Driving Capacitive Loads

Driving Capacitive Loads with Trek Amplifiers

In applications which involve driving capacitive loads, the useful bandwidth of the amplifier is often limited by the peak output current capability of the amplifier rather than the amplifier's AC gain bandwidth characteristics.

Engineers at Trek have designed many amplifiers with various voltage and current levels which can be used to drive capacitive loads. The table on page 2 lists selected Trek Amplifiers with their voltage and current ranges. The internal capacitance of each amplifier is in the X pF (pico farad) column. To determine which Trek Model amplifier is most suitable for your application:

1. Substitute the peak-to-peak voltage that will be applied to your load into the appropriate equation for driving capacitive loads with sine, triangle, or square waves. Use the table on page 2 to select the Trek amplifier with the appropriate voltage or current characteristics.
2. Select the correct internal capacitance value for the selected Trek amplifier from the X pF (pico farad) column and substitute the value into the X pF variable of the equation.
3. Substitute the capacitive value of your load (C load) into the equation.
4. Substitute the desired frequency f or rise time dt (square wave) of the output waveform into the equation.
5. Solve for the peak current needed from the amplifier.

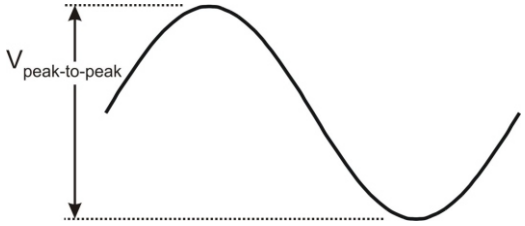
If the calculated peak current is equal to or less than the peak current range of the amplifier, the Trek amplifier will not be bandwidth limited due to output current limitations. For example, if the calculated peak current is equal to or less than 20 mA, the Model 20/20C will not be bandwidth limited due to output current limitations.

To help you select the appropriate amplifier, please refer to the following diagrams and formulas for assistance:

Driving Capacitive Loads with Sine Waves

$I = (C_{load} + X\ pF)\ \ f\ V_{peak\text{-}to\text{-}peak}$

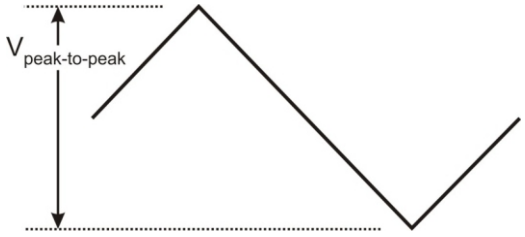
where:
- I = the peak current needed from the amplifier
- C_{load} = the load capacitance
- X pF = the internal output capacitance of the amplifier
- f = the maximum output frequency
- Vpeak-to-peak = the peak -to-peak voltage applied to the capacitive load



Driving Capacitive Loads with Triangle Waves

$I = 2\ f\ (C_{load} + X\ pF)\ V_{peak\text{-}to\text{-}peak}$

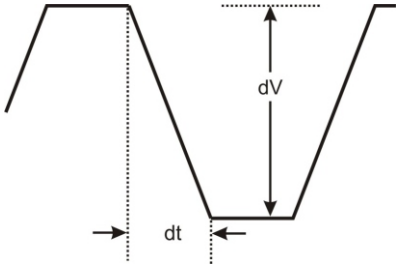
where:
- I = the peak current needed from the amplifier
- C_{load} = the load capacitance
- X pF = the internal output capacitance of the amplifier
- f = the maximum output frequency
- Vpeak -to-peak = the peak-to-peak voltage applied to the capacitive load



Driving Capacitive Loads with Square Waves

$I = (C_{load} + X\ pF)\ dV/dt$

where:
- I = the peak current needed from the amplifier
- C_{load} = the load capacitance
- X pF = the internal output capacitance of the amplifier
- dV = the peak value of the square wave
- dt = the rise time required
- dV/dt = the slope of the rise/fall time



(See reverse side for Amplifier Internal Capacitance Chart)

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TREK Amplifier Internal Capacitance Chart

Model	X pf	Output Current (DC or peak AC)	Output Voltage (DC or peak AC)
30/20A	50 pF	±20 mA	±30 kV
20/20C	60 pF	±20 mA	±20 kV
10/40A	60 pF	±40 mA	±10 kV
664	110 pF	±20 mA	±10 kV
10/10B	40 pF	±10 mA	±10 kV
610E	66 pF	±2 mA	±10 kV
609B-3	66 pF	±2 mA	±10 kV
5/80	70 pF	±80 mA	±5 kV
609E-6	50 pF	±20 mA	±4 kV
PZD2000A	400 pF	±200 mA DC or ±400 mA peak AC	±2 kV
623B	50 pF	±40 mA	±2 kV
677B	330 pF	±5 mA	±2 kV
PZD700 (±700 volt range)	665 pF	±100 mA	±700 V
PZD700 (1.4 k volt ranges)	500 pF	±50 mA	+1.4 kV *or* -1.4 kV
PZD700 M/S (±700 volt range)	1330 pF	±200 mA	±700 V
PZD700 M/S (1.4 k volt ranges)	1000 pF	±100 mA	+1.4 kV *or* -1.4 kV
601C	400 pF	±10 mA DC ±20 mA peak AC	±500 V *or* +1 kV *or* -1 kV
PZD350 (±350 volt range)	665 pF	±200 mA	±350 V
PZD350 (700 volt ranges)	400 pF	±100 mA	+700 V *or* -700 V
PZD350 M/S (±350 volt range)	1330 pF	±400 mA	±350 V
PZD350 M/S (700 volt ranges)	800 pF	±100 mA	+700 V *or* -700 V
603	800 pF	±40 mA DC ±80 mA peak AC	±125 V *or* +250 V *or* -250 V

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