

# MN13821S

## CMOS IC for Voltage Detection

### ■ Overview

The MN13821S 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.

This is a N-channel open drain output, choose the ideal element for your application from the series' wide selection of detection ranks (17 ranks 2.0 V to 4.9 V).

There is other output type, CMOS output (MN1382S) and inverted CMOS output (MN13822S).

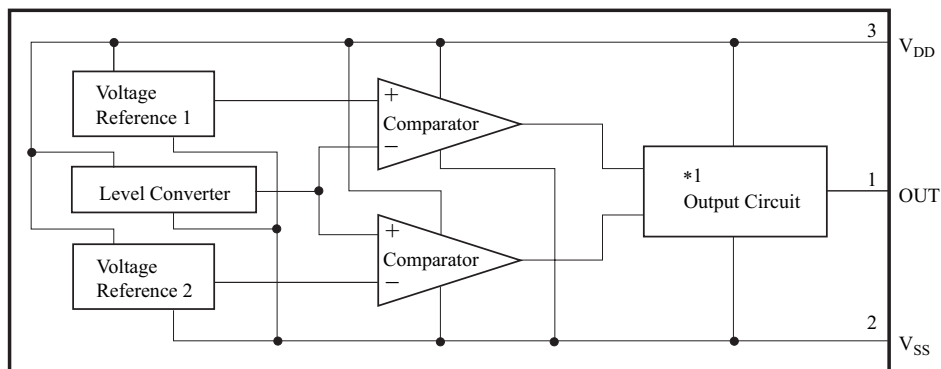
### ■ Features

- Three-pin element requiring no adjustment
- Wide selection of detection ranks (17 ranks 2.0 V to 4.9 V)
- Highly precise detection voltage
- Detection voltage with hysteresis characteristic  
 $\Delta V_D = 50 \text{ mV}$  for ranks C to K  
 $\Delta V_D = 100 \text{ mV}$  for ranks L to U
- Low current consumption:  $I_{DD} = 1 \mu\text{A}$  (typ.) for  $V_{DD} = 5 \text{ V}$
- Low fluctuation in detection voltage with temperature (1 mV/°C (typ.))

### ■ Applications

- Battery checkers
- Power outage detectors
- Level discriminators
- Memory backup systems
- Microcomputer reset circuits
- Reset circuits for other electronic circuits

### ■ Block Diagram



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

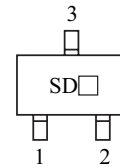
### ■ Package

#### • Code

MINI-3DC

#### • Pin name

- 1: Out Reset signal output pin
- 2:  $V_{SS}$  Ground pin
- 3:  $V_{DD}$  Power supply pin



Note) Rank symbol will be marked on the package in the □ area.

■ Detection Ranks (on Voltage)

Rank	Detection Voltage for Drop in Power Supply Voltage $V_{DL}$		Unit	Detection Voltage Hysteresis Width $\Delta V_D$		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				
K	2.8	3.1				
L	3.0	3.3				
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				

■ Absolute Maximum Ratings  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$

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	$T_{opr}$	-20 to +70	°C
Storage temperature	$T_{stg}$	-55 to +125	°C

■ Recommended Operating Conditions  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power supply voltage	$V_{DD}$	See Figures 1 and 4	1.5		6.0	V

■ Application Circuit Example



Note) Connect resistors, capacitors, and the like only to the output pin on the MN13821S element.

Note that connect-ing them to the power source pins changes  $V_{DH}$ ,  $V_{DL}$ , and  $\Delta V_D$ . Select the values of R and C to match the application.

■ Electrical Characteristics

• DC Characteristics  $V_{SS} = 0\text{ V}$ ,  $T_a = -20^\circ\text{C}$  to  $+70^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power supply current	$I_{DD}$	$V_{DD} = 5\text{ V}^*$ , Load resistor $10\text{ k}\Omega$		1	5	$\mu\text{A}$
Detection voltage for drop in power supply voltage	$V_{DL}$	$T_a = 25^\circ\text{C}$	For particulars, see the detection voltage rank table.			V
Detection voltage hysteresis width	$\Delta V_D$	See Figures 1 and 4				mV
Low level output voltage	$V_{OL}$	$V_{DD} = 1.8\text{ V}$ , $I_{OH} = 0.7\text{ mA}$	$V_{SS}$		0.4	V

Note) \*: This includes the output pin's leakage current.

