	No. 5165	<b>STK6711AMK4</b>
		<b>4-Phase Stepping Motor Driver</b> <b>Unipolar Self-Excitation Type (<math>I_O = 1.5A</math>)</b>

## Overview

The STK6711AMK4 is a unipolar fixed-current chopper-type self-excitation 4-phase stepping motor driver hybrid IC which uses MOSFET power devices. The excitation sequence signal is active-high.

## Applications

- Serial printer, line printer, and laser beam printer (LBP) paper feed and carriage motor drivers
- PPC scanner and LBP feed drivers

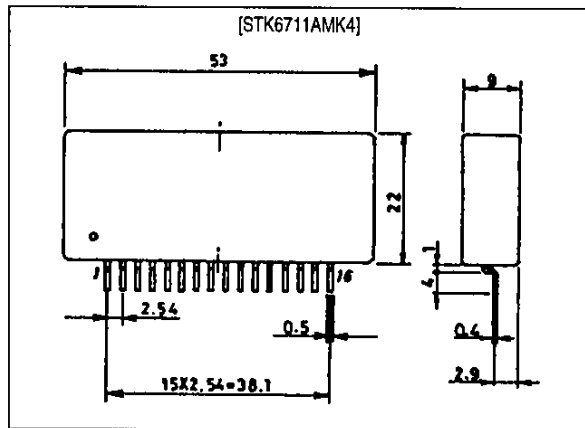
## Features

- Simultaneous ON prevention circuit built-in to prevent driver breakdown due to simultaneous ON control signals from the control system's microcontroller, etc.
- Self-excitation design means chopping frequency is determined by motor L and R. Supports chopping at 20kHz or higher.
- Two  $0.33\Omega$  current detection resistors built-in for fixed-current chopping operation
- Wide operating supply voltage range (18 to 42V for motor drive)
- Unipolar design enables use as a driver for hybrid, PM, or VR-type stepping motors
- Supports W1-2 phase operation, with dual Vref pins

## Package Dimensions

unit: mm

4129



## Series Organization

The following devices form a series with differing excitation signal active level and output capacity. Some of the following devices are under development. Contact your Sanyo sales representative if you require more detailed information.

Type No.	Excitation signal	Output current (per phase)	Type
STK6711AMK4	Active-high	1.5A	Self-excitation
STK6711BMK4	Active-low		
STK6712AMK4	Active-high	1.7A	
STK6712BMK4	Active-low		
STK6713AMK4	Active-high	3.0A	Fixed excitation
STK6713BMK4	Active-low		
STK6714AMK4	Active-high	4.0A	
STK6714BMK4	Active-low		

## Specifications

Maximum Ratings at  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage 1	$V_{CC1 \text{ max}}$	No input signal	52	V
Maximum supply voltage 2	$V_{CC2 \text{ max}}$	No input signal	7	V
Maximum phase current	$I_{OH \text{ max}}$	$R = 5\Omega$ , $L = 10\text{mH}$ , $1 \times 0.5\text{s}$ pulse, $V_{CC}$ applied	2.2	A
Repeated avalanche handling capability	$E_{ar \text{ max}}$		38	mJ
Junction temperature	$T_j \text{ max}$		150	$^\circ\text{C}$
Operating substrate temperature	$T_c \text{ max}$		105	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +125	$^\circ\text{C}$

Allowable Operating Ranges at  $T_a = 25^\circ\text{C}$

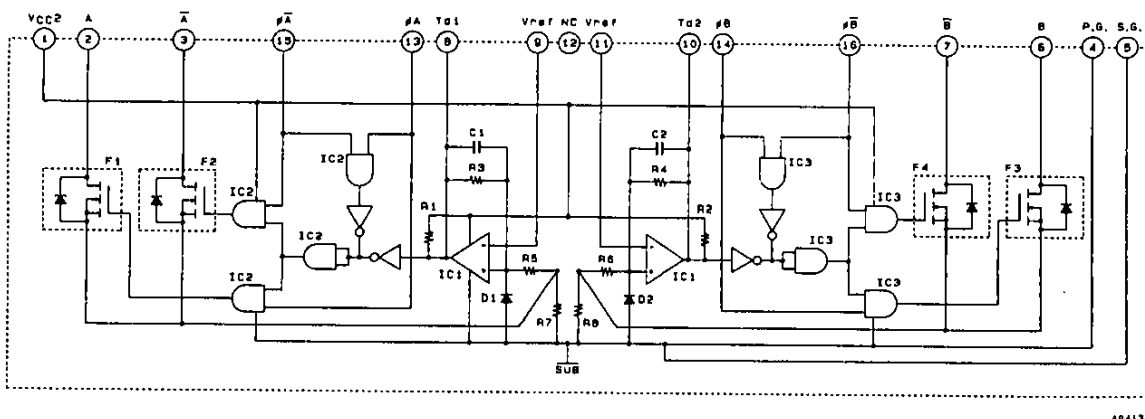
Parameter	Symbol	Conditions	min	typ	max	Unit
Supply voltage 1	$V_{CC1}$	With input signal	18	-	42	V
Supply voltage 2	$V_{CC2}$	With input signal	4.75	5.00	5.25	V
Phase driver withstand voltage	$V_{DSS}$		100	-	-	V
Phase current	$I_{OH \text{ max}}$	50% duty	-	-	1.5	A

