



## **GUIDELINES FOR GEFORCE RTX TECHNOLOGIES**

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## NVIDIA DLSS 4

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[NVIDIA DLSS](#) is a neural graphics technology that multiplies performance using AI to create entirely new frames, display higher resolution through image reconstruction, and improve the image quality of intensive ray-traced content—all while delivering best-in-class image quality and responsiveness.

DLSS 4 is a suite of technologies comprised of DLSS Multi Frame Generation, DLSS Frame Generation, DLSS Super Resolution, DLSS Ray Reconstruction, NVIDIA DLAA, NVIDIA Reflex Low Latency, and NVIDIA Reflex Frame Warp and delivers boosted frame rates, great responsiveness, and better than native IQ. To deliver this intended gaming experience, it is important for users to be able to easily toggle all components of DLSS with one global switch.

- **DLSS Multi Frame Generation** uses AI to boost frame rates by generating up to 3 additional high-quality frames, all while optimizing responsiveness with [NVIDIA Reflex](#). DLSS Multi Frame Generation is available for GeForce RTX 50 Series GPUs.
- **DLSS Frame Generation** uses AI to boost frame rates by generating one additional high-quality frame, all while optimizing responsiveness with [NVIDIA Reflex](#). DLSS Frame Generation requires a GeForce RTX 40 Series GPU or higher and a Reflex SDK integration.
- **DLSS Super Resolution** boosts frame rates by rendering fewer pixels and using AI to reconstruct high resolution frames. This feature is available for all RTX GPUs.
- **DLSS Ray Reconstruction** uses AI to enhance image quality and generate additional pixels for intensive ray-traced scenes. Ray Reconstruction replaces hand-tuned denoisers with an NVIDIA supercomputer-trained AI network that generates higher-quality pixels in between sampled rays. This feature is available for all RTX GPUs and requires Super Resolution to be enabled.
- **NVIDIA DLAA** maximizes image quality through an AI-based anti-aliasing technique. DLAA uses the same Super Resolution technology developed for DLSS, reconstructing a native resolution image to maximize image quality. This feature is available for all RTX GPUs.
- **NVIDIA Reflex** helps DLSS Multi Frame Generation and Frame Generation achieve maximum performance at the lowest latency. It accomplishes this by synchronizing the CPU frame submission with GPU processing for just in time rendering.

## UI Tooltip or Setting Description

- **NVIDIA DLSS:** NVIDIA DLSS uses AI to boost frame rates while maintaining great image quality and responsiveness. This feature requires a GeForce RTX graphics card.
  - **Frame Generation:** Frame Generation boosts frame rates by using AI to render additional frames. 2X is supported on a GeForce RTX 40 Series graphics card or higher, while 3x and 4x are supported on a GeForce RTX 50 Series graphics card.
  - **Super Resolution:** Super Resolution boosts frame rates by rendering fewer pixels and using AI to output high resolution frames. This feature requires a GeForce RTX graphics card.
  - **Ray Reconstruction:** Ray Reconstruction enhances image quality by generating high-quality pixels between sampled rays for intensive ray traced content. This feature requires a GeForce RTX graphics card.
  - **DLAA:** DLAA is an AI-based anti-aliasing mode to improve image quality. This feature requires a GeForce RTX graphics card.
- **NVIDIA Reflex Low Latency** - NVIDIA Reflex Low Latency reduces PC latency and increases responsiveness. This feature requires a GeForce graphics card.

- **Frame Warp** - Frame Warp reduces latency and improves the responsiveness for mouse and camera movements by warping frames to reflect the most up to date mouse position. This feature requires a GeForce RTX 50 Series graphics card.

## UI Menu Options

When DLSS Frame Generation is ON, please enable NVIDIA Reflex Low Latency and disable VSYNC.

- DLSS Frame Generation 2x is available for RTX 40 Series RTX graphics cards or higher.
- DLSS Frame Generation 2x, 3x and 4x are available for RTX 50 Series RTX graphics cards.

When DLSS Super Resolution is ON, please disable scaling technologies (Resolution Scaling, NVIDIA Image Scaling), and Anti-Aliasing. DLSS Super Resolution is available for all RTX graphics cards.

