MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

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by MPC1710A/D

MPC1710A

Advance Information

SMARTMOS™ H-Bridge Motor Control

**H-BRIDGE
MOTOR DRIVE
1 AMPERE
8 VOLTS
SILICON MONOLITHIC
INTEGRATED CIRCUIT**

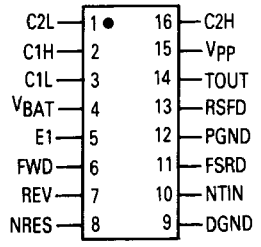
The MPC1710A is a monolithic integrated circuit primarily intended for control of low voltage battery operated motors. The circuit contains logic control, predrivers, an oscillator, charge pump, and four MOSFETs in the output connected in an H-Bridge configuration. Features of this circuit include:

- High Output Current — 1 Ampere Continuous and 3 Amperes Peak
- Four Control Modes — Forward, Reverse, Stand-by and Brake
- Undervoltage Lockout
- Low On-Resistance to Minimize "On" Losses
- Small Space Saving 16 Pin Surface Mount Package
- Low Quiescent Current — 1 mA Maximum
- Available in Plastic Rails or Tape and Reel on 32 mm Tape

Ordering Information

- Plastic Rail — Order as MPC1710AM
- Tape and Reel — Order as MPC1710AML

PINOUT



MAXIMUM RATINGS (T_J = 25°C unless otherwise noted.)

Rating	Symbol	Value	Unit
Supply Voltage for Motor (Note 1)	V_{BAT}	−0.3 to 8	Volts
Supply Voltage for Controller	E1	−0.3 to 7	Volts
Logic Input Voltage (Note 2)	V_{in}	−0.3 to 7	Volts
Drain Current — Continuous (Note 3) — Peak (100 ms per 30 sec) — Peak (10 ms per 0.2 sec)	I_D	1 3 3	Amps

THERMAL CHARACTERISTICS

Power Dissipation (T_A = 25°C)	P_D	650	mW
Thermal Resistance, Junction to Case	$R_{\theta JC}$	33	°C/W
Thermal Resistance, Junction to Ambient (Note 4)	$R_{\theta JA}$	150	°C/W
Operating Junction Temperature	T_J	125	°C
Operating Ambient Temperature Range	T_A	−30 to 60	°C
Storage Temperature Range	T_{stg}	−55 to 125	°C
Maximum Lead Temperature for Soldering Purposes (Note 5)	T_L	240	°C

Notes:
1. A 10 Volt zener diode is recommended at Pin 4 to protect against induced voltages caused by stray inductance.
2. For supply voltages between −0.3 to 7 Volts. This voltage is equal to the supply voltage.
3. With heat sink to maintain T_J below 125°C.
4. Mounted on a printed circuit board.
5. At 30 second soldering time after a preheat temperature of 180°C for 30 seconds.

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This document contains information on a new product. Specifications and information herein are subject to change without notice.

OPERATING CONDITIONS

Rating	Symbol	Value	Unit
Supply Voltage for Motor	V_{BAT}	2 to 6	Volts
Supply Voltage for Controller	E1	4.8 to 6	Volts
Charge Pump Output Voltage	V_{PP}	11 to 17	Volts
Operating Ambient Temperature	T_A	−30 to 60	°C
Charge Pump Capacitors	C1, C2 & C3	10 to 100	nF

