CONTENTS

MN1380 Series (CMOS LSI for Voltage Detection)

The circuit examples given in this catalog serve merely as a guideline for product characteristics and performance.
Though this catalog has been compiled as carefully as possible, we cannot assume any responsibility whatsoever in relation to the original circuits used in the circuit examples and to third party patents.
The specifications in this catalog are subject to change without prior notice due to product improvement, etc. Accordingly, please refer to the up-to-date specifications at the time of final design review.

Highly Reliable, Easy-to-Use CMOS LSIs for Voltage Detection

1 OUTLINE

The MN1380 Series is a series of devices with functions for:

- Monitoring the power supply voltage supplied to microcomputers and to LSI systems, and
- Generating the RESET signal for carrying out initialization when the power supply is turned ON, and for preventing runaway in systems when the power supply voltage fluctuates.

Recently, we have seen an increase in the number of battery-driven products such as cordless telephones, notebook-type personal computers, etc. In these products, highly accurate monitoring of the power supply voltage is an important point in terms of system operation and data backup. Moreover, with battery-driven systems such as these, the reduction of power consumed by the circuits, that monitor the power supply and detect the power supply voltage, is also an important factor in itself.

The MN1380 Series CMOS LSI is a device especially suited to this kind of application. While maintaining the voltage detection precision of similar voltage detection devices so far, the MN1380 Series of devices consumes 1/10 the current.

In addition, users can choose from one of three output formats: CMOS output, N-ch open drain and inverted CMOS output, and three types of package: the M type, TO-92 type, and surface-mounted Mini type.

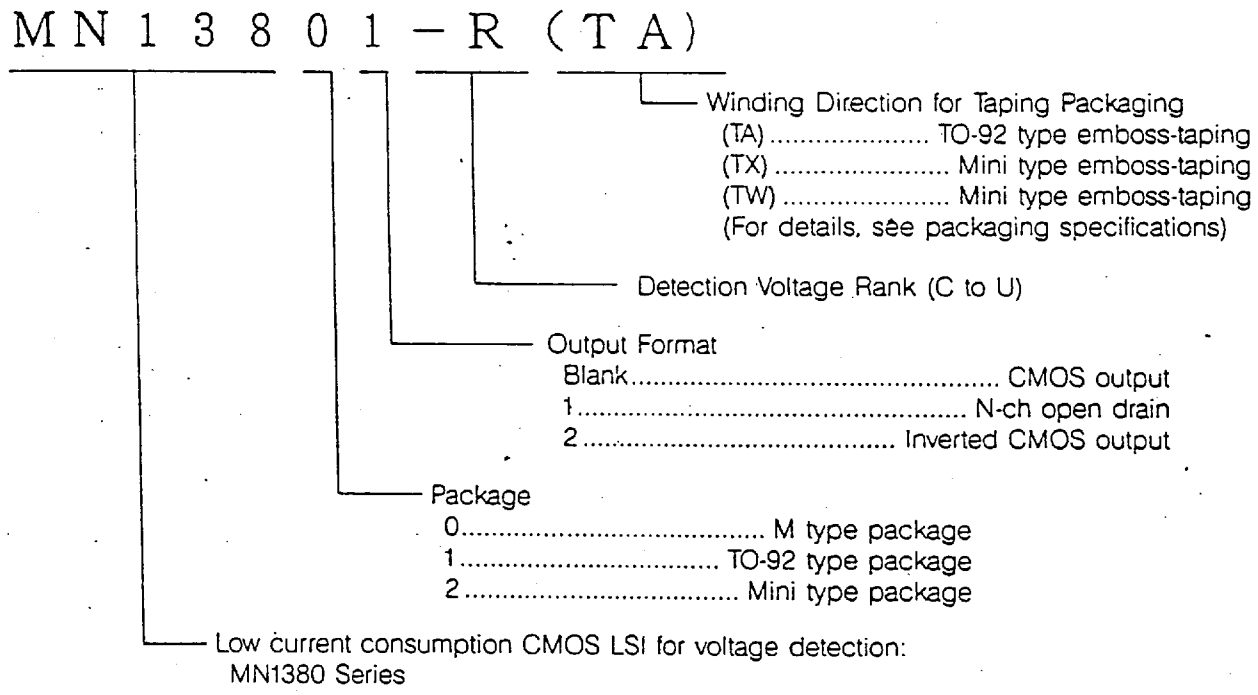
With a wide range of voltage detection ranks (17 ranks from 2.0 to 4.9V), output formats, and package types, the user can choose the product most suited to his system.

2 FEATURES

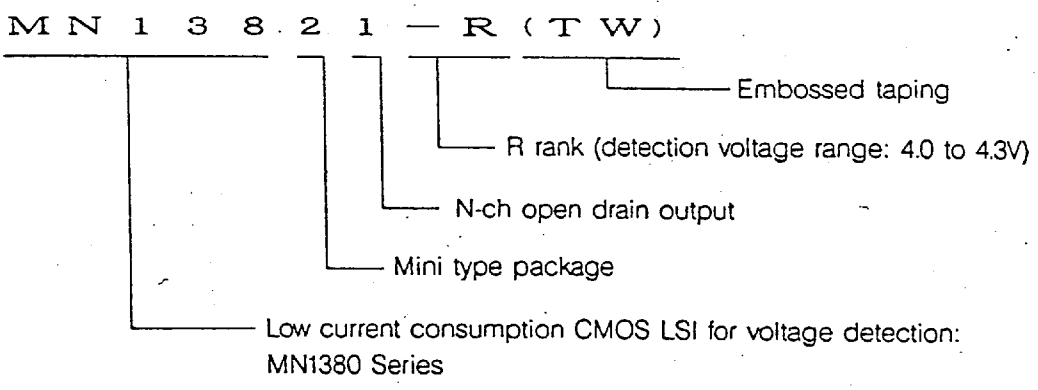
- 3-pin, non-adjustment type device
- Wide selection of detection ranks (17 ranks within range 2.0 to 4.9V)
- Highly accurate detection voltage
- Detection voltage with hysteresis characteristics (ΔVD = 50mV @C to K rank, ΔVD = 100mV @L to U rank)
- Low current consumption (I DD = 1μA type @V DD = 5V)
- Detection voltage with few changes arising from fluctuating temperature (temperature co-efficient: 1mV/°C type)
- Wide range of output formats (CMOS output, N-ch open drain, Inverted CMOS output)
- Wide selection of packages (M type, TO-92 type, surface-mounted Mini type)

3 NOMENCLATURE AND FUNCTIONS OF MN1380 SERIES

The MN1380 series of CMOS LSI s supports a wide range of detection ranks, output formats, packages and packaging formats. All possible combinations can be expressed in the format shown below. When ordering, please specify the desired MN1380 CMOS LSI correctly according to this format.



Example



4 PACKAGING QUANTITY (MINIMUM PACKAGING UNIT)

Bulk	(M type, TO-92 type, Mini type)	1000 packages
Magazine	(Mini type)	50 magazines
Taping	(Mini type, TO-92 type)	3000 tapes

6932852 0012284 389

5 TYPE NUMBER LIST

Table 5.1 Type Numbers

Output \ Type	M Type	TO-92 Type	Mini Type
CMOS Output	MN1380	MN1381	MN1382
N-ch Open Drain Output	MN13801	MN13811	MN13821
Inverted CMOS Output	MN13802	MN13812	MN13822

