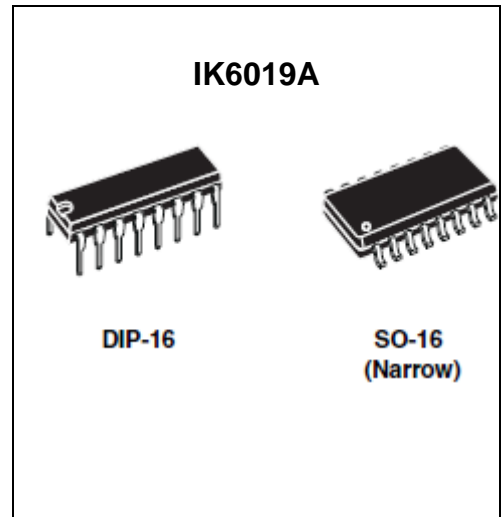


# High-Voltage High-Current Stepper Motor Driver

**IK6019A**

## FEATURES

- Eight Power Output LDMOS Transistors
- Driving Dual Stepping Motor
- Output Current 250mA per Driver
- Output Voltage 24V
- Reset Function
- Integrated Suppression Diodes for Inductive Loads
- Temperature range is -40°C to +85°C
- DIP-16, SO-16 (Narrow) Packages



## ORDERING INFORMATION

Device	Operating Temperature Range	Packing	Package
IK6019AN	T <sub>op</sub> = -40°C ~+85°C	Tube	DIP-16
IK6019ADT		Tape & Reel	SO-16 (Narrow)

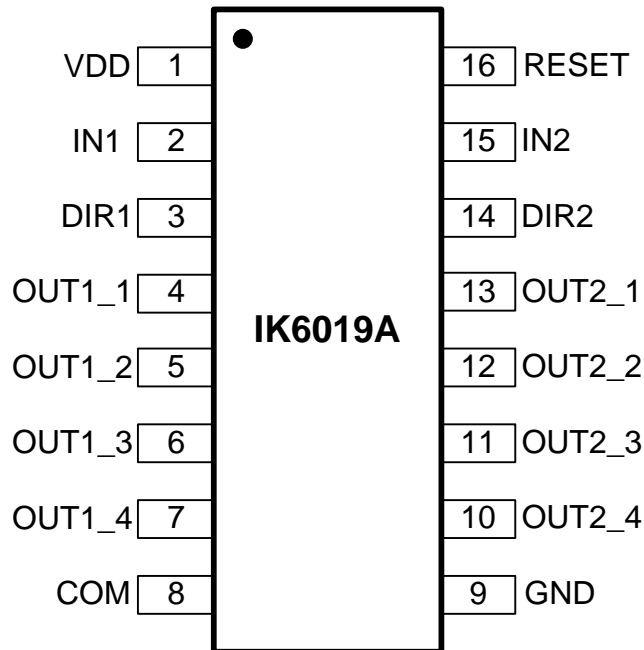
## APPLICATIONS

- Unipolar Stepper Motor Driver

## GENERAL DESCRIPTION

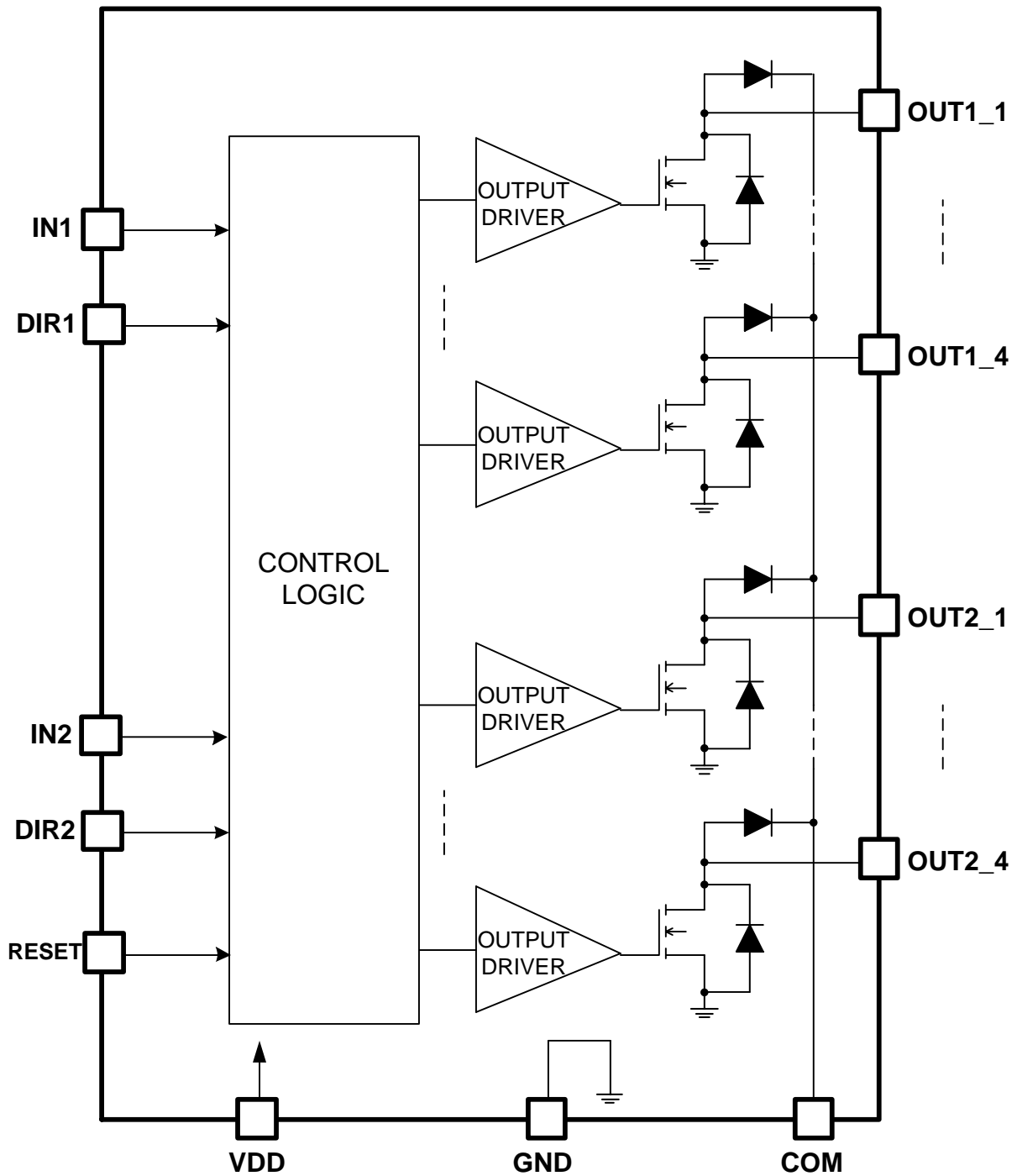
The IK6019A is a high-voltage, high-current dual stepping motor driver with four open drain LDMOSFETs per channel. The drain-current rating of single LDMOS is 250mA. Suppression diodes are integrated at the output for inductive load switching.

