KA3050

Camera Motor Drive and Control IC

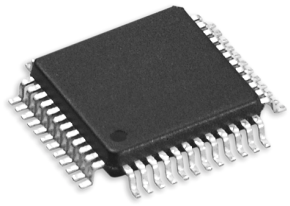
Features

- Built-in DC motor driver
  : 1.5-CH DC motor driver : CW, CCW & Brake
- Stepping motor driver
- Built-in strobo control
- Built-in IRED driver for auto-focus
- Built-in V_E selector
- Built-in V_E voltage detector
- Built-in 5V regulator
- Built-in step-up DC/DC converter controller

Description

The KA3050 is a monolithic integrated circuit, and suitable for the motor driver (AE, AF, zoom and reel motor driver) and the controller (strobo trigger, IRED driver, supply voltage detector, step-up converter control, etc.) in camera systems.

48-QFP-1010E



Typical Applications

- Camera system

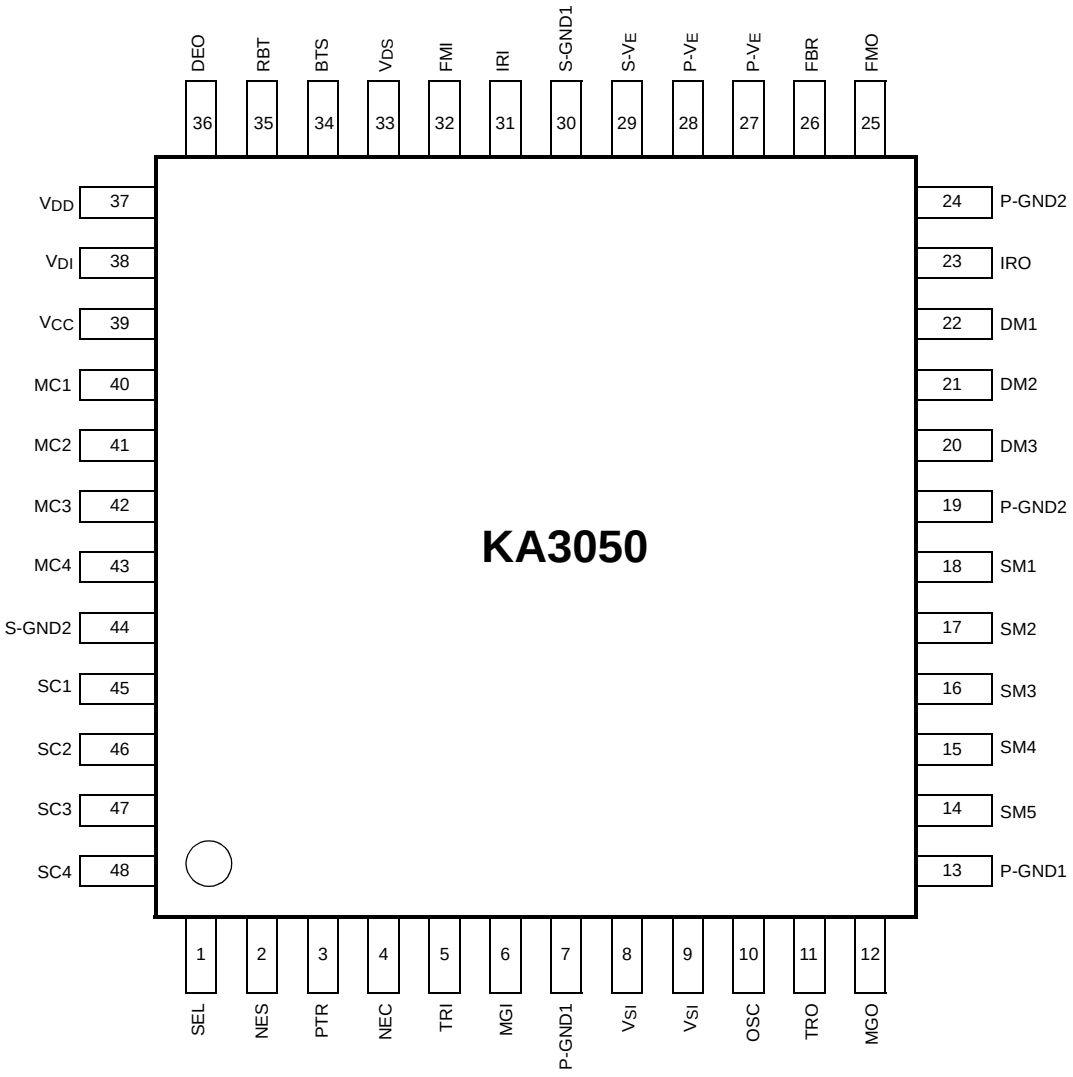
Ordering Information

Device	Package	Operating Temp.
KA3050	48-QFP-1010E	–20°C ~ +50°C

Rev. 1.0.1
February. 2000.

