Lead-free Green

60V COMPLEMENTARY NPN/PNP LOW VCE(sat) TRANSISTOR

Features

- Complementary NPN/PNP
- NPN Transistor
  - BV_{CEO} > 60V
  - I_C = 1A high Continuous Collector Current
  - Low Saturation Voltage $V_{CE(sat)}$ < 220mV @ 1A
- PNP Transistor
  - BV_{CEO} > -60V
  - I_C = -1A high Continuous Collector Current
  - Low Saturation Voltage $V_{CE(sat)}$ < -340mV @ -1A
- P_D up to 2.47W for power demanding applications
- $R_{\theta JA}$ efficient, 40% lower than SOT26
- Low profile 0.6mm high package for thin applications
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

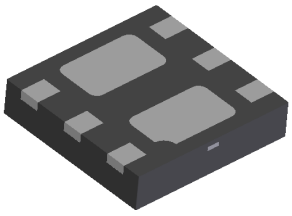
Mechanical Data

- Case: U-DFN2020-6
- UL Flammability Rating 94V-0
- Case Material: Molded Plastic. "Green" Molding Compound.
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — NiPdAu, Solderable per MIL-STD-202, Method 208 e4
- Weight: 0.0065 grams (Approximate)

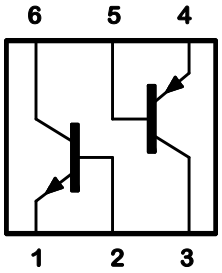
Application

- Gate Driving
- Load Switches
- Power Management
- Charging Circuits
- Power Switches (e.g. **M**otors, **F**ans)

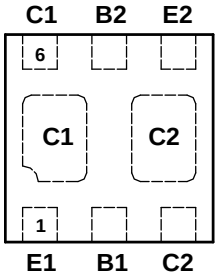
U-DFN2020-6



Bottom View



Device Symbol



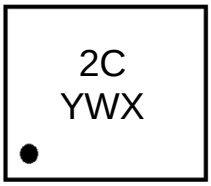
Top View
Pin-Out

Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DSS45160FDB-7	2C	7	8	3,000

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html 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 http://www.diodes.com/products/packages.html.

Marking Information



2C = Product type Marking Code
Y = Year: 0~9
W = Week: A~Z : 1~26 week;
a~z; 27~52 week; z represents
52 and 53 week
X = A~Z: Internal code

Absolute Maximum Ratings – Q1 and Q2 (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	NPN	PNP	Unit
Collector-Base Voltage	V_{CBO}	60	-60	V
Collector-Emitter Voltage	V_{CEO}	60	-60	V
Emitter-Base Voltage	V_{EBO}	7	-7	V
Continuous Collector Current	I_C	1	-1	A
Peak Pulse Collector Current	I_{CM}	1.5	-1.5	A
Base Current	I_B	300	-300	mA
Peak Base Current	I_{BM}	1	-1	A

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

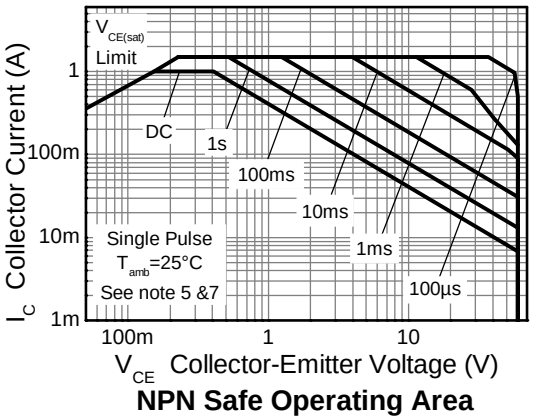
Characteristic		Symbol	Value	Unit
Power Dissipation	(Notes 5 & 7)	P_D	405	mW
	(Notes 5 & 8)		510	
	(Notes 6 & 7)		1650	
	(Notes 6 & 8)		2470	
Thermal Resistance, Junction to Ambient	(Notes 5 & 7)	$R_{\theta JA}$	308	°C/W
	(Notes 5 & 8)		245	
	(Notes 6 & 7)		76	
	(Notes 6 & 8)		51	
Thermal Resistance, Junction to Lead	(Note 9)	$R_{\theta JL}$	18	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

