

Rockchip

RK852

Datasheet

Revision History

Date	Revision	Description
2022-04-12	1.0	Initial released

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Chapter 1 Introduction

1.1 General Description

The RK852/RK852G is a primary side controller integrated in one chip. High voltage start up JFET is integrated to reduce standby current.

The RK852/RK852G integrates primary side controller which achieves primary side high voltage MOSFET control logic and driver. RK852/RK852G features a proprietary valley–lockout circuitry, ensuring stable valley switching. This system works down to the 6th valley, As the load decreases further, RK852/RK852G enter Frequency reduction mode, through decrease Ton and Toff by FB, when load is very light RK852/RK852G enter burst mode, RK852/RK852G integrates two driver, normal MOSFET driver as 12V (RK852) and GaN MOSFET driver as 6V(RK852G), Much protection such as brown out protection, internal over temperature protection, External over temperature protection, output over-voltage protection, PVCC over-voltage protection, over-current protection for LPS, over-power protection , synchronous rectifier MOSFET short protection, CS Rsense short protection are all integrated in primary side of RK852/RK852G.

1.2 Features

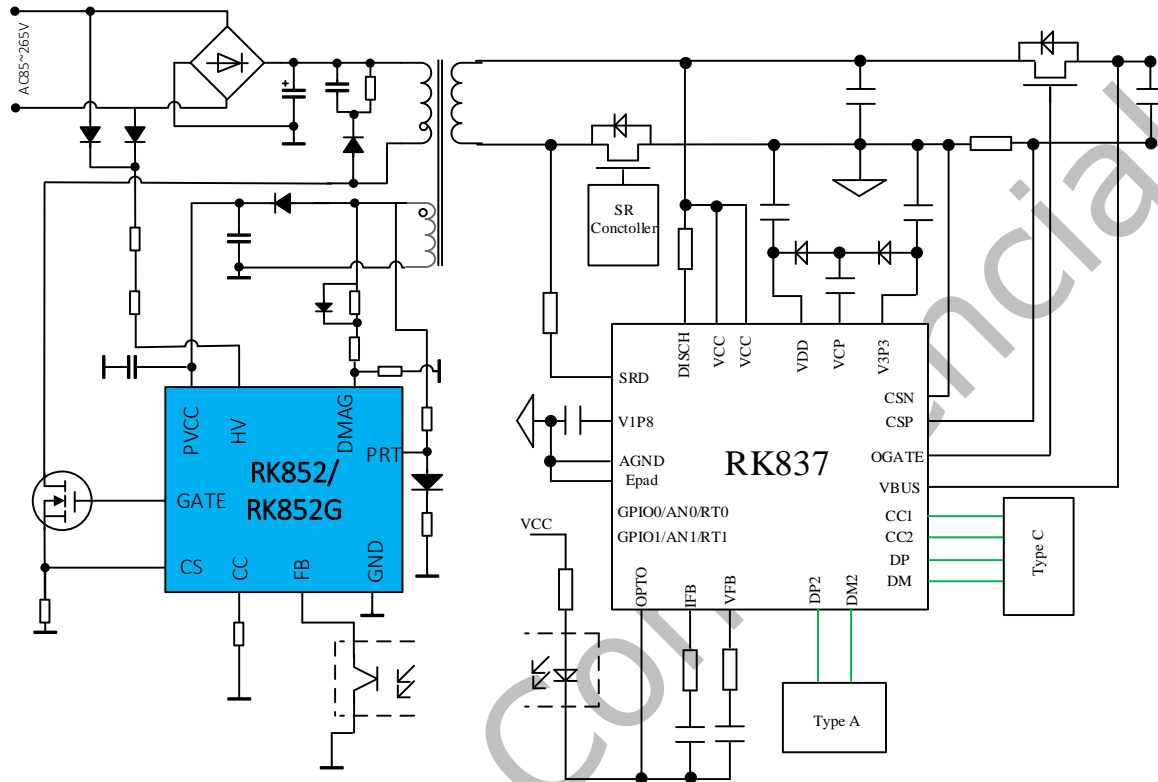
The features listed below which may or may not be present in actual product, may be subject to the third party licensing requirements. Please contact Rockchip for actual product feature configurations and licensing requirements.

