

## Hall Effect Sensor IC

### Features

- On-chip Hall Sensor
- Low Operating Supply Voltage : 3 V with Reverse Voltage Protection
- Versatile sensitivity and hysteresis setting
- Reliable and Rugged
- TO-92M3 and SOT-89 packages

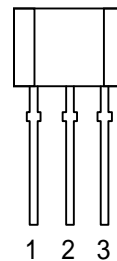
### Applications

- Brushless DC Motor
- Brushless DC Fan
- Speed Measurement
- Revolution Counting

### General Description

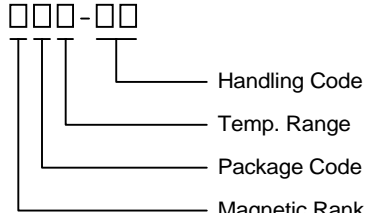
The APX9031 is an integrated Hall Effect Sensor IC designed for electric commutation of DC brushless motor applications. Even with a reverse voltage protection diode, the APX9031 still can operate at as low as 3 volts. The APX9031 is available in low cost TO-92M3 and SOT-89 packages with 3 different magnetic ranks.

### Pin Description



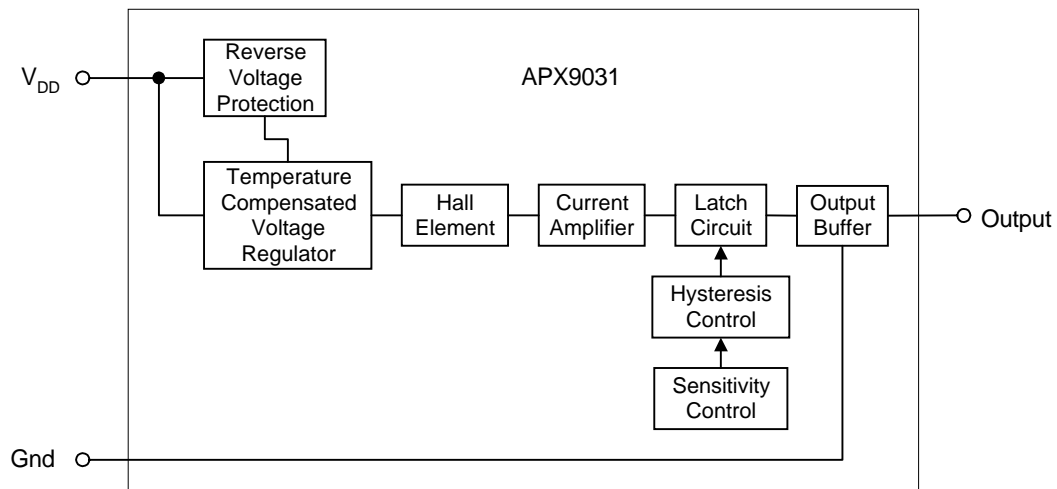
Front View  
 1 :  $V_{DD}$   
 2 : GND  
 3 : OUTPUT

### Ordering Information

<p>APX9031 <span style="font-family: monospace;">□□□-□□</span></p> <div style="margin-left: 20px;">  </div>	<p>Magnetic Rank              A : I Bop , Brp I &lt; 70Gauss              B : I Bop , Brp I &lt; 100 Gauss              C : I Bop , Brp I &lt; 150 Gauss</p> <p>Package Code              E : TO - 92M              D : SOT - 89</p> <p>Temp. Range              E : - 20 to 85 °C</p> <p>Handling Code              PB : Plastic Bag              TR : Tape &amp; Reel</p>
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ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

## Block Diagram



## Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rating	Unit
$V_{DD}$	Supply Voltage	20	V
$I_{DD}$	Supply Current	8	mA
$I_O$	Output Current	20	mA
$P_D$	Maximum Power Dissipation	400	mW
$T_A$	Operating Ambient Temperature	-20 to 85	°C
$T_{STG}$	Storage Temperature Range	-55 to 150	
$T_S$	Soldering Temperature (10 seconds)	260	

