

## Pyroelectric Infrared (PIR) IC

- RELAY output
- TRIAC output (Two TRIACs)
- Controllable TRIAC output
- CDS detection
- Controllable output duration

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## . General Description:

With PIR sensor and CDS sensor, it can be used for environment detecting or anti-theft purpose. PIR can be used to detect the motion state for activating different functions of the circuit, and the output can be chosen as TRIAC or RELAY driver by the user, which makes the application more flexible. The application circuit is very simple, which can greatly reduce the cost.

It is designed in a particular designing method, and thus can support various function modifications for user need. It takes only 2 to 4 working weeks to supply the sample to users for testing usage.

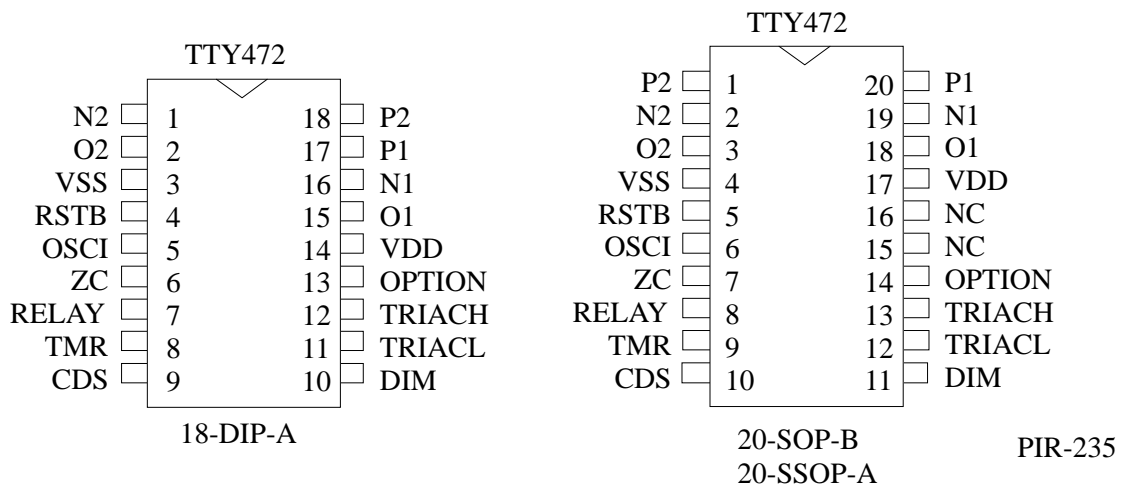
## . Feature:

- \* Operating Voltage: 2.7V – 5.5V
- \* The detecting distance can be controlled by the external part.
- \* With external CDS sensor, it has the function of restraining the output in daytime.
- \* It can control two TRIACs, one of which lights big lamp, the other one lights small lamp normally and lights big lamp after being triggered.
- \* It can control one RELAY output.
- \* With the function of controlling the TRIAC & RELAY output duration
- \* With Manual Override function
- \* Low power consumption (Stand by Current <50uA@5V)
- \* Supporting 18-DIP \ 20-SOP \ 20SSOP package

## . Applications

- \* House/Office/Factory Anti-theft Systems
- \* Automatic Illumination Devices
- \* Doorbell Devices
- \* Human Motion Detecting Devices (Such as intelligent air-conditioning)

## . Pin Assignment



. Pin Description

Name	I/O	Description
VSS	P	Negative power supply
RSTB	I	Reset input, active low (with external 100K pull high resistor)
OSCI	I	RC oscillator (32Khz), with external resistor and capacitor
ZC (PA0)	O	Detecting AC signal Zero Crossing. It is the synchro signal for TRIAC output, with internal 100K pull high resistor.
RELAY(PA1)	O	Active high, RELAY driver
TMR(PA2)	I	With external R.C. circuit, it can control the output duration of TRIACH/TRIACL & RELAY. (With 60Hz AC power supply or DC mode, it is 3 seconds to 12 minutes; With 50Hz AC power supply, it is 3.6 seconds to 14.4 minutes.)
CDS(PA3)	I	With external CDS Sensor, it can distinguish between daytime and nighttime; it needs 1 sec de-bounce when the change of CDS exceeds 5%.
DIM(PB0)	I	With external R.C. circuit, it can control the firing angle of TRIAC, and the brightness of LAMP (in the range of 20% to 95%), which is the dimmest (20%) when it is directly pulled high to VDD.
TRIACL (PB1)	O	Active low, TRIAC driver or ADP output (DC mode)
TRIACH(PB2)	O	Active low, TRIAC driver, 95% output or ADN output (DC mode)
OPTION(PB3)	I	VDD(Auto mode): Without Manual Override function (with external 10K resistor to VDD) VSS(DC mode): Without Triac Output function (ZC/DIM/TRIACL/TRIACH floating), with other functions (Relay/CDS/TMR), OSCI normally off (with external 10K resistor to VSS) Floating(Manual override & Auto mode): Lamp lights for 6 hours in nighttime, with manual override function (with external 500P capacitor to VSS)
VDD	P	Positive power supply
N1	I	Negative input of the first stage OP
P1	I	Positive input of the first stage OP
O1	O	Output of the first stage OP
N2	I	Negative input of the second stage OP
P2	I	Positive input of the second stage OP
O2	O	Output of the second stage OP

. AC / DC Characteristics

1 Absolutely max. Ratings

ITEM	SYMBOL	RATING	UNIT
Operating Temperature	Top	-20- +70	°C
Storage Temperature	Tsto	-50- +125	°C
Supply Voltage	VDD	5.5	V
Voltage to input terminal	Vin	Vss-0.3 to Vdd+0.3	V

2 D.C. Characteristics

(Condition : Ta= 25 ± 3 °C , RH ≤ 65 % , VDD =+ 5V , VSS=0V)

Item	Symb ol	Condition	Min.	Typ.	Max.	Unit
Operating voltage	VDD		2.7	5	5.5	V
Power consumption current	I <sub>OPR1</sub>	System clock off, PIR OP*2 on, No load, @5V		35	50	uA
Power consumption current	I <sub>OPR2</sub>	System clock off, PIR OP*2 on, No load, @3V		25	40	uA
Input low voltage for input and I/O port	V <sub>IL1</sub>		0		0.3VDD	V
Input high voltage for input and I/O port	V <sub>IH1</sub>		0.7VDD		VDD	V
Input low voltage for RESB pin	V <sub>IL2</sub>		0		0.35VDD	V
Input high voltage for RESB pin	V <sub>IH2</sub>		0.7VDD		VDD	V
Output port source current	I <sub>OH1</sub>	V <sub>OH</sub> =0.9VDD, @5V	4			mA
Output port sink current	I <sub>OL1</sub>	V <sub>OL</sub> =0.1VDD, @5V	10			mA

