

# MAP9001, MAP9002, MAP9003

## High Voltage AC LED Driver

### General Description

The MAP900X family is a LED Driver which has high input voltage ranged from 90V to 270V.

It can drive several series LEDs from rectified AC voltage.

The MAP900X family can achieve 0.95 or higher power factor and low total harmonic distortion less than 20%.

The MAP900X family has higher LED current drive capability up to 240mA and the current can be adjustable with external resistors.

The MAP900X family is available in eSOP-16, eSOP-8, SOP-8 with Halogen-free (fully RoHS compliant).

For more information, please contact local Magnachip sales office in world-wide or visit Magnachip's website.



**RoHS Compliant**  
HALOGEN-FREE

### Features

- Flicker-free (MAP9001)
- EMI improvement
- Input power variation:  $\pm 10\%$
- Higher power factor :  $> 0.95$
- Lower total harmonic distortion :  $< 20\%$
- Higher current drive capability
  - Up to 240mA
- eSOP-16, eSOP-8, SOP-8

### Applications

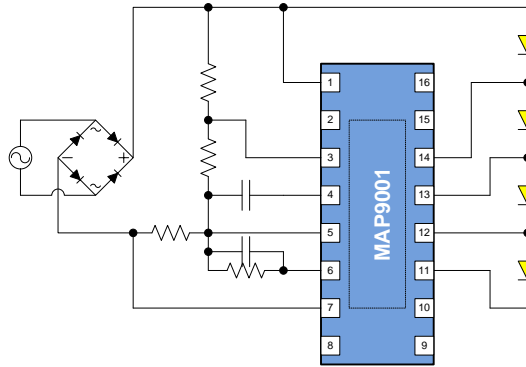
- AC LED Driver
- Lighting equipment
- LED Driver Power Supplies

### Ordering Information

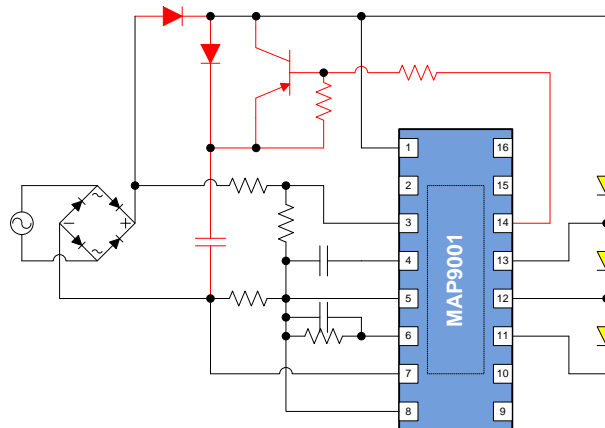
Part Number	Top Marking	Ambient Temperature Range	Package	RoHS Status
MAP9001ESRH	MAP9001	-30°C to +85°C	eSOP-16	Halogen Free
MAP9002ESRH	MAP9002	-30°C to +85°C	eSOP-8	Halogen Free
MAP9003SIRH	MAP9003	-30°C to +85°C	SOP-8	Halogen Free

### Simplified Application Circuit

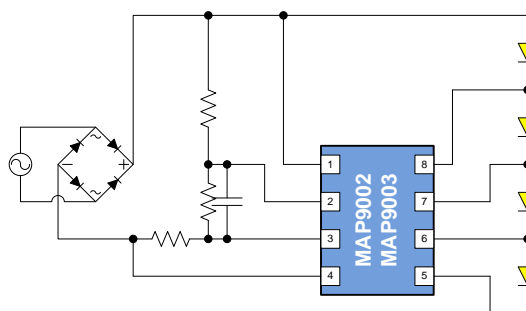
- MAP9001



- MAP9001 with flicker-free (Compliance with Energy Star)

