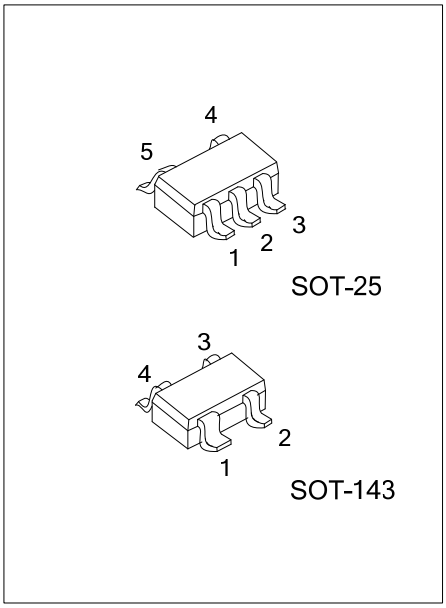
BUILT-IN DELAY CIRCUIT HIGH-PRECISION VOLTAGE DETECTOR



■ DESCRIPTION

The UTC **88NXX** is a high-precision voltage detector developed basing on CMOS technology. The detection voltage is fixed internally. A time delayed reset can be accomplished with an external capacitor. N-ch open-drain output form is available.

The UTC **88NXX** is generally used for power supply monitor of portable equipment such as notebook PCs, digital still cameras, PDAs, and mobile phones, constant voltage power monitor of cameras, video equipment and communication equipment, and power monitor or reset of CPUs and microcomputers.

■ FEATURES

* Extremely Low Current Dissipation :
  1.2μA Typ. (Detection Voltage ≥ 1.5 V @ V_{DD}=3.5 V)
* ±2.0 % Accuracy Detection Voltage
* Hysteresis Characteristics: 5% TYP
* Detection Voltage varies from 1.5V to 6.0V with 0.1V step
* Output Forms: N-ch open-drain output (when it is in Active-Low)

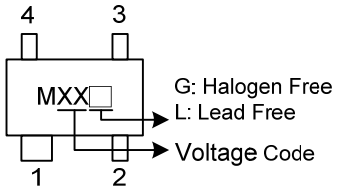
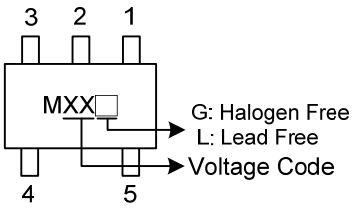
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
88NXXL-AF5-R	88NXXG-AF5-R	SOT-25	Tape Reel
88NXXL-AD4-R	88NXXG-AD4-R	SOT-143	Tape Reel

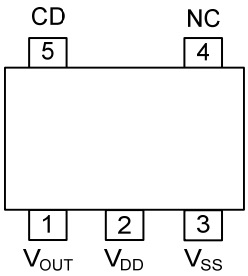
Note: XX: Output Voltage, refer to Marking Information.

88NXXG-AF5-R (1)Packing Type (2)Package Type (3)Halogen Free (4)Output Voltage Code	(1) R: Tape Reel (2) AD4: SOT-143, AF5: SOT-25 (3) G: Halogen Free, L: Lead Free (4) xx: Refer to Marking Information

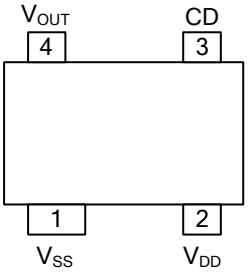
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-143	14:1.4V 18:1.8V 21:2.1V 24:2.4V 27:2.7V 28:2.8V 29:2.9V 33:3.3V	
SOT-25		

