SHARK
PLUGS

ENGINEERING EDITION / VERSION 1.0

SHARK DISTORTION

Eight nonlinear engines. One controlled destruction system.

DESIGN INTENT

Move from subtle harmonic density to broken, aggressive texture without losing control of tone, dynamics, level or translation.

DOCUMENT MAP

From first saturation to technical verification

Written for producers, mix engineers, mastering engineers and sound designers who want an immediate workflow and a precise model of the processing.

ENGINEERING PRINCIPLE Distortion should be judged at equal loudness, in the mix, and at the intended playback level. More level is not the same as more character.

01 / OPERATING CONCEPT

A distortion instrument, not one clipping curve

Shark Distortion separates drive, nonlinear character, tone, dynamics and blend so intensity can be shaped without surrendering control.

WHAT CHANGES

The selected engine reshapes instantaneous amplitude. Drive establishes operating intensity; Strength and Character alter the severity and topology of that reshaping.

WHAT STAYS CONTROLLABLE

Low Cut, Tilt, High Cut, Tone, Dynamics and Mix let the nonlinear result sit inside a production rather than merely sound exciting in solo.

PARALLEL BY DESIGN

Drive Mix blends latency-aligned dry and processed signals. This supports vocal grit, drum punishment and bass density without forcing full replacement.

TRANSLATION FIRST

Gain Match, Delta, internal Bypass and level meters expose whether a decision survives equal-level comparison and downstream processing.

ENGINEER NOTE The most useful distortion setting is often the one whose harmonics remain audible after its apparent loudness advantage is removed.

Where level becomes timbre

The dry reference is captured after Input Trim. The wet path is filtered, dynamically modulated, oversampled, shaped and filtered again before mixing.

STAGE	FUNCTION	ENGINEERING CONSEQUENCE
Input -24 to +24 dB	Sets level feeding both dry reference and wet chain.	It is a true input trim; low values do not secretly disable distortion.
Drive 0-100	Adds up to 30 dB pre-shape drive; Punish uses up to 40 dB.	The engine sees x * 10^(G/20), so small upper-range moves can be dramatic.
Level -24 to +24 dB	Wet-path level before blend and Delta.	Use to balance the engine; it is included in the difference signal.
Output -24 to +24 dB	Final delivery trim after blend or Delta.	Use for host-chain level, not to disguise an overdriven wet path.

LEVEL DISCIPLINE

Set Input for operating headroom, Drive for harmonic intensity, Level for wet balance, and Output for delivery. Each control solves a different problem.

03 / MAIN CONTROLS

The central drive field

Drive and Drive Mix establish the amount. Four Facet to Taste then changes weight, spectral contour, severity and asymmetry around the chosen engine.

CONTROL	PRIMARY ACTION	WATCH FOR
Drive	Exponential pre-shape gain.	Fast loudness growth and increasingly dense upper harmonics.
Drive Mix	Linear dry/wet interpolation.	At partial blend, phase alignment depends on oversampling latency compensation.
Fat	Adds a restrained low-order tanh body term before the engine.	Too much can cloud bass-heavy sources.
Tone	Adds or subtracts a one-pole-derived high component.	High settings emphasize edge; low settings darken the drive.
Strength	Scales engine severity; particularly important in Warm, Punish and Destroy.	Its audible range depends on the engine.
Character	Introduces asymmetry and controls quantization/fold/hold behavior.	Higher values can add DC-like imbalance, grit or instability by design.

Shape what enters the nonlinearity

Tone Shaper and Dynamics determine which energy receives distortion and how transient structure changes the instantaneous drive.

CONTROL	RANGE / MODEL	USE
Low Cut	20-1000 Hz, 2nd-order high-pass, Q=0.7071	Remove sub energy before it consumes nonlinear headroom.
Tilt	-12 to +12 dB; shelves at 650 Hz and 3.2 kHz	Rotate weight between low and high bands before clipping.
High Cut	1-22 kHz, 2nd-order low-pass, Q=0.7071	Control post-engine fizz and alias-prone brightness.
Attack	0.1-100 ms envelope coefficient	Sets how quickly transient-sensitive modulation reacts.
Release	10-1000 ms envelope coefficient	Sets recovery and density between hits.
Dynamics	0-100% modulation depth	Scales transient enhancement or suppression.
Clean / Punch / Crush	No modulation / positive transient / negative transient	Preserve, emphasize, or flatten the front edge.

CONTROL ORDER	Filter unwanted extremes, set engine and Drive, tune Strength/Character, then use Dynamics to shape motion. Finish with post-engine High Cut and level.

From warmth to punishment

Each engine is a distinct transfer family, not a cosmetic preset. Equations below are simplified to expose the intent; x denotes the driven sample.

WARM

y = tanh[x(1.2 + 0.8s)] / (1 + 0.18s) Rounded saturation with controlled gain growth.

