

2N6648 2N6649 2N6650



PNP Silicon Power Darlington Transistors

Rev. V1

Features

- Available in JAN, JANTX, JANTXV per MIL-PRF-19500/527
- TO-3 (TO-204AA) Package
- High Frequency Response
- Designed for Power Amplifier and Shunt and Series Regulator Applications



Electrical Characteristics ($T_A = +25^\circ\text{C}$ unless otherwise noted)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Emitter Breakdown Voltage	$I_C = -200 \text{ mA dc}$ 2N6648 2N6649 2N6650	$V_{(BR)CEO}$	V dc	-40 -60 -80	—
Collector - Emitter Breakdown Voltage	$I_C = -200 \text{ mA dc}; R_{BB} = 100\Omega$ 2N6648 2N6649 2N6650	$V_{(BR)CER}$	V dc	-40 -60 -80	—
Collector - Base Cutoff Current	$V_{CE} = -40 \text{ V dc}$, 2N6648 $V_{CE} = -60 \text{ V dc}$, 2N6649 $V_{CE} = -80 \text{ V dc}$, 2N6650	I_{CBO1}	mA dc	—	-1.0
Emitter - Base Cutoff Current	$V_{EB} = -5 \text{ V dc}$	I_{EBO}	mA dc	—	-10.0
Collector - Emitter Cutoff Current	$V_{CE} = -40 \text{ V dc}$, 2N6648 $V_{CE} = -60 \text{ V dc}$, 2N6649 $V_{CE} = -80 \text{ V dc}$, 2N6650	I_{CEO}	mA dc	—	-1.0
Collector - Emitter Cutoff Current	$V_{CE} = -40 \text{ V dc}; V_{BE} = +1.5 \text{ V dc}$, 2N6648 $V_{CE} = -60 \text{ V dc}; V_{BE} = +1.5 \text{ V dc}$, 2N6649 $V_{CE} = -80 \text{ V dc}; V_{BE} = +1.5 \text{ V dc}$, 2N6650	I_{CEX1}	$\mu\text{A dc}$	—	-10
Forward Current Transfer Ratio	$V_{CE} = -3.0 \text{ V dc}; I_C = -1.0 \text{ A dc}$ $V_{CE} = -3.0 \text{ V dc}; I_C = -5 \text{ A dc}$ $V_{CE} = -3.0 \text{ V dc}; I_C = -10 \text{ A dc}$	h_{FE1} h_{FE2} h_{FE3}	-	300 1000 100	20,000
Saturation Voltage and Resistance	$I_C = -5.0 \text{ A dc}; I_B = -10 \text{ mA dc}$ $I_C = -10 \text{ A dc}; I_B = -0.1 \text{ A dc}$	$V_{CE(SAT)1}$ $V_{CE(SAT)2}$	V dc	—	-2.0 -3.0
Base - Emitter Voltage (Unsaturated)	$V_{CE} = -3.0 \text{ V dc}; I_C = -5.0 \text{ A dc}$ $V_{CE} = -3.0 \text{ V dc}; I_C = -10 \text{ A dc}$	$V_{BE(on)1}$ $V_{BE(on)2}$	V dc	—	-2.8 -4.5
Collector-Emitter Cutoff Current	$T_A = +150^\circ\text{C}$ $V_{CE} = -40 \text{ V dc}; V_{BE} = +1.5 \text{ Vdc}$, 2N6648 $V_{CE} = -60 \text{ V dc}; V_{BE} = +1.5 \text{ Vdc}$, 2N6649 $V_{CE} = -80 \text{ V dc}; V_{BE} = +1.5 \text{ Vdc}$, 2N6650	I_{CEX2}	mA dc	—	-3.0
Forward - Current Transfer Ratio	$T_A = -65^\circ\text{C}$ $V_{CE} = -3.0 \text{ V dc}; I_C = -5.0 \text{ A dc}$	h_{FE4}		200	

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Electrical Characteristics ($T_A = +25^\circ\text{C}$ unless otherwise noted)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Magnitude of Small-Signal Short-Circuit Forward-Current Transfer Ratio	$V_{CE} = -5\text{ V dc}; I_C = -1.0\text{ A dc}; f = 1.0\text{ MHz}$	$ h_{fe} $	-	30	400
Open-Circuit Output Capacitance	$V_{CB} = 10\text{ V dc}; I_E = 0; 100\text{ kHz} \leq f \leq 1\text{ MHz}$	C_{obo}	pF	—	300
Turn-On Time	$V_{CC} = -30\text{ V dc}; I_C = -5\text{ A dc}; I_{B1} = -20\text{ mA dc}$	t_{on}	μs	—	2.5
Turn-Off Time	$V_{CC} = -30\text{ V dc}; I_C = -5\text{ A dc}; I_{B1} = -I_{B2} = 20\text{ mA dc}$	t_{off}	μs	—	10