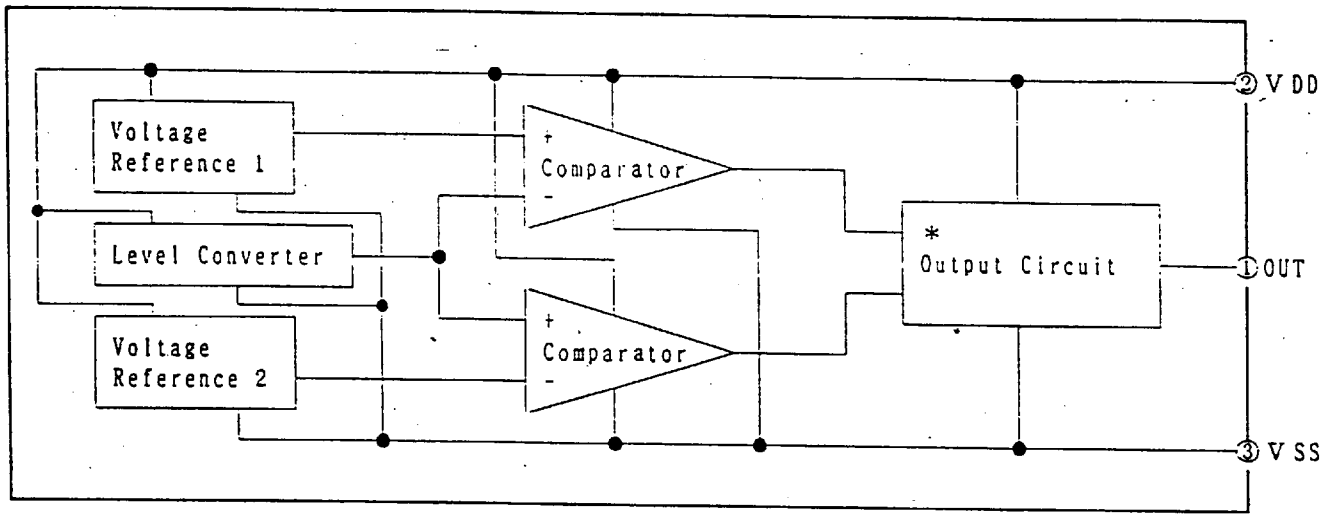
6 DETECTION VOLTAGE RANK TABLE

Table 6.1 Detection Voltage Rank

Rank	Detection Voltage at Drain Supply Voltag Drop (VDL)		Unit	Detection Voltage Hysteresis (ΔVD)		Unit
	Min.	Max.		Min.	Max.	
C	2.0	2.2	V	50	300	mV
D	2.1	2.3				
E	2.2	2.4				
F	2.3	2.5				
G	2.4	2.6				
H	2.5	2.7				
J	2.6	2.9	V	50	300	mV
K	2.8	3.1				
L	3.0	3.3	V	100	300	mV
M	3.2	3.5				
N	3.4	3.7				
P	3.6	3.9				
Q	3.8	4.1				
R	4.0	4.3				
S	4.2	4.5				
T	4.4	4.7				
U	4.6	4.9				

7 BLOCK DIAGRAM

Table 7.1 Block Diagram



* : The above circuit may vary according to the output format (CMOS, N-ch open drain, inverted CMOS drop).

8 PIN CONNECTION DIAGRAM

Fig. 8.1 M Type

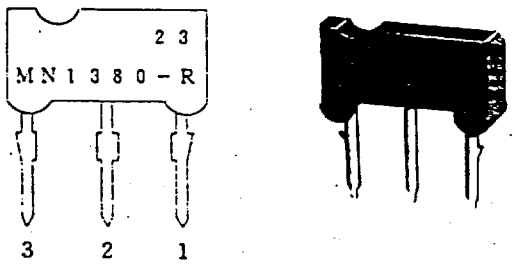


Fig. 8.2 TO-92 Type

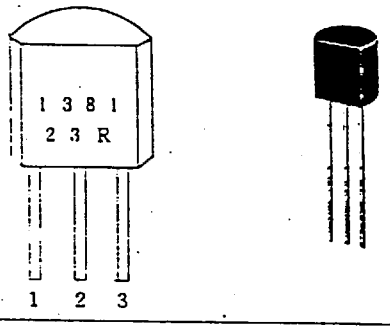


Fig. 8.3 Mini Type

Table 8.1 Pin Descriptions

Pin	Symbol	Description
1	OUT	RESET signal output pin
2	V_{DD}	Power voltage pin
3	Vss	Ground pin

9 ABSOLUTE MAXIMUM RATINGS

Table 9.1 Absolute Maximum Ratings VSS = 0 V, Ta = 25°C

	Item	Symbol	Rating	Unit
A 1	Drain Supply Voltage	V DD	7.0	V
A 2	Output Voltage	V o	− 0.3 ~ V DD + 0.3	V
A 3	Operating Ambient Temperature	T a	− 20 ~ + 70	℃
A 4	Storage Temperature	T stg	− 55 ~ + 125	℃

10 RECOMMENDED OPERATING CONDITIONS

Table 10.1 Recommended Operating Conditions VSS = 0 V, Ta = 25°C

	Item	Symbol	Conditions	Tolerable Limit			Unit
				Min.	Typ.	Max.	
B 1	Drain Supply Voltage	V DD	See Figs. 13 and 15.	1.5		6.0	V

11 DC CHARACTERISTICS

Table 11.1 DC Characteristics VSS = 0 V, Ta = −20 ~ +70°C

	Item	Symbol	Conditions		Tolerable Limit			Unit
					Min.	Typ.	Max.	
C 1 *	Drain Supply Current	I DD	V_{DD} = 5V* Load resistance 10KΩ			1	5	μA
C 2 *	Detection Voltage at Drain Supply Voltage Drop	V DL	T Ta = 25℃ ℃ See Figs. 13 and 15.			*		V
C 3	Detection Voltage Hysteresis Width	△ VD						mV
C 4	Output Voltage, High Level	V OH	CMOS Output	I OH = −40 μA	0.8 V DD		V DD	V
			Inverted CMOS Output	V DD = 1.8V I OH = −0.5mA	0.8		V DD	
C 5	Output Voltage, Low Level	V OL	CMOS Output N-OD Output	V DD = 1.8V I OL = 0.7mA	V SS		0.4	V
			Inverted CMOS Output	V DD = 6.0V I OL = 0.3mA	V SS		0.6	

* C1: This includes output pin leak voltage

* C2 and 3: Listed by rank on page 3.

