	No. 5167	<b>STK681-050</b>  <b>Bidirectional DC Brush-Type Motor Driver (<math>I_O = 5A</math>)</b>

## Overview

The STK681-050 is a bidirectional DC brush-type motor driver IC with brake function that incorporates MOSFET power elements.

## Applications

- PPC drum and scanner motor drivers
- LBP drum motor drivers
- Printer head and carriage motor drivers
- General DC motor applications

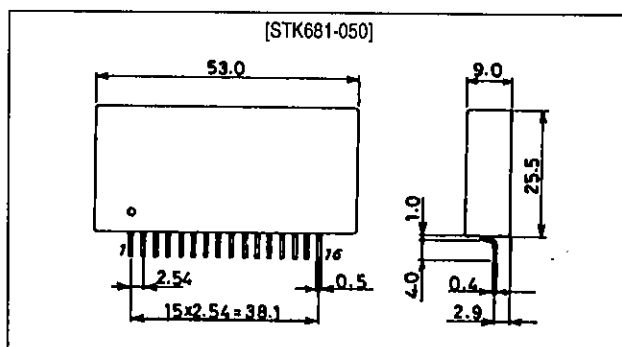
## Features

- H-bridge output stage configuration employing 4 MOSFETs
- Independent TTL/CMOS-level control for each MOSFET (4-pin control)
- External signal control of forward, reverse and brake operation
- MOSFETs supporting 12A peak starting current and 13.5A peak brake current (F3 and F4 ON)
- DC input supporting saturation operation
- Only 1 charge pump electrolytic capacitor required, compared with the STK6875 which requires 2

## Package Dimensions

unit: mm

4163



## Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage 1	$V_{CC1 \text{ max}}$	No signal	50	V
Maximum supply voltage 2	$V_{CC2 \text{ max}}$	No signal	10	V
Maximum input voltage	$V_{in \text{ max}}$	Pins 1, 3, 12, 14, 15	$\pm 10$	V
Maximum motor starting current	$I_O \text{ peak}$	1 pulse, pulse width = 70ms	12	A
Maximum motor brake current 1 (F1 and F2 ON)	$I_{Oa1 \text{ peak}}$	1 pulse, pulse width = 70ms	12	A
Maximum motor brake current 2 (F3 and F4 ON)	$I_{Oa2 \text{ peak}}$	1 pulse, pulse width = 25ms	16	A
		1 pulse, pulse width = 100ms	13.5	A
Allowable power dissipation 1	$P_{d1 \text{ max}}$	No heatsink, total loss	5.2	W
Allowable power dissipation 2	$P_{d2 \text{ max}}$	Arbitrary large heatsink, per MOSFET	25	W
Thermal resistance	$\theta_{j-c}$	per MOSFET	5	$^\circ\text{C/W}$
Junction temperature	$T_J \text{ max}$	per MOSFET	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  $T_a = 25^\circ\text{C}$ 

