Abstract MLX80153

OTP Full Bridge motor controller

1 Features Overview

- Integrated motor controller
  - Full Bridge NFET predriver
    - Double Charge pump with programmable NFET gate voltage
    - HS NFET and Low Side NFET control
    - Synchronous rectification with programmable dead time
  - 3 high voltage Wake up capable IO's on rising and falling edge
  - 3 low voltage IO's with multiple configuration options
  - Automotive Supply regulator
    - Standard Operating range [7, 18]V, Tj=[-40, 125]C
    - Extended operating range [4.5, 28]V, Tj = [-40, 150]C
    - 45V Load dump protected
    - Sleep current <50uA
  - Autosequence 10bit ADC with DMA avoids need for MCU interrupts to handle sampling. Multiple input channels
    - Battery (VSUP) and motor supply (VDRAIN)
    - Internal Temperature sensor (+/-15K)
    - All IO's can be configured as analog inputs.
    - Single shot NTC measurement with 3.3V ADC reference voltage.
  - Low Side Shunt amplifier with
    - Programmable gain,
    - Programmable Overcurrent protection and Current limiting levels
    - Synchronised measurements with programmable blanking time.
- 16bit Microcontroller
  - Two 16 bit timers for PWM communication
  - 16 bit core timer
  - 512 Byte RAM
  - 128 Byte data EEPROM
  - 16kB OTP Program memory (Flash for engineering samples only).
- TSSOP28 exposed pad package
  - AECQ100 automotive qualified, HTOL at Tj = 150C

2 Target Applications

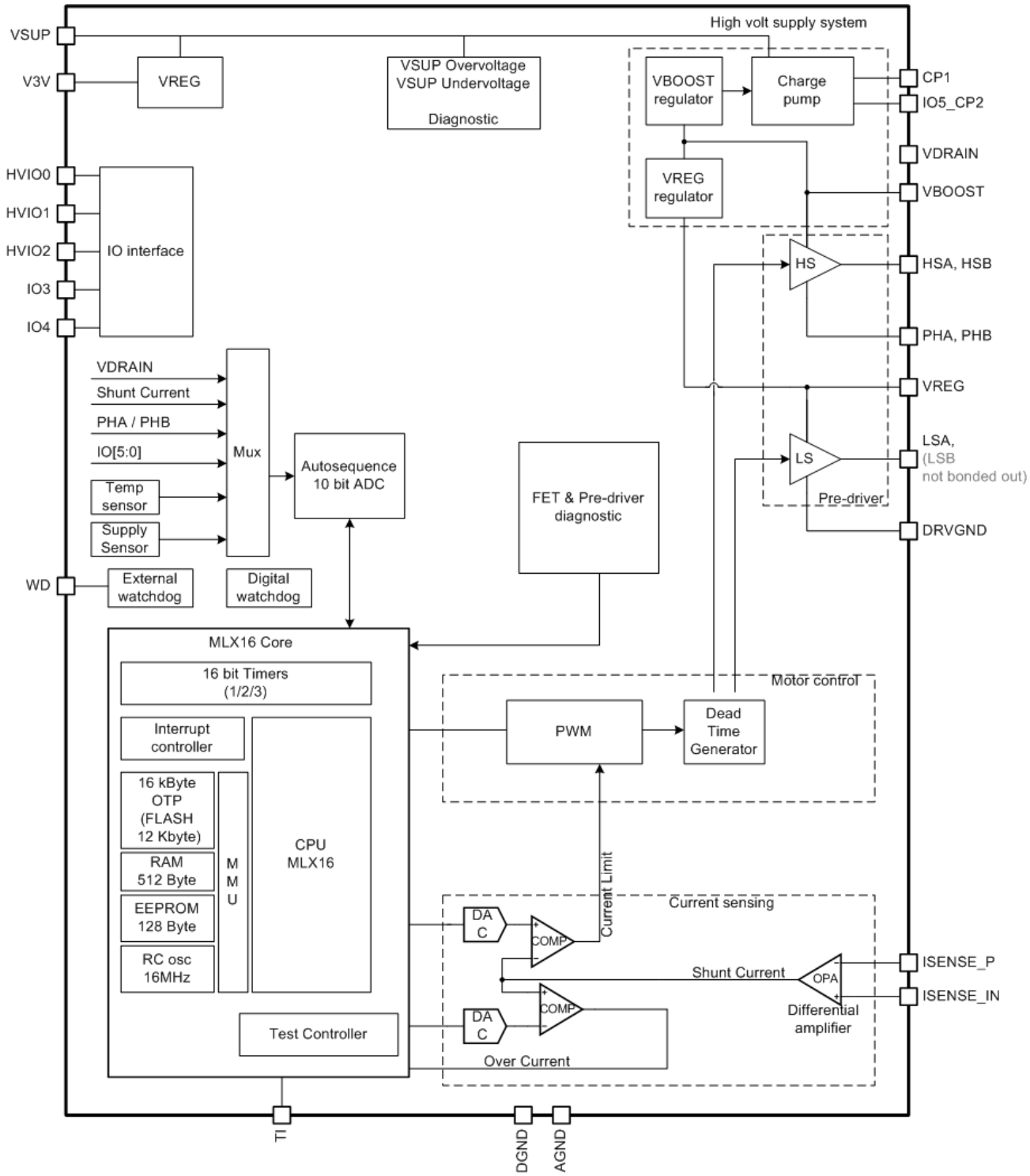
- High current DC motor control applications with PWM communication interface.
  - Fuel pumps
  - HVAC Blowers
  - Engine cooling fans: dual and single fan control possible

