XC6802 Series

800mA 1 Cell Li-ion and Li-Po Battery Linear Charger IC with Constant-Current/Constant-Voltage

GENERAL DESCRIPTION
The XC6802 series is a constant-current/constant-voltage linear charger IC for single cell Lithium-ion and Lithium polymer batteries. The XC6802 includes a reference voltage source, battery voltage monitor, driver transistor, constant-current/constant-voltage charge circuit, overheat protection circuit and phase compensation circuit. The battery charge termination voltage is internally set to 4.2V ±0.7% and the trickle charge voltage and accuracy is 2.9V ±3%. In trickle charge mode, a safe Lithium-ion and Lithium polymer battery charge is possible because approximately only 1/10 of the full charge current is supplied to the battery.

With an external RSEN resistor, the charge current can be set freely up to 800mA (MAX.), therefore, the series is ideal for various battery charge applications. The series’ charge status output pin, /CHG pin, is capable of checking the IC’s charging state while connecting with an external LED.

APPLICATIONS
- Charging docks, charging cradles
- MP3 players, portable audio players
- Cellular phones, PDAs
- Bluetooth headsets

FEATURES
- Operating Voltage Range: 4.25V ~ 6.0V
- Charge Current: Externally set up to 800mA (MAX.)
- Charge Termination Voltage: 4.2V ±0.7%
- Trickle Charge Voltage: 2.9V ±3%
- Supply Current (Stand-by): 15μA (TYP.)
- Function: Constant-current/constant-voltage Operation
  Thermal Shutdown
  Automatic Recharge
  Charge Status Output Pin
  Soft-start Function (Inrush Limit Current)
- Operating Ambient Temperature: -40℃~+85℃
- Packages: SOT-89-5, SOT-25, USP-6C, USP-6EL
- Environmentally Friendly: EU RoHS Compliant, Pb Free

TYPICAL APPLICATION CIRCUIT

TYPICAL PERFORMANCE CHARACTERISTICS
- Battery Charge Cycle

Li-ion Battery Charge Cycle

Voltage (V) vs. Time (hour)

Charge Current vs. Time (hour)

Battery Voltage vs. Time (hour)

VIN=5.0V, CIN=1μF
RSEN=2kΩ, 830mAh Battery
**PIN CONFIGURATION**

![PIN CONFIGURATION Diagram]

*The dissipation pad for the USP-6C / USP-6EL package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release. If the pad needs to be connected to other pins, it should be connected to the Vss (No. 2) pin.*

**PIN ASSIGNMENT**

<table>
<thead>
<tr>
<th>PIN NUMBER</th>
<th>PIN NAME</th>
<th>FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT-25</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>SOT-89-5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>USP-6C</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>USP-6EL</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**FUNCTIONS**

**XC6802A42X**

<table>
<thead>
<tr>
<th>PIN NAME</th>
<th>CONDITIONS</th>
<th>IC OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISEN</td>
<td>H Level (1.4V≤VSEN≤VIN) or Open</td>
<td>OFF (Shutdown Mode)</td>
</tr>
<tr>
<td></td>
<td>Pull-down by external components</td>
<td>ON, Charge Current I_BAT=1000 / RSEN*</td>
</tr>
</tbody>
</table>

* For SOT-25, SOT-89-5, and USP-6C, charge current should be set to become I_BAT≤800mA.
  For USP-6EL, charge current should be set to become I_BAT≤500mA.

**PRODUCT CLASSIFICATION**

**Ordering Information**

**XC6802A42X①②③**

<table>
<thead>
<tr>
<th>DESIGNATOR</th>
<th>ITEM</th>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>①②③ (1)</td>
<td>Packages (Order Unit)</td>
<td>PR</td>
<td>SOT-89-5 (1,000pcs/Reel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PR-G</td>
<td>SOT-89-5 (1,000pcs/Reel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MR</td>
<td>SOT-25 (3,000pcs/Reel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MR-G</td>
<td>SOT-25 (3,000pcs/Reel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ER</td>
<td>USP-6C (3,000pcs/Reel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ER-G</td>
<td>USP-6C (3,000pcs/Reel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4R-G</td>
<td>USP-6EL (3,000pcs/Reel)</td>
</tr>
</tbody>
</table>

(1) The “-G” suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.
* Diodes inside the circuits are ESD protection diodes and parasitic diodes.

## ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATINGS</th>
<th>UNIT</th>
<th>Ta=25℃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vin Pin Voltage</td>
<td>Vin</td>
<td>-0.3 ~ + 6.5 V</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>ISEN Pin Voltage</td>
<td>VSEN</td>
<td>-0.3 ~ Vin + 0.3 or +6.5 (2)</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>BAT Pin Voltage</td>
<td>VBAT</td>
<td>-0.3 ~ + 6.5 V</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>/CHG Pin Voltage</td>
<td>V/CHG</td>
<td>-0.3 ~ + 6.5 V</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>BAT Pin Current (1)</td>
<td>IBAT</td>
<td>900 mA</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>550 mA</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>Pd</td>
<td>500 mW</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1300 (PCB mounted) (3)</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>250 mW</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>600 (PCB mounted) (3)</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>120 mW</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 (PCB mounted) (3)</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>120 mW</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000 (PCB mounted) (3)</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Operating Ambient Temperature</td>
<td>Topr</td>
<td>- 40 ~ + 85 ℃</td>
<td>℃</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>Tstg</td>
<td>- 55 ~ + 125 ℃</td>
<td>℃</td>
<td></td>
</tr>
</tbody>
</table>

All voltages are described based on the VSS pin.

(1) Please use within the range of IBAT ≤ Pd/(Vin-VBAT).

(2) The maximum rating corresponds to the lowest value between Vin+0.3 or +6.5.

(3) This is a reference data taken by using the test board. Please see the power dissipation page for the mounting condition.
## ELECTRICAL CHARACTERISTICS

### INPUT VOLTAGE
- Symbol: $V_{\text{IN}}$
- Condition: Charge mode, $R_{\text{SEN}} = 10k\Omega$
- Min: 4.25
- Typ: 6.0
- Max: 10
- Unit: V

### SUPPLY CURRENT
- Symbol: $I_{\text{SS}}$
- Condition: Charge mode, $R_{\text{SEN}} = 10k\Omega$
- Min: 1.1
- Typ: 1.3
- Max: 1.5
- Unit: mA

### STAND-BY CURRENT
- Symbol: $I_{\text{STBY}}$
- Condition: Stand-by mode
- Min: 0.1
- Typ: 0.1
- Max: 0.1
- Unit: mA

### SHUT-DOWN CURRENT
- Symbol: $I_{\text{SHUT}}$
- Condition: Shut-down mode
- Min: 0.1
- Typ: 0.1
- Max: 0.1
- Unit: mA

### FLOAT VOLTAGE 1
- Symbol: $V_{\text{FLOAT1}}$
- Condition: $T_a = 25^\circ C, I_{\text{BAT}} = 40mA$
- Min: 3.9
- Typ: 4.2
- Max: 4.3
- Unit: V

### FLOAT VOLTAGE 2
- Symbol: $V_{\text{FLOAT2}}$
- Condition: $0^\circ C \leq T_a \leq 50^\circ C, I_{\text{BAT}} = 40mA$
- Min: 4.1
- Typ: 4.2
- Max: 4.3
- Unit: V

### MAXIMUM BATTERY CURRENT
- Symbol: $I_{\text{BATMAX}}$
- Condition: $V_{\text{FLOAT}}$, $I_{\text{BAT}} = 40mA$
- Min: 800
- Typ: 800
- Max: 800
- Unit: mA

