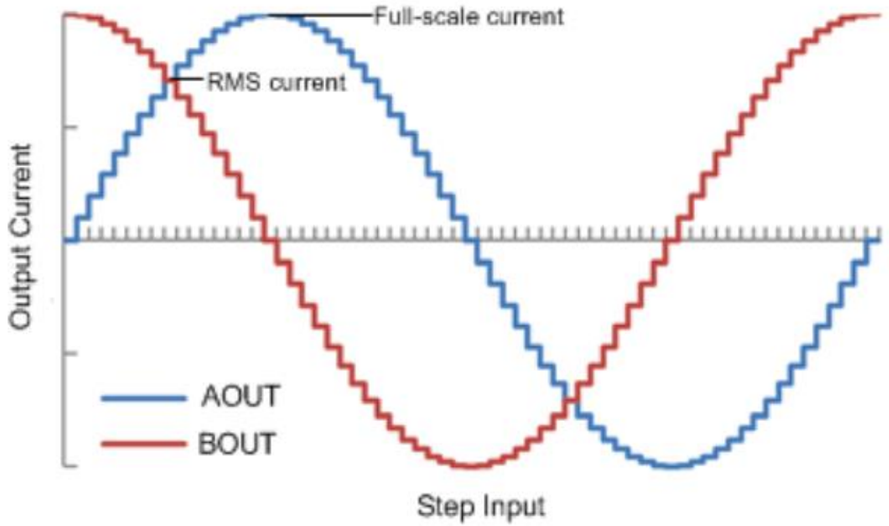
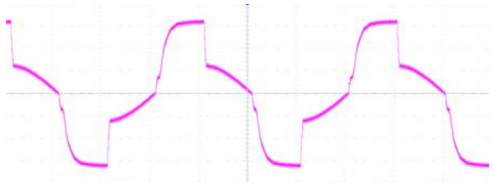
Stepper Motor 6: Smart Tune

