

408-906



MM57C200 ENCODER / DECODER

General Description

The MM57C200 is an ENCODER/DECODER circuit with MM53200 compatible functions. It requires few external components to operate as transmitter or as a receiver. Three different modes are provided with a maximum of 1M codes. The ENCODER/DECODER IC is designed in M2CMOS technology.

Features

- Simple RC oscillator with 1% tolerance for R and 5% for C
- Up to 1M encoding possibilities
- Three different modes
- Transmitter burst-mode for infrared transmission
- Few external components
- SO-20 Wide package available
- M2CMOS-technology
- Programmable output polarity
- Time delay after false code
- Up to 8 outputs can be driven
- Latched and normal output mode
- Receiver learn mode

Typical Applications

- Burglar alarm systems
- Remote control
- Central locking systems
- Valve control

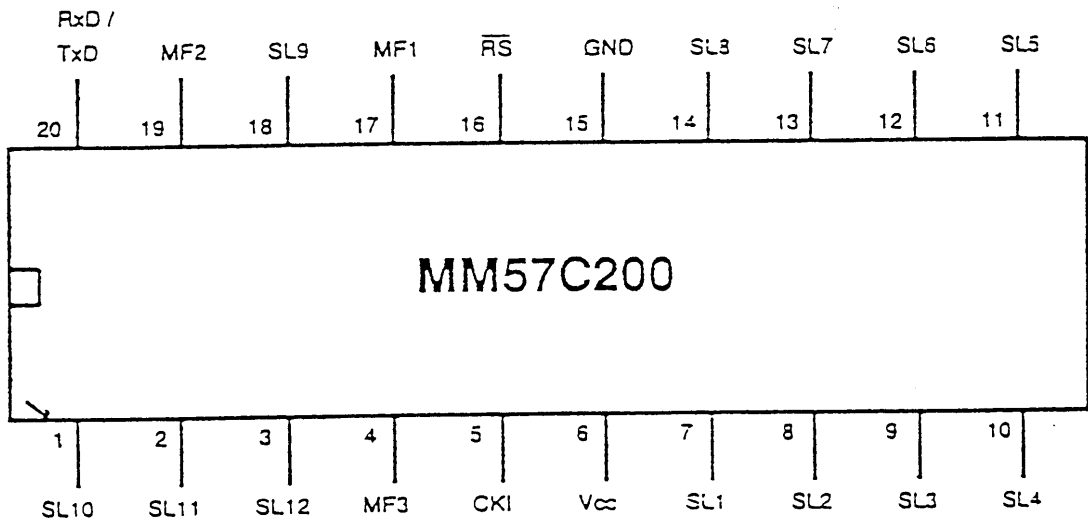


Figure 1: 20-Pin DIP - Top View

GENERAL

The device has three different operating modes: Mode I, a simple MM53200 compatible mode, Mode II, an enhanced MM53200 compatible mode in which the receiver code can be programmed via the transmitter and Mode III, a high feature mode with a 20 bit code and 8 additional outputs. After a task is executed the chip starts scanning the mode again. This precaution eliminates erroneously detected code from faulty or destroyed RAM data (encoded data from the code-select lines, or the mode word) which will be updated (recovered) if malfunctions occur.

MODE SELECT

For modes XMIT I, XMIT II and Receive I, mode select is achieved by connecting pins MF1, MF2 and MF3 as shown in table 1. For modes Receive II, Receive III and XMIT III, mode select information has to be programmed into the EEPROM as shown in table 2.

To find out which mode is selected, the chip checks if EEPROM is connected and reads in the EEPROM information, or scans the mode pins MF1 to MF3 if no EEPROM is connected.

MODE I

In this mode code is selected via the code-select lines SL1 to SL12 giving a total of 4096 codes.

When selected as transmitter the chip reads the status of code-select lines SL1 to SL12, checks if burst transmission has been selected and if the receiver output toggles. It transmits this information serially over the TxD pin.

When selected as receiver, the chip looks for a valid transmission (see section RECEIVE). In case of a valid received code, output MF1 is activated as long as the reception is acceptable. If the transmitter was in latched mode, the receiver output toggles and remains unchanged until a new received code is valid.

MODE II

In this mode, code is selected at the transmitter via the code-select lines SL1 to SL12 and the receiver code is stored in the EEPROM, so there is also a total of 4096 codes. The EEPROM can contain two codes, a basic code which is used for first communication and an extended code which can be programmed via the transmitter. To control the receiver put the code-select lines at the transmitter into the same status as the basic code in the receiver EEPROM. Now you can either control the receiver output MF1 in the same way as in mode I or put the receiver into learn mode.

When selected as transmitter the chip acts in the same way as in mode I and additionally scans pin MF3 for learn information.

