



# *RNA-direct*<sup>™</sup> SYBR<sup>®</sup> Green Realtime PCR Master Mix

QRT-201T 0.5mLx2  
QRT-201 0.5mLx5

Store at -20°C, protected from light

## Contents

---

[1]	<b>Introduction</b>
[2]	<b>Components</b>
[3]	<b>Primer design</b>
[4]	<b>Detection</b>
[5]	<b>Specimens</b>
[6]	<b>Protocol</b>
	1. Intercalation assay protocol using Applied Biosystems 7900HT
	2. Intercalation assay protocol using Roche LightCycler <sup>™</sup>
[7]	<b>Related protocol</b>
	1. DNase I treatment of total RNA
[8]	<b>Trouble shooting</b>
[9]	<b>Related products</b>
[10]	<b>References</b>

---

## CAUTION

All reagents in this kit are intended for research purposes. Do not use for diagnosis or clinical purposes. Please observe general laboratory precaution and utilize safety while using this kit.

-LightCycler<sup>™</sup> is a trademark of Idaho Technology, Inc. and Roche Molecular Systems, Inc.

-SYBR<sup>®</sup> is a registered trademark of Molecular Probes, Inc.

-RNA-direct<sup>™</sup> is a trademark of Toyobo Co., Ltd. in Japan.

---

### JAPAN

TOYOBO CO., LTD.  
Tel(81)-6-6348-3888  
www.toyobo.co.jp/e/bio  
tech\_osaka@toyobo.jp

### CHINA

TOYOBO Bio-Technology, CO., LTD.  
Tel(86)-21-58794900.4140

**FOR RESEARCH USE ONLY. NOT FOR HUMAN OR DIAGNOSTIC USE.**

## [1] Introduction

### Description

This product is a 2 x Master Mix for “1-step real-time PCR” using a thermostable DNA polymerase derived from *Thermus thermophilus* (Tth) HB8<sup>1)</sup>. Tth DNA polymerase exhibits reverse transcriptase activity in the presence of Mn<sup>2+</sup> ions. This system allows for “1-step real-time PCR”, including reverse transcription and PCR steps. This reagent can be applied to an intercalation assay with SYBR<sup>®</sup> Green I.

### Features

- This reagent is suitable for high-throughput real-time PCR and increases reliability of product, due to lowered risk of contamination.
- This reagent can be used in systems using glass capillaries (e.g., LightCycler, Roche Molecular Systems, Inc.).
- This reagent can be used in systems using passive reference (e.g., 7700, Applied Biosystems, Inc.). The passive reference dye does not affect any other systems.
- Hot Start technology, using anti-Tth DNA polymerase antibodies, allows for high specificity and reproducible amplification.

## [2] Components

This reagent includes the following components for 40 reactions (QRT-201T) and 100 reactions (QRT-201), with a total of 50 µl per reaction. All reagents should be stored at -20 °C.

#### <QRT-201T>

<i>RNA-direct</i> <sup>™</sup> SYBR <sup>®</sup> Green Realtime PCR Master Mix	0.5mlx2
50 mM Mg(OAc) <sub>2</sub>	0.2mlx1

#### <QRT-201>

<i>RNA-direct</i> <sup>™</sup> SYBR <sup>®</sup> Green Realtime PCR Master Mix	0.5mlx5
50mM Mg(OAc) <sub>2</sub>	0.5mlx1

### Notes:

This reagent can be stored at 4°C for up to 2 months, protected from light. For longer storage, this reagent should be kept at -20°C and protected from light.

## [3] Primer

### 1. Primer conditions

Primers should be designed according to the following guidelines:

- Primer length: 20-30 mer
- GC content of primer: 40-60%
- Target length: ≤200 bp (optimally, 50-150 bp)

#### Notes:

Longer targets (>200 bp) reduce efficiency and specificity of amplification. The ideal optimal target length range is 50-150 bp.

## [4] Detection

This reagent can be used with the following devices:

### 1. Normal devices, such as:

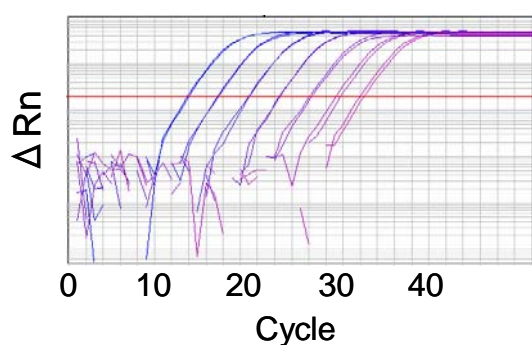
-LineGene, Bioer etc.

