



MAP9010

High Voltage AC LED Driver

High Voltage AC LED Driver

General Description

The MAP9010 is LED Driver which has high input voltage ranged from 90V to 270V. It can drive several series LEDs from rectified AC voltage.

The MAP9010 can achieve 0.95 higher power factor and low total harmonic distortion less than 20%.

The MAP9010 has high LED current drive capability up to 240mA and the current can be adjustable with external resistors.

The MAP9010 can achieve triac-dimmable better than before version at 120V application.

The MAP9010 is available in QFN 6X6 with Halogen-free (fully RoHS compliant).

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

Features

- Triac dimming
 - Better dimmer compatibility (120V dimmer)
- Analog dimming (0.3V~3V)
- PWM dimming (300Hz~20kHz)
- Thermal protection (min. 150°C)
- OVP (Over Voltage Protection)
- Constant output power
- Power variation: ±5%
- Higher power factor : > 0.95
- Lower total harmonic distortion : < 20%
- Higher current drive capability
 - Up to 240mA
- QFN 6X6 package

Applications

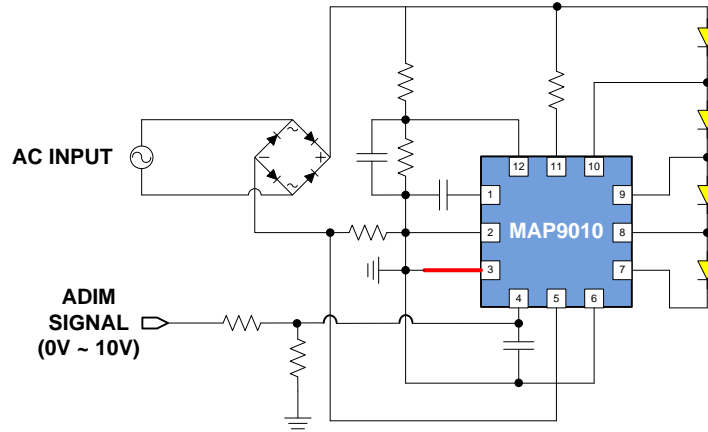
- AC LED Driver
- Lighting equipment
- LED Driver Power Supplies

Ordering Information

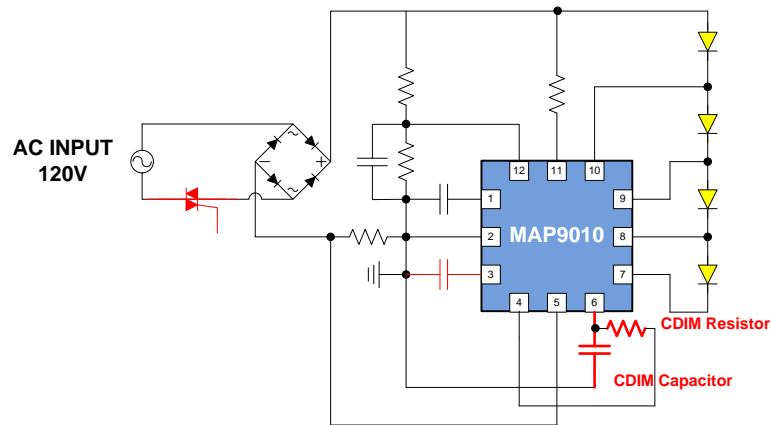
Part Number	Top Marking	Ambient Temperature Range	Package	RoHS Status
MAP9010QNRH	MAP9010	-30°C to +85°C	6X6mm QFN 12Leads	Halogen Free

