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## Wireless Power Transmitter IC, Qi (Wireless Power Consortium) Compliant

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### FEATURES

- Qi compliant power transmitter design
- Embedded MCU
- Embedded Buck-Boost DCDC converter for Inverter voltage control
- Four half-bridge gate-driver (also works as two full-bridge gate-driver)
- Single-coil solution (A10,A11) compliant
- Multi-coil, position free (A6, up to 4 coils) compliant
- High accuracy inverter voltage and current monitor
- Foreign Object Detection compliant WPC version 1.1.
- Programmable half-bridge gate-driver frequency and duty ratio
- WPC compliant current and voltage demodulator
- Wide input voltage range : VADP: 4.6 V ~ 19.5 V
- Optional high power output (>5W)  
with Panasonic AN32257A receiver IC
- Inverter output short protection
- Under voltage lockout function
- Inverter output short circuit protection
- Thermal shut down
- Temperature monitor (3ch)
- LED indicator
- Package HQFP64

### DESCRIPTION

NN32251A is a Wireless Power System transmitter IC which is designed for Qi compliance defined by Version 1.1 of the System Description Wireless Power Transfer, Volume 1 for Low Power from Wireless Power Consortium. A Qi compliance wireless power transmitter devices with NN32251A built-in could work with any wireless power receiver devices which is Qi compliance.

### APPLICATIONS

- WPC Compliant Wireless Charging Pad

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**The product specifications described in this book are subject to change without notice for the product which is currently under development. At the final stage of your design, purchasing, or use of the product, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.**

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Notes
Supply voltage	$V_{VADP}$	21	V	*1
	$V_{VINV}$	21	V	*1
Output Current	$I_{VADP}$	—	A	*1
Operating free-air temperature	$T_{opr}$	– 30 to + 85	°C	*2
Storage temperature	$T_{stg}$	– 50 to + 125	°C	*2
ESD	HBM (Human Body Model)	TBD	kV	—

Notes) This product may sustain permanent damage if subjected to conditions higher than the above stated absolute maximum rating. This rating is the maximum rating and device operating at this range is not guaranteeable as it is higher than our stated recommended operating range. When subjected under the absolute maximum rating for a long time, the reliability of the product may be affected.

\*1: The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

\*2: Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for  $T_a = 25\text{ °C}$ .

## POWER DISSIPATION RATING

PACKAGE	$\theta_{JA}$	PD ( $T_a = 25\text{ °C}$ )	PD ( $T_a = 85\text{ °C}$ )	Notes
HQFP64	TBD °C / W	TBD W	TBD W	—

Note). For the actual usage, please refer to the PD- $T_a$  characteristics diagram in the package specification, follow the power supply voltage, load and ambient temperature conditions to ensure that there is enough margin and the thermal design does not exceed the allowable value.



### **CAUTION**

Although this has limited built-in ESD protection circuit, but permanent damage may occur on it. Therefore, proper ESD precautions are recommended to avoid electrostatic damage to the MOS gates

## RECOMMENDED OPERATING CONDITIONS

Parameter	Pin Name	Min.	Typ.	Max.	Unit	Notes
Supply voltage range	$V_{VADP}$	4.6	12	19.5	V	*1
	$V_{VINV}$	3.0	-	19		

Note) Do not apply external currents and voltages to any pin not specifically mentioned.

Voltage values, unless otherwise specified, are with respect to GND.

\*1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

## ELECTRICAL CHARACTERISTICS

$V_{VADP} = 12\text{ V}$ ,  $V_{VIO} = 1.8\text{ V}$   $T_a = 25\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$  unless otherwise noted.

