MOSPEC

HIGH-POWER NPN SILICON POWER TRANSISTORS

...designed for use in general-purpose amplifier and switching application .

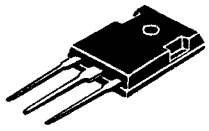
FEATURES:
* Recommend for 45 - 50W Audio Frequency Amplifier Output stage.
* Complementary to 2SB688

NPN

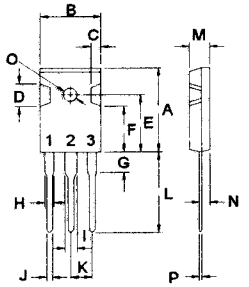
2SD718

8 AMPERE
POWER
TRANASISTOR

120 VOLTS
80 WATTS



TO-247(3P)



PIN 1.BASE
2.COLLECTOR
3.EMITTER

DIM	MILLIMETERS	
	MIN	MAX
A	20.63	22.38
B	15.38	16.20
C	1.90	2.70
D	5.10	6.10
E	14.81	15.22
F	11.72	12.84
G	4.20	4.50
H	1.82	2.46
I	2.92	3.23
J	0.89	1.53
K	5.26	5.66
L	18.50	21.50
M	4.68	5.36
N	2.40	2.80
O	3.25	3.65
P	0.55	0.70

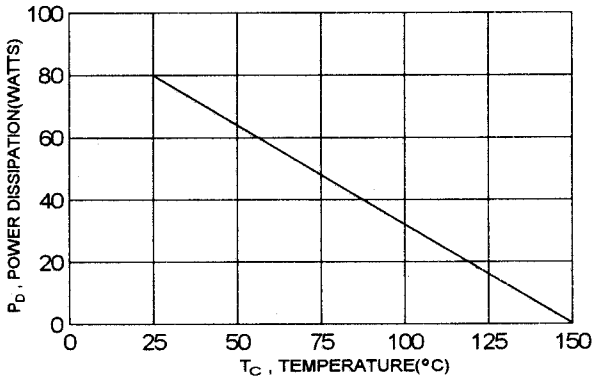
MAXIMUM RATINGS

Characteristic	Symbol	2SD718	Unit
Collector-Emitter Voltage	V_{CEO}	120	V
Collector-Base Voltage	V_{CBO}	120	V
Emitter-Base Voltage	V_{EBO}	5.0	V
Collector Current - Continuous - Peak	I_C I_{CM}	8.0 16	A
Base current	I_B	0.8	A
Total Power Dissipation @T_C = 25°C Derate above 25°C	P_D	80 0.64	W W/°C
Operating and Storage Junction Temperature Range	T_J , T_{STG}	-55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	Rθjc	1.56	°C/W

FIGURE -1 POWER DERATING



ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

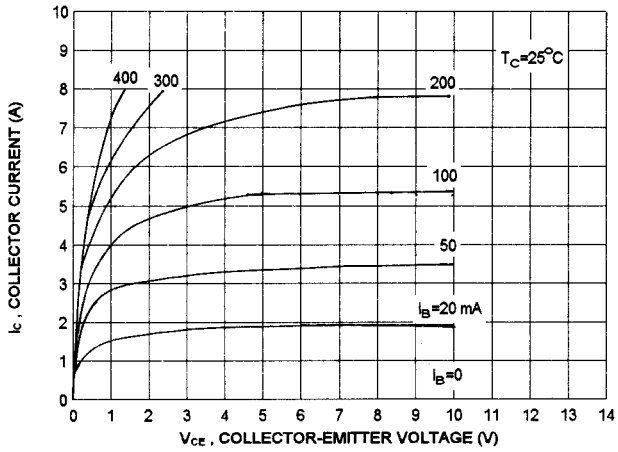
Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (I_C= 50 mA, I_B= 0)	$V_{(BR)CEO}$	120		V
Collector Cutoff Current (V_{CB}= 120 V, I_E= 0)	I_{CBO}		10	uA
Emitter Cutoff Current (V_{EB}= 5.0 V, I_C= 0)	I_{EBO}		10	uA
ON CHARACTERISTICS (1)				
DC Current Gain (I_C= 1.0 A, V_{CE}= 5.0 V) *	hFE(2)	55	160	
Collector-Emitter Saturation Voltage (I_C= 5.0 A, I_B= 0.5 A)	$V_{CE(sat)}$		2.5	V
Base-Emitter On Voltage (I_C= 5.0 A, V_{CE}=5.0 V)	$V_{BE(on)}$		1.5	V
DYNAMIC CHARACTERISTICS				
Current-Gain-Bandwidth Product (I_C = 1.0 A, V_{CE} = 5.0 V, f = 1.0 MHz)	f_T	12(typ)		MHz
Output capacitance (V_{CB} = 10 V ,I_E = 0, f = 1.0 MHz)	C_{ob}	170(typ)		pF

(1) Pulse Test: Pulse Width =300 us,Duty Cycle ≦ 2.0%

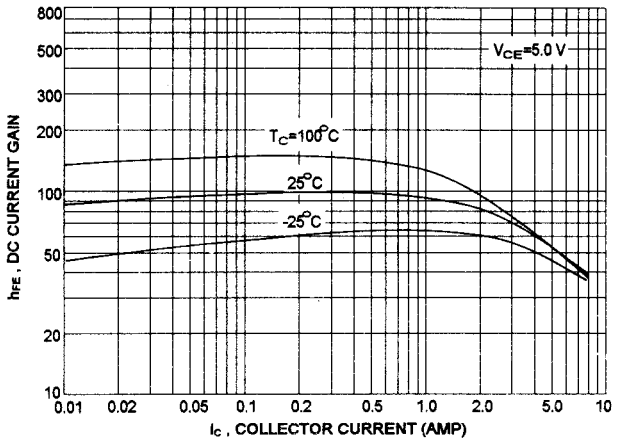
* hFE(2) Classification :

55 R 110	80 O 160

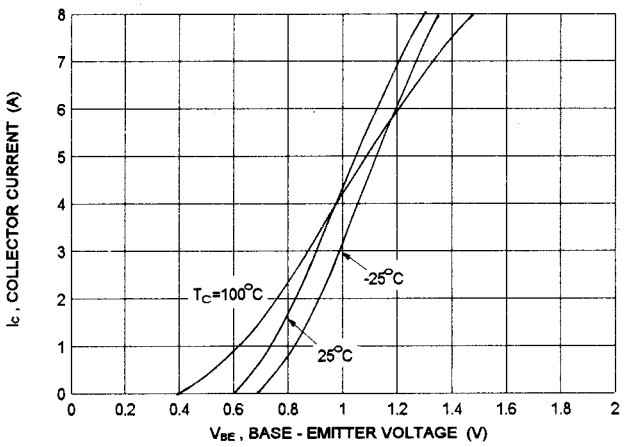
Ic - Vce



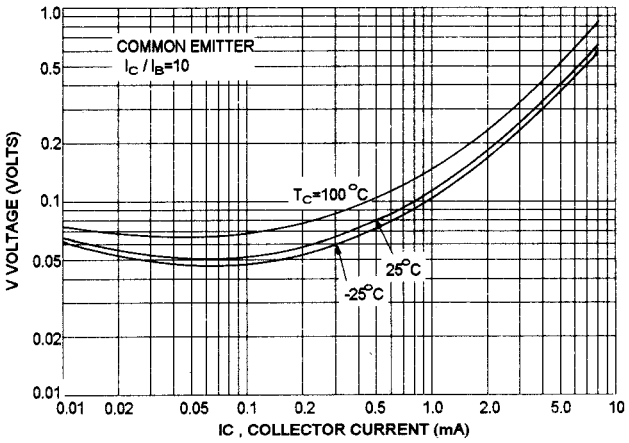
DC CURRENT GAIN



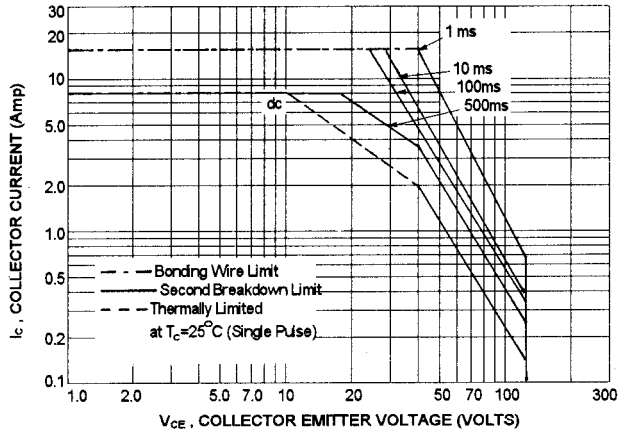
Ic - Vbe



$V_{CE(sat)}$-I_C



ACTIVE-REGION SAFE OPERATING AREA (SOA)



There are two limitation on the power handling ability of a transistor:average junction temperature and second breakdown safe operating area curves indicate I_C-V_{CE} limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation than curves indicate.

The data of SOA curve is base on $T_{J(PK)}$=150 °C; T_C is variable depending on conditions. second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(PK)}$≤150°C, At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

MOSPEC

HIGH-POWER PNP SILICON POWER TRANSISTORS

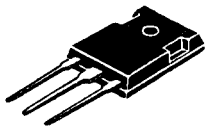
...designed for use in general-purpose amplifier and switching application .

FEATURES:
* Recommend for 45 - 50W Audio Frequency Amplifier Output stage.
* Complementary to 2SD718

PNP
2SB688

8 AMPERE
POWER
TRANASISTOR

120 VOLTS
80 WATTS



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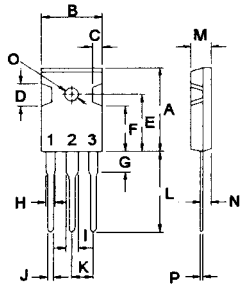

PIN 1.BASE
2.COLLECTOR
3.EMITTER

DIM	MILLIMETERS	
	MIN	MAX
A	20.63	22.38
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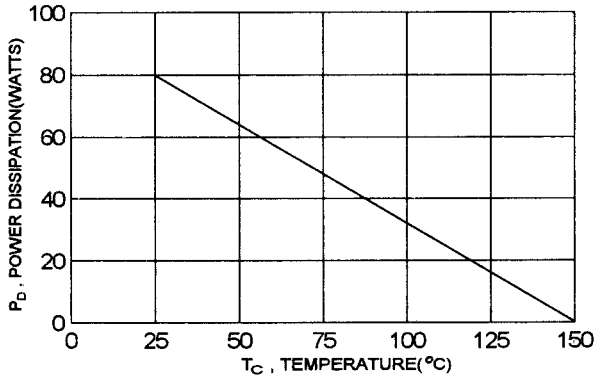
MAXIMUM RATINGS

Characteristic	Symbol	2SB688	Unit
Collector-Emitter Voltage	V_{CEO}	120	V
Collector-Base Voltage	V_{CBO}	120	V
Emitter-Base Voltage	V_{EBO}	5.0	V
Collector Current - Continuous - Peak	I_C I_{CM}	8.0 16	A
Base current	I_B	0.8	A
Total Power Dissipation @T_C = 25°C Derate above 25°C	P_D	80 0.64	W W/°C
Operating and Storage Junction Temperature Range	T_J , T_{STG}	-55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R\theta jc$	1.56	°C/W

