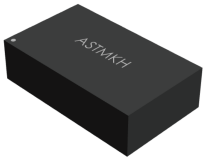
Ultra-miniature, Low Power, 32.768kHz MEMS Oscillator



2.0 x 1.2 x 0.6mm

ASTMKH

ESD Sensitive

RoHS/RoHS II compliant

Moisture Sensitivity Level (MSL) – 1

FEATURES:

- Ultra-miniature size: 2.0 x 1.2 x 0.6mm
- Supply Voltage: 1.2V to 3.63V (-10 ~ +70°C); 1.5V to 3.63V (-40 ~ +85°C)
- Ultra-Low Current Consumption: 1.4µA max. (core current, no load)
- Frequency Stabilities include:
  - ±75ppm over -10 to +70°C
  - ±100ppm over -40 to +85°C
- Internal power supply filtering eliminates external bypass capacitor for Vdd port.
- Proprietary NanoDrive™ Technology by SiTime enables programmable output swing for lower power

APPLICATIONS:

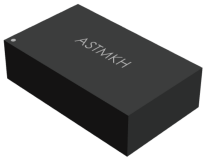
- Timekeeping
- Battery Management
- Mobile devices
- RTC reference clock
- Wireless accessories
- Fitness/Medical monitoring sensors
- Sport video cams

STANDARD SPECIFICATIONS:

Parameters		Min	Typ	Max	Unit	Notes
Output Frequency (F_{out})			32.768		kHz	
Initial Frequency Tolerance (F_{tol}) (1)		-20		+20	ppm	T_A= +25°C, post reflow, V_{dd}:1.5-3.63V
Frequency Stability over Temperature (F_{stab}) (2)		-75		+75	ppm	T_A= -10°C to +70°C, V_{dd}:1.5-3.63V
		-100		+100		T_A= -40°C to +85°C, V_{dd}:1.5-3.63V
		-250		+250		T_A= -10°C to +70°C, V_{dd}:1.2-1.5V
Aging (@+25°C)		-1		+1	ppm	First year
Supply Voltage (V_{dd})		1.2		3.63	V	T_A= -10°C to +70°C
		1.5		3.63		T_A= -40°C to +85°C
Core Operating Current (I_{dd}) (3)			0.90		µA	T_A= +25°C, Vdd: 1.8V. No load.
				1.3		T_A= -10°C to +70°C, V_{dd} max: 3.63V. No load
				1.4		T_A= -40°C to +85°C, V_{dd} max: 3.63V. No load.
Output Stage Operating Current (I_{dd_out}) (3)			0.065	0.125	$\mu A/V_{pp}$	T_A= -40°C to +85°C, V_{dd} max: 1.5-3.63V. No load.
Power Supply Ramp (t_{Vdd_Ramp})				100	ms	T_A= -40°C to +85°C, 0 to 90%*V_{dd}
Start-up Time at Power-up (T_{start}) (4)			180	300	ms	T_A= -40°C≤ T_A ≤+50°C, valid output
				450		T_A= +50°C≤ T_A ≤+85°C, valid output
Operating Temperature Range (T_{use})		-10		+70	°C	Option "M"
		-40		+85		Option "L"
Period Jitter			35		ns_{RMS}	Cycles=10000, T_A= +25°C, V_{dd}:1.5-3.63V
LVCMOS Output Option (T_A= -40°C to +85°C. Typical values are at T_A= +25°C)						
Output Rise/Fall Time (t_r/t_f)			100	200	ns	10-90%(V_{dd}), 15pF load, Vdd:1.5-3.63V
				50		10-90%(V_{dd}), 5pF load, Vdd≥1.62V
Output Clock Duty Cycle		48		52	%	
Output Voltage	V_{OH}	90%*V_{dd}			V	V_{dd}:1.5-3.63V. I_{OH}= -10µA, 15pF
	V_{OL}			10%*V_{dd}		V_{dd}:1.5-3.63V. I_{OL}= 10µA, 15pF
NanoDrive™(5) Programmable, Reduced Swing Output Option						
Output Rise/Fall Time (t_r/t_f)				200	ns	30-70%(V_{OL}/ V_{OH}), 10pF load
Output Clock Duty Cycle		48		52	%	
AC-coupled Programmable Output Swing (V_{SW})			0.20 to 0.80		V	ASTMKH does not internally AC-couple. This output description is intended for a receiver that is AC-coupled. See Part Identification section for available AC-coupled signal swing options. Vdd:1.5-3.63V. 10pF load, I_{OH}/ I_{OL} =±0.2µA

