NPN SILICON POWER TRANSISTORS
RADIATION RESISTANT

10 AMPERES

FEATURES

HIGH POWER
RADIATION EXPOSURE LEVEL TO 5×10^{14} nvt
TOTAL NEUTRON FLUX GREATER THAN 10 KEV

APPLICATIONS

POWER AMPLIFIER
RADIATION ENVIRONMENTS
ULTRA HIGH FREQUENCY

TO-*61
*All leads isolated from case

ABSOLUTE MAXIMUM RATINGS

		2N5529 2N5530*	2N5533 2N5534*
V_{CBO}	COLLECTOR-BASE VOLTAGE	60 V	90 V
V_{CEO}	COLLECTOR-EMITTER VOLTAGE	40 V	75 V
V_{EBO}	EMITTER-BASE VOLTAGE	3 V	3 V
I_C	CONTINUOUS COLLECTOR CURRENT	10 A	10 A
I_B	CONTINUOUS BASE CURRENT	4 A	4 A
T_J	OPERATING JUNCTION TEMPERATURE	−65°C to +200°C	
T_{stg}	STORAGE TEMPERATURE	−65°C to +200°C	
$R_{\theta JC}$	THERMAL RESISTANCE, JUNCTION TO CASE	5°C/W	
P_D	POWER DISSIPATION (25°C)	35 W	

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RADIATION RESISTANT NPN SILICON POWER TRANSISTORS

T-33-11

SOLITRON DEVICES INC

2N5529 2N5530 2N5533 2N5534

ELECTRICAL CHARACTERISTICS (T_C = 25°C UNLESS OTHERWISE NOTED)

CHARACTERISTICS		SYMBOL	MIN.	MAX.	UNITS
COLLECTOR EMITTER SUSTAINING VOLTAGE(1)		$V_{CEO(sus)}$			
(I_C = 50 mA)	2N5529, 2N5530		40		V
	2N5533, 2N5534		75		V
(I_C = 50 mA, NOTE 2)	2N5529, 2N5530		40		V
	2N5533,2N5534		75		V
COLLECTOR-CUTOFF CURRENT (V_{CE} = 30V, V_{BE} = 0, T_C = 100°C)		I_{CEX}		1.0	mA
COLLECTOR-CUTOFF CURRENT		I_{CBO}			
(V_{CB} = RATED)				1.0	mA
(V_{CB} = RATED, NOTE 2)				1.0	mA
COLLECTOR-CUTOFF CURRENT		I_{CBO}			
(V_{CB} = 30V)				0.1	mA
(V_{CB} = 30V, NOTE 2)				1.0	mA
COLLECTOR-CUTOFF CURRENT (V_{CE} = RATED)		I_{CEO}		50	mA
EMITTER CUTOFF CURRENT		I_{EBO}			
(V_{EB} = 3.0V)				1.0	mA
(V_{EB} = 3.0V, NOTE 2)				1.0	mA
EMITTER FLOATING POTENTIAL (V_{CB} = RATED, I_E = 0)		V_{EBF}		1.0	V
DC CURRENT GAIN(1)		h_{FE}			
(V_{CE} 5.0V, I_C = 0.5A)	2N5529, 2N5530		40	300	
(V_{CE} 5.0V, I_C = 0.5A)	2N5533, 2N5534		25	300	
(V_{CE} 5.0V, I_C = 3.0A)	2N5529, 2N5530		40	200	
(V_{CE} 5.0V, I_C = 3.0A)	2N5533, 2N5534		30	150	
(V_{CE} 5.0V, I_C = 5.0A)	2N5529, 2N5530		25		
(V_{CE} 5.0V, I_C = 5.0A)	2N5533, 2N5534		20		
(V_{CE} 2.0V, I_C = 10A)			2.5		
(V_{CE} 5.0V, I_C = 3.0A NOTE 2)	2N5529, 2N5530		15		
(V_{CE} 5.0V, I_C = 3.0A NOTE 2)	2N5533, 2N5534		7.0		
COLLECTOR-EMITTER SATURATION VOLTAGE(1)		$V_{CE(sat)}$			
(I_C = 3.0A, I_B = 0.3A)	2N5529, 2N5530			1.25	V
(I_C = 0.5A, I_B = 4.0A)	2N5533, 2N5534			1.25	V
(I_C = 10A, I_B = 4.0A)				2.0	V
(I_C = 3.0A, I_B = 0.3A, NOTE 2)	2N5529, 2N5530			2.0	V
(I_C = 3.0A, I_B = 0.5A, NOTE 2)	2N5533, 2N5534			3.0	V
BASE-EMITTER SATURATION VOLTAGE(1)		$V_{BE(sat)}$			
(I_C = 3.0A, I_B = 0.3A)	2N5529, 2N5530			1.5	V
(I_C = 3.0A, I_B = 0.5A)	2N5533, 2N5534			1.5	V
BASE-EMITTER VOLTAGE		V_{BE}			
(V_{CE} = 5.0V, I_C = 3.0A)				1.5	V
(V_{CE} = 5.0V, I_C = 5.0A)				3.0	V
MAGNITUDE OF SMALL SIGNAL GAIN (V_{CE} = 28V, I_C = 0.5A, f = 25 MHz)		$\|h_{fe}\|$	8.0		
SMALL SIGNAL GAIN		h_{fe}			
(V_{CE} = 5.0V, I_C = 3.0A, f = 1.0 KHz)	2N5529, 2N5530		20		
	2N5533, 2N5534		15		
OUTPUT CAPACITANCE (V_{CB} = 30V, f = 1.0 MHz)		C_{obo}		75	pF