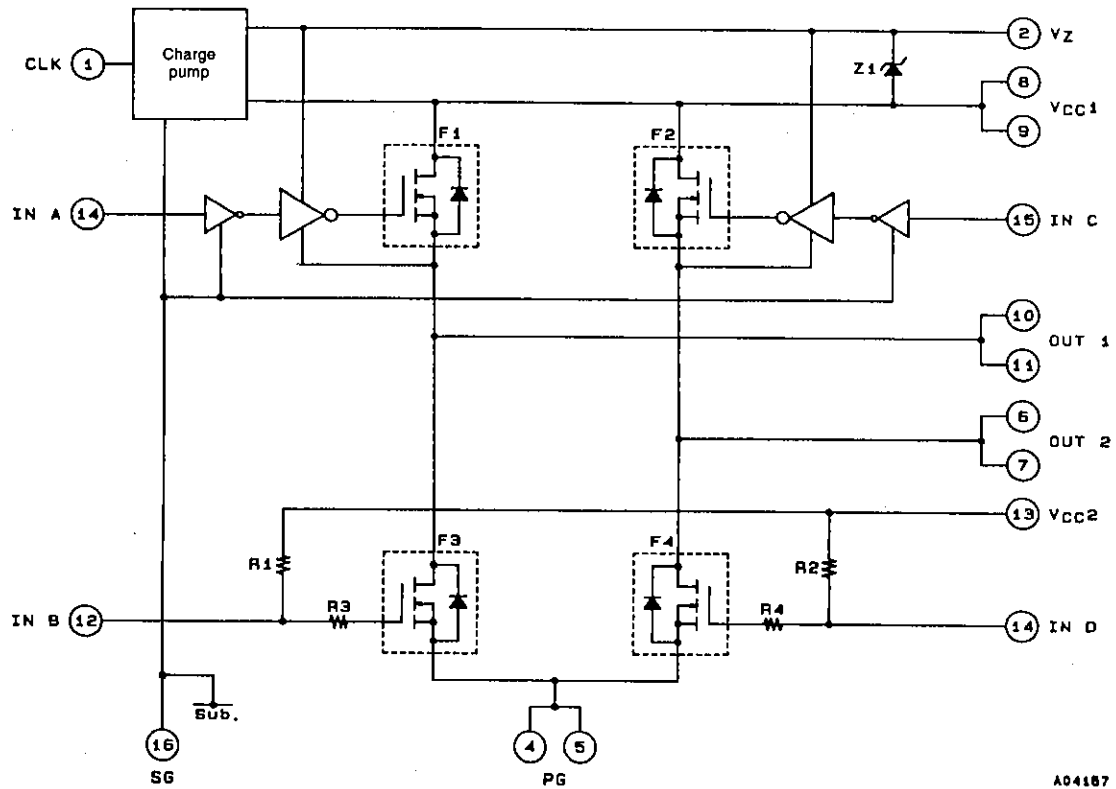
Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage 1	$V_{CC1}$	With signal	18 to 42	V
Supply voltage 2	$V_{CC2}$	With signal	4.75 to 7.00	V
Input voltage	$V_{in}$	Pins 1, 3, 12, 14, 15	-7 to +7	V
Motor output current	$I_O$	PWM frequency $f_p = 25\text{kHz}$	5	A
Motor starting current	$I_{OD}$	1 pulse, $t = 200\text{ms}$	8	A
Motor brake current 1 (F1 and F2 ON)	$I_{OB1}$	Triangle wave, 1 pulse, pulse width = 100ms	11	A
Motor brake current 2 (F3 and F4 ON)	$I_{OB2}$	Triangle wave, 1 pulse, pulse width = 100ms	13.5	A
PWM frequency	$f_p$		0 to 30	kHz
CLK input frequency	$f_{CLK}$	40 to 60% duty	10 to 30	kHz
Sensing voltage	$V_S$	Between pins 4/5 and ground	0 to 0.6	V
Gate input voltage	$V_{IG}$	Between pins 3/12 and SG	$V_{CC2}$	V
MOSFET withstand voltage	$V_{DSS}$	F1, F2, F3, F4	60	V

**Electrical Characteristics** at  $T_c = 25^\circ\text{C}$ ,  $V_{CC1} = 24\text{V}$ ,  $V_{CC2} = 5.0\text{V}$ ,  $f_{CLK} = 25\text{kHz}$ 

Parameter	Symbol	Conditions	min	typ	max	Unit
Output saturation voltage 1	$V_{st1}$	$I_O = 5\text{A}$ , F1, F2	-	0.75	1.05	V
Output saturation voltage 2	$V_{st2}$	$I_O = 5\text{A}$ , F3, F4	-	0.43	0.65	V
Output leakage current	$I_L$	Pins 12, 14, 15 = 0.8V, pin 3 open	-	-	100	$\mu\text{A}$
		Pins 3, 14, 15 = 0.8V, pin 12 open				
Supply current	$I_{CCO}$	Pins 3, 12, 14, 15 = 0.8V	2.0	2.7	4.0	mA
Input ON voltage	$V_{IH}$	Pins 1, 14, 15	2.0	-	$V_{CC2}$	V
Input OFF voltage	$V_{IL}$	Pins 1, 3, 12, 14, 15	-	-	0.80	V
Input ON current	$I_{IH}$	Pins 1, 14, 15 ( $V_{IH} = 2.7\text{V}$ )	-	0.21	0.42	mA
Input OFF current	$I_{IL}$	Pins 3, 12 ( $V_{IL} = 0.4\text{V}$ )	-	1.0	1.2	mA
Diode forward-bias voltage	$V_F$	$I_F = 5\text{A}$	-	1.0	1.4	V
Turn ON delay time 1	$t_{d-ON1}$	F1, F2 ( $I_O = 5\text{A}$ )	-	0.6	-	$\mu\text{s}$
Turn OFF delay time 1	$t_{d-OFF1}$	F1, F2 ( $I_O = 5\text{A}$ )	-	3.9	-	$\mu\text{s}$
Turn ON delay time 2	$t_{d-ON2}$	F3, F4 ( $I_O = 5\text{A}$ )	-	0.2	-	$\mu\text{s}$
Turn OFF delay time 2	$t_{d-OFF2}$	F3, F4 ( $I_O = 5\text{A}$ )	-	0.6	-	$\mu\text{s}$

