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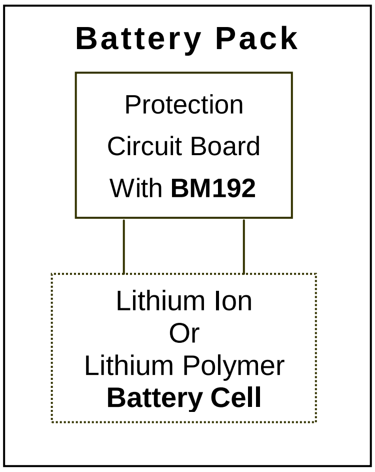
BM192-XCCA-CE

One-Cell Li Battery Protectors

General Description

The BM192-XCCA-CE is protector for lithium-ion and lithium polymer rechargeable battery with high accuracy voltage detection. It can be used for protecting single cell lithium-ion or/and lithium polymer battery packs from overcharge, overdischarge, overcurrent and short circuit. The IC has suitable protection delay functions and low power consumption property.

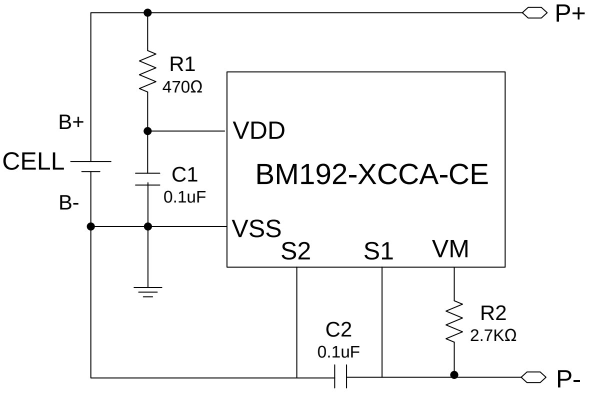
Applications



Features

- **Overcharge Detection Voltage**
  - 4.475V
  - Accuracy ±25mV (Ta=25℃)
±50mV (Ta=-30℃~80℃)
- **Overdischarge Detection Voltage**
  - 2.500V
  - Accuracy ±75mV (Ta=25℃)
- **Discharge Overcurrent Detection Voltage**
  - 0.100V (V_{DD} = 3.300V)
  - Accuracy ±15mV (Ta=25℃)
- **Short Protection Detection Voltage**
  - Typ. 0.350V (V_{DD} = 3.300V)
  - Accuracy ±100mV (Ta=25℃)
- **Low Current Consumption**
  - Typ. 2.5uA (V_{DD} = 3.900V, Ta=25℃)（Standard working current）
  - Typ. 0.8uA (V_{DD} = 2.000V, Ta=25℃)（With auto wake up）
- **0V charge function is allowed**
- **Auto Wake up function is allowed**
- **Small Package**
  - DFN2.2*2.9-6L
- **FET general characteristics**
  - VDS=20V
  - Rss(on)=30 mΩ (V_{GS}=3.7V,ID=1A)
  - ESD Rating: 2000V HBM

Typical Application Circuit



Notes

R_1 and C_1 are to stabilize the supply voltage of the BM192-XCCA-CE. R_1 C_1 is hence regarded as the time constant for V_{DD} pin. R_1 and R_2 can also be a part of current limit circuit for the BM192-XCCA-CE. Recommended values of these elements are as follows:

- R_1＜1KΩ. A larger value of R_1 results in higher detection voltage, introducing errors.
- 1.5kΩ＜R_2＜4KΩ. A larger value of R_2 possibly prevents resetting from over-discharge even with a charger.
- R_1+ R_2＞1.6KΩ. Smaller values may lead to power consumption over the maximum dissipation rating of the BM192-XCCA-CE.

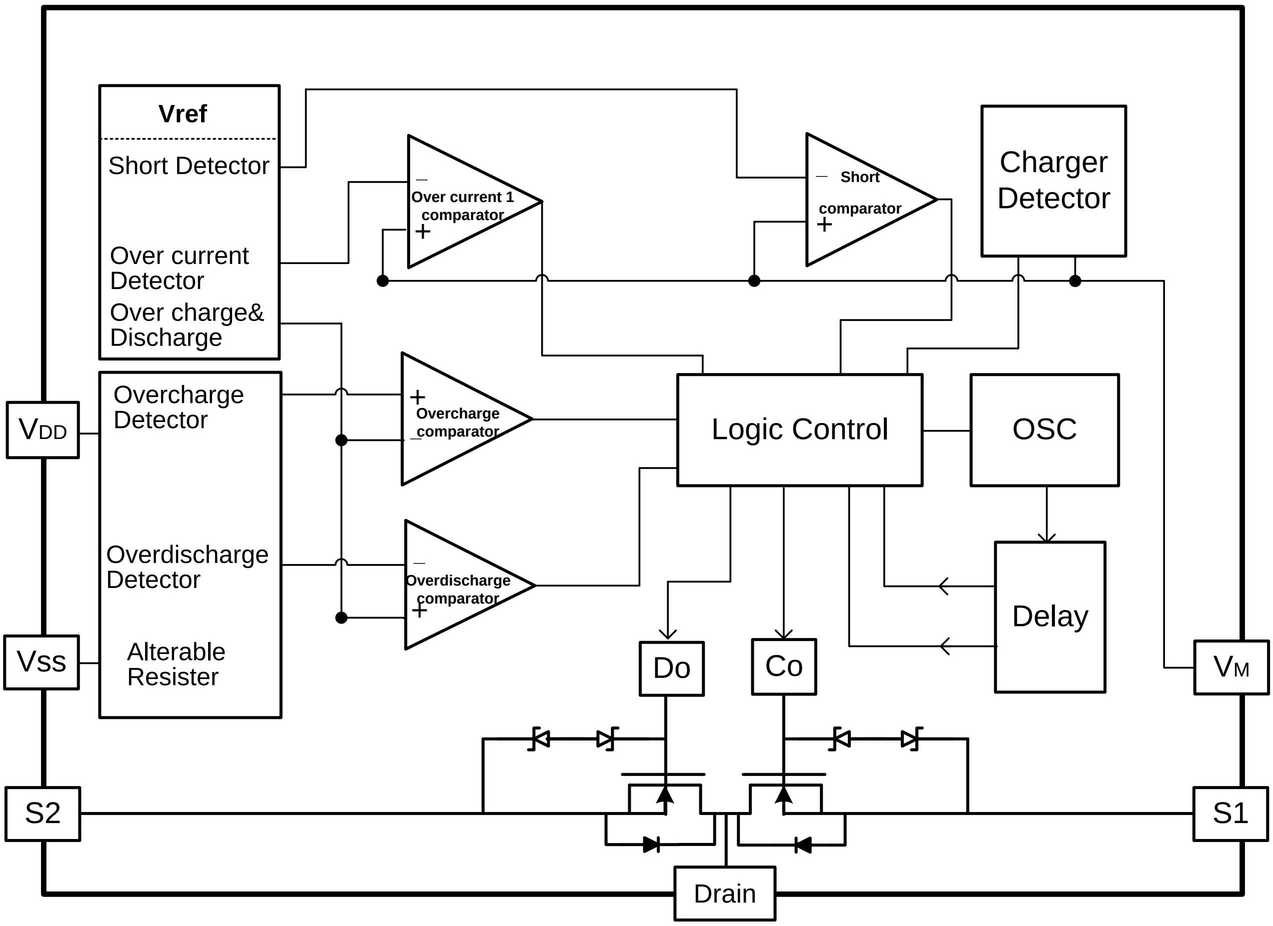
The requirement or resistors and capacitors and the value of constants should be decided depending upon the system function and characteristics.