### 2. Devices using a glass capillary or a passive reference, such as:

-LightCycler, Roche Molecular Systems

-7000, 7700, and 7900, Applied Biosystems

**Notes:** The passive reference mode of detectors should be set at "ROX".



**Fig. 1 Detection of  $\beta$ -actin expression with TaqMan<sup>®</sup> assay**

Device: Applied Biosystems 7900HT

Target:  $\beta$ -actin

Assay method: TaqMan<sup>®</sup> probe

Template: cDNA from poly(A)<sup>+</sup> RNA (HeLa cells)

## [5] Specimen

The following RNAs are appropriate for highly efficient 1-step real-time PCR.

### 1. Total RNA

Total RNA typically contains 1-2% mRNA, which can be used as template directly with this kit. RNA prepared by AGPC (Acid Guanidium-Phenol-Chloroform) or the column method contains genomic DNA; therefore, the total RNA should be treated with DNase I prior to transcription.

### 2. Poly(A)<sup>+</sup> RNA (mRNA)

Poly(A)<sup>+</sup> RNA can be used to detect low-level expressing mRNA. However, poly(A)<sup>+</sup> RNA should be treated carefully, because Poly(A)<sup>+</sup> RNA is more sensitive to RNase than total RNA.

## [6] Protocol

### 1. Intercalation assay protocol using Applied Biosystem 7900HT

The following is an intercalation assay protocol using 7900HT. If using other detection devices, this protocol should be slightly altered, according to each instruction manual.

#### (1) Preparation of reaction solution

Component	Volume	Final Concentration
Nuclease-free water	X $\mu$ l	
<i>RNA-direct</i> <sup>TM</sup> SYBR <sup>®</sup> Green Realtime PCR Master Mix	25 $\mu$ l	1x
50mM Mn(OAc) <sub>2</sub>	2.5 $\mu$ l	2.5 mM
10 pmol / $\mu$ l (10 $\mu$ M) Primer #1	1.0 $\mu$ l	0.2 $\mu$ M
10 pmol / $\mu$ l (10 $\mu$ M) Primer #2	1.0 $\mu$ l	0.2 $\mu$ M
Template RNA	Y $\mu$ l	
Total RNA		<2.5 $\mu$ g / 50 $\mu$ l
Poly (A) <sup>+</sup> RNA		<500 ng / 50 $\mu$ l
Total volume	50 $\mu$ l	

#### Notes

- Primer concentrations can be further optimized, if needed. The optimal range of primers is 0.2-0.6  $\mu$ M. In the case of commercially available primers, those recommended condition should be used.
- The final concentration of Mn(OAc)<sub>2</sub> should be adjusted to 2-3.5 mM. Lower Mn concentrations result in decreased non-specific amplification; higher Mn concentrations result in increased amplification efficiency.
- Nuclease-free water prepared without DEPC-treatment is recommended.

#### (2) Cycling condition

The following is a cycling condition the “standard mode” of 7900HT.

<3-step cycle>		
Denaturation :	90 °C, 30 sec.	
RT :	61 °C, 20 min.	
Pre-denaturation :	95 °C, 1 min.	
Denaturation :	95 °C, 15 sec.	} 45 cycles
Annealing :	55-65 °C, 15 sec.	
Extension :	74 °C, 45 sec. (data collection)	
Melting curve analysis		

#### Notes

- The PCR Master Mix contains anti-Tth DNA polymerase antibodies for Hot Start PCR. The first denaturation step (90 °C, 30 sec.) is sufficient to inactivate the antibodies. Do not prolong this denaturation step.
- The annealing temperature should to T<sub>m</sub>-5 °C. The optimal annealing temperature range is 55-65°C.

## 2. Intercalation assay protocol using Roche LightCycler™

The following is an intercalation assay protocol using Roche LightCycler™. In the case of other detection devices, this protocol should be slightly altered, according to each instruction manual.

