

N-P-N and P-N-P Silicon Power Transistors

For Audio-Frequency Amplifier Applications

Features:

- Hermetically-sealed packages
- Operation at case temperatures up to 257°F
- Pellet bonded to header — for greater power-handling capability for greater shock resistance
- Freedom from second breakdown

These devices are available with either 1½-inch leads (TO-5 package) or ½-inch leads (TO-39 package). The longer-lead versions are specified by suffix "L" after the type number; the shorter-lead versions are specified by suffix "S" after the type number.

RCA transistors 40309—40328 and 40360—40364 are diffused-junction silicon n-p-n and p-n-p transistors intended for specific applications in audio amplifiers, giving high-quality performance economically. These types cover applications from low-level input stages to high-power output

stages of 5 to 50 watts. Supply voltages range from the nominal 12-volt vehicular type to 117-volt ac-dc type.

The use of all-silicon devices permits more flexibility in the mechanical and electrical design of amplifiers since the output heat sinks can be held to a minimum.

MAXIMUM RATINGS (Absolute-Maximum Values)

CHARACTERISTIC	40309	40323	40311	40315	40314	40317	40319	40320	40326	40321	40327	40360	40361	40362	UNITS
$V_{CE0(sus)}$	18	18	30	35	40	40	-40	40	40	—	—	70	—	—	V
$V_{CER(sus)}^*$	—	—	—	—	—	—	—	—	—	300	300	—	70	-70	V
V_{CEV}^{**}	—	—	—	—	—	—	—	—	—	—	—	—	—	—	V
V_{EBO}	2.5	2.5	2.5	2.5	2.5	2.5	-2.5	2.5	2.5	5	5	4	4	-4	V
V_{CBO}	—	—	—	—	—	—	—	—	—	—	—	—	—	—	V
I_C	0.7	0.7	0.7	0.7	0.7	0.7	-0.7	0.7	0.7	1	1	0.7	0.7	-0.7	A
I_B	0.2	0.2	0.2	0.2	0.2	0.2	-0.2	0.2	0.2	0.5	0.5	0.2	0.2	-0.2	A
P_T^{***}															
T_C up to 25°C	5	5	5	5	5	5	5	5	5	5	5	5	5	5	W
T_{FA} up to 25°C	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W
T_C of 175°C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	W
TEMP. RANGE: Oper. Junction	← -65 to 200°C →														°C

* $R_{BE} = 500 \Omega$

$R_{BE} = 1,000 \Omega$ for 40327

$R_{BE} = 200 \Omega$ for 40361,
40362, & 40363

$R_{BE} = 150 \Omega$ for 40364

** $V_{BE} = -1.5V$

*** At other temperatures see derating curves

MAXIMUM RATINGS (Absolute-Maximum Values) (Cont'd.)

CHARACTERISTIC	40325	40363	40310	40324	40316	40312	40313	40318	40322	40328	40364	UNITS
$V_{CE0(sus)}$	35	-	35	35	-	-	-	-	-	-	-	V
$V_{CER(sus)*}$	-	70	-	-	40	60	300	300	300	300	60	V
V_{CEV**}	35	-	-	-	-	-	-	-	-	-	-	V
V_{EBO}	5	4	2.5	2.5	5	2.5	2.5	6	6	6	4	V
V_{CBO}	35	-	-	-	-	-	-	-	-	-	-	V
I_C	15	15	4	4	4	4	2	2	2	2	7	A
I_B	7	7	2	2	2	2	1	1	1	1	5	A
P_T^{***}												
T_C up to 25°C	117	115	29	29	29	29	35	35	35	35	35	W
T_{FA} up to 25°C	-	-	-	-	-	-	-	-	-	-	-	W
T_C of 175°C	-	-	-	-	-	-	-	5	5	5	-	W
TEMP. RANGE: Oper. Junction	-65 to 200°C											°C

