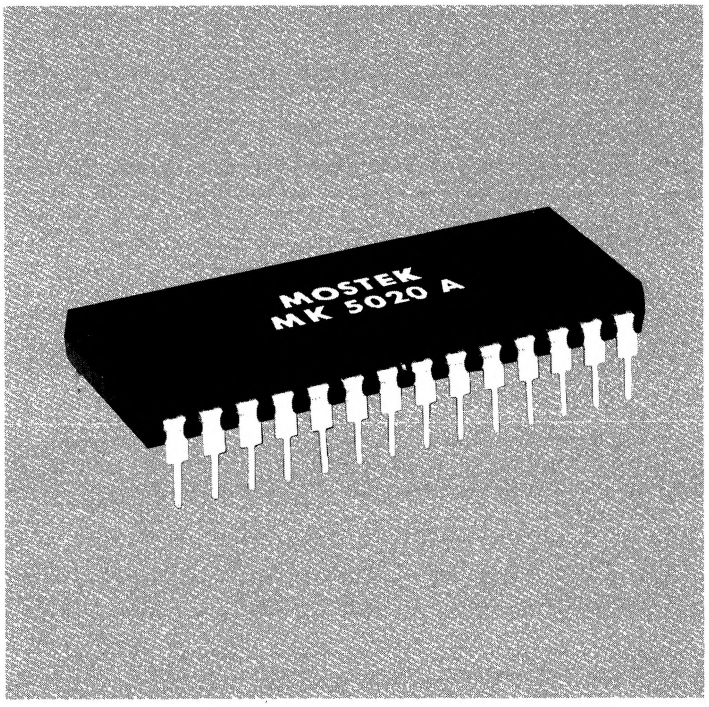
MOS Calculator Series

MOSTEK

FEATURES:

- ☐ Direct Segment Drive for LED's
- ☐ Low Power Consumption
- ☐ Single Power Supply Voltage
- ☐ Internal Encoding of Keyboard Inputs
- ☐ Internal Debouncing of Keyboard Inputs
- ☐ Single 28-pin, Dual-in-line Package
- ☐ ROM controlled

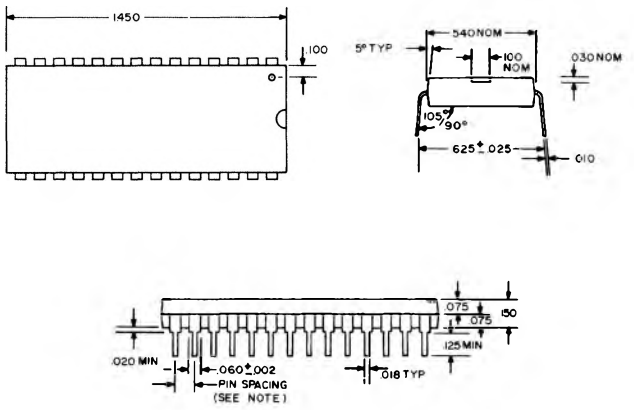


STANDARD PRODUCTS:

Consumer

☐ MK 5020 A	8-digit, six-function (+, −, X, ÷, %, √) with constant
☐ MK 5021 C	10-digit, six-function (+, −, X, ÷, %, √) with constant
☐ MK 5022 A	8-digit, five-function (+, −, X, ÷, %) with constant fully independent memory, and store/recall memory.
☐ MK 50203	8-digit, five-function (+, −, X, ÷, %) with constant, fully independent memory, reciprocal, and constant register exchange

PACKAGE 28-pin dual-in-line plastic



NOTES:
1. THE TRUE-POSITION PIN SPACING IS .100 BETWEEN CENTERLINES EACH PIN CENTERLINE IS LOCATED WITIN ±.010 OF ITS TRUE LONGITUDINAL POSITION RELATIVE TO PINS 1 AND 28.

ABSOLUTE MAXIMUM RATINGS OVER OPERATING FREE-AIR TEMPERATURE RANGE

(All voltages relative to V_{SS})

Supply Voltage Range V_{GG} ..... +0.3V to −20V

Input Voltage Range ..... +0.3V to −20V

Output Voltage Breakdown SA-SG ..... +0.3V to −7V

DI-DII ..... +0.3V to −17V

Operating Free-Air Temperature Range ..... 0°C to +55°C

Storage Temperature Range ..... −40 °C to + 100°C

RECOMMENDED OPERATING CONDITIONS ($0°C \leq T_A \leq 55°C$)

	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
V_{GG}	Supply Voltage	−12	−14.5	−17	volts	1
V_{IH}	Input Voltage, Logic 1	V_{SS} −1.2			volts	2, 8
V_{IL}	Input Voltage, Logic 0	V_{GG}		V_{SS} −5	volts	2
ϕ	Clock Period	5.5		11	μsec	3

ELECTRICAL CHARACTERISTICS ($12 \leq V \leq 17$; $0°C \leq T_A \leq 55°C$)

	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
I_{GG}	Supply Current		6		mA	
I_I	Input Current @ V_{IN} V_{SS}		150	300	μA	2
$R_{ON(SEG)}$	Segment Output "On" Resistance		300	750	Ω	4, 7
$R_{ON(DIG)}$	Digit Output "On" Resistance		250	600	Ω	4, 8
$I_{OL(SEG)}$	Segment Output Leakage Current		.1	10	μA	5, 9
$I_{OL(DIG)}$	Digit Output Leakage Current		.1	10	μA	6, 9

Notes:

(1) This parameter is relative to V_{SS}.

(2) This parameter applies to the KN, KO, KP, and KQ inputs.

