# M62242FP

## Lithium-Ion Battery Charger Control IC

REJ03F0241-0200
Rev.2.00
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## Description

M62242FP is general purpose battery charger designed for 1-2 cell lithium-ion batteries.

Integrating the indispensable circuits for charge control and the interface with MCU *[1] allows for protections against over-temperature, over-current, and over-voltage as well as charge control corresponding to the kind of battery by the simplified component design.

Note: 1. Recommended MCU: M34501

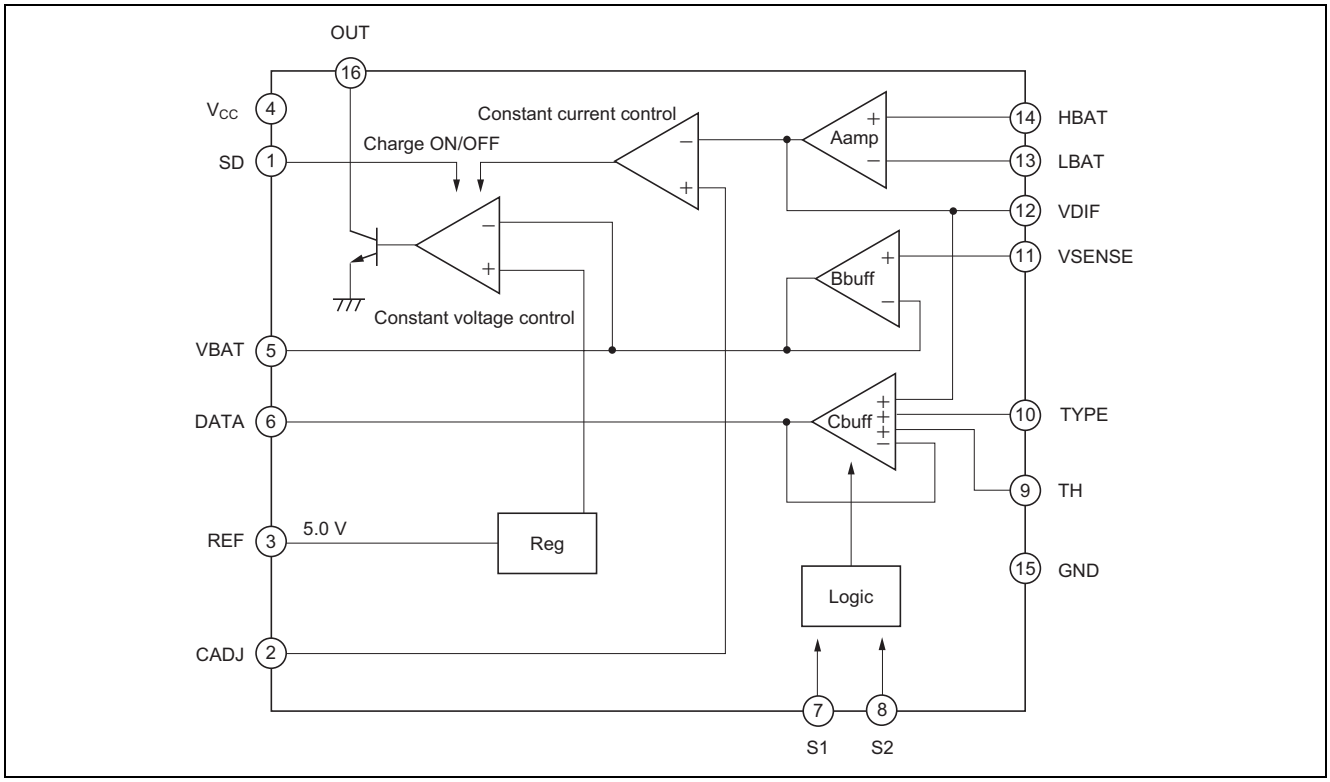
## Features

- Built-in accurate reference voltage for full charge detection
  (4.2 V ± 30 mV accuracy, prepared for 4.1 V battery voltage)
- Built-in 5 V power supply for MCU
- Using with MCU, various charge flow are available.
- Small size 16-pin SSOP package

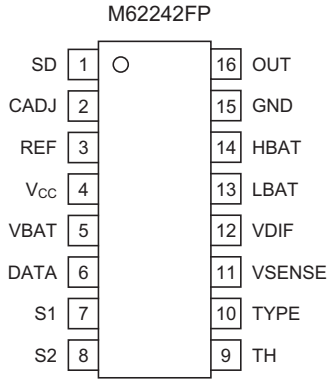
## Application

Hand held equipments and general battery charger for other digital equipments, etc.

