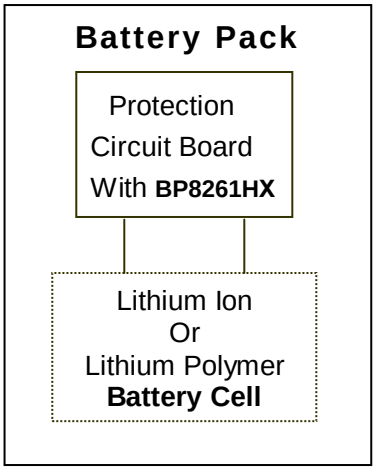
General Description

The BP8261HX is protector for lithium-ion and lithium polymer rechargeable battery with high accuracy voltage detection. It can be used for protecting single cell packs from overcharge, overdischarge, over current and short circuit. The IC has suitable protection delay functions and low power consumption property.

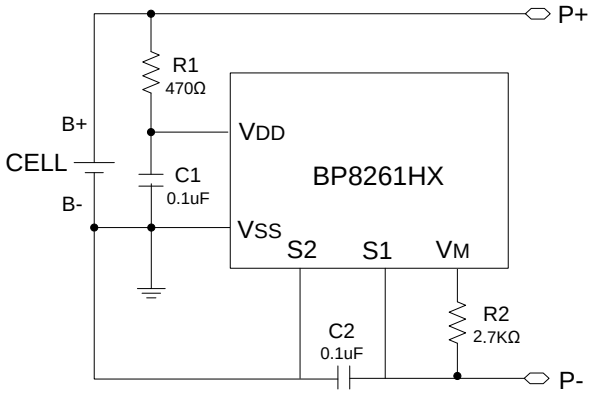
Applications



Features

- **Overcharge Detection Voltage**
  - 4.425V
  - Accuracy ±50mV (Ta=25℃)
- **Overdischarge Detection Voltage**
  - 2.470V
  - Accuracy ±100mV (Ta=25℃)
- **Discharge Overcurrent Detection Voltage**
  - 0.150V (V_{DD} = 3.300V)
  - Accuracy ±30mV (Ta=25℃)
- **Short Circuit Detection Voltage**
  - Typ. 0.9V (V_{DD} = 3.300V)
  - Accuracy ±300mV (Ta=25℃)
- **Low Current Consumption**
  - Standard working current
    Typ. 3.0uA (V_{DD} = 3.500V, Ta=25℃)
  - With auto wake up
    Typ. 0.5uA (V_{DD} = 1.8V, Ta=25℃)
- **Auto Wake up function is allowed**
- **0V charge function is allowed**
- **Small Package**
  - DFN2.2*2.9-6LT
- **FET general characteristics**
  - V_{DS}=20V
  - $R_{SS(ON)}$<40 mΩ (V_{GS}=3.7V,I_D=1A)
  - ESD Rating: 2000V HBM

Typical Application Circuits



R_1 and C_1 are to stabilize the supply voltage of the BP8261HX. 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 BP8261HX.

Recommended values of these elements are as follows:

