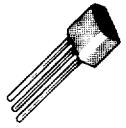
NPN Silicon Planar Medium Power Transistors

ZTX650 ZTX651 ZTX652 ZTX653

FEATURES

- 1.5W power dissipation at $T_{amb} = 25°C$*
- 2V continuous I_C
- Excellent gain characteristics to 2A
- High V_{CEO}: up to 100V
- Low saturation voltages
- Guaranteed h_{FE} specified up to 2A
- Fast switching
- Exceptional price-to-power ratio
- Complementary types



Plastic E-Line
(TO-92 Compatible)

DESCRIPTION

A range of high performance medium power transistors encapsulated in the popular E-line (TO-92) plastic package.

The 1.5W performance and outstanding electrical characteristics permit use in a wide variety of industrial and consumer applications including lamp and solenoid drivers, audio amplifiers and complementary drivers for hi-fi amplifiers.

In addition to achieving excellent linearity the devices are designed to function as high speed power switching transistors.

The specially selected silicone encapsulation provides resistance to severe environments comparable with metal can devices.

Complementary to ZTX750 series.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	ZTX650	ZTX651	ZTX652	ZTX653	Unit
Collector-base voltage	V_{CBO}	60	80	100	120	V
Collector-emitter voltage	V_{CEO}	45	60	80	100	V
Emitter-base voltage	V_{EBO}	5				V
Peak pulse current (see note)	I_{CM}	6				A
Continuous collector current	I_C	2				A
Practical power dissipation*	P_{totP}	1.5				W
Power dissipation at $T_{amb} = 25°C$ derate above 25°C at $T_{case} = 25°C$	P_{tot}	1 5.7 2.5				W mW/°C W
Operating & storage temp. range	$t_j : t_{stg}$	−55 to +200				°C

Note: Consult Safe Operating Area graph for conditions.

*The power which can be dissipated assuming device mounted in typical manner on P.C.B. with copper equal to 1 sq.inch minimum.

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CHARACTERISTICS (at $T_{amb} = 25°C$ unless otherwise stated).

Parameter	Symbol	ZTX650			ZTX651			Unit	Conditions
		Min.	Typ.	Max.	Min.	Typ.	Max.		
Collector-base breakdown voltage	$V_{(BR)CBO}$	60	–	–	80	–	–	V	$I_C = 100\mu A$
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	45	–	–	60	–	–	V	$I_C = 10mA$
Emitter-base breakdown voltage	$V_{(BR)EBO}$	5	–	–	5	–	–	V	$I_E = 100\mu A$
Collector cut-off current	I_{CBO}	–	–	0.1	–	–	–	μA	$V_{CB} = 45V$
		–	–	10	–	–	–	μA	$V_{CB} = 45V$, $T_{amb} = 100°C$
		–	–	–	–	–	0.1	μA	$V_{CB} = 60V$
		–	–	–	–	–	10	μA	$V_{CB} = 60V$, $T_{amb} = 100°C$
Emitter cut-off current	I_{EBO}	–	–	0.1	–	–	0.1	μA	$V_{EB} = 4V$
Collector-emitter saturation voltage	$V_{CE(sat)}$	–	0.12	0.3	–	0.12	0.3	V	$I_C = 1A$, $I_B = 100mA$*
		–	0.23	0.5	–	0.23	0.5	V	$I_C = 2A$, $I_B = 200mA$*
Base-emitter saturation voltage	$V_{BE(sat)}$	–	0.90	1.25	–	0.90	1.25	V	$I_C = 1A$, $I_B = 100mA$*
Base-emitter turn-on voltage	$V_{BE(on)}$	–	0.8	1	–	0.8	1	V	$I_C = 1A$, $V_{CE} = 2V$*
Static forward current transfer ratio	h_{FE}	70	200	–	70	200	–		$I_C = 50mA$, $V_{CE} = 2V$*
		100	200	300	100	200	300		$I_C = 500mA$, $V_{CE} = 2V$*
		80	170	–	80	170	–		$I_C = 1A$, $V_{CE} = 2V$*
		40	80	–	40	80	–		$I_C = 2A$, $V_{CE} = 2V$*
Transition frequency	f_T	140	175	–	140	175	–	MHz	$I_C = 100mA$, $V_{CE} = 5V$ $f = 100MHz$
Switching times	T_{on}	–	45	–	–	45	–	ns	$I_C = 500mA$, $I_{B1} = 50mA$ $I_{B2} = 50mA$, $V_{CC} = 10V$
	T_{off}	–	800	–	–	800	–	ns	
Output capacitance	C_{obo}	–	–	30	–	–	30	pF	$V_{CB} = 10V$, $f = 1MHz$

