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NPN Darlington Power Silicon Transistor

Qualified per MIL-PRF-19500/472

*Qualified Levels:
JAN, JANTX, and
JANTXV*

DESCRIPTION

This high speed NPN transistor is military qualified up to the JANTXV level. This TO-33 leaded top-hat has three isolated terminals with terminal four, the collector terminal, tied to the case.

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FEATURES

- JEDEC registered 2N6350 and 2N6351
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/472 (See [part nomenclature](#) for all available options)
- RoHS compliant versions available (commercial grade only)

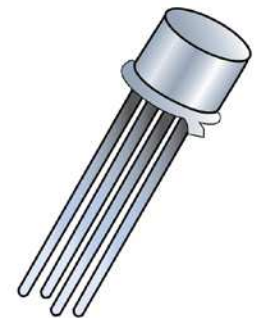
APPLICATIONS / BENEFITS

- Military and other high reliability applications
- High frequency response
- TO-33 leaded top-hat

MAXIMUM RATINGS @ T_C = +25 °C unless otherwise noted

Parameters/Test Conditions	Symbol	Value	Unit	
Junction and Storage Temperature	T _J and T _{STG}	-65 to +200	°C	
Thermal Resistance Junction-to-Case	R _{θJC}	20	°C/W	
Collector-Emitter Voltage		2N6350	80	V
		2N6351	150	
Collector-Base Voltage		2N6350	80	V
		2N6351	150	
Emitter-Base Voltage	V _{EBO}	12	V	
Total Power Dissipation		@ T _A = +25 °C ⁽¹⁾	6.0	W
		@ T _C = +100 °C ⁽²⁾	5.0	
Base Current	I _B	0.5	A	
Collector Current	I _C	5	A	

- Notes:**
1. Derate linearly 5.72 mW/°C for T_A > +25 °C
 2. Derate linearly 50 mW/°C for T_C > +100 °C



TO-33 Package

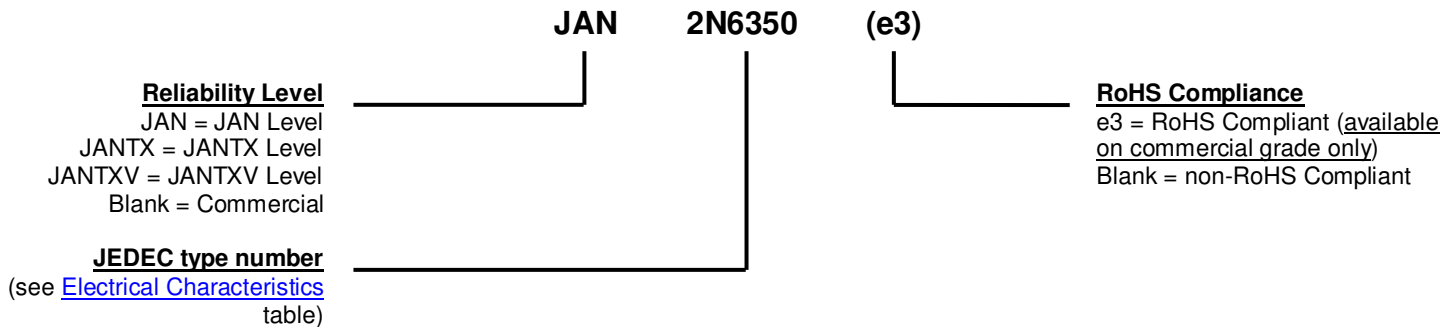
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MECHANICAL and PACKAGING

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Solder dip (Sn63/Pb37), RoHS compliant matte-tin plating available on commercial grade only.
- MARKING: Part number, date code, manufacturer's ID and serial number
- WEIGHT: Approximately 1.2 grams
- See [package dimensions](#) on last page.

PART NOMENCLATURE

SYMBOLS & DEFINITIONS

Symbol	Definition
I_B	Base current: The value of the dc current into the base terminal.
I_C	Collector current: The value of the dc current into the collector terminal.
I_E	Emitter current: The value of the dc current into the emitter terminal.
T_C	Case temperature: The temperature measured at a specified location on the case of a device.
V_{CB}	Collector-base voltage: The dc voltage between the collector and the base.
V_{CBO}	Collector-base voltage, base open: The voltage between the collector and base terminals when the emitter terminal is open-circuited.
V_{CC}	Collector-supply voltage: The supply voltage applied to a circuit connected to the collector.
V_{CEO}	Collector-emitter voltage, base open: The voltage between the collector and the emitter terminals when the base terminal is open-circuited.
V_{CE}	Collector-emitter voltage: The dc voltage between the collector and the emitter.
V_{EB}	Emitter-base voltage: The dc voltage between the emitter and the base.
V_{EBO}	Emitter-base voltage, collector open: The voltage between the emitter and base terminals with the collector terminal open-circuited.

