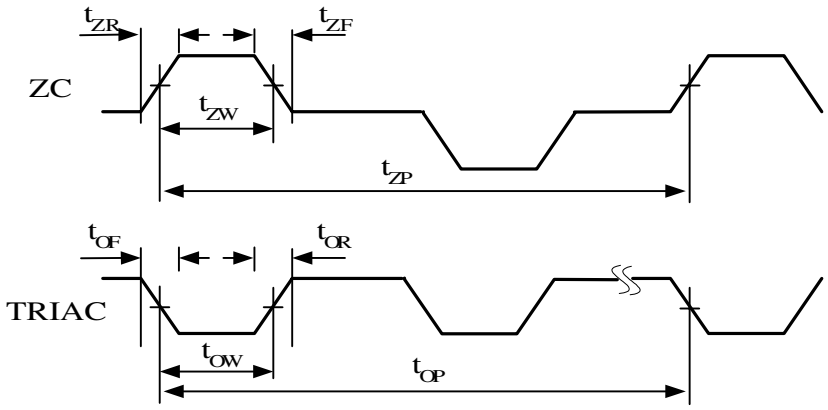
Operational Amplifier and Window Comparator

Sym	Description	Test Conditions	Min	Typ	Max	Units
BW	3dB Bandwidth	-	10	-	-	kHz
V_{TH}	Windows Comparator Threshold	V_{CC} = 5V	1.9	2.05	2.2	V
V_{TL}		V_{CC} = 5V	1.4	1.55	1.7	V

Oscillator and ZC Input Pulse and Trigger Output Pulse

Sym	Description	Test Conditions	Min	Typ	Max	Units
f_{OSC}	Oscillator Frequency	V_{CC}= 5V, R_S = 560Ω, C_S = 200pF, see above fig 3	12.8	16	19.2	kHz
t_{ZR}	ZC Pulse Rise Time		-	30	100	ns
t_{ZF}	ZC Pulse Fall Time		-	30	100	ns
t_{ZP}	ZC Pulse Period		15.1	20	22.2	ms
t_{ZW}	ZC Pulse Width		0.8	1	-	ms
t_{OR}	TRIAC Pulse Rise Time		-	30	100	ns
t_{OF}	TRIAC Pulse Fall Time		-	30	100	ns
t_{OP}	TRIAC Pulse Period		6.6	10	11	ms
t_{OW}	TRIAC Pulse Width		52	62.5	76	µs

Figure 10. Timing Diagram



Power Dissipation

Sym	Description	Test Conditions	Min	Typ	Max	Units
I_{CC}	Power Supply Current	V_{CC} = 5V, R_S = 560kΩ ,C_S=200P, R_D = 560kΩ , C_D = 200P, other input pins = GND, all outputs float. see fig 3,4	-	80	100	µA
I_{CCQ}	Quiescent Power Supply Current	V_{CC} = 5V, All Input Pins = GND, all outputs float.	-	60	80	µA