ESD Ratings (Note 10)

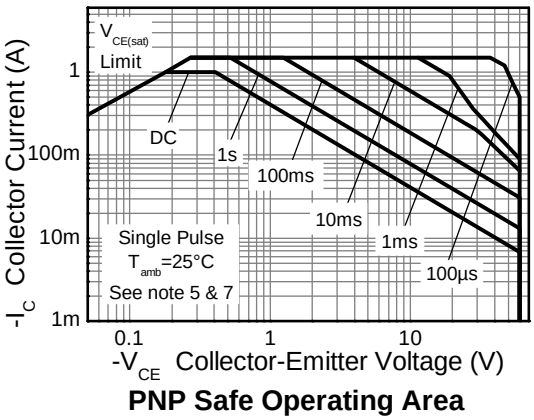
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

Notes:
5. For a device mounted with the exposed collector pads on minimum recommended pad layout 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 collector pad on 28mm x 28mm (8cm^2) 2oz copper.
7. For a dual device with one active die.
8. For dual device with 2 active die running at equal power.
9. Thermal resistance from junction to solder-point (on the exposed collector pads).
10. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics and Derating Information

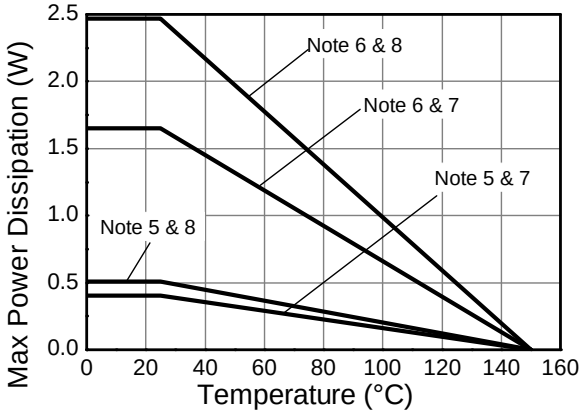


NPN Safe Operating Area

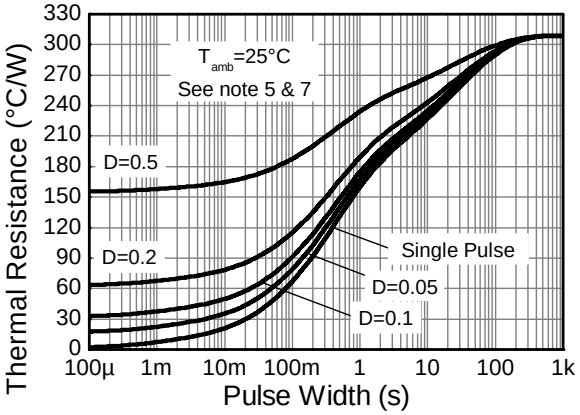


PNP Safe Operating Area

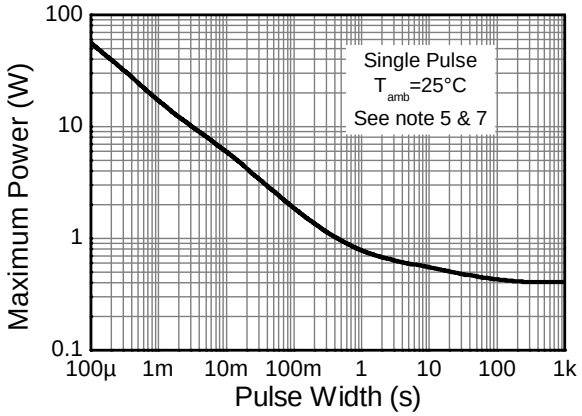
Thermal Characteristics and Derating Information



