3-PHASE CAPSTAN MOTOR DRIVER

The KA8329B is a monolithic integrated circuit, and it is suitable for 3-phase capstan motor driver of VCR system.

32-SDIPH-400

FEATURES

- 3-phase, full-wave, linear BLDC motor driver with 3 hall sensors
- Built-in TSD (Therml shutdown) circuit
- Built-in torque ripple control circuit
- Built-in output current limiter
- Motor speed control
- High output current
- Built-in FG amplifier with sinusoidal waveforms
- Built-in hall amplifier
- Built-in CW and CCW circuit

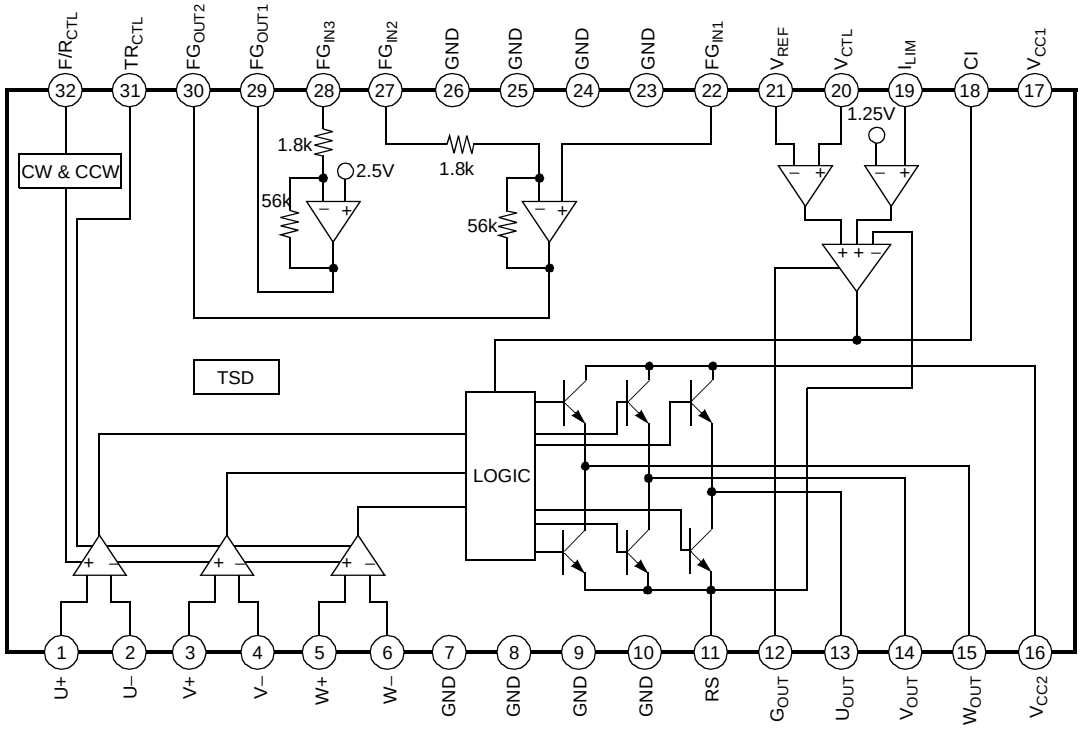
ORDERING INFORMATION

Device	Package	Operating Temperature
KA8329B	32-SDIPH-400	–25°C ~ +75°C

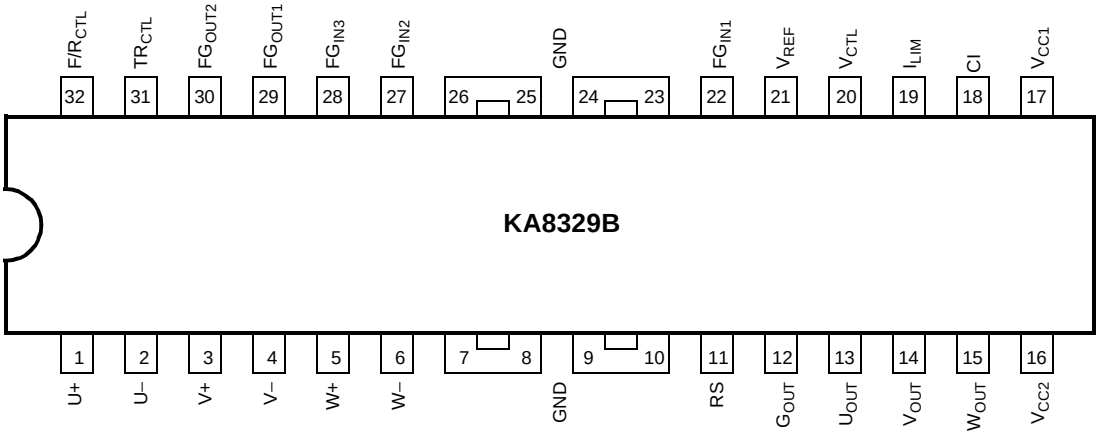
TARGET APPLICATION

- VCR capstan motors

BLOCK DIAGRAM



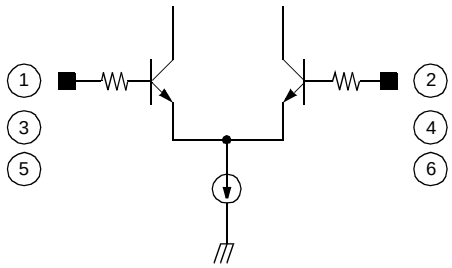
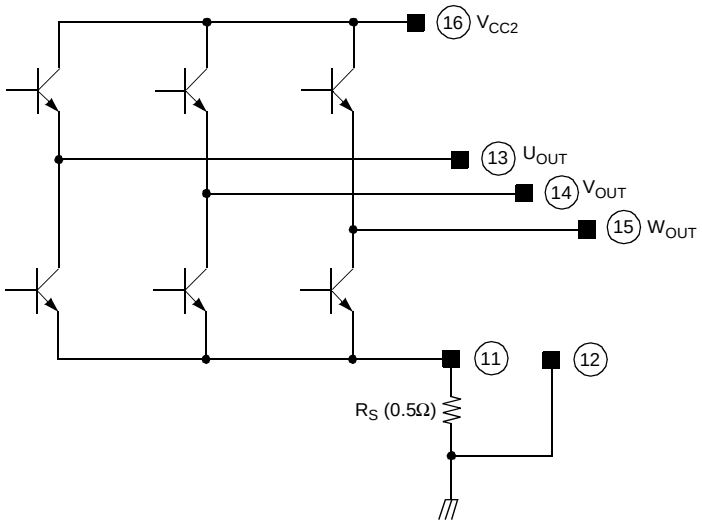
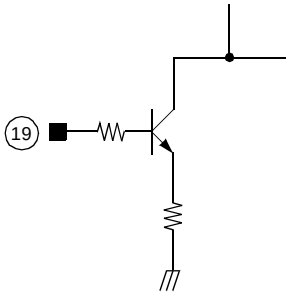
PIN CONFIGURATIONS



