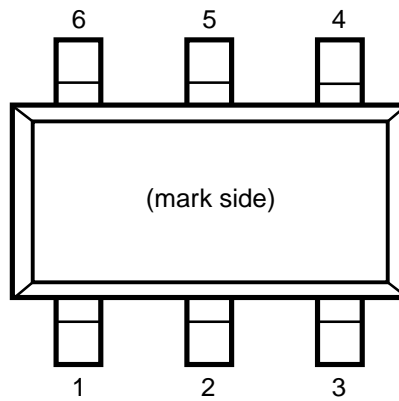

■ PIN CONFIGURATION



■ PIN DESCRIPTION

Pin No.	Symbol	Pin description
1	D _{OUT}	Output of over-discharge detection, CMOS output
2	V ₋	Pin for charger negative input
3	C _{OUT}	Output of over-charge detection, CMOS output
4	C _t	Pin for external capacitor setting output delay of VD1
5	V _{DD}	Power supply(Substrate voltage level of the IC)
6	V _{SS}	Ground(Ground pin of the IC)

■ ABSOLUTE MAXIMUM RATINGS

$V_{SS}=0V$

Symbol	Item	Ratings	Unit
V_{DD}	Supply voltage	-0.3 to 12	V
V- VCt	Input Voltage		
	V - pin	$V_{DD} - 28$ to $V_{DD} + 0.3$	V
	Ct pin	$V_{SS} - 0.3$ to $V_{DD} + 0.3$	V
VCOUT VDOUT	Output voltage		
	COUT pin	$V_{DD} - 28$ to $V_{DD} + 0.3$	V
	DOUT pin	$V_{SS} - 0.3$ to $V_{DD} + 0.3$	V
P_D	Power dissipation	150	mW
T_{opt}	Operating temperature range	-40 to 85	°C
T_{stg}	Storage temperature range	-55 to 125	°C

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are threshold limit values that must not be exceeded ever for an instant under any conditions. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

■ ELECTRICAL CHARACTERISTIC

● R5422N111C

Unless otherwise provided, T_{opt}=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
V _{DD1}	Operating input voltage	Voltage defined as V _{DD} - V _{SS}	1.5		10	V
V _{St}	Minimum operating Voltage for 0V charging	Voltage defined as V _{DD} - V ₋ , V _{DD} - V _{SS} =0V			1.2	V
V _{DET1}	Over-charge threshold	R1=330Ω(T _{opt} =25°C) R1=330Ω (T _{opt} =0 to 50°C)*Note	4.225 4.220	4.250 4.250	4.275 4.280	V V
V _{REL1}	Release voltage for over-charge detection		4.000	4.050	4.100	V
tV _{DET1}	Output delay of over-Charge	C=0.01μF, V _{DD} =3.6V to 4.3V	60	75	90	ms
tV _{REL1}	Output delay of Release from Over-charge	C=0.01μF, V _{DD} =4.3V to 4.1V	15	20	25	ms
V _{DET2}	Over-discharge threshold	Detect falling edge of supply voltage	2.437	2.500	2.563	V
tV _{DET2}	Output delay of over-Discharge	V _{DD} =3.6V to 2.4V	12	17	22	ms
V _{DET3}	Excess current threshold	Detect rising edge of 'V-' pin voltage	0.18	0.20	0.22	V
tV _{DET3}	Output delay of excess Current		7	10	13	ms
V _{short}	Short protection voltage	V _{DD} =3.0V	V _{DD} -1.2	V _{DD} -0.9	V _{DD} -0.6	V
t _{short}	Output Delay of Short protection	V _{DD} =3.0V		5	50	μs
R _{short}	Reset resistance for Excess current protection	V _{DD} =3.6V, V ₋ =1.0V	37	75	113	kΩ
V _{ol1}	Nch ON voltage of C _{OUT}	I _{ol} =40μA, V _{DD} =4.4V		0.3	0.5	V
V _{oh1}	Pch ON voltage of C _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.4	3.75		V
V _{ol2}	Nch ON voltage of D _{OUT}	I _{ol} =40μA, V _{DD} =2.2V		0.2	0.5	V
V _{oh2}	Pch ON voltage of D _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.4	3.7		V
I _{DD}	Supply current	V _{DD} =3.9V, V ₋ =0V		6.0	10.0	μA
I _{standby}	Standby current	V _{DD} =2.0V			0.1	μA

*Note: Considering of variation in process parameters, we compensate for this characteristic related to temperature by laser-trim, however, this specification is guaranteed by design, not production tested.