FIGURE -1 POWER DERATING



ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

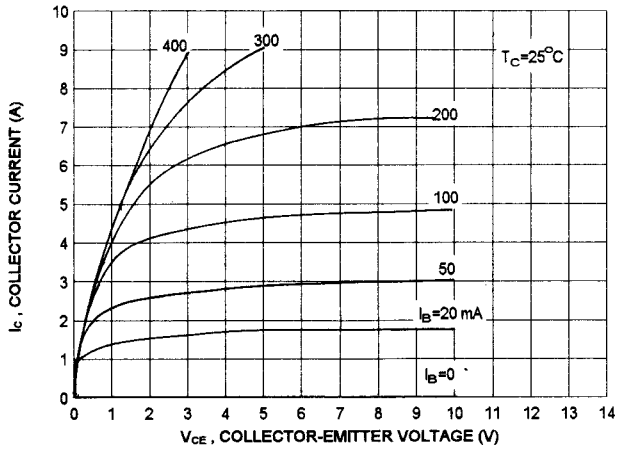
Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (I_C= 50 mA, I_B= 0)	$V_{(BR)CEO}$	120		V
Collector Cutoff Current (V_{CB}= 120 V, I_E= 0)	I_{CBO}		10	uA
Emitter Cutoff Current (V_{EB}= 5.0 V, I_C= 0)	I_{EBO}		10	uA
ON CHARACTERISTICS (1)				
DC Current Gain (I_C= 1.0 A, V_{CE}= 5.0 V) *	hFE(2)	55	160	
Collector-Emitter Saturation Voltage (I_C= 5.0 A, I_B= 0.5 A)	$V_{CE(sat)}$		2.5	V
Base-Emitter On Voltage (I_C= 5.0 A, V_{CE}=5.0 V)	$V_{BE(on)}$		1.5	V
DYNAMIC CHARACTERISTICS				
Current-Gain-Bandwidth Product (I_C = 1.0 A, V_{CE} = 5.0 V, f = 1.0 MHz)	f_T	10(typ)		MHz
Output capacitance (V_{CB} = 10 V ,I_E = 0, f = 1.0 MHz)	C_{Ob}	280(typ)		pF

(1) Pulse Test: Pulse Width =300 us,Duty Cycle ≦ 2.0%

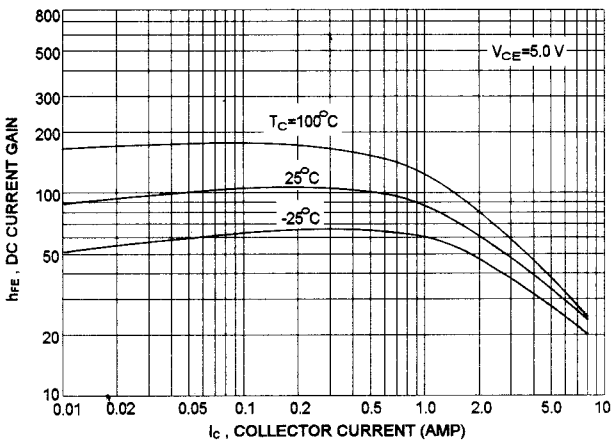
* hFE(2) Classification :

55	R	110	80	O	160

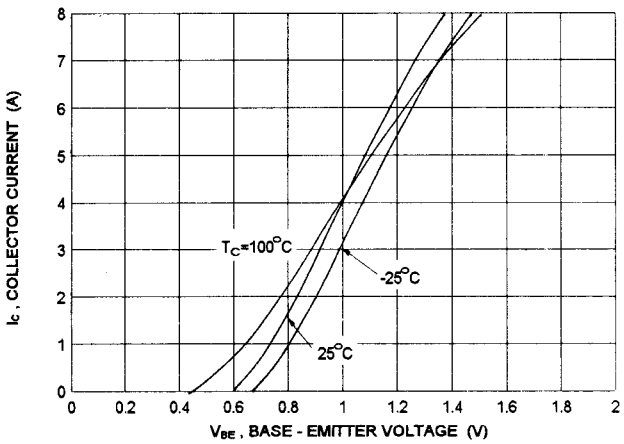
Ic - Vce



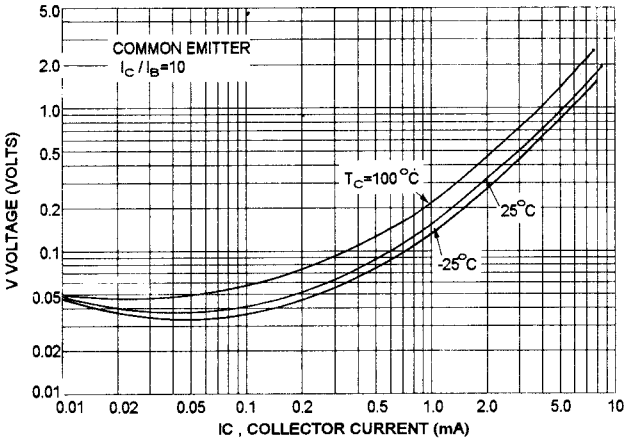
DC CURRENT GAIN



Ic - Vbe



$V_{CE(sat)}$-I_C



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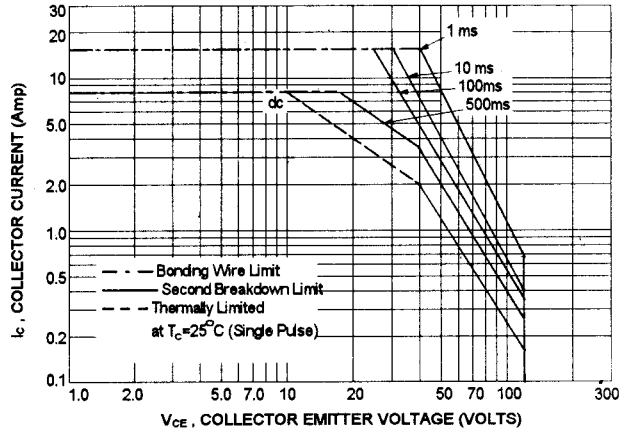

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The data of SOA curve is base on $T_{J(PK)}$=150 °C; T_C is variable depending on conditions. second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(PK)}$<150°C, At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

2SD669, 2SD669A

Silicon NPN Epitaxial

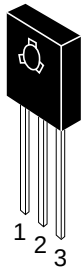
HITACHI

Application

Low frequency power amplifier complementary pair with 2SB649/A

Outline

TO-126 MOD



1. Emitter
2. Collector
3. Base

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings		Unit
		2SD669	2SD669A	
Collector to base voltage	V_{CBO}	180	180	V
Collector to emitter voltage	V_{CEO}	120	160	V
Emitter to base voltage	V_{EBO}	5	5	V
Collector current	I_C	1.5	1.5	A
Collector peak current	$I_{C(peak)}$	3	3	A
Collector power dissipation	P_C	1	1	W
	P_C*[1]	20	20	W
Junction temperature	Tj	150	150	°C
Storage temperature	Tstg	–55 to +150	–55 to +150	°C

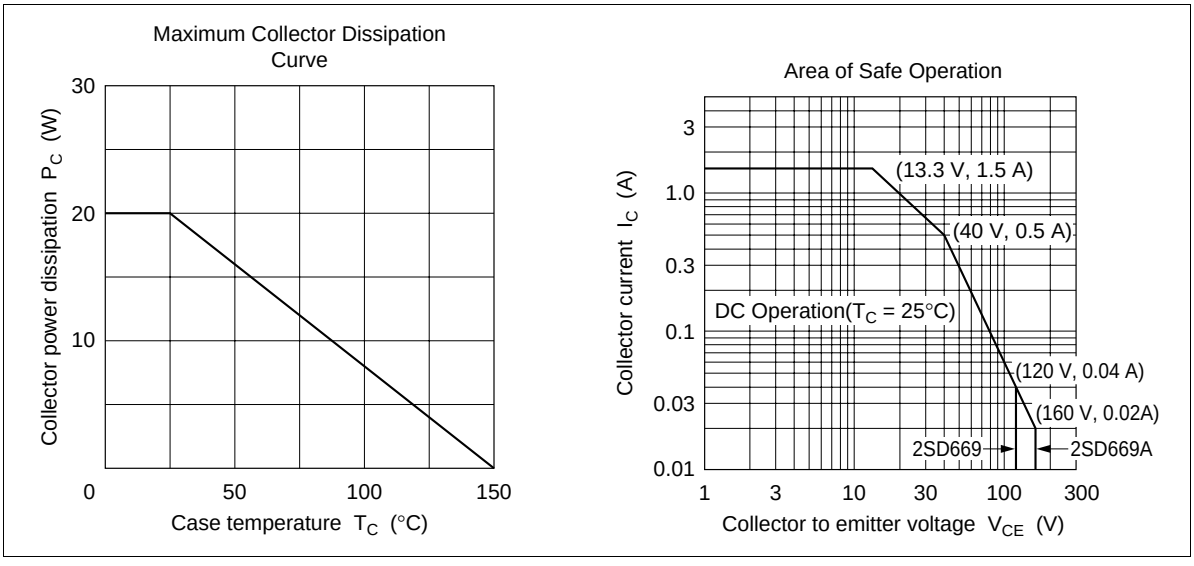
Note: 1. Value at T_C = 25°C.

Electrical Characteristics (Ta = 25°C)

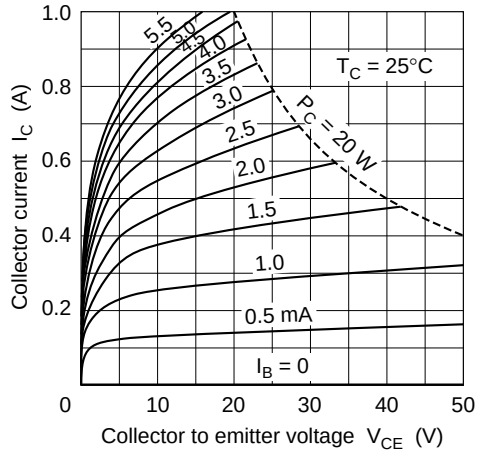
Item	Symbol	2SD669 Min	2SD669 Typ	2SD669 Max	2SD669A Min	2SD669A Typ	2SD669A Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	180	—	—	180	—	—	V	I_C = 1 mA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	120	—	—	160	—	—	V	I_C = 10 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	5	—	—	5	—	—	V	I_E = 1 mA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	10	—	—	10	µA	V_{CB} = 160 V, I_E = 0
DC current transfer ratio	h_{FE1}*[1]	60	—	320	60	—	200		V_{CE} = 5 V, I_C = 150 mA*[2]
	h_{FE2}	30	—	—	30	—	—		V_{CE} = 5 V, I_C = 500 mA*[2]
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	1	—	—	1	V	I_C = 500 mA, I_B = 50 mA*[2]
Base to emitter voltage	V_{BE}	—	—	1.5	—	—	1.5	V	V_{CE} = 5 V, I_C = 150 mA*[2]
Gain bandwidth product	f_T	—	140	—	—	140	—	MHz	V_{CE} = 5 V, I_C = 150 mA*[2]
Collector output capacitance	Cob	—	14	—	—	14	—	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz

Notes: 1. The 2SD669 and 2SD669A are grouped by h_{FE1} as follows.
2. Pulse test.

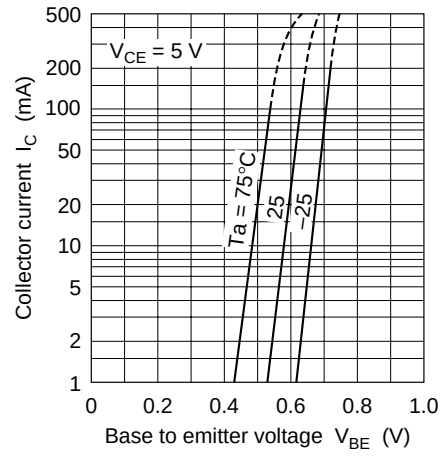
	B	C	D
2SD669	60 to 120	100 to 200	160 to 320
2SD669A	60 to 120	100 to 200	—



