Features

- Low start-up voltage: 0.7V (Typ.)
- High efficiency: 85% (Typ.)
- High output voltage accuracy: ±2.5%
- Output voltage: 2.7V, 3.0V, 3.3V, 5.0V
- Output current up to 200mA
- Ultra low supply current I_{DD}: 5μA (Typ.)
- Low ripple and low noise
- Low shutdown current: 0.5μA (Typ.)
- TO-92, SOT-89, SOT-23 and SOT-25 package

Applications

- Palmtops/PDAs
- Portable communicators/Smartphones
- Cameras/Camcorders
- Battery-powered equipment

General Description

The HK77XXA seriesisasetofPFMstep-upDC/DC converter with high efficiency and low ripple. The series features extremely low start-up voltage and high output voltage accuracy. They require only three external components to provide a fixed output voltage of 2.7V, 3.0V, 3.3V or 5.0V. CMOS technology ensures ultra low supply current and makes them ideal for battery-operated applications powered from one or more cells.

TheHK77XXA consistsofanoscillator,aPFMcontrol circuit, a driver transistor, a reference voltage unit, and a high speed comparator. They employ pulse frequency modulation (PFM) for minimum supply current and ripple at light output loading. These devices are available in space saving TO-92, SOT-89, SOT-23 and SOT-25 packages. For SOT-25 package, it also build-in a chip enable function to reduce power consumption during shutdown mode.

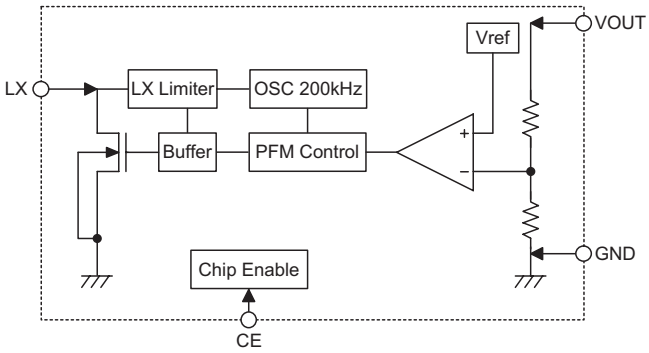
Selection Table

Part No.	Output Voltage	Package	Marking
HK7727	2.7V	TO-92 SOT-89 SOT-23 SOT-25	HK77XXA (forTO-92) HK77XXA#(forSOT-89) 7XXA# (for SOT-23) 7XXA# (for SOT-25)
HK7730	3.0V		
HK7730	3.3V		
HK7750	5.0V		

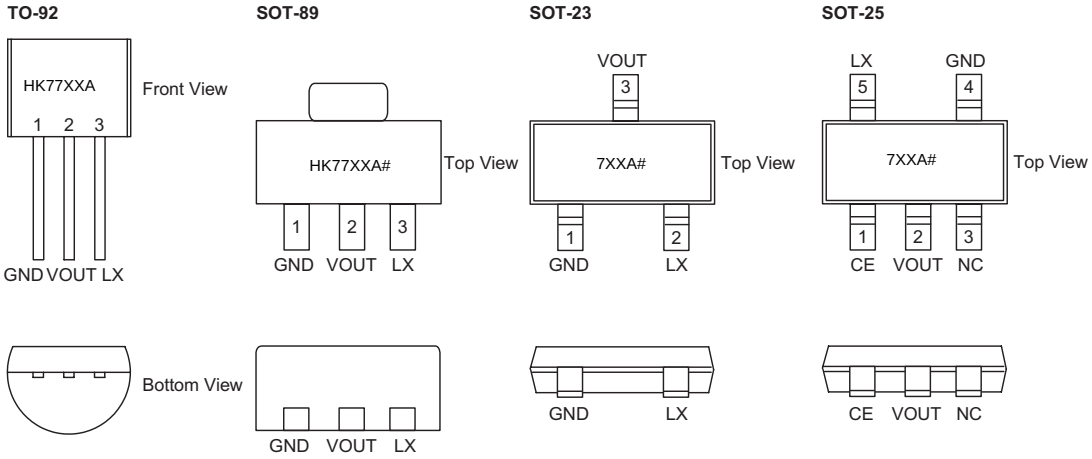
Note: "XX" stands for output voltages.

Only lead free devices are available. "#" stands for lead free devices. For the TO-92 package, there will be a "#" mark at the end of the date code.