## Electical Characteristics $T_A = 25^\circ\text{C}$ , $V_{DD}=12\text{V}$ unless otherwise noted

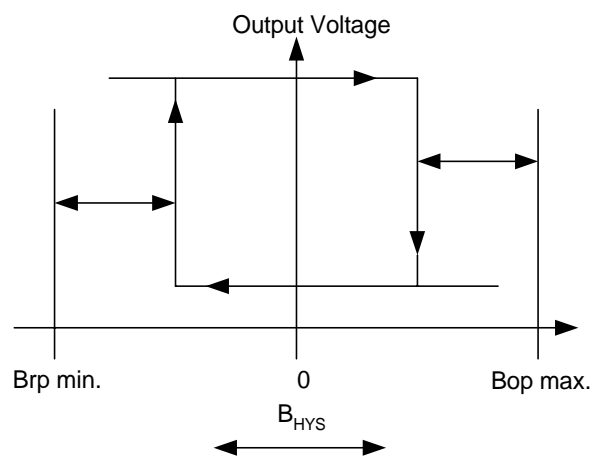
Symbol	Parameter	Test Condition	APX9031			Unit
			Min.	Typ.	Max.	
$V_{DD}$	Supply Voltage	Operating	3		20	V
$V_{SAT}$	Output Saturation Voltage	$I_{OUT}=20\text{mA}$ , $B > Bop$			0.2	V
$I_{DD}$	Supply Current	$V_{DD}=20\text{V}$ , $B < Brp$		3.5	6	mA
$I_{Leak}$	Output Leakage Current	$V_{OUT}=20\text{V}$ , $B < Brp$		0.5	2	$\mu\text{A}$
$t_r^a$	Output Rise Time	$V_{DD}=12\text{V}$ , $R_L=820\Omega$ , $C_L=20\text{pF}$		0.6		$\mu\text{s}$
$t_f^a$	Output Fall Time			0.3		$\mu\text{s}$

Notes <sup>a</sup>: use Figure 1

**Magnetic Characteristics**  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 12\text{V}$  unless otherwise noted

Rank	Maximum Operate Point Bop	Maximum Release Point Brp	Unit
A	+70	-70	Gauss
B	+100	-100	
C	+150	-150	

