Basic Electronics Series

Using Component Datasheets

Finding the Information That You Need

Why Do We Want or Need Datasheets?

- In design work, we need to know the physical and electrical capacities, dimensions, and limitations of the components we will use.
- In repair work, we often need to find a usable and suitable replacement component or part for one that may no longer be available.
- In experimentation work, we want to know how to properly install, connect, and supply the components or parts that we use.

Datasheet Contents

- Datasheets will usually provide, at a minimum…
  - Physical properties
    - Materials of construction
    - Environmental limitations
    - Available component package (case type) and pinout information
    - Dimensions
    - PCB footprint
  - Electrical properties
    - Normal operating parameters
    - Minimum and maximum permissible levels
  - Description of supply packaging

Physical Properties

- Package or case type (through-hole and SMT components)…
  - Whether axial or radial
  - Whether single inline package (SIP) or dual inline package (DIP), or some other discrete package type
  - Basic substrate type or technology
    - Silicon or Germanium, *etc*.
    - TTL, BiMOS, CMOS, *etc*.
  - Industry-standard package or case designation
  - Pinout assignments
    - Standards for package type
    - Alternatives for package variants
  - Hole or pad pattern for PCB installation

Electrical Properties

- Operating voltage(s)
  - Voltage ranges defined
- Design current levels
  - Normal operations
  - Maximum permissible
- Maximum power dissipation
- Voltages for various pin states
  - Logical high
  - Logical low
- Thermal limits
- How to handle floating pins

Component Part Numbering Variations

- A single component type may have several different part numbers associated with the part, based on component case type and/or supply packaging
  - Examples…
    - PDIP vs SOIC will generally result in different part numbers that are variations of the basic number
    - Ammo reel supply package will generally have a different ordering number than will the same component in a cut tape supply package or as bulk items

Variations Example

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)
LM386M-1/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM386 M-1
LM386MMX-1/NOPB	ACTIVE	VSSOP	DGK	8	3500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	Z86
LM386MX-1/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM386 M-1
LM386N-1/NOPB	ACTIVE	PDIP	P	8	40	Green (RoHS & no Sb/Br)	CU SN | Call TI	Level-1-NA-UNLIM	0 to 70	LM 386N-1
LM386N-3/NOPB	ACTIVE	PDIP	P	8	40	Green (RoHS & no Sb/Br)	CU SN	Level-1-NA-UNLIM	0 to 70	LM 386N-3
LM386N-4/NOPB	ACTIVE	PDIP	P	8	40	Green (RoHS & no Sb/Br)	CU SN | Call TI	Level-1-NA-UNLIM	0 to 70	LM 386N-4

- The common LM386 audio amplifier IC is offered in several package variations.
- In some cases, the only difference is the package as in the framed lines above.
- Note the different package types, *i.e.*, VSSOP, SOIC, and PDIP.

About “Package”…

- The term *“package”* can have two different meanings when used in reference to electronic components…
  - it may refer to the method in which a quantity of the components are prepared for shipping and distribution, *e.g.,* “bulk”, “cut tape”, “ammo reel”, *etc.;* or
  - it may refer to the physical style of the case in which the component is manufactured, *e.g.,* “TO-92”, “DO-35”, “DIP”, “SOIC”, *etc.*

About “Package”…

- For example, a 2N3904 transistor may be described as being in a TO-92 package, which is supplied in a cut tape package.
- Similarly, a 2N7000 FET may be described as being in a TO-92 package, while a 2N7001 FET may be described as being in an SOT-23 package, and *both of them* may be described as being supplied in a cut tape package.

