



# MAP9001, MAP9002, MAP9003

## High Voltage AC LED Driver

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.

### 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

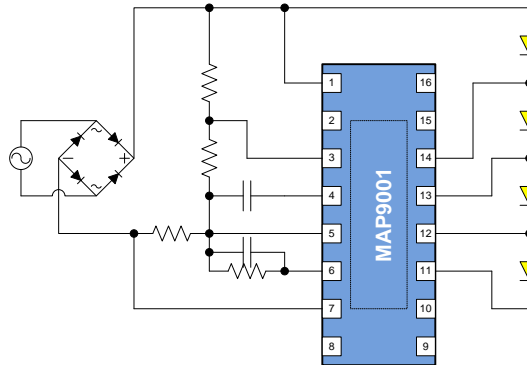
- AC LED Driver
- Lighting equipment
- LED Driver Power Supplies

### Ordering Information

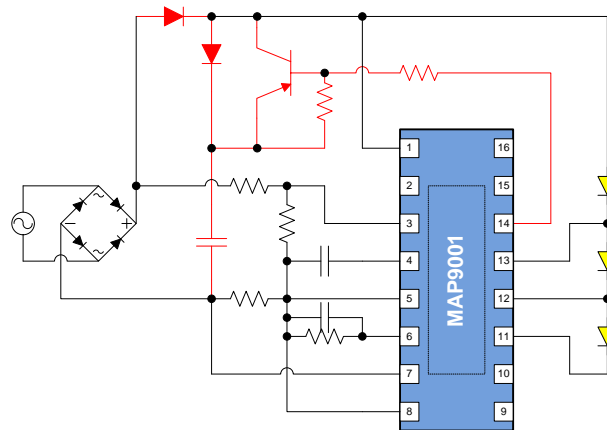
Part Number	Top Marking	Ambient Temperature Range	Package	RoHS Status
MAP9001ESRH	MAP9001	-30°C to +85°C	eSOP-16	Halogen Free
MAP9002ESRH	MAP9002	-30°C to +85°C	eSOP-8	Halogen Free
MAP9003SIRH	MAP9003	-30°C to +85°C	SOP-8	Halogen Free

### Simplified Application Circuit

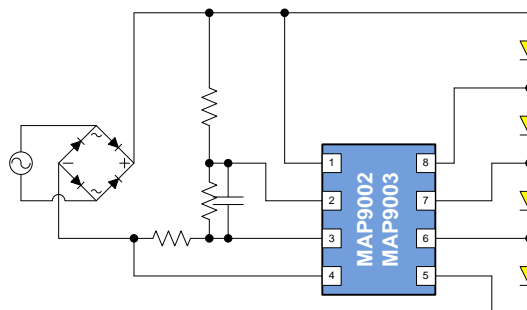
- MAP9001



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

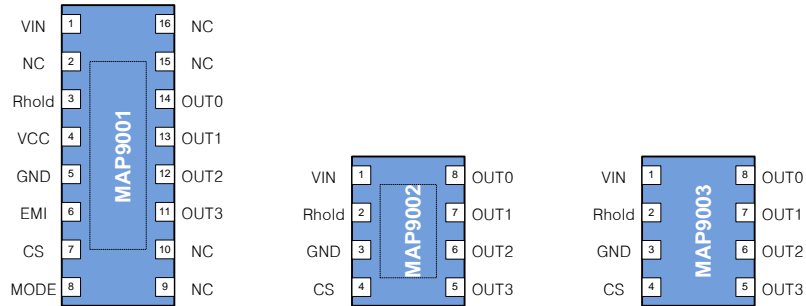


- MAP9002 & MAP9003



## 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



## Absolute Maximum Ratings

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 1)	2000	V	
	MM (Note 2)	200	V	
	CDM (Note 3)	1000	V	
Internal MOSFET Section	IDMAX(DC) (Note 4)	IOUT0	123	mA
		IOUT1	172	mA
		IOUT2	172	mA
		IOUT3	172	mA
	IDMMAX(Pulse) (Note 5)	IOUT0	491	mA
		IOUT1	688	mA
		IOUT2	688	mA
		IOUT3	688	mA