Block Diagram



Pin Assignment



Pin Description

Pin No.				Pin Name	Description
TO-92	SOT-89	SOT-23	SOT-25		
—	—	—	1	CE	Chip enable pin, high active
2	2	3	2	VOUT	DC/DC converter output monitoring pin
—	—	—	3	NC	No connection
1	1	1	4	GND	Ground pin
3	3	2	5	LX	Switching pin

Absolute Maximum Ratings

Supply Voltage .....V_{SS}–0.3V to V_{SS}+7V

Storage Temperature .....–50°C to 125°C

Operating Temperature .....–40°C to 85°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Thermal Information

Symbol	Parameter	Package	Max.	Unit
θ_{JA}	Thermal Resistance (Junction to Ambient) (Assume no ambient airflow, no heat sink)	SOT-89	300	°C/W
		TO-92	300	°C/W
		SOT-23	330	°C/W
		SOT-25	320	°C/W
P_D	Power Dissipation	SOT-89	0.33	W
		TO-92	0.33	W
		SOT-23	0.3	W
		SOT-25	0.31	W

Note: P_D is measured at Ta= 25°C

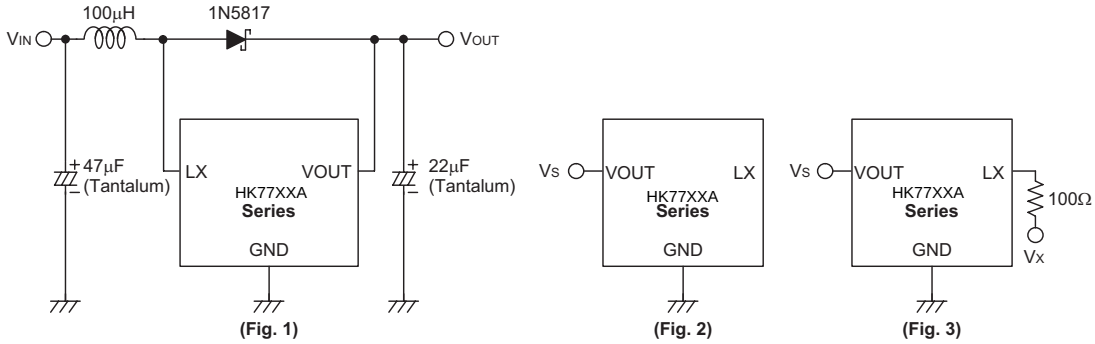
Electrical Characteristics

V_{IN}=V_{OUT}×0.6; I_{OUT}=10mA; Ta=25°C (Unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage	—	—	—	6	V
V_{OUT}	Output Voltage Tolerance	—	–2.5	—	2.5	%
V_{START}	Start-up Voltage (Fig. 1)	V_{IN}: 0→2V; I_{OUT}=1mA	—	0.7	0.9	V
V_{HOLD}	Minimum Hold-on Voltage (Fig. 1)	V_{IN}: 2→0V; I_{OUT}=1mA	—	—	0.7	V
I_{IN}	No-load Input Current (Fig. 1)	I_{OUT}=0mA	—	13	26	μA
I_{DD}	Supply Current (Fig. 2)	V_S=V_{OUT}+0.5V Measured at V_{OUT} pin	—	5	10	μA
I_{SHDN}	Shutdown Current	CE=GND	—	0.5	1	μA
V_{IH}	CE High Threshold	—	2	—	—	V
V_{IL}	CE Low Threshold	—	—	—	0.4	V
I_{LEAK}	LX Leakage Current (Fig. 3)	V_S=V_{OUT}+0.5V, V_X=6V Measured at the LX pin	—	—	0.9	μA
f_{OSC}	Maximum Oscillator Frequency (Fig. 3)	V_S=V_{OUT}×0.95, V_X=6V Measured at LX pin	—	200	—	kHz
D_{OSC}	Oscillator Duty Cycle (Fig. 3)	V_S=V_{OUT}×0.95, V_X=6V Measured at LX pin	65	75	85	%
η	Efficiency	—	—	85	—	%

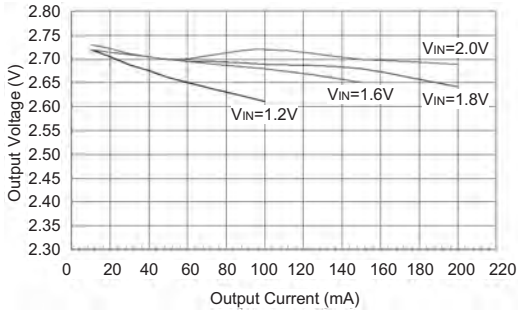
Note: Absolute maximum ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. The guaranteed specifications apply only for the test conditions listed.

Test Circuit



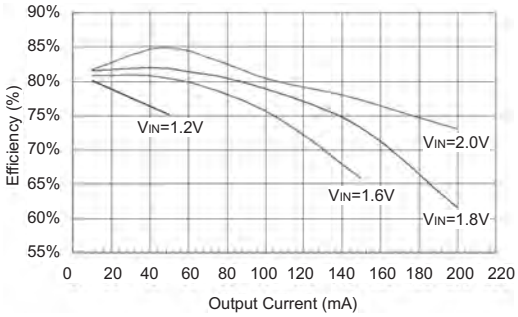
(Fig. 1) (Fig. 2) (Fig. 3)

