# Span Stock Screener

Algorithm & Massive API Documentation

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**Version:** 1.0

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**Stack:** Kotlin 2.2 / Spring Boot 4.0 / Massive.com API

**Repository:** github.com/sridharvukkadapu/span

**Live URL:** span-n9xs.onrender.com

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# 1. How It Works

When a user requests a recommendation for a ticker symbol (e.g., AAPL), the system performs the following steps:

- 1. Make 5 API calls to Massive.com to fetch real-time market data

- 2. Extract raw financial fields from the API responses

- 3. Compute derived metrics (margins, P/E, P/S, revenue growth, etc.)

- 4. Run 5 independent screening checks - each produces GREEN, YELLOW, or RED

- 5. Count the greens and reds to determine BUY, SELL, or HOLD

- 6. Assess confidence level based on how unanimous the checks are

- 7. Return the full analysis as JSON (API) or a formatted HTML page (browser)

## Endpoints

```
JSON API:  GET /api/v1/tickers/{symbol}/recommendation
HTML View: GET /view/{symbol}
```

## Caching

All API responses are cached in-memory (ConcurrentHashMap) with a 5-minute TTL. The first request for a ticker takes 2-5 seconds. Subsequent requests within 5 minutes return instantly from cache.

# 2. Massive.com API Calls (5 Total)

The application makes exactly 5 sequential HTTP GET requests to the Massive.com (Polygon.io) REST API. All requests use Bearer token authentication.

## Call 1: Ticker Details

```
GET https://api.massive.com/v3/reference/tickers/{ticker}
```

Returns company metadata. We extract:
  - name: Company name (e.g., 'Apple Inc.')
  - market_cap: Current market capitalization in USD
  - weighted_shares_outstanding: Total shares outstanding

## Call 2: Previous Day Bar

```
GET https://api.massive.com/v2/aggs/ticker/{ticker}/prev
```

Returns the most recent trading day's OHLCV data. We extract:
  - c (close): The closing price - used as the current stock price
  - Also available but not primary: o (open), h (high), l (low), v (volume)

## Call 3: Quarterly Financials (8 Quarters)

```
GET https://api.massive.com/vX/reference/financials
    ?ticker={ticker}&timeframe=quarterly&limit=8
```

Returns 8 quarters of financial statements (income statement, balance sheet, and cash flow statement). This is the most data-rich call.

Why 8 quarters? We split them into:
  - Recent 4 quarters: Used for TTM (trailing 12 months) metrics and margins
  - Prior 4 quarters: Used for Year-over-Year revenue growth comparison

This eliminates the need for a separate annual financials API call.

Fields extracted from INCOME STATEMENT:

| API Field | Used For |
|---|---|
| revenues | TTM revenue, gross margin denominator, P/S ratio |
| gross_profit | Gross margin calculation |
| operating_income_loss | Operating margin calculation |
| net_income_loss | Profit margin, EPS calculation |

Fields extracted from BALANCE SHEET:

| API Field | Used For |
|---|---|
| other_current_assets | Cash & short-term investments proxy |

| long_term_debt | Long-term debt for Cash/Debt ratio |
| current_liabilities | Short-term debt component |

Fields extracted from CASH FLOW STATEMENT:

| API Field | Used For |
|---|---|
| net_cash_flow_from_operating_activities | Operating cash flow for FCF |
| net_cash_flow_from_investing_activities | CapEx proxy for FCF |

## Call 4: 50-Day Simple Moving Average (SMA)

```
GET https://api.massive.com/v1/indicators/sma/{ticker}
    ?timespan=day&window=50&limit=1
```

Returns the current 50-day Simple Moving Average. We extract:
  - results.values[0].value: The SMA50 price level


Used in the Technicals check to determine if the stock price is trending above or below its 50-day average.