**PIN DESCRIPTION**



Pin #	Pin Name	I/O	Description
1	VDD	P	Power supply for digital part.
2	IN1	I	Input pin to activate outputs OUT1_1÷OUT1_4 and to determine the stepping mode by the first falling edge.
3	DIR1	I	Input pin to determine the motor's rotation direction (OUT1_1÷OUT1_4).
4-7	OUT1_1 to OUT1_4	O	Output pins.
8	COM	P	Power pin to connect common free-wheeling diodes.
9	GND	P	Ground for output transistors.
10-13	OUT2_1 to OUT2_4	O	Output pins.
14	DIR2	I	Input pin to determine the motor's rotation direction (OUT2_1÷OUT2_4).
15	IN2	I	Input pin to activate outputs OUT2_1÷OUT2_4 and to determine the stepping mode by the first falling edge.
16	RESET	I	Input pin to reset the circuit when it LOW.

BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS**

Parameter	Value	Unit
COM to GND	28	V
OUT to GND	28	V
VDD to GND	6	V
INPUT to GND	VDD+0.5	V
OUT current/Pin	250	mA
Output Current/Total	1.25	A
Thermal Resistance ( $\theta_{JA}$ )	DIP-16	70 °C/W
	SO-16	120 °C/W
Storage Temperature Range	-55 ~ 150	°C
ESD Rating (Note 2)	4	kV

**Notes**

1. Stress beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. Human body model: equivalent to discharging a 100 pF capacitor through a 1.5 k $\Omega$  resistor.

**OPERATING RATINGS**

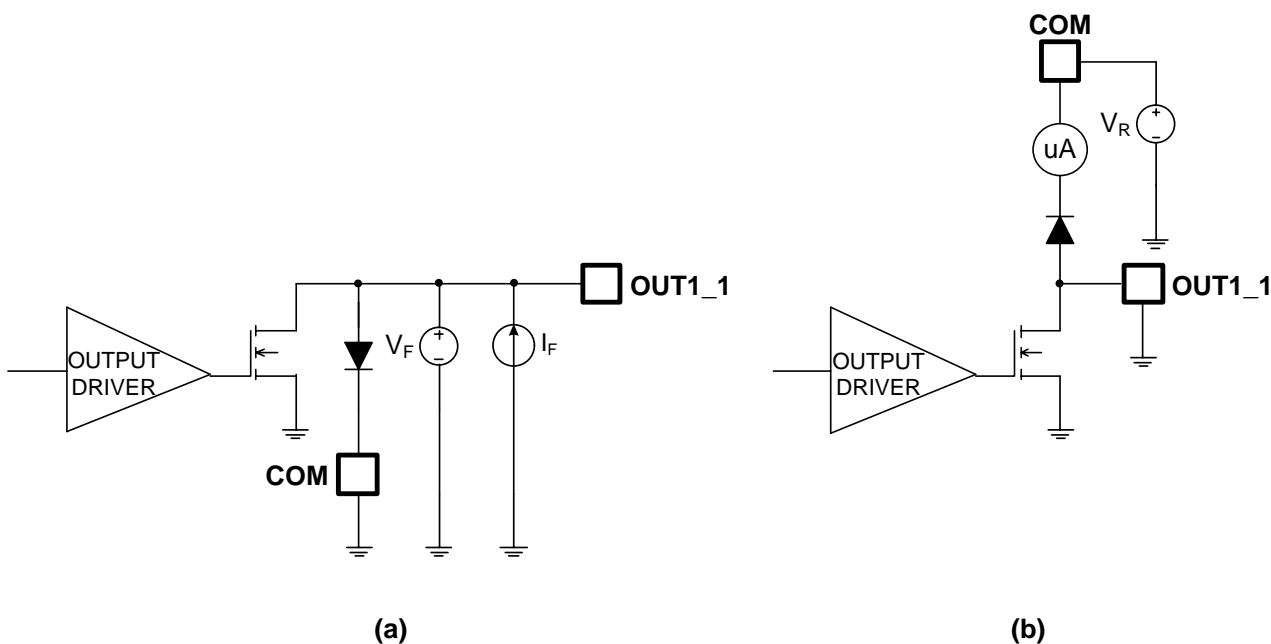
Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Logic supply voltage	VDD	3	5	5.5	V
High-level voltage	V <sub>IH</sub>	0.7VDD	-	VDD	V
Low-level voltage	V <sub>IL</sub>	0	-	0.3VDD	V
Operating temperature	T <sub>OP</sub>	-40	+25	+85	°C