### BATTERY CURRENT 1
- Symbol: $I_{\text{BAT1}}$
- Condition: $R_{\text{SEN}} = 10k\Omega$, CC mode
- Min: 93
- Typ: 100
- Max: 107
- Unit: mA

### BATTERY CURRENT 2
- Symbol: $I_{\text{BAT2}}$
- Condition: $R_{\text{SEN}} = 2k\Omega$, CC mode
- Min: 465
- Typ: 500
- Max: 523
- Unit: mA

### BATTERY CURRENT 3
- Symbol: $I_{\text{BAT3}}$
- Condition: Stand-by mode, $V_{\text{BAT}} = 4.2V$
- Min: 0.1
- Typ: 0.1
- Max: 0.1
- Unit: mA

### BATTERY CURRENT 4
- Symbol: $I_{\text{BAT4}}$
- Condition: Shut-down mode ($R_{\text{SEN}} = 10k\Omega$)
- Min: 1
- Typ: 1
- Max: 1
- Unit: mA

### BATTERY CURRENT 5
- Symbol: $I_{\text{BAT5}}$
- Condition: Sleep mode, $V_{\text{IN}} = 0V$
- Min: 1
- Typ: 1
- Max: 1
- Unit: mA

### TRICKLE CHARGE CURRENT 1
- Symbol: $I_{\text{TRIKL1}}$
- Condition: $V_{\text{TRIKL}}$, $R_{\text{SEN}} = 10k\Omega$
- Min: 6
- Typ: 10
- Max: 14
- Unit: mA

### TRICKLE CHARGE CURRENT 2
- Symbol: $I_{\text{TRIKL2}}$
- Condition: $V_{\text{TRIKL}}$, $R_{\text{SEN}} = 2k\Omega$
- Min: 30
- Typ: 50
- Max: 70
- Unit: mA

### TRICKLE VOLTAGE
- Symbol: $V_{\text{TRIKL}}$
- Condition: $R_{\text{SEN}} = 10k\Omega$
- Min: 2.9
- Typ: 2.9
- Max: 2.98
- Unit: V

### TRICKLE VOLTAGE HYSTERESIS WIDTH
- Symbol: $V_{\text{TRIKL_HYS}}$
- Min: 58
- Typ: 90
- Max: 116
- Unit: mV

### UVLO VOLTAGE
- Symbol: $V_{\text{UVLO}}$
- Condition: $V_{\text{IN}}: L \rightarrow H$
- Min: 3.686
- Typ: 3.9
- Max: 3.914
- Unit: V

### UVLO HYSTERESIS WIDTH
- Symbol: $V_{\text{UVLO_HYS}}$
- Min: 150
- Typ: 280
- Max: 280
- Unit: mV

### MANUAL SHUT-DOWN VOLTAGE
- Symbol: $V_{\text{SD}}$
- Condition: $I_{\text{SEN}}: L \rightarrow H$
- Min: 1.4
- Typ: -
- Max: -
- Unit: V

### MANUAL SHUT-DOWN VOLTAGE HYSTERESIS WIDTH
- Symbol: $V_{\text{SD_HYS}}$
- Min: -100
- Typ: -
- Max: -
- Unit: mV

### VIN-VBAT SHUT-DOWN RELEASE VOLTAGE
- Symbol: $V_{\text{ASD}}$
- Condition: $V_{\text{IN}}: L \rightarrow H$
- Min: 70
- Typ: 140
- Max: 140
- Unit: mV

### VTRI-VBAT SHUT-DOWN VOLTAGE HYSTERESIS WIDTH
- Symbol: $V_{\text{ASD_HYS}}$
- Min: -70
- Typ: -
- Max: -
- Unit: mV

### C10 CHARGE TERMINATION CURRENT THRESHOLD 1
- Symbol: $I_{\text{TERM1}}$
- Condition: $R_{\text{SEN}} = 10k\Omega$
- Min: 0.07
- Typ: 0.1
- Max: 0.13
- Unit: mA/mA

