ELECTRONIC INNOVATIONS IN ACTION

SEMICONDUCTORS

Silicon Switching Transistors

PLANAR EPITAXIAL PASSIVATED

NPN

2N5027
2N5028

The General Electric 2N5027 and 2N5028 are epoxy encapsulated planar epitaxial passivated NPN silicon transistors primarily designed for medium current, high speed switching. The 2N5027 and 2N5028 are electrically similar to the 2N2539 and 2N2540 types. These devices are also available in an equivalent TO-18 or TO-5 pin configuration.

Features:
- Low Cost
- High Speed
- Medium Current
- Environmental Performance Comparable to Hermetic

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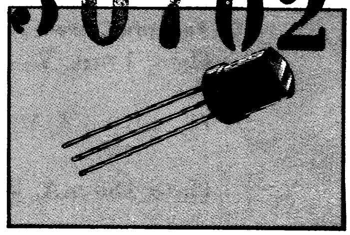

absolute maximum ratings: (25°C) (unless otherwise specified)

Voltages			
Collector to Base	V_{CBO}	60	V
Emitter to Base	V_{EBO}	5	V
Collector to Emitter	V_{CEO}	30	V
Collector to Emitter	V_{CES}	40	V
Current			
Collector (Steady State)	I_C	350	mA
Collector (pulsed, peak. 10 μsec 2% duty cycle)	I_C	700	mA
Dissipation			
Total Power (Free Air at 25°C)*	P_T	320	mW
Total Power (Free Air at 65°C)*	P_T	185	mW
Temperature			
Storage	T_S	−65 to 150	°C
Operating	T_J	−65 to 120	°C
Lead (1/16" ± 1/32" from case for 10 seconds)	T_L	260	°C

NOTE 1: Lead diameter is controlled in the zone between .070 and .250 from the seating plane. Between .250 and end of lead a max. of .021 is held.

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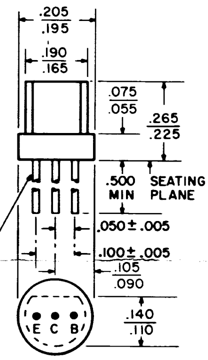
TO-98



*Derate 3.4 mW/°C for increase in ambient temperature between 25 and 120°C.

electrical characteristics: (25°C) (unless otherwise specified)

Static Characteristics		Min.	Typ.	Max.	
Collector-Base Reverse Current					
(V_{CB} = 40V, I_E = 0)	I_{CBO}			100	nA
(V_{CB} = 40V, I_E = 0, T_A = 70°C)	I_{CBO}			3.0	μA
Emitter-Base Reverse Current					
(V_{EB} = 3V, I_C = 0)	I_{EBO}			50	nA
Collector Reverse Current					
(V_{CE} = 25V)	I_{CES}			250	nA
(V_{CE} = 25V, T_A = 70°C)	I_{CES}			4.0	μA
Collector-Base Breakdown Voltage					
(I_C = 10 μA, I_E = 0)	$V_{(BR)CBO}$	60			V
Collector-Emitter Breakdown Voltage					
(I_C = 10 mA, I_B = 0)	$V_{(BR)CEO}$†	30			V

		Symbol	Min.	Typ.	Max.	
Collector-Emitter Breakdown Voltage						
($I_C = 10\ \mu A, V_{BE} = 0$)		$V_{(BR)CES}$	40			V
Emitter-Base Breakdown Voltage						
($I_E = 10\ \mu A, I_C = 0$)		$V_{(BR)EBO}$	5			V
Collector-Emitter Saturation Voltage						
($I_C = 150$ mA, $I_B = 15$ mA)		$V_{CE(sat)}$†			.45	V
($I_C = 500$ mA, $I_B = 50$ mA)		$V_{CE(sat)}$†			1.6	V
Base-Emitter Saturation Voltage						
($I_C = 150$ mA, $I_B = 15$ mA)		$V_{BE(sat)}$†	.7		1.3	V
($I_C = 500$ mA, $I_B = 50$ mA)		$V_{BE(sat)}$†			2.6	V
DC Forward Current Transfer Ratio						
($I_C = 1$ mA, $V_{CE} = 10V$)	2N5027	h_{FE}	20			
	2N5028	h_{FE}	35			
($I_C = 10$ mA, $V_{CE} = 10V$)	2N5027	h_{FE}†	30			
	2N5028	h_{FE}†	50			
($I_C = 150$ mA, $V_{CE} = 10V$)	2N5027	h_{FE}†	50		150	
	2N5028	h_{FE}†	100		300	
($I_C = 500$ mA, $V_{CE} = 10V$)	2N5027	h_{FE}†	20			
	2N5028	h_{FE}†	30			
($I_C = 150$ mA, $V_{CE} = 1V$)	2N5027	h_{FE}†	20			
	2N5028	h_{FE}†	40			
Dynamic Characteristics						
Collector-Base Capacitance						
($V_{CB} = 10V, I_E = 0, f = 1$ MHz)		C_{cb}		5	8	pF
Emitter-Base Capacitance						
($V_{EB} = 0.5V, I_C = 0, f = 1$ MHz)		C_{eb}			25	pF
Small Signal Forward Current Transfer Ratio						
($V_{CE} = 10V, I_C = 20$ mA, $f = 100$ MHz)		$\|h_{fe}\|$†	2.5			