5101 Hidden Creek Lane Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
For terms and conditions of sales please visit:
www.abracon.com

Revised: 06.17.2017



2.0 x 1.2 x 0.6mm

(Continued)

Parameters	Min	Typ	Max	Unit	Notes
DC-biased Programmable Output Voltage High Range (V_{OH})		0.60 to 1.225		V	V_{dd}:1.5-3.63V. I_{OH} =-0.2µA.10pF load. See Part Identification section for available V_{OH}/ V_{OL} levels.
DC-biased Programmable Output Voltage Low Range (V_{OL})		0.35 to 0.80		V	V_{dd}:1.5-3.63V. I_{OL} =0.2µA.10pF load. See Part Identification section for available V_{OH}/ V_{OL} levels.
Programmable Output Voltage Swing Tolerance	-0.055		+0.055	V	T_A= -40°C to +85°C, V_{dd}:1.5-3.63V

Note:

1. Measured peak-to-peak. Tested with Agilent 53132A frequency counter. Due to the low operating frequency, the gate time must be ≥100ms to ensure an accurate frequency measurement.
2. Stability is specified for two operating voltage ranges. Stability progressively degrades with supply voltage below 1.5V. Measured peak-to-peak. Inclusive of initial tolerance at +25°C, and variations over operating temperature, rated power supply voltage and load.
3. Core operating current does not include output driver operating current or load current. To derive total operating current (no load), add core operating current + output driver operating current, where output driver operating current = C_{driver}*V_{out}*F_{out}.
4. Measured from the time V_{dd} reaches 1.5V.
5. NanoDrive™ is a SiTime trademark.

Absolute Maximum Ratings

Attempted operation outside the absolute maximum ratings may cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

Parameters	Test Condition	Value	Unit
Continuous Power Supply Voltage Range (V_{dd})		-0.5 to 3.63	V
Short Duration Max. Power Supply Voltage (V_{dd})	≤30 minutes	4.0	V
Continuous Maximum Operating Temperature Range	Vdd:1.5-3.63V	105	°C
Short Duration Max. Operating Temperature Range	Vdd:1.5-3.63V, ≤30 minutes	125	°C
Human Body Model (HBM) ESD Protection	JESD22-A114	3000	V
Charge-Device Model (CDM) ESD Protection	JESD22-C101	750	V
Machine Model (MM) ESD Protection	JESD22-A115	300	V
Latch-up Tolerance	JESD78 Compliant		
Mechanical Shock Resistance	Mil 883, Method 2002	10000	g
Mechanical Vibration Resistance	Mil 883, Method 2007	70	g
2012 SMD Junction Temperature		150	°C
Storage Temperature		-65 to +150	°C

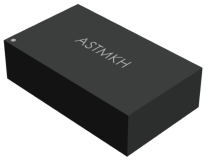
5101 Hidden Creek Lane Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
For terms and conditions of sales please visit:
www.abracon.com

