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

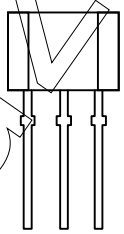
Applications

- 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



1 2 3

Front View

1 : V_{DD}

2 : GND

3 : OUTPUT

Ordering Information

APX9031 □□□-□□

- Handling Code
- Temp. Range
- Package Code
- Magnetic Rank

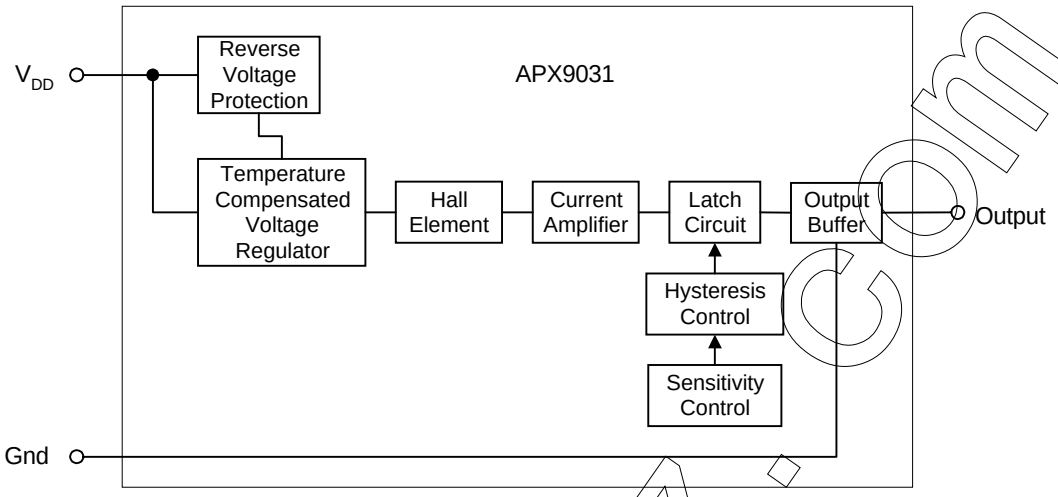
Magnetic Rank
- A : l Bop , Brp l < 70Gauss
- B : l Bop , Brp l < 100 Gauss
- C : l Bop , Brp l < 150 Gauss

Package Code
- E : TO - 92M
- D : SOT - 89

Temp. Range
- E: - 20 to 85 °C

Handling Code
- PB : Plastic Bag
- TR : Tape & Reel

Block Diagram



Absolute Maximum Ratings T_A = 25°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°C, V_{DD}=12V unless otherwise noted

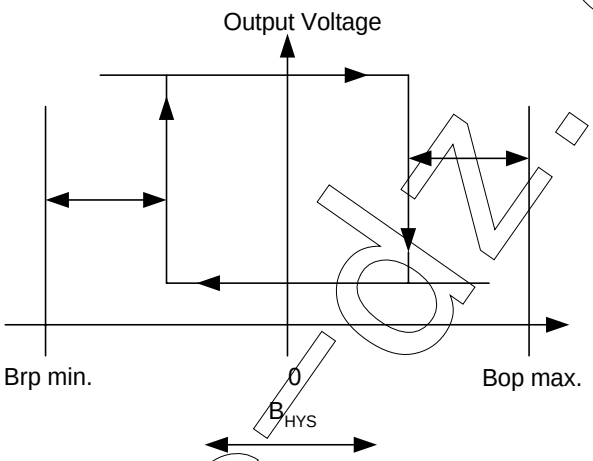
Symbol	Parameter	Test Condition	APX9031			Unit
			Min.	Typ.	Max.	
V_{DD}	Supply Voltage	Operating	3		20	V
V_{SAT}	Output Saturation Voltage	I_{OUT}=20mA, B>Bop			0.2	V
I_{DD}	Supply Current	V_{DD}=20V, B<Brp		3.5	6	mA
I_{Leak}	Output Leakage Current	V_{OUT}=20V, B<Brp		0.5	2	µA
t_r [a]	Output Rise Time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

Notes [a]: use Figure 1

Magnetic Characteristics T_A = 25°C, V_{DD}=12V 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