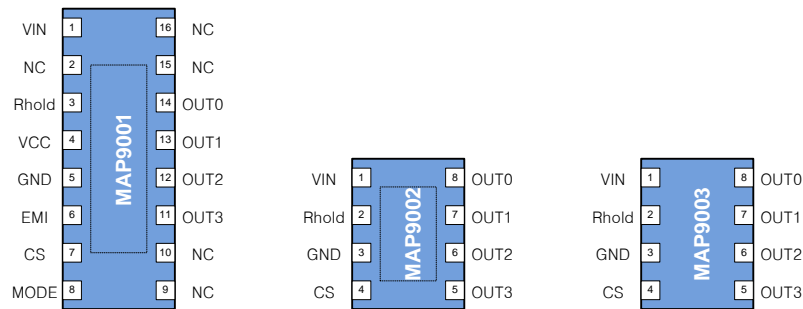


- MAP9002 & MAP9003



## Pin Configuration & Description

### - Pin Configuration



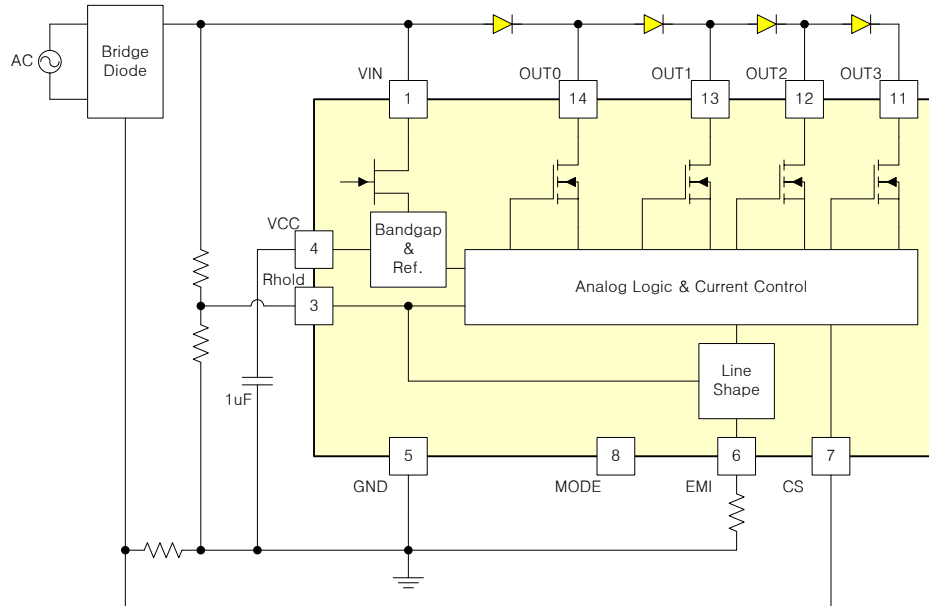
### - Pin Description

Pin	MAP9001
1	VIN VCC charging
2	NC No Connection
3	Rhold HOLD turn-on voltage
4	VCC VCC
5	GND Ground
6	EMI EMI improvement
7	CS Current sensing
8	MODE Flicker-free mode
9	NC No Connection
10	NC No Connection
11	OUT3 Output – 3
12	OUT2 Output – 2
13	OUT1 Output – 1
14	OUT0 Output – 0
15	NC No Connection
16	NC No Connection