3 A.C. Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
System clock	f <sub>SYS1</sub>	RC oscillator @5v (32Khz) With external fixed resistor/capacitor	28	32	36	KHz
External reset low pulse width	t <sub>RES</sub>		1			us

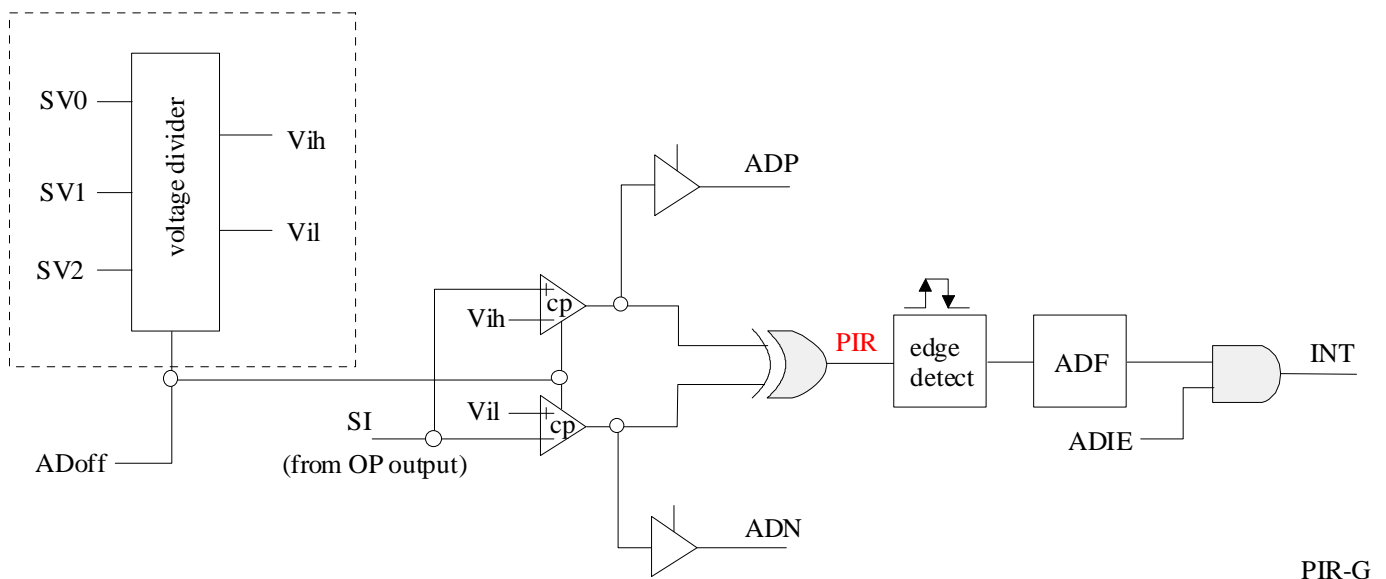
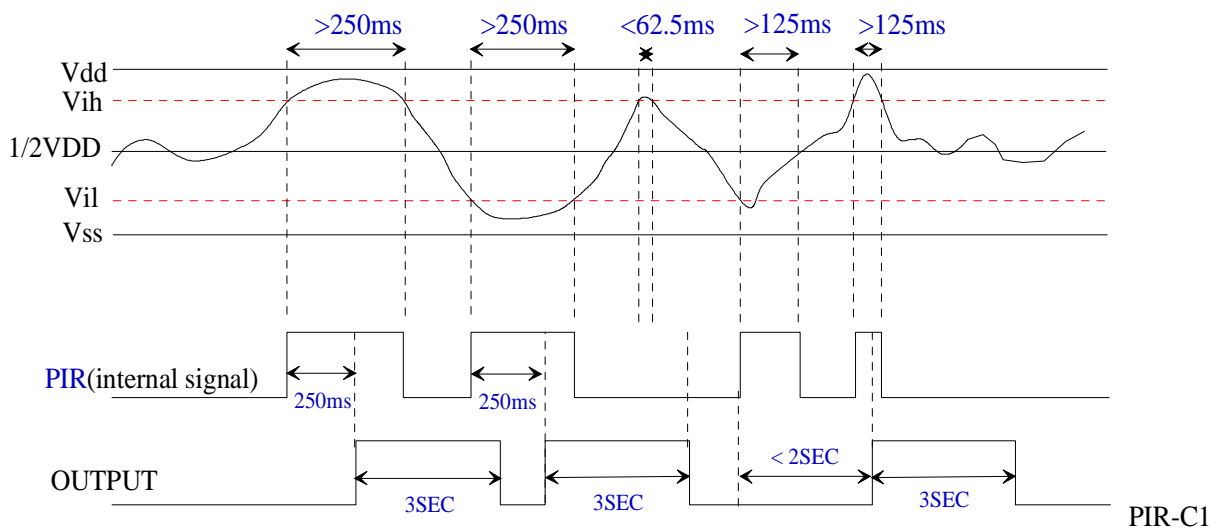
4 Operational amplifiers features (VDD=5V, 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Input offset voltage	Vios			5	10	mV
Input offset current	Iios			1	100	pA
Input bias current	Iib			10	200	pA
Positive output swing	Vsh		4.1	4.4		V
Negative output swing	Vsl			0.1	0.2	V
Unity Gain Bandwidth	fb	Loading C=50p		5		KHz
Common mode reject ratio	CMRR	Vo=1V	60	65		dB
Supply voltage reject ratio	SVRR	Vo=1V	60	65		dB
Slew rate at a unit gain	SR	No load	0.01			V/us
PIR window midpoint	Vref		2.3	2.50	2.7	V
Output short source current	Ioph	(Vin+)-(Vin-)>10mV	5			mA
Output short sink current	Iopl	(Vin+)-(Vin-)<10mV	5			mA

. Function Description

- 1 Built-in 2-stage OP, with the amplifier gain adjustable by external resistor.
- 2 Built-in PIR sensor working window comparator circuit, supporting 8 optional working windows, the second of which is the current configuration, as the table below: (That can be adjusted as user need.)