About “Package”…

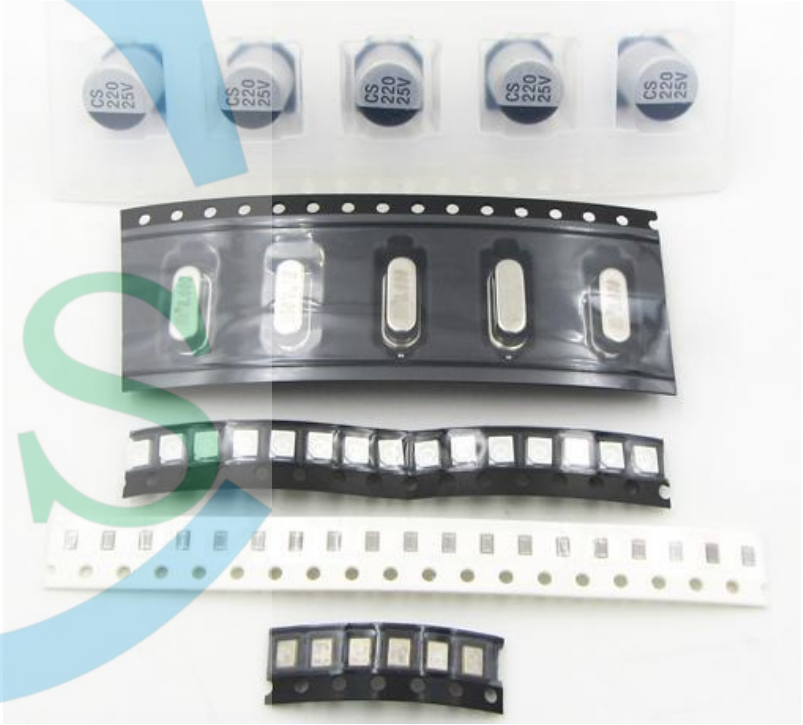
- For this reason, some manufacturers use the terms *“case”* and *“package”* to differentiate between the physical shape of the component and how the component is prepared for shipping and handling.
- Unfortunately, this is *not* by any means a standard.
- As a result, it is up to you to learn and recognize the differences.

Supply Packaging

- Descriptions of how parts are packaged for shipping
  - Bulk – individual components, loose and unparcelled
  - Ammo Reel – parts are mounted to sprocket-driven strip on a reel, meant to load into a machine for placement
    - Components are normally sold in full reels or else in short lengths of the sprocketed carrier
  - Tape – parts are affixed to tape strips at specific distances so as to aid machine handling of the parts
    - Components are normally sold in full packages or in cut strips of the taped components
  - Tube – parts are inserted into a shaped-to-fit antistatic plastic tube, designed to prevent damage to component pins
- Indications of different ordering part numbers for specific supply packaging types are found on datasheet

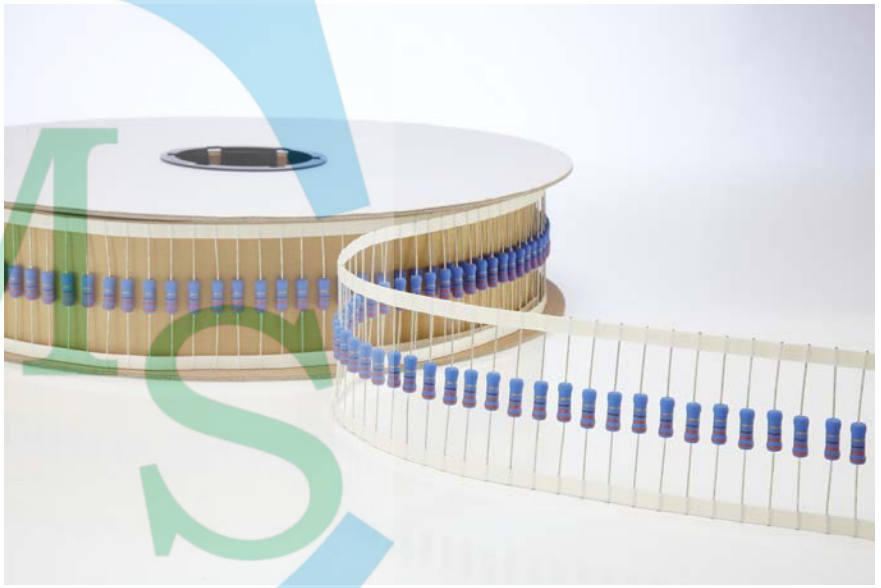
"Ammo Reel" Supply Package

- In the ammo reel package, the components are packaged in regularly-spaced capsules along a sprocket-driven strip of material, with each and every component facing in the same direction for easy placement into a circuit structure by a robotic machine.
- The components are usually visible through a clear plastic cover strip that retains the components in their capsules on the carrier strip.



