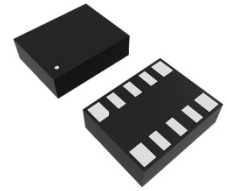


Description

Abrakon's AB-RTC-TH-32.768kHz-2 Real-Time Clock (RTC) uses I2C communication interface to configure numerous features. These include an alarm function capability, a leap year autocorrection function, timer function, and build-in temperature sensor. The RTC has a broad operating power supply range of 1.6V to 5.5V with low power consumption. The RTC's integrated 32.768kHz crystal provides precise timing accuracy in a 3.2 x 2.5 mm package.



Features

- Build-in frequency adjusted 32.768kHz crystal unit
- Build-in Temperature Sensor
- Low current consumption: 1.0uA (Typ.)
- Communication interface: I2C bus
- Leap years autocorrection
- Timer output function with adjustable period
- High stability: ± 5 ppm @ -40°C to 85°C
- [REACH/RoHS II Compliant | MSL Level 3](#)

Typical Applications

- IoT, Wireless communication
- Medical instrumentation
- Utility meters
- Data loggers and Appliances
- Consumer electronics

Absolute Maximum Ratings

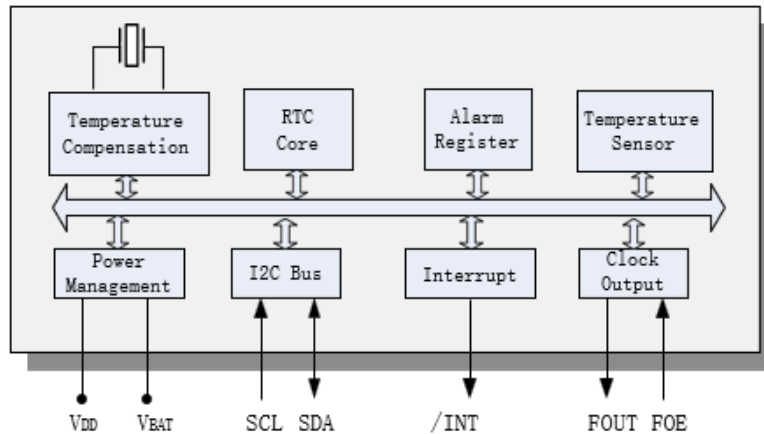
Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Supply Voltage	V _{DD}	-0.3		6.5	V	
Backup battery voltage	V _{BAT}	-0.3		6.5	V	
Input Voltage	V _{IN}	GND-0.3		6.5	V	FOE, SCL, SDA input
Clock output Voltage	V _{Out1}	GND-0.3		V _{DD} +0.3	V	FOUT output
Output Voltage	V _{Out2}	GND-0.3		6.5	V	SDA, /INT output
Operating Ambient Temperature Range	T _{OPR}	-40		85	°C	
Storage Temperature Range	T _{STO}	-55		125	°C	
Reflow Temperature				+260	°C	See Reflow Profile
ESD Protection	V _{ESD}	4kV HBM, 400V MM, 2kV CDM, (1), (2)				

1) HBM: Human Body Model, according to JESD22-A114.

2) MM: Machine Model, according to JESD22-A115.

Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability. The data sheet limits are not guaranteed if the device is operated beyond the recommended operating conditions.

Block Diagram



Frequency Characteristics (Unless otherwise specified, GND=0V, VDD = 2.5V ~ 5.5V, Ta=-40°C~+85°C)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Frequency stability	$\Delta f/f$	-5		+5	ppm	-40°C to +85°C
Oscillation start time	t_{STA}			1	s	@25°C
Year Aging	f_a			±3	ppm	First year@25°C
Temperature Sensor Accuracy	T_{temp}			±5	°C	V _{DD} =3.0V
FOUT duty cycle`	$T_{w/t}$	40	50	60	%	