(3) The maximum clock period is related to the worst-case keyboard entry time. 11 μsec corresponds to approximately 44 msec "key down" time. Any increases in the clock period will affect this entry time proportionately.

(4) Voltage across the output (relative to V_{SS}) is 0 volts to 1.5 volts.

(5) Voltage across the output (relative to V_{SS}) is 0 volts to 7 volts.

(6) Voltage across the output (relative to V_{SS}) is 0 volts to 17 volts.

(7) Segment output current must be limited to less than 7 mA per output.

(8) Because digit output voltages are used in scanning keyboard inputs, external circuitry (e.g., a display driver) must require less than 2 mA from each digit output in order that the minimum value of V_{IH} can be satisfied in all applications.

(9) Segment and digit outputs are open drain transistors.

Consume

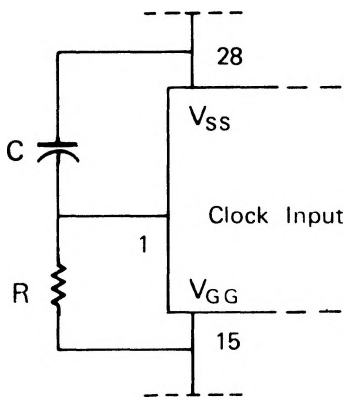
INTERNAL CLOCK OSCILLATOR

R = 390 K 10%

C = 22 pF 5%

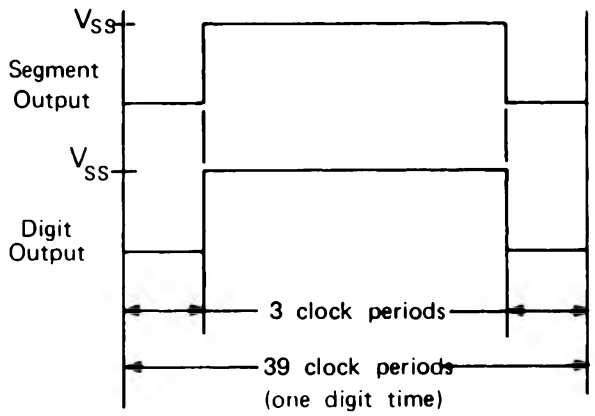
for nominal

140 KHz clock



The oscillator waveforms appears as a "sawtooth" voltage variation swinging between V_{SS} and V_{GG} /2.

SEGMENT AND DIGIT TIMING AND POLARITY



Note: Segment and digit outputs are turned on to V_{SS} for a displayed segment.

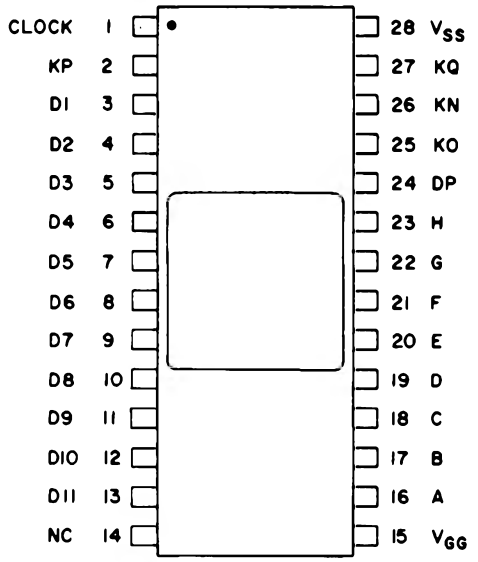
MK 5020AN

DESCRIPTION

The MK 5020 A is a six-function (+, −, X, ÷, %, √) 8-digit calculator, featuring selectable constant, floating or fixed decimal point (selectable to eight positions), selectable roundoff, algebraic or business entry, credit balance, chain calculations, leading zero suppression, and internal debouncing and encoding of keyboard inputs.

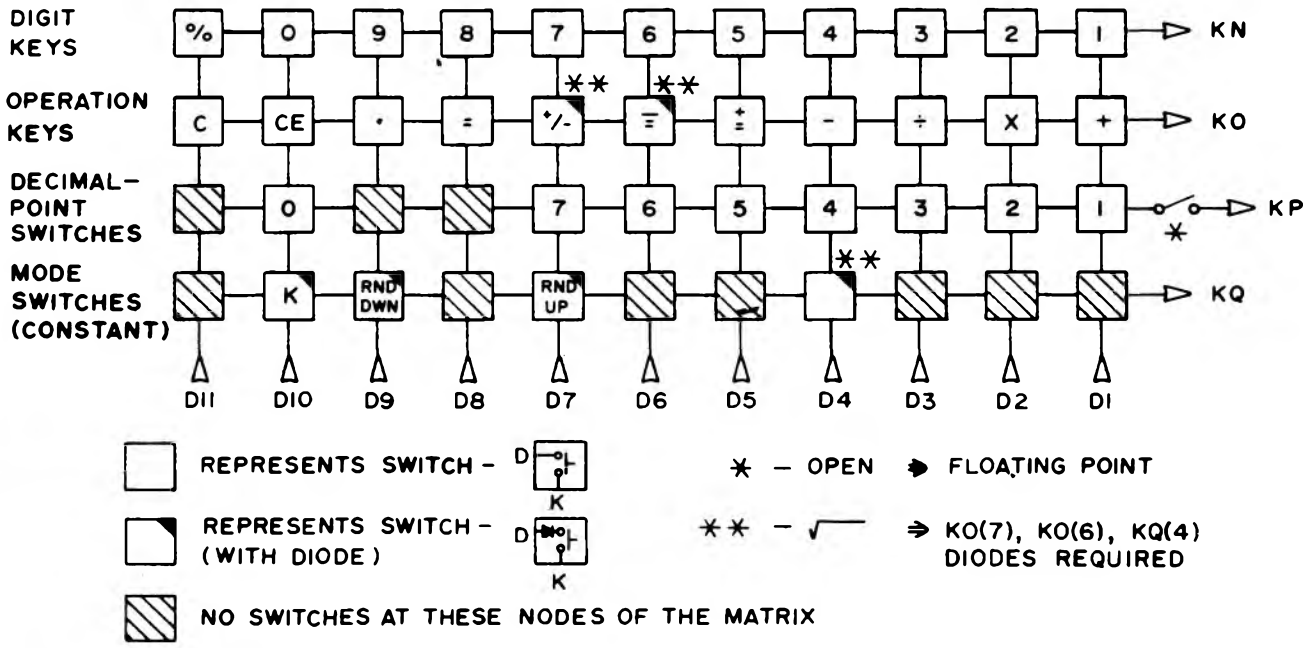
Low power dissipation, broad supply voltage range, a single power supply, and an internal clock oscillator makes the MK 5020 A ideal for battery-operated, hand-held calculators with lower system costs.