"Cut Tape" Supply Package

- "Taped" components are most often set at fixed distances along a paired set of folded tape strips
- Device polarity may be indicated by the color of the tape strips used



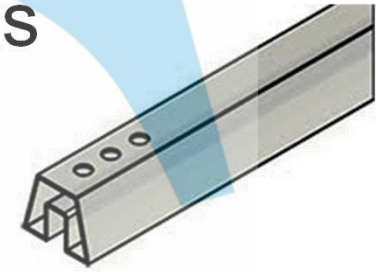
- Components sold as *"Cut Tape"* items are the specified quantity in small strips that were snipped off a large reel of taped components

“Bulk” Supply Package

- The bulk type of supply packaging is not normally available for small SMT devices.
- In this packaging method, the components are loose and are not contained or restrained in any manner.
- This is the most common package type for large components, and is often used with smaller through-hole technology (THT) devices such as capacitors or resistors.
- It is also very common with discrete semiconductor devices.

“Rail Tube” Supply Package

- The rail tube package system is most frequently used for DIP integrated circuit (IC) devices.
- The tube is made of anti-static plastic material in various cross-sectional shapes to accommodate IC’s of various sizes and shapes.
- The IC’s are retained by stop pins that are inserted in holes in the tube near each end, or by special rubber plugs inserted into the tube ends.



Common SMT Passives

- When it comes to many SMT passive devices such as resistors, capacitors, and inductors, there are some standardized sizes used throughout the industry.
- Once again, confusion can creep in due to the mingled use of metric and English or *"inch"* size specifications.
- To make matters worse, they use similar schemes in describing the package sizes.

Size Exploration

- Here is the dimension breakdown for an SMT passive device, in this case a capacitor.
- This datasheet shows the device to be sized as a *"1005M(0402)"* device.

■ Type & Dimension

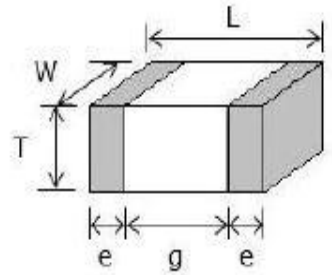


image:Dimension

Size Code : 1005M(0402) (in mm)

② L	② W	③ T	e	g
1.0+/-0.05	0.5+/-0.05	0.5+/-0.05	0.15 to 0.35	0.3 min.

- What is meant by the label *"1005M(0402)"* as shown in the line headed *Size Code*?

- Typically, these monolithic type of passives are described numerically using a code that represents the *length* and *width* of the component.
  - In the INCH sizes…
    - the first two digits indicate the length of the device in hundredths of an inch, rounded to the nearest whole hundredth; and
    - the last two digits indicate the width of the device in hundredths of an inch, rounded to the nearest whole hundredth.
  - Thus, a device described as an 0603 device would be approximately 6/100 of an inch (0.06”) by 3/100 of an inch (0.03”) overall size.

- In the METRIC sizes…
  - the first two digits indicate the length of the device in tenths of a millimeter, rounded to the nearest whole tenth; and
  - the last two digits indicate the width of the device in tenths of a millimeter, rounded to the nearest whole tenth.
- Thus, a device described as an 0603 device would be approximately 6/10 of a millimeter (0.6mm) by 3/10 of a millimeter (0.3mm) overall size.
- In this system, the decimal points are omitted, and dimensions less than 10/10 of a millimeter will carry a leading zero and a single digit size.

- So… how do these dimensions compare between the systems?
  - For any given dimensional pair, a given INCH size will be larger than that same numeric dimension in the METRIC system.
  - Examples…
    - A component sized as 0402 in the INCH system will be approximately equivalent to a device sized as 1005 in the METRIC system:
      - 0.040” is equivalent to approximately 1 millimeter; and
      - 0.020: is equivalent to approximately 1/2 of a millimeter.
    - A component sized as 1210 in the INCH system will be approximately equivalent to a device sized as 3225 in the METRIC system:
      - 0.120” is equivalent to approximately 3.2 millimeters; and
      - 0.100” is equivalent to approximately 2.5 millimeters.
  - There are some exceptions to the sizing nomenclature as shown in the table on the next slide.