■ PIN CONFIGURATION



For SOT-25



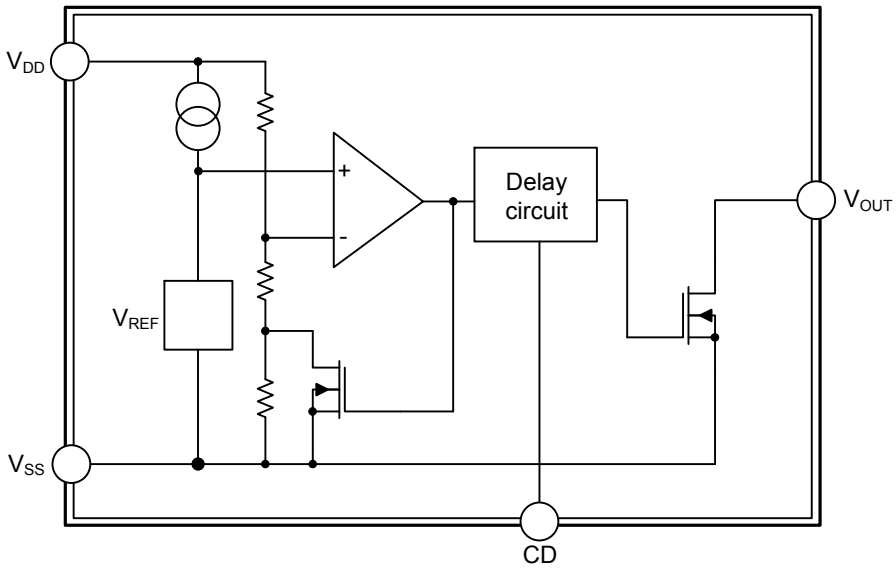
For SOT-143

■ PIN DESCRIPTION

PIN NO		PIN NAME	DESCRIPTION
SOT-143	SOT-25		
4	1	V_{OUT}	Voltage Detection Output Pin
2	2	V_{DD}	Voltage Input Pin
1	3	V_{SS}	GND Pin
-	4	NC	No Connection (Note)
3	5	CD	Connection Pin For Delay Capacitor

Note: The NC pin is electrically open and can be connected to V_{DD} or V_{SS}.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (Ta=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Power Supply Voltage		V_{DD} - V_{SS}	12	V
CD pin Input Voltage		V_{CD}	V_{SS} -0.3 ~ V_{DD}+0.3	V
Output Voltage		V_{OUT}	V_{SS} -0.3 ~ V_{SS} +12	V
Output Current		I_{OUT}	50	mA
Power Dissipation	SOT-143	P_D	150	mW
	SOT-25		250	mW
Operating Temperature		T_{OPR}	-40 ~ +85	°C
Storage Temperature		T_{STG}	-40 ~ +125	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS (Ta=25°C unless otherwise specified)

Detection Voltage: 1.4V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}= 2.0V			2.5	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V,V_{DD}=0.95V	0.23	0.64		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta - V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}= 2V, C_D=4.7 nF	27		42	ms

Detection Voltage: 1.8V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}=3.5V			2.8	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V, V_{DD}=1.2V	0.59	1.36		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta - V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}=3.5V, C_D=4.7 nF	27		42	ms

■ ELECTRICAL CHARACTERISTICS(Cont.) (Ta=25°C unless otherwise specified)

Detection Voltage: 2.1V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}=3.5 V			5	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V, V_{DD}=1.2V	0.59	1.36		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta - V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}=3.5V, C_D=4.7 nF	27		42	ms

Detection Voltage: 2.4V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}=3.5V			5	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V, V_{DD}=1.2V	0.59	1.36		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta - V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}=3.5V, C_D=4.7 nF	27		42	ms

Detection Voltage: 2.7V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}=4.5V			5	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V, V_{DD}=2.4V	2.88	4.98		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta - V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}=4.5V, C_D=4.7 nF	12		27	ms

■ ELECTRICAL CHARACTERISTICS(Cont.) (Ta=25°C unless otherwise specified)

Detection Voltage: 2.8V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}=4.5V			5	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V, V_{DD}=2.4V	2.88	4.98		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta - V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}=4.5V, C_D=4.7 nF	12		27	ms

Detection Voltage: 2.9V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}=4.5 V			5	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V, V_{DD}=2.4V	2.88	4.98		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta - V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}=4.5V, C_D=4.7 nF	12		27	ms

■ ELECTRICAL CHARACTERISTICS(Cont.) (Ta=25°C unless otherwise specified)