DC Characteristics (Unless otherwise specified, GND=0V, VBAT=VDD=1.2~5.5V, VIO=1.6V ~5.5V, Ta=-40°C~+85°C)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Power Supply (pad 2)	V _{DD}	2.5	3.0	5.5	V	
Power Supply (pad 2) ^[Note 1,2]	V _{DD}	1.6	3.0	5.5	V	Single supply VDD= VBAT
Backup Battery (pad 3)	V _{BAT}	1.6	3.0	5.5	V	
Operating Temperature	T _{OPR}	-40	25	85	°C	
Current consumption	I _{DD1}		1.25	5.1	uA	VDD = 5.0V, fSCL=0Hz, FOE=GND, /INT = VDD; VDD=VBAT; FOUT off (High-Z); compensation interval 2s; VDD voltage detection time 2ms
	I _{DD2}		1.0	4.9	uA	VDD = 3.0V, fSCL=0Hz, FOE=GND, /INT = VDD; VDD=VBAT; FOUT off (High-Z); compensation interval 2s; VDD voltage detection time 2ms
	I _{DD3}		5.8	20	uA	VDD= 5.0V, fSCL=0Hz, FOE=VDD, /INT = VDD; VDD=VBAT; FOUT:32.768kHz, CL=0pF; Compensation interval 2s; VDD voltage detection time 2ms
	I _{DD4}		3.8	19	uA	VDD= 3.0V, fSCL=0Hz, FOE=VDD, /INT = VDD; VDD=VBAT; FOUT:32.768kHz, CL=0pF; Compensation interval 2s; VDD voltage detection time 2ms
I ² C clock signal (pad 5)	SCL					
Input voltage high-level	V _{IH}	0.8*V _{DD}		5.5	V	
Input voltage low-level	V _{IL}	GND-0.3		0.2*V _{DD}	V	
Input Leak Current	I _{LK}	-0.5		0.5	uA	VIN = VDD or GND
I ² C data signal (pad 7)	SDA					
Input voltage high-level	V _{IH}	0.8*V _{DD}		5.5	V	
Input voltage low-level	V _{IL}	GND-0.3		0.2*V _{DD}	V	
Output voltage Low-level	V _{OL}	GND		GND+0.4	V	VDD≥3.0V, IOL = 3mA
Input Leak Current	I _{LK}	-0.5		0.5	uA	VIN = VDD or GND
Output Leak Current	I _{OZ}	-0.5		0.5	uA	VIN = VDD or GND
Frequency Output (pad 4)	F _{OUT}					
Output voltage high-level	V _{OH}	4.0		5.0	V	VDD=5.0V, IOH = -1mA
		2.2		3.0		VDD=3.0V, IOH = -1mA
		2.9		3.0		VDD=3.0V, IOH = -100uA
Output voltage low-level	V _{OL}	GND		GND+0.5	V	VDD=5.0V, IOL = 1mA
		GND		GND+0.8		VDD=3.0V, IOL = 1mA
		GND		GND+0.1		VDD=3.0V, IOL = 100uA

Output Control Pin (pad 1)		FOE				
Input voltage high-level	V_{IH}	$0.8 \cdot V_{DD}$		5.5	V	
Input voltage low-level	V_{IL}	GND-0.3		$0.2 \cdot V_{DD}$	V	
Input Leak Current	I_{LK}	-0.5		0.5	μA	VIN = VDD or GND
Output Control Pin (pad 10)		/INT				
Output voltage low-level	V_{OL}	GND		GND+0.25	V	VDD=5.0V, IOL = 1mA
		GND		GND+0.4		VDD=3.0V, IOL = 1mA
Output Leak Current	I_{OZ}	-0.5		0.5	μA	VIN = VDD or GND

