十速

TK8023

DATA SHEET

Rev 0.91

AMENDMENT HISTORY

Version	Date	Description
V0.90	Jul, 2017	New release.
V0.91	Nov, 2017	Modify detail information

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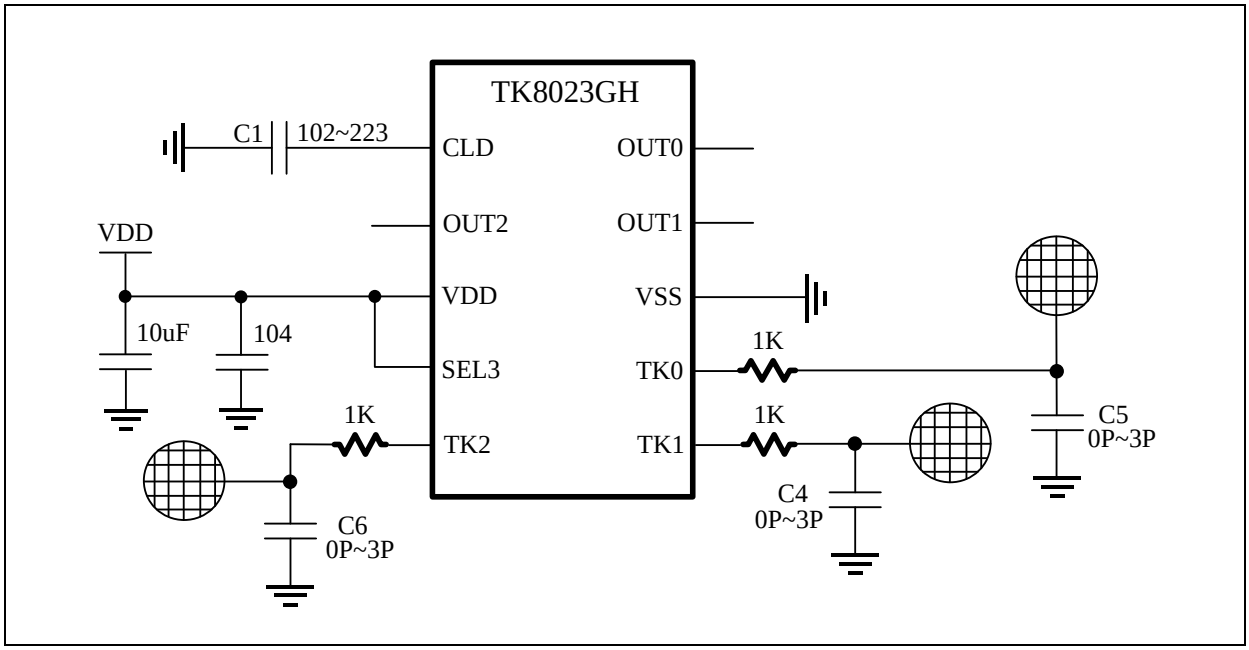
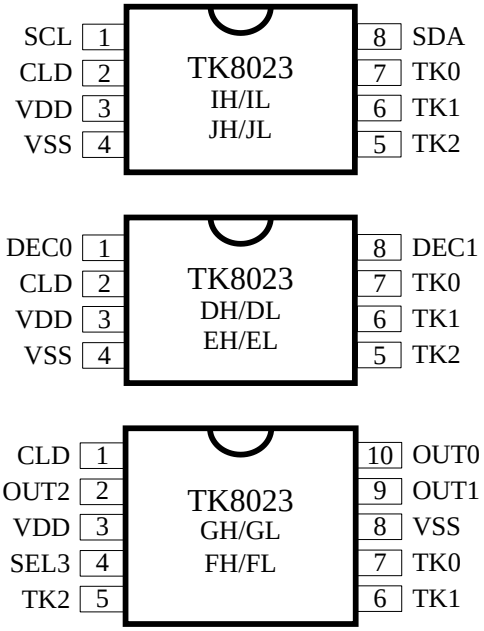
FEATURES