Typical Performance Characteristics



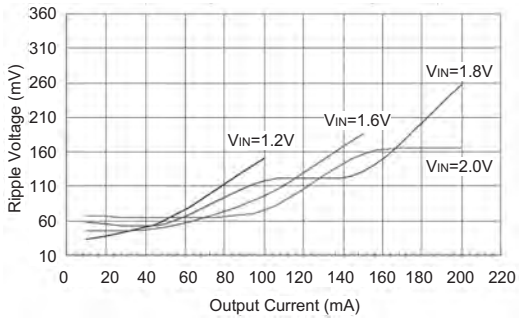
HK77XXA **OutputVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



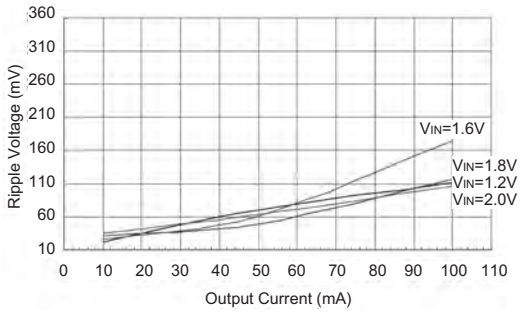
HK77XXA **Efficiencyv.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



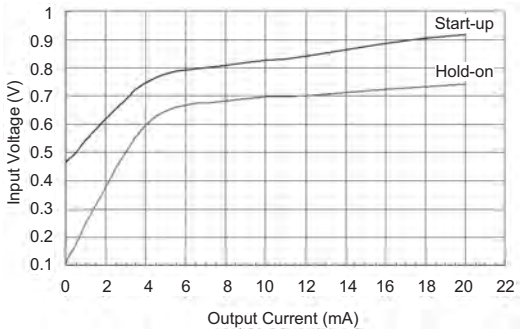
HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



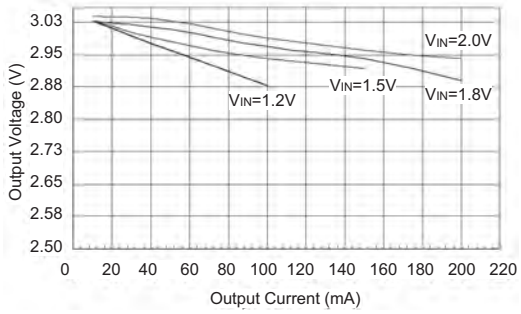
HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=100μH, C_{OUT}=22μF-Tantalum)



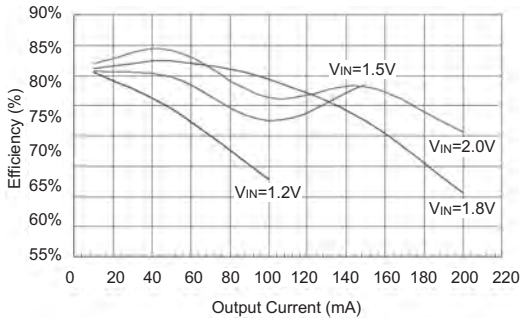
HK77XXA **Start-up/Hold-onVoltage**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



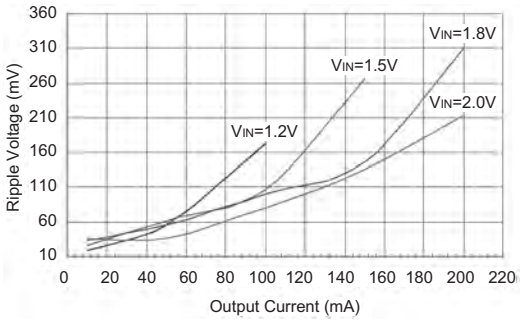
HK77XXA **OutputVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



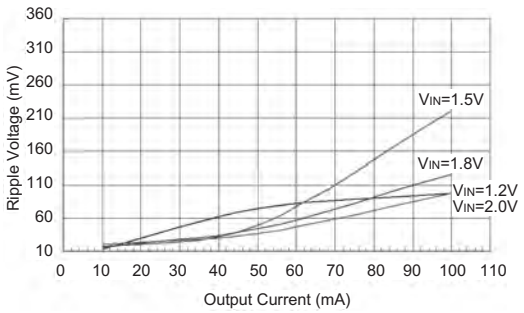
HK77XXA **Efficiencyv.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



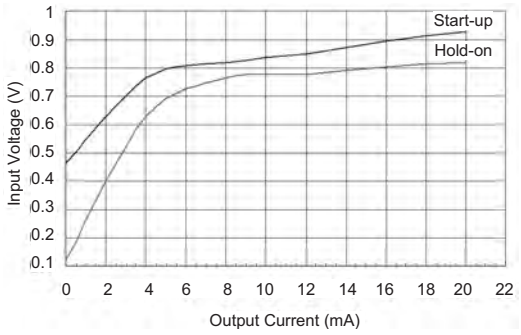
HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



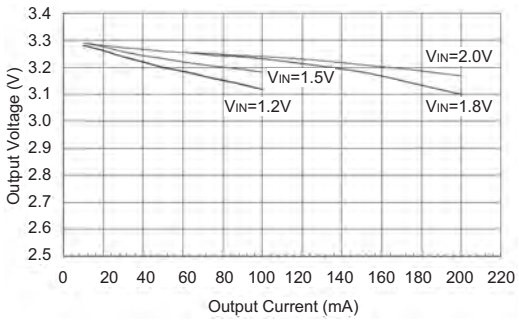
HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=100μH, C_{OUT}=22μF-Tantalum)