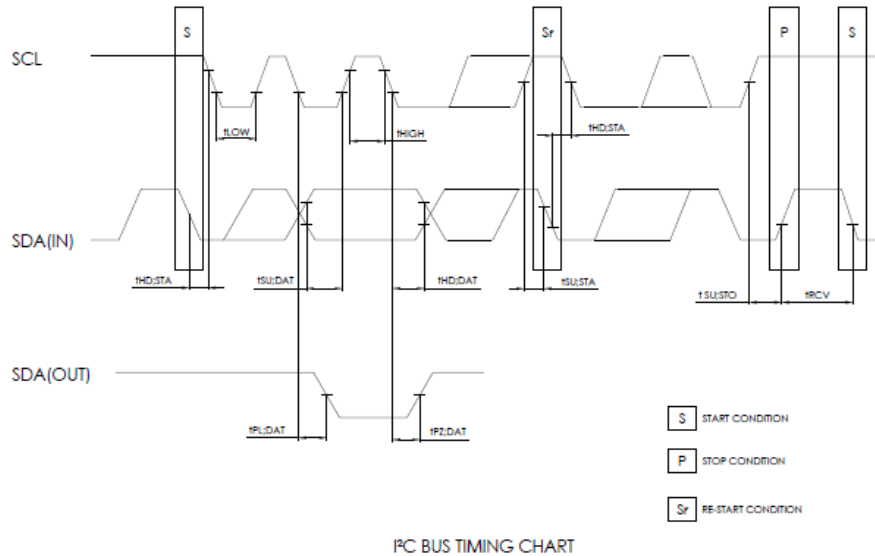
Note 1: To apply Min. value of VDD and VBAT, V_{CORE} need to be supplied with more than 2.5V at least for the oscillation to stabilize (oscillation start time t_{STA}).

Note2 : After powered off, ensure that VDD = VBAT = GND for more than 10 seconds before next power on

AC Characteristics (Unless otherwise specified, VDD =2.5V ~ 5.5V; Ta=-40°C ~ +85°C)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Start condition setup time ^[Note 1]	t _{HD;STA}	0.6			us	
Start condition hold time ^[Note 1]	t _{SU;STA}	0.6			us	
Stop condition setup time	t _{SU;STO}	0.6			us	
Bus idle time between start condition and stop condition	t _{RCV}	1.3			us	
Data setup time	t _{SU;DAT}	100			ns	
Data hold time	t _{HD;DAT}	0		0.9	ns	
I ² C clock signal (pad 5)		SCL				
SCL clock frequency	f _{SCL}			400	kHz	
SCL low voltage time	t _{LOW}	1.3			us	
SCL high voltage time	t _{HIGH}	0.6			us	
SCL rising time	t _r			0.3	us	
SCL falling time	t _f			0.3	us	
I ² C data signal (pad 7)		SDA				
SDA rising time	t _r			0.3	us	
SDA falling time	t _f			0.3	us	

