NPN Transistor Bare Die, 2N3013

Rev 1.0
02/09/17

Very High Speed Saturated Switch in bare die form
Complement PNP 2N4209 or 2N5771

Features:

- Collector current up to 200mA
- Fast t_{on} + t_{off} switching times
- Characterized at temperature extremes
- High Reliability Gold Back Metal
- High Reliability tested grades for Military + Space

Ordering Information:

The following part suffixes apply:

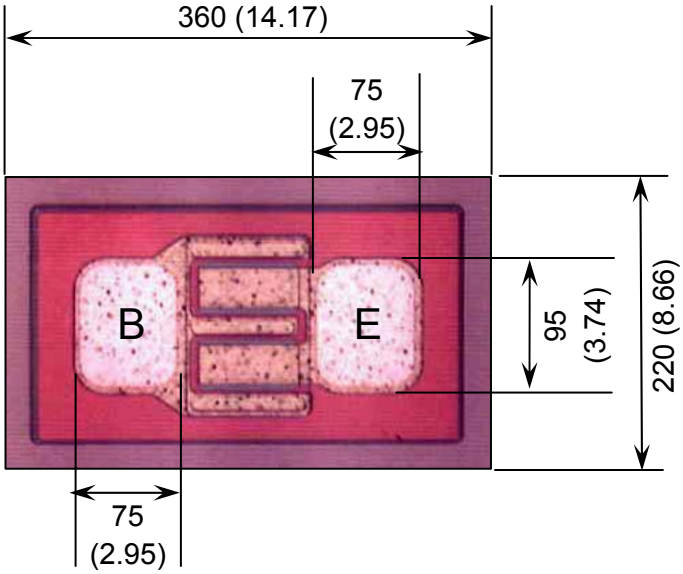
- No suffix - MIL-STD-750 /2072 Visual Inspection
- "**H**" - MIL-STD-750 /2072 Visual Inspection
  + MIL-PRF-38534 Class H LAT
- "**K**" - MIL-STD-750 /2072 Visual Inspection
  + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

www.siliconsupplies.com\quality\bare-die-lot-qualification

Die Dimensions in µm (mils)



E = EMITTER, **B** = BASE

DIE BACK = COLLECTOR

Supply Formats:

- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – Specific request
- Unsawn Wafer – Specific request
- With additional electrical selection – Specific request
- Sawn as pairs or adjacent pair pick – Specific request

Mechanical Specification

Die Size (Excluding Saw Street)	360 x 220 14.17 x 8.66	µm mils
Base Pad Size Emitter Pad Size	75 x 95 2.95 x 3.74	µm mils
Die Thickness	180 (±20) 7.09 (±0.79)	µm mils
Top Metal Composition	Al - 1.3µm	
Back Metal Composition	AuAs - 0.9µm	

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Rev 1.0
07/07/17

Absolute Maximum Ratings T_A = 25°C unless otherwise stated

PARAMETER	SYMBOL	VALUE	UNIT
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	15	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Junction & Storage Temperature	T_J, T_{stg}	-55 to 150	°C

