



KAPA™ SYBR® FAST qPCR Kit Master Mix (2X) Bio-Rad iCycler™

1. Product Description

KAPA SYBR® FAST qPCR Master Mix is designed for high performance, high-throughput, real-time PCR. The kit contains a novel DNA polymerase engineered through a process of molecular evolution. The result is a unique enzyme, specifically designed for qPCR using SYBR® Green I dye chemistry.

KAPA SYBR® DNA Polymerase has been engineered to perform optimally in stringent real-time quantitative PCR (qPCR) reaction conditions, exhibiting dramatic improvements to signal-to-noise ratio (fluorescence), cycle threshold (C_T), linearity, and sensitivity. The KAPA SYBR® DNA Polymerase and proprietary buffer system enhances the amplification efficiency of difficult templates, including both GC-rich and AT-rich templates.

KAPA SYBR® FAST qPCR Master Mix (2X) Bio-Rad iCycler™ is a ready-to-use cocktail containing all components except primers and template, for the amplification and detection of DNA in qPCR on the Bio-Rad iQ™5, iCycler iQ®, and MyiQ™ real-time PCR detection systems. The KAPA SYBR® FAST qPCR Kit is supplied as a 2X Master Mix with integrated antibody-mediated hot start, SYBR® Green I fluorescent dye, fluorescein, $MgCl_2$, dNTPs, and stabilizers.

2. Product Applications

KAPA SYBR® FAST qPCR Kits are ideally suited for:

- Gene expression analysis
- Low copy gene detection
- Microarray validation
- Gene knockdown validation

3. Product Specifications

3.1 Shipping and Storage

Upon arrival, store kit components protected from light at $-20\text{ }^\circ\text{C}$ in a constant-temperature freezer. When stored under these conditions and handled correctly, full activity of the master mix is retained for 18 months from the date of receipt.

3.2 Handling

Minimize exposure of the Master Mix (2X) to direct light. Exposure to direct light for an extended period of time may result in loss of fluorescent signal intensity. Always ensure that the product has been fully thawed and mixed before use.

3.3 Quality Control

KAPA SYBR® FAST qPCR Master Mix (2X) is free of contaminating DNase and RNase. It is functionally tested to demonstrate resolution of 5 orders of linear dynamic range using human genomic DNA as template and *B-actin* primers.

3.4 Product Use Limitations

KAPA SYBR® FAST qPCR Master Mix (2X) is sold exclusively for research purposes and *in vitro* use. Neither the product, nor any individual components, was tested for use in diagnostic applications or for drug development, nor is it suitable for administration to humans or animals. Please refer to the MSDS, available upon request.

| | |
|--|--|
| KK4606 100 reactions in 20 μl volume | KAPA SYBR® FAST Master Mix (2X) Bio-Rad iCycler™ 1 x 1ml Contains: - qPCR Master Mix (2X) with fluorescein reference dye |
| KK4607 500 reactions in 20 μl volume | KAPA SYBR® FAST Master Mix (2X) Bio-Rad iCycler™ 1 x 5 ml Contains: - qPCR Master Mix (2X) with fluorescein reference dye |
| KK4608 1000 reactions in 20 μl volume | KAPA SYBR® FAST Master Mix (2X) Bio-Rad iCycler™ 2 x 5 ml Contains: - qPCR Master Mix (2X) with fluorescein reference dye |

The final $MgCl_2$ concentration per reaction is 2.5mM

Quick Notes

- This kit contains a highly engineered enzyme optimized for use in qPCR using SYBR® Green I dye chemistry.
- The 2X Master Mix contains a proprietary buffer that together with the novel enzyme enhances the amplification efficiency of both high GC and high AT templates.
- 20 sec initial denaturation at $95\text{ }^\circ\text{C}$ is sufficient for enzyme reactivation, however optimal denaturation of complex targets may require up to 3 min denaturation.
- For two-step cycling, use 20 sec combined annealing/extension/data acquisition.
- For three-step cycling, use 20 sec for primer annealing and 10 sec for extension/data acquisition.
- Do not exceed 25 μl reaction volumes.