ELECTRICAL CHARACTERISTICS (At operating conditions unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Power Supply Current for Motor (Stand By)	I_{BAT}	—	—	1	μA
Power Supply Current for Controller (Operation)	IE1	—	—	1	mA
Input Leakage Current for Pin 6 and Pin 7					μA
High Input (E1 = 6 V)	I_{IH}	—	—	1	
(E1 = 6 V, T_A = 60°C)		—	—	2	
Low Input (V_{IL} = 0)	I_{IL}	−1	—	—	
(V_{IL} = 0, T_A = 60°C)		−2	—	—	
Logic Input Voltage Levels					Volts
Input Voltage Low	V_{IL}	—	—	0.8	
Input Voltage High	V_{IH}	3	—	—	
Input Resistance for Pin 8 and Pin 10 (Note 6)	r_i				kOhm
(E1 = 6 V, 2 ≤ V_{BAT} ≤ 6 V)		35	—	65	
(E1 = 6 V, 2 ≤ V_{BAT} ≤ 6 V, T_A = 60°C)		25	—	75	
Resistance of Motor Driving Output (I_L = 1 A) (Note 8)					Ohms
Source On-Resistance	$r_{o(so)}$	—	—	0.41	
Sink On-Resistance	$r_{o(si)}$	—	—	0.21	
Charge Pump Output Voltage (Pin 15)					Volts
Off Motor Driving Voltage	$V_{PP(off)}$	—	—	17	
On Motor Drive Voltage (Note 7)	$V_{PP(on)}$	11	—	—	
MOSFET Driving Output Voltage	V_{TOUT}	11	—	17	Volts
Undervoltage Shutdown Threshold (V_{PP} Active)	VE1S	2.5	—	4.2	Volts

SWITCHING CHARACTERISTICS

		Symbol	Min	Typ	Max	Unit
Charge Pump Rise Time	(See Figure 3)	t_{VPP}	—	—	30	ms
Turn-On Time	(See Figure 4)	t_{on}	—	—	3	μs
Turn-Off Time	(See Figure 4)	t_{off}	—	—	2	μs
TOUT Rise Time (C = 500 pF)	(See Figure 5)	t_{TOUT}	—	—	5	ms
Shut-down Time of V_{PP}	(See Figure 6)	t_{VPPS}	—	—	3	ms
Shoot-Through Current	(See Figure 4)	I_{STH}	—	—	500	mA

Notes:
6. E1 max V_{BAT} min and max.
7. 1 ms drive/brake mode driving.
8. Typical limits are measured at T_C = 25°C.

Table 1. MPC1710A Truth Table

NRES	NTIN	FWR	REV	RSFD	FSRD	TOUT
1	X	1	1	0	0	X
1	X	1	0	0	1	X
1	X	0	1	1	0	X
1	X	0	0	Z	Z	X
0	X	X	X	Z	Z	0
1	1	X	X	X	X	0
1	0	X	X	X	X	1

Z = High Impedance
X = Not Critical

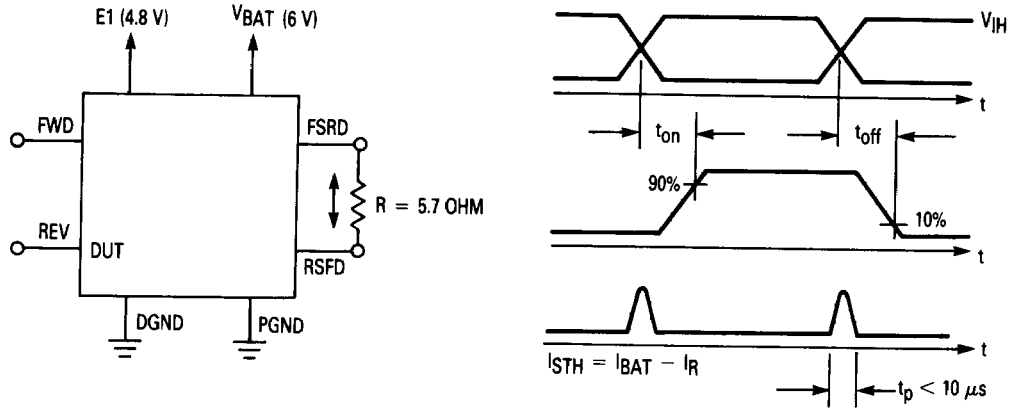


Figure 4.