Size Comparisons

Passive Components – Small Flat Chip Footprints			
0201	0.2mm x 0.1mm	008004*	0.008” x 0.004”
03015*	0.3mm x 0.15mm	(no inch size match)	
0402	0.4mm x 0.2mm	01005*	0.01” x 0.005”
0603	0.6mm x 0.3mm	0201	0.02” x 0.01”
1005	1.0mm x 0.5mm	0402	0.04” x 0.02”
1608	1.6mm x 0.8mm	0603	0.06” x 0.03”
2012	2.0mm x 1.2mm	0805	0.08” x 0.05”
2520	2.5mm x 2.0mm	1008	0.10” x 0.08”
3216	3.2mm x 1.6mm	1206	0.12” x 0.06”
3225	3.2mm x 2.5mm	1210	0.12” x 0.10”
3528	3.5mm x 2.8mm	1411	0.14” x 0.11”

NOTE the non-standard sizes near the top of the table…

- The trouble is that many datasheets don't clearly indicate which system of component size measurement is in use.
  - Instead, the reader must derive that information from the general format in which the other data is provided within that datasheet.
  - For example, if the general format in use has metric system values provided first with the inch system values in parentheses afterwards, then the device dimensions are most likely provided as metric system values.
  - The inverse holds true if the first values stated are inch-system values, with metric values after.

From the Datasheet…

- Component package or case type is almost always provided on the datasheet, but you may have to look for it carefully.
- In the datasheet sample page on the next slide, the size data is called out by the red legend and arrow.
- Note that this information tells us the component size; the component footprint is provided elsewhere and must also be looked for carefully.

Datasheet Sample Page

muRata

High Q Chip Multilayer Ceramic Capacitors (≦100Vdc) for General Purpose
GJM1555C1H160FB01_(1005M(0402), C0G(EIA), 16pF, DC 50V)
:Package

Reference Sheet

Product specifications in this catalog are as of Jan.8,2022, and are subject to change or obsolescence without notice.
Please consult the approval sheet before ordering. Please read rating and !Cautions first.

■ Scope

This product specification is applied to High Q Chip Multilayer Ceramic Capacitors (≦100Vdc) used for General Electronic equipment.
This product is applied for Only Reflow Soldering.

CAPACITOR PART # GJM1555C1H160FB01J

■ MURATA Part No. System

(Ex.)	GJM	15	5	5C	1H	160	F	B01	D
	①Series	②Dimension (L×W)	③Dimension (T)	④Temperature Characteristics	⑤Rated Voltage	⑥Capacitance	⑦Capacitance Tolerance	⑧Individual Specification	⑨Package

■ Type & Dimension

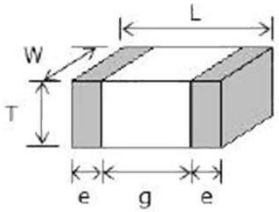


image:Dimension

SIZE INFORMATION

Size Code : 1005M(0402) (in mm)

② L	② W	③ T	e	g
1.0+/-0.05	0.5+/-0.05	0.5+/-0.05	0.15 to 0.35	0.3 min.

■ Rated Value

④Temperature Characteristics [5C] (Public STD Code : [C0G(EIA)])			⑤Rated Voltage	⑥ Capacitance	⑦ Capacitance Tolerance	Operating Temp. Range	Mounting Method
Temp. coeff. or Cap. Change	Temp. Range	Ref.Temp.					
0+/-30 ppm/°C	25 to 125°C	25°C	DC 50V	16pF	+/-1%	-55 to 125°C	Reflow

⑧Individual Specification : This denotes Murata control code.

■ Package

⑨Package	Packaging	Standard Packing Quantity
D	φ180mm Reel PAPER Tape W8P2	10000 pcs./Reel
W	φ180mm Reel PAPER Tape W8P1	20000 pcs./Reel
	φ330mm Reel PAPER Tape W8P2	50000 pcs./Reel

Part Number Breakdown

CAPACITOR PART # GJM 15 5 5C 1H 160 F B01 J

■ MURATA Part No. System

(Ex.)	GJM	15	5	5C	1H	160	F	B01	D
	①Series	②Dimension (L×W)	③Dimension (T)	④Temperature Characteristics	⑤Rated Voltage	⑥Capacitance	⑦Capacitance Tolerance	⑧Individual Specification	⑨Package

■ Type & Dimension

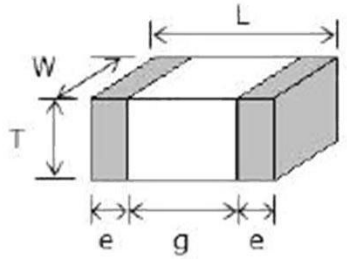


image:Dimension

The part number is often a string of coded information about the device and the datasheet shows the breakdown of that coded data. NOTE that this capacitor is a GJM series with a ***Dimension Code (L x W)*** -- item 2 -- of "**15**", which we will see again, when we look at the footprint data…

Size Code : 1005M(0402) (in mm)

② L	② W	③ T	e	g
1.0+/-0.05	0.5+/-0.05	0.5+/-0.05	0.15 to 0.35	0.3 min.

