# RAMBUS™ CLOCK DRIVER TERMINATION NETWORK

## Features

- All basic external components required for Rambus™ Clock Driver
- Operation to 400 MHz
- Meets Direct Rambus™ specification

## Application

- Direct Rambus™ Memory Systems

## Product Description

The PAC™ RAMBUS-2 provides all the basic external passive components that are required to accompany a Direct Rambus™ Clock Generator (DRCG), which provides the necessary clock signals to support a Direct Rambus™ memory subsystem. With clock signal speeds up to 400 MHz, it is imperative that the clock lines be properly terminated to assure proper operation and avoid signal integrity problems. The PAC RAMBUS-2 performs these termination functions with: series termination resistors, parallel resistors to set voltage swing, and capacitor for AC ground path.

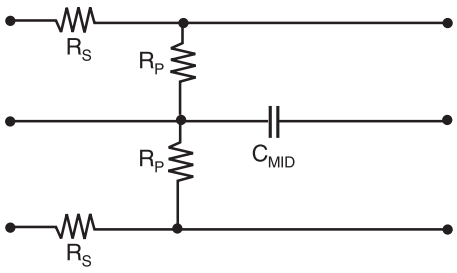
## Application Information

The differential output clock driver of the DRCG has a low output impedance of about 37 ohms. The driver produces the specified voltage swing on the channel, and should match the channel impedance. The nominal value of the channel impedance, $Z_{CH}$, is expected to be 27 ohms for a Rambus memory subsystem. External series resistor $R_S$ and parallel resistor $R_P$ are used to set the voltage swing on the channel. The driver output characteristics are defined together with the external components, and the output clock is specified at the measurement point indicated in the application schematic.

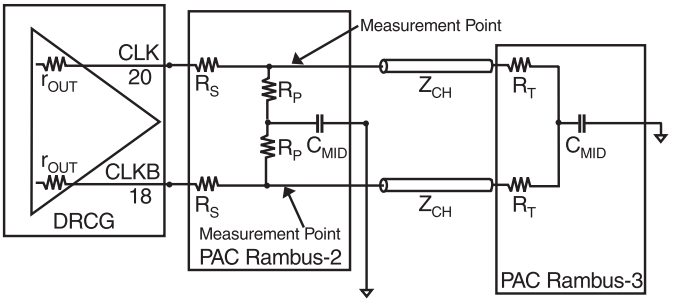
The clock driver's dynamic output impedance, $r_{OUT}$, is in series with $R_S$, and the combination is in parallel with $R_P$. The resulting effective impedance must match the channel impedance, $Z_{CH}$, in order to minimize secondary reflections. To accomplish this, the clock driver's CMOS output devices are designed to have an $r_{OUT}$ of about 37 ohms when fully turned on. The effective output impedance at the Measurement Point in the Application Schematic is therefore: $R_P(R_S+r_{OUT})/(R_P+R_S+r_{OUT})$. This calculation results in an effective output impedance of about 27 ohms for the standard values listed here. Since the total impedance is dominated by the external resistors, a large variation in the on-chip value of $r_{OUT}$ is allowed. When the output is transitioning, the impedance of the CMOS devices increases dramatically. The purpose of $R_P$ is to limit the maximum output impedance during these output transitions. The capacitor $C_{MID}$ is used to provide AC ground at the mid-point of the $R_P$ resistors.



### Product Diagram




### Application Diagram




| Standard Values | | | | |
|---|---|---|---|---|
| **Symbol** | **Parameter** | **Value** | **Tolerance** | **UNIT** |
| $R_S$ | Series Resistor | 51 | +/- 5% | ohms |
| $R_P$ | Parallel Resistor | 39 | +/- 5% | ohms |
| $C_{MID}$ | AC Ground Capacitor | 100 | +/-20% | pF |