Instrument Table

| Instrument | Reference dye |
|--------------------------------------|---------------|
| Bio-Rad iCycler iQ®, iQ™5, and MyiQ™ | 10 nM final |



4. KAPA SYBR® FAST qPCR Protocol

Any existing qPCR assay performed efficiently using standard cycling conditions may be converted to a Fast qPCR assay with KAPA SYBR® FAST qPCR Kits. Typically, minimal re-optimization of reaction parameters is required.

This protocol is intended for use with the Bio-Rad iCycler iQ®, iQ™5, and MyiQ™ real-time PCR detection systems.

4.1 Step 1: qPCR Reaction Setup

- Before preparing qPCR reactions, thoroughly mix the KAPA SYBR® FAST qPCR Master Mix (2X), template DNA, and primers.
- Calculate the required volumes of each component based on the following table:

| | Final concentration | 20 µl rxn |
|---|---------------------|-------------|
| PCR grade water up to 20 µl | | As required |
| KAPA SYBR® FAST qPCR Master Mix (2X) Bio-Rad iCycler™ | 1X | 10 µl |
| Forward Primer (10 µM) | 200 nM | 0.4 µl |
| Reverse Primer (10 µM) | 200 nM | 0.4 µl |
| Template DNA | (<20 ng/20 µl rxn) | Variable |

4.2 Step 2: Plate Setup

- Transfer the appropriate volume of reaction mixture to each well of a PCR tube/plate. Reaction volumes may be scaled down as required.
- Cap or seal the reaction tube/plate and centrifuge briefly.

4.3 Step 3: Run the qPCR Reaction

- If applicable, select fast mode on the instrument.
- Program the following cycling protocol:

| Step | Temperature | Duration | Cycles |
|-------------------|------------------------------------|-----------------|--------|
| Enzyme activation | 95 °C | 20 sec - 3 min* | Hold |
| Denature | 95 °C | 1 - 3 sec | 40 |
| Anneal/extend*** | 60 °C | ≥ 20 sec** | |
| Dissociation | According to instrument guidelines | | |

*20 sec at 95 °C is sufficient time for enzyme activation, however optimal denaturation of complex targets may require up to 3 min denaturation.

**Select minimum time (not less than 20 sec) according to instrument user guide.

***For 3 step cycling protocols, anneal at optimal annealing temperature for 20 sec followed by 10 sec extension and data acquisition at 72 °C.

4.4 Step 4: Analyze the results

- Data analysis varies depending on the instrument used. Please refer to your instrument user guide for information.



5. Important Parameters

5.1 Template

Genomic DNA, plasmid DNA, or cDNA can be used as template. For optimal quantitative results use up to 20 ng of genomic DNA or plasmid DNA per 20 µl reaction (for smaller volumes, the amount of template should be decreased equivalently). Using greater amounts of template may reduce the maximum fluorescence signal and linearity of standard curves due to binding of the SYBR® Green I dye to the template. For two-step RT-PCR, use either undiluted or diluted cDNA generated from up to 1 µg of total RNA. The volume of the cDNA added (from the RT reaction) should not exceed 10% of the final PCR volume (e.g., for a 20 µl qPCR reaction, use up to 2.0 µl of undiluted cDNA).

5.2 Primers

Careful primer design and purification (HPLC-purified primers are recommended) is particularly important in order to minimize loss in sensitivity due to the production of nonspecific amplification products in SYBR® Green I-based qPCR. This effect becomes more prominent at low target concentrations. To maximize the sensitivity of the assay, use the lowest concentration of primers that can be used without compromising the efficiency of the PCR reaction (50 - 400 nM of each primer). For optimal results, design primers that amplify PCR products 60 - 400 bp in length. The primers should exhibit a melting temperature (T_m) of approximately 60 °C, to take advantage of two-step cycling. If performing real-time two-step RT-PCR, we recommend designing primers specifically for amplification of cDNA derived from mRNA. This prevents amplification of contaminating genomic DNA and inaccurate quantification of mRNA.