■ Rated Value

④Temperature Characteristics [5C] (Public STD Code : [C0G(EIA)])			⑤Rated Voltage	⑥ Capacitance	⑦ Capacitance Tolerance	Operating Temp. Range	Mounting Method
Temp. coeff. or Cap. Change	Temp. Range	Ref.Temp.					
0+/-30 ppm/°C	25 to 125°C	25°C	DC 50V	16pF	+/-1%	-55 to 125°C	Reflow

⑧Individual Specification : This denotes Murata control code.

■ Package

⑨Package	Packaging	Standard Packing Quantity
D	φ180mm Reel PAPER Tape W8P2	10000 pcs./Reel
W	φ180mm Reel PAPER Tape W8P1	20000 pcs./Reel
J	φ330mm Reel PAPER Tape W8P2	50000 pcs./Reel

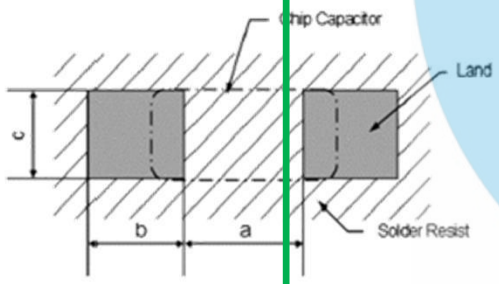
Footprint Data

- The footprint information was found on page 24 (out of 28 pages) of this datasheet.
- The table beneath the footprint diagram contains footprint data for three different capacitor dimension codes in the GJM capacitor series.

muRata

2. Land Dimensions

Please confirm the suitable land dimension by evaluating of the actual SET / PCB.



From the part number, we find that the **Dimension Code (L x W)** is "**15**", which leads us to the footprint dimensions on the third line of the table below the footprint diagram, which defines two pads that are each 0.4mm ±0.1mm x 0.4mm ±0.05mm, are in line and spaced 0.5mm ±1.0mm apart, and are surrounded by solder mask coating.

Table 1 Reflow Soldering Method

Series	Chip Dimension (L/W) Code	Chip(L×W) (Dimensions Tolerance)	a	b	c
GJM	02	0.4×0.2	0.16 to 0.2	0.12 to 0.18	0.2 to 0.23
GJM	03	0.6×0.3 (±0.03)	0.2 to 0.25	0.2 to 0.3	0.25 to 0.35
GJM	15	1.0×0.5 (±0.05)	0.3 to 0.5	0.35 to 0.45	0.4 to 0.6

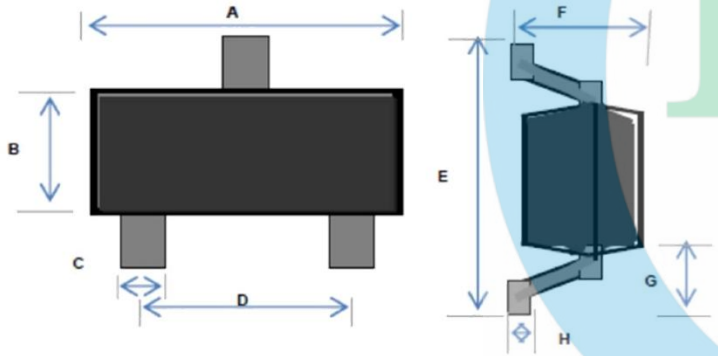
(in mm)

Something More Complex...

