

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	°C	
Storage Temperature	T_{stg}	−40 to 150	−40 to 150	−40 to 150	−40 to 150	°C	
Thermal Resistance (Junction to Lead (4 pins))	θ_{J-C}	40	26	40	26	°C/W	
Thermal Resistance (Junction to Ambient Air)	θ_{J-A}	74	71	74	71	°C/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**	°C

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

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

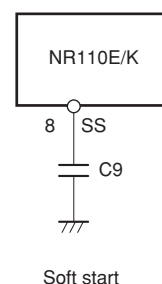
■Electrical Characteristics

($T_a = 25^\circ\text{C}$, $V_{IN} = 12\text{V}$, $V_O = 5.0\text{V}$, 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		VREF	0.784	0.8000	0.816	0.784	0.8000	0.816	0.784	0.8000	0.816	V	
Temperature Coefficient of Reference Voltage		ΔVREF/ΔT		±0.05			±0.05			±0.05		mV/°C	Ta=−40°C to +85°C
Oscillation Frequency		fsw		350			364			30		kHz	
Line Regulation		VLINE		50			50			50		mV	VIN=VINmin to 30V
Load Regulation		VLoad		50			50			50		mV	VIN=12V, VO=5.0V, IO=0.1 to Iomax
Overcurrent Protection		Is1		1.5			0.9			0.3		A	ISET=OPEN
Starting Current		Is2		5.5			2.8			2.1		A	ISET=SHORT
No-load Circuit Current		IIN		1			1			1		mA	VEN=10kΩ pull up to VIN
Quiescent Circuit Current		IIN(off)		1			1			1		μA	Io=0A, VEN=0V
SS Pin	Outflow Current at Low Voltage	IEN/SS	6	10	14	6	10	14	6	10	14	μA	VSS=0V
EN Pin	Inflow Current	IEN		20	50		20	50		20	50	μA	VEN=10V
	On Threshold Voltage	VC/EH	0.7	1.4	2.1	0.7	1.4	2.1	0.7	1.4	2.1	V	
ISET Pin	Open Voltage	VISET		1.5			1.5			1.5		V	
Maximum ON Duty		DMAX		90			90			90		%	
Minimum ON Time		TON(MIN)		150			150			150		nsec	
Thermal Protection Start Temperature		TSD	151	165		151	165		151	165		°C	
Thermal Protection Return Hysteresis		TSD_hys		20			20			20		°C	
SW MOSFET ON Resistance		RonH		85			150			150		mΩ	

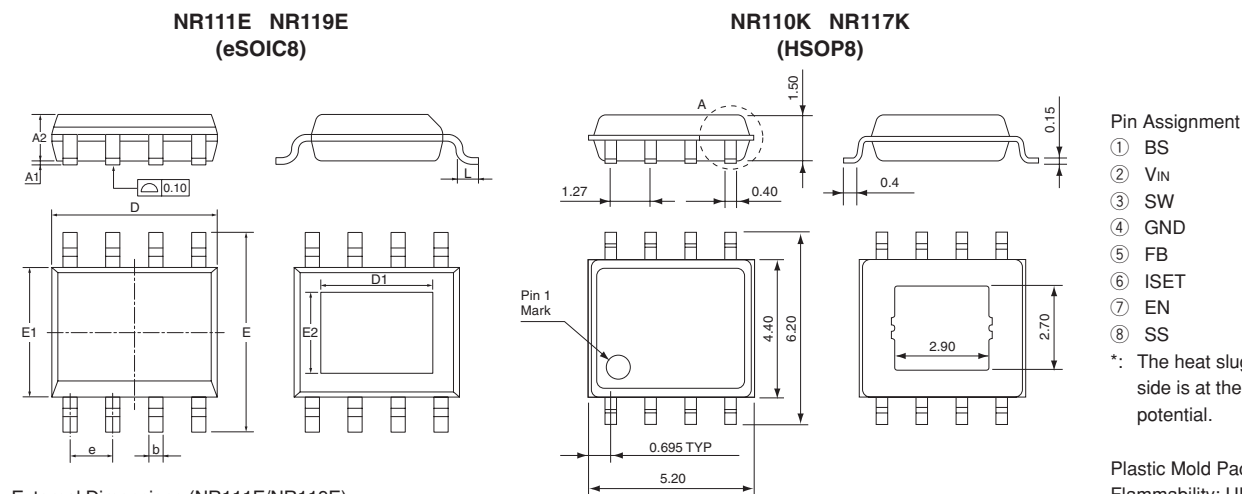
*: Pin 8 is the SS pin. Soft start at power on can be performed with a capacitor connected to this pin.

