

Battery Backup Switching IC

■ GENERAL DESCRIPTION

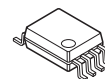
The NJU7286 is a battery backup system IC with two regulators, two voltage detectors, a battery switching system and their control circuit. It switches the regulator output from main power supply source to the backup battery when it detects main power supply drop and also has two voltage detection outputs.

The NJU7286 employs an exclusive sequence on the battery switching system which reduces the battery operation. Combining the special sequence and its low operating current, it is well-suited for battery backup systems of DSC, DVC and other portable devices. The NJU7286 is available in small and thin packages of 8-lead MSOP (TVSP) and SSOP. And there are four voltage options available, as follow table.

■ PACKAGE OUTLINE



NJU7286RB1
(MSOP8 (VSP8))



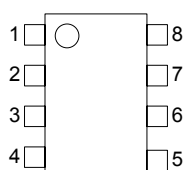
NJU7286V
(SSOP8)

■ FEATURES

- Low Quiescent Current :12 μ A max. (V_{IN} =3.6V) / Normal operation
:2.1 μ A max. (V_{BAT} =3.0V) / Backup
- Low Dropout Voltage :0.06V max. (I_{RO} =3mA) / REG1
:0.3V max. (I_{OUT} =23mA) / REG2
- 2CH(REG1, REG2) Output Voltage : $\pm$ 2.0%
- 2CH($\overline{CS}$, $\overline{RESET}$) Output Voltage : $\pm$ 2.0%
- Exclusive Sequence
- Small Package SSOP8, MSOP8 (TVSP8)*

*MEET JEDEC MO-187-DA / THIN TYPE

■ PIN CONFIGURATION



MSOP8 (TVSP-8)
SSOP-8

1. V_{SS}
2. NC
3. V_{BAT}
4. $\overline{CS}$
5. $\overline{RESET}$
6. V_{OUT}
7. V_{IN}
8. V_{RO}

■ SELECTION GUIDE

Device Name	Output Voltage (V)		CS Voltage (V)		RESET Voltage (V)		Switch Voltage (V)
	V _{RO}	V _{OUT}	-V _{DET1}	+V _{DET1}	-V _{DET2}	+V _{DET2}	V _{SW1}
NJU7286A	3.200	3.200	3.300	3.401	2.400	2.528	+V _{DET1} ×0.85
NJU7286B	3.150	3.150	4.200	4.305	2.300	2.420	+V _{DET1} ×0.85
NJU7286C	3.300	3.300	3.800	3.903	2.100	2.230	+V _{DET1} ×0.85
NJU7286D	3.200	3.200	3.300	3.401	2.250	2.362	+V _{DET1} ×0.85

Caution: The NJU7286D is available in only MSOP8 (TVSP8).

CS voltage should be set up so that switch voltage (V_{SW1}) may become more than $\overline{\text{RESET}}$ voltage (-V_{DET2}).

Note: The selection range is as follows.

V_{RO}, V_{OUT}: 2.3 to 5.4V (0.1V Step)

-V_{DET1}: 2.4 to 5.4V (0.1V Step)

-V_{DET2}: 1.7 to 3.4V (0.1V Step)

V_{SW1}: +V_{DET1}×0.85

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER		SYMBOL	RATINGS	UNIT
Main Power Supply Input Voltage		V _{IN}	+10	V
Backup Power Supply Input Voltage		V _{BAT}	+10	V
Output Voltage of Voltage Regulator		V _{RO} , V _{OUT}	V _{SS} -0.3 to V _{IN} +0.3	V
Output Voltage	CS Output Voltage	V _{CS}	V _{SS} -0.3 to +10	V
	RESET Output Voltage	V _{RESET}		V
Power Dissipation	SSOP-8	P _D	250	mW
	MSOP8 (TVSP8)		320	
Operating Temperature		T _{opr}	-40 to +85	°C
Storage Temperature		T _{stg}	-40 to +125	°C