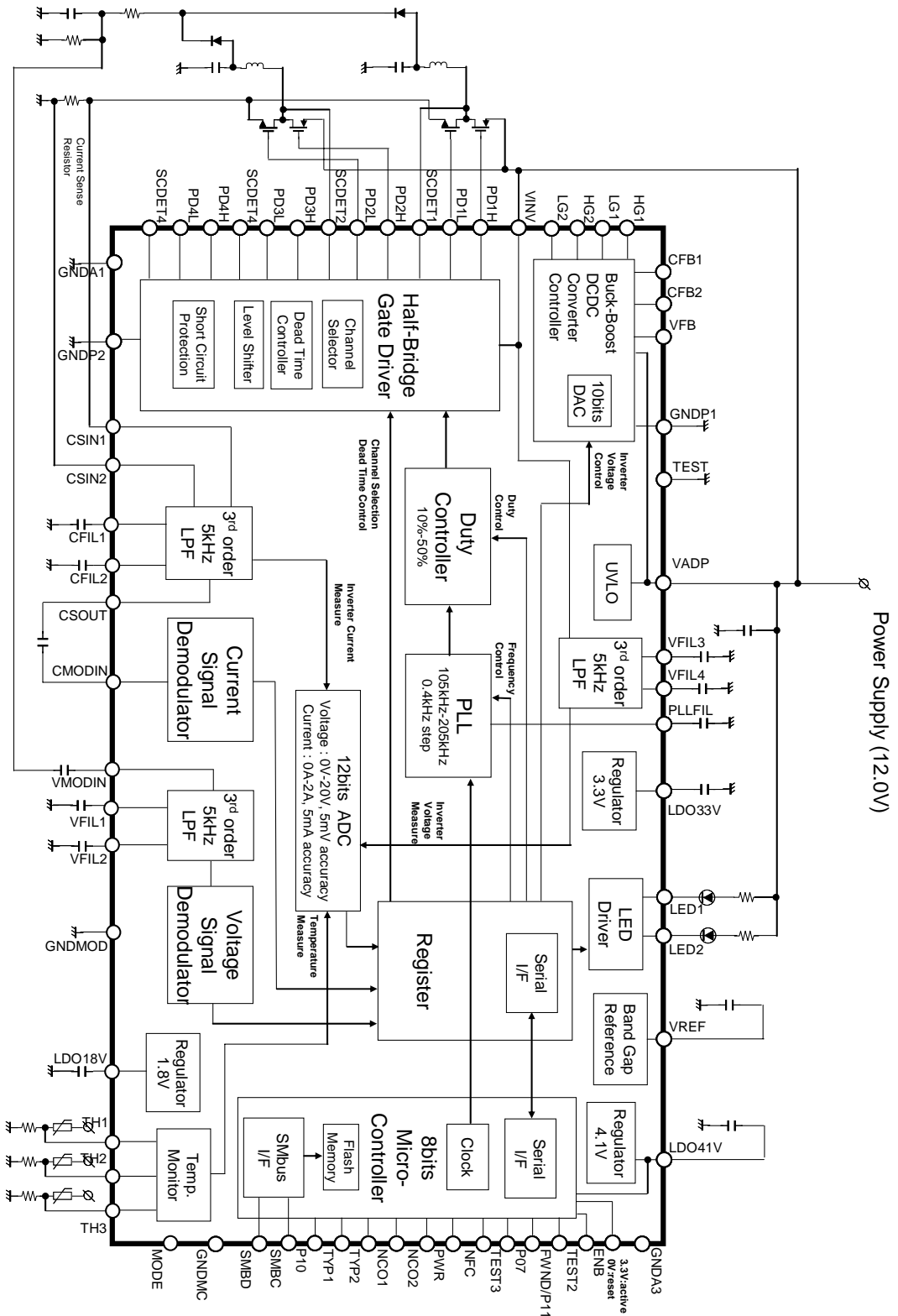
Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
<b>Current Consumption</b>							
Quiescent Current	$I_{STBY}$	ENB=L		TBD		mA	—
Operating Current	$I_{OPR}$	ENB=H		TBD		mA	—
<b>Half-Bridge Gate-Driver</b>							
Switching Frequency Range	$F_{SW}$		110		205	kHz	
Switching Frequency Control Accuracy	$F_{SWCA}$				0.4	kHz	
Duty Ratio Range	DR		10		50	%	
High-Side Output Voltage High	$V_{HSH}$	$I_{source}=1\text{ mA}$		$V_{VINV}$ -0.1		V	
High-Side Output Voltage Low	$V_{HSL}$	$I_{sink}=1\text{ mA}$		$V_{VINV}$ -4.0		V	
Low-Side Output Voltage High	$V_{LSH}$	$I_{source}=1\text{ mA}$		4.9		V	
Low-Side Output Voltage Low	$V_{LSL}$	$I_{sink}=1\text{ mA}$		0.1		V	
<b>Current Monitor</b>							
Monitor Range	$I_{MON}$	$R_{sense}=50\text{ m}\Omega$	0		2	A	
Monitor Accuracy	$I_{MONA}$	$R_{sense}=50\text{ m}\Omega$			5	mA	
<b>Voltage Monitor</b>							
Monitor Range	$V_{MON}$		0		20	V	
Monitor Accuracy	$V_{MONA}$				5	mV	
<b>Communication Demodulator</b>							
Modulation Current Input Threshold	$I_{THMOD}$				5	mA	
Modulation Voltage Input Threshold	$V_{THMOD}$				50	mV	
<b>LDO4.1V</b>							
Output Voltage	$V_{OUT5}$	$I_{out}=20\text{ mA}$		4.1		V	
<b>LDO3.3V</b>							
Output Voltage	$V_{OUT33}$	$I_{out}=10\text{ mA}$		3.3		V	
<b>LDO1.8V</b>							
Output Voltage	$V_{OUT18}$	$I_{out}=1\text{ mA}$		1.8		V	
<b>UVLO/SCPT/SD</b>							
UVLO Threshold Rising	$V_{UVLOR}$			4.0		V	
UVLO Threshold Falling	$V_{UVLOF}$			3.6		V	
Short Circuit Protection Detection Time	$V_{OCPR}$			100		us	
Thermal Shutdown Threshold Rising	$T_{SDR}$			150		$^\circ\text{C}$	
Thermal Shutdown Threshold Falling	$T_{SDF}$			130		$^\circ\text{C}$	

