

2SA2029 / 2SA1774EB / 2SA1774E3 2SA1576UB / 2SA1576U3 / 2SA1037AK

General Purpose Transistor (-50V, -150mA)

Datasheet

Parameter	Value
V_{CEO}	-50V
I_C	-150mA

●Features

1)Excellent h_{FE} linearity.

2)Complements the 2SC5658/2SC4617EB/

2SC4617E3/2SC4081UB/2SC4081U3/2SC2412K

●Application

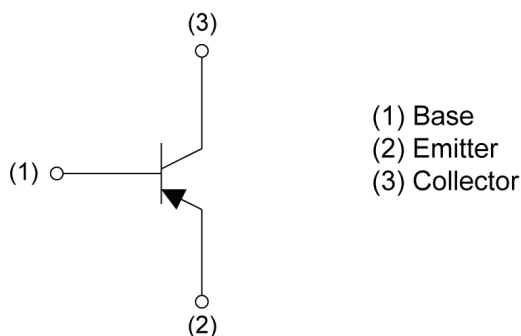
GENERAL PURPOSE SMALL SIGNAL
AMPLIFIER

●Outline

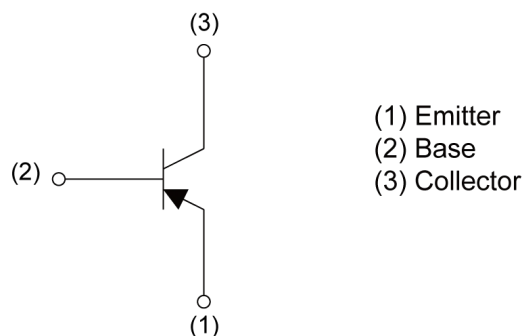
<p>SOT-723</p> <p>2SA2029 (VMT3)</p>	<p>SOT-416FL</p> <p>2SA1774EB (EMT3F)</p>
<p>SOT-416</p> <p>2SA1774E3 (EMT3)</p>	<p>SOT-323FL</p> <p>2SA1576UB (UMT3F)</p>
<p>SOT-323</p> <p>2SA1576U3 (UMT3)</p>	<p>SOT-346</p> <p>2SA1037AK (SMT3)</p>

●Inner circuit

2SA2029/2SA1774EB/2SA1576UB



2SA1774E3/2SA1576U3/2SA1037AK



●Packaging specifications

Part No.	Package	Package size	Taping code	Reel size (mm)	Tape width (mm)	Quantity (pcs)	h_{FE} rank	Marking
2SA2029	SOT-723	1212	T2L	180	8	8000	QR	F
2SA1774EB	SOT-416FL	1616	TL	180	8	3000	QR	F
2SA1774E3	SOT-416	1616	TL	180	8	3000	QR	F
2SA1576UB	SOT-323FL	2021	TL	180	8	3000	QR	F
2SA1576U3	SOT-323	2021	T106	180	8	3000	QR	F
2SA1037AK	SOT-346	2928	T146	180	8	3000	QR	F

● Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Parameter		Symbol	Values	Unit
Collector-base voltage		V_{CBO}	-60	V
Collector-emitter voltage		V_{CEO}	-50	V
Emitter-base voltage		V_{EBO}	-6	V
Collector current		I_{C}	-150	mA
		I_{CP}^{*1}	-200	mA
Power dissipation	2SA2029	P_{D}^{*2}	150	mW
	2SA1774EB		150	
	2SA1774E3		150	
	2SA1576UB		200	
	2SA1576U3		200	
	2SA1037AK		200	
Junction temperature		T_{j}	150	$^\circ\text{C}$
Range of storage temperature		T_{stg}	-55 to +150	$^\circ\text{C}$

● Electrical characteristics ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Collector-base breakdown voltage	BV_{CBO}	$I_{\text{C}} = -50\mu\text{A}$	-60	-	-	V
Collector-emitter breakdown voltage	BV_{CEO}	$I_{\text{C}} = -1\text{mA}$	-50	-	-	V
Emitter-base breakdown voltage	BV_{EBO}	$I_{\text{E}} = -50\mu\text{A}$	-6	-	-	V
Collector cut-off current	I_{CBO}	$V_{\text{CB}} = -60\text{V}$	-	-	-100	nA
Emitter cut-off current	I_{EBO}	$V_{\text{EB}} = -6\text{V}$	-	-	-100	nA
Collector-emitter saturation voltage	$V_{\text{CE(sat)}}$	$I_{\text{C}} = -50\text{mA}$, $I_{\text{B}} = -5\text{mA}$	-	-	-500	mV
DC current gain	h_{FE}	$V_{\text{CE}} = -6\text{V}$, $I_{\text{C}} = -1\text{mA}$	120	-	390	-
Transition frequency	f_{T}	$V_{\text{CE}} = -12\text{V}$, $I_{\text{E}} = 2\text{mA}$, $f = 100\text{MHz}$	-	140	-	MHz
Output capacitance	C_{ob}	$V_{\text{CB}} = -12\text{V}$, $I_{\text{E}} = 0\text{A}$, $f = 1\text{MHz}$	-	4.0	5.0	pF

h_{FE} values are classified as follows :

rank	Q	R	-	-	-
h_{FE}	120-270	180-390	-	-	-

* $P_{\text{W}}=1\text{ms}$, Single Pulse.