■ ELECTRICAL CHARACTERISTICS

NJU7286A ($C_{IN}=0.1\mu F$, $C_{O(VOUT)}=10\mu F$, $C_{O(VRO)}=10\mu F$, $T_a=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Total						
Quiescent Current	I_{SS1}	$V_{IN}=3.6V$, No-Load	-	4	12	μA
	I_{BAT1}	$V_{IN}=3.6V$, $V_{BAT}=3.0V$, No-Load	-	-	0.1	μA
	I_{BAT2}	$V_{IN}=OPEN$, $V_{BAT}=3.0V$, No-Load	-	1.0	2.1	μA
Backup Power Supply Input Voltage	V_{BAT}		2.0	-	4.0	V
Voltage Regulator 1						
Output Voltage 1	V_{RO}	$V_{IN}=7.2V$, $I_{RO}=3mA$	3.136	3.200	3.264	V
Dropout Voltage 1	ΔV_{I-O1}	$I_{RO}=3mA$	-	30	60	mV
Load Regulation 1A	$\Delta V_{ROA}/\Delta I_{RO}$	$V_{IN}=7.2V$, $I_{RO}=0.1$ to $30mA$	-	0.06	0.15	%/mA
Load Regulation 1B	$\Delta V_{ROB}/\Delta I_{RO}$	$V_{IN}=3.6V$, $I_{RO}=0.1$ to $30mA$	-	0.06	0.15	%/mA
Line Regulation 1	$\Delta V_{RO}/\Delta V_N$	$V_{IN}=4$ to $9V$, $I_{RO}=3mA$	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 1	$\Delta V_{RO}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Voltage Regulator 2						
Output Voltage 2	V_{OUT}	$V_{IN}=7.2V$, $I_{OUT}=23mA$	3.136	3.200	3.264	V
Dropout Voltage 2	ΔV_{I-O2}	$I_{OUT}=23mA$	-	150	300	mV
Load Regulation 2A	$\Delta V_{OUTA}/\Delta I_{OUT}$	$V_{IN}=7.2V$, $I_{OUT}=0.1$ to $60mA$	-	0.04	0.1	%/mA
Load Regulation 2B	$\Delta V_{OUTB}/\Delta I_{OUT}$	$V_{IN}=3.6V$, $I_{OUT}=0.1$ to $60mA$	-	0.04	0.1	%/mA
Line Regulation 2	$\Delta V_{OUT}/\Delta V_N$	$V_{IN}=4$ to $9V$, $I_{OUT}=23mA$	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 2	$\Delta V_{OUT}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
CS Voltage Detection						
Detection Voltage 1	$-V_{DET1}$	Detection Voltage V_{IN}	3.234	3.300	3.366	V
Release Voltage 1	$+V_{DET1}$		3.319	3.401	3.482	V
Average Temperature Coefficient of Detection Voltage 1	$\Delta V_{DET1}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Output Current 1	I_{SINK1}	$V_{DS}=0.5V$, $V_{IN}=V_{BAT}=2.0V$	1.50	2.30	-	mA
Leak Current 1	I_{LEAK1}	$V_{DS}=9V$, $V_{IN}=9V$	-	-	0.1	μA
Operation Voltage 1	V_{OPR1}	V_{IN} or V_{BAT}	1.7	-	9.0	V
RESET Voltage Detection						
Detection Voltage 2	$-V_{DET2}$	Detection Voltage V_{OUT}	2.351	2.400	2.449	V
Release Voltage 2	$+V_{DET2}$		2.457	2.528	2.599	V
Release Delay Time	T_{DELAY}		200	500	-	μS
Average Temperature Coefficient of Detection Voltage 2	$\Delta V_{DET2}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Output Current 2	I_{SINK2}	$V_{DS}=0.5V$, $V_{IN}=V_{BAT}=2.0V$	1.50	2.30	-	mA
Leak Current 2	I_{LEAK2}	$V_{DS}=9V$, $V_{IN}=9V$	-	-	0.1	μA
Operation Voltage 2	V_{OPR2}	V_{IN} or V_{BAT}	1.7	-	9.0	V

Switch Control						
Switch Voltage	V_{SW1}	$V_{BAT}=2.8V$, Detection Voltage V_{IN}	$+V_{DET1}$ X0.83	$+V_{DET1}$ X0.85	$+V_{DET1}$ X0.87	V
CS Output Inhibit Voltage	V_{SW2}	$V_{BAT}=3.0V$, Detection Voltage V_{OUT}	V_{OUT} X0.93	V_{OUT} X0.95	V_{OUT} X0.97	V
V_{BAT} Switch Leak Current	I_{LEAK}	$V_{IN}=3.6V$, $V_{BAT}=0V$	-	-	0.1	μA
V_{BAT} Switch Resistance	R_{SW}	$V_{IN}=OPEN$, $V_{BAT}=3.0V$, $I_{OUT}=10\sim 500\mu A$	-	30	60	Ω
Average Temperature Coefficient of Switch Voltage	$\Delta V_{SW1}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$
Average Temperature Coefficient of CS Output Inhibit Voltage	$\Delta V_{SW2}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$

NJU7286B ($C_{IN}=0.1\mu F$, $C_{O(VOUT)}=10\mu F$, $C_{O(VRO)}=10\mu F$, $T_a=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Total						
Quiescent Current	I_{SS1}	$V_{IN}=6.0V$, No-Load	-	4	12	μA
	I_{BAT1}	$V_{IN}=6.0V$, $V_{BAT}=3.0V$, No-Load	-	-	0.1	μA
	I_{BAT2}	$V_{IN}=OPEN$, $V_{BAT}=3.0V$, No-Load	-	1.0	2.1	μA
Backup Power Supply Input Voltage	V_{BAT}		2.0	-	4.0	V
Voltage Regulator 1						
Output Voltage 1	V_{RO}	$V_{IN}=6.0V$, $I_{RO}=3mA$	3.087	3.150	3.213	V
Dropout Voltage 1	ΔV_{I-O1}	$I_{RO}=3mA$	-	30	60	mV
Load Regulation 1	$\Delta V_{RO}/\Delta I_{RO}$	$V_{IN}=6.0V$, $I_{RO}=0.1\sim 30mA$	-	0.06	0.15	%/mA
Line Regulation 1	$\Delta V_{RO}/\Delta V_{IN}$	$V_{IN}=6\sim 9V$, $I_{RO}=3mA$	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 1	$\Delta V_{RO}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Voltage Regulator 2						
Output Voltage 2	V_{OUT}	$V_{IN}=6.0V$, $I_{OUT}=23mA$	3.087	3.150	3.213	V
Dropout Voltage 2	ΔV_{I-O2}	$I_{OUT}=23mA$	-	150	300	mV
Load Regulation 2	$\Delta V_{OUT}/\Delta I_{OUT}$	$V_{IN}=6.0V$, $I_{OUT}=0.1$ to $60mA$	-	0.04	0.1	%/mA
Line Regulation 2	$\Delta V_{OUT}/\Delta V_{IN}$	$V_{IN}=6$ to $9V$, $I_{OUT}=23mA$	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 2	$\Delta V_{OUT}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
CS Voltage Detection						
Detection Voltage 1	$-V_{DET1}$	Detection Voltage V_{IN}	4.116	4.200	4.284	V
Release Voltage 1	$+V_{DET1}$		4.204	4.305	4.407	V
Average Temperature Coefficient of Detection Voltage 1	$\Delta V_{DET1}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Output Current 1	I_{SINK1}	$V_{DS}=0.5V$, $V_{IN}=V_{BAT}=2.0V$	1.50	2.30	-	mA
Leak Current 1	I_{LEAK1}	$V_{DS}=9V$, $V_{IN}=9V$	-	-	0.1	μA
Operation Voltage 1	V_{OPR1}	V_{IN} or V_{BAT}	1.7	-	9.0	V
RESET Voltage Detection						
Detection Voltage 2	$-V_{DET2}$	Detection Voltage V_{OUT}	2.254	2.300	2.346	V
Release Voltage 2	$+V_{DET2}$		2.348	2.420	2.492	V
Release Delay Time	T_{DELAY}		200	500	-	μS
Average Temperature Coefficient of Detection Voltage 2	$\Delta V_{DET2}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Output Current 2	I_{SINK2}	$V_{DS}=0.5V$, $V_{IN}=V_{BAT}=2.0V$	1.50	2.30	-	mA
Leak Current 2	I_{LEAK2}	$V_{DS}=9V$, $V_{IN}=9V$	-	-	0.1	μA
Operation Voltage 2	V_{OPR2}	V_{IN} or V_{BAT}	1.7	-	9.0	V

