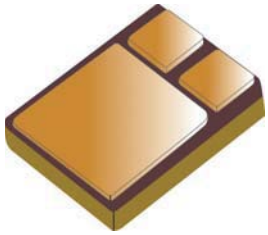
RADIATION HARDENED
NPN POWER SILICON TRANSISTOR
Qualified per MIL-PRF-19500/544

Qualified Levels:
JANSM, JANSD, 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.



U3 (SMD-0.5) Package

FEATURES

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

Also available in:

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

TO-39 Package
(leaded)
JANS_2N5152 & JANS_2N5154

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.

MSC – Lawrence
6 Lake Street,
Lawrence, MA 01841
Tel: 1-800-446-1158 or
(978) 620-2600
Fax: (978) 689-0803

MSC – Ireland
Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

Website:
www.microsemi.com

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

JANSM 2N5152 U3

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)

JEDEC type number
(See Electrical Characteristics table)

SMD Surface Mount Package

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	 2N5152U3 2N5154U3 2N5152U3 2N5154U3 2N5152U3 2N5154U3	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	2N5152U3 2N5154U3	$\|h_{fe}\|$	6 7		
Small-signal short Circuit Forward-Current Transfer Ratio I_C = 100 mA, V_{CE} = 5 V, f = 1 KHz	2N5152U3 2N5154U3	h_{fe}	20 50		
Output Capacitance V_{CB} = 10 V, I_E = 0, f = 1.0 MHz		C_{obo}		250	pF

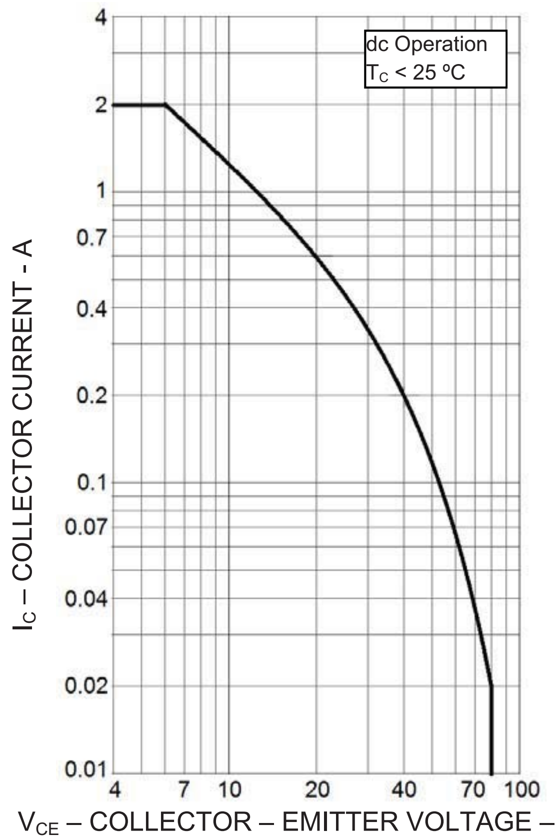
ELECTRICAL CHARACTERISTICS @ T_A = +25 °C unless otherwise noted. (continued)

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	2N5152U3		[10]		
	2N5154U3		[25]		
I_C = 2.5 A, V_{CE} = 5 V	2N5152U3		[15]	90	
	2N5154U3		[35]	200	
I_C = 5 A pulsed, V_{CE} = 5 V	2N5152U3		[10]		
	2N5154U3		[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