Marking Contents

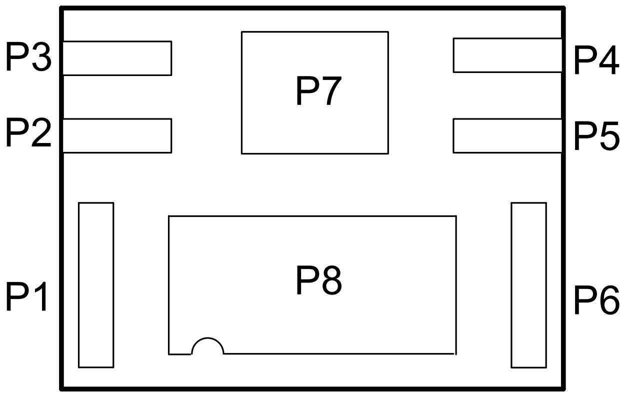
BM192-XXXX-CE

Symbol	Meaning	Description
XXXX	The first X stands for Overcharge detection voltage (Vdet1), The second X stands for Overdischarge detection voltage (Vdet2), The third X stands for Discharge Overcurrent detection voltage (Vdet3), The fourth X stands for versions.	Assigned from AAAA to WWWW
DE	Package	DFNWB2.2*2.9-6L

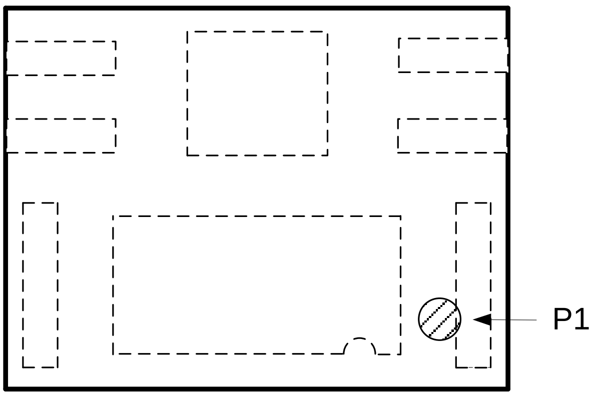
Block Diagram


Vref
Short Detector
Over current Detector
Over charge& Discharge
Overcharge Detector
Overdischarge Detector
Alterable Resister
Over current 1 comparator
Short comparator
Overcharge comparator
Overdischarge comparator
Charger Detector
Logic Control
OSC
Delay
VDD
Vss
VM
S2
S1
Do
Co
Drain

Pin Description



Bottom View



Top View

Pin	Symbol	Description
P1	S2	The source terminal of MOSFET switch for discharge control
P2	V_{SS}	Ground
P3	V_{DD}	Power supply
P4	NC	No Connection
P5	V_M	Connected to charger’s negative pin
P6	S1	The source terminal of MOSFET switch for charge control
P7	IS	The substrate of IC, IS should be floating
P8	MS	The common drain terminal of MOS, MS should be floating

Electrical Characteristics [1*]