### C10 CHARGE TERMINATION CURRENT THRESHOLD 2
- Symbol: $I_{\text{TERM2}}$
- Condition: $R_{\text{SEN}} = 2k\Omega$
- Min: 0.07
- Typ: 0.1
- Max: 0.13
- Unit: mA/mA

### ISEN PIN VOLTAGE
- Symbol: $V_{\text{ISEN}}$
- Condition: $R_{\text{SEN}} = 10k\Omega$, CC mode
- Min: 1.0
- Typ: -
- Max: -
- Unit: V

### ICHG PIN WEAK PULL-DOWN CURRENT
- Symbol: $I_{\text{CHG1}}$
- Condition: $V_{\text{BAT}} = 4.3$, $V_{\text{CHG}} = 5V$
- Min: 8
- Typ: 20
- Max: 50
- Unit: mA

### ICHG PIN STRONG PULL-DOWN CURRENT
- Symbol: $I_{\text{CHG2}}$
- Condition: $V_{\text{BAT}} = 4.0V$, $V_{\text{CHG}} = 1V$
- Min: 4
- Typ: 10
- Max: 20
- Unit: mA

### ICHG PIN OUTPUT LOW VOLTAGE
- Symbol: $V_{\text{CHG}}$
- Condition: $I_{\text{CHG}} = 5mA$
- Min: 0.35
- Typ: 0.7
- Max: -
- Unit: V

### RECHARGE BATTERY THRESHOLD VOLTAGE
- Symbol: $\Delta V_{\text{RECHRG}}$
- Condition: $V_{\text{FLOAT}} + V_{\text{RECHRG}}$
- Min: 100
- Typ: 150
- Max: 200
- Unit: mV

### ON RESISTANCE
- Symbol: $R_{\text{ON}}$
- Condition: $I_{\text{BAT}} = 100mA$
- Min: 450
- Typ: 900
- Max: -
- Unit: mΩ

### SOFT-START TIME
- Symbol: $t_{\text{SS}}$
- Min: 100
- Typ: 150
- Max: 200
- Unit: ms

### RECHARGE BATTERY TIME
- Symbol: $t_{\text{RECHRG}}$
- Min: 0.4
- Typ: 2
- Max: 4
- Unit: ms

### BATTERY TERMINATION DETECT TIME
- Symbol: $t_{\text{TERM}}$
- Condition: $I_{\text{BAT}}$ falling (less than charge current /10)
- Min: 0.3
- Typ: 1
- Max: 3.5
- Unit: ms

### ISEN PIN PULL-UP CURRENT
- Symbol: $I_{\text{SEN}_{\text{PULL UP}}}$
- Min: 1
- Typ: 1.3
- Max: -
- Unit: mA

### THERMAL SHUT-DOWN DETECT TEMPERATURE
- Symbol: $T_{\text{TSD}}$
- Condition: Junction temperature
- Min: -115
- Typ: -
- Max: -
- Unit: °C

### THERMAL SHUT-DOWN RELEASE TEMPERATURE
- Symbol: $T_{\text{TSS}}$
- Condition: Junction temperature
- Min: -95
- Typ: -
- Max: -
- Unit: °C

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* Unless otherwise stated, $V_{\text{IN}} = 5.0V$.  
(1) The figures under the condition of $0^\circ C \leq T_a \leq 50^\circ C$ are guaranteed by design calculation.  
(2) The $R_{\text{SEN}}$ resistance set: The battery current shall not be exceeded to 800mA. (SOT-25, SOT-89-5, and USP-6C) The battery current shall not be exceeded to 500mA. (USP-6EL)
\section*{OPERATIONAL EXPLANATION}

\begin{itemize}
  \item \textbf{<Charge Cycle>}
  
  If the BAT pin voltage is less than trickle voltage (TYP. 2.9V), the charger enters trickle charge mode. In this mode, a safe battery charge is possible because approximately only 1/10 of the charge current which was set by the ISEN pin, is supplied to the battery. When the BAT pin voltage rises above the trickle voltage, the charger enters constant-current mode (CC mode) and the battery is charged by the programmed charge current. When the BAT pin voltage reaches 4.2V, the charger enters constant-voltage mode (CV mode) automatically. After this, the charge current starts to drop and when it reaches a level which is 1/10 of the programmed charge current, the charge terminates.