Typical Application Circuits

Figure 11. Two-Wire Application Circuit of PT8A261

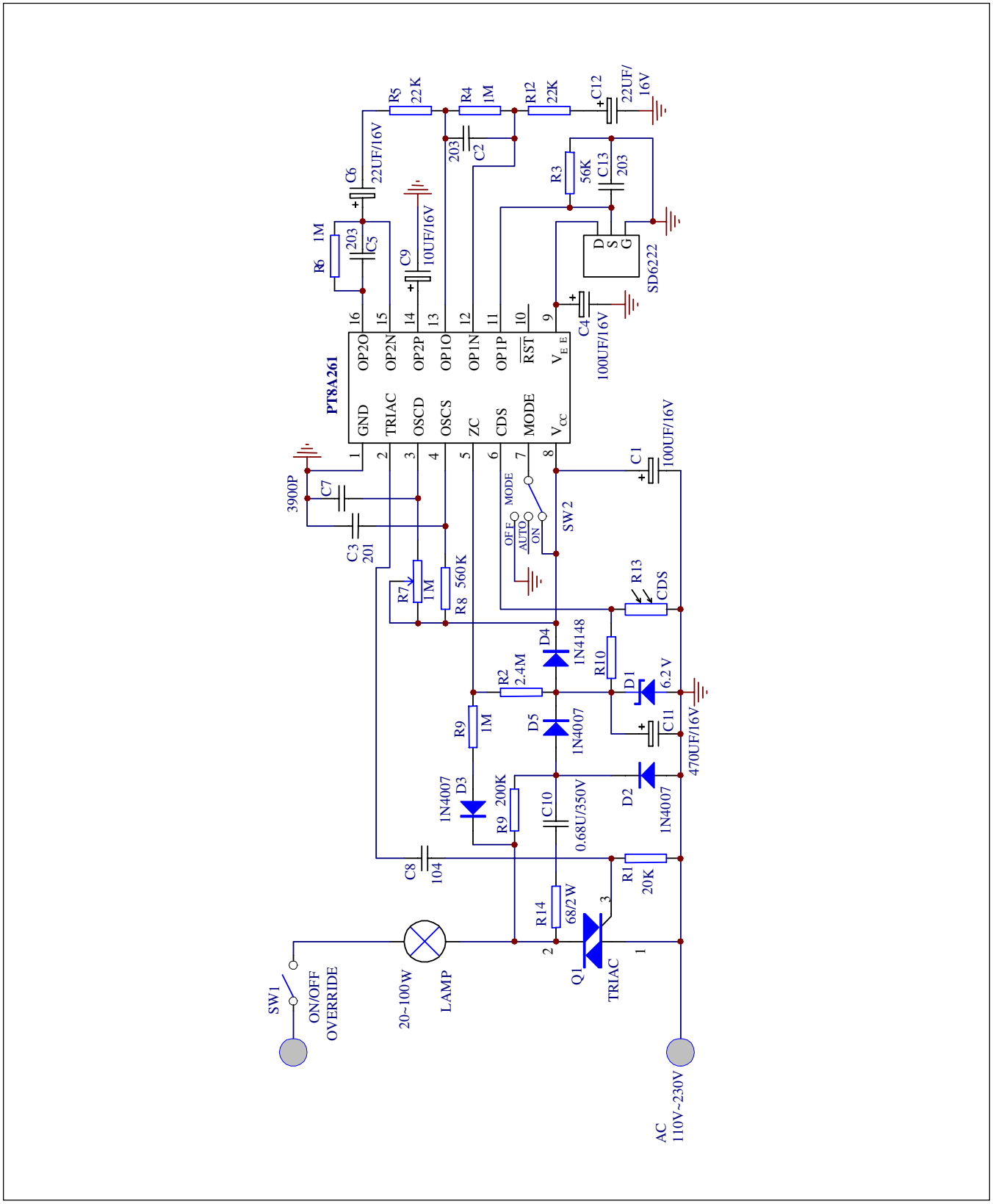