PIN CONNECTION



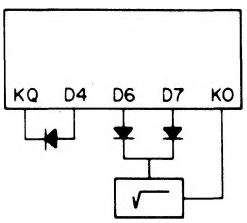
NC = NO CONNECTION

KEY MATRIX



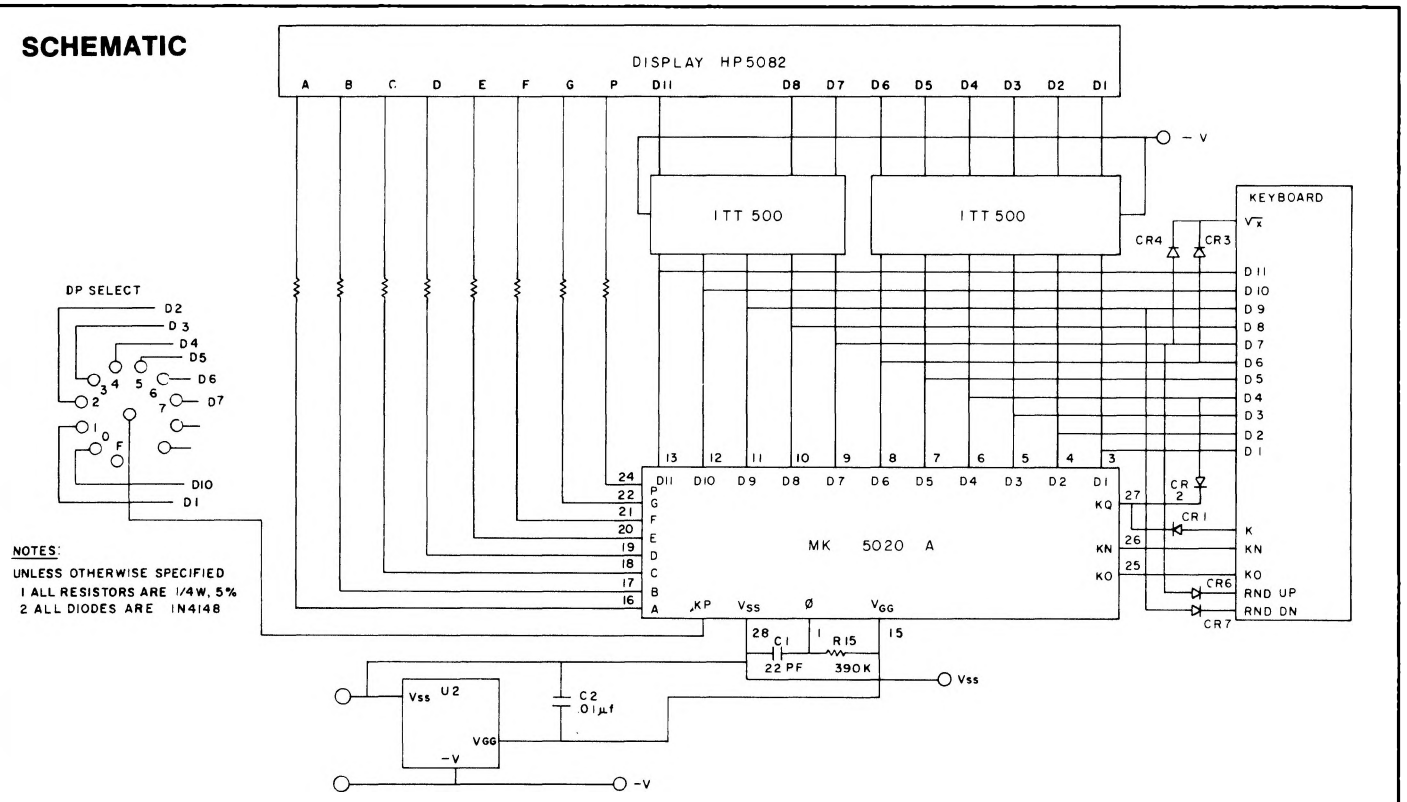
DISPLAY FONT

CONNECTIONS FOR SQUARE ROOT KEY



Consumer

SCHEMATIC



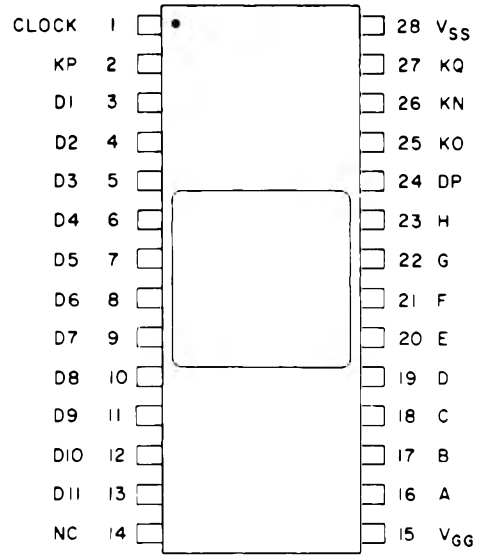
PROBLEM	FIXED POINT OR FLOATING	CONSTANT	KEY ENTRIES	REMARKS	DISPLAY
PERCENT KEY					
Find 15% of 200	Floating	*	C		0.
			15		15.
			%		0.15
			X		0.15
			200		200.
			=		30.
Find 15% of 200	Floating	*	C		0.
			200		200.
			X		200.
			15		15.
			%		30.
Find 15% mark up on $200 and total	Floating	*	C		0.
			200		200.
			+		200.
			15		15.
			%	This gives the mark up	30.
			=	This gives the total	230.
Find 22% discount and selling price on $526	Floating	*	C		0.
			526		526.
			-		526.
			22		22.
			%	This is the discount	115.72
			=	This is the selling price	410.28