## Block Diagram



## Pin Arrangement




Outline: PLSP0016JA-A (16P2E-A)

## Pin Description

| Pin No. | Pin Name | I/O | Function |
|---|---|---|---|
| 1 | SD | I | Charge ON/OFF pin.<br>L: charge on, H: charge off |
| 2 | CADJ | I | Charge current set pin.<br>Charge current depends on CADJ-pin voltage. For example,<br>• Setting current detection resistance (Rs) = 0.1 Ω<br>• Amplification rate determined by the external resistances = 20 times<br>• CADJ-pin voltage = 1.62 V yields<br>Charge current = 600 mA (1.62 – 0.42 (offset) = 0.1 × Charge current × 20) |
| 3 | REF | O | Reference voltage output pin.<br>REF-pin outputs 5.0 V reference voltage for MCU and other detector. |
| 4 | $V_{CC}$ | — | Power supply. |
| 5 | VBAT | O | Battery voltage output pin. |
| 6 | DATA | I | Select pin of DATA output.<br>The output of DATA-pin depends on the conditions of S1, S2-pin.<br>(Noted right figure) |
| 7 | S1 | I | |
| 8 | S2 | O | |
| 9 | TH | I | Battery temperature input pin.<br>Reference voltage divided by external resistance and thermistor is input to TH-pin. |
| 10 | TYPE | I | Input pin detecting the kind of battery.<br>Reference voltage divided by resistance detecting the kind of battery and external resistance is input to TYPE-pin. |
| 11 | VSENSE | I | Battery voltage input pin.<br>Charge voltage is controlled by the comparison between half of VSENSE-pin voltage and 2.1 V (inside reference voltage). |
| 12 | VDIF | O | Charge current detection pin.<br>Amplified differential voltage, between the current detection resistor (Rs), with the amplification ratio set by the external resistor between HBAT and LBAT is output to VDIF terminal. Charge current is controlled by the comparison of VDIF-pin voltage and CADJ-pin voltage. |
| 13 | LBAT | I | |
| 14 | HBAT | I | |
| 15 | GND | — | Ground pin |
| 16 | OUT | O | Output pin for charge control.<br>Constant voltage/current charge is done by controlling the gate voltage of external Pch-Tr (PNP-Tr). |

| | Input | | Output |
|---|---|---|---|
| Pin name | S1 | S2 | DATA |
| Condition | L | H | TYPE |
| | H | L | TH |
| | Other | | VDIF |

## Absolute Maximum Ratings

(Ta = 25°C, $V_{CC}$ = 8 V, unless otherwise noted)

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Supply voltage | Vmax | 16.0 | V |
| Power dissipation *[1] | Pd | 590 | mW |
| Operating temperature | Topr | –20 to +75 | °C |
| Storage temperature | Tstg | –40 to +125 | °C |
| OUT pin driving current | Idout | 50.0 | mA |
| REF pin output current | Iref | 10.0 | mA |

Note: 1. This is in the typical condition. (the velocity of the wind is 1 m/s) Power dissipation is changed by materials of the assembled board and the velocity of the wind.

## Electrical Characteristics

(Ta = 25°C, $V_{CC}$ = 8 V, unless otherwise noted)

| Block | Item | Symbol | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|---|
| Total | Power supply | $V_{CC}$ | 5.3 | — | 15.0 | V | |
| | Circuit current (normal mode) | $I_{CC}$ | 1.0 | 2.0 | 3.0 | mA | |
| | REF-pin referential voltage | Vref | 4.88 | 5.00 | 5.12 | V | Iout = 5 mA |
| | Charge control voltage | Vchg | 4.17 (4.07) | 4.20 (4.10) | 4.23 (4.13) | V | 4.2 V battery (4.1 V battery) |
| Aamp | VDIF-pin output offset voltage | Vdifo | — | 460 | — | mV | Set at 20 times |
| | H, LBAT-pin input bias current | IhIb | — | 200 | 400 | nA | |
| | VDIF-pin output dynamic range | Vdifdr | 0.3 | — | $V_{CC}$ – 0.3 | V | |
| Bbuff | VBAT-pin input offset voltage | Vbato | –5 | 0 | 5 | mV | |
| | VSENSE-pin input bias current | Ivsenseb | — | –50 | –100 | nA | |
| | VBAT-pin output dynamic range | Vbatdr | 1.0 | — | $V_{CC}$ – 0.3 | V | |
| Cbuff | DATA-pin input offset voltage | Vdatao | –5 | 0 | 5 | mV | |
| | TYPE, TH, VDIF-pin Input bias current | Ittvb | — | 50 | 100 | nA | |
| | DATA-pin output dynamic range | Vdatadr | 0.3 | — | $V_{CC}$ – 1.0 | V | |
| Logic | S1, S2 "H" voltage | Vlogich | 1.0 | — | REF | V | Same voltage when S1, S2-pin are open. |
| | S1, S2 "L" voltage | Vlogicl | 0 | — | 0.5 | V | |
| Out | OUT-pin output low voltage | Vout | — | — | 0.6 | V | Iout = 30 mA |