*2 Each terminal mounted on a reference land

●Electrical characteristic curves($T_a = 25^\circ\text{C}$)

Fig.1 Ground Emitter Propagation Characteristics

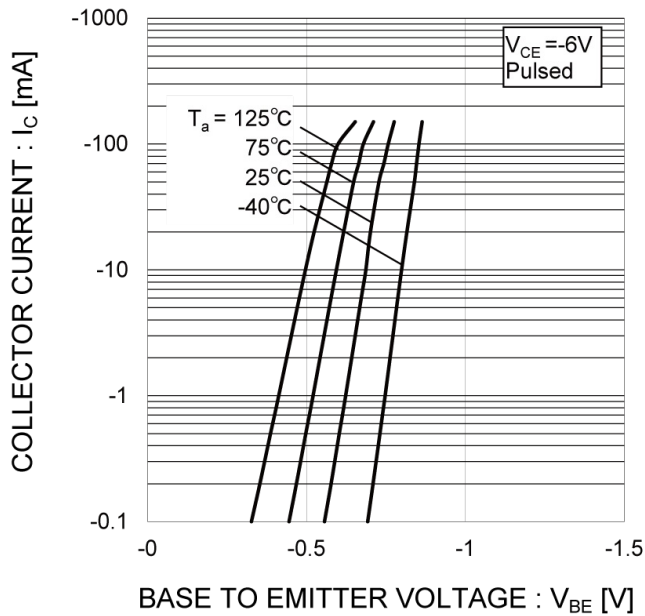


Fig.2 Typical Output Characteristics

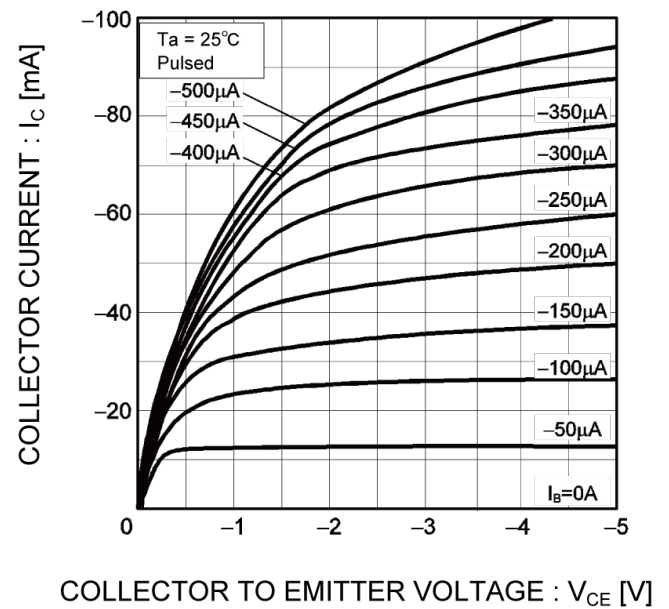


Fig.3 DC Current Gain vs. Collector Current (I)

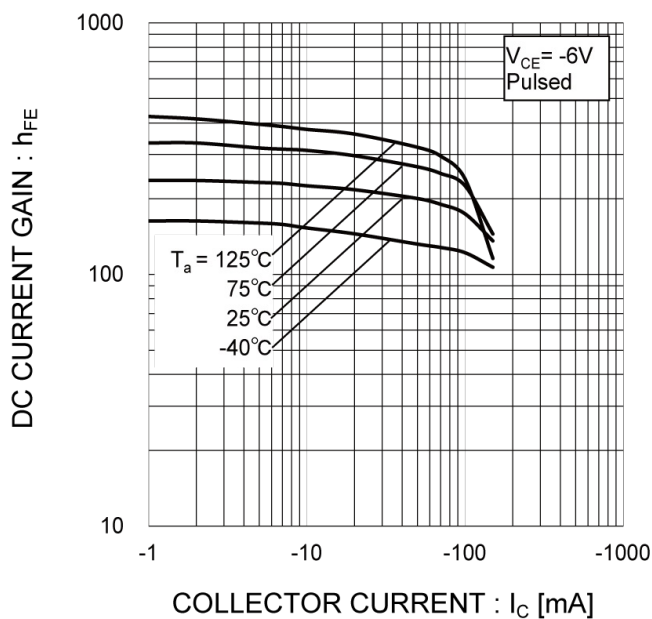
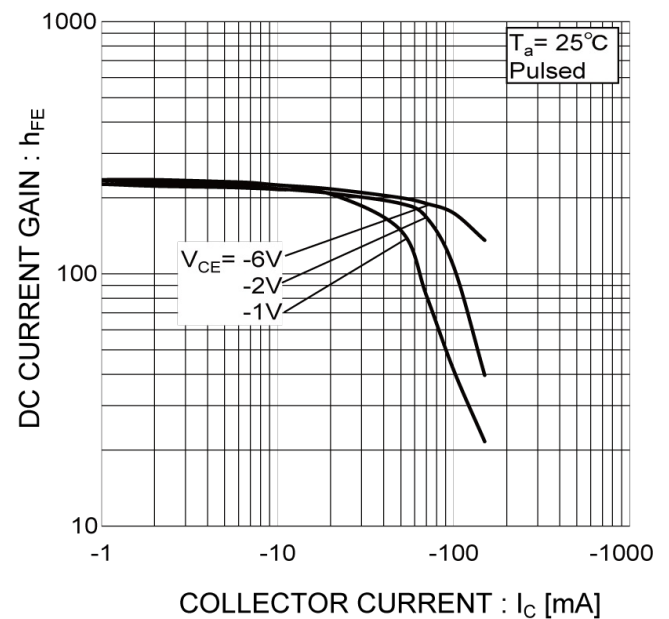


Fig.4 DC Current Gain vs. Collector Current (II)



●Electrical characteristic curves($T_a = 25^\circ\text{C}$)

Fig.5 Collector-Emitter Saturation
Voltage vs. Collector Current (I)

