Ordering number : EN5161A

Monolithic Digital IC

SANYO No. 5161A

LB8632V

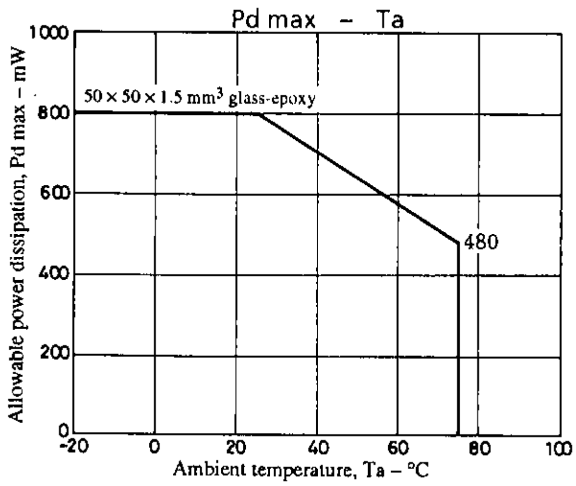
Low-Voltage/Low-Saturation Camera Motor Driver

Overview

The LB8632V is a general-purpose camera motor driver IC that supports low-saturation output and low-voltage drive and thus can be used in a wide range of applications. The LB8632V is a miniature thin form-factor IC that provides circuit structures and I/O logic that reduce development times and costs and support reduced lot sizes and end product diversity, despite increasing miniaturization and functionality in application products. Since the LB8632V supports low-voltage operation (starting from 1.2 V) in addition to low-saturation outputs, it provides characteristics that can withstand operation in low-voltage ranges even in 3 V popularly-priced cameras that do not include a step-up circuit. Since the LB8632V supports IIL, control logic can be optimized by using two ICs in parallel, thus allowing even more actuators to be driven with a small number of CPU output ports. Thus the LB8632V can also be used in 6 V top-of-the-line end products.

Features

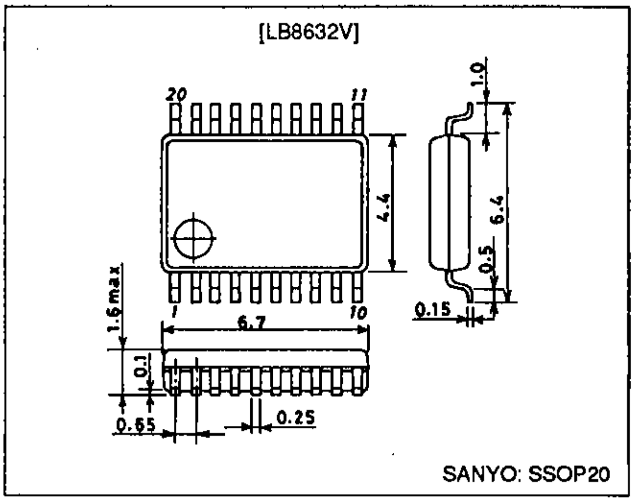
- 3, 6 V and a wide application range: from popularly priced models to top-of-the-line products
  The external transistors and the number of ICs (one or two) is determined by the number of IC required motors and actuators.
  Support for motor standby, forward, reverse and braking control for four motors using only five CPU port lines. This requires two external transistors and two ICs. The LB8632V also provides non-operating mode logic for the operating control signals (the IN input) so that ICs with other functions can be used on the same ports.
- Built-in 1 CH low-voltage drive low-saturation, forward/reverse motor drive
  I_O peak = 3.0 A maximum (t ≤ 100 ms: single shot, between OUT1 and OUT2)
  I_O DC = 1.0 A maximum
  V_O sat = 0.45 V typical (at I_O = 1 A)
  Operating voltage range: V_B = 1.2 to 7.5 V (V_B = V_S = V_{DD} = battery voltage)
- Built-in low-voltage drive - 0.5 CH forward/reverse motor driver
  Supports 1.5 CH bridge operation with the use of two external transistors. Also supports LED or solenoid drive with constant-current drive.
  Operating voltage range: V_B = 1.2 to 7.5 V (V_B = V_S = V_{DD} = battery voltage)
- Built-in regulator predriver
  V_{CC} can be regulated at 1.86 V by connecting the V_{CC} control pin (V_{CONT}) to the reference voltage, V_{REF} (1.36 V). Also, the V_{CC} output voltage can be varied by inputting the CPU D/A output to V_{CONT}.
  Either the IC itself or only the V_{CC} regulator can be turned on according to the operating mode of each motor.
  In addition, this function can also be used as a battery check comparator.
  Operating voltage range: V_B = 1.5 to 7.5 V
- Three independent power supply line systems
  The LB8632V supports either single supply specifications (V_B = V_S = V_{DD}) or dual supply specifications (battery/step-up supply) by providing a power supply voltage pin (V_B), a motor supply pin (V_S), and a CPU interface pin (V_{DD}). Also, motor output can be stabilized by taking the motor power supply from the V_{CC} regulator.
  Support for both CMOS and n-channel open drain outputs from the CPU.
- Built-in thermal protection circuit
  This circuit limits the output current if the IC overheats due to excessive loading or an output short and thus prevents the destruction of the IC.
- Provided in the miniature ultrathin SSOP-20 package (6.4 × 6.5 × 1.6 mm)



Package Dimensions

unit: mm

3179A-SSOP20



Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_B max		8.0	V
	V_S max		8.0	V
	V_{DD} max		8.0	V
Output current	I_O max	Between OUT1 and OUT2 (t ≤ 100 ms, single pulse)	3.0	A
Output supply voltage	$V_{OUT}1$	OUT1, OUT2	$V_S + V_F$	V
	$V_{OUT}2$	OUT3N, OUT3P	V_S	V
	$V_{OUT}3$	V_{REF}	V_B	V
Input supply voltage	$V_{IN}1$	MD0 to MD2, IN1, IN2	V_{DD}	V
	V_C	V_{CONT}	V_B	V
Allowable power dissipation	Pd max	Mounted on a 50 × 50 × 1.5 mm glass-epoxy printed circuit board	800	mW
Operating temperature	Topr		–20 to +75	°C
Storage temperature	Tstg		–55 to +150	°C

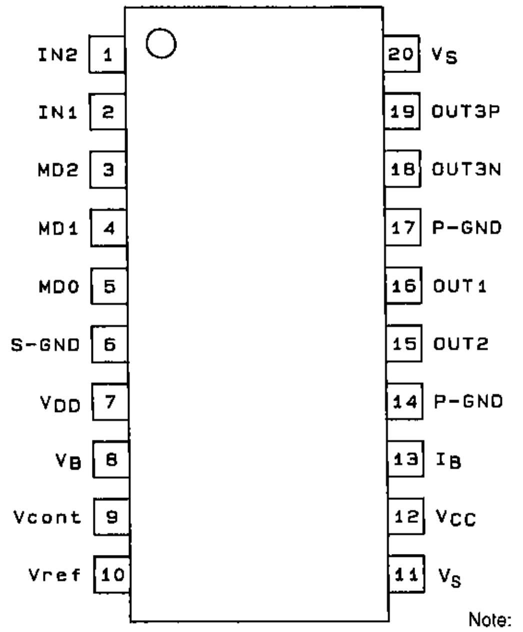
Electrical Characteristics at Ta = 25°C, $V_B = V_S = V_{DD} = 3.0$ V

Parameter	Symbol	Conditions	min	typ	max	Unit	Note
Standby current	$I_{B\ STB}$	V_B = 7.5 V		0.1	1	µA	1
[DC motor system]							
Operating voltage range 1	V_B1	V_B system	1.2		7.5	V	2
	V_S1	V_B system	1.0		V_B	V	3
Output saturation voltage (pnp + npn)	Vsat	I_O = 600 mA, $V_B = V_S = V_{DD}$ = 1.8 V		0.30	0.45	V	4
	Vsat	I_O = 1000 mA		0.45	0.65	V	4
Output constant current	I_B^+	OUT3P	–15	–20	–28	mA	5
	I_B^-	OUT3N	15	20	28	mA	5
Operating current drain 1	I_B1	$V_B + V_S$ (maximum forward/reverse/ braking drive)		80	98	mA	6
Operating current drain 2	I_B2	$V_B + V_S$ (standby in drive mode)		5.0	8.0	mA	7
Operating current drain 3	I_B3	$V_B + V_S$ (maximum single side drive)		50	70	mA	8
[V_{REF} system]							
Operating voltage range 2	V_B2		1.5		7.5	V	9
V_{CONT} input voltage range	V_{CR}		0		V_B	V	10
V_{REF} voltage	V_{REF}	I_{REF} = 10 µA	1.29	1.36	1.43	V	11
I/O voltage ratio	O_{IR}	V_{CC}/V_{CONT}	1.35	1.37	1.39	Times	12
Minimum constant output voltage	V_{CC} min			0.8	0.9	V	13
Regulator voltage	V_{REG}	$V_{REF} = V_{CONT}$, C2 = 10 µA	1.76	1.86	1.96	V	14
Line regulation	ΔV_{OLN}	2.0 V ≤ V_B ≤ 7.5 V		10	20	mV	15
Load regulation	ΔV_{OLD}	50 mA ≤ I_{CC} ≤ 500 mA		20	50	mV	16
V_{CONT} input current	I_{VC}				1	µA	17
Operating current drain 4	I_B4	V_B system		5.0	8.0	mA	18
[V_{DD} control input system]							
V_{DD} voltage range	V_{DR}		1.2		7.5	V	19
Control pin input current	I_{INL}	V_{INL} = GND, V_{DD} = 3 V		–120	–150	µA	20
	I_{INH}	$V_{INH} = V_{DD}$, V_{DD} = 3 V	–3		0	µA	20
Input low-level voltage	V_{IL}		–0.3		V_{DD} – 1.0	V	21
Input high-level voltage	V_{IH}		V_{DD} – 0.3		V_{DD}	V	21
Operating current drain	I_{VD}	MD0, MD1, MD2, IN1 and IN2 = GND, V_{DD} = 5 V	1.7	2.2	2.7	mA	22
Thermal protection operating temperature	T_{SD}	Design target value		180		°C	23