**Definition of Magnetic Switching Points and Hysteresis**



**Test Information**

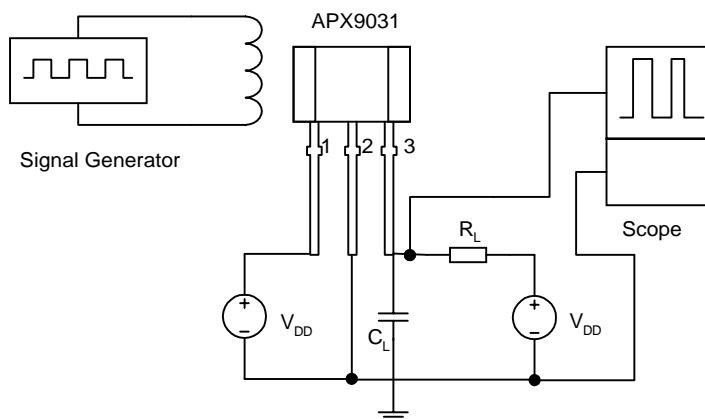


Figure 1 : Switching Circuit for Output Rise Time and Fall Time Measurement

## Application Circuit

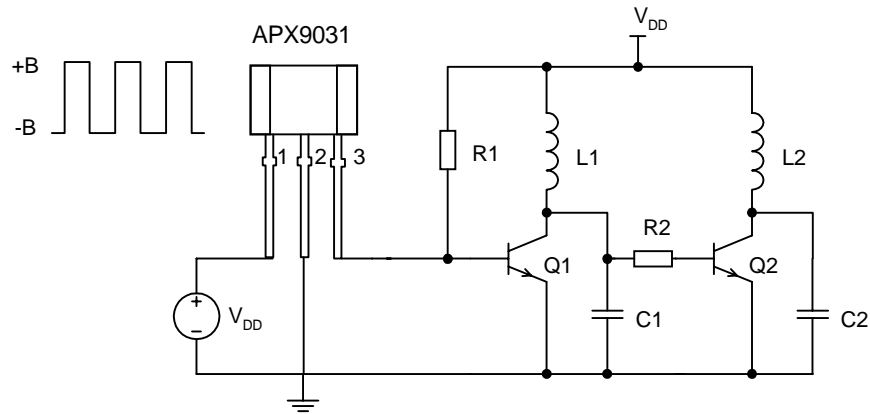
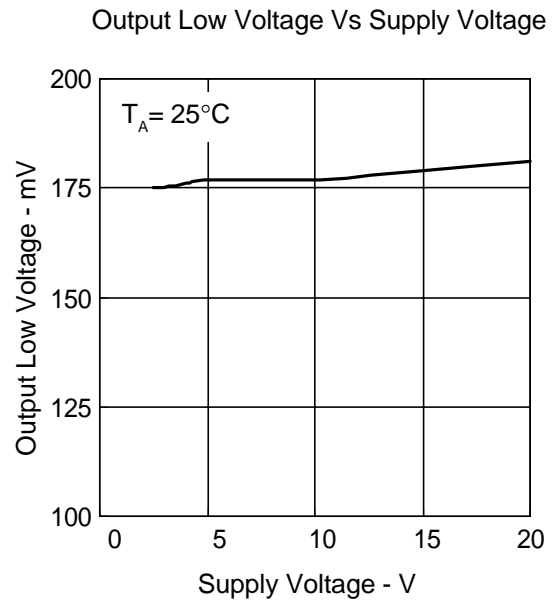
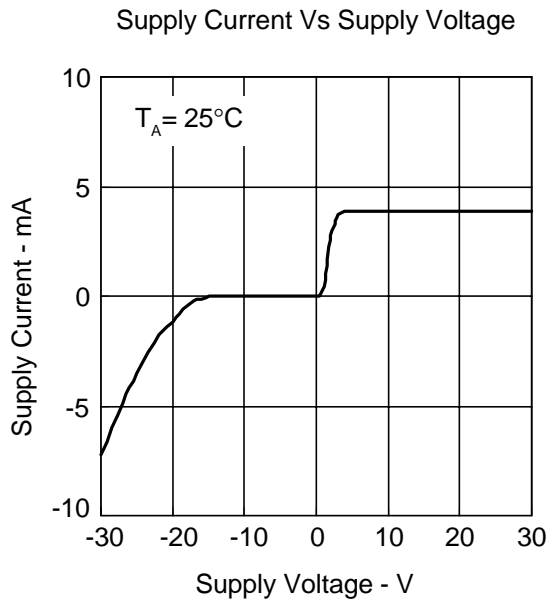


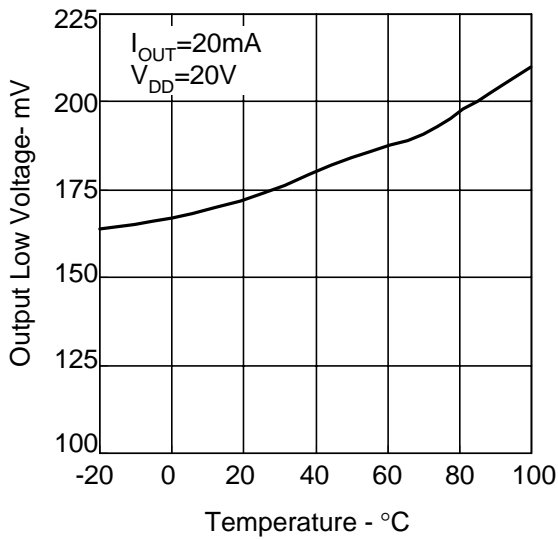
Figure 2 Typical DC brushless fan application circuit

## Typical Characteristics

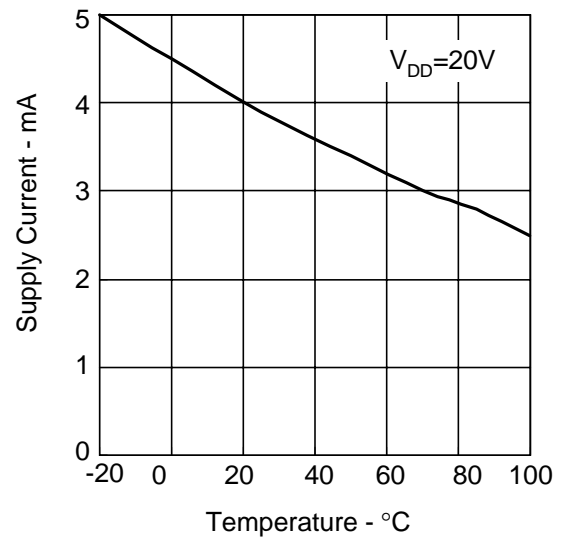


Typical Characteristics Cont.