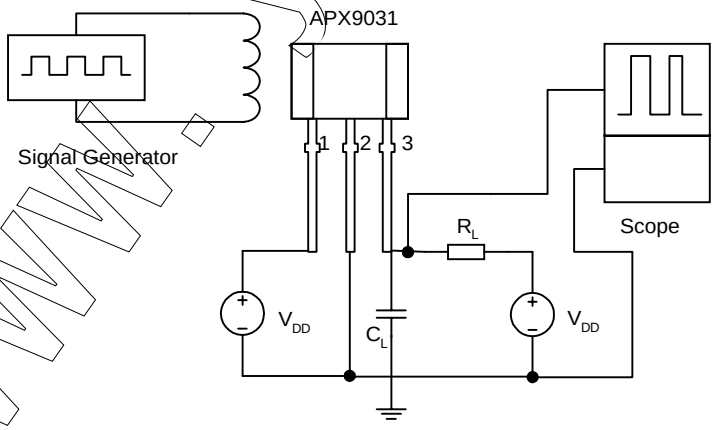


Figure 1 : Switching Circuit for Output Rise Time and Fall Time Measurement

Application Circuit

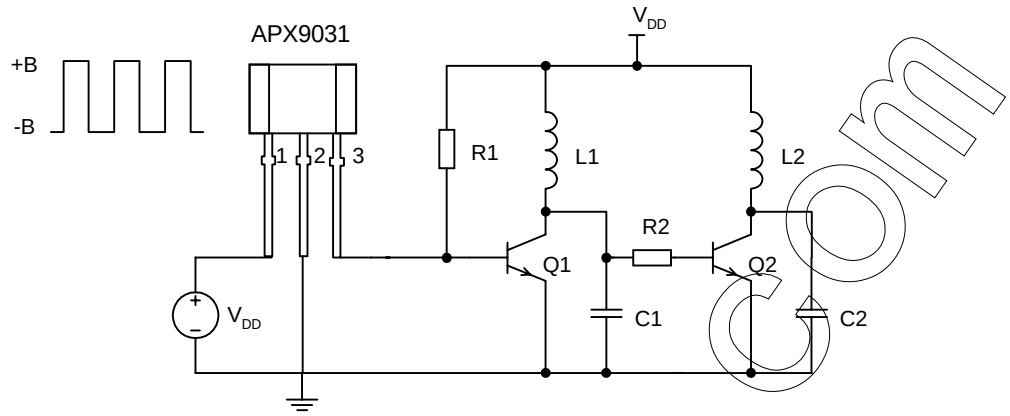
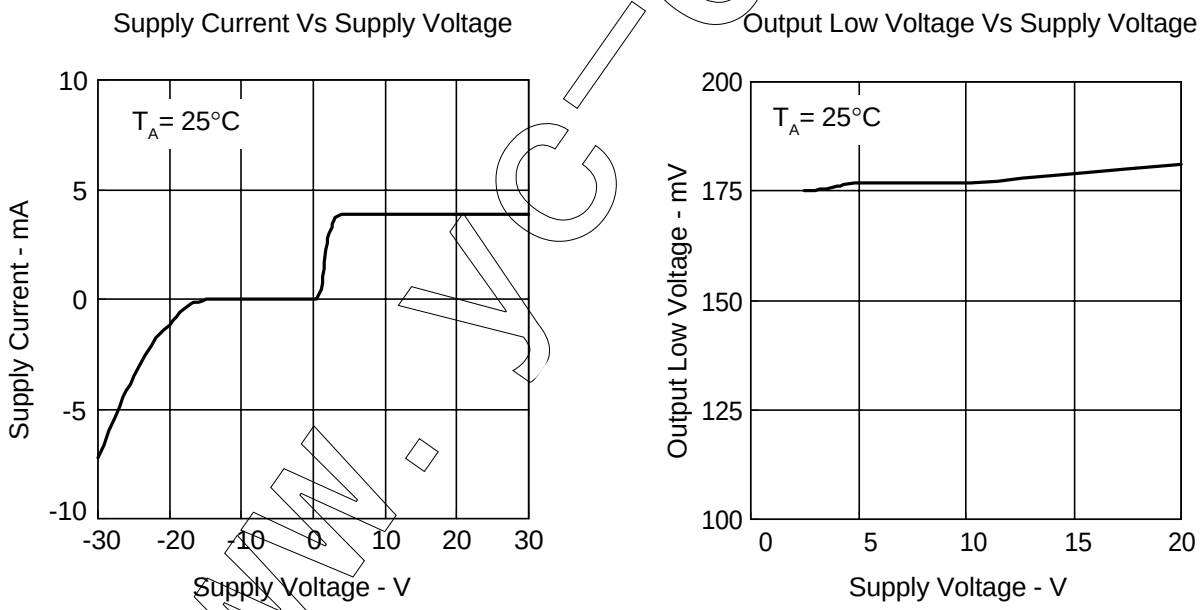


