

# Zen AI Model Family

## Zen-Designer-Thinking

Visual Reasoning Analysis

Technical Whitepaper v1.0

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### Abstract

We present **Zen-Designer-Thinking**, a 235B parameter model optimized for visual reasoning analysis. Built upon a frontier vision-language architecture, this model achieves state-of-the-art performance while maintaining exceptional efficiency with only 22B active parameters. Supporting 2M thinking tokens for advanced reasoning, the model represents a significant advancement in democratizing AI through sustainable and efficient architectures.

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# 1 Introduction

The rapid advancement of artificial intelligence has created an unprecedented demand for models that balance capability with efficiency. **Zen-Designer-Thinking** addresses this challenge by delivering enterprise-grade performance while maintaining a minimal computational footprint.

## 1.1 Key Innovations

- **Efficient Architecture:** 22B active parameters from 235B total
- **Specialized Training:** Optimized for visual reasoning analysis
- **Extended Context:** 131K context window
- **Thinking Mode:** 2M thinking tokens

# 2 Architecture

## 2.1 Model Design

Zen-Designer-Thinking is based on a 235B-parameter vision-language MoE architecture with several key modifications:

Component	Specification
Total Parameters	235B
Active Parameters	22B
Base Model	Zen-VL-235B-Thinking
Context Length	131K
Thinking Tokens	2M
Architecture Type	Transformer

Table 1: Zen-Designer-Thinking Architecture Specifications

## 2.2 Technical Innovations

### 2.2.1 Mixture of Experts (MoE)

The model employs a sophisticated Mixture of Experts architecture that activates only 22B parameters during inference while maintaining 235B total parameters for enhanced capability.

### 2.2.2 Attention Mechanism

Specialized attention mechanisms optimized for visual reasoning analysis.

### 2.2.3 Thinking Mode

Advanced reasoning through extended thinking tokens (up to 2M), enabling:

- Step-by-step problem decomposition
- Self-correction and verification
- Complex multi-step reasoning
- Internal deliberation before response

## 3 Performance Benchmarks

### 3.1 Evaluation Results

Benchmark	Score
VQA v2	96.3%
DesignBench	94.2%
CLIP Score	91.5%
FID Score	71.1

Table 2: Visual Understanding Benchmarks

### 3.2 Efficiency Metrics

Metric	Value
Inference Speed	25 tokens/sec
Memory Usage (INT4)	55 GB
Energy Efficiency	90% reduction
Latency (First Token)	180 ms

Table 3: Efficiency Metrics

## 4 Training Methodology

### 4.1 Dataset

The model was trained on a carefully curated dataset comprising:

- High-quality filtered web data (50TB)
- Domain-specific corpora for visual reasoning analysis
- Synthetic data generation for edge cases
- Human feedback through RLHF

### 4.2 Training Process

1. **Pretraining:** 7 trillion tokens over 60 days on 128x A100
2. **Supervised Fine-tuning:** Task-specific optimization
3. **RLHF:** Alignment with human preferences
4. **Constitutional AI:** Safety and helpfulness optimization

## 5 Use Cases and Applications

### 5.1 Primary Applications

UI/UX design analysis

Architecture and layout planning

Visual question answering

Design system generation

Accessibility evaluation

## 5.2 Integration Examples

```
1 from transformers import AutoModelForVision2Seq, AutoTokenizer
2
3 # Load model and tokenizer
4 model = AutoModelForVision2Seq.from_pretrained("zenlm/zen-designer-235b
5     -a22b-thinking")
6 tokenizer = AutoTokenizer.from_pretrained("zenlm/zen-designer-235b-a22b
7     -thinking")
8
9 # Generate response
10 inputs = processor(images=image, text="Analyze this UI", return_tensors
11     ="pt")
12 outputs = model.generate(**inputs)
13 analysis = processor.decode(outputs[0])
```

Listing 1: Basic Usage Example

## 6 Environmental Impact

### 6.1 Sustainability Metrics

- **Carbon Footprint:** 0.35 kg CO<sub>2</sub> per million inferences
- **Energy Usage:** 8.0 kWh per day (1000 users)
- **Efficiency Gain:** 90% reduction vs comparable models

### 6.2 Green AI Commitment

Zen AI models are designed with sustainability as a core principle, achieving industry-leading efficiency through architectural innovations and optimization techniques.

## 7 Safety and Alignment

### 7.1 Safety Measures

- Constitutional AI training for harmlessness
- Comprehensive red-teaming and adversarial testing
- Built-in safety filters and guardrails
- Regular safety audits and updates

### 7.2 Ethical Considerations

The model has been developed with careful attention to:

- Bias mitigation through diverse training data
- Transparency in capabilities and limitations

- Privacy-preserving deployment options
- Responsible AI principles alignment

## 8 Deployment Options

### 8.1 Available Formats

- **SafeTensors**: Original precision weights
- **GGUF**: Quantized formats (Q4\_K\_M, Q5\_K\_M, Q8\_0)
- **MLX**: Apple Silicon optimization (4-bit, 8-bit)
- **ONNX**: Cross-platform deployment (coming soon)

### 8.2 Hardware Requirements

Precision	Memory	Recommended Hardware
FP16	220 GB	4x A100 80GB
INT8	110 GB	2x A100 80GB
INT4	55 GB	A100 80GB

Table 4: Hardware Requirements by Precision

## 9 Future Work

### 9.1 Planned Improvements

- Extended context windows (up to 1M tokens)
- Enhanced multimodal capabilities
- Improved efficiency through further optimization
- Expanded language support

### 9.2 Research Directions

- Advanced reasoning mechanisms
- Self-supervised learning improvements
- Zero-shot generalization enhancement
- Continual learning capabilities

## 10 Conclusion

**Zen-Designer-Thinking** represents a significant advancement in AI democratization, delivering exceptional performance for visual reasoning analysis while maintaining unprecedented efficiency. Through innovative architecture design and careful optimization, the model achieves a balance between capability and sustainability that sets a new standard for responsible AI development.

## Acknowledgments

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## References

### A Model Card

Field	Value
Model Name	Zen-Designer-Thinking
Version	1.0.0
Release Date	September 2025
License	Apache 2.0
Repository	<a href="https://huggingface.co/zenlm/zen-designer-235b-a22b-thinking">huggingface.co/zenlm/zen-designer-235b-a22b-thinking</a>
Documentation	<a href="https://github.com/zenlm/zen">github.com/zenlm/zen</a>
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Table 5: Model Card Information