MAS6260

Li-ion and LiPo battery charger with LDO

This is advance information on a new product under development. Micro Analog Systems Oy reserves the right to make any changes without notice.

- **Both lithium ion and lithium polymer battery charging**
- **150mA low-dropout voltage regulator**
- **Available in DFN-12 and CSP packages**

DESCRIPTION

MAS6260 is a linear single cell charger IC for both Li-ion and LiPo batteries. It has integrated low-dropout regulator (LDO) and several battery protection functions.

MAS6260 uses a CC/CV algorithm to charge the battery. The fast-charge current can be programmed using an external resistor. Pre-charge current and termination current are scaled accordingly. The floating voltage value options available are 4.2 V, 4.35V and 4.4V.

The input supply voltage is normally used to charge the battery and provide power to the LDO regulator and SYS output. When a valid input voltage is not present and the battery is not empty, the device automatically switches to battery power.

MAS6260 integrates overcharge, overdischarge and overcurrent protection circuitry to prevent the battery from being damaged under fault conditions. It also features a charger enable input to stop the charging process when battery overtemperature is detected by external circuitry.

When the shutdown mode is activated, the battery power consumption is reduced to typ 20 nA to maximize battery life during shelf time or shipping. The device is available in a DFN-12 3x3x0.75mm and 1.31x1.66mm CSP packages.

FEATURES

- Charges single-cell Li-Ion batteries with CC-CV algorithm and charge termination
- Charge current programmable up to 400 mA
- 1% accuracy on floating voltage
- 150mA LDO regulator with 3.1V Output Voltage
- Automatic power path management
- Battery overcharge protection
- Battery overdischarge protection
- Overcurrent protection at IN, SYS and LDO
- Short-circuit protection at SYS and LDO
- Charging timeout
- Very low battery leakage in overdischarge / shutdown mode
- Low quiescent current
- Charge/fault status output
- Charger enable input
- Thin 3x3x0.75mm DFN-12 package
- 1.31x1.66mm CSP package

APPLICATIONS

- Sport watches
- Wearable devices
- Fitness and medical accessories
- Portable low-power rechargeable battery devices

BLOCK DIAGRAM

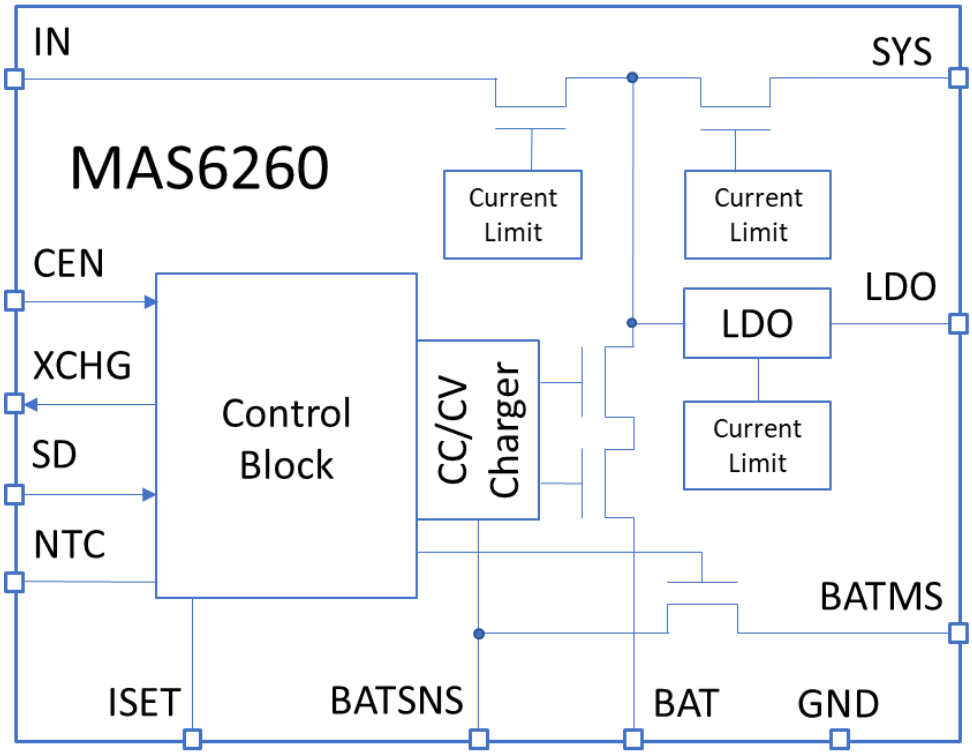


Figure 1. MAS6260 battery charger block diagram

ABSOLUTE MAXIMUM RATINGS

All voltages with respect to ground.

Parameter	Symbol	Conditions	Min	Max	Unit
Supply voltage	V_{IN}		-0.3	6.5	V
LDO pin voltage	V_{LDO}		-0.3	4.5	V
SYS pin voltage	V_{SYS}		-0.3	6.5	V
XCHG pin voltage	V_{XCHG}		-0.3	6.5	V
Control pin voltages	V_{CEN}		-2.0	6.5	V
	V_{SD}		-0.3	6.5	V
ISET pin voltage	V_{ISET}		-0.3	6.5	V
NTC pin voltage	V_{NTC}		-0.3	6.5	V
Battery pin voltages	V_{BAT}, V_{BATSNS}		-0.3	6.5	V
BATMS pin voltage	V_{BATMS}		-0.3	V_{BAT} +0.3	V
Storage temperature	T_{STG}		-40	+125	°C
ESD Rating	V_{HBM}	Human Body Model (HBM)	±1		kV
	V_{CDM}	Charged-Device Model (CDM)	±750		V

Note: Stresses beyond the values listed may cause a permanent damage to the device. The device may not operate under these conditions, but it will not be destroyed.

THERMAL INFORMATION

All voltages with respect to ground.