Electrical Characteristics T_A = 25°C unless otherwise stated

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 10µA, I_E = 0	40	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = 10mA, I_B = 0	15	-	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	I_C = 100µA, V_{BE} = 0	40	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = 10µA, I_C = 0	5	-	-	V
Collector Cutoff Current	I_{CES}	V_{CE} = 20V, V_{BE} = 0V	-	-	300	nA
		T_A = +125°C, V_{CE} = 20V, V_{BE} = 0V	-	-	40	µA
ON CHARACTERISTICS						
Forward-Current Transfer Ratio	h_{FE}	V_{CE} = 0.4V, I_C = 30mA	30	-	120	-
		T_A = -55°C, V_{CE} = 0.4V, I_C = 30mA	12	-	-	-
		V_{CE} = 0.5V, I_C = 100mA	25	-	-	-
		V_{CE} = 1V, I_C = 300mA	15	-	-	-
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 30mA, I_B = 3mA	-	-	0.18	V
		T_A = +125°C, I_C = 30mA, I_B = 3mA	-	-	0.25	V
		I_C = 100mA, I_B = 10mA	-	-	0.28	V
		I_C = 300mA, I_B = 30mA	-	-	0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	I_C = 30mA, I_B = 3mA	0.75	-	0.95	V
		I_C = 100mA, I_B = 10mA,	-	-	1.20	V
		I_C = 300mA, I_B = 30mA	-	-	1.70	V
SMALL SIGNAL CHARACTERISTICS[1]						
Current Gain – Bandwidth Product	f_T	I_C = 30mA, V_{CE} = 10V, f = 100MHz	350	-	-	MHz
Output Capacitance	C_{obo}	V_{CB} = 5V, I_E = 0, f = 1MHz	-	-	4	pF
Input Capacitance	C_{ibo}	V_{EB} = 0.5V, I_C = 0, f = 1MHz	-	-	5	
SWITCHING CHARACTERISTICS[1]						
Turn-On Time	t_{on}	V_{CC} = 15V, I_C = 300mA I_{B1} = 30mA	-	-	15	ns
Turn-Off Time	t_{off}	V_{CC} = 15V, I_C = 300mA I_{B1} = I_{B2} = 30mA	-	-	25	
Storage Time	t_s	I_{B1} = I_{B1} = I_C = 10mA	-	-	18	

Note 1: Not production testing in die form, characterized by chip design and tested in package LAT