**Note 1:** ESD tested per JESD22A-114.

**Note 2:** ESD tested per JESD22A-115.

**Note 3:** ESD tested per JESD22C-101E

**Note 4:** Continuous Drain Current

**Note 5:** Pulsed Drain Current, Pulse width  $\leq 10\mu\text{s}$ , duty cycle  $\leq 1\%$ ,

## Thermal Resistance

PARAMETER		VALUE	UNIT
Thermal Resistance ( $\theta_{JA}$ ), (Note4)	MAP9001(eSOP-16)	52.6	°C/W
Thermal Resistance ( $\theta_{JT}$ ), (Note5)		13.0	°C/W
Thermal Resistance ( $\theta_{JA}$ ), (Note4)	MAP9002(eSOP-8)	62.8	°C/W
Thermal Resistance ( $\theta_{JT}$ ), (Note5)		22.2	°C/W
Thermal Resistance ( $\theta_{JA}$ ), (Note4)	MAP9003(SOP-8)	100.7	°C/W
Thermal Resistance ( $\theta_{JT}$ ), (Note5)		50.5	°C/W

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

**Note 5:** 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.

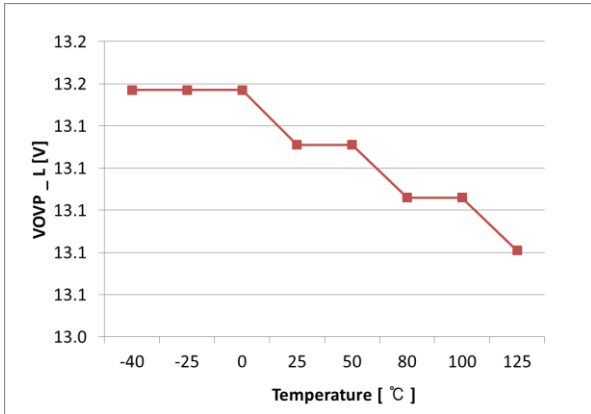
## Electrical Characteristics

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

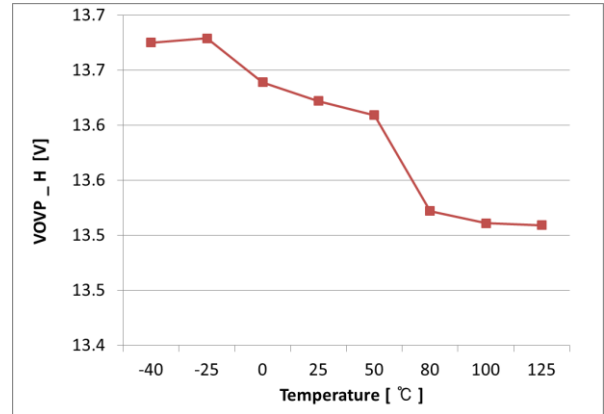
SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
<b>Supply</b>						
V <sub>VIN</sub>	Input voltage range	Note 6	50		700	V
V <sub>VCC</sub>	Operating voltage		-	15	-	V
I <sub>op</sub>	Operating current		210	465	720	μA
V <sub>VULO</sub>	Under voltage lockout	UVLO_H	-	12	-	V
		UVLO_L	-	10	-	V
<b>Driver Section</b>						
V <sub>Rhold</sub>	Rhold reference voltage	V <sub>VIN</sub> = 200V, V <sub>GNND</sub> = 0V V <sub>MODE</sub> = open	4.5	5.2	5.9	V
OVP_H	Over voltage protection	V <sub>VIN</sub> = 200V, V <sub>GNND</sub> = 0V	12.2	13.5	14.8	V
OVP_L	Over voltage protection release	V <sub>VIN</sub> = 200V, V <sub>GNND</sub> = 0V		13.2		V
I <sub>D Leak</sub>	Driver leakage current	V <sub>VIN</sub> = 200V, V <sub>GNND</sub> = 0V, V <sub>OUT0-3</sub> = 400V	-	-	10	μA
I <sub>OUT0</sub>	Driver 0 current	V <sub>VIN</sub> = 200V, V <sub>OUT0</sub> = 40V V <sub>Rhold</sub> = 0V	-	85	-	mA
I <sub>OUT1</sub>	Driver 1 current	V <sub>VIN</sub> = 200V, V <sub>OUT1</sub> = 40V V <sub>Rhold</sub> = 0V	-	130	-	mA
I <sub>OUT2</sub>	Driver 2 current	V <sub>VIN</sub> = 200V, V <sub>OUT2</sub> = 40V V <sub>Rhold</sub> = 0V	-	155	-	mA
I <sub>OUT3</sub>	Driver 3 current	V <sub>VIN</sub> = 200V, V <sub>OUT3</sub> = 40V V <sub>Rhold</sub> = 0V	-	185	-	mA
I <sub>OUT_SUM</sub>		I <sub>OUT0</sub> + I <sub>OUT1</sub> + I <sub>OUT2</sub> + I <sub>OUT3</sub>	527.5	555	587.5	mA
<b>Internal MOSFET Section</b>						
R <sub>DS(ON)1</sub>	Drain to source resistance	V <sub>d</sub> =30V, V <sub>s</sub> =0V		255		mohm
R <sub>DS(ON)2</sub>	Drain to source resistance	V <sub>d</sub> =30V, V <sub>s</sub> =0V		130		mohm
R <sub>DS(ON)3</sub>	Drain to source resistance	V <sub>d</sub> =30V, V <sub>s</sub> =0V		130		mohm
R <sub>DS(ON)4</sub>	Drain to source resistance	V <sub>d</sub> =30V, V <sub>s</sub> =0V		131		mohm