**ELECTRICAL CHARACTERISTICS**

$V_{DD}=3.3\sim 5.5V$ ,  $T_A=T_{OP}=+25^{\circ}C$ . All voltages are defined with respect to ground. Positive currents flow into the device. Unless otherwise specified. Please refer to test circuit section.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{OX}$	Output leakage current	$V_O=24V$			50	$\mu A$
$V_{O(SAT)}$	Output saturation voltage	$I_O=100mA$		0.9		V
		$I_O=150mA$		1		V
		$I_O=200mA$		1.2		V
$I_{IX}$	Input leakage current		-1	-	1	$\mu A$
$V_F$	Clamp diode forward voltage	$I_F=250mA$ (test circuit (a))		1.7	2	V
$I_R$	Clamp diode leakage current	$V_R=24V$ (test circuit (b))			50	$\mu A$

**TEST CIRCUIT FOR ELECTRICAL CHARACTERISTICS**

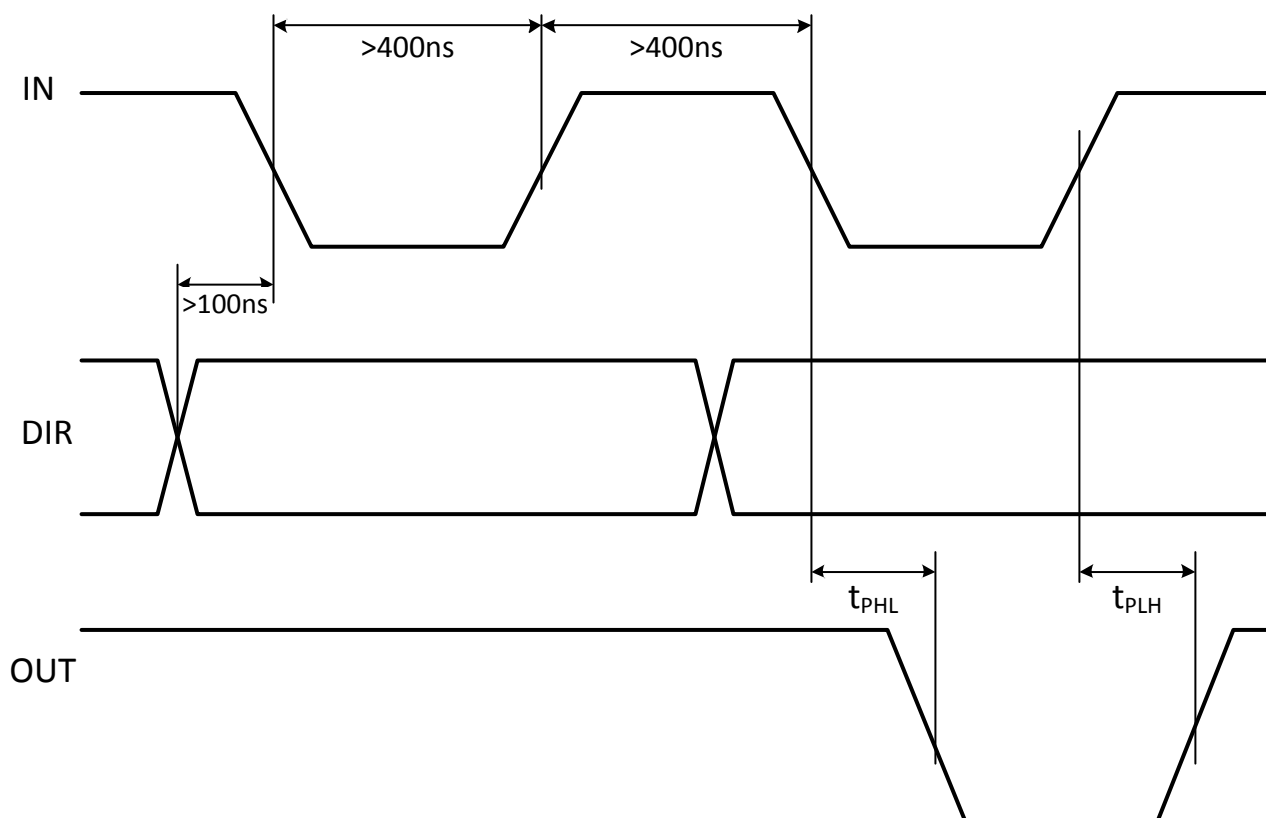


**SWITCHING CHARACTERISTICS**

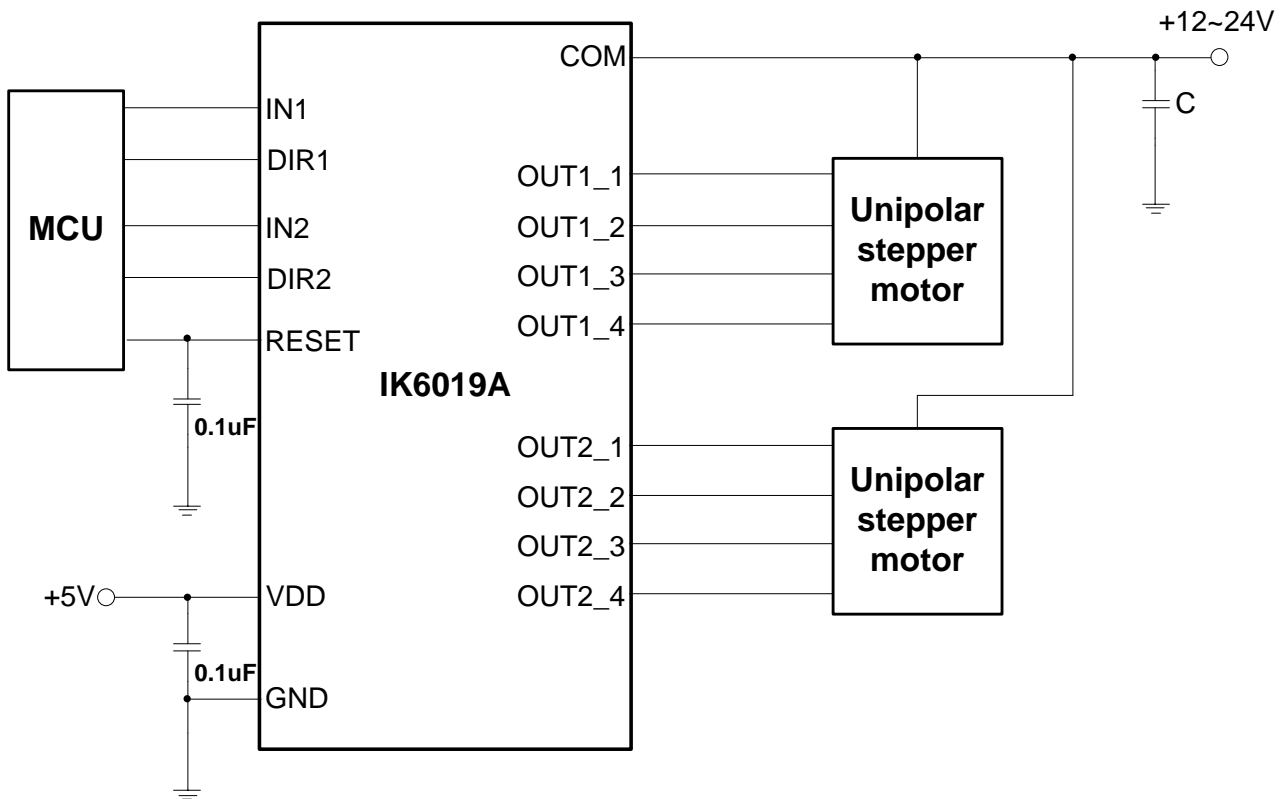
$V_{DD}=3.3\sim 5.5V$ ,  $T_A=T_{OP}=+25^{\circ}C$ . All voltages are defined with respect to ground. Positive currents flow into the device. Unless otherwise specified. Please refer to test circuit section.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PLH}$	Turn-on delay time	$0.5V_{IN}$ to $0.5V_O$		0.25	1	$\mu s$
$t_{PHL}$	Turn-off delay time	$0.5V_{IN}$ to $0.5V_O$		0.25	1	$\mu s$

**TEST CIRCUIT FOR SWITCHING CHARACTERISTICS**



APPLICATION CIRCUIT



Note:

\* C : the required capacitance value is more than 47uF.

This capacitance value should be tuned by real application conditions.

## FUNCTIONAL DESCRIPTION

The IK6019A provides 3 stepping modes setting as shown in the table below. The stepping mode depends on signals DIR1 and DIR2 at the falling edge of the first pulse of IN1 (IN2):

DIR1	DIR2	Stepping mode
1	1	Single stepping
1	0	Half stepping
0	0	High torque stepping

The second pulse of IN1 (IN2) (time from falling edge till raising edge) determines the duration of the output's operation, whereas the next time from raising edge till falling edge sets the delay time between output channels in depend on stepping mode.

After changing direction (DIR1 (DIR2) falls from "1" to "0" or rises from "0" to "1"), outputs OUT1\_1 to OUT1\_4 (OUT2\_1 to OUT2\_4) are turned off and will be switched at the next pulse of IN1 (IN2) in according with stepping mode.