Typical Application

1. Normal Mode (AC-Direct)

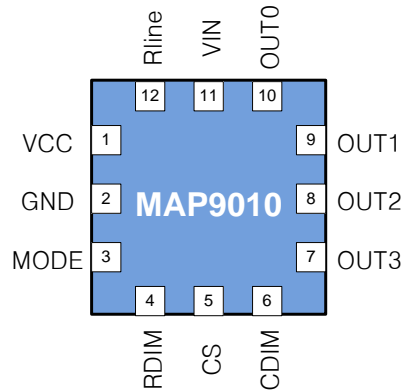


2. Traic-dimming Mode (120V Application)



Pin Configuration & Description

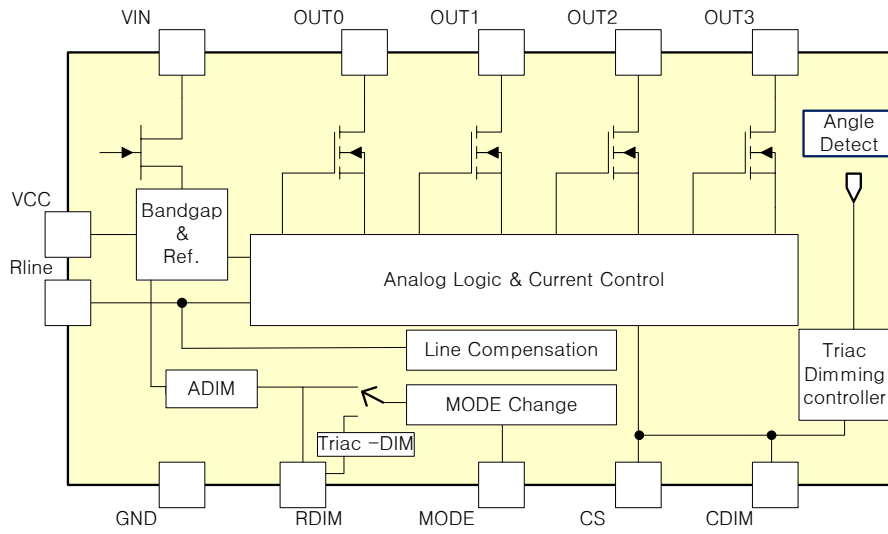
- Pin Configuration



- Pin Description

No.	Name	Description
1	VCC	Power supply pin for IC Operation.
2	GND	IC Ground
3	MODE	Operation mode selection pin. If MODE connects GND, IC operates AC direct mode (or Analog / PWM dimming mode). If MODE leaves open, IC operates triac dimming mode
4	RDIM	PWM and Analog dimming input pin. MODE pin should be connected to GND.
5	CS	Current sensing pin. Its level is negative with respect to GND. By connecting external resistor, user can adjust output power.
6	CDIM	AC input off time detecting pin for triac dimming. MODE pin should be left open. But, to avoid noise at MODE pin, recommend connecting capacitor MODE pin to GND
7	OUT3	Output LED Group 3. OUT3 level is set by CS resistor.
8	OUT2	Output LED Group 2. OUT2 level is 82% of OUT3 level.
9	OUT1	Output LED Group 1. OUT1 level is 65% of OUT3 level.
10	OUT0	Output LED Group 0. OUT0 level is 44% of OUT3 level.
11	VIN	HV input pin for VCC charging and achieving reference.
12	RLINE	Input pin for adjusting line compensation and OVP level . According to RLINE divide resistance, user can adjust degree of line compensation and OVP level.

Functional Block Diagram



Absolute Maximum Ratings

PARAMETER		VALUE	UNIT
VIN		700	V
OUT0, OUT1, OUT2, OUT3		-0.3 ~ 700	V
MODE, RDIM, CDIM, CS		-0.3 ~ 6	V
VCC, RLINE		20	V
CS		-6 ~ -0.3	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)	300	V
	CDM (Note 3)	2000	V

Note 1: ESD tested per JESD22A-114.

Note 2: ESD tested per JESD22A-115.

Note 3: ESD tested per JESD22C-101E

Thermal Resistance

PARAMETER		VALUE	UNIT
Thermal Resistance (θ_{JA}), (Note4)	6X6mm QFN 12Leads	63	°C/W
Thermal Resistance (θ_{JT}), (Note5)		8.7	°C/W

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

Note 5: The metal PCB diameter is 70mm and height is 1.6t.

