MN1380S Series (Lead-free Version)

CMOS LSIs for Voltage Detection

■ Overview

The MN1380S series are elements that monitor the power supply voltage supplied to microcomputers and other LSI systems and issue reset signals for initializing the system after the power is first applied or for preventing runaway operation when the supply voltage fluctuates.

There is a choice of three output types: CMOS output, N-channel open drain output, and inverted CMOS output. There are also three package types: MT-2, TO-92, and a mini type for surface mounting.

Choose the ideal element for your application from the series' wide selection of detection ranks (17 ranks between 2.0 and 4.9 volts), output types, and package types.

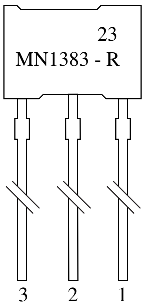
■ Features

- Three-pin element requiring no adjustment
- Wide selection of detection ranks (17 ranks between 2.0 and 4.9 volts)
- Highly precise detection voltage
- Detection voltage with hysteresis characteristic
  $\Delta VD = 50$ mV for ranks C to K
  $\Delta VD = 100$ mV for ranks L to U
- Low current consumption: $I_{DD} = 1 \mu A$ (typ.) for $V_{DD} = 5$ V
- Low fluctuation in detection voltage with temperature (typ. 1 mV/°C)
- Wide selection of output types: CMOS output, N-channel open drain output, and inverted CMOS output
- Wide selection of package types: MT-2, TO-92, and a mini type for surface mounting.

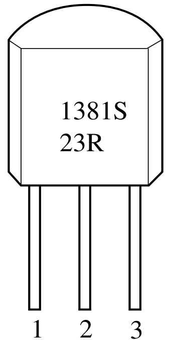
■ Applications

- Battery checkers
- Power outage detectors
- Level discriminators
- Memory backup systems
- Microcomputer reset circuits

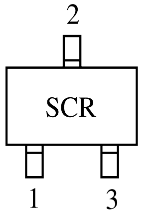
■ Pin Assignment



MT-2 type package



TO-92 type package



1=OUT
2=V_{DD}
3=V_{SS}

Mini type package

■ MN1380S Series Naming Conventions

The MN1380S series offers a wide selection of detection ranks, output types, package types, and packaging. All combinations use the following naming conventions. When ordering, be sure to give the correct part number using these naming conventions.

MN13811S–R (TA)

Winding direction for tape packaging
(TA) ...... Tape packaging for TO-92 and MT-2 type package
(TX) ...... Embossed tape packing for mini type package
For further details, see the package specifications.

Detection voltage rank (C to U)

Lead free

Output type:
Blank ········ CMOS output
1 ················ N-channel open drain output
2 ················ inverted CMOS output

Package:
1 ················ TO-92 type package
2 ················ Mini type package
3 ················ MT-2 type package

Panasonic MN1380S series of voltage detection CMOS LSIs with low current consumptions

(Example)

MN13821S–R (TX)

Embossed tape packaging

R rank (detection voltage of 4.0 to 4.3 V)

Lead free

N-channel open drain output

Mini type package

MN1380S series of voltage detection CMOS LSIs with low current consumption

■ Minimum Packaging Unit

Taping (Mini and TO-92 types) ······· 3,000
Taping (MT-2 types) ························ 2,000

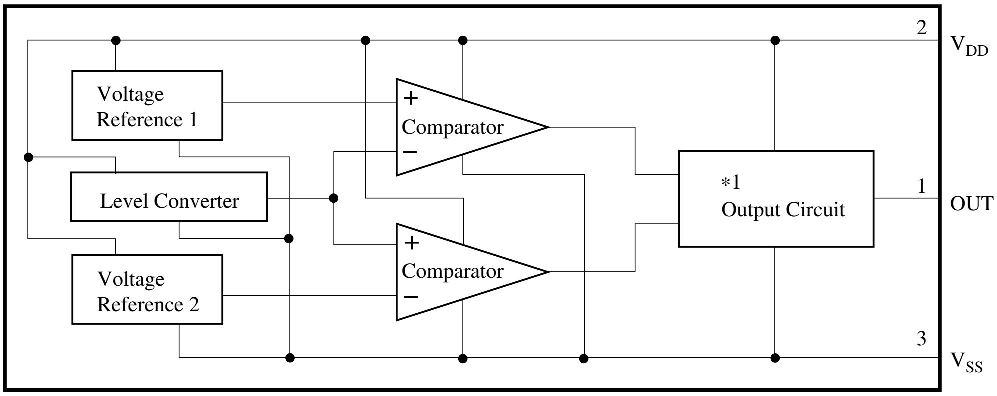
■ Series Lineup

Output \ Package	MT-2 type Package	TO-92 type Package	Mini type Package
CMOS output	MN1383	MN1381S	MN1382S
N-channel open drain output	MN13831	MN13811S	MN13821S
Inverted CMOS output	MN13832	MN13812S	MN13822S

■ Detection Ranks (on Voltage)

Rank	Detection Voltage for Drop in Power Supply Voltage (V_{DL})		Unit	Detection Voltage Hysteresis Width (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				

■ Block Diagram



Note *1: Circuits vary slightly depending on the output type (CMOS output, N-channel open drain output, or inverted CMOS output)

■ Pin Descriptions

Pin No.	Symbol	Function Description
1	OUT	Reset signal output pin
2	V_{DD}	Power supply pin
3	V_{SS}	Ground pin

■ Absolute Maximum Ratings V_{SS}=0V, Ta=25°C

Parameter	Symbol	Rating	Unit
Power supply voltage	V_{DD}	7.0	V
Output voltage	V_O	– 0.3 to V_{DD} +0.3	V
Operating ambient temperature	Ta	–20 to +70	°C
Storage temperature	T_{stg}	–55 to +125	°C

■ Recommended Operating Conditions V_{SS}=0V, Ta=25°C

Parameter	Symbol	Conditions	min	typ	max	Unit
Power supply voltage	V_{DD}	See Figures 1 and 4.	1.5		6.0	V