I2C BUS Timing Characteristics

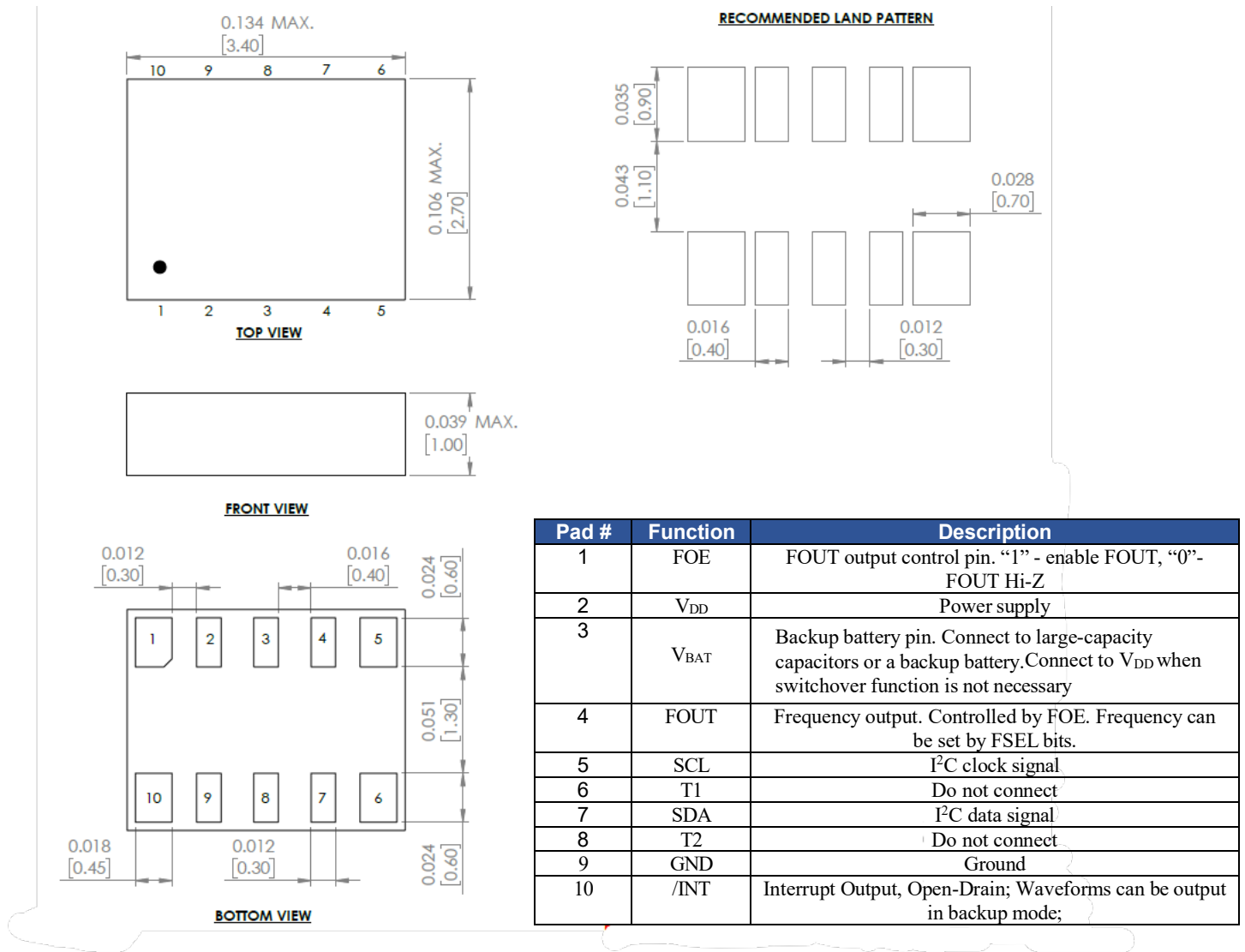


Part Identification

AB - RTC - TH - 32.768kHz - 2 -

Packaging
Blank: Bulk
T3: 3000pcs / reel

Mechanical Dimensions



Pad #	Function	Description
1	FOE	FOUT output control pin. "1" - enable FOUT, "0"- FOUT Hi-Z
2	V _{DD}	Power supply
3	V _{BAT}	Backup battery pin. Connect to large-capacity capacitors or a backup battery. Connect to V _{DD} when switchover function is not necessary
4	FOUT	Frequency output. Controlled by FOE. Frequency can be set by FSEL bits.
5	SCL	I ² C clock signal
6	T1	Do not connect
7	SDA	I ² C data signal
8	T2	Do not connect
9	GND	Ground
10	/INT	Interrupt Output, Open-Drain; Waveforms can be output in backup mode;

Dimensions: inches[mm]

Reflow Profile [JEDEC J-STD-020]