● R5422N112C

Unless otherwise provided, T_{opt}=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
V _{DD1}	Operating input voltage	Voltage defined as V _{DD} - V _{SS}	1.5		10	V
V _{St}	Minimum operating Voltage for 0V charging	Voltage defined as V _{DD} - V ₋ , V _{DD} - V _{SS} =0V			1.2	V
V _{DET1}	Over-charge threshold	R1=330Ω(T _{opt} =25°C)	4.325	4.350	4.375	V
		R1=330Ω (T _{opt} =0 to 50°C)*Note	4.320	4.350	4.380	V
V _{REL1}	Release voltage for over-charge detection		4.100	4.150	4.200	V
tV _{DET1}	Output delay of over-charge	C=0.01μF, V _{DD} =3.6V to 4.4V	61	77	93	ms
tV _{REL1}	Output delay of Release from Over-charge	C=0.01μF, V _{DD} =4.4V to 4.1V	15	20	25	ms
V _{DET2}	Over-discharge threshold	Detect falling edge of supply Voltage	2.437	2.500	2.563	V
tV _{DET2}	Output delay of over-Discharge	V _{DD} =3.6V to 2.4V	12	17	22	ms
V _{DET3}	Excess current threshold	Detect rising edge of 'V-' pin Voltage	0.18	0.20	0.22	V
tV _{DET3}	Output delay of excess Current		7	10	13	ms
V _{short}	Short protection voltage	V _{DD} =3.0V	V _{DD} -1.2	V _{DD} -0.9	V _{DD} -0.6	V
t _{short}	Output Delay of Short protection	V _{DD} =3.0V		5	50	μs
R _{short}	Reset resistance for excess current protection	V _{DD} =3.6V, V ₋ =1.0V	37	75	113	kΩ
V _{ol1}	Nch ON voltage of C _{OUT}	I _{ol} =40μA, V _{DD} =4.4V		0.3	0.5	V
V _{oh1}	Pch ON voltage of C _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.40	3.75		V
V _{ol2}	Nch ON voltage of D _{OUT}	I _{ol} =40μA, V _{DD} =2.2V		0.2	0.5	V
V _{oh2}	Pch ON voltage of D _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.4	3.7		V
I _{DD}	Supply current	V _{DD} =3.9V, V ₋ =0V		6.0	10.0	μA
I _{standby}	Standby current	V _{DD} =2.0V			0.1	μA

*Note: Considering of variation in process parameters, we compensate for this characteristic related to temperature by laser-trim, however this specification is guaranteed by design, not production tested.

● R5422N111E

Unless otherwise provided, T_{opt}=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
V _{DD1}	Operating input voltage	Voltage defined as V _{DD} - V _{SS}	1.5		10	V
V _{nochg}	Maximum Voltage for disable of 0V charging	Voltage defined as V _{DD} - V _{SS} , V _{DD} - V ₋ =4V	0.5	0.8		V
V _{DET1}	Over-charge threshold	R1=330Ω(T _{opt} =25°C)	4.225	4.250	4.275	V
		R1=330Ω (T _{opt} =0 to 50°C)*Note	4.220	4.250	4.280	V
V _{REL1}	Release voltage for over-charge detection		4.000	4.050	4.100	V
tV _{DET1}	Output delay of over-charge	C=0.01μF, V _{DD} =3.6V to 4.3V	60	75	90	ms
tV _{REL1}	Output delay of Release from Over-charge	C=0.01μF, V _{DD} =4.3V to 4.1V	15	20	25	ms
V _{DET2}	Over-discharge threshold	Detect falling edge of supply Voltage	2.437	2.500	2.563	V
tV _{DET2}	Output delay of over-Discharge	V _{DD} =3.6V to 2.4V	12	17	22	ms
V _{DET3}	Excess current threshold	Detect rising edge of 'V-' pin Voltage	0.18	0.20	0.22	V
tV _{DET3}	Output delay of excess Current		7	10	13	ms
V _{short}	Short protection voltage	V _{DD} =3.0V	V _{DD} -1.2	V _{DD} -0.9	V _{DD} -0.6	V
t _{short}	Output Delay of Short protection	V _{DD} =3.0V		5	50	μs
R _{short}	Reset resistance for excess current protection	V _{DD} =3.6V, V ₋ =1.0V	37	75	113	kΩ
V _{ol1}	Nch ON voltage of C _{OUT}	I _{ol} =40μA, V _{DD} =4.4V		0.3	0.5	V
V _{oh1}	Pch ON voltage of C _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.4	3.75		V
V _{ol2}	Nch ON voltage of D _{OUT}	I _{ol} =40μA, V _{DD} =2.2V		0.2	0.5	V
V _{oh2}	Pch ON voltage of D _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.4	3.7		V
I _{DD}	Supply current	V _{DD} =3.9V, V ₋ =0V		6.0	10.0	μA
I _{standby}	Standby current	V _{DD} =2.0V			0.1	μA

*Note: Considering of variation in process parameters, we compensate for this characteristic related to temperature by laser-trim, however, this specification is guaranteed by design, not production tested.

