



## HT6000 Series – HT6122

### High Efficiency, Dual Buck DC-DC Controller with internal Protocol, selectable switching frequency up to 350kHz

#### APPLICATION

- USB TypeC/TypeA fast charging applications
- LCD monitor/TV
- Desktop PC
- Automotive ADAS Power
- Low EMI Application (Patent Pending)

#### GENERAL DESCRIPTION

HT6122 is an easy to use, high efficiency, dual-channel, synchronous step-down switching controller designed for high-power dual ports fast charging applications. It has one channel built in QC Protocol for easy configuration to one Type-A and one Type-C fast charging output. With one channel of Type A fast charging, another channel is flexible to be used as a general purpose DC-DC applications, fitting different needs of users' requirements.

HT6122 has a wide input voltage range from 7 V to 36 V, supports output voltages from 3.6V to 20V with typical current of 3A, the Switching frequency is selectable to covers wide range of applications. The maximum output power can be up to 60W at each channel.

HT6122 has soft start function, which can prevent the inrush current at startup from affecting the stability of the input power.

HT6122 has a variety of protection, such as input overvoltage protection, undervoltage protection, output over current protection, overvoltage, undervoltage, short circuit

protection, and etc.

#### FEATURES

##### Dual-Channel Synchronous Buck converter

- Wide input voltage range: 7V to 36V
- Output current up to 3A at each channel
- One channel built in QC Protocol
- External feedback for another channel
- Dual Channel Fast Charging simultaneously
- Selectable switching frequency at 150kHz, 250kHz and 350kHz
- Support CC / CV mode
- Soft start

##### Multi-Protection

- Input under-voltage lockout (UVLO)
- Input over-voltage protection (IVP)
- Output over-voltage protection (OVP)
- Output short-circuit protection (SCP)
- Over-temperature protection (OTP)

##### Input Protection

If the input voltage is higher than IVP or smaller than Input UVLO, both buck channels stop the gate driver, reset and enter hiccup mode. It returns to Normal when the faults are cleared.

### Output Protection

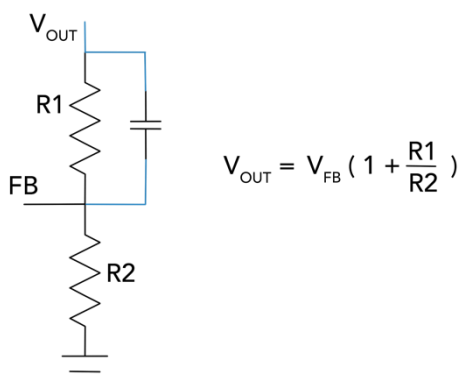
The Output Under-voltage Lockout threshold and the Output Over-voltage Protection are set at  $V_{OUT} * 60\%$  and  $V_{OUT} * 118\%$ . Once Output UVLO or OVP is triggered, the specific channel stops the gate driver, reset and enter hiccup mode.

### Soft Start

HT6000 series employs an internal soft start in the buck converter to prevent large inrush current and overshoots of  $V_{OUT}$ . The soft start time is 8ms in the design.

### Feedback and Output Voltage

HT6122 provides an external FB for setting the output voltage. Usually feedback resistor divider tap is connected and  $V_{FB}$  is regulated at 1V. The relationship between the  $V_{OUT}$  and the resistor divider tap is as follows:



### Frequency Selection

The switching frequency can be selected by applying different condition to the pin FREQ.

FREQ state	$f_{sw}$ (kHz)
Z	150
L	250
H	350

### Efficiency and External FET $R_{dson}$

The accuracy of the output voltage and the conversion efficiency is highly affected by the  $R_{dson}$  of the external FET. The lower the  $R_{dson}$  the higher the efficiency and voltage accuracy.

### DEVICE INFORMATION

Part Number	Package	Shipping
HT6122	5x5 QFN32	490 / tray

See package outline and dimensions on p.8 of this datasheet.

