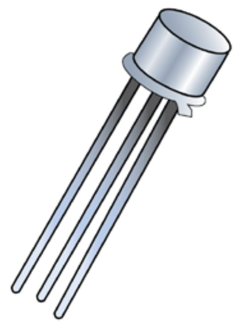
RADIATION HARDENED
NPN POWER SILICON TRANSISTOR
Qualified per MIL-PRF-19500/544

Qualified Levels:
JANSM, JANSD, JANSP, JANSL, JANSR, JANSF

DESCRIPTION

These RHA level 2N5152L and 2N5154L silicon transistor devices are military Radiation Hardness Assurance qualified up to a JANSF level for high-reliability applications. Microsemi also offers numerous other products to meet higher and lower power voltage regulation applications.

Important: For the latest information, visit our website http://www.microsemi.com.



TO-5 Package

FEATURES

- JEDEC registered 2N5152 and 2N5154.
- JANS RHA qualifications are available per MIL-PRF-19500/544.

Also available in:

TO-39 Package
(leaded)
JANS_2N5152 &
JANS_2N5154

U3 Package
(surface mount)
JANS_2N5152U3 &
JANS_2N5154U3

APPLICATIONS / BENEFITS

- High frequency operation.
- Lightweight.
- High-speed power-switching applications.
- High-reliability applications.

MAXIMUM RATINGS

Parameters/Test Conditions	Symbol	Value	Unit
Junction and Storage Temperature	T_J and T_{STG}	-65 to +200	ºC
Thermal Resistance Junction-to-Ambient	$R_{\Theta JA}$	175	ºC/W
Thermal Resistance Junction-to-Case	$R_{\Theta JC}$	10	ºC/W
Reverse Pulse Energy (1)		15	mJ
Collector Current (dc)	I_C	2	A
Collector to base voltage (static), emitter open	V_{CBO}	100	V
Collector to emitter voltage (static) base open	V_{CEO}	80	V
Emitter to base voltage (static) collector open	V_{EBO}	5.5	V
Steady-State Power Dissipation @ T_A = +25 ºC	P_D	1	W
Steady-State Power Dissipation @ T_C = +25 ºC	P_D	10	W

Notes: 1. This rating is based on the capability of the transistors to operate safely in the unclamped inductive load energy test circuit.

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MECHANICAL and PACKAGING

- CASE: Hermetically sealed, kovar base, nickel cap.
- TERMINALS: Leads are kovar, nickel plated, and finish is solder dip (Sn63/Pb37).
- MARKING: Part number, date code, manufacturer's ID.
- POLARITY: NPN (see package outline).
- WEIGHT: Approximately 1.14 grams.
- See Package Dimensions on last page.

PART NOMENCLATURE

JANSM 2N5152 L

Reliability Level
JANSM – 3K Rads (Si)
JANSD – 10K Rads (Si)
JANSP – 30K Rads (Si)
JANSL – 50K Rads (Si)
JANSR – 100K Rads (Si)
JANSF – 300K Rads (Si)

Long-Leaded Package

JEDEC type number
(See Electrical Characteristics table)

SYMBOLS & DEFINITIONS

Symbol	Definition
C_{obo}	Common-base open-circuit output capacitance
I_{CEO}	Collector cutoff current, base open
I_{CEX}	Collector cutoff current, circuit between base and emitter
I_{EBO}	Emitter cutoff current, collector open
h_{FE}	Common-emitter static forward current transfer ratio
V_{CEO}	Collector-emitter voltage, base open
V_{CBO}	Collector-emitter voltage, emitter open
V_{EBO}	Emitter-base voltage, collector open

ELECTRICAL CHARACTERISTICS @ T_A = +25 ºC unless otherwise noted.