†Pulsed operation: $\leqq$ 300 μsec, pulse width $\leqq$ 2% duty cycle

Switching

		Figure 1 ($I_C = 10\ I_{B1} = -10\ I_{B2} = 150$ mA) 2N5027	Figure 1 2N5028	Figure 2 ($I_C = I_{B1} = -I_{B2} = -20$ mA) 2N5027, 8	Figure 3 ($I_C = 10\ I_{B1} = -10\ I_{B2} = 150$ mA) 2N5027, 8	
Turn-on Delay Time	t_d	15	15	—	—	nsec
Rise Time	t_r	20	30	—	—	nsec
Turn-on Time	t_{on}	30	40	—	40	nsec
Storage Time	t_s	35	45	20	—	nsec
Fall Time	t_f	25	35	—	—	nsec
Turn-off Time	t_{off}	55	75	—	40	nsec

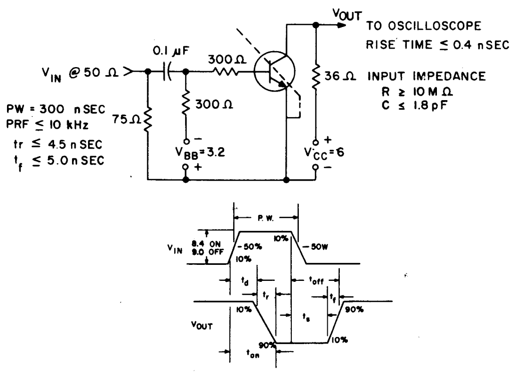


Figure 1.

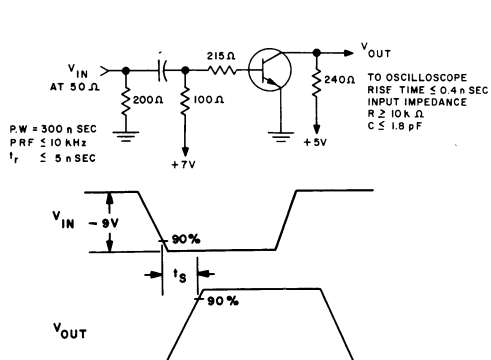


Figure 2.

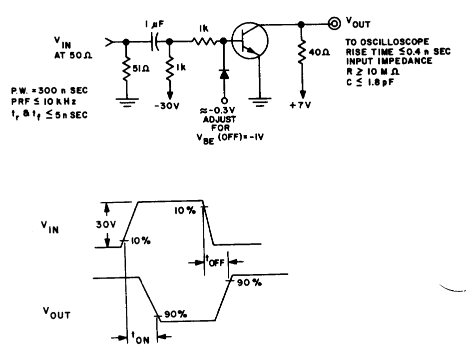


Figure 3.

GE SEMICONDUCTORS INNOVATIONS IN ACTION

Silicon Switching Transistors

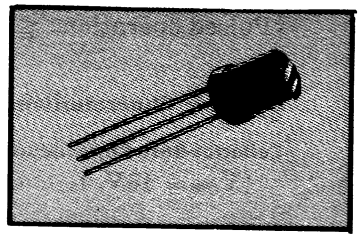
PLANAR EPITAXIAL PASSIVATED

NPN

2N5029
2N5030

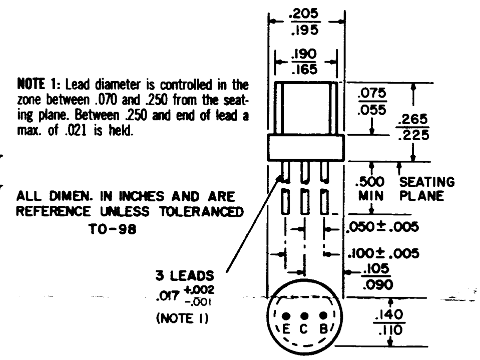
The General Electric 2N5029 and 2N5030 epoxy encapsulated planar epitaxial passivated NPN Silicon Transistors are designed primarily for high speed industrial switchings. They are electrically similar to the 2N2368 and 2N2369. These devices are also available in an equivalent TO-5 or TO-18 pin configuration.