## Functional Description

(Each voltage written in following are set in application example)

The value of each timer, over-voltage, low-voltage, over-current and charge full-current etc, are set by MCU.

### 1. Function of Charging (SD = "L")

(1) Detection of the battery connection/the battery temperature.
When (S1, S2) = (H, L), TH-pin voltage is output from DATA-pin. TH-pin voltage is used for the detection of the battery connection and battery temperature. MCU recognizes the battery connection and the battery temperature. (Noted table 1.)

(2) Detection of the battery type
TYPE-pin voltage is detected to recognize a battery type. When (S1, S2) = (L, H), TYPE-pin voltage is output from DATA-pin. The recognition of the battery type by MCU selects the suitable charge flow. (Noted table 1.)

**Table 1 S1, S2, DATA Function**

| | Input | | Output |
|---|---|---|---|
| Pin name | S1 | S2 | DATA |
| Condition | L | H | TYPE |
| | H | L | TH |
| | other | | VDIF |

Note: DATA outputs 50 μs after S1 and S2 input

(3) Detection of battery voltage
Since VSENSE-pin voltage (the battery voltage) is always output to VBAT-pin, MCU can always detect the battery voltage.

(4) Set and control of the charge current
This IC performs the constant charge current function to make CADJ-pin voltage equal to the value.

$$0.1\ \Omega \times \text{charge current} \times 20 + \text{offset voltage}$$

Detecting the offset voltage by MCU after connecting a battery and revising give highly accurate minute current detection. By changing CADJ-pin voltage after detecting the type, the temperature and the voltage of battery by MCU, the charge current can be set arbitrary.
Notes: 0.1 Ω: current detection resistance Rs
20: Amplification rate determined by external resistances connected to HBAT and LBAT-pin

(5) Control of charge voltage
Charge voltage is controlled by the comparison between the battery voltage and inside reference voltage.

(6) The charge completion
DATA-pin outputs VDIF-pin voltage (which corresponds to charge current) when (S1, S2) = (L, L) or (H, H). If DATA-pin voltage drops below the charge completion voltage, MCU stops charging.

(7) Function of protect
In the following condition, MCU stops charging for battery protection by monitoring the VBAT-pin and the DATA-pin voltage.
Example
— Battery voltage is less than 1.0 V (Low-voltage NG)
— Battery voltage is more than 4.5 V (Over-voltage NG)
— Charge current is more than 1.2 A (Over-current NG)
— Battery temperature is less than –10°C and more than 60°C (Temperature NG)
— Non-charge completion an hour after charge starts (Charge time up)