* $R_{BE} = 500 \Omega$ ** $V_{BE} = -1.5V$

*** At other temperatures see derating curves

 $R_{BE} = 1,000 \Omega$ for 40327 $R_{BE} = 200 \Omega$ for 40361,

40362, & 40363

 $R_{BE} = 150 \Omega$ for 40364

ELECTRICAL CHARACTERISTICS for Types in TO-3 Package

CHARACTERISTIC	TEST CONDITIONS					LIMITS		UNITS
	V_{CB}	V_{CE}	V_{EB}	I_C	T_C	40525	40363	
	Volts					mA	°C	
$I_{CBO}(\text{Max.})$	30				25	5		mA
	30				150	10		
$I_{CER}^{\Delta}(\text{Max.})$		60			25		1	mA
		60			150		10	
$I_{EBO}(\text{Max.})$			5			10		mA
			4				5	
$BV_{CEO}(\text{sus})(\text{Min.})$				200		35		V
$V_{CER}(\text{sus})^{\Delta}(\text{Min.})$				200			70	V
$BV_{CBO}(\text{Min.})$				100		35		V
$V_{BE}(\text{Max.})$		4		8A		2		V
		4		4A			1.8	
$V_{CE}(\text{sat})(\text{Max.})$				8A*		1.5		V
				4A**			1.1	
h_{FE}		4		8A		12-60		
		4		4A			20-70	
$\theta_{J-C}(\text{Max.})$						1.5	1.5	°C/W
$f_T(\text{Typ.})$		4		3A			700	kHz

* $I_B = 800 \text{ mA}$ ** $I_B = 400 \text{ mA}$ $\Delta R_{BE} = 200 \Omega$

ELECTRICAL CHARACTERISTICS for Types in TO-5 or TO-39 Package

CHARACTERISTIC	TEST CONDITIONS					LIMITS							UNITS
	V _{CB}	V _{CE}	V _{EB}	I _C	T _C	40309	40311	40314	40315	40317	40319	40320	
	Volts			mA	°C								
I _{CBO} (Max.)	15				25	0.25	0.25	0.25	0.25	0.25		0.25	μA
	-15				25						-0.25		
	15				150	1	1	1	1	1		1	mA
	-15				150						-1		
I _{EBO} (Max.)			2.5			1	1	1	1	1		1	mA
			-2.5								-1		
V _{CEO(sus)} (Min.)				100*		18 ^o	30	40	35 ^o	40		40	V
				-100*							-40 ^o		
V _{BE} (Max.)		4		50		1	1	1	1				V
		4		10					1		1		
		-4		-50							-1.0		
V _{CE(sat)} (Max.)				150 ^o				1.4			-1.4		V
h _{FE}		4		50		70-350	70-350	70-350	70-350				
		-4		-50							35-200		
		4		10						40-200		40-200	
θ _{J-C} (Max.)						35	35	35	35	35	35	35	°C/W
θ _{J-FA} (Max.)						175	175	175	175	175	175		°C/W
f _T (Typ.)		10		50		100	100		100				mHz
		-4		-50							100		
		4		50				100					

*Pulsed; pulse duration = 300 μsec, duty factor < 2%.

^o I_B = 15 mA[□] R_{BE} = 1,000 ohms^o V_{CEO} value.R_{BE} = 200 Ω for 40361 & 40362

† Negative value for 40362

TERMINAL CONNECTIONS

Pin 1 - Base
 Pin 2 - Emitter
 Case - Collector
 Mounting Flange - Collector

TERMINAL CONNECTIONS

Lead 1 - Emitter
 Lead 2 - Base
 Lead 3 - Collector, case

TERMINAL CONNECTIONS

Pin 1 - Base
 Pin 2 - Emitter
 Mounting Flange, Case-Collector

ELECTRICAL CHARACTERISTICS for Types in TO-5 or TO-39 Package (Cont'd.)

CHARACTERISTIC	TEST CONDITIONS					LIMITS							UNITS
	V _{CB}	V _{CE}	V _{EB}	I _C	T _C	40321	40323	40326	40327	40360	40361	40362	
	Volts			mA	°C								
I _{CEO} (Max.)		60			25					1			μA
		60			150					250			
I _{CBO} (Max.)	15				25		0.25	0.25					μA
	15				150		1	1					mA
	150				150	100			100				μA
I _{CER} [■] (Max.)		150				5			5				μA
		60 [†]			25					1	-1		
		60 [†]			150					100	-100		
I _{EBO} (Max.)			2.5				1	1					mA
			5			100			100				μA
			4 [†]							1	1	-1	mA
V _{CEO(sus)} (Min.)				100*		18 [●]	40			70			V
V _{BE} (Max.)		4		50			1				1		V
		4		10			1		1				
		10		50		2		2					
V _{CE(sat)} (Max.)				150 [◆]						1.4	1.4	-1.4	V
V _{CER(sus)} [■]				50		300			300				V
				100							70	70	
h _{FE}		4		50			70-350				70-350		
		-4		-50								35-200	
		4		10				40-200		40-200			
		10		20		25-200			40-250				
θ _{J-C} (Max.)						30	35	30	30	35	35	35	°C/W
θ _{J-FA} (Max.)							175			175	175	175	°C/W
f _T (Typ.)		10		50			100						mHz
		-4		-50								100	
		4		50						100	100		

* Pulsed; pulse duration = 300 μsec, duty factor < 2%.