Switch Control						
Switch Voltage	V_{SW1}	$V_{BAT}=2.8V$, Detection Voltage V_{IN}	$+V_{DET1}$ X0.83	$+V_{DET1}$ X0.85	$+V_{DET1}$ X0.87	V
CS Output Inhibit Voltage	V_{SW2}	$V_{BAT}=3.0V$, Detection Voltage V_{OUT}	V_{OUT} X0.93	V_{OUT} X0.95	V_{OUT} X0.97	V
V_{BAT} Switch Leak Current	I_{LEAK}	$V_{IN}=6.0V$, $V_{BAT}=0V$	-	-	0.1	μA
V_{BAT} Switch Resistance	R_{SW}	$V_{IN}=OPEN$, $V_{BAT}=3.0V$, $I_{OUT}=10$ to $500\mu A$	-	30	60	Ω
Average Temperature Coefficient of Switch Voltage	$\Delta V_{SW1}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$
Average Temperature Coefficient of CS Output Inhibit Voltage	$\Delta V_{SW2}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$

NJU7286C ($C_{IN}=0.1\mu F$, $C_{O(VOUT)}=10\mu F$, $C_{O(VRO)}=10\mu F$, $T_a=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Total						
Quiescent Current	I_{SS1}	$V_{IN}=6.0V$, No-Load	-	4	12	μA
	I_{BAT1}	$V_{IN}=6.0V$, $V_{BAT}=3.0V$, No-Load	-	-	0.1	μA
	I_{BAT2}	$V_{IN}=OPEN$, $V_{BAT}=3.0V$, No-Load	-	1.0	2.1	μA
Backup Power Supply Input Voltage	V_{BAT}		2.0	-	4.0	V
Voltage Regulator 1						
Output Voltage 1	V_{RO}	$V_{IN}=6.0V$, $I_{RO}=3mA$	3.234	3.300	3.366	V
Dropout Voltage 1	ΔV_{I-O1}	$I_{RO}=3mA$	-	30	60	mV
Load Regulation 1	$\Delta V_{RO}/\Delta I_{RO}$	$V_{IN}=6.0V$, $I_{RO}=0.1$ to $30mA$	-	0.06	0.15	%/mA
Line Regulation 1	$\Delta V_{RO}/\Delta V_{IN}$	$V_{IN}=6$ to $9V$, $I_{RO}=3mA$	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 1	$\Delta V_{RO}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Voltage Regulator 2						
Output Voltage 2	V_{OUT}	$V_{IN}=6.0V$, $I_{OUT}=23mA$	3.234	3.300	3.366	V
Dropout Voltage 2	ΔV_{I-O2}	$I_{OUT}=23mA$	-	150	300	mV
Load Regulation 2	$\Delta V_{OUT}/\Delta I_{OUT}$	$V_{IN}=6.0V$, $I_{OUT}=0.1$ to $60mA$	-	0.04	0.1	%/mA
Line Regulation 2	$\Delta V_{OUT}/\Delta V_{IN}$	$V_{IN}=6$ to $9V$, $I_{OUT}=23mA$	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 2	$\Delta V_{OUT}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
CS Voltage Detection						
Detection Voltage 1	$-V_{DET1}$	Detection Voltage V_{IN}	3.724	3.800	3.876	V
Release Voltage 1	$+V_{DET1}$		3.805	3.903	4.000	V
Average Temperature Coefficient of Detection Voltage 1	$\Delta V_{DET1}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Output Current 1	I_{SINK1}	$V_{DS}=0.5V$, $V_{IN}=V_{BAT}=2.0V$	1.50	2.30	-	mA
Leak Current 1	I_{LEAK1}	$V_{DS}=9V$, $V_{IN}=9V$	-	-	0.1	μA
Operation Voltage 1	V_{OPR1}	V_{IN} or V_{BAT}	1.7	-	9.0	V
RESET Voltage Detection						
Detection Voltage 2	$-V_{DET2}$	Detection Voltage V_{OUT}	2.058	2.100	2.142	V
Release Voltage 2	$+V_{DET2}$		2.158	2.230	2.302	V
Release Delay Time	T_{DELAY}		200	500	-	μS
Average Temperature Coefficient of Detection Voltage 2	$\Delta V_{DET2}/\Delta T$	$T_a=0^\circ C$ to $+85^\circ C$	-	± 100	-	ppm/ $^\circ C$
Output Current 2	I_{SINK2}	$V_{DS}=0.5V$, $V_{IN}=V_{BAT}=2.0V$	1.50	2.30	-	mA
Leak Current 2	I_{LEAK2}	$V_{DS}=9V$, $V_{IN}=9V$	-	-	0.1	μA
Operation Voltage 2	V_{OPR2}	V_{IN} or V_{BAT}	1.7	-	9.0	V