- Integrates high voltage start up JFET
- Integrated X2 Capacitor Discharge Capability
- QR operation mode for high efficiency
- Switch Frequency Up to 250KHz/500KHz
- 25 kHz Minimum Frequency Clamp
- Wide VDD range from 7.5 V to 60V
- Burst mode in light load
- Ultra low standby power consumption
- Brownout Detection
- Rock-chip's special technology for better EMI, such special gate driver and jitter
- 62V VCC Overvoltage Protection
- Rock-chip's special Adjustable over-current protection for LPS
- Rock-chip's special external over temperature protection and output over-voltage protection
- Internal over temperature protection
- Adjustable Overpower Protection (OPP)
- CS Rsense short protection
- Synchronous rectifier MOSFET short protection
- Normal MOSFET driver as 12V (RK852) and GaN mos driver as 6V(RK852G)
- SSOP-10package

1.3 Applications

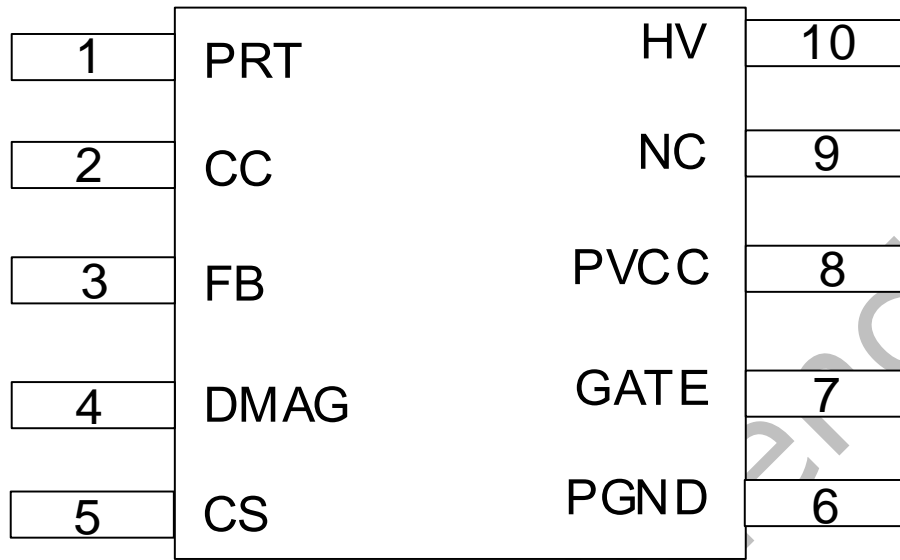
- USB PD type-C Power Adaptor for Smart-Phone, Tablet, and Notebook, etc.

Typical Application Circuit RK852/RK852G+RK837



Chapter 2 Pin Configuration and Functions

2.1 Pin Assignment



SSOP-10

Fig. 2-1 Pin Assignment

2.2 Pinout Number Order

10-Pin No	Pin Name	Pin Description
1	PRT	OVP and OTP set pin, connecting a NTC resistor to ground for OTP. Connecting a resistor from Vaux for OVP. If both OTP and OVP needed, a diode should be connected between PRT pin and the NTC resistor
2	CC	Output constant current set pin for LPS, connect a resistance to gnd
3	FB	Feedback input for the QR Flyback controller
4	DMAG	A resistor divider from the auxiliary winding to detect transformer demagnetization and sets the OPP compensation level
5	CS	Primary side peak current sense
6	PGND	Primary side ground
7	GATE	Primary side MOSFET driver output
8	PVCC	Primary side input power, connect a capacitor to PGND
9	NC	Null
10	HV	Primary side High voltage start up pin

Chapter 3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Parameter	Min	Max	Units
Max range on pin HV	-0.3	500	V
Max range on pin PVCC, DMAG	-0.3	65	V
Max range on pin GATE	-0.3	15	V
Max range on pin CS	-0.3	7	V
Storage temperature range, T _s	-60	150	°C
Operating Junction temperature range, T _j	-40	125	°C
Maximum Soldering Temperature, T _{SOLDER}		260	°C
ESD HBM	2		kV
ESD CDM	1		kV

Note 1: Exposure to the conditions exceeded absolute maximum ratings may cause the permanent damages and affect the reliability and safety of both device and systems using the device. The functional operations cannot be guaranteed beyond specified values in the recommended conditions.

3.2 Recommended Operating Conditions

Parameter	Min	TYP	Max	Units
Voltage range on pin HV			400	V
Voltage range on pin PVCC, DMAG		15	60	V
Voltage range on pin GATE			12	V
Voltage range on other pins			5	V
Power Dissipation			0.4	W
Ambient Temperature Range	-40		125	°C
Junction Temperature Range	-40		125	°C

3.3 DC Characteristics

T_A=25°C; unless otherwise specified.

