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## **Selecting the Best bq2404x, bq2405x, or bq2409x Single Cell Battery Charger for Your Application**

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### **ABSTRACT**

The bq2404x, bq2405x, and bq2409x series of devices are highly integrated Li-Ion and Li-Pol linear chargers devices targeted at space-limited portable applications. The devices operate from either a USB port or AC adapter. The high input voltage range with input overvoltage protection supports low-cost unregulated adapters. These devices have a single power output that charges the battery. A system load can be placed in parallel with the battery as long as the average system load does not keep the battery from charging fully during the 10 hour safety timer. This application note provides a selection table that highlights different specifications and features of these linear chargers. If dual input is needed, the bq2403x could be a good option. If dual power output is needed, consider using the bq2407x or bq2423x. If a switch mode charger is needed, consider using the bq2416x for dual input applications or the bq2427x for single input applications.

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**Table 1. Selection Table**

Specification or Feature	bq24040	bq24041	bq24045	bq24050	bq24052	bq24055	bq24090	bq24091	bq24092	bq24093	bq24095
VOVP(V) <sup>(1)</sup>	6.6	7.1	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Battery Regulation Voltage (V)	4.2	4.2	4.35	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.35
IN-DPM <sup>(2)</sup>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
PreTerm <sup>(3)</sup>	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
ASI/ASO <sup>(4)</sup>	No	Yes	No	No	No	No	No	No	No	No	No
Features	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>	PG <sup>(5)</sup> / BAT_EN (7) / CHG <sup>(7)</sup>	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>	TS <sup>(6)</sup> / CHG <sup>(7)</sup>	TS(5) / CHG (6)	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>	PG <sup>(5)</sup> / TS <sup>(6)</sup> / CHG <sup>(7)</sup>
Max Input Current (A)	1	1	1	1	1	1	1	1	1	1	1
Charge Current (A)	1	1	1	1	1	1	1	1	1	1	1
Temp Sensing Mode (TS) <sup>(6)</sup>	Current Mode	NO	Current Mode	Current Mode	Current Mode	Current Mode	Current Mode	Current Mode	Current Mode	Current Mode	Current Mode
JEITA <sup>(8)</sup>	YES	N/A	YES	YES	YES	YES	NO	NO	YES	YES	NO
RNTC Required	10 kΩ	N/A	10 kΩ	10 kΩ	100 kΩ	10 kΩ	10 kΩ	100 kΩ	10 kΩ	100 kΩ	10 kΩ
USB	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
D+ and D- Detection <sup>(9)</sup>	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO	NO
Minimum Vin (V) <sup>(10)</sup>	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45
Maximum Vin (V) <sup>(10)</sup>	6.45	6.45	6.45	6.45	6.45	6.45	6.45	6.45	6.45	6.45	6.45
Safety Timer <sup>(11)</sup>	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs	Fixed to 10 hrs
Thermal Regulation and Thermal Shutdown <sup>(12)</sup>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Package <sup>(13)</sup>	2 x 2 DFN-10	2 x 2 DFN-10	2 x 2 DFN-10	2 x 2 DFN-10	2 x 2 DFN-10	2 x 3 DFN-12	5 x 3 MSOP-10	5 x 3 MSOP-10	5 x 3 MSOP-10	5 x 3 MSOP-10	5 x 3 MSOP-10

<sup>(1)</sup> Overvoltage Protection: If the input source applies an overvoltage, the pass FET, if previously ON, turns OFF after a deglitch time.

<sup>(2)</sup> Input Voltage Dynamic Power Management: this feature is used to detect an input source voltage that is dropping, reaching its current limit due to an excessive load.

<sup>(3)</sup> Programs the Current Termination Threshold (5 to 50% of Iout which is set by ISET) and Sets the Pre-Charge Current.

<sup>(4)</sup> ASI: Auto Start External input. ASO: Auto Start Logic Output. It is an OR gate with two inputs; an internal power good signal and an external input from ASI pin. The OR gate is powered by the OUT pin and the OUT pin must be powered by an external source (battery, power supply or via the IN) for the ASO pin to deliver a logic High. The ASI/ASO, OUT and PG signals are used in production testing to test the system without a battery.

<sup>(5)</sup> Power Good: Low (FET on) indicates the input voltage is above UVLO and the OUT (battery) voltage.

<sup>(6)</sup> Battery Temperature Sense

<sup>(7)</sup> Charge Status Indication: Low (FET on) indicates charging and Open Drain (FET off) indicates no Charging or Charge complete.

<sup>(8)</sup> JEITA Temperature Standard

<sup>(9)</sup> This detection is designed to give the charger advance notice that an adaptor or USB port is connect for the cases where the battery is discharged and device transceiver is not able to communicate with a USB host or there is not a device transceiver.

<sup>(10)</sup> Recommended Maximum and Minimum Input Voltage

<sup>(11)</sup> The fast charge timer is fixed at 10 hours and can be increased real time by going into thermal regulation, INDPM or if in USB current limit. The pre-charge timer is set to 30 minutes.

<sup>(12)</sup> 125°C Thermal Regulation; 150°C Thermal Shutdown Protection

<sup>(13)</sup> Package Type

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