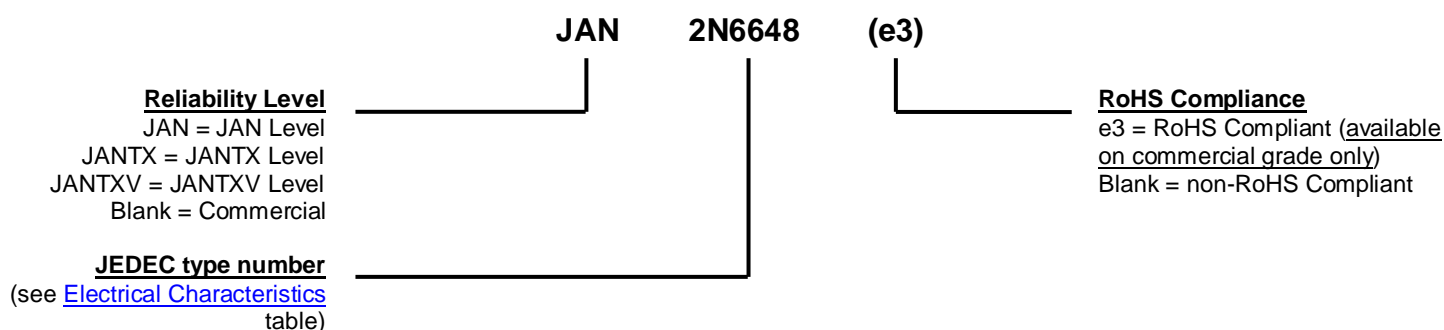


### MECHANICAL and PACKAGING

- CASE: Industry standard TO-204AA (TO-3), hermetically sealed, 0.040 inch diameter pins
- FINISH: Solder dipped tin-lead over nickel plated alloy 52 or RoHS compliant matte-tin plating. Solderable per MIL-STD-750 method 2026.
- POLARITY: PNP (see [schematic](#))
- MOUNTING HARDWARE: Consult factory for optional insulator and sheet metal screws
- WEIGHT: Approximately 15 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 $I_C = -200\text{ mA}$	2N6648 2N6649 2N6650	$V_{(BR)CEO}$	-40 -60 -80	V
Collector-Emitter Breakdown Voltage $I_C = -200\text{ mA}$ , $R_{BB} = 100\ \Omega$	2N6648 2N6649 2N6650	$V_{(BR)CER}$	-40 -60 -80	V
Collector-Emitter Cutoff Current $V_{CE} = -40\text{ V}$ $V_{CE} = -60\text{ V}$ $V_{CE} = -80\text{ V}$	2N6648 2N6649 2N6650	$I_{CEO}$		-1.0 mA
Collector-Emitter Cutoff Current $V_{CE} = -40\text{ V}$ , $V_{BE} = 1.5\text{ V}$ $V_{CE} = -60\text{ V}$ , $V_{BE} = 1.5\text{ V}$ $V_{CE} = -80\text{ V}$ , $V_{BE} = 1.5\text{ V}$	2N6648 2N6649 2N6650	$I_{CEX}$		10 $\mu\text{A}$
Emitter-Base Cutoff Current $V_{EB} = 5.0\text{ V}$		$I_{EBO}$		-10 mA
Collector-Emitter Cutoff Current $V_{CE} = -40\text{ V}$ $V_{CE} = -60\text{ V}$ $V_{CE} = -80\text{ V}$	2N6648 2N6649 2N6650	$I_{CBO}$		-1.0 mA

**ON CHARACTERISTICS**

Forward-Current Transfer Ratio $I_C = -1.0\text{ A}$ , $V_{CE} = -3.0\text{ V}$ $I_C = -5\text{ A}$ , $V_{CE} = -3.0\text{ V}$ $I_C = -10\text{ A}$ , $V_{CE} = -3.0\text{ V}$ $I_C = -5\text{ A}$ , $V_{CE} = -3.0\text{ V}$ , $T_A = -65^\circ\text{C}$		$h_{FE}$	300 1,000 100 200	20,000	
Collector-Emitter Saturation Voltage $I_C = -5.0\text{ A}$ , $I_B = -10\text{ mA}$ $I_C = -10\text{ A}$ , $I_B = -0.1\text{ mA}$		$V_{CE(sat)}$		-2.0 -3.0	V
Base-Emitter Voltage Non-saturated $V_{CE} = -3.0\text{ V}$ , $I_C = -5.0\text{ A}$ $V_{CE} = -3.0\text{ V}$ , $I_C = -10\text{ A}$		$V_{BE(on)}$		-2.8 -4.5	V