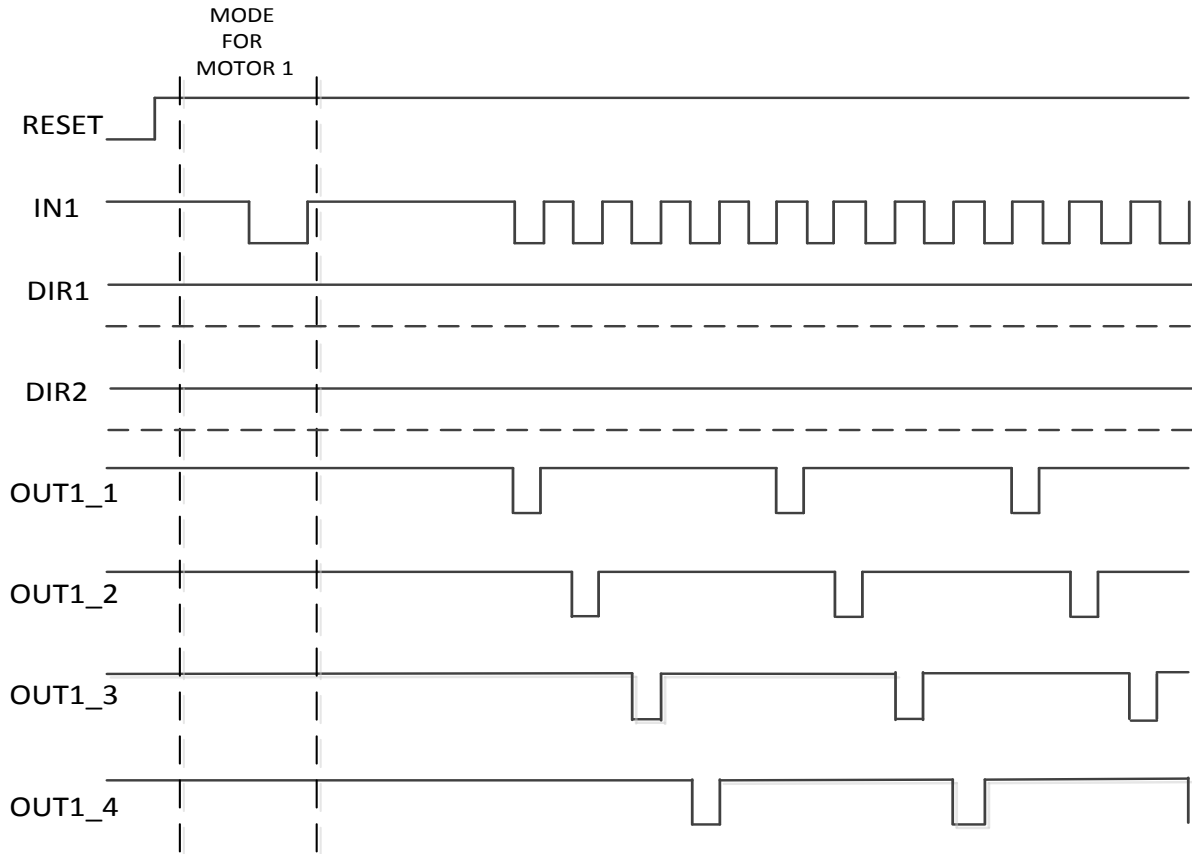
If the input RESET changes the level from HIGH to LOW, all outputs and internal triggers are turned off. After returning the HIGH level to the input RESET, it is needed to determine the stepping mode again as was described earlier. Note: in during of changing the RESET level from LOW to HIGH the IN1 (IN2) level must be HIGH.

Please, for more detail description of operation see the section TIMING DIAGRAM.