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

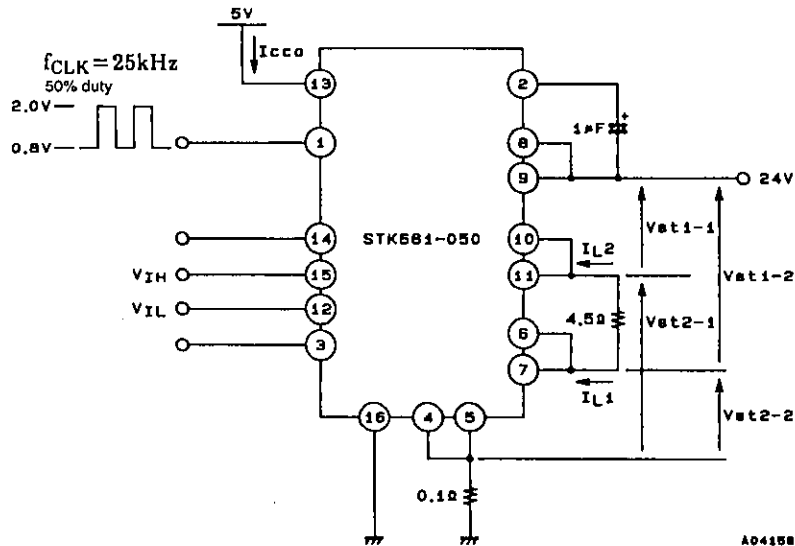
## Block Diagram



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## Test Circuit

Vst1, Vst2, I<sub>CCO</sub>, I<sub>L</sub>

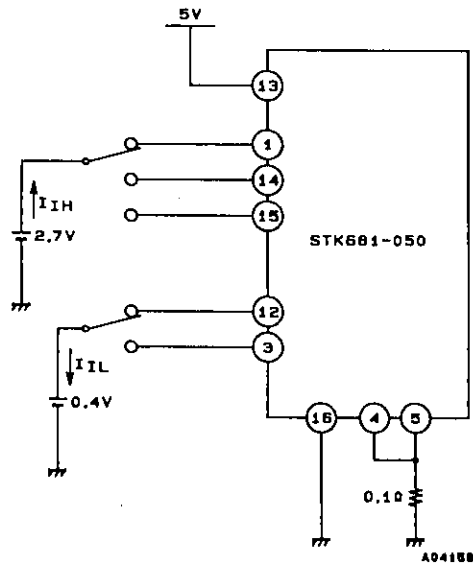


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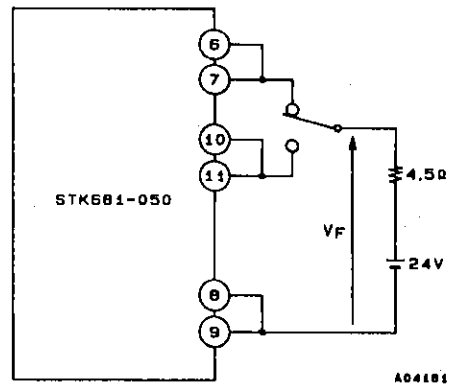
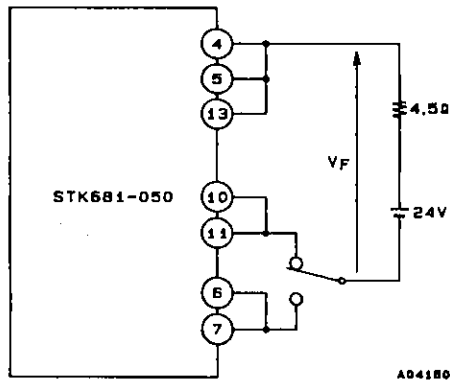
Test parameter	Input conditions			
	Pin 14	Pin 15	Pin 12	Pin 3
Vst1-1	High	Low	Low	Open
Vst1-2	Low	High	Open	Low
Vst2-1	Low	High	Open	Low
Vst2-2	High	Low	Low	Open
I <sub>CCO</sub>	Low	Low	Low	Low