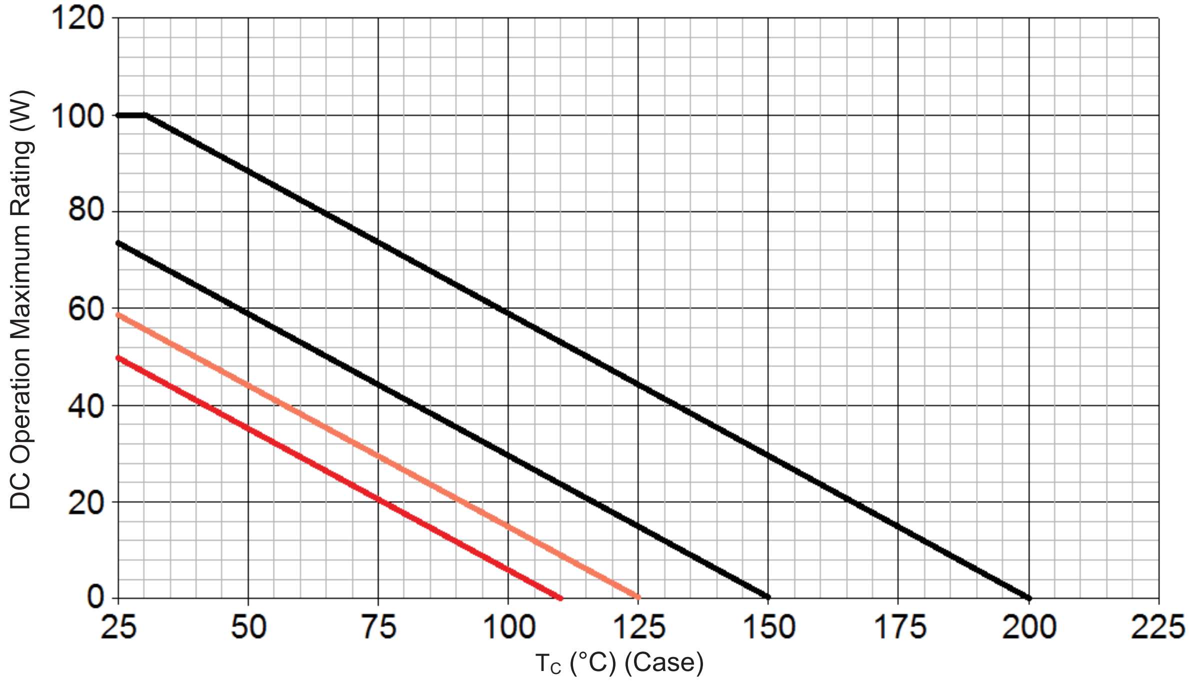


FIGURE 1
Temperature-Power Derating Curve

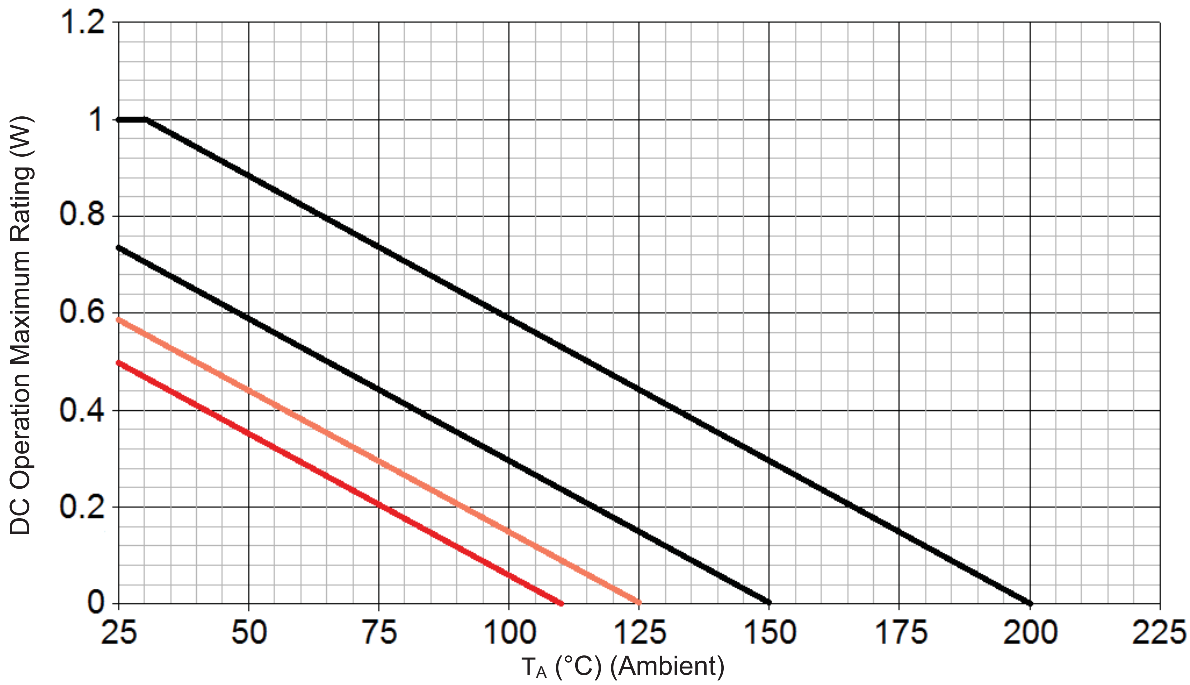


FIGURE 2