CONSTANT PERCENT					
Find 15% of: 200, 450, 372	Floating	on	C		0.
			15		15.
			%		0.15
			X		0.15
			200		200.
			=		30.
			450		450.
			=		67.5
			372		372.
			=		55.8

MK 5021CN

The MK 5021 C is a six-function (+, −, X, ÷, %, √) 10-digit calculator featuring selectable constant, floating decimal point (selectable to ten positions), floating negative sign, algebraic or business entry, credit balance, chain calculations, display blanking during claculations, leading zero suppression, and internal debouncing and encoding of keyboard inputs.

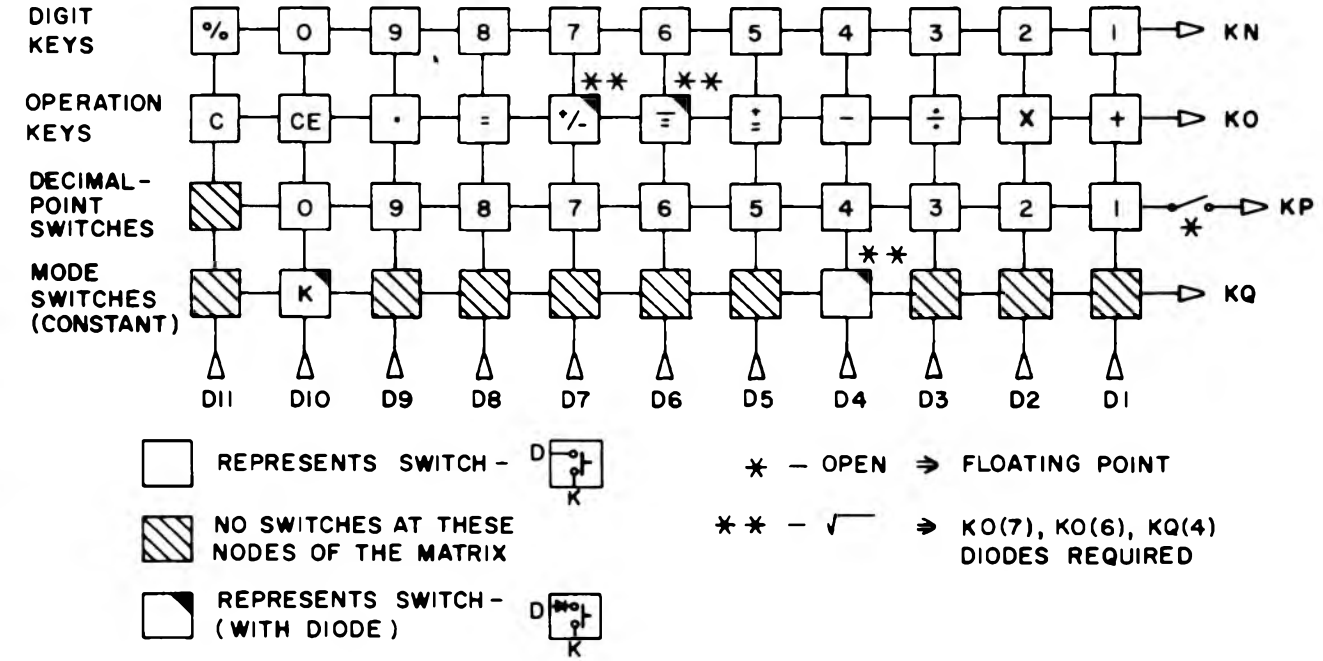
Low power dissipation, broad supply voltage range, a single power supply, and an internal clock oscillator make the MK 5021 C ideal for battery-operated, hand-held calculators with lower system costs.