Revised: 06.17.2017

Ultra-miniature, Low Power, 32.768kHz MEMS Oscillator

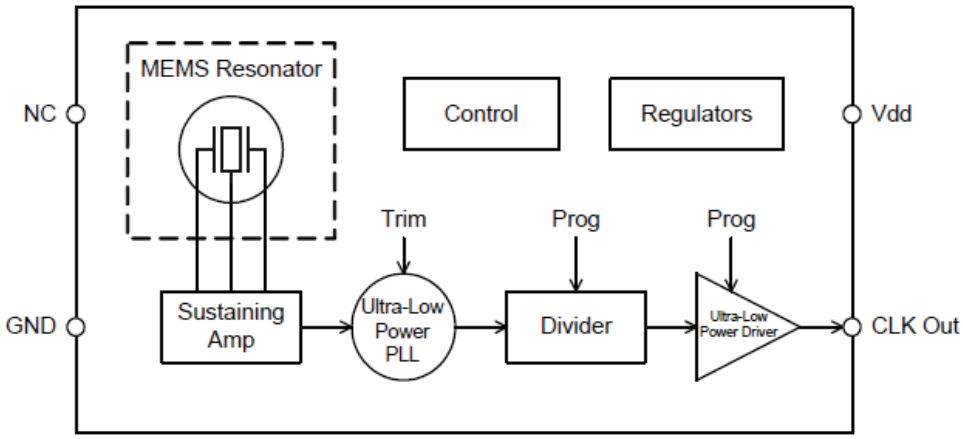
ASTMKH

RoHS/RoHS II compliant



2.0 x 1.2 x 0.6mm

Block Diagram



PART IDENTIFICATION:

ASTMKH - 32.768 kHz - □□ - □□□ - □

Operating Temp.
M: -10°C ~ +70°C
L: -40°C ~ +85°C

Freq. Stability
P: ±75ppm (-10°C ~ +70°C only)
Q: ±100 ppm (-40°C ~ +85°C only)

Packaging
Blank: Bulk
T: Tape & Reel (1kpcs / reel)
T3: Tape & Reel (3kpcs / reel)
T10: Tape & Reel (10kpcs / reel)

Output Level Option
DCC: Rail-to-Rail LVCMOS
AA3: AC-coupled signal, swing level: 0.3V min.
D14: DC-coupled signal, V_{OL}: 0.400V max, V_{OH}: 1.100V min
D26: DC-coupled signal, V_{OL}: 0.525V max, V_{OH}: 1.225V min

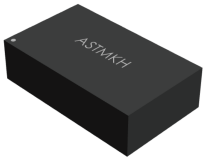
5101 Hidden Creek Lane Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
For terms and conditions of sales please visit:
www.abracon.com

Revised: 06.17.2017

Ultra-miniature, Low Power, 32.768kHz MEMS Oscillator

ASTMKH

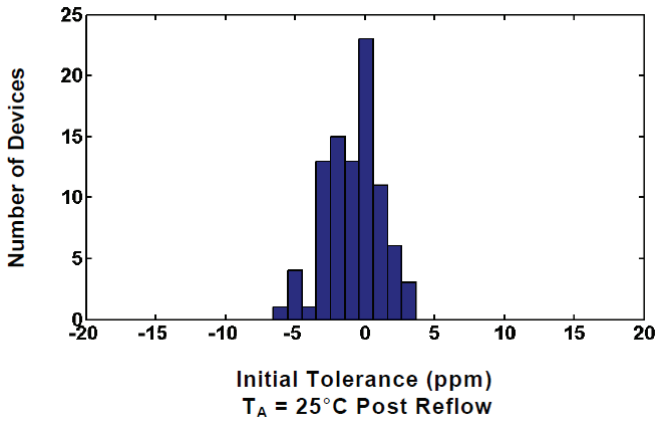
RoHS/RoHS II compliant



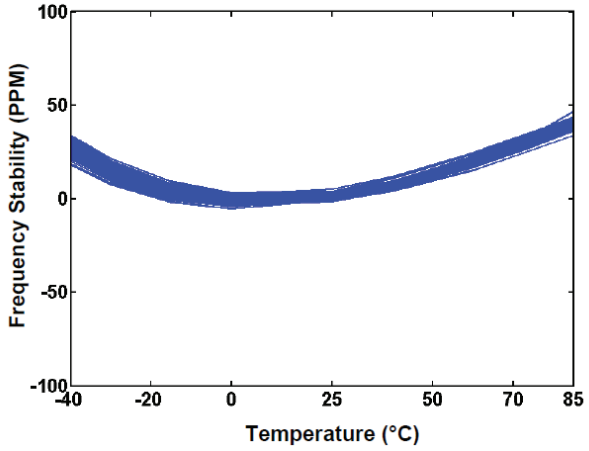
2.0 x 1.2 x 0.6mm

Typical Performance Data (TA=25°C, Vdd=1.8V, unless otherwise stated)