## Block Diagram

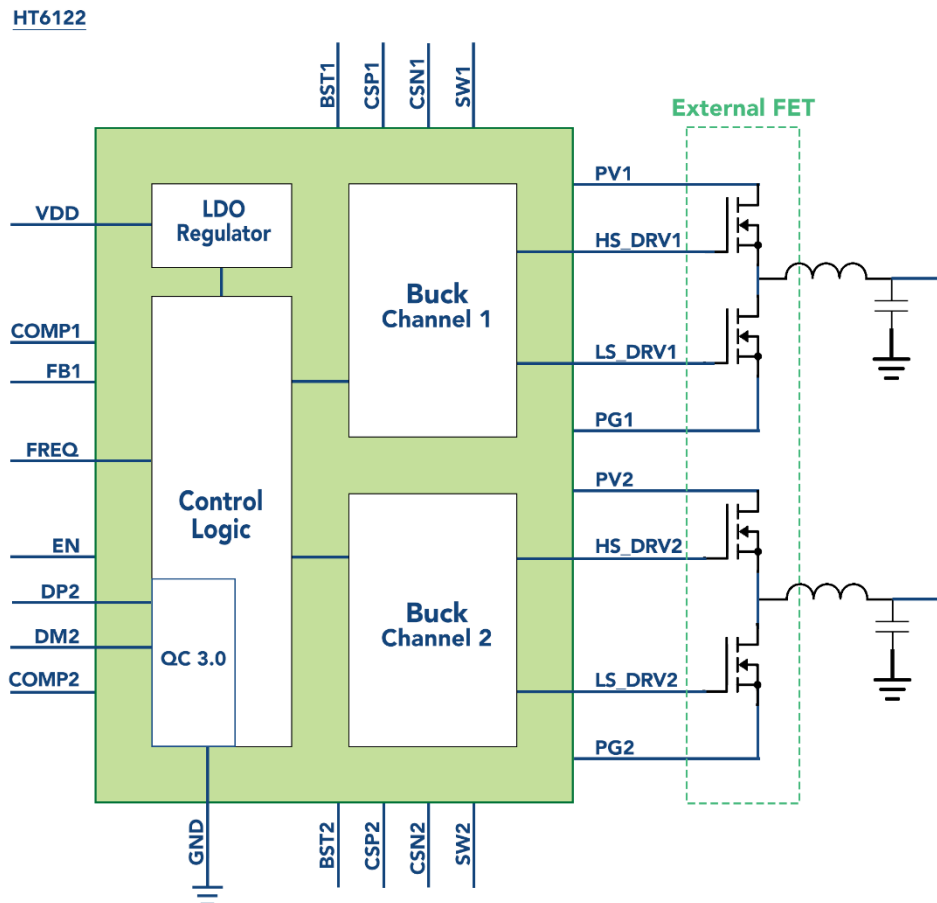


Fig. 1 HT6122 Block diagram

### Absolute Maximum Ratings

PV1, PV2, SW1, SW2, EN, BST1, BST2	-0.3V to 40V
CSP1, CSN1, CSP2, CSN2	-0.3V to 22V
VDD, COMP1, COMP2, FB1, FB2, COMB	-0.3V to 6V
Operation Temperature	-40°C to 85 °C
Junction Temperature	-40°C to 125°C
Storage Temperature	-65°C to 125°C
Soldering Temperature	300°C