• AC Characteristics  $V_{SS} = 0\text{ V}$ ,  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Rank	Allowable Value (typ)	Unit
Reset release time	$t_{OH}$	See Figures 2 and 3	C	2.5	$\mu\text{s}$
			D		
			E		
			F		
			G		
			H		
			J	3.0	
			K		
			L		
			M	4.0	
			N		
			P		
			Q		
			R		
			S		
			T		
			U		
Reset time	$t_{OL}$	See Figures 2 and 3	C	160.0	$\mu\text{s}$
			D		
			E		
			F		
			G		
			H	100.0	
			J		
			K		
			L	35.0	
			M		
			N		
			P		
			Q		
			R		
			S		
			T		
			U		

■ Reference Data

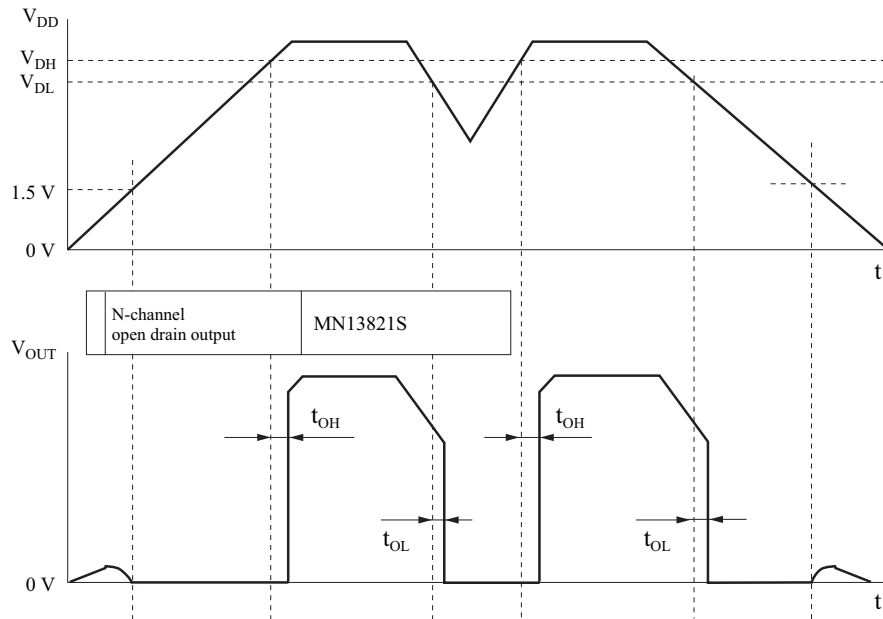


Figure 1. Description of Operation

- Note) 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 Low 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 High 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

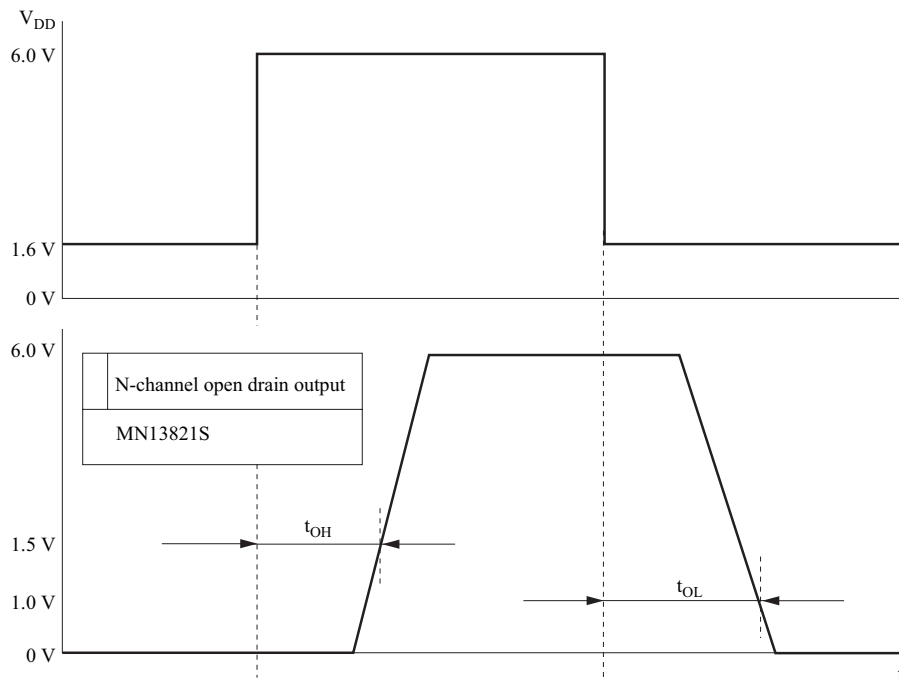


Figure 2. Description chart of Measuring the Output Characteristics

■ Reference Data (Continued)