  \item \textbf{<Setting Charge Current>}
  
  The charge current can be set by connecting a resistor between the ISEN pin and the VSS pin. The battery charge current, I_{BAT}, is calculated by the following equations:

  \begin{equation}
  I_{BAT} = \frac{V_{ISEN}}{R_{SEN}} \times 1000 \quad (V_{ISEN} = 1.0V \text{ (TYP.)}: \text{Current sense pin voltage})
  \end{equation}

  However, \(I_{BAT} \leq 800\text{mA} \text{ (SOT-25, SOT-89-5, and USP-6C)}, \ I_{BAT} \leq 500\text{mA} \text{ (USP-6EL)}\)

  \item \textbf{<Charge Termination>}
  
  The battery charge is terminated when the charge current decreases to 1/10 of the full charging level after the battery pin voltage reaches a float voltage. An internal comparator monitors the ISEN pin voltage to detect the charge termination. When the comparator monitors the ISEN pin voltage is less than 100mV (charge termination detect) \(^{(1)}\) for 1ms TYP. (charge termination detect time), the IC enters stand-by mode. A driver transistor turns off during the stand-by mode. In this state, a failure detection circuit and a monitoring circuit of the battery pin voltage operates.

  \(^{(1)}\) The detect after charging completed: ISEN pin voltage should be less than 100mV.

  \item \textbf{<Automatic Recharge>}
  
  In stand-by mode battery voltage falls. When the voltage level at the battery pin drops to recharge battery threshold voltage (TYP. 4.05V) or less, the charge cycle automatically re-starts after a delay of (TYP. 2ms). As such, no external activation control is needed.
\end{itemize}
OPERATIONAL EXPLANATION (Continued)

<Charge Condition Status>
The /CHG pin constantly monitors the charge states classified as below:

- Strong pull-down: $I_{CHG} = 10\, \text{mA (TYP.)}$ in a charge cycle,
- Weak pull-down: $I_{CHG} = 20\, \mu\text{A (TYP.)}$ in a stand-by mode,
- High impedance: in shutdown mode.

<Connection of Shorted BAT Pin>
Even if the BAT pin is shorted to the $V_{SS}$, a trickle charge mode starts to operate for protecting the IC from destruction caused by over current.

<Under-voltage Lockout (UVLO)>
The UVLO circuit keeps the charger in shut-down mode until the input voltage, $V_{IN}$, rises more than the UVLO voltage. Moreover, in order to protect the battery charger, the UVLO circuit keeps the charger in shut-down mode when a voltage between the input pin voltage and BAT pin voltage falls to less than $30\, \text{mV (TYP.)}$. The charge will not restart until the voltage between the input pin voltage and BAT pin voltage rises more than $100\, \text{mV (TYP.)}$. During the shut-down mode, the driver transistor turns off but a failure detection circuit operates, and supply current is reduced to $10\, \mu\text{A (TYP.)}$.

<Soft-start Function>
To protect against inrush current from the input to the battery, soft-start time is set in the circuit optimally ($150\, \mu\text{s, TYP.}$).

<Manual Shut-down>
During the charge cycle, the IC can be shifted to the shut-down mode by floating the $V_{SEN}$ pin. For this, a drain current to the battery is reduced to less than $2\, \mu\text{A}$ and a shut-down current of the IC is reduced to less than $10\, \mu\text{A (TYP.)}$. A new charge cycle starts when reconnecting the current sense resistor.