Typical Electrical Characteristics

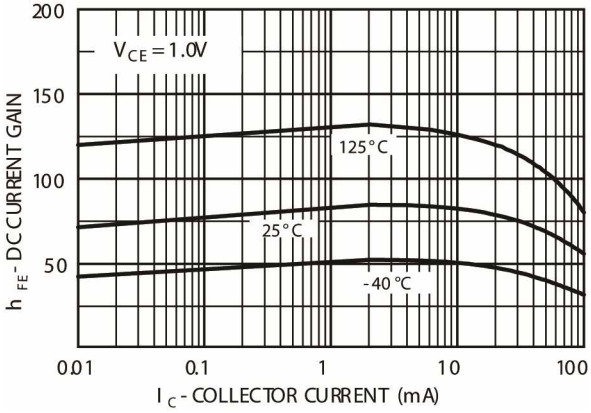

Fig 1 - DC Current Gain versus Collector Current

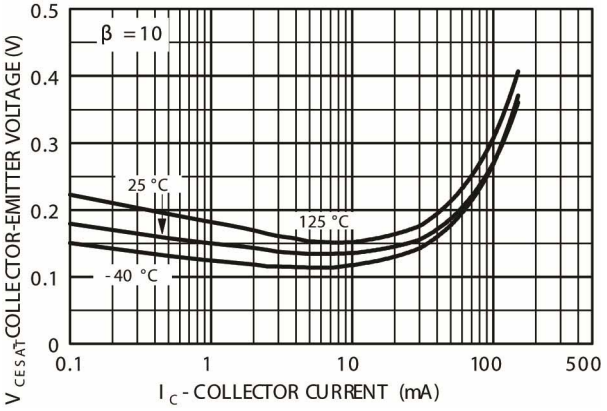

Fig 2 - Collector-Emitter Saturation Voltage versus Collector Current

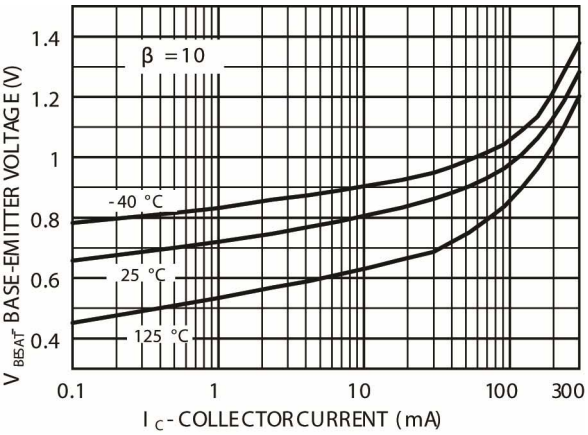

Fig 3 - Base-Emitter Saturation Voltage versus Collector Current

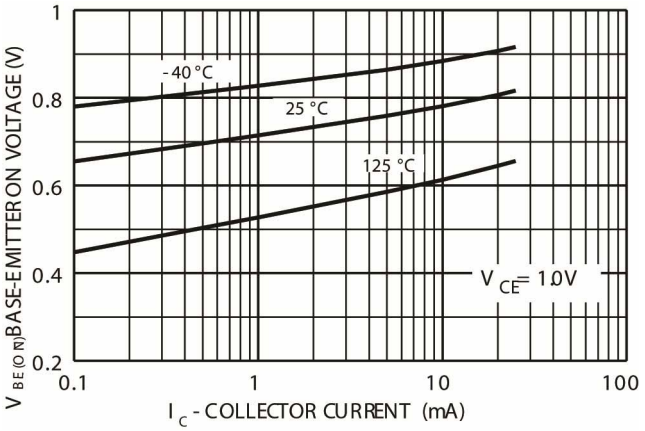

Fig 4 - Base-Emitter ON Voltage versus Collector Current

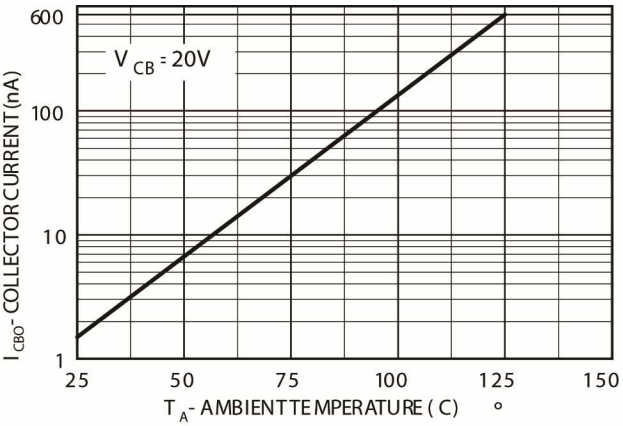

Fig 5 - Collector-Cut-off Current versus Ambient Temperature

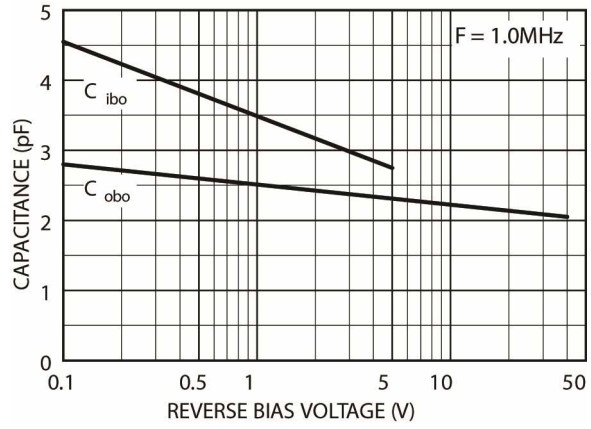

Fig 6 - Output Capacitance versus Reverse Bias Voltage

Typical Electrical Characteristics (Continued)