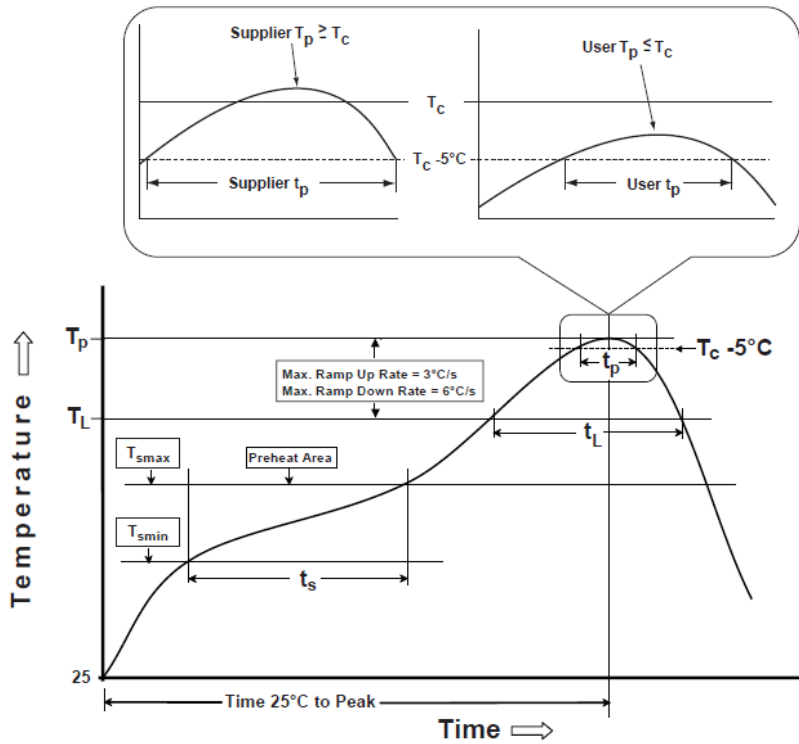


Table 1

SnPb Eutectic Process Classification Temperatures (T_c)		
Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2

Pb-Free Process Classification Temperatures (T_c)			
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

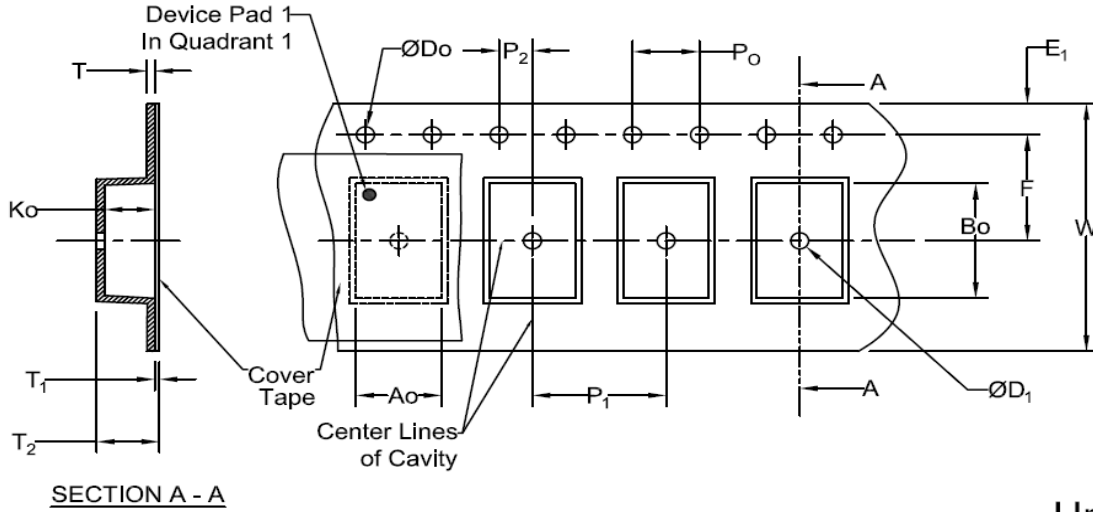
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum (T_{smin})	100°C	150°C
Temperature maximum (T_{smax})	150°C	200°C
Time (T_{smin} to T_{smax}) (t_s)	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate (T_{smax} to T_p)	3°C/sec. max	3°C/sec. max
Liquidous temperature (T_L)	183°C	217°C
Time at liquidous (t_L)	60 - 150 sec.	60 - 150 sec.
Peak package body temperature (T_p)*	see Table 1	see Table 2
Time (t_p)** within 5°C of the specified classification temperature (T_c)	20 sec.	30 sec.
Ramp-down rate (T_p to T_{smax})	6°C/sec. max	6°C/sec. max
Time 25°C to peak temperature	6 min. max	8 min. max
Reflow cycles	2 max	2 max

*Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

**Tolerance for time at peak profile temperature (t_p) is defined as supplier minimum and a user maximum.

Packaging

T3: 3,000pcs/reel

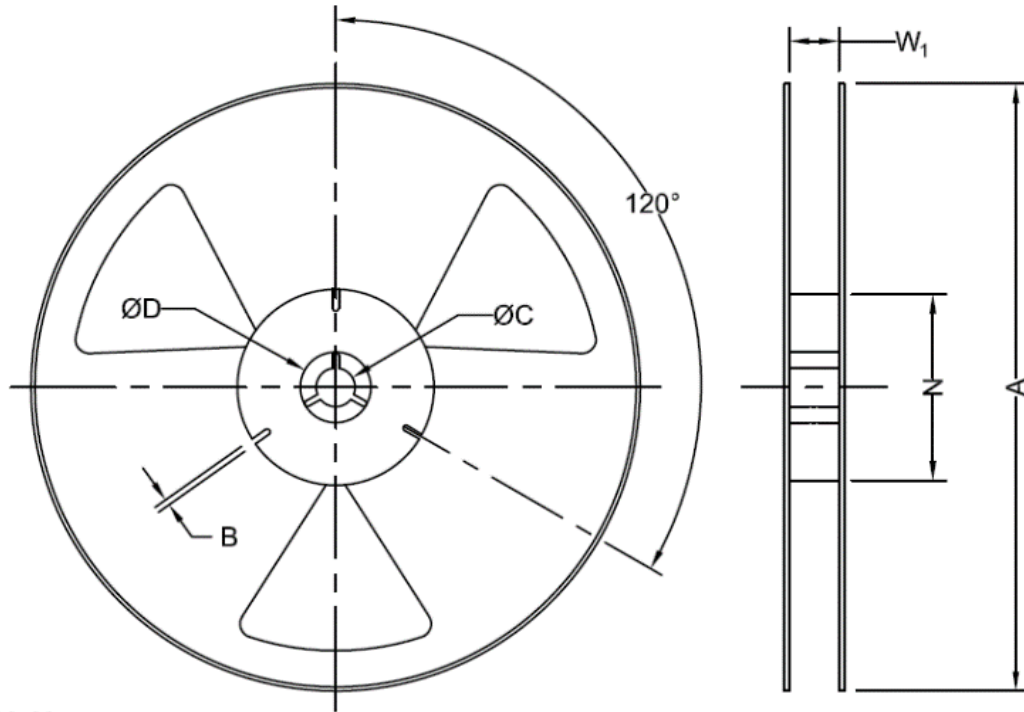


Unit: mm

Tape Specifications (mm)							
Width	Ao	Bo	Do	D ₁ (Min)	E ₁	F	Ko
8mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	3.5±0.05	*

Tape Specifications (mm)							
Width	P ₁	P ₂	P ₀	T (Max)	T ₁ (Max)	T ₂ (Max)	W (Max)
8mm	4.0±0.1	2.0±0.05	4.0±0.1	0.6	0.1	2.5	8.3

*Note: Compliant to EIA-481



Unit: mm

Tape Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W ₁
8mm	3000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0