

Motion Control

Last updated 11/29/21

Motion Control

- Fundamentals
 - Motion controlled by wheel movement
 - Wheel movement controlled by motors
 - Motor movement controlled by
 - Motor voltage
 - Direction inputs
 - PWM duty cycle
 - Standby

Motion Control

- Fundamentals
 - Motor Voltage
 - 5 AA Alkaline Batteries
 - Nominal voltage 7.5V
 - New – 8.25V (5 x 1.65)
 - Old – 6.5V (5 x 1.3)

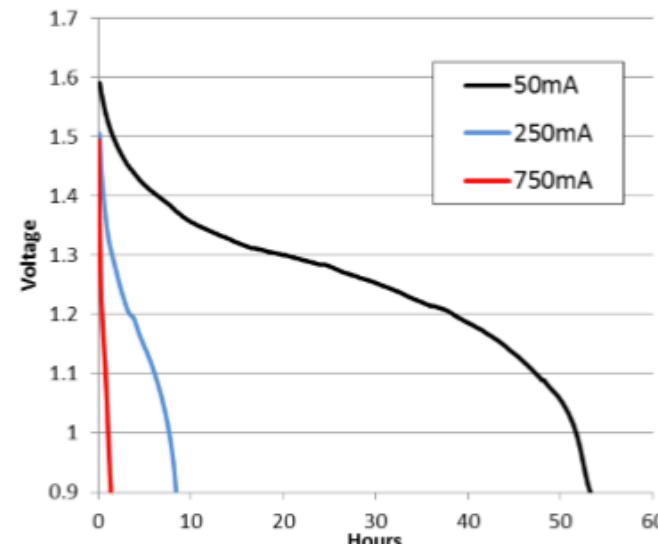
Motion Control

- Fundamentals
 - Battery Spec
 - See the website

Typical Service Life – ANSI Application Tests

Application and Duty Cycle	Discharge Load	Service
Digital Camera (2 sec Load 1, 28 sec Load 2) 5 min/hr	Load 1: 1.5W Load 2: 0.65W	97 pulses
Grooming 2 min/hr	750 mA	1.18 hours
Lighting 4 min/hr, 8 hr/day	3.9 Ω	7.92 hours
Toy 1 h/day	3.9 Ω	8.53 hours
CD / Games 1 hr/day	250 mA	9.08 hours
Digital Audio 1 hr/day	100 mA	26.1 hours
Remote/Radio/Clock 1 hr on / 7 hr off	50 mA	52.0 hours

Discharge Curves (Continuous Load)



Motion Control

- Fundamentals
 - Battery Spec

No.	Item	Specification	Remark
1	Type designation	IEC/JIS: LR6 ANSI: 15A Common: AA	
2	Chemical system	Zn/KOH-H2/MnO2	
3	Nominal Voltage	1.5V	
4	Nominal Capacity	Approx. 3000mAh	10mA, 24h/d, 20°C, 0.8V cut-off voltage
5	Weight	Approx. 23.8g	
6	Operating temperature	-18 ~ 50°C	
7	Recommended storage temperature	Not to exceed 30°C	

Load	10Ω	1000mA	1.5w/ 0.65w	1000 mA	3.3Ω	250mA	3.9Ω	100mA	24Ω	43Ω	
Test mode	24h/d	24h/d	2s/28s 5min/h	10s/m 1h/d	4m/h 8h/d	1h/d	1h/d	1h/d	15s/m 8h/d	4h/d	
End voltage	0.9V	0.9V	1.05V	0.9V	0.9V	0.9V	0.8V	0.9V	1.0V	0.9V	
Unit	h	m	pulse	pulse	m	h	h	h	h	h	
Applications	Reference	Reference	Digital still camera	Photo flash	Portable lighting	CD/Electronic games	Motor/toy	Digital audio	Remote control	Radio/Clock	
Initial	MAD	19.5	52	90	500	320	7.5	7.5	21.5	44	91
	Normal	20.5	60	120	570	350	8.3	8.2	23.5	47	96
Stored 1 year	MAD	19.0	43	75	400	300	7.2	7.2	21.0	43	88
	Normal	20.0	55	100	550	330	7.8	7.8	22.5	45	93

m: minute h: hour d: day

Remark: 1) The initial discharge test shall commence within 30 days of manufacture. During stored period, the cells shall be stored under room temperature conditions.