5.3 KAPA SYBR® DNA Polymerase

KAPA SYBR® DNA polymerase is a highly engineered version of Taq DNA polymerase designed specifically for real-time qPCR. KAPA SYBR® DNA Polymerase displays no enzymatic activity at ambient temperature. This prevents the formation of misprimed products and primer-dimers during reaction setup and the first denaturation step, resulting in high PCR specificity and accurate quantification. The enzyme is activated at the start of a reaction by a 20 sec, 95 °C incubation step. The activation of the enzyme is complete after 20 sec, however complex targets may require up to 3 min for optimal denaturation. The hot start feature enables reactions to be set up rapidly and conveniently at room temperature.

5.4 Melting Curve Analysis

Following real-time qPCR, melting curve analysis should always be performed to identify the presence of primer-dimers and analyze the specificity of the reaction. Program your thermocycler according to the instructions provided.

5.5 SYBR® Green I

KAPA SYBR® FAST qPCR Master Mix (2X) contains an elevated, optimized concentration of the fluorescent dye, SYBR® Green I. High signal intensities are achieved as a result of increased tolerance to high concentrations of SYBR® Green I by the engineered, novel KAPA SYBR® DNA Polymerase. SYBR® Green I binds all double-stranded DNA molecules, emitting a fluorescent signal on binding. The excitation and emission maxima of SYBR® Green I are at 494 nm and 521 nm, respectively, which are compatible with use on any real-time cycler.

5.6 Magnesium chloride

The $MgCl_2$ concentration in KAPA SYBR® FAST qPCR Master Mix (2X) is optimized for most primer combinations. You do not need to add additional $MgCl_2$ to the mix to get efficient and specific PCR.



6. Troubleshooting

| Symptom | Possible Cause | Solution |
|---|---|---|
| High baseline fluorescence No product on either qPCR graph or on a gel | Starting amount of template is too high The protocol was not followed correctly Template contains inhibitors Primer design incorrect or annealing temperature too high | Reduce the amount of template in the reaction. Verify that all the steps have been followed and the correct reagents, dilutions, volumes, detection format, and cycling parameters have been used. This kit requires a minimum of 20 sec annealing and 1 sec extension for optimal performance. Re-purify or re-isolate your template. Verify primer selection. Lower the annealing temperature in 2 °C increments. |
| Product detected later than expected | Amplicon length is too long PCR annealing/extension time is too short for optimal performance. MgCl ₂ concentration adjusted | Optimal results are obtained with amplicons of 60 - 400 bp or less. This kit requires a minimum of 20 sec annealing/extension or 20 sec annealing followed by 1 sec extension for 3 step protocols. Do not adjust the MgCl ₂ concentration of KAPA SYBR® qPCR Master Mix (2X). |
| Poor low copy number sensitivity | Primer design or annealing temperature sub-optimal | Redesign primers. HPLC purification of primers greatly reduces primer-dimer problems and increases sensitivity. Adjust primer concentration and T _m . Ensure correct cycling parameters. |
| Low fluorescence intensity | Incorrect handling of samples | SYBR® Green I dye is light sensitive; avoid exposure to light and repeated freeze-thaw cycles. |
| Increased signal in no DNA control | One of the reagents has been contaminated Primer-dimer formation | Take standard precautions to avoid contamination when preparing your PCR reactions. Ideally, amplification reactions should be set up in a DNA-free environment using aerosol-resistant barrier tips. Redesign primers. HPLC purification of primers greatly reduces primer-dimer problems and increase sensitivity. Adjust primer concentration and T _m . |
| Melting temperature of a product varies from experiment to experiment | Variations in reaction mixture (e.g. salt) | Check the purity of the template solution. |
| Double melting peak appears for one product | Two products of the same length or non-uniform GC distribution in a single amplicon | Check the products on an agarose gel. Redesign primers to a region containing a uniform distribution of nucleotides (i.e., no GC hot-spots). |

7. Note to Purchaser: Limited License

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