### UI: DLSS ON

NVIDIA DLSS				OFF, ON (Default)
Frame Generation				OFF, Auto (Default), 2X, 3X, 4X
Super Resolution				OFF, Auto (Default), Quality, Balanced, Performance, Ultra Performance, Custom, DLAA
Ray Reconstruction				ON, OFF
Sharpness	0			0 (Default), 0 TO 1 (Value dependent on developer choice)
NVIDIA Reflex Low Latency				ON (Default), Boost, OFF (OFF not available if Frame Generation is enabled)
Frame Warp				OFF (Default), ON (Also enables NVIDIA Reflex Low Latency)
NVIDIA Image Scaling				Feature is disabled when DLSS Super Resolution is ON
Sharpness	0			Feature is disabled when DLSS Super Resolution is ON
Anti-Aliasing				Feature is disabled when DLSS Super Resolution is ON
Resolution Scale	100			Feature is disabled when DLSS Super Resolution is ON
VSYNC				Feature is disabled when DLSS Frame Generation is ON

## Developer UI Checklist

- DLSS Feature Support
  - We **strongly** recommend a global DLSS Feature toggle, which enables DLSS Frame Generation, DLSS Super Resolution, Ray Reconstruction, and NVIDIA Reflex Low Latency mode. This is the easiest way for end users to get the targeted performance, image quality, and latency benefits of DLSS.
  - Please make sure NVIDIA DLSS is **disabled** when on unsupported hardware or drivers.
  - Please make sure PCL Markers are always enabled on all vendor GPUs, whether Reflex is toggled on or off. This allows all gamers to accurately measure their PC latency, even on non NVIDIA GPUs.
- DLSS Frame Generation
  - The DLSS mode titled “Auto” should be the first option in the UI after Off and be enabled by default when NVIDIA RTX hardware is detected. For supported RTX GPUs, Auto is set to 2X.
  - DLSS Frame Generation **requires** NVIDIA Reflex Low Latency integration and enablement. Users should not be able to disable NVIDIA Reflex Low Latency when Frame Generation is ON.

- DLSS Frame Generation **requires** Windows OS “Hardware-accelerated GPU Scheduling” and fails to initialize if not enabled. If this occurs, the game should notify the user to enable this feature.
- DLSS Super Resolution
  - The DLSS mode titled “Auto” should be the first option in the UI after Off and be enabled by default when NVIDIA RTX hardware is detected. The Auto mode isn’t itself a true mode and should select the appropriate default mode from the table below depending on the current output resolution.
  - When the UI shows the DLSS modes horizontally or in a left-right scrolling list, the order should be: Off, Auto, Quality, Balanced, Performance, Ultra-Performance, DLAA.
  - When the UI shows the DLSS modes vertically or in an up-down scrolling list, the order should be:
    1. Off
    2. Auto
    3. Quality
    4. Balanced
    5. Performance
    6. Ultra-Performance
    7. DLAA
  - When DLSS Super Resolution is turned on, **make sure the anti-aliasing settings are disabled** (both UI, as itself)
  - When DLSS Super Resolution is turned on, **make sure the resolution scale settings are disabled** (UI disables, the application uses render target size from DLSS optimal settings)
- DLSS Ray Reconstruction
  - The DLSS mode titled “Auto” should be the first option in the UI after Off, and be enabled by default when NVIDIA RTX hardware is detected, DLSS Super Resolution is enabled, and when Ray Tracing content is enabled.
  - **Requires DLSS Super Resolution to be ON.** Disable when Super Resolution is not enabled.
  - Requires Ray Tracing to be ON. Disable when Ray Tracing is not enabled.
- Sharpness Slider
  - Sharpness slider is a requirement for DLSS integration and the preferred integration is NVIDIA Image Scaling (please see below). When sharpness is on for DLSS, make sure other sharpening features are disabled.

## DLSS Multi Frame and DLSS Frame Generation Options

Mode	Description	Resolution Support	GPU Requirements
<b>OFF</b>	Turns DLSS Frame Generation off.	N/A	N/A
<b>AUTO</b>	Dynamically enables Frame Generation to 2X to boost performance.	ALL RESOLUTIONS	RTX 40+ Series RTX GPUs
<b>2X</b>	The total number of frames is doubled, with one rendered and one generated frame.	ALL RESOLUTIONS	RTX 40+ Series RTX GPUs

<b>3X</b>	The total number of frames is tripled, with one rendered and two generated frames.	ALL RESOLUTIONS	RTX 50 Series RTX GPUs
<b>4X</b>	The total number of frames is quadrupled, with one rendered and three generated frames.	ALL RESOLUTIONS	RTX 50 Series RTX GPUs