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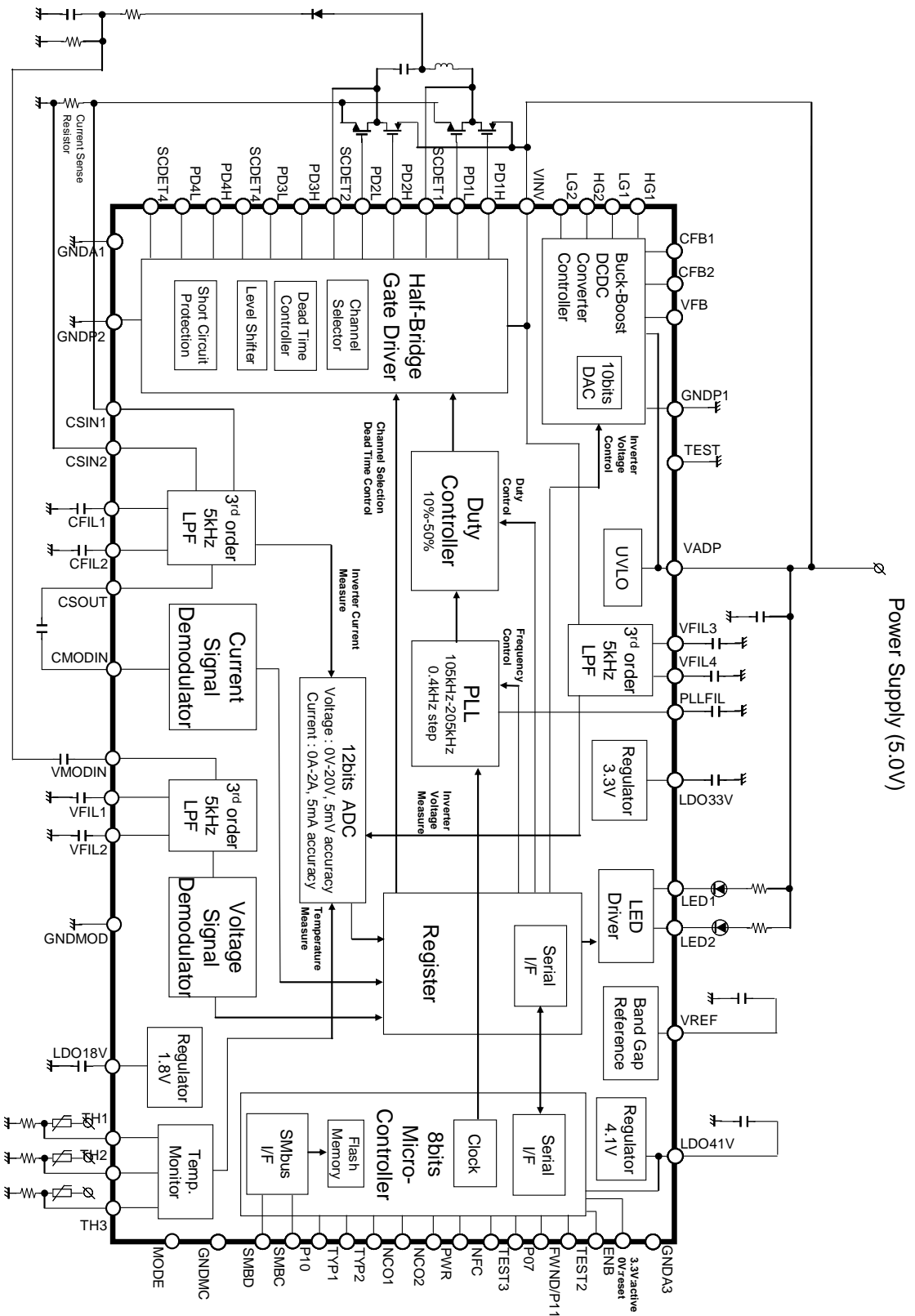
Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
<b>Temperature Monitor</b>							
Monitor Range	$T_{MON}$		TBD		TBD	V	
<b>LED Driver</b>							
Output Saturation Voltage	$V_{LEDSAT}$	$I_{out}=20\text{mA}$			TBD	V	
<b>Buck-Boost DCDC Converter (for Inverter Voltage Control)</b>							
Output Voltage Range	$V_{OUT}$		4		19	V	
Output Voltage Control Accuracy	$V_{OUTCA}$				20	mV	
Output Current	$I_{OUT}$				TBD	A	