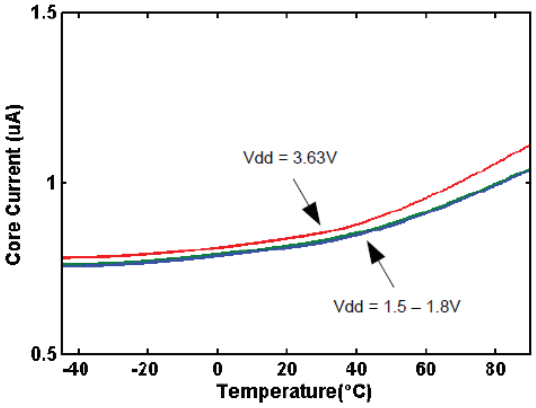
Initial Tolerance Histogram



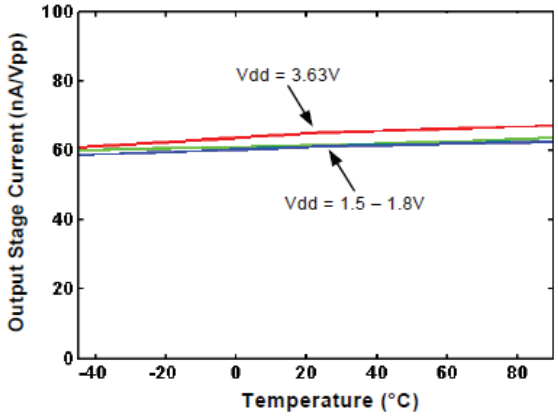
Frequency Stability vs. Operating Temperature Range



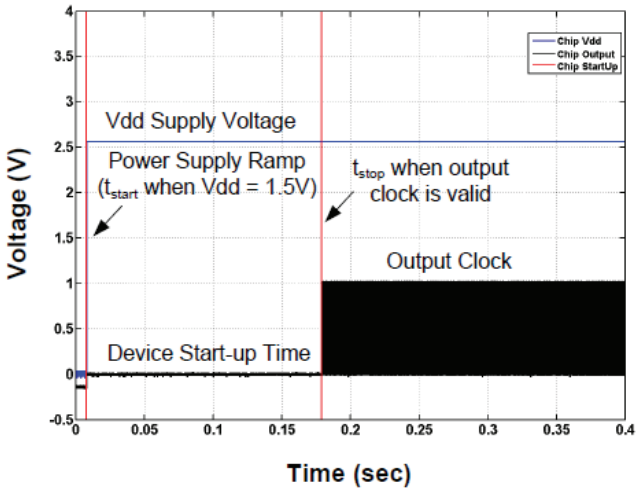
Core Current vs Operating Temperature Range



Output Stage Current vs Operating Temperature Range

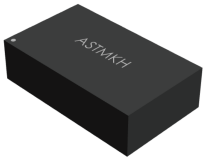


Start-up Time



5101 Hidden Creek Lane Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
For terms and conditions of sales please visit:
www.abracon.com