**Electrical Characteristics** ( $V_{IN}=8V$ ,  $T_A=25^{\circ}C$  unless specified) **(this table to be finalized)**

Parameters	Symbol	Test Conditions	Rating			Unit
			MIN	TYP	MAX	
<b>Input Characteristics</b>						
Input Voltage	$V_{IN}$		7		36	V
Input under voltage lockout threshold	$V_{UVLO}$			5.5		V
Input under voltage lockout Hysteresis	$V_{UVHYS}$			0.6		V
Quiescent current	$I_Q$			9		mA
EN Threshold	$V_{EN}$			1.35		V
EN Hysteresis	$V_{ENHYS}$			110		mV
VDD regulator	$V_{REG}$			5.3		V
<b>Switching Characteristics</b>						
Switching Frequency	$f_{sw}$	FREQ=Z		150		kHz
		FREQ=L		250		kHz
		FREQ=H		350		kHz
Minimum Off-Time	$t_{OFF, Min}$			80		ns
<b>Output Characteristics</b>						
Output Voltage Range	$V_{OUT}$		3.6		20	V
Cycle by cycle Current Limit	$I_{OCP}$			6		A
<b>Output Channel 1 control by FB</b>						
Output voltage Reference	$V_{FB}$			1		V
Output Current limit	$I_{LIMIT\_FB}$	Rcs = 10 mΩ		3		A
<b>Output Channel 2 control by QC3</b>						
Single Channel Output Voltage (QC3)	$V_{OUT\_QC3}$	QC5V: D+ = 0.6V, D- = 0V		5		V
		QC9V: D+ = 3.3V, D- = 0.6V		9		V
		QC12V: D+ = 0.6V, D- = 0.6V		12		V
		$V_{IN}=24V$ , QC20V: D+ = 3.3V, D- = 3.3V		20		V
	$V_{STEP\_QC3}$	Cont.Mode: D+ = 0.6V, D- = 3.3V		200		mV
Single Channel Output Current (QC3)	$I_{OUT\_QC3}$	Rcs = 10 mΩ, $V_{OUT}=5V$		3.3		A
		Rcs = 10 mΩ, $V_{OUT}=9V$		2.1		A
		Rcs = 10 mΩ, $V_{OUT}=12V$		1.6		A
		$V_{IN}=24V$ , Rcs = 10 mΩ, $V_{OUT}=20V$		1		A

Parameters	Symbol	Test Conditions	Rating			Unit
			MIN	TYP	MAX	
<b>Protection</b>						
<b>Input Over-voltage Protection</b>						
Input Over-Voltage Protection	$V_{OVP}$			39		V
<b>Output Under-voltage Lockout</b>						
Output Under-voltage Protection	$V_{UVLO}$			$V_{FB}^*$ 60%		V
<b>Output Over-voltage Protection</b>						
Over-Voltage Protection	$V_{OVP}$			$V_{FB}^*$ 118%		V
<b>Over-Temperature Protection</b>						
Thermal Shutdown	$T_{SD}$	Increasing Temperature		140		°C
Thermal Shutdown Hysteresis	$T_{SD\_HYS}$	Decreasing temperature		30		°C