Detection Voltage: 3.3V

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Detection Voltage (Note 1)	$-V_{DET}$	1		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis Width	V_{HYS}	1		$-V_{DET}$ ×0.03	$-V_{DET}$ ×0.05	$-V_{DET}$ ×0.08	V
Current Consumption	I_{SS}	2	V_{DD}=4.5V			5	μA
Operating Voltage	V_{DD}	1		0.95		10.0	V
Output Current	I_{OUT}	3	Output transistor Nch, V_{DS}=0.5V, V_{DD}=2.4V	2.88	4.98		mA
Leakage Current	I_{LEAK}	3	Output transistor Nch, V_{DS}=10V, V_{DD}=10V			0.1	μA
Detection Voltage Temperature Coefficient (Note 2)	$\frac{\Delta -V_{DET}}{\Delta Ta \times -V_{DET}}$	1	Ta=-40°C ~ +85°C		±100	±350	ppm/°C
Delay Time	t_D	4	V_{DD}=4.5V, C_D=4.7 nF	12		27	ms

Note: 1. $-V_{DET}$: Actual detection voltage
$-V_{DET(S)}$: Specified detection voltage

2. The temperature change ratio in the detection voltage [mV/°C] is calculated by using the following equation:

$$\frac{\Delta -V_{DET}}{\Delta Ta}[mV/°C]^{(1)} = -V_{DET}(Typ.)[V]^{(2)} \times \frac{\Delta -V_{DET}}{\Delta Ta \times -V_{DET}}[ppm/°C]^{(3)} \div 1000$$

(1) Temperature change ratio of the detection voltage
(2) Specified detection voltage
(3) Detection voltage temperature coefficient

■ TEST CIRCUITS

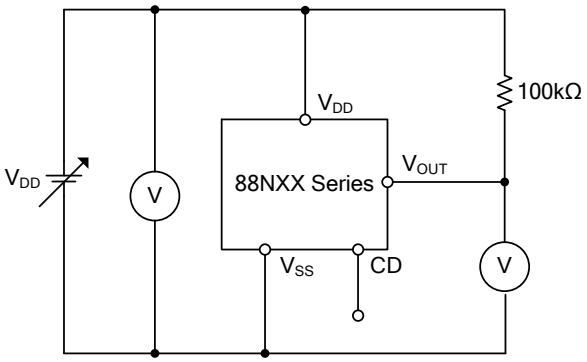


Figure 1

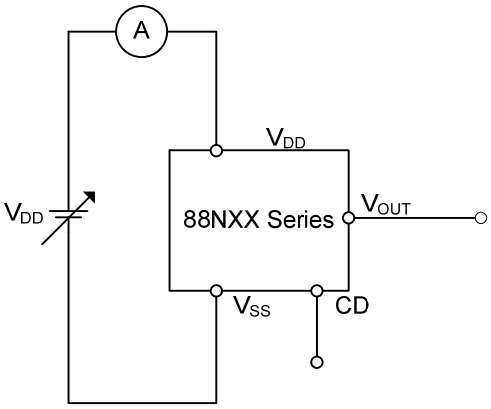


Figure 2

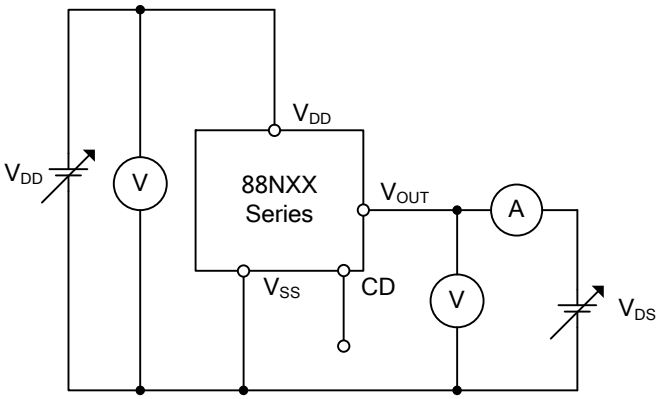


Figure 3

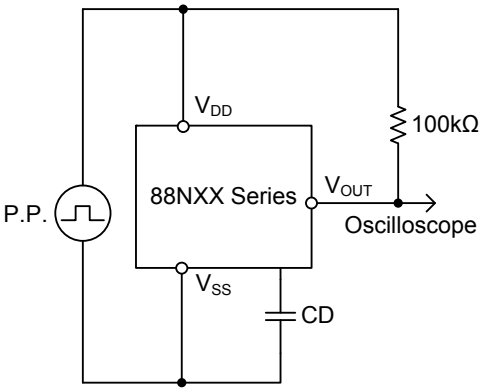


Figure 4