

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

Features

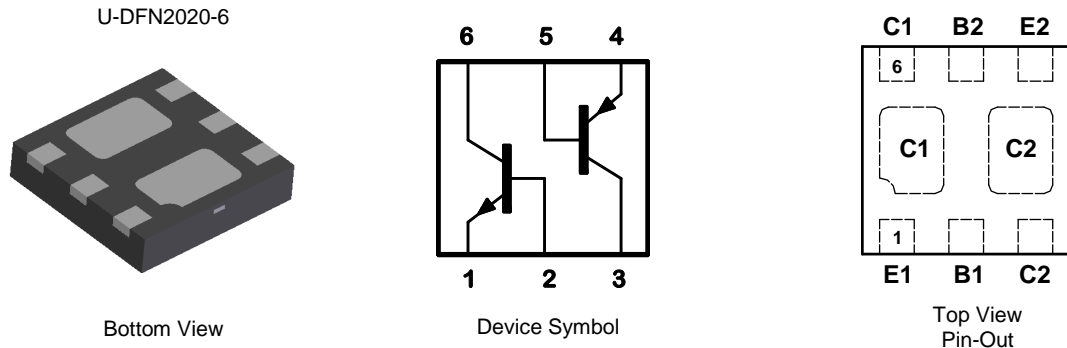
- Complementary NPN/PNP
- NPN Transistor
 - $BV_{CEO} > 60V$
 - $I_C = 1A$ high Continuous Collector Current
 - Low Saturation Voltage $V_{CE(sat)} < 220mV @ 1A$
- PNP Transistor
 - $BV_{CEO} > -60V$
 - $I_C = -1A$ high Continuous Collector Current
 - Low Saturation Voltage $V_{CE(sat)} < -340mV @ -1A$
- 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. Motors, Fans)

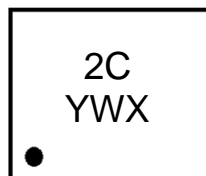


Ordering Information (Note 4)

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 _{CB0}	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

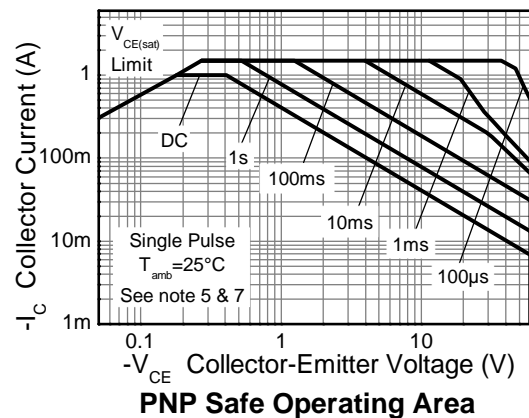
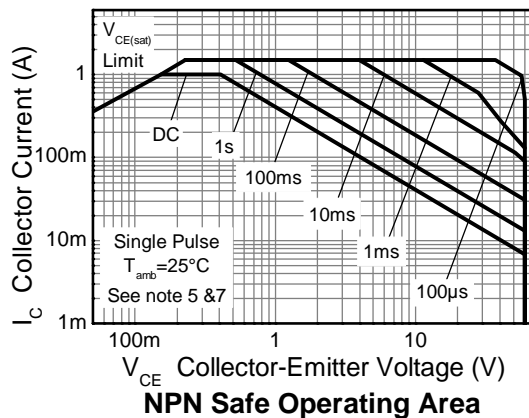
Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit	
Power Dissipation	P _D	(Notes 5 & 7)	405	
		(Notes 5 & 8)	510	
		(Notes 6 & 7)	1650	
		(Notes 6 & 8)	2470	
Thermal Resistance, Junction to Ambient	R _{θJA}	(Notes 5 & 7)	308	
		(Notes 5 & 8)	245	
		(Notes 6 & 7)	76	
		(Notes 6 & 8)	51	
Thermal Resistance, Junction to Lead	(Note 9)	R _{θJL}	18	°C/W
Operating and Storage Temperature Range	T _J , T _{STG}	-55 to +150	°C	