**Note 6:** 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.

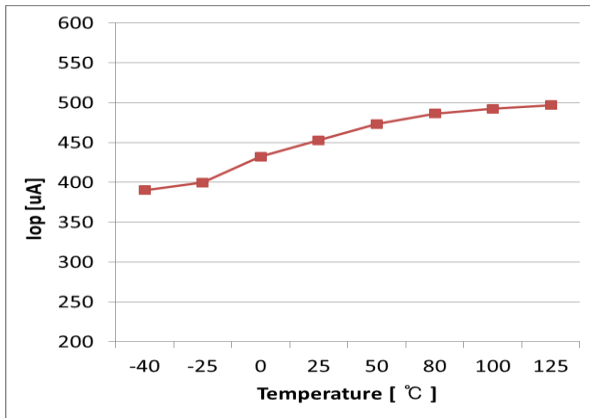
### Typical Operating Characteristics



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



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

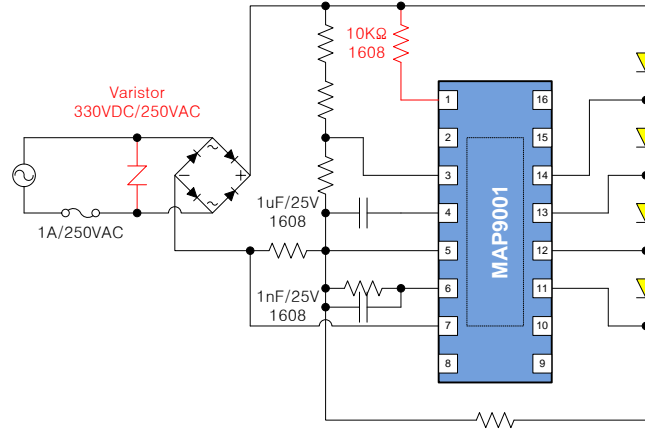


Operating current Vs. temperature

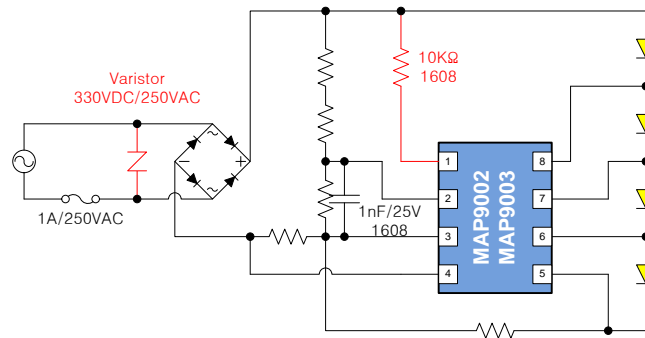
## Recommended Surge Protection Circuit

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

- MAP9001



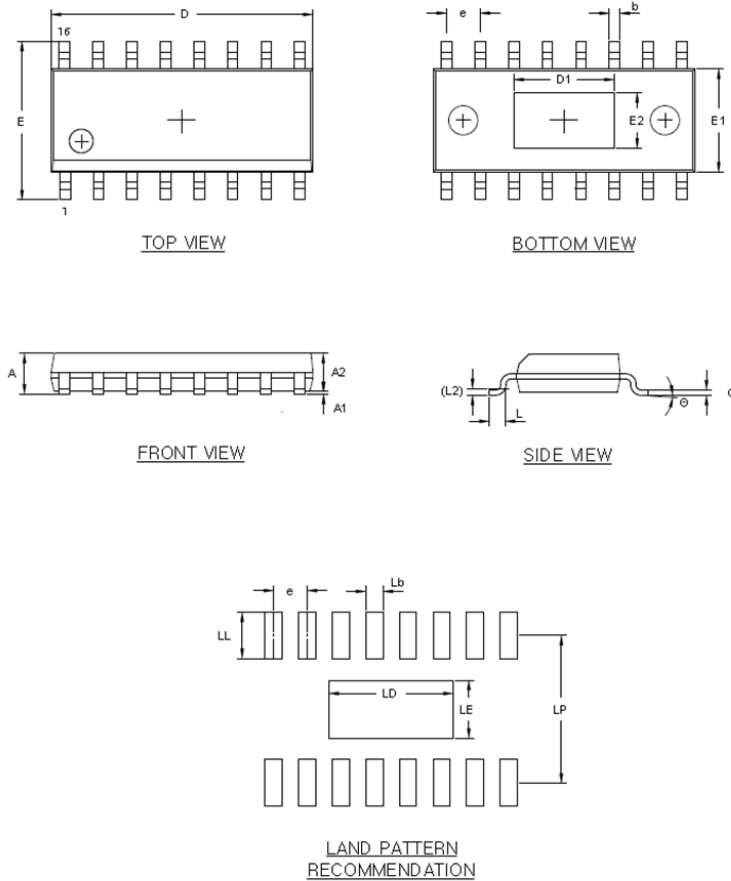
- MAP9002 & MAP9003





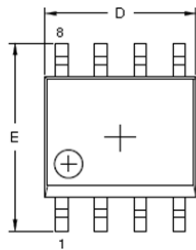
## Physical Dimensions

### 1) ESOP 16LD

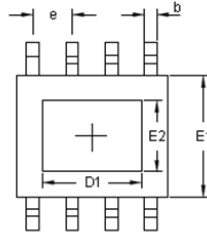


Symbol	Dimension [mm]	