Electrical Characteristics at  $T_c = 25^\circ\text{C}$ ,  $V_{CC1} = 36\text{V}$ ,  $V_{CC2} = 5\text{V}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Output saturation voltage	$V_{st}$	$R_L = 23\Omega$ , $V_{in} = 2.4\text{V}$	-	1.4	1.9	V
Average output current	$I_{oave}$	Load: $R = 3.5\Omega$ , $L = 3.8\text{mH}$ , $V_{in} = 2.4\text{V}$ , per phase	0.45	0.50	0.55	A
Pin current drain	$I_{CC2}$	Load: $R = 3.5\Omega$ , $L = 3.8\text{mH}$ , $V_{in} = 2.4\text{V}$ , per phase	-	15	25	mA
FET diode forward voltage	$V_{df}$	$I_f = 1.0\text{A}$	-	1.2	1.8	V
TTL-input high level voltage	$V_{IH}$	Input voltage when F1, F2, F3, F4 ON	2.0	-	-	V
TTL-input low level voltage	$V_{IL}$	Input voltage when F1, F2, F3, F4 OFF	-	-	0.8	V
Switching time	$t_{ON}$	$R_L = 24\Omega$ , $V_{in} = 2.4\text{V}$	-	50	-	ns
	$t_{OFF}$	$R_L = 24\Omega$ , $V_{in} = 2.4\text{V}$	-	0.1	-	$\mu\text{s}$

Note: All tests are made using a constant-voltage supply.