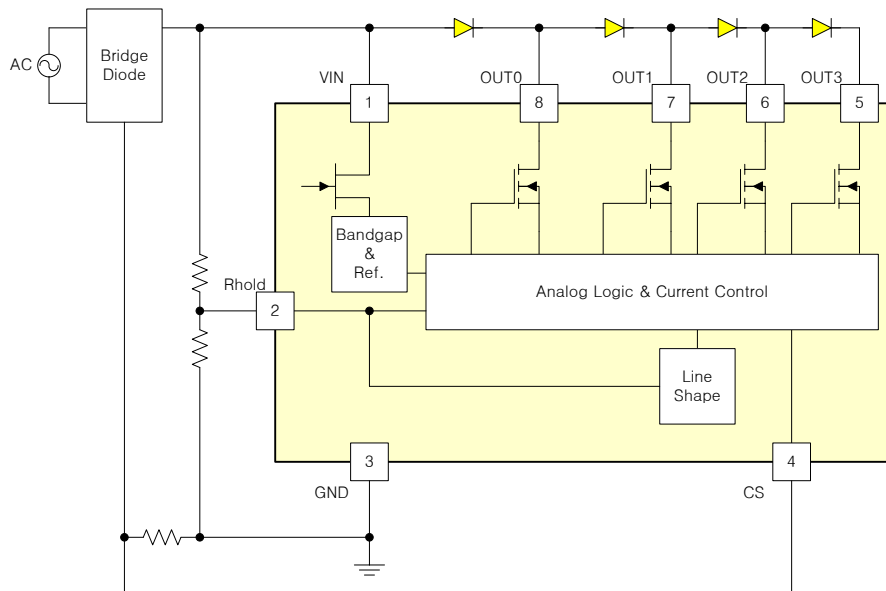
Pin	MAP9002, MAP9003
1	VIN VCC charging
2	Rhold HOLD turn-on voltage
3	GND Ground
4	CS Current sensing
5	OUT3 Output – 3
6	OUT2 Output – 2
7	OUT1 Output – 1
8	OUT0 Output – 0

### Functional Block Diagram

- MAP9001



- MAP9002 & MAP9003



**Absolute Maximum Ratings** (Note 1)

PARAMETER		VALUE	UNIT	
VIN		700	V	
HOLD, OUT1, OUT2, OUT3		-0.3 ~ 700	V	
EMI,CS		-0.3 ~ 6	V	
VCC, Rhold, MODE		20	V	
Operating Temperature Range		-40 ~ 125	°C	
Junction Temperature Range		-40 ~ 150	°C	
Storage Temperature Range		-65 ~ 150	°C	
Lead temperature(soldering, 10sec )		260	°C	
ESD Susceptibility	HBM (Note 2)	2000	V	
	MM (Note 3)	200	V	
	CDM (Note 4)	1000	V	
Internal MOSFET Section	IDMAX(DC) (Note 5)	IOUT0	123	mA
		IOUT1	172	mA
		IOUT2	172	mA
		IOUT3	172	mA
	IDMMAX(Pulse) (Note 6)	IOUT0	491	mA
		IOUT1	688	mA
		IOUT2	688	mA
		IOUT3	688	mA

**Note 1:** Stress beyond the maximum ratings listed above may incur permanent damage to the device. Operating above the recommended conditions for extended time may stress the device and affect device reliability. Also the device may not operate normally above the recommended operating conditions. These are stress ratings only.

**Note 2:** ESD tested per JESD22A-114.

**Note 3:** ESD tested per JESD22A-115.

**Note 4:** ESD tested per JESD22C-101E

**Note 5:** Continuous Drain Current

**Note 6:** Pulsed Drain Current, Pulse width ≤ 10us, duty cycle ≤ 1%

**Thermal Resistance**

PARAMETER		VALUE	UNIT
Thermal Resistance ( $\theta_{JA}$ ) , (Note 7)	MAP9001(eSOP-16)	52.6	°C/W
Thermal Resistance ( $\theta_{JT}$ ) , (Note 8)		13.0	°C/W
Thermal Resistance ( $\theta_{JA}$ ) , (Note 7)	MAP9002(eSOP-8)	62.8	°C/W
Thermal Resistance ( $\theta_{JT}$ ) , (Note 8)		22.2	°C/W
Thermal Resistance ( $\theta_{JA}$ ) , (Note 7)	MAP9003(SOP-8)	100.7	°C/W
Thermal Resistance ( $\theta_{JT}$ ) , (Note 8)		50.5	°C/W

**Note 7:** Multi-layer PCB based on JEDEC standard (JESD51-7, 4Layer PCB)

**Note 8:** The metal PCB's diameter is

- ✓ MAP9001 50mm and height is 1.6t.
- ✓ MAP9002 53mm and height is 1.6t.
- ✓ MAP9003 47mm and height is 1.6t.