Electrical Characteristics
 $T_A = 25^\circ\text{C}$, CS Resistance = 6.8Ω unless otherwise specified

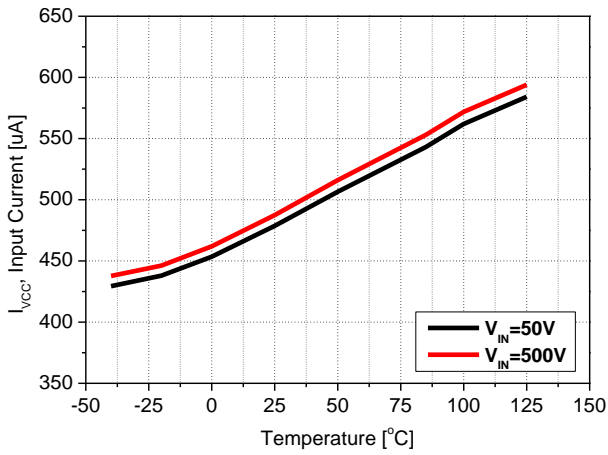
SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
Supply						
V _{VIN}	Input Voltage Range	Note 6	50		700	V
V _{VCC}	Operating Voltage		-	14	-	V
I _{VCC}	Input Current		300	600	900	uA
V _{UVLO}	Under Voltage Lockout	UVLO_H	-	12.4	-	V
		UVLO_L	-	8.4	-	V
RLINE Section						
R _{LINE}	RLINE pin Impedance	V _{VIN} = 200V, V _{GN} D = 0V, V _R LINE = 10V	0.5	2.75	5.1	uA
V _{RSE}	RLINE Sensing Voltage		1.64	1.97	2.30	V
V _{RSEC}	RLINE Sensing Voltage After CDIM Reset		2.43	2.93	3.43	V
V _{RLINE_hys}	RLINE Sensing Voltage Hysteresis			0.96		V
V _{RLINE_OVP}	Over Voltage Protection	V _{VIN} = 200V, V _{GN} D = 0V	12.2	13.5	14.8	V
Driver Section						
I _{D_Leak}	Driver Leakage Current	V _{VIN} = 200V, V _{GN} D = 0V, OUT0 ~ 3 = 700V	-	-	10	uA
I _{OUT0}	Driver 0 Current	V _{VIN} = 200V, OUT0 = 35V RLINE = 5V	76.7	85.2	93.7	mA
I _{OUT1}	Driver 1 Current	V _{VIN} = 200V, OUT1 = 35V RLINE = 5V	113.4	126.0	138.6	mA
I _{OUT2}	Driver 2 Current	V _{VIN} = 200V, OUT2 = 35V RLINE = 5V	140.4	156.0	171.6	mA
I _{OUT3}	Driver 3 Current	V _{VIN} = 200V, OUT3 = 35V RLINE = 5V	171.9	191.0	210.1	mA
I _{OUT_SUM}	-	I _{OUT0} + I _{OUT1} + I _{OUT2} + I _{OUT3}	527.3	555.0	582.8	mA

RDIM Section						
V _{RDIM}	RDIM Input Voltage Range		0.3	-	3	V
I _{RDIM}	RDIM pin Current	MODE Pin GND	0.4	2.75	5.1	uA
V _{RDIM_off_hys}	RDIM Off Hysteresis		5	15	25	mV
V _{RDIM(OUT)}	RDIM Output Voltage Range	I _{RDIM} = 70uA	5.005	5.5	5.995	V
R _{INT}	Internal RDIM Resistance		6.73	13.5	20.27	KΩ
CDIM Section						
I _{CDIM}	CDIM Charging Current		0.3	2.77	4.3	uA
V _{CDIM_RESET} ⁽⁷⁾	CDIM RSET Voltage	V _{CDIM_RESET} / V _{RDIM(OUT)}	33.88	38.5	43.12	%
MODE Section						
I _{MODE}	MODE pin Current		2.8	10	17	uA
Over Temperature Protection						
OTP ⁽⁷⁾	Over Temperature Protection	Shutdown temperature	150	-	-	°C
		Hysteresis	-	25	-	°C

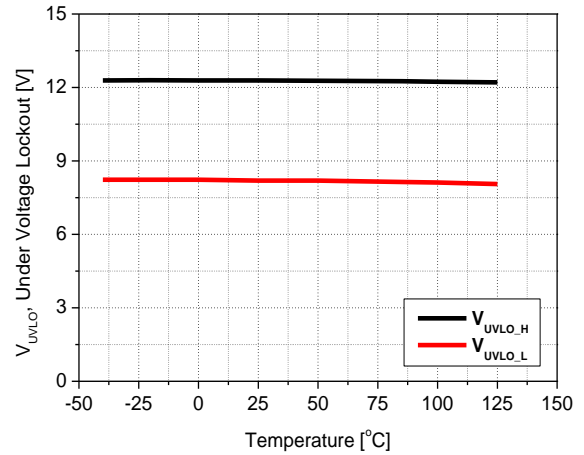
Note 6: Stress beyond the maximum ratings listed above may incur permanent damage to the device. Operating above the recommended conditions for extended time may stress the device and affect device reliability. Also the device may not operate normally above the recommended operating conditions. These are stress ratings only.