Absolute Maximum Ratings ($T_A = +25^\circ\text{C}$ unless otherwise noted)

Ratings	Symbol	2N6648	2N6649	2N6650	Units
Collector - Emitter Voltage	V_{CEO}	-40	-60	-80	V dc
Collector - Base Voltage	V_{CBO}	-40	-60	-80	V dc
Emitter - Base Voltage	V_{EBO}	-5.0			V dc
Collector Current	I_C	-10			A dc
Base Current	I_B	-0.25			A dc
Total Power Dissipation @ $T_A = +25^\circ\text{C}$ ⁽¹⁾ @ $T_C = +25^\circ\text{C}$ ⁽²⁾	P_T	5.0 85			W
Operating & Storage Temperature Range	T_J, T_{STG}	-65 to +175			$^\circ\text{C}$

(1) Derate linearly @ 33.3 mW / $^\circ\text{C}$ above $T_A > 25^\circ\text{C}$.

(2) Derate linearly @ 567 mW / $^\circ\text{C}$ above $T_C > 25^\circ\text{C}$.

Thermal Characteristics

Characteristics	Symbol	Max. Value
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.76 $^\circ\text{C/W}$

Safe Operating Area

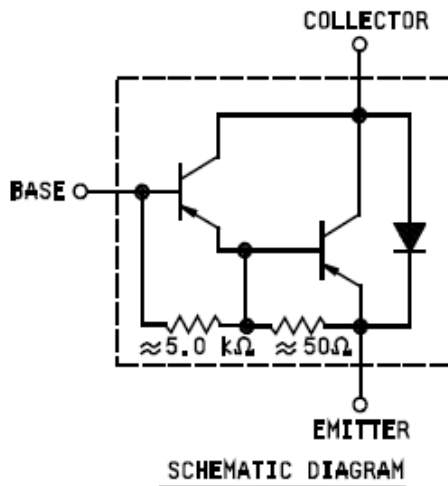
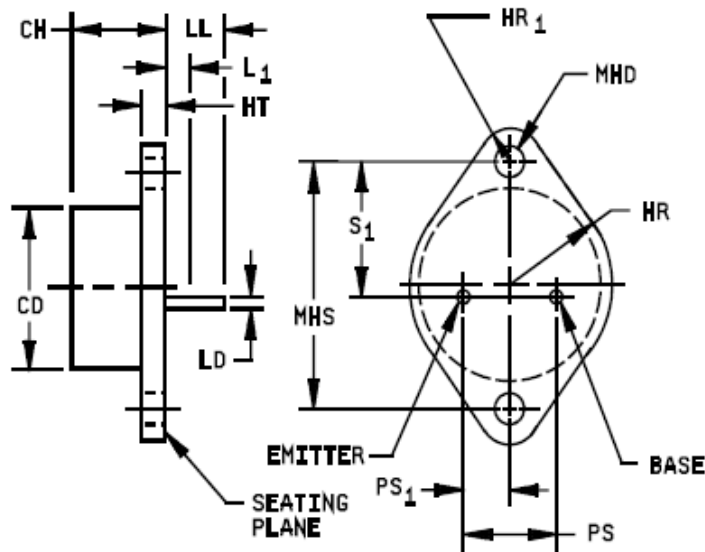
DC Tests:	$T_C = +25^\circ\text{C}, 1\text{ Cycle}, t = 1.0\text{ s}$
Test 1:	$V_{CE} = 8.5\text{ Vdc}; I_C = -10\text{ A dc},$ All Types
Test 2:	$V_{CE} = 25\text{ Vdc}; I_C = -3.4\text{ A dc},$ All Types
Test 3:	$V_{CE} = -40\text{ Vdc}; I_C = -0.9\text{ A dc},$ 2N6648
	$V_{CE} = -60\text{ Vdc}; I_C = -0.3\text{ A dc},$ 2N6649
	$V_{CE} = -80\text{ Vdc}; I_C = -0.14\text{ A dc},$ 2N6650

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Outline Drawing (TO-3)



Outline Drawing (TO-3)