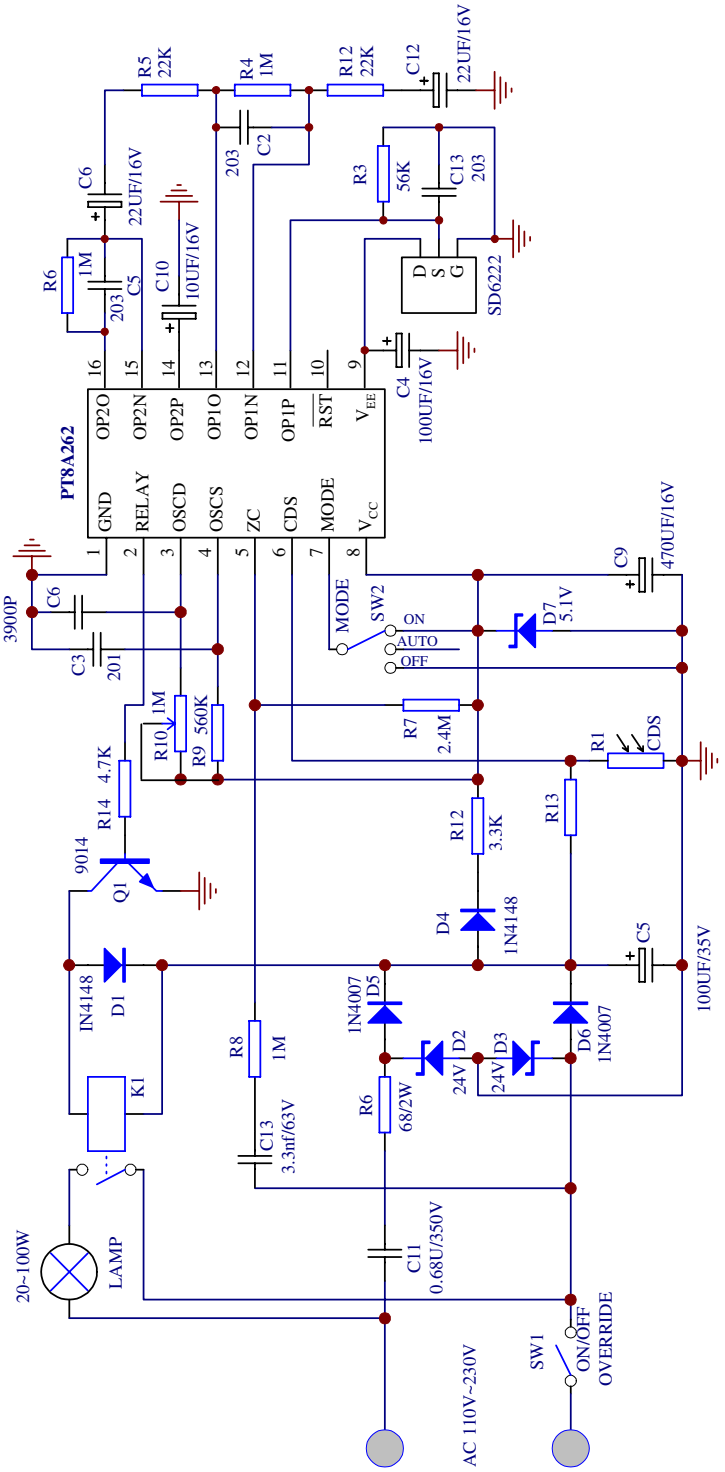
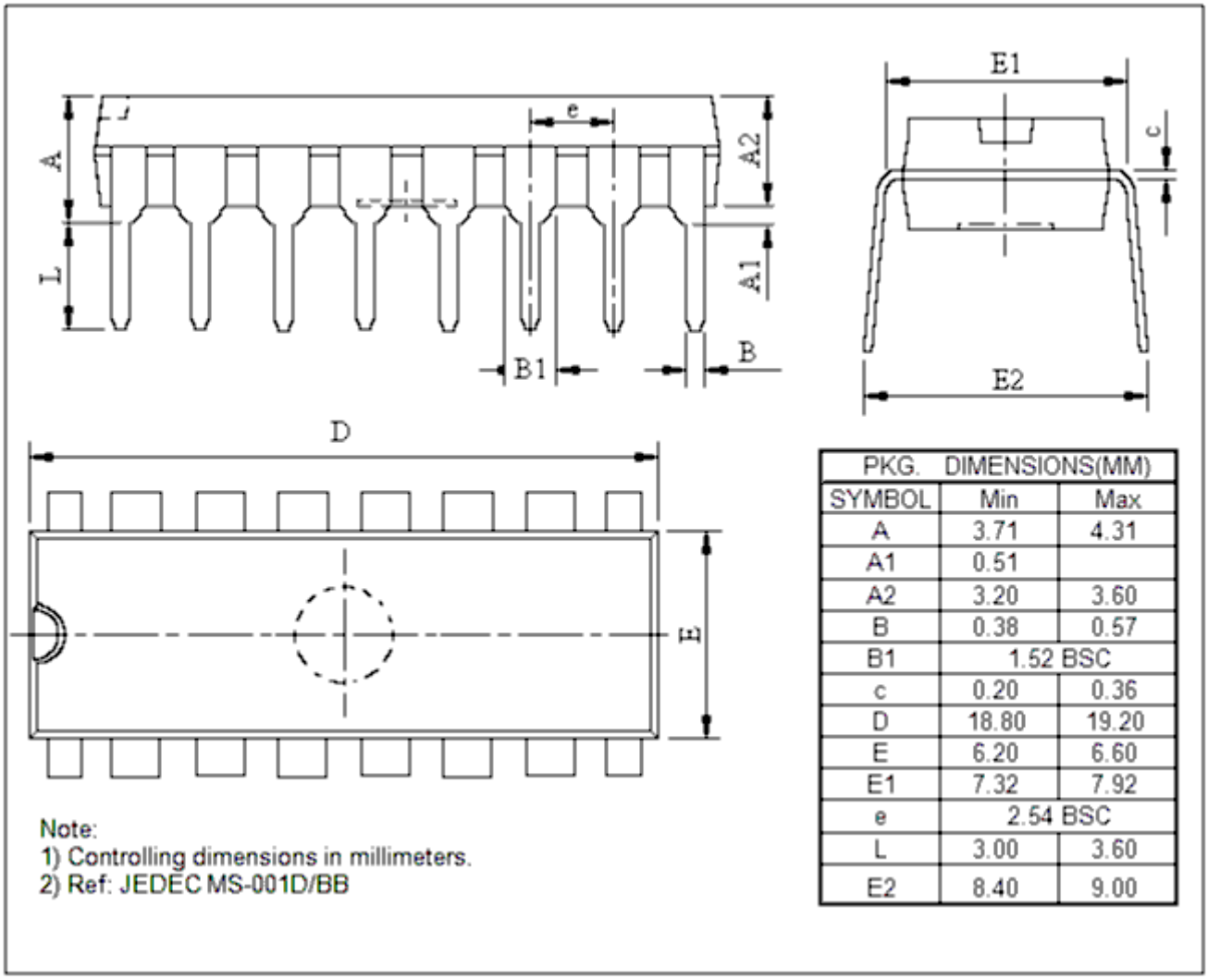