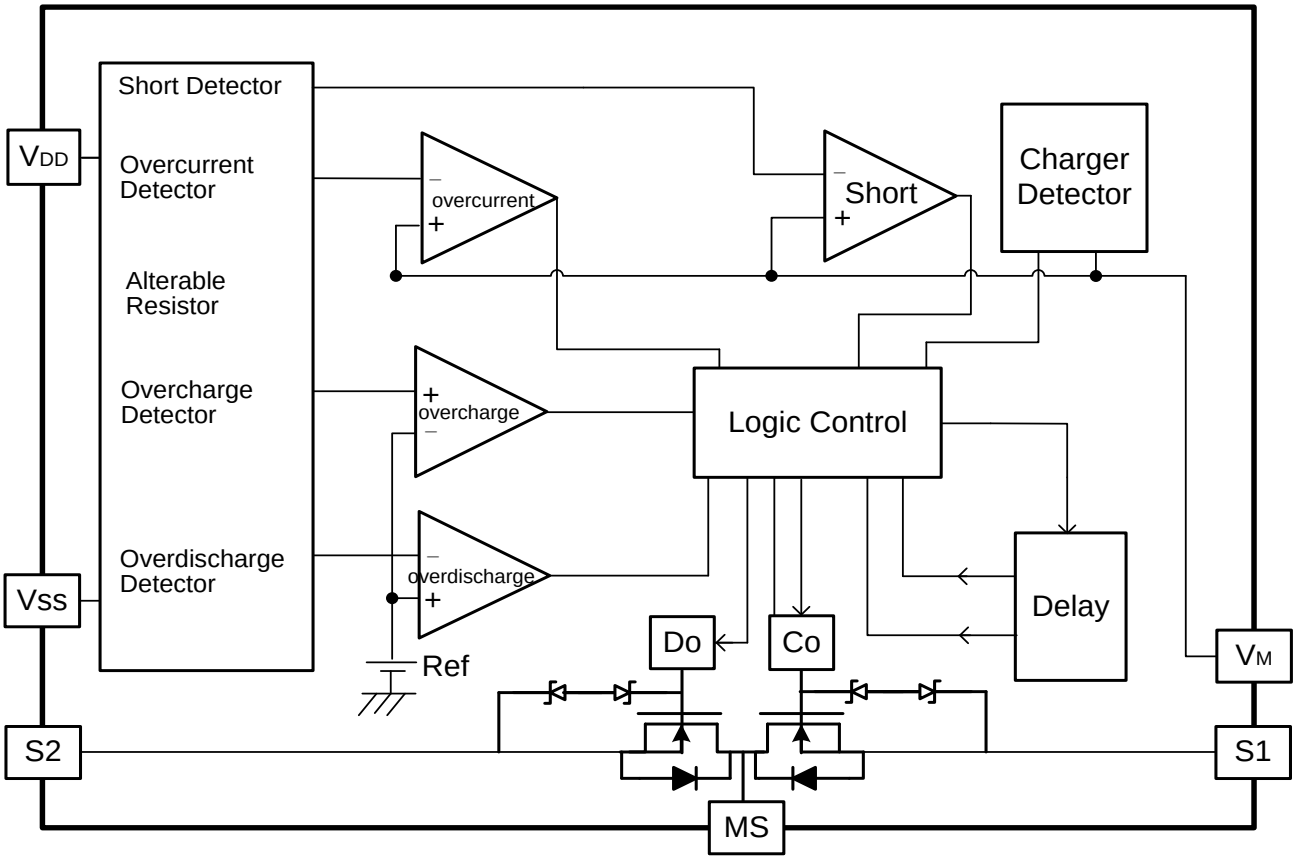
- R_1＜1KΩ. A larger value of R_1 results in higher detection voltage, introducing errors.
- 1.5KΩ＜R_2＜4KΩ. A larger value of R_2 possibly prevents resetting from Overdischarge even with a charger.
- R_1+ R_2＞1.6KΩ. Smaller values may lead to power consumption over the maximum dissipation rating of the BP8261HX.

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

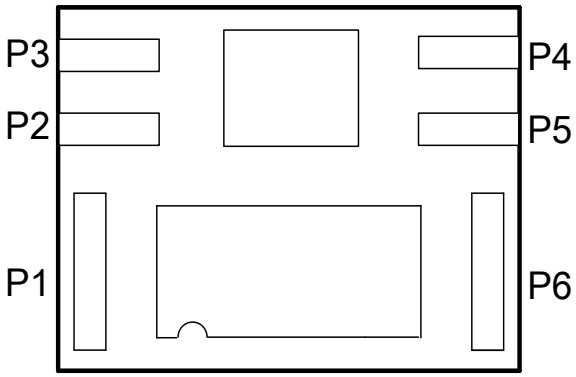
Marking Contents

Part number	Marking	Package	Quantity perreel
BP8261HX	VBEB	DFN2.2*2.9 - 6LT	3000

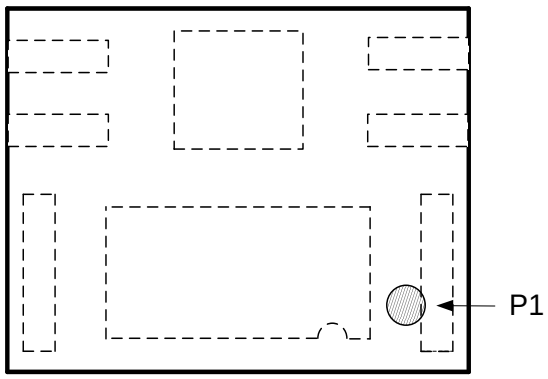
Block Diagram



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

(T_{OPT}=25°C unless otherwise specified)