MIL-PRF-19500/527F

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD		.875		22.23	
CH	.250	.450	6.35	11.43	
HR	.495	.525	12.57	13.34	
HR ₁	.131	.188	3.33	4.78	
HT	.050	.135	1.27	3.43	
LD	.038	.043	0.97	1.09	
LL	.312	.500	7.92	12.70	
L ₁		.050		1.27	
MHD	.151	.161	3.84	4.09	
MHS	1.177	1.197	29.90	30.40	
PS	.420	.440	10.67	11.18	3
PS ₁	.205	.225	5.21	5.72	3
s ₁	.655	.675	16.64	17.15	

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. These dimensions should be measured at points .050 inch (1.27 mm) and .055 inch (1.40 mm) below seating plane. When gauge is not used measurement will be made at the seating plane.
4. The seating plane of the header shall be flat within .001 inch (0.03 mm) concave to .004 inch (0.10 mm) convex inside a .930 inch (23.62 mm) diameter circle on the center of the header and flat within .001 inch (0.03 mm) concave to .006 inch (0.15 mm) convex overall.
5. Mounting holes shall be deburred on the seating plane side.
6. Collector is electrically connected to the case.
7. In accordance with AMSE Y14.5M, diameters are equivalent to ϕ x symbology.

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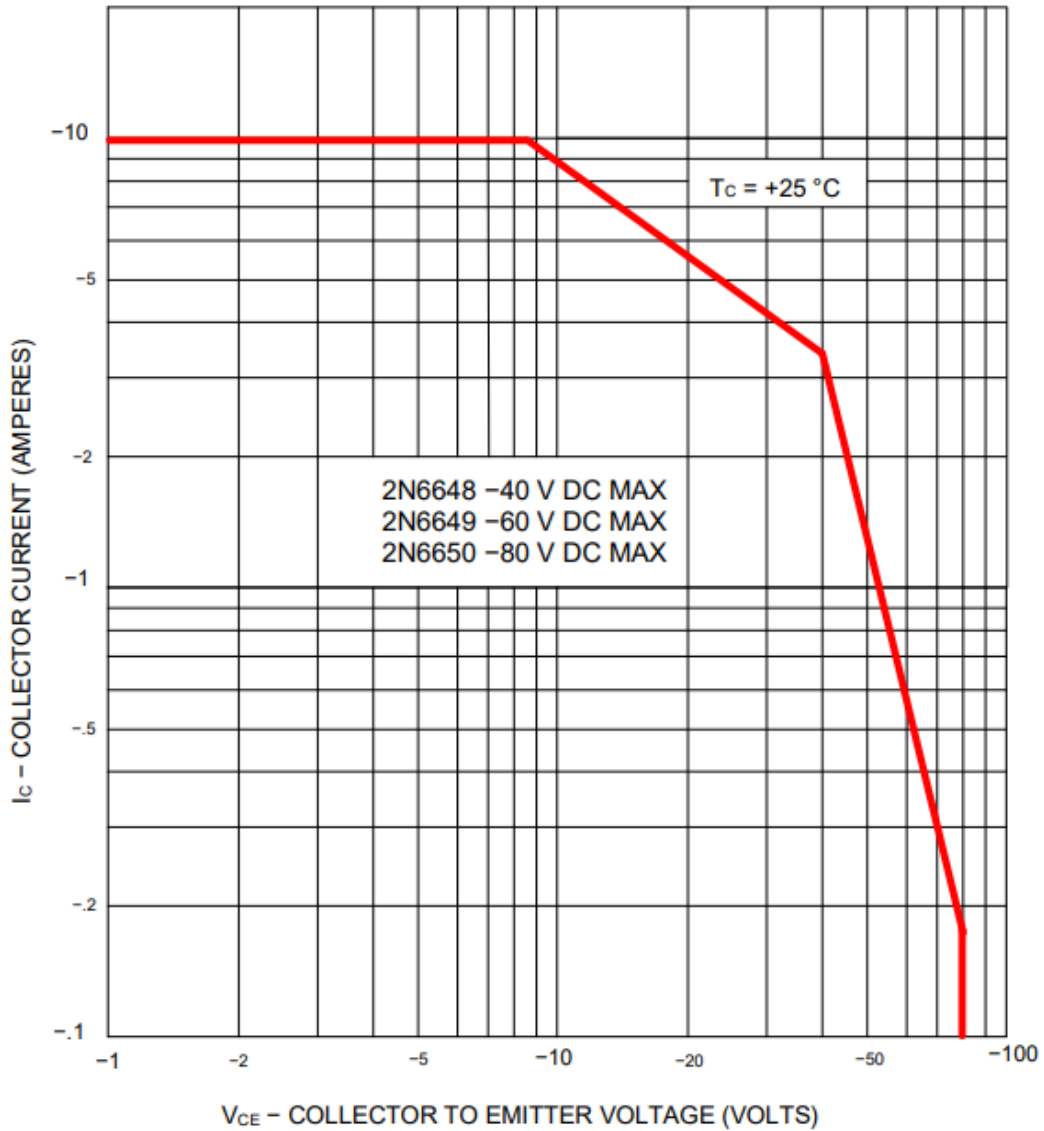


FIGURE 3. Maximum safe operating area graph (continuous dc).