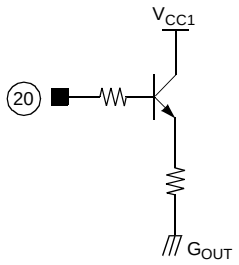
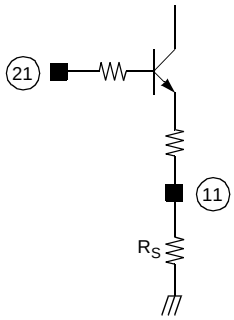
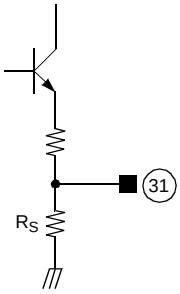
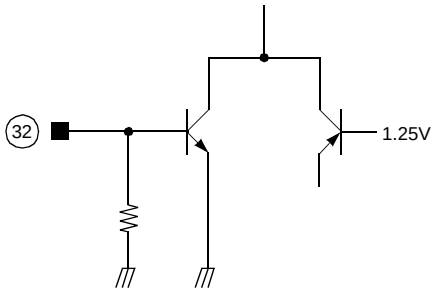
PIN DESCRIPTION

Pin No.	Symbol	I/O	Description	Pin No.	Symbol	I/O	Description
1	U+	I	U+ hall signal input	17	V_{CC1}	–	Supply voltage
2	U–	I	U– hall signal input	18	CI	–	Phase stabilization
3	V+	I	V+ hall signal input	19	I_{LIM}	I	Current limitation
4	V–	I	V– hall signal input	20	V_{CTL}	I	Voltage control
5	W+	I	W+ hall signal input	21	V_{REF}	I	Voltage control reference
6	W–	I	W– hall signal input	22	FG_{IN1}	I	FG amp1 input1
7	GND	–	Ground (Signal)	23	GND	–	Ground (Signal)
8	GND	–	Ground (Signal)	24	GND	–	Ground (Signal)
9	GND	–	Ground (Signal)	25	GND	–	Ground (Signal)
10	GND	–	Ground (Signal)	26	GND	–	Ground (Signal)
11	RS	O	Output current detection	27	FG_{IN2}	I	FG amp1 input2
12	G_{OUT}	–	Ground (Power)	28	FG_{IN3}	I	FG amp2 input1
13	U_{OUT}	O	U-phase output	29	FG_{OUT1}	O	FG amp2 output
14	V_{OUT}	O	V-phase output	30	FG_{OUT2}	O	FG amp1 output
15	W_{OUT}	O	W-phase output	31	TR_{CTL}	I	Troque ripple control
16	V_{CC2}	–	Supply voltage (Power)	32	F/R_{CTL}	I	Forward & reverse control

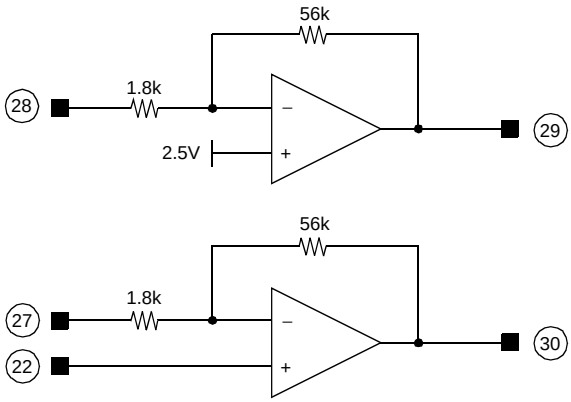
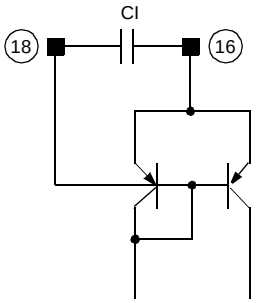
INTERNAL CIRCUIT

Description	Pin No.	Internal circuit
Hall input	1, 2, 3 4, 5, 6	
Output & Current detection	13, 14, 15, 12	
Speed control (Current limitation)	19	

INTERNAL CIRCUIT (Continued)

Description	Pin No.	Internal circuit
Speed control (Voltage control)	20	
Voltage control reference	21	
Torque ripple control	31	
Forward & Reverse control	32	

INTERNAL CIRCUIT (Continued)

Description	Pin No.	Internal circuit
FG AMP.	28, 29 22, 27, 30	
Phase stabilization	16, 18	

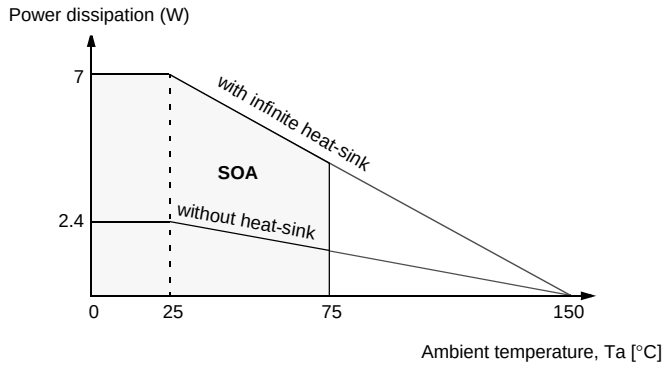
ABSOLUTE MAXIMUM RATING (Ta=25°C)

Characteristics	Symbol	Value	Unit	Remark
Supply voltage (Signal)	V_{CC1max}	7	V	–
Supply voltage (Power)	V_{CC2max}	28	V	–
Output current	I_{Omax}	1.5[note1]	A / Phase	–
Power dissipation	P_d	2.4[note2]	W	No heat sink
Thermal resistance	R_T	60.2	mW / °C	No heat sink
Junction temperature	T_J	150	°C	–
Operating temperature	T_{OPR}	–25 ~ +75	°C	–
Storage temperature	T_{STG}	–40 ~ +125	°C	–

NOTES:

1. Duty 1/100, pulse width 500µs
2. 1) When mounted on glass epoxy PCB (76.2 × 114 × 1.57mm)
   2) Power dissipation reduces 19.2mW / °C for using above Ta=25°C. (Without heat-sink)
   3) Do not exceed Pd and SOA.