(Ta=25℃ unless otherwise specified)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
DETECTION VOLTAGE AND DELAY TIME						
Vdet1	Overcharge Detection Voltage	-	4.450	**4.475**	4.500	V
Vrel1	Release Voltage For Overcharge Detection	-	4.225	**4.275**	4.325	V
Vdet2	Overdischarge Detection Voltage	-	2.455	**2.530**	2.605	V
Vrel2	Release Voltage For Overdischarge	-	2.800	**2.900**	3.000	V
Vrel2’	Release Voltage For Overdischarge 2	Charger connected	2.455	**2.530**	2.605	V
Vdet3	Discharge Overcurrent Detection Voltage	V_{DD} = 3.300V	0.085	**0.100**	0.115	V
Vshort	Short Protection Voltage	V_{DD} = 3.300V	0.250	**0.350**	0.450	V
Vcha	Charger Detection (Charge Overcurrent)	-	-0.120	**-0.100**	-0.080	V
Vriov	Discharge Overcurrent Release Voltage	-	0.75*V_{DD}	**0.85*V_{DD}**	0.95*V_{DD}	V
V0cha	0V Battery Charge Starting Charger Voltage	Applied for 0V battery charge function	1.2	**-**	-	V
Tvdet1	Overcharge Detection Delay Time	V_{DD} = 4.0V→4.5V	600	**1200**	1800	ms
Tvrel1	Overcharge Release Delay Time	V_{DD} = 4.5V→4.0V	9	**16**	30	ms
Treset	Overcharge Reset Delay Time	V_{DD} = 4.5V→4.0V→4.5V	7	**14**	28	ms
Tvdet2	Overdischarge Detection Delay Time	V_{DD} = 4.0V→2.0V	36	**72**	108	ms
Tvrel2	Overdischarge Release Delay Time	V_{DD} = 2.0V→3.0V, V_M = 0V	1	**2**	3	ms
Tvdet3	Discharge Overcurrent Detection Delay Time	V_{DD} =3.3V, V_M = 0V→0.2V	5	**10**	15	ms
Tab	Charge Overcurrent Detection Delay Time	V_{DD} =3.3V, V_M = 0V→-0.2V	5	**10**	15	ms
Tshort	Short Detection Delay Time	V_{DD} =3.3V, V_M = 0V→1.2V	200	**400**	600	us
Tvrel3	Discharge Overcurrent Release Delay Time	V_{DD} =3.3V, V_M = 0.2V→0 V	1	**2**	3	ms
OUTPUT VOLTAGE AND V_M INTERNAL RESISTANCE						
R_{VMD}	Resistance between V_M and V_{DD}	V_{DD}=2.0V, V_M=0V	100	**600**	900	kΩ
R_{VMS}	Resistance between V_M and V_{SS}	V_{DD}=3.3V, V_M=1V	60	**100**	300	kΩ
OPERRATION VOLTAGE AND CURRENT CONSUMPTION						
V_{DD}	Operating Input Voltage	V_{DD}-Vss	1.6	**V_{DD}**	8.0	V
V_M	Operating Input Voltage	V_{DD}-V_M	1.5	**-**	28	V
I_{DD}	Supply Current	V_{DD} = 3.9V, V_M = 0V	-	**2.5**	5.0	uA
$I_{STANDBY}$	Standby Current	V_{DD} = 2.0V, V_M =0V→2.0V	-	**0.8**	1.5	uA

[1*] The Electrical parameters for this temperature range is guaranteed by design, not tested in production.

Electrical Characteristics [1*]

(Ta =-30℃～80℃ unless otherwise specified)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
DETECTION VOLTAGE AND DELAY TIME						
Vdet1	Overcharge Detection Voltage	-	4.425	**4.475**	4.525	V
Vrel1	Release Voltage For Overcharge Detection	-	4.205	**4.275**	4.345	V
Vdet2	Overdischarge Detection Voltage	-	2.430	**2.530**	2.630	V
Vrel2	Release Voltage For Overdischarge	-	2.800	**2.900**	3.000	V
Vrel2'	Release Voltage For Overdischarge 2	Charger connected	2.430	**2.530**	2.630	V
Vdet3	Discharge Overcurrent Detection Voltage	V_{DD} = 3.300V	0.080	**0.100**	0.120	V
Vshort	Short Protection Voltage	V_{DD} = 3.300V	0.200	**0.350**	0.500	V
Vcha	Charger Detection (Charge Overcurrent)	-	-0.130	**-0.100**	-0.070	V
Vriov	Discharge Overcurrent Release Voltage	-	0.75*V_{DD}	**0.85*V_{DD}**	0.95*V_{DD}	V
V0cha	0V Battery Charge Starting Charger Voltage	Applied for 0V battery charge function	1.2	**-**	-	V
Tvdet1	Overcharge Detection Delay Time	V_{DD} = 4.0V→4.5V	480	**1200**	1920	ms
Tvrel1	Overcharge Release Delay Time	V_{DD} = 4.5V→4.0V	7	**16**	32	ms
Treset	Overcharge Reset Delay Time	V_{DD} = 4.5V→4.0V→4.5V	5	**14**	30	ms
Tvdet2	Overdischarge Detection Delay Time	V_{DD} = 4.0V→2.0V	29	**72**	115	ms
Tvrel2	Overdischarge Release Delay Time	V_{DD} = 2.0V→3.0V, V_M = 0V	0.8	**2**	3.2	ms
Tvdet3	Discharge Overcurrent Detection Delay Time	V_{DD} =3.3V, V_M = 0V→0.2V	4	**10**	16	ms
Tab	Charge Overcurrent Detection Delay Time	V_{DD} =3.3V, V_M = 0V→-0.2V	4	**10**	16	ms
Tshort	Short Detection Delay Time	V_{DD} =3.3V, V_M = 0V→1.2V	160	**400**	640	us
Tvrel3	Discharge Overcurrent Release Delay Time	V_{DD} =3.3V, V_M = 0.2V→0 V	0.8	**2**	3.2	ms
OUTPUT VOLTAGE AND V_M INTERNAL RESISTANCE						
R_{VMD}	Resistance between V_M and V_{DD}	V_{DD}=2.0V, V_M =0V	100	**600**	900	kΩ
R_{VMS}	Resistance between V_M and V_{SS}	V_{DD}=3.3V, V_M =1V	60	**100**	300	kΩ
OPERRATION VOLTAGE AND CURRENT CONSUMPTION						
V_{DD}	Operating Input Voltage	V_{DD}-Vss	1.6	**V_{DD}**	8.0	V
V_M	Operating Input Voltage	V_{DD}-V_M	1.5	**-**	28	V
I_{DD}	Supply Current	V_{DD} = 3.9V, V_M = 0V	-	**2.5**	6.0	uA
$I_{STANDBY}$	Standby Current	V_{DD} = 2.0V, V_M =0V→2.0V	-	**0.8**	2.5	uA

[1*] The Electrical parameters for this temperature range is guaranteed by design, not tested in production.

Electrical Characteristics [1*] (Ta=25ºC , GND=0V unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Drain current at cut off of MOS-FET	I_{DSS}			1	uA	Vds=20V
Source -source on state resistance 1	$R_{SS(on)}1$	21	33	45	mΩ	Vdd=2.6V , I_D=1.0A
Source -source on state resistance 2	$R_{SS\ (on)}2$	20	30	40	mΩ	Vdd=3.7V , I_D=1.0A
Source -source on state resistance 3	$R_{SS\ (on)}3$	19	29	39	mΩ	Vdd=4.2V , I_D=1.0A
Body Diode-Forward Voltage	V_{SD}	0.40	0.70	1.20	V	Is=1.0A , V_{GS}=0V

1* The Electrical parameters for this temperature range is guaranteed by design, not tested in production.