Switch Control						
Switch Voltage	V_{SW1}	$V_{BAT}=2.8V$, Detection Voltage V_{IN}	$+V_{DET1}$ X0.83	$+V_{DET1}$ X0.85	$+V_{DET1}$ X0.87	V
CS Output Inhibit Voltage	V_{SW2}	$V_{BAT}=3.0V$, Detection Voltage V_{OUT}	V_{OUT} X0.93	V_{OUT} X0.95	V_{OUT} X0.97	V
V_{BAT} Switch Leak Current	I_{LEAK}	$V_{IN}=6.0V$, $V_{BAT}=0V$	-	-	0.1	μA
V_{BAT} Switch Resistance	R_{SW}	$V_{IN}=OPEN$, $V_{BAT}=3.0V$, $I_{OUT}=10$ to $500\mu A$	-	30	60	Ω
Average Temperature Coefficient of Switch Voltage	$\Delta V_{SW1}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$
Average Temperature Coefficient of CS Output Inhibit Voltage	$\Delta V_{SW2}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$

NJU7286D (C_{IN}=0.1μF, C_{O(VOUT)}=10μF, C_{O(VRO)}=10μF, Ta=25°C)

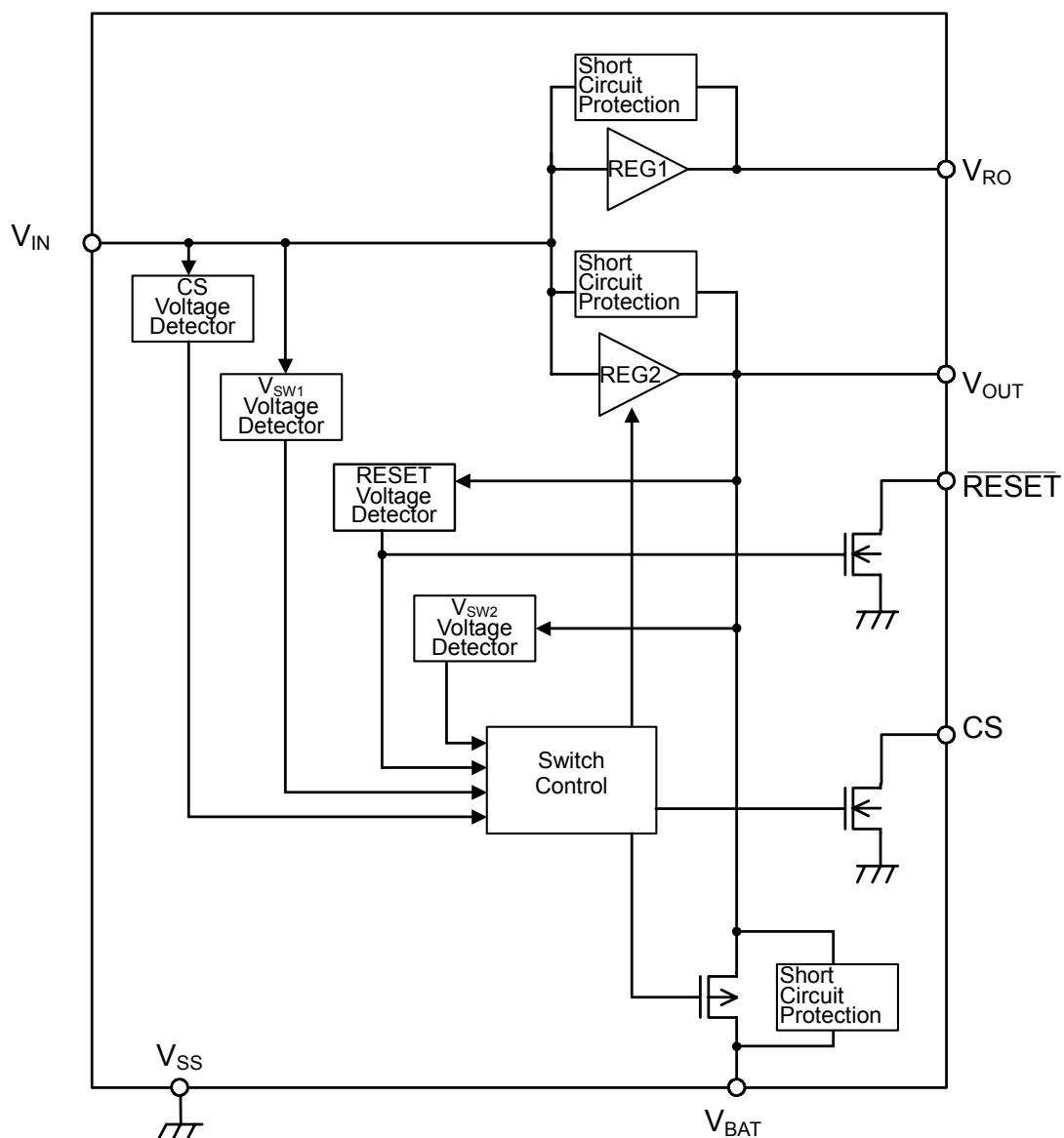
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Total						
Quiescent Current	I _{SS1}	V _{IN} =3.6V, No-Load	-	4	12	μA
	I _{BAT1}	V _{IN} =3.6V, V _{BAT} =3.0V, No-Load	-	-	0.1	μA
	I _{BAT2}	V _{IN} =OPEN, V _{BAT} =3.0V, No-Load	-	1.0	2.1	μA
Backup Power Supply Input Voltage	V _{BAT}		2.0	-	4.0	V
Voltage Regulator 1						
Output Voltage 1	V _{RO}	V _{IN} =7.2V, I _{RO} =3mA	3.136	3.200	3.264	V
Dropout Voltage 1	ΔV _{I-O1}	I _{RO} =3mA	-	30	60	mV
Load Regulation 1A	ΔV _{ROA} /ΔI _{RO}	V _{IN} =7.2V, I _{RO} =0.1 to 30mA	-	0.06	0.15	%/mA
Load Regulation 1B	ΔV _{ROB} /ΔI _{RO}	V _{IN} =3.6V, I _{RO} =0.1 to 30mA	-	0.06	0.15	%/mA
Line Regulation 1	ΔV _{RO} /ΔV _N	V _{IN} =4 to 9V, I _{RO} =3mA	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 1	ΔV _{RO} /ΔT	Ta=0°C to +85°C	-	±100	-	ppm/°C
Voltage Regulator 2						
Output Voltage 2	V _{OUT}	V _{IN} =7.2V, I _{OUT} =23mA	3.136	3.200	3.264	V
Dropout Voltage 2	ΔV _{I-O2}	I _{OUT} =23mA	-	150	300	mV
Load Regulation 2A	ΔV _{OUTA} /ΔI _{OUT}	V _{IN} =7.2V, I _{OUT} =0.1 to 60mA	-	0.04	0.1	%/mA
Load Regulation 2B	ΔV _{OUTB} /ΔI _{OUT}	V _{IN} =3.6V, I _{OUT} =0.1 to 60mA	-	0.04	0.1	%/mA
Line Regulation 2	ΔV _{OUT} /ΔV _N	V _{IN} =4 to 9V, I _{OUT} =23mA	-	-	0.2	%/V
Average Temperature Coefficient of Output Voltage 2	ΔV _{OUT} /ΔT	Ta=0°C to +85°C	-	±100	-	ppm/°C
CS Voltage Detection						
Detection Voltage 1	-V _{DET1}	Detection Voltage V _{IN}	3.234	3.300	3.366	V
Release Voltage 1	+V _{DET1}		3.319	3.401	3.482	V
Average Temperature Coefficient of Detection Voltage 1	ΔV _{DET1} /ΔT	Ta=0°C to +85°C	-	±100	-	ppm/°C
Output Current 1	I _{SINK1}	V _{DS} =0.5V, V _{IN} =V _{BAT} =2.0V	1.50	2.30	-	mA
Leak Current 1	I _{LEAK1}	V _{DS} =9V, V _{IN} =9V	-	-	0.1	μA
Operation Voltage 1	V _{OPR1}	V _{IN} or V _{BAT}	1.7	-	9.0	V
RESET Voltage Detection						
Detection Voltage 2	-V _{DET2}	Detection Voltage V _{OUT}	2.205	2.250	2.295	V
Release Voltage 2	+V _{DET2}		2.298	2.362	2.426	V
Release Delay Time	T _{DELAY}		200	500	-	μS
Average Temperature Coefficient of Detection Voltage 2	ΔV _{DET2} /ΔT	Ta=0°C to +85°C	-	±100	-	ppm/°C
Output Current 2	I _{SINK2}	V _{DS} =0.5V, V _{IN} =V _{BAT} =2.0V	1.50	2.30	-	mA
Leak Current 2	I _{LEAK2}	V _{DS} =9V, V _{IN} =9V	-	-	0.1	μA
Operation Voltage 2	V _{OPR2}	V _{IN} or V _{BAT}	1.7	-	9.0	V

