

RADIATION HARDENED NPN POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/544

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

DESCRIPTION

These RHA level 2N5152U3 and 2N5154U3 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>.

FEATURES

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

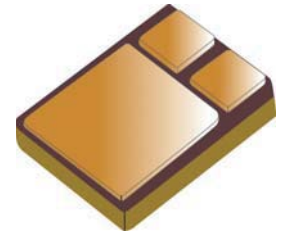
APPLICATIONS / BENEFITS

- 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	°C
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	175	°C/W
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	10	°C/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 @ $T_A = +25\text{ °C}$	P_D	1	W
Steady-State Power Dissipation @ $T_C = +25\text{ °C}$	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.



**U3 (SMD-0.5)
Package**

Also available in:

 **TO-5 Package**
(long-leaded)
JANS_2N5152L &
JANS_2N5154L

 **TO-39 Package**
(leaded)
JANS_2N5152 &
JANS_2N5154

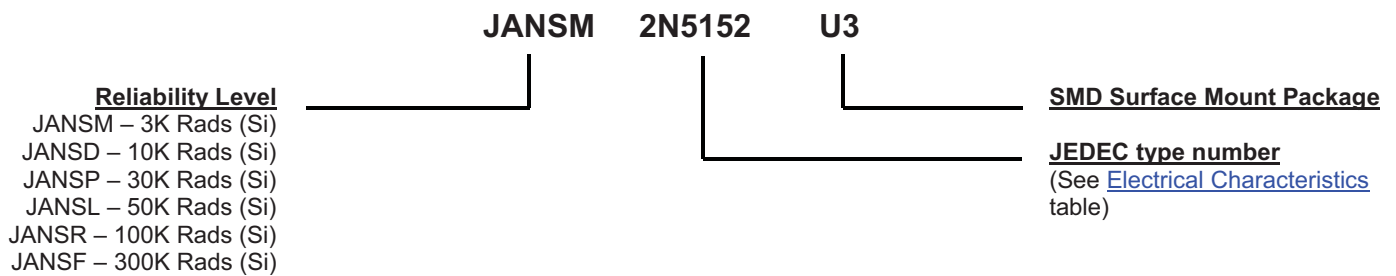
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MECHANICAL and PACKAGING

- CASE: Ceramic and gold over nickel plated steel.
- TERMINALS: Gold over nickel plated tungsten/copper.
- MARKING: Part number, date code, A = anode.
- POLARITY: See [schematic](#) on last page.
- WEIGHT: 0.9 grams.
- See [Package Dimensions](#) on last page.

PART NOMENCLATURE

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

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

ON CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Forward-Current Transfer Ratio $I_C = 50\text{ mA}, V_{CE} = 5\text{ V}$	h_{FE}	20	--	
2N5152U3		50	--	
$I_C = 2.5\text{ A}, V_{CE} = 5\text{ V}$		30	90	
2N5154U3		70	200	
$I_C = 5\text{ A}, V_{CE} = 5\text{ V}$		20	--	
2N5154U3		40	--	
Collector-Emitter Saturation Voltage $I_C = 2.5\text{ A}, I_B = 250\text{ mA}$ $I_C = 5.0\text{ A}, I_B = 500\text{ mA}$	$V_{CE(sat)}$		0.75 1.5	V
Base-Emitter Voltage Non-Saturation $I_C = 2.5\text{ A}, V_{CE} = 5\text{ V}$	V_{BE}		1.45	V
Base-Emitter Saturation Voltage $I_C = 2.5\text{ A}, I_B = 250\text{ mA}$ $I_C = 5.0\text{ A}, I_B = 500\text{ mA}$	$V_{BE(sat)}$		1.45 2.2	V