TI Precision Labs – Motor Drivers

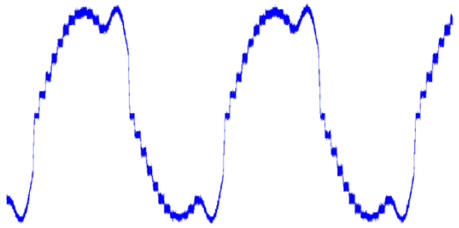
Presented and prepared by Wang Li

Ideal stepper motor winding current

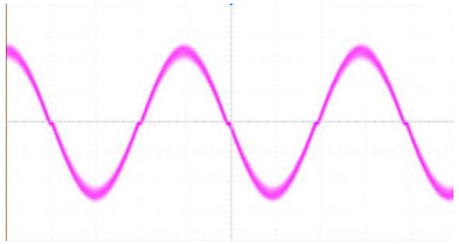




Example 1:
Slow Decay

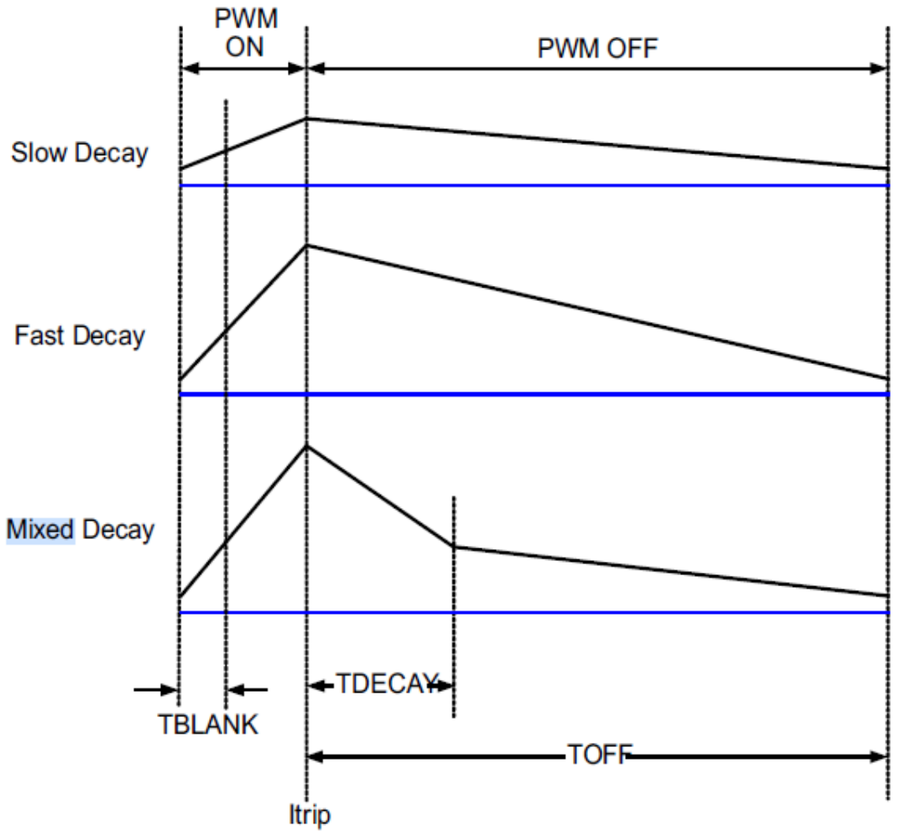


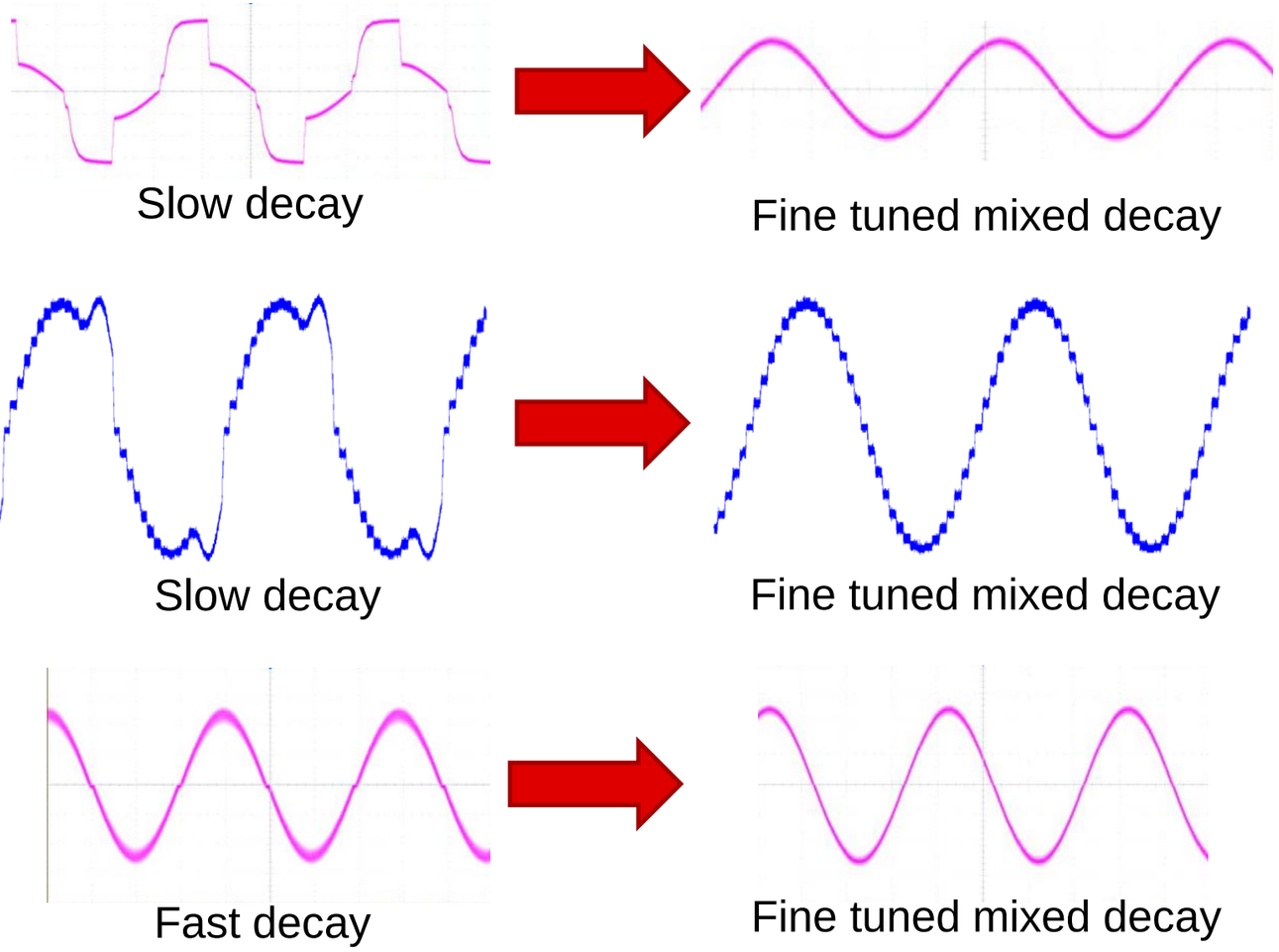
Example 2:
Slow Decay



Example 3:
Fast Decay

Fine-tuned mixed decay

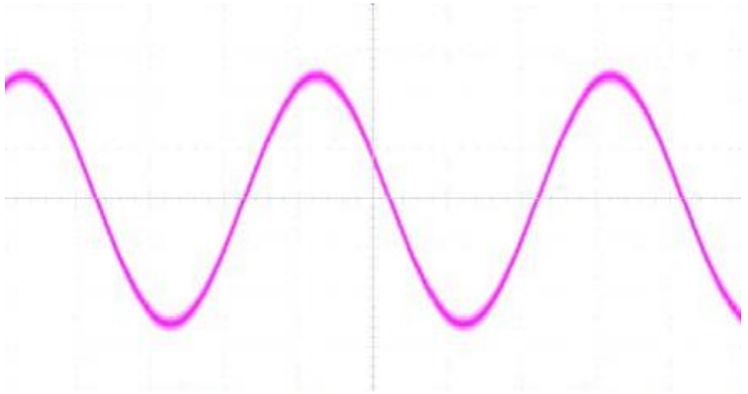