When selected as receiver, the chip looks if MF3 is pulled low for longer than 2 seconds which indicates that the basic code shall be used as valid code from now on. By reactivating the basic code the chip activates output MF2 for 2 seconds to indicate that the basic code is now reprogrammed. If the basic code was valid MF2 is not activated. Further, the chip scans for a valid transmission (see section RECEIVE). In case of a valid reception output MF1 is either tied low as long as the reception is acceptable or toggles if the transmitter requests the receiver output to toggle. The third possibility is that the transmitted information puts the receiver into the learn mode. Note that the Receiver goes only into learn mode if the transmitted code is valid and the learn bit in the transmitted code is set. Now the receiver activates output MF2 and enters learn mode. In the following 45 seconds (approximately) the receiver accepts each code which is received twice as new code which we will call the extended code. The receiver exits the learn mode and inactivates MF2 either if an extended code is received or the time limit is exceeded. Note that the basic code is not destroyed and you can switch back to the basic code at any time by pulling the receiver's MF2 pin low for longer than 2 seconds. This is useful if something went wrong when programming the extended code.

MODE III

This is the ultra high coding mode. Mode select information and a 20 bit code are stored in the transmitter and the receiver EEPROM. So there are over 1 million codes. Additional information from the transmitter code-select lines SL1 to SL8 is appended and transmitted with the code. This additional information will be copied to the receiver pins SL1 to SL8 which are used as outputs in this mode.

When selected as transmitter the chip transmits the 20 bit key from the EEPROM and the status of the code-select lines SL1 to SL8. This block is transmitted with latched bit set or reset depending on the level of pin MF2, either in normal or in burst mode.

When selected as receiver the chip looks for a valid transmission (see section RECEIVE). In case of a valid reception output MF1 is either tied low as long as the reception is acceptable or toggles if the transmitter determines the receiver output to toggle. Additionally the pins SL1 to SL8 are switched as outputs corresponding to the information transmitted. Another feature is that you can determine if the 8 additional dedicated outputs are active-low or active-high and also if they are latched or unlatched. For further information please refer to table 3.

RECEIVE

If the received code matches with the right format the ENCODER/DECODER looks for a second transmission which must be equal to the first transmission to prevent a receive error. If both transmissions are equal the receiver returns if in the learn mode. If it was not in learn mode the chip reads in its own code either from the code-select lines or from the EEPROM depending on the selected mode and compares it with the received code. If both codes are identical the transmission is valid otherwise the transmission is invalid. If the transmission is invalid a time delay of 2 seconds is initiated and the chip continues with scanning the mode again. This precaution is implemented in order to avoid 'misuse'. This means, it is not possible to find out and send the right 'code combination', (by successively trying different codes), in a realistic period of time. Note that there is a difference between a receive error and an invalid transmission which causes the receiver to do a time delay. A receive error happens if no code is received, the received code has not the right format or two received codes are not identical. However, an invalid transmission will occur if the transmitted code is not identical to the receiver code but in the right format.

TRANSMIT

When the circuit is selected as a transmitter, it creates a PWM pulse sequence of the code it has identified after scanning the code-select lines or reading the EEPROM and scanning the mode pins. See timing diagram.

USING A EEPROM

When using a EEPROM please refer to table 2, 3 and 4.

PIN DESCRIPTION

SL1-SL8 Code select lines 1 to 8
 These pins are dedicated for encoding purposes in mode XMIT I + II and Receive I. They are dedicated as information inputs in mode XMIT III, and as outputs for this information in mode Receive III. They are unused in mode Receive II. These pins are provided with internal pull-ups and input switches should pull them to ground.

SL9-SL12 Code-select lines 9 to 12
 These pins are dedicated for encoding purposes in mode XMIT I + II and Receive I. They are used as serial interface to an external EEPROM in mode XMIT III and Receive II + III. Note that only SL9 to SL11 have internal pull-ups but not SL12.

MF1 Multi-function pin 1
 This pin serves as output in all receiver modes and as input which determines if the key is to be transmitted in normal or burst format for all transmitter modes. It has an on-chip pull-up.

MF2 Multi-function pin 2
 In all transmit modes this pin determines if the receiver output is latched or normal. In mode Receive I, MF2 is used as mode-select pin which must be left open circuited. In mode Receive II, MF2 serves as LEARN-INDICATE output. It has an on-chip pull-up and is not used in mode Receive III.

MF3 Multi-function pin 3
 In mode XMIT I and Receive I this pin is a mode-select pin. In mode XMIT II it determines if the receiver shall initiate a learn cycle. In mode Receive II it is an input which has to be grounded for longer than 2 seconds to retrieve the basic-code. It is not used in mode XMIT III and Receive III. Note that this pin is not provided with an internal pull-up.

RxD/TxD Receive/transmit pin
 Configured as receiver this pin receives the pulse-width modulated signals from the detector. Selected as transmitter this pin transmits the pulse-width modulated signals either in normal or in burst-format.

CKI RC oscillator input
 Allowed tolerances:
 Delta R/R = +/- 1 %
 Delta C/C = +/- 5 %

RS System reset input
 An RC network is required with a diode in parallel to R. RC time constant 5 times power supply rise time.