*Measured under pulsed conditions. Pulse width = 300μs. Duty cycle ≤ 2%.

THERMAL CHARACTERISTICS (ZTX650/3)

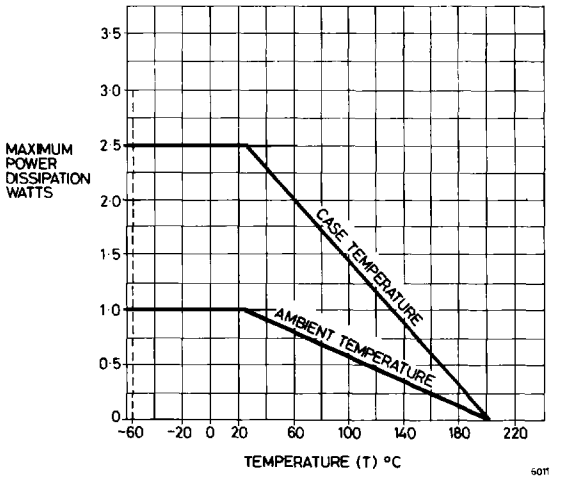
Parameter	Symbol	Maximum	Unit
Thermal resistance: Junction to ambient$_1$	$R_{th(j\text{-}amb)1}$	175	°C/W
Junction to ambient$_2$	$R_{th(j\text{-}amb)2}$†	116	°C/W
Junction to case	$R_{th(j\text{-}case)}$	70	°C/W

†Device mounted on P.C.B. with copper equal to 1 sq.inch minimum.

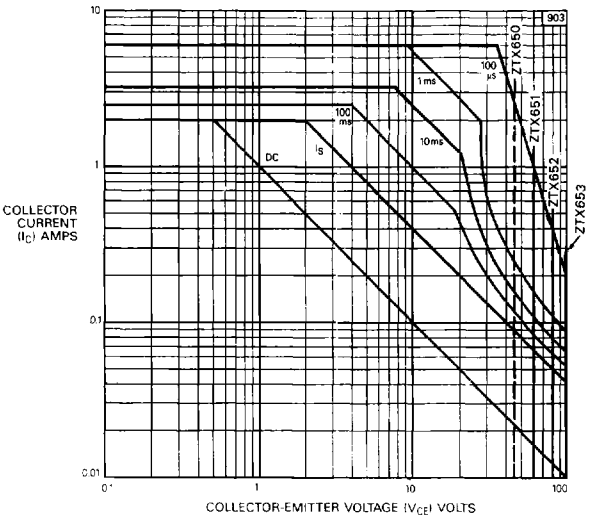
CHARACTERISTICS (at $T_{amb} = 25°C$ unless otherwise stated).