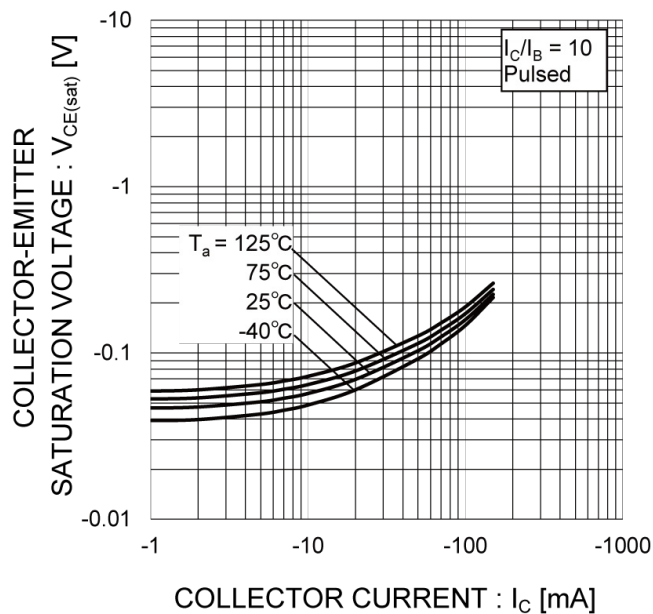


Fig.6 Collector-Emitter Saturation
Voltage vs. Collector Current (II)

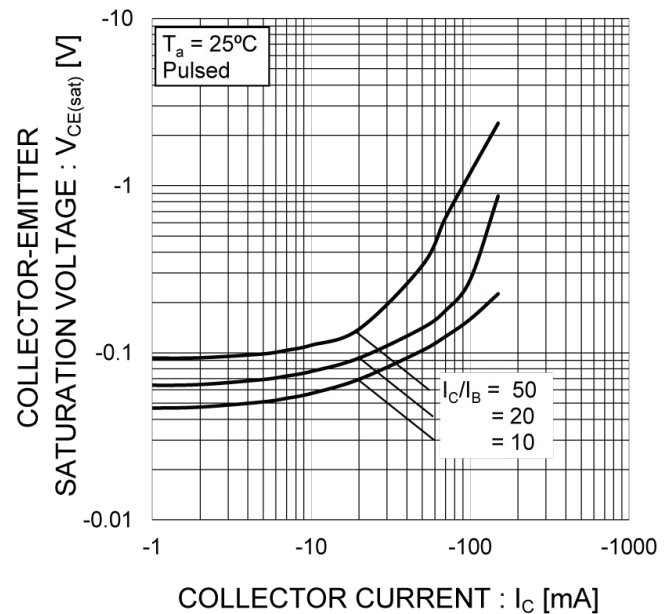


Fig.7 Base-Emitter Saturation Voltage
vs. Collector Current

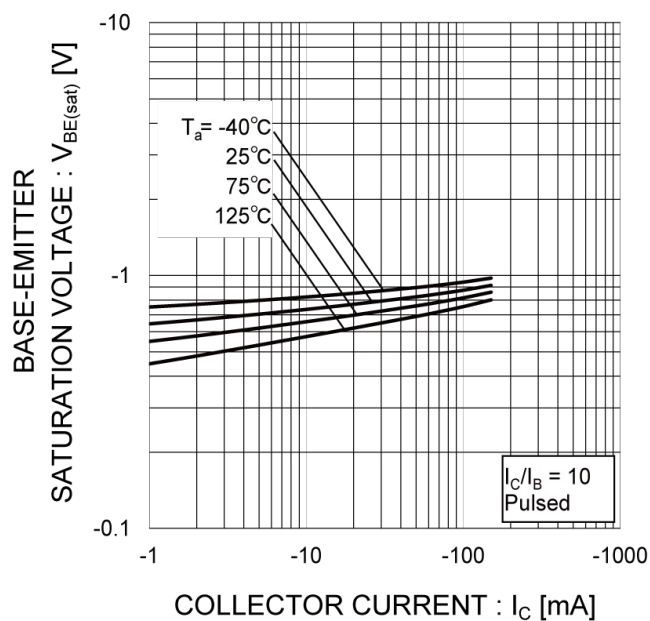
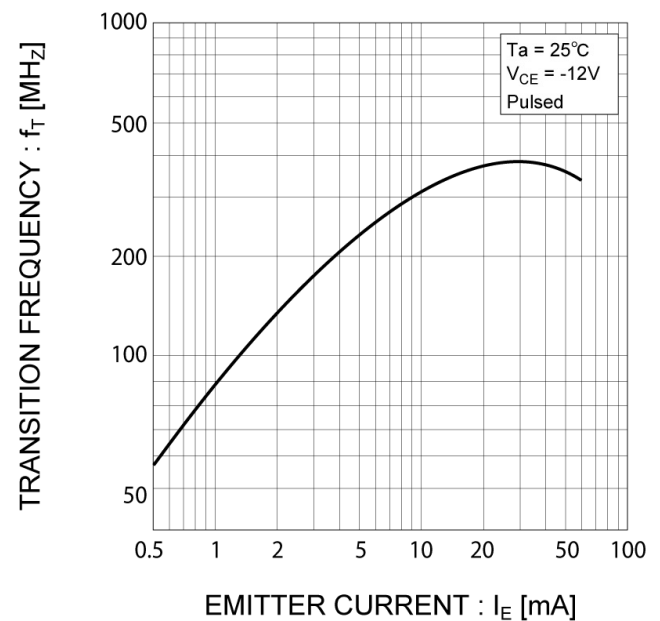


Fig.8 Gain Bandwidth Product vs.
Emitter Current



●Electrical characteristic curves($T_a = 25^\circ\text{C}$)

Fig.9 Emitter Input Capacitance vs.
Emitter-Base Voltage
Collector Output Capacitance vs.
Collector-Base Voltage