## Call 5: 14-Day Relative Strength Index (RSI)

```
GET https://api.massive.com/v1/indicators/rsi/{ticker}
    ?timespan=day&window=14&limit=1
```

Returns the current 14-day RSI. We extract:
  - results.values[0].value: The RSI value (0-100)


Used in the Technicals check:
  - RSI > 70: Overbought (bearish warning)
  - RSI 30-70: Neutral zone (healthy)
  - RSI < 30: Oversold (bearish or potential reversal)

# 3. Data Extraction Summary

Below is a complete mapping of every Massive.com API field used by the screener and what it feeds into:

| API Call | Field | Feeds Into |
|---|---|---|
| Ticker Details | name | Company name display |
| Ticker Details | market_cap | P/S ratio, overview |
| Ticker Details | weighted_shares_out | EPS calculation |
| Prev Day Bar | c (close) | Price, P/E, technicals |
| Financials | revenues | TTM revenue, margins, P/S, growth |
| Financials | gross_profit | Gross margin |
| Financials | operating_income_loss | Operating margin |
| Financials | net_income_loss | Profit margin, EPS |
| Financials | other_current_assets | Cash (balance sheet check) |
| Financials | long_term_debt | Cash/Debt ratio |
| Financials | current_liabilities | Total debt calculation |
| Financials | operating CF | FCF margin |
| Financials | investing CF | FCF margin (CapEx proxy) |
| SMA Indicator | value | SMA50 for trend check |
| RSI Indicator | value | RSI14 for momentum check |

# 4. Computed Metrics & Formulas

## 4.1 Overview Metrics

| Metric | Formula |
| --- | --- |
| TTM Revenue | Sum of 'revenues' from latest 4 quarters |
| TTM Net Income | Sum of 'net_income_loss' from latest 4 quarters |
| TTM EPS | TTM Net Income / Shares Outstanding |
| P/E Ratio | Closing Price / TTM EPS (only if EPS > 0) |
| P/S Ratio | Market Cap / TTM Revenue |

## 4.2 Margin Metrics (all TTM from latest 4 quarters)

| Metric | Formula |
| --- | --- |
| Gross Margin % | (Sum of gross_profit / Sum of revenues) x 100 |
| Operating Margin % | (Sum of operating_income_loss / Sum of revenues) x 100 |
| Profit Margin % | (Sum of net_income_loss / Sum of revenues) x 100 |
| FCF Margin % | ((Operating CF + Investing CF) / Sum of revenues) x 100 |

## 4.3 Revenue Growth (Year-over-Year)

YoY growth is computed by comparing the sum of the recent 4 quarters vs. the sum of the prior 4 quarters:

```
Growth % = ((Recent 4Q Revenue - Prior 4Q Revenue) / Prior 4Q Revenue) x 100
```

Additionally, all 8 quarters are grouped by fiscal year to show annual revenue breakdowns in the response.

## 4.4 Balance Sheet Metrics

| Metric | Formula |
| --- | --- |
| Cash | other_current_assets from most recent quarter |
| Total Debt | long_term_debt + current_liabilities |
| Cash/Debt Ratio | Cash / Total Debt |

# 5. The 5 Screening Checks

Each check independently evaluates one dimension of the stock and produces a traffic light signal: GREEN (bullish), YELLOW (neutral/caution), or RED (bearish). If the data for a check is unavailable, the check is skipped entirely.

## Check 1: Margins

Evaluates whether the company has strong pricing power and profitability.

| Light | Condition | Reasoning |
|---|---|---|
| GREEN | Gross Margin >= 50% | High-margin business, strong pricing power |
| YELLOW | GM 30-50% AND Profit Margin > 10% | Moderate margins but still profitable |
| RED | Gross Margin <= 30% | Low margin, commodity business risk |

Primary data: gross_profit and revenues from income statement.

## Check 2: Price/Sales Ratio

Evaluates valuation relative to revenue. High P/S can be justified by growth + cash flow.

| Light | Condition | Reasoning |
|---|---|---|
| GREEN | P/S <= 10 | Reasonably valued relative to revenue |
| GREEN | P/S 10-20, Growth+FCF% > 30% | High P/S justified by strong fundamentals |
| YELLOW | P/S 10-20, Growth+FCF% <= 30% | Elevated valuation, not enough growth |
| RED | P/S >= 20 | Very expensive - needs exceptional growth |

This check combines valuation (P/S) with a 'Rule of 40'-style test: Revenue Growth % + FCF Margin % should exceed 30% to justify a higher P/S.

## Check 3: Revenue Growth (Year-over-Year)

Evaluates whether the company is growing revenue fast enough.

| Light | Condition | Reasoning |
|---|---|---|
| GREEN | YoY Growth >= 20% | Strong growth company |
| YELLOW | Growth 10-20% | Moderate growth, may be maturing |
| RED | Growth < 10% | Slow or no growth |

Growth is computed from 8 quarters: sum of recent 4Q vs. sum of prior 4Q. This gives a true trailing comparison without waiting for annual filings.