Parameter	Symbol	Conditions	Value	Unit
Junction to ambient thermal resistance	$R_{\theta JA}$	DFN-12 package	49	°C/W

RECOMMENDED OPERATING CONDITIONS

All voltages with respect to ground.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating junction temperature	T_J		-40		+125	°C
Operating ambient temperature	T_A		-40	+27	+85	°C
Operating supply voltage	V_{IN}		4.55	5.0	5.4	V

ELECTRICAL CHARACTERISTICS

T_A = -40°C to +85°C, typical values at T_A = 27°C, V_{IN} = 5.0 V, V_{BAT} = 3.6 V, R_{ISET} = 1 kΩ, C_{BAT} = 4.7 uF, C_{IN} = C_{SYS} = C_{LDO} = 2.2 uF. SD = low, CEN = high; unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Battery floating voltage	V_{FLOAT}	MAS6260BA1 MAS6260BA2 MAS6260BA3	4.158 4.307 4.356	4.2 4.35 4.4	4.242 4.394 4.444	V
Input overvoltage protection	V_{INOVP}	V_{IN} rising	5.55	5.75	6.00	V
Input overvoltage protection hysteresis	V_{INOVPH}	V_{IN} falling		150		mV
Undervoltage lockout	V_{UVLO}	V_{IN} falling	4.00	4.15	4.30	V
Undervoltage lockout hysteresis	V_{UVLOH}	V_{IN} rising		250		mV
IN pin supply current	I_{IN}	Charger disable mode (CEN=low) I_{SYS}=I_{LDO}=0A		245		µA
		Charging, V_{HOT}<V_{NTC}<V_{COLD}, including R_{ISET} current		3.5		mA
BAT pin supply current	I_{BAT}	Battery-powered mode (1) (V_{IN}<V_{UVLO}), I_{LDO}=0A		16		µA
		VIN-powered mode (V_{UVLO} <V_{IN}<V_{INOVP}) Standby, no charging (1)		8	20	µA
		Shutdown mode (SD=high)		20		nA
		Overdischarge mode (V_{BAT}<V_{ODC}, V_{IN}<V_{UVLO})		20		nA
Fast-charge current (2)	I_{FAST}	R_{ISET} = 487Ω, CC mode R_{ISET} = 1kΩ, CC mode R_{ISET} = 5.36kΩ, CC mode R_{ISET} = 9.31kΩ, CC mode R_{ISET} = 12.1kΩ, CC mode R_{ISET} = 17.8kΩ, CC mode	36	400 200 40 25 20 15	44	mA
Pre-charge current	I_{PRE}	V_{BAT}<3V, charger active		20		% I_{FAST}
End-of-charge current	I_{END}	Charging in CV mode		5		% I_{FAST}
Fast-charge programming resistor range	R_{ISET}		0.5		18	kΩ
ISET pin regulated voltage	V_{ISET}			0.5		V
Pre-charge to fast-charge battery voltage threshold	V_{PRE}	Charger active		2.9		V

Note 1: Current through external voltage division resistors (RDIV1, RDIV2) not included.

Note 2: I_{FAST} [mA] = 4.05 + 193.8 / R_{ISET} [kΩ]. Valid range of RISET resistor values range from 0.5kΩ to 18kΩ.

ELECTRICAL CHARACTERISTICS

T_A = -40°C to +85°C, typical values at T_A = 27°C, V_{IN} = 5.0 V, V_{BAT} = 3.6 V, R_{ISET} = 1 kΩ, C_{BAT} = 4.7 uF, C_{IN} = C_{SYS} = C_{LDO} = 2.2 uF. SD = low, CEN = high; unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Battery voltage overcharge threshold	V_{OCHG}	V_{BAT} rising MAS6260BA1 MAS6260BA2 MAS6260BA3	 4.257 4.406 4.455	 4.30 4.45 4.50	 4.343 4.495 4.545	V
Battery voltage overdischarge threshold	V_{ODC}	V_{IN}<V_{UVLO}, I_{LDO}=100mA	2.75	2.80	2.85	V
Battery voltage overdischarge threshold hysteresis	V_{ODCH}			200		mV
Battery voltage overdischarge release threshold	V_{ODCR}			3		V
Input to battery on-resistance	R_{ON-IB}			1.0	1.7	Ω
Battery to SYS on-resistance	R_{ON-BS}	I_{SINK}=100mA		0.7	1.3	Ω
BATSNS to BATMS on-resistance	$R_{ON-BATMS}$	I_{SINK}=500uA		12		Ω
Output low level (XCHG)	V_{OL}	I_{SINK}=5mA			0.4	V
Logic low input level (SD, CEN)	V_{IL}	V_{LDO} = 3.1V			0.4	V
Logic high input level (SD, CEN)	V_{IH}	V_{LDO} = 3.1V	1.6			V
CEN pull-up resistor	R_{UP}			350		kΩ
SD pull-down resistor	R_{DOWN}			350		kΩ
LDO output voltage	V_{LDO}	I_{LDO} = 1mA	3.02	3.1	3.18	V
LDO static load regulation	$V_{OUT-LOAD}$	I_{LDO} = 1mA to 150mA		±0.01		%/mA
LDO current limit	$I_{LDO-LIM}$			300		mA
Input switch current limit	I_{INLIM}			420		mA
System switch current limit	$I_{SYS-LIM}$			220		mA
Battery discharge overcurrent protection (1)	I_{BATOCP}	V_{IN} < V_{UVLO} or V_{IN} > V_{INOVP} (powered from battery)		520		mA
LDO short-circuit protection threshold	V_{SCLDO}	V_{IN} < V_{UVLO} or V_{IN} > V_{INOVP} (powered from battery)		0.7		V
SYS short-circuit protection threshold	V_{SCSYS}	V_{IN} < V_{UVLO} or V_{IN} > V_{INOVP} (powered from battery)		V_{BAT}-0.8		V
NTC bias current	I_{NTCB}	V_{NTC} = 0.25V	40	50	60	µA
Thermal management hot threshold	V_{HOT}	Increasing NTC temperature		0.26		V
Thermal management cold threshold	V_{COLD}	Decreasing NTC temperature		1.32		V

Note 1: Battery discharge overcurrent protection is implemented by SYS and LDO pin current limitations; I_{BATOCP} = $I_{SYS-LIM}$ + $I_{LDO-LIM}$ = 220mA+300mA=520mA typ