PD GRAPH



RECOMMENED OPERATING CONDITIONS (Ta=25°C)

Characteristics	Symbol	Value	Unit
Operating supply voltage (Signal)	V_{CC1}	4.5 ~ 5.5	V
Operating supply voltage (Power)	V_{CC2}	8 ~ 27	V

ELECTRICAL CHARACTERISTICS

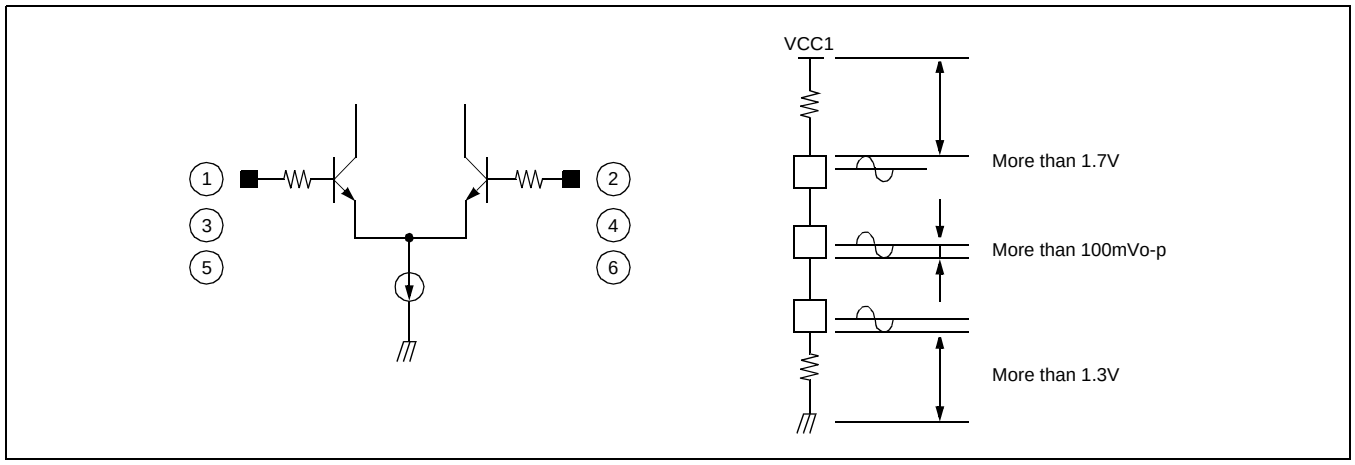
(Ta=25°C, V_{CC1}=5V, V_{CC2}=16V, R_S=0.5Ω, unless otherwise specified)

Characteristic	Symbol	Pin No.	Test conditions	Min.	Typ.	max.	Unit
Quiescent input current	I_{CC1}	17	VF/R=0V or 5V	5	8.5	12	mA
Hall amp. input voltage range	V_{INS}	1 ~ 6	mVo-p	100	–	–	mV
Power TR stauration voltage (Outflow current)	V_{SAT1}	16–13, 14, 15	V_{CC2}=13V, I_{OUT}=0.8A/Phase	–	1.8	2.0	V
Power TR saturation voltage (Inflow current)	V_{SAT2}	11–13, 14, 15	V_{CC2}=13V, I_{OUT}=0.8A/Phase	–	1.8	2.0	V
I_{LIM} input voltage range	V_{LIM}	19	–	0	–	V_{CC1}	V
I_{LIM} input current	I_{19}	19	V_{CTL}=3.5V, V_{LIM}=3V	–	350	2000	nA
I_{LIM} current limit level	GML	19–13, 14, 15	V_{CTL}=3.5V, V_{LIM}=Adjustable	0.61	0.67	0.73	A/V
I_{LIM} quiescent output current	I_{O1}	19	V_{LIM}=0V	–	1.5	5.0	mA
I_{LIM} limit offset voltage	V_{O1}	19	V_{REF}=2.5V	1.17	1.25	1.33	V
V_{CTL} input voltage range	V_{CTL}	20	–	0	–	V_{CC1}	V
V_{CTL} input current	I_{20}	20	V_{CTL}=3V, V_{LIM}=5V	–	350	2000	nA
V_{CTL} control gain	GM	20–13, 14, 15	V_{CTL}=3.5V, V_{LIM}=Adjustable	0.9	1.0	1.1	A/V
V_{CTL} quiescent output current	I_{O2}	20	V_{CTL}=0V	–	1.5	5.0	mA
V_{CTL} input offset voltage	V_{O2}	20	V_{CTL}=Adjustable	–50	0	50	mV
Forward rotation mode	V_F	32	–	1.0	1.3	1.6	V
Reverse rotation mode	V_R	32	–	0	–	0.8	–
V_{REF} input voltage range	V_{REF}	21	–	2.0	–	V_{CC1}–2.0	V
FG_{AMP} internal reference voltage	V_{28}	28	–	2.2	2.5 –	2.8	V V
FG_{AMP} input voltage range	FG_{IN}	27, 28	Pin28=10kHz, 60mVp-p	1	–	4	–
FG_{AMP1} gain	FG_{AV1}	28, 29	Sinusoidal waveforms Pin27=10kHz, 60mVp-p	28	31	34	Times
FG_{AMP2} gain	FG_{AV2}	27 ~ 30	Sinusoidal waveforms Pin22=2.5V	28	31	34	Times