2) Lot release service output test is conducted by 10Ω continuous discharging to 0.9volts

- The batteries shall not leak during the service life test before the end voltage reached.

MAD=Minimal Average Duration

Motion Control

- Fundamentals
 - Motor Spec



Dimensions

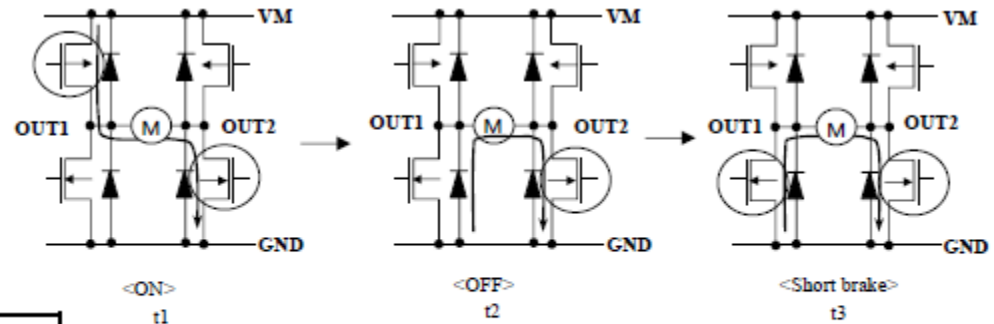
Size:	64.4 x 22.3 x 21 mm ¹
Weight:	32 g
Shaft diameter:	7 mm

General specifications

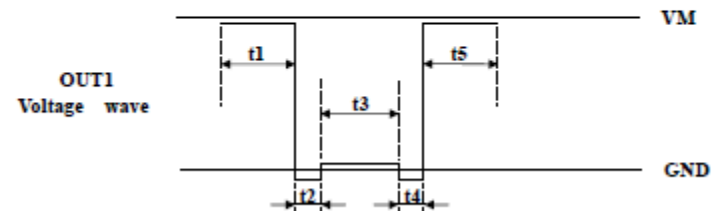
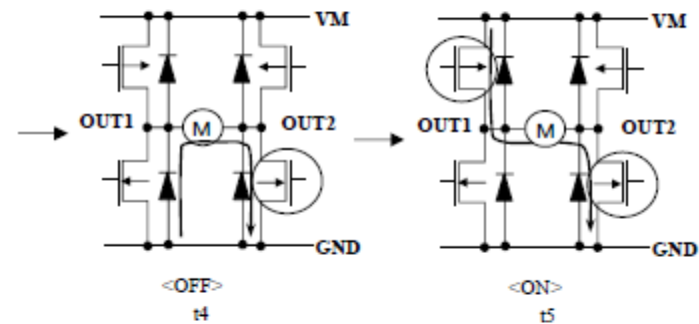
Typical operating voltage:	6 V
Gear ratio:	200:1
Free-run speed @ 6V:	51 rpm
Free-run current @ 6V:	70 mA
Stall current @ 6V:	800 mA
Stall torque @ 6V:	100 oz·in

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 - Motor Driver Spec



Input				Output		
IN1	IN2	PWM	STBY	OUT1	OUT2	Mode
H	H	H/L	H	L	L	Short brake
L	H	H	H	L	H	CCW
		L	H	L	L	Short brake
H	L	H	H	H	L	CW
		L	H	L	L	Short brake
L	L	H	H	OFF (High impedance)		Stop
H/L	H/L	H/L	L	OFF (High impedance)		Standby



Motion Control

- Fundamentals
 - Direction Inputs
 - 2 inputs for each motor
 - 3.3v signals
 - 4 possible combinations
 - 0, 1 Forward*
 - 1, 0 Reverse*
 - 0, 0 High Z
 - 1, 1 Brake

* Direction is relative to motor placement and wiring

Motion Control

- Fundamentals
- Notes

Motion Control

- Fundamentals
 - Forward / Reverse motion
 - Both wheels moving at same speed
 - Same PWM value
 - May need to characterize for an offset
 - Wheel diameter
 - Motor variation
 - Offset may be speed dependent
 - Constant offset -> add /subtract a fixed value from one PWM
 - Speed dependent -> multiply / divide a ratio for one PWM
 - May even need a piece-wise linear table

Motion Control

- Fundamentals
 - Forward / Reverse motion
 - Distance
 - PWM and Time (AND Voltage)

Motion Control

- Advanced
 - Spin
 - Arc