Parameter	Symbol	ZTX652			ZTX653			Unit	Conditions
		Min.	Typ.	Max.	Min.	Typ.	Max.		
Collector-base breakdown voltage	$V_{(BR)CBO}$	100	–	–	120	–	–	V	$I_C = 100\mu A$
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	80	–	–	100	–	–	V	$I_C = 10mA$
Emitter-base breakdown voltage	$V_{(BR)EBO}$	5	–	–	5	–	–	V	$I_E = 100\mu A$
Collector cut-off current	I_{CBO}	–	–	0.1	–	–	–	μA	$V_{CB} = 80V$
		–	–	10	–	–	–	μA	$V_{CB} = 80V$, $T_{amb} = 100°C$
		–	–	–	–	–	0.1	μA	$V_{CB} = 100V$
		–	–	–	–	–	10	μA	$V_{CB} = 100V$, $T_{amb} = 100°C$
Emitter cut-off current	I_{EBO}	–	–	0.1	–	–	0.1	μA	$V_{EB} = 4V$
Collector-emitter saturation voltage	$V_{CE(sat)}$	–	0.13	0.3	–	0.13	0.3	V	$I_C = 1A$, $I_B = 100mA$*
		–	0.23	0.5	–	0.23	0.5	V	$I_C = 2A$, $I_B = 200mA$*
Base-emitter saturation voltage	$V_{BE(sat)}$	–	0.90	1.25	–	0.90	1.25	V	$I_C = 1A$, $I_B = 100mA$*
Base-emitter turn-on voltage	$V_{BE(on)}$	–	0.8	1	–	0.8	1	V	$I_C = 1A$, $V_{CE} = 2V$*
Static forward current transfer ratio	h_{FE}	70	200	–	70	200	–		$I_C = 50mA$, $V_{CE} = 2V$*
		100	200	300	100	200	300		$I_C = 500mA$, $V_{CE} = 2V$*
		55	110	–	55	110	–		$I_C = 1A$, $V_{CE} = 2V$*
		25	55	–	25	55	–		$I_C = 2A$, $V_{CE} = 2V$*
Transition frequency	f_T	140	175	–	140	175	–	MHz	$I_C = 100mA$, $V_{CE} = 5V$ $f = 100MHz$
Switching times	T_{on}	–	80	–	–	80	–	ns	$I_C = 500mA$, $I_{B1} = 50mA$ $I_{B2} = 50mA$, $V_{CC} = 10V$
	T_{off}	–	1200	–	–	1200	–	ns	
Output capacitance	C_{obo}	–	–	30	–	–	30	pF	$V_{CB} = 10V$, $f = 1MHz$

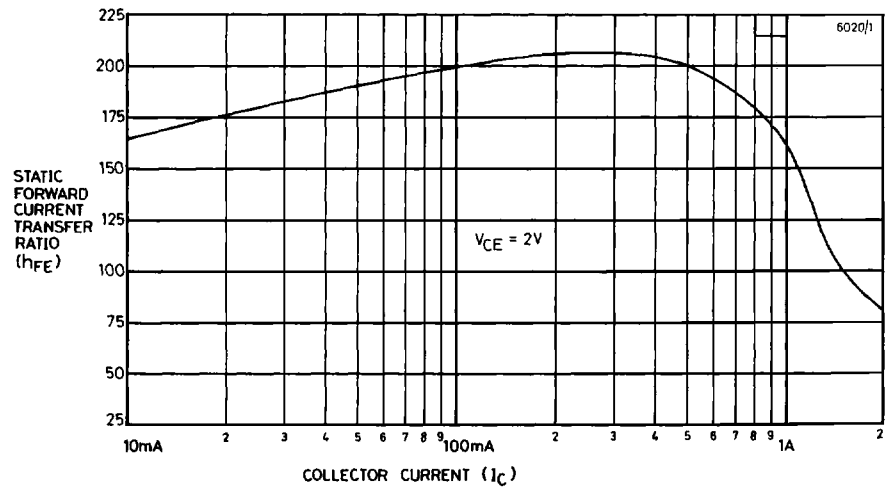
*Measured under pulsed conditions. Pulse width = 300μs. Duty cycle ≤ 2%.



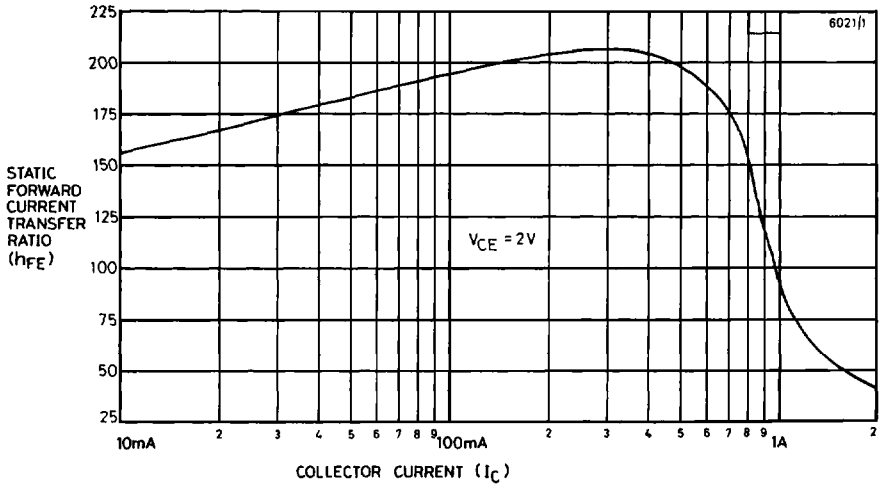
Dissipation derating curve for all types