Working Window	Vih	Vil
1	$0.5VDD + 0.07VDD$	$0.5VDD - 0.07VDD$
2	$0.5VDD + 0.10VDD$	$0.5VDD - 0.10VDD$
3	$0.5VDD + 0.13VDD$	$0.5VDD - 0.13VDD$
4	$0.5VDD + 0.16VDD$	$0.5VDD - 0.16VDD$
5	$0.5VDD + 0.19VDD$	$0.5VDD - 0.19VDD$
6	$0.5VDD + 0.22VDD$	$0.5VDD - 0.22VDD$
7	$0.5VDD + 0.25VDD$	$0.5VDD - 0.25VDD$
8	$0.5VDD + 0.28VDD$	$0.5VDD - 0.28VDD$



- 3 PIR signal de-bounce contains the following 3 conditions, and if the PIR signal fits any of them, it would be acknowledged.
  - 3.1 More than 250ms
  - 3.2 In 2 seconds, two signals each more than 125ms, as the graph above (That can be adjusted as user need.)
  - 3.3 In 2 seconds, three signals each more than 62.5ms, (That can be adjusted as user need.)
- 4 CDS de-bounce time is 1 sec. It uses Resistor/Capacitor Charging/Discharging Principle to generate different pulse width to distinguish between daytime and nighttime. (That can be adjusted as user need.)
- 5 TMR needs external resistor and capacitor. It can control the output duration of RELAY and TRIAC (With 60Hz AC power supply or DC mode, it is 3 seconds to 12 minutes; With 50Hz AC power supply, it is 3.6 seconds to 14.4 minutes), and the range can be adjusted to any condition that user needs (for example, 3 seconds to 3 hours).
- 6 When OPTION = 1, without MANUAL OVERRIDE function, the system always functions with AUTO MODE.
  - 6.1 TRIACH output conditions:
    - 6.1.1 It is always OFF in daytime mode.
    - 6.1.2 In nighttime mode, after PIR signal is acknowledged, its output brightness is 95%, with the output duration controlled by TMR.
  - 6.2 TRIACL output conditions:
    - 6.2.1 It is always OFF in daytime mode.
    - 6.2.2 In nighttime mode, normally the output brightness is controlled by DIM (20%-95%, for the small lamp application). After PIR signal is acknowledged, its output brightness is 95% (the brightest), with the output duration controlled by TMR, and after the output, it returns to small lamp mode.
  - 6.3 RELAY output conditions:
    - 6.3.1 It is always OFF in daytime mode.
    - 6.3.2 In nighttime mode, after PIR signal is acknowledged, it outputs high, with the output duration controlled by TMR.
- 7 When OPTION = floating, it functions with MANUAL OVERRIDE & AUTO MODE:
  - 7.1 When power on, the default is AUTO MODE, which is the same as the above.
  - 7.2 When AC power supply is switched OFF -> ON for more than 0.25S and less than 2.5S, the

system enters **MANUAL OVERRIDE**, and the function is:

7.2.1 TRIACH output condition:

7.2.1.1 Not controlled by CDS, its output brightness is 95%, and the output duration is 6 hours. After the output, it returns to **AUTO MODE**.

7.2.2 TRIACL output condition:

7.2.2.1 Not controlled by CDS, its output brightness is 95%, and the output duration is 6 hours. After the output, it returns to **AUTO MODE**.

7.2.3 RELAY output condition:

7.2.3.1 Not controlled by CDS, it outputs high, and the output duration is 6 hours. After the output, it returns to **AUTO MODE**.

7.3 In **MANUAL OVERRIDE**, if the AC power supply is switched OFF -> ON for more than 2.5S, the system returns back to AUTO MODE.

8 When **OPTION=VSS**, the system functions with **DC MODE**:

8.1 TRIACH real time outputs the signal of ADN (without de-bounce).

8.2 TRIACL real time outputs the signal of ADP (without de-bounce).

8.3 RELAY output conditions:

8.3.1 It is always OFF in daytime mode.

8.3.2 In nighttime mode, after PIR signal is acknowledged, it outputs high, with the output duration controlled by TMR.

9 At **AUTO MODE** and **MANUAL OVERRIDE & AUTO MODE**, when the system is power off, it will shut down all outputs to reduce the power consumption to the lowest.

10 When TRIACH/ TRIACL/ RELAY is output (OFF -> ON) or shut off (ON -> OFF) or MANUAL OVERRIDE is activated (before ZC occurs), the system ignores the PIR signal for 1 second (That can be adjusted as user need).