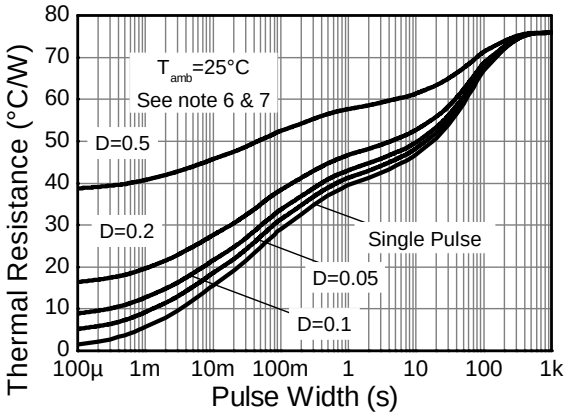
Derating Curve



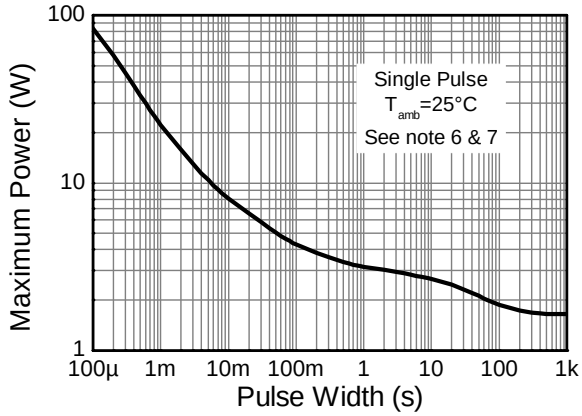
Transient Thermal Impedance



Pulse Power Dissipation



Transient Thermal Impedance



Pulse Power Dissipation

Electrical Characteristics – Q1 NPN (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector-Base Breakdown Voltage	BV_{CBO}	60	—	—	V	I_C = 100µA
Collector-Emitter Breakdown Voltage (Note 11)	BV_{CEO}	60	—	—	V	I_C = 10mA
Emitter-Base Breakdown Voltage	BV_{EBO}	7	—	—	V	I_E = 100µA
Collector-Base Cutoff Current	I_{CBO}	—	—	100	nA	V_{CB} = 48V, I_E = 0
		—	—	50	µA	V_{CB} = 48V, I_E = 0, T_A = +150°C
Emitter-Base Cutoff Current	I_{EBO}	—	—	100	nA	V_{EB} = 5.6V, I_C = 0
DC Current Gain (Note 11)	h_{FE}	290	430	—	—	V_{CE} = 2V, I_C = 100mA
		150	220	—		V_{CE} = 2V, I_C = 500mA
		70	110	—		V_{CE} = 2V, I_C = 1A
Collector-Emitter Saturation Voltage (Note 11)	$V_{CE(sat)}$	—	90	120	mV	I_C = 500mA, I_B = 50mA
		—	170	220		I_C = 1A, I_B = 100mA
		—	185	240		I_C = 1A, I_B = 50mA
Equivalent On-Resistance (Note 11)	$R_{CE(sat)}$	—	180	240	mΩ	I_C = 500mA, I_B = 50mA
Base-Emitter Saturation Voltage (Note 11)	$V_{BE(sat)}$	—	—	1	V	I_C = 0.5A, I_B = 50mA
		—	—	1.1		I_C = 1A, I_B = 50mA
		—	—	1.1		I_C = 1A, I_B = 100mA
Base-Emitter Turn-on Voltage (Note 11)	$V_{BE(on)}$	—	—	0.9	V	V_{CE} = 2V, I_C = 0.5A
Transition Frequency	f_T	90	175	—	MHz	V_{CE} = 10V, I_C = 50mA, f = 100MHz
Output (Collector) Capacitance	$C_{ob\ (c)}$	—	4	6	pF	V_{CB} = -10V, f = 1MHz
Turn-On Time	t_{on}	—	105	—	ns	V_{CC} = -10V, I_C = -0.5A, I_{B1} = -I_{B2} = 25mA
Delay Time	t_d	—	15	—	ns	
Rise Time	t_r	—	90	—	ns	
Turn-Off Time	t_{off}	—	540	—	ns	
Storage Time	t_s	—	410	—	ns	
Fall Time	t_f	—	130	—	ns	