I <sub>L1</sub>	Low	Low	Low	Open
I <sub>L2</sub>	Low	Low	Open	Low

High: V<sub>IH</sub> = 2.0V  
Low: V<sub>IL</sub> = 0.8V

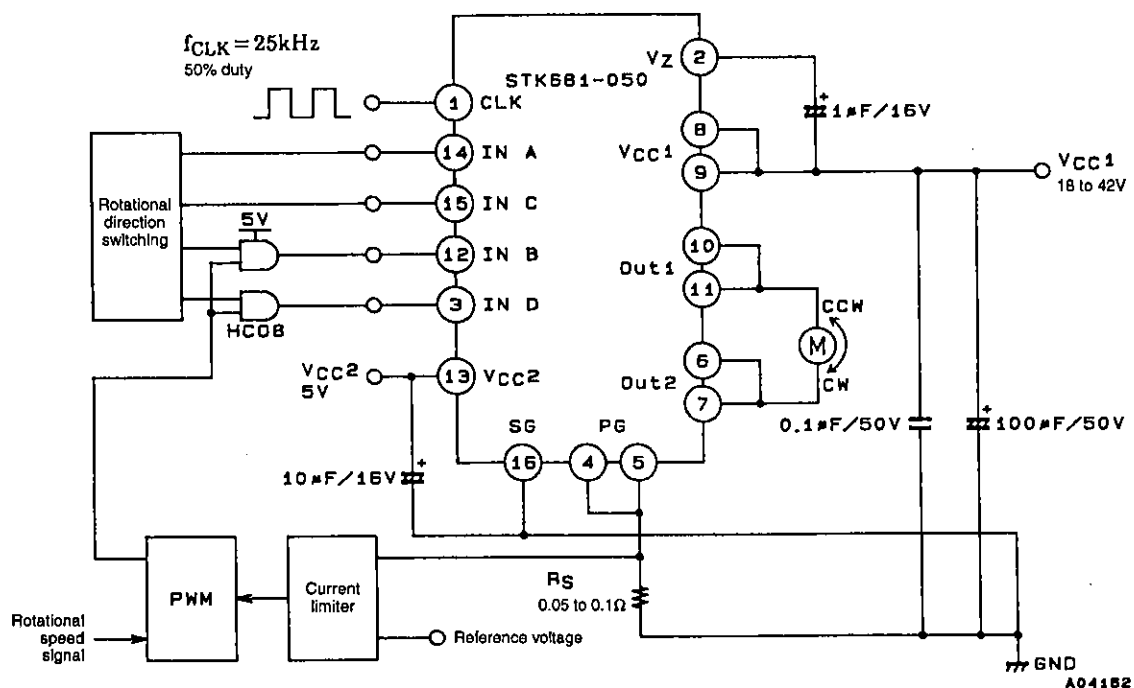
$I_{IH}, I_{IL}$



$V_F$



## Sample Application Circuit



Mode	IN A	IN C	IN B	IN D
Standby (before drive)	Low	Low	Low	Low
CW	High	Low	Low	PWM
CCW	Low	High	PWM	Low
Brake	Low	Low	V <sub>CC2</sub>	V <sub>CC2</sub>
Inhibit mode	High	×	High	×
	×	High	×	High

High: V<sub>IH</sub> ≥ 2.7V

Low: V<sub>IL</sub> ≤ 0.4V

High level during PWM operation = V<sub>CC2</sub>

× = don't care

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