GND System ground

Vcc System power supply

Table 1: Mode select depending on MF1, MF2 and MF3

MF1	MF2	MF3	MODE *see Note 1	
OUTPUT	open	GND	Receive I	
open	GND	Vcc	XMIT I/II latched	NORMAL TRANSFER
open	open	Vcc	XMIT I/II MM53200	
GND	GND	Vcc	XMIT I/II latched	BURST TRANSFER
GND	open	Vcc	XMIT I/II MM53200	
open	GND	GND	XMIT II learn	NORMAL TRANSFER
GND	GND	GND	XMIT II learn	BURST TRANSFER

Table 2: Mode-select information in the EEPROM

bit 9	bit 8	mode
0	1	Receive II
1	0	XMIT III
0	0	Receive III

Additional mode select information is stored in the EEPROM in register 0D bit 8 and 9. Burst/normal-Transfer and MM53200 compatible or latched output are controlled with Transmitter-pins MF1 and MF2 in the same way as shown in table 1. This mode information is only accepted if the EEPROM-ID is correct. This ID is to be located in register 0D bit 0 to 7 and MUST be set to 047 (hex).

Table 3: Additional output configuration in EEPROM Reg. "D"

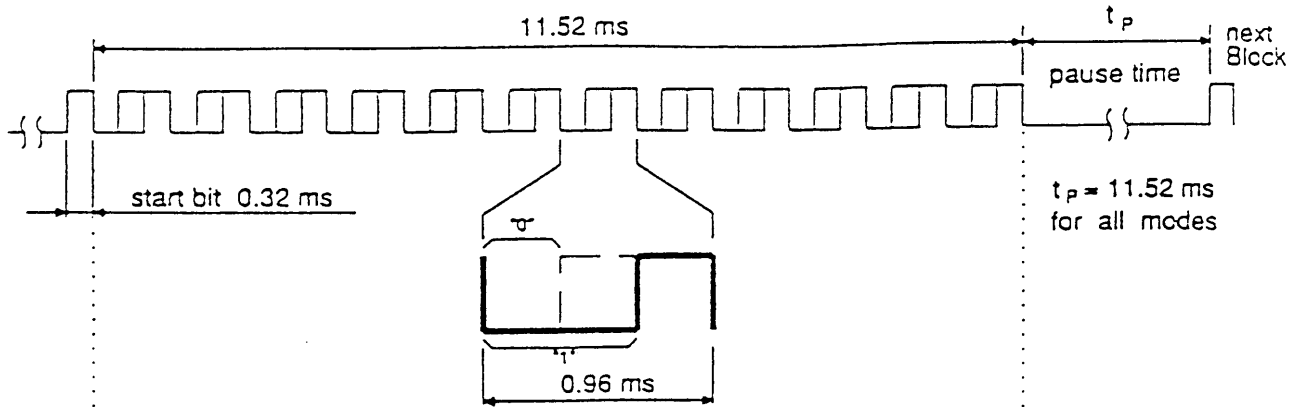
CASE	BIT B	BIT A	Comments
1	0	0	Receiver outputs SL1 - SL8 are logical "0" after power on and after Reset. If valid data is sent from a transmitter, the open transmitter will cause the corresponding output of the receiver to be switched high. When transmission stops the outputs will return to "0" level.
2	0	1	Receiver output states are the invers of case 1. Receiver outputs SL1 - SL8 are logical "1" after power on and after Reset. If valid data is sent from a transmission, the open switches at SL1 - SL8 of the transmitter will cause the corresponding output of the receiver to be turned off. When transmission stops, the output return to "1" level.
3	1	0	Same as Case 1, but outputs of receiver remain latched until new combination of SL1 - SL8 data will be sent by transmitter.
4	1	1	Same as case 2, but outputs of receiver remain latched until new combination on SL1 - SL8 data will be sent by transmitter.

Table 4: Code-data in EEPROM in mode Receive II and XMIT/Receive III

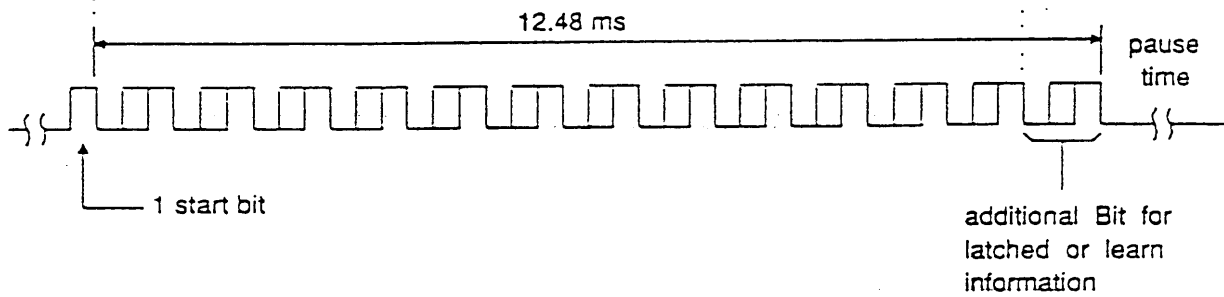
mode	register	bit	
II	00	00-0B	learn-key 1 to 12
	00	0C	basic-code bit If this bit is set to '1' the basic-code is used.
	0F	00-0B	basic-code bit 1 to 12
III	0E	00-0F	key bit 1 to 16
	0F	00-03	key bit 17 to 20

