2N828 (continued)

ELECTRICAL CHARACTERISTICS (continued)

Characteristic	Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS					
Current-Gain — Bandwidth Product (I_C = 10 mAdc, V_{CE} = 1 Vdc, f = 100 MHz)	f_T	300	400	-	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0)	C_{ob}	-	3.5	-	pF
Small Signal Current Gain (I_C = 10 mAdc, V_{CE} = 1 Vdc, f = 100 MHz)	h_{fe}	3	4.0	-	-
Delay Plus Rise Time (Figure 1)	$t_d + t_r$	-	50	70	ns
Storage Time (Figure 1)	t_s	-	33	50	ns
Fall Time (Figure 1)	t_f	-	35	50	ns
Charge Storage Time Constant (Figure 2)	τ_s	-	14	25	ns
Rise Time (Figure 3)	t_r	-	7.0	-	ns
Storage Time (Figure 4)	t_s	-	5.0	-	ns
Fall Time (Figure 4)	t_f	-	3.0	-	ns

2N828A (GERMANIUM)
2N829

CASE 22
(TO-18)

Collector connected to case

PNP germanium epitaxial mesa transistors for high-speed switching applications

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector to Base Voltage	V_{CB}	15	Vdc
Collector to Emitter Voltage	V_{CES}	15	Vdc
Emitter to Base Voltage	V_{EB}	2.5	Vdc
Collector Current (Continuous)	I_C	200	mAdc
Total Device Dissipation at 25°C case Temperature (Derate 4.0mw/°C above 25°C)	P_D	300	mW
Total Device Dissipation at 25°C Ambient Temperature (Derate 2.0mw/°C)	P_D	150	mW
Junction Temperature	T_J	+100	°C
Storage Temperature	T_{stg}	-65 to +100	°C

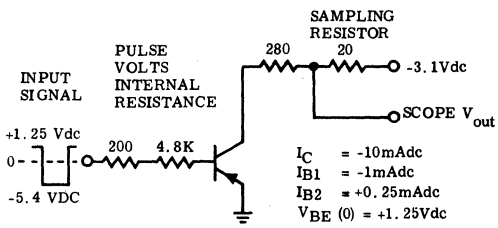
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Collector to Base Breakdown Voltage I_E = 0, I_C = 100μAdc		BV_{CBO}	15	25	--	Vdc
Collector to Emitter Breakdown Voltage V_{EB} = 0, I_C = 100μAdc		BV_{CES}	15	25	--	Vdc
Emitter to Base Breakdown Voltage I_C = 0, I_E = 100μAdc		BV_{EBO}	2.5	--	--	Vdc
Collector Cutoff Current I_E = 0, V_{CB} = 6Vdc		I_{CBO}	--	0.4	3.0	μAdc
Forward Current Transfer Ratio I_C = 10mAdc, V_{CE} = 0.3Vdc	2N828A 2N829	h_{FE}	 25 50	 40 80	--	--
Forward Current Transfer Ratio I_C = 150mAdc, V_{CE} = 1Vdc	2N828A 2N829	h_{fe}	 25 50	 40 80	--	--
Collector Saturation Voltage I_C = 10mAdc, I_B = 1.0 mAdc I_C = 10mAdc, I_B = 0.5mAdc	 2N828A 2N829	$V_{CE(sat)}$	--	 0.11 0.11	 0.20 0.20	Vdc
Collector Saturation Voltage I_C = 50mAdc, I_B = 5.0mAdc		$V_{CE(sat)}$	--	--	0.25	Vdc
Collector Saturation Voltage I_C = 150mAdc, I_B = 15mAdc I_C = 150mAdc, I_B = 7.5mAdc	 2N828A 2N829	$V_{CE(sat)}$	--	 0.35 0.38	 0.50 0.50	Vdc
Base to Emitter Voltage I_C = 10mAdc, I_B = 1mAdc I_C = 10mAdc, I_B = 0.5mAdc	 2N828A 2N829	V_{BE}	 0.34 0.30	 0.40 0.38	 0.44 0.44	Vdc
Base to Emitter Voltage I_C = 150mAdc, I_B = 15mAdc I_C = 150mAdc, I_B = 7.5mAdc	 2N828A 2N829	V_{BE}	--	 0.70 0.65	 0.85 0.85	Vdc
Collector Capacitance I_E = 0, V_{CB} = 6Vdc, f = 100 kHz)		C_{ob}	--	2.2	4.0	pF