◆ I_B = 15 mA■ R_{BE} = 1,000 ohms● BV_{CEO} value.R_{BE} = 200 Ω for 40361 & 40362

† Negative value for 40362

ELECTRICAL CHARACTERISTICS for Types in TO-66 Package At $T_C = 25^\circ\text{C}$ Unless Otherwise Specified.

CHARACTERISTIC	CONDITIONS					LIMITS								UNITS	
	V_{CB}	V_{CE}	V_{EB}	I_C	T_C	40310	40312	40313	40316	40318	40322	40324	40328		40364
	Volts			A	$^\circ\text{C}$										
$I_{CEO}(\text{Max.})$		150						5		5			5		mA
$I_{CEV}(\text{Max.})$		150	1.5^{D}		25					5			10		mA
		300	1.5^{D}					10							
		150	1.5^{D}		150					10			10		
		300	1.5^{D}					10		5			10		
$I_{CER}^{\Delta}(\text{Max.})$		50			25									0.5	mA
		50			150									2	
$I_{CBO}(\text{Max.})$	15				25	10	10		10			10			μA
	15				150	5	5		5			5			
$I_{EBO}(\text{Max.})$			2.5			5	5	5				5			mA
			5					5							
			6						5	5			5		
			4											5	
$V_{CEO}(\text{sus})(\text{Min.})$				0.1^*	35^\bullet							35^\bullet			V
$V_{BE}(\text{Max.})$		2		1		1.4	1.4		1.4			1.4			V
		10		0.1				1.5							
		10		0.5					1.5						
		10		1									1.5		
		5		2.5										1.8	
$V_{CE}(\text{sat})(\text{Max.})$				2.5										2^{D}	V
$V_{CER}(\text{sus})(\text{Min.})$				0.1^*		60		40							V
				0.2			300^\bullet		300^\bullet	300^\bullet		300^\bullet	70^{b}		
$h_{FE}(\text{Min. or range})$		2		1		20-120	20-120		20-120			10-120			
		5		0.5										35-175	
		5		2.5										20	
		10		0.1				40-250							
		10		0.5				40		50	75				
		10		0.02						40	40		40		
		10		1									20		

JEDEC TO-3 PACKAGE

40325
40363

JEDEC TO-5 OR TO-39 PACKAGE

40309 40319 40327
40311 40320 40360
40314 40321 40361
40315 40323 40362
40317 40326

JEDEC TO-66 PACKAGE

40310 40322
40312 40324
40313 40328
40316 40364
40318

ELECTRICAL CHARACTERISTICS for Types in TO-66 Package At $T_C = 25^{\circ}C$ Unless Otherwise Specified (Cont'd.)

CHARACTERISTIC	CONDITIONS					LIMITS										UNITS
	V_{CB}	V_{CE}	V_{EB}	I_C	T_C	40310	40312	40313	40316	40318	40322	40324	40328	40364		
	Volts			A	$^{\circ}C$											
f_T (Typ.)		4		0.5		750	750		750			750				kHz
		10		2.5										15		mHz
$I_{S/b}$ # (Min.)		150						150		100	100		100			mA
		40												750		mA
$E_{S/b}$ # (Min.)			4							50	50					μJ
θ_{J-C} (Max.)						6	6	5	6	5	5	6	5	5		$^{\circ}C/W$

* Pulsed; Pulse duration = 300 μ sec, duty factor < 2%.

[†] R_{BE} value

[‡] $R_{BE} = 200 \Omega$, $L = 5$ mH

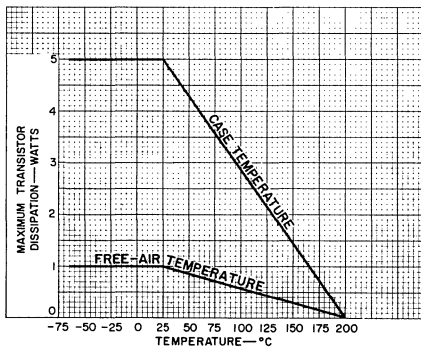
$I_{S/b}$ is defined as the current at which second breakdown occurs at a specified collector voltage with the emitter-base junction forward biased

$E_{S/b}$ is defined as the energy at which second breakdown occurs under specified reverse bias conditions. $E_{S/b} = \frac{1}{2} I_C^2 L$, where L is a series load or leakage inductance and I is the peak collector current. $R_{BE} = 20$ ohms & $L = 100 \mu$ h.