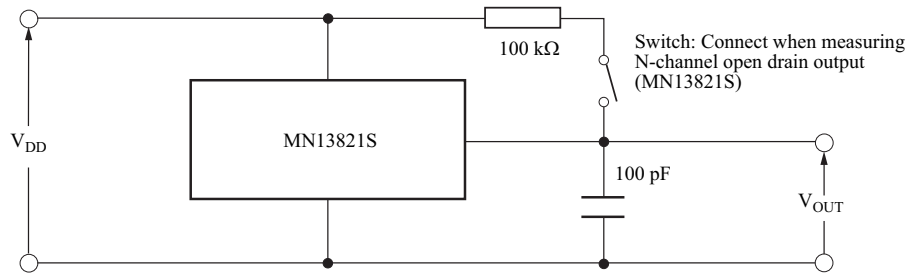


Figure 3. Circuit for Measuring the Output Characteristics

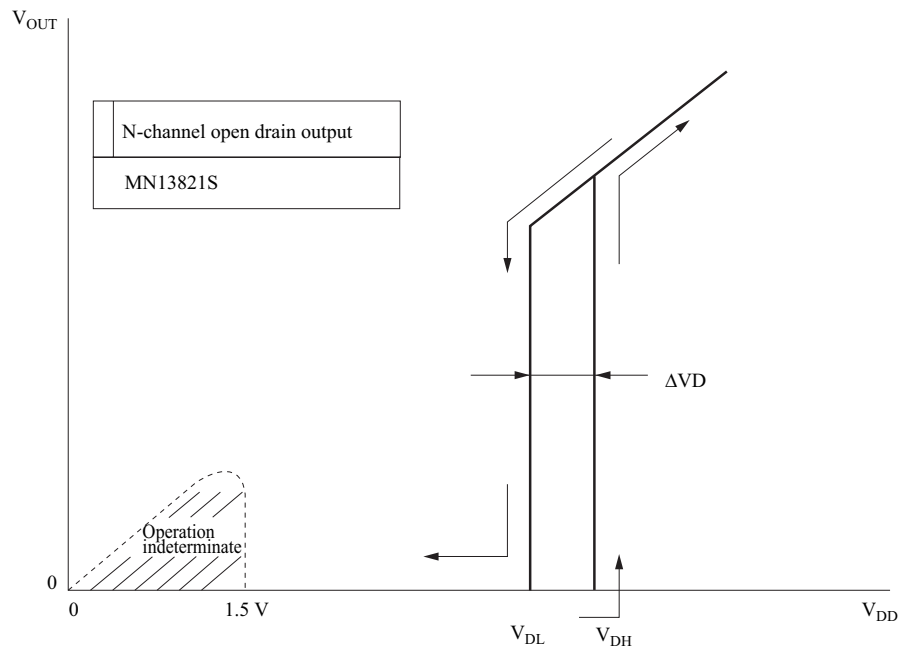


Figure 4. Description chart for Measuring the I/O Characteristics

- Note) 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.

■ Reference Characteristics

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

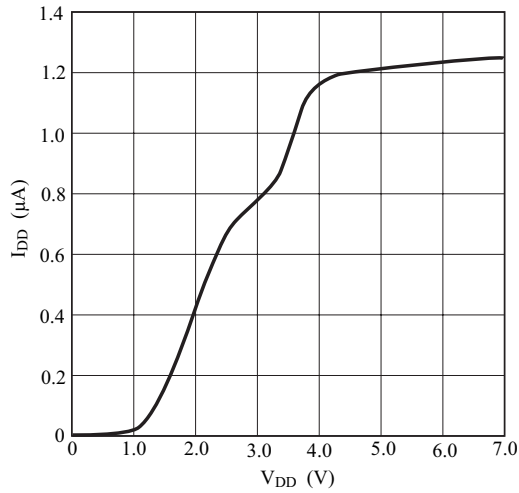


Figure 5-a I<sub>DD</sub> — V<sub>DD</sub> Characteristic (Rank Q)