Note: There are no limitations on the magnitude relationships between the V_B, V_S and V_{DD} supply voltages.

1. Stipulates the total leakage current for $V_B = V_S = V_{DD}$ when the IC is in standby mode.
2. Stipulates the operating range voltages (for guaranteed functionality) when a single power supply with $V_B = V_S = V_{DD}$ is used for the DC motor system.
3. Stipulates the operating range voltages (for guaranteed functionality) for the DC motor system V_S pin, i.e., the motor power supply. The drive current will be a constant current when $V_B = V_S$ = 2.0 V or higher.
4. Stipulates the output saturation voltage when either the DC motor driver $V_B = V_S = V_{DD}$ = 1.8 V and the output current is 600 mA or when $V_B = V_S = V_{DD}$ = 3.0 V and the output current is 1000 mA.
5. Stipulates the current emitted or accepted by the OUT3P and OUT3N pins. These are constant currents as long as $V_B = V_S$ = 2.0 V or higher.
6. Stipulates the maximum total current drain for the V_B and V_S pins for the forward, reverse, or brake operations when drive between the DC motor system OUT1 and OUT2 outputs is used.
7. Stipulates the maximum total current drain for the V_B and V_S pins for the DC motor driver drive mode standby state.
8. Stipulates the maximum total current drain for the V_B and V_S pins for the DC motor driver single-sided drive mode, i.e. when a single output from the OUT1, OUT2, OUT3P and OUT3N pins is used.
9. Stipulates the operating voltage range (for guaranteed functionality) for the V_{REF} circuit system.
10. Stipulates the input voltage range for the Vcont pin. When a constant-voltage circuit is formed by adding an external transistor, the voltage is held constant by sensing the V_{CC} pin.
11. Stipulates the reference voltage generated at the V_{REF} pin.
12. Stipulates the ratio of the constant V_{CC} pin voltage value to the V_{CONT} pin input voltage.
13. Stipulates the minimum output voltage for the V_{CC} pin constant voltage output. The voltage will only fall to this value, even when the V_{CONT} pin is set to 0 V.
14. Stipulates the V_{CC} pin stabilized output voltage when the V_{REF} and V_{CONT} pins are connected directly.
15. Stipulates the change in the value of the V_{CC} voltage when V_{CC} is set for constant voltage output and the V_B voltage varies from 2 V to 7.5 V.
16. Stipulates the change in the value of the V_{CC} voltage when V_{CC} is set for constant voltage output and the load current varies from 50 mA to 500 mA.
17. Stipulates the V_{CONT} pin input current in the range 0 V ≤ V_{CONT} ≤ V_B – 0.3 V. The value of the V_{CC} output constant voltage can be varied by inputting the CPU D/A output.
18. Stipulates the V_B system maximum current drain in all modes when the V_{CC} output has no load.
19. Stipulates the operating voltage range (for guaranteed functionality) for the V_{DD} pin. The V_{DD} pin is connected either to the CPU power supply or V_B.
20. Stipulates the input current and allowable leakage current for the control input pins: MD0, MD1, MD2, IN1 and IN2.
21. Stipulates the high and low input voltages for the control input pins: MD0, MD1, MD2, IN1 and IN2. (When input pins are open, they appear to be high-level inputs.)
22. Stipulates the V_{DD} pin current drain when all the for the control input pins (MD0, MD1, MD2, IN1 and IN2) are at the ground level.
23. When the temperature exceeds the stipulated temperature, output current limitation is applied, thus protecting the IC. The stipulated temperature is a design target value and is not tested prior to shipment.

Pin Assignment



Note: Connect both P-GND pins and both V_S pins.

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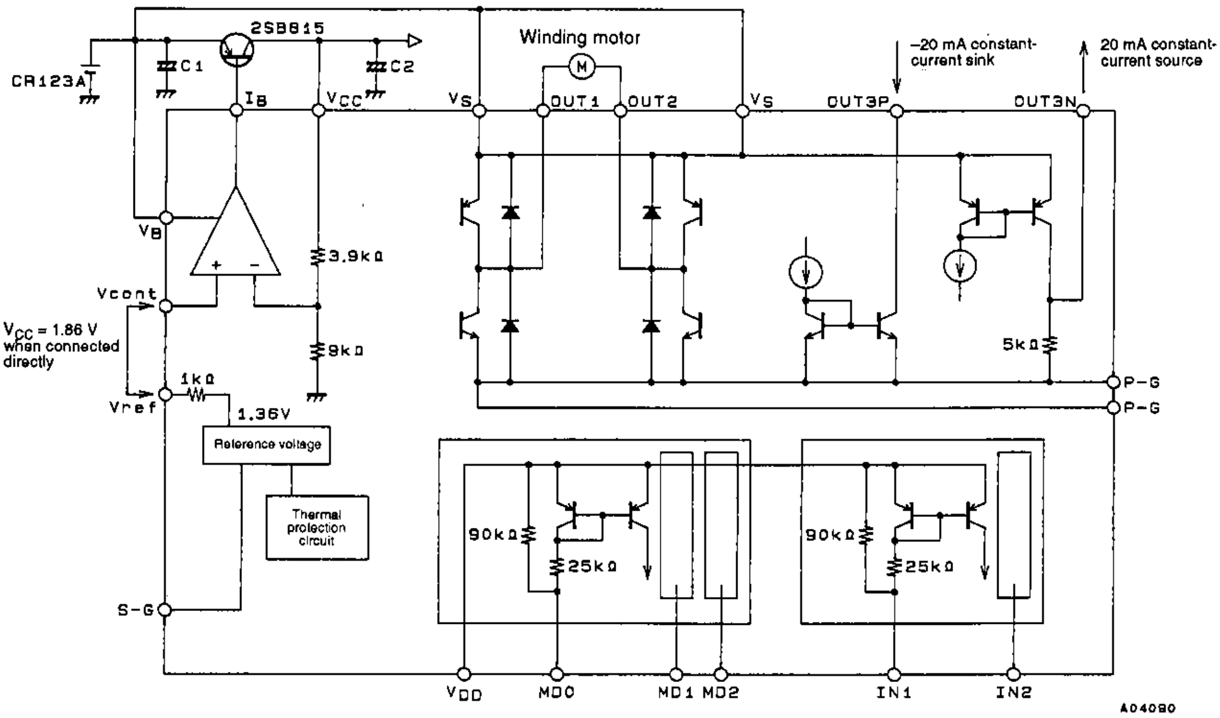
Truth Table (active low)