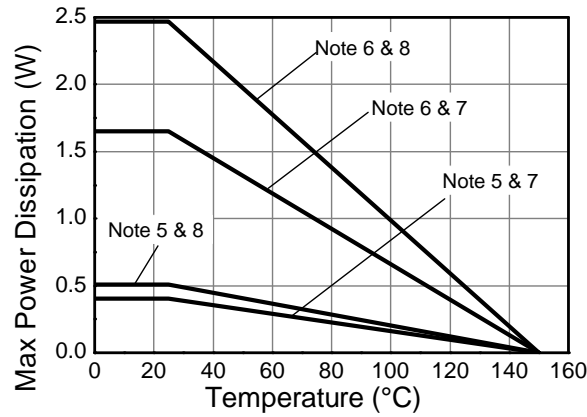
ESD Ratings (Note 10)

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

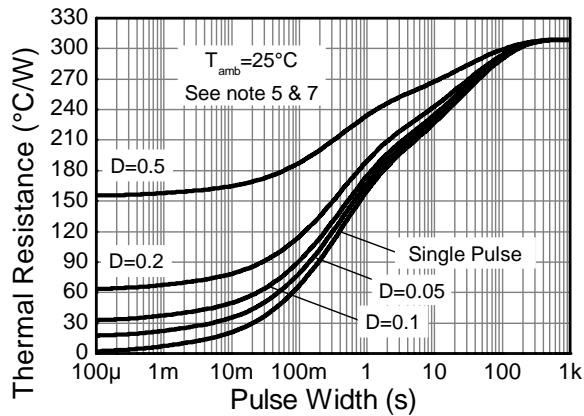
- Notes:
- For a device mounted with the exposed collector pads on minimum recommended pad layout that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
 - Same as note (5), except the device is mounted with the collector pad on 28mm x 28mm (8cm²) 2oz copper.
 - For a dual device with one active die.
 - For dual device with 2 active die running at equal power.
 - Thermal resistance from junction to solder-point (on the exposed collector pads).
 - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics and Derating Information


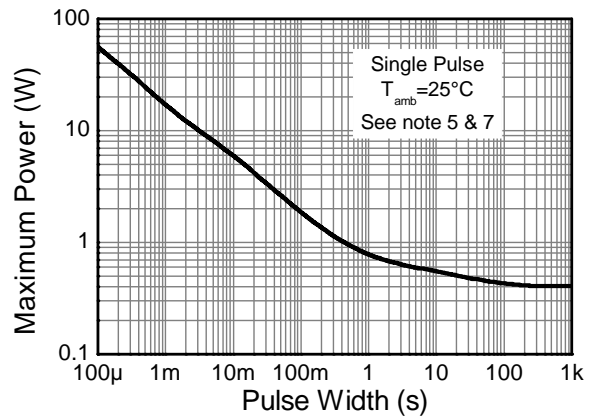
Thermal Characteristics and Derating Information