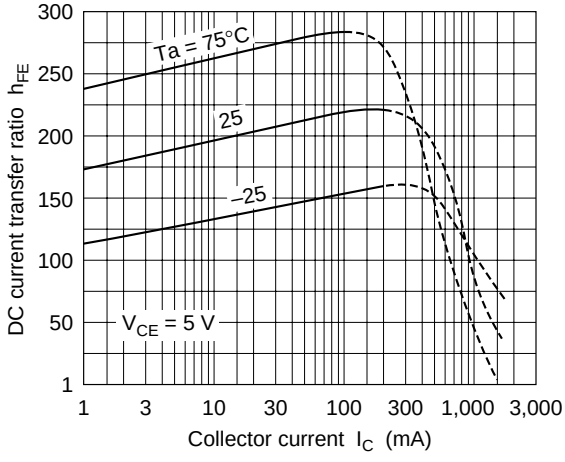
Typical Output Characteristecs



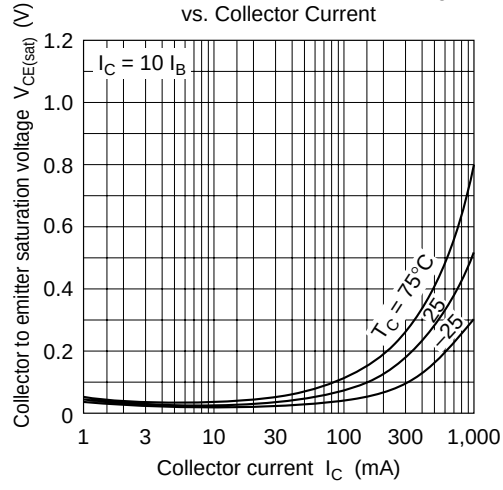
Typical Transfer Characteristics



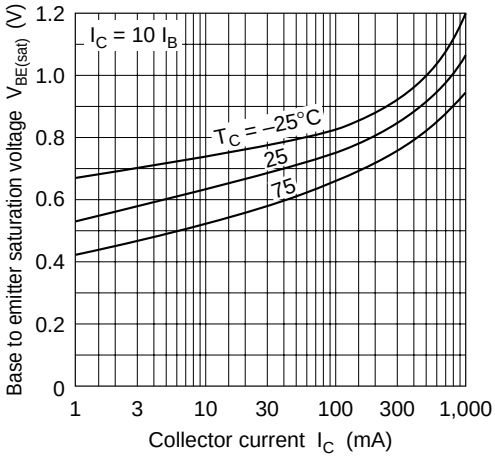
DC Current Transfer Ratio vs. Collector Current



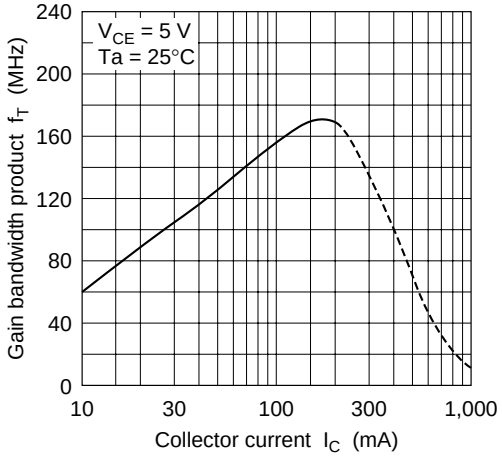
Collector to Emitter Saturation Voltage vs. Collector Current



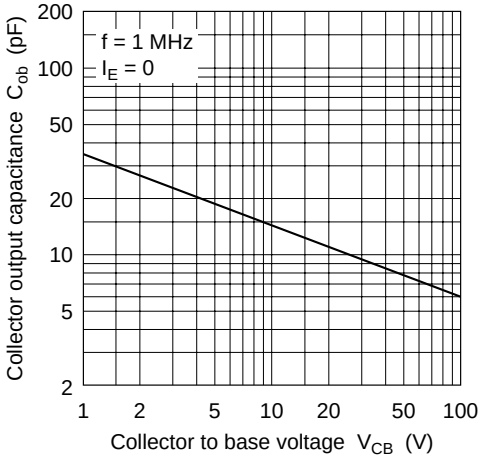
Base to Emitter Saturation Voltage
vs. Collector Current



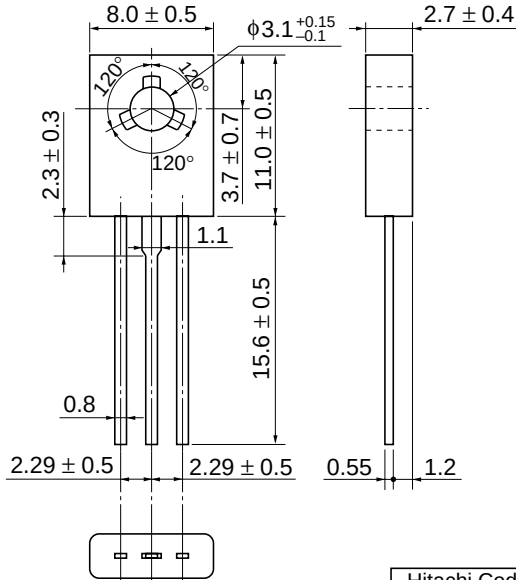
Gain Bandwidth Product
vs. Collector Current

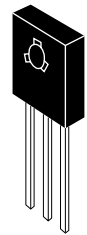


Collector Output Capacitance
vs. Collector to Base Voltage



Unit: mm





Hitachi Code	TO-126 Mod
JEDEC	—
EIAJ	—
Weight (reference value)	0.67 g

Cautions

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Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX

2SB649, 2SB649A

Silicon PNP Epitaxial

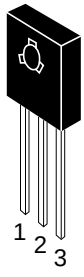
HITACHI

Application

Low frequency power amplifier complementary pair with 2SD669/A

Outline

TO-126 MOD



1. Emitter
2. Collector
3. Base

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings		Unit
		2SB649	2SB649A	
Collector to base voltage	V_{CBO}	–180	–180	V
Collector to emitter voltage	V_{CEO}	–120	–160	V
Emitter to base voltage	V_{EBO}	–5	–5	V
Collector current	I_C	–1.5	–1.5	A
Collector peak current	$I_{C(peak)}$	–3	–3	A
Collector power dissipation	P_C	1	1	W
	P_C*[1]	20	20	W
Junction temperature	Tj	150	150	°C
Storage temperature	Tstg	–55 to +150	–55 to +150	°C

Note: 1. Value at T_C = 25°C

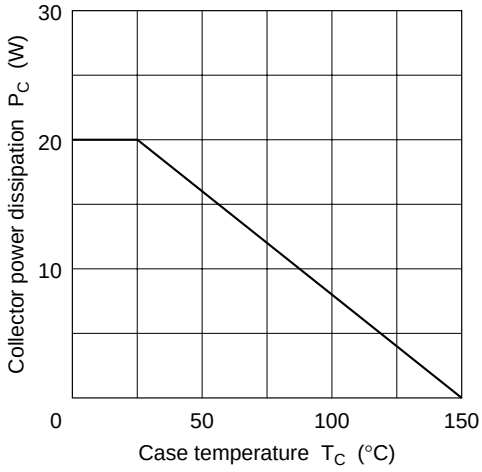
Electrical Characteristics (Ta = 25°C)

Item	Symbol	2SB649 Min	2SB649 Typ	2SB649 Max	2SB649A Min	2SB649A Typ	2SB649A Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	–180	—	—	–180	—	—	V	I_C = –1 mA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	–120	—	—	–160	—	—	V	I_C = –10 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	–5	—	—	–5	—	—	V	I_E = –1 mA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	–10	—	—	–10	µA	V_{CB} = –160 V, I_E = 0
DC current transfer ratio	h_{FE1}*[1]	60	—	320	60	—	200		V_{CE} = –5 V, I_C = –150 mA
	h_{FE2}	30	—	—	30	—	—		V_{CE} = –5 V, I_C = –500 mA*[2]
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	–1	—	—	–1	V	I_C = –500 mA, I_B = –50 mA
Base to emitter voltage	V_{BE}	—	—	–1.5	—	—	–1.5	V	V_{CE} = –5 V, I_C = –150 mA
Gain bandwidth product	f_T	—	140	—	—	140	—	MHz	V_{CE} = –5 V, I_C = –150 mA
Collector output capacitance	Cob	—	27	—	—	27	—	pF	V_{CB} = –10 V, I_E = 0, f = 1 MHz

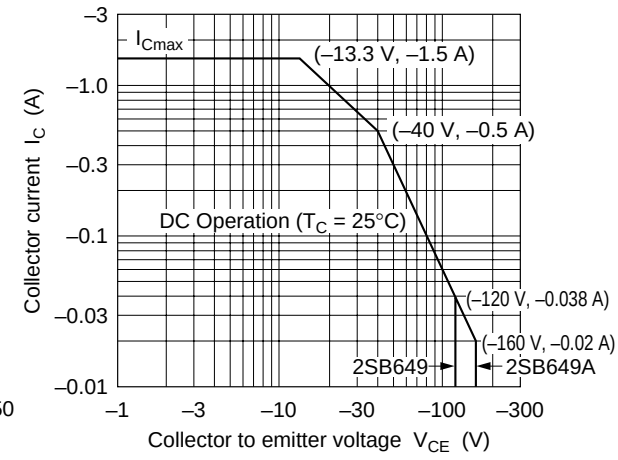
Notes: 1. The 2SB649 and 2SB649A are grouped by h_{FE1} as follows.
2. Pulse test

	B	C	D
2SB649	60 to 120	100 to 200	160 to 320
2SB649A	60 to 120	100 to 200	—

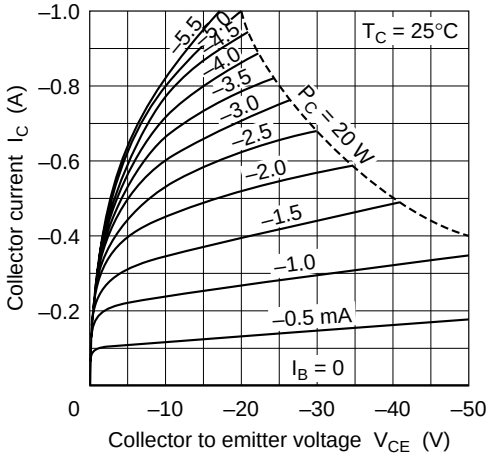
Maximum Collector Dissipation Curve



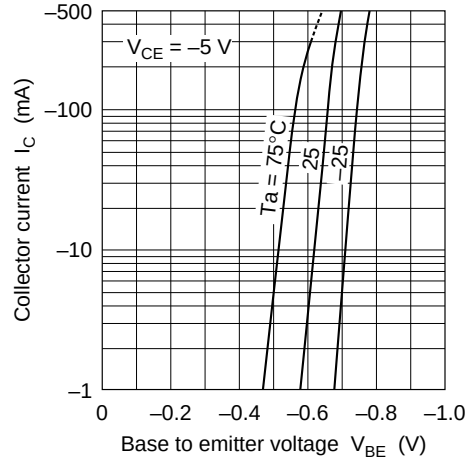
Area of Safe Operation



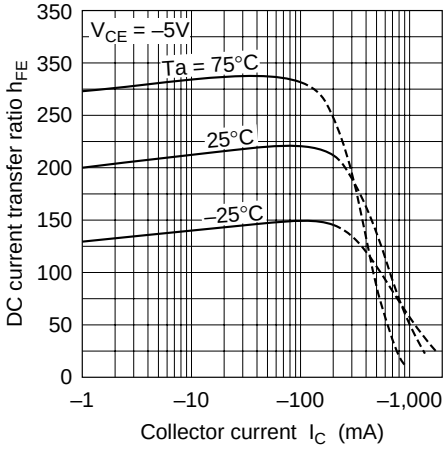
Typical Output Characteristics



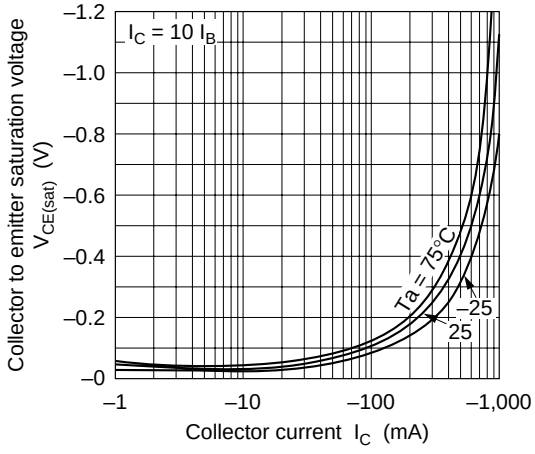
Typical Transfer Characteristics



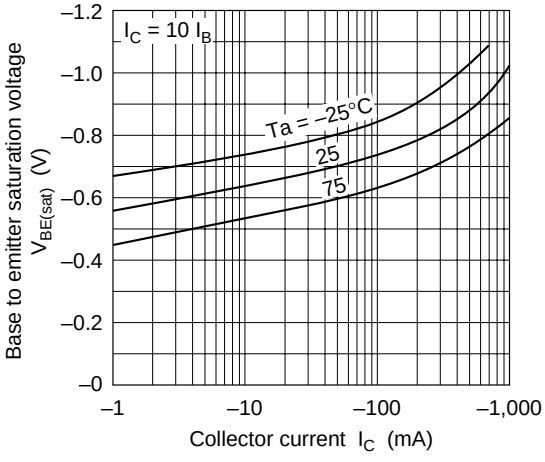
DC Current Transfer Ratio
vs. Collector Current