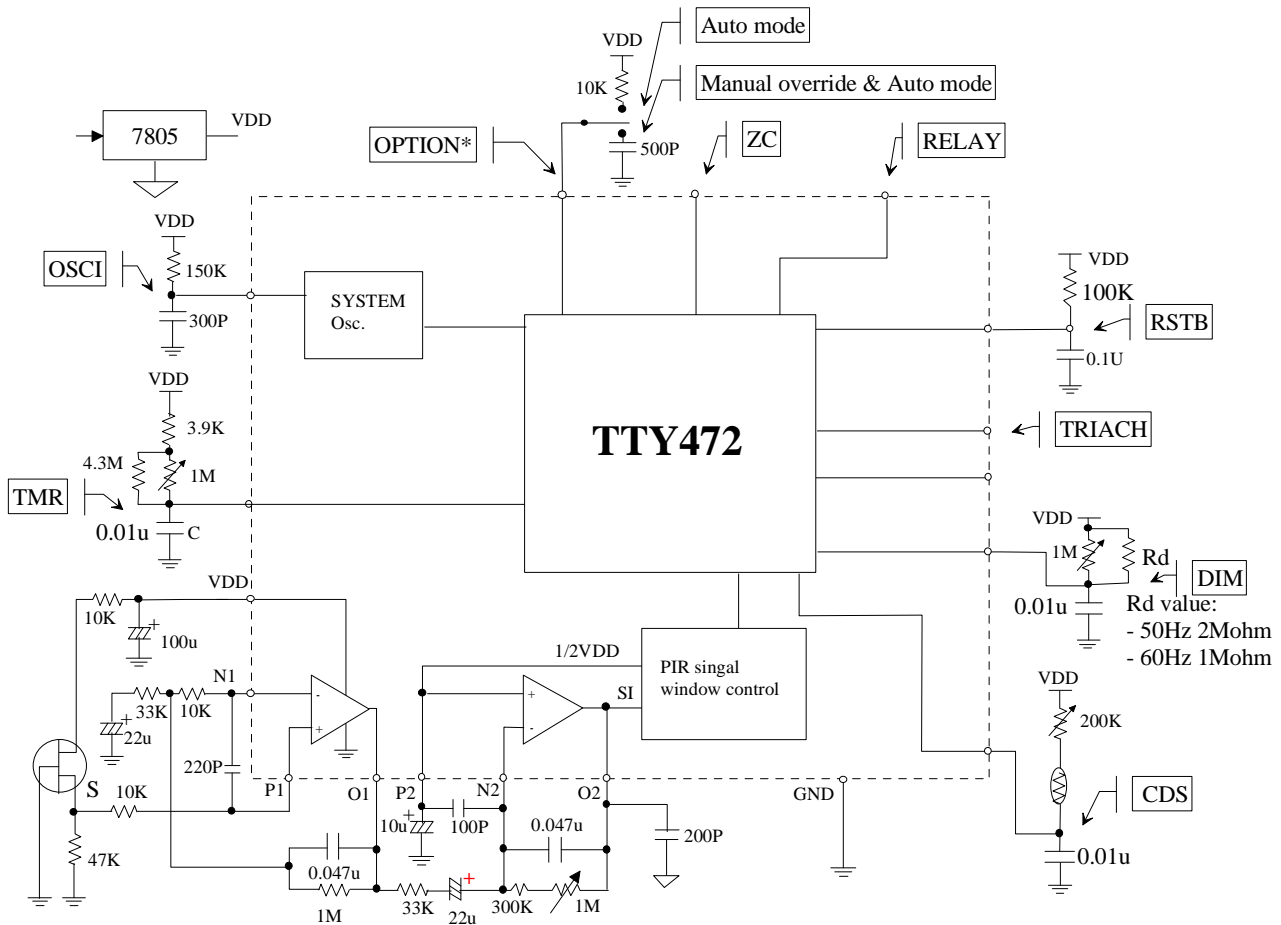
## . Special Note

- 1 With OSCI (RC oscillator, 1% resistor, 5% capacitor), this product can implement the function of 50HZ/ 60HZ auto judgment, which needs to be requested by the user.
- 2 This product uses SOC approach to integrate the PIR peripheral circuit into one IC, so it can be adjusted as user need, to provide more choices for user.
- 3 If the spec of user need is clear, it takes about 2 to 4 weeks to supply user ES.



. Application Circuit

(With TRIAC/RELAY/CDS/TMR/DIMMER Application)

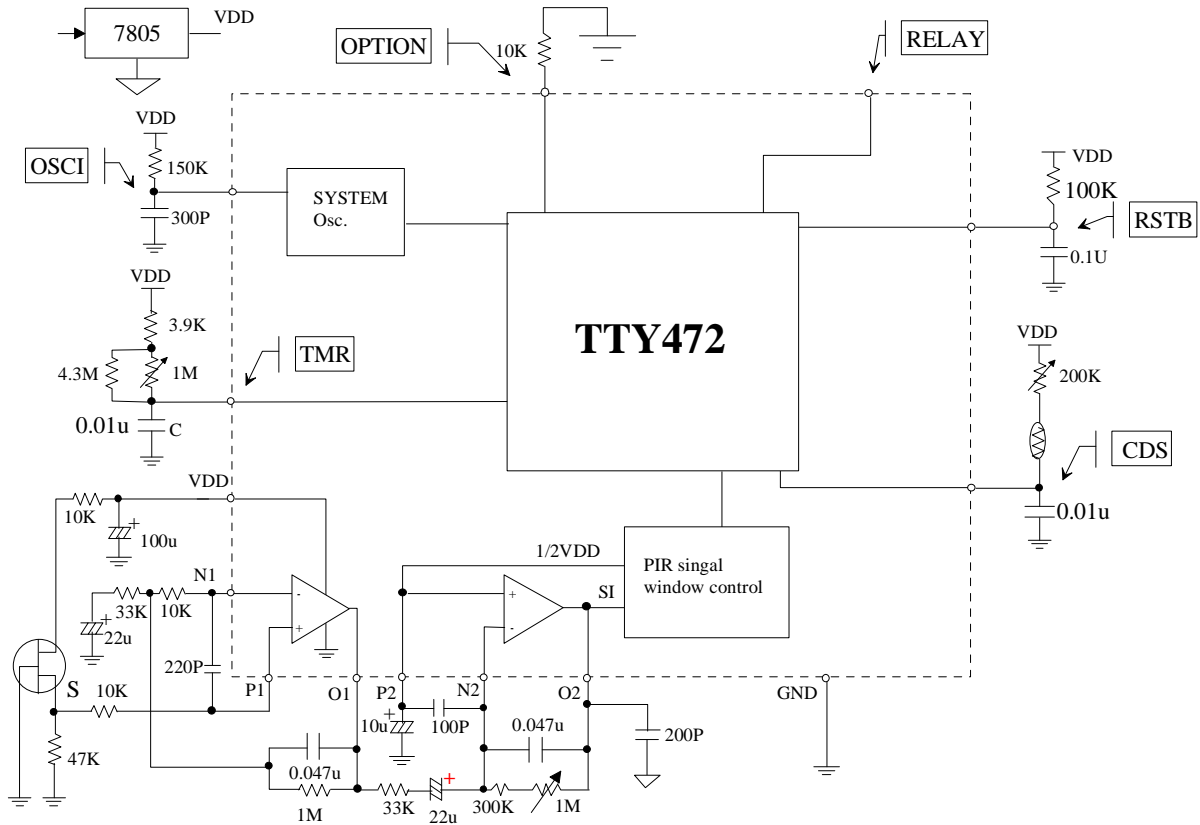


OPTION pin :  
 - VDD: No manual override function  
 - NC(connect capacitor to VSS): With manual override function

PIR-1B

- \* In TRIACH application, this system functions the same as 8072.
- \* The additional functions of DIM/ TRAIACL/ MANUAL OVERRIDE in this IC, are optional for users, with application circuits.
- \* For power saving, it can choose 3V as the operating voltage, and then the power consumption would be reduced (with modified MASK).
- \* The connection of OPTION pin:
  - VDD (with external 10K resistor to VDD): Auto mode function
  - VSS (with external 10K resistor to VSS): DC mode function, without Triac function
 (ZC/DIM/TRIACL/TRIACH pins are not used, and floating), with the other functions(Relay/CDS/TMR), OSCI normally off
  - Floating (with external 500P capacitor to VSS): Manual override & Auto mode function, lamp lights for 6 hours in nighttime

(With RELAY/CDS/TMR Application Only)