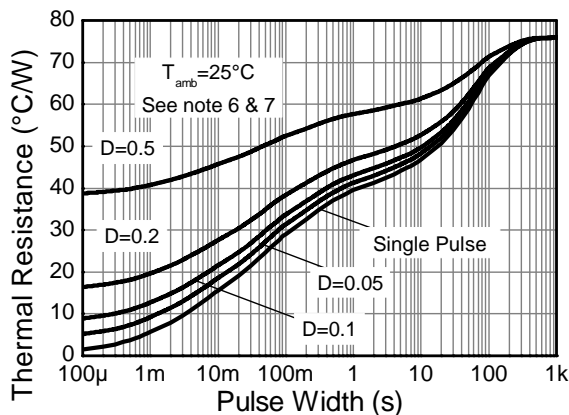
Derating Curve



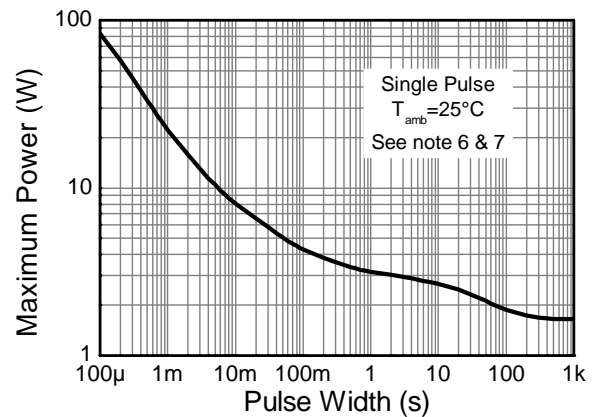
Transient Thermal Impedance



Pulse Power Dissipation



Transient Thermal Impedance



Pulse Power Dissipation

Electrical Characteristics – Q1 NPN (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector-Base Breakdown Voltage	BV_{CBO}	60	—	—	V	$I_C = 100\mu\text{A}$
Collector-Emitter Breakdown Voltage (Note 11)	BV_{CEO}	60	—	—	V	$I_C = 10\text{mA}$
Emitter-Base Breakdown Voltage	BV_{EBO}	7	—	—	V	$I_E = 100\mu\text{A}$
Collector-Base Cutoff Current	I_{CBO}	—	—	100	nA	$V_{CB} = 48\text{V}, I_E = 0$
		—	—	50	μA	$V_{CB} = 48\text{V}, I_E = 0, T_A = +150^\circ\text{C}$
Emitter-Base Cutoff Current	I_{EBO}	—	—	100	nA	$V_{EB} = 5.6\text{V}, I_C = 0$
DC Current Gain (Note 11)	h_{FE}	290	430	—	—	$V_{CE} = 2\text{V}, I_C = 100\text{mA}$
		150	220	—		$V_{CE} = 2\text{V}, I_C = 500\text{mA}$
		70	110	—		$V_{CE} = 2\text{V}, I_C = 1\text{A}$
Collector-Emitter Saturation Voltage (Note 11)	$V_{CE(sat)}$	—	90	120	mV	$I_C = 500\text{mA}, I_B = 50\text{mA}$
		—	170	220		$I_C = 1\text{A}, I_B = 100\text{mA}$
		—	185	240		$I_C = 1\text{A}, I_B = 50\text{mA}$
Equivalent On-Resistance (Note 11)	$R_{CE(sat)}$	—	180	240	m Ω	$I_C = 500\text{mA}, I_B = 50\text{mA}$
Base-Emitter Saturation Voltage (Note 11)	$V_{BE(sat)}$	—	—	1	V	$I_C = 0.5\text{A}, I_B = 50\text{mA}$
		—	—	1.1		$I_C = 1\text{A}, I_B = 50\text{mA}$
		—	—	1.1		$I_C = 1\text{A}, I_B = 100\text{mA}$
Base-Emitter Turn-on Voltage (Note 11)	$V_{BE(on)}$	—	—	0.9	V	$V_{CE} = 2\text{V}, I_C = 0.5\text{A}$
Transition Frequency	f_T	90	175	—	MHz	$V_{CE} = 10\text{V}, I_C = 50\text{mA}, f = 100\text{MHz}$
Output (Collector) Capacitance	$C_{ob(c)}$	—	4	6	pF	$V_{CB} = -10\text{V}, f = 1\text{MHz}$
Turn-On Time	t_{on}	—	105	—	ns	$V_{CC} = -10\text{V}, I_C = -0.5\text{A}, I_{B1} = -I_{B2} = 25\text{mA}$
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 $\leq 300\mu\text{s}$. Duty cycle $\leq 2\%$.