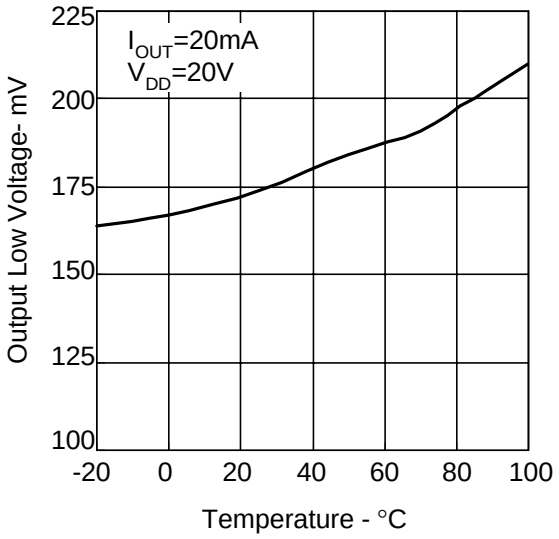
Figure 2 Typical DC brushless fan application circuit

Typical Characteristics

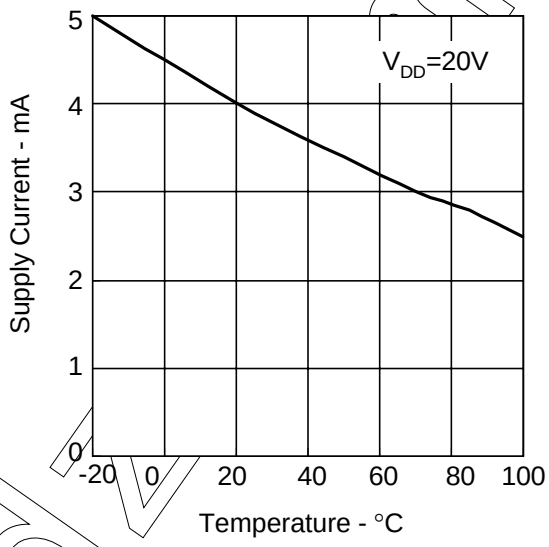


Typical Characteristics Cont.

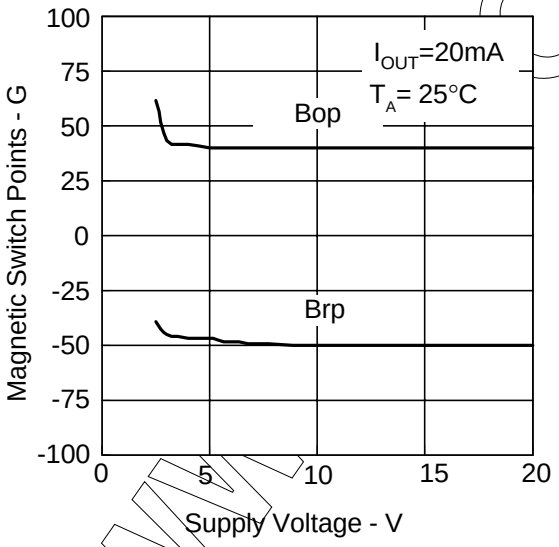
Output Low Voltage vs Ambient Temperature