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Pin Assignments



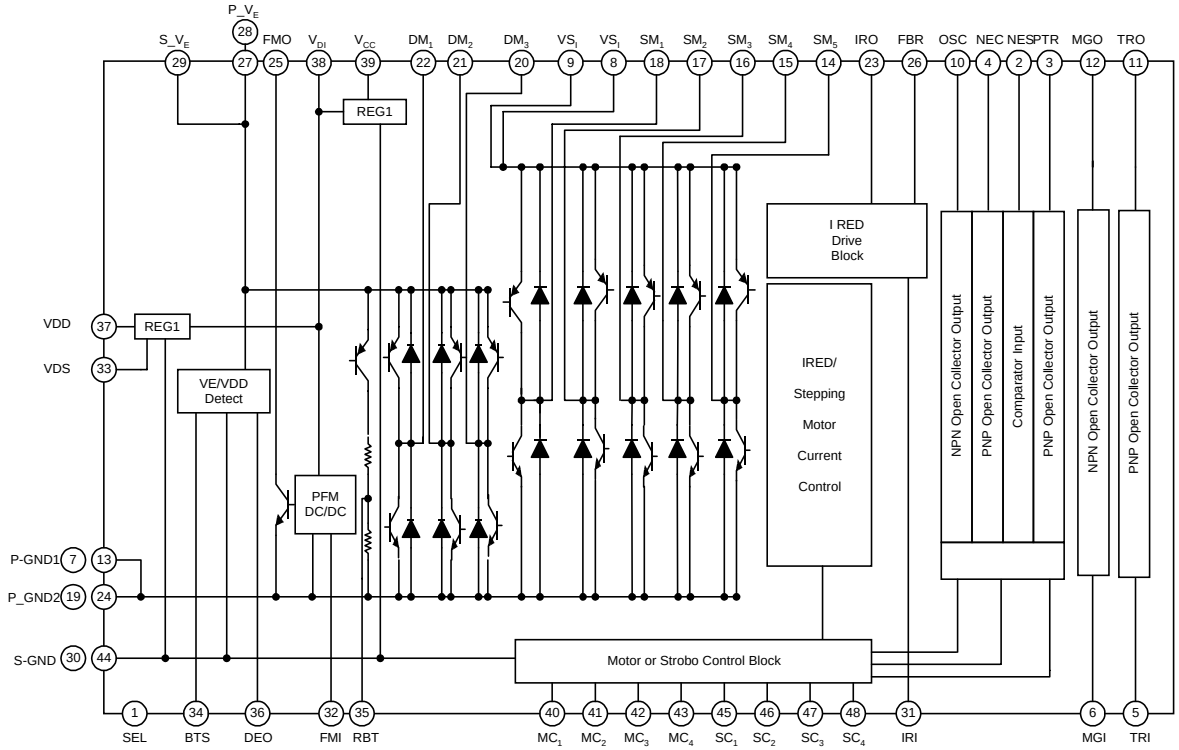
Pin Definitions

Pin Number	Pin Name	Pin Function Description
1	SEL	IC on/off
2	NES	Comparator input
3	PTR	PNP open collector output
4	NEC	PNP open collector output
5	TRI	Trigger input
6	MGI	Magnet drive input
7	P-GND1	Power ground 1
8	V_{SI}	Step motor & AE meter power
9	V_{SI}	Step motor & AE meter power
10	OSC	NPN open collector output
11	TRO	PNP open collector output
12	MGO	Magnet drive output (NPN open collector output)
13	P-GND1	Power ground 1
14	SM_5	Step motor & AE meter output 5
15	SM_4	Step motor & AE meter output 4
16	SM_3	Step motor & AE meter output 3
17	SM_2	Step motor & AE meter output 2
18	SM_1	Step motor & AE meter output 1
19	P-GND2	Power ground 2
20	DM_3	DC motor output 3
21	DM_2	DC motor output 2
22	DM_1	DC motor output 1
23	IRO	IRED drive output
24	P-GND2	Power ground 2
25	FMO	Step-up converter switching output
26	FBR	IRED feedback input
27	P-V_E	Power V_E (Battery power)
28	P-V_E	Power V_E (Battery power)
29	S-V_E	Signal V_E (Battery power)
30	S-GND1	Signal ground 1
31	IRI	IRED control input
32	FMI	Step-up converter clock input
33	V_{DS}	V_{DD} selection (4V/5V)
34	BTS	Battery selection (3V/6V)
35	RBT	V_E voltage detection output(analog)
36	DEO	V_E voltage detection output(digital)
37	V_{DD}	Inside power & outside power output
38	V_{DI}	Step-up voltage
39	V_{CC}	Motor drive IC power & control block power (5V) output
40	MC_1	MC code input 1

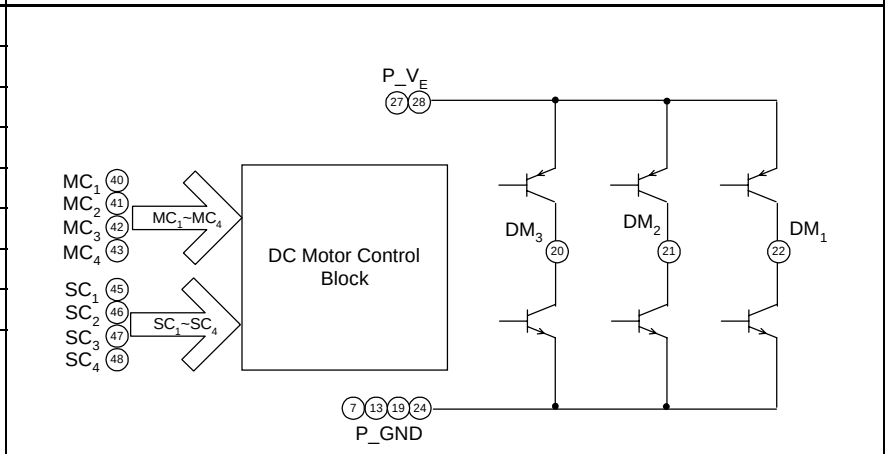
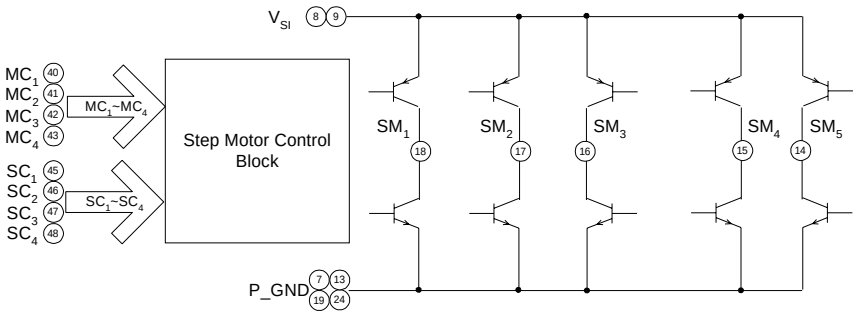
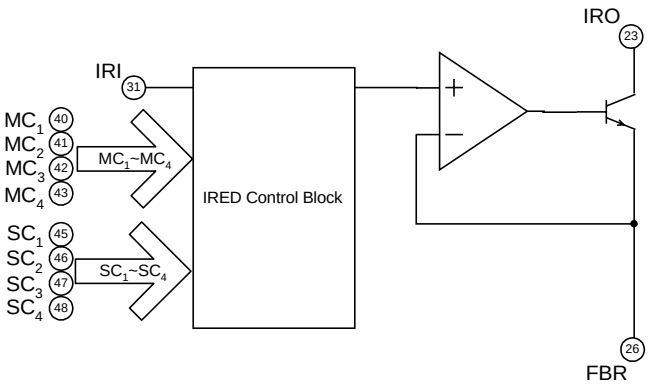
Pin Definitions (Continued)

Pin Number	Pin Name	Pin Function Description
41	MC_2	MC code input 2
42	MC_3	MC code input 3
43	MC_4	MC code input 4
44	S-GND2	Signal ground 2
45	SC_1	SC code input 1
46	SC_2	SC code input 2
47	SC_3	SC code input 3
48	SC_4	SC code input 4 / buffer output

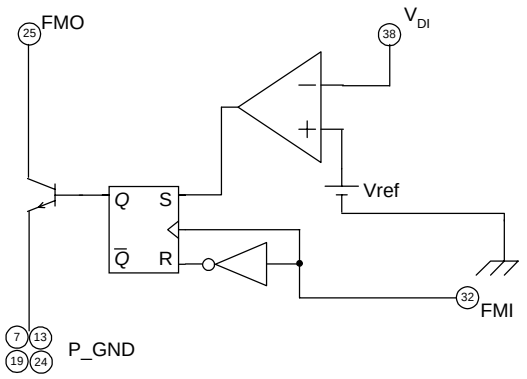
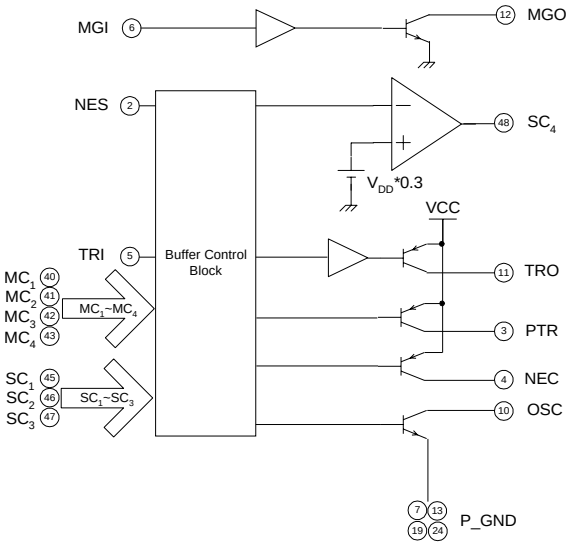
Internal Block Diagram