3 Ordering Information

Part No.	Temperature Code	Package Code	Option Code
MLX80153	K (-40 to 125°C) (*)	GO (TSSOP28-EP)	AAA 000
MLX80154	Engineering samples	(TSSOP28-EP)	

(*) operation up to Tj=150C possible after review of the mission profile.

4 Block diagram



5 Package data: TSSOP28- exposed pad

	A	A1	A2	D	E	H	e	L	b	c	α	P	P1
min		0.05	0.85	9.60	4.30	6.4 B.S.C	0.65 B.S.C	0.5	0.19	0.09	0°	3.00 B.S.C	5.50 B.S.C
Max	1.10	0.15	0.95	9.80	4.50			0.75	0.30	0.20	8°		

Table 1: Mechanical Dimensions TSSOP28_EP, all dimensions in mm

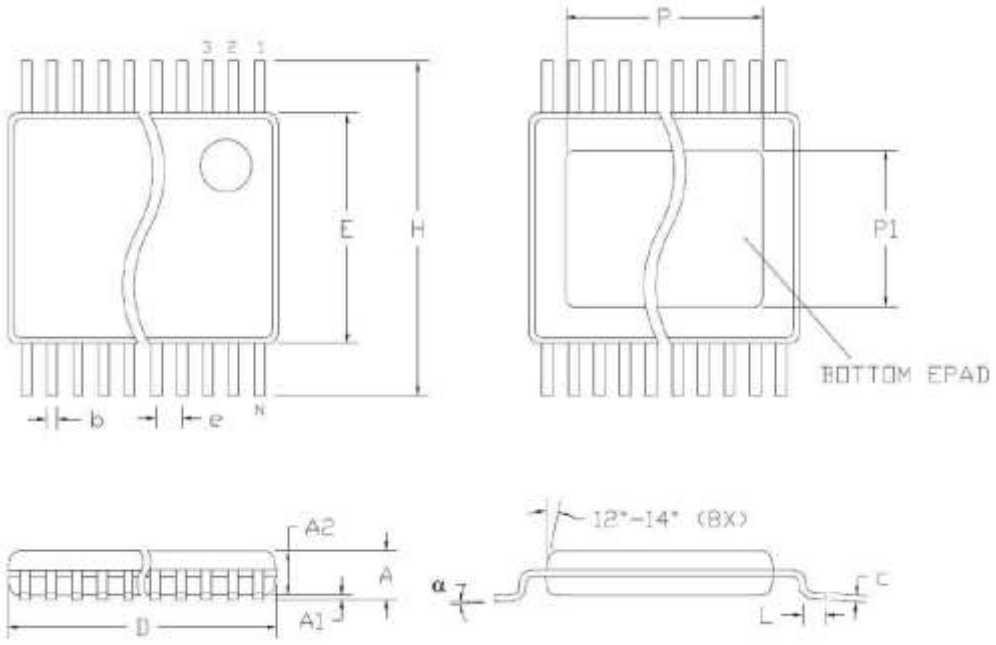


Figure 1: Package dimensions in mm

6 Pin out description MLX80153

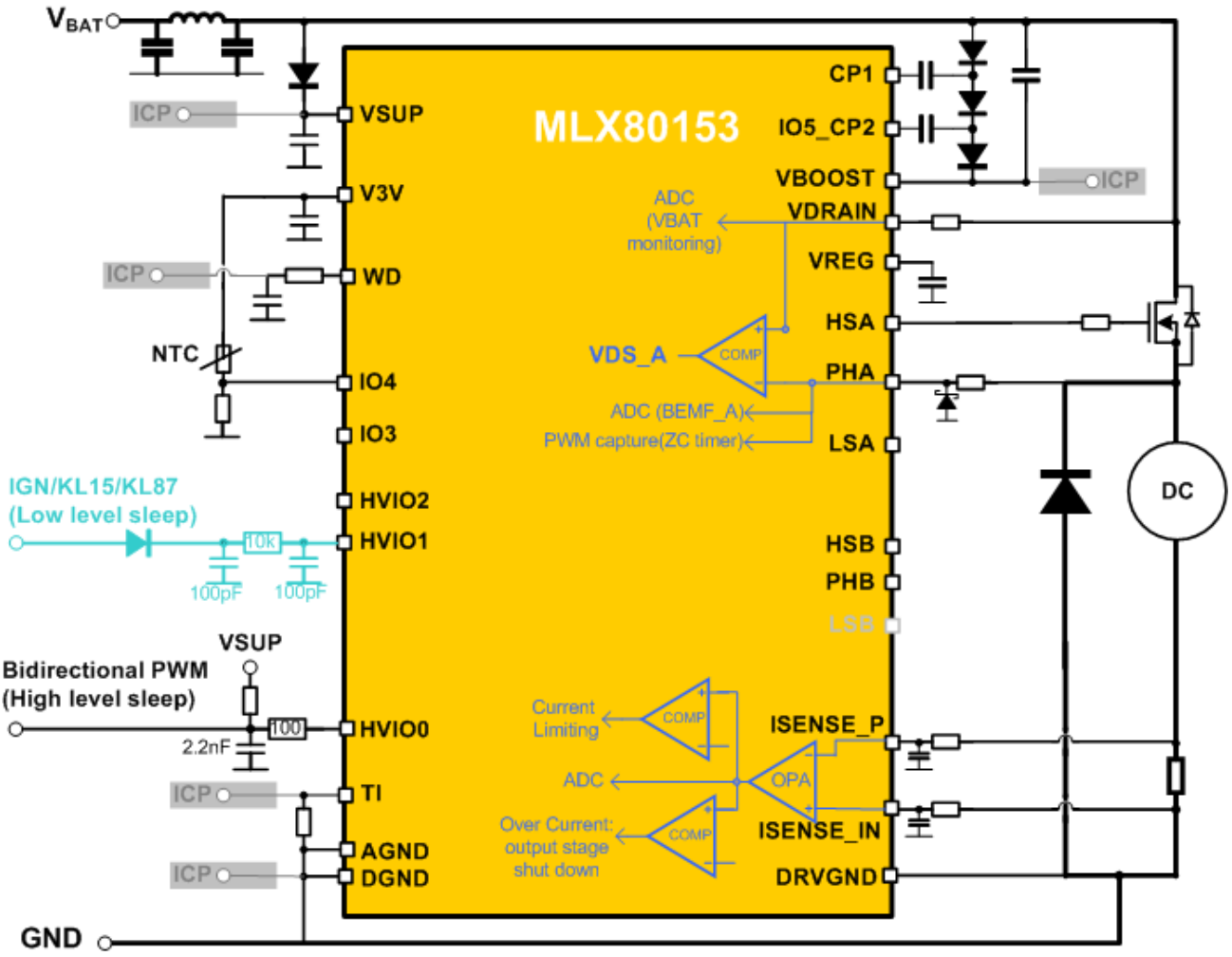
Pin Number	Pin name MLX80153 MLX80154	remarks and description MLX80153
1	HVIO2	High Voltage digital IO (-2V, +Vbat), analog input Wake up capable on rising edge.
2	ISENSE_IN	Current Sense shunt, negative input
3	ISENSE_P	Current Sense shunt, positive input
4	AGND	Analog IC Ground
5	WD	Watchdog input
6	V3V	3.3V regulated supply
7	DGND	Digital IC Ground
8	TI	Test input (connect to GND in application), used for Flash/OTP programming and software debugging
9	n.c.	Not connected
10	VDRAIN	High side VDS monitoring input
11	VBOOST	Charge pump voltage input
12	n.c.	Not connected
13	PHB	Motor phase, (Sink output of HS driver)
14	HSB	High side NFET driver
15	PHA	Motor phase, (Sink output of HS driver)
16	HSA	High side NFET driver
17	VREG	Regulated supply voltage (used to drive NFETs)
18	LSA	Low side NFET driver
19	DRVGND	Ground for IC driver stage
20	CP1	1st stage Charge pump clock output
21	IO5_CP2	2nd stage Charge pump clock output, or Low voltage IO5
22	n.c.	Not connected
23	VSUP	Supply input (reverse polarity protection required)
24	HVIO1	High Voltage digital IO (-2V, +Vbat), analog input Wake up capable on rising edge.
25	HVIO0	High Voltage digital IO (-2V, +Vbat) Wake up capable on falling edge. Applicable for bidirectional communication
26	n.c.	Not connected
27	IO3	Low Voltage digital IO (3.3V), analog input
28	IO4	Low Voltage digital IO (3.3V), analog input