1. Three Key Touch Detector
2. Operation Voltage: 2.1V~5.5V (Type-1, LVR=1.9V) or 1.4V~5.5V (Type-2, LVR=1.2V)
3. Operation Current: 2.3uA @V_{DD}=3V (typical)
4. Enter Low Power mode after no activity for 16 second
5. Sensitivity adjusted by CLD capacitor (1nF~22nF)
6. Direct mode or Toggle mode output selectable
7. Decode output mode selectable
8. I2C mode selectable
9. 16 second or 64 second key press timeout, selectable by IC part number
10. SOP8, MSOP10 package

APPLICATION CIRCUIT



PIN ASSIGNMENT



PIN DESCRIPTION

Name	In/Out	Pin Description		
OUT0~OUT2	O	Touch Key corresponding output (CMOS active-low)		
SCL, SDA	I/O	I2C Bus communication pin		
DEC0, DEC1	O	Decode mode output (CMOS active-low)		
TK0~TK2	I	Touch Key input		
CLD	I/O	Key sensitivity adjust capacitor (1nF~22nF)		
SEL2, SEL3	I	SEL3	SEL2	output mode
		VDD	–	Direct mode: OUT0, OUT1, OUT2 pin CMOS active low output
		VSS	–	Toggle mode: OUT0, OUT1, OUT2 pin CMOS active low output
		floating	VDD	I2C mode: SCL, SDA pin communication
		floating	floating	Decode mode: DEC0, DEC1 pin CMOS active low output
VDD, VSS	P	Power input pin and ground		

***Note*:** In 8-pin package, SEL2 and SEL3 pins are bonding option.

DEVICE LIST

Type-1 IC Part number	Package	output mode	Max. time for key press timeout
TK8023IH	SOP8	I2C mode	16S, @VDD=3V
TK8023DH	SOP8	Decode mode	
TK8023GH	MSOP10	Direct mode / Toggle mode	
TK8023JH	SOP8	I2C mode	64S, @VDD=3V
TK8023EH	SOP8	Decode mode	
TK8023FH	MSOP10	Direct mode / Toggle mode	

Type-1 Device Feature:

- @25℃ : Operation Voltage = 2.1V~5.5V, LVR=1.9V
- @VDD=3V: Normal mode current=3.3uA, Low Power mode current=1.5uA

Type-2 IC Part number	Package	output mode	Max. time for key press timeout
TK8023IL	SOP8	I2C mode	9S, @VDD=3V 16S, @VDD=1.5V
TK8023DL	SOP8	Decode mode	
TK8023GL	MSOP10	Direct mode / Toggle mode	
TK8023JL	SOP8	I2C mode	36S, @VDD=3V 64S, @VDD=1.5V
TK8023EL	SOP8	Decode mode	
TK8023FL	MSOP10	Direct mode / Toggle mode	

Type-2 Device Feature:

- @25℃ : Operation Voltage = 1.4V~5.5V, LVR=1.2V
  @0℃ : Operation Voltage = 1.5V~5.5V, LVR=1.35V
- @VDD=3V: Normal mode current=8.4uA, Low Power mode current=5.2uA
  @VDD=1.5V: Normal mode current=1.8uA, Low Power mode current=1.0uA

FUNCTIONAL DESCRIPTION

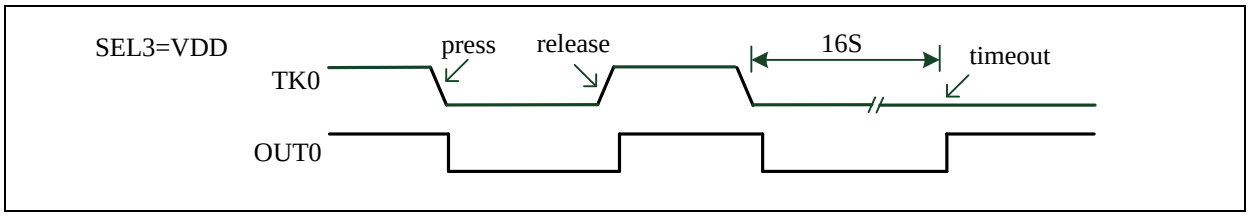
1. Output Pin Mode Selection

For the TK8023GH MSOP10 group devices, SEL3 is a user-controllable pin to select the OUT0~2's Direct/Toggle output mode. For the other devices, SEL2 and SEL3 are package bonding option to select the I2C/Decode mode.

