



## MM5766 calculator programmer

### general description

The MM5766 provides a convenient and inexpensive means of adding "learn mode" programmability to the National Semiconductor MM5758 scientific calculator chip. The monolithic MOS integrated circuit combines P-channel enhancement and depletion mode technologies to obtain low voltage and low power characteristics necessary for economical battery-powered products.

The MM5766 is a dynamic key sequence programmer that memorizes any combination of key entries while in the Load Mode, then automatically plays back the programmed sequence as often as desired in the Run Mode. Up to 102 characters can be stored in multiprogram sequence blocks. Each block, or program, can be executed individually or the operator can make the decision to branch to specific programs, run each in series or perform intermediate calculations from the keyboard. When programming in the Load Mode, the Delete key provides a convenient editing feature and the Halt key programs variable data entry points where control is temporarily returned to the operator in the Run Mode. Start and Skip keys control operation in both modes.

Synchronization with the calculator chip is accomplished by monitoring its Digit Output and Ready signals. The digit signals give timing information while the Ready indicates status of the calculator and synchronizes the key entry interface between it and the MM5766.

Up to four switch inputs (K1, K2, K3 and K4) and up to twelve digit lines are connected in parallel with the calculator switch and digit terminals that scan the keyboard. Keys stored in the MM5766 that are entered by selecting K1 through K4 are encoded simply as matrix positions, i.e., a particular switch input at a specific digit time. Therefore it is the key matrix address that is stored and not the key function. Please refer to the MM5765 data sheet for a detailed functional description.

### features

- Any key sequence, including constants and data entry points, may be stored automatically in the Load Mode and executed in the Run Mode.
- 102 step storage capacity of up to 47 different keys arranged in a 12 x 4 matrix.
- Multiprogram capability
- Provision for editing in Load Mode using the Delete key
- Convenient verification of programs using a Step Mode feature
- Alarm for full storage condition—or if a deletion of the first step in a program is attempted
- Power-on clear

### block and connection diagrams

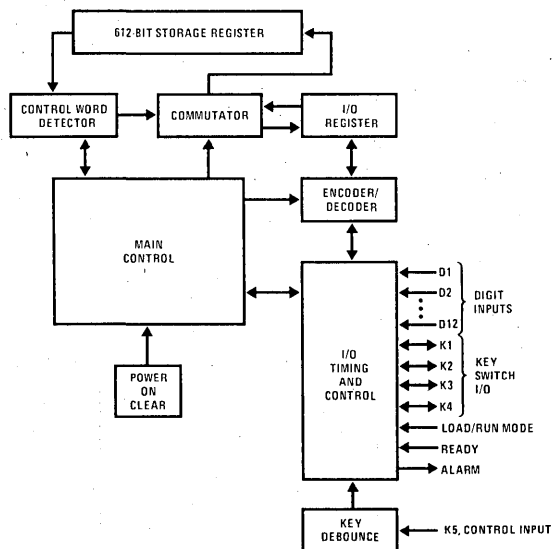
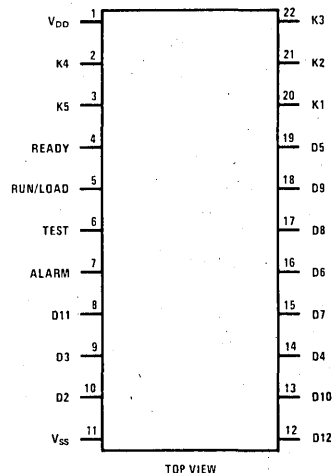