Symbol	Item	Conditions	Min.	TYP.	Max.	Unit
DETECTION VOLTAGE AND DELAY TIME						
Vdet1	Overcharge Detection Voltage		4.375	**4.425**	4.475	V
Vrel1	Release Voltage For Overcharge Detection		4.155	**4.225**	4.295	V
Vdet2	Overdischarge Detection Voltage		2.370	**2.470**	2.570	V
Vrel2	Release Voltage For Overdischarge		2.950	**3.100**	3.250	V
Vdet3	Discharge Overcurrent Detection Voltage	V_{DD} = 3.30V	0.120	**0.150**	0.180	V
Vshort	Short Protection Voltage	V_{DD} = 3.30V	0.6	**0.9**	1.2	V
Tvdet1	Overcharge Detection Delay Time	V_{DD} = 4.0V→4.5V	1.02	**1.28**	1.54	s
Tvdet2	Overdischarge Detection Delay Time	V_{DD} = 3.0→2.0V	-	**24**	100	ms
Tvdet3	Discharge Overcurrent Detection Delay Time	V_{DD} = 3.30V	-	**12**	20	ms
Tshort	Short Detection Delay Time	V_{DD} = 3.30V	-	**375**	550	us
OUTPUT VOLTAGE AND V_M INTERNAL RESISTANCE						
Vc_{OL}	CO Pin L Voltage	I_{OL}=50uA, V_{DD} =4.4V	0.150	**0.200**	0.250	V
Vc_{OH}	CO Pin H Voltage	I_{OH}=-50uA, V_{DD}=3.9V	3.750	**3.700**	3.650	V
V_{DOL}	DO Pin L Voltage	I_{OL}=50uA, V_{DD}=2.0V	0.050	**0.070**	0.090	V
V_{DOH}	DO Pin H Voltage	I_{OH}=-50uA, V_{DD} =3.9V	3.850	**3.830**	3.810	V
R_{VMD}	Resistance between V_M and V_{DD}	V_{DD}=2.0V, V_M=0V	150	**300**	600	KΩ
R_{VMS}	Resistance between V_M and V_{SS}	V_{DD}=3.3V, V_M=1V	60	**130**	260	KΩ
OPERRATION VOLTAGE AND CURRENT CONSUMPTION						
V_{DD}	Operating Input Voltage	V_{DD}-Vss	1.6	**V_{DD}**	7.0	V
V_M	Operating Input Voltage	V_{DD}-V_M	1.5	**-**	18.0	V
I_{DD}	Supply Current	V_{DD} = 3.5V, V_M = 0V	-	**3.0**	6.0	uA
$I_{STANDBY}$	Standby Current(with Auto wake up)	V_{DD} =VM= 1.8V	-	-	0.5	uA

Absolute Maximum Ratings

(Ta=25ºC,V_{SS}=0 V)

Item	Symbol	Ratings	Unit
Supply Voltage	V_{DD}	-0.3 to 7	V
V_M Pin Input Voltage	V_M	V_{DD} -18 to V_{DD} +0.3	V
Gate-Source Voltage	V_{GS}	±10	V
Drain- Source Voltage	V_{DS}	20	V
Drain Current	ID	6	A
Co Pin Output Voltage	V_{CO}	V_{DD} -18 to V_{DD} +0.3	V
Do Pin Output Voltage	V_{DO}	Vss-0.3 to V_{DD} +0.3	V
Power Dissipation	Pd	150	mW
Operating Temperature Range	Topt	-30 to 80	℃
Storage Temperature Range	Tstg	-55 to 125	℃

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

Electrical Characteristics

(25 ºC,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}	0.60	0.74	1.20	V	Is=1.0A , V_{GS}=0V

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 V_{SS} 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),discharging is stopped. It calls overcharge protection.