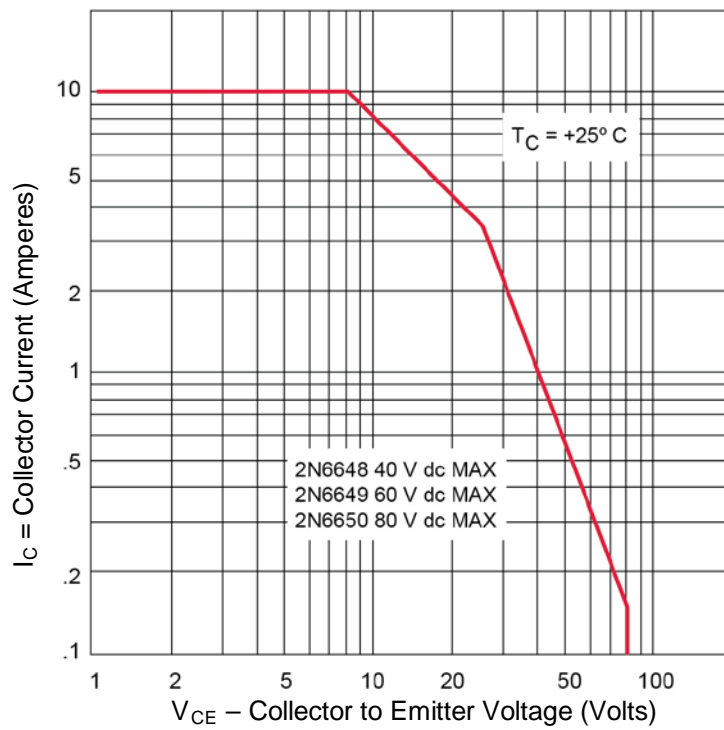
**DYNAMIC CHARACTERISTICS**

Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = -1.0\text{ A}$ , $V_{CE} = -5.0\text{ V}$ , $f = 1.0\text{ MHz}$		$ h_{fe} $	30	400	
Output Capacitance $V_{CB} = -10\text{ V}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1\text{ MHz}$		$C_{obo}$		300	pF

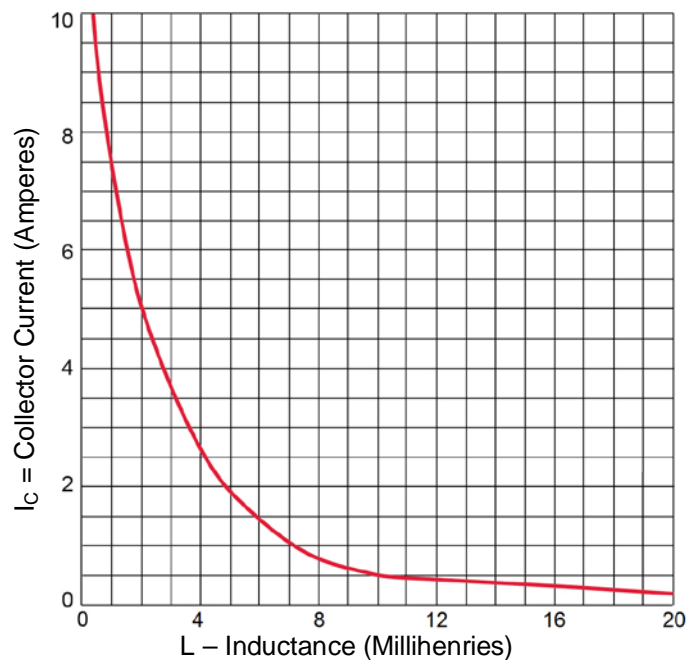
**ELECTRICAL CHARACTERISTICS @  $T_C = 25^\circ\text{C}$  unless otherwise noted. (continued)****SWITCHING CHARACTERISTICS**

Turn-On Time $V_{CC} = -30\text{ V}$ , $I_C = -5.0\text{ A}$ ; $I_B = -20\text{ mA}$	$t_{on}$		2.5	$\mu\text{s}$
Turn-Off Time $V_{CC} = -30\text{ V}$ , $I_C = -5.0\text{ A}$ ; $I_{B1} = I_{B2} = -20\text{ mA}$	$t_{off}$		10	$\mu\text{s}$