<table>
<tr><th colspan="3">MD</th><th colspan="2">IN</th><th rowspan="2">OUT1</th><th rowspan="2">OUT2</th><th rowspan="2">OUT
3P
3N</th><th rowspan="2">V_{CC}</th><th rowspan="2" colspan="2">Note</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>1</th><th>2</th></tr>
<tr><td>H</td><td>H</td><td>H</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td colspan="2">Standby (zero current drain)</td></tr>
<tr><td rowspan="9">H</td><td rowspan="4">H</td><td rowspan="4">L</td><td>H</td><td>H</td><td>—</td><td>—</td><td rowspan="4">—</td><td rowspan="4">On</td><td rowspan="4">Standby
Forward
Reverse
Brake</td><td rowspan="4">Motor 1</td></tr>
<tr><td>H</td><td>L</td><td>L</td><td>H</td></tr>
<tr><td>L</td><td>H</td><td>H</td><td>L</td></tr>
<tr><td>L</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td>L</td><td>H</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>On</td><td colspan="2">The IN input is ignored. Motor 3 drive used.</td></tr>
<tr><td rowspan="4">L</td><td rowspan="4">L</td><td>H</td><td>H</td><td>—</td><td>—</td><td rowspan="4">—</td><td rowspan="4">On</td><td rowspan="4">Standby
Forward
Reverse
Brake</td><td rowspan="4">Motor 2</td></tr>
<tr><td>H</td><td>L</td><td>—</td><td>H</td></tr>
<tr><td>L</td><td>H</td><td>—</td><td>L</td></tr>
<tr><td>L</td><td>L</td><td>—</td><td>L</td></tr>
<tr><td rowspan="10">L</td><td>L</td><td>L</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>On</td><td colspan="2">Only V_{CC} on</td></tr>
<tr><td rowspan="4">H</td><td rowspan="4">L</td><td>H</td><td>H</td><td>—</td><td>—</td><td>—</td><td rowspan="4">On</td><td rowspan="4">Standby
Forward
Reverse
Brake</td><td rowspan="4">Motor 4
External transistor</td></tr>
<tr><td>H</td><td>L</td><td>L</td><td>—</td><td>3P</td></tr>
<tr><td>L</td><td>H</td><td>H</td><td>—</td><td>3N</td></tr>
<tr><td>L</td><td>L</td><td>L</td><td>—</td><td>3N</td></tr>
<tr><td>L</td><td>H</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>On</td><td colspan="2">The IN input is ignored</td></tr>
<tr><td rowspan="4">H</td><td rowspan="4">H</td><td>H</td><td>H</td><td>—</td><td>—</td><td>—</td><td rowspan="4">On</td><td rowspan="4">Standby
Forward
Reverse
Brake</td><td rowspan="4">Motor 5
External transistor</td></tr>
<tr><td>H</td><td>L</td><td>—</td><td>—</td><td>3P</td></tr>
<tr><td>L</td><td>H</td><td>—</td><td>—</td><td>3N</td></tr>
<tr><td>L</td><td>L</td><td>—</td><td>—</td><td>3N</td></tr>
</table>

Note: The "—" entries for active-low/IN inputs are don't care states, and the "—" entries for OUT outputs are OFF states.
See the sample application circuit for the motor number.

Internal Block Diagram



Wiring Notes

1. Connect both the P-GND and both the V_S pins. Although both the P-GND and V_S lines are connected internally, both must be connected to provide currents of 1 A or over, or to provide even lower saturation output. However, operation with only one of each of these pairs connected, or with through power supply wiring, is possible.

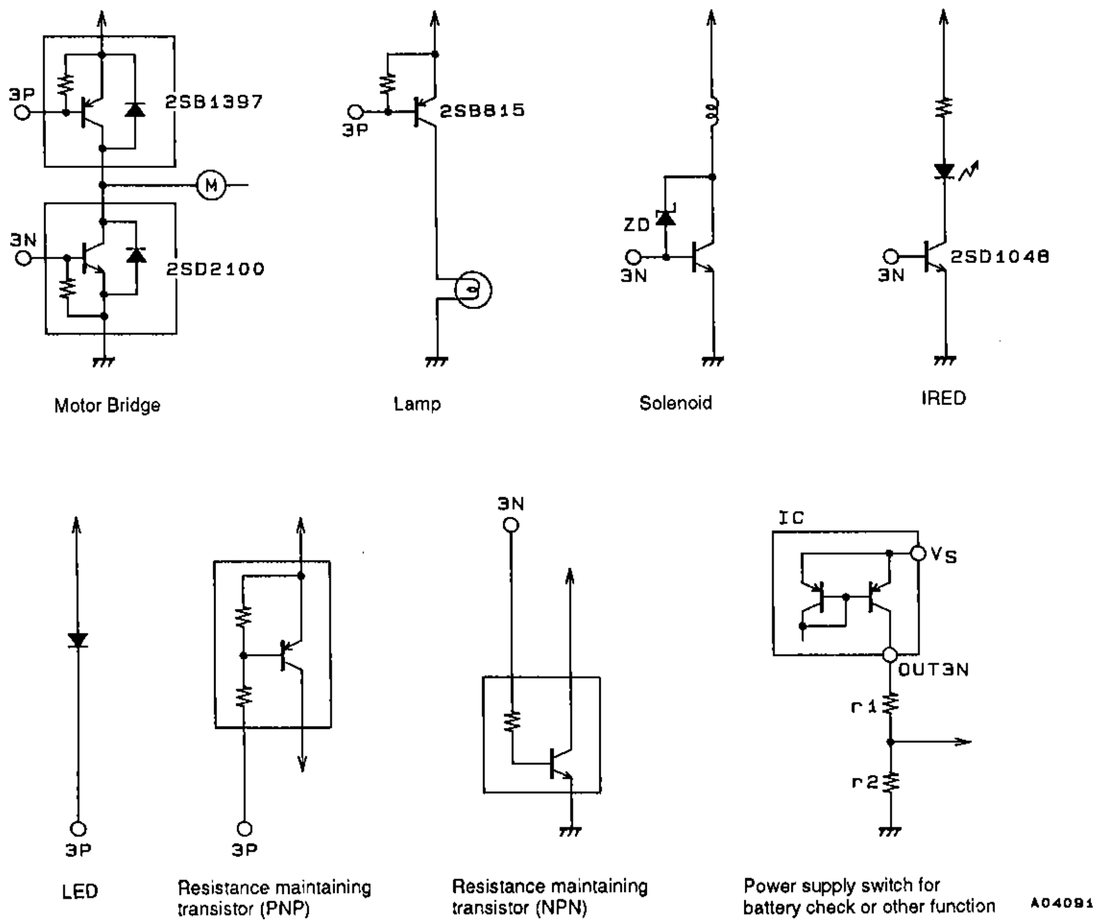
2. Since large currents flow in the V_S and P-GND lines, these lines should be made thicker, and line impedance reducing capacitors should be inserted in the vicinity of the IC.

3. Since S-GND is the ground for the control system, rather than using the same wiring as the P-GND line, it is preferable to connect this pin to the CPU ground line.

4. If the CPU outputs are CMOS outputs, connect VDD to the CPU power supply line and if they are n-channel open drain outputs, connect V_{DD} to the V_B pin (battery). However, since V_{DD} is the control input system power supply, it should not be set to the same impedance as the V_S line.

Sample OUT3P/OUT3N Pin Application

The OUT3P and OUT3N pins support –20 mA (typical) and 20 mA (typical) constant current drive, respectively. Constant current is supported when $V_B = V_S = 2.0$ V or higher. A 5 kΩ shunt resistor between the OUT3P pin and ground is included within the IC. Inversely, the OUT3N pin is an open collector pin, and there is no resistor inserted between this pin and the V_S pin. A current limiting resistor (resistance maintaining transistor) may be inserted between the OUT3P and OUT3N pins and the external transistors. These pins can also be used for direct LED drive, battery check, or other power supply switching functions.



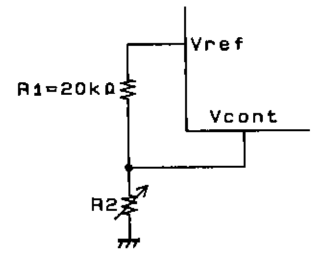
Recommended Transistors

Low-saturation transistors		
2SB815/2SD1048	CP	$I_O = 0.7$ A
2SB1120/2SD1620	PCP	$I_O = 2.5$ A
Transistors with spark killer diodes and E-B resistors		
2SB1527/2SD2324	CP	$I_O = 0.8$ A
2SB1397/2SD2100	PCP	$I_O = 2$ A
Transistors with resistors		
2SA1520/2SC3914	CP	$I_O = 0.5$ A

Sample I_B and V_{CC} Pin Applications

1. Stabilized Power Supply
   A low-saturation type stabilized power supply can be formed using an external pnp transistor (2SB815). This circuit has a wide operating voltage range of 1.5 to 7.5 V, and can supply stable power to other pins and loads. This circuit outputs a constant voltage 1.37 times the Vcont input voltage. A 1.86 V constant voltage output can be acquired by directly connecting the V_{REF} reference voltage (1.36 V) to the Vcont pin.

   - This circuit sets up a constant voltage output of 1.86 V or lower.
     When R1 is 20 kΩ, the output voltage can be set to any voltage between 0.8 and 1.86 V (typical) by adjusting R2.