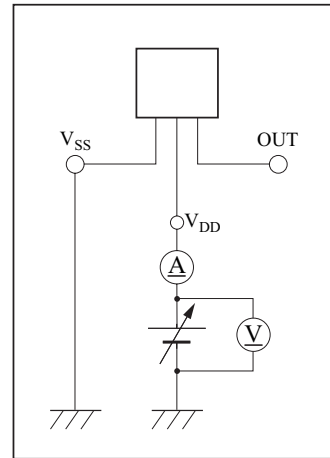


Figure 5-b Measurement Circuit

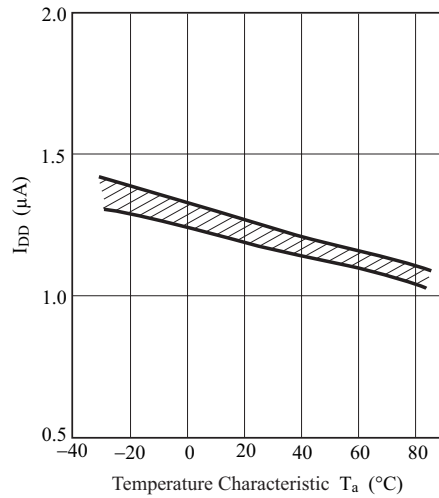


Figure 6-a I<sub>DD</sub> — Temperature Characteristic (Rank Q)

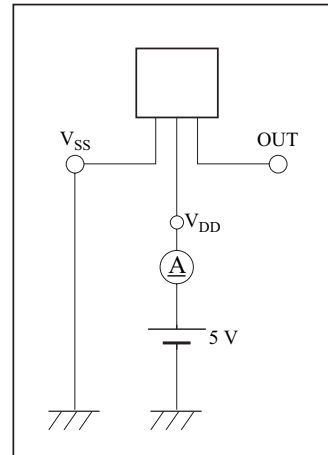


Figure 6-b Measurement Circuit

■ Reference Characteristics (Continued)

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

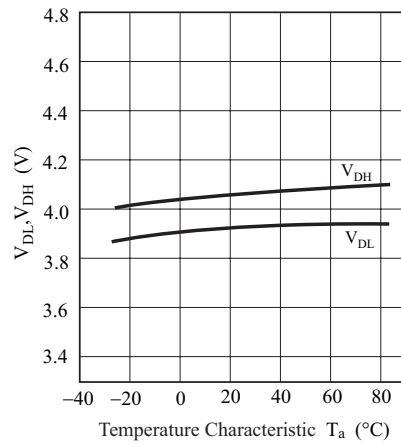


Figure 7-a  $V_{DL} - V_{DH}$  Temperature Characteristic (Rank Q)

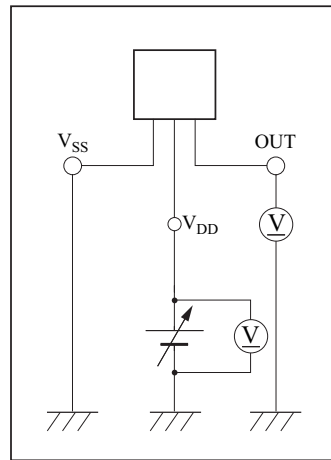


Figure 7-b Measurement Circuit

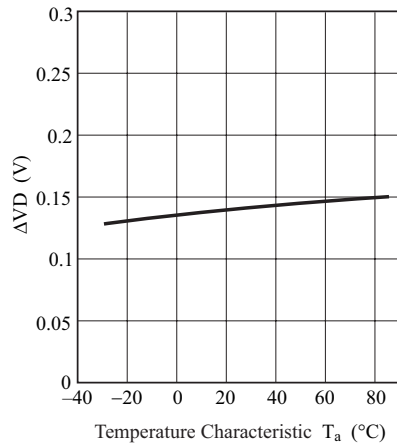


Figure 8-a  $\Delta V_D$  Temperature Characteristic (Rank Q)

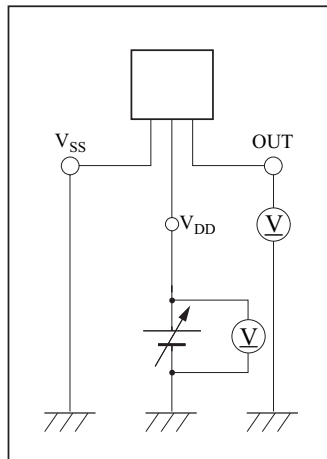


Figure 8-b Measurement Circuit

■ Reference Characteristics (Continued)