Parameter	Symbol	Condition	Min	Typ	Max	Units
HV Section						
HV Supply current when start up	I _{HV_ST}	HV=100V,VDD=2V	1	2		mA
HV Leakage current	I _{HV_LK}	HV=500V,VDD=18V		10	20	uA
Brown-out threshold	V _{BR_OUT}	V _{HV} decreasing	88	94	100	V
Brown-out hys	V _{BR_OUT_HYS}	V _{HV} increasing	9	14	19	V
Brown-in threshold	V _{BR_IN}	V _{HV} increasing	102	108	114	V
Brown-out De-bounce time	T _{BR_OUT}		40	50	60	mS

Parameter	Symbol	Condition	Min	Typ	Max	Units
X-cap discharge						
AC-OFF threshold	V_{AC-OFF_rising}			76		V
AC-OFF debounce time	T_{AC-OFF}			100		ms
VCC Section						
Turn on threshold	V_{PVCC_ON}	PVCC Rising		13.5		V
Turn off threshold	V_{PVCC_OFF}	PVCC Falling		7.5		V
Start-up current	I_{PVCC_ST}			200		uA
Operation current	I_{PVCC_OP}			2		mA
VCC OVP	V_{PVCC_OVP}			62		V
Latch release voltage	V_{th_latch}			4.5		V
Auto-recovery restart time	$T_{d_recovery}$			3		S
Gate Section						
RK852 GATE output Clamp voltage	V_{GATEH}	High level		12		V
RK852G GaN GATE output Clamp voltage	V_{GATEH}	High level		6		V
GATE output Low voltage	V_{GATEL}	Low level	-	-	0.25	V
GATE Rising time	T_r	$C_L=1nF$		150		nS
GATE Falling time	T_f	$C_L=1nF$		50		nS
OTP Section						
Thermal shut down threshold	OTP_{SD}			150		°C
Thermal shut down hysteresis	OTP_{hys}		-	20		°C
FB Section						
FB open voltage				5.0		V
Internal Pull-Up Resistor				20		Kohm
VFB to Internal Current Setpoint Division Ratio				4		V/V
Transition Thresholds from 1st to 2nd valley	V1to2	VFB decreasing		1.4		V
Transition Thresholds from 2nd	V2to3	VFB decreasing		1.2		V

Parameter	Symbol	Condition	Min	Typ	Max	Units
to 3rd valley						
Transition Thresholds from 3rd to 4th valley	V3to4	VFB decreasing		1.1		V
Transition Thresholds from 4th to 5th valley	V4to5	VFB decreasing		1.0		V
Transition Thresholds from 5th to 6th valley	V5to6	VFB decreasing		0.9		V
Transition Thresholds from 6th to 5th valley	V6to5	VFB increasing		1.5		V
Transition Thresholds from 5th to 4th valley	V5to4	VFB increasing		1.6		V
Transition Thresholds from 4th to 3rd valley	V4to3	VFB increasing		1.7		V
Transition Thresholds from 3rd to 2nd valley	V3to2	VFB increasing		1.8		V
Transition Thresholds from 2nd to 1st valley	V2to1	VFB increasing		2.0		V
Transition Thresholds from 6 th valley to Frequency reduction mode	V6toFF	VFB decreasing		0.8		V
Maximum Frequency reduction mode CS_MIN	Vcsm_max	Option 0: VFB=0.8V (linear change vs. VFB)		0.4		V
		Option 1: VFB=0.8V (linear change vs. VFB)		0.5		V
Minimum Frequency reduction mode CS_MIN	Vcsm_min	Option 0: VFB<=0.4V		0.2		V
		Option 1: VFB<=0.4V		0.15		V
Maximum Frequency Clamp	Fmax	Option 0		500		KHz
		Option 1		250		KHz
Minimum Frequency Clamp	Fmin			25		KHz
Maximum On Time	Ton_max			20		uS
The threshold enter burst mode	Vburst	VFB decreasing		400		mV
The threshold of Open Loop	Vopen			4.6		V

Parameter	Symbol	Condition	Min	Typ	Max	Units
protection						
Open Loop protection blanking time	Tblk_open	From start-up		50		mS
CS Section						
CS Current limit threshold	V _{CS_LIM1}	Base current limit		800		mV
CS Current limit blanking time	T _{CS_LEB}	Start from GATE rising edge		330		nS
Total delay of CS_LIM to GATE low		Step VCS 0 V to VILIM1 + 0.5 V. All CS CMP has the same delay.		95		nS
SR short protection threshold	VILIM2			1.2		V
SR short protection Debounce time	T _{SR_SHORT}			8		cycle
Soft start time	T _{soft_ST}			5		mS
Pull-Up Current Source				5.0		uA
Jitter Frequency	Fjitter			3.9		KHz
DEMAG Section						
ZCD threshold voltage	V _{ZCD}	VDEMAG decreasing		80		mV
Blanking Delay After Turn-Off	T _{BLK_ZCD}	For blanking ring		500		nS
PRT Section						
OVP threshold current	I _{PRTOVP}		47.5	50	52.5	uA
Overvoltage Protection Delay				8		cycle
OTP resistance Threshold	V _{OTP}			9		Kohm
OTP Protection Delay				40		cycle
CC Section						
CC open voltage	V _{cc_open}			5		V
LPS Protection Delay				32		mS