Note 1: Pulsed 300 μsec, 1.8% Duty Cycle

Note 2: After exposure 1×10^{14} nvt, FLUX ≥ 10 KEV

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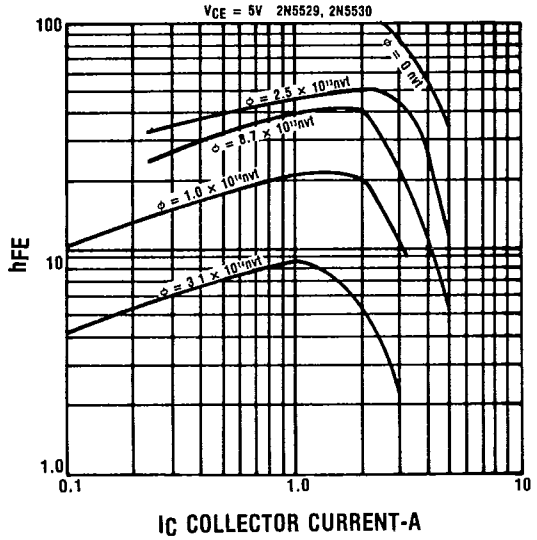
2N5529 2N5530 2N5533 2N5534

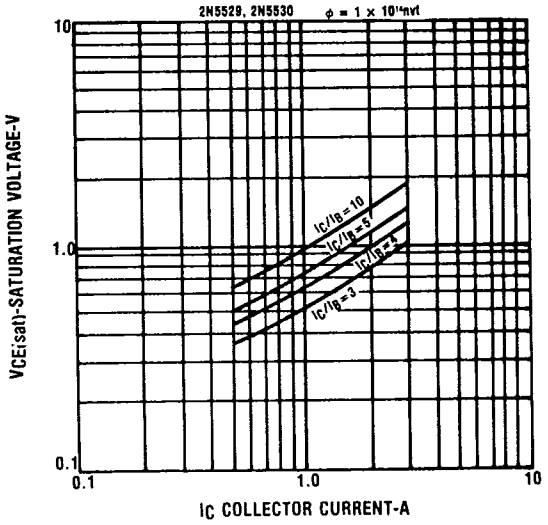
ELECTRICAL CHARACTERISTICS (T_C = 25°C UNLESS OTHERWISE NOTED)

CHARACTERISTICS	SYMBOL	MIN.	MAX.	UNITS
PROMPT PRIMARY PHOTOCURRENT ($\dot{\gamma}$ = 1×10^9 R/sec, $\in \geq$ 1Mev, V_{CB} = 10V)	I_{ppc}		500	mA(PK)

TYPICAL STATIC FORWARD CURRENT TRANSFER RATIO



TYPICAL COLLECTOR-EMITTER SATURATION VOLTAGE



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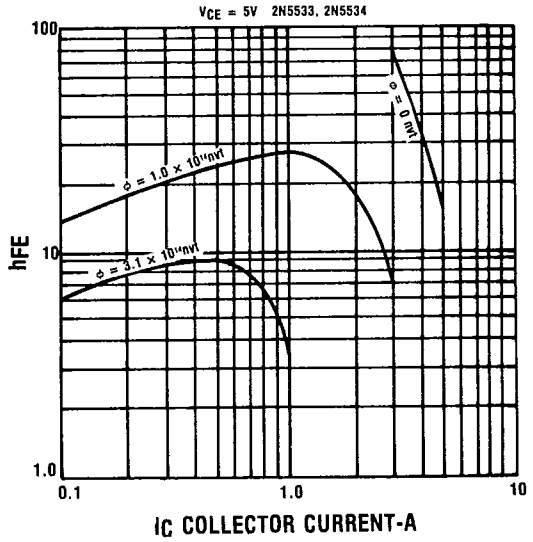