Transmit timings

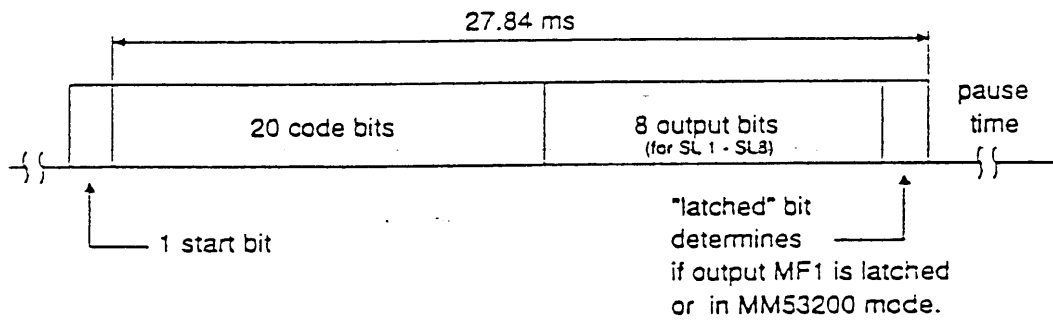
Mode I and II (compatible to MM53200)



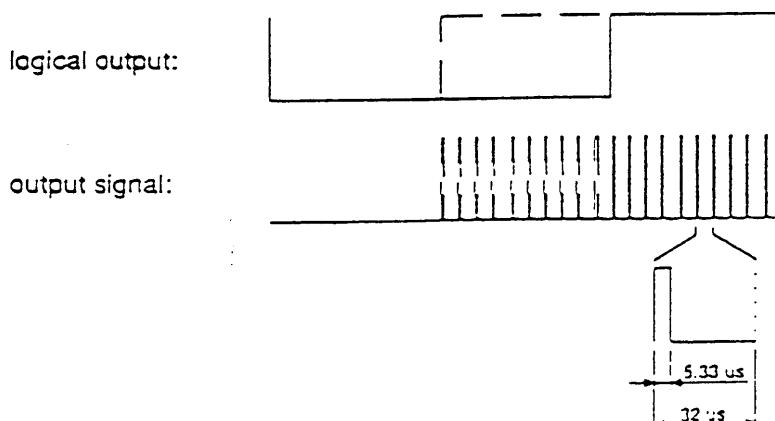
Mode I and II in latched or learn mode



Mode III



burst Transmission



Please note: all timings given here are typical and vary with the clock tolerances

Figure 2: MM57C200 in MM53200 compatible transmit / receive mode.

