

# Design Tools

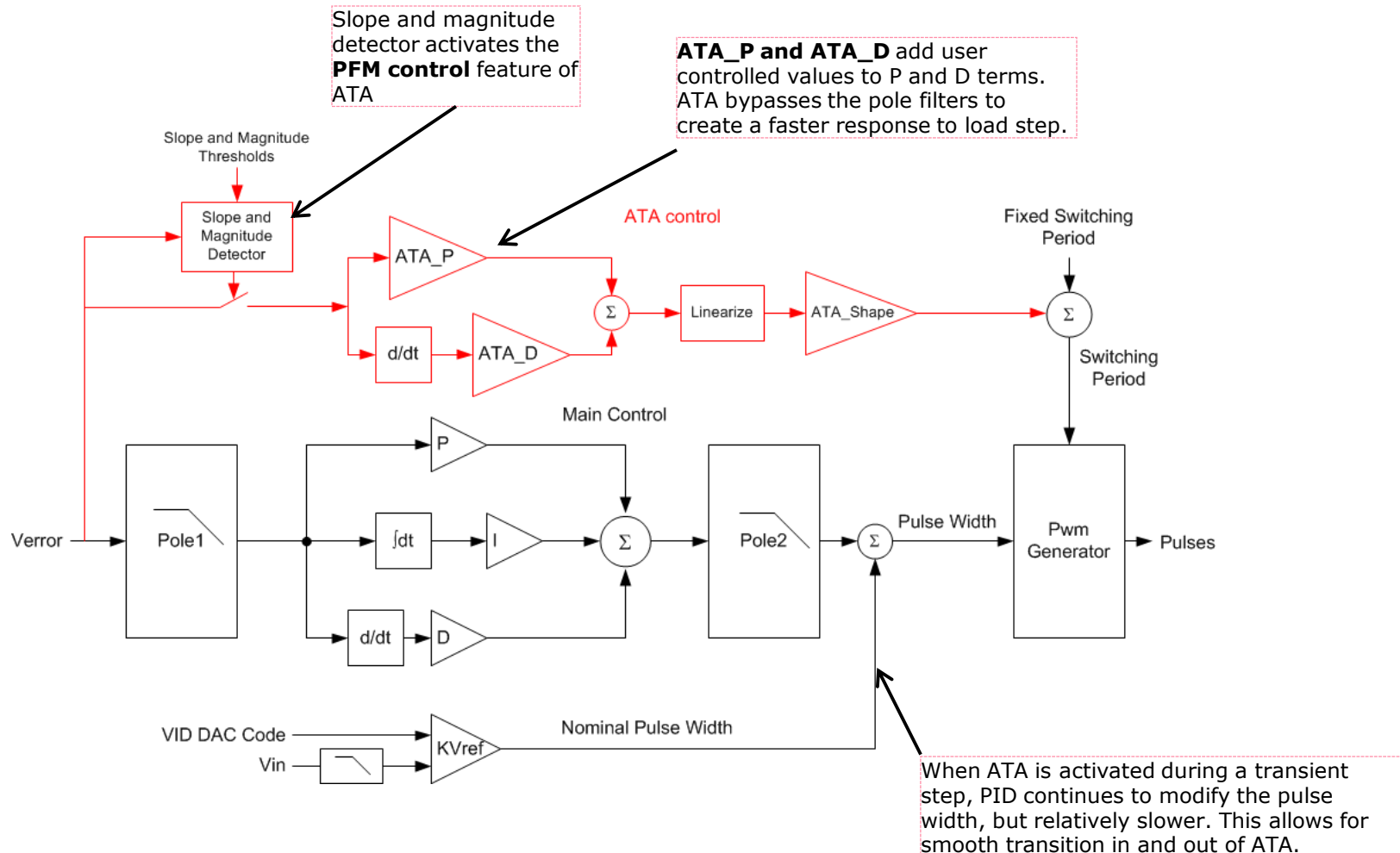
## Transient Settings



### 8. Transient Settings

AC Load, Adaptive Transient Algorithm

Block diagram representing ATA working in parallel with PID control loop.