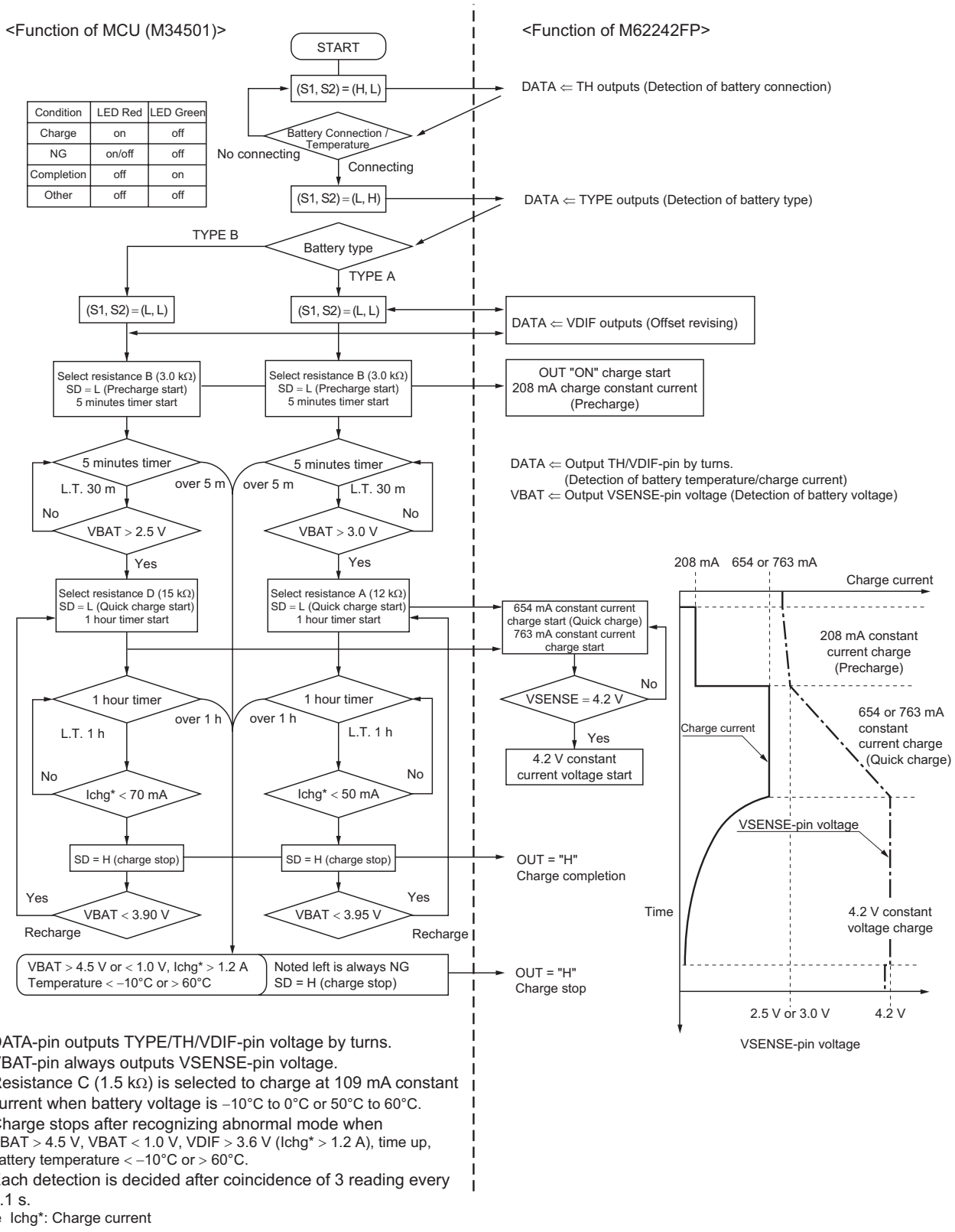
## 2. Function of Non-charge (SD = "H")

In each abnormal states, charge completion state and non-battery state etc, inputting "H" voltage from MCU to SD-pin makes OUT-pin "H" and then the charge function of this IC stops.

## 3. Function of Recharge

VBAT-pin outputs VSENSE-pin voltage continually even after the charge completion. So MCU restarts charging if VSENSE-pin voltage drops below the set voltage by self-discharge etc.