OFF CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Collector-Emitter Breakdown Voltage I_C = 100 mA, I_B = 0	$V_{(BR)CEO}$	80		V
Emitter-Base Cutoff Current V_{EB} = 4.0 V, I_C = 0 V_{EB} = 5.5 V, I_C = 0	I_{EBO}		1.0 1.0	µA mA
Collector-Emitter Cutoff Current V_{CE} = 60 V, V_{BE} = 0 V_{CE} = 100 V, V_{BE} = 0	I_{CES}		1.0 1.0	µA mA
Collector-Emitter Cutoff Current V_{CE} = 40 V, I_B = 0	I_{CEO}		50	µA

ON CHARACTERISTICS

Parameters / Test Conditions		Symbol	Min.	Max.	Unit
Forward-Current Transfer Ratio I_C = 50 mA, V_{CE} = 5 V I_C = 2.5 A, V_{CE} = 5 V I_C = 5A, V_{CE} = 5V	 2N5152L 2N5154L 2N5152L 2N5154L 2N5152L 2N5154L	h_{FE}	 20 50 30 70 20 40	 -- -- 90 200 -- --	
Collector-Emitter Saturation Voltage I_C = 2.5 A, I_B = 250 mA I_C = 5.0 A, I_B = 500 mA		$V_{CE(sat)}$		0.75 1.5	V
Base-Emitter Voltage Non-Saturation I_C = 2.5 A, V_{CE} = 5 V		V_{BE}		1.45	V
Base-Emitter Saturation Voltage I_C = 2.5 A, I_B = 250 mA I_C = 5.0 A, I_B = 500 mA		$V_{BE(sat)}$		1.45 2.2	V

DYNAMIC CHARACTERISTICS

Parameters / Test Conditions		Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio I_C = 500 mA, V_{CE} = 5 V, f = 10 MHz	2N5152L 2N5154L	$\|h_{fe}\|$	6 7		
Small-signal short Circuit Forward-Current Transfer Ratio I_C = 100 mA, V_{CE} = 5 V, f = 1 KHz	2N5152L 2N5154L	h_{fe}	20 50		
Output Capacitance V_{CB} = 10 V, I_E = 0, f = 1.0 MHz		C_{obo}		250	pF

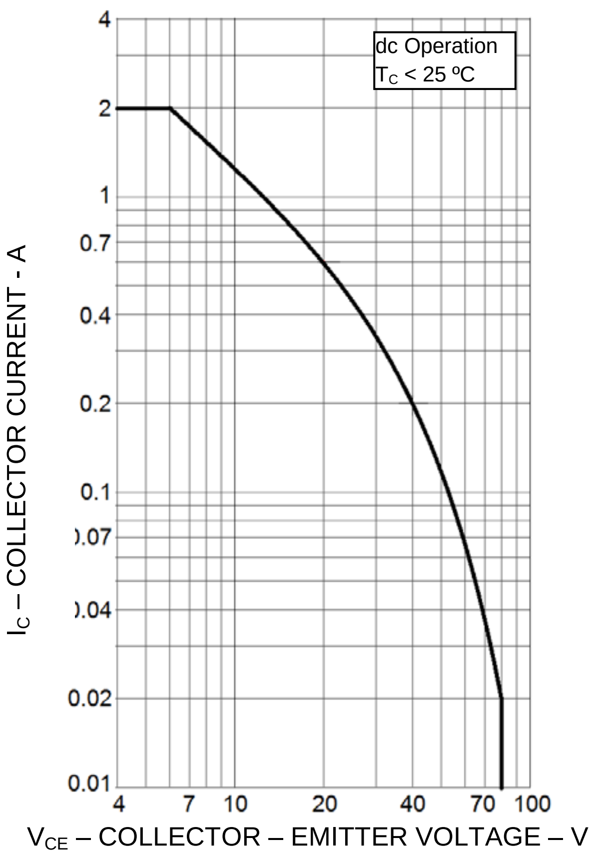
ELECTRICAL CHARACTERISTICS @ T_A = +25 °C unless otherwise noted. (continued)

SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-On Time I_C = 5 A, I_{B1} = 500 mA	t_{on}		0.5	µs
Turn-Off Time R_L = 6Ω	t_{off}		1.5	µs
Storage Time I_{B2} = -500 mA	t_S		1.4	µs
Fall Time $V_{BE(OFF)}$ = 3.7 V	t_f		0.5	µs

SAFE OPERATING AREA (See SOA graph below and MIL-STD-750, method 3053)

DC Tests
T_C = +25 °C, t_P = 1.0 s, 1 Cycle
Test 1
V_{CE} = 5.0 V, I_C = 2.0 A
Test 2
V_{CE} = 32 V, I_C = 310 mA
Test 3
V_{CE} = 80 V, I_C = 12.5 mA



Maximum Safe Operating Area

ELECTRICAL CHARACTERISTICS @ T_A = +25 °C, unless otherwise noted (continued)

POST RADIATION ELECTRICAL CHARACTERISTICS

Parameters / Test Conditions		Symbol	Min.	Max.	Unit
Collector to Emitter Cutoff Current V_{CE} = 40 V		I_{CEO}		100	µA
Emitter to Base Cutoff Current V_{EB} = 4 V		I_{EBO}		2.0	µA
Breakdown Voltage, Collector to Emitter I_C = 100 mA		$V_{(BR)CEO}$	80		V
Collector to Emitter Cutoff Current V_{CE} = 60 V		I_{CES}		2.0	µA
Emitter to Base Cutoff Current V_{EB} = 5.5 V		I_{EBO}		2.0	mA
Forward-Current Transfer Ratio (1)		$[h_{FE}]$			
I_C = 50 mA, V_{CE} = 5 V	2N5152L		[10]		
	2N5154L		[25]		
I_C = 2.5 A, V_{CE} = 5 V	2N5152L		[15]	90	
	2N5154L		[35]	200	
I_C = 5 A pulsed, V_{CE} = 5 V	2N5152L		[10]		
	2N5154L		[20]		
Base to Emitter voltage (non-saturated) V_{CE} = 5 V, I_C = 2.5 A, pulsed		V_{BE}		1.45	V
Collector-Emitter Saturation Voltage I_C = 2.5 mA, I_B = 250 mA, pulsed I_C = 500 mA, I_B = 500 mA, pulsed		$V_{CE(sat)}$		0.86 1.73	V
Base-Emitter Saturation Voltage I_C = 2.5 A, I_B = 250 mA, pulsed I_C = 5 A, I_B = 500 mA, pulsed		$V_{BE(sat)}$		1.67 2.53	V

(1) See method 1019 of MIL-STD-750 for how to determine $[h_{FE}]$ by first calculating the delta $(1/h_{FE})$ from the pre- and post-radiation h_{FE}. Notice the $[h_{FE}]$ is not the same as h_{FE} and cannot be measured directly. The $[h_{FE}]$ value can never exceed the pre-radiation minimum h_{FE} that it is based upon.