**FUNCTIONAL BLOCK DIAGRAM :**  
**(Type A6, 2 coils)**



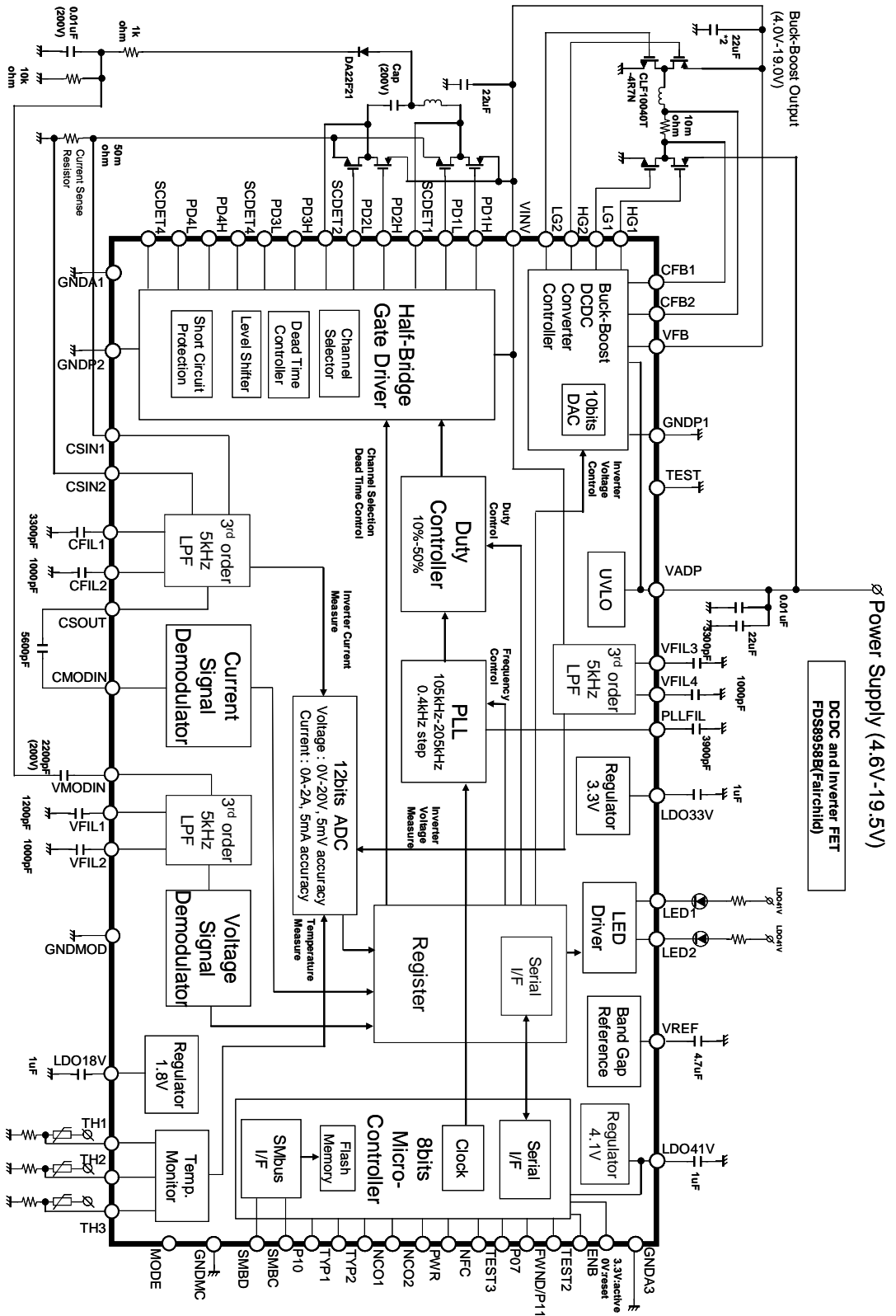
Notes) • This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