Equivalent Circuits

Description	Pin No.	Internal Circuit
1.5-Channel DC Motor Drive Block		
$MC_{1\sim4}$	40~43	
$SC_{1\sim4}$	45~48	
DM_1	22	
DM_2	21	
DM_3	20	
P_V_E	27,28	
P_GND	7, 13, 19, 24	
Stepping Motor Drive Block		
$MC_{1\sim4}$	40~43	
$SC_{1\sim4}$	45~48	
SM_1	18	
SM_2	17	
SM_3	16	
SM_4	15	
SM_5	14	
V_{SI}	8, 9	
P_GND	7, 13, 19, 24	
IRED Drive Block		
$MC_{1\sim4}$	40~43	
$SC_{1\sim4}$	45~48	
IRO	23	
FBR	26	

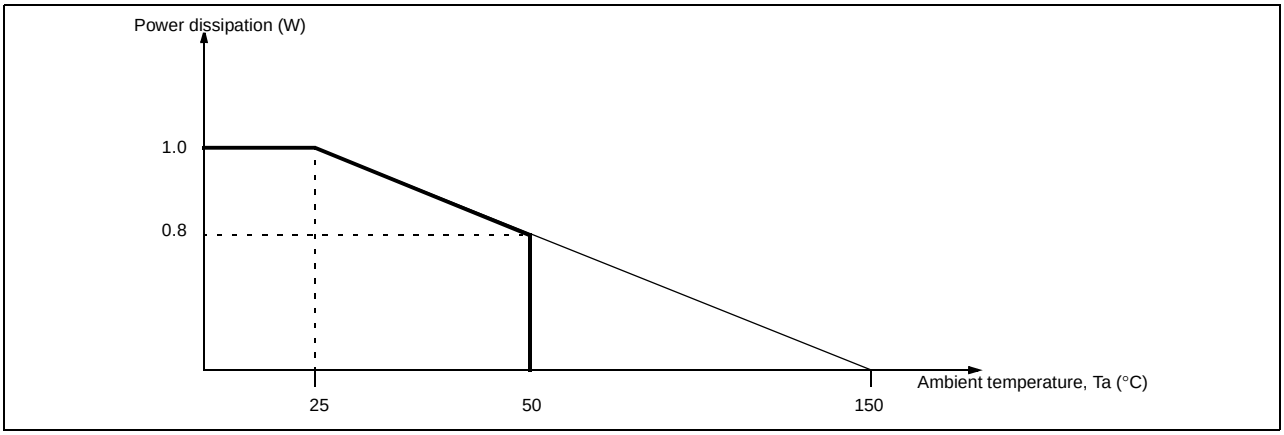
Equivalent Circuits (Continued)

Description	Pin No.	Internal Circuit
Step-up Control Block		
FMI	32	
V_{DI}	38	
FMO	25	
P_GND	7, 13, 19, 24	
General Buffer & Comparator Drive Block		
$MC_{1\sim4}$	40~43	
$SC_{1\sim3}$	45~47	
MGI	17	
MGO	16	
NES	2	
SC_4	48	
TRI	5	
TRO	11	
PTR	3	
NEC	4	
OSC	10	
P_GND	7, 13, 19, 24	

Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Value	Unit	Remark
Supply voltage	V_E	–0.3 ~ +7.5	V	
Output current (V_{DD})	I_{VDD}	80	mA	
Output current (V_{CC})	I_{VCC}	50	mA	
Output current (Stepping motor)	$I_{SM1, 2, 3, 4}$	500	mA	Within 70ms
Output current (AE meter)	$I_{SM4, 5}$	1000	mA	Within 70ms
Current (DC motor)	I_{DM}	3000	mA	Within 10ms
Output current (IRO)	I_{IRO}	2000	mA	Within 500µs
Output current (MGO)	I_{MGO}	500	mA	Within 200ms
Output terminal voltage	V_{OUT}	–0.3 ~ +7.5	V	
Input terminal voltage	V_{IN}	–0.3 ~ +7.5	V	
Power dissipation	P_D	1.0	W	
Operating temperature range	T_{OPR}	–20 ~ +50	°C	
Storage temperature	T_{STG}	–55 ~ +125	°C	

Power Dissipation Curve



Recommended Operating Conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Supply Voltage	V_E	2.0	-	7.5	V

Electrical Characteristics (Ta = 25°C)

Block	Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes
Total	Leakage current	I_{STB}	V_E=6.0V	-	-	1.0	μA	1
	Low input voltage range	V_{INL}	-	–0.3	-	0.6	V	2
	High input voltage range	V_{INH}	-	1.6	-	7.0	V	3
	Control input current	I_{IH}	V_{IH}=4.0V	-	80	120	μA	4
		I_{IL}	V_{IL}=GND	–1	-	0		
Step-up & V_{DD}	Min. operating voltage	V_{MIN}	-	-	-	1.0	V	5
	Step-up output voltage 1	V_{VDI1}	V_E=2.0V, I_{LOAD}=100mA	5.35	5.5	5.65	V	6
	Step-up output voltage 2	V_{VDI2}	V_E=2.0V, I_{LOAD}=100mA	8.3	8.6	8.9		
	FMO output voltage 1	V_{OL1}	V_E=2.0V, I_{LOAD}=700mA	-	-	0.3	V	7
	FMO output voltage 2	V_{OL2}	V_E=2.0V, I_{LOAD}=1000mA	-	-	0.4		
	FMI step-up clock	f	V_E=2.0V	39	156	313	KHz	8
	V_{DD} output voltage 3	V_{VDD3}	I_O=80mA	3.85	4.0	4.15	V	9
	V_{DD} output voltage 4	V_{VDD4}	I_O=80mA	4.85	5.0	5.15		
	Input & output potential difference 1	V_{SAT1}	I_O=80mA	-	-	0.3	V	10
V_{DET}	V_E detection voltage (1-1)	V_{TH+1}	V_E=6V	3.0	3.15	3.3	V	11
	V_E detection voltage (1-2)	V_{TH-1}	V_E=6V	2.7	2.85	3.0		
	V_E detection voltage (2-1)	V_{TH+2}	V_E=6V/3V	1.5	1.65	1.8	V	12
	V_E detection voltage (2-2)	V_{TH-2}	V_E=6V/3V	1.2	1.35	1.5		
	Output saturation voltage	V_{DEO}	V_E=2.0V, I_{OL}=5mA	-	-	0.5	V	13
	Operating voltage range 1	V_{OPR1}	V_E	1.2	-	7.5	V	14
RBT	Stand-by output voltage	V_{SBT}	-	-	-	0.1	V	15
	Output voltage in operating	V_{RBT1}	I_{OL}=10μA	0.47	0.5	0.53	× V_E	16
	Operating voltage range 2	V_{OPR2}	-	1.5	-	7.5	V	17
	Output voltage temperature coefficient	V_T	-	-	-	2.0	mV/°C	18
V_{CC}	VCC output voltage	V_{VDD5}	I_O=50mA	4.85	5.0	5.15	V	19
	Input & output potential difference 2	V_{DAT2}	I_O=50mA, V_{CC}=3V	-	-	0.3	V	20
	Function compensation voltage range 3	V_{OPR3}	V_E	1.0	-	7.5	V	21
DC MOTOR	Function compensation voltage range 4	V_{OPR4}	-	1.0	-	7.5	V	22
	Output voltage (PNP+NPN) 1	V_{DM1}	V_E=2.0V, I_{OL}=800mA	-	0.6	0.8	V	23
	Output voltage (PNP+NPN) 2	V_{DM2}	V_E=2.0V, I_{OL}=1000mA	-	0.8	1.0		