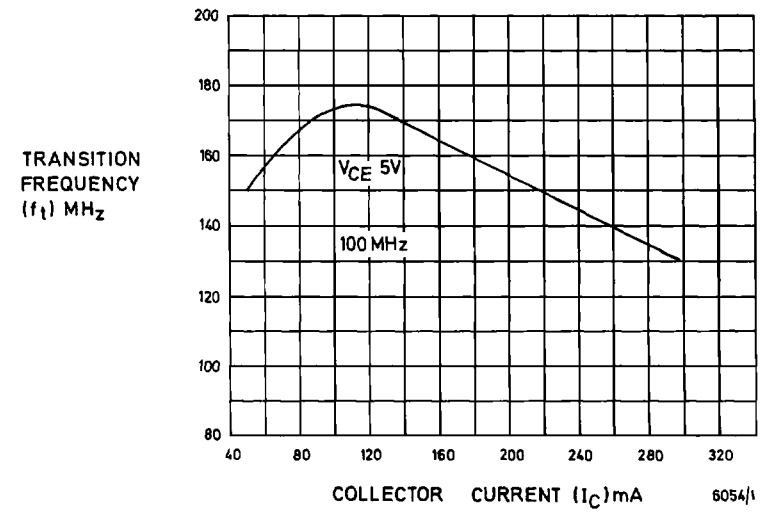
Safe operating area at $T_{amb} = 25°C$ (single pulse)



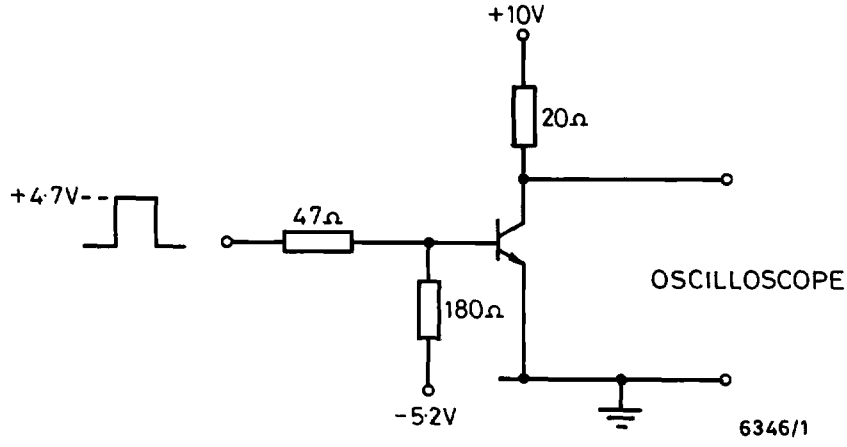
Static forward current transfer ratio plotted against collector current for ZTX650/ZTX651