**FUNCTIONAL BLOCK DIAGRAM :**  
**(Type A11, 1 coil)**



Notes) • This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

## FUNCTIONAL BLOCK DIAGRAM : (Optional High Power Mode)



Notes) • This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

## PIN FUNCTIONS

Pin No.	Pin Name	Type	Description
1	LDO18V	Input	1.8V LDO Output (for MCU). Connect 1uF Capacitor.
2	GNDMC	GND	GND for MCU.
3	MODE	Input	MCU Mode Control.
4	P10	Input/Output	MCU GPIO.
5	TYP1	Input	WPC Primary Type Selection.
6	TYP2	Input	WPC Primary Type Selection.
7	NCO1	Input	Number of Primary Coil Selection.
8	NCO2	Input	Number of Primary Coil Selection.
9	PWR	Input	High Power/Low Power Selection.
10	NFC	Input	NFC Enable/Disable Selection.
11	TEST3	Input/Output	Test Control. Connect to GND.
12	P07	Input/Output	MCU GPIO.
13	FWMD/P11	Input	MCU Test Mode Control./MCU GPIO.
14	TEST2	Input	Test Control. Connect to GND.
15	ENB	Input	System Enable. High-Active, Low-Reset.
16	PLLFIL	Output	PLL Loop Filter Output. Connect 3900pF Capacitor.
17	VREF	Output	BGR Output, Connect 4.7uF Capacitor
18	VFIL2	Output	Active Filter Output. Connect 1000pF Capacitor.
19	VFIL1	Output	Active Filter Output. Connect 1200pF Capacitor.
20	TH3	Input	Thermistor Voltage Input 3.
21	TH2	Input	Thermistor Voltage Input 2.
22	TH1	Input	Thermistor Voltage Input 1.
23	VMODIN	Input	Voltage ASK Signal Input.
24	GNDMOD	GND	GND for Demodulator Circuit.
25	CMODIN	Input	Current ASK Signal Input.
26	CSOUT	Output	Current ASK Signal Output. Connect 5600pF between CMODIN.
27	CFIL2	Output	Active Filter Output. Connect 1000pF Capacitor.
28	CFIL1	Output	Active Filter Output. Connect 3300pF Capacitor.
29	CSIN2	Input	Current Sensing Input 2.
30	CSIN1	Input	Current Sensing Input 1. Connect 50m ohm resistor between CSIN2.
31	GND A1	GND	GND for Analog Circuit 1.
32	VFIL3	Output	Active Filter Output. Connect 3300pF Capacitor.

