

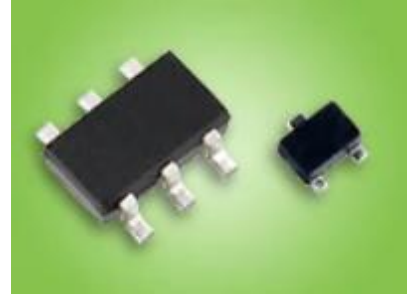
Introduction to Toshiba small package Bipolar Transistors

Toshiba offers a wide range of Bipolar Transistors (BJT : Bipolar junction transistor) mounted in small packages, including single-type and combined-type diodes.

Toshiba, a leading company in transistors

Since Toshiba succeeded in developing a transistor in 1951, it has been one of the major transistor vendors [Note] who have continued to market products as a pioneer in the industry since the early days of semiconductors. We will continue to provide a wide range of highly reliable transistor products based on our experience in delivering products to many customers.

[Note] according to a survey by Toshiba (as of February 1st, 2021)



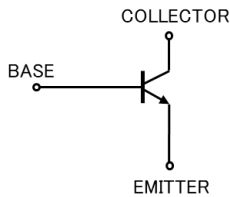
High-quality, stable delivery at plants in Japan and Thailand

Our transistor products are mainly surface-mount type small packages. High-quality, stable production at plants in Japan and Thailand enables stable delivery. We will respond quickly and seriously to sudden delivery problems as well.

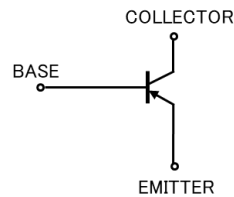
Transistor overview

A bipolar transistor is one of the typical semiconductors that controls the current flowing through the collector by the base current, and to operate as "amplification" and "switching" on the electric circuit. As shown in the figure below, there are two types, NPN type and PNP type.

NPN Transistor



PNP Transistor












When selecting a transistor product, it is necessary to consider the breakdown voltage (V_{CEO}: collector-emitter withstand voltage), current (I_C: collector current), h_{FE}: DC current amplification factor, package / mounting area, etc.

Features of bipolar transistor





































Bipolar transistors have the following advantages and disadvantages compared to MOSFETs. We recommend the optimum usage according to the circuit to be used.

	Bipolar transistor	MOSFET
Advantages	<ul style="list-style-type: none"> - Strong ESD susceptibility - High breakdown voltage (V_{CEO}) - The transistor turns on even if the base voltage is low. 	<ul style="list-style-type: none"> - There are a few external parts - Switching speed is fast - Current does not flow into the gate terminal
Disadvantages	<ul style="list-style-type: none"> - Switching speed is slow - Large number of external parts 	<ul style="list-style-type: none"> - ESD susceptibility is relatively weak - The gate voltage (V_{th}) required to turn on the MOSFET is generally higher than bipolar transistors - It is necessary to pay attention to the influence of the body diode when using it

• Bipolar Transistors selection table
[Single product]

Classification	$ V_{CE0} $ (V)	$ I_c $ (mA)	CST3 (SOT-883)		VESM (SOT-723)		SSM (SOT-416)	
			Bottom View					
			 1.0x0.6		 1.2x1.2		 1.6x1.6	
General Purpose	50	100	Part Number					
			NPN	PNP	NPN	PNP	NPN	PNP
	50	100	2SC6026CT 	2SA2154CT 				
	50	150			2SC6026MFV 	2SA2154MFV 	2SC4738 	2SA1832 

[2in1 product]

Classification	$ V_{CE0} $ (V)	$ I_c $ (mA)	USM (SOT-323)		UFM (SOT-323F)		S-Mini (SOT-346)		SOT23 (SOT-23)		SOT-23F	
			 2.0x2.1		 2.0x2.1		 2.9x2.5		 2.9x2.4		 2.9x2.8	
			Part Number									
General Purpose	30	500	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
				50	150	2SC4116 	2SA1588 				2SC2712 	2SA1182 
	50	200	TTC4116FU 	TTA1586FU 						TMBT3904 	TMBT3906 	
	50	500					2SC3325 	TTC1949 	2SA1313 			
	45								TTA1713 			
Low Noise	120	100	2SC4117 	2SA1587 			2SC2713 	2SA1163 				
Low Saturation	15	800						2SA1362 				
Muting	20	300	2SC4213 				2SC3326 					
High Current	20	2500				2SA2215 						TTA502 
	25	800					2SC3265 	2SA1298 				
	50	1000			2SC6135 						TTC500 	TTA500 
	50	1700				2SA2195 						
	50	2000										TTA501 
	50	2500			2SC6100 							
High Breakdown	300	100						2SA1721 				
	600	50					2SC6105 					

☆ New Products, ★ Under Development (The specification is subject to change without notice.)



LINK

- Parametric search [Click](#)
- Application Notes [Click](#)
- Frequently Asked Questions (FAQ) of Bipolar Transistors [Click](#)
- Stock Check & Purchase [Click](#)
- Cross Reference Search [Click](#)

*Company names, product names, and service names may be trademarks of their respective companies.

RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA".

Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.
- PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE"). Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, lifesaving and/or life supporting medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, and devices related to power plant. IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT. For details, please contact your TOSHIBA sales representative or contact us via our website.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.