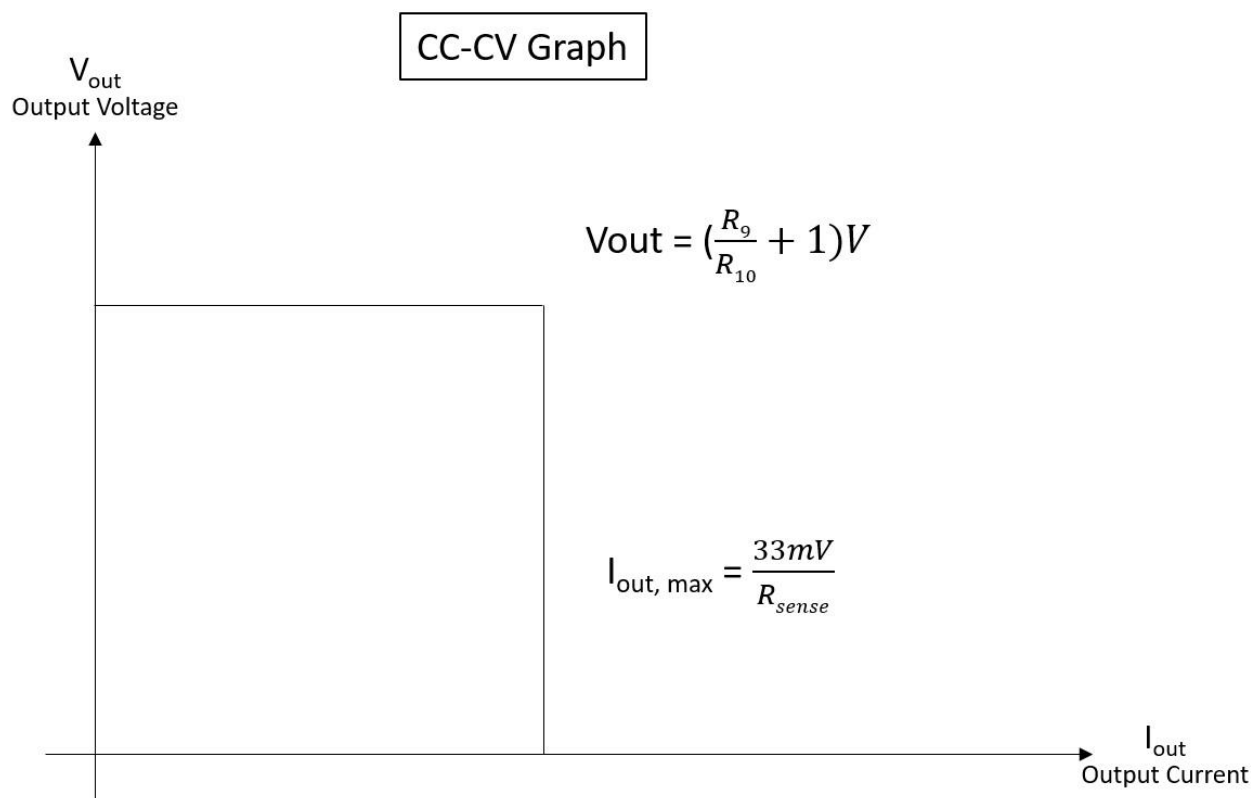


Fig. 2 CC-CV Graph

## Pin Configuration

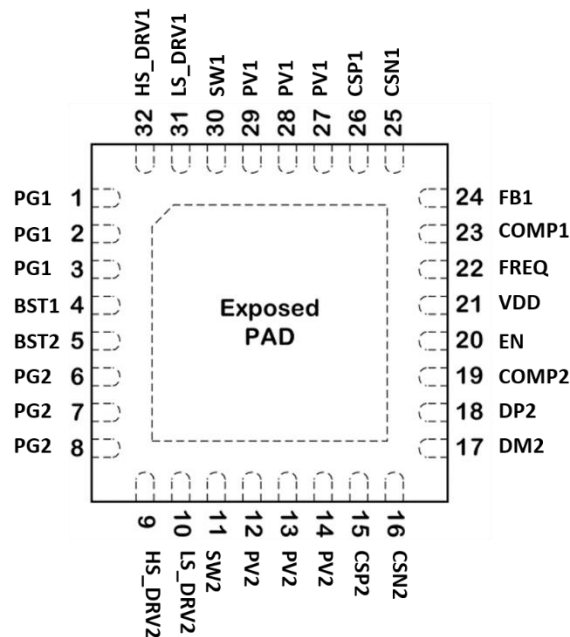


Fig. 3 32-pin QFN, 5x5 mm<sup>2</sup>, 0.5mm pitch TOP VIEW

## Pin Functions

HT6122 package: QFN32 (5mmx5mm)

Pin	Name	Description	Pin	Name	Description
1	PG1	Power Ground Channel 1	17	DM2	USB D- channel 2
2	PG1	Power Ground Channel 1	18	DP2	USB D+ channel 2
3	PG1	Power Ground Channel 1	19	COMP2	Compensation Pin 2
4	BST1	High Side Power Channel 1	20	EN	Chip Enable
5	BST2	High Side Power Channel 2	21	VDD	VDD Regulator
6	PG2	Power Ground Channel 2	22	FREQ	Frequency selection
7	PG2	Power Ground Channel 2	23	COMP1	Compensation Pin 1
8	PG2	Power Ground Channel 2	24	FB1	Feedback Pin 1
9	HS_DRV2	High Side Gate Drive Channel 2	25	CSN1	Current Sense Negative 1
10	LS_DRV2	Low Side Gate Drive Channel 2	26	CSP1	Current Sense Positive 1
11	SW2	Inductor Connection Channel 2	27	PV1	Input Power Channel 1
12	PV2	Input Power Channel 2	28	PV1	Input Power Channel 1
13	PV2	Input Power Channel 2	29	PV1	Input Power Channel 1
14	PV2	Input Power Channel 2	30	SW1	Inductor Connection Channel 1
15	CSP2	Current Sense Positive 2	31	LS_DRV1	Low Side Gate Drive Channel 1
16	CSN2	Current Sense Negative 2	32	HS_DRV1	High Side Gate Drive Channel 1
33	EPAD	Signal Ground and Thermal Dissipation Pad			

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**Typical Application Circuit**