12 AC CHARACTERISTICS

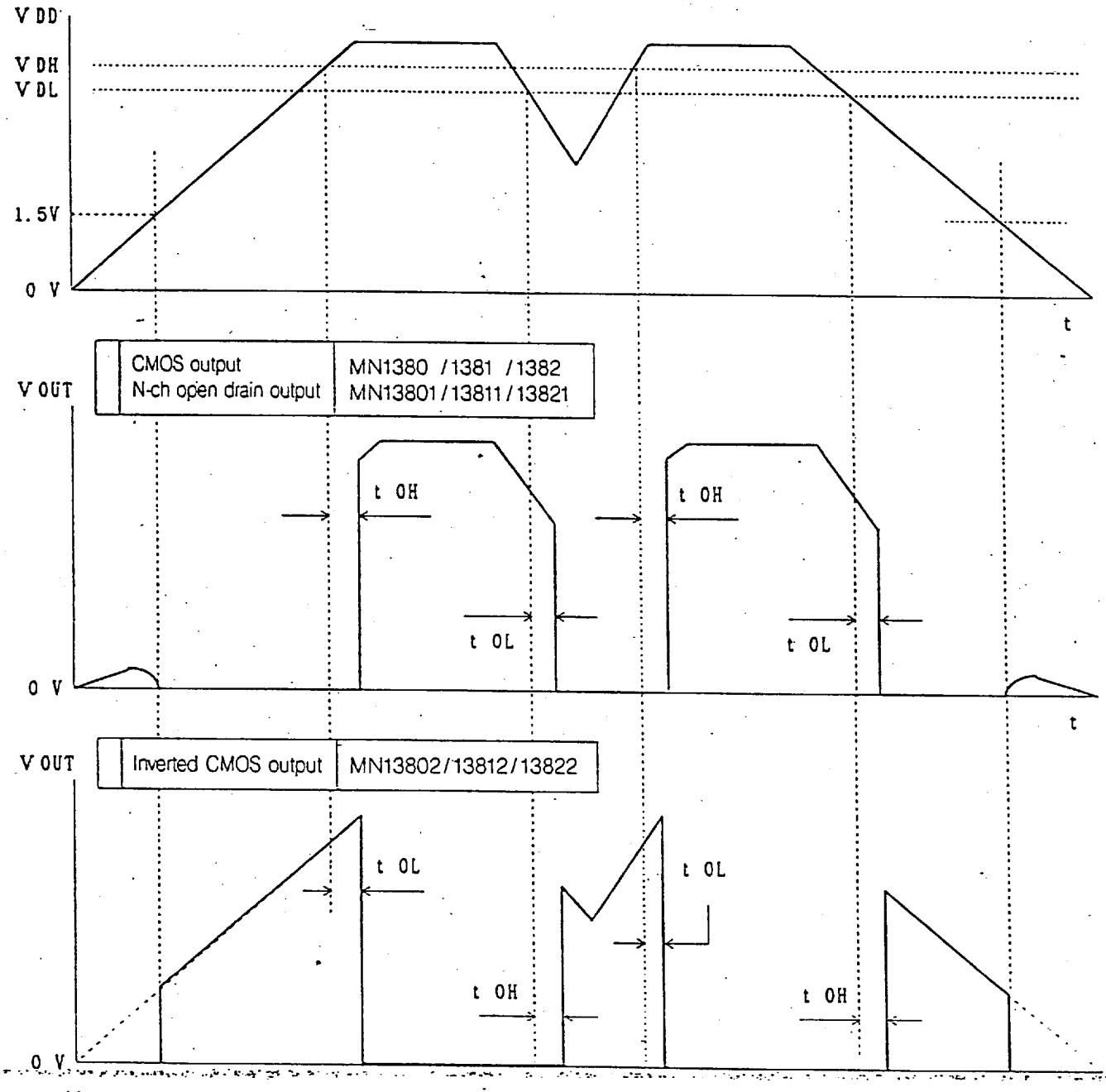
Table 12.1 AC Characteristics

Ta = 25°C
VSS = 0 V

	Item	Symbol	Conditions	Rank	Tolerable Limit (Typ.) MN1380 MN1381 MN1382	Tolerable Limit (Typ.) MN13801 MN13811 MN13821	Tolerable Limit (Typ.) MN13802 MN13812 MN13822	Unit
C 6	Reset Time	t 0H	See Fig.14	C D E F	3.0	*2.5	230.0	μs
				G H J K	3.0	3.0	100.0	
				L M N P Q R S T	2.0	4.0	30.0	
C 7	Reset Time	t 0L	See Fig.14	C D E F	250.0	160.0	3.0	μs
				G H J K	115.0	100.0	3.0	
				L M N P Q R S T	15.0	35.0	3.0	

13 OPERATION EXPLANATORY DRAWING

Fig. 13.1 Operation Explanatory Drawing



Notes

1. Output cannot be stipulated as operation is not guaranteed when the drain supply voltage is less then 1.5V.
2. V_{DL} : Detection voltage at drop in power suppiy
   V_{DH} : Detection voltage at rise in power supply
   t_{OL} : Time from when drain supply voltage reaches detection voltage (V_{DL} or V_{DH}) up to when output (OUT) becomes Low.
   t_{OH} : Time from when drain supply voltage reaches detection voltage (V_{DL} or V_{DH}) up to when output (OUT) becomes High
3. The characteristics of N-ch open drain output are the characteristics when no-load resistance is connected across the OUT and V_{DD} terminals.

14 MEASUREMENT OF OUTPUT CHARACTERISTICS EXPLANATORY DRAWING

Table. 14.1 Measurement of Output Characteristics Explanatory Diagram

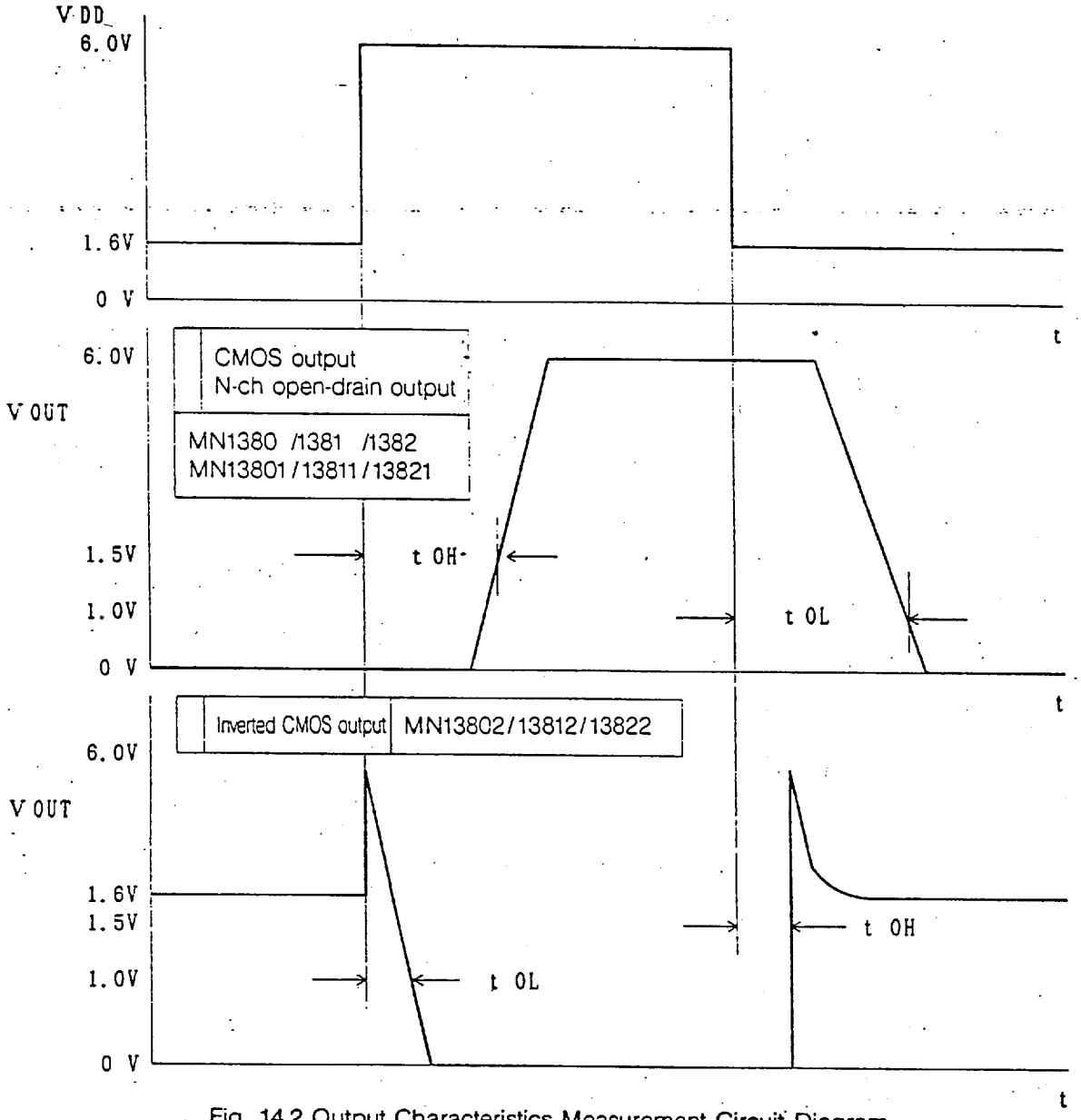
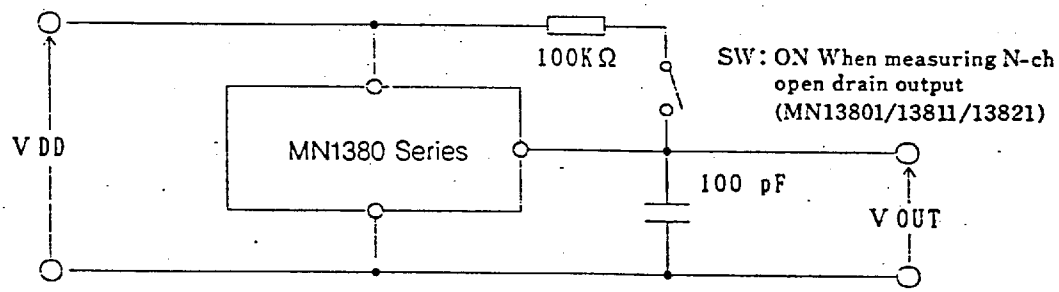
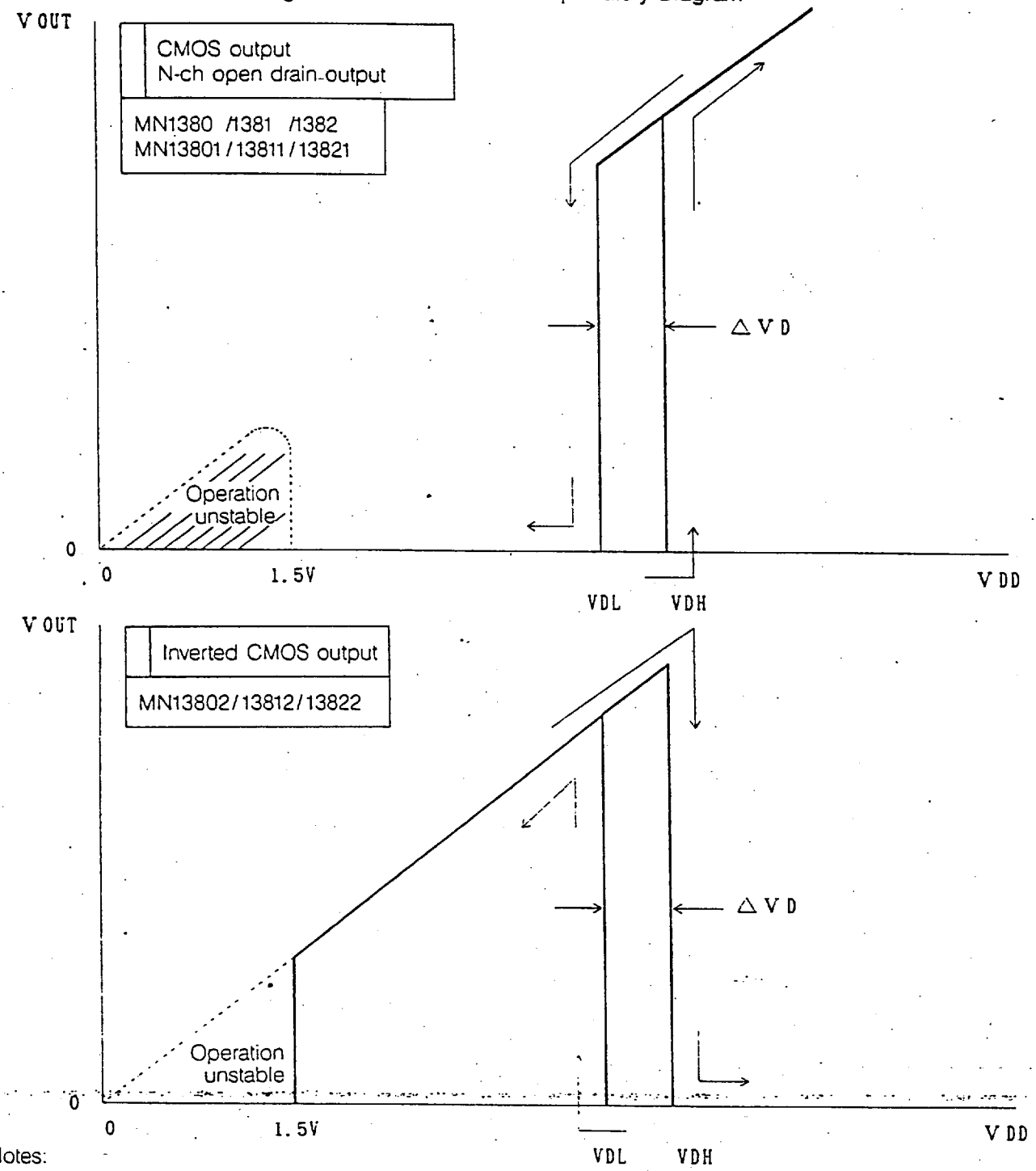