## DLSS Super Resolution Options

Mode	Description	Resolution Support	GPU Support
<b>OFF</b>	Turns DLSS Super Resolution off.	N/A	N/A
<b>AUTO</b>	Selects the best DLSS Mode for the current output resolution.	ALL RESOLUTIONS	ALL RTX GPUs
<b>QUALITY</b>	Offers higher image quality than balanced mode.	ALL RESOLUTIONS	ALL RTX GPUs
<b>BALANCED</b>	Offers both optimized performance and image quality.	ALL RESOLUTIONS	ALL RTX GPUs
<b>PERFORMANCE</b>	Offers a higher performance boost than balanced mode.	ALL RESOLUTIONS	ALL RTX GPUs
<b>ULTRA PERFORMANCE</b>	Offers the highest performance boost.	ALL RESOLUTIONS	ALL RTX GPUs
<b>DLAA</b>	Recommended placement for DLAA.	ALL RESOLUTIONS	ALL RTX GPUs

These are the recommended DLSS settings based on output resolution. This is automatically set when user sets to 'AUTO'

Default DLSS Mode	Output (Resolution)	Output (Megapixels)
<b>Disabled</b>	Below 1920x1080	Below 2.03
<b>Quality mode</b>	Equal to 1920x1080, equal or below 2560x1440	Up to 3.68
<b>Performance mode</b>	Greater than 2560x1440, equal or below 3840x2160	3.69 - 8.29
<b>Ultra Performance mode</b>	3840x2160 and higher (e.g. 5120x2880 and 7680x4320)	3.69+

## DLSS Ray Reconstruction Options

Mode	Description	Resolution Support	GPU Support
OFF	Turns Ray Reconstruction OFF	N/A	N/A
AUTO	Automatically enables Ray Reconstruction when Ray Tracing is ON, or disables it when Ray Tracing is OFF	ALL RESOLUTIONS	ALL RTX GPUs

## DLSS Super Resolution & Dynamic Resolution Systems

As detailed in the DLSS Programming Guide, DLSS Super Resolution can support dynamically varying input sizes if the renderer has a Dynamic Resolution System (DRS).

If DRS is enabled, the game UI should:

1. Present only two options for DLSS Super Resolution: "Off" and "On"; or
2. If the UI system does not allow the DLSS Super Resolution options to change, disable (hide or gray out) all DLSS Modes and only allow the user to select "Off" or "Auto".

## NVIDIA REFLEX 2

NVIDIA Reflex 2 is an RTX technology which provides both system latency optimization and measurement capabilities, giving players a more responsive experience. It improves the feel of almost any game, and is particularly beneficial in competitive titles where victory can be measured in milliseconds.

NVIDIA Reflex 2 comprises two technologies: NVIDIA Reflex Low Latency Mode, and NVIDIA Reflex Frame Warp.

- **Reflex Low Latency Mode** synchronizes CPU frame submission with GPU processing for just in time rendering to minimize queuing and reduce latency in GPU bound scenarios.
- **Reflex Frame Warp** reduces latency and improves the responsiveness for mouse and camera movements by warping frames to reflect the most up to date mouse position.

We recommend exposing Reflex Low Latency mode in the UI in any game with DLSS Frame Generation.

Whenever DLSS Frame Generation or Multi Frame Generation is enabled, please ensure Reflex Low Latency mode is enabled and can not be set to "Off".

When Reflex Low Latency mode is enabled, Reflex Frame Warp can be toggled to deliver the best responsiveness for mouse and camera movements in 1st and 3rd person games. Actions like moving the camera, viewing the world, and aiming at targets feel best with Reflex Frame Warp. When Reflex Frame Warp is toggled on, please set Reflex Low Latency mode to "On", and ensure it can not be set to "Off".

## UI Tooltip or Setting Description

- **NVIDIA Reflex Low Latency** - *NVIDIA Reflex Low Latency reduces PC latency and increases responsiveness by syncing up the CPU and GPU for more efficient rendering. In Boost mode, NVIDIA Reflex will save slightly more latency and attempt to optimize latency in CPU bound cases. Boost mode can slightly decrease FPS and increase GPU power draw.*
- **NVIDIA Reflex Frame Warp**- *NVIDIA Reflex Frame Warp reduces latency and improves the responsiveness for mouse and camera movements by warping frames to reflect the most up to date mouse position.*

## UI Menu Options

Low Latency Mode - "NVIDIA Reflex Low Latency"

NVIDIA Reflex Low Latency	◀	ON	▶	ON (Default), Boost, OFF (OFF not available if Frame Generation is enabled)
Frame Warp	◀	ON	▶	OFF (Default), ON (Also enables NVIDIA Reflex Low Latency)

General   Display   **Graphics**   Stats

Frame Rate Limiter	<	Unlimited	>
NVIDIA Reflex Low Latency	<	On	>
Overall Graphics Quality	<	Medium	>

Options are Off, On, On + Boost

**Note:** Reflex Low Latency is required for DLSS Frame Generation and Multi Frame Generation, and will automatically turn on when DLSS Frame Generation is enabled. Reflex Low Latency does not currently support other frame generation technologies (e.g. FSR), and should therefore be unavailable when these are enabled.