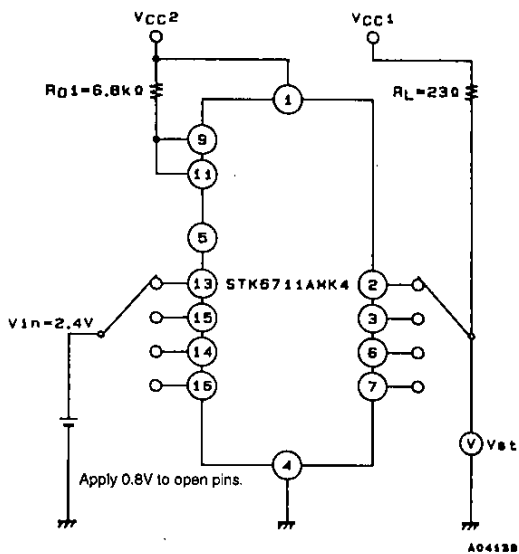
## Equivalent Circuit



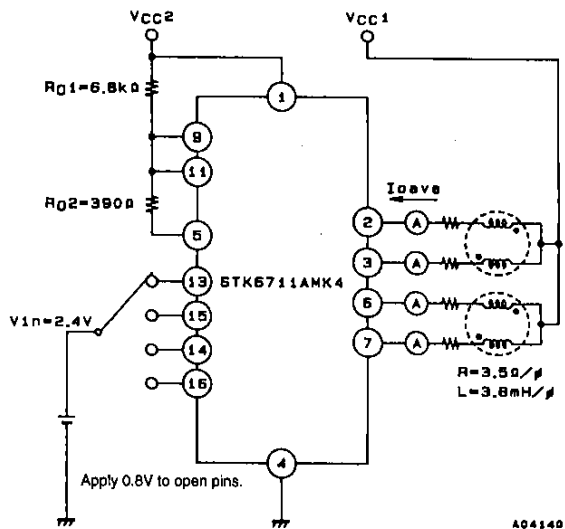
# STK6711AMK4

## Test Circuits

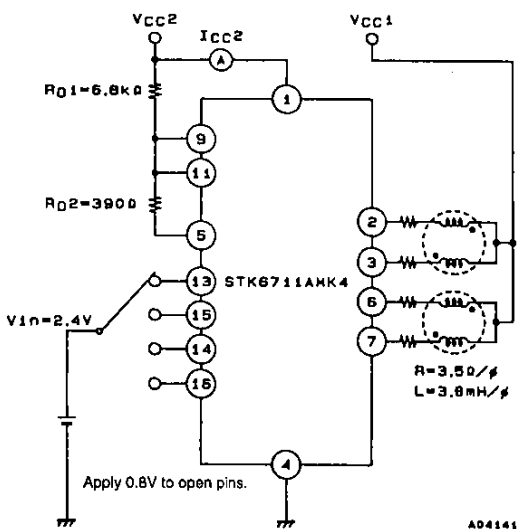
Vst



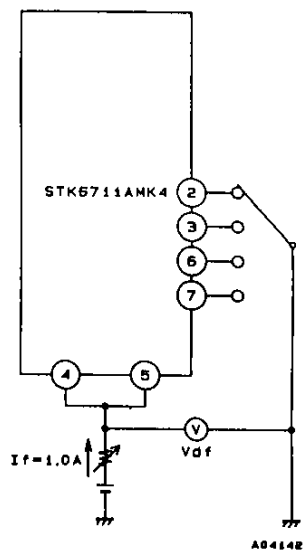
Iave



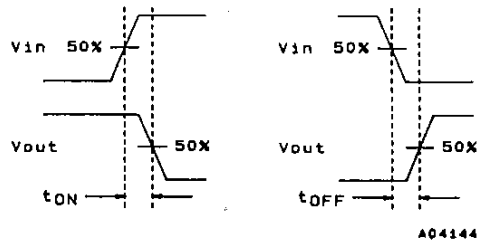
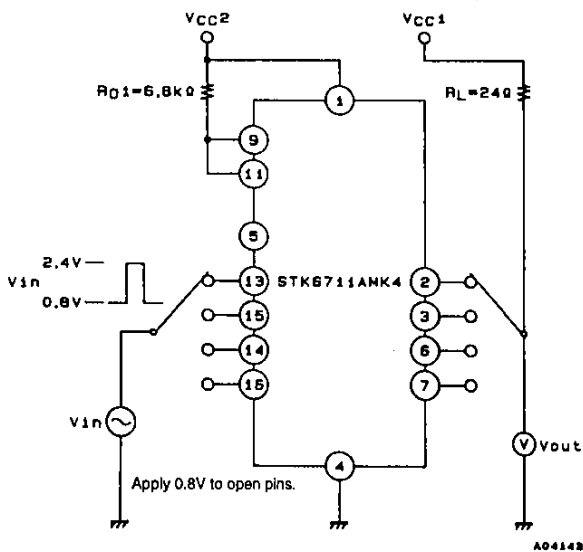
Icc2



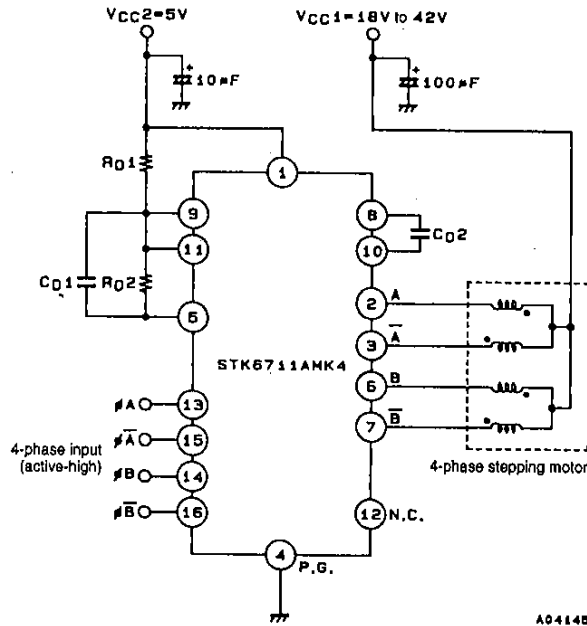
Vdf



tON, tOFF

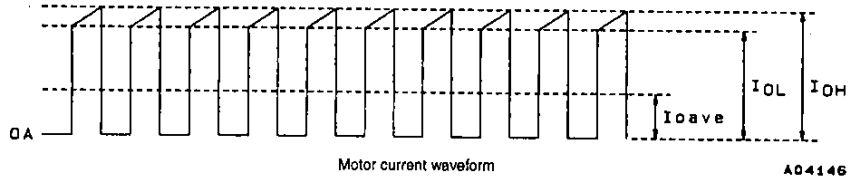


Sample Application Circuit



Motor Current

The following figure shows the motor current waveform when all 4-phase inputs are locked.



The motor current is set by the Vref voltage which is determined by the resistors RO1 and RO2 connected to pins 9 and 11. IOH and Vref are related as shown in the following equations, where K is a correction coefficient for actual measurement.

$$I_{OH} = K \times \frac{R_{O2}}{R_{O1} + R_{O2}} \times \frac{V_{CC2}}{R7}$$

$$V_{ref} = \frac{R_{O2}}{R_{O1} + R_{O2}} \times V_{CC2}$$

$K \approx 1.2$  and  $R7 = R8 \approx 0.33\Omega \pm 3\%$

Reference values are such that  $R_{O1} = 6.8k\Omega$  and  $R_{O2} = 390\Omega$  at  $I_{OH} \approx 1A$ .

Motor Hold Noise Countermeasures (CO1 and CO2 Capacitors)

During motor hold, there may be cases where the motor generates audible noise. In this case, capacitors CO1  $\approx 0.01\mu F$  and CO2  $\approx 100$  to  $200pF$  can be added to prevent this noise as shown in the Sample Application Circuit. During normal operation, however, these capacitors are not necessary.

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