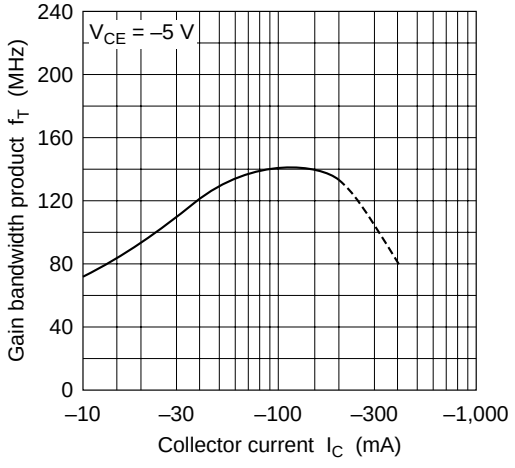
Collector to Emitter Saturation
Voltage vs. Collector Current



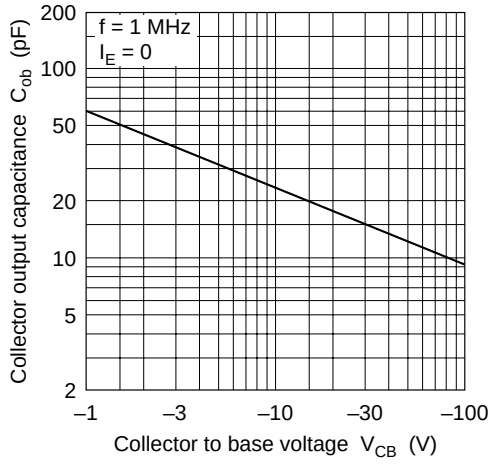
Base to Emitter Saturation Voltage
vs. Collector Current



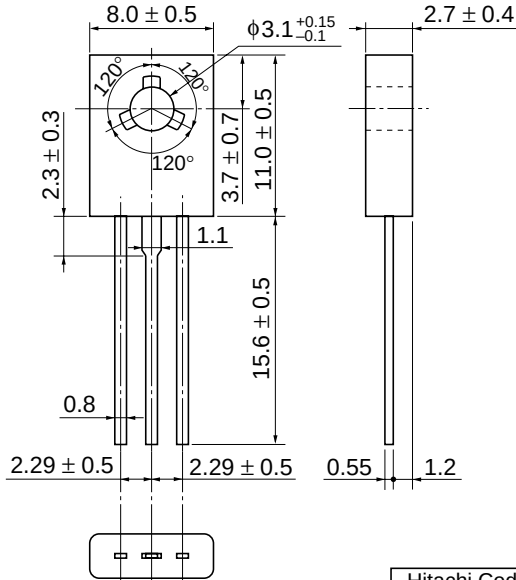
Gain Bandwidth Product
vs. Collector Current

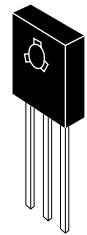


Collector Output Capacitance vs.
Collector to Base Voltage



Unit: mm





Hitachi Code	TO-126 Mod
JEDEC	—
EIAJ	—
Weight (reference value)	0.67 g

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Telex: 40815 HITEC HX

TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL TYPE

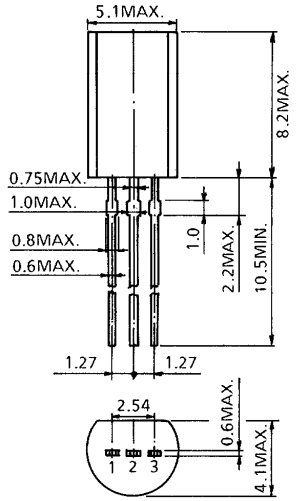
2SC2383

COLOR TV VERT. DEFLECTION OUTPUT APPLICATIONS

COLOR TV CLASS B SOUND OUTPUT APPLICATIONS

- High Voltage : V_{CEO} = 160 V
- Large Continuous Collector Current Capability.
- Recommended for Vert. Deflection Output & Sound Output Applications for Line Operated TV.
- Complementary to 2SA1013

Unit in mm



1. EMITTER
2. COLLECTOR
3. BASE

JEDEC	TO-92MOD
EIAJ	—
TOSHIBA	2-5J1A

Weight : 0.36 g

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	160	V
Collector-Emitter Voltage	V_{CEO}	160	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	1	A
Base Current	I_B	0.5	A
Collector Power Dissipation	P_C	900	mW
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{stg}	−55~150	°C

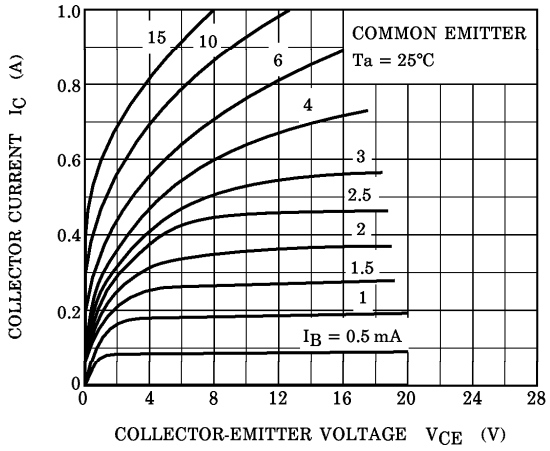
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB} = 150 V, I_E = 0	—	—	1.0	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 6 V, I_C = 0	—	—	1.0	μA
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = 10 mA, I_B = 0	160	—	—	V
DC Current Gain	h_{FE} (Note)	V_{CE} = 5 V, I_C = 200 mA	60	—	320	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 500 mA, I_B = 50 mA	—	—	1.5	V
Base-Emitter Voltage	V_{BE}	V_{CE} = 5 V, I_C = 5 mA	0.45	—	0.75	V
Transition Frequency	f_T	V_{CE} = 5 V, I_C = 200 mA	20	100	—	MHz
Collector Output Capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz	—	—	20	pF

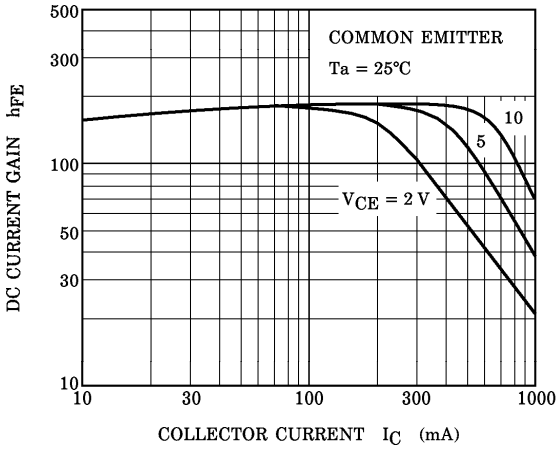
(Note) : h_{FE} Classification R : 60~120, O : 100~200, Y : 160~320

961001EAA2

$I_C - V_{CE}$



$h_{FE} - I_C$



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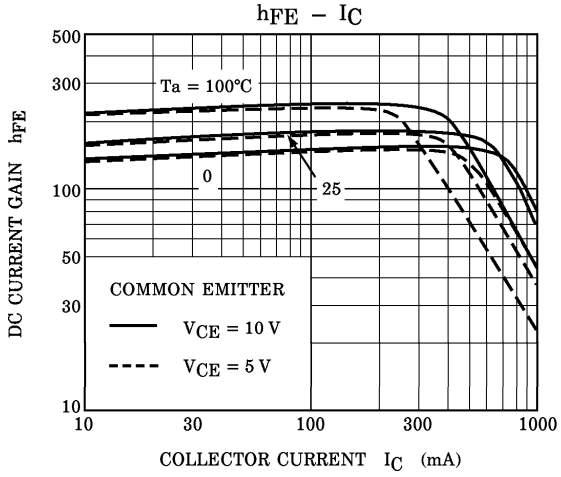
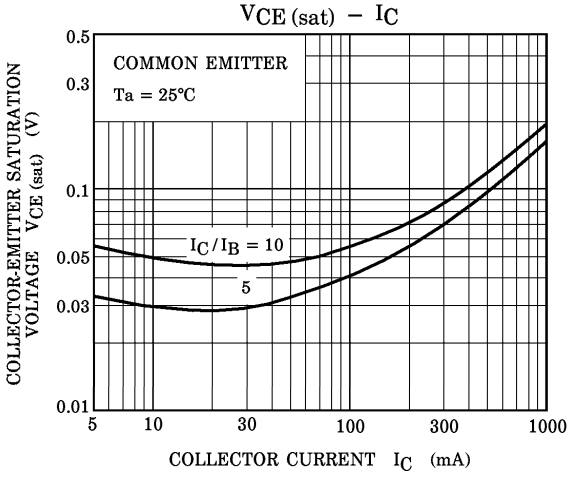
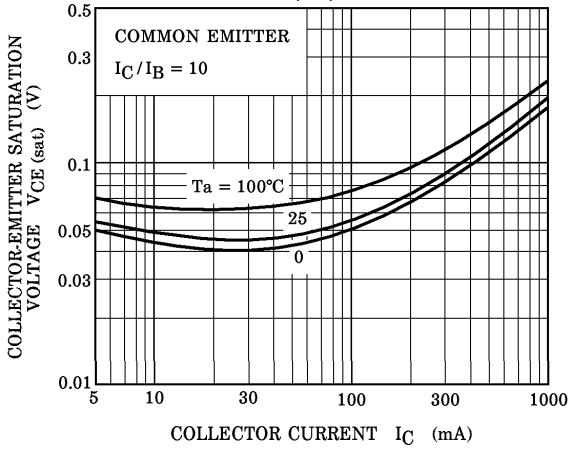