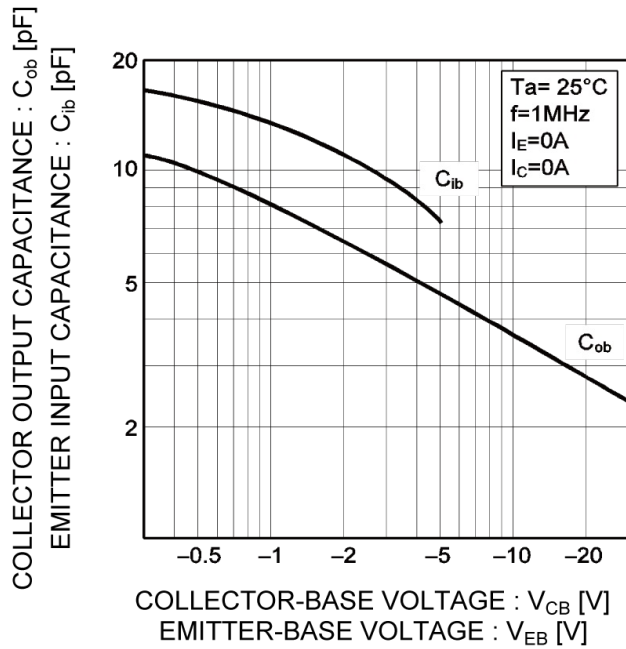


Fig.10 Safe Operating Area (I)

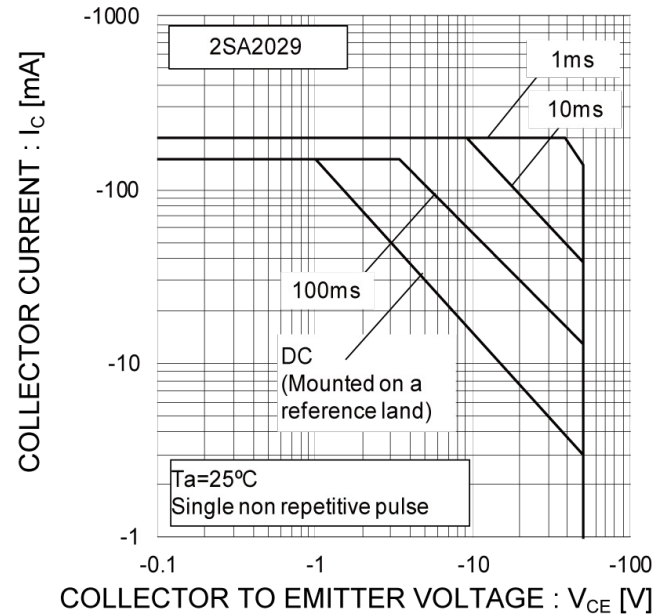


Fig.11 Safe Operating Area (II)

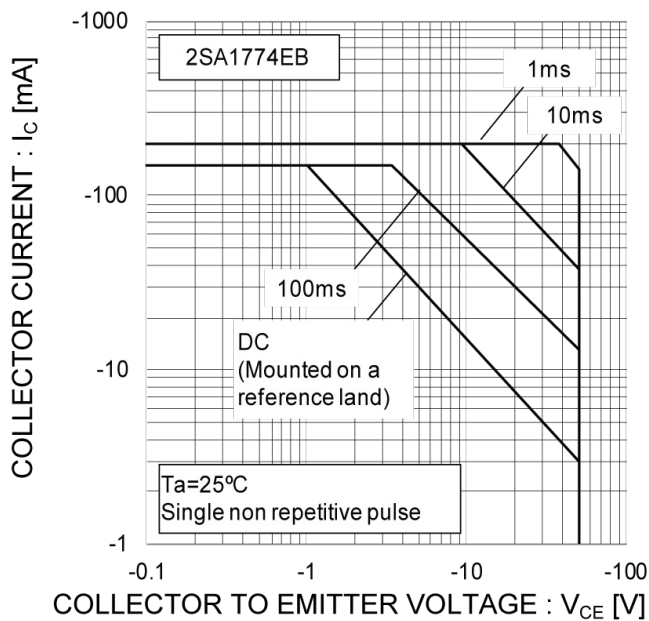
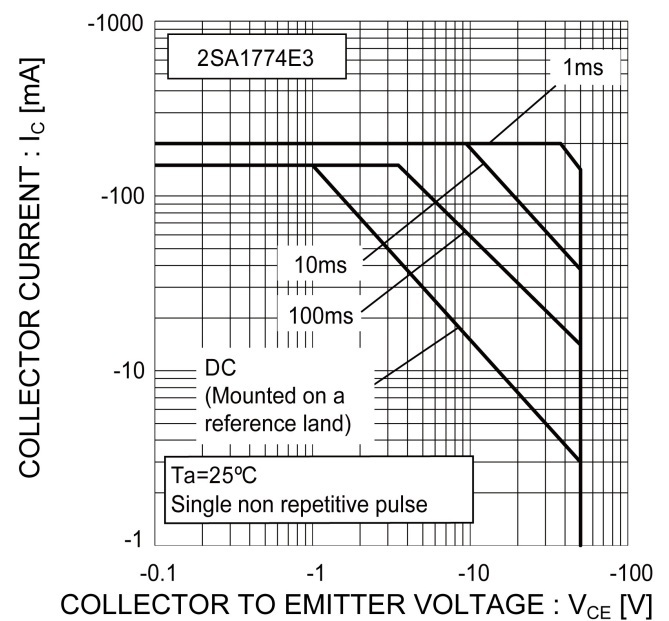


Fig.12 Safe Operating Area (III)



●Electrical characteristic curves(Ta=25°C)

Fig.13 Safe Operating Area (IV)