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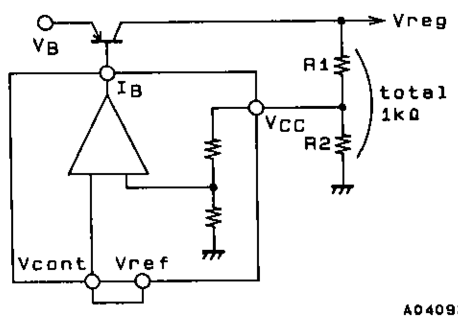
   - This circuit sets up a constant voltage output of 1.86 V or higher.
     Taking the manufacturing variation in the IC internal sensing resistor (3.9 to 9 kΩ) into account, the total resistance of the external sensing resistors (R1 and R2) should be about 1 kΩ.
     Example: A constant voltage output V_{REG} of 3.05 V is acquired when R1 is 360 Ω and R2 is 680 Ω.



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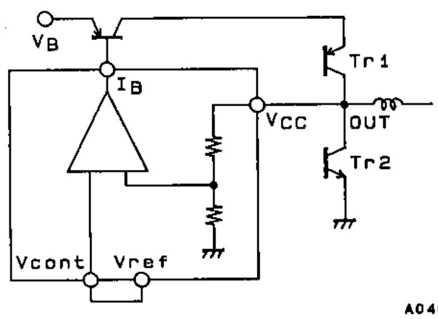
   - Making the OUT pin output voltage a constant voltage.
     Connect the OUT pin, which is to be made a constant voltage output, to the V_{CC} pin. When one side of the bridge output is connected, when the connected side is a high-level output the circuit will be a constant voltage drive circuit, and when the other side is a high-level output the circuit will be a saturated drive circuit.



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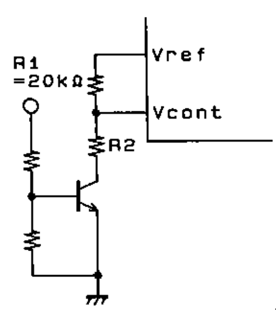
   - Generating a hold voltage.
     This circuit uses a resistance maintaining transistor to lower the V_{CONT} input and generate a hold voltage.
     A 0.8 V (typical) hold voltage is acquired when R2 is 0 Ω.



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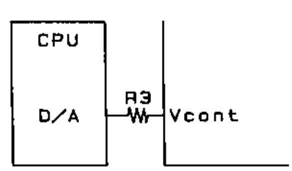
   - Generating a set constant voltage for different modes.
     The V_{CONT} input has a high impedance of 1 µA maximum, and thus the set constant voltage can be changed as required for each mode by inputting the CPU D/A converter output.



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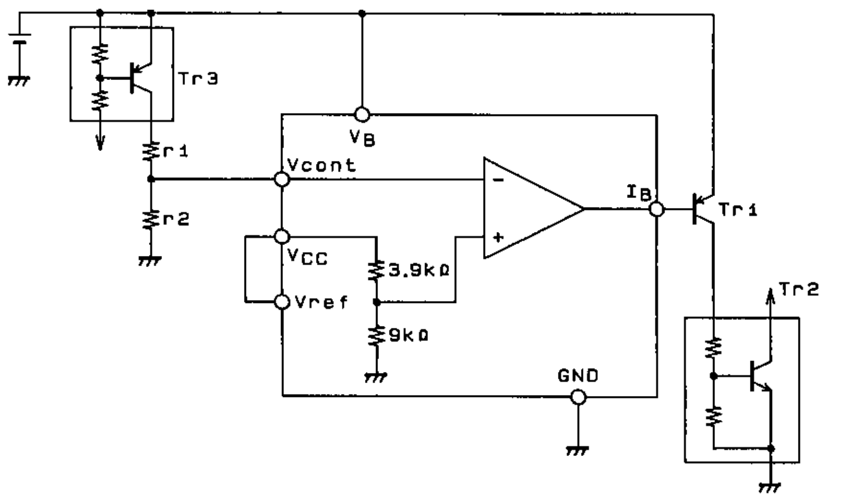
2. Battery Check

Tr2 will turn off when the Vcont input voltage, which is $V_B \times \frac{r2}{r2 + r1}$, falls to 0.95 V or lower.

Example: This circuit can check for V_B being 2.0 V or lower by setting r1 to be 22 kΩ and r2 to be 20 kΩ. Note that the Tr3 transistor can also use the OUT3N output.



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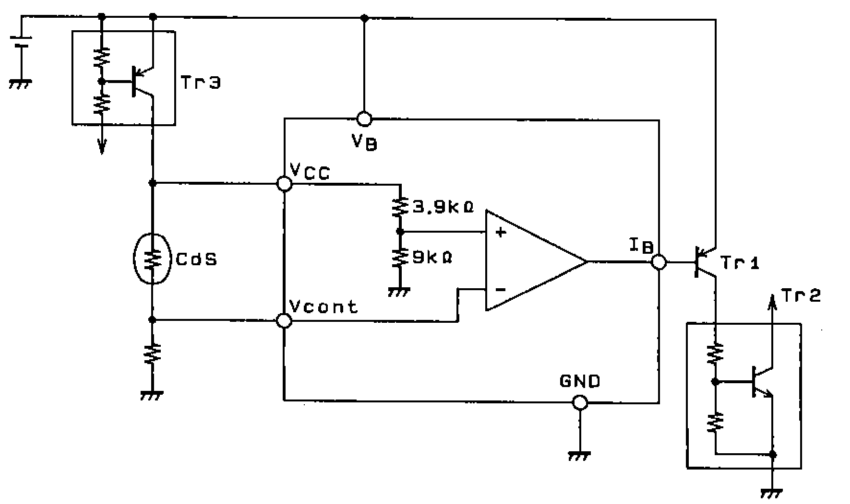
3. Light Measurement

Tr2 will turn on when the V_{CONT} input voltage becomes $V_B \times 70\%$ (= 9 k/(3.9 k + 9 k)) or higher. Note that the Tr3 transistor can also use the OUT3N output.



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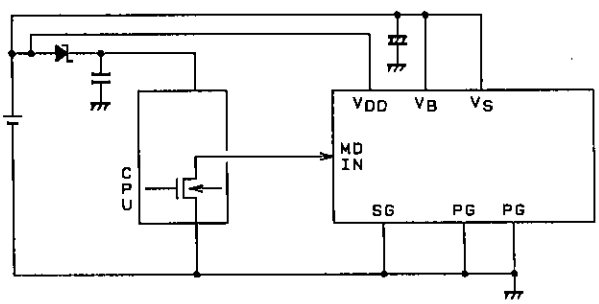
Power Supply Specifications

1. Single Supply Specifications



Since the V_{DD} line is the control input system line, it should not have the same impedance as the V_S line.

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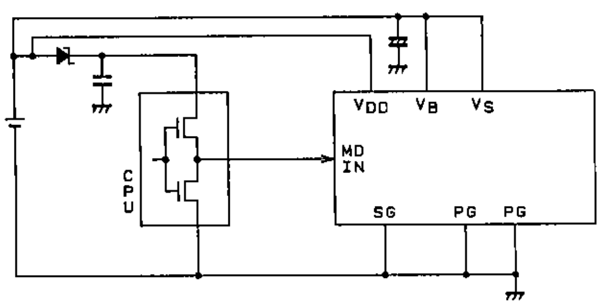

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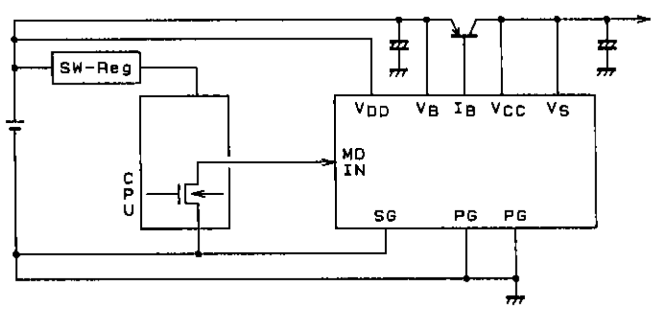
2. Step-Up Supply Specifications



Voltage application conditions
$V_{CONT} \leq V_B$
V_{IN}, $V_{MD} \leq V_{DD}$
There are no limitations on the magnitude relationships between the V_B, V_S and V_{DD} supply voltages.