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## Transient Settings



### 8. Transient Settings

AC Load, Adaptive Transient Algorithm

This tool is used to control the Adaptive Transient Algorithm (ATA), a high speed non-linear control technique to improve transient responses when PID isn't enough.

**Note:** ATA Overshoot and Undershoot controls and operations are independent of each other.

#### Undershoot Threshold

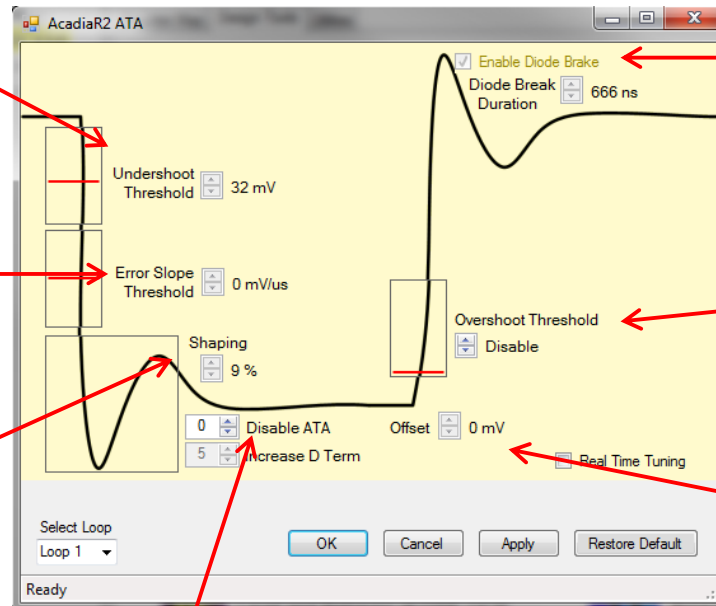
The threshold  $V_{ERR}$  must exceed for the ATA to work and limit the undershoot.

#### Error Slope Threshold

The  $V_{RR}$  slope must exceed this threshold. ATA start working to limit undershoot, when this threshold and undershoot threshold are exceeded.

#### Shaping

Provide additional gain to the ATA P and D terms if required. Only acts when slope is greater than threshold



#### Increase D Term

ATA D term multiplies switching frequency by the slope of  $V_{ERR}$ .

#### Enable Diode Brake

During load release events, the ATA can be programmed to turn off the low-side MOSFET and forces the load current to flow through the FET body diode. This reduces output voltage overshoot during a load release event. User can control maximum duration of diode body break event.

#### Overshoot Threshold

The threshold  $V_{ERR}$  must exceed for the ATA to work and limit overshoot. Can be independent of undershoot control

#### Offset

Temporary offset added to  $V_{out}$  following a positive load step event. Can be used when the application wants to **avoid undershoot**, but can **handle high overshoot**.

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The same functions from this tool can also be programmed in the I2C command tree list.

In Loop 1 and Loop 2 section, under **ATA Overshoot** and **ATA Undershoot** can be controlled independently

Indicate slope threshold when ATA will start working to limit under shoot

Indicate **voltage undershoot threshold** when ATA will start working to limit under shoot

**Shape Term** adds further gain to the P and D term. Only acts when slope is greater than threshold

Controls **ATA P term** value and whether **ATA Undershoot** is enabled or disabled(0).

Controls additional **offset voltage** during load oscillation.

Indicate **slope threshold** when ATA will start working to limit under shoot

The screenshot shows the 'Transient Settings' tool interface. It has a central tree view with tabs for 'Common', 'Loop 1', and 'Loop 2'. The 'Common' tab is selected, showing a tree structure with 'ATA Overshoot' and 'ATA Undershoot' sections. Arrows point from these sections to various parameter input fields on the left and right sides of the interface. The left side fields include 'fc\_d' (40), 'fc\_hth' (32 mV), 'fc\_shape' (9%), 'fc\_p' (ATA disabled), 'v\_lift' (0 mV), and 'fc\_slope\_th' (0 mV). The right side fields include 'db\_duration' (666 ns), 'err\_th' (Disable), 'diode\_brake' (Enable), 'always\_allow\_bbrk' (Do not allow body braking), and 'bbrk\_freq\_th' (69 kHz). Each field has a 'Read' and 'Write' button.