## NVIDIA Reflex Low Latency Settings Options

Mode	Description	Driver Support	GPU Support
<b>Off</b>	NVIDIA Reflex Low Latency mode is disabled.	N/A	N/A
<b>On</b>	NVIDIA Reflex Low Latency mode is now enabled and optimizes PC latency.	R455+	Maxwell GPUs+ (Pascal+ for VK)
<b>Boost</b>	NVIDIA Reflex Low Latency mode is now enabled and optimizes PC latency. In Boost mode, NVIDIA Reflex will save slightly more latency and attempt to optimize latency in CPU bound cases. This option can slightly decrease FPS and increase GPU power draw.	R455+	Maxwell GPUs+ (Pascal+ for VK)

## NVIDIA Reflex Frame Warp Options

Mode	Description	Driver Support	GPU Support
<b>Off</b>	NVIDIA Reflex Frame Warp is disabled.	R570+	
<b>On</b>	NVIDIA Reflex Frame Warp is enabled. This will reduce latency and improve responsiveness for mouse and camera movements by warping frames to reflect the most up to date mouse position.	R570+	RTX 50 Class GPU (RTX 20+ Class GPU at later date)

**Note:** Reflex Low Latency is required for Reflex Frame Warp, and will automatically turn on when Reflex Frame Warp is enabled.

Reflex Frame Warp is compatible with all RTX GPUs, with availability for RTX 50 Class GPUs at launch. Support for other GPUs is available following launch.

## Developer UI Checklist

- NVIDIA Reflex Frame Warp
  - Reflex Frame Warp requires Reflex Low Latency to be ON. When user turn on Reflex Frame Warp, it also enables Reflex Low Latency

## Settings Defaults

PC Latency is supported for all IHVs and should be enabled **at all times**. No UI setting is required

# NVIDIA IMAGE SCALING

NVIDIA Image Scaling enables developers to complement their NVIDIA DLSS integrations, so they can provide the best image quality with NVIDIA DLSS, and cross-platform support with NVIDIA Image Scaling. NVIDIA Image Scaling offers best-in-class spatial scaling and sharpening and supports all GPUs.

## Naming Guidelines

There is no strict requirement to brand this as an NVIDIA feature. Here are optional recommendations for UI names:

- “NVIDIA Image Scaling”
- “Image Scaling”

## UI Tooltip or Setting Description

- *NVIDIA Image Scaling boosts frame rates using GPU scaling and sharpening.*

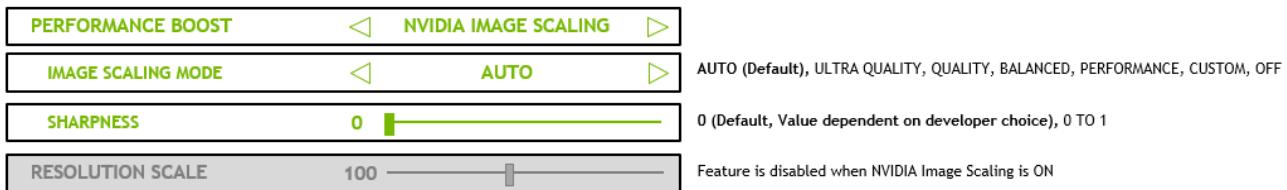
## UI Menu Options

Developers can expose NVIDIA Image Scaling either as a standalone UI element or combined with other performance boosting features (NVIDIA DLSS, etc)

### Standalone UI: NVIDIA Image Scaling



### Combo UI: NVIDIA Image Scaling



## Mode Defaults

These are the default NVIDIA Image Scaling Mode settings based on output resolution:

Quality Preset	Scale Factor	Input Resolution for 2160P Output	Input Resolution for 1440P Output	Input Resolution for 1080P Output
Ultra Quality	77%	2954x1662	1970x1108	1477x831
Quality	66.667%	2560x1440	1706x960	1280x720

<b>Balanced</b>	59%	2259x1271	1506x847	1129x635
<b>Performance</b>	50%	1920x1080	1280x720	960x540
<b>Custom</b>	50%-100%	1920x1080 to 3840x2160	1280x720 to 2560x1440	960x540 to 1920x1080

# RAY TRACING

Ray tracing is the holy grail of gaming graphics, simulating the physical behavior of light. [GeForce RTX graphics cards](#) have dedicated RT Cores to accelerate ray tracing, enabling higher quality and performance.