Note 7: These parameters are not production tested: Guaranteed by design correlation.

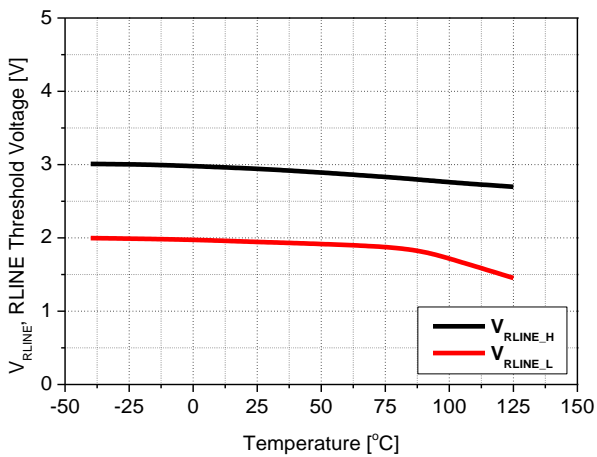
Typical Operating Characteristics



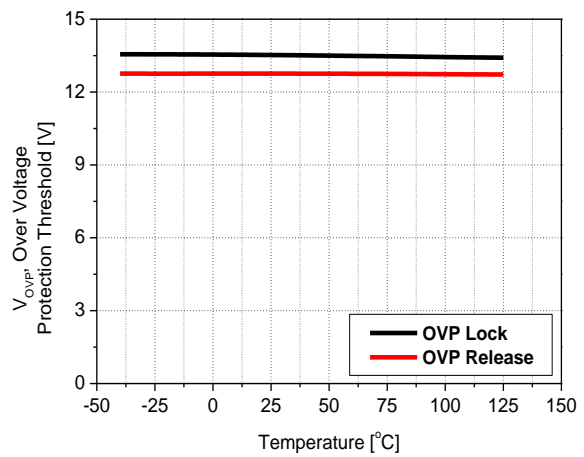
Temperature vs Operating Current



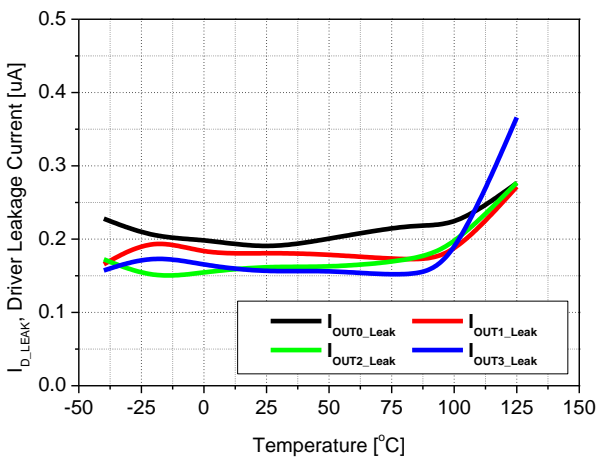
Temperature vs Under Voltage Lockout



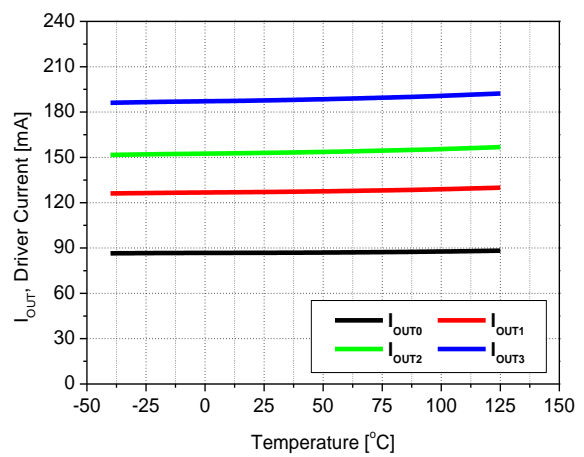
Temperature vs RLINE Threshold



Temperature vs OVP Threshold

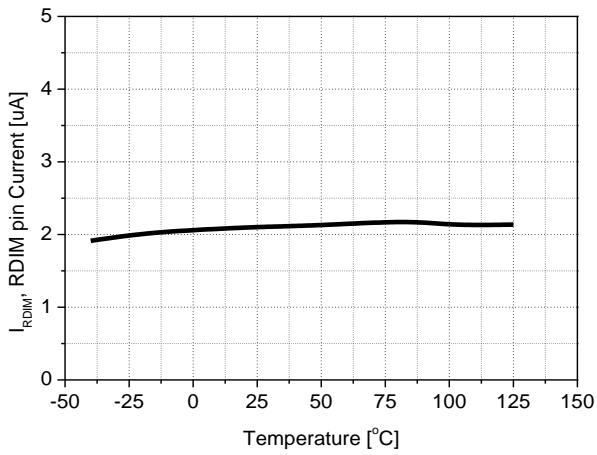


Temperature vs Driver Leakage Current

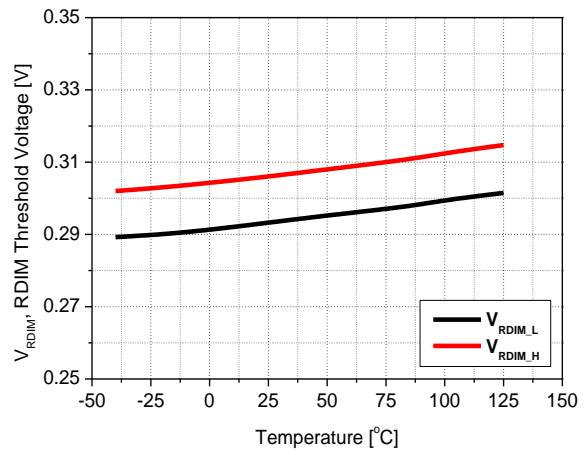