■ Electrical Characteristics

1) DC Characteristics V_{SS}=0V, Ta=–20°C to +70°C

Parameter	Symbol	Conditions		min	typ	max	Unit
Power supply current	I_{DD}	V_{DD} = 5 V *1 Load resistance = 10 kW			1	5	µA
Detection voltage for drop in power supply voltage *2	V_{DL}	Ta=25°C See Figures 1 and 4.		*2		*2	V
Detection voltage hysteresis width *2	ΔVD			*2		*2	mV
"H" level output voltage	V_{OH}	CMOS output	I_{OH}=– 40µA	0.8V_{DD}		V_{DD}	V
		Inverted CMOS output	V_{DD}=1.8V I_{OH}=– 0.5mA	0.8		V_{DD} –1.5	
"L" level output voltage	V_{OL}	N-channel open drain output	V_{DD}=1.8V I_{OL}=0.7mA	V_{SS}		0.4	V
		Inverted CMOS output	V_{DD}=6.0V I_{OH}=0.3mA	V_{SS}		0.6	

Notes

*1: This includes the output pin's leakage current.

*2: For particulars, see the detection voltage rank table.

■ Electrical Characteristics (continued)

2) AC Characteristics V_{SS}=0V, Ta=25˚C

Parameter	Symbol	Conditions		Allowable Value (typ)			Unit
			Rank	MN1383 MN1381S MN1382S	MN13831 MN13811S MN13821S	MN13832 MN13812S MN13822S	
Reset release time	t_{OH}	See Figures 2 and 3.	C	3.0	2.5	230.0	µs
			D				
			E				
			F				
			G	3.0	3.0	100.0	
			H				
			J				
			K				
			L	2.0	4.0	30.0	
			M				
			N				
			P				
			Q				
			R				
			S				
			T				
Reset time	t_{OL}	See Figures 2 and 3.	C	250.0	160.0	3.0	µs
			D				
			E				
			F				
			G	115.0	100.0	3.0	
			H				
			J				
			K				
			L	15.0	35.0	3.0	
			M				
			N				
			P				
			Q				
			R				
			S				
			T				

■ Description of Operation

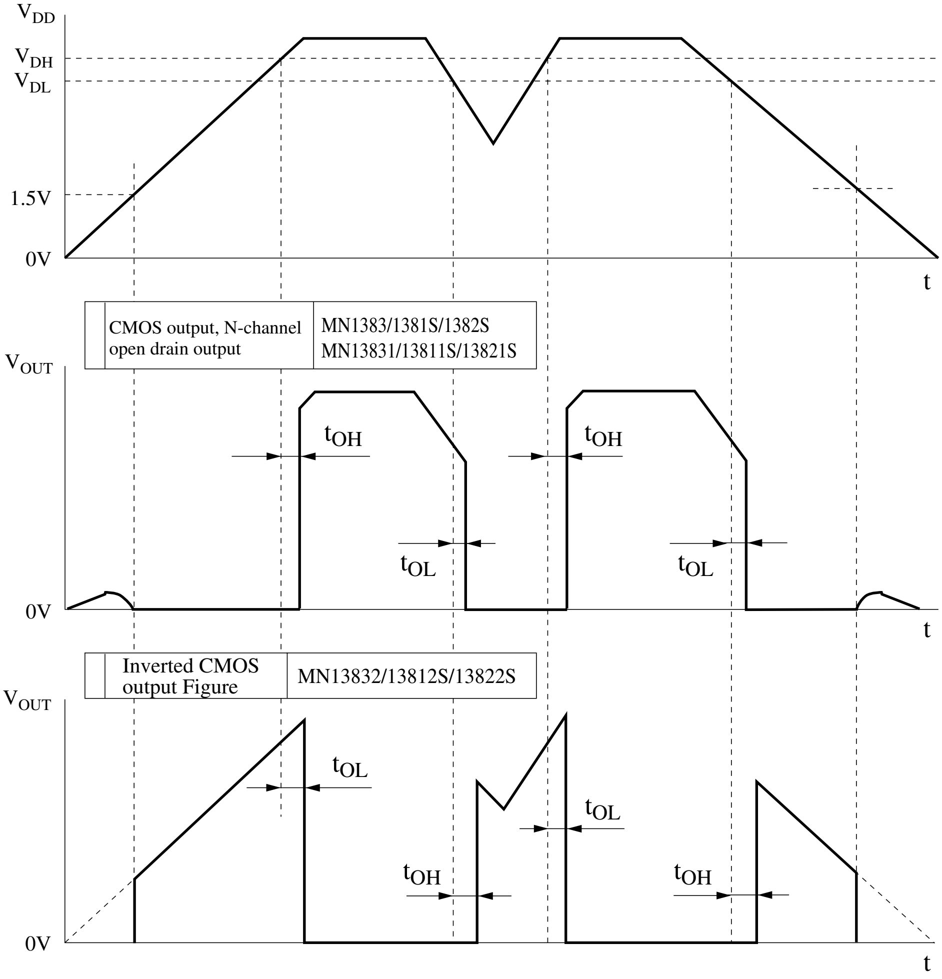


Figure 1. Description of Operation

Notes

1: Output cannot be specified for power supply voltages under 1.5 V because operation is not guaranteed for that range.

2: V_{DL}: Detection voltage for drop in power supply voltage

V_{DH}: Detection voltage for rise in power supply voltage

t_{OL} : Time lag between the time that the power supply voltage reaches the detection voltage (V_{DL} or V_{DH}) and the time that the output pin (OUT) goes to "L" level.

t_{OH} : Time lag between the time that the power supply voltage reaches the detection voltage (V_{DL} or V_{DH}) and the time that the output pin (OUT) goes to "H" level.

3: These characteristics for the N-channel open drain output are when a load resistor is connected between the OUT and V_{DD} pins.