Electrical Characteristics (Continued)

Block	Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes
S.M & AE METER	Function compensation voltage range 5	V_{OPR5}	$V_{SI}=V_E$	1.6	-	7.5	V	24
	Output saturation voltage	V_{STP}	V_{SI}=3.5V, I_O=500mA	-	-	0.8	V	25
	Output voltage relative error	ΔV	I_O=300mA, SMI1,2,3,4	-	-	0.1	V	26
	V_{COIL} voltage	V_{COIL}	V_{CC}=5V	1.7	1.8	1.9	V	27
	V_{COIL} voltage STEP	V_{COST}	-	-	190	-	mV	
STROBO	Function compensation voltage range 6	V_{OPR6}	-	1.0	-	7.5	V	28
	TRO output voltage	V_{TRO}	I_O=10mA	-	-	0.5	V	29
	PTR output voltage	V_{PTR}	I_O=10mA	-	-	0.5	V	30
	NEC output voltage	V_{NEC}	I_O=10mA	-	-	0.5	V	31
	OSC output voltage	V_{OSC}	I_O=10mA	-	-	0.5	V	32
	NES detection voltage	V_{NES}	-	0.27	0.3	0.33	$\times V_{DD}$	33
	SC4 “L” level	V_{SOL}	-	-	-	0.3	V	34
	SC4 “H” level	V_{SOH}	-	0.8	-	-	$\times V_{DD}$	35
IRED	Output saturation voltage 3	V_{SAT3}	I_{OL}=1A	-	-	1.0	V	36
	Output current	I_O	R_{FBR}=0.25Ω V_{FBR}=200mV	0.72	0.8	0.88	A	37
	Operating voltage range	V_{OP}	-	1.5	-	7.5	V	38
MG	MGI detection voltage	V_{MGI}	-	0.22	0.25	0.28	$\times V_{CC}$	39
	MGO output saturation voltage	V_{MGO}	I_O=500mA	-	-	0.5	V	40

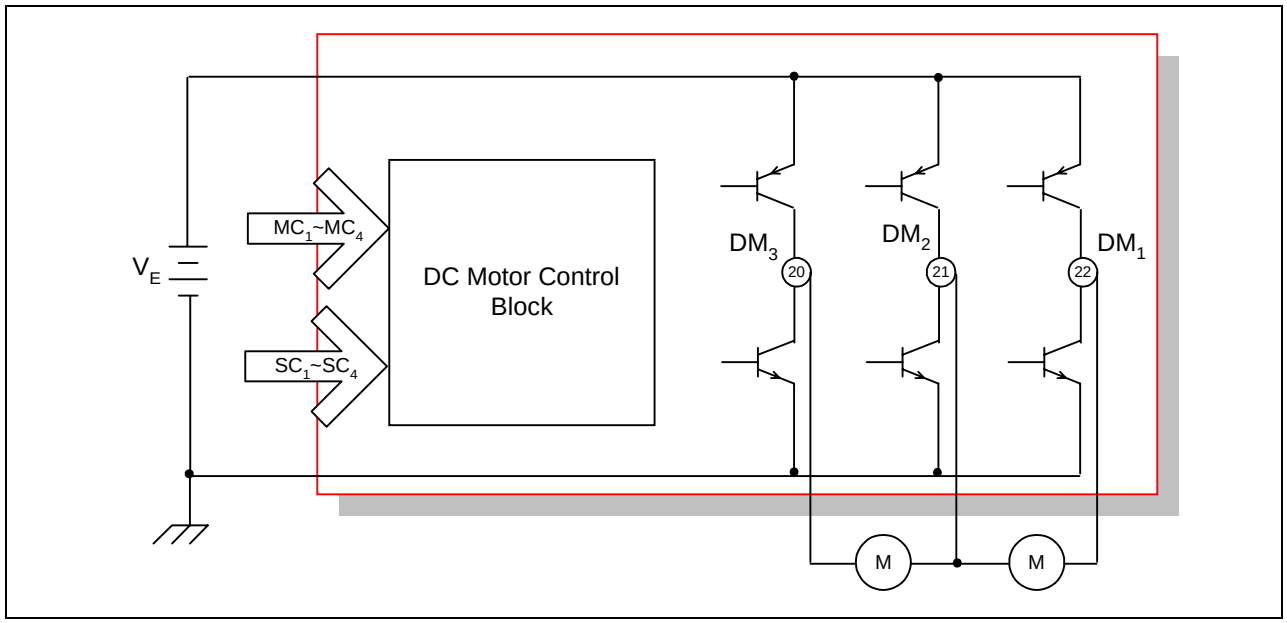
Electrical Characteristics (Continued)

Notes:

1. Define Input Current at Stand-By.
2. Define Low Level of Input Terminals.
3. Define High Level of Input Terminals.
4. Define Input Current of Each Control Input Terminals.
5. Define Min. Operating Voltage for Step-up Circuits (SEL, FMO)
6. Define Output Voltage of V_{DD} at Step-up.
7. Define Saturation Voltage of FMO Output.
8. Define Frequency of Step-up Clock.
9. Define Output Voltage of V_{DD}.
10. Define Input and Output Potential Difference of V_{DD} Regulator.
11. Define Detection Voltage of V_E Detection Circuit. (with Hysteresis, Using 6V Battery)
12. Define Detection Voltage of V_E Detection Circuit. (with Hysteresis, Using 6V or 3V Battery)
13. Define Output Saturation Voltage of DEO.
14. Define Operating Voltage Range of V_E Detection Circuit.
15. Define Output Voltage at Stand-by.
16. Define RBT Output Voltage at Operating RBT Circuit.
17. Define Operating Voltage Range of RBT Circuit.
18. Define Temperature Coefficient of RBT Output Voltage.
19. Define V_{CC} Output Voltage at Connecting V_{SI} and V_E.
20. Define Input and Output Potential Difference of V_{CC} Regulator.
21. Define Function Compensation Voltage of V_{CC} Output Circuit.
22. Define Function Compensation Voltage of DC Motor Driving Circuit.
23. Define Output Saturation Voltage (PNP + NPN) of DC Motor Driving Circuit.
24. Define Function Compensation Voltage of Stepping Motor and AE Meter Driving Circuit.
25. Define Output Saturation Voltage (PNP + NPN) at Flowing Specified Current.
26. Define Relative Error of Output Voltage at Flowing Specified Current between SM_{1-2} and SM_{3-4}.
27. Define Voltage between Both Side of V_{COIL}.
28. Define Function Compensation Voltage of Strobo Control Circuit.
29. Define Output Saturation Voltage of TRO.
30. Define Output Saturation Voltage of PTR.
31. Define Output Saturation Voltage of NEC.
32. Define Output Saturation Voltage of OSC.
33. Define Detection Voltage of NES Voltage Detection Circuit.
34. Define Low Level of SC_4.
35. Define High Level of SC_4.
36. Define Output Saturation Voltage of IRED Driving Circuit.
37. Define Output Current of IRO.
38. Define Operating Voltage Range of IRED Driving Circuit.
39. Define Detection Voltage of MGI.
40. Define Output Saturation Voltage at Flowing Specified Current of MGO.

