

## DIGITAL TONE GENERATOR

### FEATURES:

- Tunable 30 Hz to 5 KHz Range
- Revert to "0" Output
- Continuous or Tone Burst Operation
- Adjustable Output Amplitude
- Operation to 50 Hz
- Separate Enable/Timing Gate with Override

### APPLICATIONS:

- Systems requiring audio tones in the 30 Hz to 5 KHz range.

### DESCRIPTION:

The MX205 is a monolithic PMOS tone generator useful in applications where an audio tone in the 30 Hz to 5 KHz range is required. The output is a sinusoidally weighted series of eight current steps per cycle. Principal undesired harmonics are the 3rd, down 50 dB, and the 7th, down 18 dB from the fundamental (without external capacitive smoothing).

Operation to 50 KHz may be obtained by applying an external clock operating at eight times the desired output frequency. Tones to 5 KHz are "tuned" by selecting external R and C values. Output amplitude is adjustable over a 70% range via a DC reference voltage applied to a control pin. The tone output may be continuous or pulsed under control of an on-chip, one-shot timer, whose period is externally controlled.

Frequency stability of the MX205 is 0.06% per 1% change in supply voltage and 0.015% per degree change in operating temperature. The circuit is designed to always start and end tone generation at the minimum current step, i.e. the most negative output voltage.

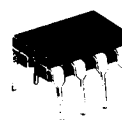
The output frequency,  $f_o$ , can be obtained from the following formula:

$$f_o = \frac{1}{5.6 (R_2 + 2R_1) C_1} \text{ Hz}$$

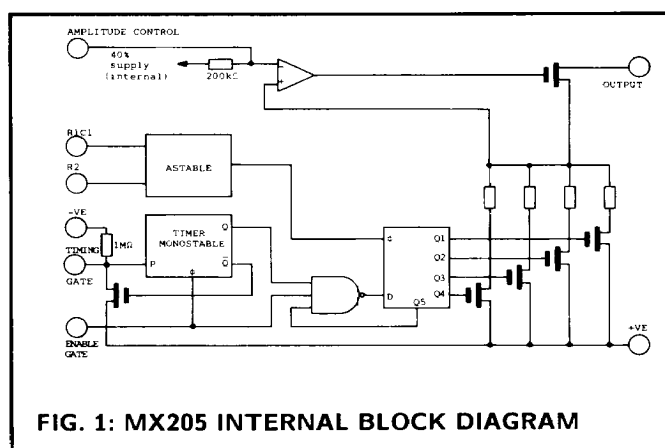
where  $R_1$  and  $R_2$  are expressed in megaohms,  $C_1$  is in microfarads, and the value of "5.6" is a device constant, subject to a  $\pm 10\%$  tolerance.



**MX205**  
(8p metal can)

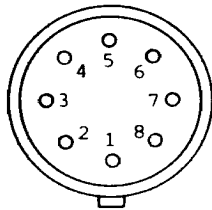


**MX205P**  
(8p PDIP)



# FIG. 2:MX205 PINOUT DIAGRAM

## MX205

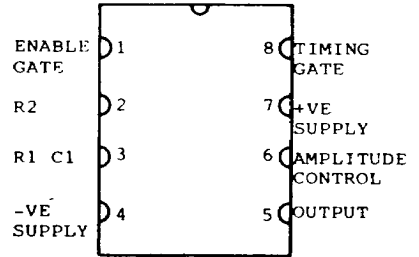


View on pins

1. R1 C1
2. -VE Supply
3. Output
4. Amplitude Control
5. +VE Supply
6. Timing Gate
7. Enable Gate
8. R2

Note: Pin 5 is internally connected to the case.

## MX205P



## DEVICE OPERATION

The MX205 will generate an output for the period of time that the ENABLE GATE is held positive. Alternatively, a resistor ( $R_t$ ) and capacitor ( $C_t$ ) can be provided, as shown in the Component Connection Diagram. This ensures that the output is generated for a minimum duration, given by the following formula:  $T = 0.7 \cdot R_t \cdot C_t$  seconds. Here,  $R_t$  is expressed in megaohms,  $C_t$  in microfarads, and 0.7 the device constant with a  $\pm 5\%$  tolerance.

The monostable multivibrator is not retriggerable, and a further time period can be initiated only after completion of the original tone burst. Should the ENABLE input be held positive for longer than time  $T$ , the device will continue generating a tone until disabled.

The output voltage can be adjusted over a range of  $\pm 35\%$  from the nominal level by applying a voltage ( $V_b$ ) to the AMPLITUDE CONTROL input as shown below.  $V_b$  can range from 25% to 55% of the supply voltage (internal bias is 40% nominally).