ELECTRICAL CHARACTERISTICS

T_A = -40°C to +85°C, typical values at T_A = 27°C, V_{IN} = 5.0 V, V_{BAT} = 3.6 V, R_{ISET} = 1 kΩ, C_{BAT} = 4.7 uF, C_{IN} = C_{SYS} = C_{LDO} = 2.2 uF. SD = low, CEN = high; unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Hot/cold temperature threshold hysteresis (1)	T_{HYST}	10 kΩ NTC, β = 3370		3		°C
Thermal shutdown die temperature	T_{SD}	Rising temperature	154	160	168	°C
Thermal shutdown hysteresis	T_{HYS}			15		°C
XCHG pin toggling frequency	f_{FAULT}			1		Hz
Input voltage connection to charging-start delay	t_{CHGD}	V_{BAT}=3.5V, R_{NTC}=10k		250		ms
Overcharge detection delay	t_{OCD}	V_{BAT}>V_{OCHG}, V_{UVLO}<V_{IN}<V_{INOVP}		1.4		s
Overdischarge detection delay	t_{ODD}	V_{BAT}<V_{ODC}, V_{IN}<V_{UVLO} or V_{IN}>V_{INOVP}		90		ms
Discharge overcurrent detection delay	t_{DOD}	I_{BAT}> I_{BATOCP}, V_{IN}<V_{UVLO} or V_{IN}> V_{INOVP}		14		ms
Pre-charge to fast-charge transition deglitch time	t_{PFD}	Rising		125		ms
Fast-charge to pre-charge fault deglitch time	t_{FPD}			10		ms
End-of-charge deglitch time	t_{END}			90		ms
Pre-charge timeout	t_{PRE}	V_{BAT}<V_{PRE}, charging		1800		s
Fast-charge timeout (2)	t_{FAST}			21600		s
Battery temperature transition deglitch time	t_{NTCD}			90		ms
CEN/SD valid input pulse width	t_{PW}		30			ms
Thermal protection deglitch time	t_{THPD}			10		ms

Note 1: NTC thermistor Mitsubishi TH05-3H103F
Note 2: 21600 s = 6 h

OPERATION DESCRIPTION

♦ Power-on

In shutdown mode the LDO and SYS outputs are not supplied and the device draws only a very small current from battery. In order to turn the device on a valid input voltage (V_{IN}>4.55V) must be connected to the IN input. To enable charging the CEN pin must be either floating or tied high during the power-on sequence.

♦ Battery charger

The MAS6260 is suitable for charging single cell Li-Ion/Polymer batteries from 4.2V up to 4.4V voltage. See page 13 ordering information for available battery V_{FLOAT} voltage options. The charging uses constant current constant voltage (CC-CV) algorithm. See figure 2 illustrating MAS6260 charging cycle.

When valid input voltage is connected to the IN input the MA6260 starts charge cycle and pulls XCHG charging indicator output low. If battery is deeply discharged (V_{BAT}<2.9V) the charging is started with a low pre-charge current (I_{PRE} = 20% I_{FAST}). If the battery voltage does not reach pre-charge to fast-charge voltage threshold V_{PRE}=2.9V within 1800s pre-charge timeout the device stops charging and enters pre-charge fault state. See table 1 for XCHG output fault state signalling.

When battery voltage reaches the V_{PRE}=2.9V the charge current is increased to I_{FAST} current level. The constant current (CC) charging is continued until battery voltage V_{BAT} reaches V_{FLOAT} voltage. When battery voltage reaches V_{FLOAT} the device switches to constant voltage (CV) charging mode. In this mode battery voltage is regulated to constant V_{FLOAT} voltage and battery charging current is monitored. The charging is continued until charging current drops to I_{END} which is typ 5% of I_{FAST}. The XCHG output is set to high impedance state after the charging has finished. If the I_{END} charging current limit is not reached within fast-charge timeout period of 21600s (6 hours) the device enters fast-charge fault state. See table 1.

The battery temperature is monitored via NTC resistor throughout charging process. See next chapter Battery temperature monitoring for details.