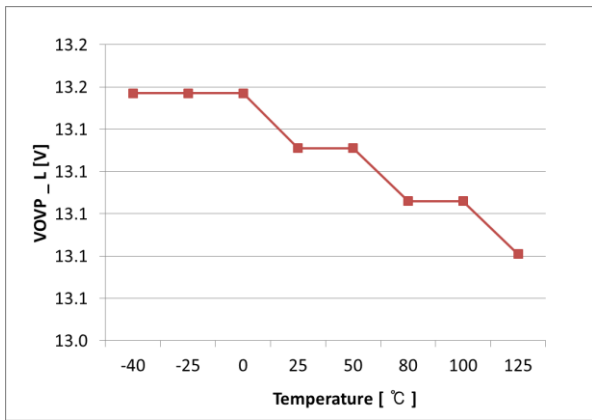
**Electrical Characteristics**

Ta = 25°C, CS Resistance = 6.8Ω unless otherwise specified

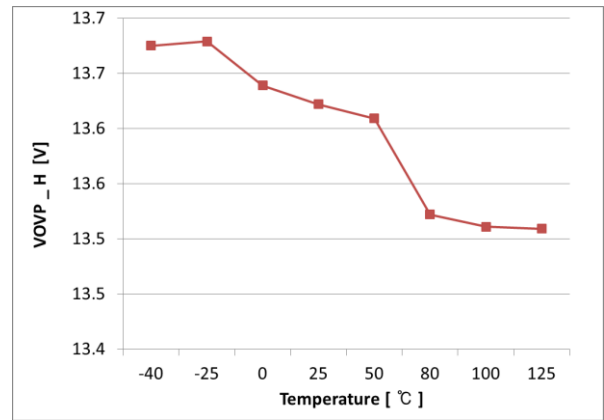
SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
<b>Supply</b>						
VVIN	Input voltage range	Note 6	50		700	V
VVCC	Operating voltage		-	15	-	V
Iop	Operating current		210	465	720	uA
VUVLO	Under voltage lockout	UVLO_H	-	12	-	V
		UVLO_L	-	10	-	V
<b>Driver Section</b>						
VRHOLD	Rhold reference voltage	VVIN = 200V, VGND = 0V V <sub>MODE</sub> = open	4.5	5.2	5.9	V
OVP_H	Over voltage protection	VVIN = 200V, VGND = 0V	12.2	13.5	14.8	V
OVP_L	Over voltage protection release	VVIN = 200V, VGND = 0V		13.2		V
ID Leak	Driver leakage current	VVIN = 200V, VGND = 0V, V <sub>OUT0-3</sub> = 700V	-	-	10	uA
IOUT0	Driver 0 current	VVIN =200V, V <sub>OUT0</sub> = 40V V <sub>Rhold</sub> = 0V	-	85	-	mA
IOUT1	Driver 1 current	VVIN =200V, V <sub>OUT1</sub> = 40V V <sub>Rhold</sub> = 0V	-	130	-	mA
IOUT2	Driver 2 current	VVIN =200V, V <sub>OUT2</sub> = 40V V <sub>Rhold</sub> = 0V	-	155	-	mA
IOUT3	Driver 3 current	VVIN =200V, V <sub>OUT3</sub> = 40V V <sub>Rhold</sub> = 0V	-	185	-	mA
IOUT_SUM		IOUT0 + IOUT1 + IOUT2 + IOUT3	527.5	555	587.5	mA
<b>Internal MOSFET Section (Note 9)</b>						
R <sub>DS(ON)1</sub>	Drain to source resistance	V <sub>OUT0</sub> =30V, GND=0V		160		Ω
R <sub>DS(ON)2</sub>	Drain to source resistance	V <sub>OUT1</sub> =30V, GND=0V		80		Ω
R <sub>DS(ON)3</sub>	Drain to source resistance	V <sub>OUT2</sub> =30V, GND=0V		80		Ω
R <sub>DS(ON)4</sub>	Drain to source resistance	V <sub>OUT3</sub> =30V, GND=0V		80		Ω