OPTION pin :  
 - VSS: Only Relay/ CDS/ TMR function

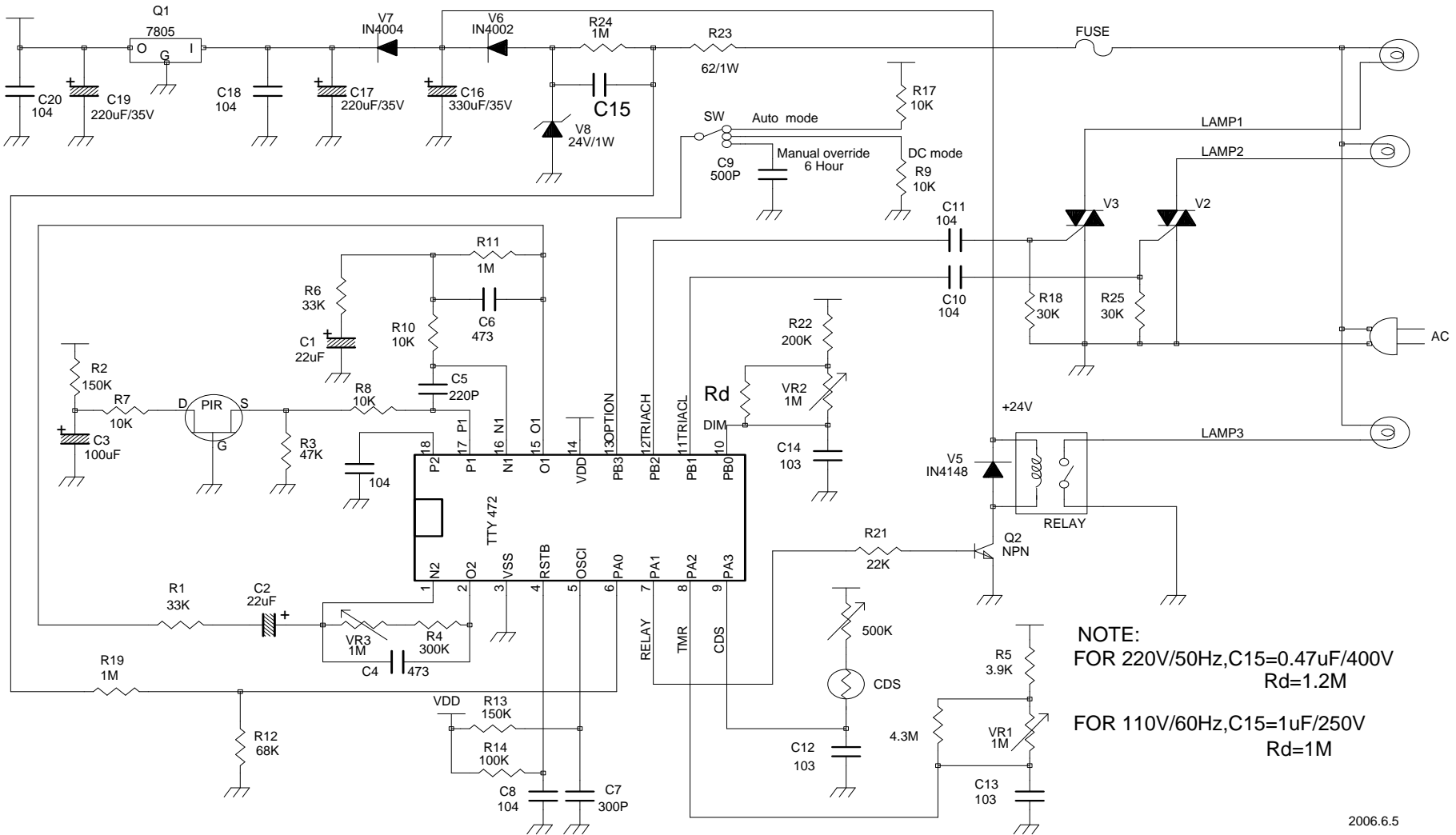
PIR-1C

Note: The pin not used should not connect



DEMO BOARD CIRCUIT

Auto Mode/DC Mode/Manual Override Mode