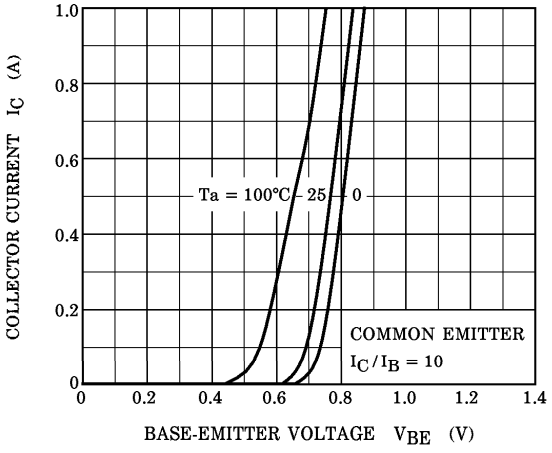
$V_{CE\,(sat)} - I_C$



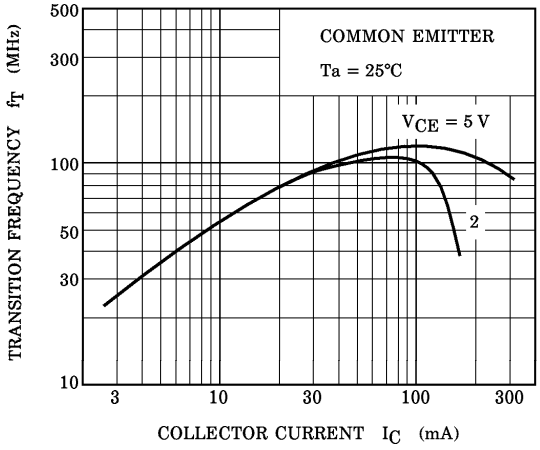
$V_{CE\,(sat)} - I_C$



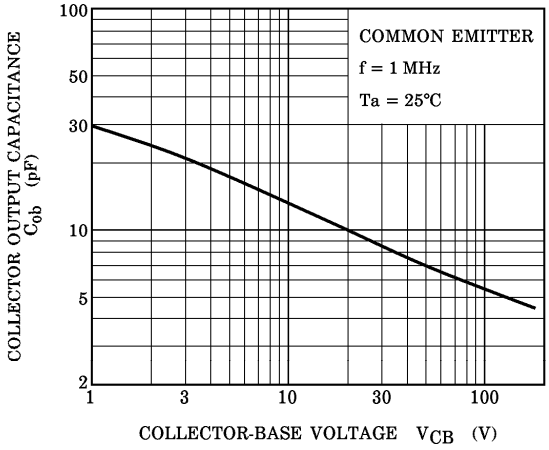
$I_C - V_{BE}$



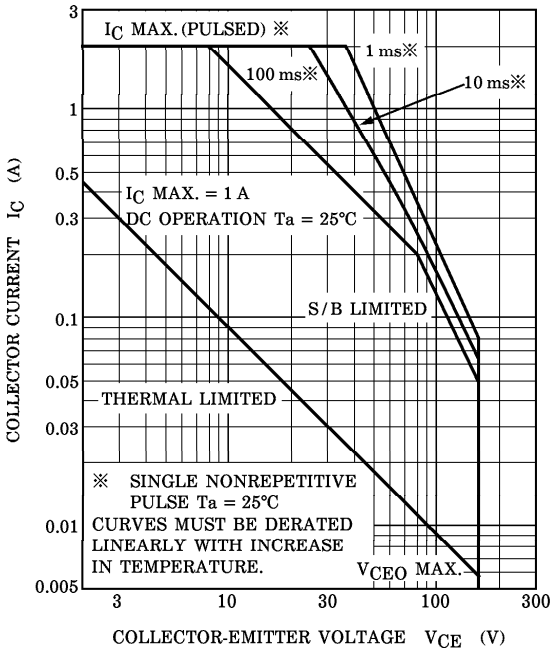
f_T – I_C



C_{ob} – V_{CB}



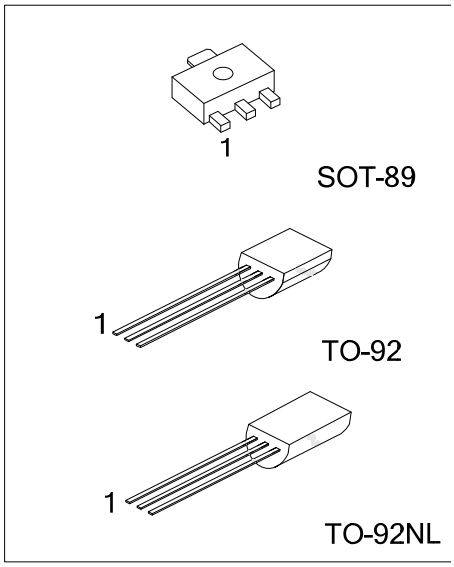
SAFE OPERATING AREA



2SA1013

PNP EPITAXIAL SILICON TRANSISTOR

PNP EPITAXIAL SILICON TRANSISTOR



■ DESCRIPTION

The UTC **2SA1013** is a PNP epitaxial silicon transistor, it uses UTC's advanced technology to provide the customers with high BV_{CEO} and high DC current gain, etc.

The UTC **2SA1013** is suitable for power switching and color TV vertical deflection output, etc.

■ FEATURES

* High BV_{CEO}
* High DC current gain
* Large continuous collector current capability

■ ORDERING INFORMATION

Ordering Number		Package	Pin assignment			Packing
Lead Free	Halogen Free		1	2	3	
2SA1013L-x-AB3-R	2SA1013G-x-AB3-R	SOT-89	B	C	E	Tape Reel
2SA1013L-x-T92-B	2SA1013G-x-T92-B	TO-92	B	C	E	Tape Box
2SA1013L-x-T92-K	2SA1013G-x-T92-K	TO-92	B	C	E	Bulk
2SA1013L-x-T9N-B	2SA1013G-x-T9N-B	TO-92NL	B	C	E	Tape Box
2SA1013L-x-T9N-K	2SA1013G-x-T9N-K	TO-92NL	B	C	E	Bulk

2SA1013L-x-AB3-R

(1)Packing Type	(1) R: Tape Reel, B: Tape Box
(2)Package Type	(2) AB3: SOT-89, T92: TO-92, T9N: TO-92NL
(3)Rank	(3) refer to Classification of h_{FE}
(4)Lead Free	(4) L: Lead Free, G: Halogen Free

■ ABSOLUTE MAXIMUM RATINGS (T_A=25°C)

PARAMETER		SYMBOL	RATINGS	UNIT
Collector-Base Voltage		V_{CBO}	-160	V
Collector-Emitter Voltage		V_{CEO}	-160	V
Emitter-Base Voltage		V_{EBO}	-6	V
Collector Current		I_C	-1	A
Base Current		I_B	-0.5	A
Collector Power Dissipation	SOT-89	P_C	500	W
	TO-92/TO-92NL		900	W
Junction Temperature		T_J	150	°C
Storage Temperature		T_{STG}	-55 ~150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

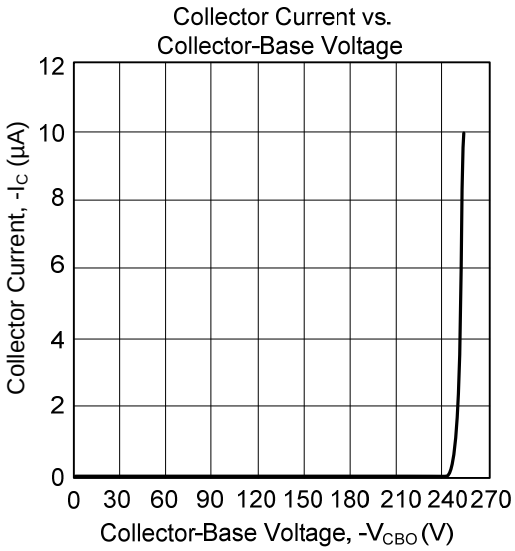
■ ELECTRICAL CHARACTERISTICS (T_A =25°C)

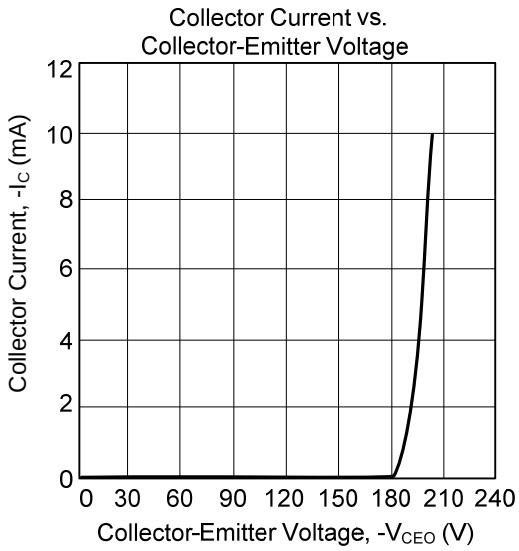
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Collector Cut-Off Current	I_{CBO}	V_{CB}=-150V, I_E=0			-1.0	μA
Emitter Cut-Off Current	I_{EBO}	V_{EB}=-6V, I_C=0			-1.0	μA
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C=-10mA, I_B=0	-160			V
DC Current Gain	h_{FE}	V_{CE}=-5V, I_C=-200mA	60		320	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=-500mA, I_B=-50mA			-1.5	V
Base-Emitter Voltage	V_{BE}	V_{CE}=-5V, I_C=-5mA	-0.45		-0.75	V
Transition Frequency	f_T	V_{CE}=-5V, I_C=-200mA	15	50		MHz
Collector Output Capacitance	C_{ob}	V_{CB}=-10V, f=1MHz, I_E=0			35	pF

■ CLASSIFICATION OF h_{FE}

RANK	R	O	P
RANGE	60~120	100~200	160~320

■ TYPICAL CHARACTERISTICS

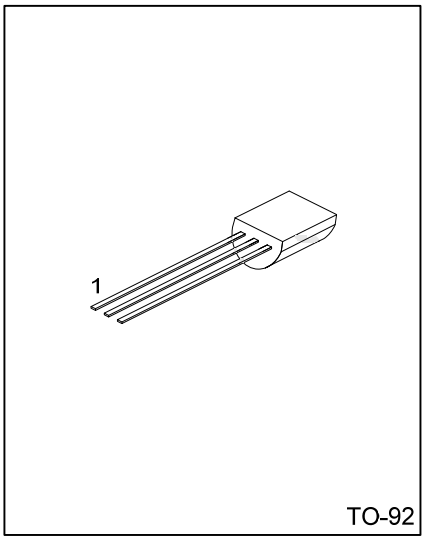




2SA1015

PNP SILICON TRANSISTOR

LOW FREQUENCY PNP AMPLIFIER TRANSISTOR



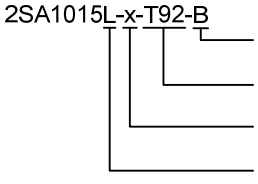
Lead-free: 2SA1015L
Halogen-free: 2SA1015G

■ FEATURES

* Collector-Emitter Voltage: BV_{CEO}=-50V
* Collector Current up to 150mA
* High h_{FE} Linearity
* Complement to UTC 2SC1815

■ ORDERING INFORMATION

Ordering Number			Package	Pin Assignment			Packing
Normal	Lead Free Plating	Halogen Free		1	2	3	
2SA1015-x-T92-B	2SA1015L-x-T92-B	2SA1015G-x-T92-B	TO-92	E	C	B	Tape Box
2SA1015-x-T92-K	2SA1015L-x-T92-K	2SA1015G-x-T92-K	TO-92	E	C	B	Bulk



(1) B: Tape Box, K:Bulk

(2) T92: TO-92

(3) x: refer to Classification of h_{FE}

(4) G: Halogen Free, L: Lead Free Plating, Blank: Pb/Sn

■ ABSOLUTE MAXIMUM RATING (Ta=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Collector-Base Voltage	V_{CBO}	-50	V
Collector-Emitter Voltage	V_{CEO}	-50	V
Emitter-Base Voltage	V_{EBO}	-5	V
Collector Current	I_C	-150	mA
Base Current	I_B	-50	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	T_J	125	°C
Storage Temperature	T_{STG}	-55 ~ +125	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified)

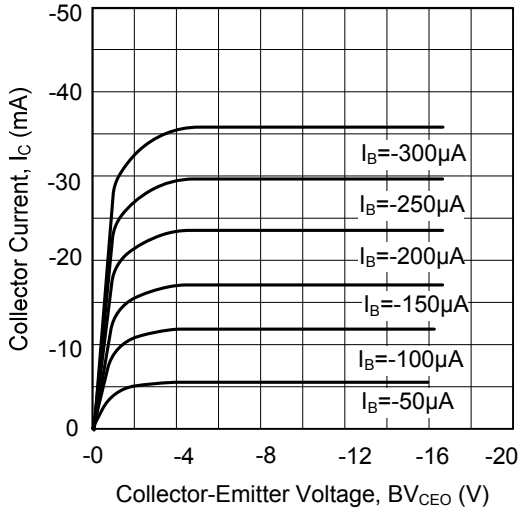
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=-100μA, I_E=0	-50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=-10mA, I_B=0	-50			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=-10μA, I_C=0	-5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=-50V, I_E=0			-100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=-5V, I_C=0			-100	nA
DC Current Gain	h_{FE1}	V_{CE}=-6V, I_C=-2mA	120		700	
	h_{FE2}	V_{CE}=-6V, I_C=-150mA	25			
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_C=-100mA, I_B=-10mA		-0.1	-0.3	V
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	I_C=-100mA, I_B=-10mA			-1.1	V
Output Capacitance	C_{OB}	V_{CB}=-10V, I_E=0, f=1MHz		4.0	7.0	pF
Current Gain Bandwidth Product	f_T	V_{CE}=-10V, Ic=-1mA	80			MHz
Noise Figure	NF	V_{CE}=-6V , I_C=-0.1mA, R_G=1kΩ, f=100Hz		0.5	6	dB