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

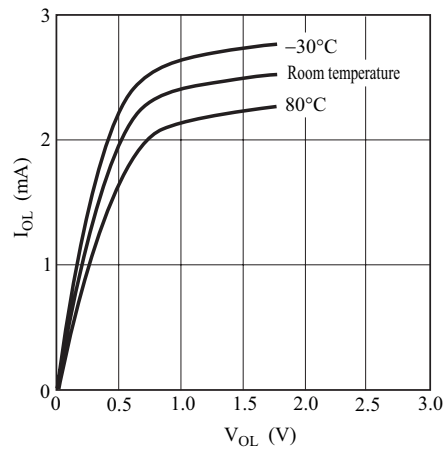


Figure 9-a I<sub>OL</sub> — V<sub>OL</sub> Characteristic

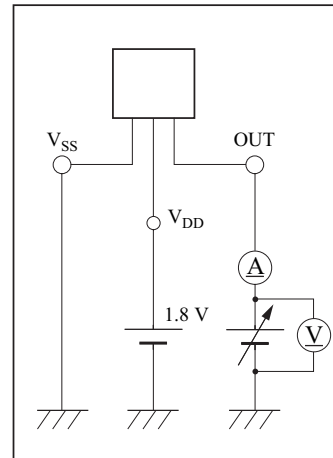


Figure 9-b Measurement Circuit

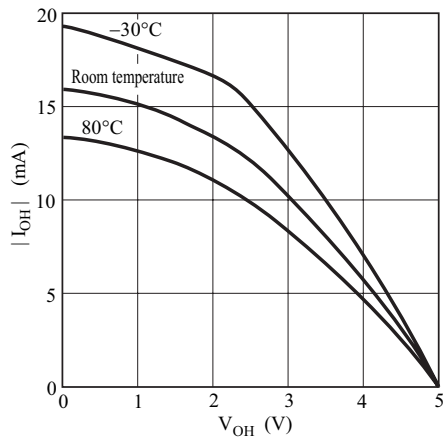


Figure 10-a |I<sub>OH</sub>| — V<sub>OH</sub> Characteristic

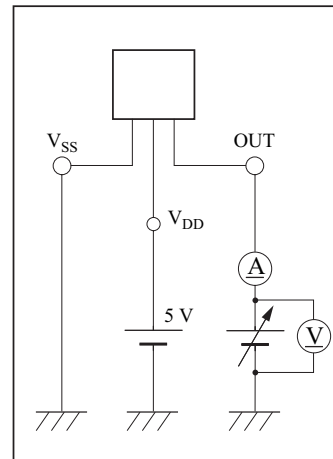


Figure 10-b Measurement Circuit



■ Reference Characteristics (Continued)