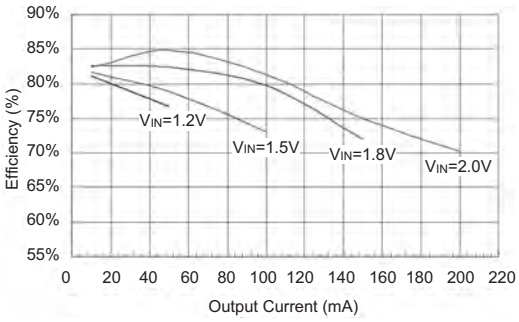
HK77XXA **Start-up/Hold-onVoltage**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



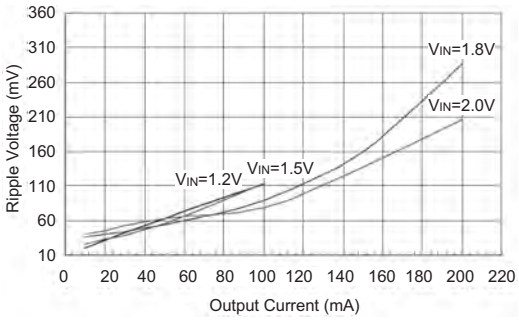
HK77XXA **OutputVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



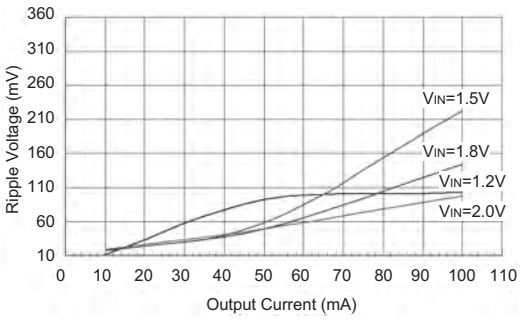
HK77XXA **Efficiencyv.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



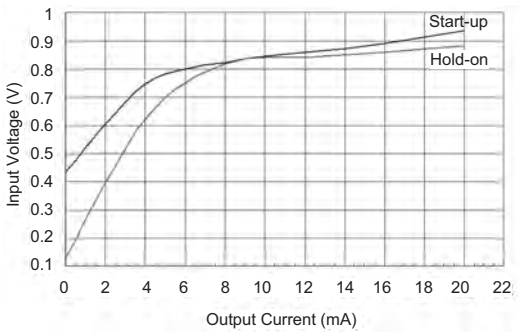
HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



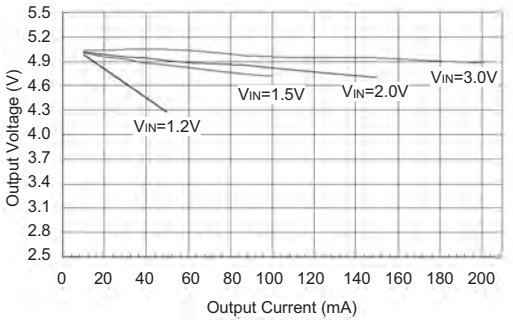
HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=100μH, C_{OUT}=22μF-Tantalum)



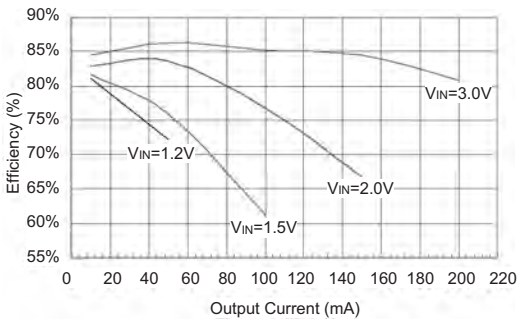
HK77XXA **Start-up/Hold-onVoltage**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



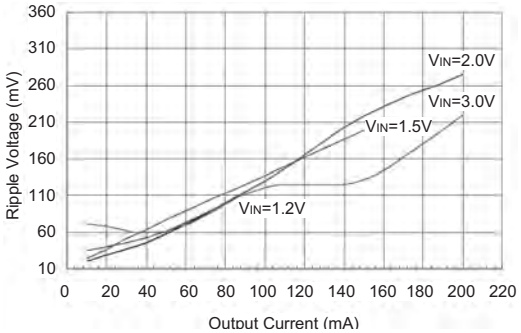
HK77XXA **OutputVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



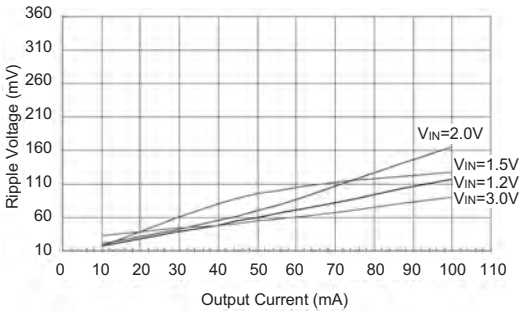
HK77XXA **Efficiencyv.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