DYNAMIC CHARACTERISTICS

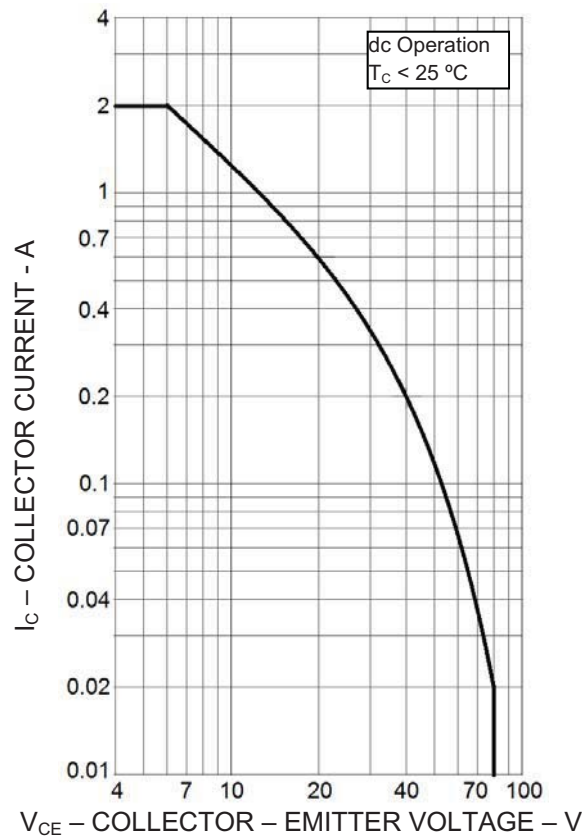
Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio 2N5152U3 2N5154U3 $I_C = 500\text{ mA}, V_{CE} = 5\text{ V}, f = 10\text{ MHz}$	$ h_{fe} $	6 7		
Small-signal short Circuit Forward-Current Transfer Ratio 2N5152U3 2N5154U3 $I_C = 100\text{ mA}, V_{CE} = 5\text{ V}, f = 1\text{ KHz}$	h_{fe}	20 50		
Output Capacitance $V_{CB} = 10\text{ V}, I_E = 0, f = 1.0\text{ MHz}$	C_{obo}		250	pF

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

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

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

DC Tests
 $T_C = +25^\circ\text{C}$, $t_p = 1.0\text{ s}$, 1 Cycle

Test 1
 $V_{CE} = 5.0\text{ V}$, $I_C = 2.0\text{ A}$
Test 2
 $V_{CE} = 32\text{ V}$, $I_C = 310\text{ mA}$
Test 3
 $V_{CE} = 80\text{ V}$, $I_C = 12.5\text{ mA}$

Maximum Safe Operating Area

ELECTRICAL CHARACTERISTICS @ $T_A = +25\text{ }^\circ\text{C}$, unless otherwise noted (continued)
POST RADIATION ELECTRICAL CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Collector to Emitter Cutoff Current $V_{CE} = 40\text{ V}$	I_{CEO}		100	μA
Emitter to Base Cutoff Current $V_{EB} = 4\text{ V}$	I_{EBO}		2.0	μA
Breakdown Voltage, Collector to Emitter $I_C = 100\text{ mA}$	$V_{(BR)CEO}$	80		V
Collector to Emitter Cutoff Current $V_{CE} = 60\text{ V}$	I_{CES}		2.0	μA
Emitter to Base Cutoff Current $V_{EB} = 5.5\text{ V}$	I_{EBO}		2.0	mA
Forward-Current Transfer Ratio ⁽¹⁾ $I_C = 50\text{ mA}$, $V_{CE} = 5\text{ V}$				
	2N5152U3	[10]		
	2N5154U3	[25]		
$I_C = 2.5\text{ A}$, $V_{CE} = 5\text{ V}$				
	2N5152U3	[15]	90	
	2N5154U3	[35]	200	
$I_C = 5\text{ A}$ pulsed, $V_{CE} = 5\text{ V}$				
	2N5152U3	[10]		
	2N5154U3	[20]		
Base to Emitter voltage (non-saturated) $V_{CE} = 5\text{ V}$, $I_C = 2.5\text{ A}$, pulsed	V_{BE}		1.45	V
Collector-Emitter Saturation Voltage $I_C = 2.5\text{ mA}$, $I_B = 250\text{ mA}$, pulsed $I_C = 500\text{ mA}$, $I_B = 500\text{ mA}$, pulsed	$V_{CE(sat)}$		0.86 1.73	V
Base-Emitter Saturation Voltage $I_C = 2.5\text{ A}$, $I_B = 250\text{ mA}$, pulsed $I_C = 5\text{ A}$, $I_B = 500\text{ mA}$, 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.