Application Information

1. Zoom And Reel Motor Drive Block (1.5-Channel Dc Motor Drive Block)



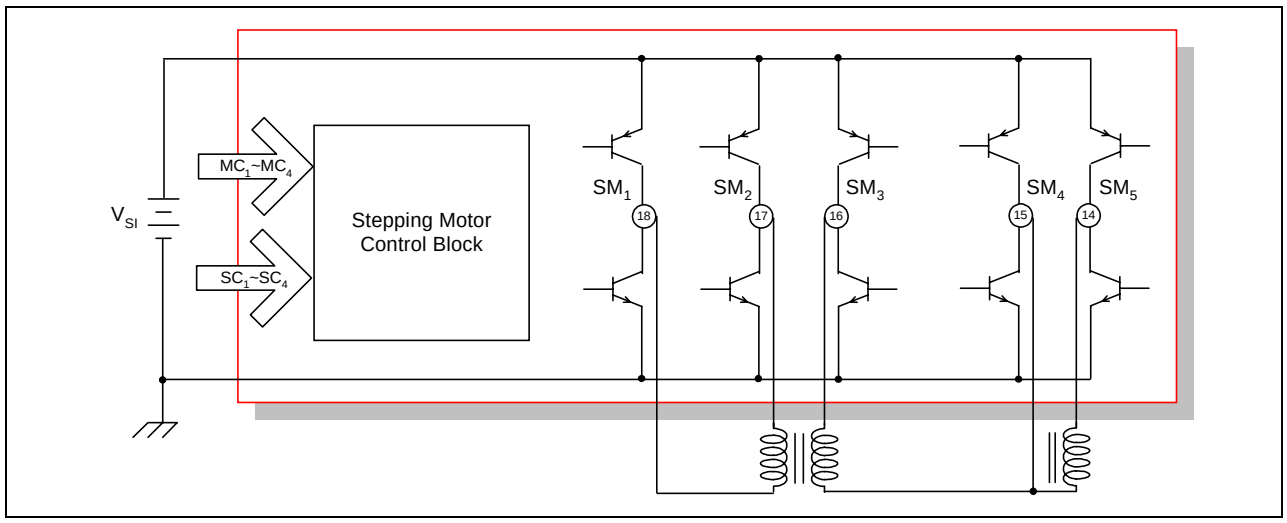
This block diagram describes the driver of zoom and reel motor in camera systems.

The drive block is controlled by MC1~4 and SC1~4, which are come from micro controller.

Follow is the control logic table.

INPUT								OUTPUT		
MC_1	MC_2	MC_3	MC_4	SC_1	SC_2	SC_3	SC_4	DM_1	DM_2	DM_3
L	L	L	H	L	L	L	L	L	H	-
	L	H	L					H	L	-
	L	H	H					L	L	-
	H	L	H					-	H	L
	H	H	L					-	L	H
	H	H	H					-	L	L

2. Af Motor And Ae Meter Drive Block (Stepping Motor Drive Block)



The block diagram describes the driver of AF motor and AE meter in camera systems.

The drive output is selected by MC signals ($MC_{1\sim4}$).

These MC codes are as follows.

INPUT				OUTPUT				
MC_1	**MC_2**	**MC_3**	**MC_4**	**SM_1**	**SM_2**	**SM_3**	**SM_4**	**SM_5**
H	L	L	H	-	-	-	L	H
	L	H	L	-	-	-	H	L
	L	H	H	-	-	-	L	L
	H	L	L	L	H	L	H	-
	H	L	H	L	H	H	L	-
	H	H	L	H	L	L	H	-
	H	H	H	H	L	H	L	-

The output voltage (V_{COIL}) is determined by $SC_{1\sim4}$.

The V_{COIL} is potential difference between drive output and ground.

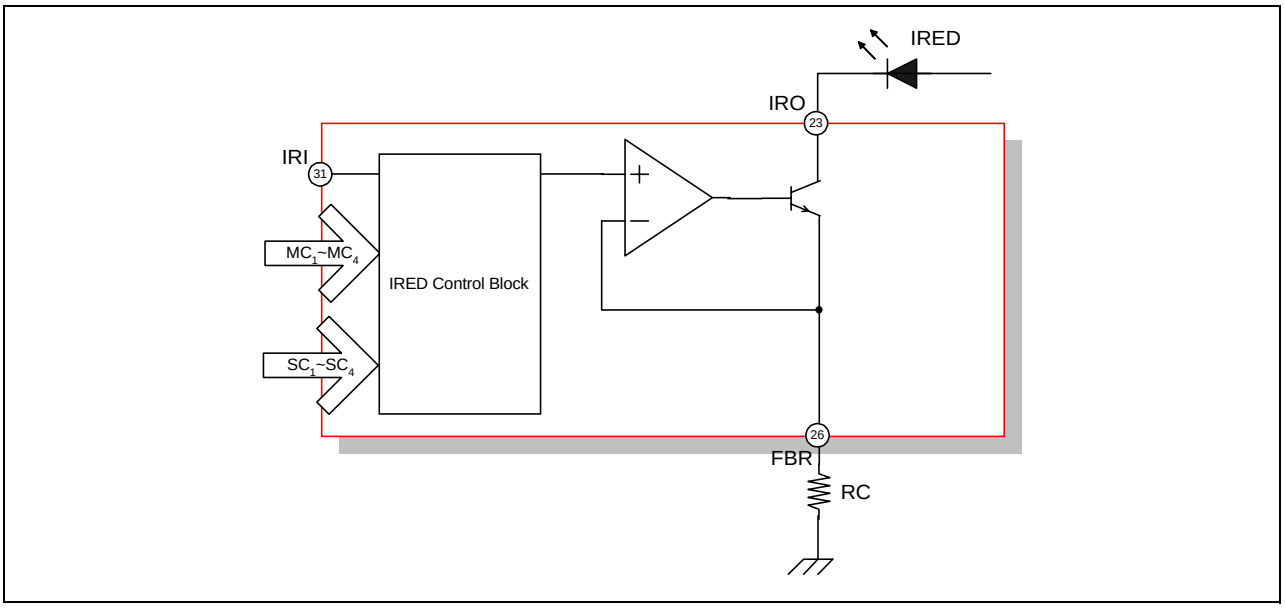
i.e.,

$V_{COIL} = V_{SM}$ - GND.

The V_{COIL} is selected by following table.

INPUT				V_{COIL} OUTPUT VOLTAGE [V]
SC_1	SC_2	SC_3	SC_4	
L	L	L	L	1.80
L	L	L	H	1.99
L	L	H	L	2.18
L	L	H	H	2.37
L	H	L	L	2.56
L	H	L	H	2.75
L	H	H	L	2.94
L	H	H	H	3.13
H	L	L	L	3.32
H	L	L	H	3.51
H	L	H	L	3.70
H	L	H	H	3.89
H	H	L	L	4.08
H	H	L	H	4.27
H	H	H	L	4.46
H	H	H	H	4.65

3. Ired Drive Block



The block drives infrared emitting diode (IRED).

The FBR voltage (V_{FBR}) is controlled by MC codes and SC codes.

The IRED current (I_{IRED}) is determined by V_{FBR} and resistor Rc.