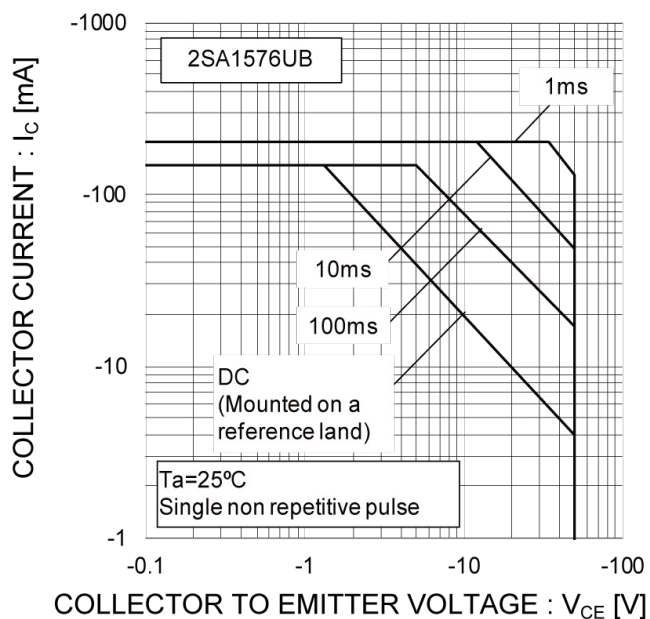


Fig.14 Safe Operating Area (V)

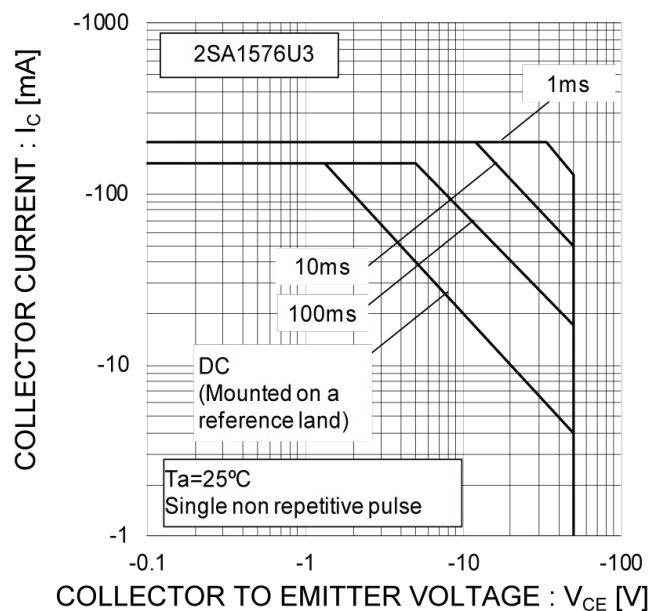
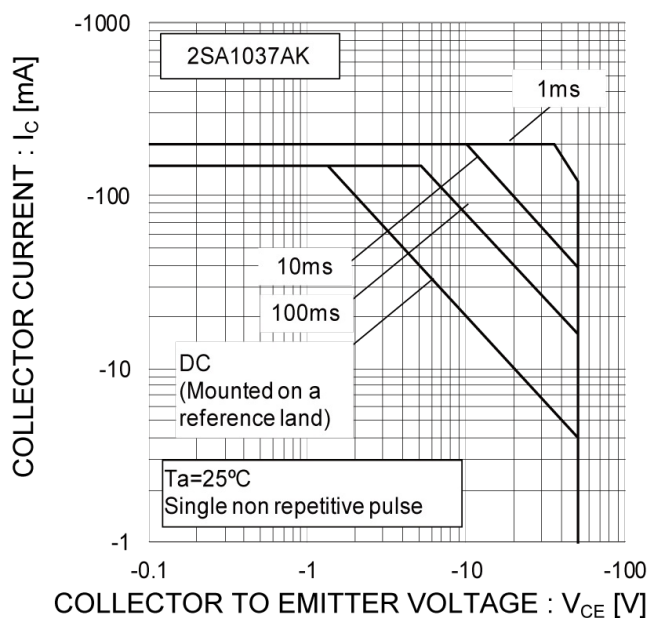
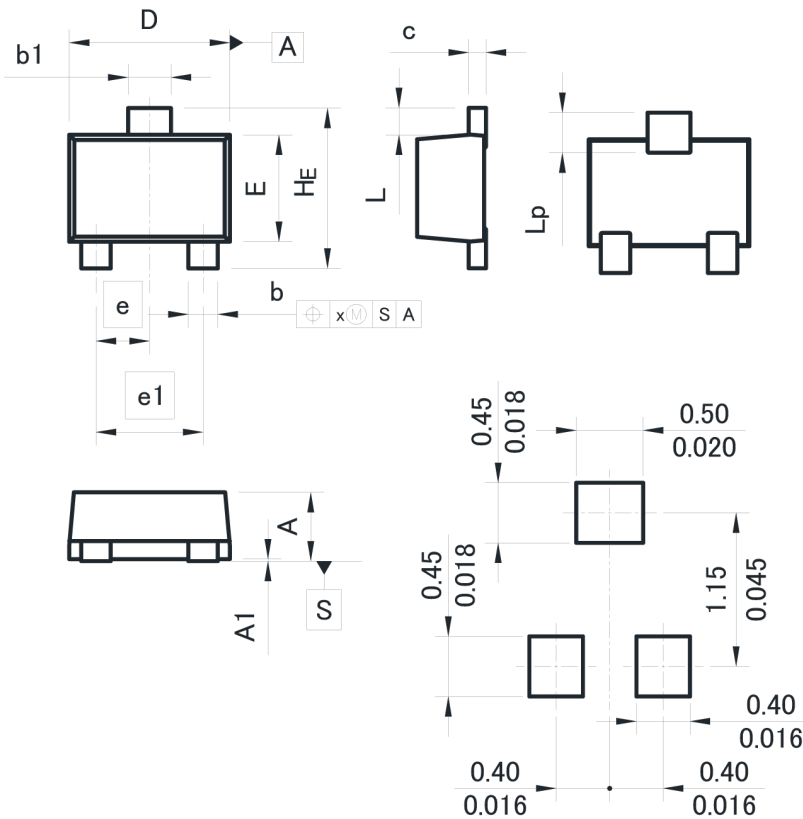