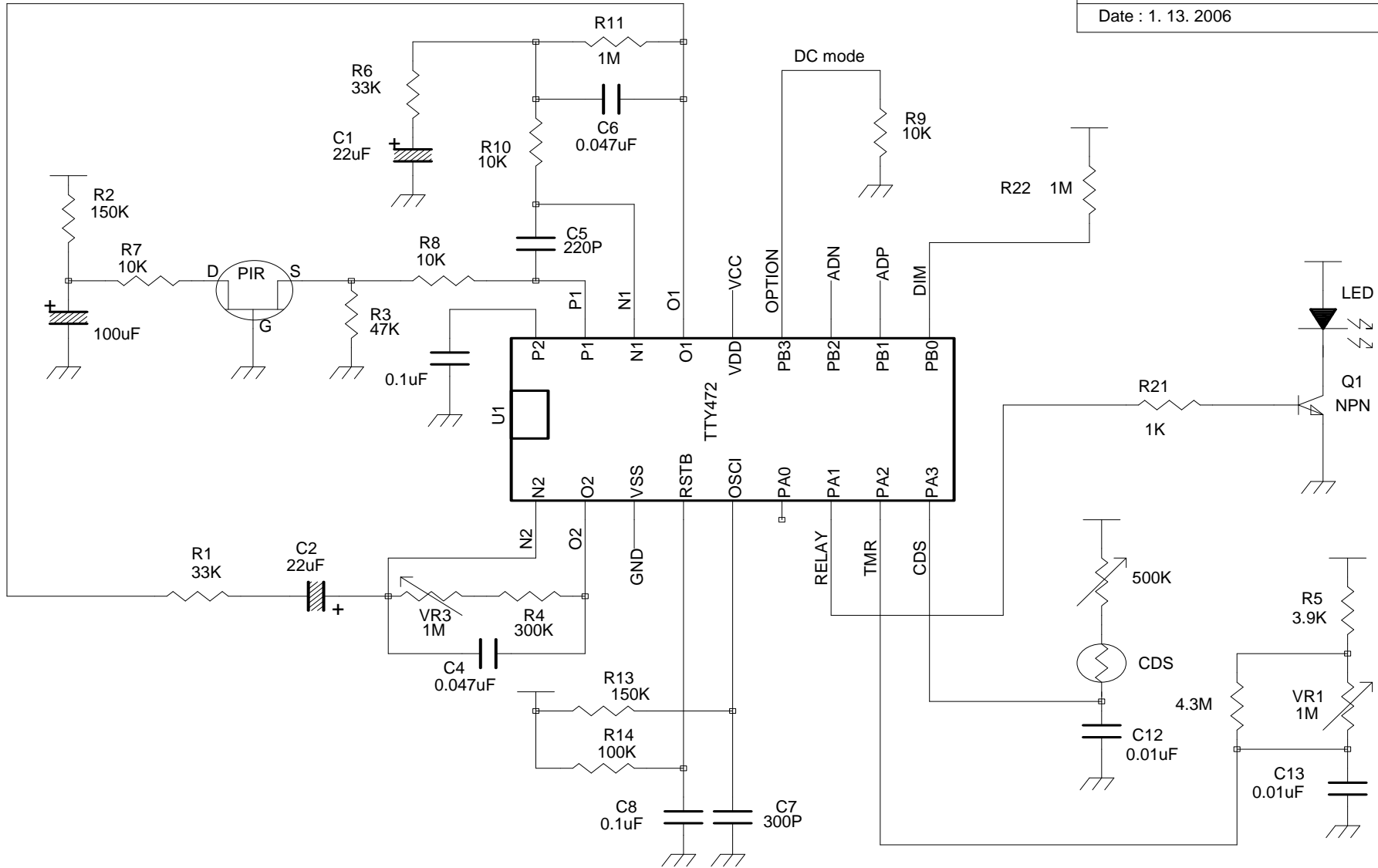


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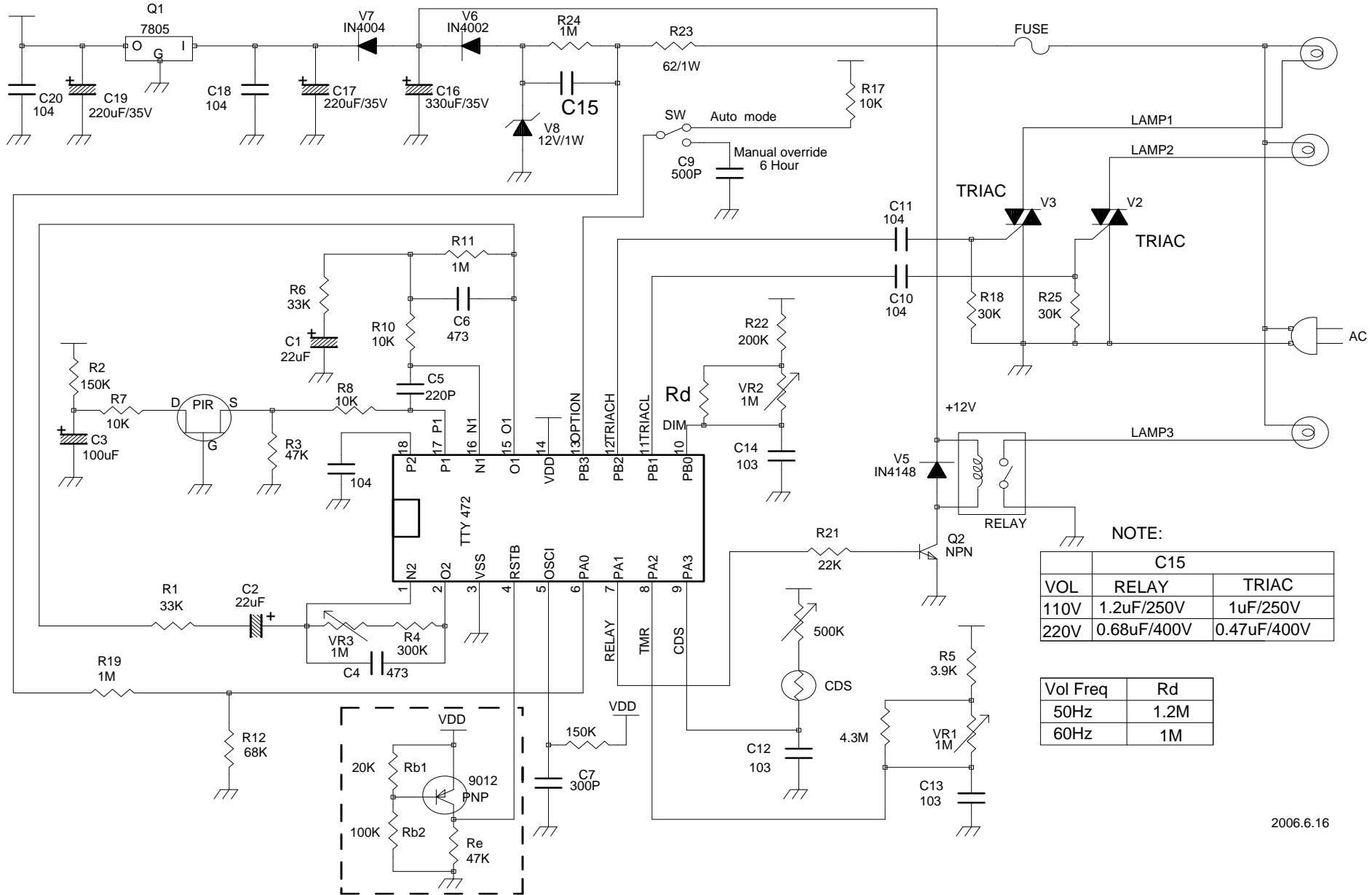
DC Mode

TONTEK Design Technology Ltd.
TTY472 Application Circuit
Drawn by 張生坤
Date : 1. 13. 2006