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 V_{SS}, V_{DD} becomes lower than the Overcharge Release Voltage (Vrel1) ,the charge control FET turns on.

(2) When a charger is disconnected with the battery pack and a load is connected, 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. It calls overdischarge protection.

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 V_{SS} and V_{DD}.

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.

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. $V_M < Vdet3$, 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 the Short Protection Detection Voltage (Vshort) is far higher than Vdet3. 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. $V_M <$ Vdet3, 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.

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) 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 VM floating under overdischarge condition, the current I_{DD} flowing through V_{DD} pin is the power down current consumption ($I_{STANDBY}$).

(5) Overcharge detection delay time and overdischarge detection 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 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.

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

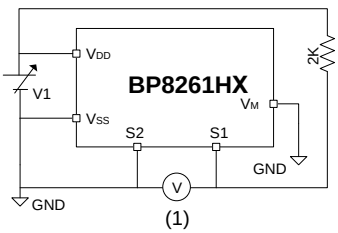
If V2 increases to be Vdet3 or over Vdet3 and keeps the condition for some time, the discharging control FET will turn off, Vs_1=V1. The time is called Discharge Overcurrent Delay Time. It is used to judge whether Discharge Overcurrent happens indeed.

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.

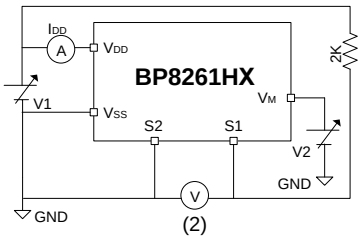
(7) Internal resistance V_M-V_{DD} and V_M-V_{SS} (Test circuit 4)

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)



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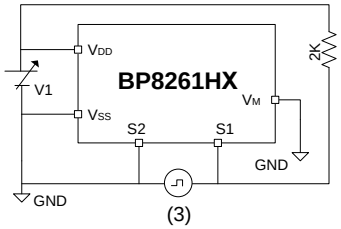

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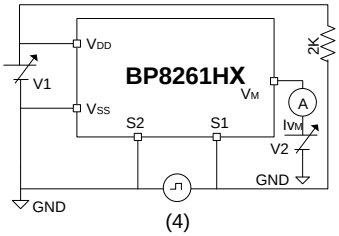
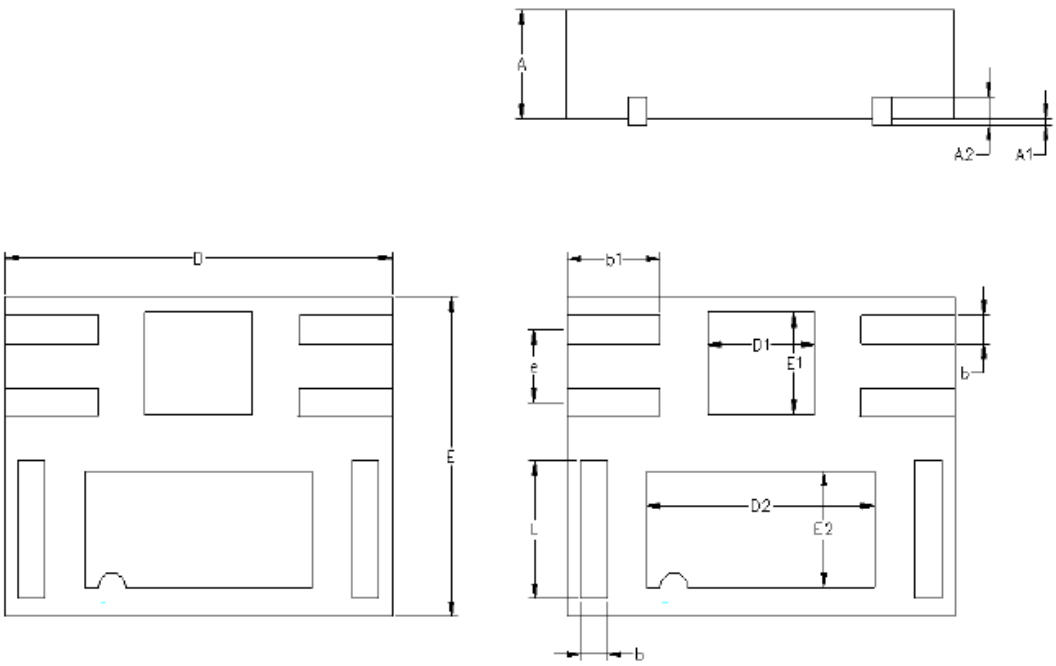