Switch Control

Switch Voltage	V_{SW1}	$V_{BAT}=2.8V$, Detection Voltage V_{IN}	$+V_{DET1}$ X0.83	$+V_{DET1}$ X0.85	$+V_{DET1}$ X0.87	V
CS Output Inhibit Voltage	V_{SW2}	$V_{BAT}=3.0V$, Detection Voltage V_{OUT}	V_{OUT} X0.93	V_{OUT} X0.95	V_{OUT} X0.97	V
V_{BAT} Switch Leak Current	I_{LEAK}	$V_{IN}=3.6V$, $V_{BAT}=0V$	-	-	0.1	μA
V_{BAT} Switch Resistance	R_{SW}	$V_{IN}=OPEN$, $V_{BAT}=3.0V$, $I_{OUT}=10$ to $500\mu A$	-	30	60	Ω
Average Temperature Coefficient of Switch Voltage	$\Delta V_{SW1}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$
Average Temperature Coefficient of CS Output Inhibit Voltage	$\Delta V_{SW2}/\Delta T$	$T_a=0^{\circ}C$ to $+85^{\circ}C$	-	± 100	-	ppm/ $^{\circ}C$

CAUTION ON USE

- Wiring of a power supply should lower impedance using thick wiring.
Especially V_{IN} wiring needs to cautions, because the output current of the regulator flows.
- I_{RO} or I_{OUT} should be set $10\mu A$ or more. because output voltage rises and a load regulation becomes unstable.
- IC or the capacitor which are connected to the NJU7286 should not exceed rating by the exaggerated shot of a regulator etc.
- The V_{IN} terminal, the V_{OUT} terminal and the V_{RO} terminal should surely connect the capacitor between V_{SS} .
The capacitor connected to the V_{OUT} terminal should connect the capacity of $10\mu F$ or more. Because, in order to prevent carrying out voltage descending at the time of a REG2 operation change.
- External parts should connect near the NJU7286.
- If $\overline{RESET}$ voltage detection becomes active, it will shift to special sequence from usually sequence. In order to suppress generating of an under shot etc. V_{OUT} terminal should connect the capacity of the suitable value.
- When bringing down V_{IN} to $0V$, the circumference circuit of the NJU7286 should design so that V_{IN} may fall over the time for $10ms$ or more. In the case of less than $10ms$, $\overline{RESET}$ output is set to "L".
- Power dissipation should use in the range which is not exceeded.