APPLICATION INFORMATION

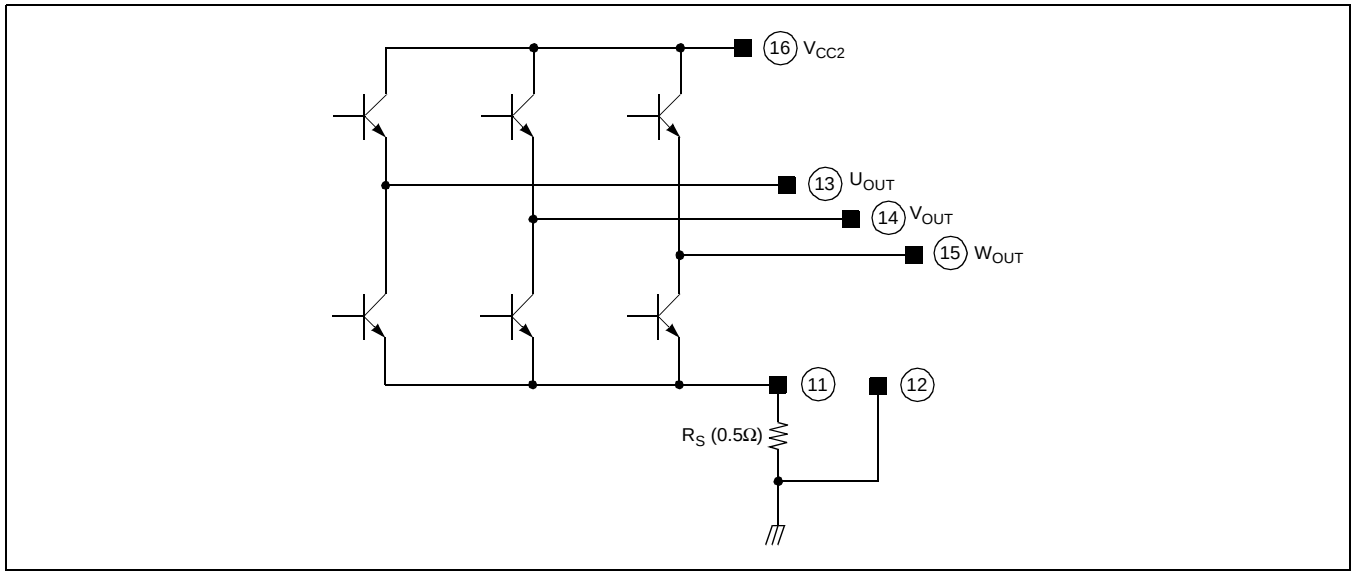
1. HALL INPUT

The input signal of the hall sensor requires more amplitude than 100mVo-p. and the operating voltage level of the hall sensor is from 1.2V ~ V_{CC1}-0.8V.



2. OUTPUT CURRENT DETECTION

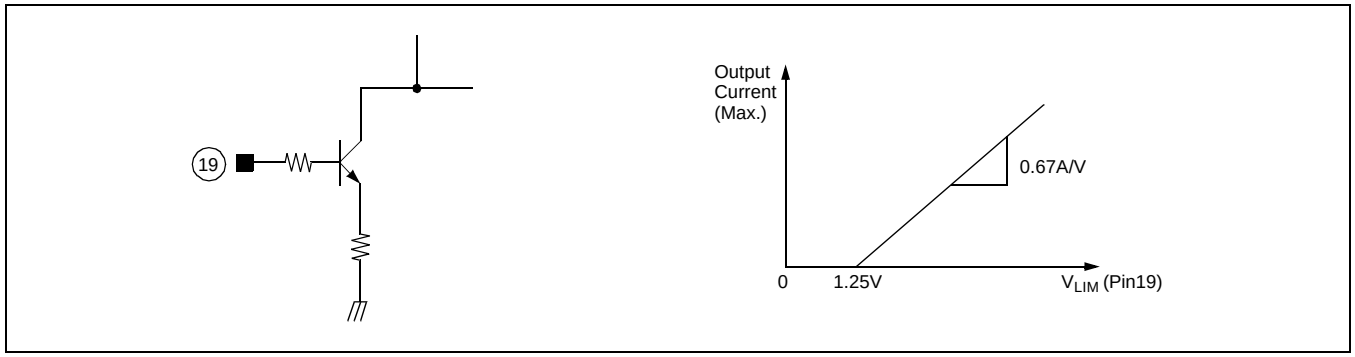
Pin 11 is usually connected with R_S (Approx. 0.5Ω), and the motor current is converted to a voltage by the R_S and provided to a feedback amplifier. Pin 12 is connected to the circuit with the ground side or R_S.



3. MOTOR SPEED CONTROL (INPUT CURRENT LIMITATION)

The maximum output current is limitted by pin 19 voltage as follows. So a motor speed is controlled by the output current. In case of no-use, it is to be short-circuit with V_{CC1}.

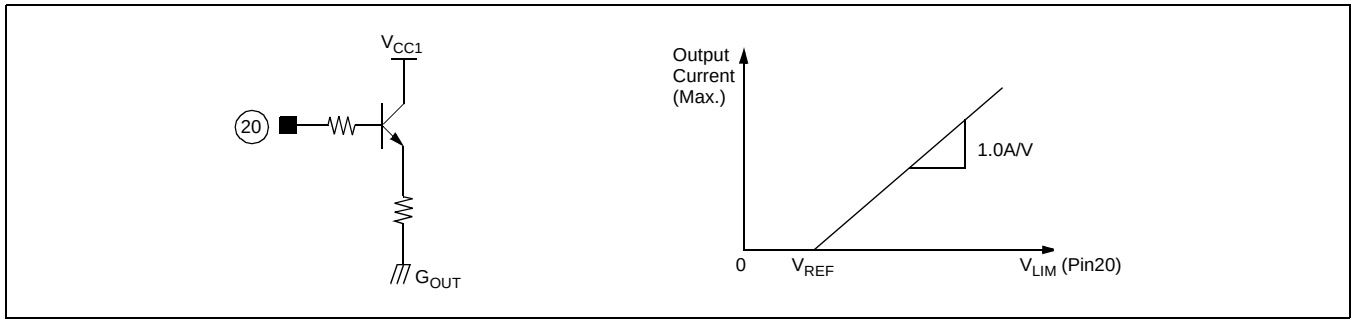
GML = $\Delta I_O / \Delta V_{LIM} = (I_{O2} - I_{O1}) / (V_{LIM2} - V_{LIM1})$, where V_{LIM1} = 1.45V → Output current=I_{O1}
V_{LIM2} = 1.55V → Output current=I_{O2}