■ CLASSIFICATION OF h_{FE1}

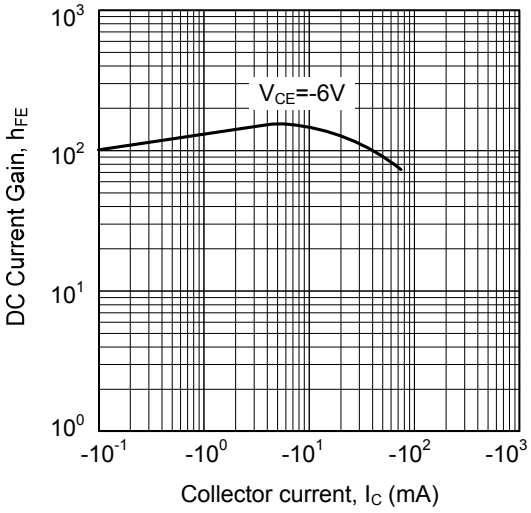
RANK	Y	GR	BL
RANGE	120-240	200-400	350-700

■ TYPICAL CHARACTERISTICS

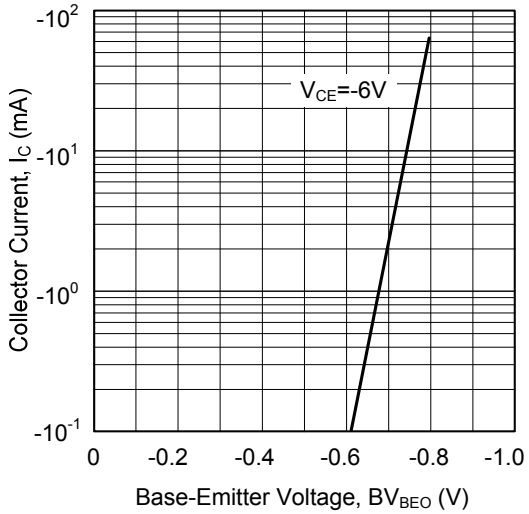
Static characteristics



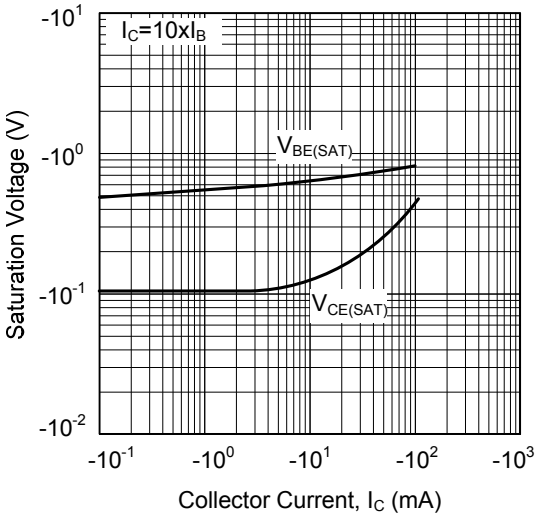
DC Current Gain



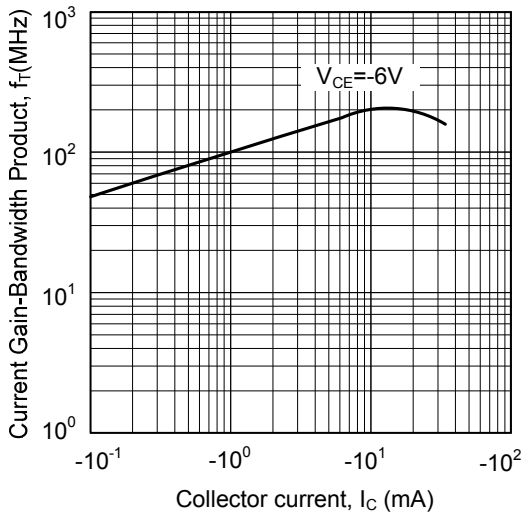
Base-Emitter on Voltage



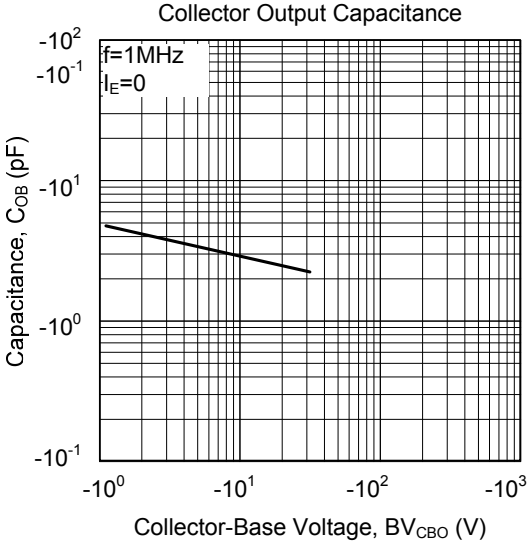
Saturation voltage



Current Gain-Bandwidth Product



Collector Output Capacitance



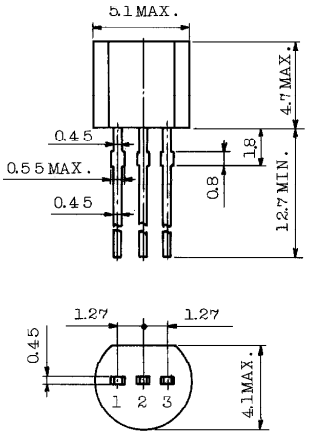
TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL TYPE (PCT PROCESS)

2SC1815

AUDIO FREQUENCY GENERAL PURPOSE AMPLIFIER APPLICATIONS.
DRIVER STAGE AMPLIFIER APPLICATIONS.

- High Voltage and High Current
  : V_{CEO} = 50V (Min.), I_C = 150mA (Max.)
- Excellent h_{FE} Linearity
  : $h_{FE(2)}$ = 100 (Typ.) at V_{CE} = 6V, I_C = 150mA
  : h_{FE} (I_C = 0.1mA) / h_{FE} (I_C = 2mA) = 0.95 (Typ.)
- Low Noise : NF = 1dB (Typ.) at f = 1kHz
- Complementary to 2SA1015 (O, Y, GR class)

Unit in mm



1. EMITTER
2. COLLECTOR
3. BASE

JEDEC	TO-92
EIAJ	SC-43
TOSHIBA	2-5F1B

Weight : 0.21g

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	150	mA
Base Current	I_B	50	mA
Collector Power Dissipation	P_C	400	mW
Junction Temperature	T_j	125	°C
Storage Temperature Range	T_{stg}	−55~125	°C

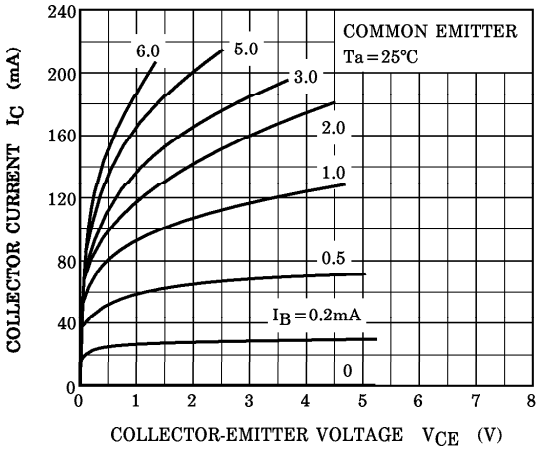
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB} = 60V, I_E = 0	—	—	0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 5V, I_C = 0	—	—	0.1	μA
DC Current Gain	$h_{FE(1)}$ (Note)	V_{CE} = 6V, I_C = 2mA	70	—	700	
	$h_{FE(2)}$	V_{CE} = 6V, I_C = 150mA	25	100	—	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 100mA, I_B = 10mA	—	0.1	0.25	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C = 100mA, I_B = 10mA	—	—	1.0	V
Transition Frequency	f_T	V_{CE} = 10V, I_C = 1mA	80	—		MHz
Collector Ouput Capacitance	C_{ob}	V_{CB} = 10V, I_E = 0, f = 1MHz	—	2.0	3.5	pF
Base Intrinsic Resistance	$r_{bb'}$	V_{CE} = 10V, I_E = −1mA f = 30MHz	—	50	—	Ω
Noise Figure	NF	V_{CE} = 6V, I_C = 0.1mA f = 1kHz, R_G = 10kΩ	—	1.0	10	dB

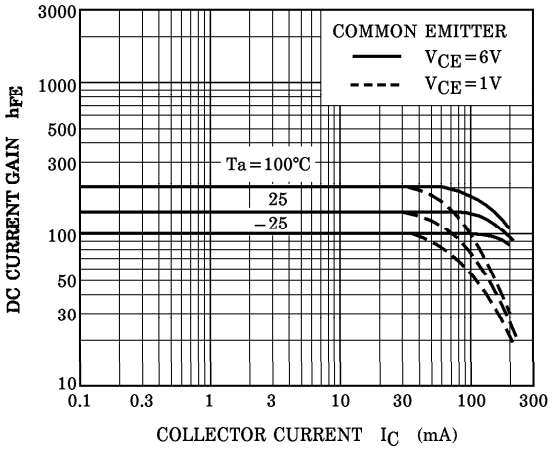
Note : h_{FE} Classification O : 70~140 Y : 120~240 GR : 200~400 BL : 350~700