Table 2: Pin out description

7 Application Schematic example

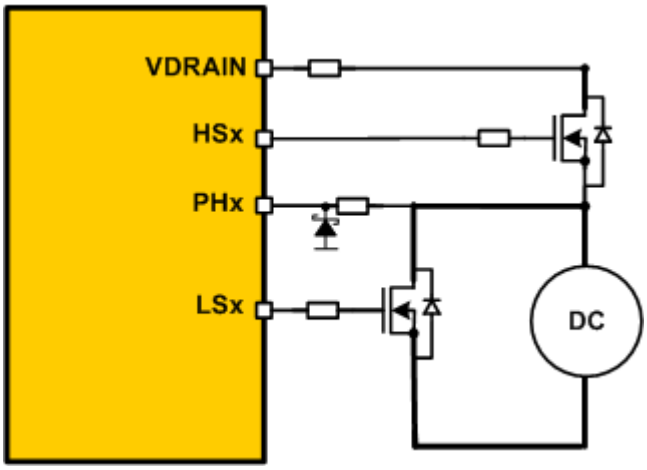
NOTE: *Shown schematics are reference examples that give a realistic indication of typical external components. In actual applications additional components may be required, and component values will have to be revised.*

7.1 Basic pump / fan example



- Double charge pump allows controlling HS NFETs under low battery conditions.
- High side NFET VDS monitoring (programmable voltage levels and blanking time) protects for short circuits to ground.
- Phase voltage (BEMF) can be measured back via the phase pin.
- Applied Motor voltage is measured directly on the FET drains via VDRAIN pin.
- IC can wake up from either a falling or rising edge on one of its High Voltage inputs.

7.2 Freewheeling NFET control for reduced thermal dissipation



Applying a full NFET halfbridge allows extending the power range for thermally limited pcb designs by another 30% compared to designs with freewheeling diode. See below graphs.

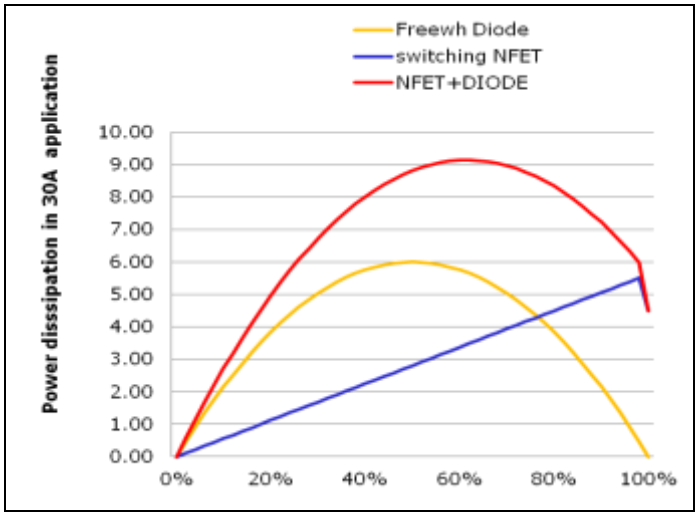


**Fig. 1: Contributions in power dissipation with Freewheeling Diode.
Peak dissipation around 50% duty cycle**

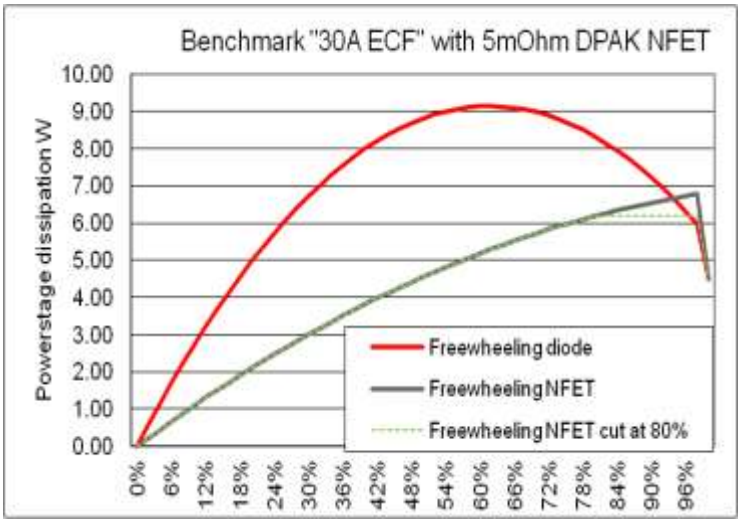


**Fig. 2: Up to 30% lower peak dissipation with Freewheeling NFET.
Peak dissipation at 80% duty cycle**