<Opened BAT Pin>
When the BAT pin is left open, the IC needs to be shut-down once after monitoring the CHG pin by a microprocessor etc and keeping the $V_{SEN}$ pin in H level.

<Backflow Prevention Between the BAT Pin and the $V_{IN}$ Pin>
A backflow prevention circuit protects against current flowing from the BAT pin to the $V_{IN}$ pin even the BAT pin voltage is higher than the $V_{IN}$ pin voltage.
NOTES ON USE

1. Please note that in cases where the charge current is less than 100mA, there is a possibility that the trickle charge and the detection of charge completion may not function correctly.

2. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.

3. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please wire the CIN as close to the IC as possible.

4. Torex places an importance on improving our products and their reliability. We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.
1. ON Resistance, Shut-down Voltage, $I_{SEN}$ Pull-up current

2. Battery Termination Detect Time, Recharge Battery Time
   C/10 Charge Termination Current Threshold 1~2,
   Battery Termination Voltage 1

3. Trickle Charge Current 1~2, Battery Current 1~3, Battery Current 5
   $I_{SEN}$ Pin Voltage, Trickle Charge Voltage, UVLO,
   Recharge Battery Threshold Voltage
   $V_{IN}-V_{BAT}$ Shut-down Release Voltage, /CHG Pin Weak Pull-down Current
   /CHG Pin Strong Pull-down Current, Stand-by Current, Shut-down Current

4. /CHG Pin, Output Low Voltage

5. Battery Current 4

6. Soft-start
# TYPICAL PERFORMANCE CHARACTERISTICS

(1) Charge Cycle

![Charge Cycle Graph](image)

(2) Battery Current vs. Battery Voltage

![Battery Current vs. Battery Voltage Graph](image)
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Battery Voltage vs. Battery Current

- **XC6802A42X**
  - $V_N=5V$, $R_{SEN}=10k\Omega$
  - Battery Voltage: $V_{BAT} (V)$
  - Battery Current: $I_{BAT} (mA)$

- **XC6802A42X**
  - $V_N=5V$, $R_{SEN}=2k\Omega$
  - Battery Voltage: $V_{BAT} (V)$
  - Battery Current: $I_{BAT} (mA)$

(4) Charge Termination Voltage vs. Ambient Temperature

- **XC6802A42X**
  - $V_N=5V$, $I_{BAT}=40mA$, $R_{SEN}=10k\Omega$
  - Charge Termination Voltage: $V_{FLOAT1} (V)$
  - Ambient Temperature: $T_a (°C)$

- **XC6802A42X**
  - $V_N=5V$, $I_{BAT}=200mA$, $R_{SEN}=2k\Omega$
  - Charge Termination Voltage: $V_{FLOAT1} (V)$
  - Ambient Temperature: $T_a (°C)$
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Battery Current vs. Ambient Temperature

**XC6802A42X**

\[ V_{IN}=5V, \ V_{BAT}=3.8V, \ R_{SEN}=10k\Omega \]

(6) Trickle Charge Current vs. Ambient Temperature

**XC6802A42X**

\[ V_{IN}=5V, \ V_{BAT}=3.8V, \ R_{SEN}=2k\Omega \]

(7) Trickle Voltage vs. Ambient Temperature

**XC6802A42X**

\[ V_{IN}=5V, \ V_{BAT}=3.8V, \ R_{SEN}=10k\Omega \]

(8) Manual Shutdown Voltage vs. Ambient Temperature

**XC6802A42X**

\[ V_{IN}=5V, \ V_{BAT}=3.8V, \ R_{SEN}=2k\Omega \]
(9) UVLO Voltage vs. Ambient Temperature

(10) VIN – VBAT Shutdown Voltage vs. Ambient Temperature

(11) Charge Termination Detect Time vs. Ambient Temperature

(12) Recharge Time vs. Ambient Temperature

(13) Recharge Threshold Voltage vs. Ambient Temperature

(14) Soft Start Time vs. Ambient Temperature
(15) ON Resistance vs. Ambient Temperature

[Graph showing ON Resistance vs. Ambient Temperature for XC6802A42X with $V_{IN}=4.15V$, $I_{BAT}=100mA$, $V_{SEN}=0.5V$.]