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector-Base Breakdown Voltage	BV _{CB0}	-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 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

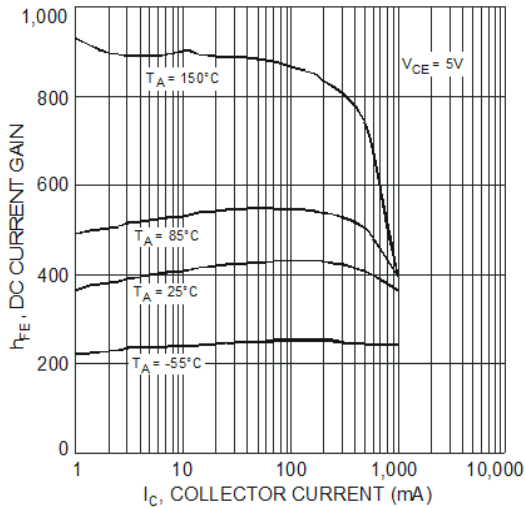


Fig. 1 Typical DC Current Gain vs. Collector Current

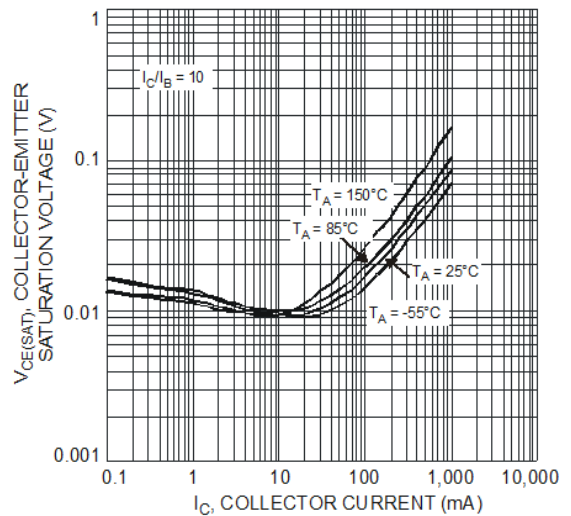


Fig. 2 Typical Collector-Emitter Saturation Voltage vs. Collector Current

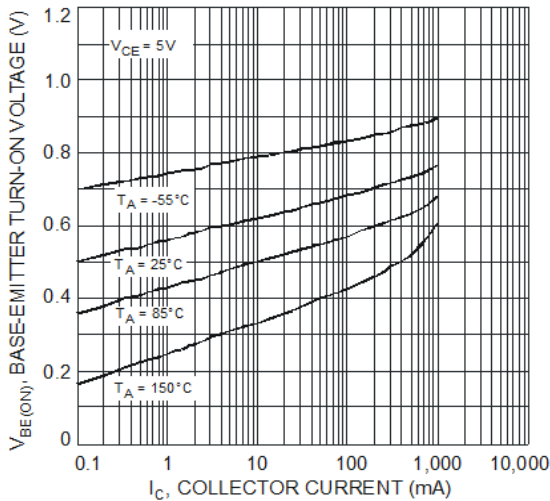