	min	max
A	-	1.70
A1	0.00	0.15
A2	1.25	-
b	0.31	0.51
c	0.10	0.25
D	9.90 BSC	
D1	3.60	4.00
E	6.00 BSC	
E1	3.90 BSC	
E2	1.90	2.30
e	1.27 BSC	
$\theta$	0°	8°
L	0.40	1.27
L2	0.25 (GAUGE PLANE)	
Lb	0.60	
LD	4.70	
LE	2.20	
LL	1.75	
LP	5.60	

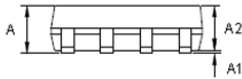
2) ESOP 8LD



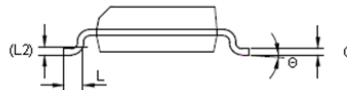
TOP VIEW



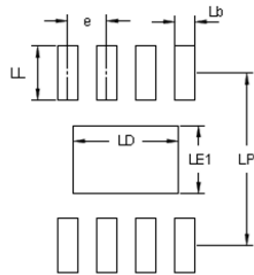
BOTTOM VIEW



FRONT VIEW



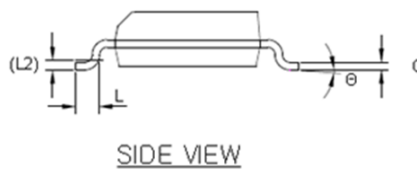
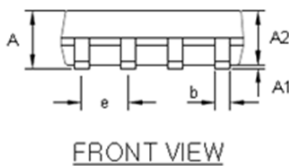
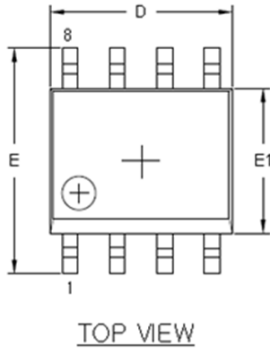
SIDE VIEW



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	
θ	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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