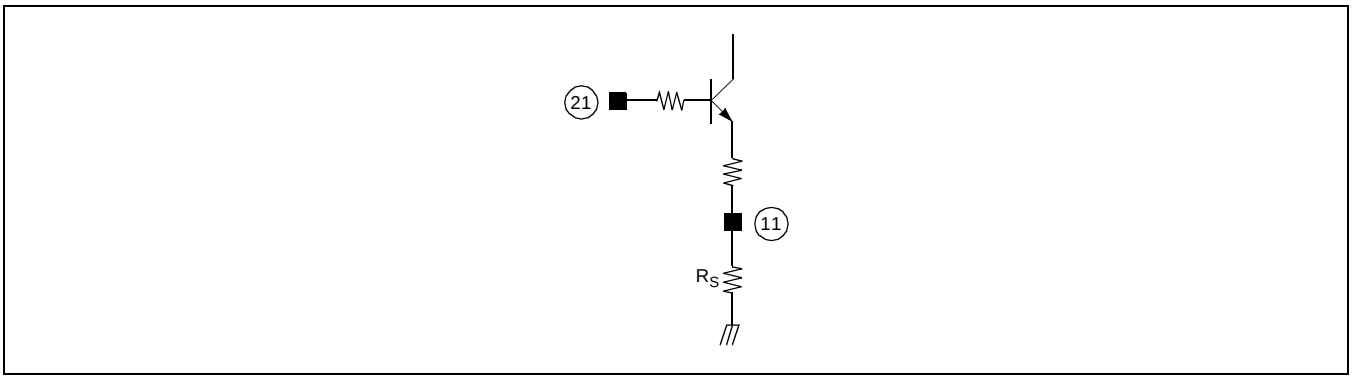
4. MOTOR SPEED CONTROL (INPUT VOLTAGE CONTROL)

The control of motor speed is possible on the conditions of V_{CTL} (Pin20) ≥ V_{REF}.
The control gain is approx. 1.0A/V as follows.

GML = $\Delta I_O / \Delta V_{CTL} = (I_{O2} - I_{O1}) / (V_{CTL2} - V_{CTL1})$, where V_{REF} = 2.5V, V_{CTL1} = 2.6V → Output current=I_{O1}
V_{REF} = 2.5V, V_{CTL2} = 2.7V → Output current=I_{O2}

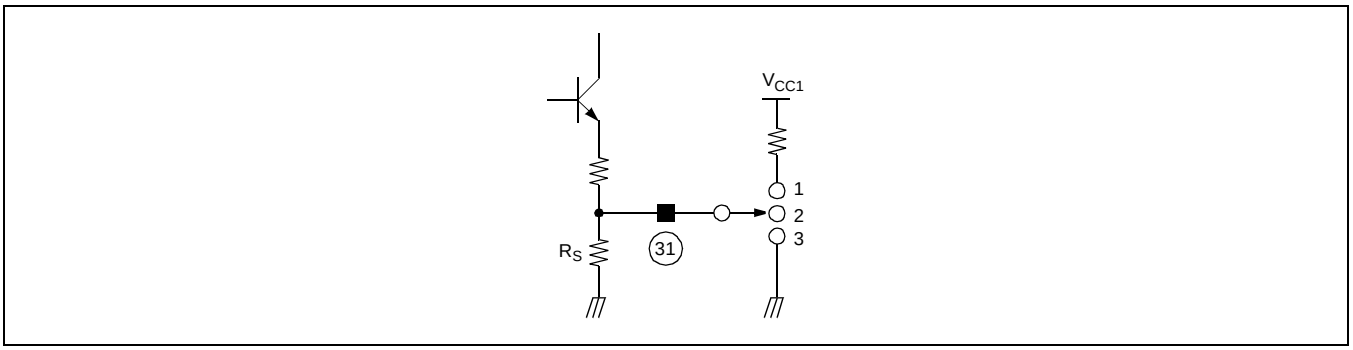


5. VOLTAGE CONTROL REFERENCE



The input voltage range is $2V \leq V_{REF} \leq (V_{CC1} - 2V)$.

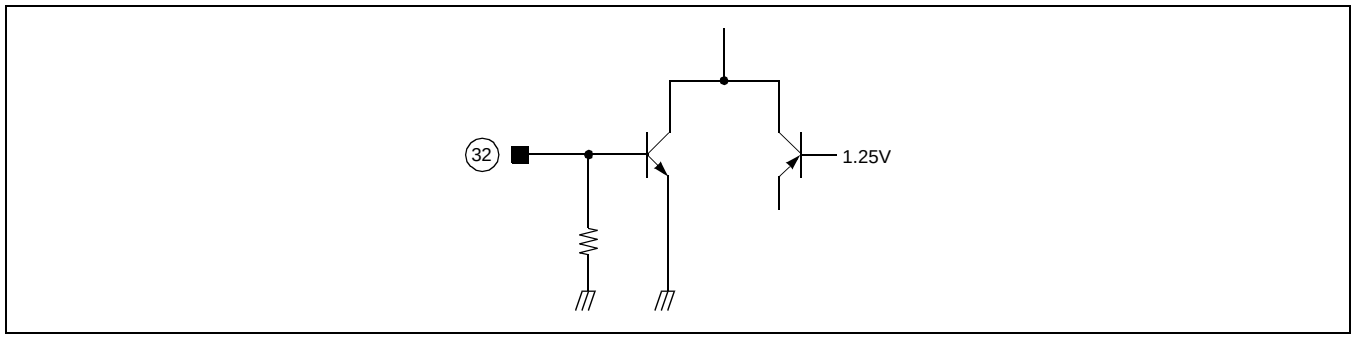
6. TORQUE RIPPLE CONTROL



The motor torque ripple is controlled by Pin 31 voltege as follows.

