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CBP bromodomain TR-FRET Assay Kit

Item No. 600850

www.caymanchem.com
Customer Service 800.364.9897
Technical Support 888.526.5351
1180 E. Ellsworth Rd · Ann Arbor, MI · USA

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GENERAL INFORMATION

Materials Supplied

Kit will arrive packaged as a -80°C kit. After opening the kit, store individual components as stated below.

Item Number	Item	384 wells Quantity/Size	1,920 wells Quantity/Size	9,600 wells Quantity/Size	Storage
600851	CBP bromodomain Europium Chelate	1 vial/ 420 wells	5 vials/ 420 wells	5 vials/ 2,100 wells	-80°C
600852	CBP bromodomain Ligand/APC Acceptor Mixture	1 vial/ 420 wells	5 vials/ 420 wells	5 vials/ 2,100 wells	-80°C
600503	TR-FRET Assay Buffer (10X)	1 vial/2 ml	1 vial/10 ml	5 vials/50 ml	-20°C
600504	TR-FRET Assay Buffer Additive	1 vial/200 mg	1 vial/1 g	5 vials/5 g	-20°C
600853	I-CBP112 Positive Control	1 vial/ 24 nmol	5 vials/ 24 nmol	5 vials/ 120 nmol	-80°C
600854	384-Well Solid Plate (low volume; white)	1 plate	5 plates	25 plates	RT
400023	Foil Plate Covers	1 cover	5 covers	25 covers	RT

If any of the items listed on page 3 are damaged or missing, please contact our Customer Service department at (800) 364-9897 or (734) 971-3335. We cannot accept any returns without prior authorization.

WARNING: THIS PRODUCT IS FOR RESEARCH ONLY - NOT FOR HUMAN OR VETERINARY DIAGNOSTIC OR THERAPEUTIC USE.

Safety Data

This material should be considered hazardous until further information becomes available. Do not ingest, inhale, get in eyes, on skin, or on clothing. Wash thoroughly after handling. Before use, the user must review the complete Safety Data Sheet, which has been sent *via* email to your institution.

Precautions

Please read these instructions carefully before beginning this assay.

The reagents in this kit have been tested and formulated to work exclusively with Cayman's CBP bromodomain TR-FRET Assay Kit. This kit may not perform as described if any reagent or procedure is replaced or modified.

If You Have Problems

Technical Service Contact Information

Phone: 888-526-5351 (USA and Canada only) or 734-975-3888

Email: techserv@caymanchem.com

In order for our staff to assist you quickly and efficiently, please be ready to supply the lot number of the kit (found on the outside of the box).

Storage and Stability

This kit will perform as specified if stored as directed in the **Materials Supplied** section (see page 3) and used before the expiration date indicated on the outside of the box.

Materials Needed But Not Supplied

1. A plate reader equipped with a TR-FRET option and capable of measuring fluorescence with excitation and emission wavelengths of 340 and 620/665 nm, respectively
2. Adjustable pipettes; multichannel or repeating pipettor recommended
3. A source of ultrapure water, with a resistivity of 18.2 MΩ-cm and total organic carbon (TOC) levels of <10 ppb, is recommended. Pure water - glass-distilled or deionized - may not be acceptable. *NOTE: UltraPure Water is available for purchase from Cayman (Item No. 400000).*
4. Ethanol

INTRODUCTION

Background

The acetylation of histone lysine residues plays a crucial role in the epigenetic regulation of gene transcription. Acetylated lysine residues are recognized by a small protein domain known as a bromodomain.[1] These domains recruit regulatory complexes to acetylated nucleosomes, thereby controlling chromatin structure and gene expression. Initial efforts to develop small molecule bromodomain inhibitors have focused on the BET family of proteins, a class of proteins that contain tandem bromodomains and an extra terminal domain.[2] These proteins play a key role in many cellular processes, including inflammatory gene expression, mitosis, and viral/host interactions.[3-5] The isolated individual or tandem bromodomains of many BET family members have been shown to bind acetylated histone tails, serving to couple histone acetylation marks to the transcriptional regulation of target promoters.[4,6-9] Small molecule inhibitors of bromodomain/histone interactions, exemplified by I-BET and JQ-1, hold promise as useful therapeutics for human disease.[10-12]