SEL3	SEL2	output mode
VDD	–	Direct mode: OUT0, OUT1, OUT2 pin CMOS active low output
VSS	–	Toggle mode: OUT0, OUT1, OUT2 pin CMOS active low output
Floating	VDD	I2C mode: SCL, SDA bus communication
Floating	Floating	Decode mode: DEC0, DEC1 pin CMOS active low output

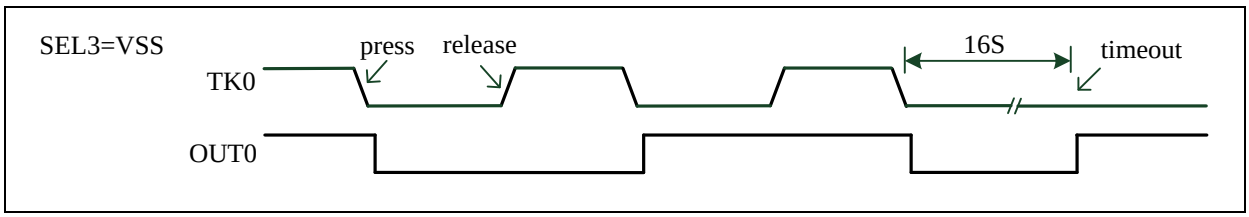
1.1 Direct output mode

This mode needs to connect SEL3 to VDD. Take TK0-OUT0 as an example, the Direct mode waveform is as shown below.



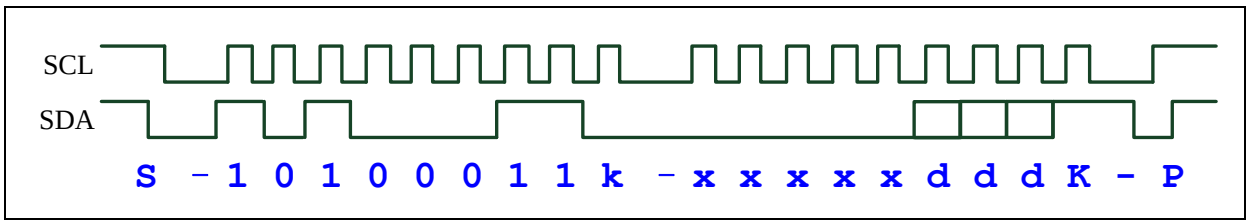
1.2 Toggle output mode

This mode needs to connect SEL3 to VSS. Take TK0-OUT0 as an example, the Toggle mode waveform is as shown below.



1.3 I2C mode

The chip support 1 byte I2C read command.



S-10100011k-xxxxxdddK-P
S = Master send I2C START
P = Master send I2C STOP
k = Slave (TK8023) reply ACK (=0)
K = Master reply ACK (=1)
10100011 = Master send slave address
xxxxxddd = Slave reply Data, **ddd** represent the TK2, TK1 and TK0's press status

1.4 Decode output mode

The TK0~2 events are decoded to DEC0 and DEC1 pin (CMOS active low) as below.

TK0	TK1	TK2	DEC1	DEC0
Press	–	–	Low	Low
Release	Press	–	Low	High
Release	Release	Press	High	Low
Release	Release	Release	High	High

2. Touch Sensitivity Adjustment

The Touch Key Sensitivity can be adjusted by CLD pin's capacitor C1 (1nF~22nF). Larger CLD capacitance makes more sensitivity. The TK pin's capacitor C4/C5/C6 (0pF~3pF) is used to balance the TK0, TK1 and TK2 pin's sensitivity. Smaller TK capacitance makes more sensitivity.