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

Electrical Characteristics – Q2 PNP (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector-Base Breakdown Voltage	BV_{CBO}	-60	—	—	V	I_C = -100μA
Collector-Emitter Breakdown Voltage (Note 11)	BV_{CEO}	-60	—	—	V	I_C = -10mA
Emitter-Base Breakdown Voltage	BV_{EBO}	-7	—	—	V	I_E = -100μA
Collector-Base Cutoff Current	I_{CBO}	—	—	-100	nA	V_{CB} = -48V, I_E = 0
		—	—	-50	μA	V_{CB} = -48V, I_E = 0, T_A = +150°C
Emitter-Base Cutoff Current	I_{EBO}	—	—	-100	nA	V_{EB} = -5.6V, I_C = 0
DC Current Gain (Note 11)	h_{FE}	170	—	—	—	V_{CE} = -2V, I_C = -100mA
		120	—	—		V_{CE} = -2V, I_C = -500mA
		70	—	—		V_{CE} = -2V, I_C = -1A
Collector-Emitter Saturation Voltage (Note 11)	$V_{CE(sat)}$	—	—	-180	mV	I_C = -500mA, I_B = -50mA
		—	—	-340		I_C = -1A, I_B = -100mA
		—	—	-550		I_C = -1A, I_B = -50mA
Equivalent On-Resistance (Note 11)	$R_{CE(sat)}$	—	—	360	mΩ	I_C = -500mA, I_B = -50mA
Base-Emitter Saturation Voltage (Note 11)	$V_{BE(sat)}$	—	—	-1	V	I_C = -0.5A, I_B = -50mA
		—	—	-1.0		I_C = -1A, I_B = -50mA
		—	—	-1.1		I_C = -1A, I_B = -100mA
Base-Emitter Turn-on Voltage (Note 11)	$V_{BE(on)}$	—	—	-0.9	V	V_{CE} = -2V, I_C = -0.5A
Transition Frequency	f_T	65	—	—	MHz	V_{CE} = -10V, I_C = -50mA, f = 100MHz
Output Capacitance	C_{ob}	—	—	15	pF	V_{CB} = -10V, f = 1MHz
Turn-On Time	t_{on}	—	75	—	ns	V_{CC} = -10V, I_C = -0.5A, I_{B1} = -I_{B2} = 25mA
Delay Time	t_d	—	35	—	ns	
Rise Time	t_r	—	40	—	ns	
Turn-Off Time	t_{off}	—	265	—	ns	
Storage Time	t_s	—	230	—	ns	
Fall Time	t_f	—	35	—	ns	

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

Typical Electrical Characteristics - Q1 NPN (@T_A = +25°C, unless otherwise specified.)