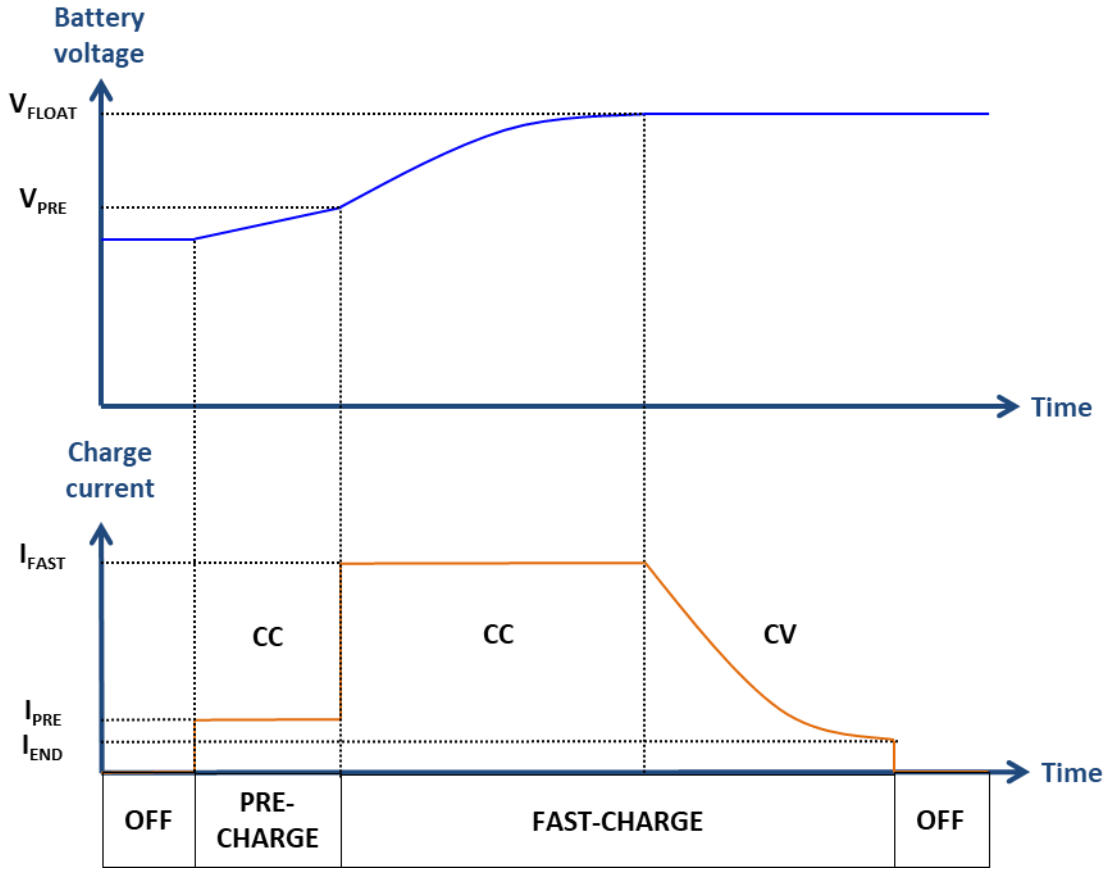


Figure 2. MAS6260 CC-CV algorithm charging cycle

Table 1. MAS6260 charging and fault state signalling at XCHG output

Device state	XCHG output state
Not charging	High Z
Charging	Low
Battery voltage below V_{PRE} fault after fast-charge started	Toggling at 1Hz with 50% duty cycle
Charging timeout fault (pre- or fast-charge)	Toggling at 1Hz with 62.5% duty cycle
Overcharge fault	Toggling at 1Hz with 75% duty cycle
Battery temperature fault	Toggling at 1Hz with 87.5% duty cycle

Note 1: For example in 25% duty cycle the open drain output XCHG pin is 25% of time high by external pull-up resistor (XCHG pin at high-Z state) and 75% of time low (internal pull down).

♦ Battery temperature monitoring

External NTC thermistor (R_{25}=10kΩ, β=3370 e.g. Mitsubishi TH05-3H103F) is used to monitor battery temperature throughout charging process. If battery temperature exceeds normal charging temperature range of 0°C…+45°C the charging is put on hold and XCHG output starts signalling battery temperature fault signal (see table 1). Charging and normal mode is resumed when battery temperature returns to valid charging temperature range with additional 3°C temperature hysteresis margin.

♦ Battery overcharge protection

When valid input voltage (V_{IN}>4.55V) is connected the battery overcharge protection feature is active. If battery voltage exceeding battery voltage overcharge threshold (V_{OCHG}) is detected the current path from input to the battery is blocked and device enters overcharge fault state. See table 1 for XCHG output fault state signalling. When the device is in overcharge state but switched to battery power (V_{IN} < V_{UVLO}) the SYS and LDO voltages are switched off. Resuming normal operation requires disconnecting and reconnecting proper input voltage voltage (V_{IN} > V_{UVLO}) after the battery voltage has gone below V_{OCHG}.

♦ Battery over-discharge protection

When device is running from battery power (valid input voltage not available) the battery voltage is monitored to avoid over-discharge. If the battery voltage falls below V_{ODC} = 2.80V typ for more than t_{ODD} = 90ms typ the device turns off. This corresponds to shutdown mode in which current consumption is reduced to typ 20nA. See further information in chapter Shutdown mode.

♦ Overcurrent protection

The MAS6260 has overcurrent protection at the input (IN) and at both outputs (SYS, LDO). This is achieved by current limitations as follows.

I_{IN-LIM}=420mA typ

$I_{SYS-LIM}$=220mA typ

$I_{LDO-LIM}$=300mA typ

These current limitations cause following limitations to battery charge and discharge currents.

Maximum battery charge current (powered from IN input):

I_{BAT} max charge = $I_{IN-LIM} – I_{SYS} – I_{LDO}$

Maximum battery discharge overcurrent protection (powered from battery):

I_{BAT} max discharge = $I_{BATOCP} = I_{SYS-LIM} + I_{LDO-LIM}$ = 220mA+300mA=520mA typ

If SYS and LDO pin current limitations last for more than typ t_{DOD}=14ms the device is disabled and valid input voltage (V_{IN}>4.55V) must be connected to restore normal operating conditions.

♦ SYS and LDO short-circuit protection

When powered from battery (V_{IN} < V_{UVLO} or V_{IN} > V_{INOVP}) the SYS and LDO pins are short-circuit protected to prevent battery getting discharged at such fault condition. Short-circuit protection is triggered when either SYS pin voltage falls below V_{SCSYS} or LDO pin voltage below V_{SCLDO} for typ 4ms. Returning to normal operation requires removal of the short-circuit condition and disconnecting and reconnecting proper input voltage voltage (V_{IN} > V_{UVLO}).
When powered from VIN (V_{UVLO} < V_{IN} < V_{INOVP}) the short-circuit protection is inactive but SYS and LDO currents are limited to $I_{SYS-LIM}$ =220mA typ and $I_{LDO-LIM}$ =300mA typ respectively by current limitation circuitry.

♦ Input (IN) overvoltage protection

In case input voltage (V_{IN}) rises over V_{INOVP} = 5.75V typ voltage threshold the device switches to battery power to protect any external circuit connected to SYS output. Device supply and SYS output voltage are switched back to IN pin voltage when the input voltage returns into normal input voltage range.

♦ Shutdown mode (SD pin)

SD pin is a digital input pin with internal 350 kΩ pull-down which selects normal operating mode. The MAS6260 can be set to shutdown mode by giving high level signal to SD pin when there is no valid input voltage connected. In shutdown mode the device is turned off to reduce battery drain to minimal typ 20nA level. All outputs (SYS, LDO, BATMS) are switched off in this mode. This operating mode is useful for example during product storage to maintain battery charge. To restore normal operation valid input voltage must be connected.