GRAPHS

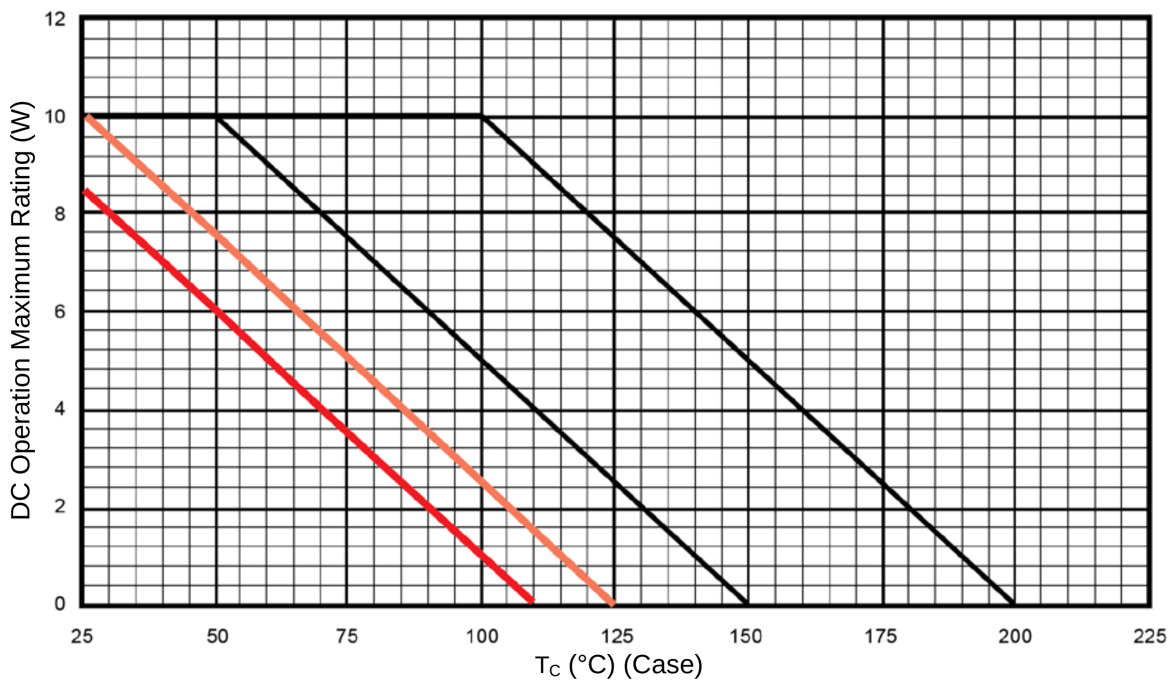


FIGURE 1
Temperature-Power Derating Curve

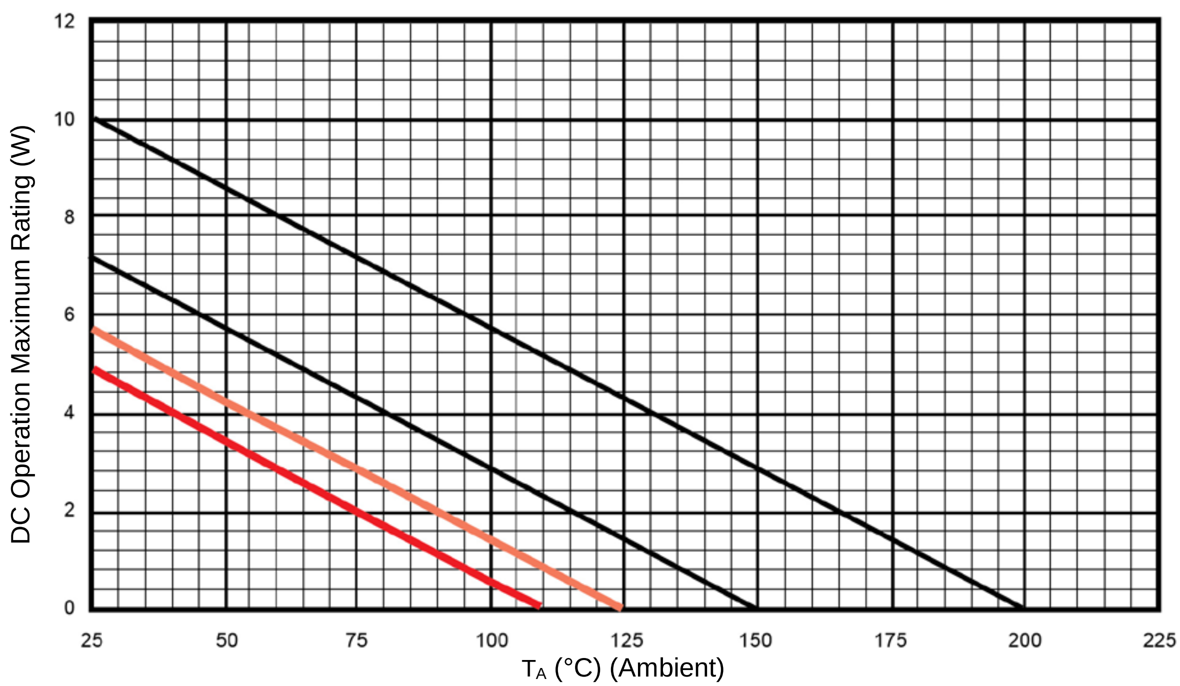


FIGURE 2
Temperature-Power Derating Curve

GRAPHS (continued)