■ Description for Measuring the Output Characteristics

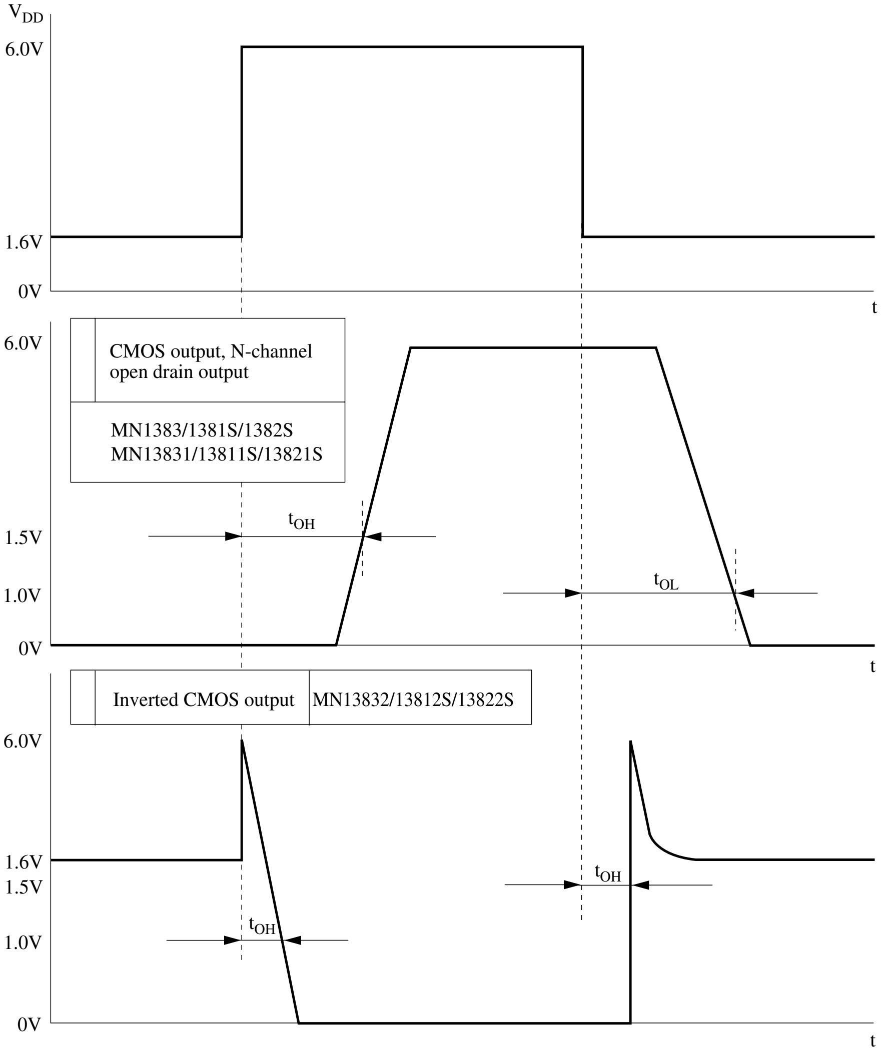


Figure 2. Description chart of Measuring the Output Characteristics

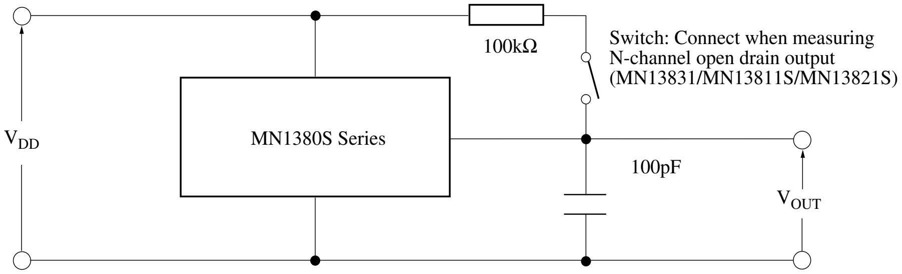


Figure 3. Circuit for Measuring the Output Characteristics

■ Description for Measuring the I/O Characteristics

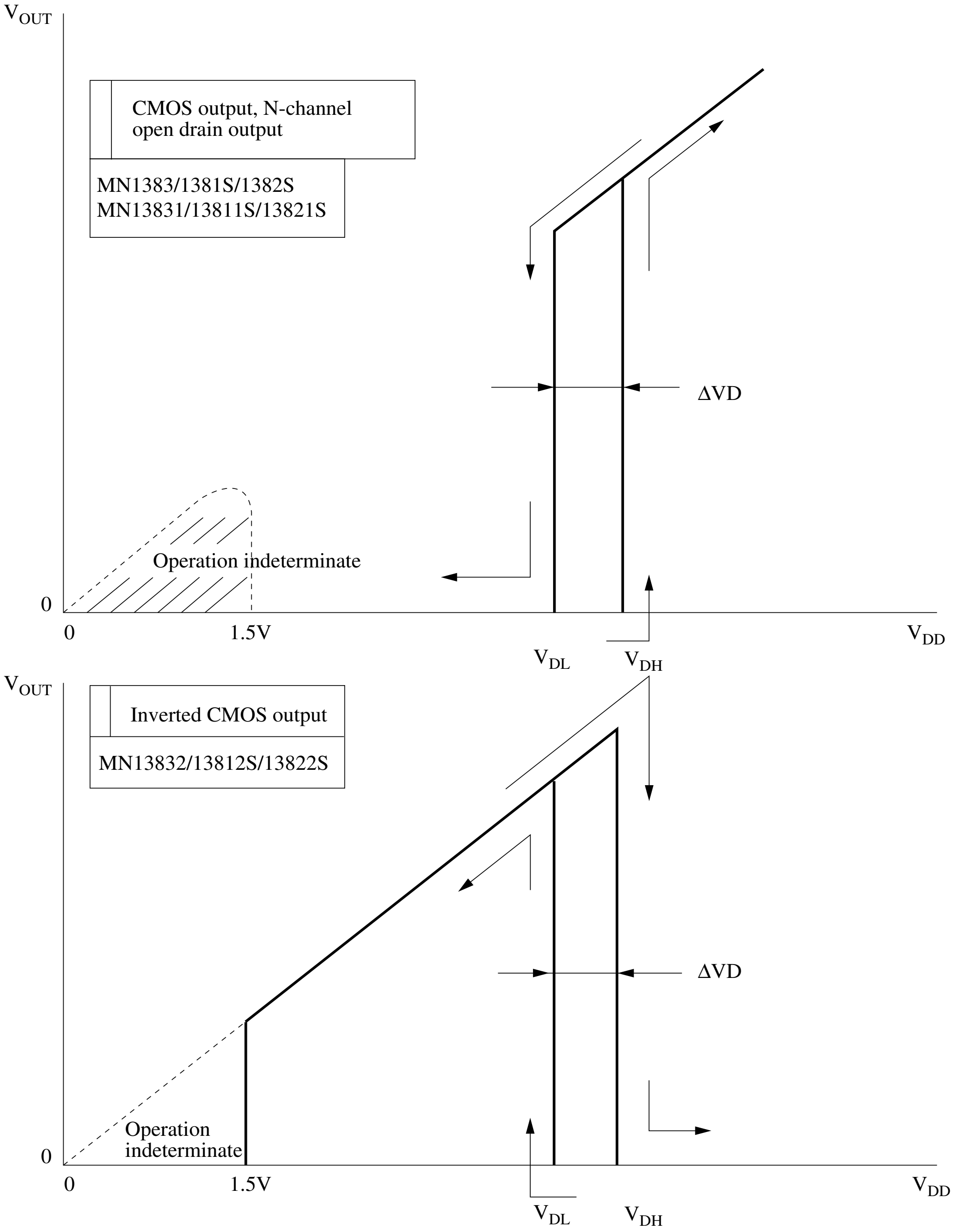


Figure 4. Description chart for Measuring the I/O Characteristics

Notes

1: Output cannot be specified for power supply voltages under 1.5 V because operation is not guaranteed for that range.

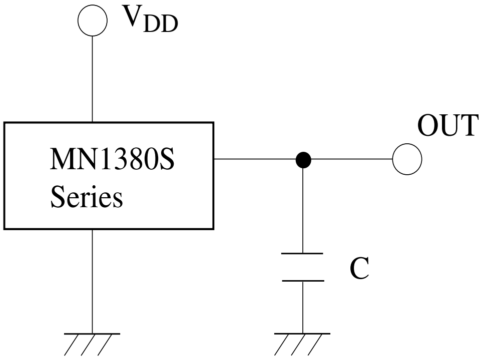