3. Key Press Timeout Reset

If any key is pressed more than 16 or 64 seconds (select by part number), the chip reset itself.

4. Normal mode and Low Power mode

The chip starts at Normal mode after reset. If no event occurred for 16 second, it switches to Low Power mode. It switches to Normal mode after detecting TK pin's capacitance variation event.

ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply voltage	V_{SS} –0.3 ~ V_{SS} +5.5	V
Input voltage	V_{SS} –0.3 ~ V_{DD} +0.3	
Operating temperature	–20 ~ +70	℃
Storage temperature	–65 ~ +150	

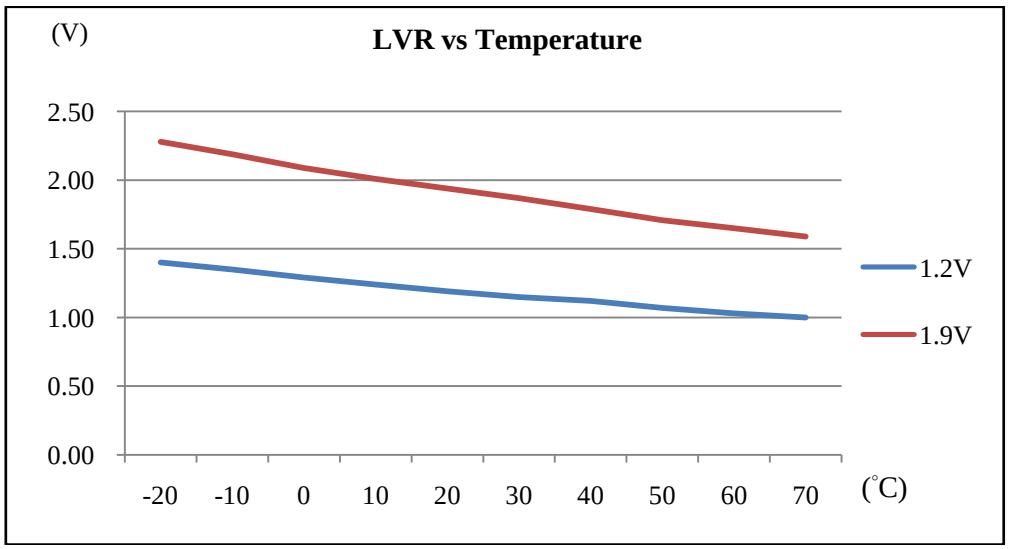
DC Characteristics (T_A=25℃)

Parameter	Sym	Conditions		Min	Typ	Max	Unit
Input High Voltage	V_{IH}	all Input	–	0.8V_{DD}			V
Input Low Voltage	V_{IL}			–	–	0.2V_{DD}	
I/O Port Source Current	I_{OH}	all Output	V_{DD}=3.0V V_{OH}=2.7V	–	5	–	mA
			V_{DD}=5.0V V_{OH}=4.5V	–	10	–	
I/O Port Sink Current	I_{OL}	all Output	V_{DD}=3.0V V_{OL}=0.3V	–	11	–	
			V_{DD}=5.0V V_{OL}=0.5V	–	20	–	
Power Supply Current Normal mode	I_{DD}	LVR=1.9V	V_{DD}=5.0V	–	9.8	–	uA
		LVR=1.9V	V_{DD}=3.0V	–	3.3	–	
		LVR=1.2V		–	8.4	–	
		LVR=1.2V	V_{DD}=1.5V	–	1.8	–	
Power Supply Current Low Power mode	I_{DD}	LVR=1.9V	V_{DD}=5.0V	–	5.7	–	uA
		LVR=1.9V	V_{DD}=3.0V	–	1.5	–	
		LVR=1.2V		–	5.2	–	
		LVR=1.2V	V_{DD}=1.5V	–	1.0	–	
Timeout Lead Time	T_{LT}	LVR=1.9V	V_{DD}=3~5V	–	16/64	–	S
		LVR=1.2V	V_{DD}=3.0V	–	9/36	–	
			V_{DD}=1.5V	–	16/64	–	
LVR Voltage	V_{LVR}	select 1.9V		1.7	1.9	2.1	V
		select 1.2V		1.0	1.2	1.4	