Set Body Brake max duration.

Set **ATA Overshoot threshold** or disable(0) it.

Enable(1) or disable(0) diode body brake. This function is ANDed with **ATA Overshoot threshold**. It will not operate unless ATA overshoot is enabled as well

**Always allow body braking** regardless of transient load oscillation frequency

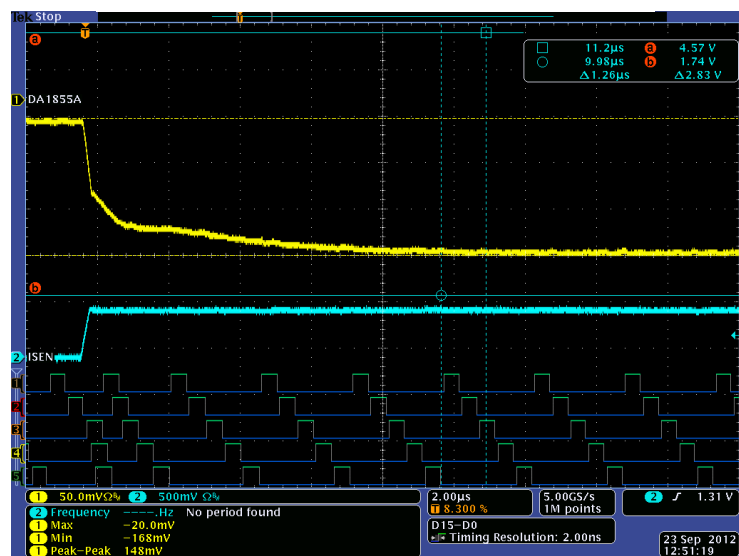
Indicate the max **transient load oscillation frequency** threshold, which body braking is allowed to operate under.

## Recommendations for Tuning ATA

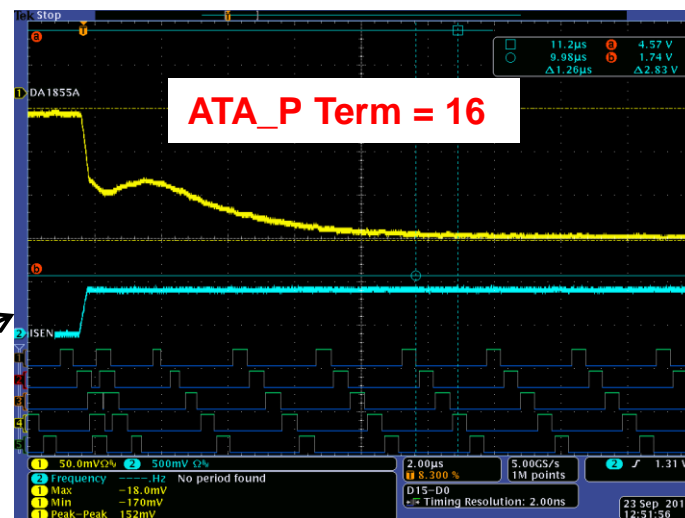
- › Before ATA tuning, correctly tune the PID and check the output cap is capable of meeting the required LL.
- › Start with setting high thresholds and decrease them until the ATA triggers at the smallest desired load step.
- › Set ATA **error slope threshold** low to have a more reliable triggering of the ATA.
- › Increase ATA\_P, ATA\_D, and Shape term to reduce undershoot. The D term has less effect because it is based on the slope of V\_ERR and the slope is reduced to 0 quickly due to the nature of transient load step.
- › ATA\_P and ATA\_D terms adds to the PID P and D terms, so when changing PID P and D terms, remember to change ATA\_P and ATA\_D in the opposite same amount to maintain the same non-linear response.
- › Diode Brake is usually disabled.