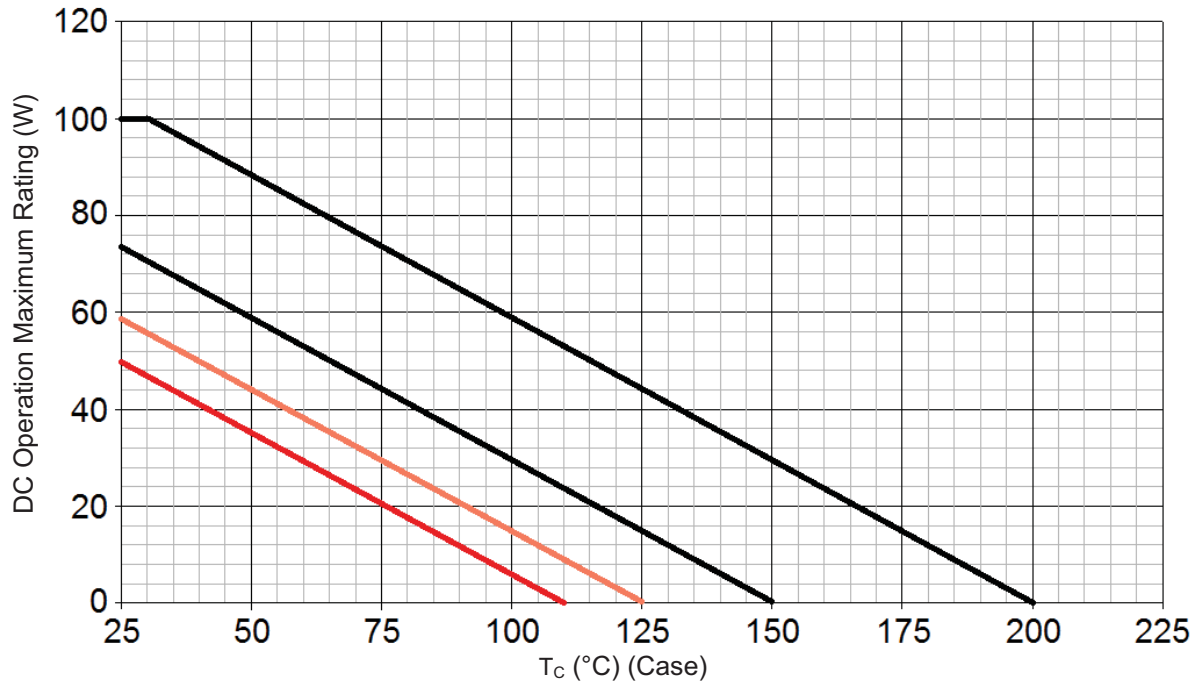
GRAPHS


FIGURE 1
Temperature-Power Derating Curve

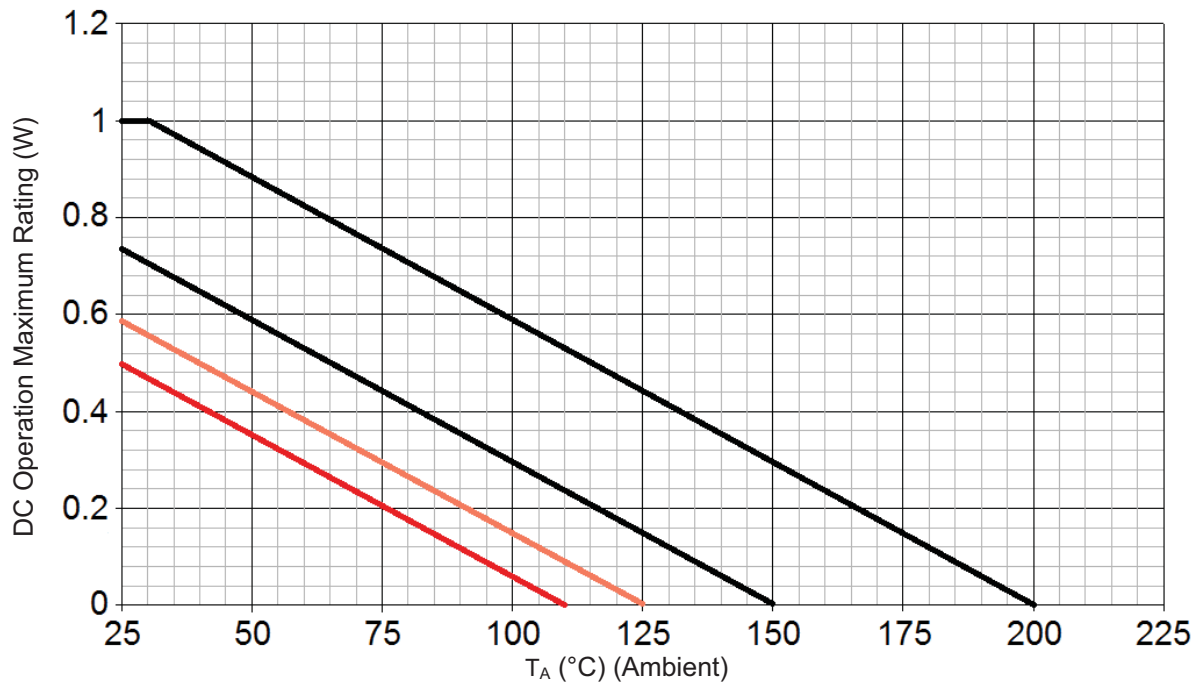


FIGURE 2
Temperature-Power Derating Curve

GRAPHS (continued)