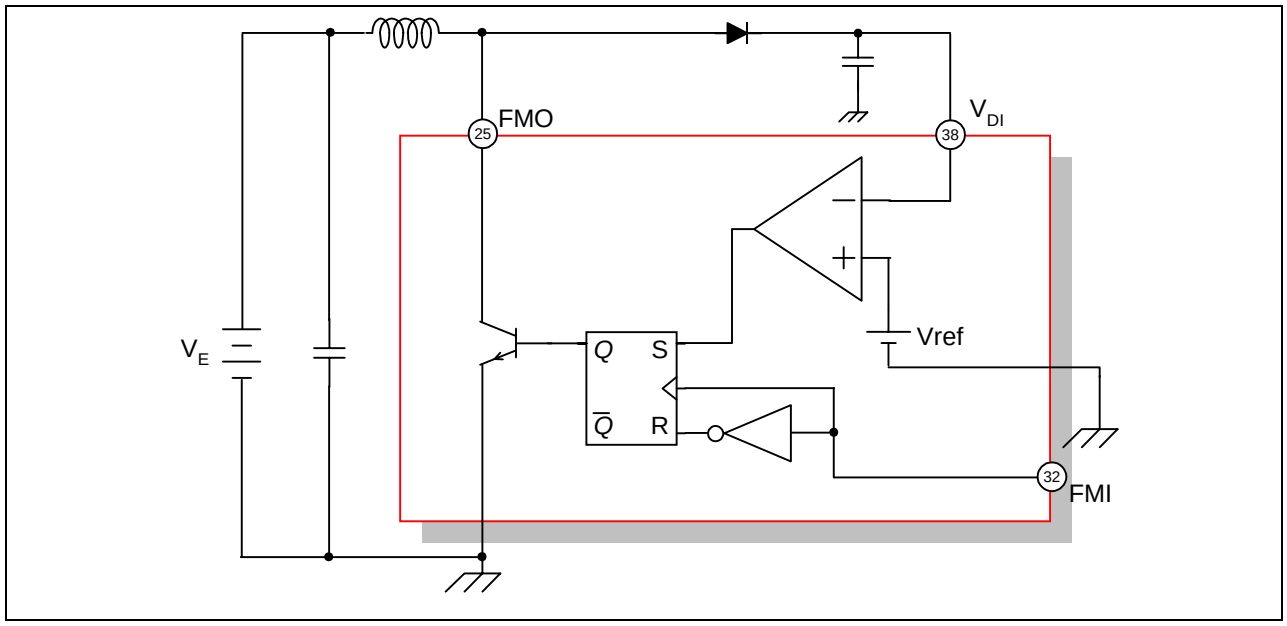
i.e.,

$I_{IRED} = V_{FBR} / R_C$

The V_{FBR} is controlled as following table.

INPUT								V_{FBR} [mV]
MC_1	MC_2	MC_3	MC_4	SC_1	SC_2	SC_3	SC_4	
L	H	L	L	L	L	L	L	190
				L	L	L	H	210
				L	L	H	L	230
				L	L	H	H	250
				L	H	L	L	270
				L	H	L	H	290
				L	H	H	L	310
				L	H	H	H	330
				H	L	L	L	350
				H	L	L	H	370
				H	L	H	L	390
				H	L	H	H	410
				H	H	L	L	430
				H	H	L	H	450
				H	H	H	L	470
				H	H	H	H	490

4. Step-up Control Block



The FMO frequency from KA3050 steps up the battery voltage V_E.

The FMO frequency depends on the FMI frequency, which is come from micro controller.

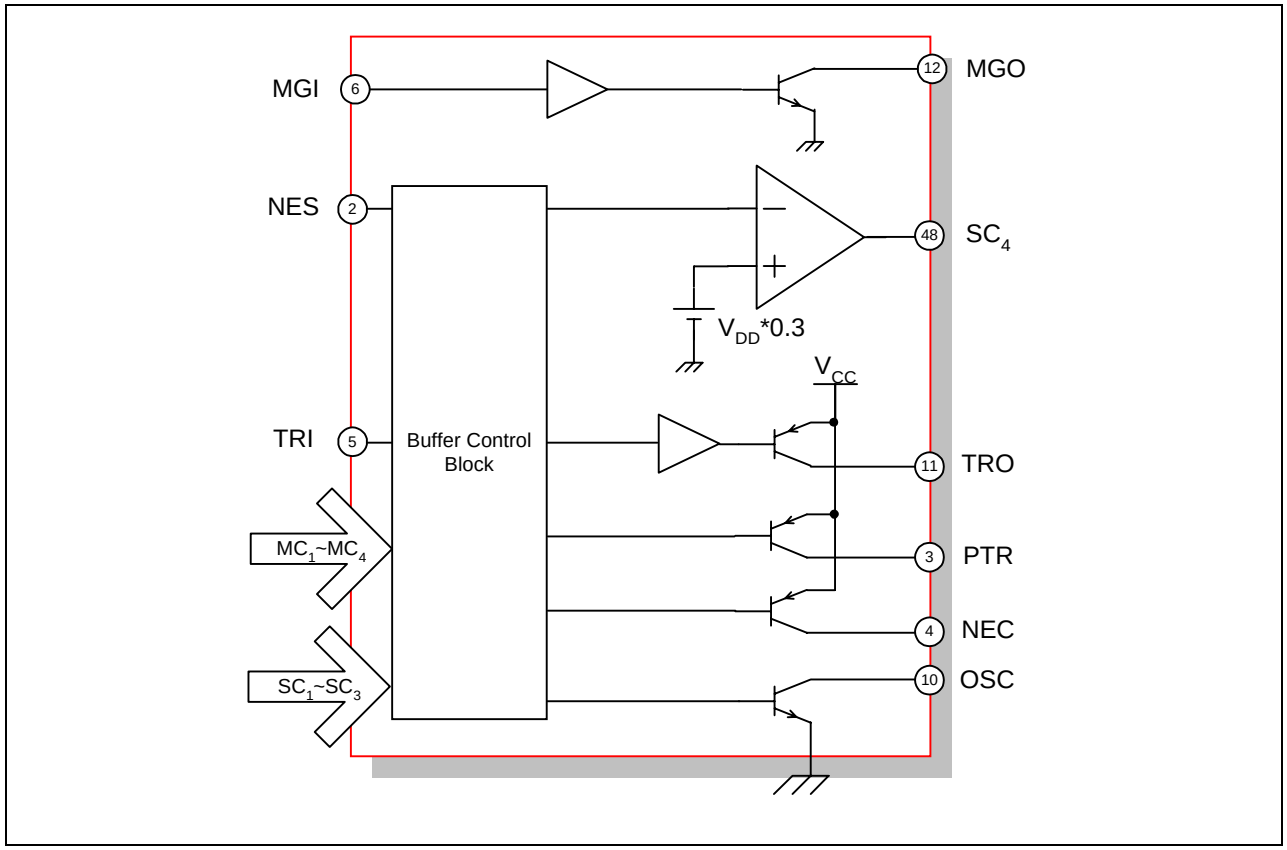
Maximum value of V_{DI} is 5.5V in normal operation mode, and 8.6V in IRED operation mode.

i.e.,

Normal Operation Mode: V_{DI} = 5.5V

IRED Operation Mode: V_{DI} = 8.6V

5. General Buffer And Comparator Drive Block



The KA3050 is composed of 5 general buffers and a comparator.

This block has 10 inputs and 6 outputs.

All output are controlled by MC and SC codes except MGO.

The control codes are as follows.