**Note 9:** These parameters are guaranteed by design.

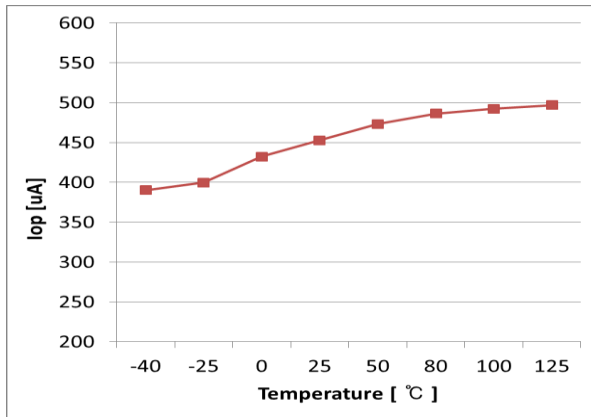
### Typical Operating Characteristics



V<sub>OVP\_L</sub> Vs. temperature



V<sub>OVP\_H</sub> Vs. temperature

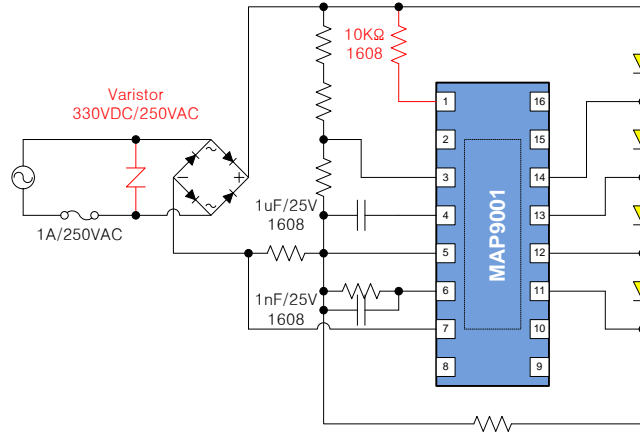


Operating current Vs. temperature

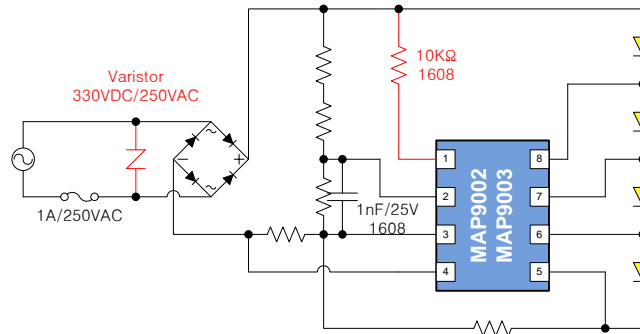
### Recommended Surge Protection Circuit

The surge test using our demo-board and pass 0.5KV surge voltage at input wattage 16W