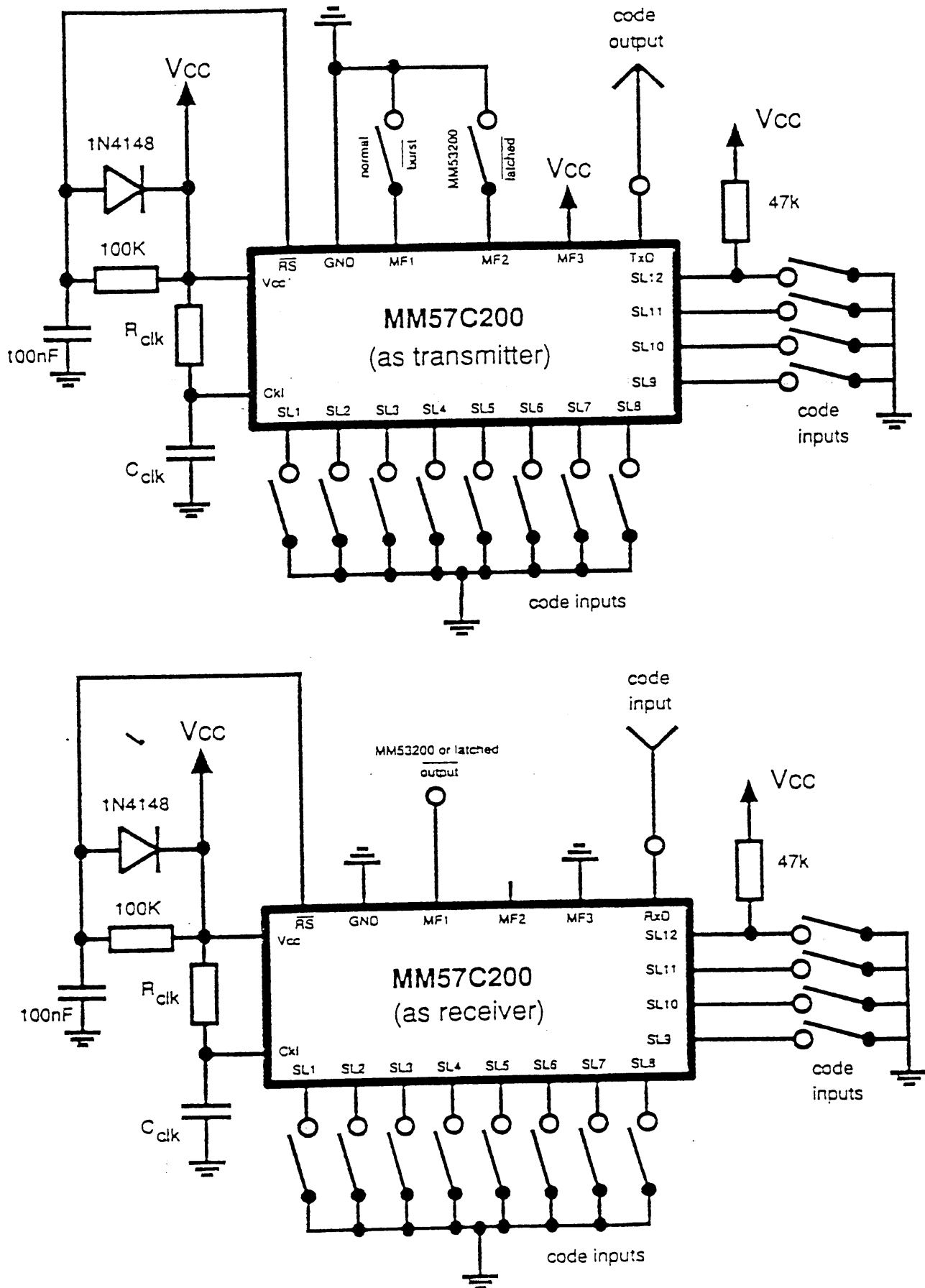


Figure 3: MM57C200 in MM53200 compatible transmit mode, receiver code in EEPROM (Mode II)