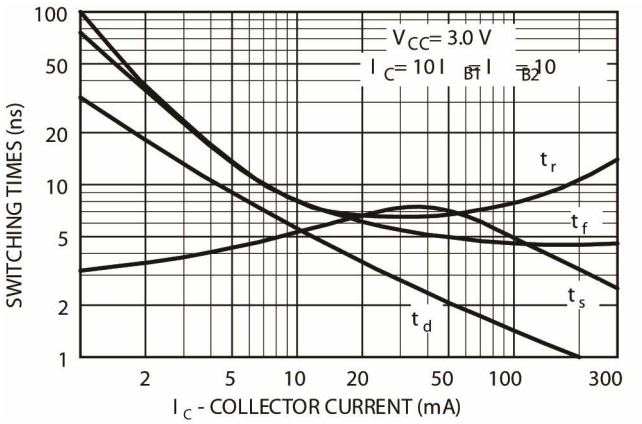

Fig 7 - Switching Times versus Collector Current

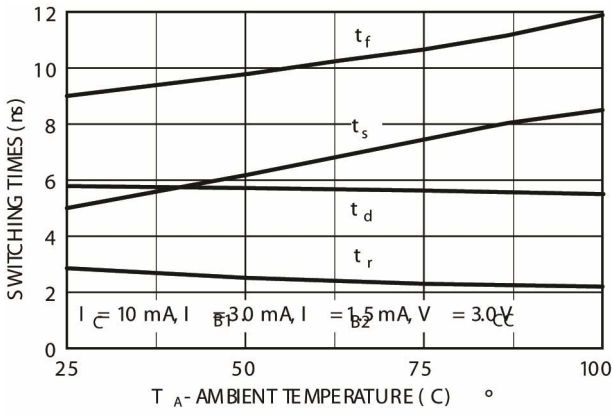

Fig 8 - Switching Times versus Ambient Temperature

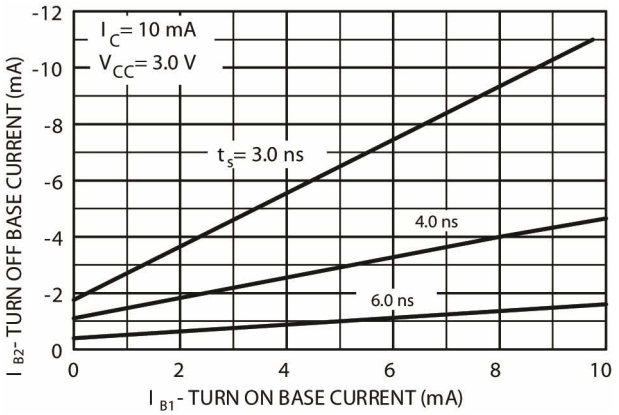

Fig 8 - Storage Time versus Turn On and Turn Off Base Currents

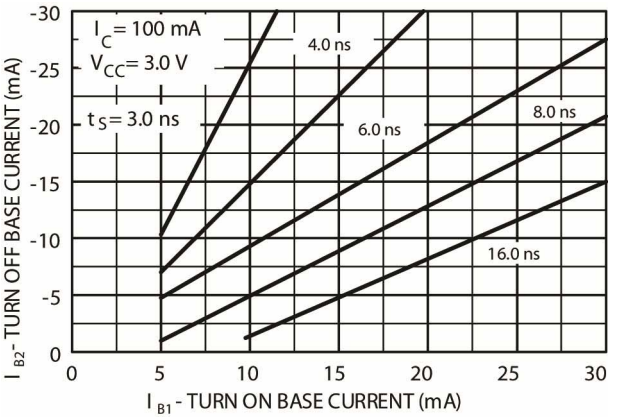

Fig 9 - Storage Time versus Turn On and Turn Off Base Currents

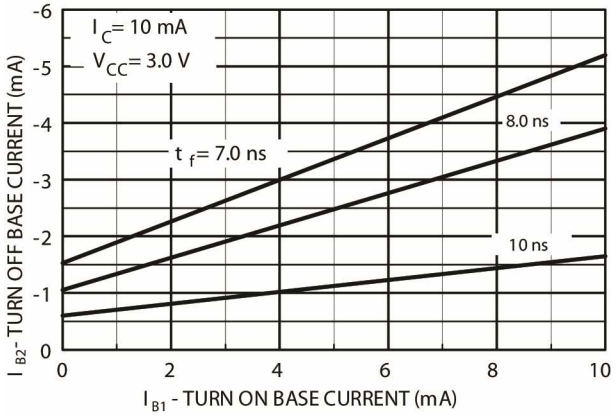

Fig 10 - Fall Time versus Turn On and Turn Off Base Currents