(4)

Package Outline

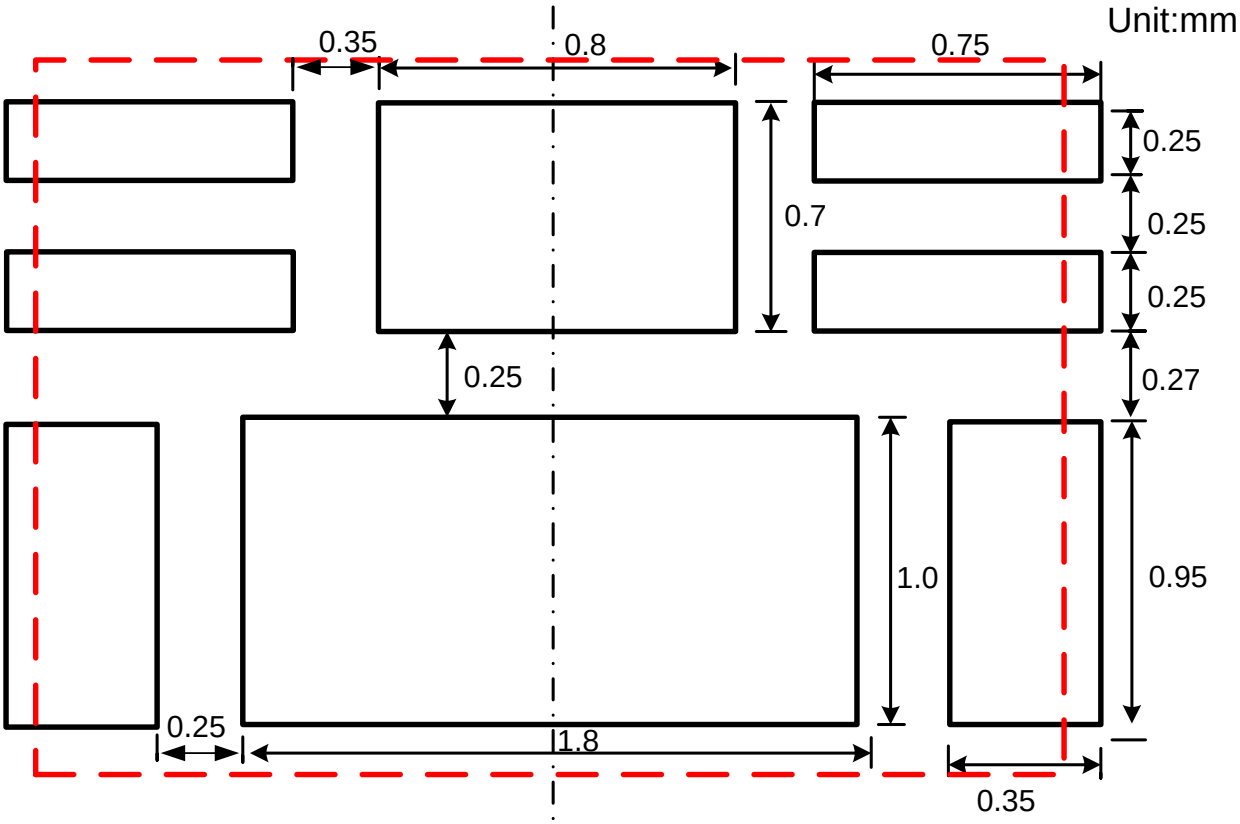
DFN 2.2*2.9-6LT



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

PCB Layout



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