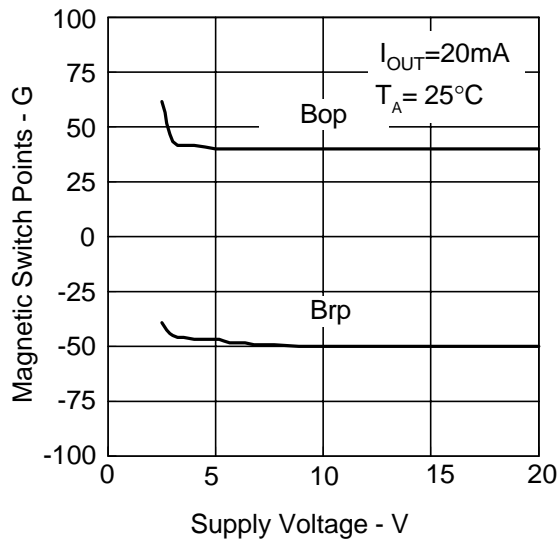
Output Low Voltage vs Ambient Temperature



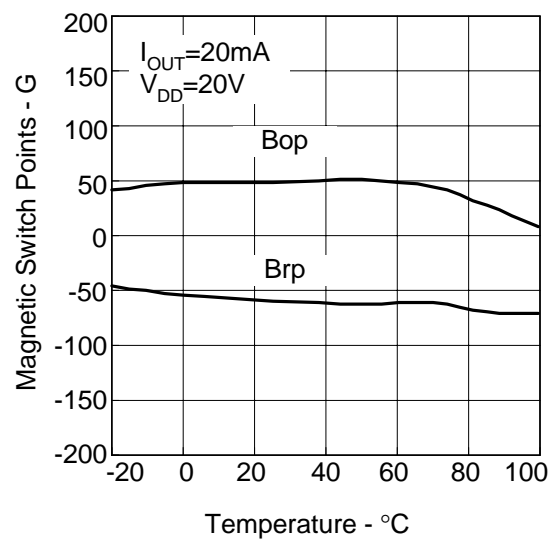
Supply Current vs Temperature



Magnetic Switch Points vs Supply Voltage

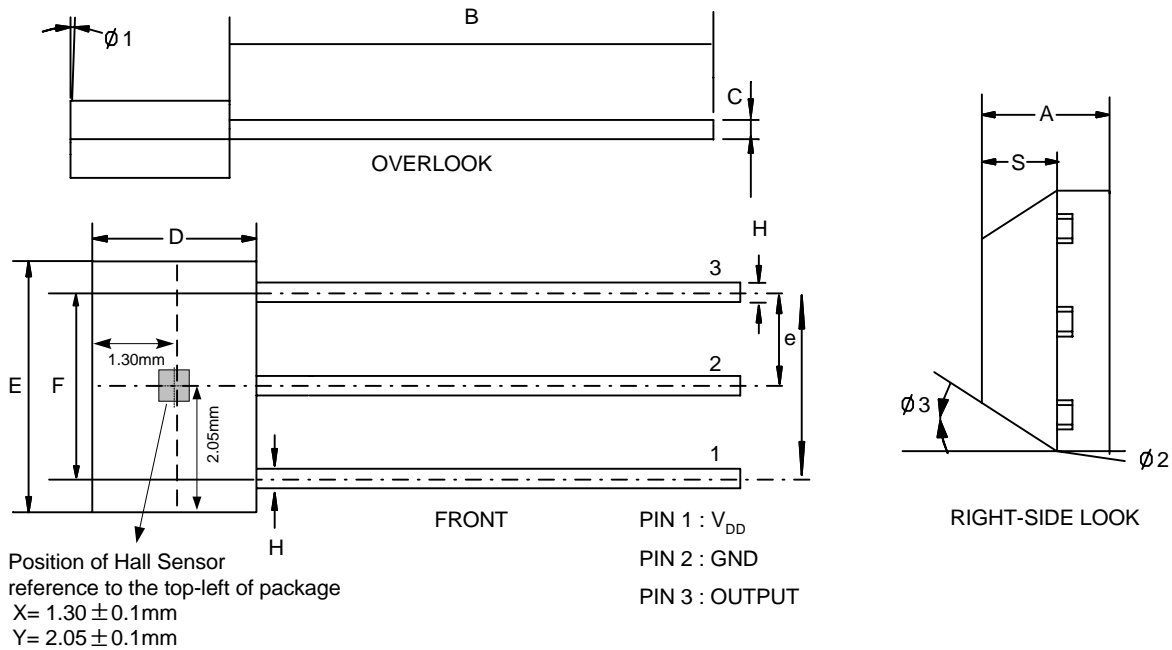


Magnetic Switch Points vs Temperature



Package Information

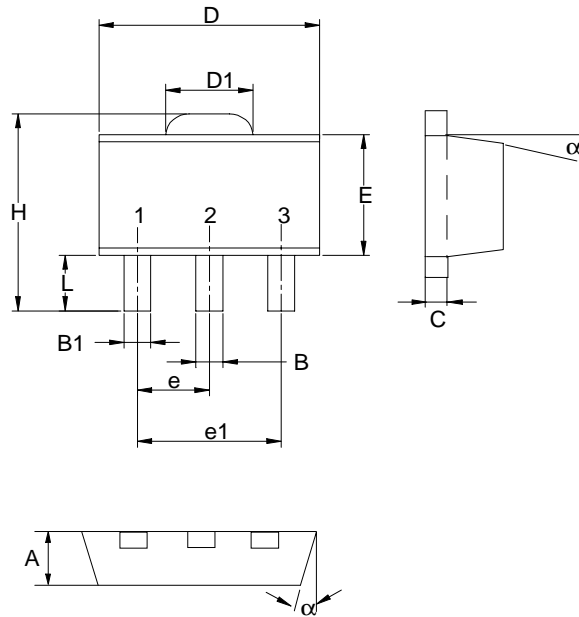
TO-92M3



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.055	0.063
B	10	11	0.394	0.433
	14	15	0.551	0.591
C	0.35	0.41	0.014	0.016
D	2.80	3.20	0.110	0.126
e	1.24	1.30	0.049	0.051
E	3.90	4.30	0.154	0.169
F	2.34	2.64	0.092	0.104
G	4.04	4.24	0.159	0.167
H	0.35	0.41	0.014	0.016
I	2.51	2.57	0.099	0.101
S	0.63	0.81	0.025	0.032
φ 1	5°		5°	
φ 2	3°		3°	
φ 3	45°		45°	

## Packaging Information

SOT-89 ( Reference EIAJ ED-7500A Registration SC-62)



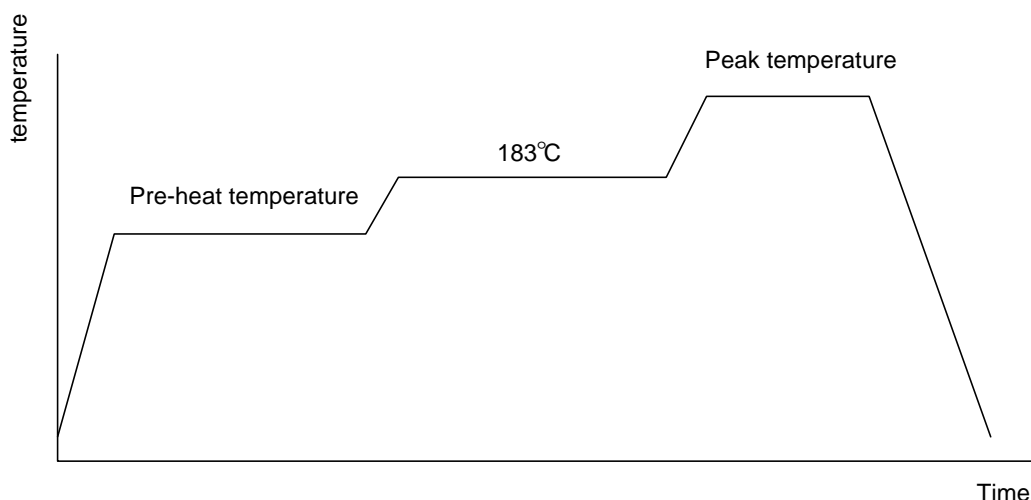
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.055	0.063
B	0.40	0.56	0.016	0.022
B1	0.35	0.48	0.014	0.019
C	0.35	0.44	0.014	0.017
D	4.40	4.60	0.173	0.181
D1	1.35	1.83	0.053	0.072
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
E	2.29	2.60	0.090	0.102
H	3.75	4.25	0.148	0.167
L	0.80	1.20	0.031	0.047
$\alpha$		10°		10°

## Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb)
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.
Packaging	1000 devices per reel

## Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A APRIL 1999



## Classification Reflow Profiles

	Convection or IR/ Convection	VPR
Average ramp-up rate(183°C to Peak)	3°C/second max.	10 °C /second max.
Preheat temperature 125 ± 25°C)	120 seconds max	
Temperature maintained above 183°C	60 – 150 seconds	
Time within 5°C of actual peak temperature	10 –20 seconds	60 seconds
Peak temperature range	220 +5/-0°C or 235 +5/-0°C	215-219°C or 235 +5/-0°C
Ramp-down rate	6 °C /second max.	10 °C /second max.
Time 25°C to peak temperature	6 minutes max.	