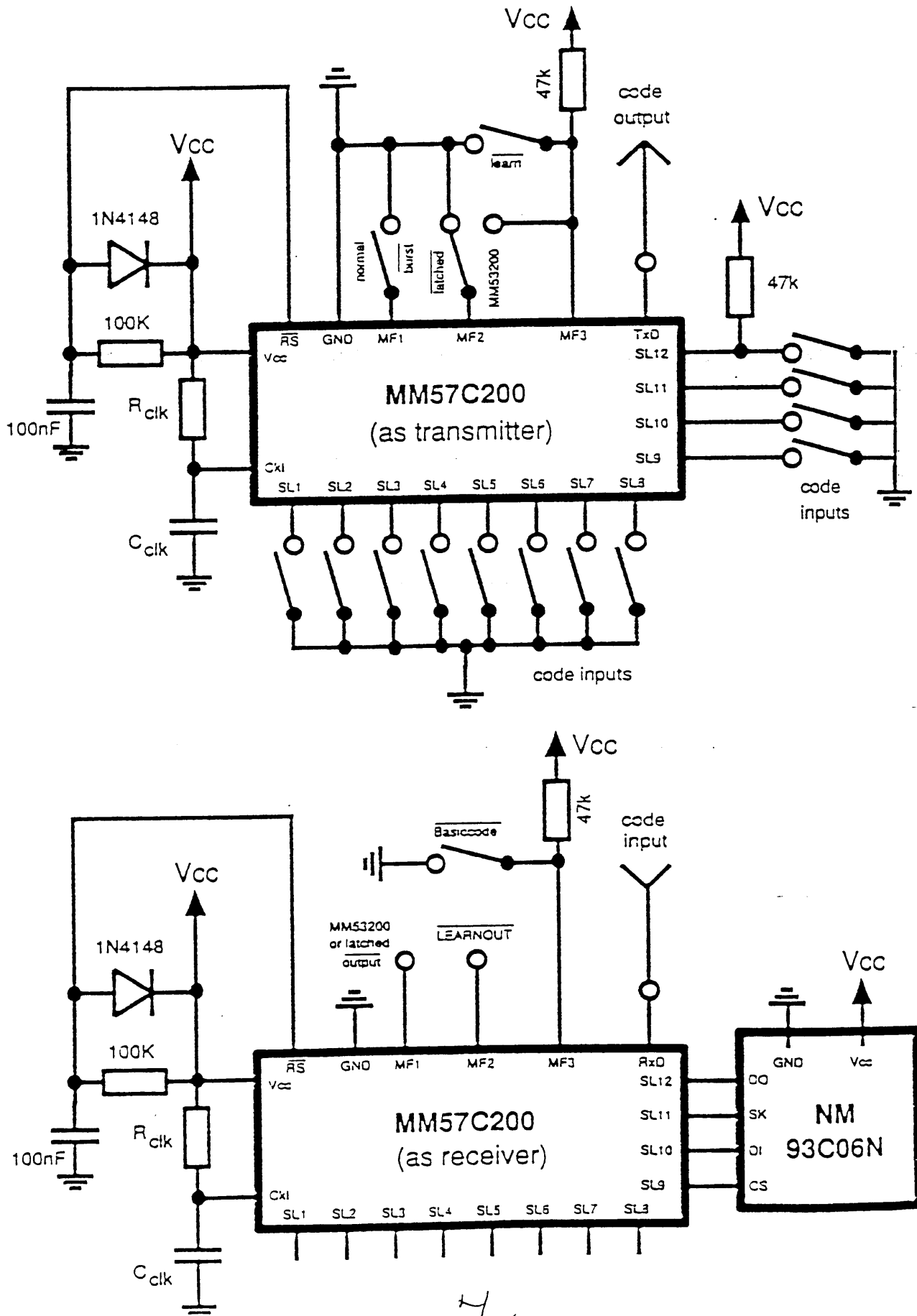
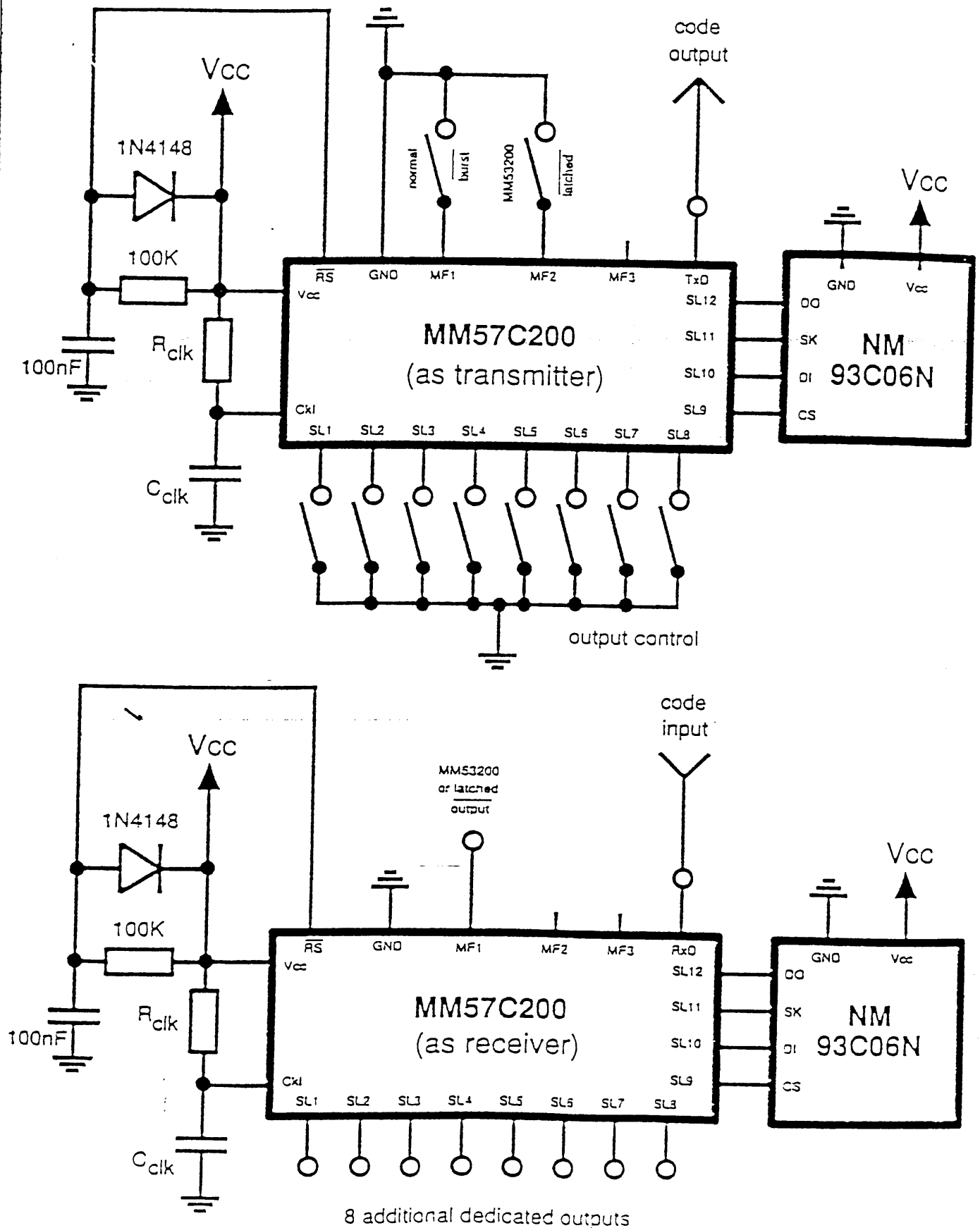


Figure 4: Ultra high coding mode (transmitter (Mode III) and receiver code in EEPROM) + 8 additional dedicated outputs.



8

MM57C200

Absolute Maximum Ratings

If Military / Aerospace specified devices are required, please contact the National Semiconductor Sales Office / Distributors for availability and specifications.

Total Current out of GND Pin (Sink)
Storage Temperature Range

60 mA
-65°C to +140°C

Supply Voltage (Vcc) 7V
Voltage at any Pin -0.3V to Vcc + 0.3V
ESD Susceptibility (Note 3) 2000V
Total Current into Vcc Pin (Source) 50 mA

Note: Absolute maximum ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications are not ensured, when operating the device at absolute maximum ratings.