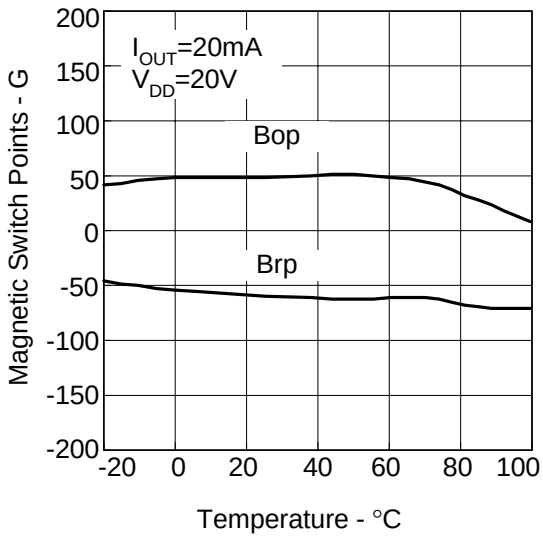
Supply Current vs Temperature



Magnetic Switch Points vs Supply Voltage

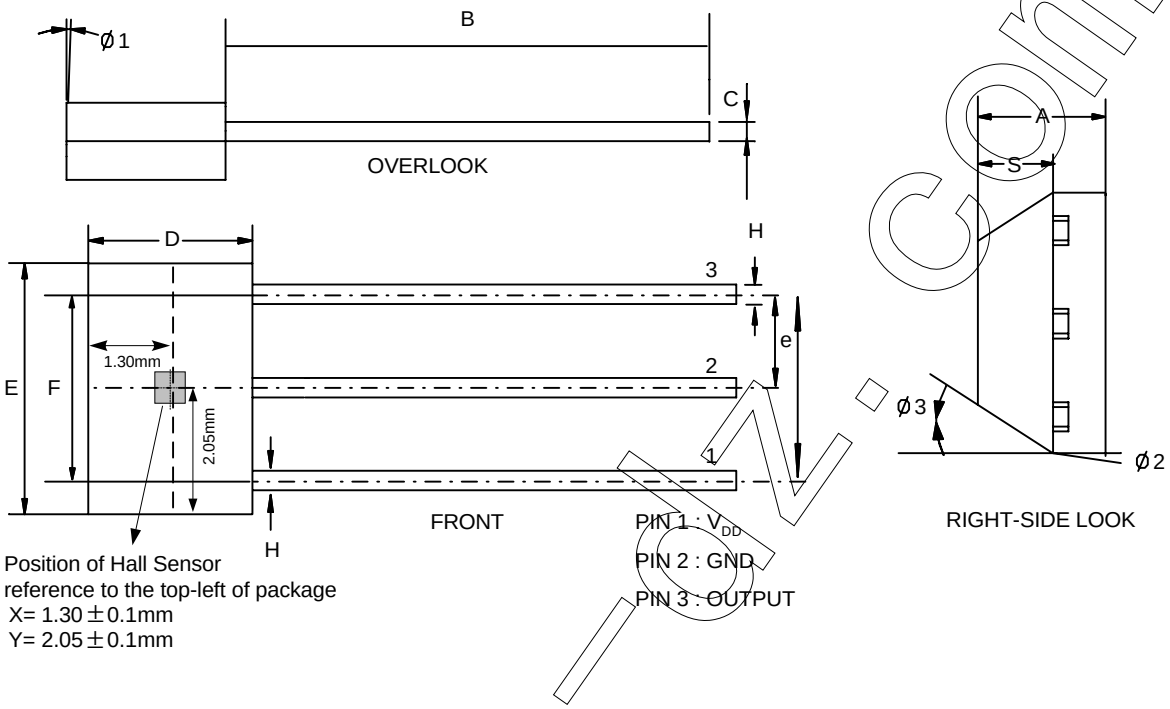


Magnetic Switch Points vs Temperature



Package Information

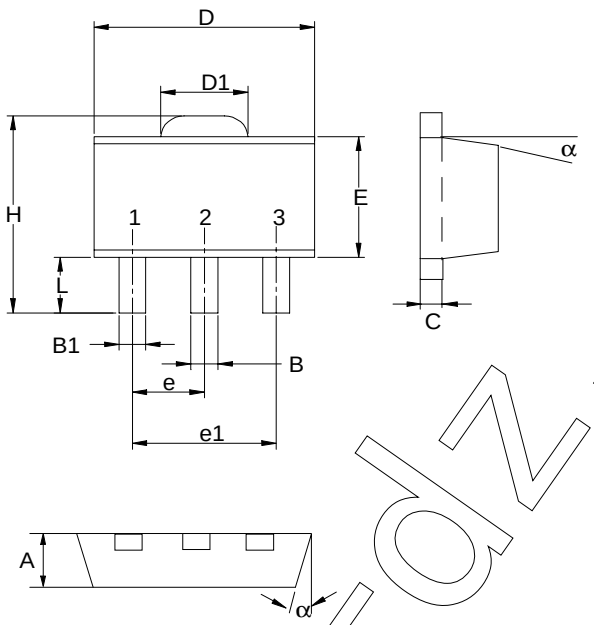
TO-92M3



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
ϕ1	5°		5°	
ϕ2	3°		3°	
ϕ3	45°		45°	