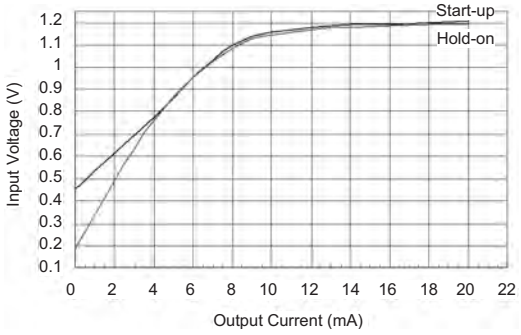
HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)



HK77XXA **RippleVoltagev.sOutputCurrent**

(C_{IN}=47μF-Tantalum, L=100μH, C_{OUT}=22μF-Tantalum)

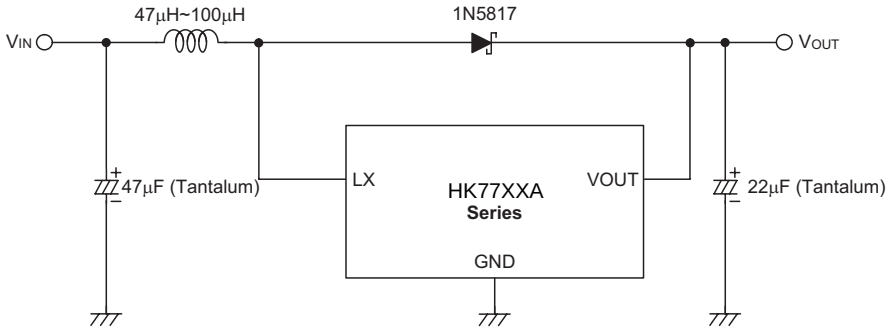


HK77XXA **Start-up/Hold-onVoltage**

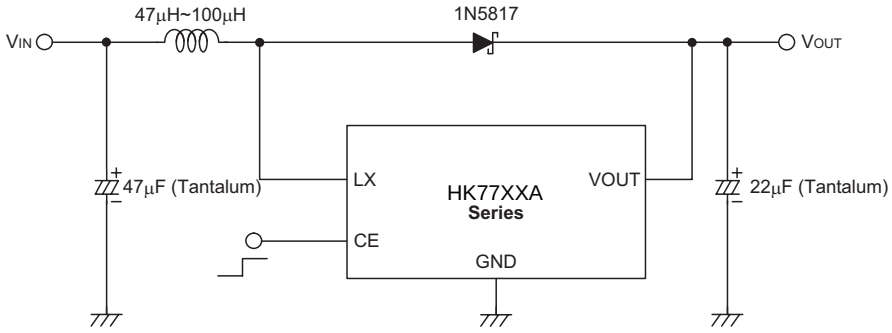
(C_{IN}=47μF-Tantalum, L=47μH, C_{OUT}=22μF-Tantalum)

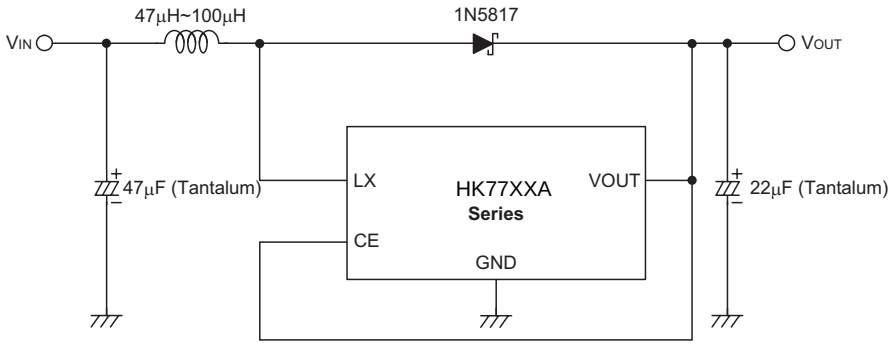
Application Circuits

Without CE Pin



With CE Pin

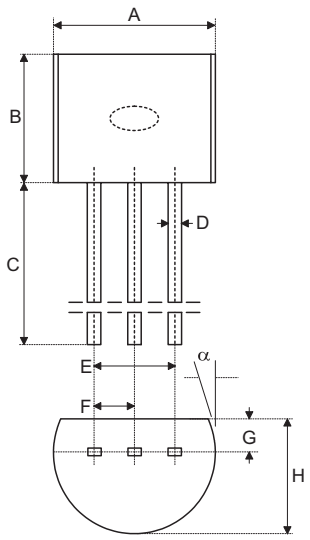




Note: For the SOT-25 package, when CE is pulled low, the internal blocks of the device, such as the reference band gap, gain block, and all feedback and control circuitry will be switched off. The boost converter′s output, V_{OUT}, will be at a value one Schottky diode voltage drop below the input voltage and the LX pin remains in a high impedance condition. The output capacitor and load at V_{OUT} determine the rate at which V_{OUT} decays.