Fig. 14.2 Output Characteristics Measurement Circuit Diagram



15 I/O CHARACTERISTICS EXPLANATORY DRAWING

Fig. 15.1 I/O Characteristics Explanatory Diagram

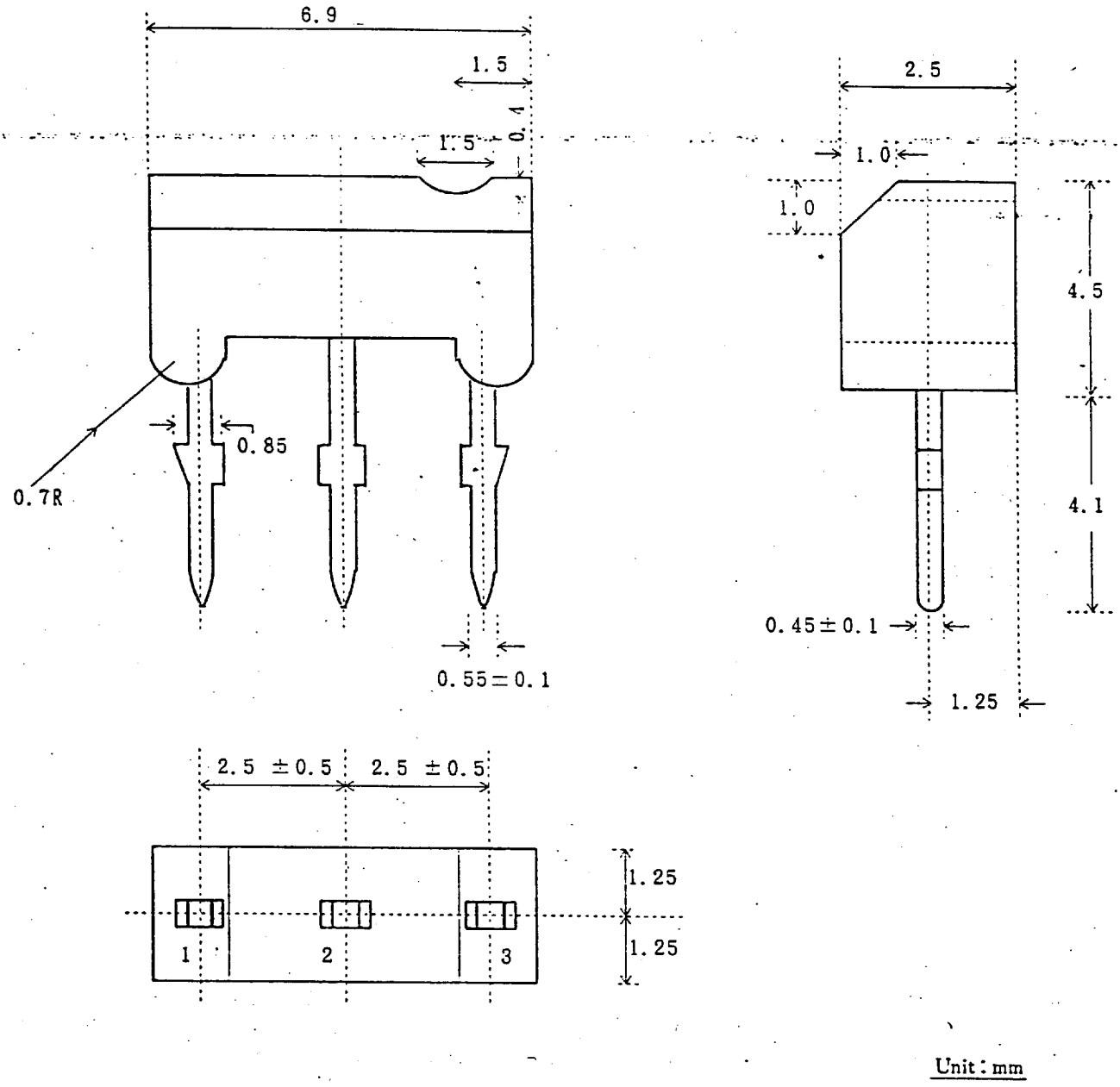


Notes:

1. Output cannot be stipulated as operation is not guaranteed when the drain supply voltage is less then 1.5V.
2. VDL: Detection voltage at drop in power supply
   VDH: Detection voltage at rise in power supply
3. The characteristics of N-ch open drain output are the characteristics when load resistance is connected across the OUT and VDD pins.