CBP (CREB-binding protein or CREBBP) was initially identified as a protein that binds to CREB and functions as a CREB transcriptional coactivator.[13] This coactivator activity was originally attributed to CBP acting as a scaffold between CREB and the basal transcriptional machinery.[14] CBP was later shown to function as a histone acetyltransferase; catalyzing the transfer of an acetyl group from the cofactor acetyl-CoA to the ε-amine of a substrate lysine side chain.[15] Predominant CBP acetylation sites on histones include lysines 12 and 15 on histone H2B, lysines 14 and 18 on histone H3, and lysines 5 and 8 on histone H4. CBP has also been shown to acetylate numerous non-histone proteins including various transcription factors and coactivators.[16] In addition to the central histone acetyltransferase domain responsible for the catalytic activity, CBP also contains an N-terminal bromodomain that binds acetylated residues on histone tails.[17] Stereotypical inhibitors of BET family bromodomains (JQ-1 and I-BET) weakly inhibit the interaction of CBP with peptide binding partners (IC_{50} = ≥50 μM). Chromosomal abnormalities in a single copy of the CBP gene have been linked Rubinstein-Taybi syndrome, a multiple anomaly syndrome characterized by mental retardation, growth deficiency, microcephaly, broad thumbs, and dysmorphic facial features.[14] Chromosomal translocations have also been observed in acute myeloid leukemia (AML) and in myeloid/lymphoid or mixed lineage leukemia (MLL).[18] CBP has been shown to function as a transcriptional coactivator for numerous oncogenes and tumor suppressors.[18]

About This Assay

Cayman's CBP bromodomain TR-FRET Assay Kit is a homogeneous, time-resolved Förster resonance energy transfer (TR-FRET) assay method amenable to rapid characterization of inhibitors of the bromodomain-acetylated peptide interaction in a high-throughput format. The donor fluorophore in this assay consists of CBP bromodomain (BRD; human; amino acids 1,081-1,197) directly labeled with a europium (Eu^{3+}) chelate (BRD-Eu^{3+}). A biotinylated peptide containing acetylated lysines serves as the ligand for the CBP bromodomain. Allophycocyanin (APC)-labeled avidin binds with high affinity to the peptide substrate *via* the biotin moiety and serves as the acceptor fluorophore in the assay. Inhibition of the BRD-peptide interaction displaces BRD-Eu^{3+} from the APC-labeled avidin resulting in a loss of TR-FRET signal. The CBP bromodomain TR-FRET Assay Kit is robust (Z´ = >0.6) and suitable for high-throughput screening in the provided 384-well plate or can be scaled to higher density plate formats (*e.g.*, 1,536-well plate) if desired. The assay is stable at room temperature for at least four hours and in the presence of less than 2% DMSO.

Introduction to TR-FRET

TR-FRET is based upon the principles of FRET but possesses a number of advantages that make it a superior technology for high-throughput screening. When an optically active molecule absorbs a photon, it has several options by which it may release that energy: it may release a photon of a longer wavelength (less energy) than the photon it absorbed, it may dissipate the energy as heat, or it can transfer the energy non-radiometrically to a suitable acceptor fluorophore. The latter effect is known as FRET, and it is a commonly used phenomenon in biological assays. In these assays, a donor flurophore is coupled to one binding partner and an acceptor fluorophore is coupled to the other binding partner. The binding partners are mixed in an assay well and allowed to associate. The donor fluorophore is then excited with a wavelength of light that does not excite the acceptor fluorophore, and if the molecules are within approximately 100 Å of each other, the donor fluorophore can non-radiometrically transfer the energy to the acceptor fluorophore, which will then release that photon as light at a wavelength characteristic of the acceptor fluorophore (see Figure 1 on page 10). For each assay point, the fluorescence intensity of the donor fluorophore and the acceptor fluorophore are measured, and the data are generally presented as the ratio of acceptor fluorophore intensity/donor fluorophore intensity. This methodology is particularly sensitive because the FRET efficiency decays as a function of the inverse 6^{th} power of the distance between the two fluorophores. Therefore, unassociated binding partners are unlikely to lie within the distance required for efficient FRET.