Electrical Characteristics [1*] (Ta=25℃ ,GND=0V, S1=0 unless otherwise specified)

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit	Note
Discharge Overcurrent Detect Current	Idet3 1	VDD=2.6V	2.3	3.0	4.2	A	Vdet3=0.100V Vcha=-0.100V
	Idet3 2	VDD=3.8V	2.6	3.3	4.4	A	
	Idet3 3	VDD=4.2V	2.6	3.4	4.6	A	
Charge Overcurrent Detect Current	Icha 1	VDD=2.6V	2.1	3.0	4.4	A	
	Icha 2	VDD=3.8V	2.4	3.3	4.6	A	
	Icha 3	VDD=4.2V	2.5	3.4	4.8	A	

1* The Electrical parameters for this temperature range is guaranteed by design, not tested in production.

Absolute Maximum Ratings (Ta=25ºC , V_{SS}=0V)

Symbol	Item	Ratings	Unit
V_{DD}	Supply Voltage	-0.3 to 8	V
V_M	V_M Pin Input Voltage	V_{DD} -28 to V_{DD}+0.3	V
V_{GS}	Gate-Source Voltage	±12	V
V_{DS}	Drain- Source Voltage	20	V
ID	Drain Current	8	A
Pd	Power Consumption	150	mW
Ta	Operating Temperature Range	-30 to 80	℃
Tstg	Storage Temperature Range	-55 to 125	℃

Caution: These values must not be exceeded under any conditions!

Function Description

Normal Condition:

V_{DD} is between the Overdischarge Detection Voltage (Vdet2) and Overcharge Detection Voltage (Vdet1) and the V_M voltage is between Charger Detection Voltage (Vcha) and the Discharge Overcurrent Detection Voltage (Vdet3), therefore the MOS-FET of charge and discharge are all on. Charging and discharging can be carried out freely.

Overcharge Condition:

When V_{DD} increases and passes Vdet1 during charging under the normal condition, the charge control FET turns off after Overcharge Detection Delay Time (Tvdet1). If, within Tvdet1, V_{DD} becomes lower than Vdet1 and stays for duration shorter than Overcharge Reset Delay Time (Treset) before rising up over Vdet1 again, this type of instantaneous falling of V_{DD} is ignored. Otherwise, if the time V_{DD} stays lower than Vdet1 is longer than Treset, the timing related to Tvdet1 shall be reset.

Charge Overcurrent Condition:

If the V_M voltage falls below the Charger Detection Voltage (Vcha) during charging under normal condition and it continues for the Charge Overcurrent Delay Time (Tvcha) or longer, the charge control FET turns off and charging stops. This action is called the charge overcurrent detection.
Charge overcurrent detection works when the discharging control FET is on and the V_M voltage falls below the Charger Detection Voltage (Vcha). To an overdischarged battery, only when charging makes the battery voltage higher than the Overdischarge Detection Voltage (Vdet2), the charge overcurrent detection can act. Charge overcurrent state is released, once the voltage difference between VM and VSS becomes less than the Charge Overcurrent Detection Voltage (Vcha).

Overcharge Protection Release Condition:

The charging state can be reset and charge control FET will turn on ,as follow condition:

(1) When the V_M voltage is between Vdet3 and Vcha, V_{DD} becomes lower than the Overcharge Release Voltage (Vrel1) , and stays longer than Overcharge Release Delay Time (Tvrel1), the charge control FET turns on.

(2) When a charger is disconnected with the battery pack, and the V_{DD} level is lower than Vdet1, the charge control FET turns on.

Note: when a charger keep connecting, even if V_{DD} level is lower than Vrel1, the overcharge state will not release and charge control FET keep off until disconnect the charger with the battery pack.

Overdischarge Condition:

While discharging, after V_{DD} lowers below Overdischarge Detection Voltage (Vdet2), the discharge control FET turns off after Overdischarge Detection Delay Time (Tvdet2), discharging is stopped.

Overdischarge Protection Release Condition:

When IC is in overdischarge condition, if a charger is connected to the battery pack, and the battery supply voltage becomes higher than Vdet2, the discharge control FET turns on, allowing discharging action.

The discharging state also can be reset and the output of Do becomes high when V_{DD} becomes higher than the Overdischarge Release Voltage (Vrel2), V_M is between Vdet3 and Vcha, and stays longer than Release Delay Time (Tvrel2).

When a charger is connected from the battery pack, while the V_{DD} level is lower than Vdet2, the battery pack makes charger current allowable through the internal parasitic diode.

Charger Detect Condition:

When a battery in the overdischarge condition is connected to a charger and provided that the VM voltage is lower than the Charger Detection Voltage (Vcha), IC releases the overdischarge condition and turns on the discharge control FET as the battery voltage becomes higher than the Overdischarge Detection Voltage (Vdet2) since the charger detection function works. This action is called charger detection.

When a battery in the overdischarge condition is connected to a charger and provided that the V_M pin voltage is between the Charger Detection Voltage (Vcha) and Discharge Overcurrent Detection Voltage (Vdet3), IC releases the overdischarge condition when the battery voltage reaches the Overdischarge Release Voltage (Vrel2) or higher.

Discharge Overcurrent Protection:

During discharging, the current varies with load, and V_M increases with the rise of the discharging current. Once V_M rises up to the Discharge Overcurrent Detection Voltage (Vdet3) or higher and stays longer than the Discharge Overcurrent Delay Time (Tvdet3), IC will turn off the discharge control FET. After that Discharge Overcurrent state is removed, i.e. V_M＜Vriov, and the circuit recovers to normal condition. The current of Discharge Overcurrent protection is related to Vdet3 and the ON resistance of the two FETs ($R_{SS\,(on)}$).