- Here is the footprint information for a device in the SOT-23 package, the MMBT3904 transistor…

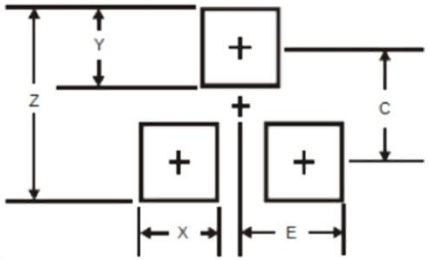
PACKAGE OUTLINE DIMENSIONS

SOT-23



DIM.	Unit(mm)		Unit(inch)	
	Min	Max	Min	Max
A	2.70	3.10	0.106	0.122
B	1.10	1.50	0.043	0.059
C	0.30	0.51	0.012	0.020
D	1.78	2.04	0.070	0.080
E	2.10	2.64	0.083	0.104
F	0.89	1.30	0.035	0.051
G	0.55 REF		0.022 REF	
H	0.10 REF		0.004 REF	

SUGGEST PAD LAYOUT



DIM	Unit (mm)	Unit (inch)
	TYP	TYP
Z	2.90	0.114
X	0.80	0.031
Y	0.90	0.035
C	2.00	0.079
E	1.35	0.053

- Note that the dimensions are provided in both metric and inch values.
- Pin assign-ments are not shown.

More on the MMBT3904

- This is the SMT equivalent of the very common 2N3904 NPN TO-92 THT transistor.

FEATURES

- Epitaxial planar die construction
- Surface device type mounting
- Moisture sensitivity level 1
- Matte Tin (Sn) lead finish with Nickel (Ni) underplate
- Pb free version and RoHS compliant
- Packing code with suffix "G" means green compound (halogen-free)

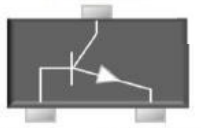
MECHANICAL DATA

- Case: SOT- 23, molded plastic
- Terminal: Matte tin plated, lead free, solderable per MIL-STD-202, Method 208 guaranteed
- High temperature soldering guaranteed: 260°C/10s
- Weight: 8 mg (approximately)
- Marking Code: 1E.

Physical Appearance

SOT-23

Pin Assignments



Before We Go Too Far…

- What do these two markings mean?

The ROHS COMPLIANT mark indicates that not only this device, but its entire manufacturing process in in compliance with the ROHS mandate, which called for the general reduction of several hazardous substances in products as well as in the manufacturing processes for those products.

The Pb-Free mark indicates that the device, component, or assembly so marked is lead free in compliance with the international initiatives to reduce the use of lead in consumer and commercial products.

Now For The Data…

In most cases, the maximum values and limits are listed first, followed by the normal operating ranges for the various values for the device.

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS (T_A=25°C unless otherwise noted)

PARAMETER	SYMBOL	VALUE	UNIT
Power Dissipation	P_D	300	mW
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Junction and Storage Temperature Range	T_J , T_{STG}	-55 to +150	°C

Notes: Valid provided that electrodes are kept at ambient temperature

PARAMETER			SYMBOL	MIN	MAX	UNIT
Collector-Base Breakdown Voltage	I_C = 10 µA	I_E = 0	$V_{(BR)CBO}$	60	-	V
Collector-Emitter Breakdown Voltage	I_C = 1 mA	I_B = 0	$V_{(BR)CEO}$	40	-	V
Emitter-Base Breakdown Voltage	I_E = 10 µA	I_C = 0	$V_{(BR)EBO}$	6	-	V
Collector Cut-off Current	V_{CB} = 60 V	I_E = 0	I_{CBO}	-	0.1	µA
Collector Cut-off Current	V_{CE} = 30 V	$V_{BE(OFF)}$ = 3 V	I_{CEO}	-	50	nA
Emitter Cut-off Current	V_{EB} = 5 V	I_C = 0	I_{EBO}	-	0.1	µA
DC Current Gain	V_{CE} = 1 V	I_C = 10 mA	h_{FE}	100	400	
	V_{CE} = 1 V	I_C = 50 mA		60	-	
	V_{CE} = 1 V	I_C = 100 mA		30	-	
Collector-Emitter Saturation Voltage	I_C = 50 mA	I_B = 5 mA	$V_{CE(sat)}$	-	0.3	V
Base-Emitter Saturation Voltage	I_C = 50 mA	I_B = 5 mA	$V_{BE(sat)}$	-	0.95	V
Transition frequency	V_{CE} = 20 V	I_C = 10 mA f= 100MHz	f_T	250	-	MHz
Delay time	V_{CC} = 3 V	V_{BE} = 0.5 V I_C = 10 mA	t_d	-	35	ns
Rise time		I_{B1} = 1.0 mA	t_r	-	35	ns
Storage time		V_{CC} = 3 V I_C = 10 mA	t_s	-	200	ns
Fall time		I_{B1} = I_{B2} = 1.0 mA	t_f	-	50	ns