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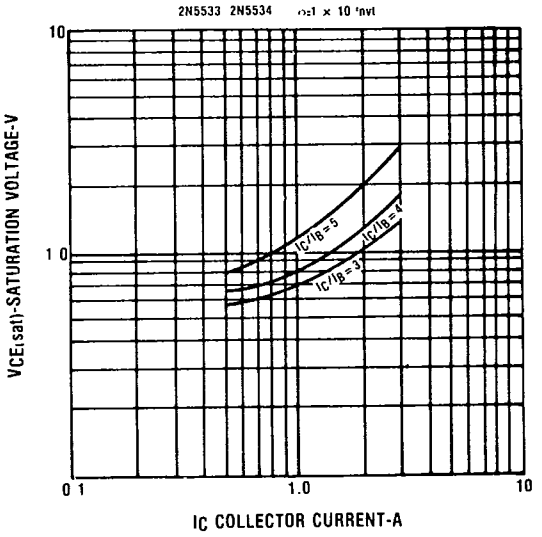


RADIATION RESISTANT NPN SILICON POWER TRANSISTORS

2N5529 2N5530 2N5533 2N5534

SAFE OPERATING AREA (SOAR) INFORMATION

The Safe Operating ARea (SOAR) principle is a method of specifying the exact transistor to use in an amplifier, switching or DC application. SOAR defines the region which encloses all of the points representing simultaneous values of the collector current and the collector-to -emitter voltage which a transistor can safely handle under specified conditions for base current, time, junction temperature and average power dissipation. With transistors specified under the Solitron SOAR technique, secondary breakdown is virtually eliminated.

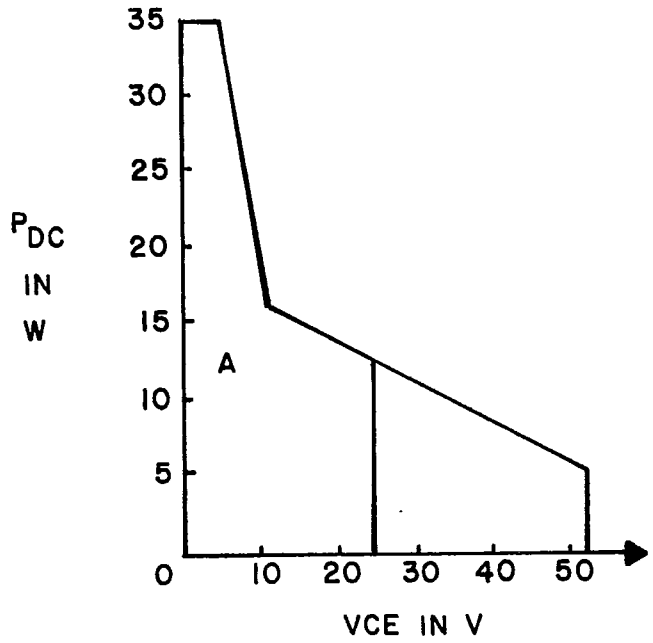
The suggested test circuits are shown for each type of SOAR operation. Any other thermally stable circuit may also be used as long as the SOAR conditions and maximum ratings are observed.

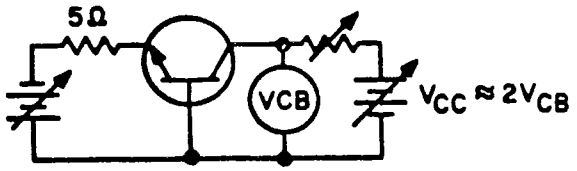
SOAR VALUES

TYPE NUMBER	V1 V	V2 V
2N5530 2N5534	30 65	60 90

CONTINUOUS DC OPERATION

Conditions: 1. $T_J = T_{CASE} + \Theta_{J-C}$ PDC $\leq$ 200°C
2. PDC $\leq$ PDC max rating for specified transistor type
3. PDC $\leq$ PDC = f (V_{CE}) Area A
4. $V_{CE} \leq$ 24V (2N5529, 2N5530)
52V (2N5533, 2N5534)