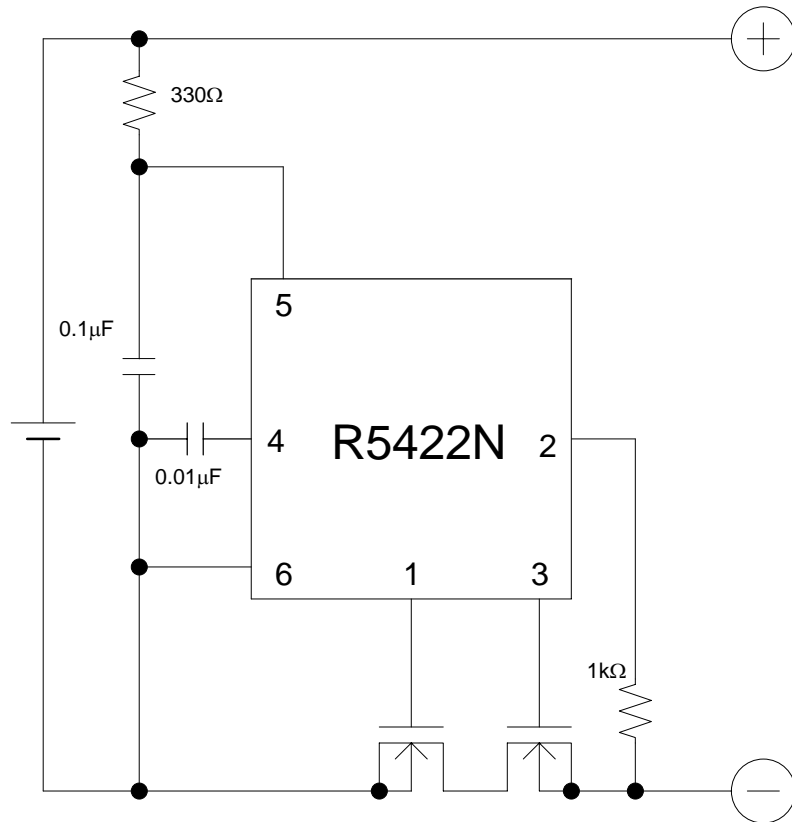
● R5422N112E

Unless otherwise provided, T_{opt}=25°C

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
V _{DD1}	Operating input voltage	Voltage defined as V _{DD} - V _{SS}	1.5		10	V
V _{nochg}	Maximum Voltage for disable of 0V charging	Voltage defined as V _{DD} - V _{SS} , V _{DD} - V ₋ =4V	0.5	0.8		V
V _{DET1}	Over-charge threshold	R1=330Ω(T _{opt} =25°C)	4.325	4.350	4.375	V
		R1=330Ω (T _{opt} =0 to 50°C)*Note	4.320	4.350	4.380	V
V _{REL1}	Release voltage for over-charge detection		4.100	4.150	4.200	V
tV _{DET1}	Output delay of over-Charge	C=0.01μF, V _{DD} =3.6V to 4.4V	61	77	93	ms
tV _{REL1}	Output delay of Release from Over-charge	C=0.01μF, V _{DD} =4.4V to 4.1V	15	20	25	ms
V _{DET2}	Over-discharge threshold	Detect falling edge of supply Voltage	2.437	2.500	2.563	V
tV _{DET2}	Output delay of over-Discharge	V _{DD} =3.6V to 2.4V	12	17	22	ms
V _{DET3}	Excess current threshold	Detect rising edge of 'V-' pin Voltage	0.18	0.20	0.22	V
tV _{DET3}	Output delay of excess Current	V _{DD} =3.0V	7	10	13	ms
V _{short}	Short protection voltage	V _{DD} =3.0V	V _{DD} -1.2	V _{DD} -0.9	V _{DD} -0.6	V
t _{short}	Output Delay of Short protection	V _{DD} =3.0V		5	50	μs
R _{short}	Reset resistance for excess current protection	V _{DD} =3.6V, V ₋ =1.0V	37	75	113	kΩ
V _{ol1}	Nch ON voltage of C _{OUT}	I _{ol} =40μA, V _{DD} =4.4V		0.3	0.5	V
V _{oh1}	Pch ON voltage of C _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.4	3.7		V
V _{ol2}	Nch ON voltage of D _{OUT}	I _{ol} =40μA, V _{DD} =2.2V		0.2	0.5	V
V _{oh2}	Pch ON voltage of D _{OUT}	I _{oh} =-40μA, V _{DD} =3.9V	3.4	3.7		V
I _{DD}	Supply current	V _{DD} =3.9V, V ₋ =0V		6.0	10.0	μA
I _{standby}	Standby current	V _{DD} =2.0V			0.1	μA

*Note: Considering of variation in process parameters, we compensate for this characteristic related to temperature by laser-trim, however, this specification is guaranteed by design, not production tested.

■ TYPICAL APPLICATION



■ APPLICATION HINTS

R1 and C1 will stabilize a supply voltage to the R5422Nxxxx. A recommended R1 value is less than 1kΩ.

A larger value of R1 leads higher detection voltage, makes some errors, because of shoot through current flowed in the R5422Nxxxx.

R2 will stabilize a V- pin voltage. The resetting from over-discharge with connecting a charger possibly be disabled by larger value of R2. Recommended value is less than 1 kΩ.

R1 and R2 can operate also as a part of current limit circuit against for setting cell reverse direction or for applying excess charging voltage to the R5422Nxxxx, battery pack, while smaller R1 and R2 may cause a power consumption over rating of power dissipation of the R5422Nxxxx and a total of 'R1+R2' should be more than 1kΩ.