## Flow Chart (Noted Equivalent Circuit)

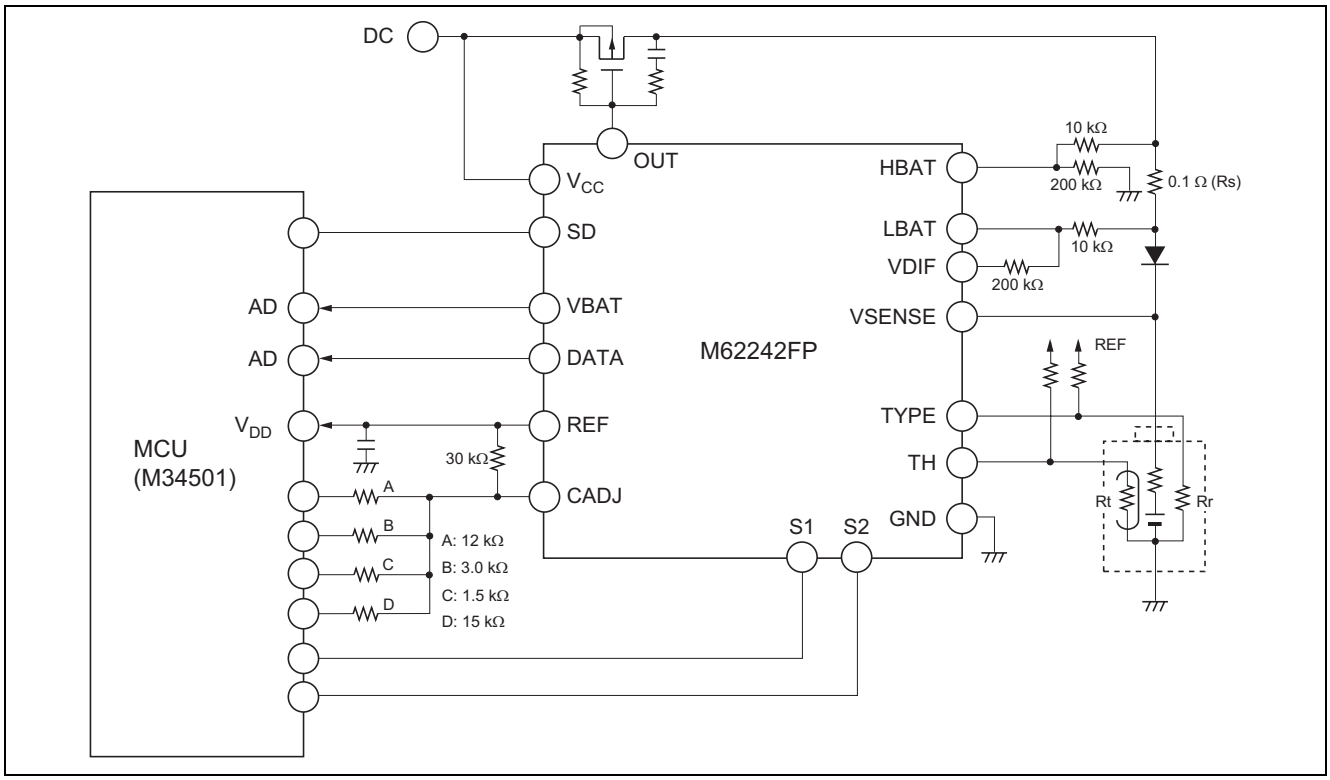



| Condition | LED Red | LED Green |
|---|---|---|
| Charge | on | off |
| NG | on/off | off |
| Completion | off | on |
| Other | off | off |

- DATA-pin outputs TYPE/TH/VDIF-pin voltage by turns. VBAT-pin always outputs VSENSE-pin voltage.
- Resistance C (1.5 kΩ) is selected to charge at 109 mA constant current when battery voltage is −10°C to 0°C or 50°C to 60°C.
- Charge stops after recognizing abnormal mode when VBAT > 4.5 V, VBAT < 1.0 V, VDIF > 3.6 V (Ichg* > 1.2 A), time up, battery temperature < −10°C or > 60°C.
- Each detection is decided after coincidence of 3 reading every 0.1 s.

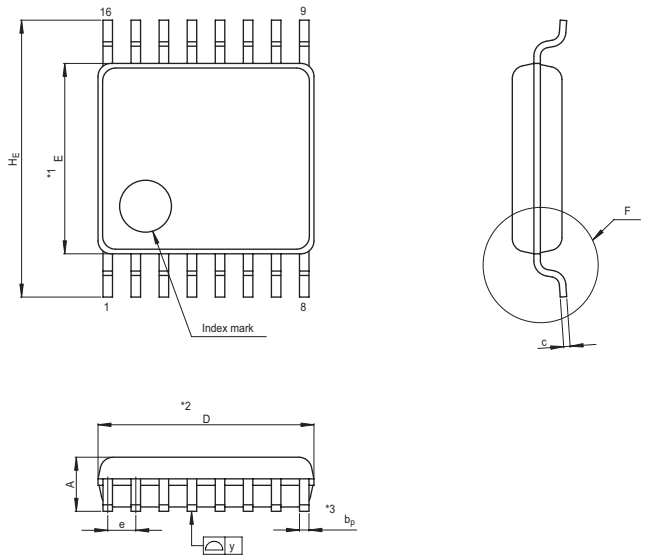
Note Ichg*: Charge current

## Equivalent Circuit



## Package Dimensions

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-LSSOP16-4.4x5-0.65 | PLSP0016JA-A | 16P2E-A | 0.06g |




NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| D | 4.9 | 5.0 | 5.1 |
| E | 4.3 | 4.4 | 4.5 |
| $A_2$ | — | 1.15 | — |
| A | — | — | 1.45 |
| $A_1$ | 0 | 0.1 | 0.2 |
| $b_p$ | 0.17 | 0.22 | 0.32 |
| c | 0.13 | 0.15 | 0.2 |
| $\theta$ | 0° | — | 10° |
| $H_E$ | 6.2 | 6.4 | 6.6 |
| e | 0.53 | 0.65 | 0.77 |
| y | — | — | 0.10 |
| L | 0.3 | 0.5 | 0.7 |

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