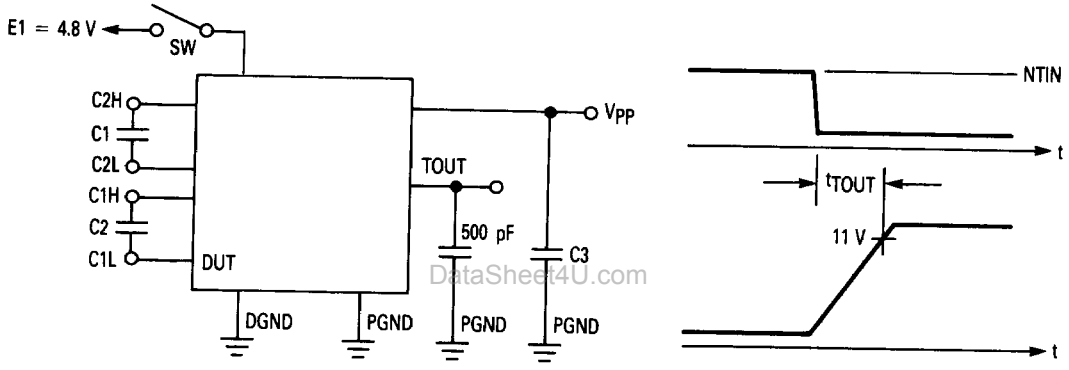


Figure 5.

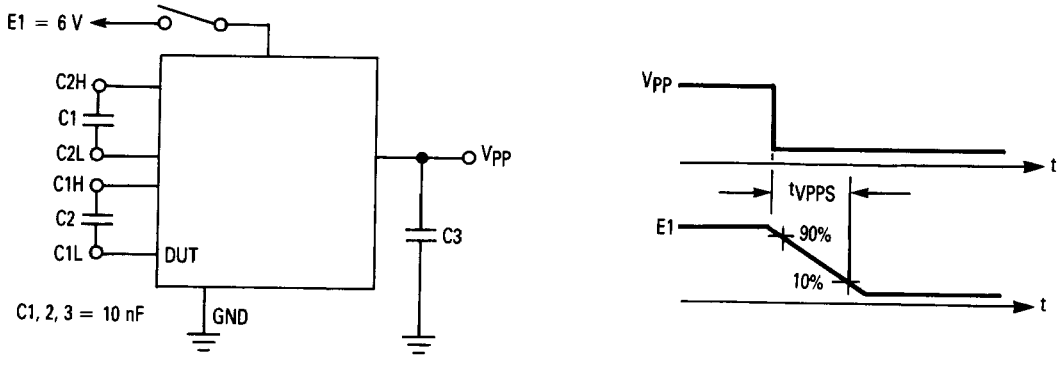
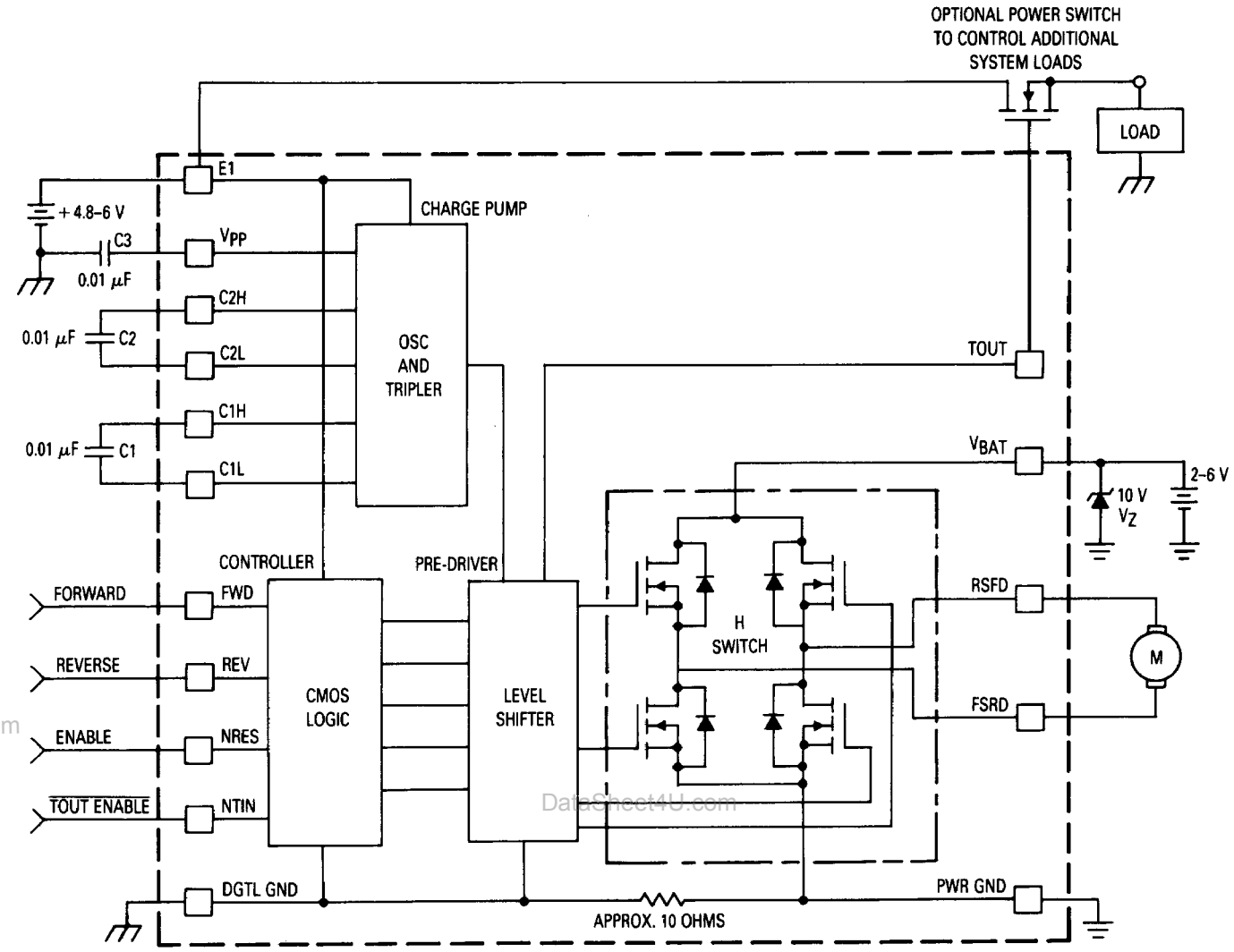