ELECTRICAL CHARACTERISTICS @ $T_A = +25^\circ\text{C}$ unless otherwise noted

Characteristics	Symbol	Min.	Max.	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage $I_C = 25\text{ mA}$, $R_{B1E} = 2.2\text{ k}\Omega$, $R_{B2E} = 100\ \Omega$	2N6350 2N6351	$V_{(BR)CEO}$	80 150	V
Collector-Emitter Breakdown Voltage $I_E = 12\text{ mA}$, base 1 open $I_E = 12\text{ mA}$, base 2 open		$V_{(BR)EBO}$	6.0 12	V
Collector-Emitter Cutoff Current $V_{CE} = 80\text{ V}$, $V_{EB1} = 2\text{ V}$, $R_{B2E} = 100\ \Omega$ $V_{CE} = 150\text{ V}$, $V_{EB1} = 2\text{ V}$, $R_{B2E} = 100\ \Omega$	2N6350 2N6351	I_{CEX}	1.0	μA

ON CHARACTERISTICS

Forward-Current Transfer Ratio $I_C = 1.0\text{ A}$, $V_{CE} = 5.0\text{ V}$, $R_{B2E} = 1\text{ k}\Omega$	2N6350 2N6351	hFE	2,000 1,000	
$I_C = 5.0\text{ A}$, $V_{CE} = 5.0\text{ V}$, $R_{B2E} = 100\ \Omega$	2N6350 2N6351		2,000 1,000	10,000 10,000
$I_C = 10.0\text{ A}$, $V_{CE} = 5.0\text{ V}$, $R_{B2E} = 100\ \Omega$	2N6350 2N6351		400 200	
Collector-Emitter Saturation Voltage $I_C = 5.0\text{ A}$, $I_B = 5\text{ mA}$, $R_{B2E} = 100\ \Omega$ $I_C = 5.0\text{ A}$, $I_B = 10\text{ mA}$, $R_{B2E} = 100\ \Omega$		$V_{CE(sat)}$	1.5 2.5	V
Base-Emitter Voltage Non-saturated $V_{CE} = 5.0\text{ V}$, $I_C = 5.0\text{ A}$, $R_{B2E} = 100\ \Omega$		V_{BE}	2.5	V

DYNAMIC CHARACTERISTICS

Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 1.0\text{ A}$, $V_{CE} = 10.0\text{ V}$, $f = 10\text{ MHz}$, $R_{B2E} = 100\ \Omega$	$ h_{fe} $	5	25	
Output Capacitance $V_{CB} = 10\text{ V}$, $100\text{ kHz} \leq f \leq 1\text{ MHz}$, base 2 open	Cobo		120	pF

ELECTRICAL CHARACTERISTICS @ $T_C = 25^\circ\text{C}$ unless otherwise noted. (continued)
SWITCHING CHARACTERISTICS

Turn-On Time $V_{CC} = 30\text{ V}, I_C = 5.0\text{ A}$	t_{on}		0.5	μs
Turn-Off Time $V_{CC} = 30\text{ V}, I_C = 5.0\text{ A}$	t_{off}		1.2	μs

SAFE OPERATING AREA (See [Figures 1 and 2](#) and [MIL-STD-750, Test Method 3053](#))
DC Tests
 $T_C = +100^\circ\text{C}, t \geq 1\text{ second}, 1\text{ Cycle}; t_r + t_f = 10\ \mu\text{s}, R_{B2E} = 100\ \Omega$
Test 1
 $V_{CE} = 1.5\text{ V}, I_C = 3.3\text{ A}$
Test 2
 $V_{CE} = 30\text{ V}, I_C = 167\text{ mA}$
Test 3
 $V_{CE} = 80\text{ V}, I_C = 35\text{ mA}$ (2N6350)

Test 4
 $V_{CE} = 150\text{ V}, I_C = 13\text{ mA}$ (2N6351)

