400V NPN HIGH-VOLTAGE TRANSISTOR IN SOT89

Features

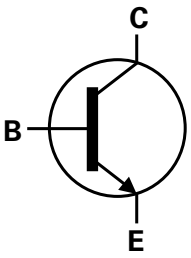
- BV_{CEO} > 400V
- I_C = 225mA Continuous Collector Current
- Low Saturation Voltage $V_{CE(sat)}$ < 200mV @ 20mA
- Complementary PNP Type: FCX558
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability. https://www.diodes.com/quality/product-definitions/**
- **An automotive-compliant part is available under a separate datasheet (FCX458Q)**

Mechanical Data

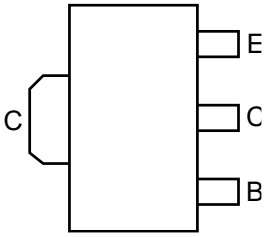
- Package: SOT89
- Package Material: Molded Plastic. "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.055 grams (Approximate)

SOT89

Top View



Equivalent Circuit



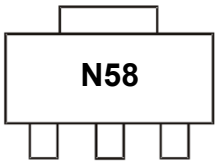
Top View
Pinout

Ordering Information (Note 4)

Orderable Part Number	Marking	Package	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
FCX458TA	N58	SOT89	7	12	1,000	Reel

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/

Marking Information



N58 = Product Type Marking Code

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	400	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	7	V
Continuous Collector Current	I_C	225	mA
Peak Pulse Current	I_{CM}	500	mA
Base Current	I_B	200	mA

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Power Dissipation	(Note 5)	P_D	0.7	W
	(Note 6)		1	
	(Note 7)		1.5	
	(Note 8)		2	
Thermal Resistance, Junction to Ambient Air	(Note 5)	$R_{\theta JA}$	178	°C/W
	(Note 6)		125	
	(Note 7)		83	
	(Note 8)		60	
Thermal Resistance, Junction to Lead	(Note 9)	$R_{\theta JL}$	22	
Operating and Storage Temperature Range		T_J, T_{STG}	-65 to +150	°C

ESD Ratings (Note 10)

Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

Notes:
5. For a device mounted with the exposed collector pad on minimum recommended pad layout (MRP) 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady state.
6. Same as Note 5, except the device is mounted with the exposed collector pad on 15mm x 15mm 1oz copper.
7. Same as Note 5, except the device is mounted with the exposed collector pad on 25mm x 25mm 1oz copper.
8. Same as Note 5, except the device is mounted with the exposed collector pad on 50mm x 50mm 1oz copper.
9. Thermal resistance from junction to solder-point (on the exposed collector pad).
10. Refer to JEDEC specifications JESD22-A114 and JESD22-A115.