Short Circuit Protection:

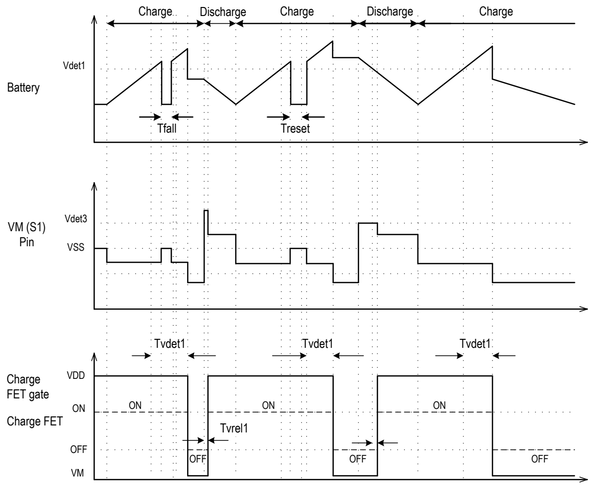
This function has the same principle as the overcurrent protection. But, the Short Circuit Protection Delay Time (Tshort) is far shorter than Tvdet3 and Tvdet4, and the Short Protection Detection Voltage (Vshort) is far higher than Vdet3 and Vdet4. When the circuit is shorted, V_M increases rapidly. Once $V_M \geq$Vshort, IC will turn off the discharge control FET. After the short circuit state is removed, i.e. V_M＜Vriov, the circuit recovers to the normal condition. The short circuit peak current is related to Vshort and the ON resistance of the two FETs ($R_{SS\,(on)}$).

0V battery charge function:

This function is used to recharge the connected battery whose voltage is 0V due to the self-discharge. When the 0 V battery charge starting charger voltage (V0cha) or higher is applied between P+ and P− pins (in the Typical Application Circuits of Page1) by connecting a charger, the charge control FET gate is fixed to V_{DD} pin voltage. When the voltage between the gate and source of the charge control FET becomes equal to or higher than the turn-on voltage by the charger voltage, the charge control FET turns on to start charging. At this time, the discharge control FET is off and the charging current flows through the internal parasitic diode in the discharge control FET. When the battery voltage becomes equal to or higher than the Overdischarge Detection Voltage (Vdet2), the IC enters the normal condition

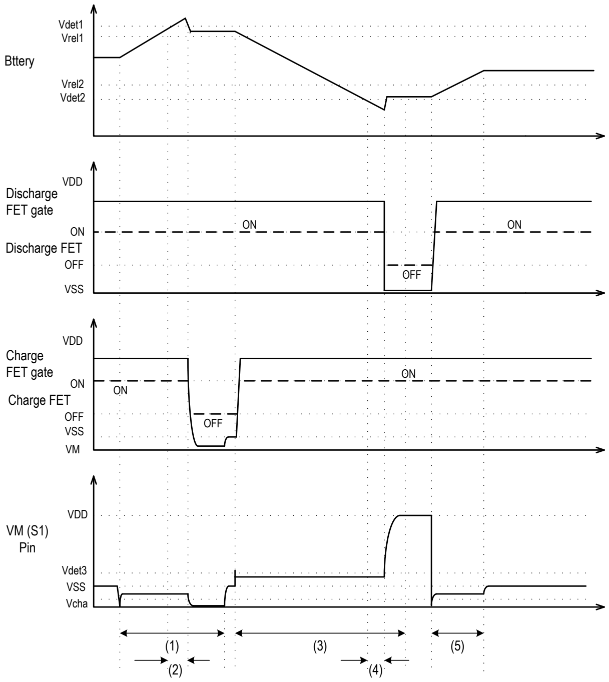
Operation Timing Chart (1)

Overcharge, Timer Reset for Overcharge


Charge
Discharge
Charge
Discharge
Charge
Vdet1
Battery
Tfall
Treset
VM (S1) Pin
Vdet3
VSS
Tvdet1
Tvdet1
Tvdet1
Charge FET gate
Charge FET
VDD
ON
ON
ON
ON
Tvrel1
OFF
OFF
OFF
OFF
VM

Operation Timing Chart (2)

Overcharge/Overdischarge Detection


Vdet1
Vrel1
Bttery
Vrel2
Vdet2
Discharge FET gate
Discharge FET
VDD
ON
ON
ON
OFF
OFF
VSS
Charge FET gate
Charge FET
VDD
ON
ON
ON
OFF
OFF
VSS
VM
VM (S1) Pin
VDD
Vdet3
VSS
Vcha
(1)
(2)
(3)
(4)
(5)

(1) Charger connected

(2) Overcharge Detection Delay Time (Tvdet1)

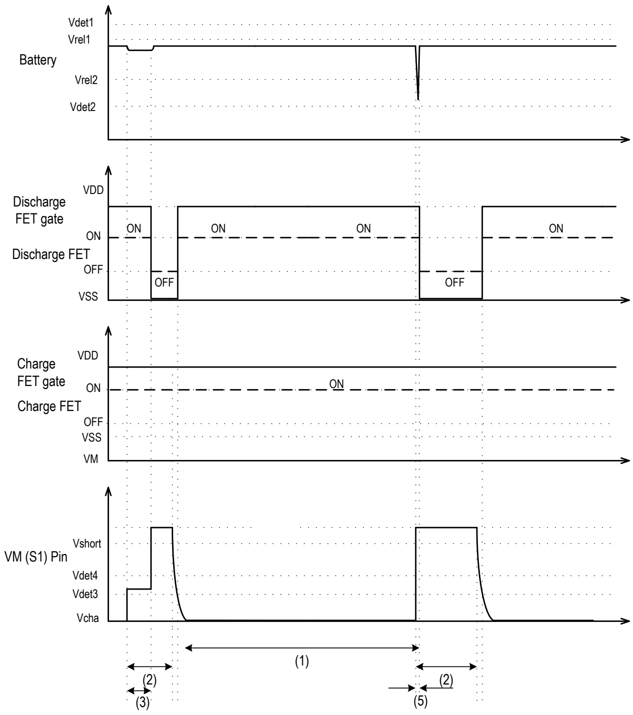
(3) Load connected

(4) Overdischarge Detection Delay Time (Tvdet2)

(5) Normal charging

Operation Timing Chart (3)

Discharge Overcurrent and Short Protection


Vdet1
Vrel1
Battery
Vrel2
Vdet2
Discharge FET gate
Discharge FET
VDD
ON
ON
ON
ON
ON
OFF
OFF
OFF
VSS
Charge FET gate
Charge FET
VDD
ON
ON
OFF
VSS
VM
VM (S1) Pin
Vshort
Vdet4
Vdet3
Vcha
(1)
(2)
(3)
(2)
(5)