PIN CONNECTION

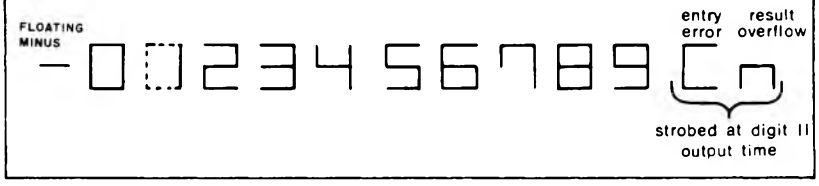


NC = NO CONNECTION

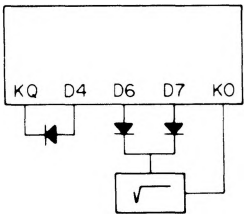
KEY MATRIX



DISPLAY FONT

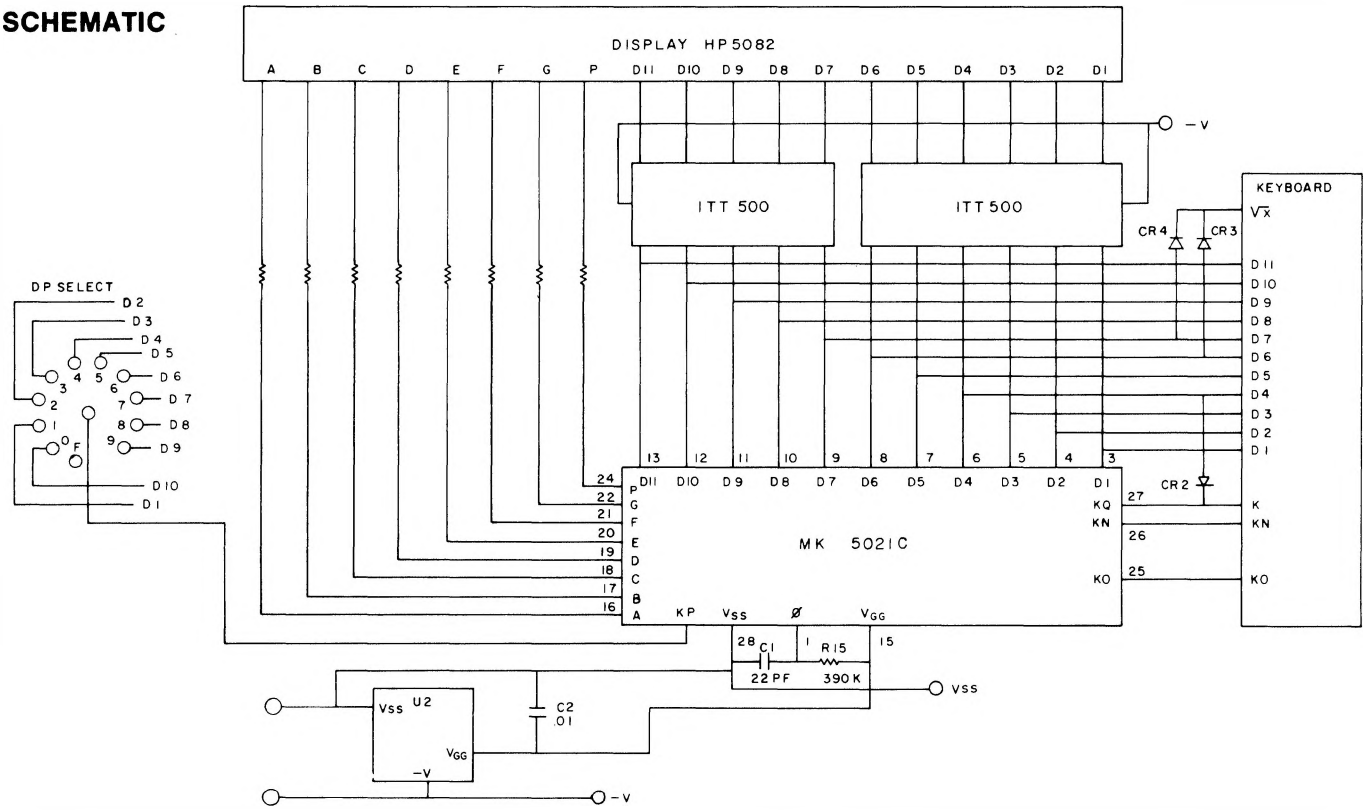


CONNECTIONS FOR SQUARE ROOT KEY



Consumer

SCHEMATIC



PROBLEM	FIXED POINT OR FLOATING	CONSTANT	KEY ENTRIES	REMARKS	DISPLAY
PERCENT KEY					
Find 15% of 527	Floating	*	C		0.
			15		15.
			%		0.15
			X		0.15
			527		527.
			±		79.05
Find 15% of 527	Floating	*	C		0.
			527		527.
			X		527.
			15		15.
			%		79.05
Find 12.5% mark up and selling price on $450 item	Floating	*	C		0.
			450		450.
			X		450.
			12.5		12.5
			%	This is the mark up	56.25
			±	This is the selling price	506.25
Find 8.3% discount and selling price on $200 item	Floating	*	C		0.
			200		200.
			X		200.
			8.3		8.3
			%	This is the discount	16.6
			=	This is the selling price	183.4
CONSTANT PERCENT					
Find 15% of: 200, 450, 372	Floating	on	C		0.
			15		15.
			%		0.15
			X		0.15
			200		200.
			=		30.
			450		450.
			=		67.5
			372		372.
			=		55.8

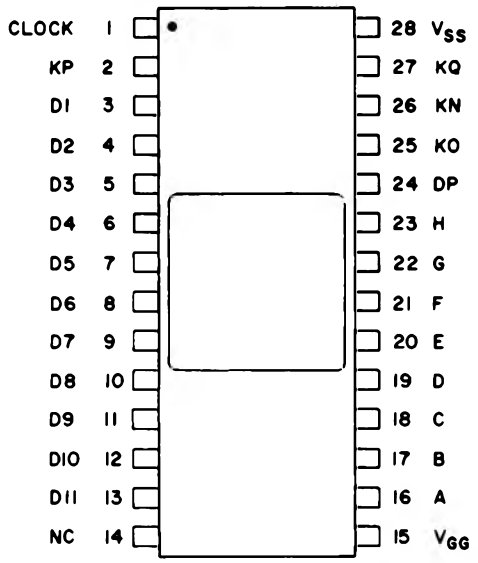
MK 5022AN

DESCRIPTION

The MK 5022 A is a five-function (+, −, X, ÷, %), 8-digit calculator with fully independent memory. Only 20 keys are required to implement the five functions with memory, resulting in a unit which is compact, economical, and simple to operate. Additional features are automatic constant, floating negative sign, algebraic entry, floating decimal point, chain calculations, credit balance, leading zero suppression, display blanking during calculations, and internal debouncing and encoding of keyboard inputs.