♦ Thermal shutdown

The MAS6260 has protection against overheating which might take place in combination of high ambient temperature and internal heating due to power dissipation. The device is turned off if die temperature exceeds thermal shutdown temperature T_{SD} = +160°C typ. To restore normal operation the temperature has to drop below T_{SD_FALL} = +145°C typ and input voltage must be disconnected and reconnected.

♦ Reverse current protection

In case input voltage (V_{IN}) is lower than battery voltage (V_{BAT}) the current path from BAT to IN is blocked to prevent undesired discharge of the battery.

♦ SYS and LDO pin voltages

The SYS is input voltage for the low dropout (LDO) regulator. SYS and LDO output voltages depend on operating conditions of MAS6260. In battery power the SYS pin is at battery voltage (V_{BAT}) and when valid input voltage (V_{IN} > V_{UVLO}) is present it is at IN input pin voltage (V_{IN}). Table 2 illustrates SYS and LDO pin voltages at different operating conditions.

Table 2. SYS and LDO pin voltages

V_{IN}	V_{BAT}	V_{SYS}	V_{LDO}	Condition
> V_{UVLO} and < V_{INOVP}	Don't care	V_{IN} (1)	ON	VIN powered without any fault
< V_{UVLO}	< V_{ODC} (2)	OFF	OFF	Battery powered at battery overdischarge fault
< V_{UVLO}	> V_{ODC} (2)	V_{BAT} (1)	ON	Battery powered without any fault
> V_{INOVP}	< V_{ODC} (2)	OFF	OFF	VIN powered at input overvoltage and battery overdischarge fault
> V_{INVOP}	> V_{ODC} (2)	V_{BAT} (1)	ON	VIN powered at input overvoltage fault

Note 1: Voltage drop over internal MOSFET switch not included
Note 2: V_{ODCR} if shutdown mode or over-discharge protection has been activated

♦ CEN pin usage

CEN pin is a digital input pin with internal 350 kΩ pull-up to LDO which enables charging function. It can be left floating or tied high at power on. A logic low level at CEN pin disables the battery charger. By giving transition from high to low and then back high restarts the charger when the charge has been stopped for one of the following reasons.

- Charging timeout (either pre-charge or fast-charge phase)
- Batter voltage below VPRE fault after fast-charge has already started
- End-of-charge

The CEN pin has no effect if the charging cycle has been stopped by a battery overcharge condition.

If the charger is temporarily stopped because of the battery temperature being out of the normal range a logic low level on the CEN pin disable the charger and resets the charging timeout counters. If CEN is then driven high again the charger is restarted only if a no-fault condition is active and battery temperature is not out of range.

♦ BATMS pin usage

The MAS6260 has BATMS pin for monitoring battery voltage in the system. The battery voltage (V_{BAT}) is always available at BATMS pin except when device is shutdown during which it is switched off to keep battery drain at very low 20nA typ level. See figure 3 below for typical BATMS pin connection. There is an external voltage divider (RDIV1, RDIV2) used to scale down higher battery voltage to valid input voltage range of the system ADC which is in this example powered from the 3V LDO voltage.

APPLICATION DIAGRAM

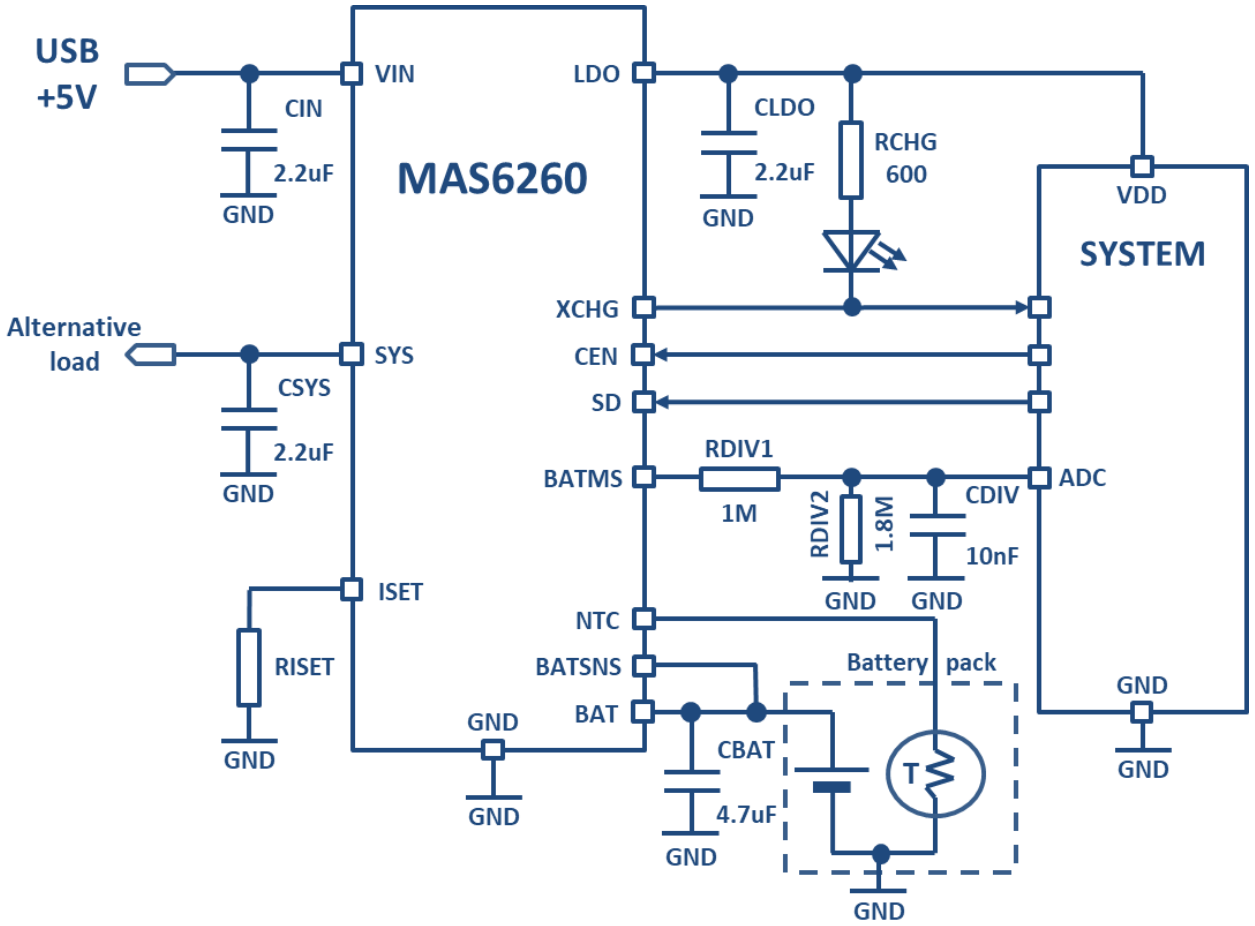


Figure 3. Battery charger application diagram

Table 3. Typical bill of materials (BOM)