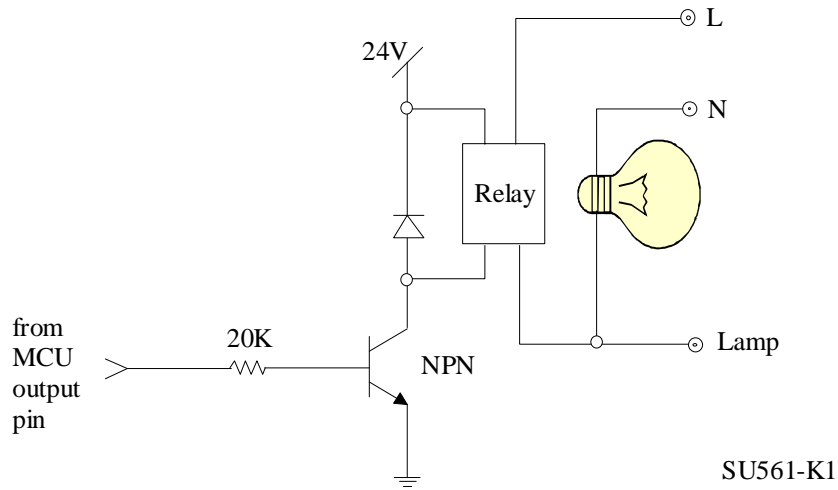
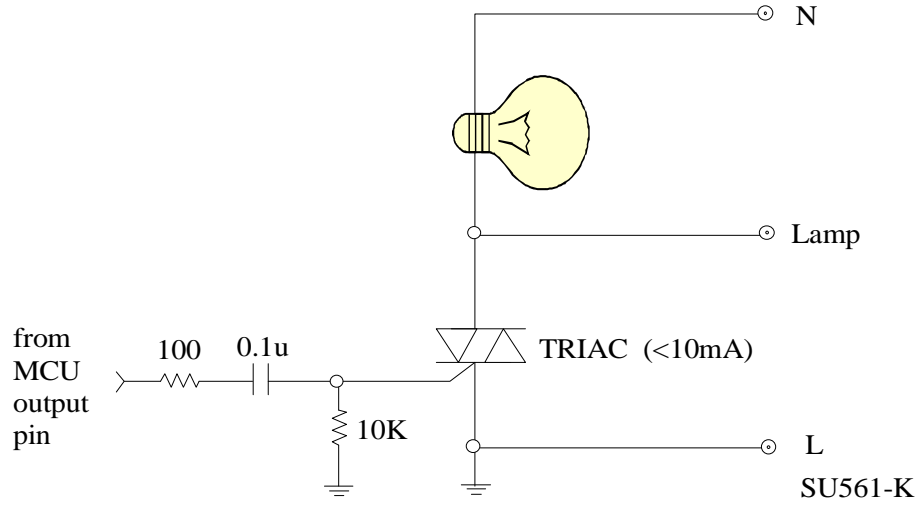
Auto Mode/Manual Override Mode



NOTE:

	C15	
VOL	RELAY	TRIAC
110V	1.2uF/250V	1uF/250V
220V	0.68uF/400V	0.47uF/400V

Vol Freq	Rd
50Hz	1.2M
60Hz	1M

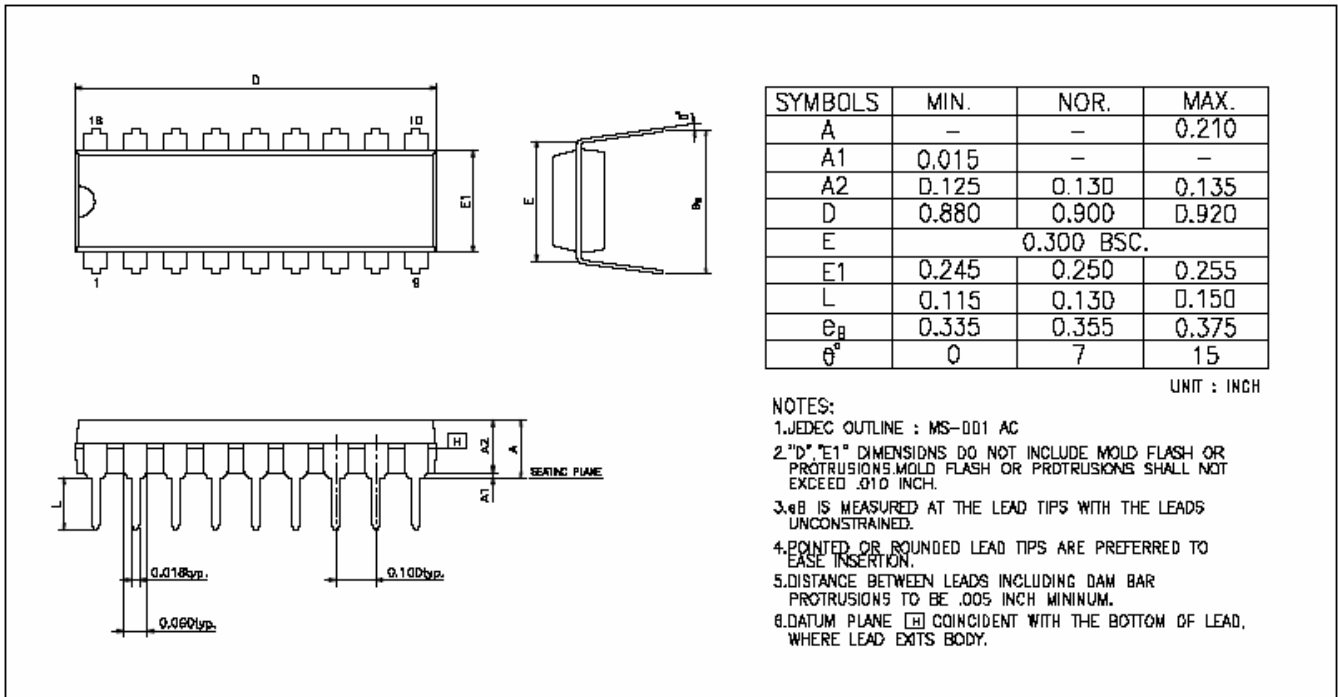


. Order Information

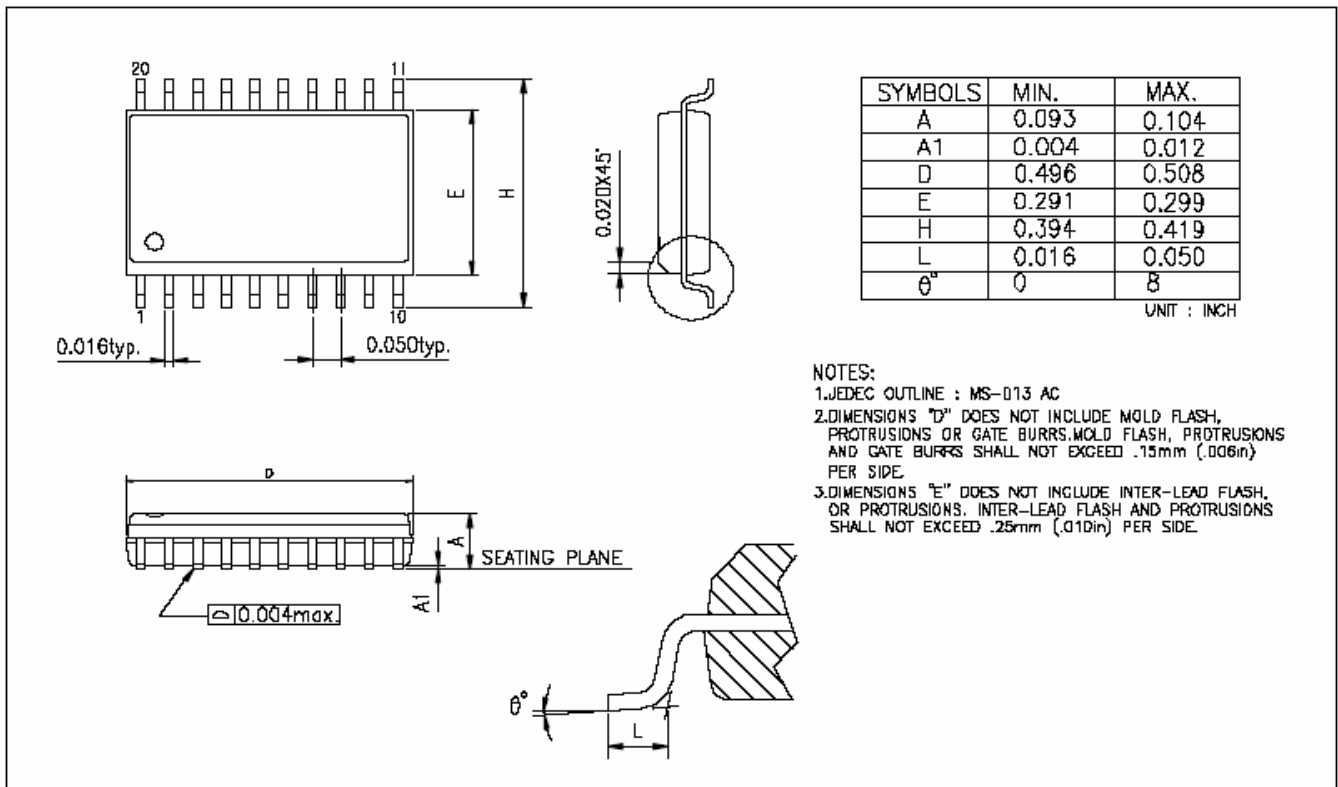
	Project Number Name
Package form	TTY472
Chip form	TCY472
Wafer base	TDY472

. Package Information

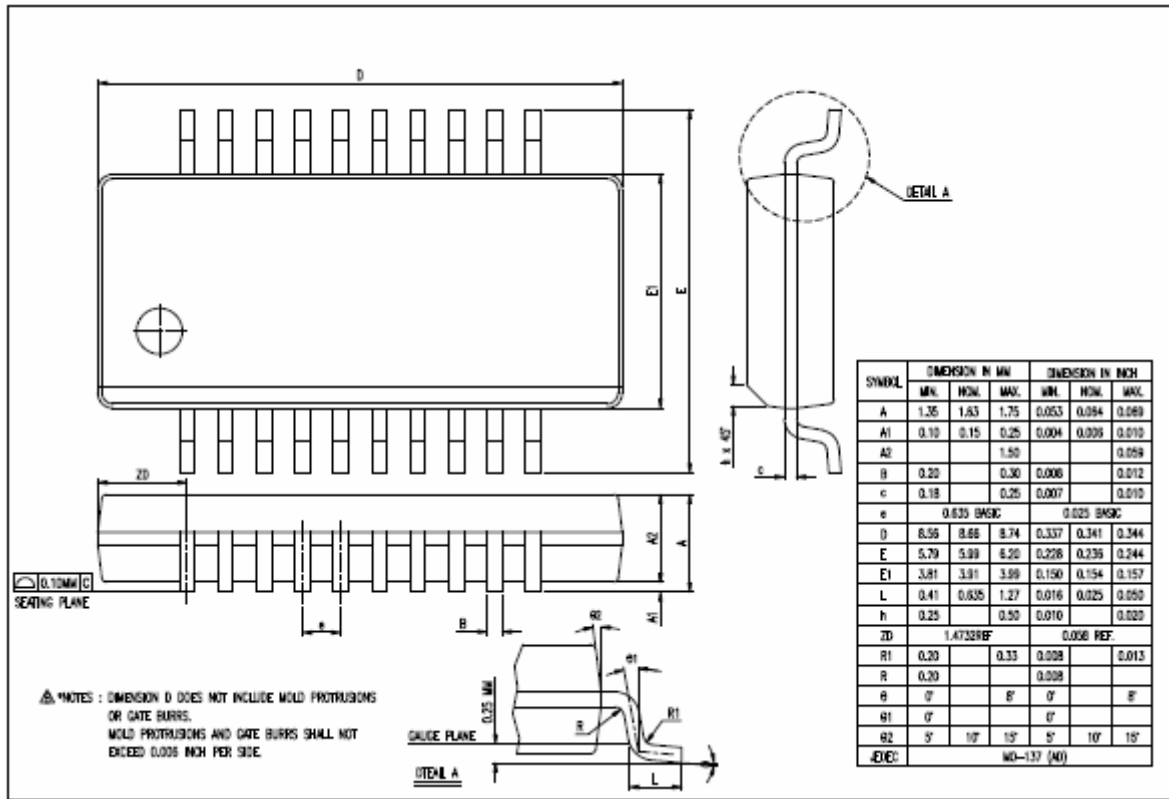
(18-DIP)



(20-SOP)



(20-SSOP)





## . Revise History

- \* 2004/6/15
  - Add MANUAL OVERRIDE function
- \* 2004/8/11
  - Modify pins
- \* 2004/8/31
  - Modify pins (Swap the functions of PA1 and PA3)
- \* 2004/9/1
  - Modify the function of Option pin
- \* 2004/9/2
  - Add application circuit functions and notes
- \* 2004/10/13
  - Add the value of power consumption
- \* 2004/11/01
  - Modify application circuit
  - Add the application note of OPTION
  - Modify PIR working windows
- \* 2004/11/08
  - Modify application circuit
- \* 2005/07/11
  - Update AC/DC Characteristics
- \* 2005/09/27
  - Update P11, application circuit Rd: 1M is changed to 1M(60Hz) or 1.2M(50Hz), R13: 120K is changed to 150K, CT: 2uf/125V is changed to 0.47uF(220V) or 1uF(110V).
  - Update P3&P7, "3 seconds to 12 minutes" in original spec is changed to "With 60Hz AC power supply or DC mode, it is 3 seconds to 12 minutes; with 50Hz AC power supply, it is 3.6 seconds to 14.4 minutes"
- \* 2005/12/30
  - modify P10,Application circuit
- \* 2006/11/13
  - Modify AC mode/Manu override mode Title
  - Add external Tr & R for LVR function
- \* 2010/10/11
  - Update Page 11 DEMO BOARD CIRCUIT