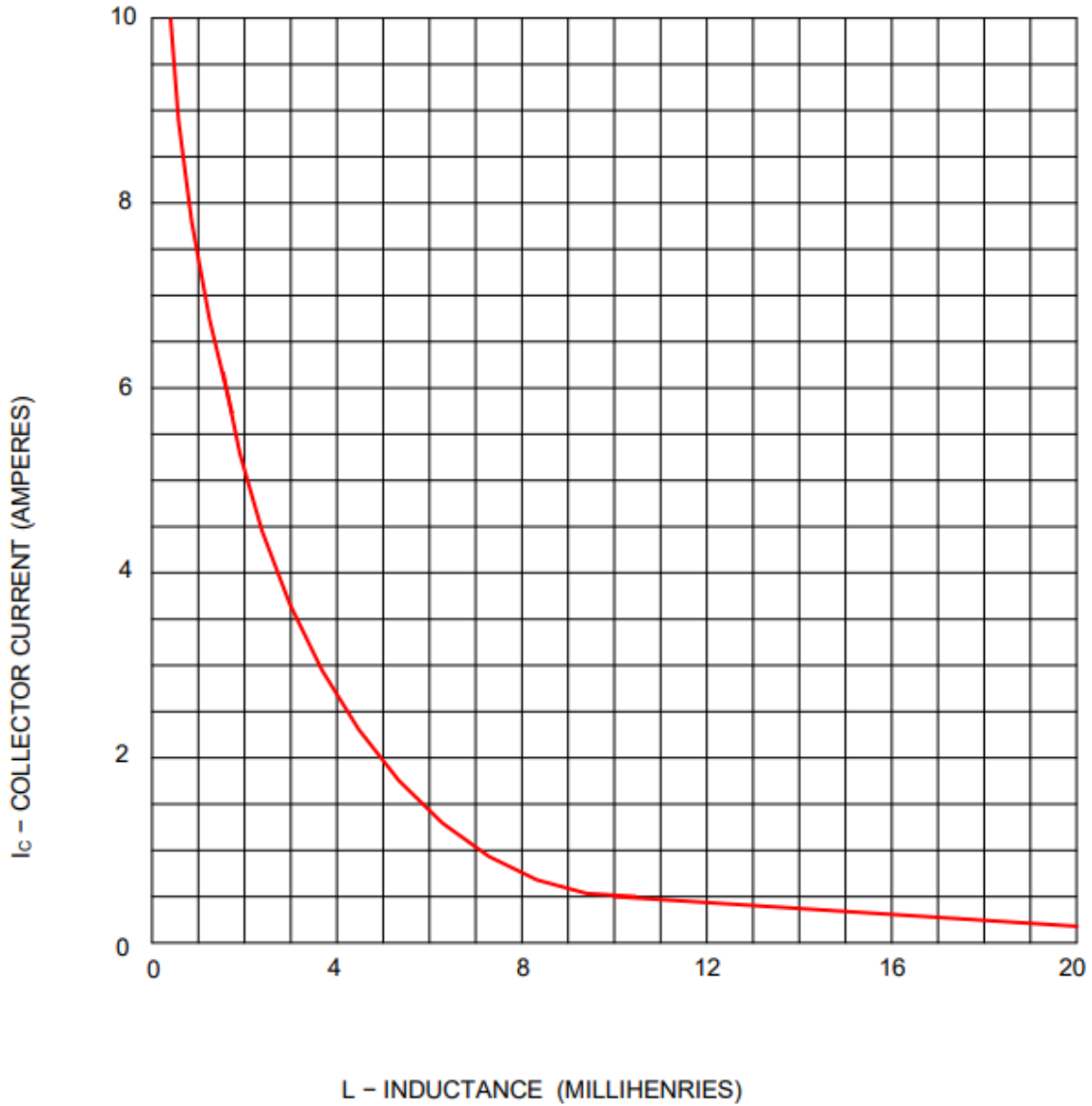


FIGURE 4. Safe operating area for switching between saturation and cutoff (unclamped inductive load).

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