TR-FRET is an extension of FRET that utilizes a donor fluorophore with a long fluorescent half-life. These fluorophores are based upon lanthanide (most often Eu^{3+} or Tb^{3+}) chelates that have characteristically large Stokes shifts and fluorescent half-lives on the order of milliseconds. The long fluorescent lifetime allows the TR-FRET signal to be sustained for dramatically longer periods of time than standard fluorescence. This is particularly advantageous because it affords the ability to measure the TR-FRET signal after background fluorescence in the assay (*e.g.*, buffer/reagent autofluorescence) has dissipated (see Figure 2 on page 11). The increased signal:noise ratio and the diminished effects of screening compound fluorescence makes TR-FRET assays particularly useful for high-throughput screening applications.

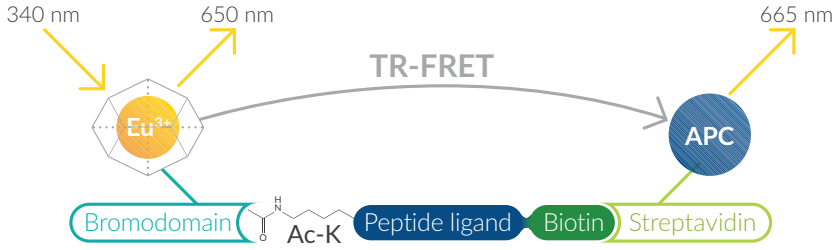

Figure 1. Assay schematic for the bromodomain TR-FRET Assay Kit. Upon excitation, the europium chelate can release a photon or transfer its energy to an APC molecule, provided the APC is in close proximity to the europium fluorophore.

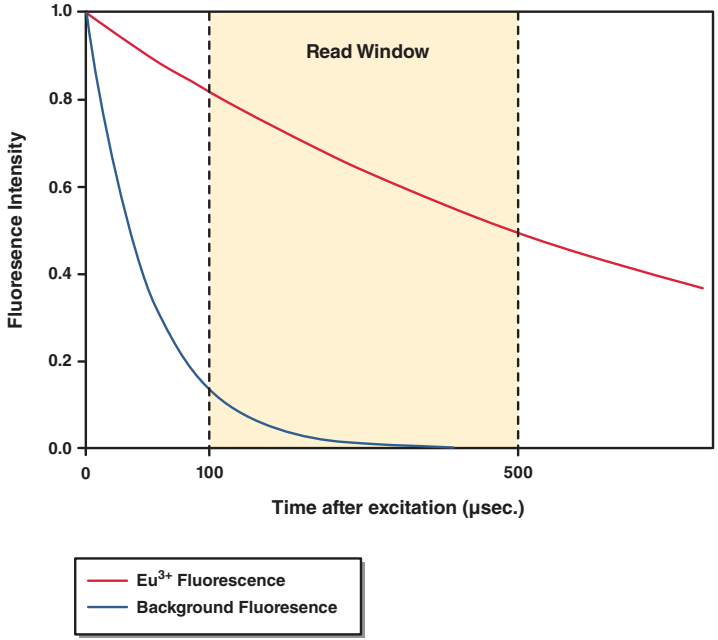

Figure 2. Fluorescence lifetime of Eu^{3+}-based fluorophores. The extended fluorescence lifetimes of Eu^{3+}-based fluorophores allows the samples to be analyzed after the background fluorescence has decayed, improving the signal-to-noise ratio and reducing spectral artifacts.

PRE-ASSAY PREPARATION

Sample Preparation

All inhibitors (including small molecules, natural products, or proteins) should be diluted in TR-FRET Assay Buffer (1X) at 4X the final assay concentration (*e.g.*, for 1 µM final assay concentration, a 4 µM stock should be made). This solution may contain up to 8% organic solvents such as DMSO, dimethyl formamide (DMF), or short-chain alcohols (*e.g.*, MeOH, EtOH). The final concentration of organic solvents in the assay will then be ≤2%. Avoid using high concentrations of metal chelating agents or phosphate buffers.

Buffer Preparation

2 ml vial TR-FRET Assay Buffer (10X) (384-well kit; Item No. 600503): Add 18 ml of ultrapure water to the vial. Add 200 mg of TR-FRET Assay Buffer Additive (Item No. 600504) and allow to dissolve. For best results, filter the TR-FRET Assay Buffer (1X) with a 0.22 µm filter before use. *NOTE: It is normal for the concentrated buffer to contain crystalline salts after thawing. These will completely dissolve upon dilution with ultrapure water.* Store unused TR-FRET Assay Buffer (1X) at 4°C; it will be stable for approximately one month.