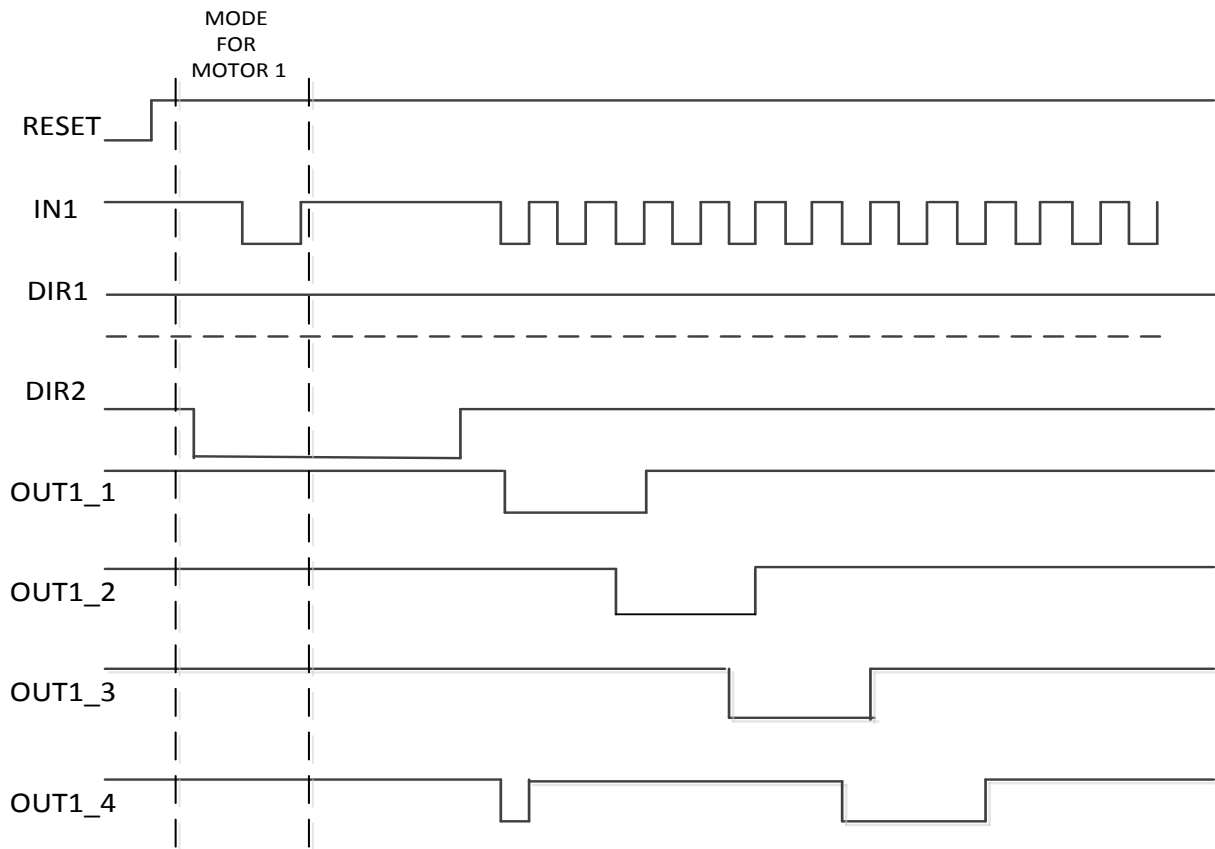


**TIMING DIAGRAM (Output waveform shows output voltage)**

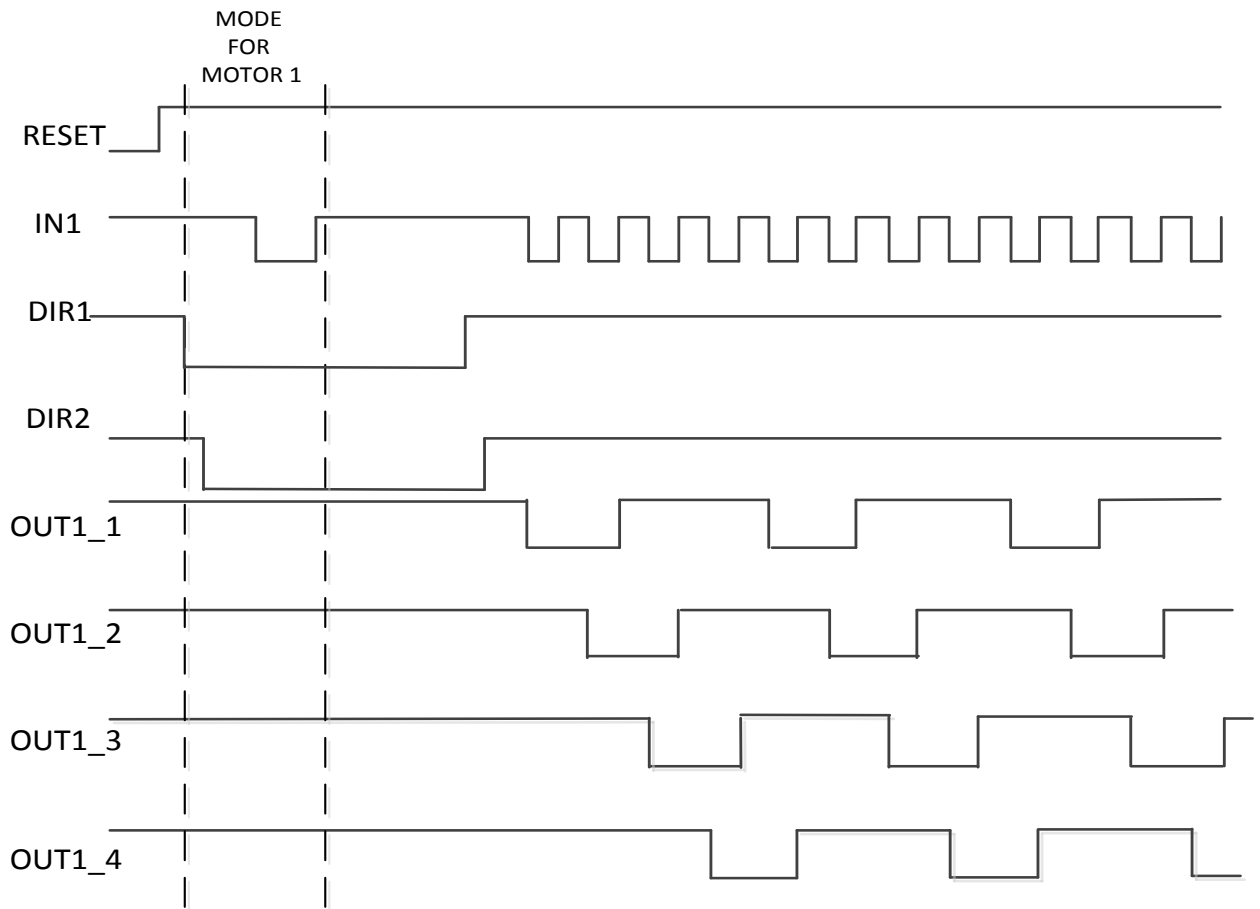
**Single Stepping Mode**



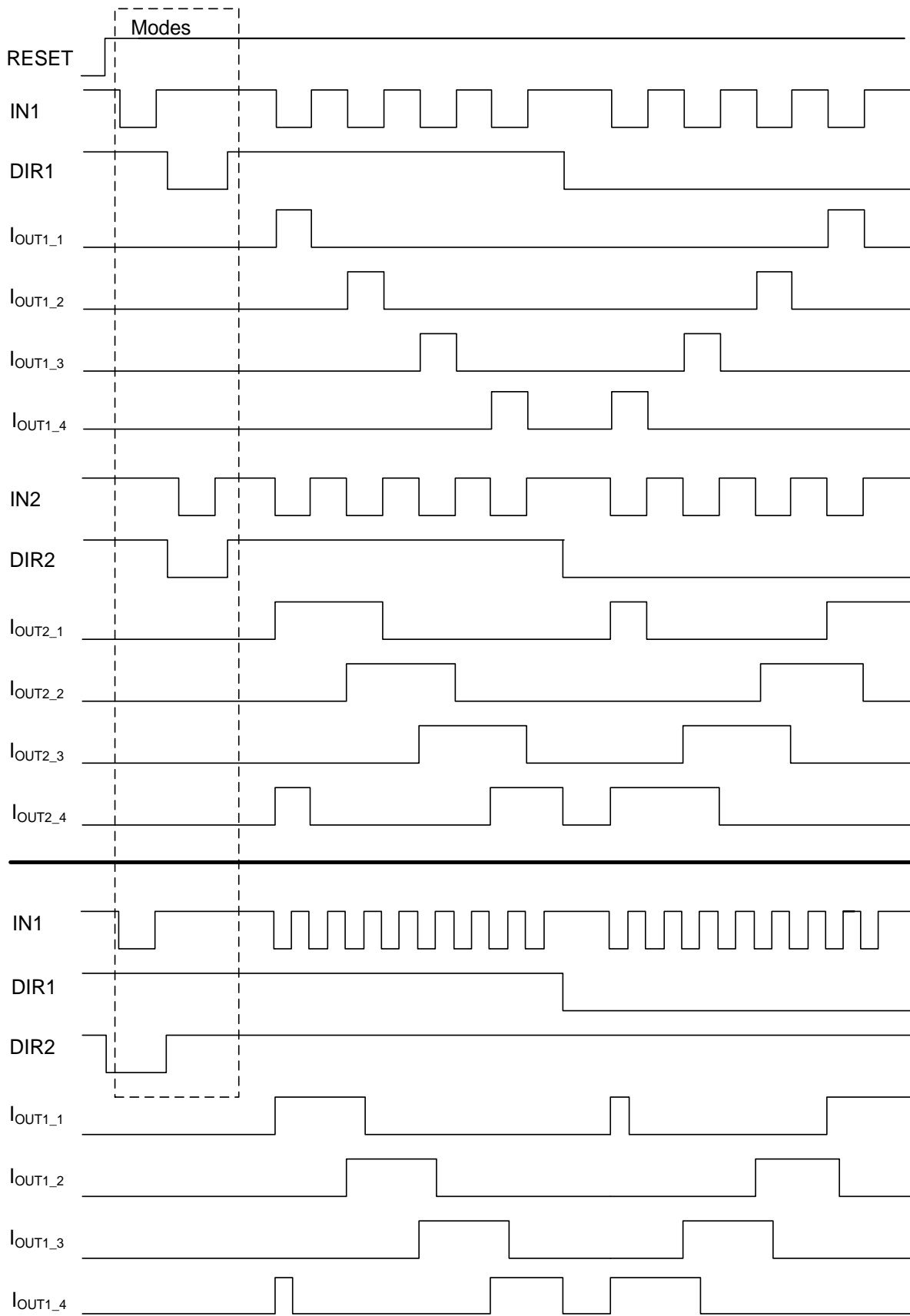
### Half Stepping Mode



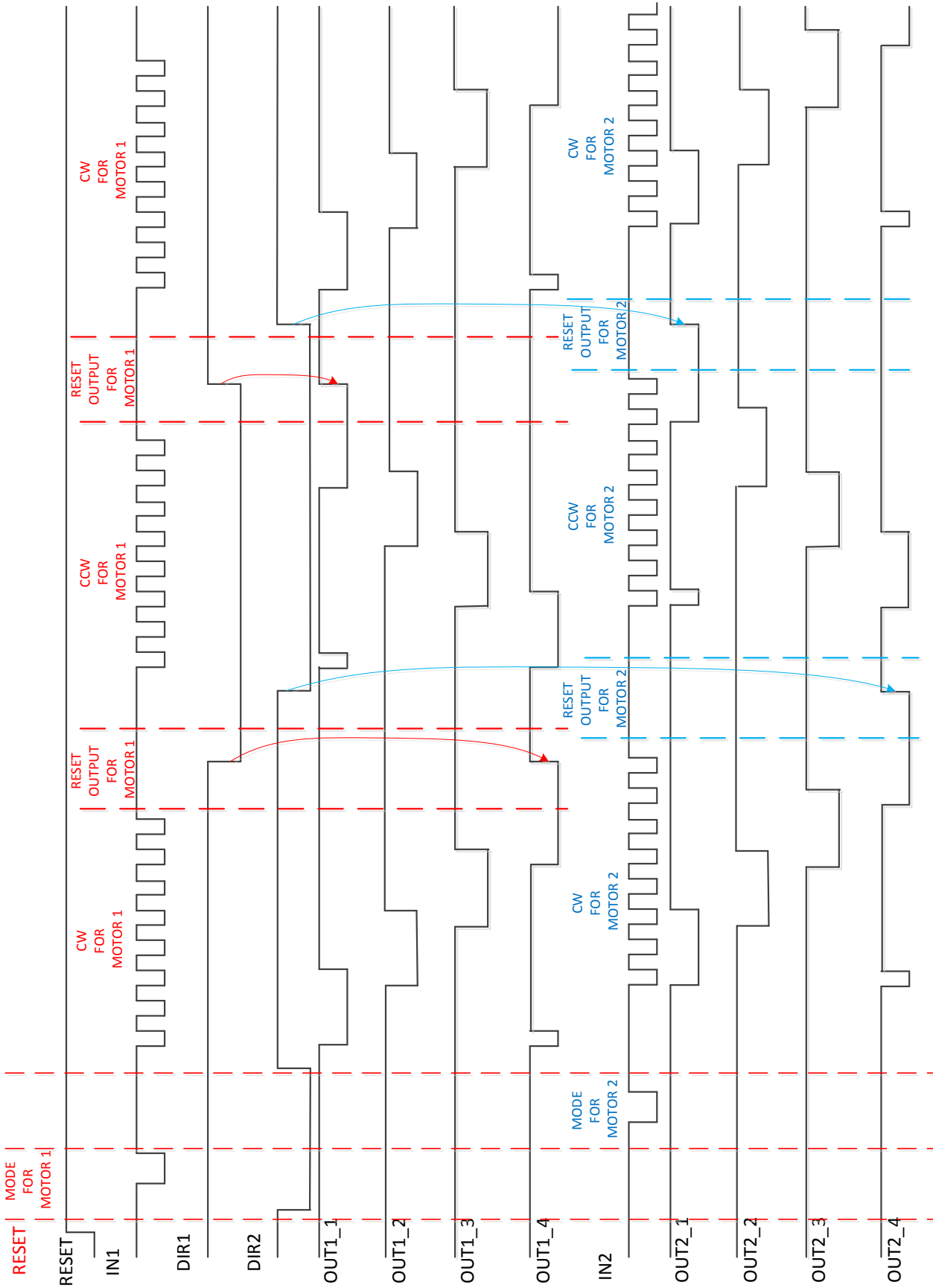
### High Torque Stepping Mode



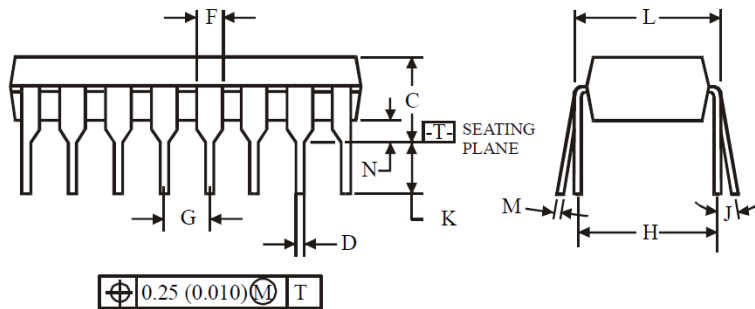
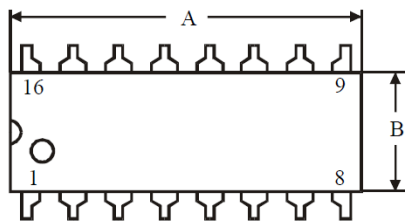