2: V_{DL}: Detection voltage for drop in power supply voltage
V_{DH}: Detection voltage for rise in power supply voltage

3: These characteristics for the N-channel open drain output are when a load resistor is connected between the OUT and V_{DD} pins.

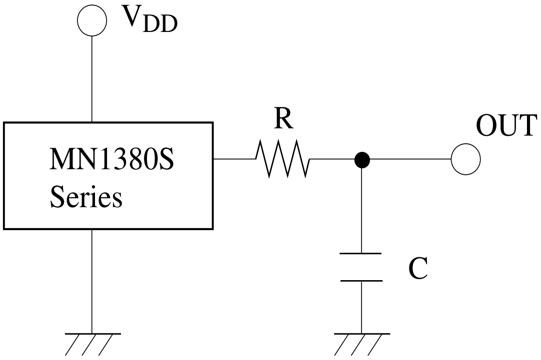
■ Application Circuit Example

Connect resistors, capacitors, and the like only to the output pin on the MN1380S series element. Note that connecting them to the Power source pins changes V_{DH}, V_{DL}, and ΔVD.

Sample Circuit 1



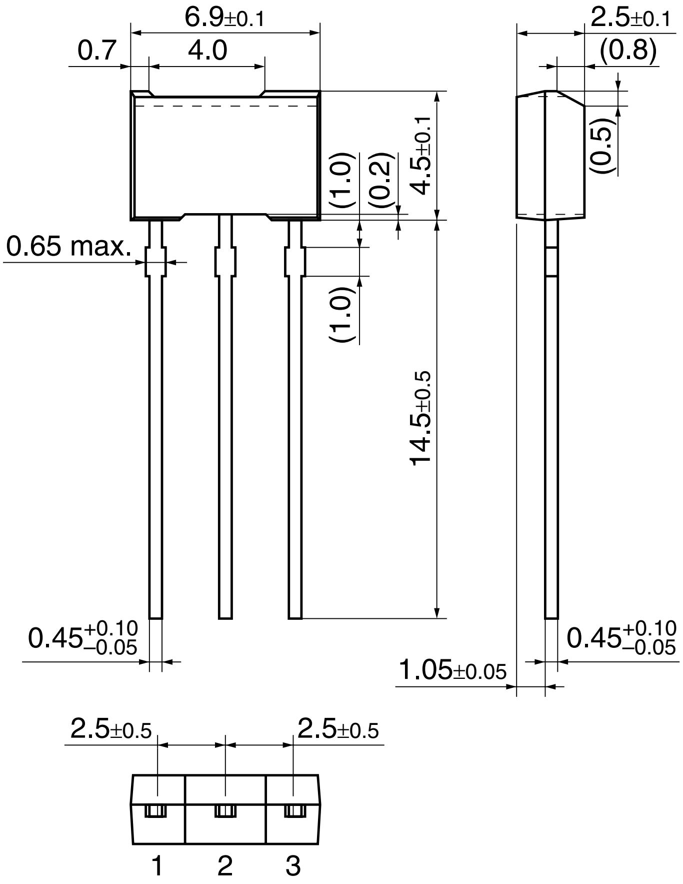
Sample Circuit 2



Select the values of R and C to match the application.