Fig.15 Safe Operating Area (VI)



●Dimensions

SOT-723
SC-105AA
(VMT3)



Soldering footprint

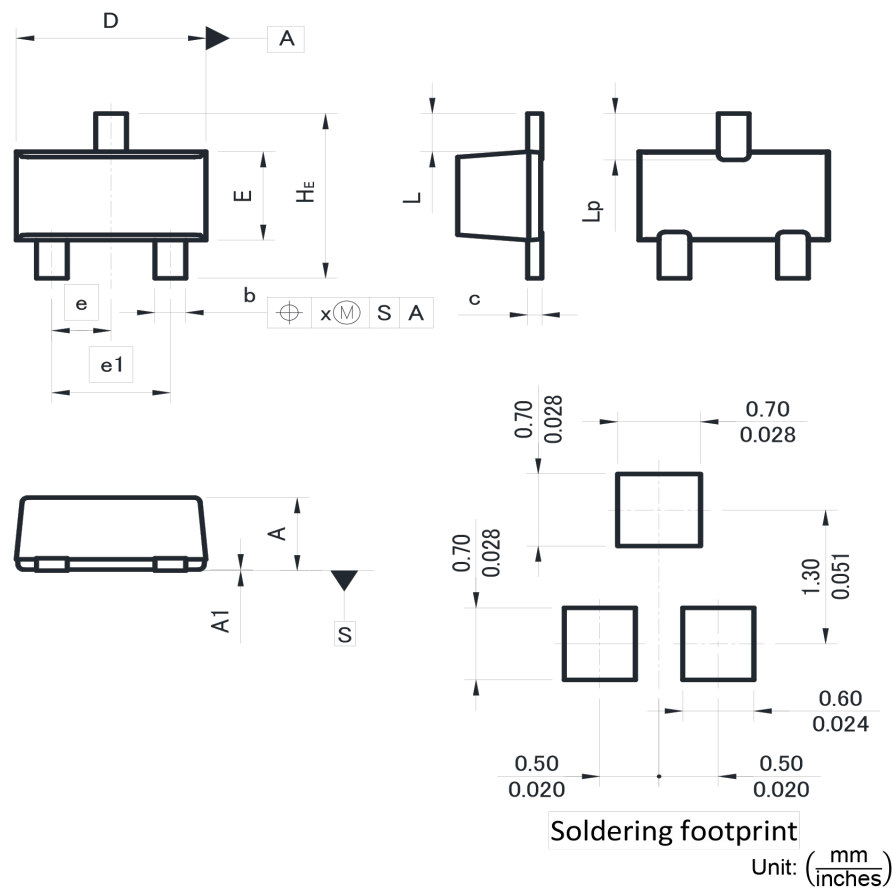
Unit: (mm / inches)

DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.45	0.55	0.018	0.022
A1	0.00	0.10	0.000	0.004
b	0.17	0.27	0.007	0.011
b1	0.27	0.37	0.011	0.015
c	0.08	0.18	0.003	0.007
D	1.10	1.30	0.043	0.051
E	0.70	0.90	0.028	0.035
e	0.40		0.016	
e1	0.80		0.031	
HE	1.10	1.30	0.043	0.051
L	0.10	0.30	0.004	0.012
Lp	0.20	0.40	0.008	0.016
x	-	0.10	-	0.004

Dimension in mm / inches

●Dimensions

SOT-416FL
SC-89
(EMT3F)

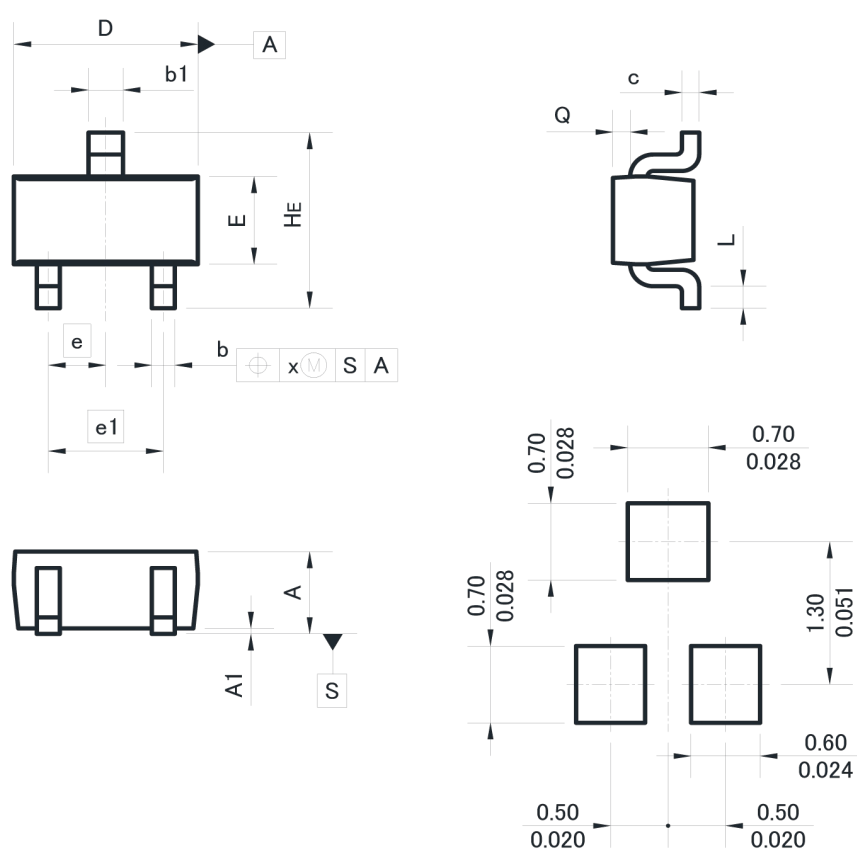


DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.60	0.90	0.024	0.035
A1	0.00	0.10	0.000	0.004
b	0.21	0.36	0.008	0.014
c	0.08	0.18	0.003	0.007
D	1.50	1.70	0.059	0.067
E	0.76	0.96	0.030	0.038
e	0.50		0.020	
e1	0.90	1.10	0.035	0.043
HE	1.50	1.70	0.059	0.067
L	0.37		0.015	
Lp	0.35	0.55	0.014	0.022
x	-	0.10	-	0.004