(16) Shutdown Current vs. Ambient Temperature

[Graph showing Shutdown Current vs. Ambient Temperature for XC6802A42X with $V_{IN}=5V$, $R_{SEN}=NC$.]

(17) Stand-by Current vs. Ambient Temperature

[Graph showing Stand-by Current vs. Ambient Temperature for XC6802A42X with $V_{IN}=5V$, $V_{BAT}=4.3V$.]

(18) /CHG Weak Pull Down Current vs. /CHG Pin Voltage

[Graph showing /CHG Weak Pull Down Current vs. /CHG Pin Voltage for XC6802A42X with $V_{IN}=5V$, $V_{BAT}=4.3V$.]

(19) /CHG Strong Pull Down Current vs. /CHG Pin Voltage

[Graph showing /CHG Strong Pull Down Current vs. /CHG Pin Voltage for XC6802A42X with $V_{IN}=5V$, $V_{BAT}=4.0V$.]

(20) /CHG Pin Output Low Voltage vs. Ambient Temperature

[Graph showing /CHG Pin Output Low Voltage vs. Ambient Temperature for XC6802A42X with $I_{CHG}=5mA$, $V_{IN}=5V$, $V_{BAT}=2.5V$.]
**PACKAGING INFORMATION**

- **SOT-25**

- **SOT-89-5**

---

**SOT-25 Reference Pattern Layout**

**SOT-89-5 Reference Pattern Layout**

[unit: mm]
PACKAGING INFORMATION (Continued)

● **USP-6C**

![USP-6C Reference Pattern Layout](image)

![USP-6C Reference Metal Mask Design](image)

● **USP-6C Reference Pattern Layout**

● **USP-6C Reference Metal Mask Design**

● **USP-6EL**

![USP-6EL Reference Pattern Layout](image)

![USP-6EL Reference Metal Mask Design](image)

● **USP-6EL Reference Pattern Layout**

● **USP-6EL Reference Metal Mask Design**

(unit: mm)
SOT-89-5 Power Dissipation

Power dissipation data for the SOT-89-5 is shown in this page. The value of power dissipation varies with the mount board conditions. Please use this data as the reference data taken in the following condition.

1. Measurement Condition

- **Condition**: Mount on a board
- **Ambient**: Natural convection
- **Soldering**: Lead (Pb) free
- **Board**: Dimensions 40 x 40 mm (1600 mm2 in one side)
  - Copper (Cu) traces occupy 50% of the board area in top and back faces
  - Package heat-sink is tied to the copper traces
- **Material**: Glass Epoxy (FR-4)
- **Thickness**: 1.6mm
- **Through-hole**: 5 x 0.8 Diameter

2. Power Dissipation vs. Ambient Temperature

<table>
<thead>
<tr>
<th>Ambient Temperature (°C)</th>
<th>Power Dissipation Pd (mW)</th>
<th>Thermal Resistance (°C/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1300</td>
<td>76.92</td>
</tr>
<tr>
<td>85</td>
<td>520</td>
<td></td>
</tr>
</tbody>
</table>

![Evaluation Board Layout (unit: mm)](image)

**Pd vs Ta**

![Graph showing Power Dissipation vs Ambient Temperature](image)
SOT-25 Power Dissipation

Power dissipation data for the SOT-25 is shown in this page. The value of power dissipation varies with the mount board conditions. Please use this data as the reference data taken in the following condition.