Packaging Information

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



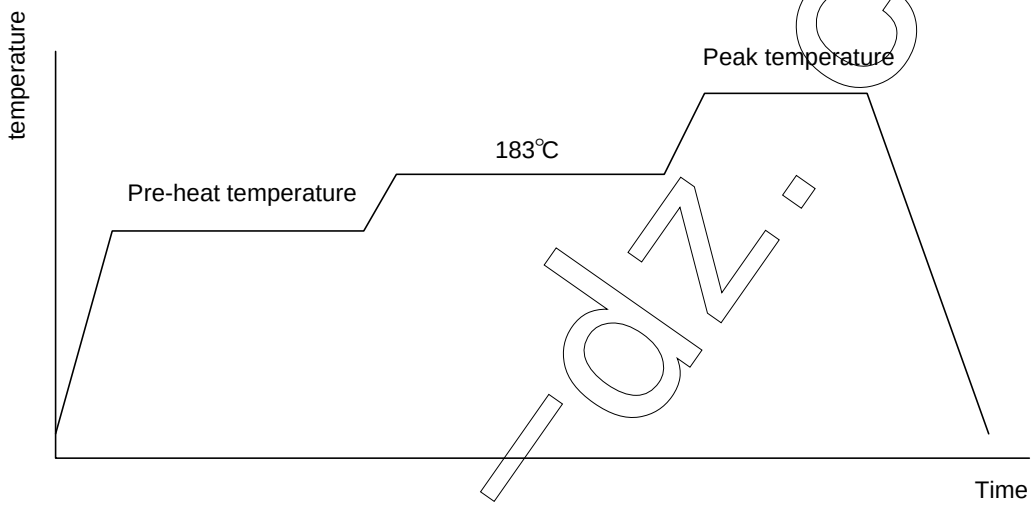
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.055	0.063
B	0.40	0.56	0.016	0.022
B1	0.35	0.48	0.014	0.019
C	0.35	0.44	0.014	0.017
D	4.40	4.60	0.173	0.181
D1	1.35	1.83	0.053	0.072
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
E	2.29	2.60	0.090	0.102
H	3.75	4.25	0.148	0.167
L	0.80	1.20	0.031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

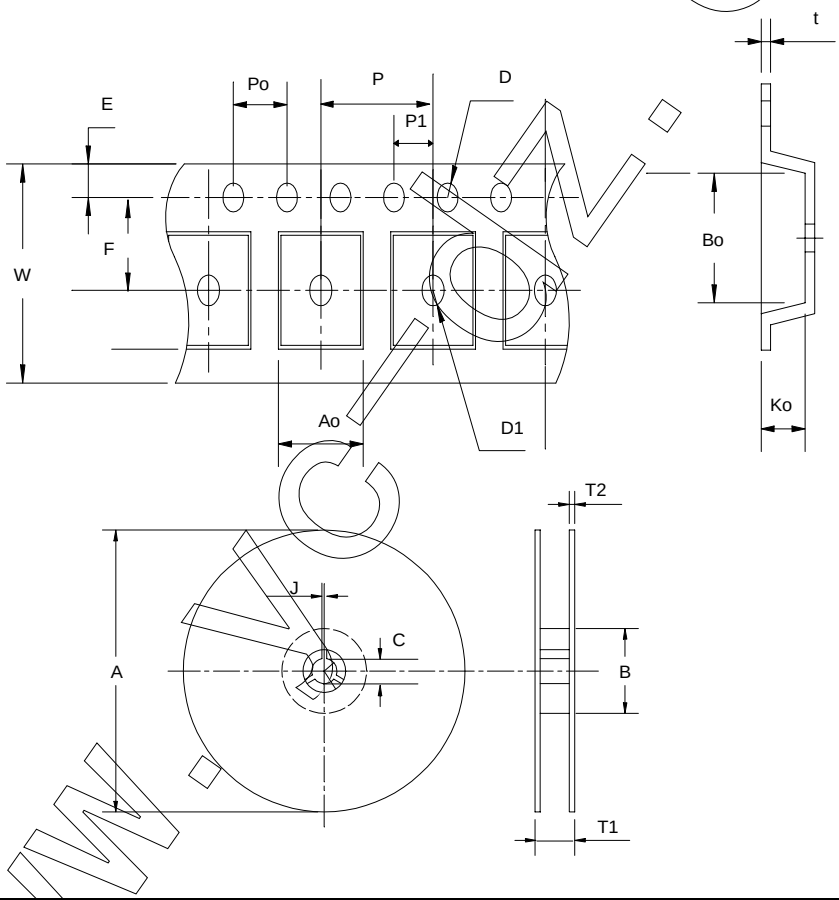
Package Reflow Conditions

pkg. thickness ≥ 2.5mm and all bgas	pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm³	pkg. thickness < 2.5mm and pkg. volume < 350mm³
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



Application	A	B	C	J	T1	T2	W	P	E
SOT-89	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
Application	F	D	D1	Po	P1	Ao	Bo	Ko	t
SOT-89	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)