16 PACKAGE DIMENSIONS

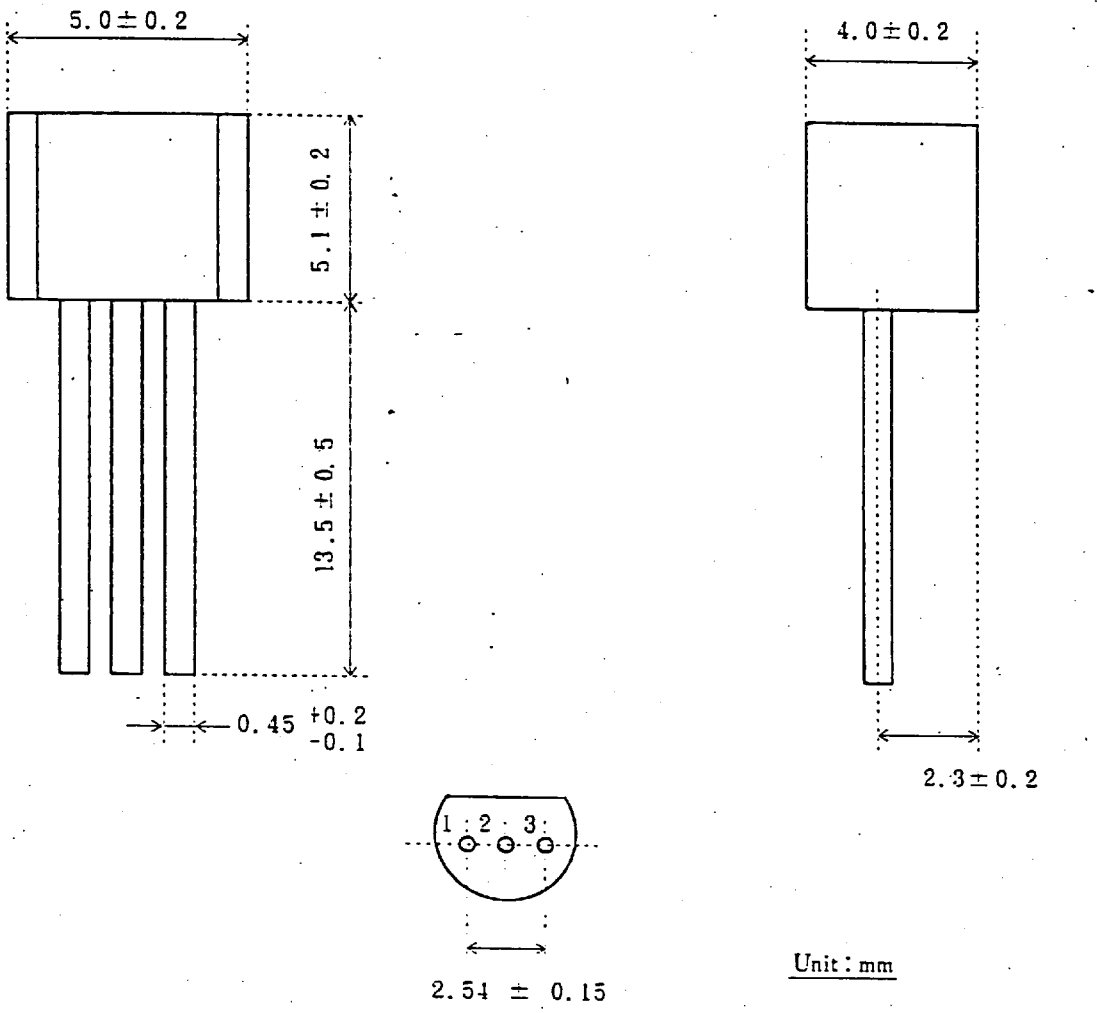
Fig. 16.1 M Type Package Dimensions



Unit : mm

16 PACKAGE DIMENSIONS (Cont.)

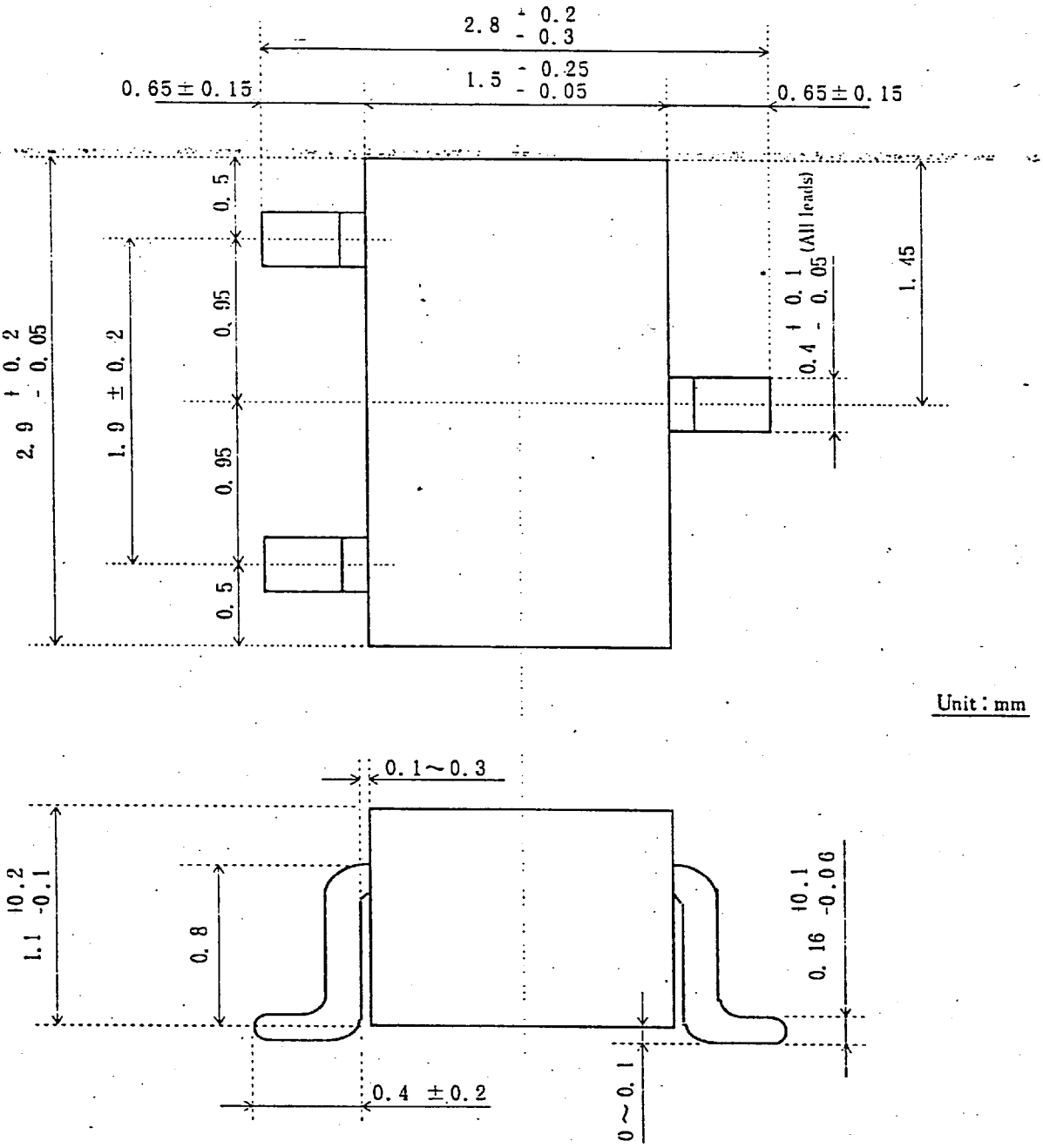
Fig. 16.2 TO-92 Type Package Dimensions



Unit : mm

16 PACKAGE DIMENSIONS (Cont.)

Fig. 16.3 Mini Type Package Dimensions



17 REFERENCE CHARACTERISTICS DRAWINGS (Cont.)

Fig. 17.3A V_{DL}/V_{DH} – Temperature Characteristics (at Q rank)