■ FUNCTIONAL EXPLANATION OF BLOCK

1. Voltage regulator(REG1,REG2)

- Output Voltage serialization is possible with 0.1V step.

2. CS Voltage Detector

- V_{IN} (main power supply) terminal voltage is supervised, and the fall of the main power supply is detected.
- Detection result is outputted to CS terminal as follows. (At the time of CS release permission signal output.)
 - Detection voltage($-V_{DET1}$) or less : "L" Output
 - More than release voltage($+V_{DET1}$) : "H" Output
- power supply supplies from two terminals of V_{IN} and V_{BAT} .

3. RESET Voltage Detector

- RESET Voltage Detector supervises the voltage of a V_{OUT} terminal.
- Detection result is outputted to RESET terminal as follows.
 - Detection voltage($-V_{DET1}$) or less : "L" Output
 - More than release voltage($+V_{DET1}$) : "H" Output
- power supply supplies from V_{OUT} terminals.(Normal logic will be outputted if V_{OUT} terminal voltage is more than 1.0V.)

4. V_{SW1} Voltage Detector

- V_{SW1} voltage detector supervises V_{IN} voltage.
- Detection voltage (V_{SW1}) follows the setting value of CS detection voltage.

5. V_{SW2} Voltage Detector

- V_{SW2} voltage detector supervises V_{IN} voltage.
- CS release permission signal is as follows with V_{OUT} terminal voltage.
 - The output voltage V_{OUT} of REG2 is 95% or more of spec. : CS release permission signal is outputted.
 - The output voltage V_{OUT} of REG2 is 95% or less of spec. : CS release permission signal is stopped.
- The CS release permission signal is as follows.
 - CS release permission voltage or less : CS terminal is "L" Fix.
 - More than CS release permission voltage : CS terminal outputs CS detection result.
 - (If V_{IN} terminal voltage is more than CS detection voltage even if V_{OUT} terminal voltage falls below on V_{SW2} voltage, CS output will maintain "H".)

6. Sequence explanation

Special sequence

- Special sequence is until V_{IN} voltage rises from 0V and CS output is set to "H".
- When the voltage of V_{OUT} falls and a RESET output is set to the "L" level.
- The period of a special sequence fixes V_{OUT} output to REG2.

Usual sequence

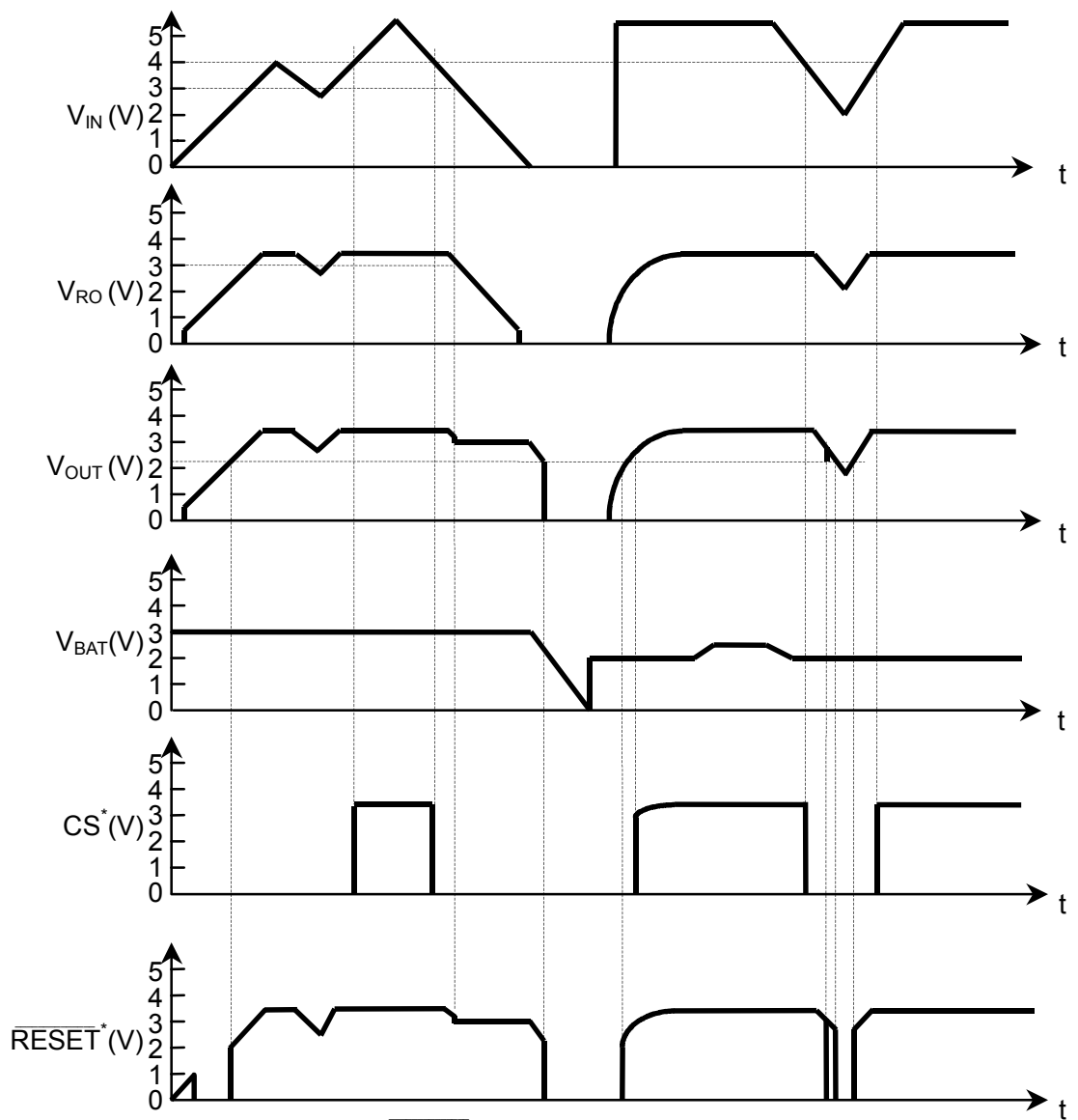
- Usual sequence is until V_{IN} voltage rises and RESET output is set to the "L" level.
- The period of the usual sequence switches V_{OUT} output to REG2 or V_{BAT} by the detection result of the V_{SW1} detection circuit which is supervising V_{IN} voltage.