SAFE OPERATING AREA

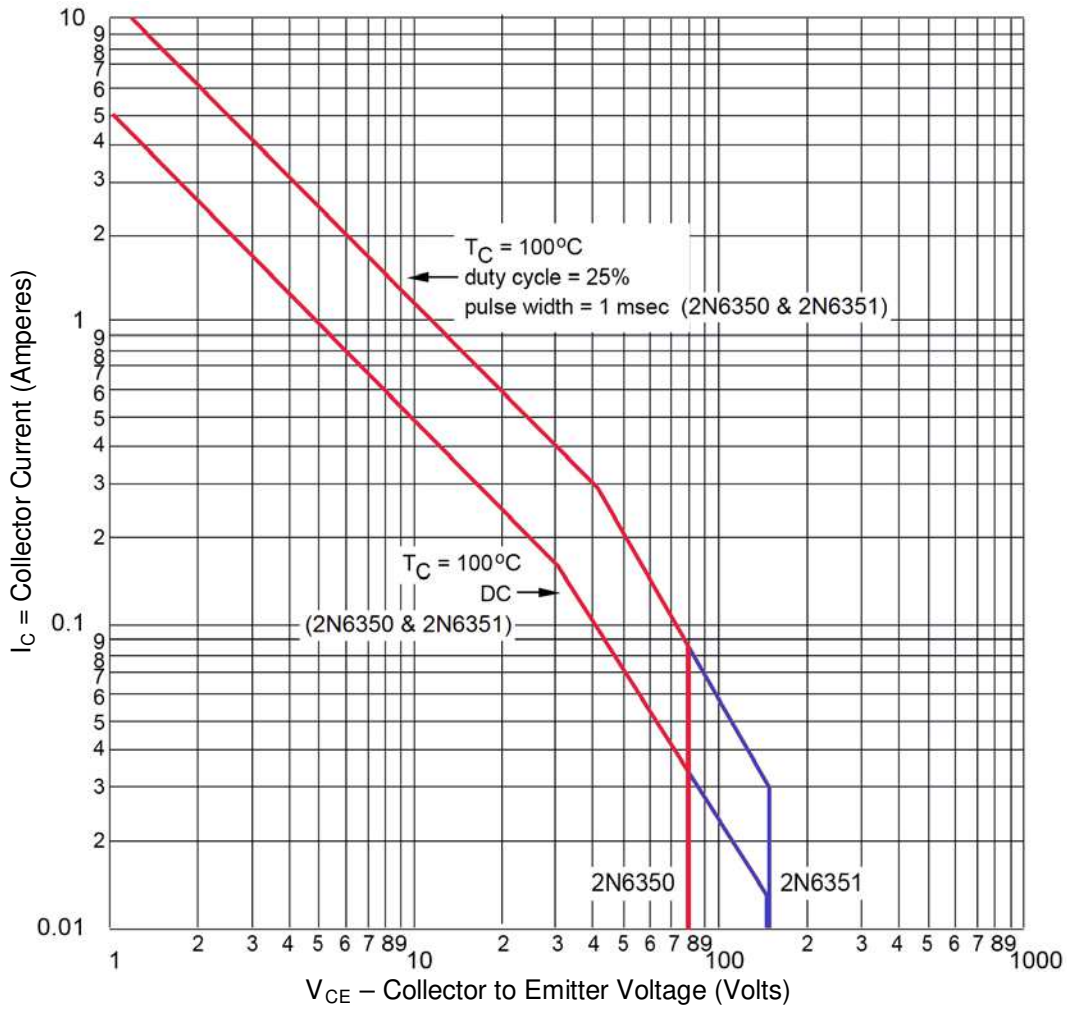


FIGURE 1
Maximum Safe Operating Area

SAFE OPERATING AREA (continued)