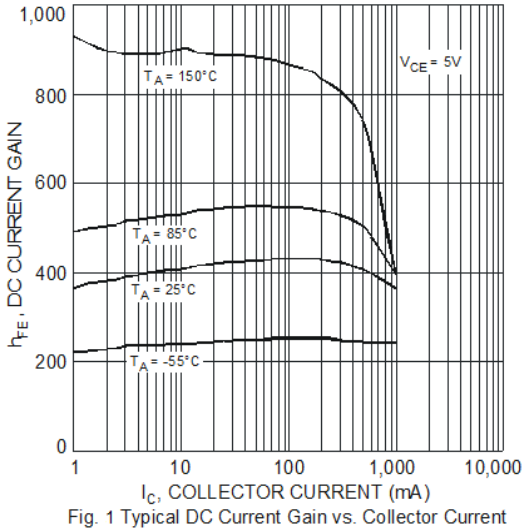


Fig. 1 Typical DC Current Gain vs. Collector Current

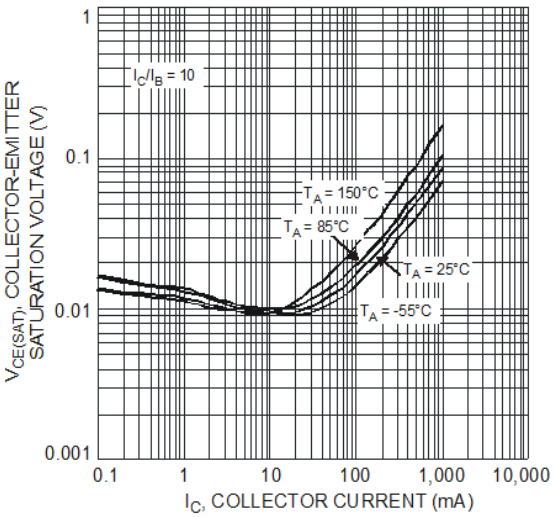


Fig. 2 Typical Collector-Emitter Saturation Voltage vs. Collector Current

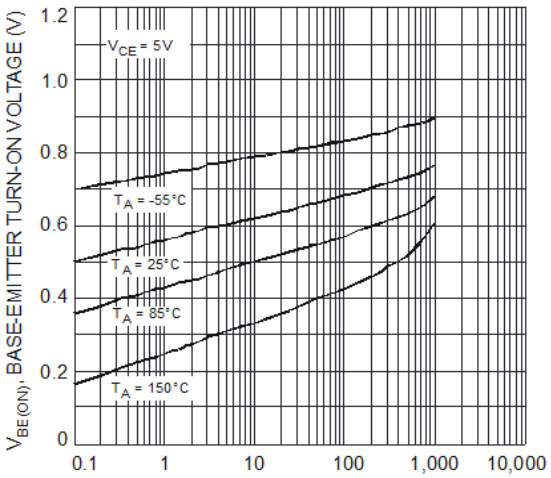


Fig. 3 Typical Base-Emitter Turn-On Voltage vs. Collector Current

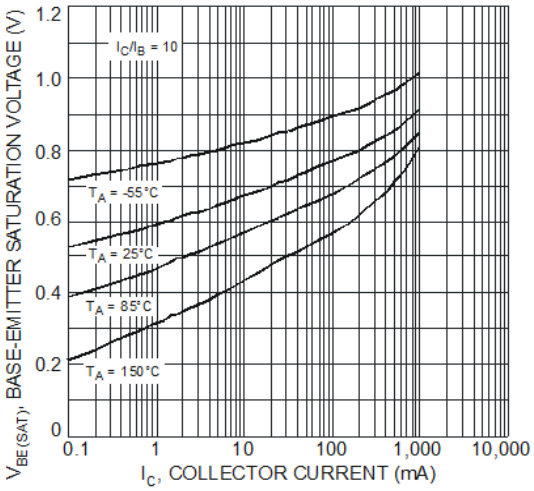


Fig. 4 Typical Base-Emitter Saturation Voltage vs. Collector Current