(1) Normal condition

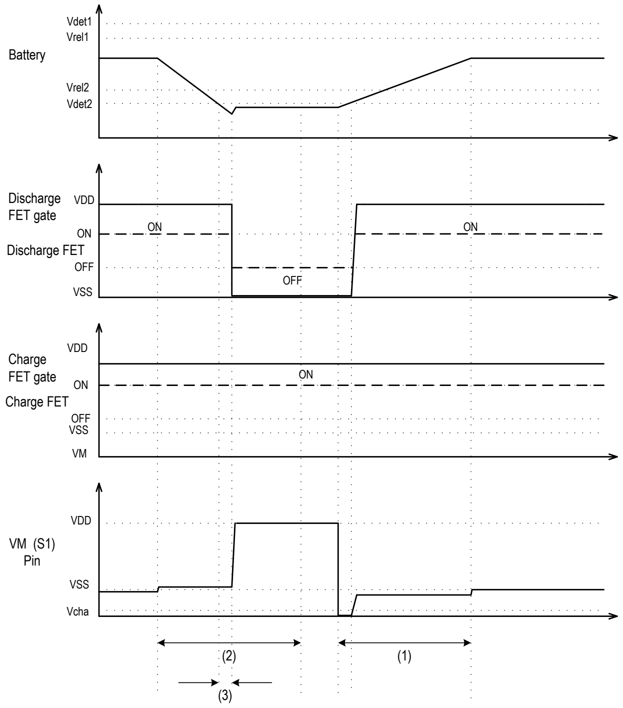
(2) Load connection

(3) Discharge Overcurrent Delay Time (Tvdet3)

(4) Short Circuit Delay Time (Tshort)

Operation Timing Chart (4)

Charger Connection Detection


Vdet1
Vrel1
Battery
Vrel2
Vdet2
Discharge FET gate
VDD
ON
Discharge FET
OFF
VSS
ON
ON
OFF
Charge FET gate
VDD
ON
Charge FET
OFF
VSS
VM
ON
VM (S1) Pin
VDD
VSS
Vcha
(2)
(1)
(3)

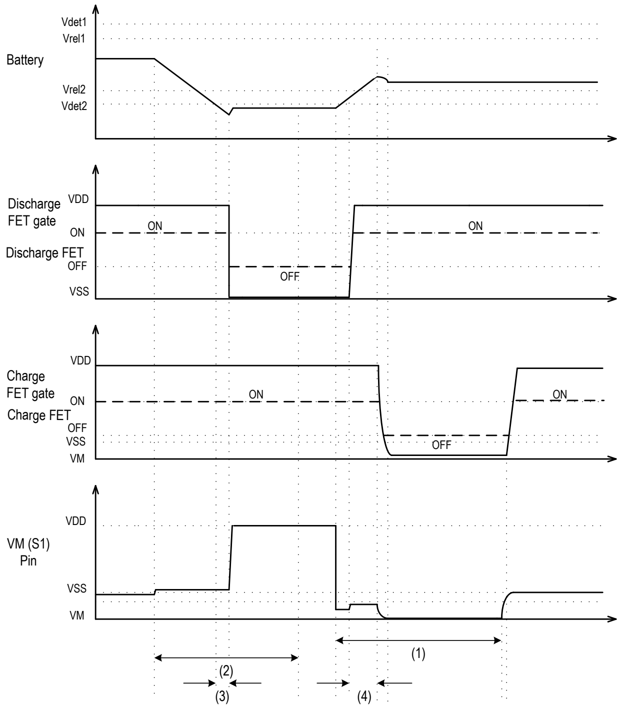
(1) Charger connection

(2) Load connection

(3) Overdischarge Detection Delay (Tvdet2)

Operation Timing Chart (5)

Charge Overcurrent Detection


Vdet1
Vrel1
Battery
Vrel2
Vdet2
Discharge FET gate
VDD
ON
Discharge FET
OFF
VSS
ON
ON
OFF
Charge FET gate
VDD
ON
Charge FET
OFF
VSS
VM
ON
ON
OFF
VM (S1) Pin
VDD
VSS
VM
(1)
(2)
(3)
(4)

(1) Charger connection

(2) Load connection

(3) Overdischarge Detection Delay Time (Tvdet2)

(4) Charge Overcurrent Detection Delay Time

Test Circuits

(1) Overcharge detection voltage and overcharge release voltage (Test circuit 1)

The Overcharge Detection Voltage (Vdet1) is the voltage between V_{DD} and V_{SS} to which when V1 increases and keeps the condition for overcharge delay time, The charging control FET turns off, Vs_1 is the threshold of a diode, The Overcharge Release Voltage (Vrel1) is the voltage between V_{DD} and V_{SS} to which when V1 decreases, The charging control FET turns on, Vs_1=0V.

(2) Overdischarge detection voltage and Overdischarge release voltage (Test circuit 1)

The Overdischarge Detection Voltage (Vdet2) is the voltage between V_{DD} and V_{SS} to which when V1 decreases and keep the condition for overdischarge delay time, The discharging control FET turns off, Vs_1=V1. The overdischarge Release Voltage (Vrel2) is the voltage between V_{DD} and V_{SS} to which when V1 increases, The discharging control FET turns on, Vs_1=0V.

(3) Discharge overcurrent detection voltage and short circuit detection voltage (Test circuit 2)

The Discharge Overcurrent Detection Voltage (Vdet3) is the voltage between V_M and V_{SS} to which when V_M increases and keep the condition for Discharge Overcurrent Delay Time (Tvdet3), The discharging control FET turns off, Vs_1=V1.

The Short Circuit Detection Voltage (Vshort) is the voltage between V_M and V_{SS} to which when V_M increases and keep the condition for Short Circuit Delay Time (Tshort), The discharging control FET turns off, Vs_1=V1.

(4) Charger detection voltage and charge overcurrent detection voltage (Test circuit 2)

In the overdischarge condition, increase V1 gradually until it is between Vdet2 and Vrel2. T The voltage between V_M and V_{SS} to which when V2 decreases, when the discharging control FET turns on, Vs_1=0V, is the Charger Detection Voltage (Vcha).