# ATA\_P Term – Normal vs Too Much/Little

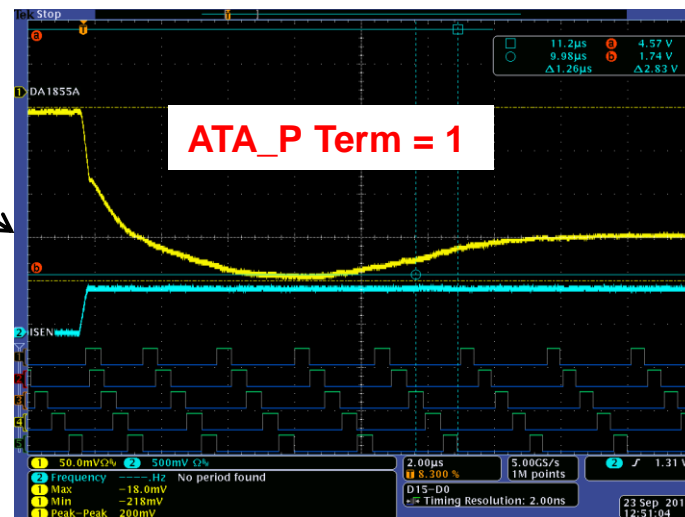
**ATA\_P Term = 6**



**ATA\_P Term = 16**

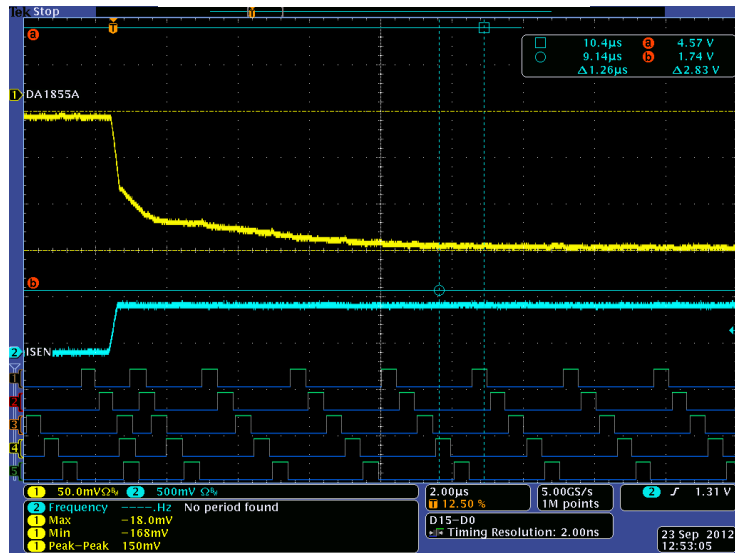


**ATA\_P Term = 1**

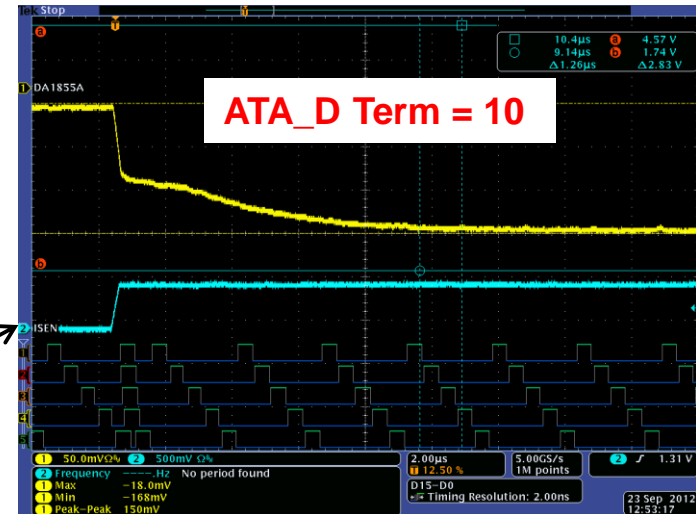


# ATA\_D Term – Normal vs Too Much/Little

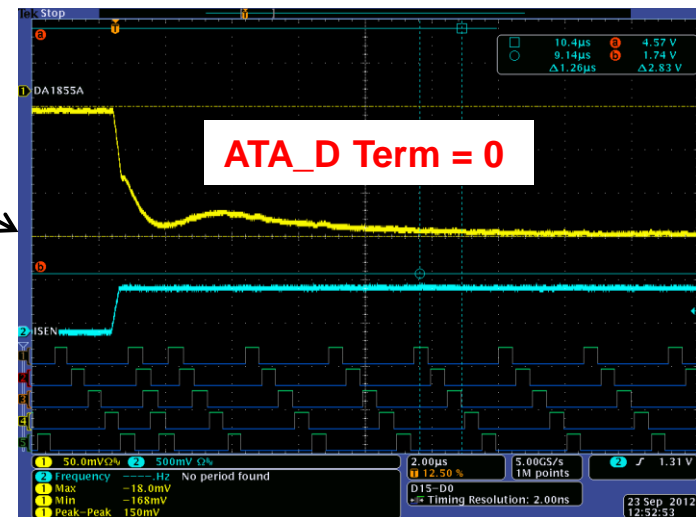