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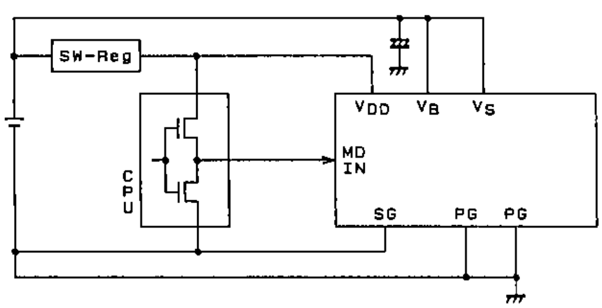

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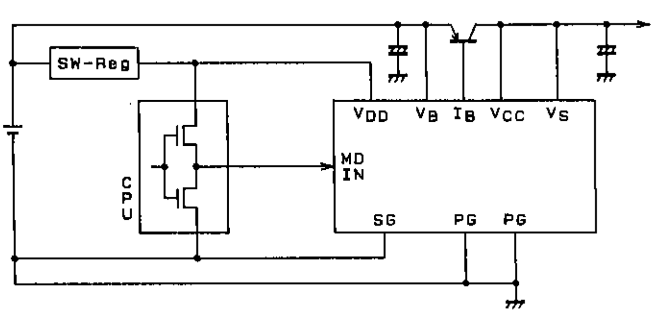

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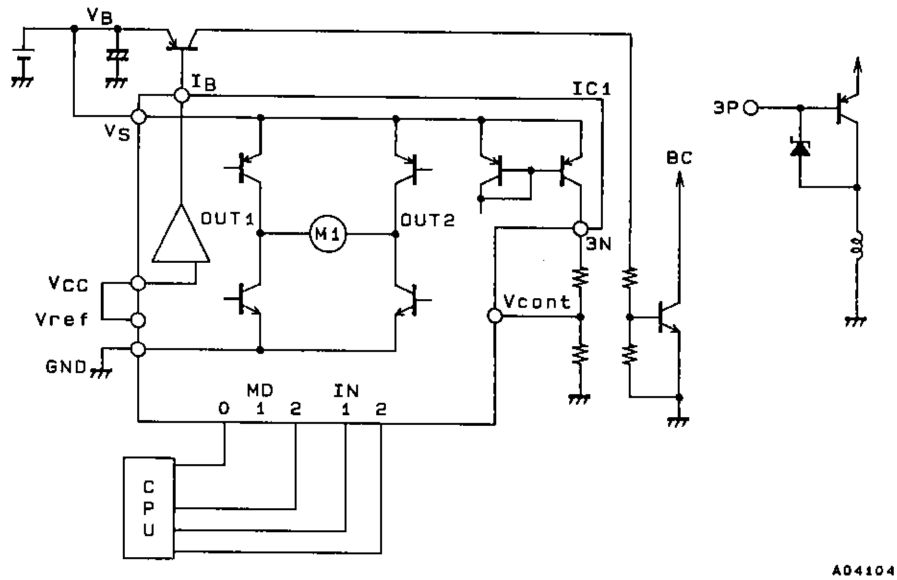
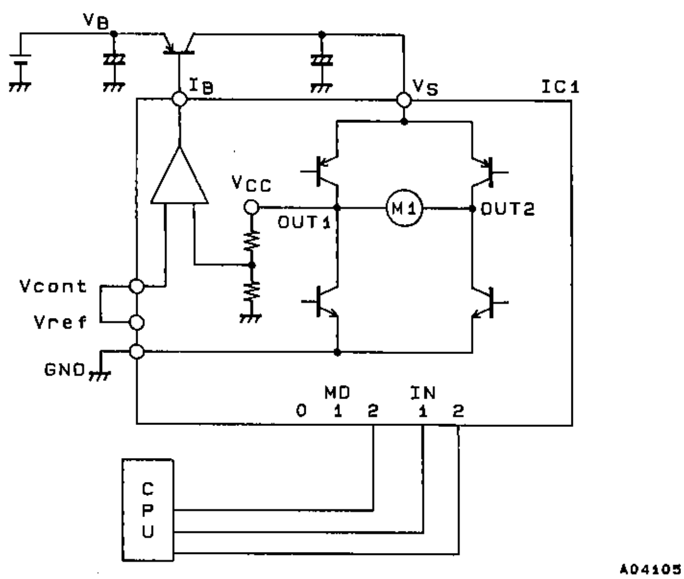
Sample Application 1



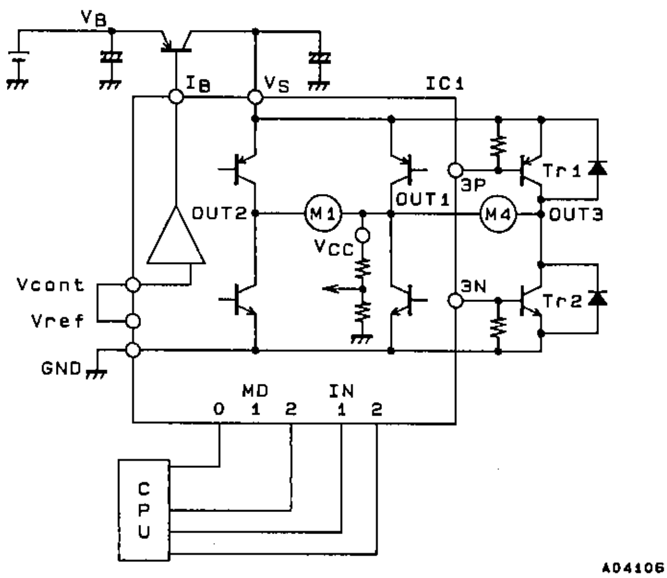
MD		Mode
0	2	
H	H	Standby (zero current drain)
H	L	Motor 1
L	H	Solenoid, battery check

Sample Application 2



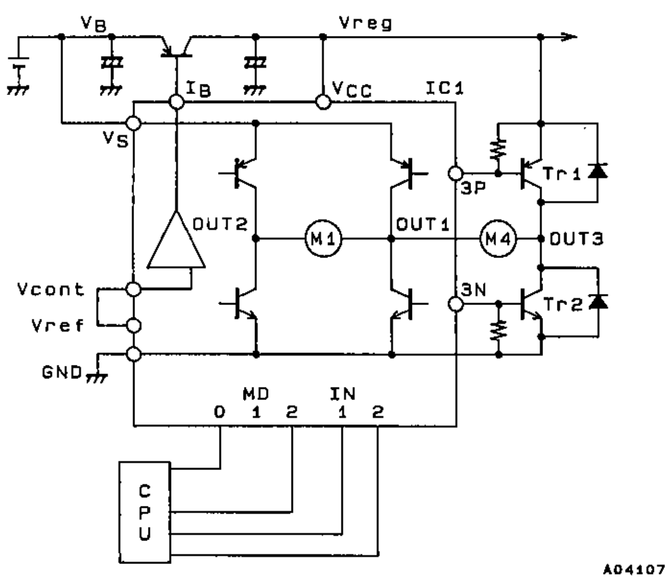
MD	Mode
2	
H	Standby (zero current drain)
L	Motor 1 (single-direction regulator output)

Sample Application 3



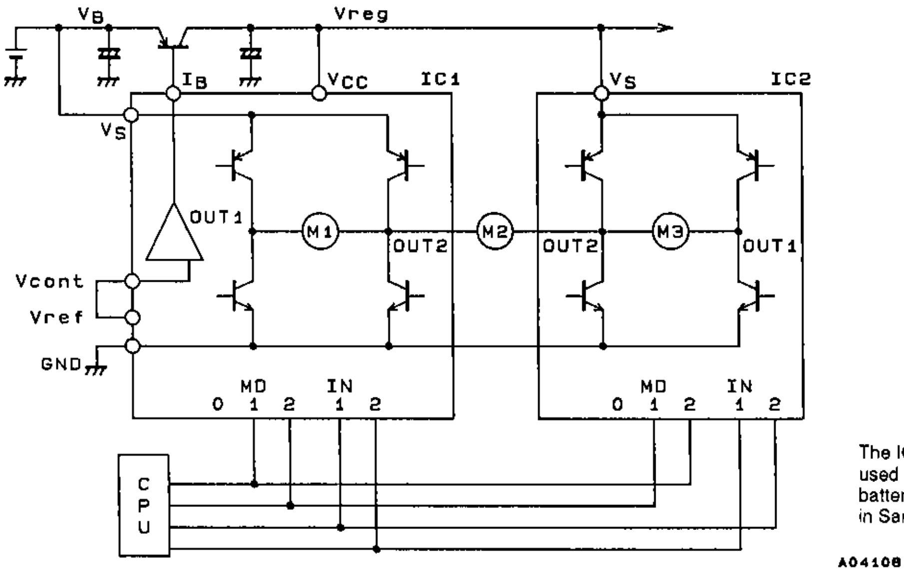
MD		Mode
0	2	
H	H	Standby (zero current drain)
H	L	Motor 1 (single-direction regulator output)
L	H	V_S line saturated output (battery voltage switch)
L	L	Motor 4 (single-direction regulator output)

Sample Application 4



MD		Mode
0	2	
H	H	Standby (zero current drain)
H	L	Motor 1
L	H	Only the V_{CC} regulator output on
L	L	Motor 4 (single-direction regulator output)

