Motor Driver ICs Faults and Protection

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Pete Millett – Senior Technical Marketing Engineer



2014–Present

- MPS Senior Technical Marketing Engineer for motor driver ICs
- Responsible for new product definitions as well as application engineering

2005-2013

- Systems Engineer and Systems Manager at Texas Instruments
- Product definition and systems engineering for motor driver ICs (DRV8XXX)

1982–2005

• Board-level hardware design engineer at various computer and consumer electronics companies

Motor Drivers – Power Dissipation and PCB Design

DC Motor Basics

Starting, Stopping, and Reversing Motors

Abnormal Stresses – Shorts, Overvoltage

Motor Driver Protection Features

Summary / Q&A



DC Motor Basics





Torque and Current







DC Motor Specs and Ratings



Output Power	15	Watts
Nominal Voltage (V _{SRC})	24	Volts
No Load Speed	4000	RPM
No Load Current	0.11	Amps
Full Load Speed	2920	RPM
Full Load Continuous Torque	50	mNm
Full Load Continuous Current	1	А
Stall Torque	190	nMn
Stall Current	3.6	Amps
Resistance (R _s)	6.7	Ω



Startup of a DC Motor





When speed = 0: I = V_{SRC} / R_S



Managing Startup Current







Stopping the Motor: Coasting



Coast I = 0



Stopping the Motor: Braking





Short Brake $I = V_{SRC} / R_S$





Reverse I = $(V_{BEMF} + V_{SRC}) / R_S$ = ~ 2 * V_{SRC} / R_S



Short Circuits

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Voltage Rise due to Deceleration





Resistive Losses $P_R = I^2 R$







Motor Driver Protection Features: Overcurrent / Short Circuit



False Overcurrent Trips





Motor Driver Protection Features: Over/Under Voltage



Motor Driver Protection Features: Thermal Protection



- Consider the stresses in a motor drive circuit when starting, stopping, and reversing the motor
- Minimize power supply inductance
- Add clamp circuits and large bulk capacitors to mitigate voltage transients
- Be aware of heat dissipated in a motor driver, especially during abnormal conditions



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