Symbol	Value	Type	Description
CIN	2.2µF	Ceramic	Input supply voltage capacitor
CSYS	2.2µF	Ceramic	System output capacitor
CLDO	2.2µF (1)	Ceramic	LDO output capacitor
CBAT	4.7µF	Ceramic	Battery positive terminal capacitor
RISET	0.5kΩ–18kΩ	Film	Charge current programming resistor
RCHG	600Ω	Film	Charging / fault pull-up resistor
D1			Light emitting diode (LED)
RDIV1, RDIV2	See table 3	Film	Battery monitor resistor divider
CDIV	10nF	Ceramic	Battery monitor filter capacitor

Note 1: It is recommended to not exceed maximum 47µF capacitor value at LDO output to avoid potential regulator instability at high capacitive loads.

Figure 3 presents typical battery charger application circuit. In this example system is powered from the on-chip 3V LDO of the MAS6260. The system has control for the charger enable (CEN) and it can also trigger shutdown mode via SD pin to make product to enter storage mode. The system monitors charging process via XCHG output and BATMS battery voltage measurement pins. An external voltage divider (RDIV1, RDIV2) is needed to scale down higher battery voltage to valid input voltage range of the system ADC which is here powered from the 3V LDO voltage. Resistor divider impedance has been chosen to MΩ level to keep extra current consumption of the voltage divider in µA level. The voltage divider has CDIV=10nF filter capacitor to stabilize measured battery voltage during ADC sampling and to filter out disturbances from battery voltage. BATMS pin voltage divider output voltage (V_{DIV}) and battery current draw (I_{DIV}) are presented in equations 1-2.

$$V_{DIV} = \frac{V_{BAT}}{1+\frac{R_{DIV1}}{R_{DIV2}}}$$ Equation 1.

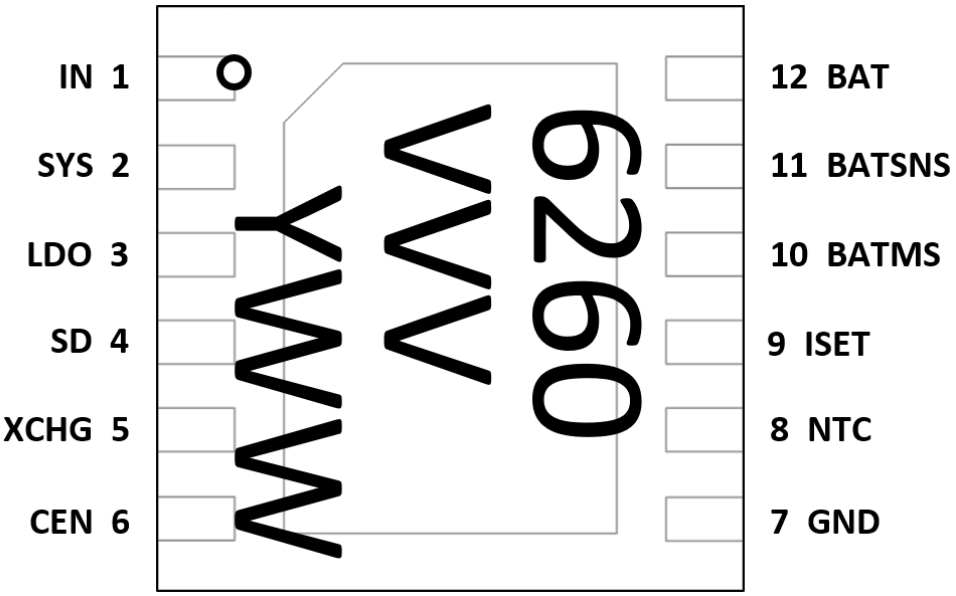
$$I_{DIV} = \frac{V_{BAT}}{R_{DIV1}+R_{DIV2}}$$ Equation 2.

Table 4 shows output voltage and battery current draw values of figure 3 voltage divider at battery voltage levels from 2.8V up to 4.5V.

Table 4. Output voltage (V_{DIV}) and current consumption (I_{DIV}) of voltage divider; R_{DIV1}=1MΩ and R_{DIV2}=1.8MΩ.