Temperature vs Driver Current

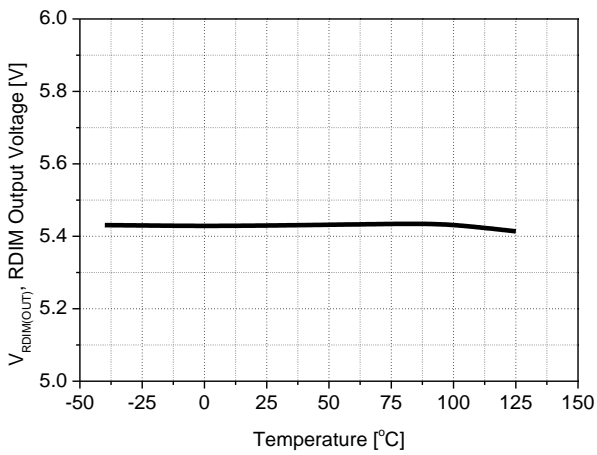
Typical Operating Characteristics



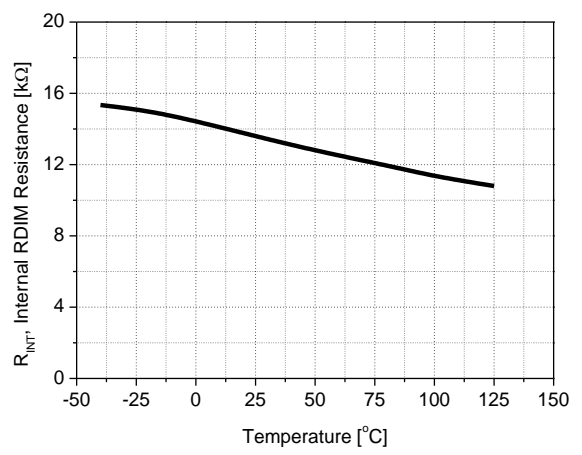
Temperature vs RDIM pin Current



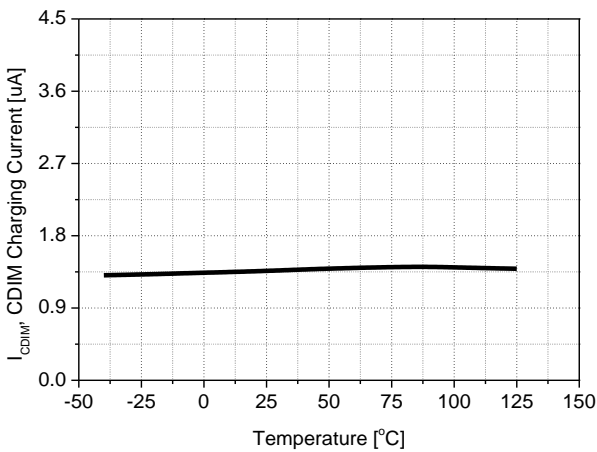
Temperature vs RDIM Threshold



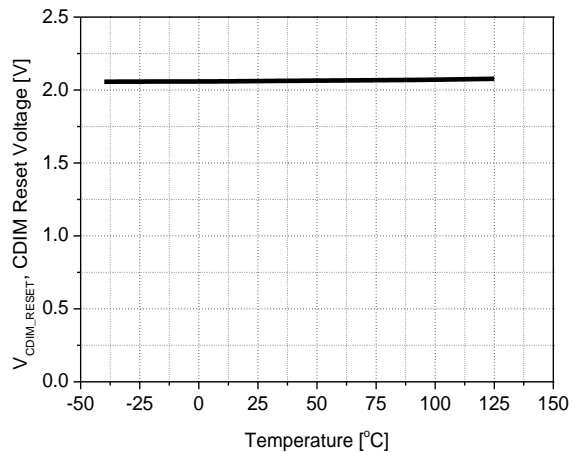
Temperature vs RDIM Output Voltage



Temperature vs Internal RDIM Resistance



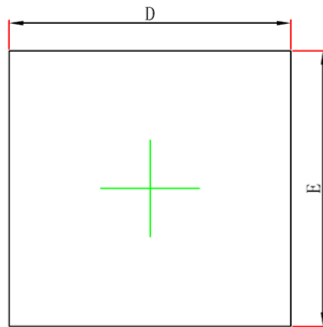
Temperature vs CDIM Charging Current



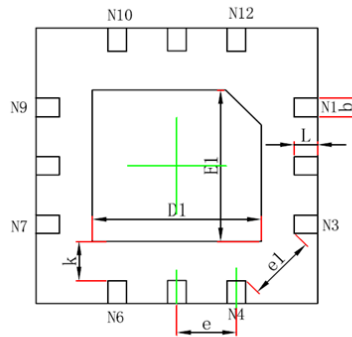
Temperature vs CDIM Reset Voltage

Physical Dimensions