DC Electrical Characteristics $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ unless otherwise specified

Parameter	Condition	Min	Typ	Max	Units	
Operating Voltage	Rclk = 3.3kOhm	4.5		6.0	V	
	Cclk = 100pF					
	Rclk = 6.8kOhm	2.5		6.0	V	
	Cclk = 100pF					
Power Supply Ripple (Note 1)	Peak to Peak			0.1 Vcc	V	
Supply Current (Note 4)	Rclk = 3.3kOhm, Cclk = 100pF					
	Tc = 5.33 usec	5 V	2.62		mA	
	Rclk = 6.8kOhm, Cclk = 100pF	3 V	0.66		mA	
	Tc = 11 usec	5 V	1.74		mA	
Input Levels RS, CKI	Logic High	0.9 Vcc			V	
	Logic Low			0.1 Vcc	V	
	All Other Inputs	Logic High	0.7 Vcc			V
		Logic Low			0.2 Vcc	V
Hi-Z Input Leakage	Vcc=6.0V, Vin=0V	-2		+2	uA	
Input Pullup Current	Vcc=6.0V, Vin=0V	40		250	uA	
Input Hysteresis MF1,2,3, SL9-12,RxD			0.05 Vcc		V	
Output Current Levels	Source (Weak Pull-Up)	Vcc=4.5V, Voh=3.2V	10		110	uA
		Vcc=2.5V, Voh=1.8V	2.5		33	uA
	Source (Push-Pull Mode)	Vcc=4.5V, Voh=3.8V	0.4			mA
		Vcc=2.5V, Voh=1.8V	0.2			mA
	Sink (Push-Pull Mode)	Vcc=4.5V, Vol=0.4V	1.6			mA
		Vcc=2.5V, Vol=0.4V	0.7			mA
TRI-STATE Leakage		-2.0		+2.0	uA	
Allowable Sink/Source Current Per Pin				3	mA	
Maximum Input Current Without Latchup (Note 2)	Room Temp			+/- 100	mA	
RAM Retention Voltage, Vr	500 ns Rise and Fall Time (Min)	2.0			V	
Input Capacitance				7	pF	

Note 1: Rate of voltage change must be less than 0.5V/ms

Note 2: Except pins SL12, MF3, RS
pins SL12, RS -60mA, -100mA
pin MF3 -100mA, -25mA
Sampled but not 100% tested.

Note 3: Human body model, 100pF through 1500 Ohm

Note 4: RS tied to high, all other in- and outputs open.

MM57C200

AC Electrical Characteristics $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ unless otherwise specified

Parameter	Condition	Min	Typ	Max	Units
Inputs t_{SETUP} t_{HOLD}	$V_{\text{CC}} \geq 4.5\text{V}$	200			ns
	$2.5\text{V} \leq V_{\text{CC}} < 4.5\text{V}$	500			ns
	$V_{\text{CC}} \geq 4.5\text{V}$	60			ns
	$2.5\text{V} \leq V_{\text{CC}} < 4.5\text{V}$	150			ns
Output Propagation Delay $t_{\text{PD1}}, t_{\text{PD0}}$ SL10, SL11 All Others	$C_L = 100\text{pF}$ $R_L = 2.2\text{k}\Omega$				
	$V_{\text{CC}} \geq 4.5\text{V}$			0.7	us
	$2.5\text{V} \leq V_{\text{CC}} < 4.5\text{V}$			1.75	us
	$V_{\text{CC}} \geq 4.5\text{V}$			1	us
	$2.5\text{V} \leq V_{\text{CC}} < 4.5\text{V}$			2.5	us
MICROWIRE Setup Time t_{WS}		20			ns
MICROWIRE Hold Time t_{WH}		56			ns
MICROWIRE Output Propagation Delay t_{UPO}				220	ns
Reset Pulse Width		1.0			us