I2C Characteristics (T_A=25℃)

Parameter	Min	Typ	Max	Unit
SCL clock low time	500	–	–	nS
SCL clock high time	500	–	–	
SDA setup time	100	–	–	
SDA data hold time	100	–	–	
SDA and SCL rise time	–	–	150	
SDA and SCL fall time	–	–	150	
START condition hold time	500	–	–	
STOP condition setup time	500	–	–	
STOP to START condition time	800	–	–	
Capacitive load for each bus line	–	–	200	pF

Characteristics Graphs



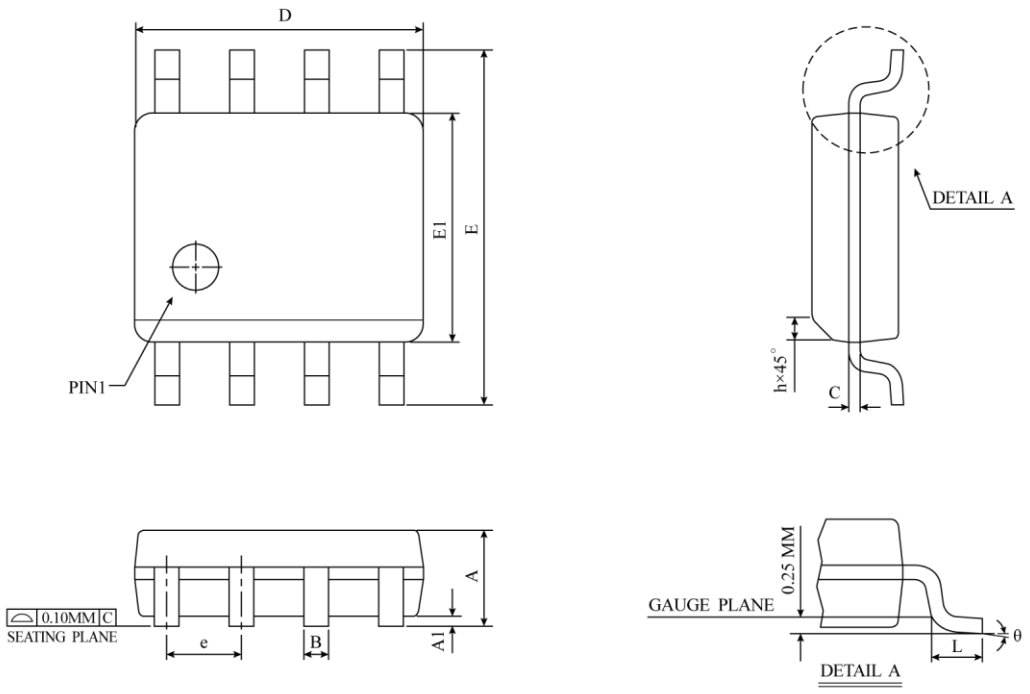
PACKAGE INFORMATION

Ordering Information

Ordering number	Package
TK8023IH-301-14	SOP8 (150mil)
TK8023IL-302-14	
TK8023JH-303-14	
TK8023JL-304-14	
TK8023DH-301-14	
TK8023DL-302-14	
TK8023EH-303-14	
TK8023EL-304-14	
TK8023GH-301-53	MSOP10 (118mil)
TK8023GL-302-53	
TK8023FH-303-53	
TK8023FL-304-53	