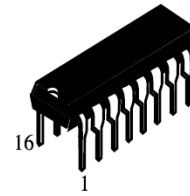
**TIMING DIAGRAM (Output waveform shows driving current)**



APPLICATION TIMING DIAGRAM



**N SUFFIX DIP**  
**(MS - 001BB)**

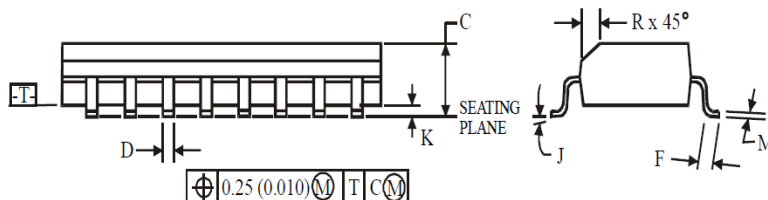
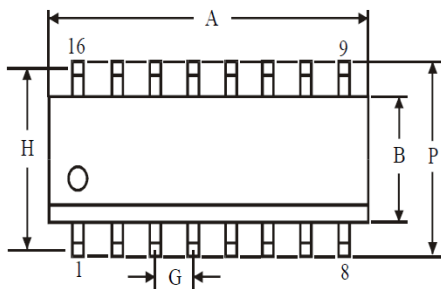
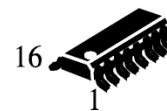


Symbol	Dimension, mm	
	MIN	MAX
A	18.67	19.69
B	6.10	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.20	0.36
N	0.38	

**NOTES:**

- Dimensions "A", "B" do not include mold flash or protrusions. Maximum mold flash or protrusions 0.25 mm (0.010) per side.

**D SUFFIX SOP**  
**(MS - 012AC)**



Symbol	Dimension, mm	
	MIN	MAX
A	9.80	10.00
B	3.80	4.00
C	1.35	1.75
D	0.33	0.51
F	0.40	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.10	0.25
M	0.19	0.25
P	5.80	6.20
R	0.25	0.50

**NOTES:**

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.