MOS INTEGRATED CIRCUIT

M 147

13-BIT LATCH PEDAL SUSTAIN

- PRIORITY OF THE FIRST LEFT PEDAL
- PRIORITY PEDAL FREQUENCY MEMORIZATION
- TRIGGER OUTPUT FOR ENVELOPE CIRCUITS
- CHOICE BETWEEN TWO DIFFERENT INPUT FREQUENCIES (2.00024 MHz or 500.06 kHz)
- ANTIBOUNCE INTERNAL CIRCUIT ON BOTH TOUCH AND RELEASE SITUATION
- STANDARD POLYPHONIC KEYBOARDS
- P-CHANNEL SILICON GATE PROCESS

The M 147 is a monolithic integrated circuit for pedal sustain specifically designed for electronic organs and other musical instruments.
Constructed on a single chip using P-channel Silicon Gate technology it is supplied in a 24-lead dual in line plastic package.

ABSOLUTE MAXIMUM RATINGS*

V_{GG}**	Source supply voltage	-20 to 0.3	V
V_I**	Input voltage	-20 to 0.3	V
I_O	Output current (at any pin)	3	mA
T_{stg}	Storage temperature	-65 to 150	°C
T_{op}	Operating temperature	0 to 70	°C

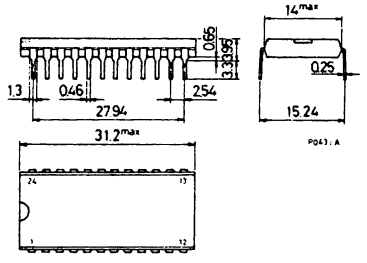
* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other condition above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

** All voltage values are referred to V_{SS} pin voltage.

ORDERING NUMBER: M 147 B1

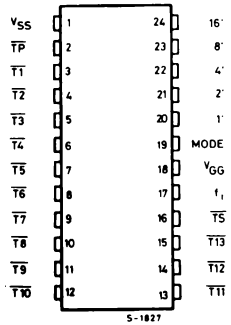
MECHANICAL DATA

Dimensions in mm

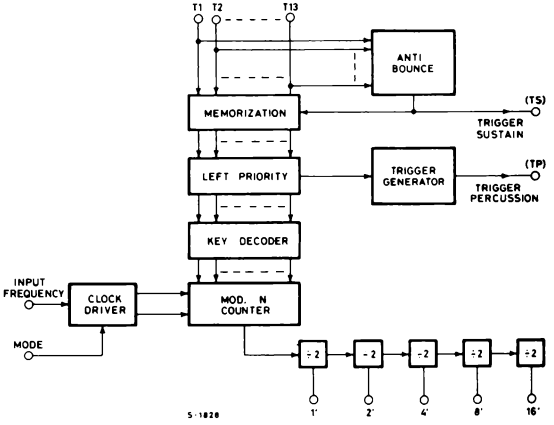


M 147

CONNECTION DIAGRAM



BLOCK DIAGRAM



GENERAL CATACTERISTICS

The circuit comprises
a) 13 pins for input pedals
b) 1 clock pin for input frequency
c) 1 input for MODE selection
d) 5 frequency outputs
e) 1 output for trigger sustain (TS)
f) 1 output for trigger percussion (TP)
g) 2 supply pins

DESCRIPTION OF OPERATION

The first negative front, which is obtained by pressing any key, starts a delay circuit whose duration is a function of the key pressed and varies from 4 to 8 ms in normal mode (with the MODE input at V_{SS} and f_I= 500 kHz or with the MODE input at V_{GG} and f_I= 2 MHz (note 1)).
If the key is released before this delay time has passed, it will not be memorized.
Releasing the key retriggers the delay circuit, and not until the end of the delay will any further keys to the right be accepted, unless the new key was already pressed **before** the release of the first key then the new key is accepted immediately.
Any key to the left will be accepted immediately it is pressed. Re-pressing the same key will output the same frequency but with a jump of phase as the internal counters will be reset to zero.
When a pedal is depressed, the corresponding frequency (square wave, 50% of duty cycle) in 5 octaves is present in parallel at the 5 outputs.
These outputs remain when the pedal is released, until a new pedal is depressed. When two or more pedals are depressed, only the left one is accepted (corresponding to the lowest, frequency).
A TP output pulse is present whenever a pedal with priority is depressed. If the pedal is again depressed, successive TP pulses are generated.
A pulse appears at the TP output if, when two pedals are depressed, the left one is released.
The TS output is activated only when one or more pedals are depressed. An internal circuit provides bounce suppression on this output.

Note 1: With MODE at V_{SS} and f_I= 1 MHz the time is halved (2 to 4 ms)
With MODE at V_{GG} and f_I= 1 MHz the time is doubled (8 to 16 ms).

MODE OF OPERATION

If the MODE input is connected to V_{SS}, the input frequency must be 500.06 kHz.
If the MODE input is connected to V_{GG}, the input frequency must be 2.00024 MHz.