- MAP9001



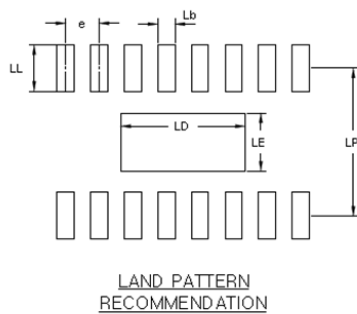
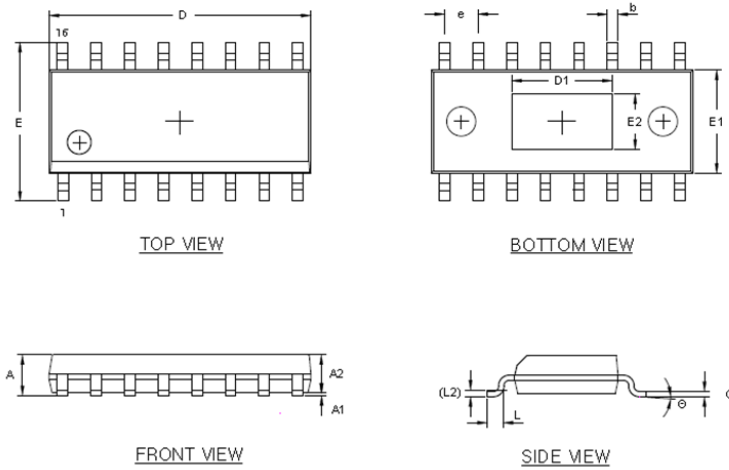
- MAP9002 & MAP9003





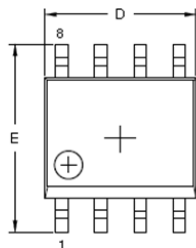
### Physical Dimensions

#### 1) ESOP 16LD

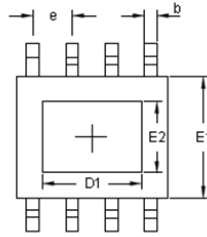


Symbol	Dimension [mm]	
	min	max
A	-	1.70
A1	0.00	0.15
A2	1.25	-
b	0.31	0.51
c	0.10	0.25
D	9.90 BSC	
D1	3.60	4.00
E	6.00 BSC	
E1	3.90 BSC	
E2	1.90	2.30
e	1.27 BSC	
θ	0°	8°
L	0.40	1.27
L2	0.25 (GAUGE PLANE)	
Lb	0.60	
LD	4.70	
LE	2.20	
LL	1.75	
LP	5.60	

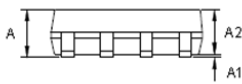
2) ESOP 8LD



TOP VIEW



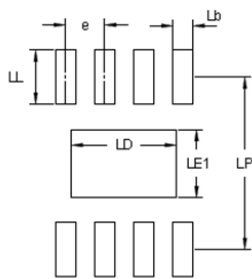
BOTTOM VIEW



FRONT VIEW



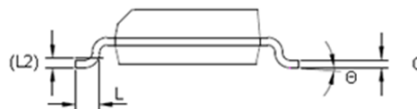
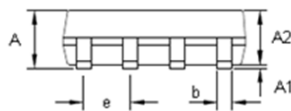
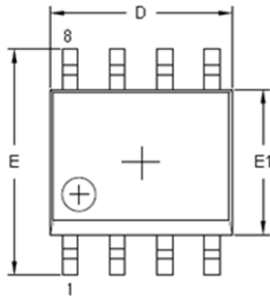
SIDE VIEW



LAND PATTERN RECOMMENDATION

Symbol	Dimension [mm]	
	min	max
A	-	1.70
A1	0.00	0.15
A2	1.25	-
b	0.31	0.51
c	0.10	0.25
D	4.90 BSC	
D1	2.95	3.35
E	6.00 BSC	
E1	3.90 BSC	
E2	2.05	2.45
e	1.27 BSC	
$\Theta$	0°	8°
L	0.40	1.27
L2	0.25(GAUGE PLANE)	
Lb	0.60	
LD	3.40	
LE	2.20	
LL	1.75	
LP	5.60	

3) SOP 8LD



Symbol	Dimension [mm]	
	min	max
A	-	1.75
A1	0.10	0.25
A2	1.25	-
b	0.31	0.51
c	0.10	0.25
D	4.90 BSC	
E	6.00 BSC	
E1	3.90 BSC	
e	1.27 BSC	
$\theta$	0°	8°
L	0.40	1.27
L2	0.25(GAUGE PLANE)	

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