**ATA\_D Term = 5**



**ATA\_D Term = 10**

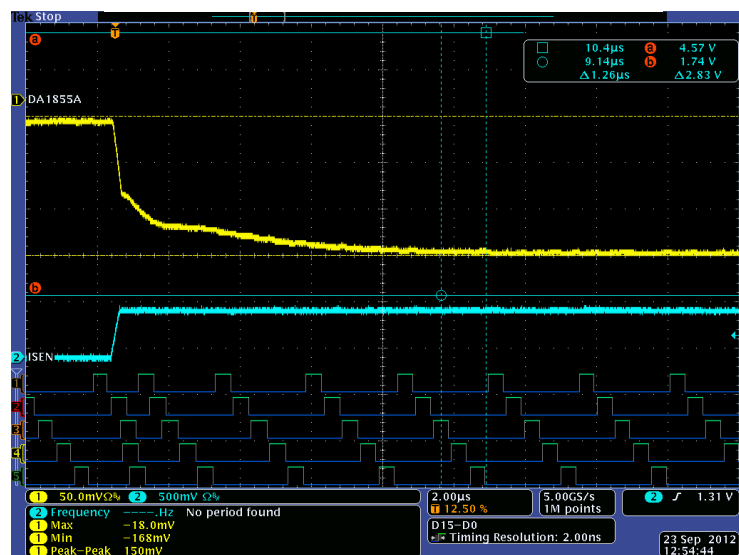


**ATA\_D Term = 0**

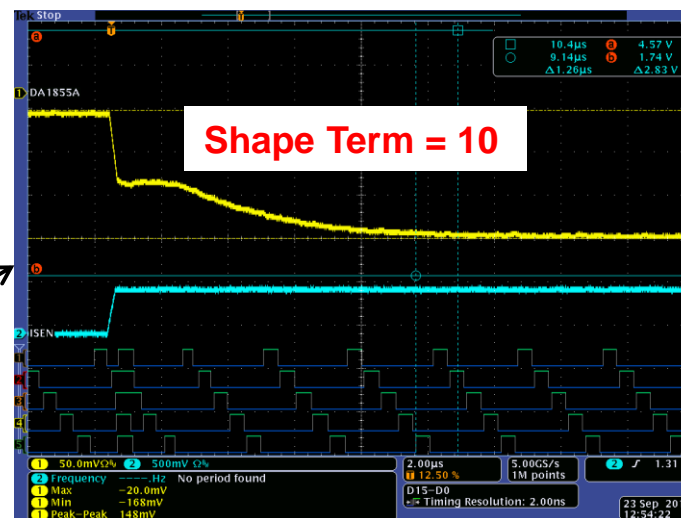


# Shape Term – Normal vs Too Much/Little

**Shape Term = 5**



**Shape Term = 10**



**Shape Term = 0**