## Check 4: Cash/Debt Ratio

Evaluates balance sheet strength - can the company cover its debts?

| Light | Condition | Reasoning |
|---|---|---|
| GREEN | Cash/Debt >= 1.0 | More cash than debt, strong position |
| YELLOW | Cash/Debt 0.5-1.0 | Manageable debt levels |
| RED | Cash/Debt <= 0.5 | High leverage, financial risk |

Cash = other_current_assets. Debt = long_term_debt + current_liabilities.

## Check 5: Technicals (SMA50 + RSI14)

Combines trend analysis (price vs. 50-day moving average) with momentum (14-day RSI) to assess short-term technical health.

| Light | Condition | Reasoning |
|---|---|---|
| GREEN | Price > SMA50, RSI 30-70 | Uptrend, not overbought |
| YELLOW | Price > SMA50, RSI > 70 | Uptrend but overbought warning |
| YELLOW | Price < SMA50, RSI >= 30 | Below trend but not oversold |
| RED | Price < SMA50, RSI < 30 | Downtrend and oversold |

# 6. Signal Determination

After all 5 checks run, the system counts the GREEN and RED results to produce a final recommendation. SELL is evaluated first (defensive bias).

## Decision Logic

```
total = number of checks that ran (max 5, fewer if data missing)
reds  = count of RED checks
greens = count of GREEN checks

if reds >= total / 2    --> SELL
if greens >= total / 2  --> BUY
otherwise               --> HOLD
```

Examples with 5 checks:
  - 4 GREEN, 1 RED   --> BUY  (4 >= 2.5)
  - 3 GREEN, 2 YELLOW --> BUY  (3 >= 2.5)
  - 1 GREEN, 4 YELLOW --> HOLD (neither threshold met)
  - 0 GREEN, 3 RED    --> SELL (3 >= 2.5)
  - 2 GREEN, 2 YELLOW, 1 RED --> HOLD

# 7. Confidence Level

Confidence reflects how unanimous the screening checks are:

| Level | Condition |
|---|---|
| HIGH | All checks are the same color (all GREEN or all RED) |
| MEDIUM | At most 1 check differs from the majority |
| LOW | Mixed results (2+ checks differ) - default |

Examples:
  - 5 GREEN, 0 RED  --> HIGH confidence BUY
  - 4 GREEN, 1 other --> MEDIUM confidence BUY
  - 3 GREEN, 1 YELLOW, 1 RED --> LOW confidence BUY
  - 5 RED, 0 GREEN --> HIGH confidence SELL

# 8. Complete Example: AAPL

Here is a real analysis of Apple Inc. (AAPL) showing each step:

## API Data Retrieved

```
Ticker Details:  name=Apple Inc., market_cap=$3.88T, shares=14.68B
Previous Bar:    close=$264.35
Financials:      8 quarterly filings (Q3'24 through Q2'26)
SMA(50):         $266.74
RSI(14):         48.90
```

## Computed Metrics

```
TTM Revenue:      $435.6B
TTM Net Income:   $117.8B
EPS (TTM):        $8.02
P/E Ratio:        32.96x
P/S Ratio:        8.91x
Gross Margin:     47.33%
Operating Margin: 32.38%
Profit Margin:    27.04%
FCF Margin:       31.22%
YoY Rev Growth:   10.07%
Cash/Debt:        0.61x
```

## Check Results

| # | Check | Light | Detail |
|---|-------|-------|--------|
| 1 | Margins | YELLOW | Gross margin 47.33% (30-50%), PM 27.04% |
| 2 | Price/Sales | GREEN | P/S 8.91 <= 10 |
| 3 | Revenue Growth | YELLOW | Revenue growth 10.07% (10-20%) |
| 4 | Cash/Debt Ratio | YELLOW | Cash/Debt ratio 0.61 (0.5-1.0) |
| 5 | Technicals | YELLOW | Price below $MA50, RSI 48.9 |

## Final Result

```
Signal:     HOLD
Confidence: LOW
Reasoning:  1/5 checks GREEN, 4/5 YELLOW, 0 RED
            Neither greens (1) nor reds (0) reach threshold (2.5)
            --> HOLD with LOW confidence (mixed results)
```