Smart Tune

Automatically optimizes the decay scheme to:

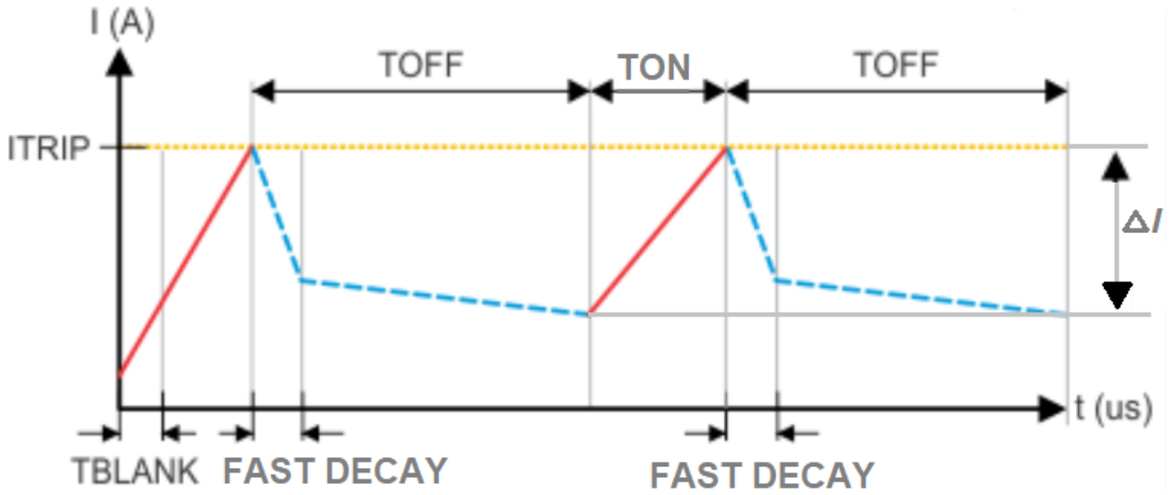
- Increase motor performance
- Maximize efficiency
- Minimize noise and vibration
- Reduce weeks or months of tuning time



Ideal sinusoidal waveform
with smart tune

Smart tune automatically adjust for different supply voltage, load current, motor parameters and step frequency.