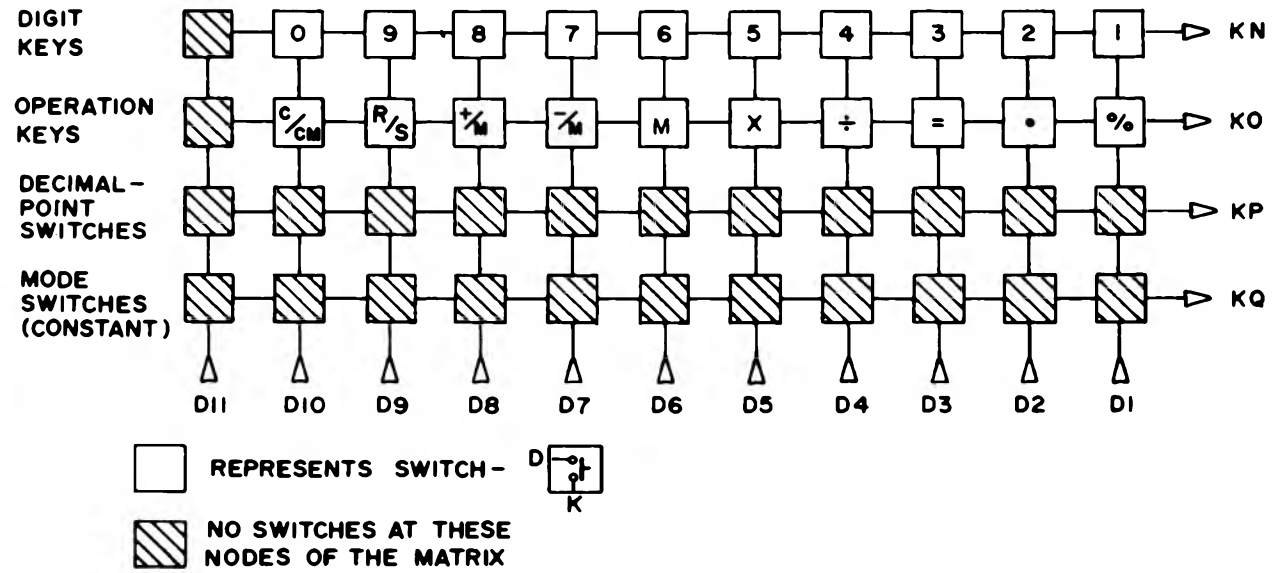
Low power dissipation, broad supply voltage range, a single power supply, and an internal clock oscillator make the MK 5022 A ideal for battery-operated handheld calculators with lower system costs.