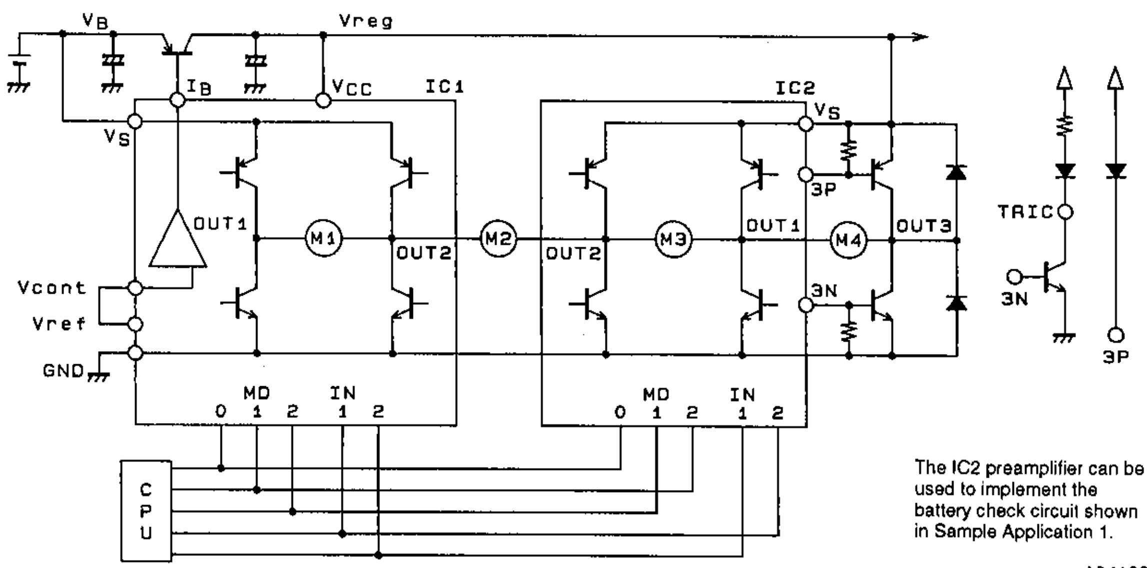
Sample Application 5



The IC2 preamplifier can be used to implement the battery check circuit shown in Sample Application 1.

MD		Mode
1	2	
H	H	Standby (zero current drain)
H	L	Motor 1
L	H	Motor 3 (bidirectional regulator output)
L	L	Motor 2 (single-direction regulator output)

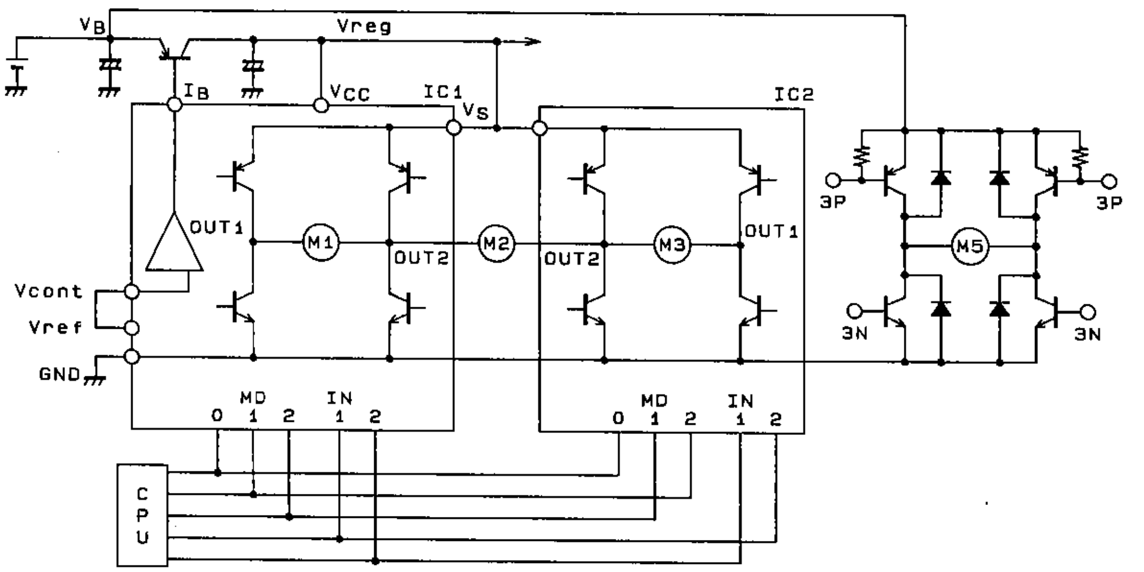
Sample Application 6



The IC2 preamplifier can be used to implement the battery check circuit shown in Sample Application 1.

MD			Mode
0	1	2	
H	H	H	Standby (zero current drain)
H	H	L	Motor 1
H	L	H	Motor 3 (bidirectional regulator output)
H	L	L	Motor 2 (single-direction regulator output)
L	L	L	Only the V_{CC} regulator output on
L	L	H	Motor 4 (bidirectional regulator output)
L	H	H	IRED, LED

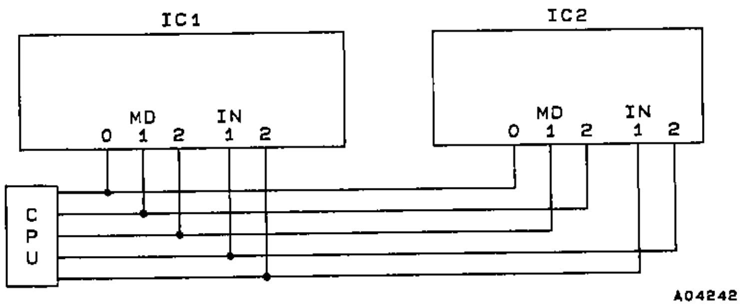
Sample Application 7



MD			Mode
0	1	2	
H	H	H	Standby (zero current drain)
H	H	L	Motor 1 (bidirectional regulator output)
H	L	H	Motor 3 (bidirectional regulator output)
H	L	L	Motor 2 (bidirectional regulator output)
L	L	L	Only the V_{CC} regulator output on
L	H	H	Motor 5 (H bridge formed using external transistors)

Truth Table for Two LB8632V ICs

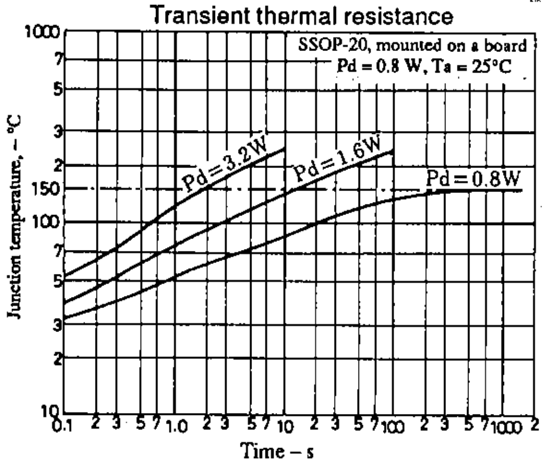
This truth table specifies the logic when using two LB8632V ICs (IC1 and IC2). As shown in the figure below, the five lines from the CPU should be connected to MD0, MD1, MD2, IN1, and IN2 for IC1 and to MD0, MD2, MD1, IN2, and IN1 for IC2, respectively.



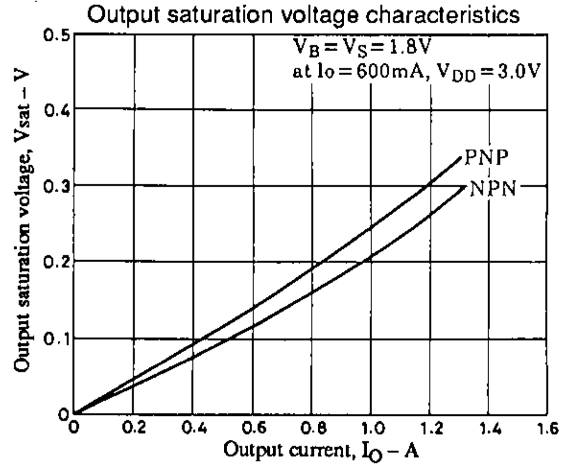
Note: The "—" entries for active-low/IN inputs are don't care states, and the "—" entries for OUT outputs are OFF states.
See the sample application circuit for the motor number.

