

NR110E/K Surface-Mount, Current Mode Control Step-down Switching Mode

Features

- Compact surface-mount package
- Input voltage range (V_{IN}): $V_O + 3$ to 31 V
- Oscillation frequency: 30 kHz, 350 kHz, 364 kHz
- High efficiency under light load
- High efficiency: 94% or higher
- Current mode control
- Stable with low-ESR ceramic output capacitors
- Built-in phase compensation component
- Output current: 1.5 A, 2 A, 4 A
- Reference voltage and accuracy of $0.8 \text{ V} \pm 2\%$
- Overcurrent protection function that can be adjusted externally
- Output ON/OFF available
- Undervoltage lockout
- Soft start function

Applications

- Power supply for LCDTV, STB and Blu-Ray
- Power supplies for domestic appliances
- On-board local power supply
- Switching power supplies

Absolute Maximum Ratings

Parameter	Symbol	Ratings				Unit	Conditions
		NR110K	NR111E	NR117K	NR119E		
Input Voltage	V_{IN}	35	35	35	35	V	
BS Pin Voltage	V_{BS}	44	44	44	44	V	
Pin Voltage between BS and SW	V_{BS-SW}	8	8	8	8	V	
SW Pin Voltage	V_{SW}	35	35	35	35	V	
FB Pin Voltage	V_{FB}	5.5	5.5	5.5	5.5	V	
EN Pin Voltage	V_{EN}	35	35	35	35	V	
SS Pin Voltage	V_{SS}	5.5	5.5	5.5	5.5	V	
Power Dissipation	P_D	1.69	1.76	1.69	1.76	W	When mounted on 30×30 mm glass-epoxy board (with a 25×25 mm copper area)
Junction Temperature	T_J	-40 to 150	-40 to 150	-40 to 150	-40 to 150	$^{\circ}\text{C}$	
Storage Temperature	T_{stg}	-40 to 150	-40 to 150	-40 to 150	-40 to 150	$^{\circ}\text{C}$	
Thermal Resistance (Junction to Lead (4 pins))	θ_{J-C}	40	26	40	26	$^{\circ}\text{C}/\text{W}$	
Thermal Resistance (Junction to Ambient Air)	θ_{J-A}	74	71	74	71	$^{\circ}\text{C}/\text{W}$	When mounted on 30×30 mm glass-epoxy board (with a 25×25 mm copper area)

Recommended Operating Conditions

Parameter	Symbol	Ratings				Unit
		NR110K	NR111E	NR117K	NR119E	
Input Voltage Range	V_{IN}	8.0 or $V_O + 3^*$ to 31	6.5 or $V_O + 3^*$ to 31	8.0 or $V_O + 3^*$ to 31	6.5 or $V_O + 3^*$ to 31	V
Output Current Range	I_{OUT}	0 to 4.0**	0 to 4.0**	0 to 1.5**	0 to 2.0**	A
Output Voltage Range	V_O	0.8 to 24	0.8 to 24	0.8 to 24	0.8 to 24	V
Operating Temperature Range	T_{op}	-40 to 85**	-40 to 85**	-40 to 85**	-40 to 85**	$^{\circ}\text{C}$

*: The minimum value of the input voltage range is indicated value or $V_O + 3$ V, whichever is higher.

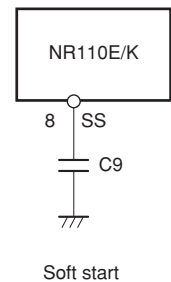
** : The device must be used within the range indicated by the T_a - P_D characteristics.

Electrical Characteristics

($T_a = 25^{\circ}\text{C}$, $V_{IN} = 12\text{V}$, $V_O = 5.0\text{V}$, and $I_O = 1\text{A}$, unless otherwise specified)

Parameter	Symbol	Ratings									Unit	Conditions	
		NR110K/NR111E			NR119E			NR117K					
		min.	typ.	max.	min.	typ.	max.	min.	typ.	max.			
Reference Voltage	V_{REF}	0.784	0.8000	0.816	0.784	0.8000	0.816	0.784	0.8000	0.816	V		
Temperature Coefficient of Reference Voltage	$\Delta V_{REF}/\Delta T$		± 0.05			± 0.05			± 0.05		mV/ $^{\circ}\text{C}$	$T_a = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	
Oscillation Frequency	f_{sw}		350			364			30		kHz		
Line Regulation	V_{LINE}		50			50			50		mV	$V_{IN} = V_{INmin}$ to 30V	
Load Regulation	V_{Load}		50			50			50		mV	$V_{IN} = 12\text{V}$, $V_O = 5.0\text{V}$, $I_O = 0.1$ to I_{Omax}	
Overcurrent Protection	I_{s1}		1.5			0.9			0.3		A	ISET=OPEN	
Starting Current	I_{s2}		5.5			2.8			2.1		A	ISET=SHORT	
No-load Circuit Current	I_{IN}		1			1			1		mA	$V_{EN} = 10\text{k}\Omega$ pull up to V_{IN}	
Quiescent Circuit Current	$I_{IN(off)}$		1			1			1		μA	$I_O = 0\text{A}$, $V_{EN} = 0\text{V}$	
SS Pin	Outflow Current at Low Voltage	$I_{EN/SS}$	6	10	14	6	10	14	6	10	14	μA	$V_{SS} = 0\text{V}$
EN Pin	Inflow Current	I_{EN}		20	50		20	50		20	50	μA	$V_{EN} = 10\text{V}$
	On Threshold Voltage	$V_{C/EH}$	0.7	1.4	2.1	0.7	1.4	2.1	0.7	1.4	2.1	V	
ISET Pin	Open Voltage	V_{ISET}		1.5			1.5			1.5		V	
Maximum ON Duty	D_{MAX}		90			90			90		%		
Minimum ON Time	$T_{ON(MIN)}$			150			150			150		nsec	
Thermal Protection Start Temperature	TSD		151	165		151	165		151	165		$^{\circ}\text{C}$	
Thermal Protection Return Hysteresis	TSD_hys			20			20			20		$^{\circ}\text{C}$	
SW MOSFET ON Resistance	R_{onH}			85			150			150		m Ω	