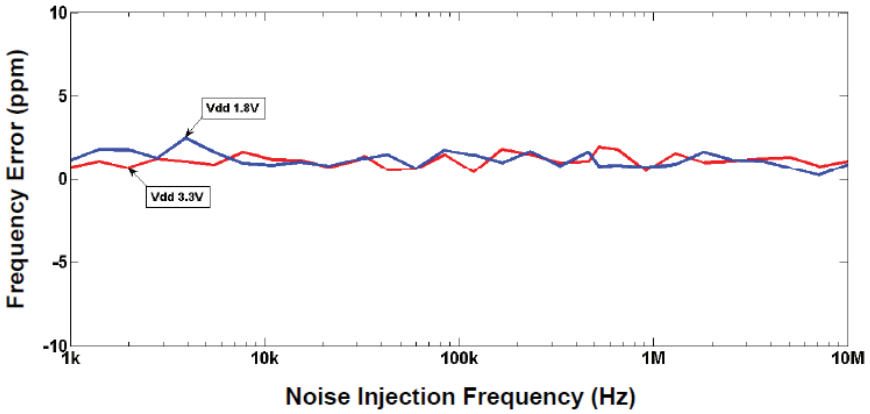
Revised: 06.17.2017



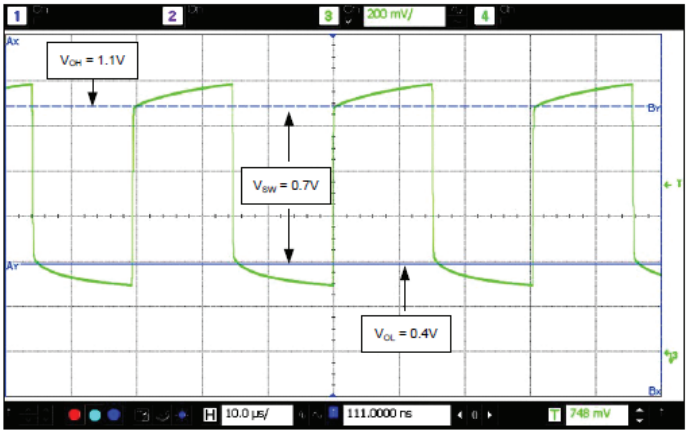
2.0 x 1.2 x 0.6mm

Typical Performance Data (TA=25°C, Vdd=1.8V, unless otherwise stated)---(Continued)

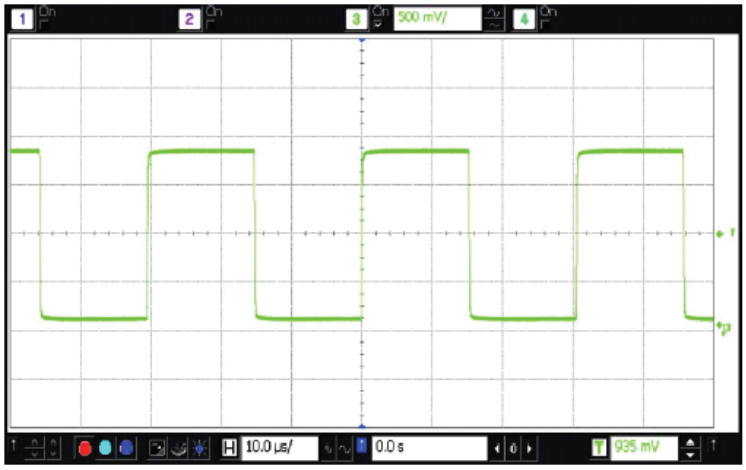
Power Supply Noise Rejection (±150mV Noise)



NanoDrive™ Output Waveform (V_{OH} = 1.1V, V_{OL} = 0.4V)



LVCMOS Output Waveform (V_{swing} = 1.8V)



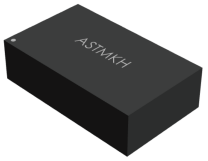
5101 Hidden Creek Lane Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
For terms and conditions of sales please visit:
www.abracon.com