PIN CONNECTION

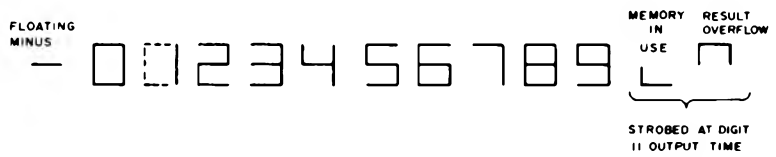


NC = NO CONNECTION

KEY MATRIX

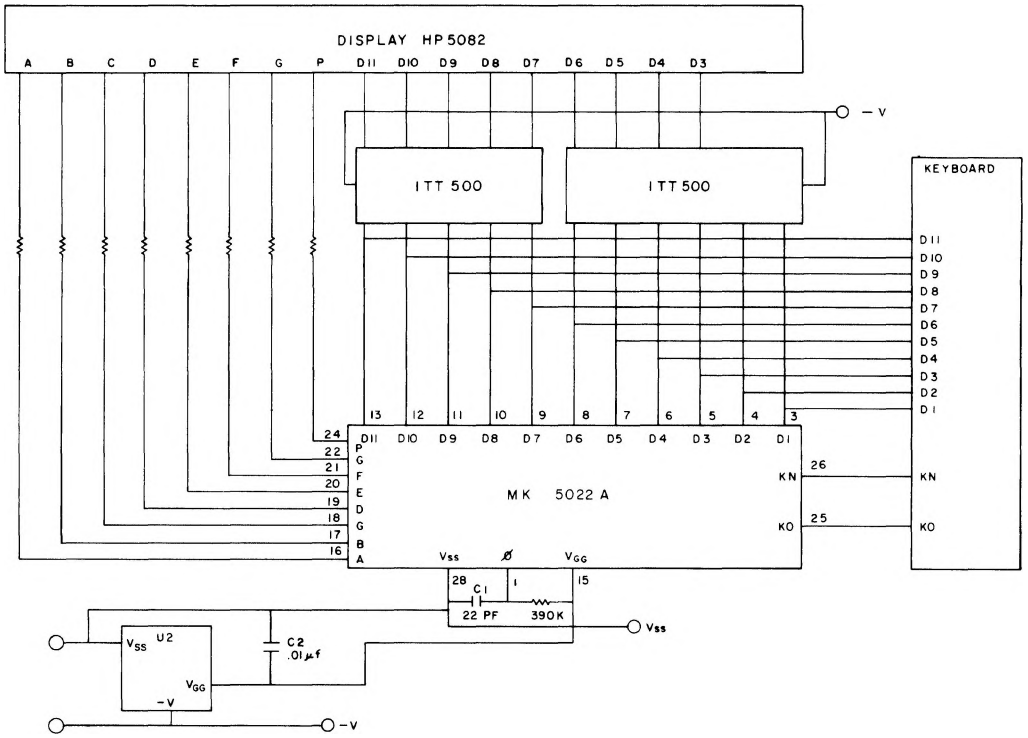


DISPLAY FONT



Consumer

SCHEMATIC



PROBLEM	KEY ENTRIES	REMARKS	DISPLAY
MEMORY ADD	M C	Clears Memory	
+27.84	C	Clears display	0.
+56.352	27.84		27.84
	M		27.84
	+	Memory in use indicator	L 27.84
	56.352		L 56.352
	M +	adds display to memory	L 56.352 L 56.352
	R/S	recals total	L 84.192
MEMORY SUBTRACT	M C	clears memory	84.192
+27.20	C	clears display	0.
-56.35	27.20		27.20
	M +	adds display to memory	27.20 L 27.20
	56.35		L 56.35
	M -	subtracts display from memory	L 56.35 L 56.35
	R/S	recalls difference memory has credit balance	L -29.15
MEMORY STORE	M C	Scratchpad	-29.15
	C		0.
9/4, 9/5, 9/6, 9X4	9	constant dividend	9.
	M	stores	9.
	R/S	in memory	L 9.
	÷		L 9.
	4	division # 1	L 4.
	=	quotient # 1	L 2.25
MEMORY RECALL	R/S	recalls memory	L 9.
	÷		L 9.
	5	divisor # 2	L 5.
	=	quotient # 2	L 1.8
	R/S	recalls memory	L 9.
	÷		L 9.
	6	divisor # 3	L 6.
	=	quotient # 3	L 1.5
	R/S		L 9.
	X		L 9.
	4	multiplier	L 4.
	=	product	L 36.

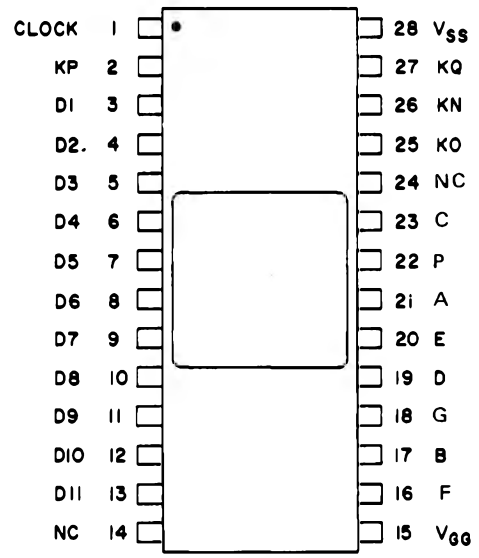
MK 50203 N

DESCRIPTION

The MK 50203 is a six-function (+, –, X, ÷, %, 1/X), 8-digit calculator with fully independent memory. Additional features are automatic constant, repeat add, exchange, floating negative sign, algebraic entry, floating decimal point, chain calculations, credit balance, leading zero suppression, display blanking during calculations, and internal debouncing and encoding of keyboard inputs.

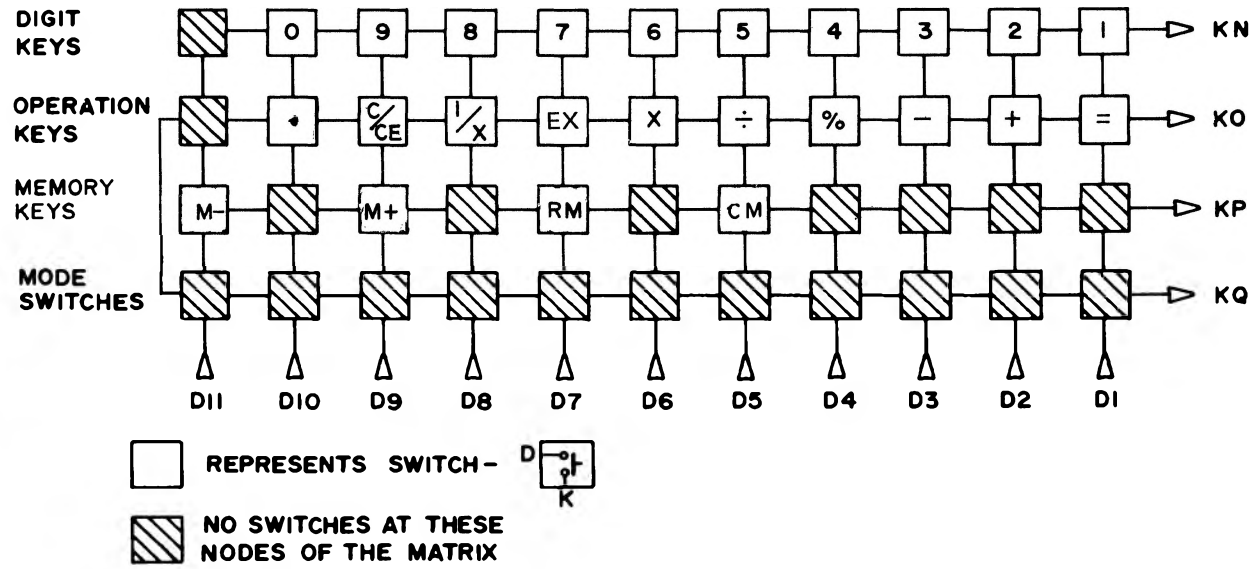
Low power dissipation, broad supply voltage range, a single power supply, and an internal clock oscillator make the MK 50203 ideal for battery-operated handheld calculators with lower system costs.