Figure 12. Three-Wire Application Circuit of PT8A262



Mechanical Information

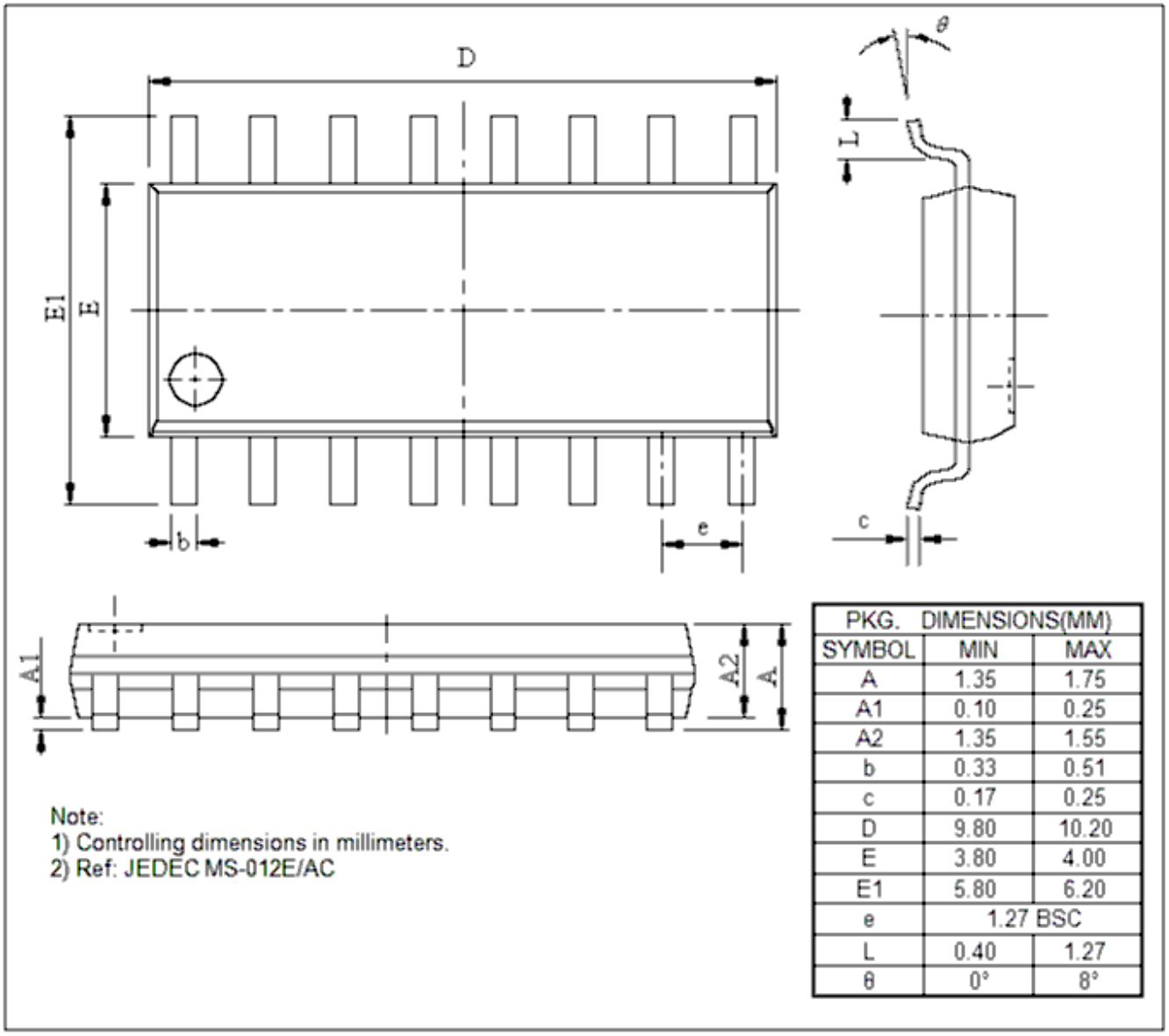
P(DIP-16)



PKG.	DIMENSIONS(MM)	
SYMBOL	Min	Max
A	3.71	4.31
A1	0.51	
A2	3.20	3.60
B	0.38	0.57
B1	1.52 BSC	
c	0.20	0.36
D	18.80	19.20
E	6.20	6.60
E1	7.32	7.92
e	2.54 BSC	
L	3.00	3.60
E2	8.40	9.00

Note:
1) Controlling dimensions in millimeters.
2) Ref: JEDEC MS-001D/BB

W(SOIC-16)



PKG.	DIMENSIONS(MM)	
SYMBOL	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
A2	1.35	1.55
b	0.33	0.51
c	0.17	0.25
D	9.80	10.20
E	3.80	4.00
E1	5.80	6.20
e	1.27 BSC	
L	0.40	1.27
θ	0°	8°

Note:
1) Controlling dimensions in millimeters.
2) Ref: JEDEC MS-012E/AC