Figure 6.

TYPICAL MPC1710A APPLICATION



MPC1710A Pin Definition

Pin 1	C2L	Second stage charge pump capacitor (Low potential).
Pin 2	C1H	First stage charge pump capacitor (High potential).
Pin 3	C1L	First stage charge pump capacitor (Low potential).
Pin 4	V_{BAT}	Motor (H-Bridge) voltage supply.
Pin 5	E1	Control logic voltage supply.
Pin 6, 7	FWD, REV	Logic inputs to control motor direction and braking.
Pin 8	NRES	Control circuit enable pin.
Pin 9	DGND	Control logic (Digital) ground.
Pin 10	NTIN	Enable control for TOUT. A logic "0" on this pin charge pump drives TOUT.
Pin 11, 13	FSRD, RSFD	H-Bridge outputs which control motor direction (See truth table).
Pin 12	PGND	H-Bridge power ground.
Pin 14	TOUT	Charge pumped output for driving an external MOSFET switch.
Pin 15	V_{PP}	Charge pump output.
Pin 16	C2H	Second stage charge pump capacitor (High potential).

Figure 7.

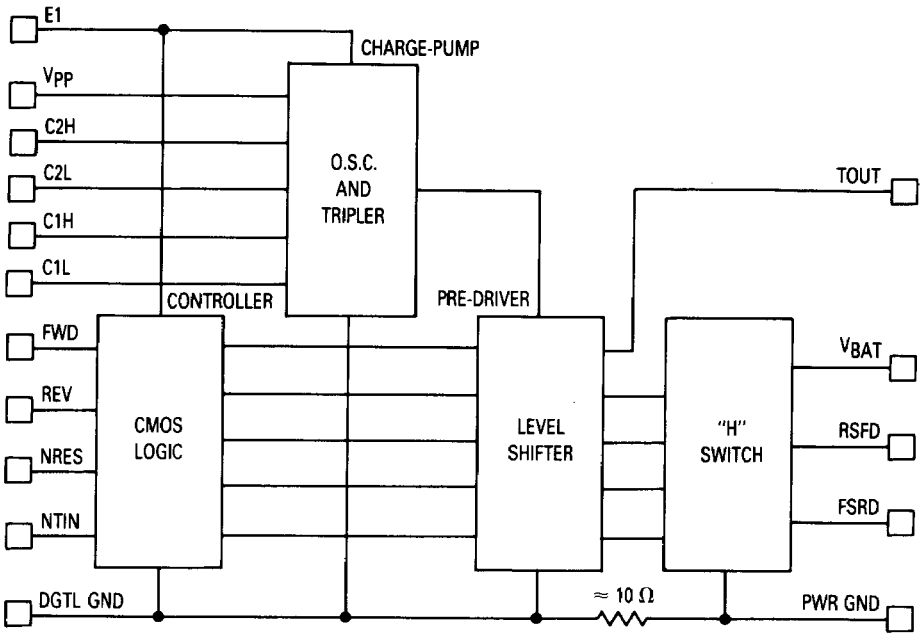


Figure 1. Block Diagram

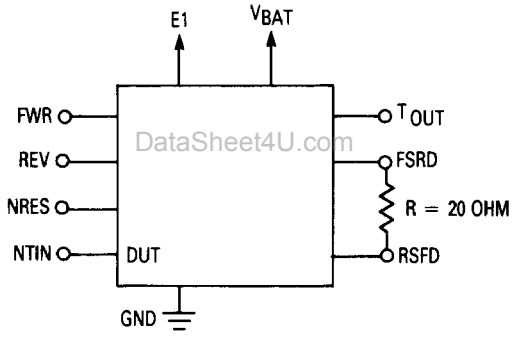


Figure 2.

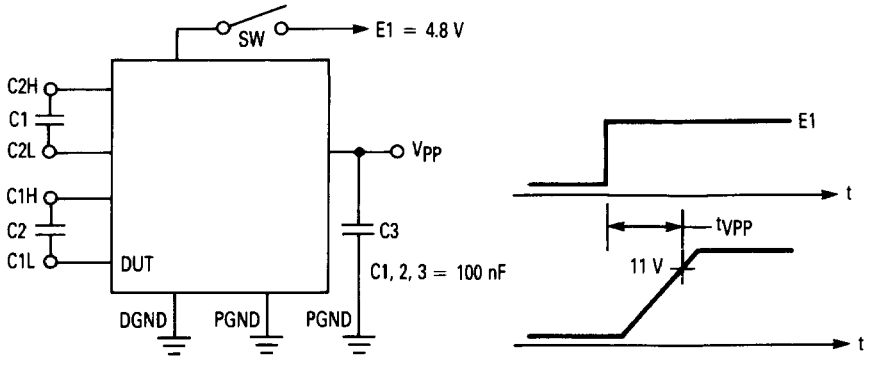
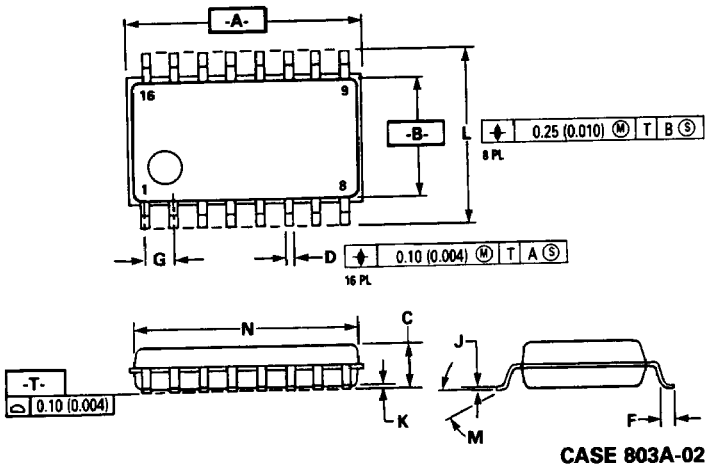


Figure 3.

OUTLINE DIMENSIONS



CASE 803A-02

NOTES:
1. DIMENSIONS "A" AND "B" ARE DATUMS AND "T" IS A DATUM SURFACE.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
3. CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.00	10.50	0.355	0.413
B	5.10	5.40	0.201	0.212
C	—	2.00	—	0.078
D	0.35	0.45	0.014	0.017
F	0.65	0.85	0.026	0.033
G	1.27 BSC		0.050 BSC	
J	0.18	0.23	0.007	0.009
K	0.05	0.20	0.002	0.007
L	8.00	8.60	0.315	0.339
M	1°	7°	1°	7°
N	10.16	REF	0.400	REF

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