INPUT									OUTPUT				
MC1	**MC2**	**MC3**	**MC4**	**SC1**	**SC2**	**SC3**	**NES**	**TRI**	**SC4**	**OSC**	**NEC**	**PTR**	**TRO**
L	L	L	L	L	L	H	H/L	-	L/H	-	H	-	-
				L	H	L	H/L	-	L/H	L	H	-	-
				L	H	H	-	-	-	L	-	-	-
				H	L	L	-	H/L	-	-	-	H	H/ OPEN

The NES and SC_4 are conflict with each other, it means.

NES = High → SC_4 = Low

NES = Low → SC_4 = High

The meaning of H/L in TRI signal and H/OPEN in TRO signal are as follows.

TRI = High → SC_4 = High

TRI = Low → SC_4 = Open

The OSC signal refer to following table.

V_{DET1}	DEO(V_{DET2})	BTS	OSC	Step-up Circuit
H	-	Open(6V)	Enable	Enable
L	H		Disable	Enable
	L		Disable	Disable
	H	Ground(3V)	Enable	Enable
	L		Disable	Disable

Where,

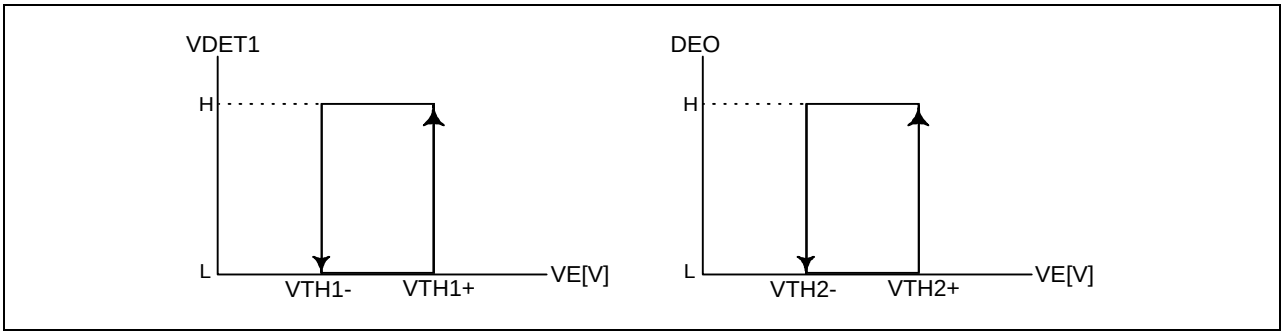
DEO: Battery Voltage Checker, Pin 36

BTS: Battery Selector, Pin 34

Users can't check the V_{DET1} because V_{DET1} is selected automatically inside the KA3050 in 6V battery usage.

But step-up circuit (SUC) can be checked by DEO signal.

The V_{DET1} and DEO have hysteresis loop as following graph.



The V_{TH1} and V_{TH2} refer to electrical characteristics.

6. Other Control Blocks

The following table is description of other control blocks.

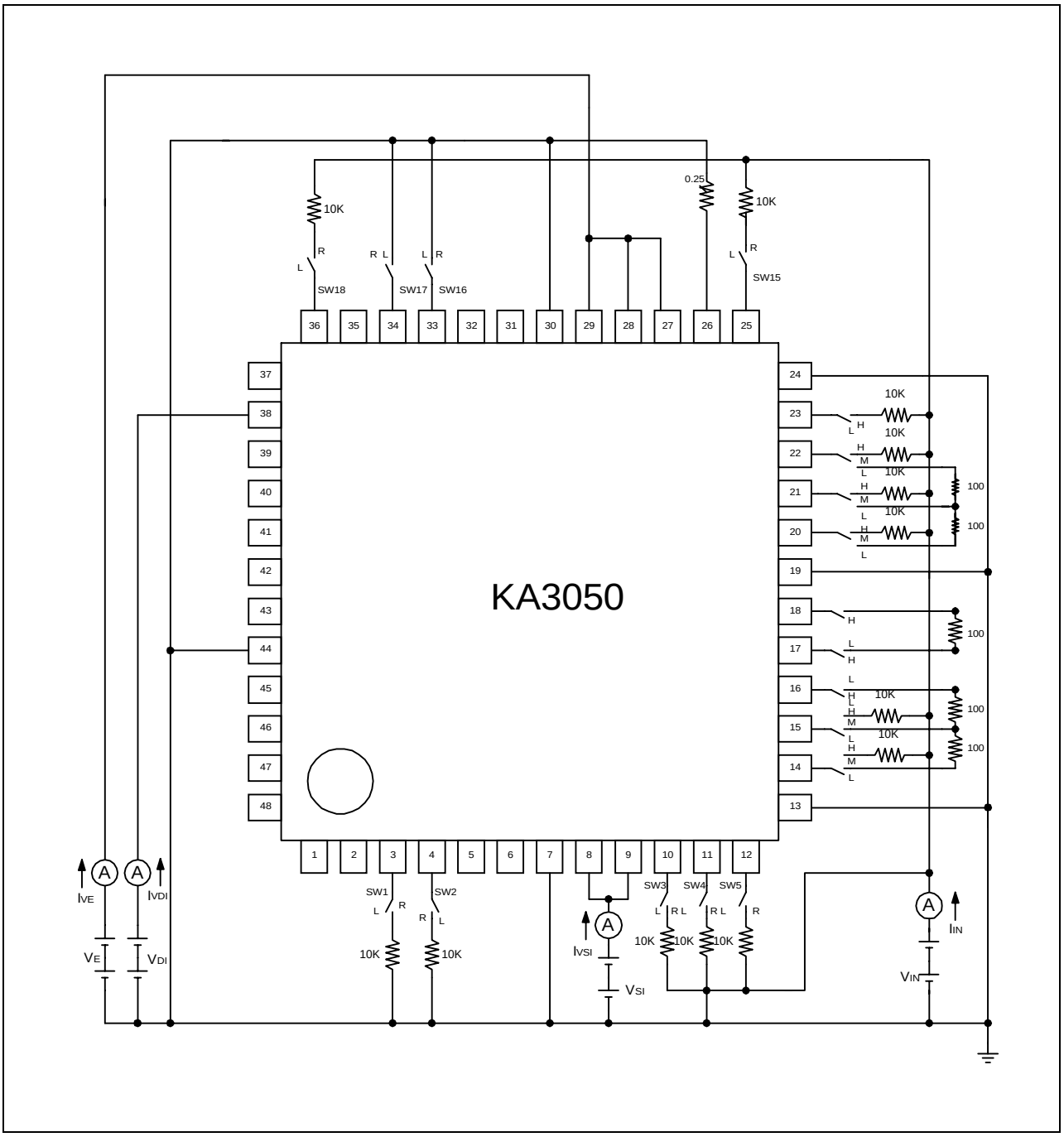
Pin No.	Symbol	Function
1	SEL	High: KA3050 Operation
		Low: KA3050 No Operation
33	VDS	Open: V_{DD} = 5V
		Ground: V_{DD} = 4V
34	BTS	Open: V_E = 6V
		Ground: V_E = 3V
35	RBT	$V_{RBT} = V_E / 2$
36	DEO	High: Sufficient Battery
		Low: Insufficient Battery
37	V_{DD}	4V or 5V Regulator output
39	V_{CC}	5V Regulator output