Dimension in mm / inches

●Dimensions

SOT-416
SC-75A
(EMT3)



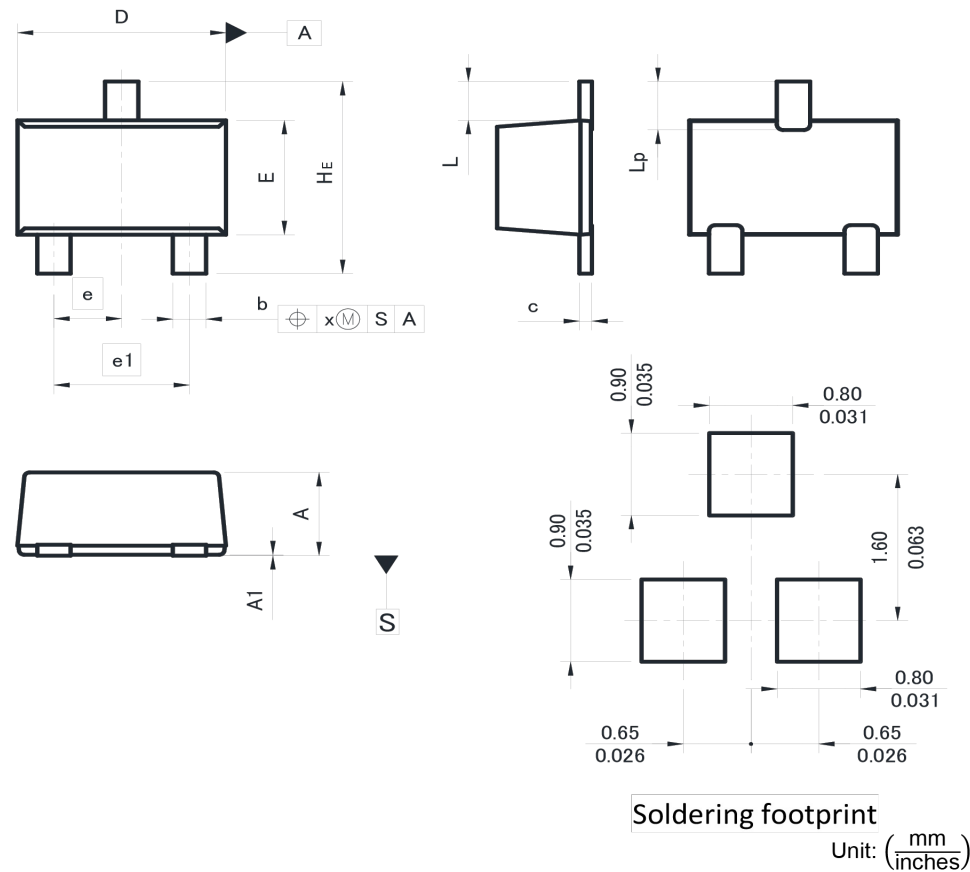
Soldering footprint
Unit: ($\frac{\text{mm}}{\text{inches}}$)

DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.60	0.90	0.024	0.035
A1	0.00	0.10	0.000	0.004
b	0.15	0.30	0.006	0.012
b1	0.25	0.40	0.010	0.016
c	0.10	0.20	0.004	0.008
D	1.50	1.70	0.059	0.067
E	0.70	0.90	0.028	0.035
e	0.50		0.020	
e1	1.00		0.039	
HE	1.40	1.80	0.055	0.071
L	0.10	-	0.004	-
Q	0.05	0.25	0.002	0.010
x	-	0.10	-	0.004

Dimension in mm/inches

●Dimensions

SOT-323FL
SC-85
(UMT3F)