Temperature-Power Derating Curve

GRAPHS (continued)

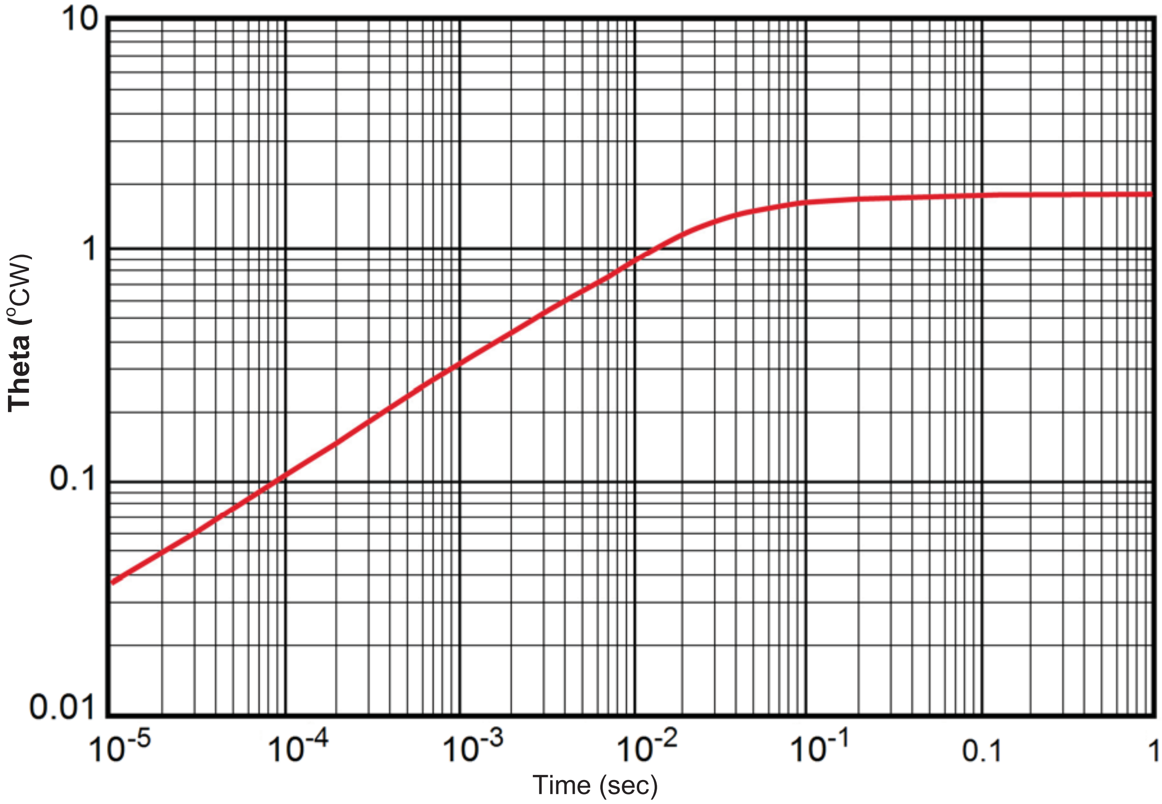


FIGURE 3

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