961001EAA2

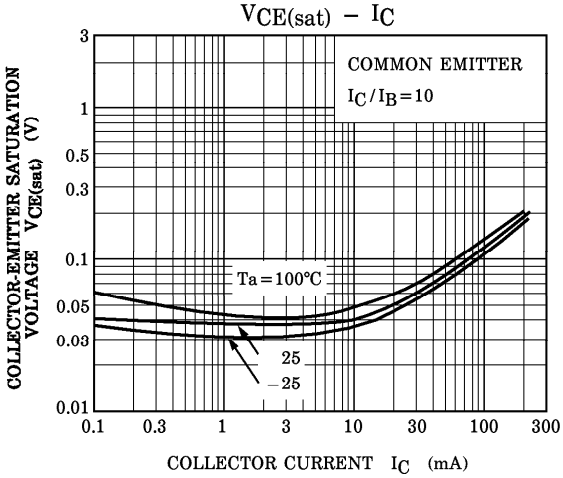
I_C – V_{CE}



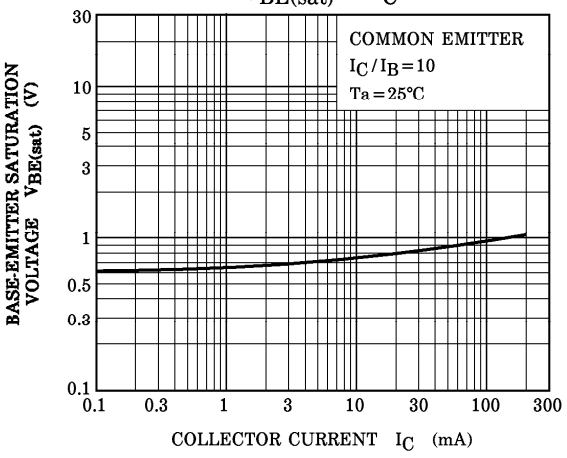
h_{FE} – I_C



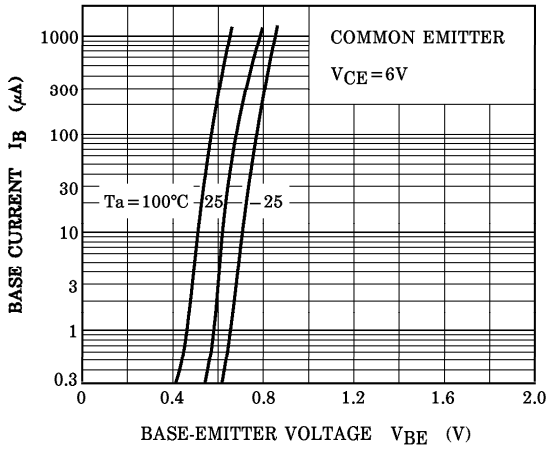
$V_{CE(sat)}$ – I_C



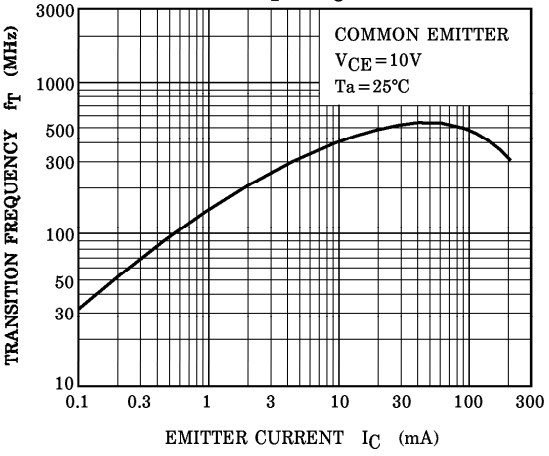
$V_{BE(sat)}$ – I_C



I_B – V_{BE}

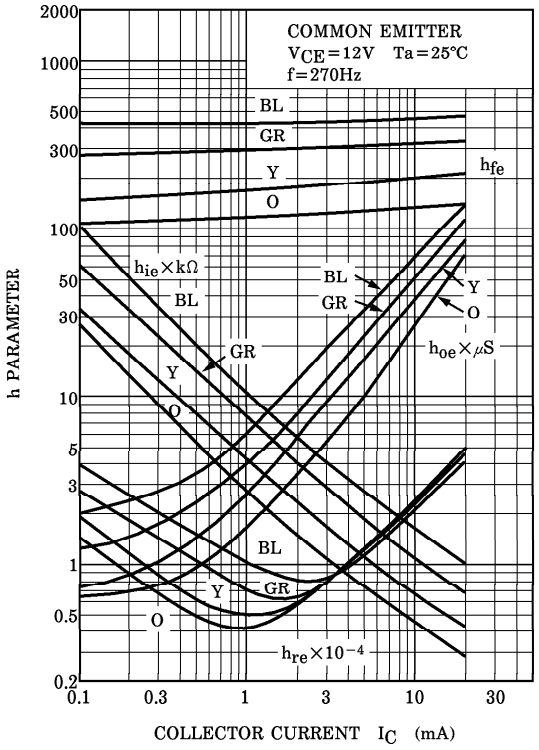


f_T – I_C

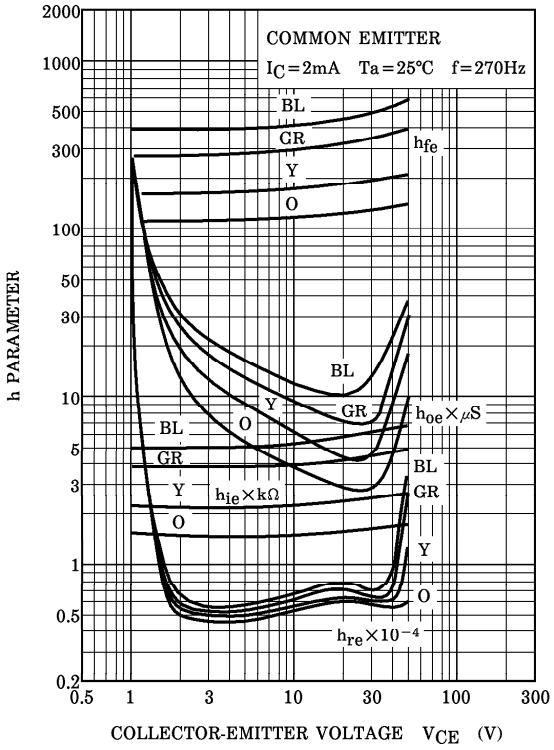


961001EAA2'

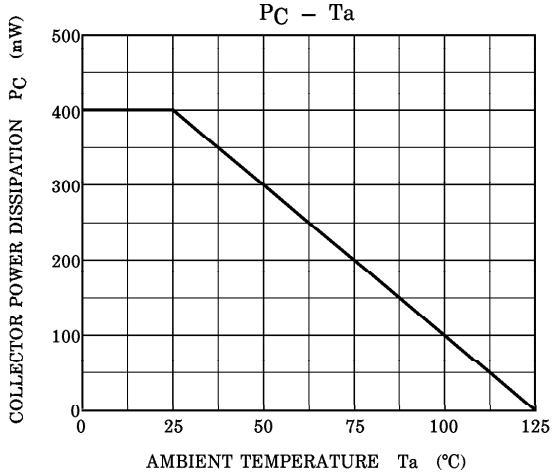
h PARAMATER – I_C



h PARAMATER – V_{CE}



P_C – Ta



1N4001 - 1N4007

1.0A RECTIFIER

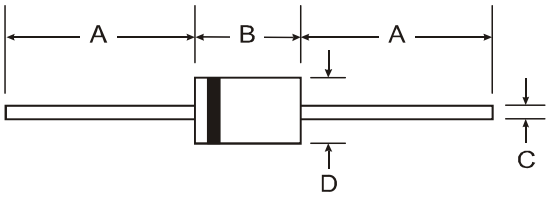
Please click here to visit our online spice models database.

Features

- Diffused Junction
- High Current Capability and Low Forward Voltage Drop
- Surge Overload Rating to 30A Peak
- Low Reverse Leakage Current
- **Lead Free Finish, RoHS Compliant (Note 3)**

Mechanical Data

- Case: DO-41
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals: Finish - Bright Tin. Plated Leads Solderable per MIL-STD-202, Method 208
- Polarity: Cathode Band
- Mounting Position: Any
- Ordering Information: See Page 2
- Marking: Type Number
- Weight: 0.30 grams (approximate)



Dim	DO-41 Plastic	
	Min	Max
A	25.40	—
B	4.06	5.21
C	0.71	0.864
D	2.00	2.72
All Dimensions in mm		

Maximum Ratings and Electrical Characteristics @T_A = 25°C unless otherwise specified

Single phase, half wave, 60Hz, resistive or inductive load.
For capacitive load, derate current by 20%.

Characteristic	Symbol	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	800	1000	V
RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	280	420	560	700	V
Average Rectified Output Current (Note 1) @ T_A = 75°C	I_O	1.0							A
Non-Repetitive Peak Forward Surge Current 8.3ms single half sine-wave superimposed on rated load	I_{FSM}	30							A
Forward Voltage @ I_F = 1.0A	V_{FM}	1.0							V
Peak Reverse Current @T_A = 25°C at Rated DC Blocking Voltage @ T_A = 100°C	I_{RM}	5.0 50							μA
Typical Junction Capacitance (Note 2)	C_j	15				8			pF
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	100							K/W
Maximum DC Blocking Voltage Temperature	T_A	+150							°C
Operating and Storage Temperature Range	T_J, T_{STG}	-65 to +150							°C

Notes:
1. Leads maintained at ambient temperature at a distance of 9.5mm from the case.
2. Measured at 1.0 MHz and applied reverse voltage of 4.0V DC.
3. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied, see EU Directive 2002/95/EC Annex Notes.

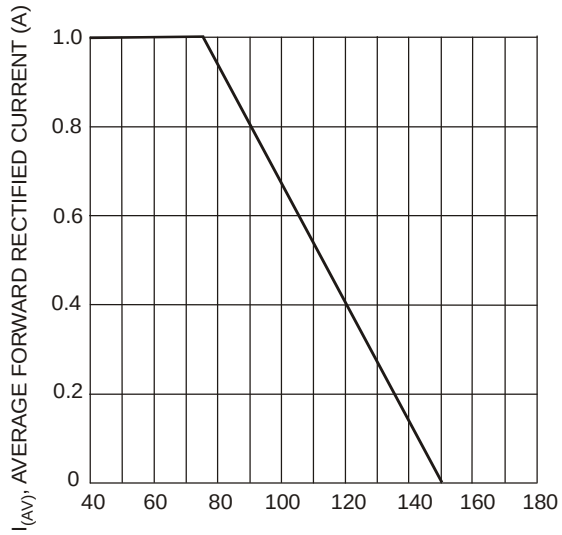


Fig. 1 Forward Current Derating Curve

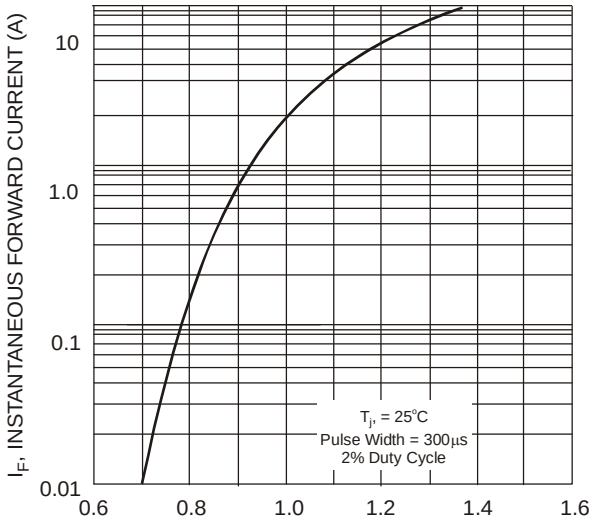


Fig. 2 Typical Forward Characteristics

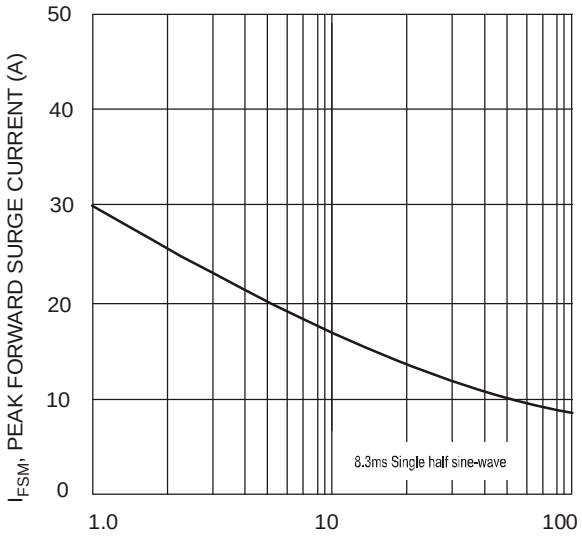


Fig. 3 Max Non-Repetitive Peak Fwd Surge Current

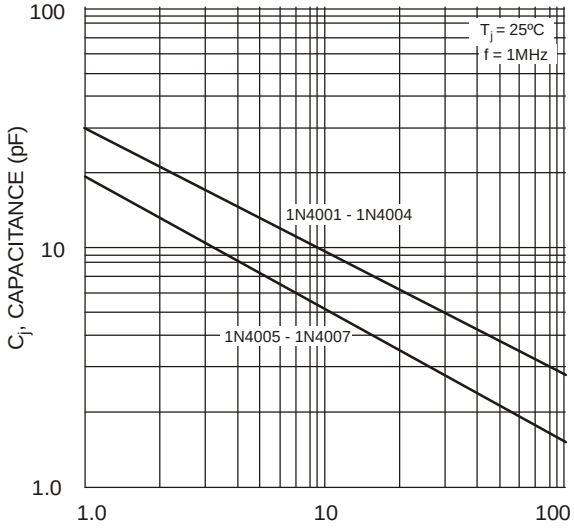


Fig. 4 Typical Junction Capacitance

Ordering Information (Note 4)

Device	Packaging	Shipping
1N4001-B	DO-41 Plastic	1K/Bulk
1N4001-T	DO-41 Plastic	5K/Tape & Reel, 13-inch
1N4002-B	DO-41 Plastic	1K/Bulk
1N4002-T	DO-41 Plastic	5K/Tape & Reel, 13-inch
1N4003-B	DO-41 Plastic	1K/Bulk
1N4003-T	DO-41 Plastic	5K/Tape & Reel, 13-inch
1N4004-B	DO-41 Plastic	1K/Bulk
1N4004-T	DO-41 Plastic	5K/Tape & Reel, 13-inch
1N4005-B	DO-41 Plastic	1K/Bulk
1N4005-T	DO-41 Plastic	5K/Tape & Reel, 13-inch
1N4006-B	DO-41 Plastic	1K/Bulk
1N4006-T	DO-41 Plastic	5K/Tape & Reel, 13-inch
1N4007-B	DO-41 Plastic	1K/Bulk
1N4007-T	DO-41 Plastic	5K/Tape & Reel, 13-inch

Notes: 4. For packaging details, visit our website at http://www.diodes.com/datasheets/ap02008.pdf.