MD			IN		IC1				IC2				V_{CC}	Note	
0	1	2	1	2	OUT1	OUT2	OUT3 PNP	OUT3 NPN	OUT2	OUT1	OUT3 PNP	OUT3 NPN			
H	H	H	—	—	—	—	—	—	—	—	—	—	—	Standby (zero current drain)	
H	H	L	H	H	—	—	—	—	—	—	—	—	On	Standby	Motor 1
			H	L	L	H	—	—	—	—	—	—		Forward	
			L	H	H	L	—	—	—	—	—	—		Reverse	
			L	L	L	L	—	—	—	—	—	—		Brake	
	L	H	H	H	—	—	—	—	—	—	—	—	On	Standby	Motor 3
			H	L	—	—	—	—	L	H	—	—		Forward	
			L	H	—	—	—	—	H	L	—	—		Reverse	
			L	L	—	—	—	—	L	L	—	—		Brake	
	L	L	H	H	—	—	—	—	—	—	—	—	On	Standby	Motor 2
			H	L	—	H	—	—	L	—	—	—		Forward	
			L	H	—	L	—	—	H	—	—	—		Reverse	
			L	L	—	L	—	—	L	—	—	—		Brake	
L	L	L	—	—	—	—	—	—	—	—	—	—	On	Only V_{CC} on	
	H	L	H	H	—	—	—	—	—	—	—	—	On		
			H	L	L	—	On	—	—	—	—	—			
			L	H	H	—	—	On	—	—	—	—			
			L	L	L	—	—	On	—	—	—	—			
	L	H	H	H	—	—	—	—	—	—	—	—	On	Standby	Motor 4 External transistor
			H	L	—	—	—	—	—	H	—	On		Forward	
			L	H	—	—	—	—	—	L	On	—		Reverse	
			L	L	—	—	—	—	—	L	—	On		Brake	
	H	H	H	H	—	—	—	—	—	—	—	—	On	Standby	Motor 5 External transistor
			H	L	—	—	On	—	—	—	—	On		Forward	
			L	H	—	—	—	On	—	—	On	—		Reverse	
			L	L	—	—	—	On	—	—	—	On		Brake	

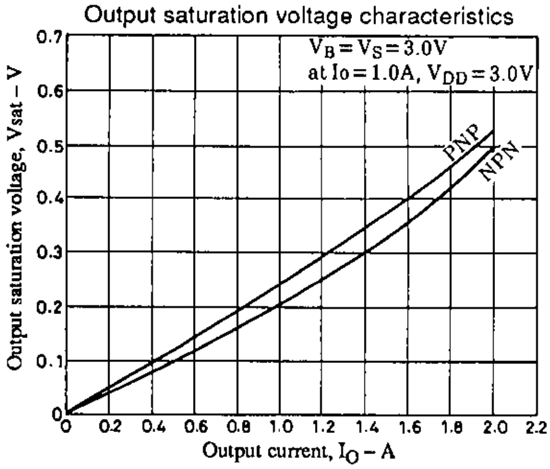
Transient thermal resistance



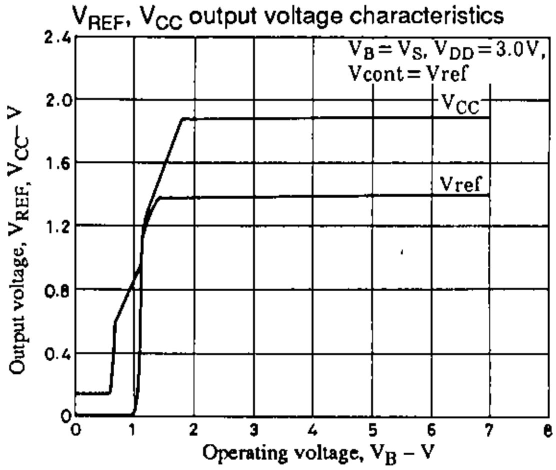
Output saturation voltage characteristics



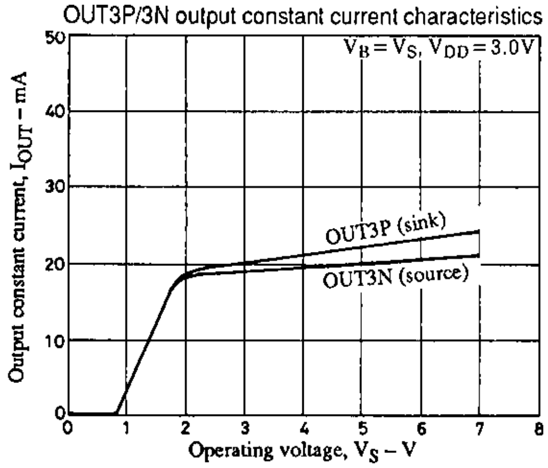
Output saturation voltage characteristics



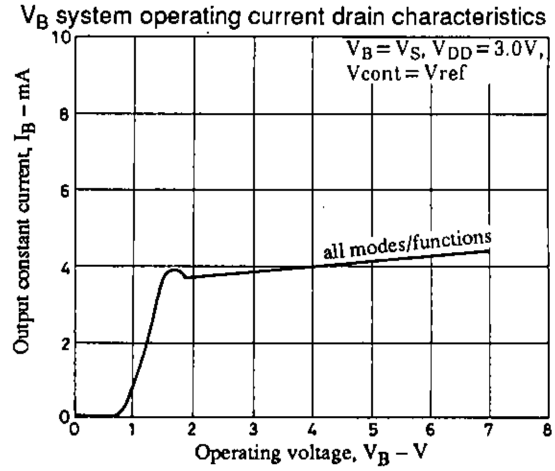
V_{REF}, V_{CC} output voltage characteristics



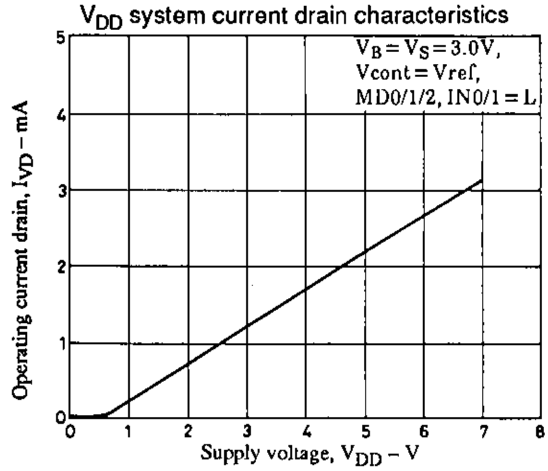
OUT3P/3N output constant current characteristics



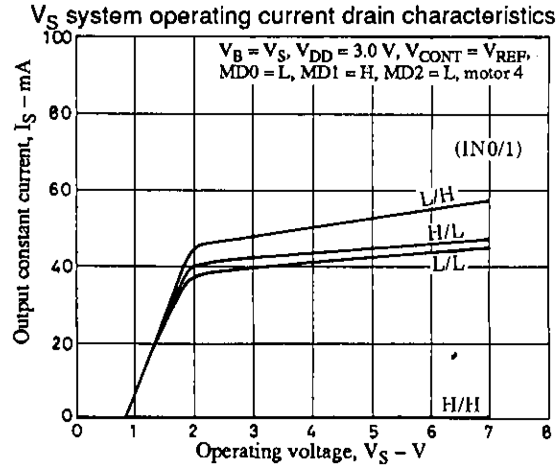
V_B system operating current drain characteristics



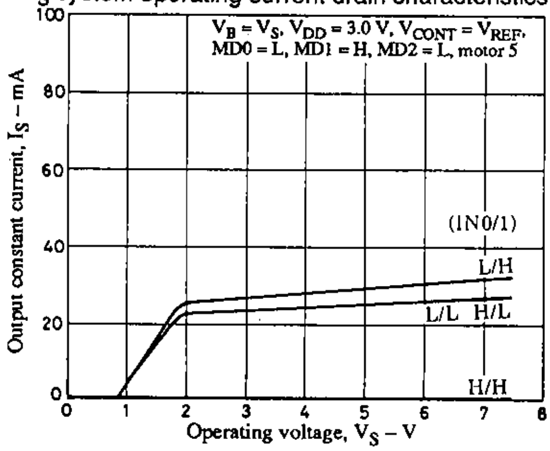
V_{DD} system current drain characteristics



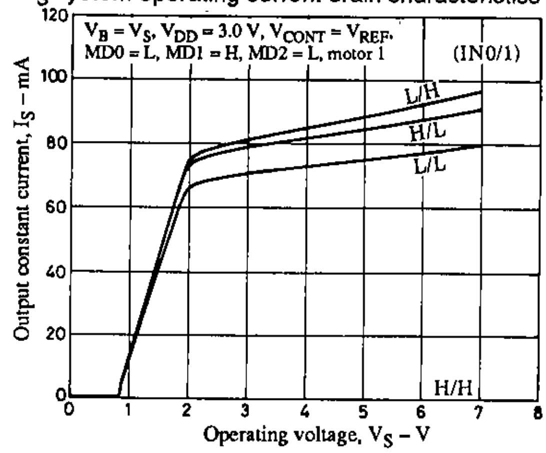
V_S system operating current drain characteristics