V_{BAT} [V]	V_{DIV} [V]	I_{DIV} [µA]
2.8	1.80	1.00
3.7	2.38	1.32
4.2	2.70	1.50
4.5	2.89	1.61

DEVICE OUTLINE CONFIGURATION



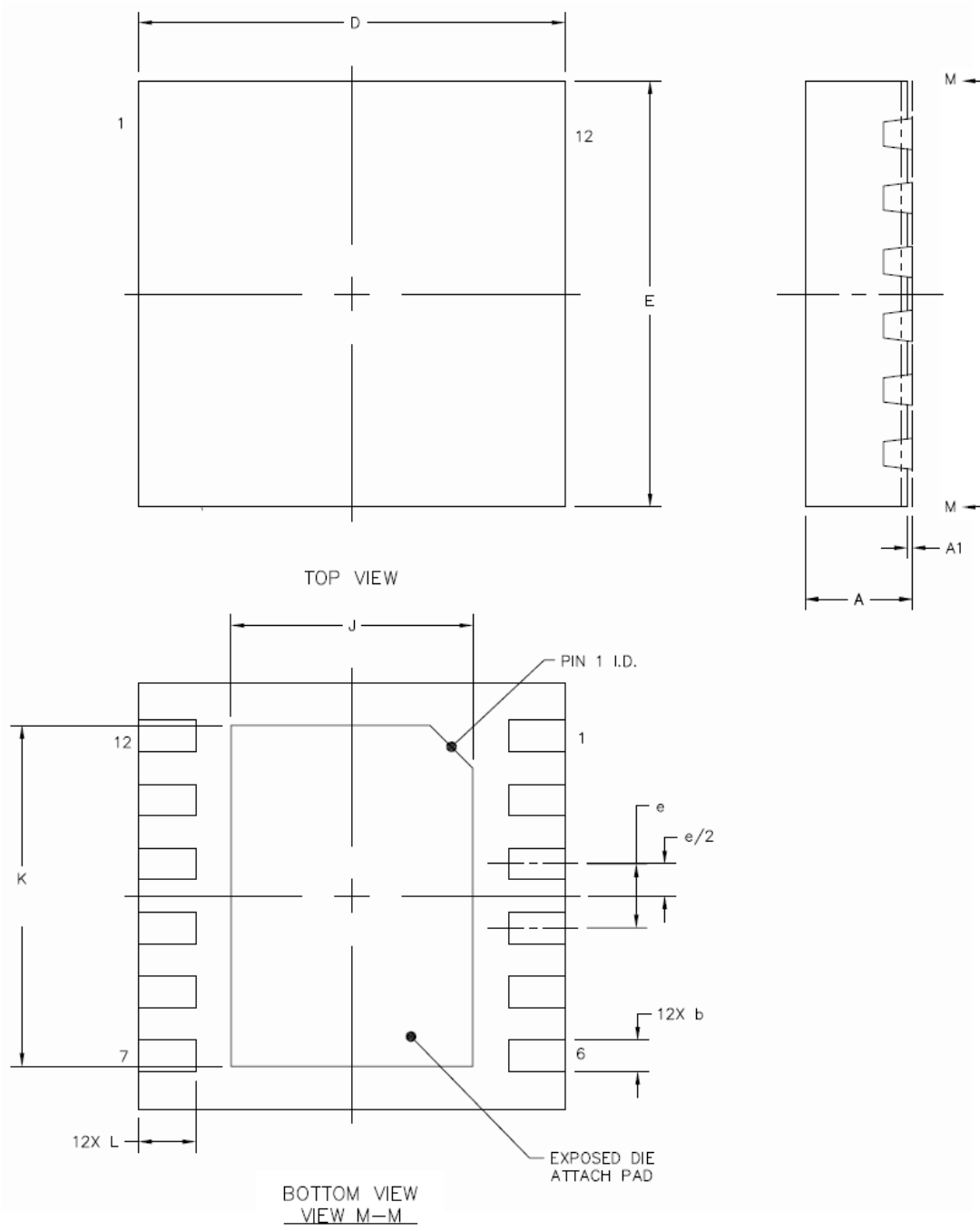
Top Marking Information:
6260 = Product Number
VVV = Version Number
YWW = Year Week

DFN-12 3x3x0.75 PIN DESCRIPTION

Pin Name	Pin	Type	Function	Note
IN	1	P	5V input supply voltage	
SYS	2	AO	System output	1
LDO	3	AO	3.1V LDO output	
SD	4	DI	Shutdown control input	2
XCHG	5	AO	Charging / Fault flag	3
CEN	6	DI	Charger enable pin	4
GND	7	G	Ground	
NTC	8	AIO	Battery temperature monitor pin	
ISET	9	AO	Fast-charge programming resistor	
BATMS	10	AO	Battery voltage measurement pin	
BATSNS	11	AI	Battery voltage sensing	5
BAT	12	P	Battery positive terminal	
EXP_PAD	-	G	Exposed thermal pad	6

G = Ground, P = Power, D = Digital, A = Analog, I = Input, O = Output
Note 1: In battery power SYS pin is at battery voltage V_{BAT}. When powered from IN pin the SYS is at V_{IN} voltage.
Note 2: Active HIGH (shutdown). Internal 350 kΩ pull-down.
Note 3: Open drain output, active LOW (charging in progress).
Note 4: Active HIGH (charging enabled). Internal 350 kΩ pull-up to LDO output.
Note 5: Connect as close as possible to the battery's positive terminal.
Note 6: On PCB the exposed thermal pad must be connected to GND plane using thermal vias functioning as thermal heat sink.

PACKAGE (DFN-12 3x3x0.75 MM) OUTLINE



Symbol	Min	Nom	Max	Unit
PACKAGE DIMENSIONS				
A	0.7	0.75	0.8	mm
A1	0	0.035	0.05	mm
b	0.17	0.22	0.27	mm
D	3 BSC			mm
E	3 BSC			mm
e	0.45 BSC			mm
J (Exposed.pad)	1.6	1.7	1.8	mm
K (Exposed.pad)	2.3	2.4	2.5	mm
L	0.35	0.4	0.45	mm

Dimensions do not include mold or interlead flash, protrusions or gate burrs.