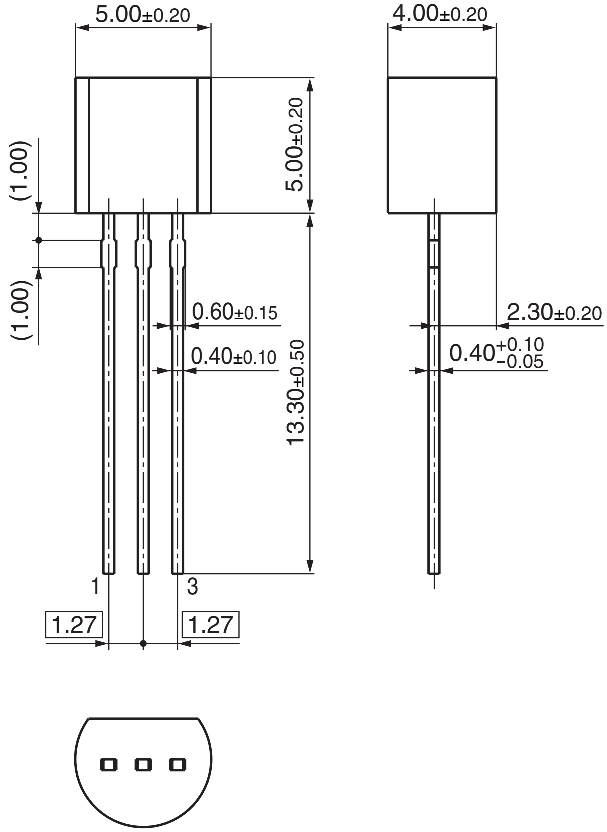
■ Package Dimensions (Unit: mm)

MT-2 type package (Lead-free package)



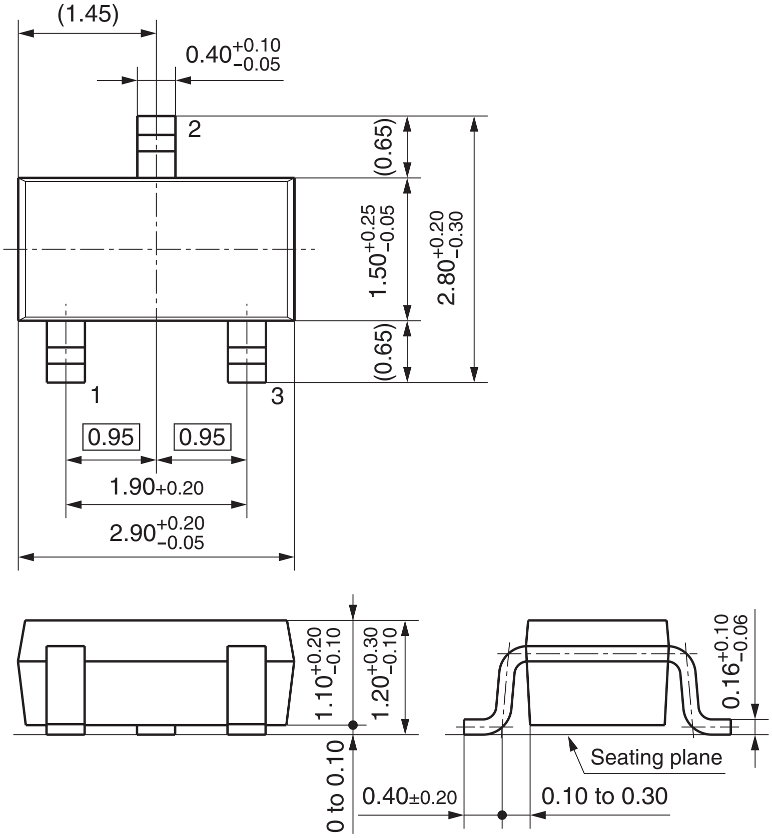
■ Package Dimensions (Unit: mm)(continued)

- SSIP003-P-0000S (Lead-free package)



■ Package Dimensions (Unit: mm)(continued)

- MINI-3DC (Lead-free package)



■ Reference Characteristics

The following characteristics curves represent results from a specific sample therefore they do not guarantee the characteristics for the final product.

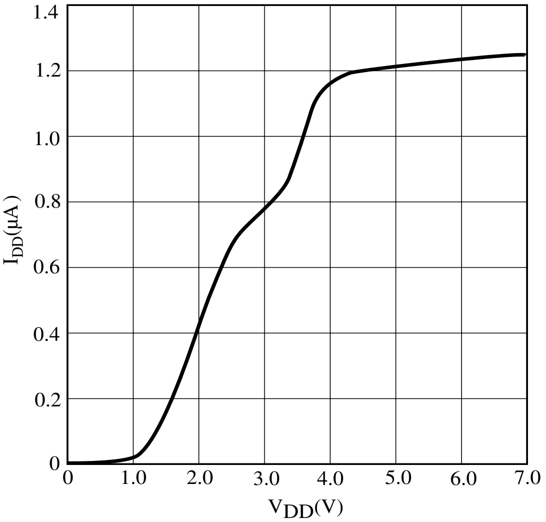


Figure 5.a. I_{DD} vs. V_{DD} Characteristic (Rank Q)

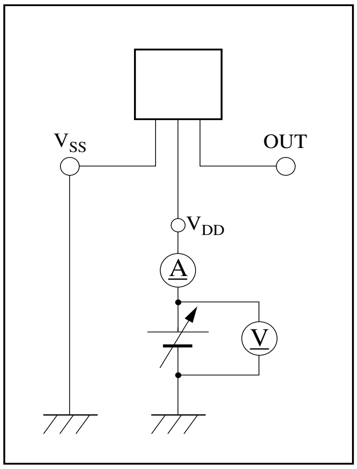


Figure 5.b. Measurement Circuit

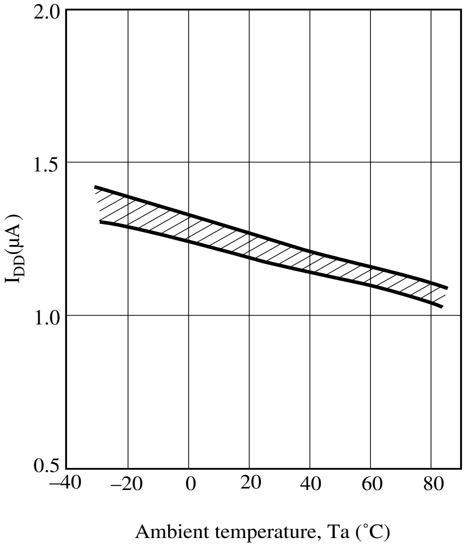


Figure 6.a. I_{DD} Temperature Characteristic (Rank Q)