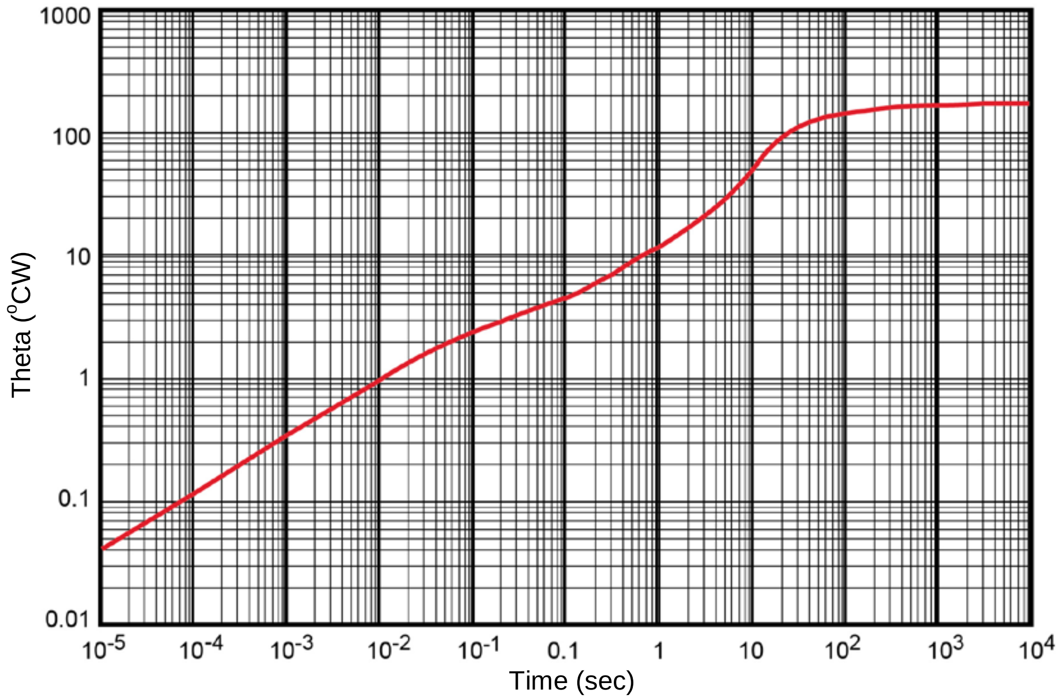


FIGURE 3
Thermal Impedance ($R_{\Theta JA}$)