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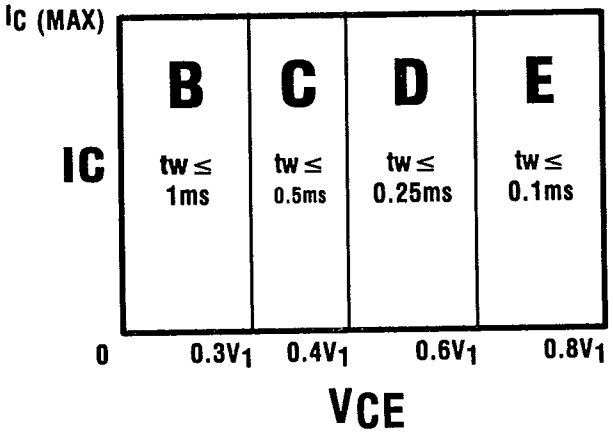
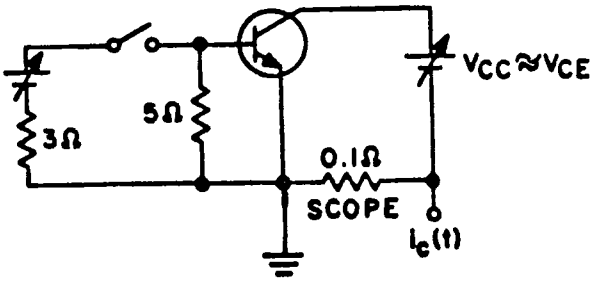
PULSED OPERATION

Conditions:

1. $T_J = T_{CASE} + \Theta_{J-C}$ Pavg $\leq$ 200°C
2. Pavg $= \frac{1}{2ms}\int_0^{2ms}$ ic vce dt $\leq$ the allowed DC power dissipation for a V_{CE} equal to the highest v_{ce} applied to the transistor
3. Operation in the active region should be limited to a maximum pulse width of tw = 1 ms for Area B, tw = 0.5 ms for Area C, tw = 0.25 ms for Area D, and tw = 0.10 ms for Area E. tr $\leq$ 20 μs and tf $\leq$ 20μs for Areas B-E.



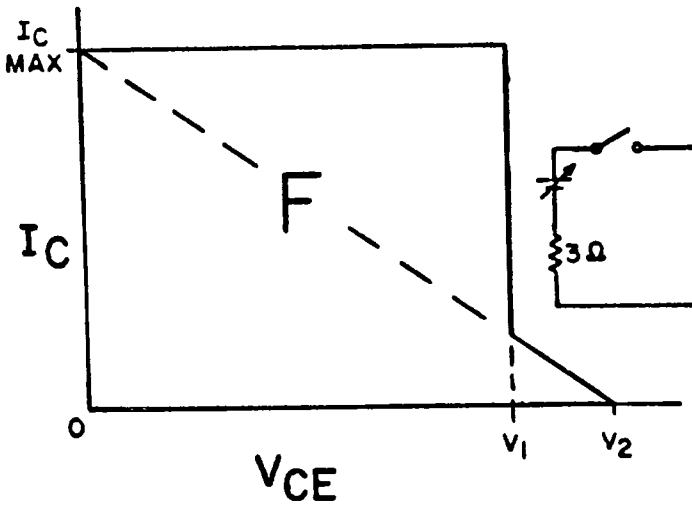


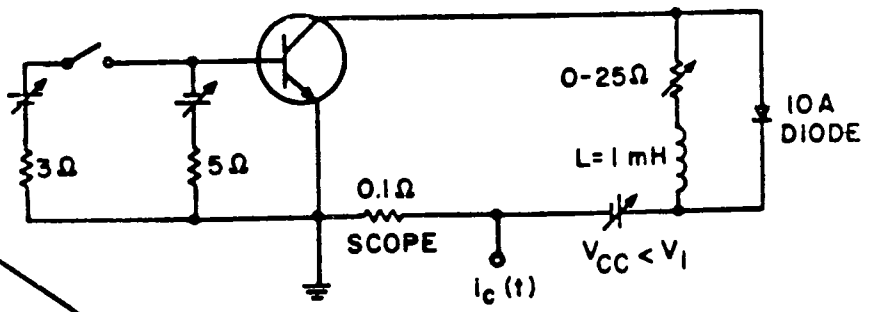
RESISTIVE AND CLAMPED INDUCTIVE SWITCHING

(Switching from saturation to cutoff)

Conditions:

1. $T_J = T_C + \Theta_{J-C}$ Pavg $\leq$ 200°C
2. Pavg $= \frac{1}{2ms}\int_0^{2ms}$ ic vce dt $\leq$ PDC max.
3. For the resistive loadline, L = 0 and V_{CC} = V2
4. tr $\leq$ 2μs, tf $\leq$ 2 μs in Area F





RADIATION RESISTANT NPN SILICON POWER TRANSISTORS

UNCLAMPED SWITCHING

(Switching from saturation to cutoff)

Conditions:

1. $T_J = T_C + \Theta_{J-C}$ Pavg $\leq$ 200°C
2. Pavg $= \frac{1}{2ms} \int_0^{2ms}$ ic vce dt $\leq$ PDC max.
3. I_C peak $\leq$ I_C max rating for specified transistor type
4. ½ $LIC^2 \leq 80\mu Ws$