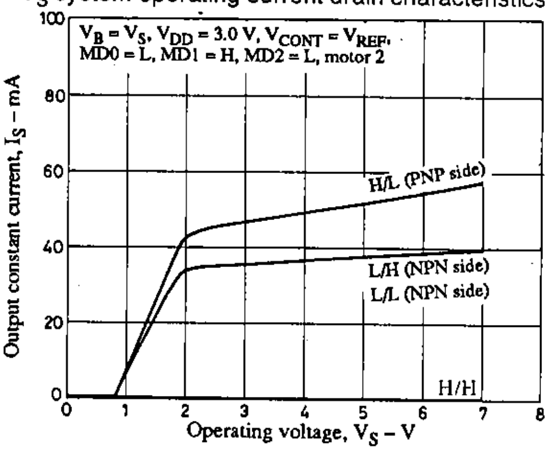
V_S system operating current drain characteristics



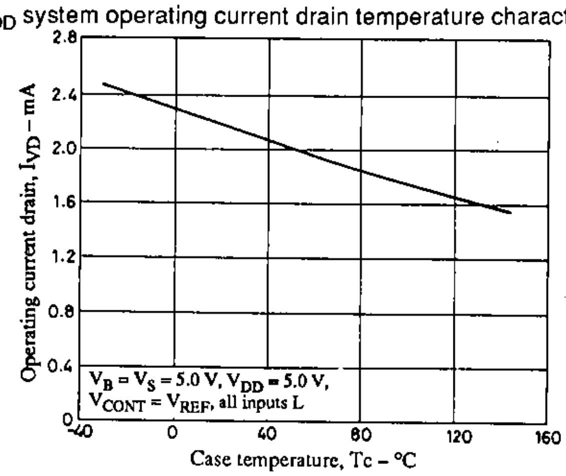
V_S system operating current drain characteristics



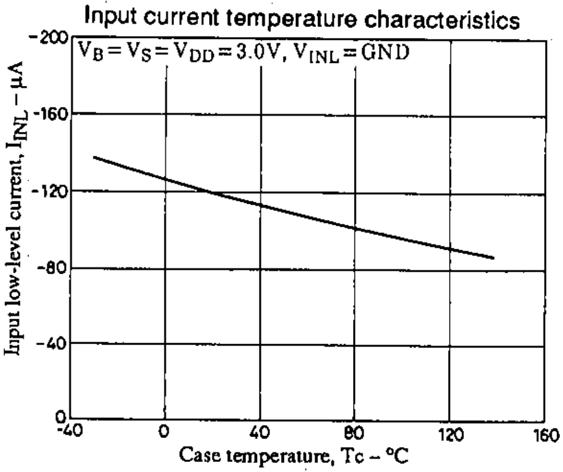
V_S system operating current drain characteristics



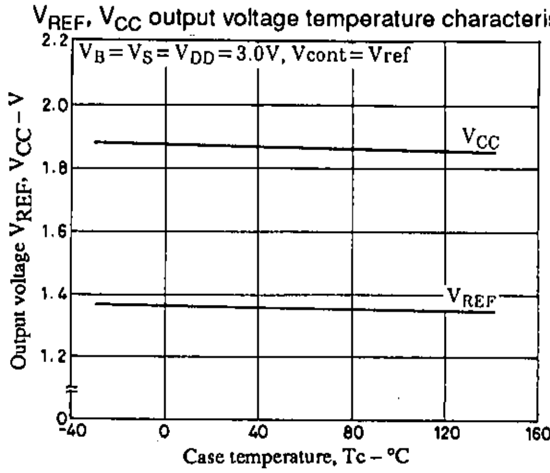
V_{DD} system operating current drain temperature characteristics



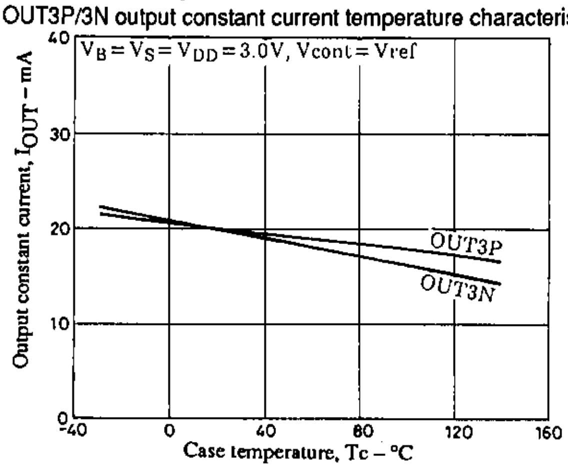
Input current temperature characteristics



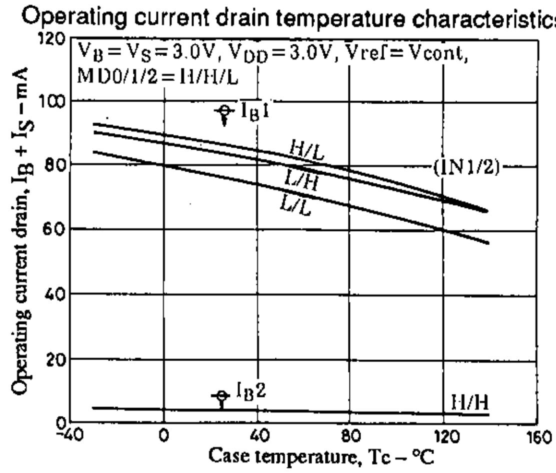
V_{REF}, V_{CC} output voltage temperature characteristics



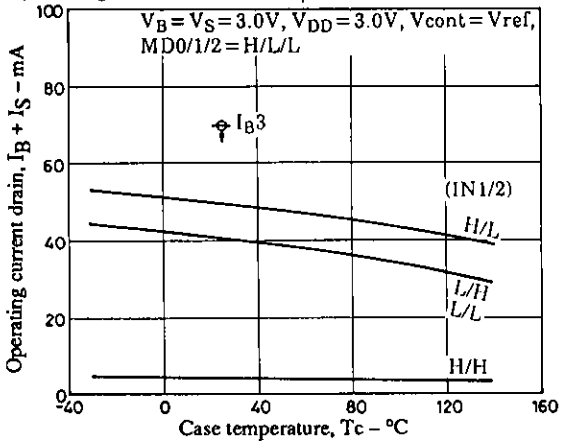
OUT3P/3N output constant current temperature characteristics



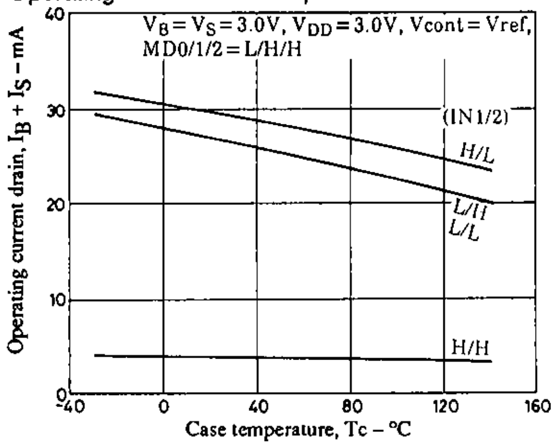
Operating current drain temperature characteristics



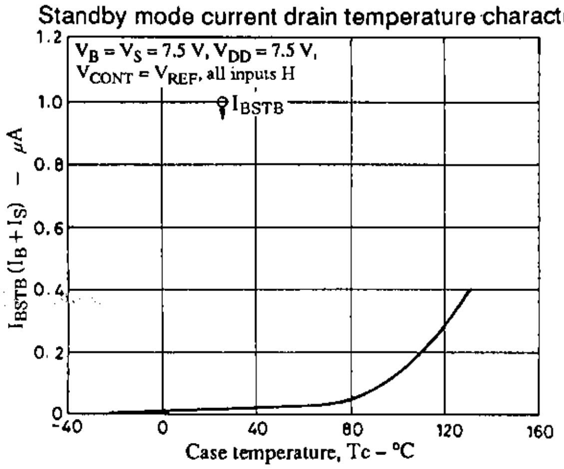
Operating current drain temperature characteristics



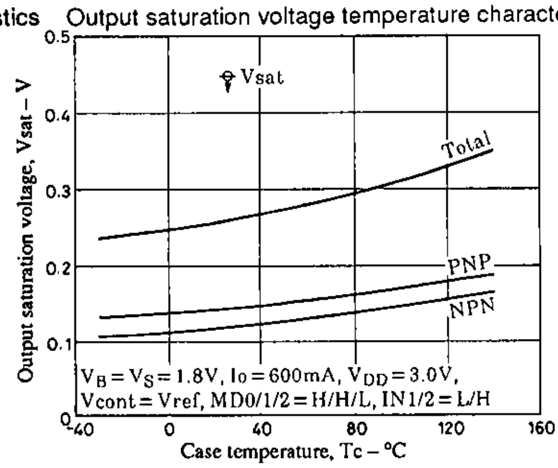
Operating current drain temperature characteristics



Standby mode current drain temperature characteristics



Output saturation voltage temperature characteristics



Output saturation voltage temperature characteristics