1. GND
2. Normal Mode
3. Control Mode

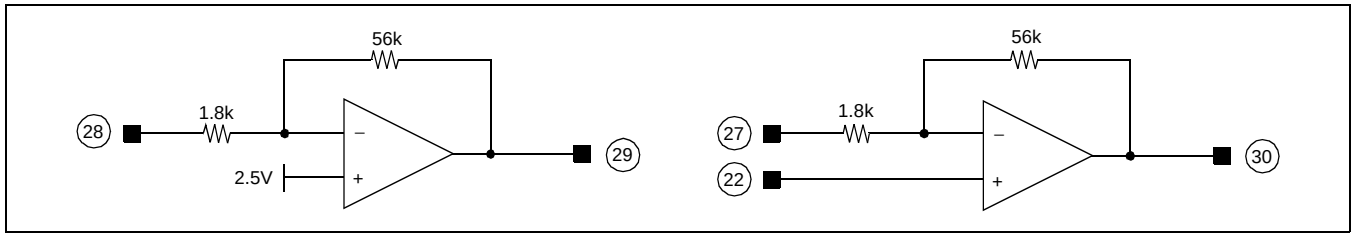
7. FORWARD & REVERSE ROTATION CONTROL



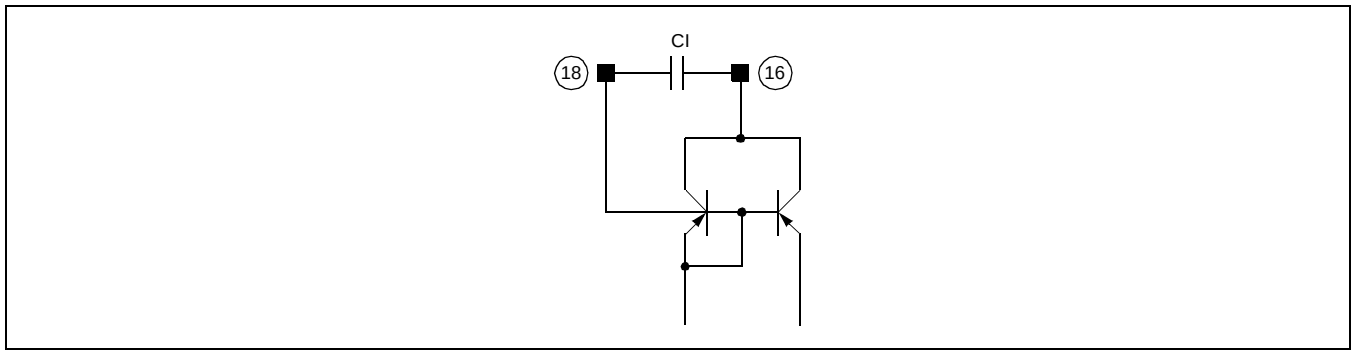
Forward mode: Pin 32 ≥ 1.8V
Reverse mode: Pin 32 ≤ 0.8V

8. FG AMP

These amplifiers are the inversion type. One amplifier is built in both the reference voltage (Approx. 2.5V) and the gain setting resistors. The voltage gain is approx. 31 times.

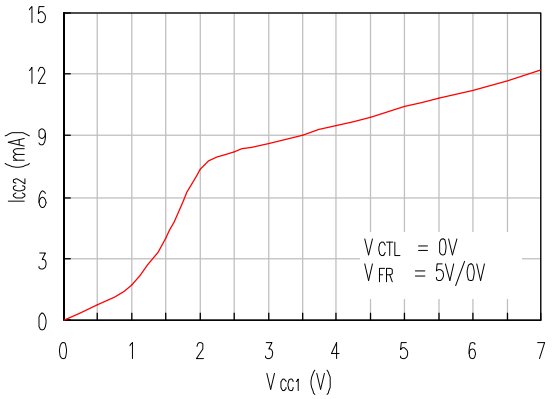


9. PHASE STABILIZATION

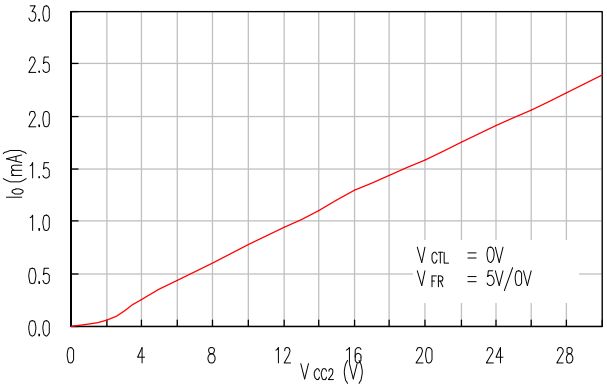


Be inserted a capacitor between pin 16 and pin 18. This capacitor, approx. 0.1µF is for the phase stabilization of the circuit.