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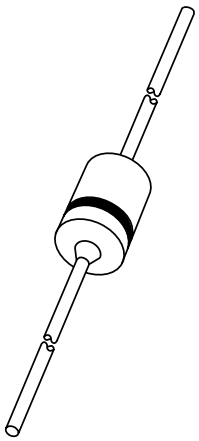
DATA SHEET



1N914
High-speed diode

Product specification
Supersedes data of 1996 Sep 03

1999 May 26

Philips
Semiconductors

PHILIPS

High-speed diode 1N914

FEATURES

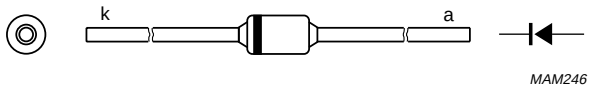
- Hermetically sealed leaded glass SOD27 (DO-35) package
- High switching speed: max. 4 ns
- Continuous reverse voltage: max. 75 V
- Repetitive peak reverse voltage: max. 100 V
- Repetitive peak forward current: max. 225 mA.

APPLICATIONS

- High-speed switching.

DESCRIPTION

The 1N914 is a high-speed switching diode fabricated in planar technology, and encapsulated in a hermetically sealed leaded glass SOD27 (DO-35) package.



The diode is type branded.

Fig.1 Simplified outline (SOD27; DO-35) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{RRM}	repetitive peak reverse voltage		–	100	V
V_R	continuous reverse voltage		–	75	V
I_F	continuous forward current	see Fig.2; note 1	–	75	mA
I_{FRM}	repetitive peak forward current		–	225	mA
I_{FSM}	non-repetitive peak forward current	square wave; T_j = 25 °C prior to surge; see Fig.4			
		t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note 1	–	250	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	175	°C

Note

1. Device mounted on an FR4 printed circuit-board; lead length 10 mm.

ELECTRICAL CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 10 mA; see Fig.3	1	V
I_R	reverse current	see Fig.5		
		V_R = 20 V	25	nA
		V_R = 75 V	5	µA
		V_R = 20 V; T_j = 150 °C	50	µA
C_d	diode capacitance	f = 1 MHz; V_R = 0; see Fig.6	4	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	8	ns
		when switched from I_F = 10 mA to I_R = 60 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.7	4	ns
V_{fr}	forward recovery voltage	when switched from I_F = 50 mA; t_r = 20 ns; see Fig.8	2.5	V

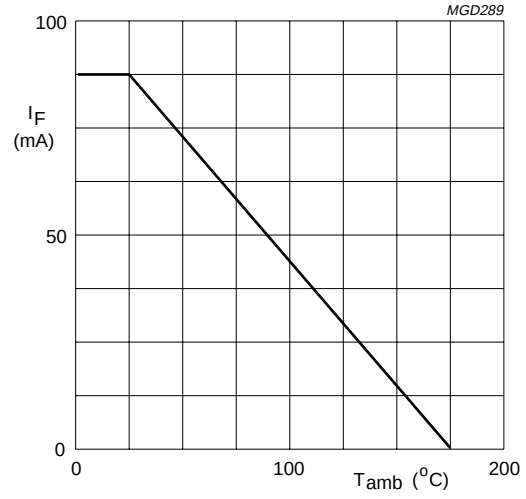
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}tp}$	thermal resistance from junction to tie-point	lead length 10 mm	240	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	lead length 10 mm; note 1	500	K/W

Note

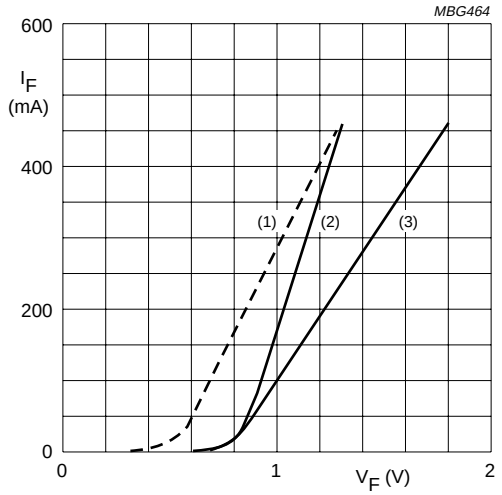
1. Device mounted on a printed circuit-board without metallization pad.

GRAPHICAL DATA



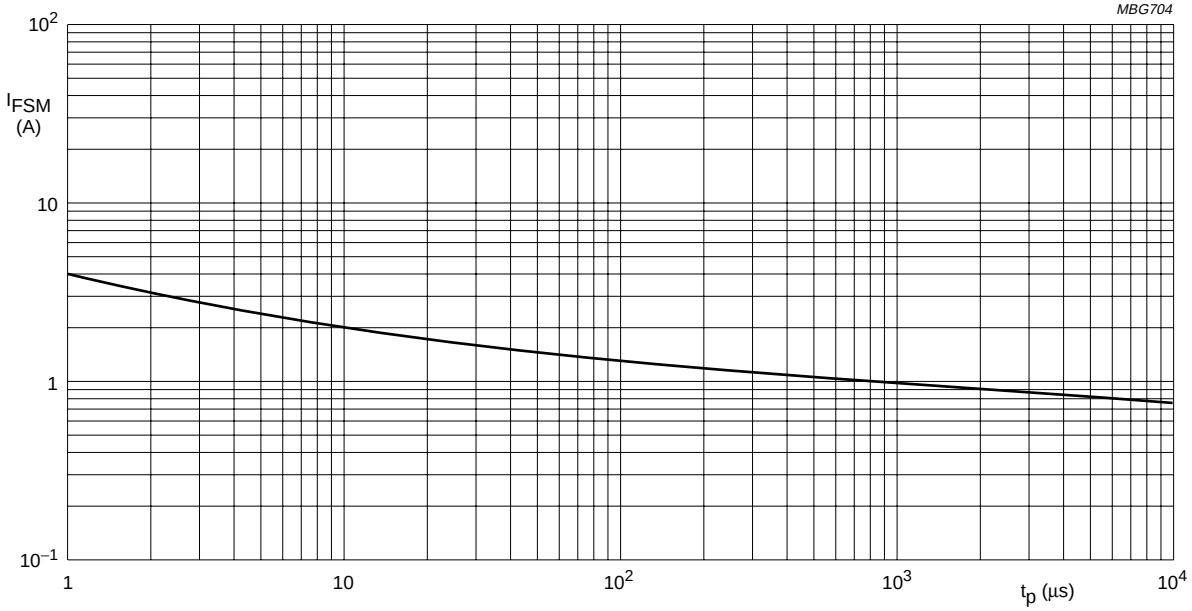
Device mounted on an FR4 printed-circuit board; lead length 10 mm.

Fig.2 Maximum permissible continuous forward current as a function of ambient temperature.



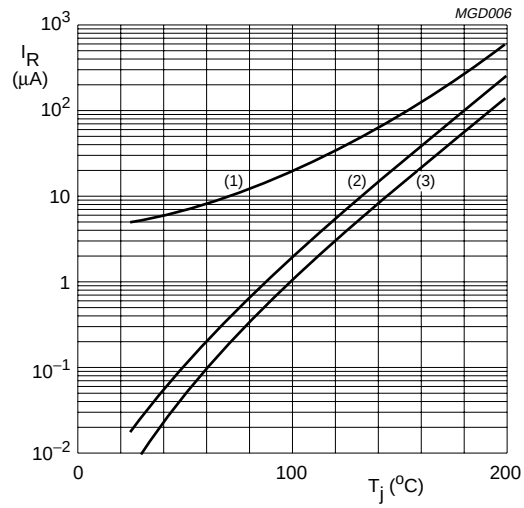
(1) T_j = 175 °C; typical values.
(2) T_j = 25 °C; typical values.
(3) T_j = 25 °C; maximum values.

Fig.3 Forward current as a function of forward voltage.



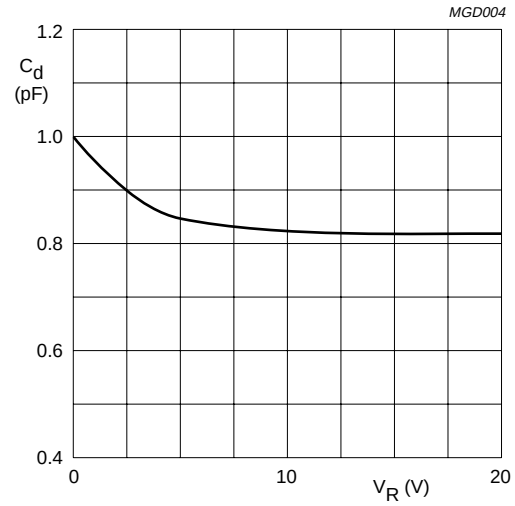
Based on square wave currents.
T_j = 25 °C prior to surge.

Fig.4 Maximum permissible non-repetitive peak forward current as a function of pulse duration.



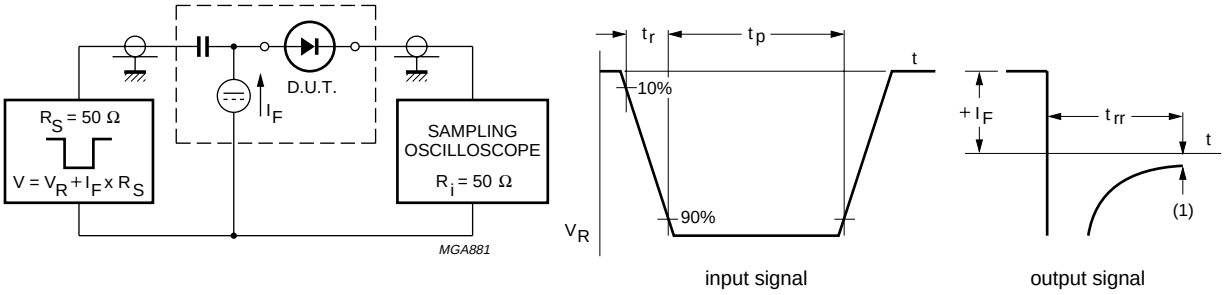
(1) V_R = 75 V; maximum values.
(2) V_R = 75 V; typical values.
(3) V_R = 20 V; typical values.

Fig.5 Reverse current as a function of junction temperature.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage; typical values.



(1) I_R = 1 mA.

Fig.7 Reverse recovery voltage test circuit and waveforms.

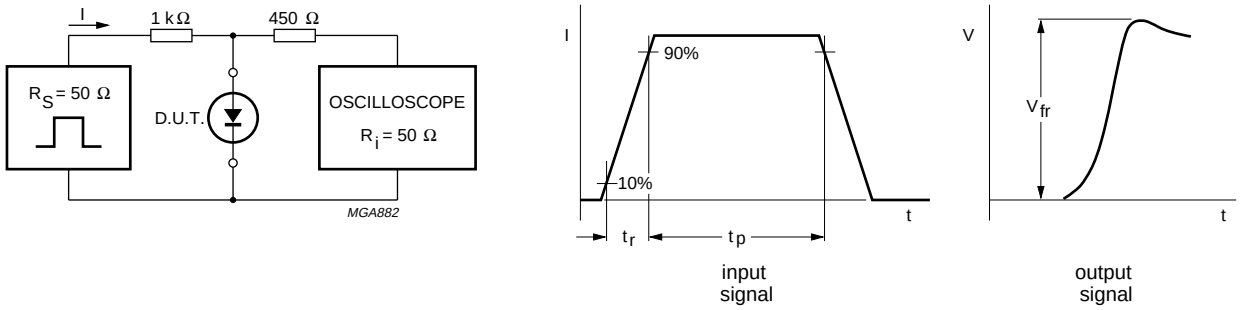
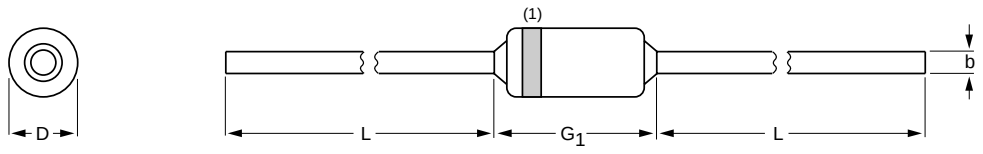


Fig.8 Forward recovery voltage test circuit and waveforms.

PACKAGE OUTLINE

Hermetically sealed glass package; axial leaded; 2 leads **SOD27**



DIMENSIONS (mm are the original dimensions)

UNIT	b max.	D max.	G_1 max.	L min.
mm	0.56	1.85	4.25	25.4

0 1 2 mm
scale

Note

1. The marking band indicates the cathode.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOD27	A24	DO-35	SC-40			97-06-09

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

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