FIGURE 1

Dual-In-Line Package



Order Number MM5766N  
See Package 21

**absolute maximum ratings**Voltage at Any Pin Relative to  $V_{SS}$   $V_{SS} + 0.3V$  to  $V_{SS} - 12V$ (All other pins connected to  $V_{SS}$ )Ambient Operating Temperature  $0^{\circ}C$  to  $+70^{\circ}C$ Ambient Storage Temperature  $-55^{\circ}C$  to  $+150^{\circ}C$ Lead Temperature (Soldering, 10 seconds)  $300^{\circ}C$ **operating voltage range** $V_{SS} - 6.5V \leq V_{DD} \leq V_{SS} - 9.5V$  $(V_{SS}$  is always the most positive supply)**dc electrical characteristics**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$I_{DD}$ Operating Supply Current	$V_{DD} = V_{SS} - 9.5V$ , $T_A = 25^{\circ}C$		8.0	18.0	mA
Keyboard Scan Input Levels (K1, K2, K3, K4)					
$V_{IH}$ Logical High Level	$V_{DD} = V_{SS} - 7.2V$	$V_{SS} - 2.5$			V
	$V_{DD} = V_{SS} - 8.8V$	$V_{SS} - 4.0$			V
$V_{IL}$ Logical Low Level	$V_{DD} = V_{SS} - 6.5V$			$V_{DD} + 1.0$	V
	$V_{DD} = V_{SS} - 9.5V$			$V_{DD} + 1.5$	V
K5 and Digit Input Levels (D2 through D12)					
$V_{IH}$ Logical High Level	$V_{DD} = V_{SS} - 7.2V$ ; $I_{IH} \geq -200\mu A$	$V_{SS} - 2.5$			V
	$V_{DD} = V_{SS} - 8.8V$ ; $I_{IH} \geq -200\mu A$	$V_{SS} - 4.0$			V
$V_{IL}$ Logical Low Level	$V_{DD} = V_{SS} - 6.5V$			$V_{DD} + 1.0$	V
	$V_{DD} = V_{SS} - 9.5V$			$V_{DD} + 1.5$	V
Other Inputs (Ready, Run and Test)					
$V_{IH}$ Logical High Level		$V_{SS} - 2.5$			V
$V_{IL}$ Logical Low Level	$V_{DD} = V_{SS} - 6.5V$			$V_{SS} - 5.0$	V
	$V_{DD} = V_{SS} - 9.5V$			$V_{SS} - 6.0$	V
Switch Buffer Output Levels (K1, K2, K3, K4)					
$V_{OH}$ Logical High Level	$V_{DD} = V_{SS} - 7.2V$	$V_{SS} - 1.5$		$V_{SS}$	V
	$V_{DD} = V_{SS} - 8.8V$	$V_{SS} - 3.0$		$V_{SS}$	V
$V_{OL}$ Logical Low Level	$V_{DD} = V_{SS} - 6.5V$			$V_{SS} - 6.0$	V
	$V_{DD} = V_{SS} - 9.5V$ , $I_{OL} \leq -1.5 mA$			$V_{SS} - 7.0$	V
Alarm Output Current Source Current	$V_{OUT} = V_{SS} - 4.5V$ , $V_{DD} = V_{SS} - 6.5V$	-5.0			mA
	$V_{OUT} = V_{SS} - 5.2V$ , $V_{DD} = V_{SS} - 7.25V$		-8.0		mA
	$V_{OUT} = V_{SS} - 7.8V$ , $V_{DD} = V_{SS} - 9.5V$			-20.0	mA

**ac electrical characteristics**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Digit Input Time	(Figure 3)	70			$\mu s$
Word Time	(Figure 3)	0.64			ms
Switch Input Time	(Figure 3)	70			$\mu s$
Switch Output Time	(Figure 4)	70			$\mu s$
Switch Propagation Delay Output	(Figure 4)		15	26	$\mu s$
$t_R$ and $t_F$ Switch Output Transition Time	$C_{LOAD} = 100 pF$ , (Figure 4)		2		$\mu s$
Switch Input K5 Key Bounce-out Stability Time		4.5		17.0	ms
(The time a keyboard input must be continuously higher than the minimum Logical High Level to be accepted as a key closure, or lower than the maximum Logical Low Level to be accepted as a key release, i.e., 6 or 7 cycles of D2.)					
Ready Timing	(Figure 3)				
$t_R = t_F$			3	5	$\mu s$
$t_D$		0.1			$\mu s$
$t_{SETUP}$		20			$\mu s$
$t_{PW}$		400			$\mu s$
Key Closure Rate (Time between consecutive key outputs in Run Mode.)			40		ms
Key Acceptance Rate (Time between consecutive key inputs in Load Mode.)				47	ms