In the normal charging condition, the voltage between V_M and V_{SS} to which when V2 decreases, The charging control FET turns off, Vs_1 is the threshold of a diode, is the charge overcurrent detection voltage. It has the same value as the Charger Detection Voltage (Vcha).

(5) 0V battery charge starting charger voltage (Test circuit 2)

Set V1=V2=0V and decrease V2 gradually. The voltage between VDD and VM when the charging control FET turns on, Vs_1 is the threshold of a diode, is the 0V battery charge starting charger voltage.

(6) Normal operation current consumption and power down current consumption (Test circuit 2)

Set V1=3.9V and V2=0V under normal condition, the current I_{DD} flowing through V_{DD} pin is the normal operation consumption current (I_{DD}).

Set V1=3.9V and V2=0V，let IC work in normal condition, set V1 from 3.9V to 2.0V, then Let the VM floating, under overdischarge condition, the current I_{DD} flowing through V_{DD} pin is the power down current consumption ($I_{STANDBY}$).

(7) Overcharge detection (release) delay time and overdischarge detection (release) delay time (Test circuit 3)

If V1 increases to be Vdet1 or over Vdet1 and keeps the condition for some time, the charging control FET will turn off, Vs_1 is the threshold of a diode, The time is called overcharge detection delay time. It is used to judge whether overcharge happens indeed.

If V1 decreases from Vdet1 or over Vdet1 to below Vrel1, the charging control FET will turn on, Vs_1=0V. The difference between this time and Treset is called overcharge release delay time.

If V1 decreases to be Vdet2 or below Vdet2 and keeps the condition for some time, the discharging control FET will turn off, Vs_1=V1. The time is called overdischarge detection delay time. It is used to judge whether overdischarge happens indeed.

If V1 increases from Vdet2 or below Vdet2 to over Vrel2 and keeps the condition for some time, the discharging control FET will turn on, Vs_1=0V. The time is called overdischarge release delay time.

(8) Discharge overcurrent detection delay time and short circuit detection delay time (Test circuit 4)

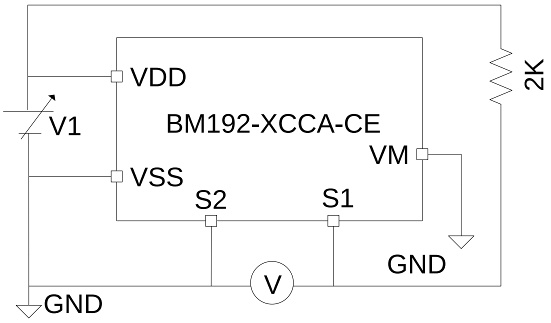
If V2 increases to be Vdet3 or over Vdet3 and keeps the condition for some time, the discharging control FET will turn off, Vs_1=V1. The time is called Discharge Overcurrent Delay Time. It is used to judge whether Discharge Overcurrent happens indeed.

If V2 increases to be Vshort or over Vshort and keeps the condition for some time, the discharging control FET will turn off, Vs_1=V1. The time is called short circuit delay time. It is used to judge whether short circuit happens indeed.

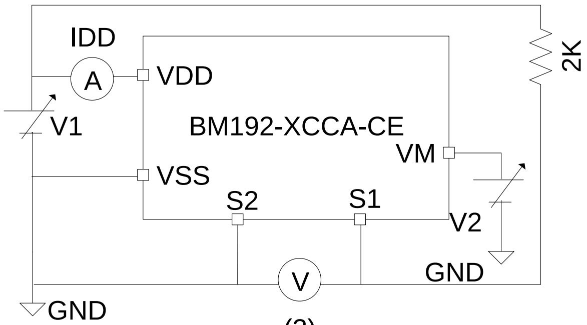
(9) Internal resistance VM -VDD and VM -VSS (Test circuit 4)

Set V1=2.0 V, V2=0 V, V1/I_{VM} is the internal resistance $R_{VMD.}$

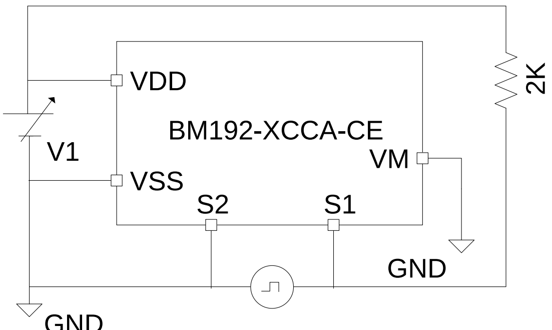
Set V1=3.3 V, V2=1 V, V2/I_{VM} is the internal resistance $R_{VMS.}$



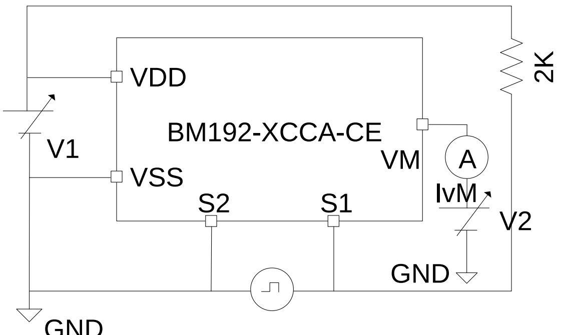
(1)



(2)