THT vs SMT Comparison

- How does this SMT device compare with its THT equivalent? Take a look below…

MMBT3904

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS (T_A=25°C unless otherwise noted)

PARAMETER	SYMBOL	VALUE	UNIT
Power Dissipation	P_D	300	mW
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C

Notes: Valid provided that electrodes are kept at ambient temperature

2N3904

MAXIMUM RATINGS

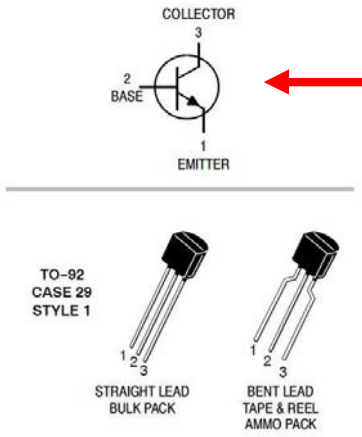
Rating	Symbol	Value	Unit
Collector – Emitter Voltage	V_{CEO}	40	Vdc
Collector – Base Voltage	V_{CBO}	60	Vdc
Emitter – Base Voltage	V_{EBO}	6.0	Vdc
Collector Current – Continuous	I_C	200	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	 625 5.0	 mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	 1.5 12	 W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

THT vs SMT Comparison

- As is evident from the data on the previous slide, the only real difference is in the *power handling capacity* of the SMT device as compared to its equivalent THT device.
- Apart from the maximum power dissipation, most if not all operating and maximum electrical characteristics remain the same in the transition to SMT – otherwise, the SMT device would carry a different type number from the THT device that it replaces.

Pinout Information

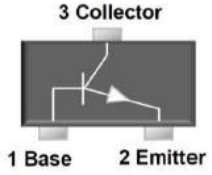
- Another important piece of information found on the datasheet is the pinout data for the device, in each of the different package types in which it is offered.



2N3904 THT device

SOT-23

MMBT3904 SMT device



Pinout Information

- Three different package types for the TL071H Op-Amp integrated circuit device.

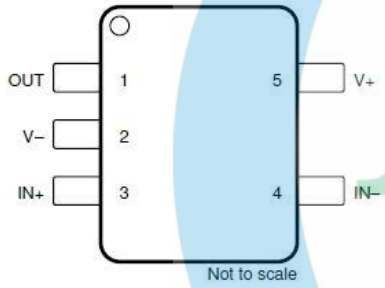


Figure 5-1. TL071H DBV Package
5-Pin SOT-23
(Top View)

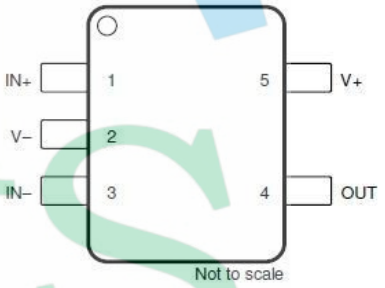
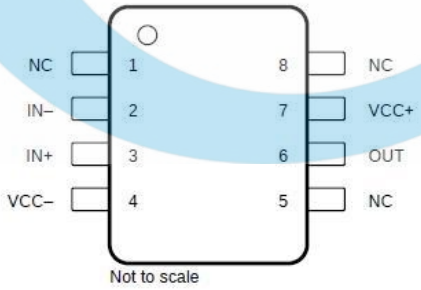


Figure 5-2. TL071H DCK Package
5-Pin SC70
(Top View)



NC- no internal connection

Figure 5-3. TL071H D Package
8-Pin SOIC
(Top View)