Fig. 3 Typical Base-Emitter Turn-On Voltage vs. Collector Current

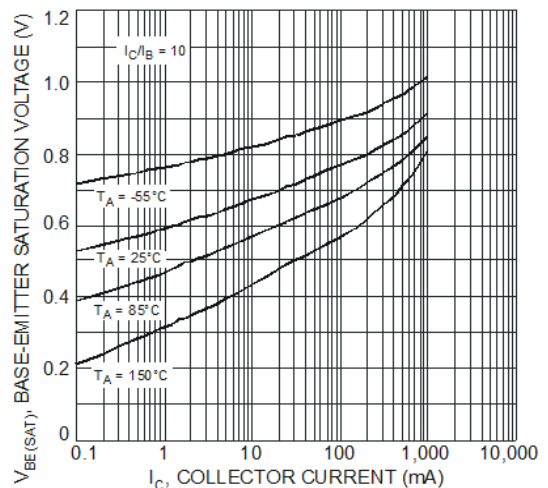


Fig. 4 Typical Base-Emitter Saturation Voltage vs. Collector Current

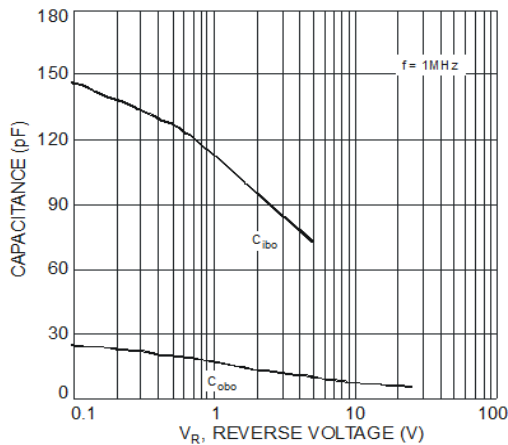
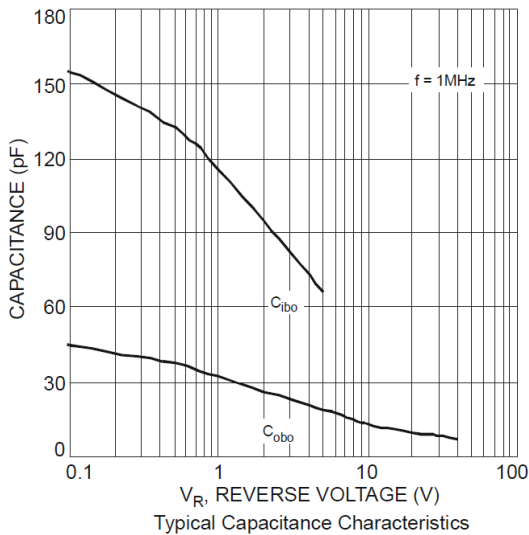
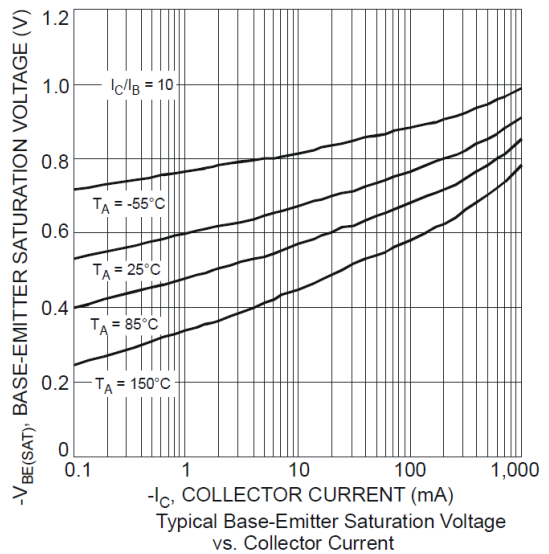
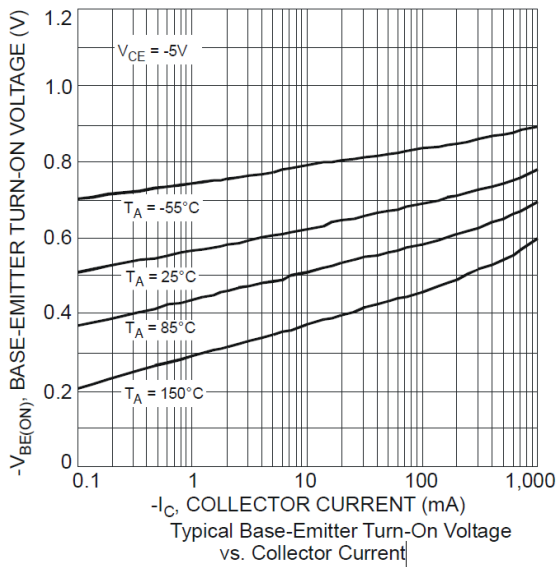
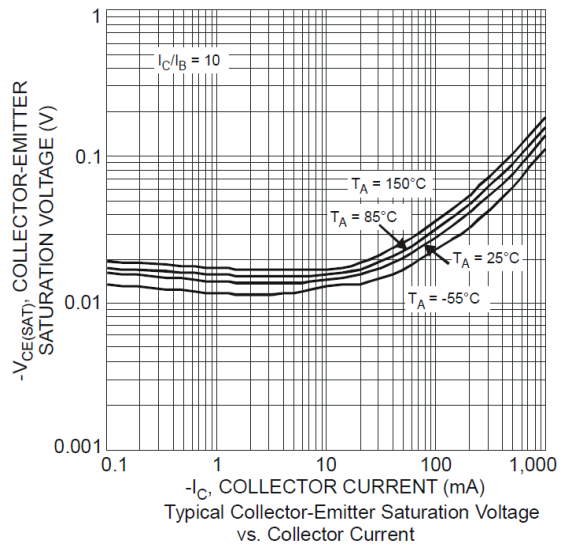
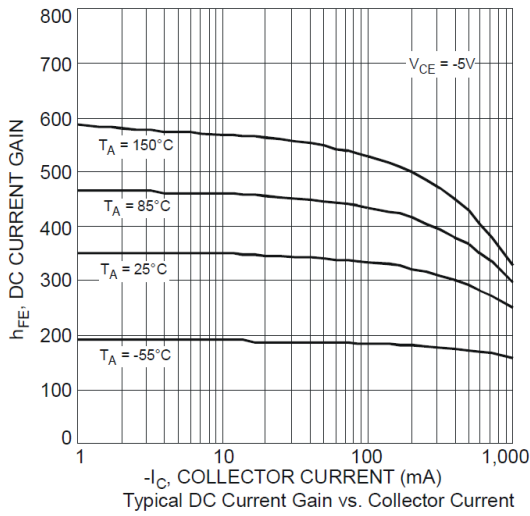


