49. 860 MHz Tony Hawk TMH Skateboarder #95456
Operational Description

The Tony Hawk skateboarder is a TMH™ (7.2V NiCD) powered, radio controlled toy skateboarder. It is designed to operate on a single fixed frequency in the 49.82 – 49.90 MHz band. See the attached block diagram and schematic.

The skateboard receiver receives and demodulates the AM transmitted signal from the transmitter, using a standard super-regenerative AM receiver/demodulator circuit comprised of ANT1, Q104, L1, L101, C112, C110, L100, C114, R100, R113, C115, and R114. The output of the AM receiver/demodulator is applied to a high gain differential amplifier comprised of Q100, Q101, Q102, Q103, C100 through C109, and R101 through R112, which amplifies, filters and limits the data. This amplifier consists of two differential amplifier stages Q100//Q101 and Q102//Q103 with a common, well-filtered bias supply comprised of C1, C2, C3, C4, and C6. The output stage differential amplifier typically runs into saturation when input data from the receiver is present. Low pass filtering of the data is accomplished with R103//C108 and R104//C109. The 100-microsecond time constant of these filters provides sufficient filtering of the 2 Kb/s data stream, to reduce noise, while not over filtering the data. The output signal swing is from the supply voltage (3.3V) to about 0.5V above ground. A zener regulator circuit comprised of D1, Q2, and R3 creates the supply voltage, VDD for the super-regenerative radio and differential amplifier.

Digital data recovered by the aforementioned receiver/demodulator/amplifier is capacitively coupled to an MCU input pin on Port C via C7. MCU U1 reads the transmitted data and responds appropriately by adjusting position or speed of the commanded motor. Position feedback is accomplished by a wiper/PCB combination arrangement. The encoding for data retrieved from the feedback wiper/PCB combination is Gray code encoded to reduce error introduced by the mechanical system. Each input used for wiper feedback is AC terminated and pulled high internally via U1.

Drive motors M4and M1 are controlled by a high power H-bridge comprised of U2, U3, Q1, and Q7. Q24, Q20, Q4, and Q8 are low current gate transistors used to switch high current MOSFET transistors into saturation. Diodes, D11, D10, D13, and D12 are clamp diodes used to shunt inductive spikes created by collapsing magnetic fields back to the power supply. Capacitors C8 and C20 are used to filter motor noise. Steering and Torso motors are controlled by medium power H-bridges comprised of Q23, Q26, Q27, Q14, Q13, Q22 and Q10, Q3, Q15, Q12, Q21 and Q11 respectively. Capacitors C19, C23, C24, C16, C17, C18 are used to filter motor noise. Diodes D3, D4, D5, D6, D7, D8, D16, and D15 are clamp diodes used to shunt inductive spikes created by collapsing magnetic fields back to the power supply. Steering motor M2 has an active brake circuit comprised of Q19, D9, and D14. Command signals MTWR, MTWL, MBRK, MRIGHT, MLEFT, MREV and MFOR are used to control motor bridge operation and are generated via U1.

A comparator circuit comprised of an NTC thermistor, R65, R30, C38, C21, C28, R72, R71, and R73 accomplishes thermal sensing and circuit shutoff due to excessive drive motor heating. Resistor R72 is used as a tuning resistor to nullify deviations in thermistor tolerance.

Power input to U1, the thermistor circuit and reset are filtered for noise reduction purposes by C31, R61, C26 and C25.