The SS pin is pulled up to the power supply in the IC, so applying the external voltage is prohibited.



External Dimensions

(Unit : mm)

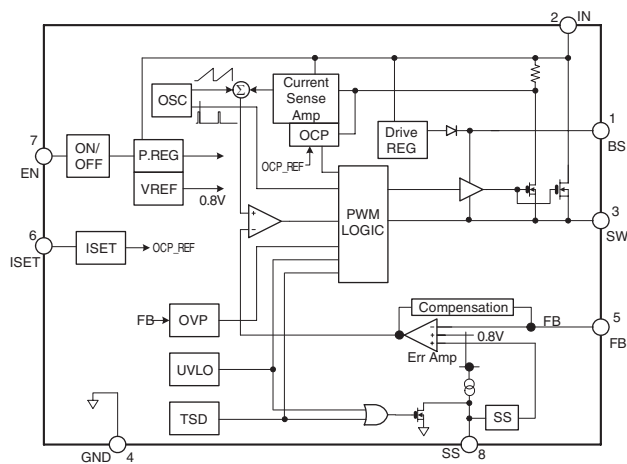


External Dimensions (NR111E/NR119E)

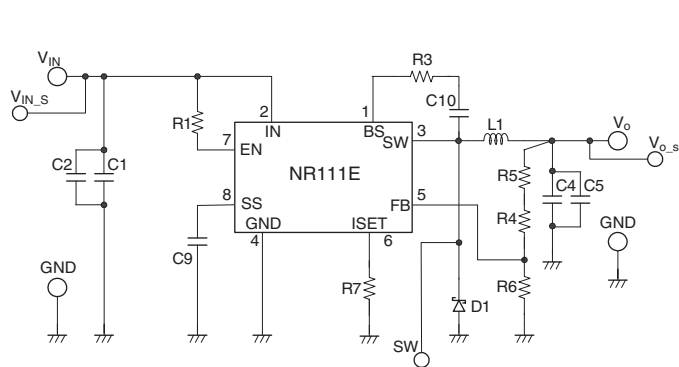
Symbol	Package A			Package B		
	MIN	TYP	MAX	MIN	TYP	MAX
A1	0	—	0.1524	0	0.1	0.15
A2	1.398	1.448	1.498	1.25	1.4	1.65
b	0.33	—	0.508	0.38	—	0.51
D	4.8	4.902	5.004	4.8	4.9	5
D1	3.053	3.18	3.307	3.1	3.3	3.5
E	5.893	—	6.918	5.8	6	6.2
E1	3.73	—	3.89	3.8	3.9	4
E2	2.033	2.16	2.287	2.2	2.4	2.6
e	—	1.27	—	—	1.27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

Delivered in Package A or B.

Block Diagram



Typical Connection Diagram



- C1 : 10 μ F / 35V
- C2 : 10 μ F / 35V
- C4 : 22 μ F / 16V
- C5 : 22 μ F / 16V
- C9 : 0.1 μ F
- C10 : 0.1 μ F
- R1 : 1.7M Ω
- R3 : 22 Ω
- R4 : 20k Ω
- R5 : 470 Ω ($V_o=5.0V$)
- R6 : 3.9k Ω
- R7 : 0k Ω (When ISET SHORT)
- L1 : 10 μ H (NR110K, NR111E, NR119E)
150 μ H (NR117K)