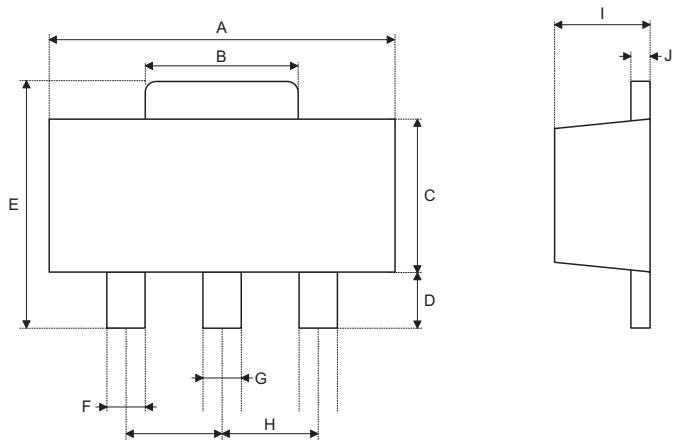
Package Information

3-pin TO-92 Outline Dimensions



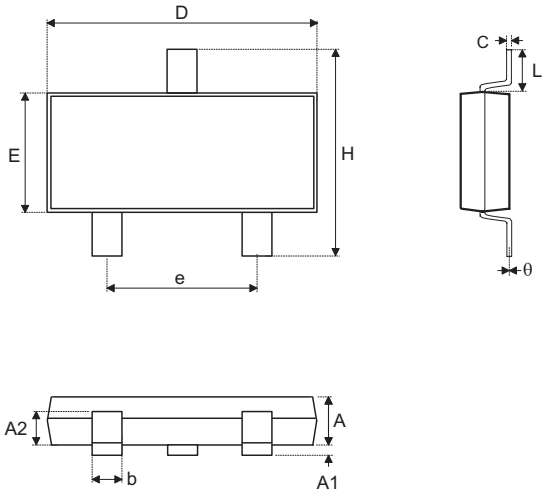
Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	170	—	200
B	170	—	200
C	500	—	—
D	11	—	20
E	90	—	110
F	45	—	55
G	45	—	65
H	130	—	160
I	8	—	18
α	4°	—	6°

3-pin SOT-89 Outline Dimensions



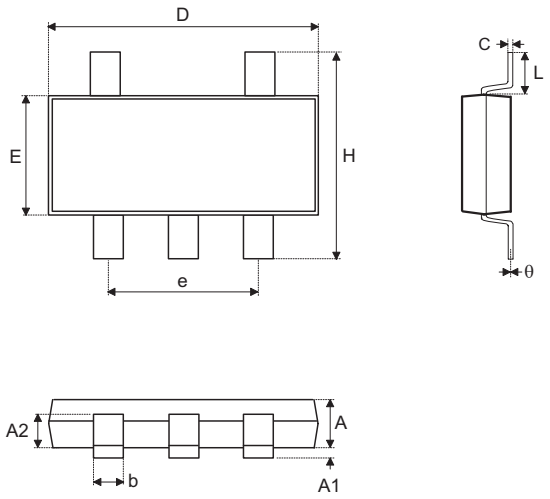
Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	173	—	181
B	64	—	72
C	90	—	102
D	35	—	47
E	155	—	167
F	14	—	19
G	17	—	22
H	—	59	—
I	55	—	63
J	14	—	17

3-pin SOT-23 Outline Dimensions



Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	1	—	1.3
A1	—	—	0.1
A2	0.7	—	0.9
b	0.35	—	0.5
C	0.1	—	0.25
D	2.7	—	3.1
E	1.4	—	1.8
e	—	1.9	—
H	2.6	—	3
L	0.37	—	—
θ	1°	—	9°

