

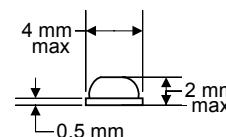
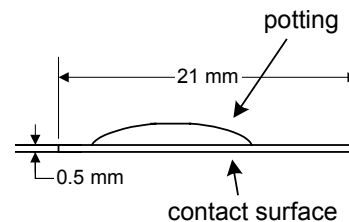
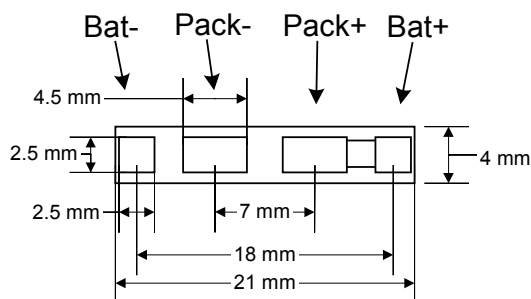
## Panther Lithium Battery Protection Module

The Panther module is a Lithium battery protection circuit, which is designed to enhance the operating life of a one-cell rechargeable battery pack. Cell protection features include internally trimmed charge and discharge voltage limits as well as charge and discharge current limit detection. The voltage and current ratings are designed for the use in battery packs for portable phones, paging systems, music players and other portable equipment such as "Bluetooth" applications.

### Features

- Continuous battery voltage and current monitoring
- Trimmed charge and discharge voltage limits
- Temperature dependant charge and discharge current limit detection
- Short circuit protected
- No external elements needed
- Low resistance power MOS switches
- Small PCB footprint
- Very small module height due to COB and SMD assembly

### Structure and Dimensions



Pad material: flash gold  
PCB material: FR4



# PRELIMINARY EM MICROELECTRONIC-MARIN SA

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## Electrical Characteristics

### Absolute Maximum Ratings

PARAMETER	Symbol	MIN	TYP	MAX	UNITS
Supply voltage	$V_{PACK+}$	-1.3		9.0	V
Storage Temperature	$T_{store}$	-65		150	°C
Operating temperature	$T_A$	-20		80	°C

### Operating Conditions

#### Supply voltage and current consumption

PARAMETER	Symbol	CONDITIONS	MIN	TYP	MAX	UNITS
Supply voltage	$V_{PACK+}$		1.3	3.6	8.5	V
Current consumption	$I_{dd}$	@ 4.0V, FET ON		10	12	μA
Sleep mode	$I_{dd}$	@ 2.2V, FET OFF		3.7	5	μA
Continuous current	$I_{cont}$	@ 20°C, -25mA/°C	2.0			A
Current limit	$I_{max}$	@ 20°C, -25mA/°C	2.5	3.0	4.0	A
Power switch on-resistance	$R_i$	@ I = 2A		50	65	mΩ

#### State transitions levels

PARAMETER	Symbol	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Panther -4.25</b>						
Overvoltage high limit	$V_{ovh}$	@ 20°C, +0.9mV/°C	4.20	4.25	4.30	V
Overvoltage low level	$V_{ovl}$		3.80	3.90	4.00	V
Undervoltage high level	$V_{uvh}$		3.40	3.50	3.60	V
Undervoltage low limit	$V_{uvl}$		2.30	2.37	2.45	V
<b>Panther -4.35</b>						
Overvoltage high limit	$V_{ovh}$	@ 20°C, +0.9mV/°C	4.30	4.35	4.40	V
Overvoltage low level	$V_{ovl}$		3.85	4.00	4.10	V
Undervoltage high level	$V_{uvh}$		3.45	3.60	3.70	V
Undervoltage low limit	$V_{uvl}$		2.35	2.45	2.55	V

#### V<sub>dd</sub> backup duration

PARAMETER	Symbol	CONDITIONS	MIN	TYP	MAX	UNITS
Backup time of chip supply	$T_{back}$	$C_{Backup} = 1 \mu F$	100	200		ms