Revised: 06.17.2017

Ultra-miniature, Low Power, 32.768kHz MEMS Oscillator

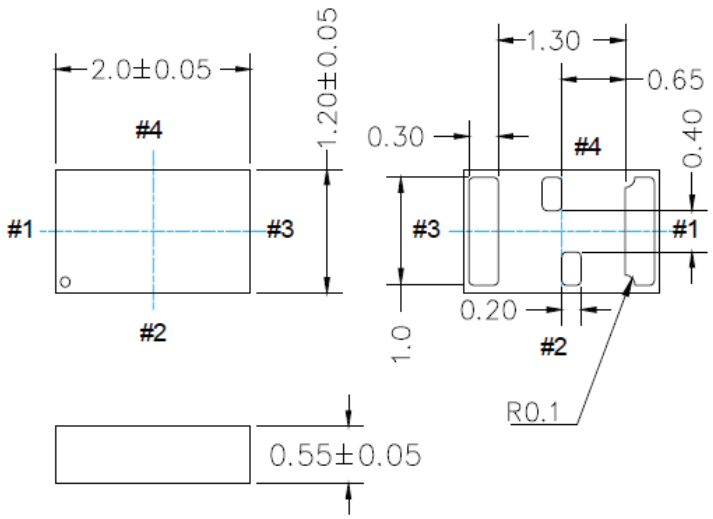
ASTMKH

RoHS/RoHS II compliant

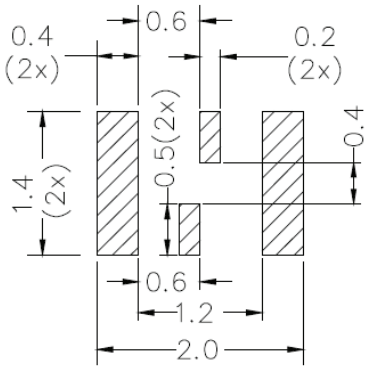


2.0 x 1.2 x 0.6mm

OUTLINE DIMENSION:



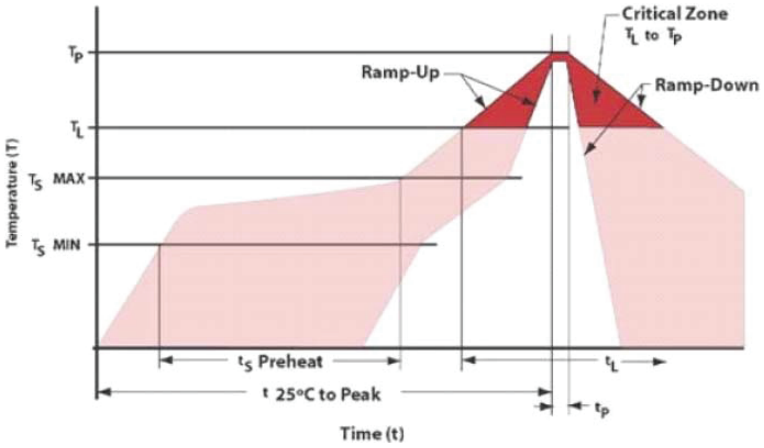
Recommended Land Pattern



Pin	Name	I/O	Functionality
1	NC	No Connect	No connection. Will not respond to any input signal.
2	GND	Power Supply Ground	Connect to ground. All GND pins must be connected to power supply ground.
3	CLK Out	OUT	Oscillator clock output.
4	V_{dd}	Power Supply	Connect to power supply $1.5V \leq V_{dd} \leq 3.63V$ for operation over -40°C to +85°C temperature range. Under normal operating conditions, V_{dd} doesn't require external bypass/decoupling capacitor(s). Internal power supply filtering will reject more than ±150mVpp with frequency components through 10MHz.

Dimensions: mm

REFLOW PROFILE:



Item	Conditions
T_S MAX to T_L (Ramp-up Rate)	3°C/second max
Preheat	
Temperature Minimum (T_S MIN)	150°C
Temperature Typical (T_S TYP)	175°C
Temperature Maximum (T_S MAX)	200°C
Time (t_S)	60 – 180 seconds
Ramp-up Rate (T_L to T_P)	3°C/second max
Time Maintained Above	
Temperature (T_L)	217°C
Time (t_L)	60 – 150 seconds
Peak Temperature (T_P)	260°C max
Target Peak Temperature (T_P Target)	255°C
Time within 5°C of actual peak (t_P)	20 – 40 seconds
Max. Number of Reflow Cycles	3
Ramp-down Rate	6°C/second max
Time 25°C to Peak Temperature (t)	8 minutes max

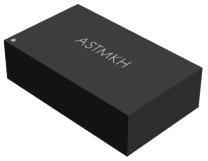
5101 Hidden Creek Lane Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
For terms and conditions of sales please visit:
www.abracon.com