[†] $R_{BE} = 150 \Omega$

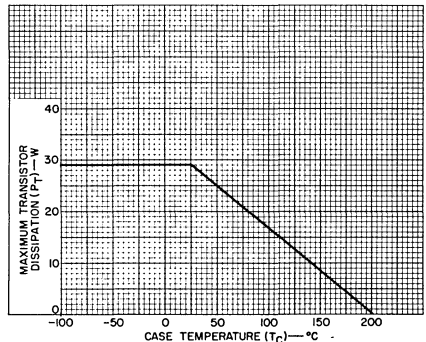
[‡] $I_B = 0.25$ A

* BV_{CEO} value.



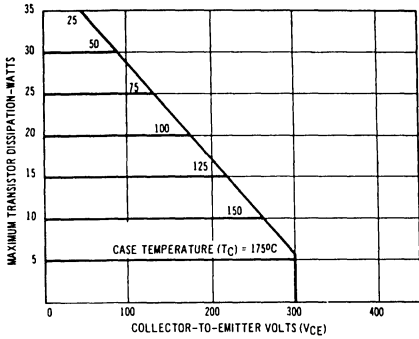
92CS-11172R1

Fig. 1 - Dissipation rating curves for types 40309, 40311, 40314, 40315, 40317, 40319, 40320, 40323, 40326, 40360, 40361, and 40362.



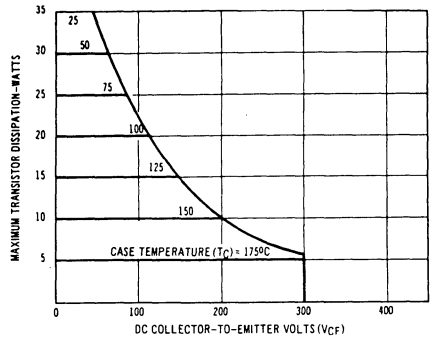
92CS-13005R1

Fig. 2 - Dissipation derating curve for types 40310, 40312, 40316, and 40324.



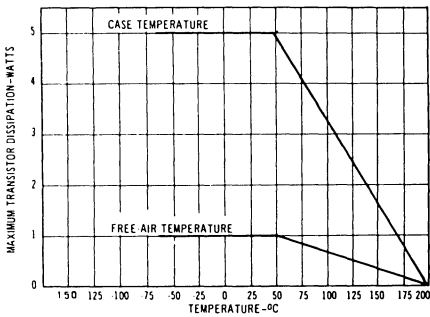
92CS-22431

Fig. 3 - Dissipation derating curve for type 40313.



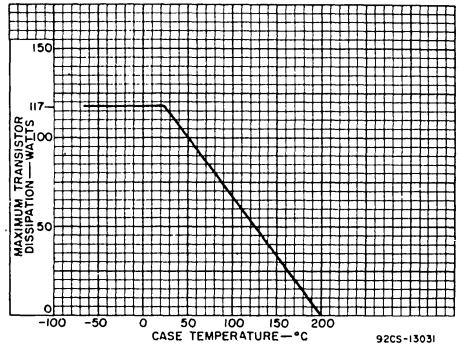
92CS-22432

Fig. 4 - Dissipation derating curve for types 40318, 40322, and 40328.



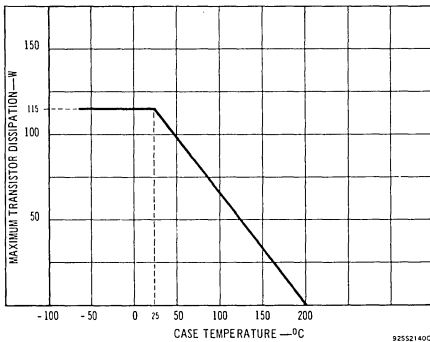
92CS-22433

Fig. 5 - Dissipation derating curves for types 40321 and 40327.



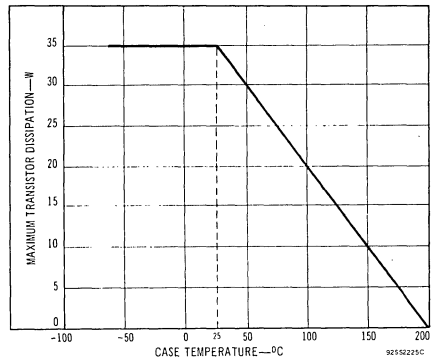
92CS-13031

Fig. 6 - Dissipation derating curve for type 40325.



92SS2140C

Fig. 7 - Dissipation derating curve for type 40363.



92SS2225C

Fig. 8 - Dissipation derating curve for type 40364.