Package Information

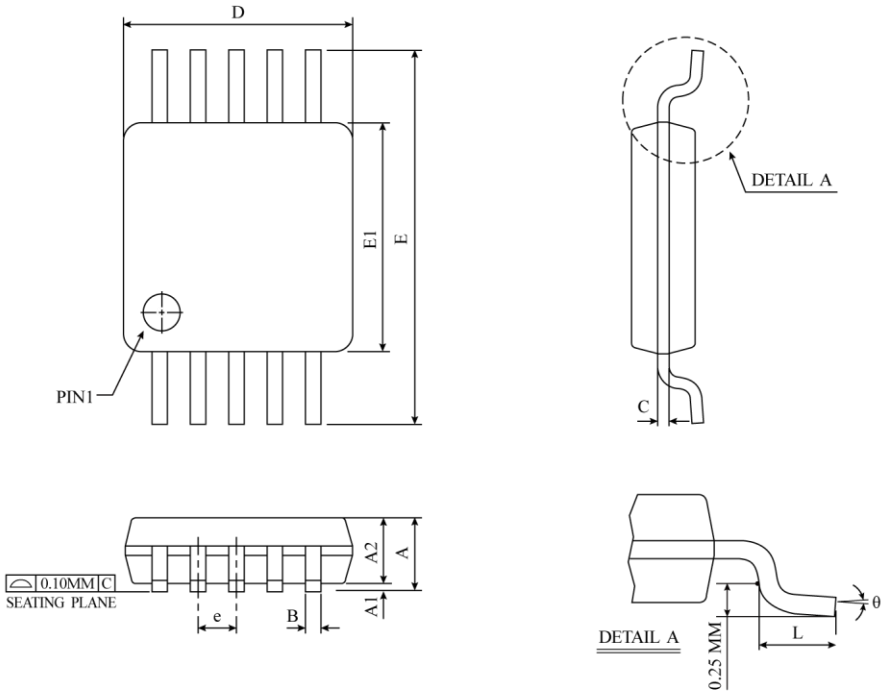
● SOP-8 (150mil) Package Dimension



SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.55	1.75	0.0532	0.0610	0.0688
A1	0.10	0.18	0.25	0.0040	0.0069	0.0098
B	0.33	0.42	0.51	0.0130	0.0165	0.0200
C	0.19	0.22	0.25	0.0075	0.0087	0.0098
D	4.80	4.90	5.00	0.1890	0.1939	0.1988
E	5.80	6.00	6.20	0.2284	0.2362	0.2440
E1	3.80	3.90	4.00	0.1497	0.1536	0.1574
e	1.27 BSC			0.050 BSC		
h	0.25	0.38	0.50	0.0099	0.0148	0.0196
L	0.40	0.84	1.27	0.0160	0.0330	0.0500
θ	0°	4°	8°	0°	4°	8°
JEDEC	MS-012 (AA)					

△ * NOTES : DIMENSION " D " DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL
NOT EXCEED 0.15 MM (0.006 INCH) PER SIDE.

● MSOP-10 (118mil) Package Dimension



SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.81	0.96	1.10	0.032	0.038	0.043
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.75	0.85	0.95	0.030	0.034	0.037
B	0.17	0.22	0.27	0.007	0.009	0.011
C	0.13	0.18	0.23	0.005	0.007	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.75	4.90	5.05	0.187	0.193	0.199
E1	2.90	3.00	3.10	0.114	0.118	0.122
e	0.50 BSC			0.020 BSC		
L	0.40	0.55	0.70	0.016	0.022	0.028
θ	0°	3°	6°	0°	3°	6°
JEDEC						

△ * NOTES : DIMENSION " D " DOES NOT INCLUDE MOLD PROTRUSIONS OR GATE BURRS.
MOLD PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.12 MM (0.005 INCH) PER SIDE.
DIMENSION " E1 " DOES NOT INCLUDE MOLD PROTRUSIONS
MOLD PROTRUSIONS SHALL NOT EXCEED 0.25 MM (0.010 INCH) PER SIDE.