2N828A, 2N829 (continued)
ELECTRICAL CHARACTERISTICS (continued)

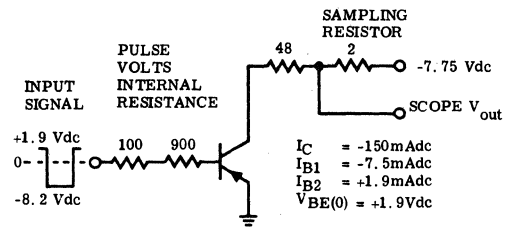
Characteristic	Symbol	Min	Typ	Max	Unit
Input Capacitance (V_{BE} = 1Vdc, I_E = 0, f = 100 kHz)	C_{ib}	--	2.2	3.5	pF
Small Signal Forward Current Transfer Ratio (I_C = 10mAdc, V_{CE} = -1Vdc, f = 100 MHz	h_{fe}	3.0	4.0	--	--
Current Gain Bandwidth Product (V_{CE} = 1Vdc, I_C = -10mAdc, f = 100 MHz	f_T	300	400	--	MHz
Delay Plus Rise Time (Fig. 1) (I_C = 10mAdc	td+tr	--	35	50	ns
Storage Time (Fig. 1) (I_C = 10mAdc	ts	--	30	50	ns
Fall Time (Fig. 1) (I_C = 10mAdc	tf	--	30	50	ns
Total Control Charge (Fig. 3) (I_C = 10mAdc	Q_T	--	50	80	pC
Delay Plus Rise Time (Fig. 2) (I_C = 150mAdc	t_d+t_r	--	25	50	ns
Turn Off Time (Fig. 2) (I_C = 150mAdc	t_{off}	--	60	100	ns
Total Control Charge (Fig. 4) (I_C = 150mAdc	Q_T	--	120	175	pC

FIGURE 1 — 10mA SWITCHING TIME TEST CIRCUIT



SCOPE INPUT IMPEDANCE = 1Megohm
SCOPE INPUT CAPACITANCE = 20 pF
GENERATOR OUTPUT IMPEDANCE = 50 ohms
INPUT PULSE $t_r = t_f$ = 2ns

FIGURE 2 — 150mA SWITCHING TIME TEST CIRCUIT



SCOPE INPUT IMPEDANCE = 1Megohm
SCOPE INPUT CAPACITANCE = 20 pF
GENERATOR OUTPUT IMPEDANCE = 50 ohms
INPUT PULSE $t_r = t_f$ = 2ns

FIGURE 3 — 10mA TOTAL CONTROL CHARGE TEST CIRCUIT

*ADJUST V_{BB} FOR -5.4 VOLT PULSE AT POINT A

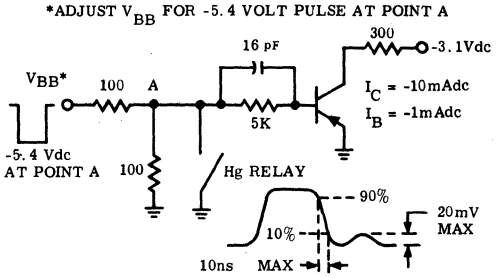


FIGURE 4 — 150mA TOTAL CONTROL CHARGE TEST CIRCUIT

*ADJUST V_{BB} FOR -8 VOLT PULSE AT POINT A