Additional details on Ray Tracing Best Practices can be found [here](#).

## Ray Tracing: Settings Options

The recommended RT settings are “ON”, “HIGH”, and “ULTRA.” When ray tracing is “ON,” there should be a noticeable image quality difference. Additionally, there should be a very noticeable difference between each quality level, otherwise fewer setting options are appropriate. In the case of path tracing, individual Ray Tracing effects settings such as Shadows or Reflections should be grayed out and a global Ray Tracing setting should be set to “ULTRA”.

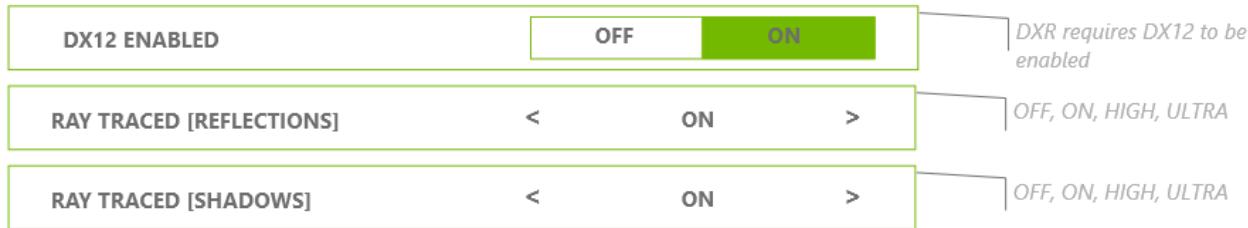
## Ray Tracing: Target Performance

We recommend the following targets for 60 fps average gameplay in your benchmark or areas of the game that are relatively heavy for ray tracing effects.

- **GeForce RTX 4060/3060 Ti:** Ray tracing set to “ON” at 1920x1080 with DLSS enabled
- **GeForce RTX 4070/3080:** Ray tracing set to “HIGH” at 2560x1440 with DLSS enabled
- **GeForce RTX 4080:** Ray tracing set to “ULTRA” at 2560x1440 or 4K with DLSS enabled

## Ray Tracing: Recommended UI

DISPLAY GRAPHICS ADVANCED



## UI Tooltip or Setting Description

- **DXR:** Enable DirectX Raytracing (DXR) for life-like [EFFECT NAME] (i.e., Shadows, Reflections, etc)
- **NON-DXR:** Enable ray tracing for life-like [EFFECT NAME] (i.e., Shadows, Reflections, etc)

## RTX Hair

RTX Hair uses Linear-Swept Spheres (LSS), a GeForce RTX 50 Series GPU-accelerated algorithm for path-traced strand-based hair. RTX Hair reduces the amount of geometry necessary to render strands of hair, and uses spheres/tubes instead of triangles to get a more accurate fit for hair shapes in ray tracing.

Additional details on LSS can be found [here](#).

### RTX Hair: Settings Options

The recommended RTX Hair settings are “**ON**” and “**OFF**”. When RTX Hair “ON”, there should be a noticeable lighting difference on individual strands of hair. RTX Hair requires all RT settings to be enabled.

### RTX Hair: Recommended UI



UI Copy

- **RTX Hair:** More detailed hair with realistic lighting and shadows on GeForce RTX 50 Series GPUs.