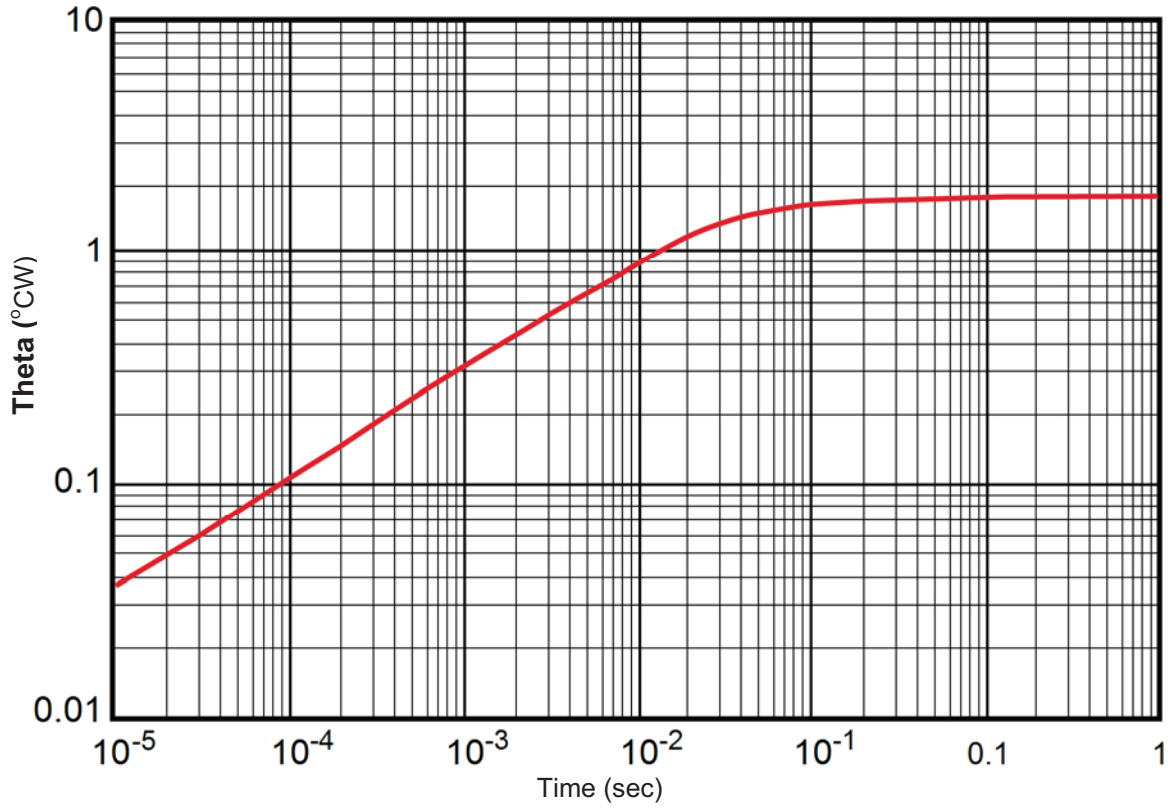
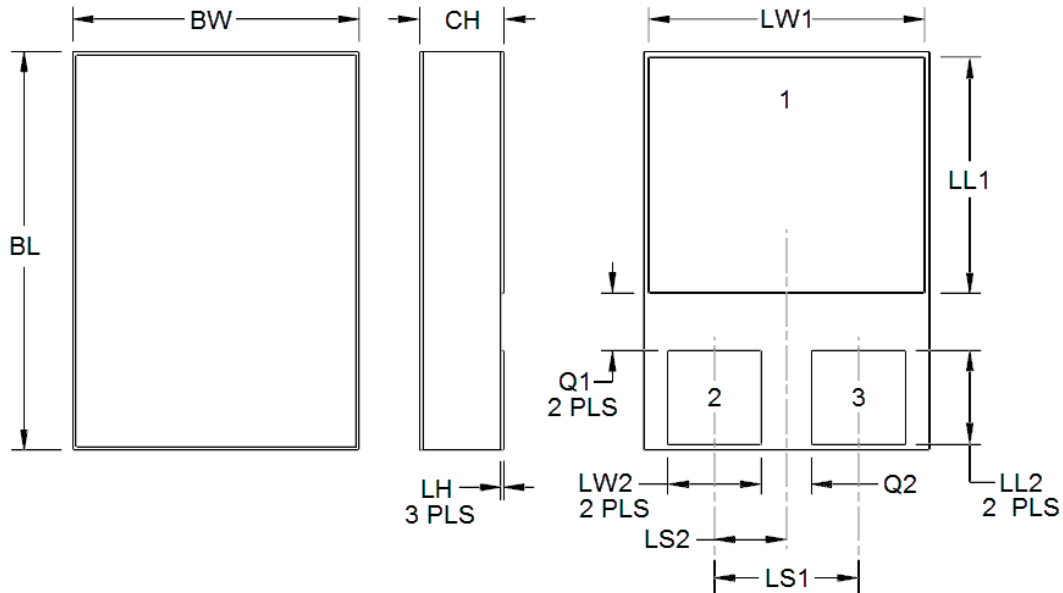
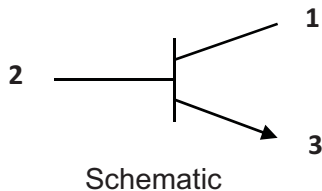


FIGURE 3
Maximum Thermal Impedance ($R_{\theta JC}$)

PACKAGE DIMENSIONS

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.



Symbol	DIMENSIONS			
	INCH		MILLIMETERS	
	Min	Max	Min	Max
BL	.395	.405	10.03	10.29
BW	.291	.301	7.39	7.65
CH	.112	.124	2.84	3.15
LH	.010	.020	0.25	0.51
LL1	.220	.230	5.59	5.84
LL2	.115	.125	2.92	3.18
LS1	.150 BSC		3.81 BSC	
LS2	.075 BSC		1.91 BSC	
LW1	.281	.291	7.14	7.39
LW2	.090	.100	2.29	2.54
Q1	.030		0.76	
Q2	.030		0.76	
Term 1	Collector			
Term 2	Base			
Term 3	Emitter			