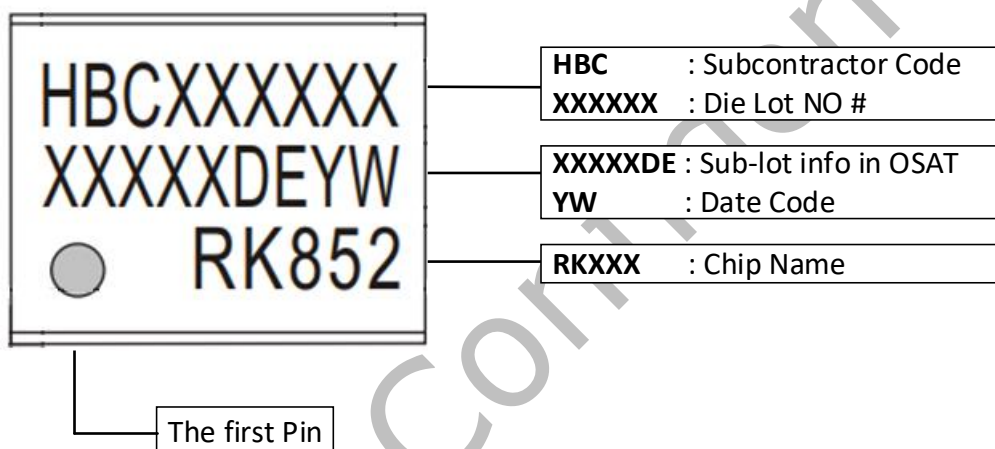
Chapter 4 Package information

4.1 Ordering Information

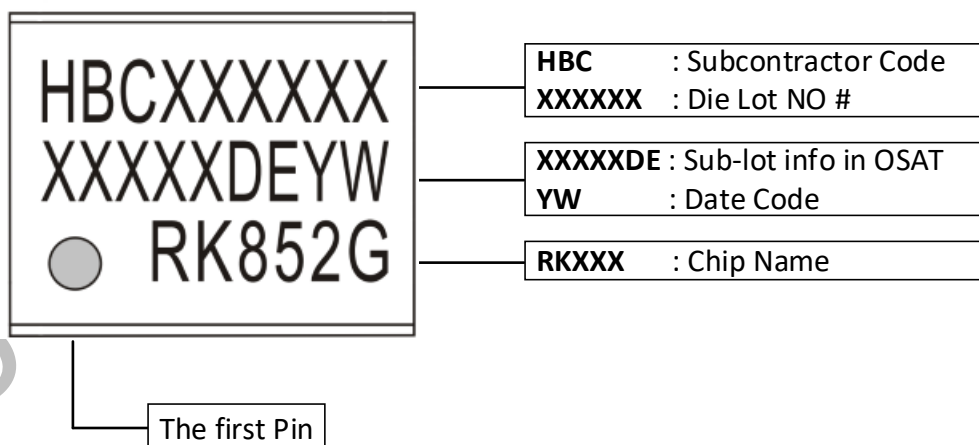
Orderable Device	RoHS status	Package	Package Qty	Device Feature
RK852	RoHS	SSOP10	2500pcs by tape	Primary Controller for Adapter
RK852G	RoHS	SSOP10	2500pcs by tape	Primary Controller for Adapter

4.2 Top Marking

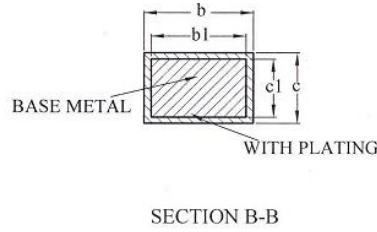
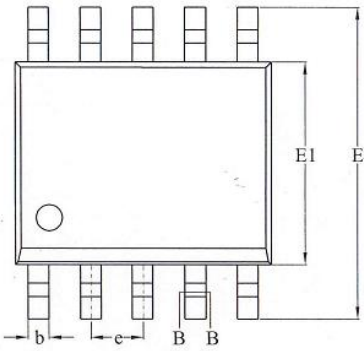
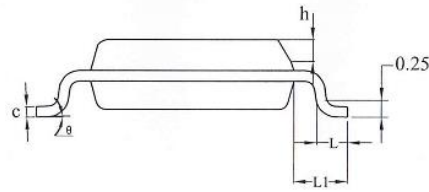
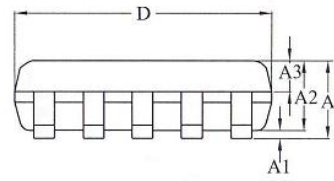
4.2.1 RK852 Marking



4.2.2 RK852G Marking



4.3 Dimension



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.47
b1	0.38	0.41	0.44
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.00BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

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