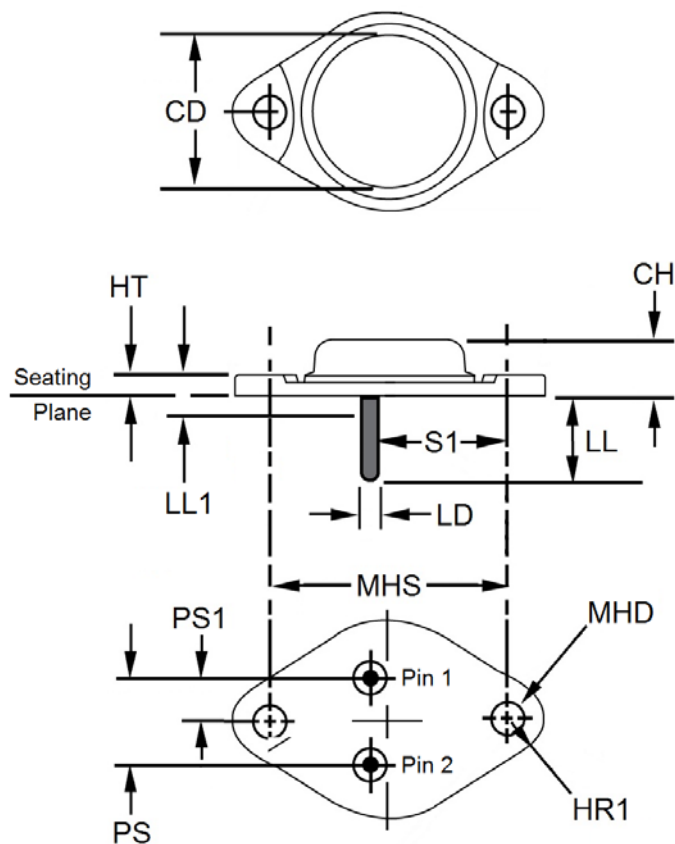
**SAFE OPERATING AREA (See [Figures 1 and 2](#) and [MIL-STD-750, Test Method 3053](#))****DC Tests** $T_C = +25^\circ\text{C}$ ,  $t = 1\text{ second}$ , 1 Cycle**Test 1** $V_{CE} = -8.5\text{ V}$ ,  $I_C = -10\text{ A}$ **Test 2** $V_{CE} = -25\text{ V}$ ,  $I_C = -3.4\text{ A}$ **Test 3** $V_{CE} = -40\text{ V}$ ,  $I_C = -0.9\text{ A}$  (2N6648) $V_{CE} = -60\text{ V}$ ,  $I_C = -0.3\text{ A}$  (2N6649) $V_{CE} = -80\text{ V}$ ,  $I_C = -0.14\text{ A}$  (2N6650)

**SAFE OPERATING AREA**


**FIGURE 1**  
Maximum Safe Operating Graph (continuous dc)



**FIGURE 2**  
Safe Operating Area for Switching Between Saturation and Cutoff (unclamped inductive load)

**PACKAGE DIMENSIONS**


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	-	0.875	-	22.23	
CH	0.250	0.450	6.35	11.43	
HR	0.495	0.525	12.57	13.34	
HR1	0.131	0.188	3.33	4.78	
HT	0.050	0.135	1.52	3.43	
LD	0.038	0.043	0.97	1.09	
LL	0.312	0.500	7.92	12.70	
LL1	-	0.050	-	1.27	
MHD	0.151	0.161	3.84	4.09	
MHS	1.177	1.197	29.90	30.40	
PS	0.420	0.440	10.67	11.18	3
PS1	0.205	0.225	5.21	5.72	3
S1	0.655	0.675	16.64	17.15	

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for information only.
3. These dimensions should be measured at points 0.050 inch (1.27 mm) and 0.055 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 0.001 inch (0.03 mm) concave to 0.004 inch (0.10 mm) convex inside a 0.930 inch (23.62 mm) diameter circle on the center of the header and flat within 0.001 inch (0.03 mm) concave to 0.006 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  $\Phi$ x symbology.

See schematic on next page

**SCHEMATIC**