STATIC ELECTRICAL CHARACTERISTICS (V_{GG} = -16 to -18V, V_{SS} = 0V, T_{amb} = 0 to 70°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_{IH}	Input high voltage		V_{SS}-1		V_{SS}	V
V_{IL}	Input low voltage		V_{GG}		V_{SS}-5	V
R_{ON}	Output resistance	V_O=V_{SS}-1V to V_{SS}		1	1.6	κΩ
$I_{O(off)}$	Output leakage current	V_I=V_{IH}, V_O=V_{SS}-10V T_{amb}= 25°C			10	μA
I_L	Input leakage current	V_I=V_{SS}-14V T_{amb}= 25°C			10	μA
I_{GG}	Supply current	T_{amb}= 25°C		35	45	mA

DYNAMIC ELECTRICAL CHARACTERISTICS (V_{GG} = -16 to -18V, V_{SS}=0V, T_{amb}= 0 to 70°C unless otherwise specified; f_I= 2.00024 MHz if MODE input is connected to V_{GG}; f_I= 500.06 kHz if MODE input is connected to V_{SS}).

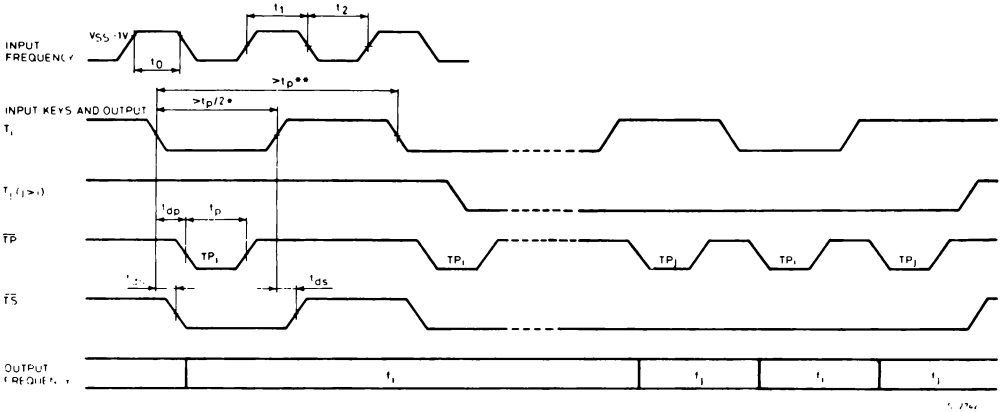
Parameter		Test conditions	Min.	Typ.	Max.	Unit	Notes
t_0	Input frequency "1" time		150			ns	
t_{1A}	Input frequency positive half period		0.8	1		μs	1-3
t_{2A}	Input frequency negative half period		0.8	1		μs	1-3
t_{1B}	Input frequency positive half period		200	250		ns	2-3
t_{2B}	Input frequency negative half period		200	250		ns	2-3
t_{ds}	Delay time of TS			300	1000	ns	3
t_{dp}	Delay time of TP				10	μs	3
t_p	Width of TP			10	22	ms	3

Notes: 1) With MODE connected to V_{SS}
2) With MODE connected to V_{GG}
3) All these delay and width times are measured at 50% of the swing.

OUTPUT FREQUENCIES (Hz)

Input	Outputs				
	1'	2'	4'	8'	16'
T1	523.075	261.538	130.769	65.384	32.692
T2	554.390	277.195	138.598	69.299	34.649
T3	586.925	293.462	146.731	73.366	36.683
T4	621.965	310.983	155.491	77.746	38.873
T5	659.710	329.855	164.927	82.464	41.232
T6	698.408	349.204	174.602	87.301	43.650
T7	739.734	369.867	184.933	92.467	46.233
T8	783.793	391.897	195.948	97.974	48.987
T9	830.664	415.332	207.666	103.833	51.917
T10	880.387	440.194	220.097	110.048	55.024
T11	932.948	466.474	233.237	116.618	58.309
T12	988.261	494.130	247.065	123.533	61.766
T13	1046.151	523.075	261.538	130.769	65.384

TIMING WAVEFORMS

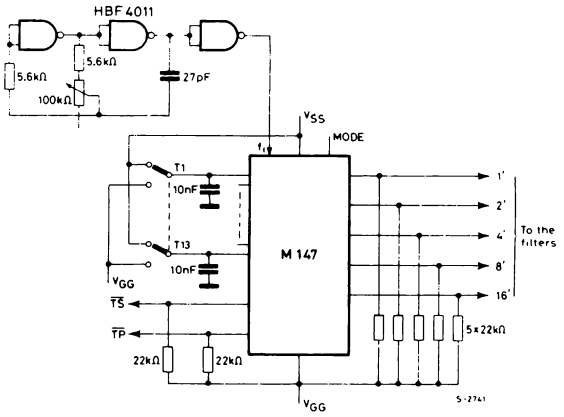


* In order to obtain memorization the key must be pressed for more than Tp/2.

** If the key is pressed twice for a time less than Tp only a single percussion trigger Tp output will be available.

TYPICAL APPLICATIONS

Typical application circuit



Circuit for a 25 pedal system using the M 147