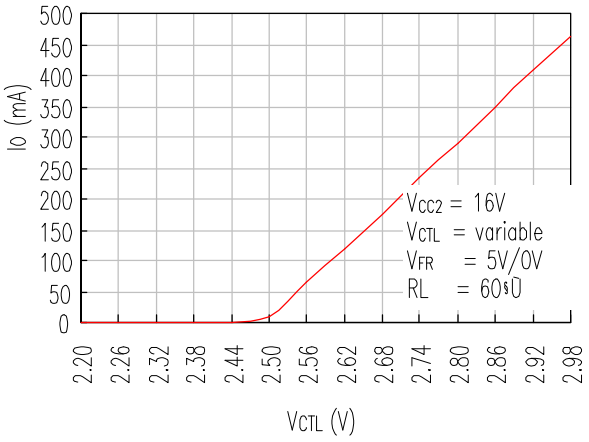
CHARACTERISTIC GRAPHS



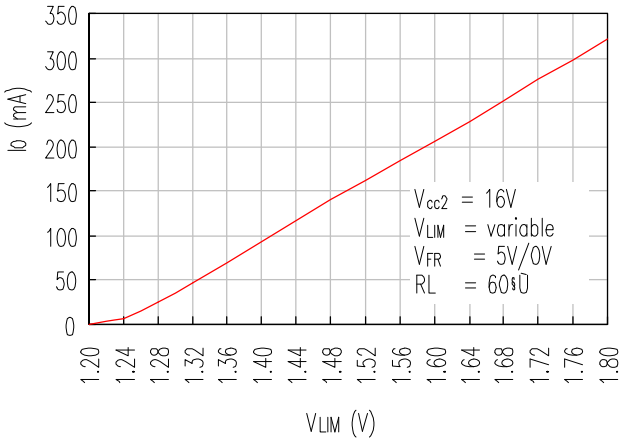
1. V_{CC1} vs I_{CC2}



2. V_{CC2} vs I_O

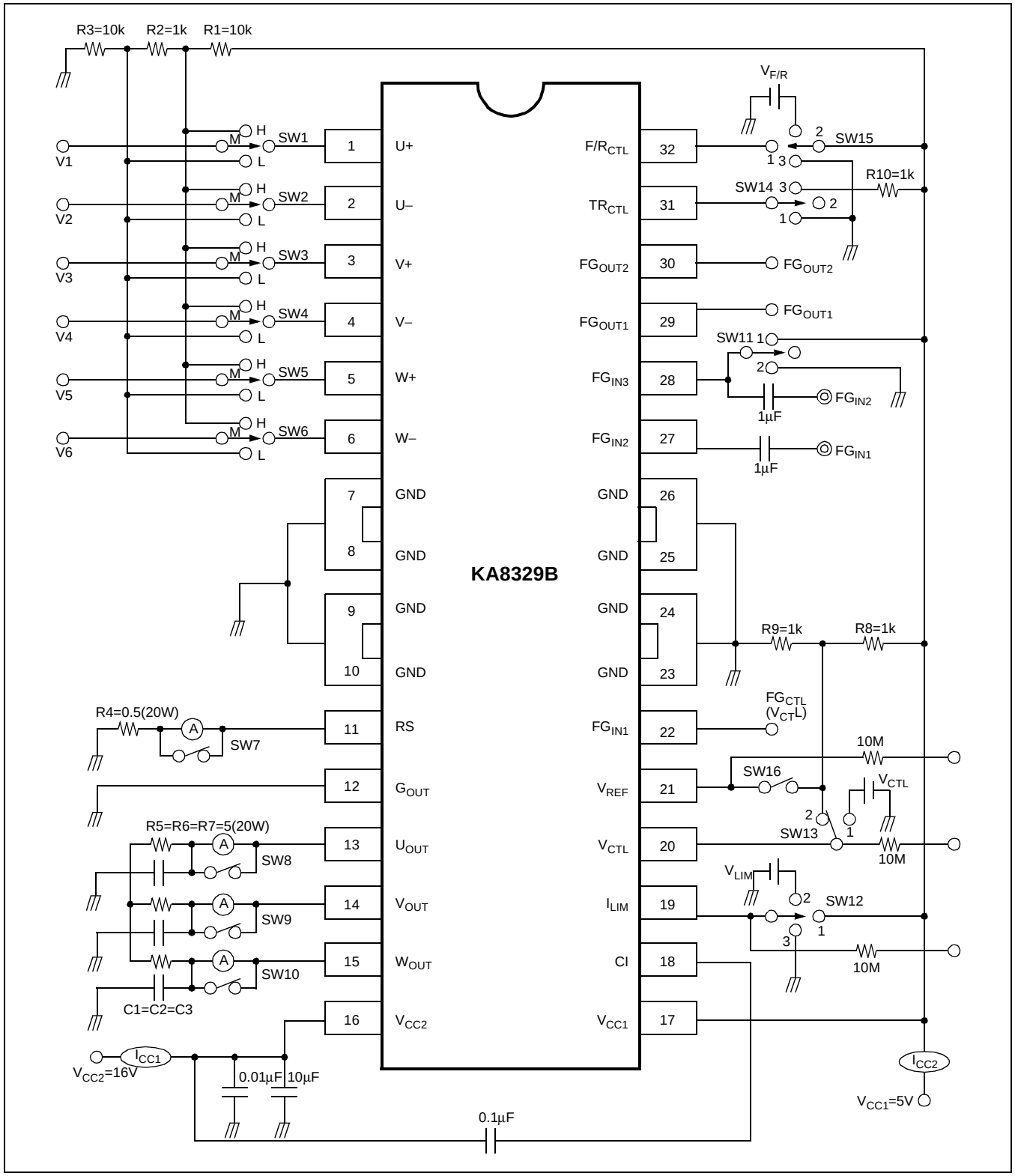


3. V_{CTL} vs I_O