Control Code Table

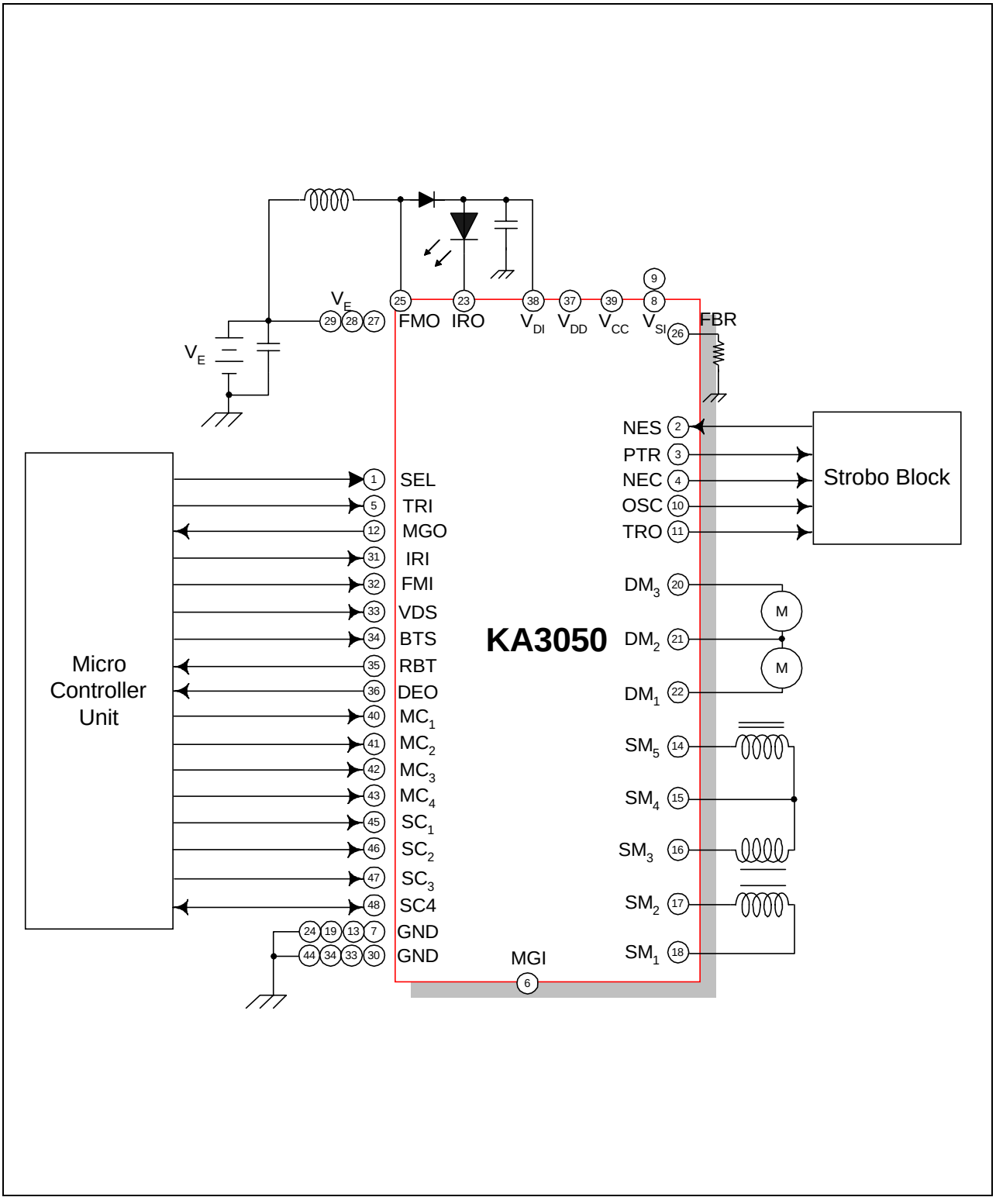
MC_1	MC_2	MC_3	MC_4	SC_1	SC_2	SC_3	SC_4	DM_1	DM_2	DM_3	SM_1	SM_2	SM_3	SM_4	SM_5	OSC	NEC	PTR	NES	TR_1	TR0	FBR	VCO
L	L	L	L	L	L	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L	L	L	H					L	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L	L	H	L					H	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L	L	H	H					L	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L	H	L	L	CODE				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L	H	L	H	L	L	L	L	-	H	L	-	-	-	-	-	-	-	-	-	-	-	-	-
L	H	H	L					-	L	H	-	-	-	-	-	-	-	-	-	-	-	-	-
L	H	H	H					-	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-
H	L	L	L	CODE				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H	L	L	H					-	-	-	-	-	-	L	H	-	-	-	-	-	-	-	-
H	L	H	L					-	-	-	-	-	-	H	L	-	-	-	-	-	-	-	-
H	L	H	H					-	-	-	-	-	-	L	L	-	-	-	-	-	-	-	-
H	H	L	L					-	-	-	L	H	L	H	-	-	-	-	-	-	-	-	-
H	H	L	H					-	-	-	L	H	H	L	-	-	-	-	-	-	-	-	-
H	H	H	L					-	-	-	H	L	L	H	-	-	-	-	-	-	-	-	-
H	H	H	H					-	-	-	H	L	H	L	-	-	-	-	-	-	-	-	-
L	L	L	L	L	L	H	*1	-	-	-	-	-	-	-	-	-	H	-	H/L	-	-	-	-
				L	H	L	*1	-	-	-	-	-	-	-	-	L	H	-	H/L	-	-	-	-
				L	H	H	*1	-	-	-	-	-	-	-	-	L	-	-	-	-	-	-	-
				H	L	L	*1	-	-	-	-	-	-	-	-	-	-	H	-	H/L	H/OPEN	-	-
L / H	H / *	L / *	L / *	L	L	L	L	-	-	-	-	FBR 190mV			-	-	-	V_{COIL} 1.80V			-	-	-
				L	L	L	H	-	-	-	-	210mV			-	-	-	1.99V			-	-	-
				L	L	H	L	-	-	-	-	230mV			-	-	-	2.18V			-	-	-
				L	L	H	H	-	-	-	-	250mV			-	-	-	2.37V			-	-	-
				L	H	L	L	-	-	-	-	270mV			-	-	-	2.56V			-	-	-
				L	H	L	H	-	-	-	-	290mV			-	-	-	2.75V			-	-	-
				L	H	H	L	-	-	-	-	310mV			-	-	-	2.94V			-	-	-
				L	H	H	H	-	-	-	-	330mV			-	-	-	3.13V			-	-	-
				H	L	L	L	-	-	-	-	350mV			-	-	-	3.32V			-	-	-
				H	L	L	H	-	-	-	-	370mV			-	-	-	3.51V			-	-	-
				H	L	H	L	-	-	-	-	390mV			-	-	-	3.70V			-	-	-
				H	L	H	H	-	-	-	-	410mV			-	-	-	3.89V			-	-	-
				H	H	L	L	-	-	-	-	430mV			-	-	-	4.08V			-	-	-
				H	H	L	H	-	-	-	-	450mV			-	-	-	4.27V			-	-	-
				H	H	H	L	-	-	-	-	470mV			-	-	-	4.46V			-	-	-
				H	H	H	H	-	-	-	-	490mV			-	-	-	4.65V			-	-	-

Note: * mark : Detect NES signal and send a inverted signal to SC4.

Test Circuits



Typical Application Circuits



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