TAPE

y = 0.72 tanh(1.45x) + 0.28 y[n-1] Soft clipping with short memory and smoothed edges.

TUBE

y = 0.64 tanh(1.7x) + 0.36(1-e^(-2.2|x|))sgn(x) Blended saturation with strong low-order density.

CONSOLE

y = clip(x - 0.16x^3) + 0.08 sin(3x) Cubic softening with a restrained harmonic ripple.

LISTENING MAP

Warm rounds; Tape smooths; Tube thickens; Console adds forward nonlinear polish. Begin with these when the source must remain recognizable.

Break it on purpose

The final four engines move from severe saturation into quantization, folding and hybrid destruction.

PUNISH

y = tanh[x(3.5 + 5s)] High-drive saturation. Dynamics modulation is reduced internally to limit pumping.

CRUSH

y = round(clip(x)q) / q, q = 32 - 27c Bit-depth style quantization; Character reduces the step count.

FOLD

Triangular foldback over a four-unit period Reflects peaks back into range, creating complex non-monotonic harmonics.

DESTROY

clip + fold + quantize + sample hold + growl Hybrid topology: hot drive, foldback, bit reduction, short hold and a sinusoidally perturbed tanh growl.

LEVEL CALIBRATION	Punish includes -4 dB engine trim; Crush includes +2 dB. These offsets improve browsing consistency but do not replace Gain Match.

Distortion that follows the envelope

An attack/release envelope estimates recent magnitude. The difference between instantaneous magnitude and envelope becomes a transient control signal.

$$e[n] = a\, e[n-1] + (1-a)|x[n]|$$

$$t[n] = \mathrm{clamp}(|x[n]| - e[n], -0.75, 0.75)$$

$$x'[n] = x[n]\, G_{drive}\, (1 + m\, t[n]) + FatTerm$$

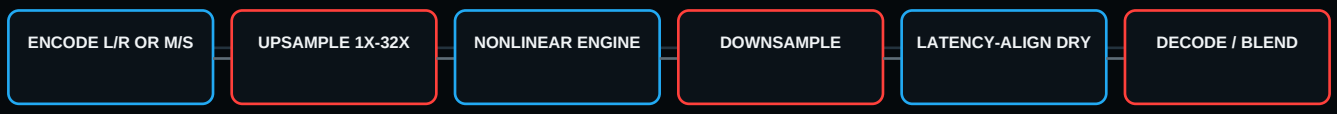
MODE	MODULATION	AUDIBLE RESULT
Clean	m = 0	Static drive; envelope has no effect.
Punch	m = +2.2 Dynamics	Attacks receive more instantaneous drive.
Crush	m = -2.2 Dynamics	Attacks receive less relative drive, increasing density.
Punish safety	m is multiplied by 0.55	Reduces overreaction and audible pumping in the hottest engine.

TIME CONSTANTS

$a = \exp[-1/(F_s\, T)]$. Short Attack follows peaks quickly; long Release retains envelope memory and can make the distortion feel denser.

Nonlinearity at a higher sample rate

The engine can run from 1x to 32x using half-band polyphase IIR stages. The dry path is delayed by the reported oversampler latency before parallel blending.



STEREO

Left and right are processed independently. Use for conventional channel-domain distortion and predictable panning.

MID / SIDE

M=(L+R)/sqrt(2), S=(L-R)/sqrt(2). Both components are processed, then decoded.

WHY OVERSAMPLE

Nonlinear harmonics can exceed Nyquist and fold into the audible band. A higher internal Fs raises the folding boundary and enables filtered decimation.

COST

Higher factors increase CPU and latency. Use 2x-4x while shaping; verify 8x or higher for exposed bright distortion when the host budget permits.

QUALITY SELECTOR In v1.0, Oversampling is the active nonlinear sample-rate control. Quality selections are stored with the state as workflow profiles.

Make the decision honest and repeatable

The toolbar is part of the engineering workflow: state comparison, reversible edits, preset navigation and user-preset exchange are all available without leaving the plugin.

TOOL	ACTION	BEST PRACTICE
A/B	Stores two complete working states.	Keep A conservative and B aggressive; compare in context.
Undo / Redo	Moves through parameter edit history.	Use after multi-control experiments rather than guessing the old state.
History arrows	Navigate complete snapshots.	Useful for broader state changes and preset exploration.
Preset arrows	Previous/next preset.	Browse at equal input level with Gain Match enabled.
Save	Names and stores a custom preset.	Use descriptive source + intention names.
Menu	Import or export user preset files.	Exchange settings or archive session-critical sounds.
Themes	Click logo: red, purple, gold, blue.	Visual only; no audio parameter changes.

Starting points that invite listening

Values are directional ranges, not recipes. Begin in context, enable Gain Match, and choose the engine before fine-tuning the four facets.