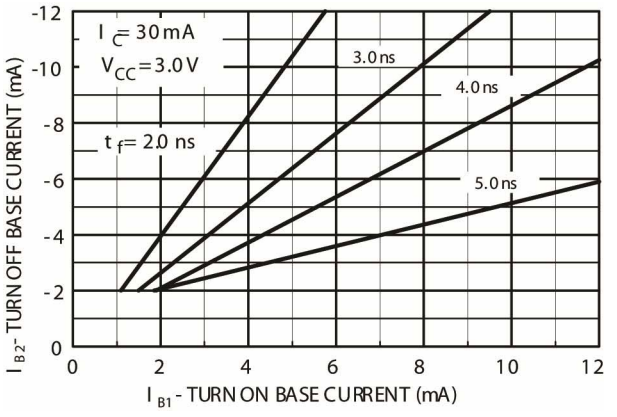

Fig 11 - Fall Time versus Turn On and Turn Off Base Currents

Typical Electrical Characteristics (Continued)

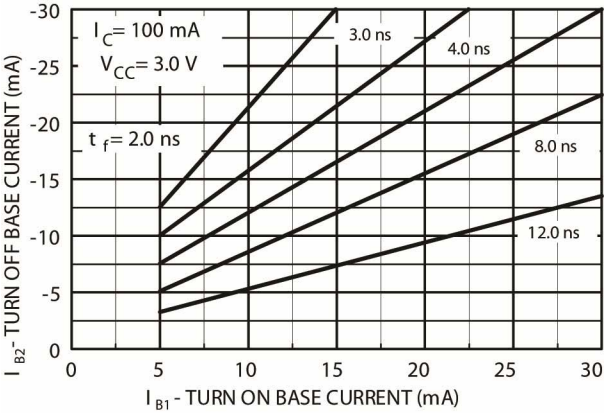

Fig 12 - Fall Time versus Turn On and Turn Off Base Currents

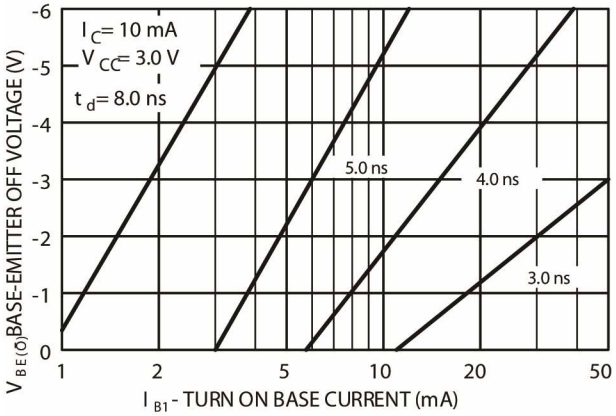

Fig 13 - Delay Time versus Base-Emitter OFF Voltage and Turn On Base Current

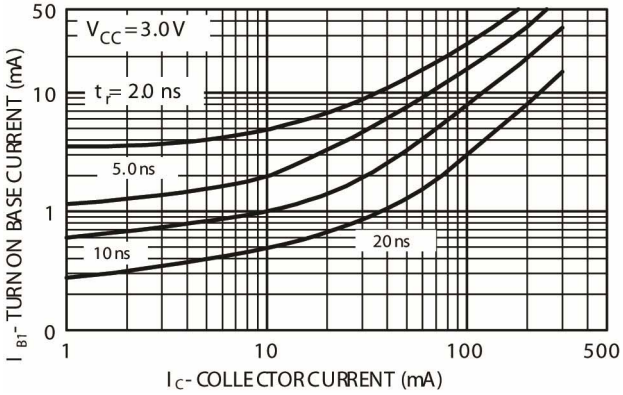

Fig 14 - Rise Time vs. Turn On Base Current and Collector Current