## Package Reflow Conditions

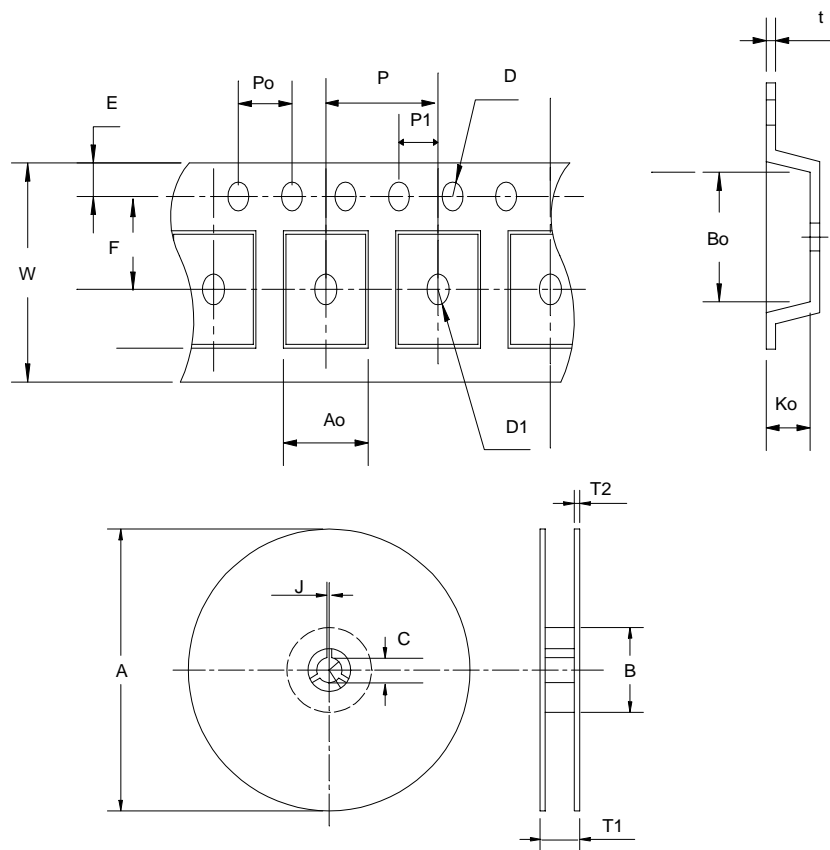
pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm <sup>3</sup>	pkg. thickness < 2.5mm and pkg. volume < 350mm <sup>3</sup>
Convection 220 +5/-0 °C		Convection 235 +5/-0 °C
VPR 215-219 °C		VPR 235 +5/-0 °C
IR/Convection 220 +5/-0 °C		IR/Convection 235 +5/-0 °C



## Reliability test program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C , 5 SEC
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @ 125 °C
PCT	JESD-22-B, A102	168 Hrs, 100 % RH , 121°C
TST	MIL-STD-883D-1011.9	-65°C ~ 150°C, 200 Cycles
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms , $I_{tr} > 100mA$

## Carrier Tape & Reel Dimensions



<b>Application</b>	A	B	C	J	T1	T2	W	P	E
<b>SOT-89</b>	178±1	70 ± 1.5	13.5+0.15	3 ± 0.15	14 ±0.2	1.3± 0.3	12 + 0.3 - 0.1	8± 0.1	1.75± 0.1
<b>Application</b>	F	D	D1	Po	P1	Ao	Bo	Ko	t
<b>SOT-89</b>	5.5 ± 0.05	1.5+0.1	1.5+0.1	4.0 ± 0.1	2.0 ± 0.1	4.8 ± 0.1	4.5± 0.1	1.8± 0.1	0.3±0.013

(mm)

## Cover Tape Dimensions

Carrier Width	12
Cover Tape Width	9.3

(mm)

## Customer Service

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