OR

10 ml vial TR-FRET Assay Buffer (10X) (1,920- or 9,600-well kit; Item No. 600503): For five 384-well plates, dilute 10 ml of TR-FRET Assay Buffer to a total volume of 100 ml with ultrapure water. Add 1 g of TR-FRET Assay Buffer Additive (Item No. 600504) and allow to dissolve. For best results, filter the TR-FRET Assay Buffer (1X) with a 0.22 µm filter before use. *NOTE: It is normal for the concentrated buffer to contain crystalline salts after thawing. These will completely dissolve upon dilution with ultrapure water.* Store unused TR-FRET Assay Buffer (1X) at 4°C; it will be stable for approximately one month.

ASSAY PROTOCOL

Preparation of Assay-Specific Reagents

CBP bromodomain Europium Chelate (Item No. 600851)

420-well vial CBP bromodomain Europium Chelate (384- or 1,920-well kit):

On ice, thaw one vial of CBP bromodomain Europium Chelate (420 wells) per 384-well plate and briefly centrifuge before opening. Dilute the contents to a final volume of 4.2 ml in TR-FRET Assay Buffer (1X). The content volume is indicated on the label. Mix gently (do not vortex) and keep on ice. Diluted protein should be used within the same day.

OR

2,100-well vial CBP bromodomain Europium Chelate (9,600-well kit):

On ice, thaw one vial of CBP bromodomain Europium Chelate (2,100 wells) per five 384-well plates and briefly centrifuge before opening. Dilute contents to a final volume of 21 ml in TR-FRET Assay Buffer (1X). The content volume is indicated on the label. Mix gently (do not vortex) and keep on ice. Diluted protein should be used within the same day.

CBP bromodomain Ligand/APC Acceptor Mixture (Item No. 600852)

420-well vial CBP bromodomain Ligand/APC Acceptor Mixture (384- or 1,920-well kit):

For each 384-well plate, add 2.1 ml of TR-FRET Assay Buffer (1X) to one vial of the CBP bromodomain Ligand/APC Acceptor Mixture (420 wells) and gently vortex. Keep the solution in the dark to prevent photobleaching. Long-term storage of the diluted mixture is not recommended.

OR

2,100-well vial CBP bromodomain Ligand/APC Acceptor Mixture (9,600-well kit):

For five 384-well plates, add 3 ml of TR-FRET Assay Buffer (1X) to one vial of the CBP bromodomain Ligand/APC Acceptor Mixture (2,100 wells) and gently vortex. Transfer contents to a new tube and adjust the mixture to a final volume of 10.5 ml with TR-FRET Assay Buffer (1X). Keep the solution in the dark to prevent photobleaching. Long-term storage of the diluted mixture is not recommended.

I-CBP112 Positive Control (Item No. 600853)

24 nmol vial I-CBP112 Positive Control (384- or 1,920-well kit):

This vial contains 24 nmol I-CBP112 Positive Control. This positive control, when stored as supplied, will be stable for one year at -80°C. Prior to use, add 15 µl of ethanol to the vial and vortex gently. Briefly centrifuge, add 185 µl of TR-FRET Assay Buffer (1X), and vortex briefly. Unused solutions may be stored at -20°C for approximately two weeks.

OR

120 nmol vial I-CBP112 Positive Control (9,600-well kit):

This vial contains 120 nmol I-CBP112 Positive Control. This positive control, when stored as supplied, will be stable for one year at -80°C. Prior to use, add 75 µl of ethanol to the tube and vortex gently. Briefly centrifuge, add 925 µl of TR-FRET Assay Buffer (1X), and vortex briefly. Unused solutions may be stored at -20°C for approximately two weeks.

Performing the Assay

Pipetting Hints

- Use different tips to pipette each reagent.
- Do not expose the pipette tip to the reagent(s) already in the well.
- Avoid introducing bubbles into the wells.

Follow the steps below to accurately measure the TR-FRET ratio in the assay. Allow all reagents except the CBP bromodomain Europium Chelate to equilibrate to room temperature prior to performing the assay. Keep the CBP bromodomain Europium Chelate on ice until just prior to use. NOTE: Volumes indicated below are for a 384-well plate format with a 20 µl final assay volume. Scale as needed for higher or lower density plate formats.