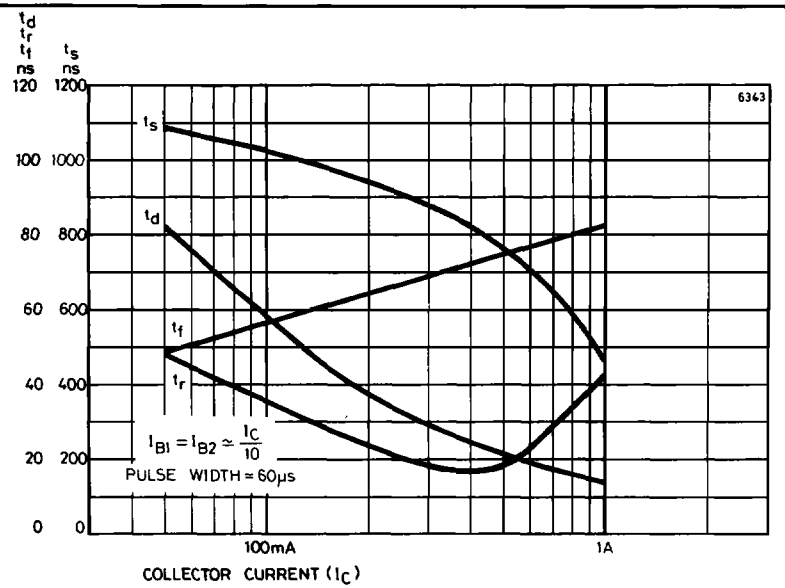
Static forward current transfer ratio plotted against collector current for ZTX652/ZTX653



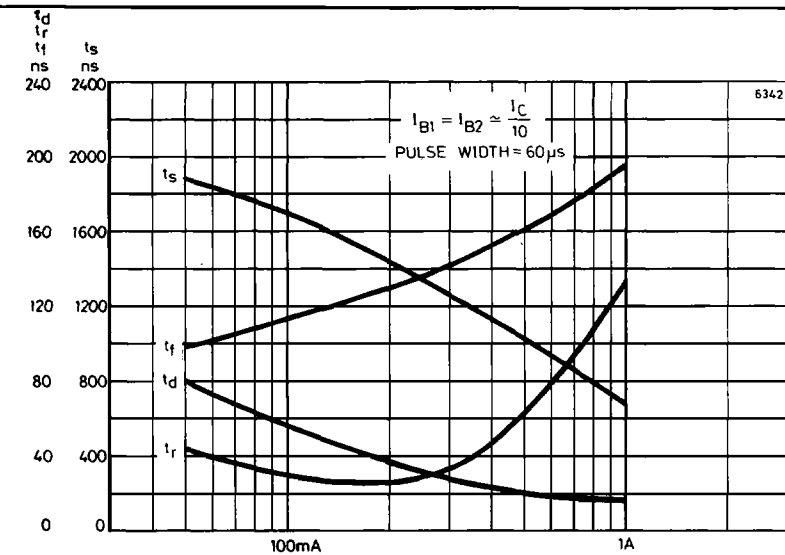
Typical transition frequency plotted against collector current for ZTX650