1. Measurement Condition

- **Condition**: Mount on a board
- **Ambient**: Natural convection
- **Soldering**: Lead (Pb) free
- **Board**: Dimensions 40 x 40 mm (1600 mm2 in one side)
  - Copper (Cu) traces occupy 50% of the board area in top and back faces
  - Package heat-sink is tied to the copper traces (Board of SOT-26 is used.)
- **Material**: Glass Epoxy (FR-4)
- **Thickness**: 1.6mm
- **Through-hole**: 4 x 0.8 Diameter

2. Power Dissipation vs. Ambient Temperature

<table>
<thead>
<tr>
<th>Ambient Temperature (°C)</th>
<th>Power Dissipation Pd (mW)</th>
<th>Thermal Resistance (°C/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>600</td>
<td>166.67</td>
</tr>
<tr>
<td>85</td>
<td>240</td>
<td></td>
</tr>
</tbody>
</table>

**Pd vs. Ta**

[Graph showing the relationship between power dissipation (Pd) and ambient temperature (Ta)]
USP-6C Power Dissipation

Power dissipation data for the USP-6C is shown in this page. The value of power dissipation varies with the mount board conditions. Please use this data as the reference data taken in the following condition.

1. Measurement Condition

- **Condition**: Mount on a board
- **Ambient**: Natural convection
- **Soldering**: Lead (Pb) free
- **Board**: Dimensions 40 x 40 mm
  - (1600 mm² in one side)
  - Copper (Cu) traces occupy 50% of the board area in top and back faces
  - Package heat-sink is tied to the copper traces
- **Material**: Glass Epoxy (FR-4)
- **Thickness**: 1.6mm
- **Through-hole**: 4 x 0.8 Diameter

2. Power Dissipation vs. Ambient Temperature

<table>
<thead>
<tr>
<th>Ambient Temperature (°C)</th>
<th>Power Dissipation Pd (mW)</th>
<th>Thermal Resistance (°C/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>400</td>
<td>100.00</td>
</tr>
</tbody>
</table>

![Diagram](image.png)

**Pd vs Ta**

![Graph](image.png)

Ambient Temperature Ta (°C)
● USP-6ELパッケージ許容損失

USP-6ELパッケージにおける許容損失特性例となります。
許容損失は実装条件等に影響を受け値が変化するため、下記実装条件にての参考データとなります。

1. 測定条件（参考データ）

測定条件：基板実装状態
雰囲気：自然対流
実装：Pbフリーはんだ
実装基板：基板40mm x 40mm (片面1600mm²)に対して
銅箔面積 表面 約50%裏面 約50%
放熱板と周りの銅箔接続
基板材質：ガラスエポキシ（FR-4）
板厚：1.6mm
スルーホール：ホール径 0.8mm 4個

2. 許容損失-周囲温度特性

基板実装（Tjmax = 125℃）

<table>
<thead>
<tr>
<th>周囲温度（℃）</th>
<th>許容損失Pd（mW）</th>
<th>熱抵抗（℃/W）</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>400</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Pd-Ta特性グラフ
### MARKING RULE

#### USP-6C / USP-6EL

1 pin →

<table>
<thead>
<tr>
<th>MARK</th>
<th>PRODUCT SERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>XC6802******-G</td>
</tr>
</tbody>
</table>

#### SOT-25

<table>
<thead>
<tr>
<th>MARK</th>
<th>PRODUCT SERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>XC6802A*****-G</td>
</tr>
</tbody>
</table>

#### SOT-89-5

<table>
<thead>
<tr>
<th>MARK</th>
<th>PRODUCT SERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>XC6802<em>4</em>***-G</td>
</tr>
</tbody>
</table>

1 Represents product series

2 Standard product, Represent the 7th digits

3 Standard product, Represents the 8th digits

4-5 Represents production lot number
   01 to 09, 0A to 0Z, 11 to 9Z, A1 to A9, AA to AZ, B1 to ZZ in order.
   *(G, I, J, O, Q, W excepted)*

*No character inversion used.*
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