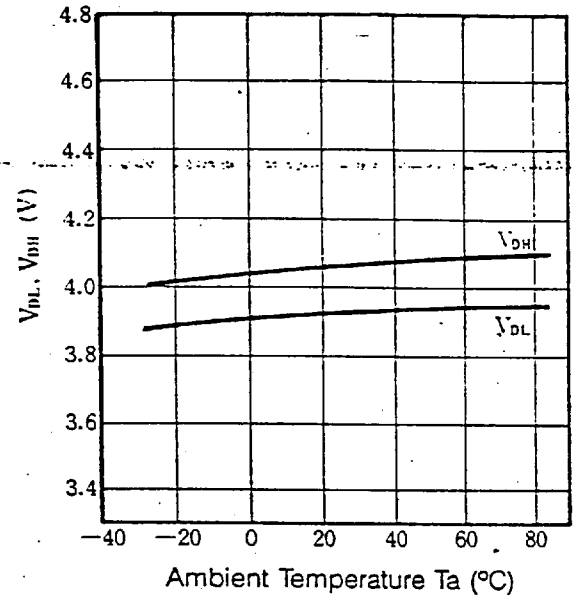


Fig. 17.3B Measurement Circuit Diagram

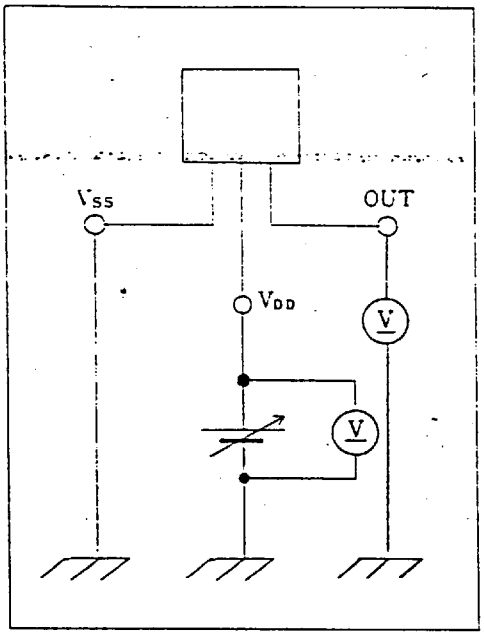


Fig. 17.4A ΔV_D – Temperature Characteristics (at Q rank)

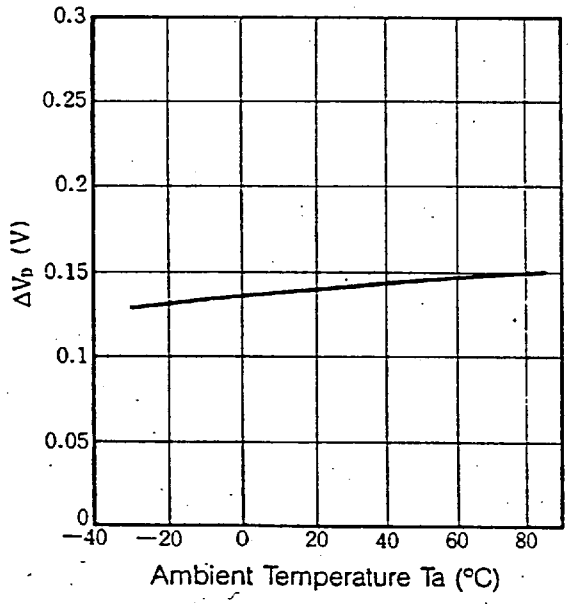
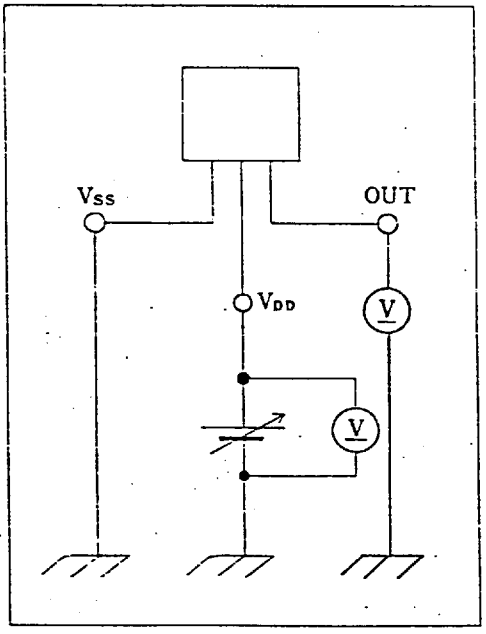


Fig. 17.4B Measurement Circuit Diagram



17 REFERENCE CHARACTERISTICS DRAWINGS (Cont.)

Fig. 17.5A I_{OL} – V_{OL} Characteristics

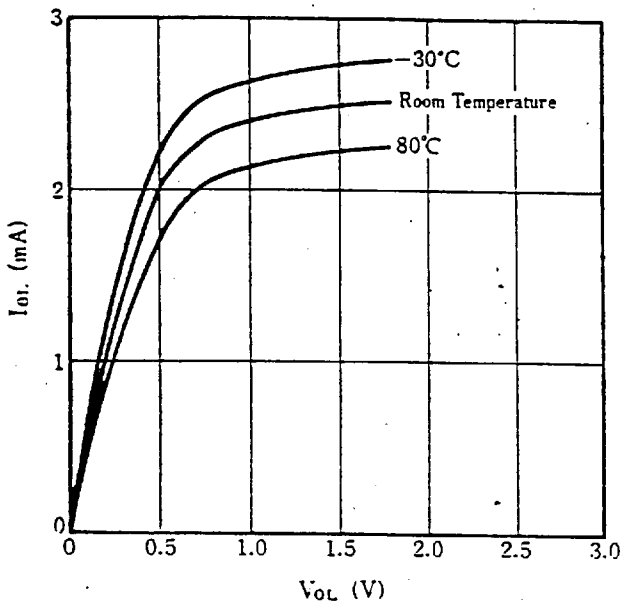


Fig. 17.5B Measurement Circuit Diagram

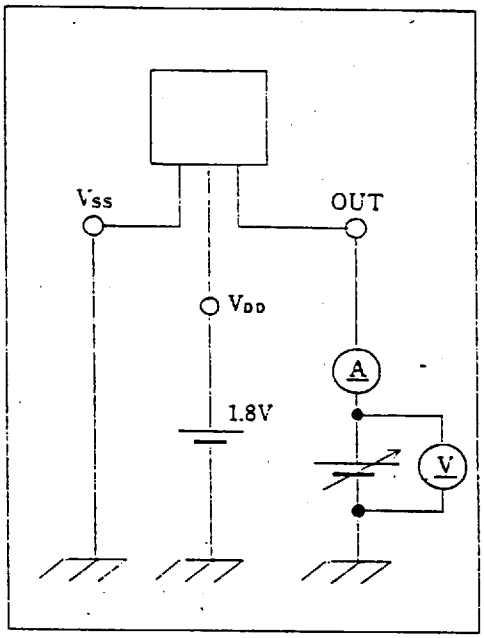


Fig. 17.6A I_{OH} – V_{OH} Characteristics

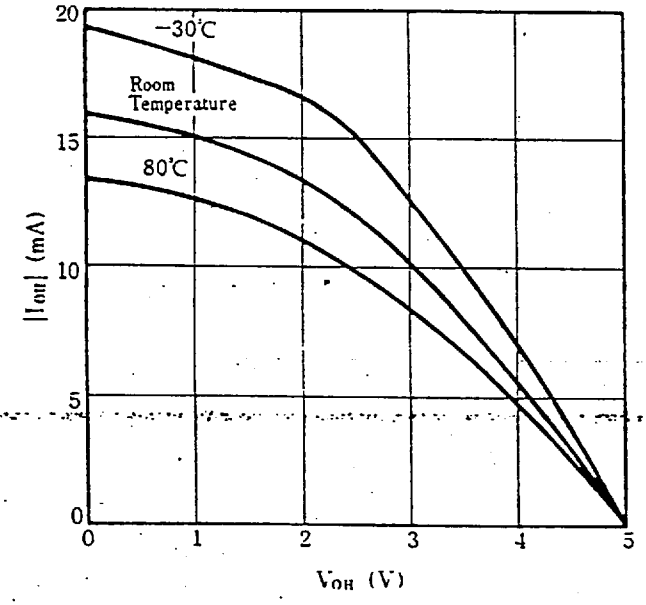
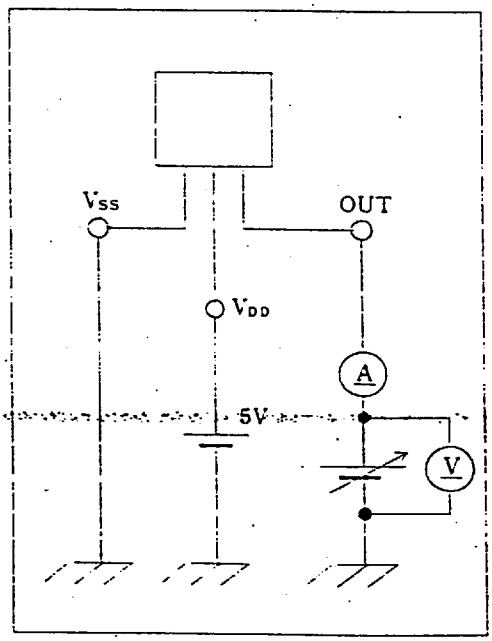