### (1) Preparation of reaction solution

Component	Volume	Final Concentration
Nuclease-free water	X $\mu$ l	
<i>RNA-direct</i> ™ SYBR® Green Realtime PCR Master Mix	10 $\mu$ l	1x
50 mM Mn(OAc) <sub>2</sub>	1 $\mu$ l	2.5 mM
10 pmol / $\mu$ l (10 $\mu$ M) Primer #1	0.4 $\mu$ l	0.2 $\mu$ M
10 pmol / $\mu$ l (10 $\mu$ M) Primer #2	0.4 $\mu$ l	0.2 $\mu$ M
Template RNA	Y $\mu$ l	
Total RNA		<1 $\mu$ g / 20 $\mu$ l
Poly(A) <sup>+</sup> RNA		<200 ng / 20 $\mu$ l
Total volume	20 $\mu$ l	

### Notes

- The primer concentration can be further optimized, if needed. The optimal range of primers is 0.2-0.6  $\mu$ M. In the case of commercially available primers, those recommended conditions should be used.
- The final concentration of Mn(OAc)<sub>2</sub> should be adjust to 2-3.5 mM. Lower Mn concentrations result in decreased non-specific amplification; higher Mn concentrations result in increased the amplification efficiency.
- Nuclease-free water prepared without DEPC-treatment is recommended.

### (2) Cycling condition

The following condition is recommended.

<2-step cycle>		
Denaturation :	90 °C, 30 sec.	
RT :	61 °C, 20 min.	
Pre-denaturation :	95 °C, 30 sec.	
Denaturation :	95 °C, 5 sec.	} 45 cycles
Annealing :	55-65 °C, 10 sec.	
Extension :	74 °C, 15 sec. (data collection)	

### Notes

- The PCR Master Mix contains anti-Tth DNA polymerase antibodies for Hot Start PCR. The first denaturation step (90°C, 30 sec.) is sufficient to inactivate the antibodies. Do not prolong this denaturation step.
- The temperature transition rate should be set to 20 °C/sec. Poor amplification may be improved by adjusting the temperature transition rate to 2 °C/sec.
- If the target length is  $\leq$  200 bp, the extension time should be adjusted to 15 sec. Data collection steps should be at least 15 sec.

## [7] Related Protocol

### 1. DNase I treatment of total RNA

Total RNA prepared by general methods contains genomic DNA. Genomic DNA can be eliminated by the following method.

#### (1) Mix the following reagents.

Nuclease-free water	X $\mu$ l
Total RNA (<10 $\mu$ g)	Y $\mu$ l
10 x DNase I Buffer [e.g. 100 mM Tris-Cl, 20 mM MgCl <sub>2</sub> (pH 7.5)]	1 $\mu$ l
RNase-free DNase I (10 U/ $\mu$ l)	0.5 $\mu$ l
<hr/>	
Total volume	10 $\mu$ l

#### (2) Incubate on ice for 10-30 min.

#### (3) Purify the treated RNA according to the following step.

##### **DNase I-treated RNA**

- ↓ ← Add nuclease-free water (adjust volume to 100  $\mu$ l)
- ↓ ← Add 100  $\mu$ l TE-saturated phenol

##### **Vortex**

##### **Keep on ice for 5 min**

- ↓ Centrifuge at 12,000 rpm for 5 min

##### **Supernatant**

- ↓ ← Add 100  $\mu$ l chloroform: isoamyl alcohol (24:1), Vortex
- ↓ Centrifuge at 12,000 rpm for 5 min at 4 °C

##### **Supernatant**

- ↓ ← Add 100  $\mu$ l 5 M ammonium acetate + 200  $\mu$ l isopropanol  
+ [5  $\mu$ l 2 mg/ml glycogen\* (for coprecipitation) : optional]