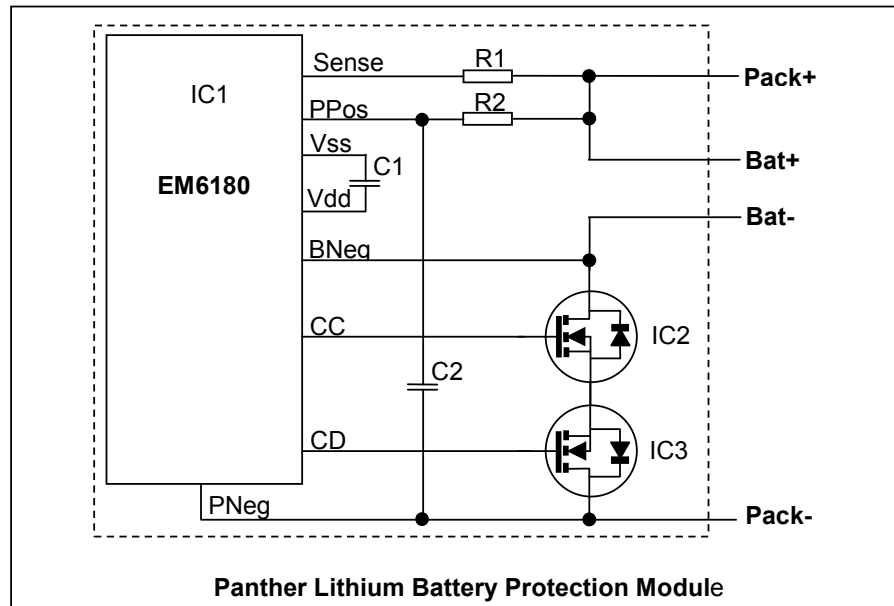
#### Reaction times

PARAMETER	Symbol	CONDITIONS	MIN	TYP	MAX	UNITS
Overvoltage dead time	$t_{oh}$		26	32	38	ms
Undervoltage dead time	$t_{uv}$		26	32	38	ms
Overcurrent dead time	$t_{oc}$		6	12	14	ms
Short-circuit dead time	$t_{sh}$	I > 20A		1.5	2	ms

#### Overcurrent protection test period

PARAMETER	Symbol	CONDITIONS	MIN	TYP	MAX	UNITS
Testperiod	$T_{iover}$	Charge mode User mode		4 2		s
Number of tests to recover normal function	$N_{tests}$	Charge mode User mode		unlimited 64		

### Electrical Schematic



### Functional Description

#### Overcharge

If the battery voltage rises over the overvoltage high limit, charging is stopped by opening the power switch. The switch is closed again when:

- The battery voltage falls below overvoltage low level (self discharge of the battery).
- A discharge current is detected.

#### Overdischarge

If the battery voltage falls under the undervoltage low limit, discharging is stopped by opening the power switch. The switch is closed again when:

- The battery voltage rises over undervoltage high level.
- A charge current is detected.

### Charge Overcurrent

If an overcurrent is detected, charging is interrupted by opening the power switch. After 4 seconds, the switch is closed again. If an overcurrent is detected again, the power switch reopens. This process is repeated every 4 seconds until:

- The overcurrent is removed.
- The battery voltage rises over the overcharge voltage limit.

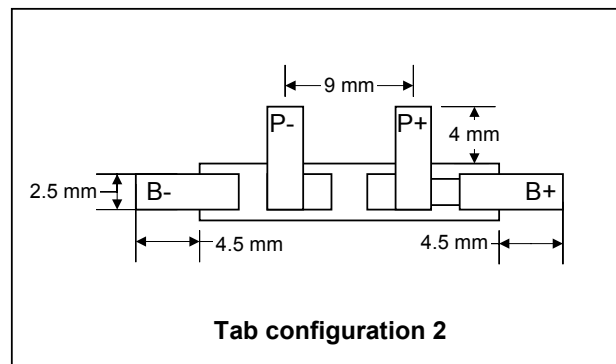
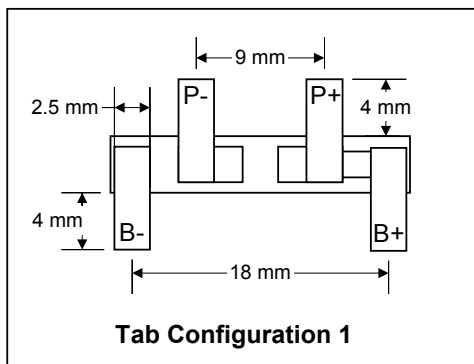
### Discharge Overcurrent or short circuit

If an overcurrent is detected, discharging is interrupted by opening the power switch. The overcurrent counter is incremented. After 2 seconds the switch is closed again. If an overcurrent is detected again, the power switch reopens. This process is repeated every 2 seconds until:

- The overcurrent is removed.
- The battery voltage falls under the discharge voltage limit.
- The overcurrent still exists after 64 attempts (which corresponds to a short circuit of 2 minutes). In this case the power switch will be shut down permanently in order to interrupt the short circuit. The switch will be closed again if a charge current is detected.

## Tabs

Nickel connection tabs are available to customer requirements. The following standard tab configurations exist:



The tab material is 99% Ni, 0.1mm thick.



# PRELIMINARY

## EM MICROELECTRONIC-MARIN SA

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### Ordering Information

EMLB180MD 0 D – 4.35

#### Overvoltage Level

4.25	Overvoltage high 4.25V
4.35	Overvoltage high 4.35V

#### Delivery Form

C	Bulk
D	Trays
F	Matrix

#### Tab Configuration

0	no tabs
1	tab configuration 1
2	tab configuration 2
X1	custom tabs, please contact EM Sales

Panther Lithium-battery Protection Module

### Updates

Date, Name Version	Chapter concerned	Old Version (Text, Figure, etc.)	New Version (Text, Figure, etc.)

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