Fig. 17.6B Measurement Circuit Diagram



17 REFERENCE CHARACTERISTICS DRAWINGS (Cont.)

Fig. 17.7A I_{OL} – Temperature Characteristics

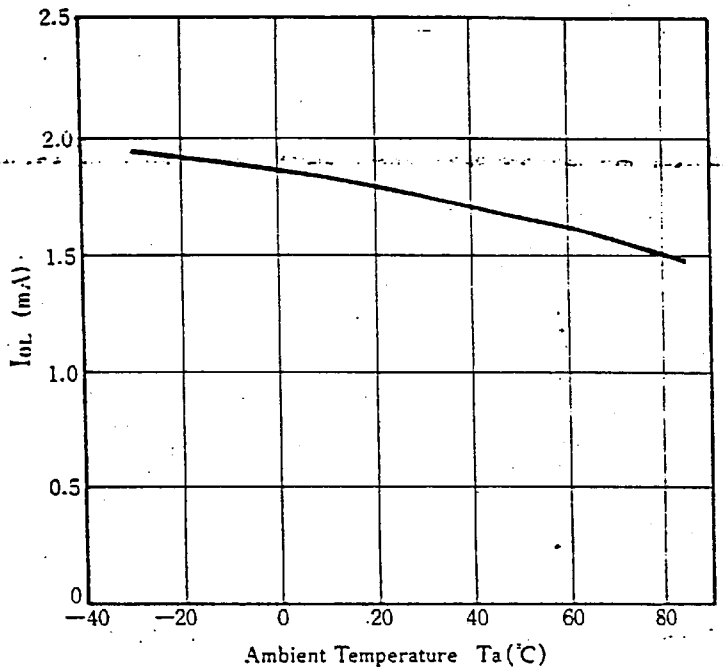


Fig. 17.7A Measurement Circuit Diagram

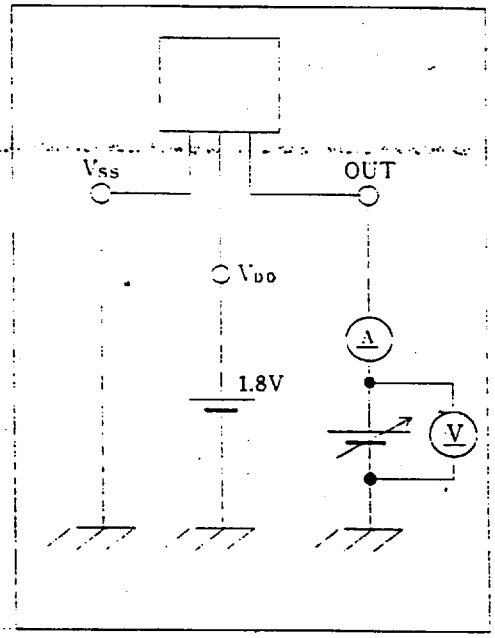


Fig. 17.8A I_{OH} – Temperature Characteristics

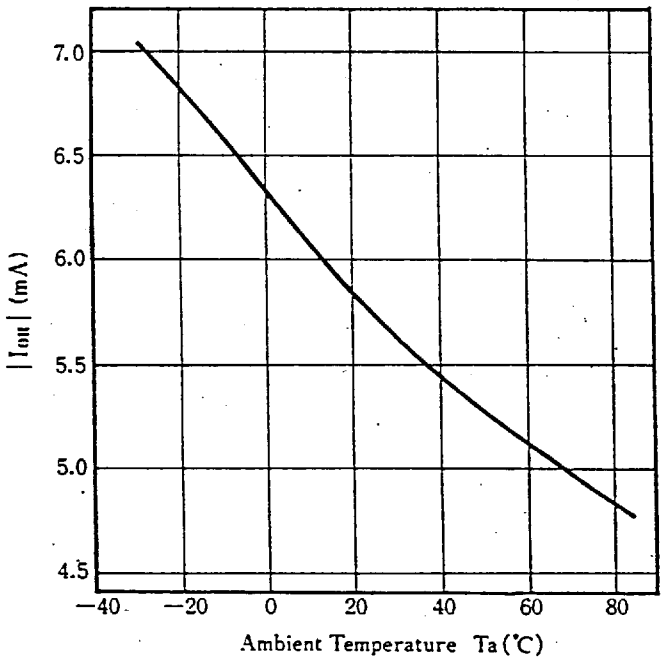
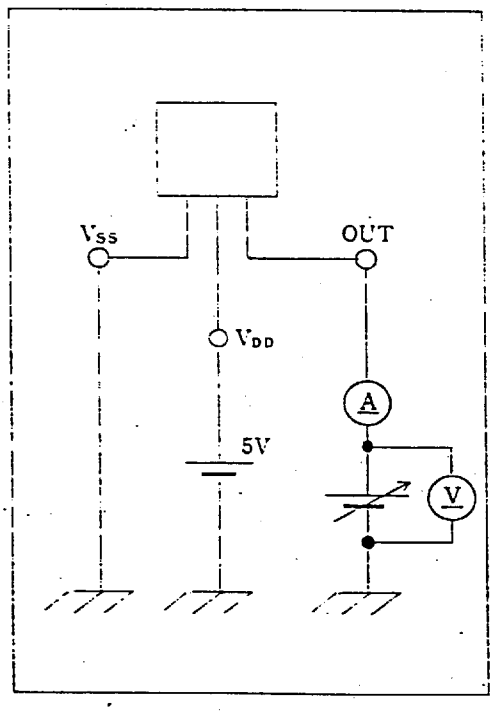


Fig. 17.8B Measurement Circuit Diagram



18 EXAMPLE OF MN1380 SERIES CIRCUIT

O Applications

- Battery checkers
- Interrupted power detectors
- Level discriminators
- Memory backup
- Microcomputer resetting circuits
- Resetting circuits for other electronic circuits

O Example of Circuit

In principle, use output pins when connecting resistors and capacitors.

Note that V_{OH}, V_{OL} and ΔV_D will fluctuate if a resistor is connected to the power supply pin.

Fig. 18.1 Circuit Example 1

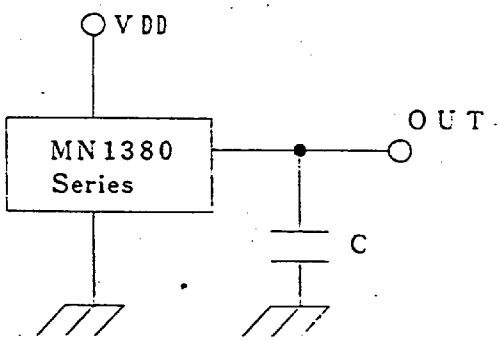
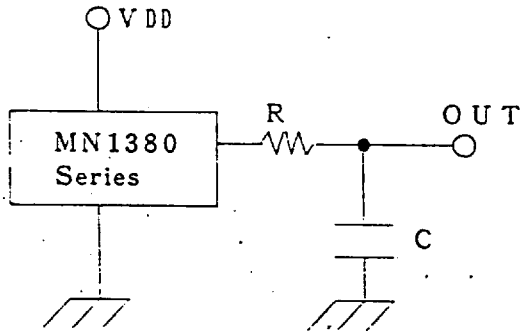


Fig. 18.2 Circuit Example 2



Select values C and R according to the purpose for which the MN1380 Series CMOS LSI is used.