##### **Vortex**

##### **Incubate at - 20 °C for 30 min**

- ↓ Centrifuge at 12,000 rpm for 10-15 min at 4 °C

##### **Discard supernatant**

##### **Precipitate**

- ↓ ← Add 1 ml 70% ethanol
- ↓ Centrifuge at 12,000 rpm for 5 min

##### **Discard supernatant**

##### **Precipitate**

- ↓ ← Dissolve in appropriate volume of nuclease-free water

##### **RNA solution**

\*Molecular biology grade

## [8] Troubleshooting

Symptom	Cause	Solution
No amplification	Incorrect setting of detector mode for the fluorescence dye.	Confirm the detector setting.
	Incorrect setting for data collection.	Confirm the data collection setting.
	Incorrect setting for sample position.	Reposition the sample tubes.
	Inappropriate concentration of primers or probes.	Optimize primer or probe concentration according to instructions (see [6]).
	Inappropriate design of primers or probes.	Confirm specificity and T <sub>m</sub> of primers and probes.
	Inappropriate cycle conditions.	Confirm T <sub>m</sub> of the primers and probes.
	Low purity or quality of samples	Check the purity or quality of sample DNA.
	Low concentration of Mn(OAc) <sub>2</sub>	Increase the Mn concentration to 3.5 mM.
Variation in detection	Failure or malfunction of device	Check the device
	Low quality of sample DNA.	Repurify DNA sample by phenol/chloroform extraction and ethanol precipitation, or other method.
	Inappropriate concentration of primers or probes.	Optimize primer or probe concentration according to the instructions (see [6]).
	Inappropriate design of primers or probes.	Confirm specificity and T <sub>m</sub> of primers and probes.
	Inappropriate cycle conditions.	Confirm T <sub>m</sub> of the primers and probes.
	Variation of dispensed volume	Increase the reaction volume
Signals in blank reactions	Contamination of amplicons or sample DNAs.	Use fresh PCR grade water. Re-make primer solution, probe solution, and master mix.
	Detection of a non-specific amplification.	Optimize the primer and cycle conditions.

## [ 9 ] Related products

Product name	Package	Code No.
High efficient cDNA synthesis kit for real-time PCR <b>ReverTra Ace<sup>®</sup> qPCR RT Kit</b>	200 rxns	FSQ-101
High efficient revers transcriptase <b>ReverTra Ace<sup>®</sup></b>	10,000U	TRT-101
<b>RNase inhibitor (Recombinant type)</b>	2,500U	SIN-201
Realtime PCR master mix for probe assay <b>Realtime PCR Master Mix</b>	1mLx1 1mLx5	QPK-101T QPK-101
Realtime PCR master mix for SYBR <sup>®</sup> Green assay <b>SYBR<sup>®</sup> Green Realtime PCR Master Mix</b>	1mLx1 1mLx5	QPK-201T QPK-201
Realtime PCR master mix for SYBR <sup>®</sup> Green assay (improved version) <b>SYBR<sup>®</sup> Green Realtime PCR Master Mix -Plus-</b>	1mLx1 1mLx5	QPK-212T QPK-212
One-step realtime PCR master mix for probe assay <b>RNA-direct<sup>™</sup> Realtime PCR Master Mix</b>	0.5mLx2 0.5mLx5	QRT-101T QRT-101

## [ 10 ] References

- 1) Reverse transcription and DNA amplification by a *Thermus thermophilus* DNA polymerase. Myers T. W. and Gelfand D. H. , *Biochemistry*, 30: 7661-6 (1991)





**NOTICE TO PURCHASER: LIMITED LICENSE**

Use of this product is covered by one or more of the following US patents and corresponding patent claims outside the US: 5,079,352, 5,789,224, 5,618,711, 6,127,155, 5,677,152, 5,773,258, 5,407,800, 5,322,770, 5,310,652, 5,994,056, 6,171,785, and claims outside the US corresponding to US Patent No. 4,889,818. The purchase of this product includes a limited, non-transferable immunity from suit under the foregoing patent claims for using only this amount of product for the purchaser's own internal research. No right under any other patent claim (such as apparatus or system claims in US Patent No. 6,814,934) and no right to perform commercial services of any kind, including without limitation reporting the results of purchaser's activities for a fee or other commercial consideration, is conveyed expressly, by implication, or by estoppel. This product is for research use only. Diagnostic uses under Roche patents require a separate license from Roche. Further information on purchasing licenses may be obtained by contacting the Director of Licensing, Applied Biosystems, 850 Lincoln Centre Drive, Foster City, California 94404, USA.

---

**JAPAN**

TOYOBO CO., LTD.  
Tel(81)-6-6348-3888  
[www.toyobo.co.jp/e/bio](http://www.toyobo.co.jp/e/bio)  
tech\_osaka@toyobo.jp

**CHINA**

TOYOBO Bio-Technology, CO., LTD.  
Tel(86)-21-58794900.4140

**FOR RESEARCH USE ONLY. NOT FOR HUMAN OR DIAGNOSTIC USE.**