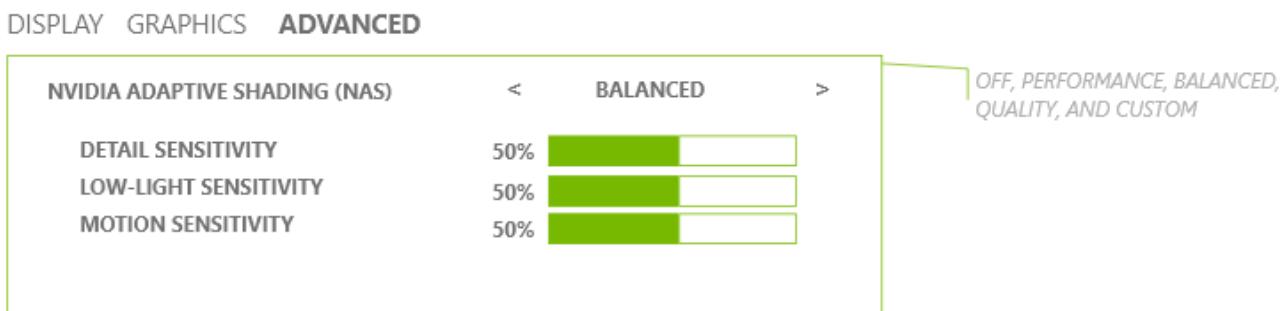
## NVIDIA ADAPTIVE SHADING (NAS)

NVIDIA Adaptive Shading (NAS) boosts performance by selectively lowering pixel shading rate, without affecting perceived image quality. Screen regions without high contrast details or with fast motion speeds are identified and shaded in lower rate, using the Variable Rate Shading (VRS) feature introduced on Turing.

### Game Options

The recommended NAS settings are “**OFF**”, “**BALANCED**”, “**PERFORMANCE**,” and **CUSTOM**.

### UI Options



Notes:

NAS changes to Custom mode when user changes the default settings (Detail sensitivity, low-light sensitivity, and motion sensitivity).

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## UI Copy

- **NVIDIA ADAPTIVE SHADING:** *Boost frame rates by adapting shading rate based on content and motion information. This will disable deferred rendering.*
- **DETAIL SENSITIVITY:** *Shading rate sensitivity to image details*
- **LOW-LIGHT SENSITIVITY:** *Shading rate sensitivity to dark regions*
- **MOTION SENSITIVITY:** *Shading rate sensitivity to motion*

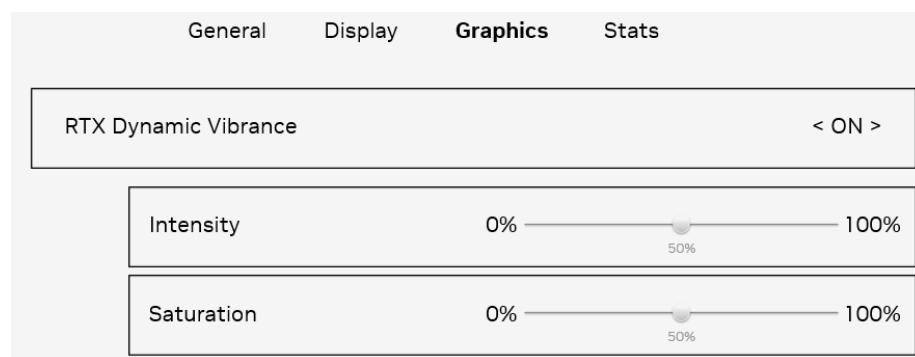
## NVIDIA DYNAMIC VIBRANCE

RTX Dynamic Vibrance SDK is an AI network that transforms color to improve visual clarity, allowing players to better distinguish in-game elements. Dynamic Vibrance adaptively tunes color saturation and contrast depending on the game scene—colors pop more on-screen, and color crushing is minimized. Featuring adjustable intensity and saturation, Dynamic Vibrance provides players with a flexible option to calibrate the game's visual aesthetic to their preference.

### UI Tooltip or Setting Description

- **RTX Dynamic Vibrance** - *RTX Dynamic Vibrance enhances visual clarity by dynamically tuning color saturation and contrast.*

### UI Menu Options



**Note:** Lowering “Intensity” to 0% is equivalent to turning Dynamic Vibrance off, and should therefore gray out the Saturation slider to make it inoperable.

### Settings Options

Mode	Description	Driver Support	GPU Support
OFF	Turns Dynamic Vibrance off	N/A	N/A
ON	Turns Dynamic Vibrance on	r550+	Turing+ (20-series)
INTENSITY	Dictates the strength of the effect, where 100% is strongest, and 0% is equivalent to turning Dynamic Vibrance off.	r550+	Turing+ (20-series)
SATURATION	Dictates the range of colors affected, where 100% is strongest, and 0% is equivalent to no saturation boost.	r550+	Turing+ (20-series)

### Settings Defaults

Dynamic Vibrance “Off” is the recommended default setting. When Dynamic Vibrance is enabled, the default recommended values for both intensity and saturation are 50%.

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