Thermal Characteristics and Derating Information

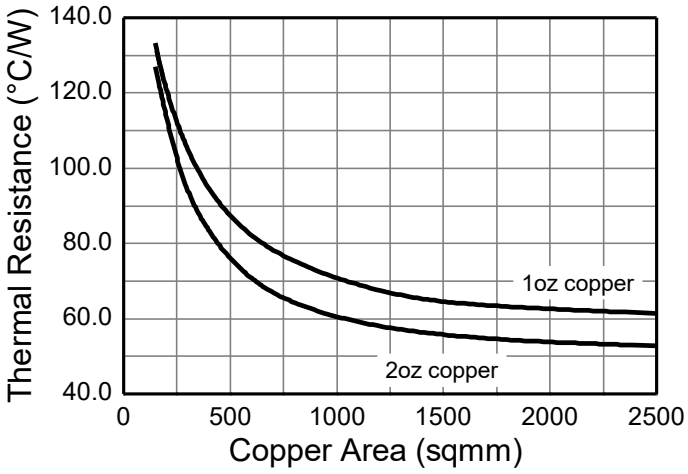


Figure 1. Thermal Impedance

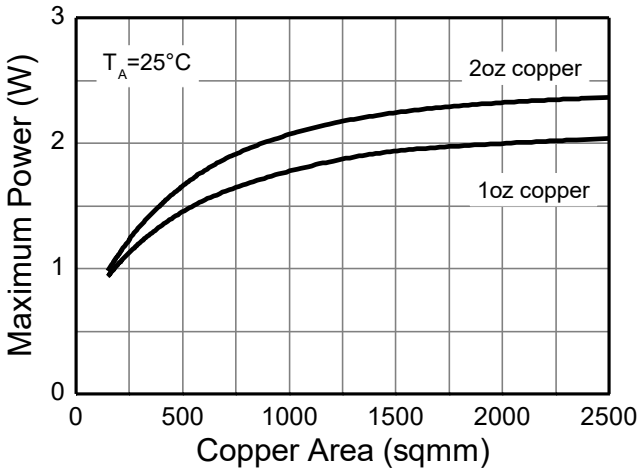


Figure 2. Power Dissipation

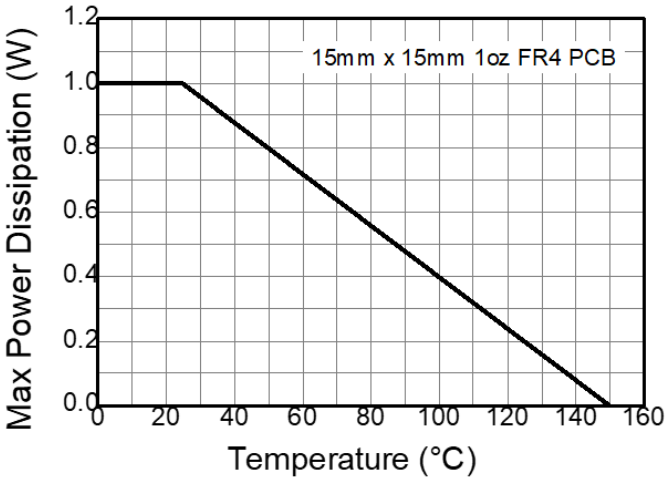


Figure 3. Derating Curve

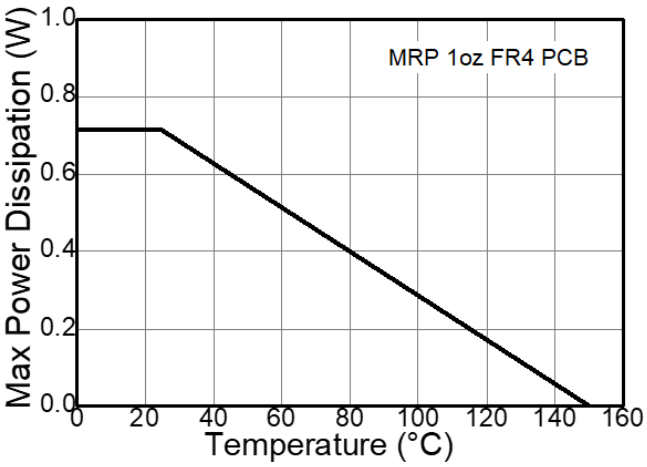


Figure 4. Derating Curve

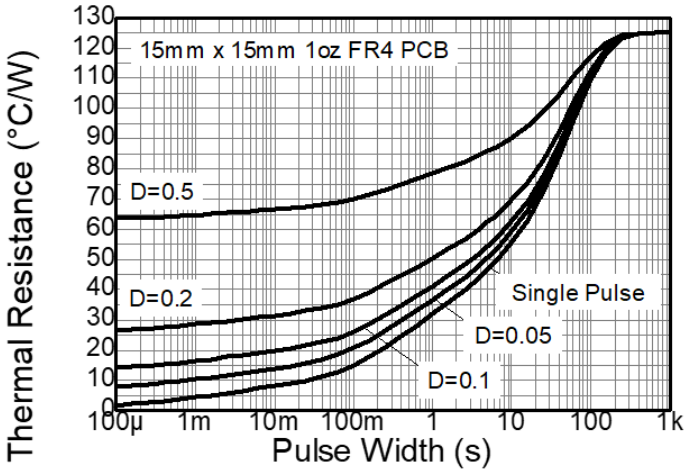


Figure 5. Transient Thermal Impedance

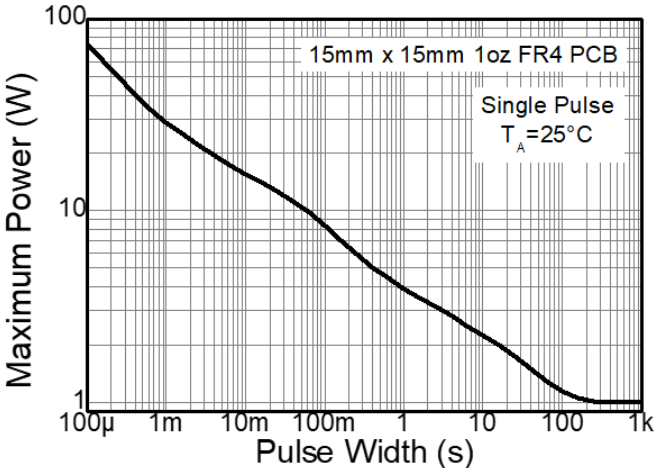


Figure 6. Pulse Power Dissipation

Thermal Characteristics and Derating Information (continued)