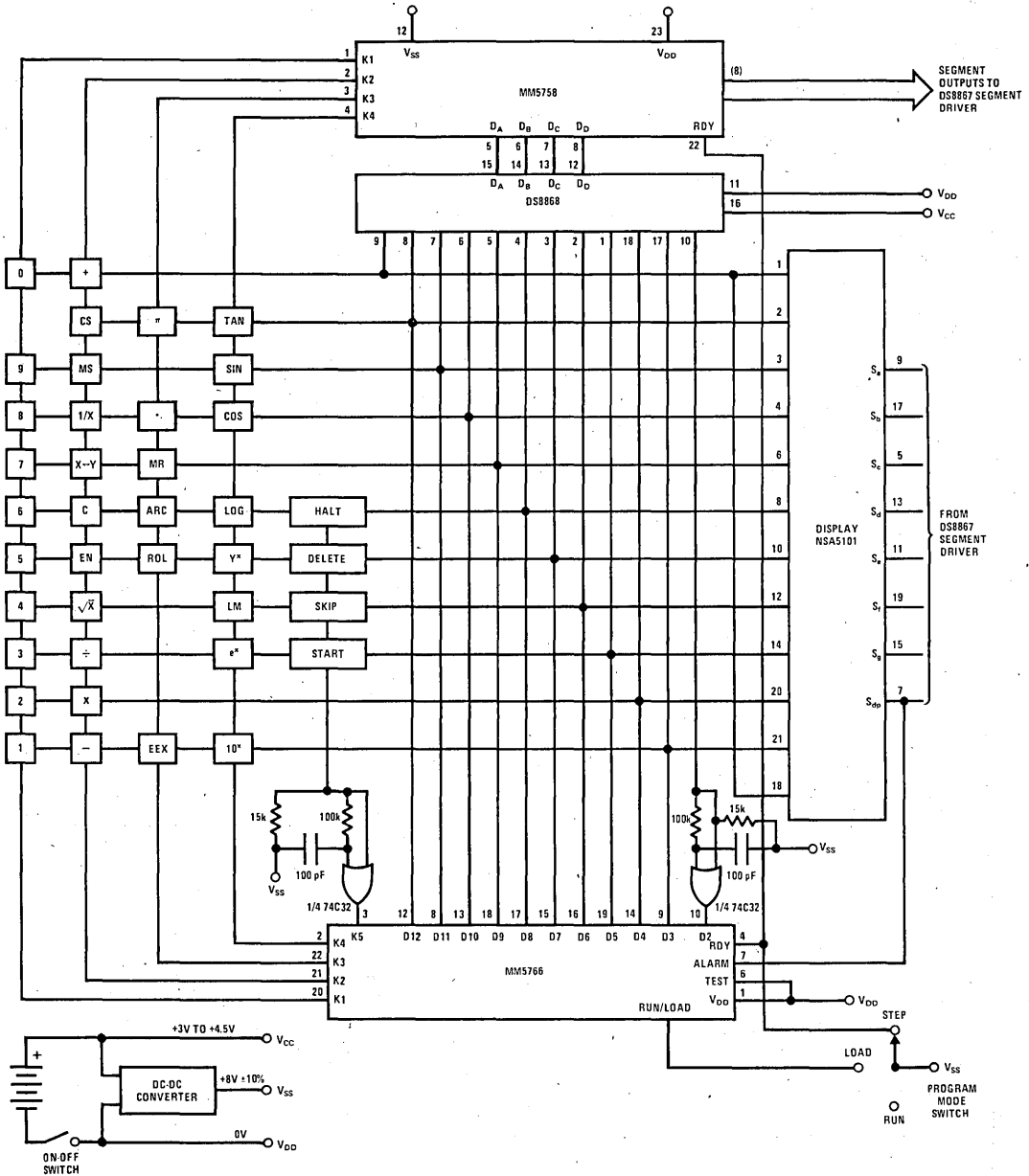


FIGURE 2. Interface of MM5766 Programmer with MM5758 Scientific Calculator

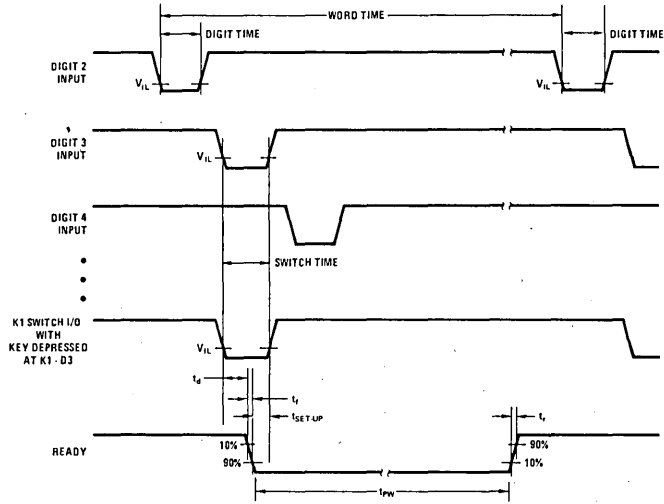


FIGURE 3. Input Timing

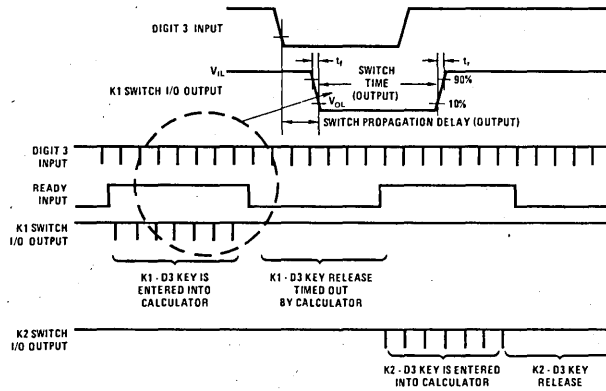


FIGURE 4. Programmer Output Timing