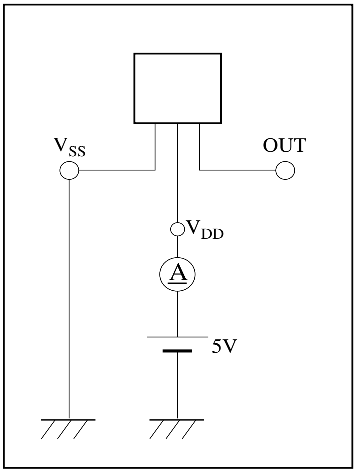


Figure 6.b. Measurement Circuit

■ Reference Characteristics (continued)

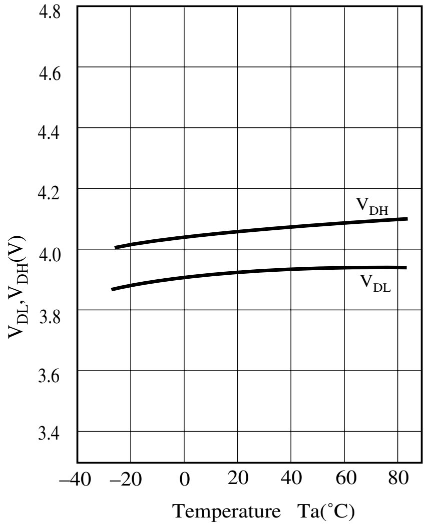


Figure 7.a. V_{DL}/V_{DH} Temperature Characteristic (Rank Q)

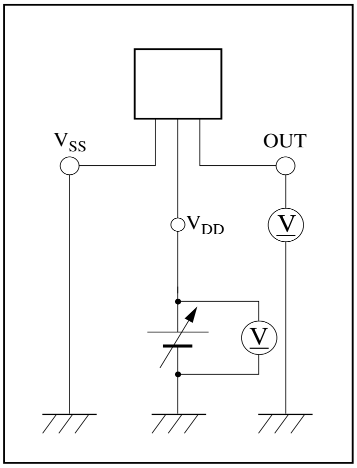


Figure 7.b. Measurement Circuit

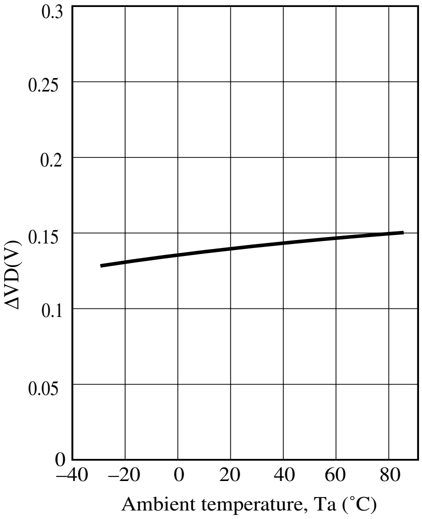


Figure 8.a. ΔVD Temperature Characteristic (Rank Q)

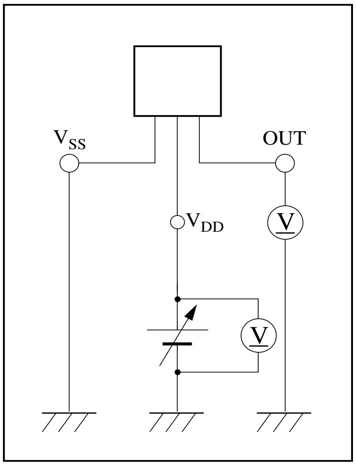


Figure 8.b. Measurement Circuit

■ Reference Characteristics (continued)