Pinout Information

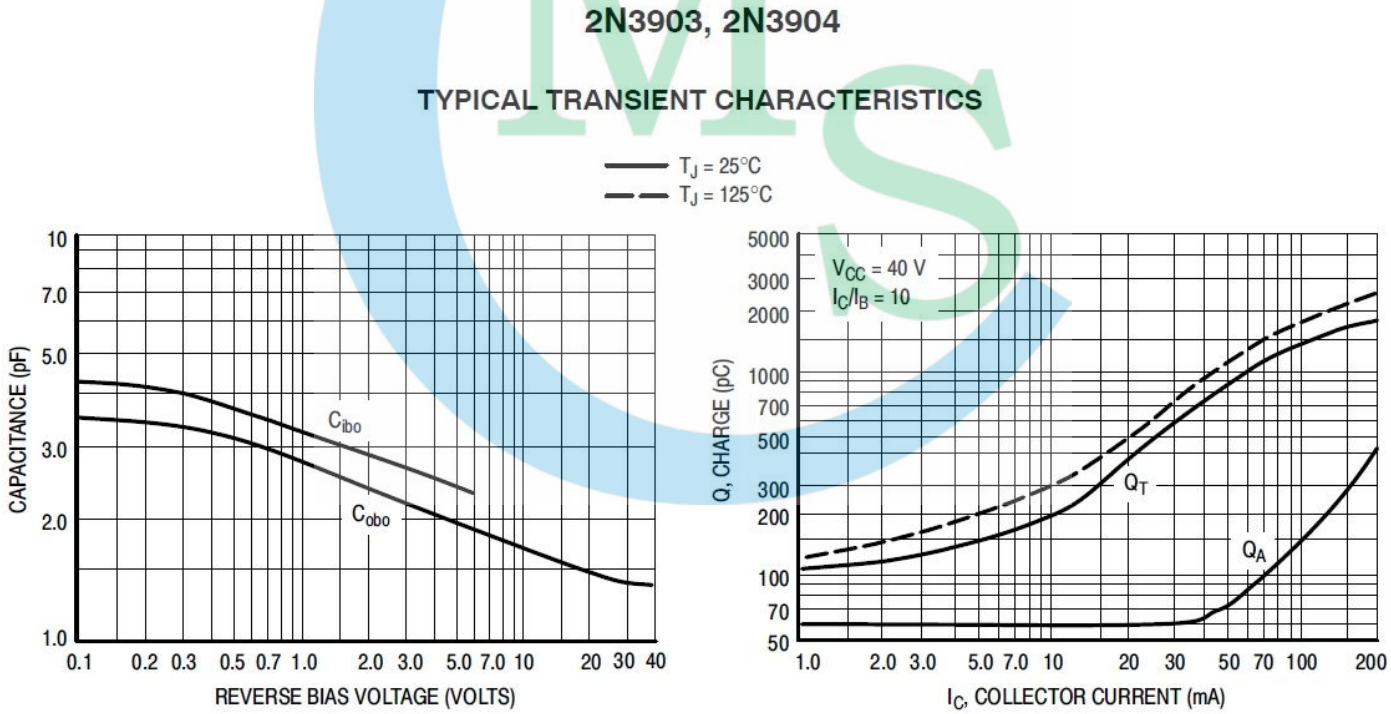
- The device datasheet also provides a table of pin functions when appropriate.

Table 5-1. Pin Functions: TL071H

PIN				I/O	DESCRIPTION
NAME	DBV	DCK	D		
IN–	4	3	2	I	Inverting input
IN+	3	1	3	I	Noninverting input
NC	—	—	8	—	Do not connect
NC	—	—	1	—	Do not connect
NC	—	—	5	—	Do not connect
OUT	1	4	6	O	Output
VCC–	2	2	4	—	Power supply
VCC+	5	5	7	—	Power supply

Performance Curves

- For those with the need to know, device performance curves are also included.



Ordering Information

- Many datasheets also include device ordering information to help the purchaser.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)
81023052A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	81023052A TL072MFKB
8102305HA	ACTIVE	CFP	U	10	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	8102305HA TL072M
8102305PA	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	8102305PA TL072M
81023062A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	81023062A TL074MFKB
8102306CA	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	8102306CA TL074MJB
8102306DA	ACTIVE	CFP	W	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	8102306DA TL074MWB
JM38510/11905BPA	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510 /11905BPA
M38510/11905BPA	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	JM38510 /11905BPA
TL071ACD	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	071AC
TL071ACDG4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	071AC

In Summary…

- Component datasheets are the user's best source for any and all pertinent data as regards the specifications, packages and packaging, characteristics and performance, and almost anything else one might wish to know about a specific component.
- Datasheets are still readily available for most outdated or obsolete components, which can make sourcing a replacement a little bit easier.

Questions?