Smart Tune: Dynamic Decay

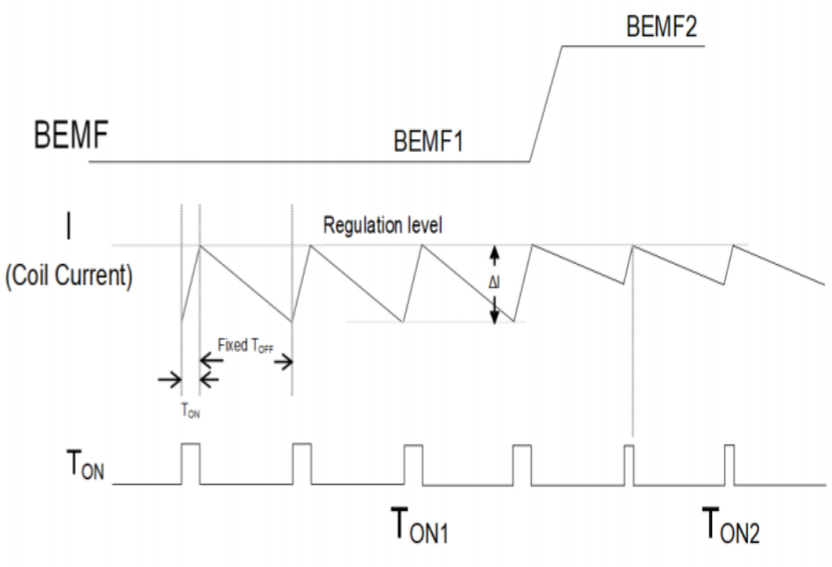


$$\Delta I = \frac{(V_{VM} - V_{BEMF} - I \times (Rds_{on} + R_L + Rsns)) \times TON}{L}$$

Automatically adjusts the fast decay percentage to:

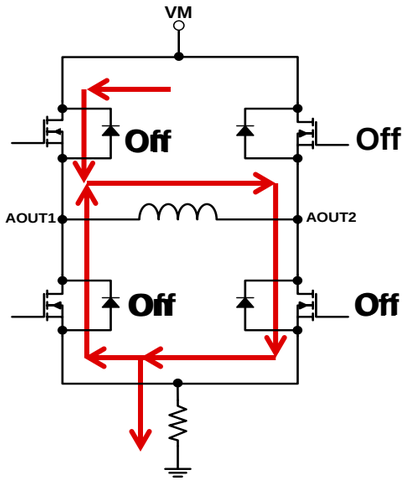
- Keep winding current following the ideal sinusoidal waveform
- Optimize the ripple current
- Avoid audible noise

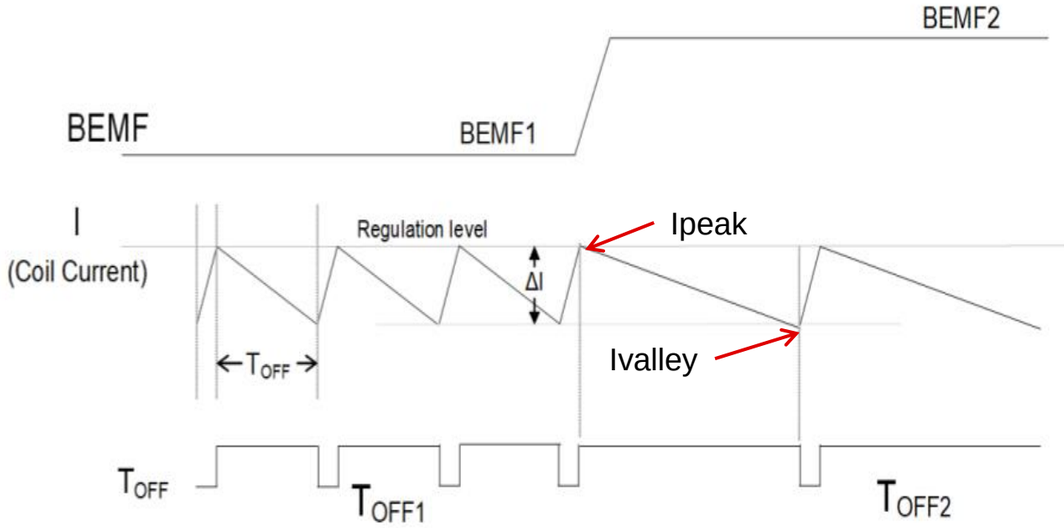
Smart Tune: Ripple Control Decay



Fixed OFF-time Method

(Slow, Fast, Mixed, Smart Tune Dynamic Decay)





Fixed Ripple Current Method

(Smart Tune Ripple Control Decay)

To find more stepper driver technical resources and search products, visit http://www.ti.com/motor-drivers/stepper-driver/overview.html

Reference

1. *DRV8711 Decay Mode Setting Optimization*
2. The Difference Between Slow Decay Mode and Fast Decay Mode in H-Bridge DC Motor Applications
3. Stepper motors made easy with smart tune
4. *Smart tune for quiet and smooth stepper motor operation*
5. *Current Recirculation and Decay Modes*
6. *How smart tune regulates current in stepper motors*
7. Sensorless Stall Detection With the DRV8889-Q1