*: Pin 8 is the SS pin. Soft start at power on can be performed with a capacitor connected to this pin. The SS pin is pulled up to the power supply in the IC, so applying the external voltage is prohibited.



External Dimensions

(Unit : mm)

**NR111E NR119E
(eSOIC8)**

**NR110K NR117K
(HSOP8)**

Pin Assignment

- ① BS
- ② VIN
- ③ SW
- ④ GND
- ⑤ FB
- ⑥ ISET
- ⑦ EN
- ⑧ SS

*: The heat slug on the rear side is at the ground potential.

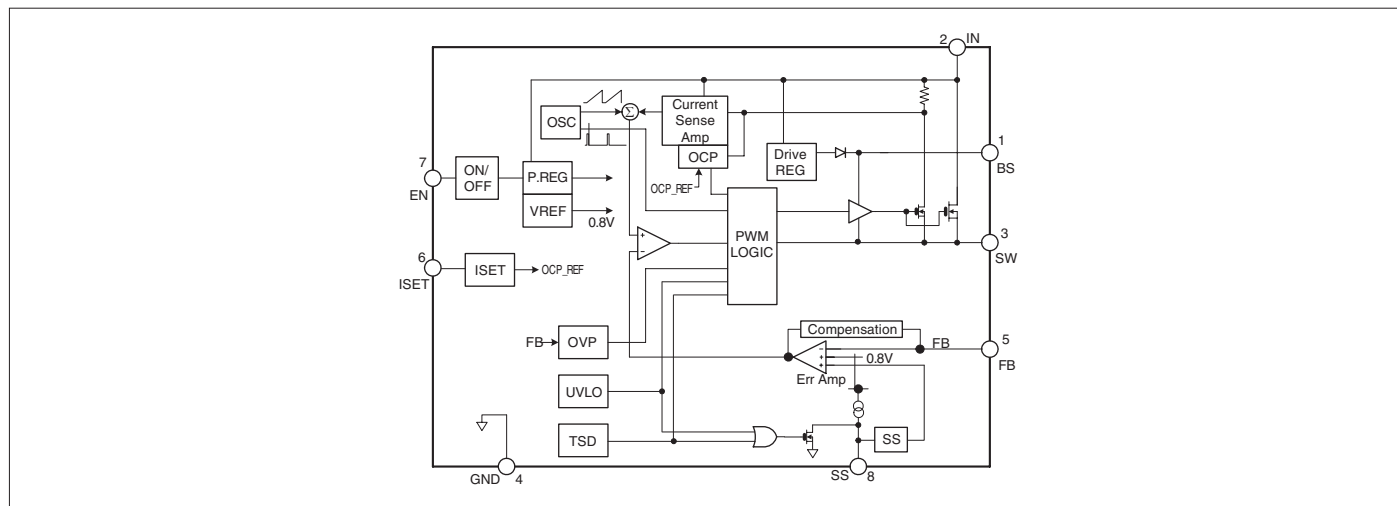
Plastic Mold Package Type
Flammability: UL 94V-0
Product Mass: Approx. 0.1g

External Dimensions (NR111E/NR119E)

Symbol	Package A			Package B		
	MIN	TYP	MAX	MIN	TYP	MAX
A1	0	—	0.1524	0	0.1	0.15
A2	1.398	1.448	1.498	1.25	1.4	1.65
b	0.33	—	0.508	0.38	—	0.51
D	4.8	4.902	5.004	4.8	4.9	5
D1	3.053	3.18	3.307	3.1	3.3	3.5
E	5.893	—	6.918	5.8	6	6.2
E1	3.73	—	3.89	3.8	3.9	4
E2	2.033	2.16	2.287	2.2	2.4	2.6
e	—	1.27	—	—	1.27	—
L	0.508	—	0.762	0.45	0.6	0.8

Delivered in Package A or B.

Block Diagram



Typical Connection Diagram

- C1 : 10μF / 35V
- C2 : 10μF / 35V
- C4 : 22μF / 16V
- C5 : 22μF / 16V
- C9 : 0.1μF
- C10 : 0.1μF
- R1 : 1.7MΩ
- R3 : 22Ω
- R4 : 20kΩ
- R5 : 470Ω (Vo=5.0V)
- R6 : 3.9kΩ
- R7 : 0kΩ (When ISET SHORT)
- L1 : 10μH (NR110K, NR111E, NR119E)
150μH (NR117K)