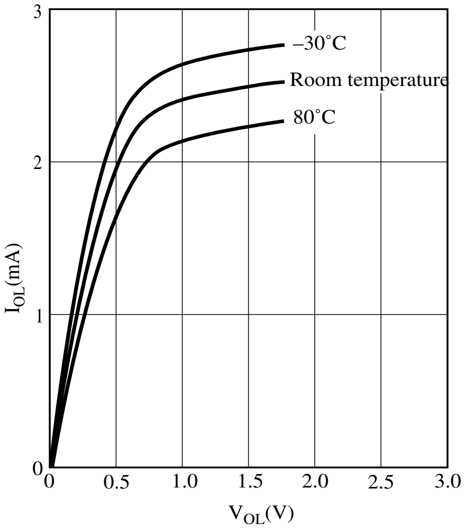


Figure 9.a. I_{OL} vs. V_{OL} Characteristic

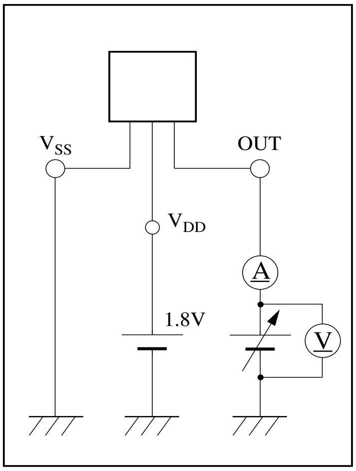


Figure 9.b. Measurement Circuit

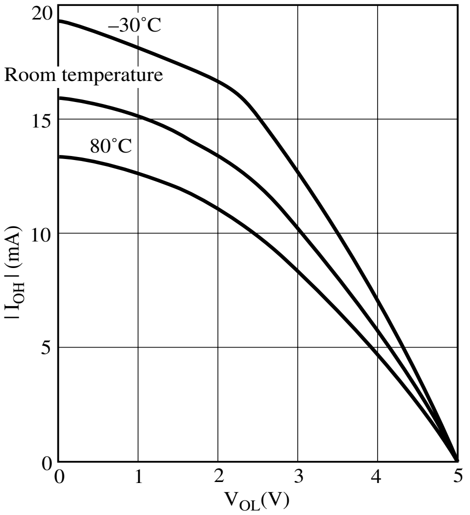


Figure 10.a. I_{OH} vs. V_{OH} Characteristic

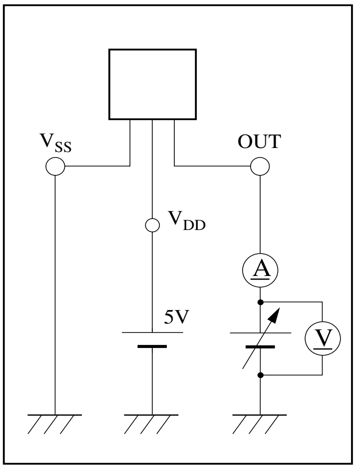
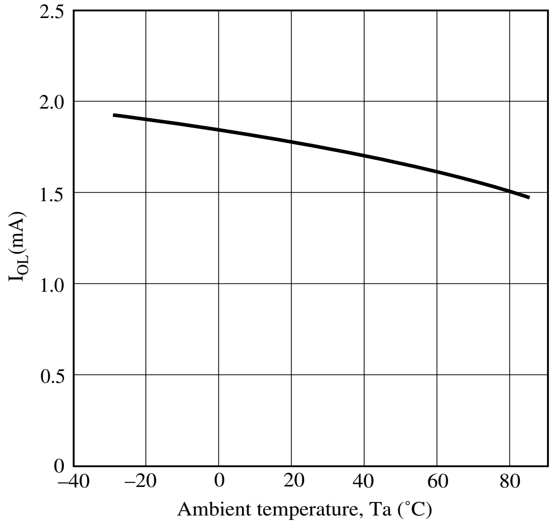


Figure 10.b. Measurement Circuit

■ Reference Characteristics (continued)



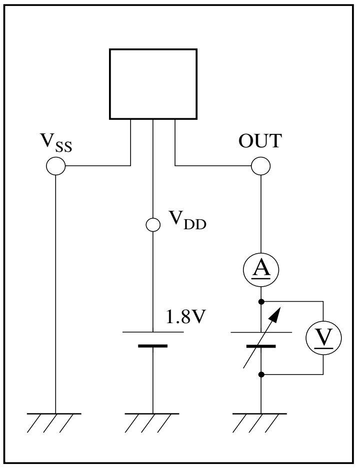
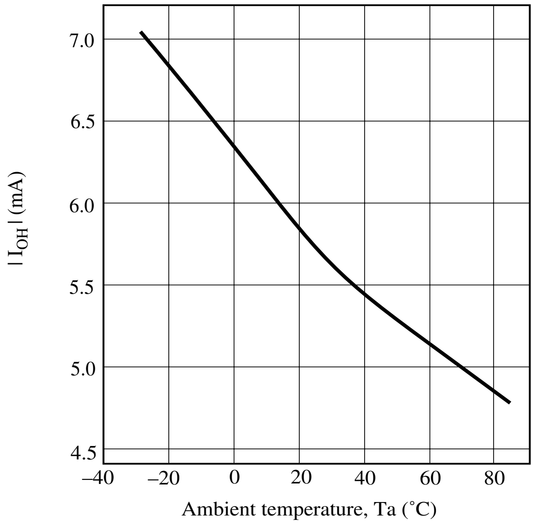


Figure 11.a. I_{OL} vs. Temperature Characteristic

Figure 11.b. Measurement Circuit



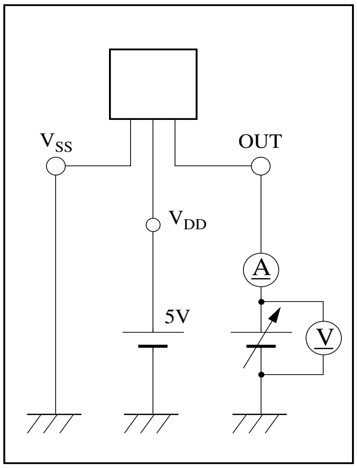


Figure 12.a. I_{OH} vs. Temperature Characteristic

Figure 12.b. Measurement Circuit

■ TO-92 Type Package Taping-Specifications (MN1381S/MN13811S/MN13812S)

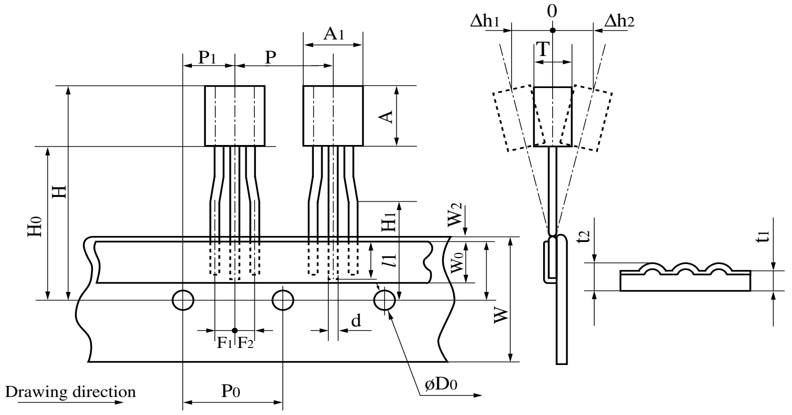


Figure 13. TO-92 Type Package Taping-Dimensions (Ammunition pack)

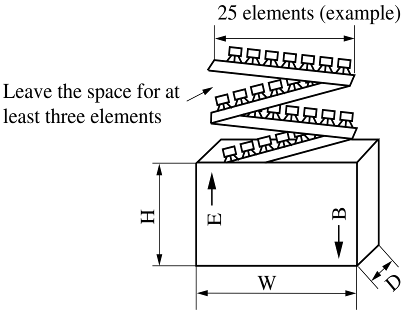
TO-92 Type Package Taping Dimensions (Ammunition pack)