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

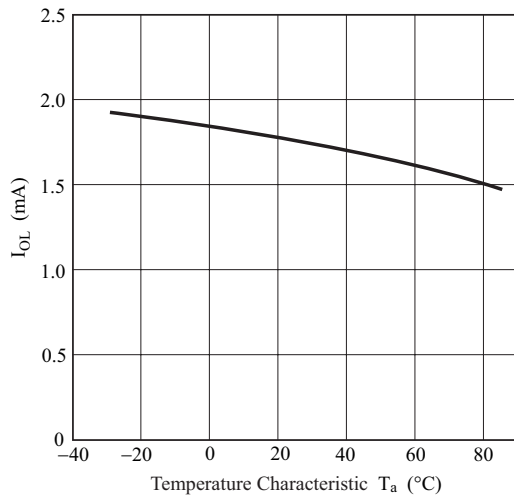


Figure 11-a  $I_{OL}$  — Temperature Characteristic

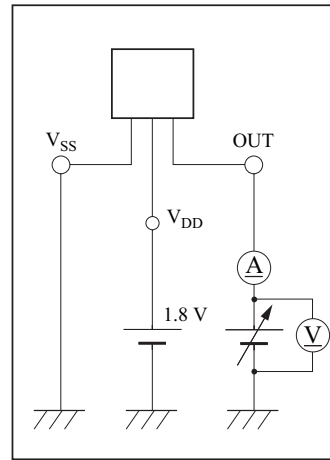


Figure 11-b Measurement Circuit

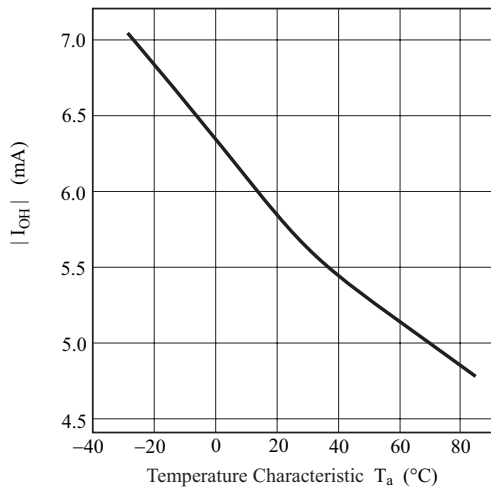


Figure 12-a  $I_{OH}$  — Temperature Characteristic

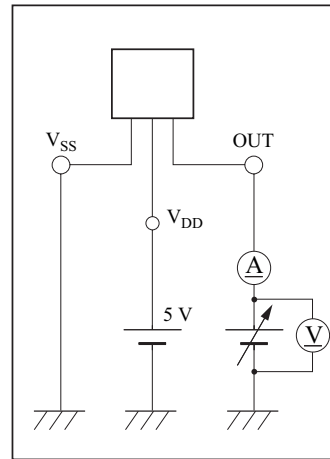
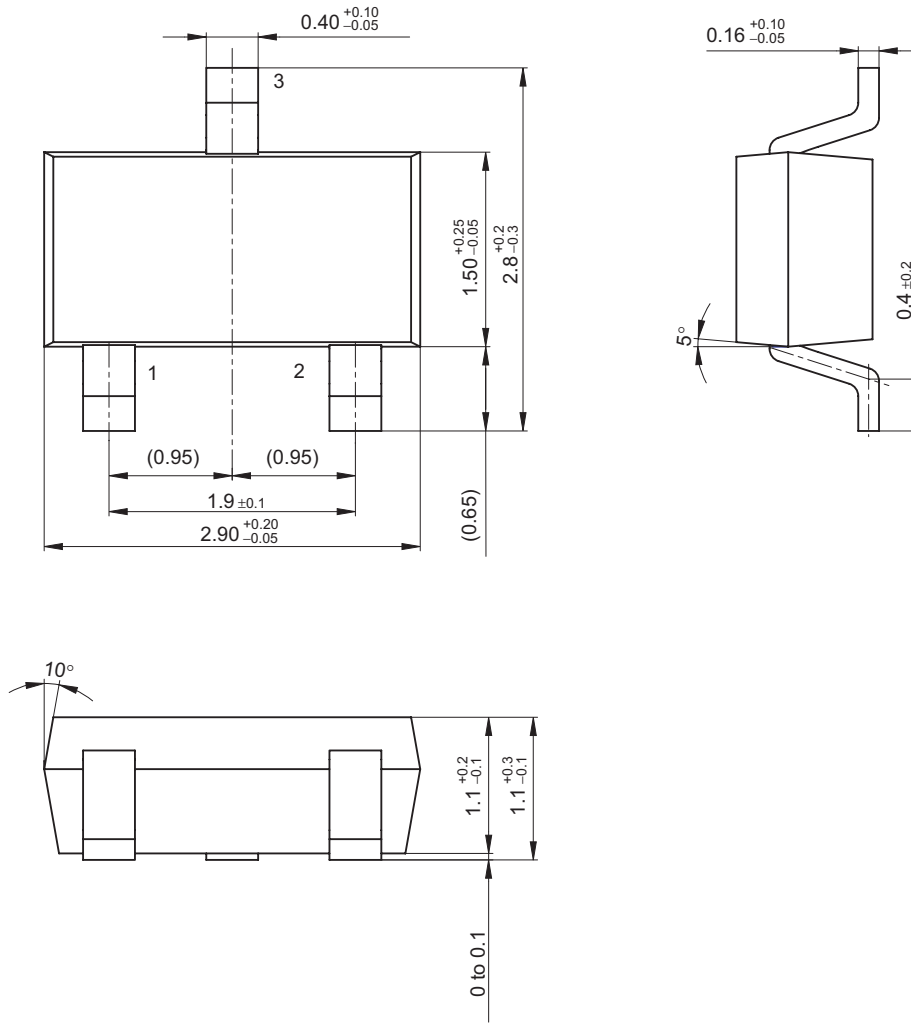


Figure 12-b Measurement Circuit

# MINI-3DC



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