PIN CONNECTION



NC = NO CONNECTION

KEY MATRIX

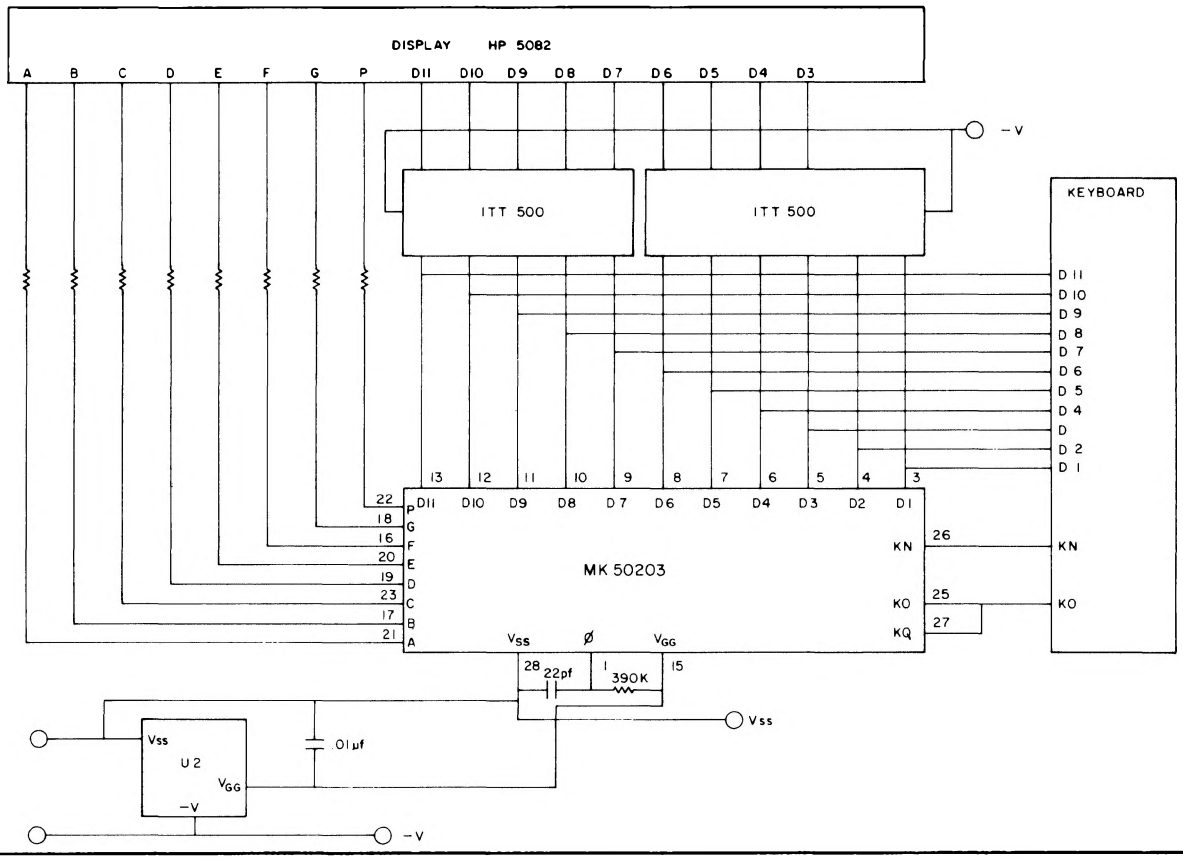


EXTERNALLY CONNECT KQ AND KO

DISPLAY FONT

Consumer

SCHEMATIC


DISPLAY HP 5082
A B C D E F G P D11 D10 D9 D8 D7 D6 D5 D4 D3
-V
ITT 500
ITT 500
KEYBOARD
D 11
D 10
D 9
D 8
D 7
D 6
D 5
D 4
D
D 2
D 1
13 12 11 10 9 8 7 6 5 4 3
22 P
18 G
16 F
20 E
19 D
23 C
17 B
21 A
D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1
MK 50203
KN 26
KO 25
KQ 27
KN
KO
Vss ø VGG
28 22pf 1 390K 15
Vss
Vss
U2
VGG
-V
.01µf
-V

REMARKS	KEY ENTRIES	REMARKS	DISPLAY
MEMORY ADD			
	M }	{ Clears	1.0
	C }	{ Memory	0.
+27.84	C	Clears display	27.84
+56.352	27.84		27.84
	M		L 27.84
	+	Memory in use indicator	L 56.352
	56.352		L 56.352
	M }	{ adds display	L 56.352
	+ }	{ to memory	L 84.192
	R/S	recals total	
Exchange Operands			
26.3 ÷ 2.18 =	C		0.
	26.3		26.3
	÷		26.3
	2.18		2.18
	=		12.06422
2.18 ÷26.3 =	C		0.
	26.3		26.3
	÷		26.3
	2.18		2.18
	EX	1st entry will be stored as constant	26.3
	=		0.0828897
39.7 ÷ 26.3=	39.7		39.7
	=		1.5095057
2X3 =	C		0.
4X2 =	2		2.
5X2 =	X		2.
	3		3.
	EX	1st entry will be stored as constant	2.
	=		6.
	4		4.
	=		8.
	5		5.
	=		10.