1. **Inhibitor Samples**

   Dilute inhibitor samples in TR-FRET Assay Buffer (1X) to a concentration that is 4X the desired final concentration (*e.g.*, for 1 µM final assay concentration a 4 µM stock should be made). This solution may contain up to 8% of an organic solvent (*e.g.*, ethanol). Add 5 µl of this solution to the desired wells. For best results, perform the assay in duplicate.

   It is recommended that inhibitor compounds be tested in a concentration-response format with at least eight independent concentrations that span an approximately 1,000-fold range around the expected IC_{50} value of the inhibitor.

2. **Positive and Negative Control Samples**

   For positive (inhibitor control) control wells, add 5 µl of I-CBP112 Positive Control to the desired wells. This will provide a final assay concentration of 30 µM I-CBP112.

   For negative (no inhibition) control wells, add 5 µl of TR-FRET Assay Buffer (1X) to the desired wells. If inhibitor samples from step 1 contain organic solvent, add an equivalent amount of the solvent into the assay in this step.

3. **CBP bromodomain Europium Chelate**

   Add 10 µl of the diluted CBP bromodomain Europium Chelate to every well of the 384-well plate.

4. **Pre-incubation (optional)**

   If desired, incubate the control and sample wells for 15 minutes at room temperature to allow pre-equilibration of the inhibitor and control compounds with the CBP bromodomain Europium Chelate. *Protect from light.*

5. **CBP bromodomain Ligand/APC Acceptor Mixture**

   Add 5 µl of the reconstituted CBP bromodomain Ligand/APC Acceptor Mixture to every well.

6. **Incubation of the Plate**

   Seal the plate with the Foil Plate Cover (Item No. 400023) and incubate at room temperature for one hour. For automation purposes, the plate does not have to be sealed, but it should remain in the dark to prevent photobleaching.

7. **Reading the Plate**

   Read the plate(s) in a time-resolved format by exciting the sample at 340 nm and reading emissions at 620 and 665 nm, using a 100 µs delay and a 500 µs read window. To ensure optimal assay sensitivity, it is strongly recommended that a filter-based instrument be used to perform TR-FRET measurements. The plate reader used to validate the assay has a 340/30 nm excitation filter, 620/15 nm, and 665/10 nm emission filters. Samples will be stable for analysis for at least five hours if stored at room temperature and protected from light. Data analysis is performed using the TR-FRET ratio (665 nm emission/620 nm emission).

Well Type	I-CBP112 Positive Control (µl)	TR-FRET Assay Buffer (1X) (µl)	Test Sample (µl)	CBP bromodomain Europium Chelate (µl)	CBP bromodomain Ligand/APC Acceptor Mixture (µl)
Positive Control	5	-	-	10	5
Negative Control	-	5*	-	10	5
Experimental Samples	-	-	5*	10	5

Table 1. Pipetting summary

*This solution may contain up to 8% organic solvents such as DMSO, DMF, or short-chain alcohols (*e.g.*, MeOH, EtOH). If an organic solvent is used at concentrations >2% in the test samples, include it in the negative control wells at the same concentration as the sample wells to control for solvent effects.

Effects of Solvents

Samples may be prepared in organic solvents such as DMSO, DMF, or short-chain alcohols (*e.g.*, MeOH, EtOH), as long as the final concentration of organic solvents in the assay is ≤2%. High concentrations of metal chelating agents or phosphate buffers may interfere with the fluorescence of the donor fluorophore and should be avoided. If conditions require different solvents or higher concentrations, additional assays may be required to assess solvent interference.

ANALYSIS

Calculations

A plot of the TR-FRET ratio (665 nm emission/620 nm emission) *versus* inhibitor concentration on semi-log axes results in a sigmoidal dose-response curve typical of competitive binding assays. This data can be fit to a four-parameter logistic equation as shown in Figure 3 on page 19 to calculate IC_{50} values.

Performance Characteristics

Z´ Factor:

Z´ factor is a term used to describe the robustness of an assay, which is calculated using the equation below.[19]

$$Z' = 1 - \frac{3\sigma_{c+} + 3\sigma_{c-}}{|\mu_{c+} - \mu_{c-}|}$$

Where σ: Standard deviation
μ: Mean
c+: Positive control
c-: Negative control

The theoretical upper limit for the Z´ factor is 1.0. A robust assay has a Z´ factor >0.5. The Z´ factor for Cayman's CBP bromodomain TR-FRET Assay Kit was determined to be 0.72.