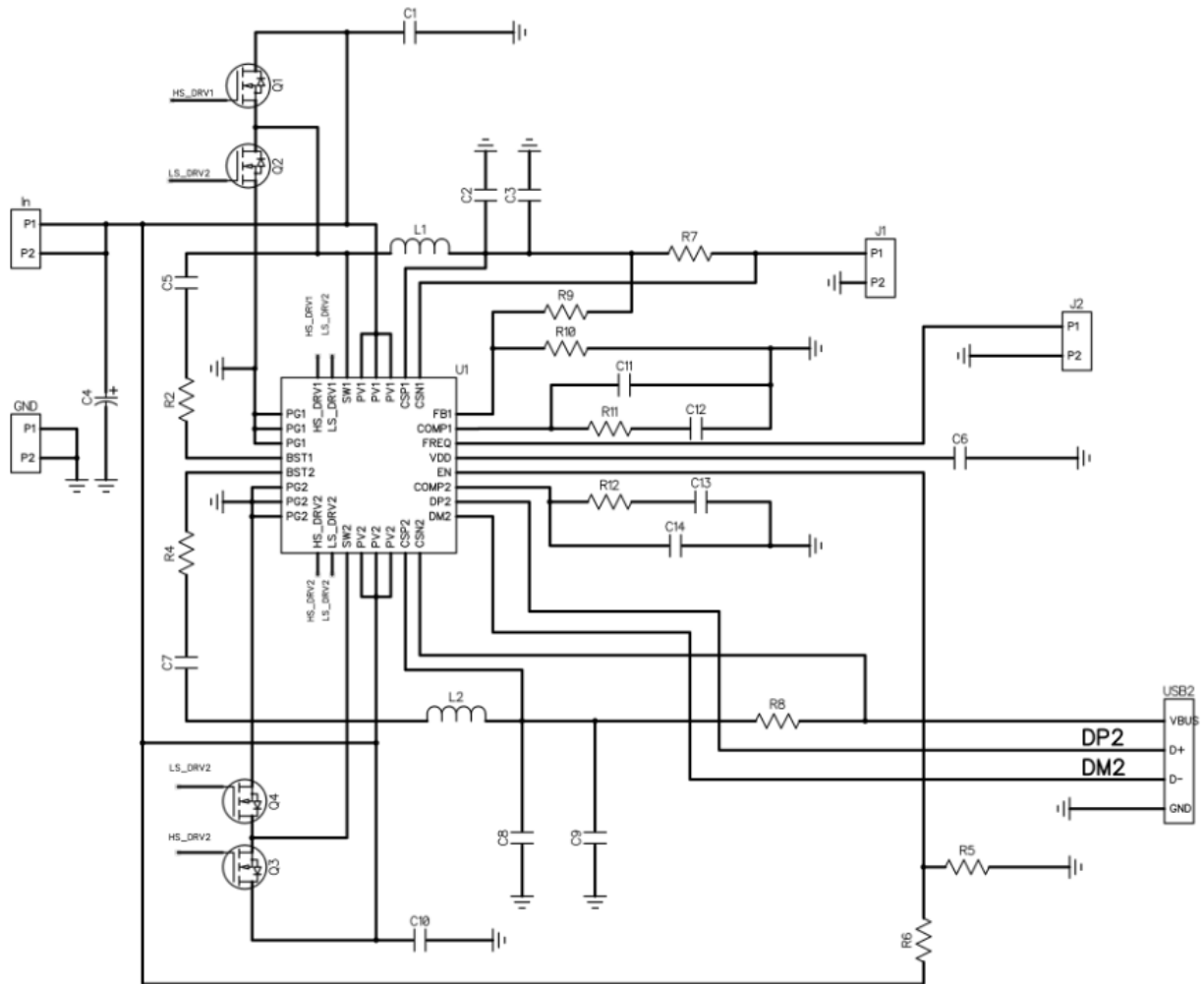
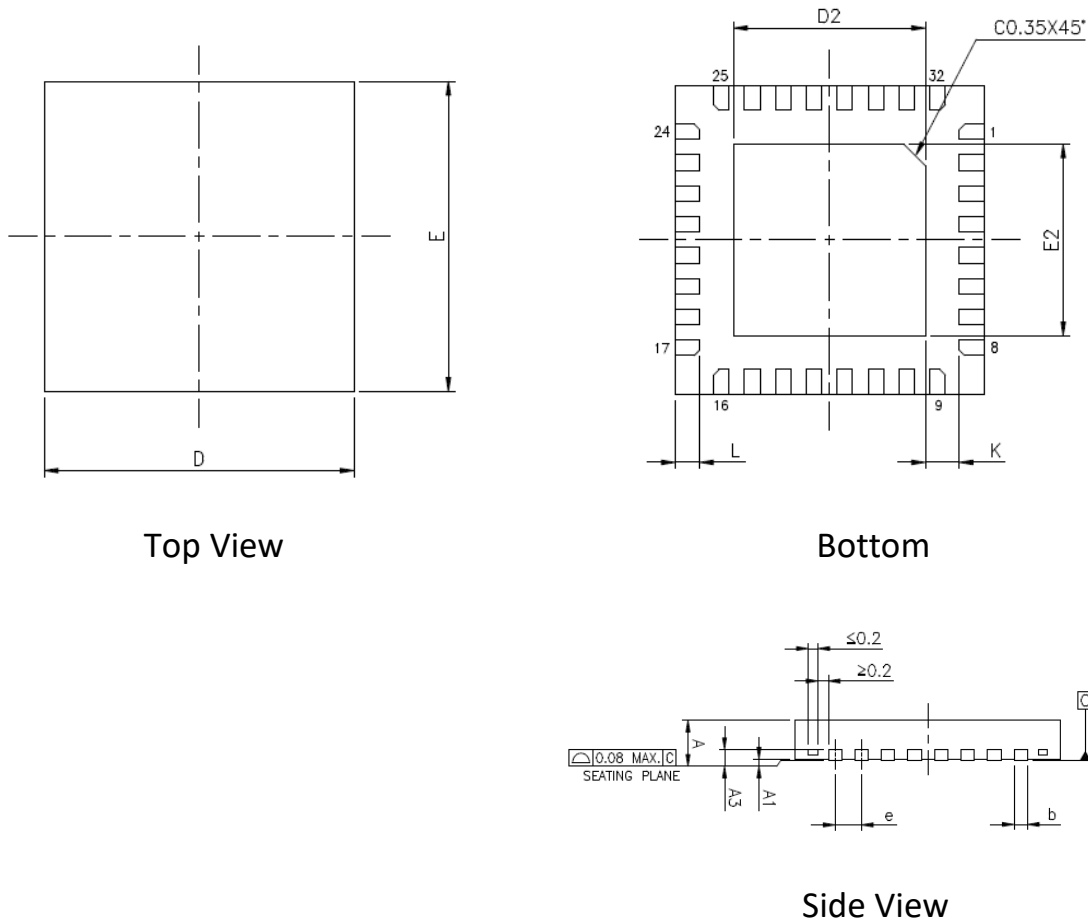