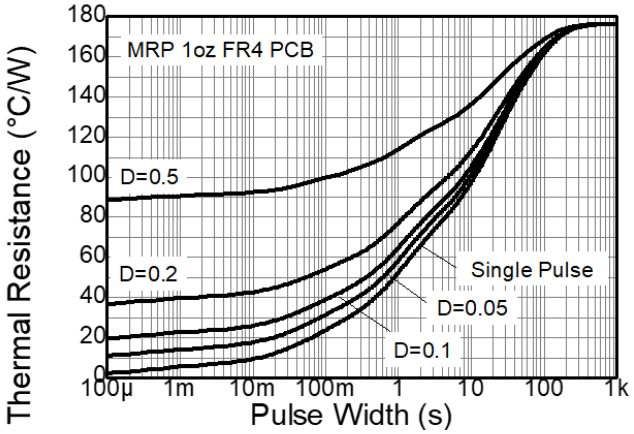


Figure 7. Transient Thermal Impedance

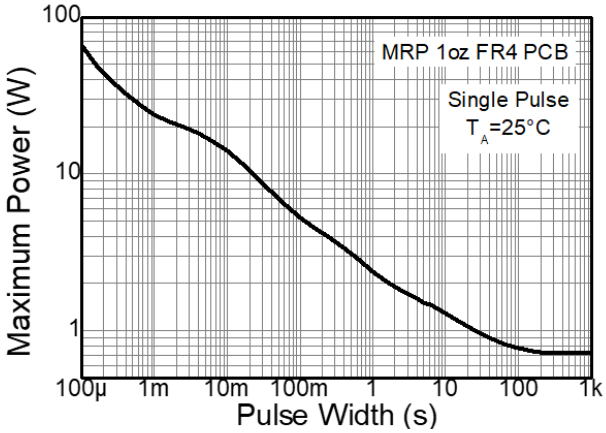


Figure 8. Pulse Power Dissipation

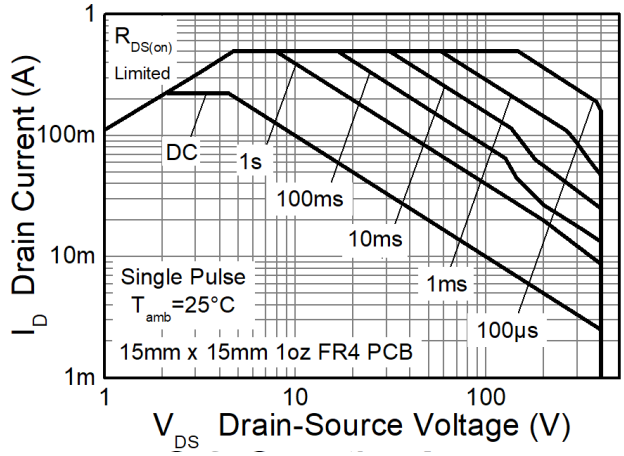


Figure 9. Safe Operating Area

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	BV_{CBO}	400	550	—	V	I_C = 100µA
Collector-Emitter Breakdown Voltage	BV_{CES}	400	550	—	V	I_C = 100µA
Collector-Emitter Breakdown Voltage (Note 11)	BV_{CEO}	400	450	—	V	I_C = 1mA
Emitter-Base Breakdown Voltage	BV_{EBO}	7	8.1	—	V	I_E = 100µA
Collector-Base Cutoff Current	I_{CBO}	—	1	100	nA	V_{CB} = 320V
Collector Cutoff Current	I_{CES}	—	2	100	nA	V_{CES} = 320V
Emitter Cutoff Current	I_{EBO}	—	1	20	nA	V_{EB} = 6V
Collector-Emitter Saturation Voltage (Note 11)	$V_{CE(sat)}$	— —	— —	200 500	mV	I_C = 20mA, I_B = 2mA I_C = 50mA, I_B = 6mA
Base-Emitter Saturation Voltage (Note 11)	$V_{BE(sat)}$	—	—	900	mV	I_C = 50mA, I_B = 5mA
Base-Emitter Turn-On Voltage (Note 11)	$V_{BE(on)}$	—	—	900	mV	I_C = 50mA, V_{CE} = 10V
DC Current Gain (Note 11)	h_{FE}	100 100 15	—	300	—	I_C = 1mA, V_{CE} = 10V I_C = 50mA, V_{CE} = 10V I_C = 100mA, V_{CE} = 10V
Transitional Frequency	f_T	50	—	—	MHz	I_C = 10mA, V_{CE} = 20V, f = 20MHz
Output Capacitance	C_{obo}	—	—	5	pF	V_{CB} = 20V, f = 1MHz
Turn-On Time	t_{on}	—	135	—	ns	I_C = 50mA, V_{CE} = 100V, I_{B1} = 5mA, I_{B2} = -10mA
Turn-Off Time	t_{off}	—	2260	—	ns	

Note: 11. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.

Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

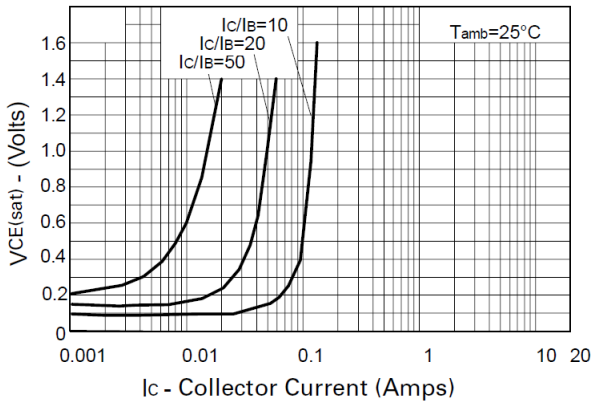


Figure 10. $V_{CE(sat)}$ vs. I_C

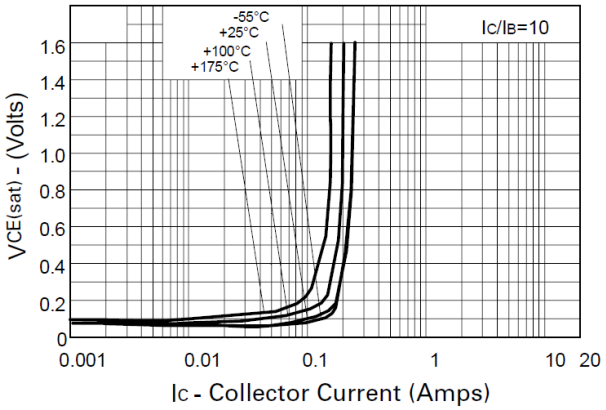


Figure 11. $V_{CE(sat)}$ vs. I_C

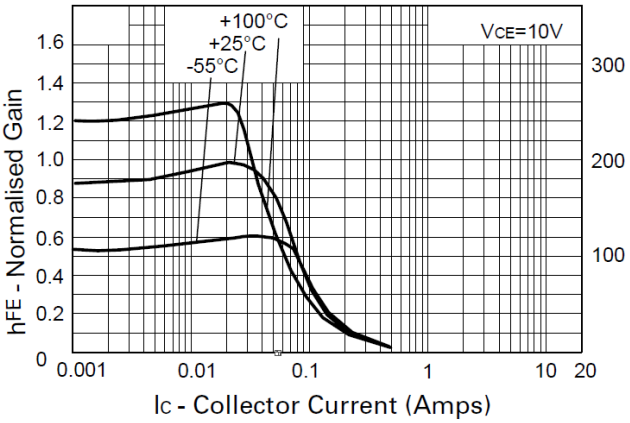


Figure 12. h_{FE} vs. I_C

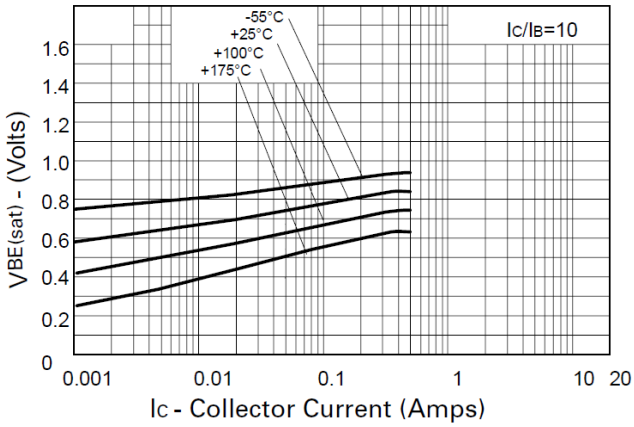


Figure 13. $V_{BE(sat)}$ vs. I_C

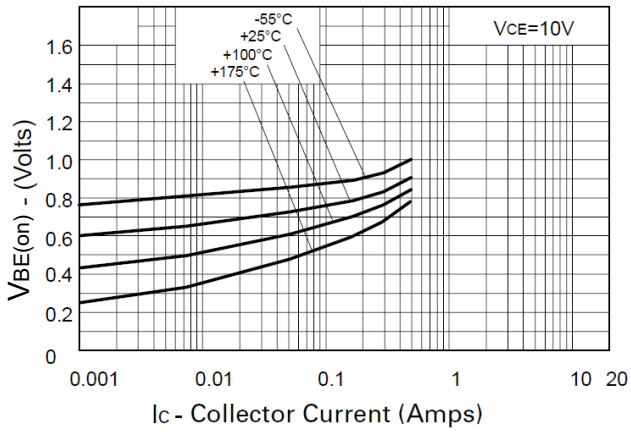
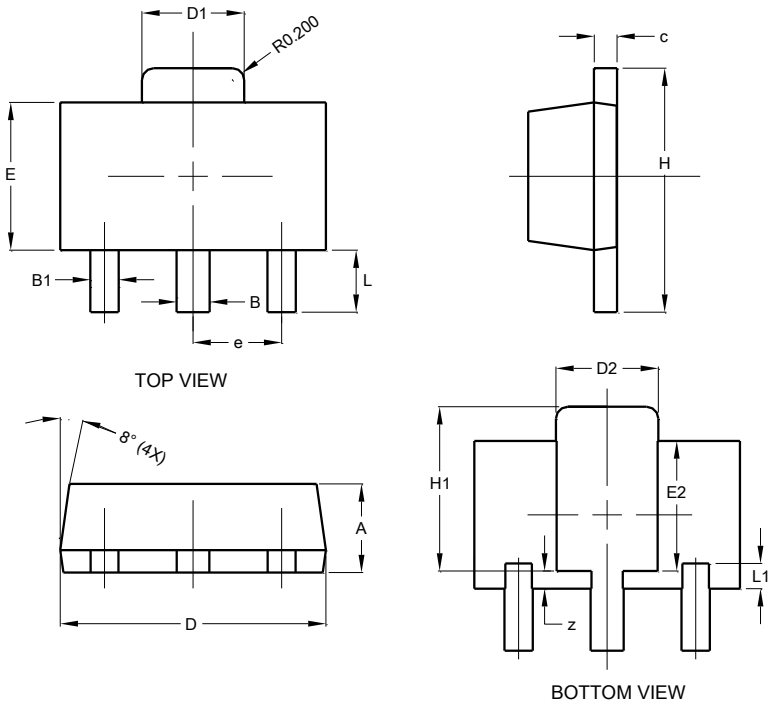


Figure 14. $V_{BE(on)}$ vs. I_C

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT89

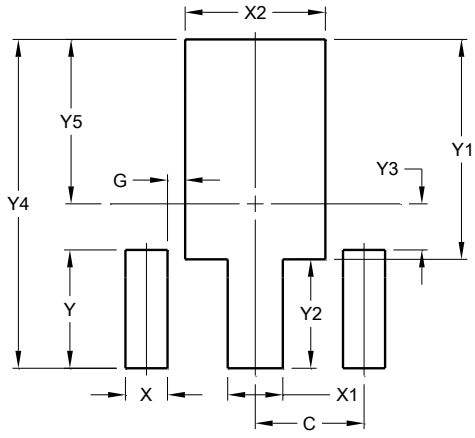


SOT89			
Dim	**Min**	**Max**	**Typ**
A	1.40	1.60	1.50
B	0.50	0.62	0.56
B1	0.42	0.54	0.48
c	0.35	0.43	0.38
D	4.40	4.60	4.50
D1	1.62	1.83	1.733
D2	1.61	1.81	1.71
E	2.40	2.60	2.50
E2	2.05	2.35	2.20
e	-	-	1.50
H	3.95	4.25	4.10
H1	2.63	2.93	2.78
L	0.90	1.20	1.05
L1	0.00	0.527	0.327
z	0.20	0.40	0.30
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT89



Dimensions	Value (in mm)
C	1.500
G	0.244
X	0.580
X1	0.760
X2	1.933
Y	1.630
Y1	3.030
Y2	1.500
Y3	0.635
Y4	4.530
Y5	2.265

Notes:
12. The suggested land pattern dimensions have been provided for reference only, as actual pad layouts may vary depending on application. These dimensions may be modified based on user equipment capability or fabrication criteria. A more robust pattern may be desired for wave soldering and is calculated by adding 0.2mm to the 'Z' dimension. For further information, please reference document IPC-7351A, Naming Convention for Standard SMT Land Patterns, and for International grid details, please see document IEC, Publication 97.
13. For high-voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device Terminals and PCB tracking.

IMPORTANT NOTICE

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

9. This Notice may be periodically updated with the most recent version available at https://www.diodes.com/about/company/terms-and-conditions/important-notice

www.diodes.com