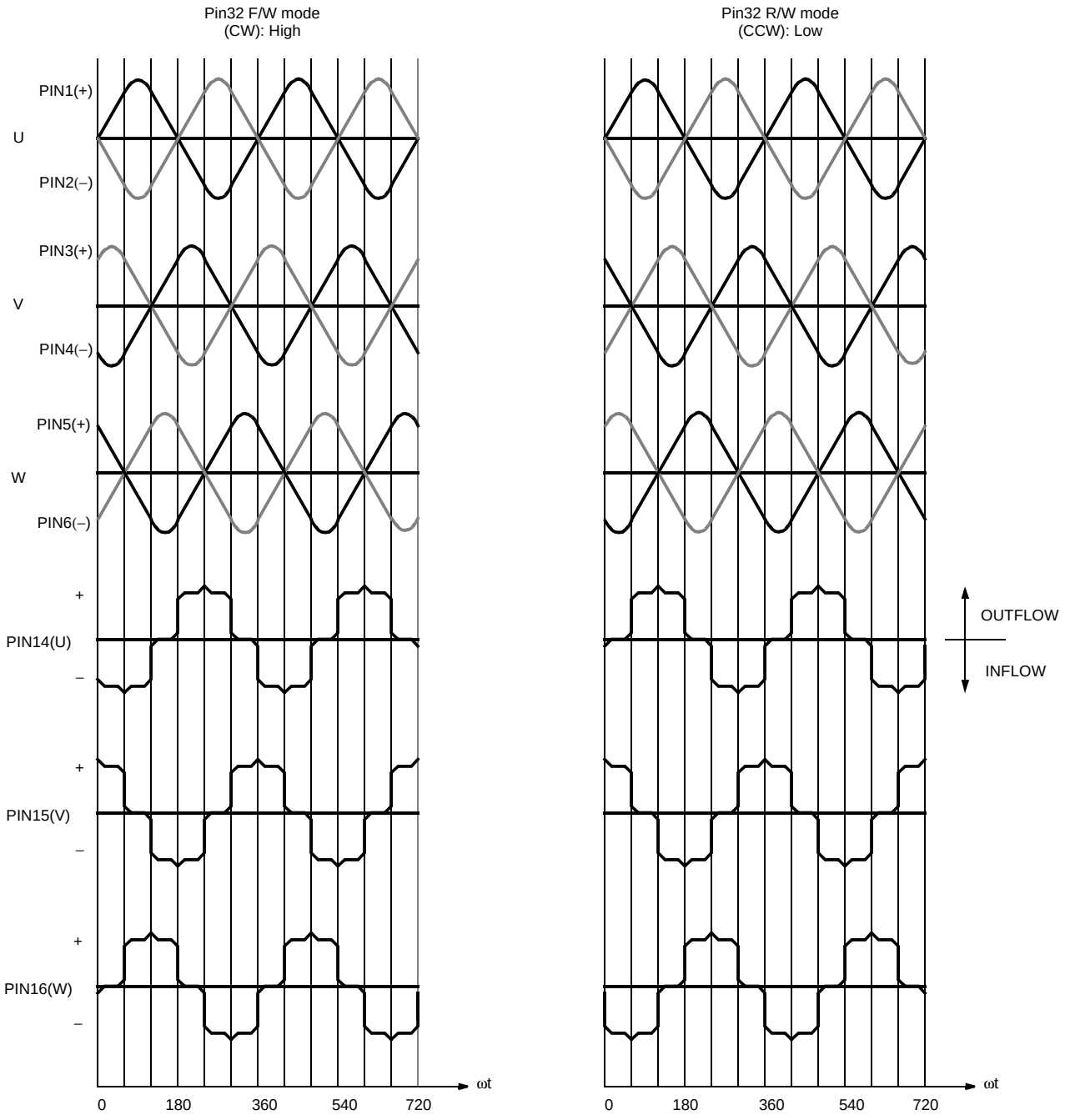


4. V_{LIM} vs I_O

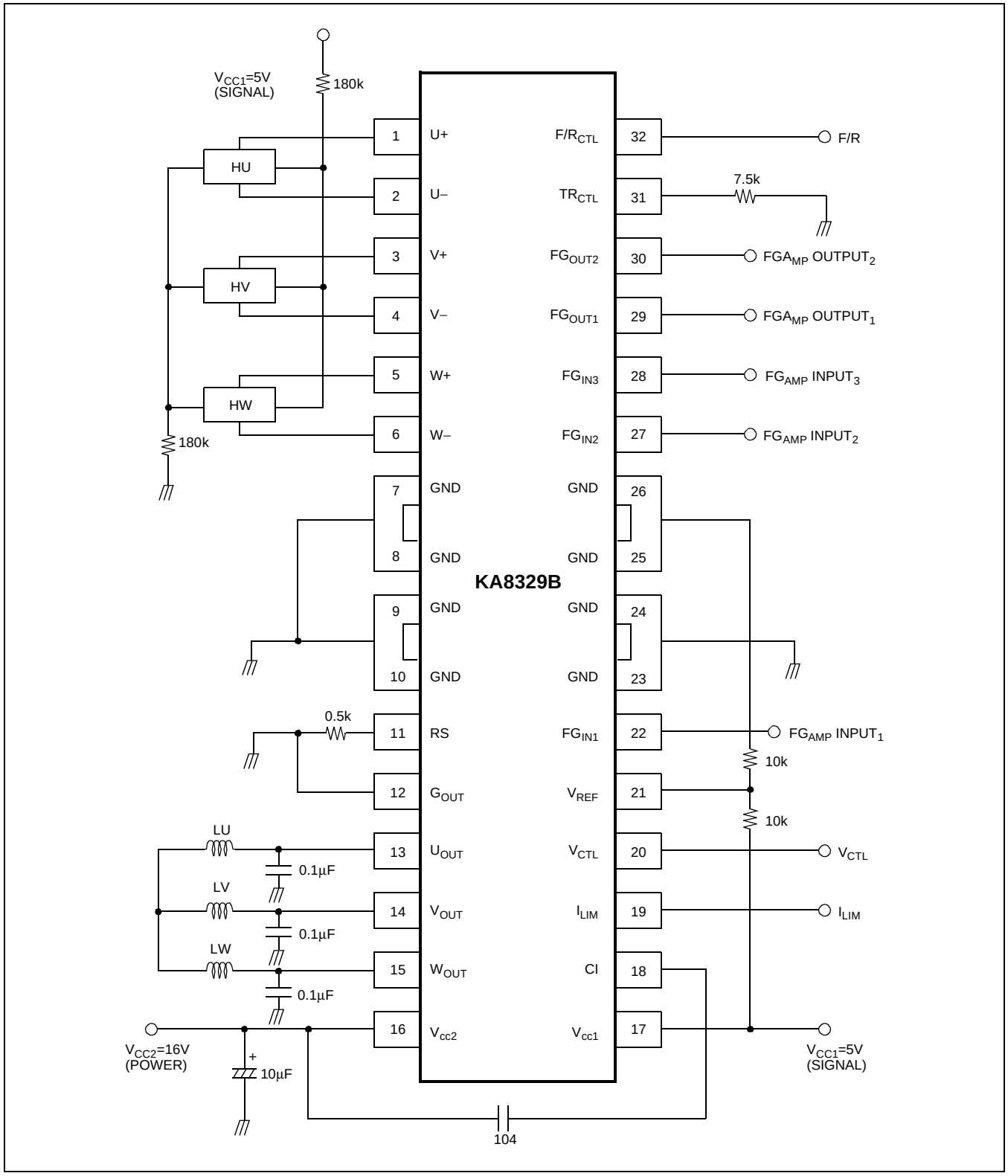
TEST CIRCUIT



TIMMING CHART



APPLICATION CIRCUIT



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