Revised: 06.17.2017

Ultra-miniature, Low Power, 32.768kHz MEMS Oscillator

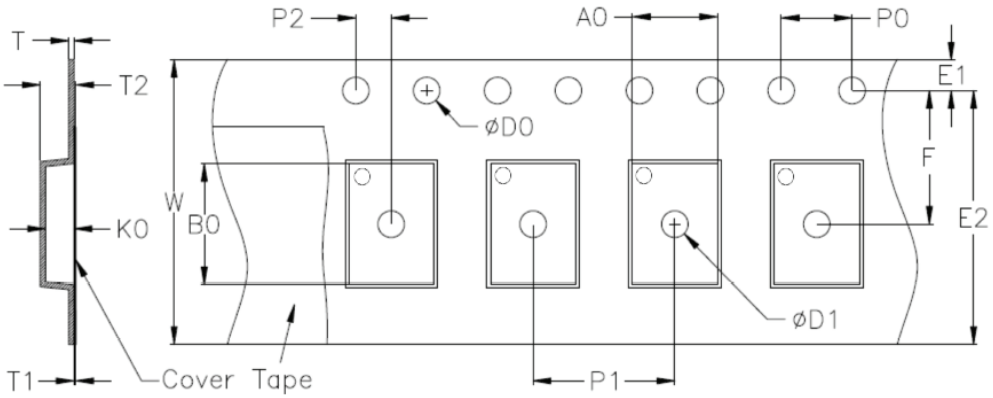
ASTMKH

RoHS/RoHS II compliant

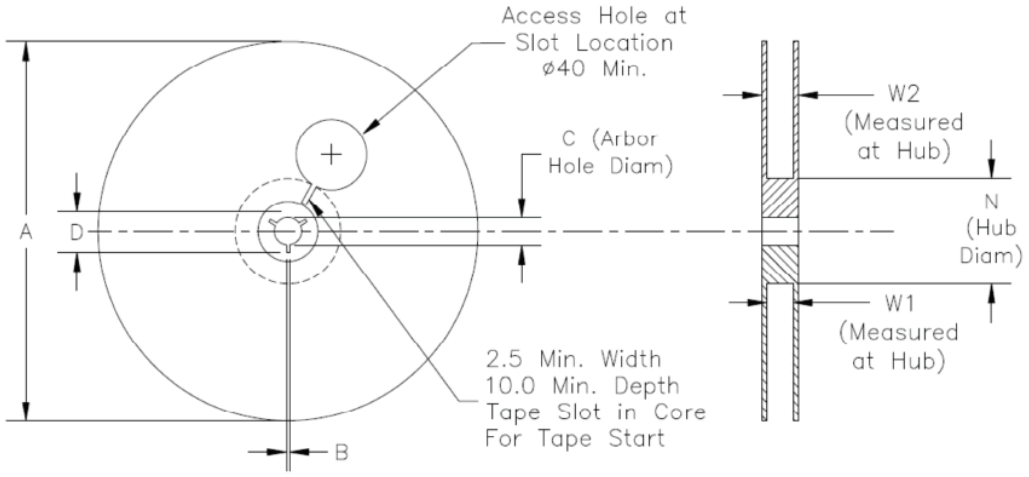


2.0 x 1.2 x 0.6mm

TAPE & REEL:



D0	D1 min.	E1	E2 min.	F	P0	P1	P2
1.55±0.05	0.18	1.75±0.1	6.05	3.5±0.05	4.0±0.1	4.0±0.1	2.0±0.05
T	**T1 max.**	**T2 max.**	**W max.**	**A0**	**B0**	**K0**	
0.20±0.02	NA	NA	8.3	0.96±0.03	1.66±0.03	0.63±0.03	



Option	A max.	B min.	C	D min.	N	W1	W2 max.
T & T3	180.5	1.5	13.0+0.6/-0.2	20.2	60±0.5	8.4+1.5/-0	14.4
T10	330	1.5	13.0±0.2	20.2	100±0.5	8.4+1.5/-0	14.4

T= Tape and reel (1,000pcs/reel)
T3= Tape and reel (3,000pcs/reel)
T10= Tape and reel (10,000pcs/reel)

Unit: mm

5101 Hidden Creek Lane Spicewood TX 78669
Phone: 512-371-6159 | Fax: 512-351-8858
For terms and conditions of sales please visit:
www.abracon.com

Revised: 06.17.2017