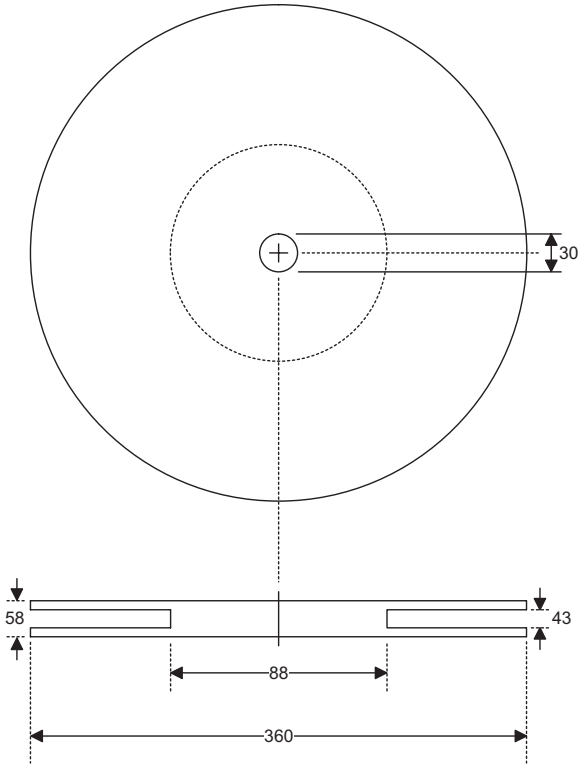
5-pin SOT-25 Outline Dimensions

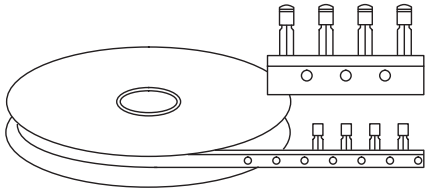


Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	1.00	—	1.30
A1	—	—	0.10
A2	0.70	—	0.90
b	0.35	—	0.50
C	0.10	—	0.25
D	2.70	—	3.10
E	1.40	—	1.80
e	—	1.90	—
H	2.60	—	3
L	0.37	—	—
θ	1°	—	9°

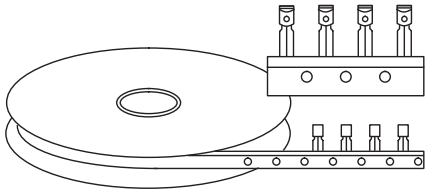
Product Tape and Reel Specifications

TO-92 Reel Dimensions (Unit: mm)



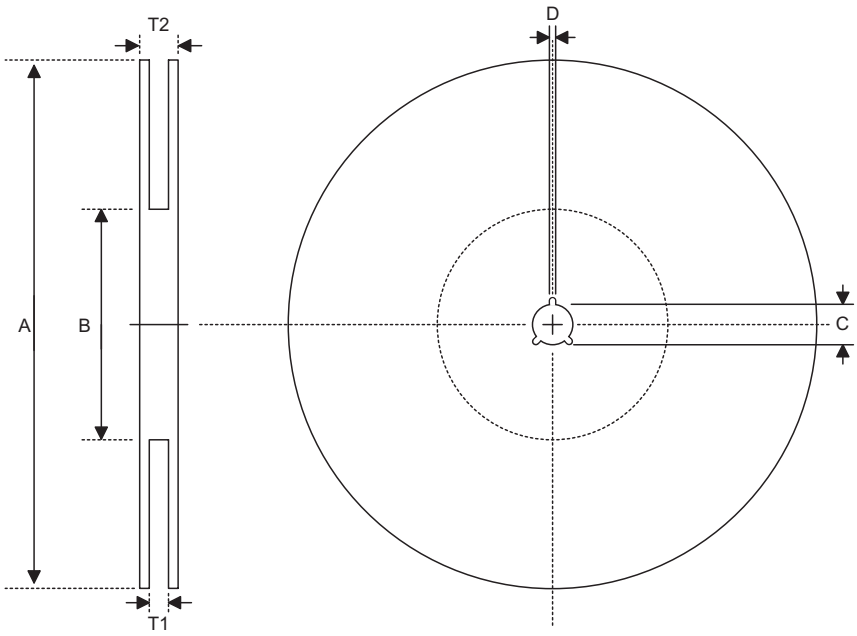


Package Up, Flat Side Up



Package Up, Flat Side Down

SOT-89, SOT-23 & SOT-25 Reel Dimensions



SOT-89

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	180±1.0
B	Reel Inner Diameter	62±1.5
C	Spindle Hole Diameter	12.75+0.15
D	Key Slit Width	1.9±0.15
T1	Space Between Flange	12.4+0.2
T2	Reel Thickness	17–0.4

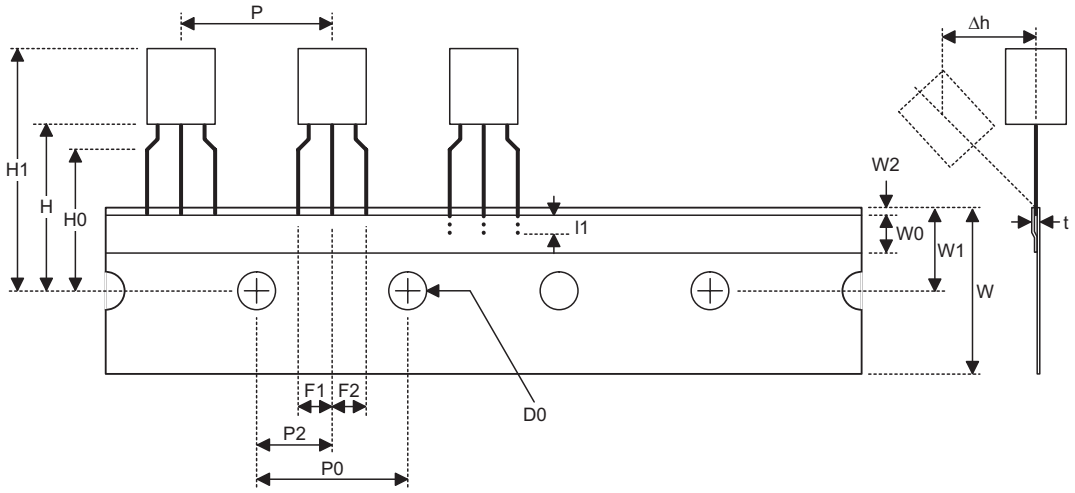
SOT-23

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	178±1
B	Reel Inner Diameter	62±1
C	Spindle Hole Diameter	13±0.2
D	Key Slit Width	2.5±0.25
T1	Space Between Flange	8.4+1.5
T2	Reel Thickness	11.4+1.5