SOURCE	STARTING DIRECTION	ENGINEER CHECK
Lead vocal	Warm/Tube; Drive 20-45; Mix 15-45; Punch modest	Consonants remain clear; Delta contains grit, not the whole vocal.
Drum bus	Tape/Console/Punish; Drive 25-60; Mix 20-70	Kick level and snare transient survive equal-level bypass.
Bass	Warm/Tube/Fold; Drive 20-55; Fat 45-75	Fundamental remains stable on small speakers.
Electric guitar	Console/Tube/Crush; Drive 35-75; Mix 60-100	Pick definition survives High Cut and mix context.
Synth	Tape/Fold/Destroy; Character 40-85	Stereo image stays intentional in M/S and mono.
Mix bus	Tape/Console; Drive 5-25; Mix 50-100	Preference survives a low-volume gain-matched check.

06 / AGGRESSIVE WORKFLOW

Build violence without losing the record

Punish and Destroy can sound enormous quickly. The sequence below preserves intent while exposing level, pumping and spectral problems.

1. Choose the engine at Drive 25-35 and Mix 100%.
2. Set Strength and Character while listening to the wet path.
3. Use Attack/Release and Punch or Crush to shape movement.
4. Trim High Cut until fizz supports rather than masks the source.
5. Set Level, enable Gain Match, then compare in the arrangement.
6. Use Delta to hear only w-d; lower Mix for parallel integration.
7. Increase oversampling and re-check transients, CPU and latency.

FAILURE SIGN	If the effect sounds smaller after Gain Match, the setting may be relying on level. Reduce Drive or Dynamics, restore tone, and rebuild.

The compact model

The implementation is a cascade of linear conditioning, level-dependent modulation, memoryless or short-memory nonlinearity, and a latency-aligned parallel mix.

INPUT	`x0[n] = x[n] 10^(Gin/20)`
DRIVE	`xd[n] = Fpre{x0[n]} 10^(30d/20) (1 + m t[n]) + 0.12 f tanh(0.6x)`
ASYMMETRY	`xa = xd + 0.32(c - 0.5) xd^2`
ENGINE	`w0[n] = Phi_engine(xa[n], s, c)`
WET LEVEL	`w[n] = Fpost{w0[n]} Cengine 10^(Glevel/20)`
MIX	`y[n] = (1-mix)d[n] + mix w[n]`
DELTA	`ydelta[n] = w[n] - d[n]`
OUTPUT	`z[n] = y[n] 10^(Gout/20)`

NOTATION d is normalized Drive, f is Fat, s is Strength, c is Character, m is dynamics modulation, and Phi is the selected nonlinear transfer.

07 / MEASUREMENT

A disciplined verification pass

Measurement should answer a listening question. Distortion changes crest factor, bandwidth, peak density and spectrum even when average level appears stable.

CHECK	METHOD	PASS CONDITION
Loudness	Enable Gain Match; compare several passages.	Preference remains without the level advantage.
Delta	Listen to w-d at the chosen Level.	Removed/added content matches the intended color.
Spectrum	Compare harmonic slope and high-frequency foldback.	Added brightness is musical, not detached alias hash.
True peak	Inspect downstream peak meter/limiter.	No accidental overload or excessive limiter action.
Mono / M-S	Check mono and monitor Mid and Side roles.	Center and low-end identity remain intentional.
CPU / latency	Change oversampling while monitoring the host.	Production setting fits the session and recalls correctly.
Low level	Monitor quietly in context.	The effect improves tone, not only apparent excitement.

Troubleshooting and specifications

Return to a simple, gain-matched state when a setting becomes confusing. Rebuild one decision at a time.

SYMPTOM	LIKELY CAUSE	MOVE
Pumping	Dynamics depth or release too active.	Reduce Dynamics; try Clean; shorten release; compare Punish carefully.
Harsh top	Too much driven high energy or low oversampling.	Lower Tone/High Cut; raise oversampling for final verification.
Thin parallel blend	Dry/wet interaction or destructive engine topology.	Check Mix at 100%, then blend; compare Stereo and M/S.
Delta sounds clean	Wet and dry are too similar or Level is low.	Raise Drive/Strength; verify Delta is w-d, not bypass.
Preset is louder	Gain Match disabled or Level/Output differs.	Enable Gain Match; reset Output; compare sustained passages.
CPU rises	High oversampling factor.	Use 2x-4x while working; reserve higher factors for render.

REFERENCE

Stereo AU / VST3 | Input, Level and Output: -24 to +24 dB | Low Cut: 20-1000 Hz | High Cut: 1-22 kHz | Attack: 0.1-100 ms | Release: 10-1000 ms | Oversampling: 1x-32x | 100 factory presets | User save/import/export | Resizable 3:2 interface | Red, purple, gold and blue themes

Support: support@sharkplugs.com Website: sharkplugs.com

RESET METHOD	Warm, Drive 20, Mix 100, facets near center, filters open, Dynamics Clean, Gain Match on, Stereo, Delta off. Then rebuild.