Sample Data

The data shown here is an example of the data typically produced with this kit; however, your results will not be identical to these. Do not use the data below to directly compare to your samples. Your results could differ substantially.

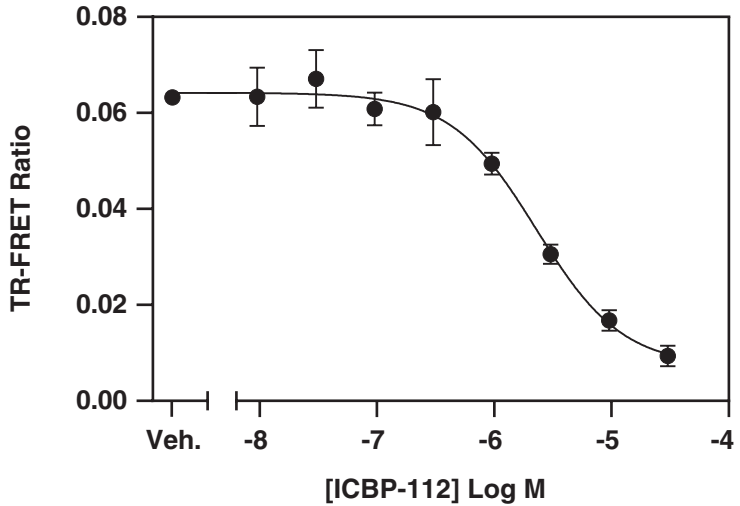

Figure 3. Typical inhibition curve for the displacement of the acetylated peptide from CBP bromodomain by the I-CBP112 Positive Control. Veh. represents the compound vehicle control.

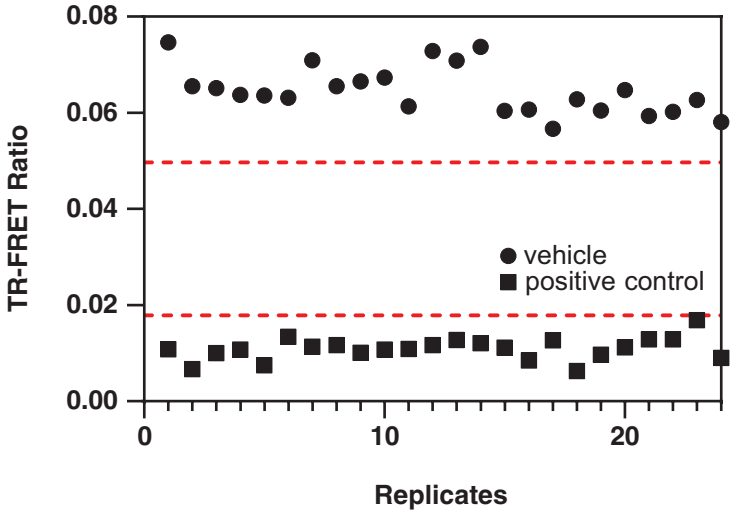

Figure 4. Typical Z´ data for the CBP bromodomain TR-FRET Assay Kit. Data are shown from 32 replicate wells of both positive and negative controls prepared as described in the kit booklet. The calculated Z´ factor from this experiment was 0.72. The red lines correspond to three standard deviations from the mean for each control value.

RESOURCES

Troubleshooting

Problem	Possible Causes	Recommended Solutions
Erratic values; dispersion of duplicates	A. Bubble in the well B. Poor pipetting/technique	A. Centrifuge the plate briefly
Low fluorescence signal	A. Incompatible sample matrix B. CBP bromodomain protein handled improperly C. Monochromater-based instrument used for data acqusition	A. Test sample matrix for interference before running samples in the assay B. Keep the protein frozen at -80°C until ready to use; thaw the protein and keep on ice until adding to the assay C. Analyze the assay using a filter-based plate reader

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NOTES

Warranty and Limitation of Remedy

Buyer agrees to purchase the material subject to Cayman's Terms and Conditions. Complete Terms and Conditions including Warranty and Limitation of Liability information can be found on our website.