Name	Symbol	Length (mm)
Product height*	A	5.3 max
Product width*	A1	5.2 max
Product thickness*	T	4.2 max
Lead width*	d	$0.45^{+0.15}_{-0.1}$
Taped lead length	l1	2.0 max
Product pitch	P	12.7±1.0
Feed hole pitch	P0	12.7±0.3
Feed hole position	P1	6.35±0.5
Lead spacing	F1, F2	$2.5^{+0.5}_{-0.2}$
Product deflection angle	Δh1, Δh2	2.0 max
Tape width	W	$18.0^{+1.0}_{-0.5}$
Adhesive tape width	W0	6.0±0.5
Feed hole position	W1	9.0±0.5
Adhesive tape position	W2	0.5 max
Distance to top of product	H	25.0 max
Distance to bottom of product	H0	19.0±0.5
Lead clinch height	H1	16.0±0.5
Feed hole diameter	D0	4.0±0.2
Tape thickness	t1	0.7±0.2
Total tape thickness	t2	1.5 max

Note*1: For further details, see the specifications issued separately.

W	H	D
330	250	41

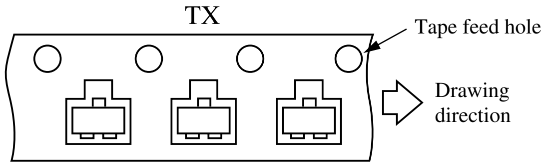
Unit: mm


25 elements (example)

Leave the space for at least three elements

Figure 14. Box Dimensions for TO-92 Type Packages with Ammunition pack

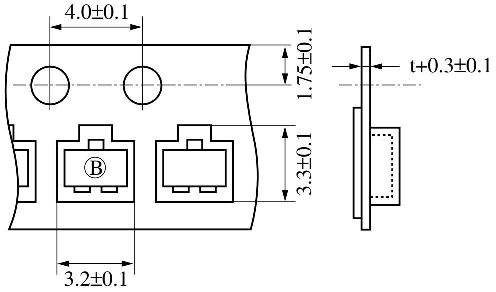
■ Embossed Taping Specifications for Mini Type Package (MN1382S/MN13821S/MN13822S)



(Marking surface on top)

Figure 15. TX Orientation

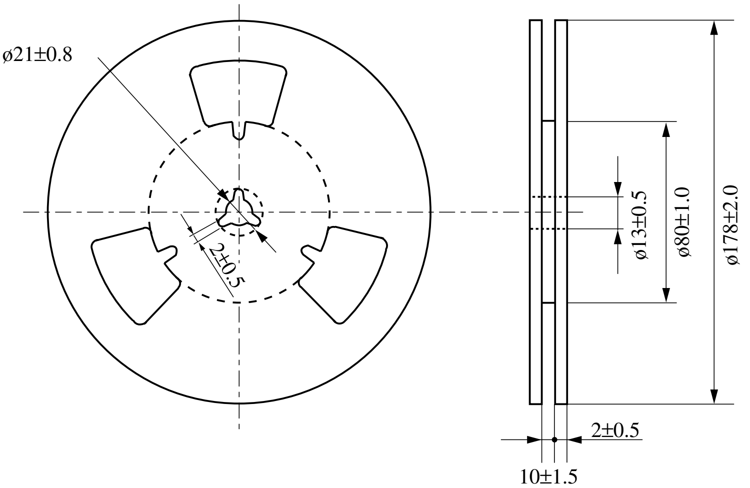
Unit: mm



Product orientation A is labeled TW; orientation B, TX.

Figure 16. Embossed Taping Dimensions for Mini Type Package

Unit: mm



3,000 packages per reel

Figure 17. Embossed Taping Reel Dimensions for Mini Type Package

■ Reliability Testing Results for MN1380S Series

(1) MT-2 type package (MN1383/MN13831/MN13832) and TO-92 type package (MN1381S/MN13811S/MN13812S)

Test Subjects	Test Conditions	Results
Operating lifetime test	V_{DD}=5.5V, Ta=125˚C, t=1000hrs	0/15
High-temperature storage test	Ta=150˚C, t=1000hrs	0/15
Low-temperature storage test	Ta=–65˚C, t=1000hrs	0/15
High-temperature, high-humidity storage test	Ta=85˚C, RH=85%, t=1000hrs	0/15
High-temperature, high-humidity bias test	V_{DD}=5.5V, Ta=85˚C, RH=85%, t=1000hrs	0/15
Thermal shock test	Ta=150˚C and –65˚C. Five minutes at each temperature for ten cycles	0/15
Temperature cycle test	Ta=150˚C and –65˚C. Thirty minutes at each temperature for ten cycles	0/15
Pressure cooker test	Two atmospheres for 50 hours at ambient temperature (Ta) of 121˚C	0/15
Soldering test	Ambient temperature (Ta) of 230˚C for five seconds	0/15
Solder heat resistance test	Ambient temperature (Ta) of 270˚C for ten seconds	0/15

(2) Mini type package (MN1382S/MN13821S/MN13822S)

Test Subjects	Test Conditions	Results
Operating lifetime test	V_{DD}=5.5V, Ta=125˚C, t=1000hrs	0/15
High-temperature storage test	Ta=150˚C, t=1000hrs	0/15
Low-temperature storage test	Ta=–65˚C, t=1000hrs	0/15
High-temperature, high-humidity storage test	Ta=85˚C, RH=85%, t=1000hrs	0/15
High-temperature, high-humidity bias test	V_{DD}=5.5V, Ta=85˚C, RH=85%, t=1000hrs	0/15
Thermal shock test	Ta=150˚C and –65˚C. Five minutes at each temperature for ten cycles	0/15
Temperature cycle test	Ta=150˚C and –65˚C. Thirty minutes at each temperature for ten cycles	0/15
Pressure cooker test *1	Two atmospheres for 24 hours at ambient temperature (Ta) of 121˚C	0/15
Soldering test	Ambient temperature (Ta) of 230˚C for five seconds	0/15
Solder heat resistance test *1	Ambient temperature (Ta) of 260˚C for five seconds	0/15

Note*1: Note that the testing conditions for the mini package differ from those for the other two packages.