Terminal voltage	REG2 operation state	V_{OUT} output	State of operation
$0V \text{ to } V_{IN} < +V_{DET1}$	ON	REG2	Special sequence
$V_{IN} > +V_{SW1}$	ON	REG2	Usual sequence
$V_{IN} \leq +V_{SW1}$	OFF	$V_{BAT} - \Delta VT1$	Usual sequence
$V_{OUT} > -V_{DET2}$	ON	REG2	Special sequence

$\Delta VT1$: VDS of the switch transistor between V_{BAT} - V_{OUT} .

Note : Before REG2 turns on from OFF, it will take the time of 100 μ s by the longest. In the meantime, V_{OUT} may become high impedance. In order to prevent voltage descending, the V_{OUT} terminal should connect the capacitor of 10 μ F or more.

■ Timing Chart

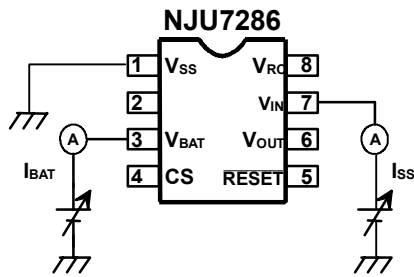


* CS and $\overline{RESET}$ are pulled up to V_{OUT} .

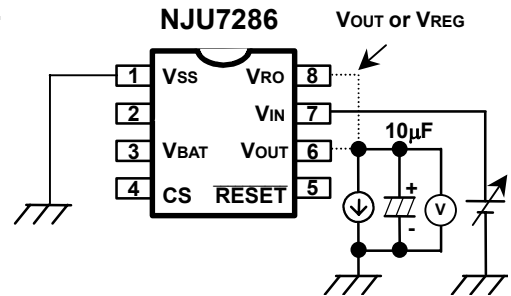
NJU7286

■ TEST CIRCUIT

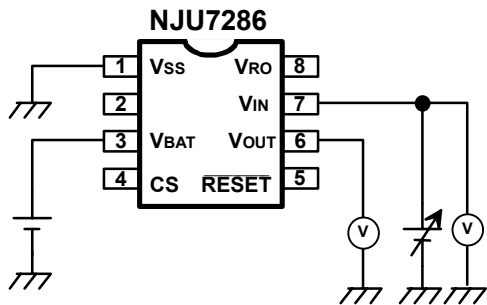
1.



2.

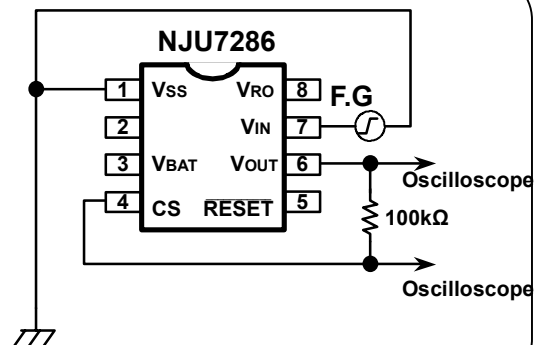


3.

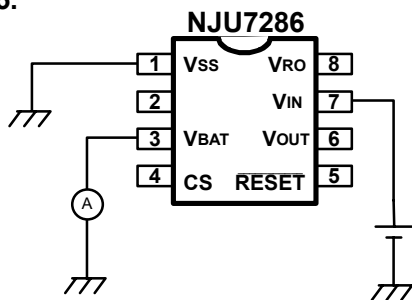


Measure the value after applying 5.4V to V_{IN}

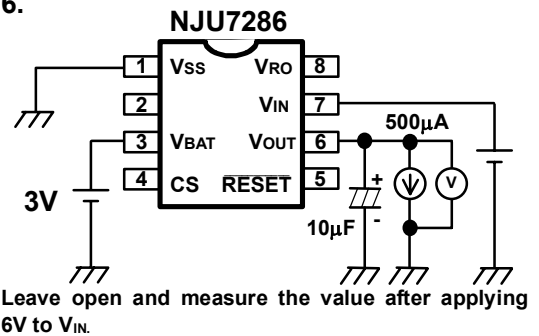
4.



5.

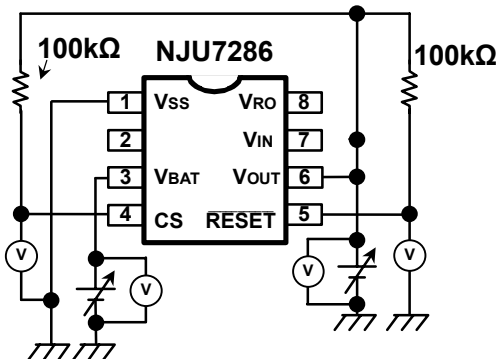


6.

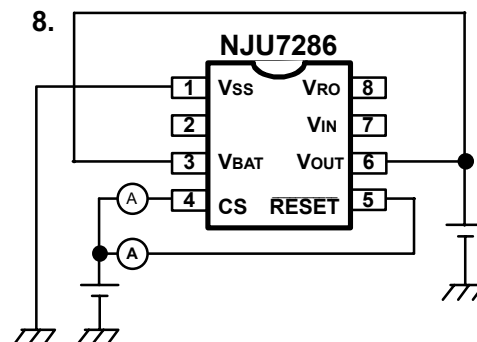


Leave open and measure the value after applying 6V to V_{IN} .