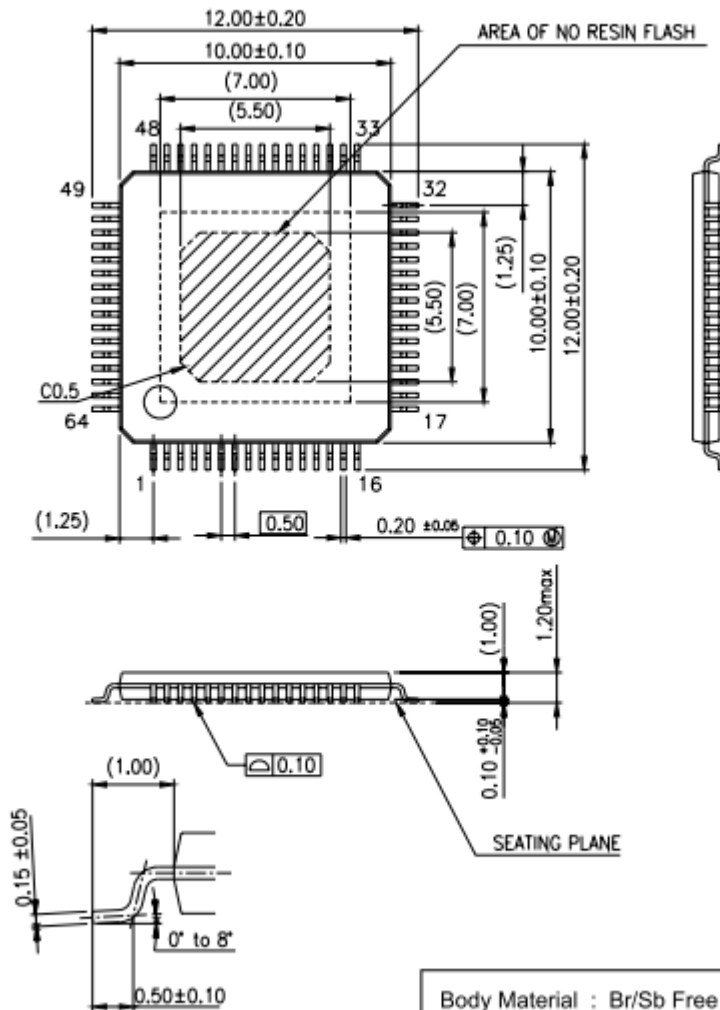


## PIN FUNCTIONS

Pin No.	Pin Name	Type	Description
33	VFIL4	Output	Active Filter Output. Connect 1000pF Capacitor.
34	LDO33V	Output	3.3V LDO Output (for Internal). Connect 1uF Capacitor.
35	SCDET1	Input	External Inverter Output Short Detection 1.
36	SCDET2	Input	External Inverter Output Short Detection 2.
37	PD1H	Output	Half-Bridge Gate Driver 1 High Side Output.
38	PD1L	Output	Half-Bridge Gate Driver 1 Low Side Output.
39	PD2H	Output	Half-Bridge Gate Driver 2 High Side Output.
40	PD2L	Output	Half-Bridge Gate Driver 2 Low Side Output.
41	VINV	Power Supply	External Inverter Power Supply Input.
42	GNDP2	GND	GND for Power 2.
43	PD3H	Output	Half-Bridge Gate Driver 3 High Side Output.
44	PD3L	Output	Half-Bridge Gate Driver 3 Low Side Output.
45	PD4H	Output	Half-Bridge Gate Driver 4 High Side Output.
46	PD4L	Output	Half-Bridge Gate Driver 4 Low Side Output.
47	SCDET3	Input	External Inverter Output Short Detection 3.
48	SCDET4	Input	External Inverter Output Short Detection 4.
49	HG1	Output	Buck-Boost DCDC Converter High Side Gate Driver Output 1.
50	VADP	Power Supply	AC Adaptor Input.
51	LG1	Output	Buck-Boost DCDC Converter Low Side Gate Driver Output 1.
52	GNDP1	GND	GND for Power 1.
53	HG2	Output	Buck-Boost DCDC Converter High Side Gate Driver Output 2.
54	TEST	Input	Test Control. Connect to GND.
55	LG2	Output	Buck-Boost DCDC Converter Low Side Gate Driver Output 2.
56	CFB1	Input	Buck-Boost DCDC Converter Current Sensing Input 1.
57	CFB2	Input	Buck-Boost DCDC Converter Current Sensing Input 2.
58	LED1	Output	LED Driver Output 1.
59	LED2	Output	LED Driver Output 2.
60	GND A3	GND	GND for Analog Circuit 2.
61	VFB	Input	Buck-Boost DCDC Voltage Feedback Input.
62	SMBC	Input/Output	SMBus Clock Input/Output.
63	SMBD	Input/Output	SMBus Data Input/Output.
64	LDO41V	Output	4.1V LDO Output. Connect 1uF between GND.

**PACKAGE OUTLINE**

Package Code : HQFP064-P-1010B



Body Material	: Br/Sb Free Epoxy resin
Lead Material	: Cu Alloy
Lead Finish Method	: Pd Plating