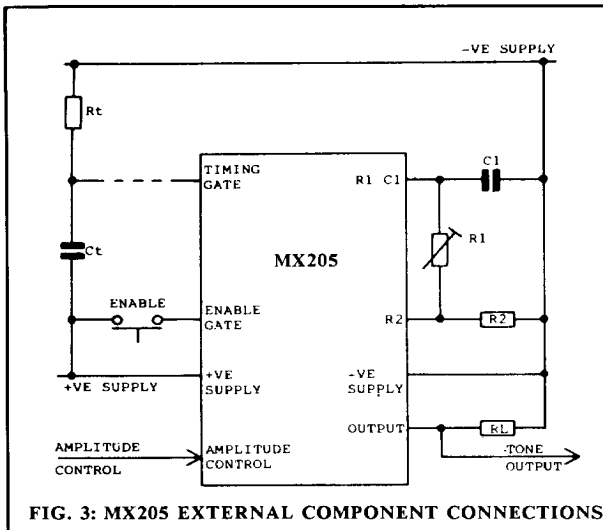


FIG. 3: MX205 EXTERNAL COMPONENT CONNECTIONS

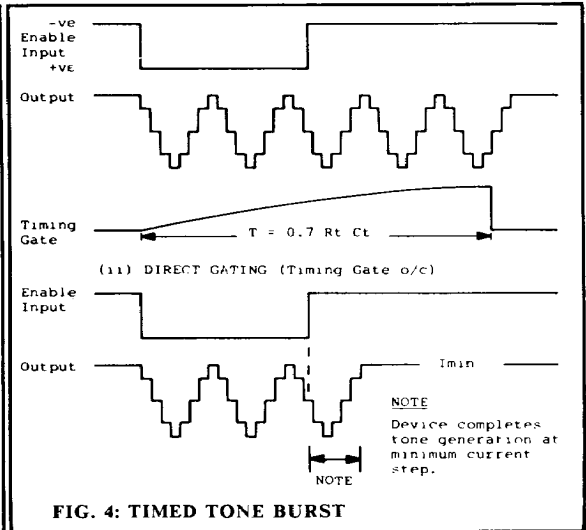
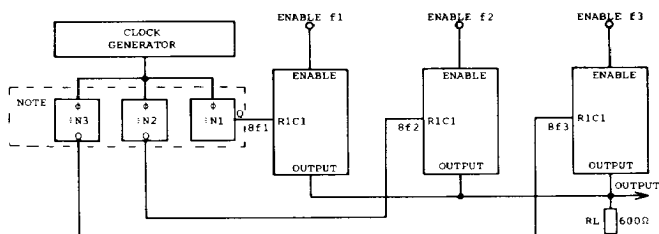


FIG. 4: TIMED TONE BURST

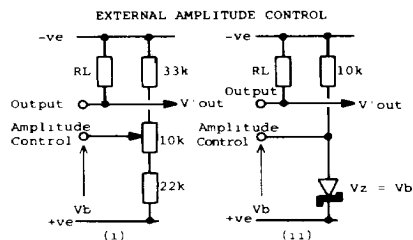
# FIGURES 5-10: APPLICATIONS DIAGRAMS

## MULTI-TONE OUTPUT USING A MASTER CLOCK AND PROGRAMMABLE DIVIDERS.

$$V_{out} = iR_L(Sin\omega_1 t + Sin\omega_2 t + Sin\omega_3 t)$$

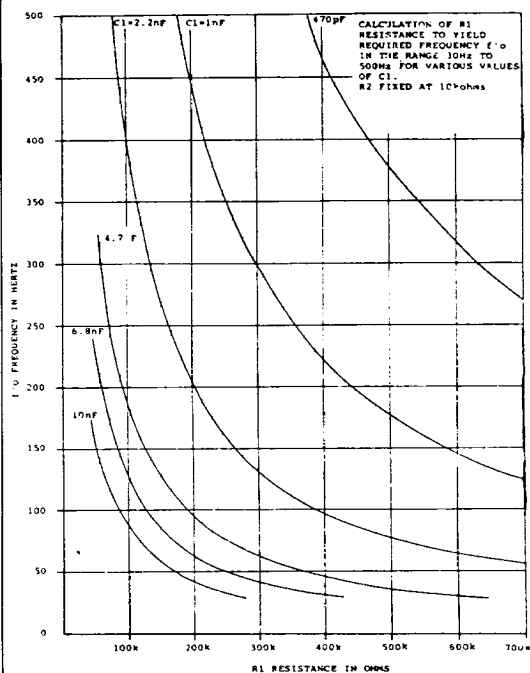
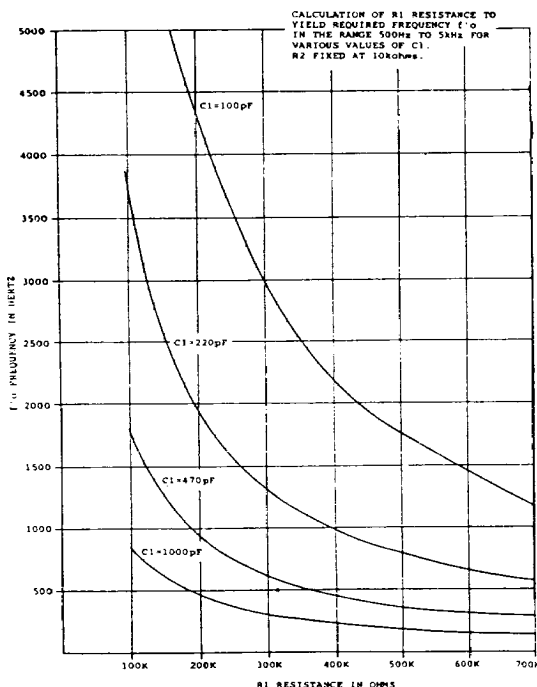
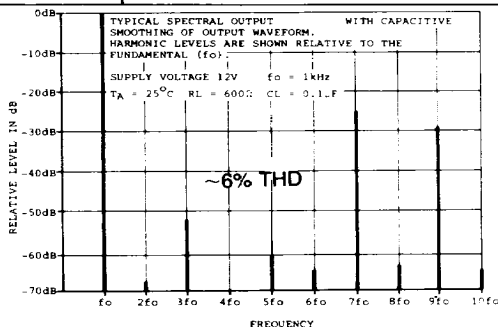
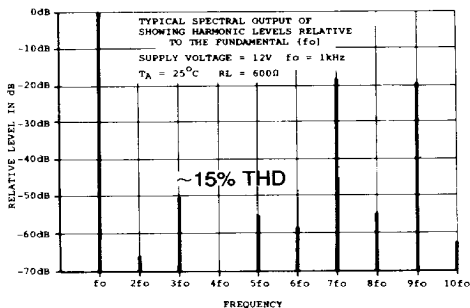