7.



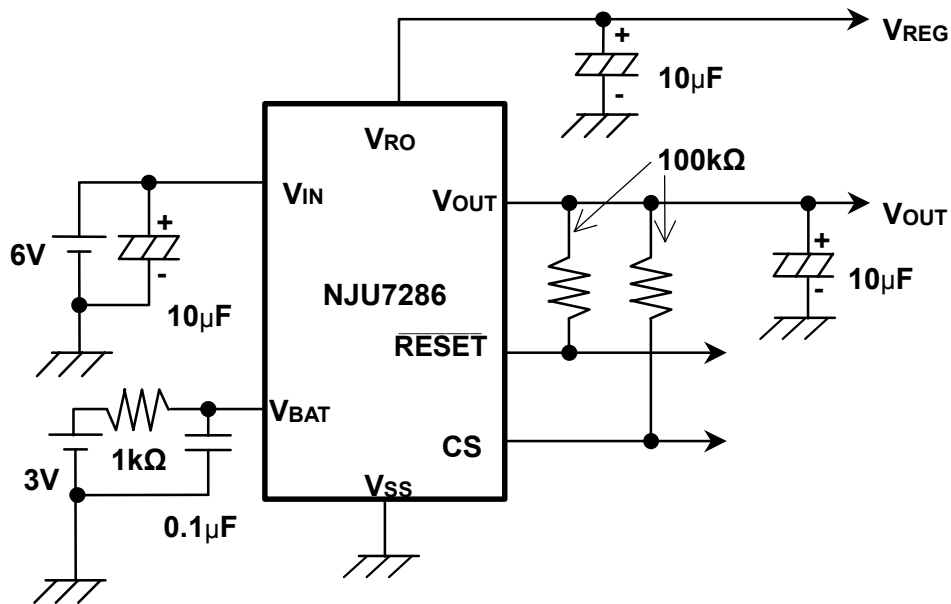
8.



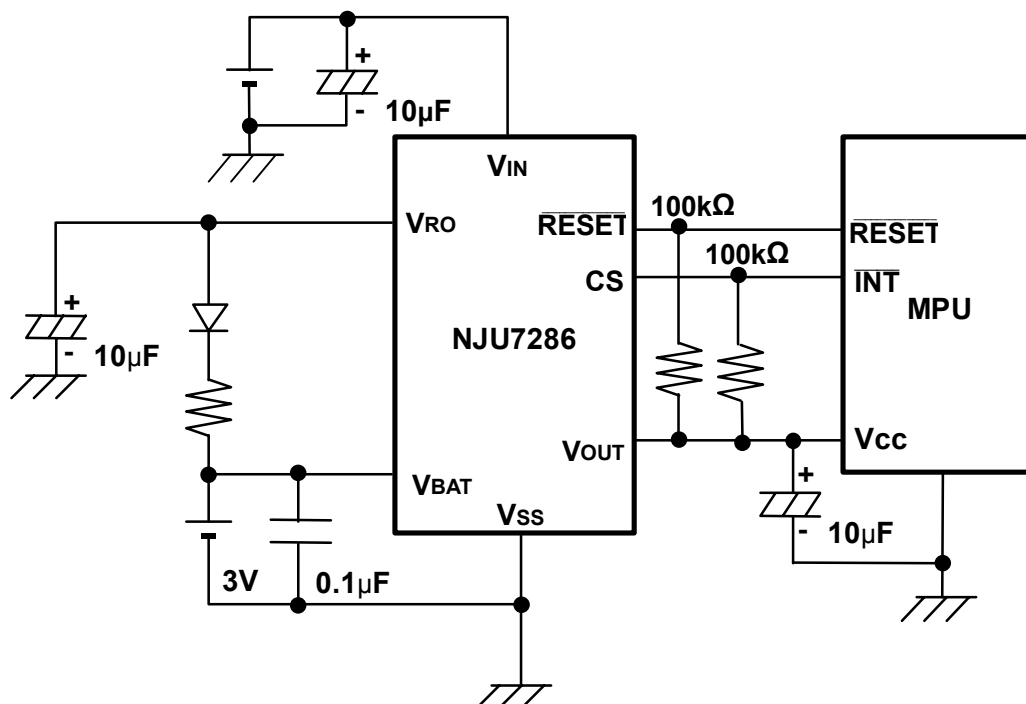
■ CORRESPOND TABLE OF TEST CIRCUIT

TEST PARAMETER	TEST CIRCUIT NUMBER
Quiescent Current	1
Power Supply Voltage Operation Range	2,7
Output Voltage 1	2
Dropout Voltage 1	2
Load Regulation 1	2
Line Regulation 1	2
Average Temperature Coefficient of Output Voltage 1	2
Output Voltage 2	2
Dropout Voltage 2	2
Load Regulation 2	2
Line Regulation 2	2
Average Temperature Coefficient of Output Voltage 2	2
Switch Voltage	3
Average Temperature Coefficient of Switch Voltage	3
Average Temperature Coefficient of INT release permission voltage	4
INT release permission voltage	4
V _{BAT} Switch Leak Current	5
V _{BAT} Switch Resistance	6
Backup Power Supply Input Voltage	6
INT Detection Voltage	7
INT Release voltage	7
Detection Voltage 1	7
Release voltage 1	7
Detection Voltage 2	7
Release voltage 2	7
Operation Voltage	7
Average Temperature Coefficient of Detection Voltage	7
Output Current	8
Leak Current	8

■ TYPICAL APPLICATIONS



When the rechargeable battery is used as the backup battery.



The backup battery can be flating-recharged by using voltage regulator 1.

[CAUTION]

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