Fig. 4 HT6122 application schematic diagram

## Package Outline and Dimensions



Top View

Bottom

Side View

JEDEC OUTLINE	PACKAGE TYPE					
	MO-220			MO-220		
PKG CODE	WQFN(X532)			VQFN(Y532)		
SYMBOLS	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.80	0.85	0.90
A1	0.00	0.02	0.05	0.00	0.02	0.05
A3	0.203 REF.			0.203 REF.		
b	0.18	0.25	0.30	0.18	0.25	0.30
D	5.00 BSC			5.00 BSC		
E	5.00 BSC			5.00 BSC		
e	0.50 BSC			0.50 BSC		
L	0.35	0.40	0.45	0.35	0.40	0.45
K	0.20	—	—	0.20	—	—

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSION b APPLIES TO METALIZED TERMINAL AND IS MEASURED BETWEEN 0.15mm AND 0.30mm FROM THE TERMINAL TIP. IF THE TERMINAL HAS THE OPTIONAL RADIUS ON THE OTHER END OF THE TERMINAL, THE DIMENSION b SHOULD NOT BE MEASURED IN THAT RADIUS AREA.
3. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.

Fig. 5 32-pin QFN, 5mm x 5mm, 0.5mm pitch



Dual Ports **MAX**  
**SPEED**

**HT6000 Series**

Fast Charging is just a Breeze



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