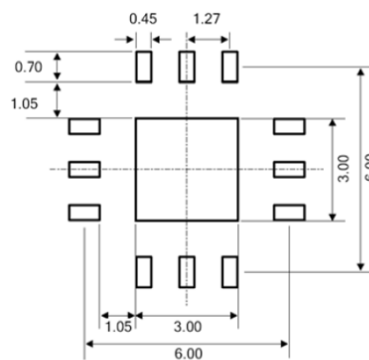
1) QFN 6x6 12LD



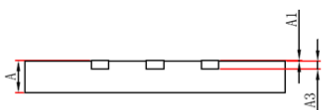
TOP VIEW



BOTTOM VIEW



LAND PATTERN RECOMMENDATION




SIDE VIEW

Symbol	Dimension [mm]	
	min	max
A	0.70	0.90
A1	0.00	0.05
A3	0.203REF.	
D	5.90	6.10
E	5.90	6.10
D1	3.50	3.70
E1	3.20	3.40
k	0.20MIN.	
b	0.35	0.45
e	1.27TYP	
e1	1.45TYP	
L	0.42	0.58

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MagnaChip Semiconductor Ltd.

424, Teheran-ro, Gangnam-Gu, Seoul, 135-738 Korea

Tel : 82-2-6903-3843 / Fax : 82-2-6903-3668 -9

www.magnachip.com