SOT-25

Symbol	Description	Dimensions in mm
A	Reel Outer Diameter	178±1.0
B	Reel Inner Diameter	62±1.0
C	Spindle Hole Diameter	13.0±0.2
D	Key Slit Width	2.5±0.25
T1	Space Between Flange	8.4+1.5 –0.0
T2	Reel Thickness	11.4+1.5

TO-92 Carrier Tape Dimensions



TO-92

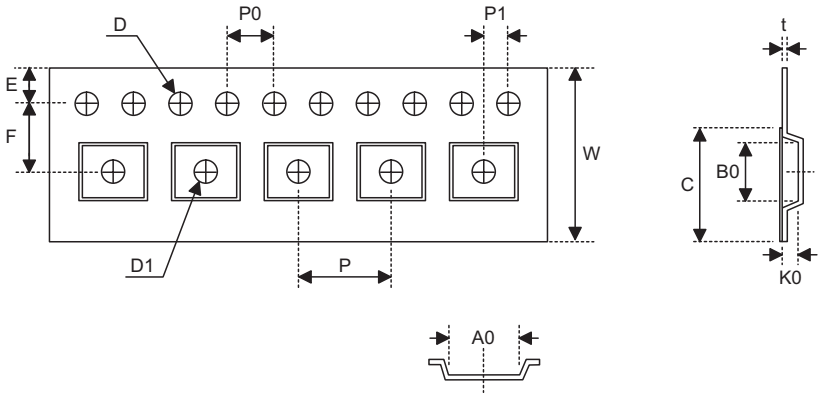
Symbol	Description	Dimensions in mm
I1	Taped Lead Length	(2.5)
P	Component Pitch	12.7±1.0
P_0	Perforation Pitch	12.7±0.3
P_2	Component to Perforation (Length Direction)	6.35±0.4
F_1	Lead Spread	2.5+0.4 −0.1
F_2	Lead Spread	2.5+0.4 −0.1
Δh	Component Alignment	0±0.1
W	Carrier Tape Width	18.0+1.0 −0.5
W_0	Hold-down Tape Width	6.0±0.5
W_1	Perforation Position	9.0±0.5
W_2	Hold-down Tape Position	(0.5)
H_0	Lead Clinch Height	16.0±0.5
H_1	Component Height	Less than 24.7
D_0	Perforation Diameter	4.0±0.2
t	Taped Lead Thickness	0.7±0.2
H	Component Base Height	19.0±0.5

Note: Thickness less than 0.38±0.05mm~0.5mm

P0 Accumulated pitch tolerance: ±1mm/20pitches.

( ) Bracketed figures are for reference only.

SOT-89, SOT-23 & SOT-25 Carrier Tape Dimensions



SOT-89

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	12.0+0.3 −0.1
P	Cavity Pitch	8.0±0.1
E	Perforation Position	1.75±0.1
F	Cavity to Perforation (Width Direction)	5.5±0.05
D	Perforation Diameter	1.5+0.1
D1	Cavity Hole Diameter	1.5+0.1
P0	Perforation Pitch	4.0±0.1
P1	Cavity to Perforation (Length Direction)	2.0±0.10
A0	Cavity Length	4.8±0.1
B0	Cavity Width	4.5±0.1
K0	Cavity Depth	1.8±0.1
t	Carrier Tape Thickness	0.30±0.013
C	Cover Tape Width	9.3

SOT-23

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	8±0.3
P	Cavity Pitch	4
E	Perforation Position	1.75
F	Cavity to Perforation (Width Direction)	3.5±0.05
D	Perforation Diameter	1.5+0.1
D1	Cavity Hole Diameter	1.5+0.1
P0	Perforation Pitch	4
P1	Cavity to Perforation (Length Direction)	2
A0	Cavity Length	3.15
B0	Cavity Width	3.2
K0	Cavity Depth	1.4
t	Carrier Tape Thickness	0.2±0.03
C	Cover Tape Width	5.3

SOT-25

Symbol	Description	Dimensions in mm
W	Carrier Tape Width	8.0±0.3
P	Cavity Pitch	4.0
E	Perforation Position	1.75
F	Cavity to Perforation (Width Direction)	3.5±0.05
D	Perforation Diameter	1.5+0.1
D1	Cavity Hole Diameter	1.5+0.1
P0	Perforation Pitch	4.0
P1	Cavity to Perforation (Length Direction)	2.0
A0	Cavity Length	3.15
B0	Cavity Width	3.2
K0	Cavity Depth	1.4
t	Carrier Tape Thickness	0.20±0.03
C	Cover Tape Width	5.3