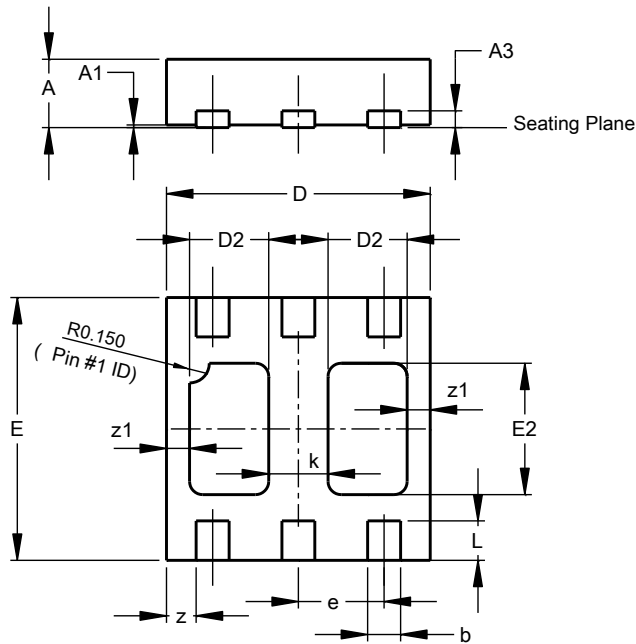
Fig. 5 Typical Capacitance Characteristics

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



Package Outline Dimensions

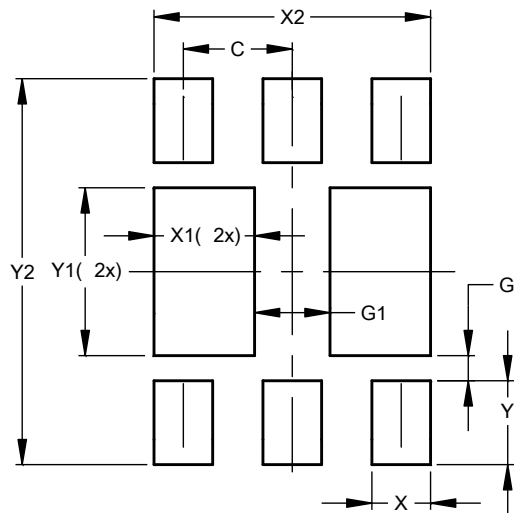
Please see AP02001 at http://www.diodes.com/_files/datasheets/ap02001.pdf for the latest version.



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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