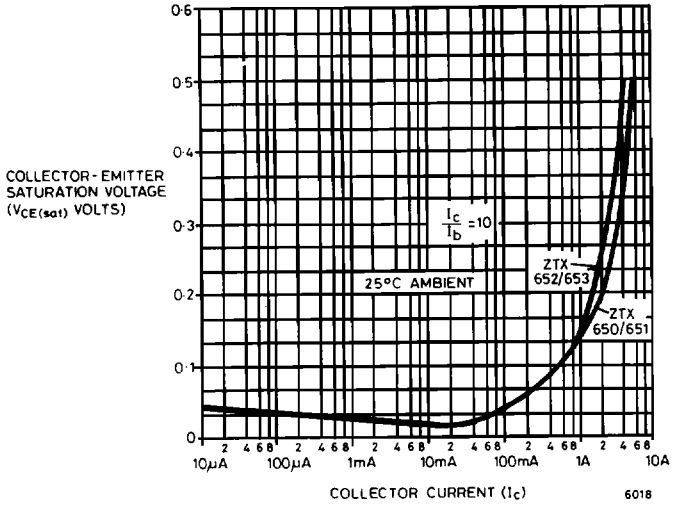
Switching speeds test circuit



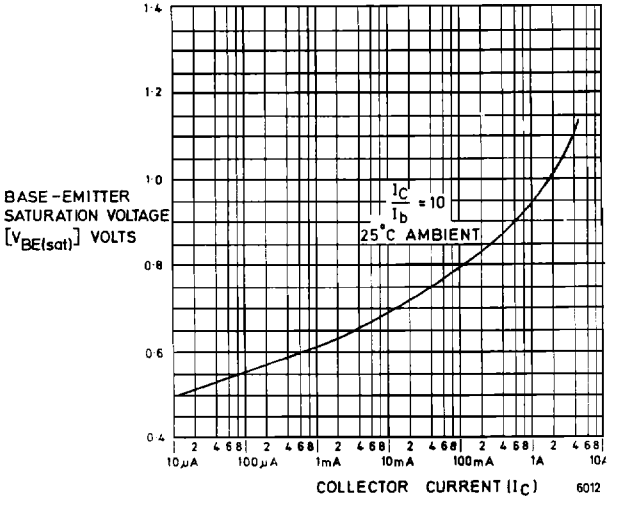
Typical switching speeds (ZTX650/ZTX651)



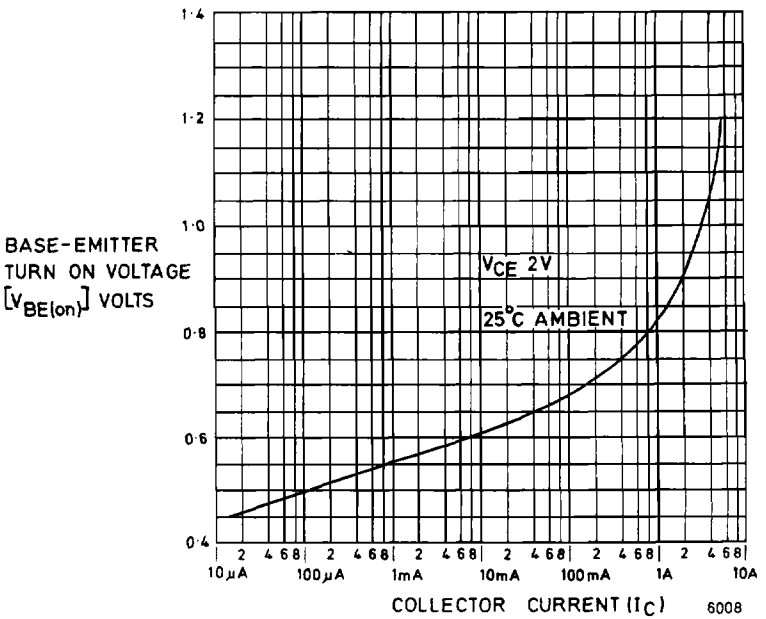
Typical switching speeds (ZTX652/ZTX653)



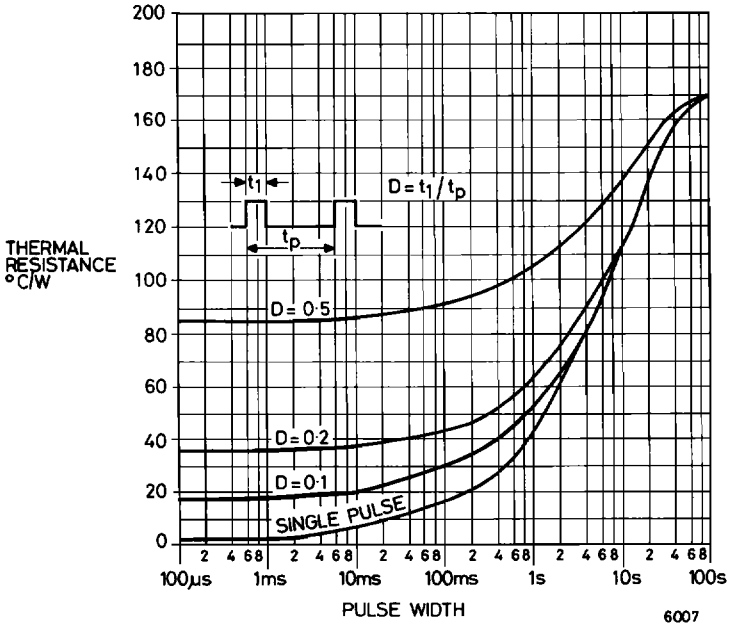
Typical collector-emitter saturation voltages plotted against collector current



Typical base-emitter saturation voltages plotted against collector current for all types



Typical base-emitter turn-on voltages plotted against collector current for all types



Maximum transient thermal impedance curves