19 TO-92 TYPE TAPING PACKAGING SPECIFICATIONS (MN1381/13811/13812)

Fig. 19.1 TO-92 Type Taping Dimensions (Zig-zag folding)

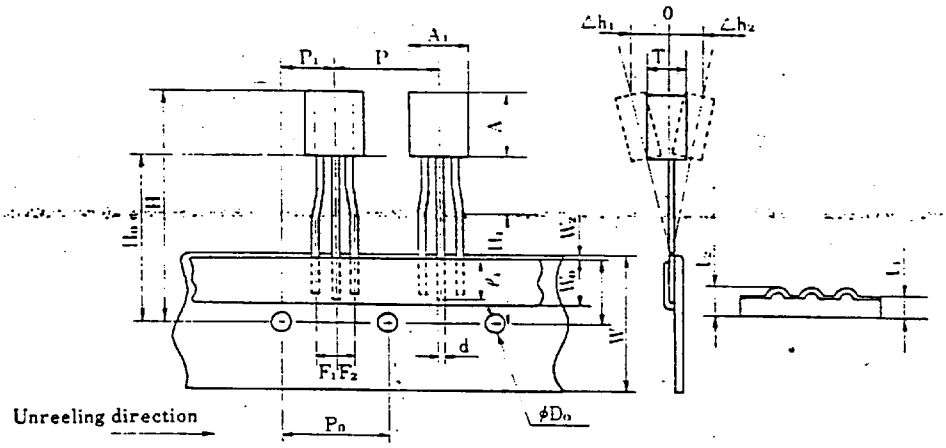


Table 19.1 TO-92 Type Taping Dimensions (Zig-zag folding)

Name	Symbol	Dimensions (mm)
Product Height *	A	5.3 max
Product Width *	A 1	5.2 max
Product Thickness *	T	4.2 max
Lead Width *	d	$0.45^{+0.15}_{-0.1}$
Affixed Lead Length	ℓ 1	2.0 max
Pitch between Products	P	12.7 ±1.0
Feed Hole Pitch	P 0	12.7 ±0.3
Feed Hole Positions	P 1	6.35±0.5
Lead Interval	F 1/F 2	$2.5^{+0.5}_{-0.2}$
Product Angling	Δ h1 Δ h2	2.0 max
Tape Width	W	$18.0^{+1.0}_{-0.5}$

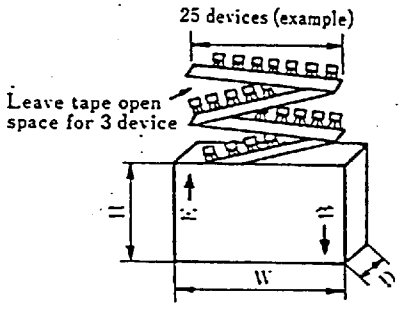
Name	Symbol	Dimensions (mm)
Affixed Tape Width	W 0	6.0 ±0.5
Feed Hole Position	W 1	9.0 ±0.5
Affixed Tape Position	W 2	0.5 max
Product Upper Surface	H	25.0 max
Product Lower Surface	H 0	19.0 ±0.5
Lead Clinch Height	H 1	16.0 ±0.5
Feed Hole Diameter	D 0	4.0 ±0.2
Tape Thickness	t 1	0.7 ±0.2
Tape Thickness (overall)	t 2	1.5 max

Note
* Details are based on separate specifications.

Fig.19.2 TO-92 Type Zig-zag Folding Box Dimension

W	H	D
330	250	41

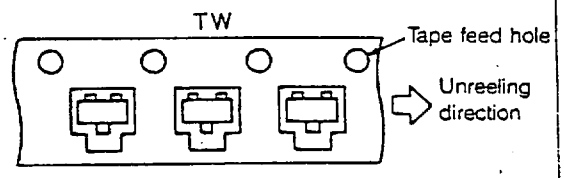
Unit: mm



20 MINI TYPE EMBOSSED TAPING PACKAGING SPECIFICATIONS (MN1382/13821/13822)

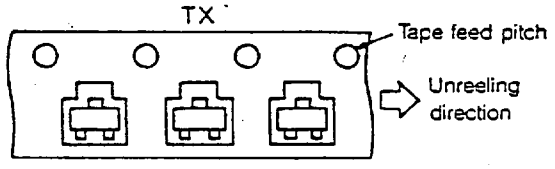
○ There are two taping packaging methods, TW and TX, according to the direction in which the product is inserted into the tape.

Fig. 20.1 Product Sealed in Direction TW



(marking surface face up)

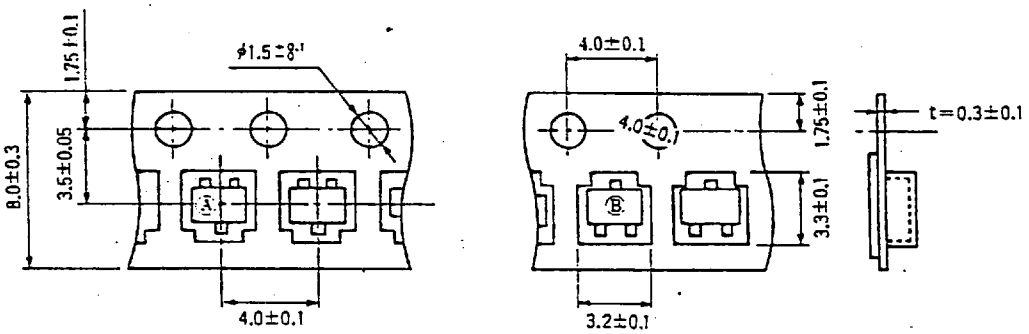
Fig. 20.2 Product Sealed in TY Direction



(marking surface face up)

Fig. 20.3 Mini Type Package Embossed Taping Dimensions

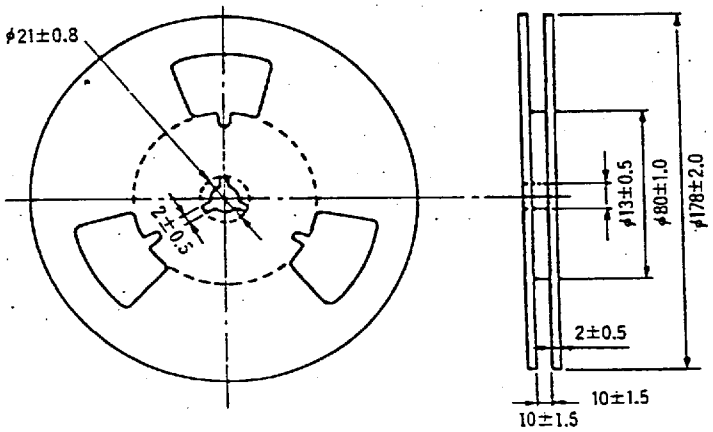
Unit: mm



Product sealing direction TW is shown on left. Product sealing direction TX is shown on right.

Fig. 20.4 Mini Type Package Embossed Tape Reel Dimensions

Unit: mm



(3000 products per reel)

21 MN1380 SERIES RELIABILITY TEST RESULTS

Table 21.1 M Type Packages (MN1380/MN13801/MN13802)
TO-92 Type Packages (MN1381/MN13811/MN13812)

Test Item	Test Conditions	Results
Operating Life Test	VDD = 5.5V、Ta = 125 ℃、t = 1000hrs	0／15
High-temperature Storage Test	Ta = 150 ℃、t = 1000hrs	0／15
Low-temperature Storage Test	Ta = -65 ℃、t = 1000hrs	0／15
High-temperature, High-humidity Storage Test	Ta = 85℃、RH = 85 %、t = 1000hrs	0／15
High-temperature, High-humidity Bias Test	VDD = 5.5V、Ta = 85℃、RH = 85 %、t = 1000hrs	0／15
Thermal Shock Test	Ta = 150 ℃ ～ -65℃、5 min each, 10 cycles	0／15
Temperature Cycle Test	Ta = 150 ℃ ～ -65℃、30 min each, 10 cycles	0／15
Steam Pressurization Test	2 atmospheres, 50 hrs, Ta=121℃	0／15
Solderability Test	Ta = 230 ℃、5 sec	0／15
Solder Heat Resistance Test	Ta = 270 ℃、10 sec	0／15

Table 21.2 Mini Type Package (MN1382/MN13821/MN13822)

	Test Item	Test Conditions	Results
	Operating Life Test	VDD = 5.5V、Ta = 125 ℃、t = 1000hrs	0／15
	High-temperature Storage Test	Ta = 150 ℃、t = 1000hrs	0／15
	Low-temperature Storage Test	Ta = -65 ℃、t = 1000hrs	0／15
	High-temperature, High-humidity Storage Test	Ta = 85℃、RH = 85 %、t = 1000hrs	0／15
	High-temperature, High-humidity Bias Test	VDD = 5.5V、Ta = 85℃、RH = 85 %、t = 1000hrs	0／15
	Thermal Shock Test	Ta = 150 ℃ ～ -65℃、5 min each, 10 cycles	0／15
	Temperature Cycle Test	Ta = 150 ℃ ～ -65℃、30 min each, 10 cycles	0／15
*	Steam Pressurization Test	2 atmospheres, 24 hrs, Ta=121℃	0／15
	Solderability Test	Ta = 230 ℃、5 sec	0／15
*	Solder Heat Resistance Test	Ta = 260 ℃、5 sec	0／15

* Note: Note that the test conditions of Mini type packages vary with other packages.