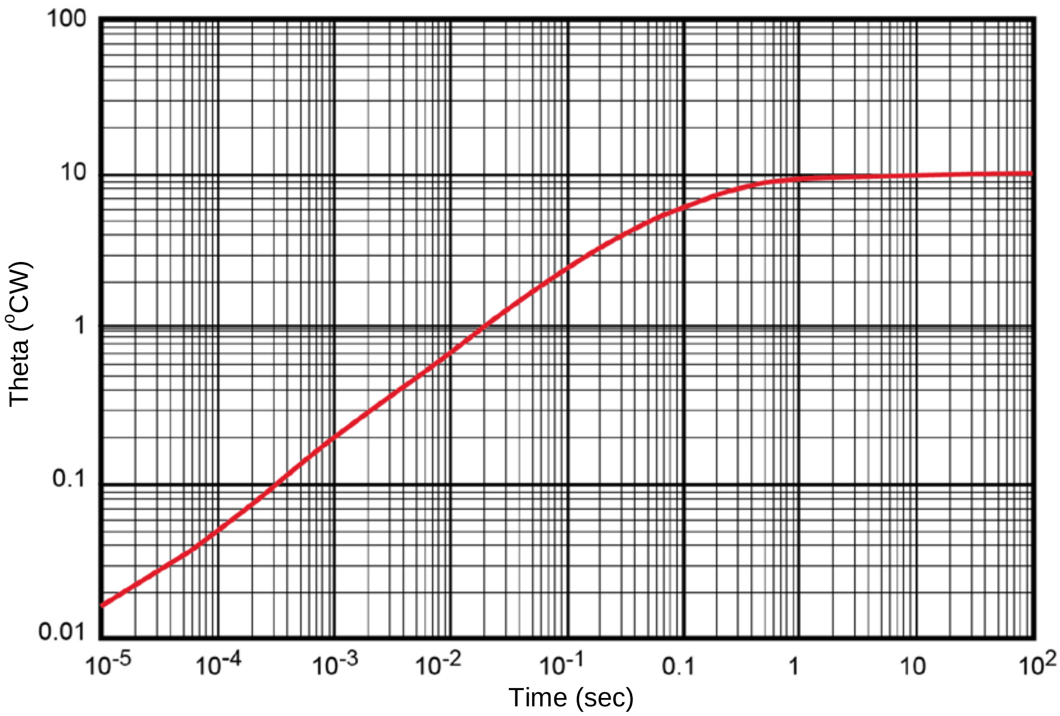
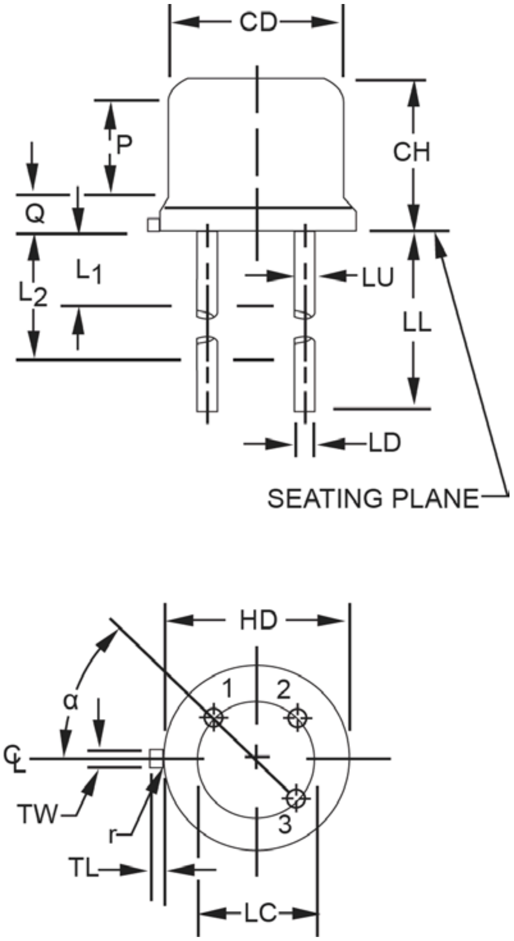


FIGURE 4
Thermal Impedance ($R_{\Theta JC}$)

PACKAGE DIMENSIONS



Symbol	Dimensions				Note
	Inch		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	6
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		7
LD	.016	.019	0.41	0.48	8,9
LL	See note 14				
LU	.016	.019	0.41	0.48	8,9
L1		.050		1.27	8,9
L2	.250		6.35		8,9
P	.100		2.54		7
Q		.030		0.76	5
TL	.029	.045	0.74	1.14	3,4
TW	.028	.034	0.71	0.86	3
r		.010		0.25	10
α	45° TP		45° TP		7

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
7. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .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 or by gauging procedure.
8. Dimension LU applies between L1 and L2. Dimension LD applies between L2 and LL minimum. Diameter is uncontrolled in and beyond LL minimum.
9. All three leads.
10. The collector shall be internally connected to the case.
11. Dimension r (radius) applies to both inside corners of tab.
12. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
14. TO-5 dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max.