Features:
- Low Cost
- High Speed
- Environmental Performance Comparable to Hermetic



absolute maximum ratings: (25°C) (unless otherwise specified)

		2N5029	2N5030	
Voltages				
Collector to Base	V_{CBO}	40	30	V
Emitter to Base	V_{EBO}	4.5	4.0	V
Collector to Emitter	V_{CEO}	15	12	V
Collector to Emitter	V_{CES}	40	30	V
Currents				
Collector (Steady State)	I_C	200	200	mA
Collector (pulsed, peak, 10 μsec. 2% duty cycle)	I_C	500	500	mA
Dissipation				
Total Power (Free Air at 25°C)*	P_T	320	320	mW
Total Power (Free Air at 65°C)*	P_T	185	185	mW
Temperature				
Storage	T_S	−65 to +150		°C
Operating Junction	T_J	−65 to +120		°C
Lead (1/16" ± 1/32" from case for 10 seconds).	T_L	260	260	°C



*Derate 3.4 mW/°C for increase in ambient temperature between 25 and 120°C.

electrical characteristics: (25°C) (unless otherwise specified)

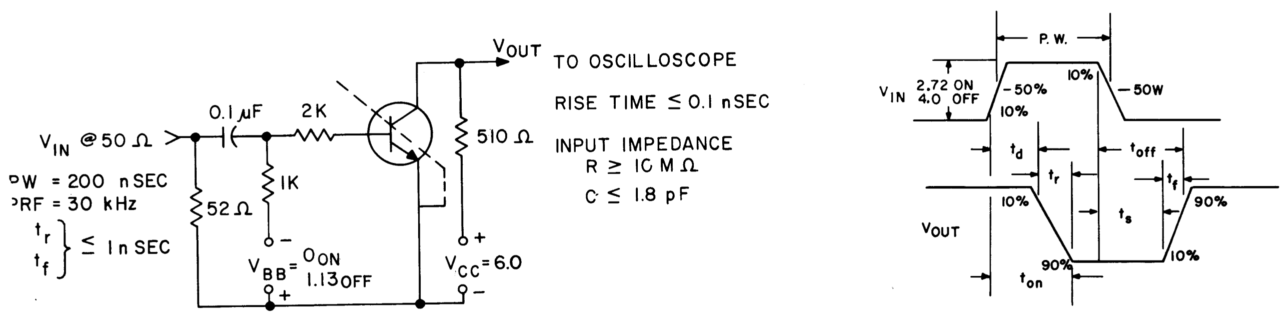
Static Characteristics		2N5029 Min.	2N5029 Typ.	2N5029 Max.	2N5030 Min.	2N5030 Typ.	2N5030 Max.	
Emitter-Base Reverse Current ($V_{EB} = 3V, I_C = 0$)	I_{EBO}			20			50	nA
Collector Reverse Current ($V_{CE} = 20V$)	I_{CES}			250			250	nA
($V_{CE} = 20V, T_A = 70°C$)	I_{CES}			4.0			4.0	μA
Collector-Base Breakdown Voltage ($I_C = 10\mu A, I_E = 0$)	$V_{(BR)CBO}$	40			30			V
Collector-Emitter Breakdown Voltage ($I_C = 10mA, I_B = 0$)	$V_{(BR)CEO}$†	15			12			V
Collector-Emitter Breakdown Voltage ($I_C = 10\mu A$)	$V_{(BR)CES}$	40			30			V
Emitter-Base Breakdown Voltage ($I_E = 10\mu A, I_C = 0$)	$V_{(BR)EBO}$	4.5			4.0			V

		2N5029			2N5030			
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Emitter Saturation Voltage								
($I_C = 10mA, I_B = 1mA$)	$V_{CE(sat)}$†			0.25			0.25	V
Base-Emitter Saturation Voltage								
($I_C = 10mA, I_B = 1mA$)	$V_{BE(sat)}$†	0.72		0.87	0.72		0.87	V
Static Forward Current Transfer Ratio								
($I_C = 10mA, V_{CE} = 1V$)	h_{FE}†	40		120	30			
($I_C = 100mA, V_{CE} = 2.0V$)	h_{FE}†	20						

†Pulsed operation: $\leqq$ 300 μsec plus width, $\leqq$ 2% duty cycle

Dynamic Characteristics

		2N5029			2N5030			
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Collector-Base Capacitance								
($V_{CB} = 10V, I_E = 0, f = 1MHz$)	C_{cb}			4			4	pF
Emitter-Base Capacitance								
($V_{EB} = 0.5V, I_C = 0, f = 1MHz$)	C_{eb}			5			5	pF
Small Signal Forward Current Transfer Ratio								
($V_{CE} = 10mA, I_C = 10mA, f = 100MHz$)	$\|h_{fe}\|$	5			4			
Switching (See Figure 1)								
($I_C = 10mA, I_{B1} = 1.0mA, I_{B2} = 1mA$)								
Turn-on Delay Time	t_d			10			10	nsec
Rise Time	t_r			12			14	nsec
Turn-on Time	t_{on}			20			22	nsec
Storage Time	t_s			12			14	nsec
Fall Time	t_f			14			16	nsec
Turn-off Time	t_{off}			24			28	nsec
Typical Operation in 2N2368-9 Test Circuits								
Turn-on Time								
($I_C = 10mA, I_{B1} = 3mA, I_{B2} = -1.5mA$)	t_{on}		12			12		nsec
Storage Time								
($I_C = I_{B1} = I_{B2} = 10mA$)	t_s		14			14		nsec
Turn-off Tune								
($I_C = 10mA, I_{B1} = 3mA, I_{B2} = -1.5mA$)	t_{off}		8			8		nsec



INPUT AND OUTPUT WAVEFORMS

Figure 1.

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