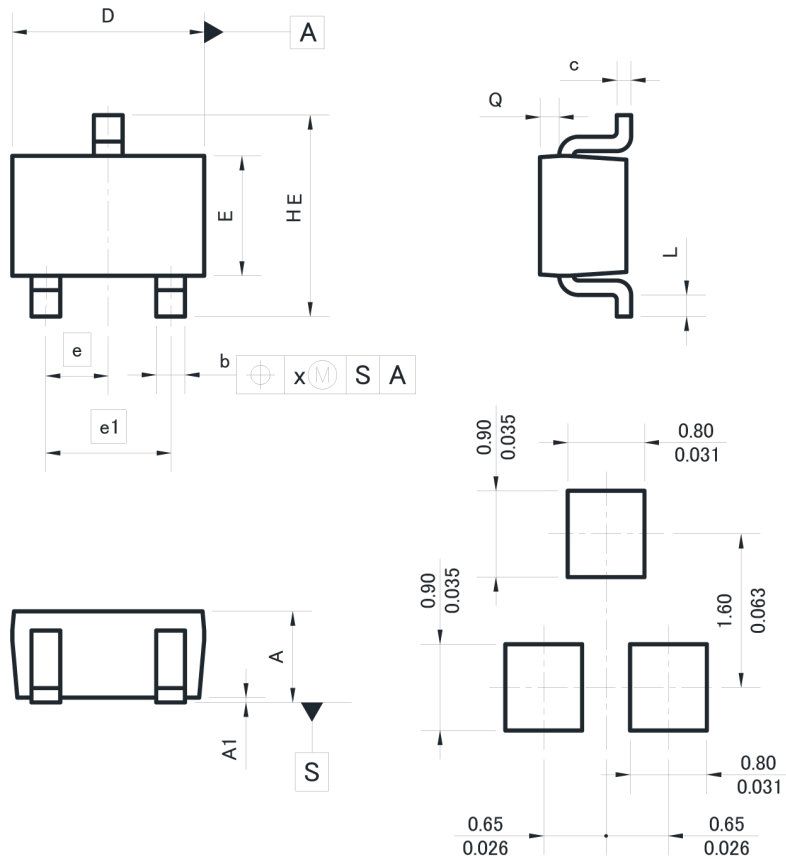


DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.80	1.10	0.031	0.043
A1	0.00	0.10	0.000	0.004
b	0.27	0.42	0.011	0.017
c	0.08	0.18	0.003	0.007
D	1.90	2.10	0.075	0.083
E	1.15	1.35	0.045	0.053
e	0.65		0.026	
e1	1.20	1.40	0.047	0.055
HE	2.00	2.20	0.079	0.087
L	0.43		0.017	
Lp	0.43	0.63	0.017	0.025
x	-	0.10	-	0.004

Dimension in mm / inches

●Dimensions

SOT-323
SC-70
(UMT3)



Soldering footprint

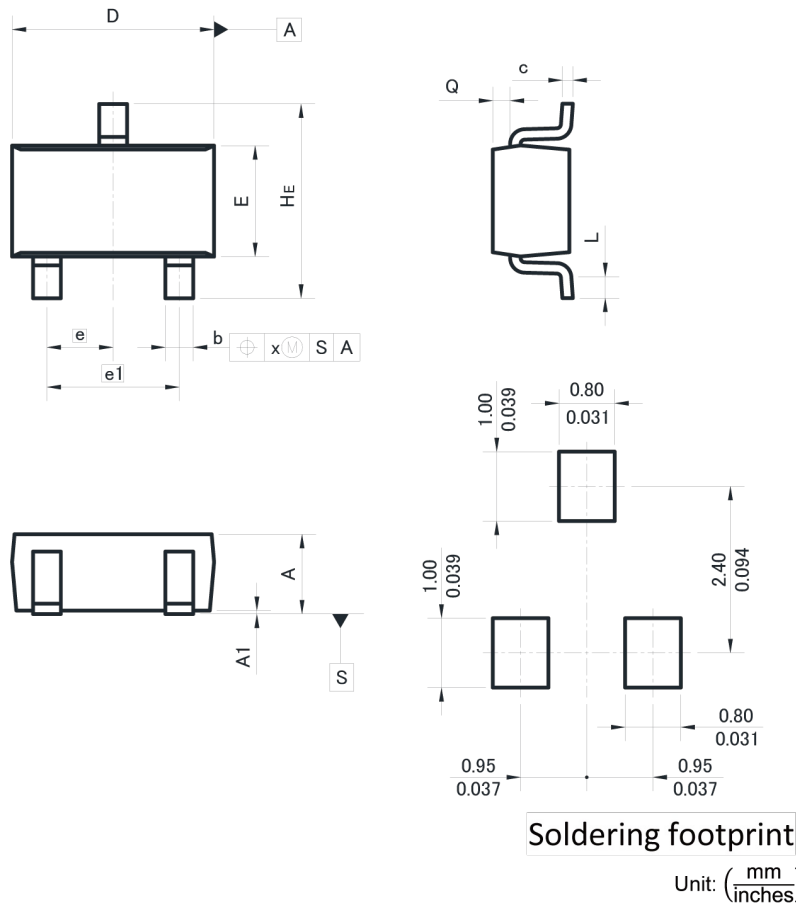
Unit: (mm / inches)

DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.80	1.10	0.031	0.043
A1	0.00	0.10	0.000	0.004
b	0.25	0.40	0.010	0.016
c	0.10	0.20	0.004	0.008
D	1.90	2.10	0.075	0.083
E	1.15	1.35	0.045	0.053
e	0.65		0.026	
e1	1.30		0.051	
HE	2.00	2.20	0.079	0.087
L	0.10	-	0.004	-
Q	0.10	0.30	0.004	0.012
x	-	0.10	-	0.004

Dimension in mm / inches

●Dimensions

SOT-346
SC-59
(SMT3)



DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.00	1.40	0.039	0.055
A1	0.00	0.10	0.000	0.004
b	0.35	0.50	0.014	0.020
c	0.09	0.25	0.004	0.010
D	2.80	3.00	0.110	0.118
E	1.50	1.80	0.059	0.071
e	0.95		0.037	
e1	1.90		0.075	
HE	2.60	3.00	0.102	0.118
L	0.30	0.60	0.012	0.024
Q	0.20	0.50	0.008	0.020
x	-	0.10	-	0.004

Dimension in mm / inches

Notice

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- Our Products are designed and manufactured for application in ordinary electronic equipment (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment ^(Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

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JAPAN	USA	EU	CHINA
CLASS III	CLASS III	CLASS II b	CLASS III
CLASS IV		CLASS III	

- ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
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 - Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
 - Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
 - Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
 - Sealing or coating our Products with resin or other coating materials
 - Use of our Products without cleaning residue of flux (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.) ; or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
 - Use of the Products in places subject to dew condensation
- The Products are not subject to radiation-proof design.
- Please verify and confirm characteristics of the final or mounted products in using the Products.
- In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.
- Confirm that operation temperature is within the specified range described in the product specification.
- ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

- When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
- In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
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Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
 - [a] the Products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [b] the temperature or humidity exceeds those recommended by ROHM
 - [c] the Products are exposed to direct sunshine or condensation
 - [d] the Products are exposed to high Electrostatic
2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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