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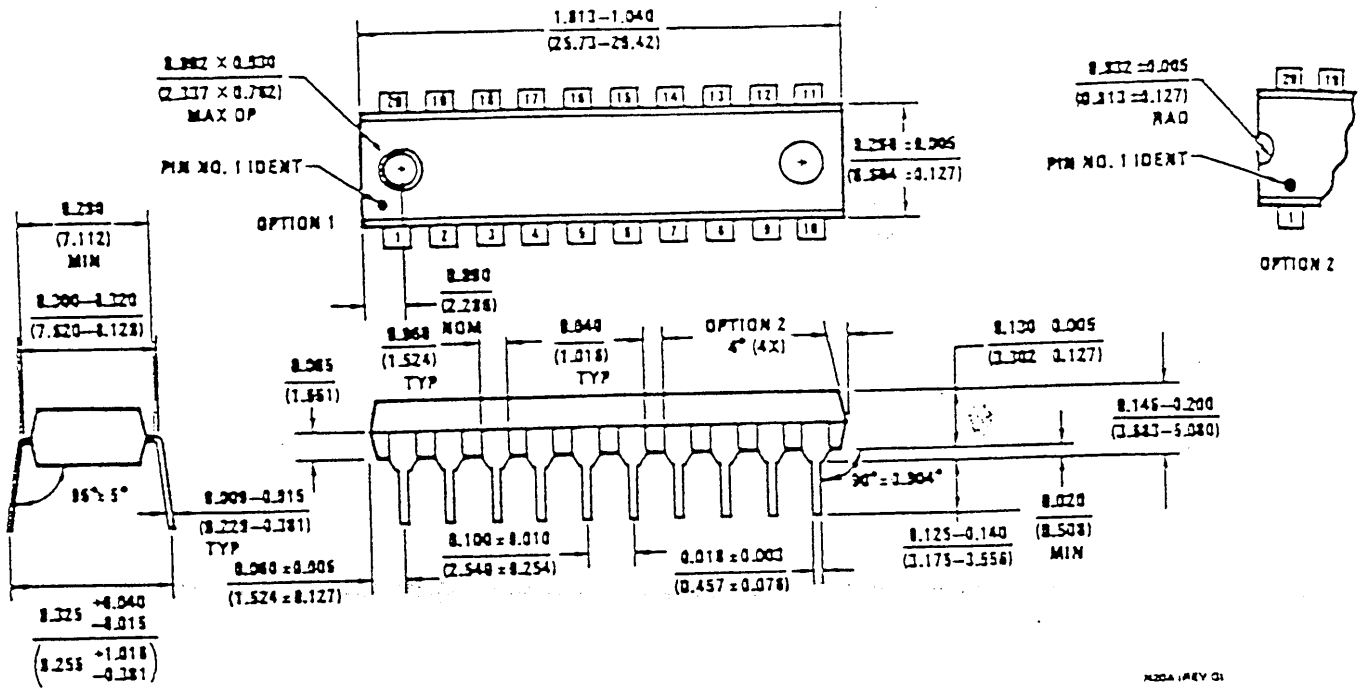
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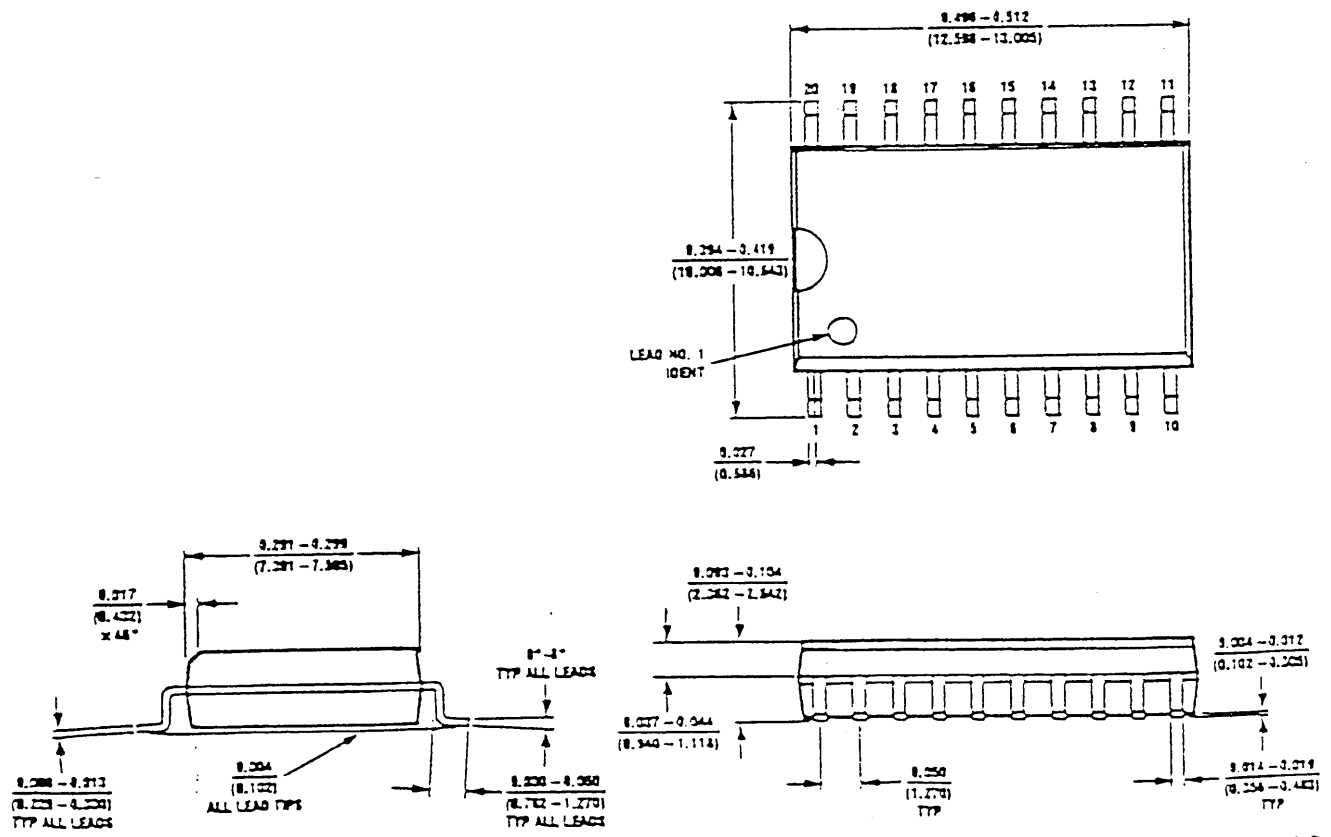
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Physical Dimensions



20-Lead Molded Dual-in-Line (N)
 Order Number MM57C200/N
 NS Package Number N20 A



20-Lead Surface Mount Package (M)
 Order Number MM57C200/WM
 NS Package Number M20B