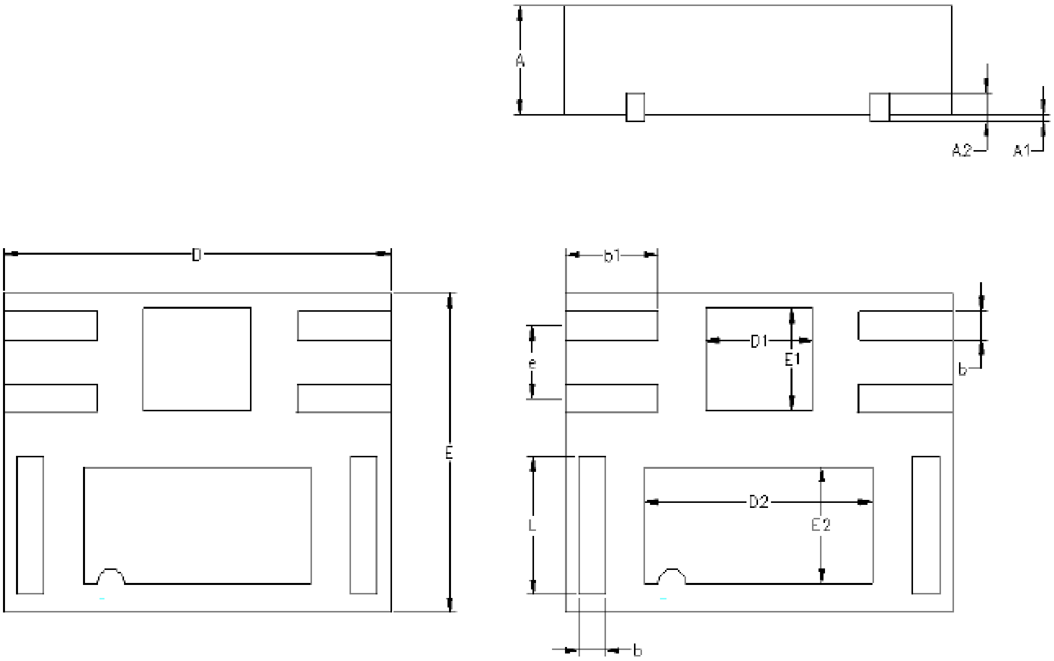
(3)



(4)

Package Outline

DFNWB 2.2*2.9-6L



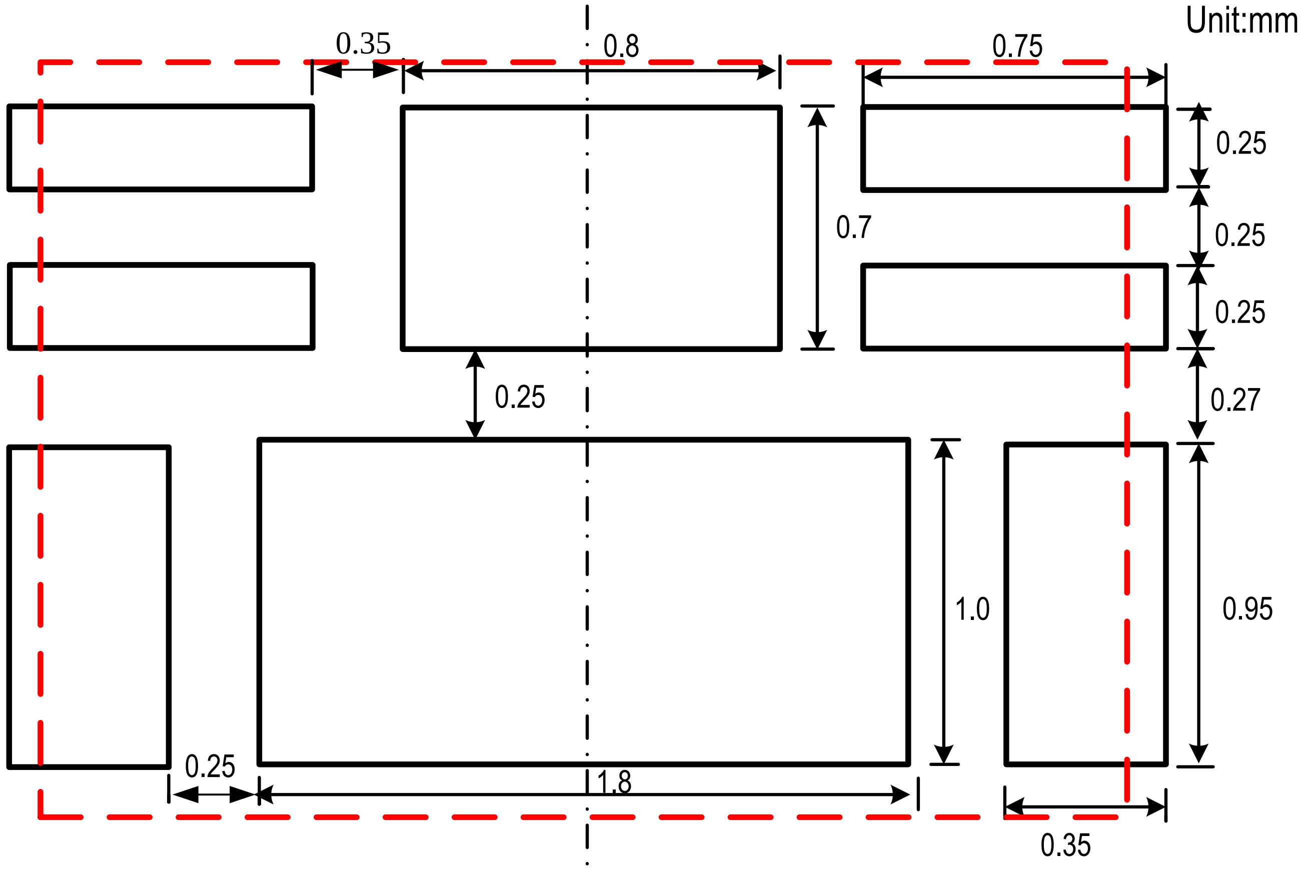
Dimensions (mm)

COMMON DEIMENSIONS(mm)			
RER	MIN	NOM	MAX
A	0.45	0.50	0.55
A1	0.00		0.05
A2	0.15REF		
D	2.85	2.90	2.95
E	2.15	2.20	2.25
D1	0.75	0.80	0.85
E1	0.65	0.70	0.75
b	0.15	0.20	0.25
e	0.50BSC		
L	0.90	0.95	1.00
b1	0.65	0.70	0.75
D2	1.65	1.70	1.75
E2	0.75	0.80	0.85

Packing

MBB packing.7”reel: 3000pcs per reel.

PCB Layout


Unit:mm
0.35
0.8
0.75
0.25
0.25
0.25
0.27
0.7
0.25
1.0
0.95
0.25
1.8
0.35

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