NOTE CMOS Programmable Synchronous  $\div$  by 'N' Counters e.g. CD4059 or similar



$$V'_{out} = \frac{V_b}{6800} \times R_L \text{ V.r.m.s.}$$

where  $R_L$  is in ohms and 6800 is a device constant (subject to  $\pm 20\%$  tolerance)



# MX205 ELECTRICAL SPECIFICATIONS

**MAXIMUM RATINGS.** Exceeding maximum rating may result in device damage.

|                                                   |        |                  |
|---------------------------------------------------|--------|------------------|
| Maximum Voltage between any pin<br>and +ve supply |        | – 20v to +0.3v   |
| Operating Temperature Range                       | MX205  | – 30°C to +85°C  |
|                                                   | MX205P | – 10°C to +60°C  |
| Storage Temperature Range                         | MX205  | – 55°C to +125°C |
|                                                   | MX205P | – 40°C to +85°C  |
| Device Dissipation at 85°C                        | MX205  | 200mW            |
| at 60°C                                           | MX205P | 120mW            |

## OPERATING CHARACTERISTICS

Unless otherwise stated: Supply voltage = 12v T'amb = 25°C  
Output Frequency ≤ 3kHz

| SYMBOL          | CHARACTERISTICS                                                                        | MIN.                 | TYP.  | MAX.  | UNITS     |
|-----------------|----------------------------------------------------------------------------------------|----------------------|-------|-------|-----------|
| V <sub>s</sub>  | Supply Voltage (+ve supply = 0v)                                                       | – 10                 | – 12  | – 15  | V         |
| I <sub>s</sub>  | Supply Current (no load current)                                                       |                      | 7     |       | mA        |
| f <sub>o</sub>  | Output Frequency Range<br>(determined by R1, C1 & R2)                                  | 30                   |       | 5k    | Hz        |
| f <sub>o</sub>  | Output Frequency Range<br>(determined by external clock)                               | 0                    |       | 50k   | Hz        |
| Δf <sub>o</sub> | Frequency Variation per 1% change<br>in V <sub>s</sub>                                 |                      | 0.06  |       | %         |
| Δf <sub>o</sub> | Frequency Variation per 1°C change in<br>temperature                                   |                      | 0.015 |       | %         |
| V <sub>o</sub>  | Pulse Width of External Clock                                                          | 1.25                 |       |       | μs        |
|                 | Output Voltage (RL = 600Ω,<br>Amplitude Control Pin o/c)                               |                      | 550   |       | mV r.m.s. |
| ΔV <sub>o</sub> | Output Amplitude adjustment range<br>(V <sub>b</sub> applied to Amplitude Control Pin) |                      | ± 35  |       | %         |
|                 | Input Level to Enable Device                                                           |                      |       | – 1.5 | V         |
|                 | Input Level to Disable Device                                                          | – 9                  |       |       | V         |
|                 | Enable Input Pulse width                                                               | 10                   |       |       | μs        |
|                 | Input Impedance of Enable Input                                                        |                      | 100k  |       | Ω         |
|                 | Value of R1                                                                            | 47k                  |       | 1M    | Ω         |
|                 | Value of R2                                                                            |                      | 10k   |       | Ω         |
|                 | Value of RL                                                                            |                      | 600   |       | Ω         |
|                 | Value of Rt                                                                            | 100k                 |       | 10M   | Ω         |
|                 | Value of C1                                                                            | 1 × 10 <sup>–4</sup> |       | 0.1   | μF        |
|                 | Value of Ct                                                                            | 1 × 10 <sup>–4</sup> |       | 1.5   | μF        |
| T               | Period of Timed Tone Burst<br>(T = 0.7 Rt Ct)                                          | 1/fo                 |       | 10    | seconds   |