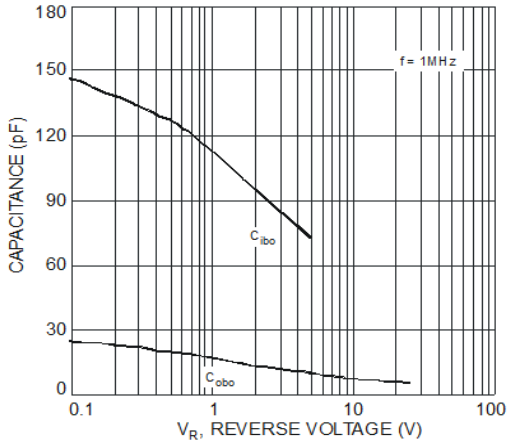
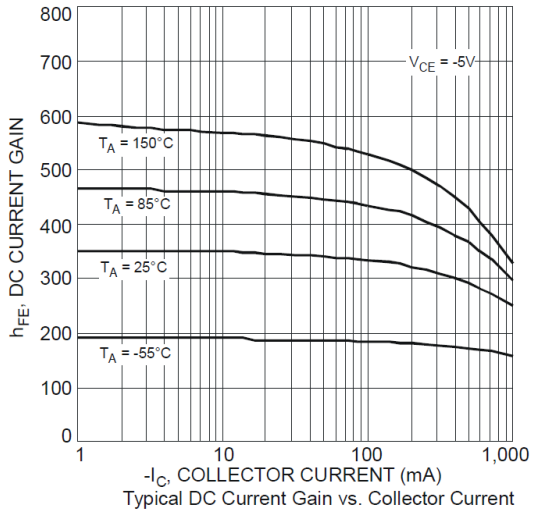
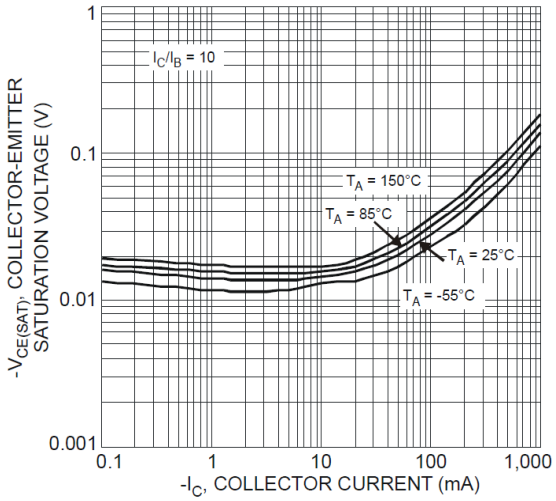


Fig. 5 Typical Capacitance Characteristics

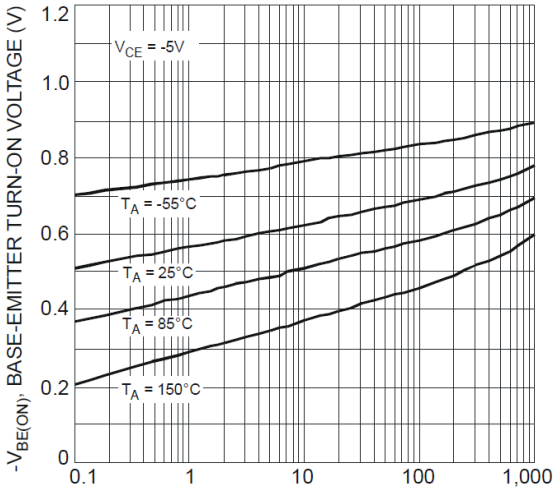
Typical Electrical Characteristics - Q2 PNP (@T_A = +25°C, unless otherwise specified.)



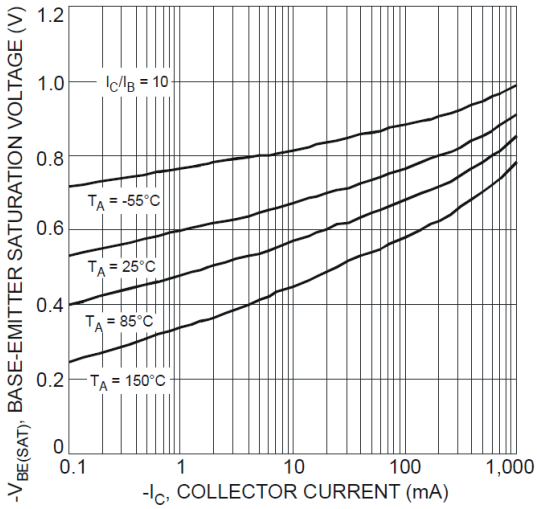
Typical DC Current Gain vs. Collector Current