DEVICE OUTLINE CONFIGURATION

	1	2	3
A	A1 BAT	A2 IN	A3 SYS
B	B1 BATSNS	B2 SD	B3 LDO
C	C1 ISET	C2 BATMS	C3 XCHG
D	D1 GND	D2 NTC	D3 CEN

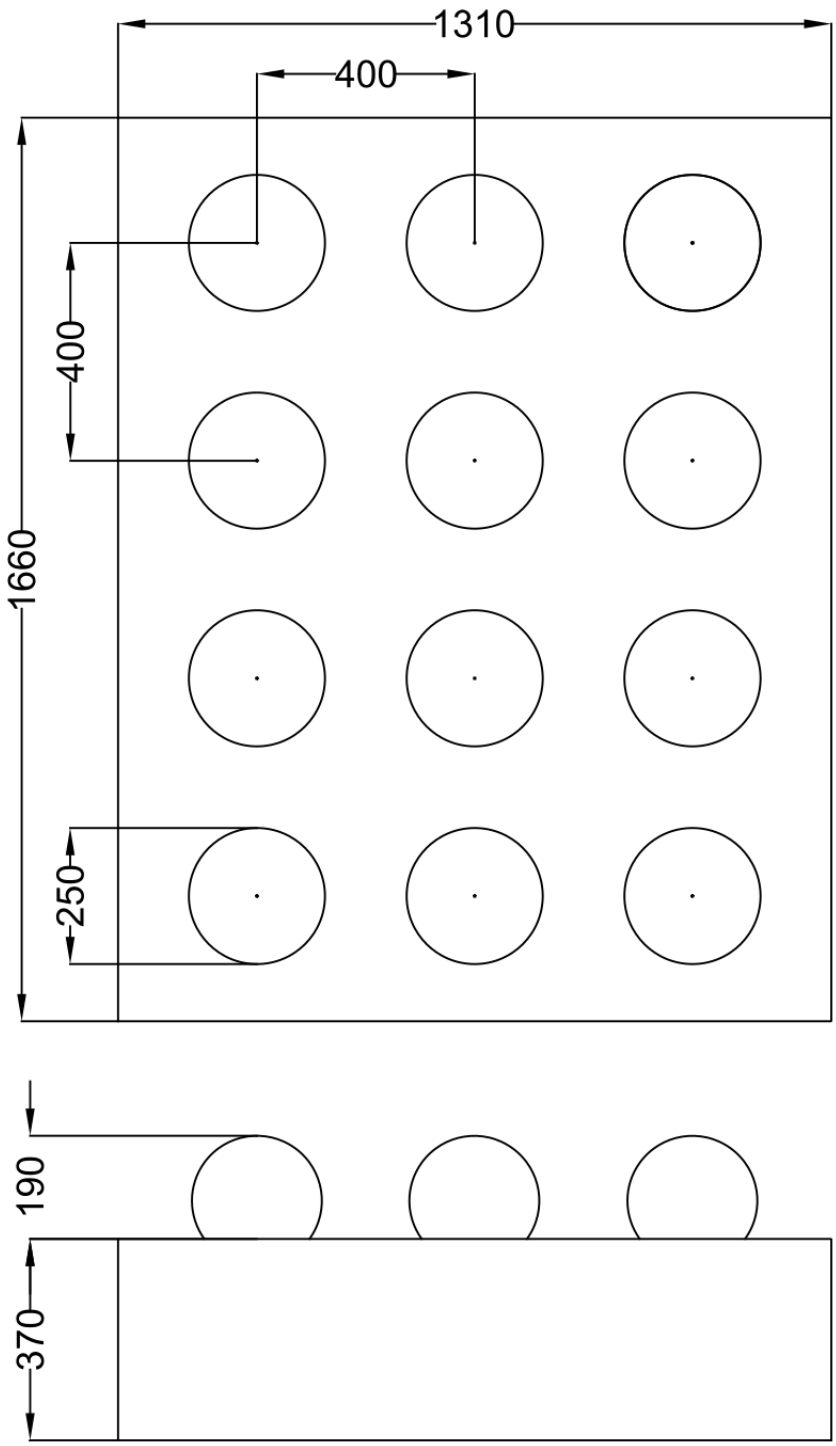
Pin configuration top through view

CSP-12 1.31x1.66 mm PIN DESCRIPTION

Pin Name	Bump Name	Type	Function	Note
BAT	A1	P	Battery positive terminal	
IN	A2	P	5V input supply voltage	
SYS	A3	AO	System output	1
BATSNS	B1	AI	Battery voltage sensing	2
SD	B2	DI	Shutdown control input	3
LDO	B3	AO	3.1V LDO output	
ISET	C1	AO	Fast-charge programming resistor	
BATMS	C2	AO	Battery voltage measurement pin	
XCHG	C3	AO	Charging / Fault flag	4
GND	D1	G	Ground	
NTC	D2	AIO	Battery temperature monitor pin	
CEN	D3	DI	Charger enable pin	5

G = Ground, P = Power, D = Digital, A = Analog, I = Input, O = Output
Note 1: In battery power SYS pin is at battery voltage V_{BAT}. When powered from IN pin the SYS is at V_{IN} voltage.
Note 2: Connect as close as possible to the battery's positive terminal.
Note 3: Active HIGH (shutdown). Internal 350 kΩ pull-down.
Note 4: Open drain output, active LOW (charging in progress).
Note 5: Active HIGH (charging enabled). Internal 350 kΩ pull-up to LDO output.

PACKAGE (CSP-12 1.31x1.66 mm) OUTLINE



ORDERING INFORMATION

Product Code	Product	V_{FLOAT} Option	Package	Comment
MAS6260BA1D1006	Li-ion and LiPo battery charger with LDO	4.2V	DFN-12 3x3x0.75, Pb-free, RoHS compliant	Tape and Reel 3000 pcs / r
MAS6260BA2D1006	Li-ion and LiPo battery charger with LDO	4.35V	DFN-12 3x3x0.75, Pb-free, RoHS compliant	Tape and Reel 3000 pcs / r
MAS6260BA3D1006	Li-ion and LiPo battery charger with LDO	4.4V	DFN-12 3x3x0.75, Pb-free, RoHS compliant	Tape and Reel 3000 pcs / r
MAS6260BA1CA406 (1)	Li-ion and LiPo battery charger with LDO	4.2V	CSP-12 1.31x1.66, 400µm pitch, 250µm bumps, Pb-free, RoHS compliant	Tape and Reel TBD pcs / r
MAS6260BA2CA406 (1)	Li-ion and LiPo battery charger with LDO	4.35V	CSP-12 1.31x1.66, 400µm pitch, 250µm bumps, Pb-free, RoHS compliant	Tape and Reel TBD pcs / r
MAS6260BA3CA406 (1)	Li-ion and LiPo battery charger with LDO	4.4V	CSP-12 1.31x1.66, 400µm pitch, 250µm bumps, Pb-free, RoHS compliant	Tape and Reel TBD pcs / r

Note 1: Please contact Micro Analog Systems Oy to check package availability
TBD = To Be Defined

LOCAL DISTRIBUTOR

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