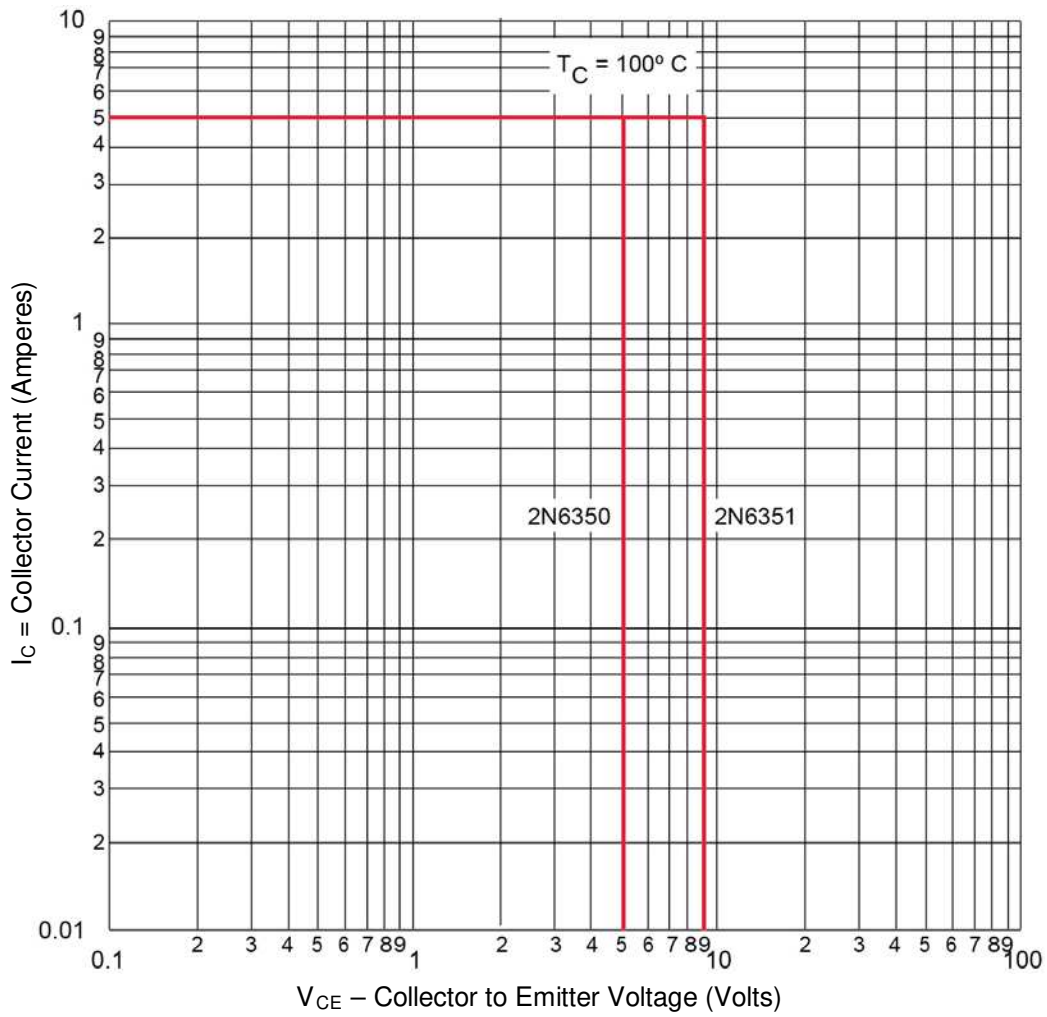
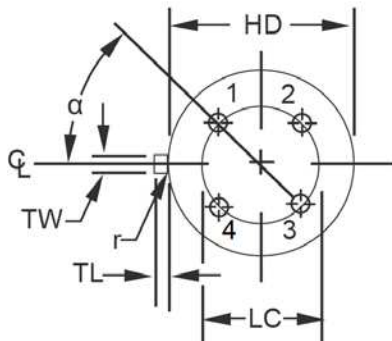
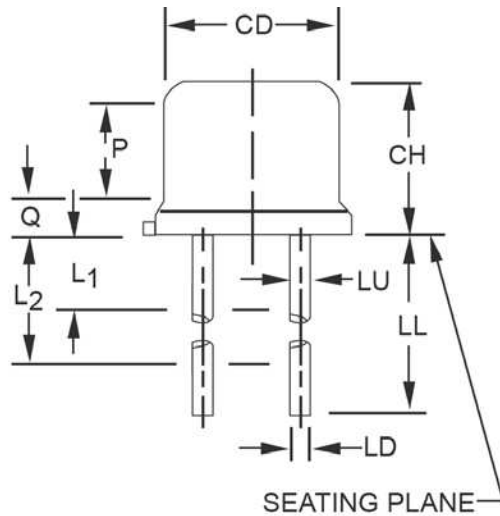


FIGURE 2
Safe Operating Area For Switching Between Saturation And Cutoff
 (unclamped inductive load)

PACKAGE DIMENSIONS


Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	0.305	0.335	7.75	8.51	3
CH	0.240	0.260	6.10	6.60	
HD	0.335	0.370	8.51	9.40	
LC	0.200 TP		5.08 TP		4
LD	0.016	0.021	0.41	0.53	5, 6
LL	1.500	1.750	38.10	44.45	5, 6
LU	0.016	0.019	0.41	0.48	5, 6
L₁	-	0.050	-	1.27	5, 6
L₂	0.250	-	6.35	-	5, 6
Q	-	0.050	-	1.27	9
TL	0.029	0.045	0.74	1.14	7
TW	0.028	0.034	0.71	0.86	8
r	-	0.010	-	0.25	10
α	45° TP		45° TP		4
P	0.100	-	2.54	-	3

NOTES:

- Dimensions are in inches. Millimeters are given for information only.
- Internal resistance (typically 750 ohms). This resistor is optional.
- Dimension CD shall not vary more than 0.010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
- Leads at gauge plane 0.054 +0.001 -0.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within 0.007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods.
- Dimension LU applies between dimension L1 and dimension L2. Dimension LD applies between L2 and LL minimum. Diameter is uncontrolled in dimension L1 and beyond dimension LL minimum.
- All terminals.
- Dimension TL measured from maximum HD.
- Beyond r (radius) maximum, dimension TW shall be held for a minimum length of 0.011 inch (0.28 mm).
- Outline in this zone is not controlled.
- The radius (dimension r) applies to both inside corners of the tab.
- Terminal designation is as follows: 1 – emitter, 2 – base (B2), 3 – base (B1), 4 – collector. The collector shall be connected to the case.
- In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.

See schematic on next page

SCHEMATIC