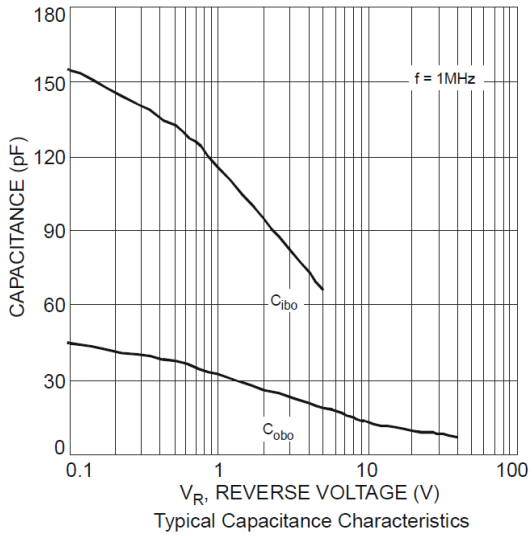
Typical Collector-Emitter Saturation Voltage vs. Collector Current



Typical Base-Emitter Turn-On Voltage vs. Collector Current



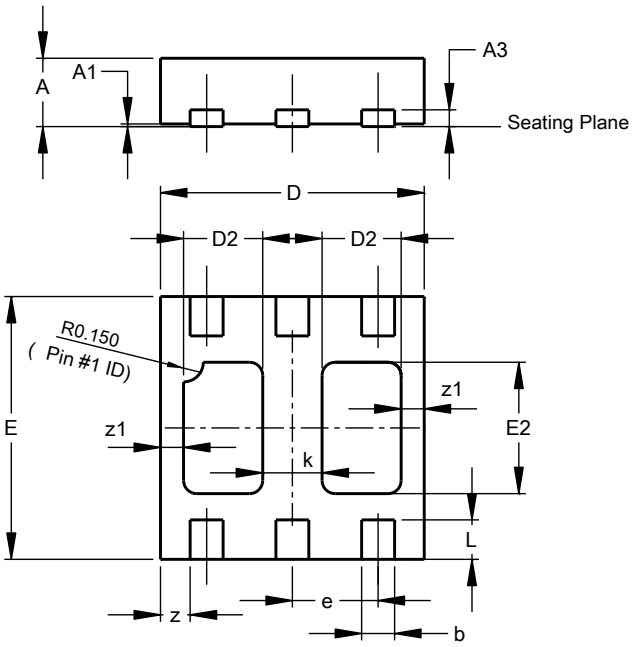
Typical Base-Emitter Saturation Voltage vs. Collector Current



Typical Capacitance Characteristics

Package Outline Dimensions

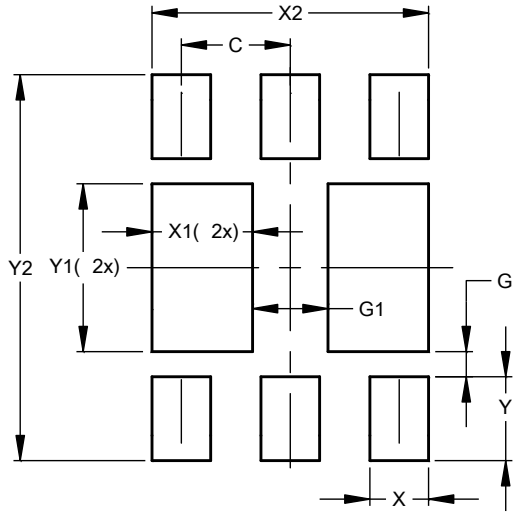
Please see AP02001 at http://www.diodes.com/_files/datasheets/ap02001.pdf for the latest version.



U-DFN2020-6 Type B			
Dim	**Min**	**Max**	**Typ**
A	0.545	0.605	0.575
A1	0.00	0.05	0.02
A3	-	-	0.13
b	0.20	0.30	0.25
D	1.95	2.075	2.00
D2	0.50	0.70	0.60
e	-	-	0.65
E	1.95	2.075	2.00
E2	0.90	1.10	1.00
k	-	-	0.45
L	0.25	0.35	0.30
z	-	-	0.225
z1	-	-	0.175
All Dimensions in mm			

Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/_files/datasheets/ap02001.pdf for the latest version.



Dimensions	Value (in mm)
C	0.650
G	0.150
G1	0.450
X	0.350
X1	0.600
X2	1.650
Y	0.500
Y1	1.000
Y2	2.300

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   1. are intended to implant into the body, or
   2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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