COMPLEMENTARY NPN / PNP SMALL SIGNAL TRANSISTOR IN SOT363

Features & Benefits

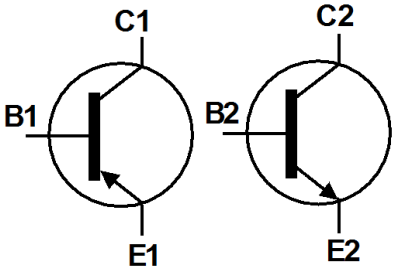
- Complementary Pairs:
  - One 2222A Type (NPN)
  - One 2907A Type (PNP)
- Ideal for Low-Power Amplification and Switching
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The MMDT2227Q is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF16949 certified facilities.**
  https://www.diodes.com/quality/product-definitions/

Mechanical Data

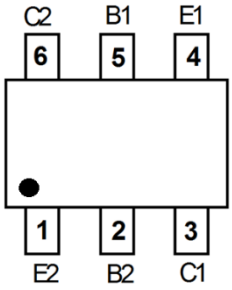
- Package: SOT363
- Package Material: Molded Plastic, "Green" Molding Compound UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.006 grams (approximate)

SOT363

Top View



Device Symbol



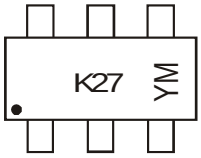
Top View
Pin-Out

Ordering Information (Note 4)

Orderable Part Number	Marking	Reel size (inches)	Tape width (mm)	Packing	
				Quantity	Carrier
MMDT2227Q-7-F	K27	7	8	3,000	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



K27 = Product Type Marking Code
YM = Date Code Marking
Y or $\overline{Y}$ = Year (ex: K = 2023)
M or $\overline{M}$ = Month (ex: 2 = February)

Date Code Key

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Code	J	K	L	M	N	O	P	R	S	T	U	V

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

Maximum Ratings, 2222A Type (NPN) (@ T_{amb} = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	75	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Continuous Collector Current	I_C	600	mA

Maximum Ratings, 2907A Type (PNP) (@ T_{amb} = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	-60	V
Collector-Emitter Voltage	V_{CEO}	-60	V
Emitter-Base Voltage	V_{EBO}	-6	V
Continuous Collector Current	I_C	-600	mA

Thermal Characteristics (@ T_{amb} = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Power Dissipation	(Note 5)	P_D	200	mW
Thermal Resistance, Junction to Ambient	(Note 5)	$R_{\theta JA}$	625	°C/W
Thermal Resistance, Junction to Case	(Note 6)	$R_{\theta JC}$	150	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

ESD Ratings (Note 7)

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 the device mounted on minimum recommended pad layout FR-4, device is measured under still air conditions whilst operating in a steady-state.
6. Thermal resistance from junction to the top of package.
7. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristic and Derating Information

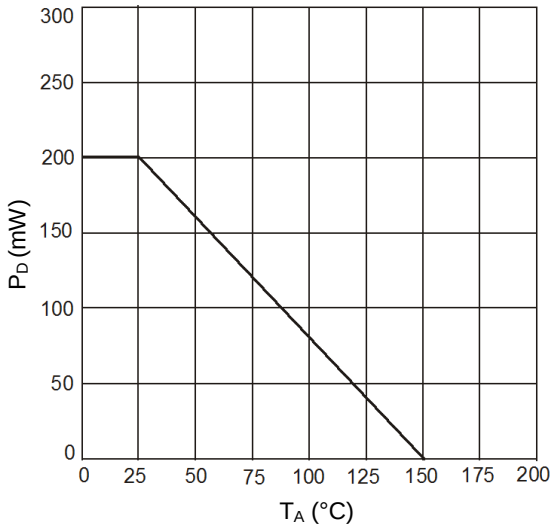


Figure 1. P_D v T_A

Electrical Characteristics, 2222A Type (NPN) (@ T_{amb} = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 8)					
Collector-Base Breakdown Voltage	BV_{CBO}	75	—	V	I_C = 100µA
Collector-Emitter Breakdown Voltage	BV_{CEO}	40	—	V	I_C = 10mA
Emitter-Base Breakdown Voltage	BV_{EBO}	6.0	—	V	I_E = 100µA
Collector Cutoff Current	I_{CBO}	—	10	nA µA	V_{CB} = 60V V_{CB} = 60V, T_{amb} = +150°C
Collector Cutoff Current	I_{CEX}	—	10	nA	V_{CE} = 60V, $V_{EB(off)}$ = 3.0V
Emitter Cutoff Current	I_{EBO}	—	10	nA	V_{EB} = 5.0V
Base Cutoff Current	I_{BL}	—	20	nA	V_{CE} = 60V, $V_{EB(off)}$ = 3.0V
ON CHARACTERISTICS (Note 8)					
DC Current Gain	h_{FE}	35 50 75 100 40 50 35	— — — 300 — — —	—	I_C = 100µA, V_{CE} = 10V I_C = 1mA, V_{CE} = 10V I_C = 10mA, V_{CE} = 10V I_C = 150mA, V_{CE} = 10V I_C = 500mA, V_{CE} = 10V I_C = 10mA, V_{CE} = 10V, T_{amb} = -55°C I_C = 150mA, V_{CE} = 1V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	—	0.3 1.0	V	I_C = 150mA, I_B = 15mA I_C = 500mA, I_B = 50mA
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	0.6 —	1.2 2.0	V	I_C = 150mA, I_B = 15mA I_C = 500mA, I_B = 50mA
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{obo}	—	8	pF	V_{CB} = 10V, f = 1MHz
Input Capacitance	C_{ibo}	—	25	pF	V_{EB} = 0.5V, f = 1MHz
Current Gain-Bandwidth Product	f_T	300	—	MHz	V_{CE} = 20V, I_C = 20mA, f = 100MHz
Noise Figure	NF	—	4.0	dB	V_{CE} = 10V, I_C = 100µA, R_S = 1kΩ, f = 1kHz
SWITCHING CHARACTERISTICS					
Delay Time	t_d	—	10	ns	V_{CC} = 30V, I_C = 150mA, $V_{BE(off)}$ = - 0.5V, I_{B1} = 15mA
Rise Time	t_r	—	25	ns	
Storage Time	t_s	—	225	ns	V_{CC} = 30V, I_C = 150mA, I_{B1} = -I_{B2} = 15mA
Fall Time	t_f	—	60	ns	

Note: 8. Pulse test: Pulse width ≤ 300µs, duty cycle ≤ 2%.

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

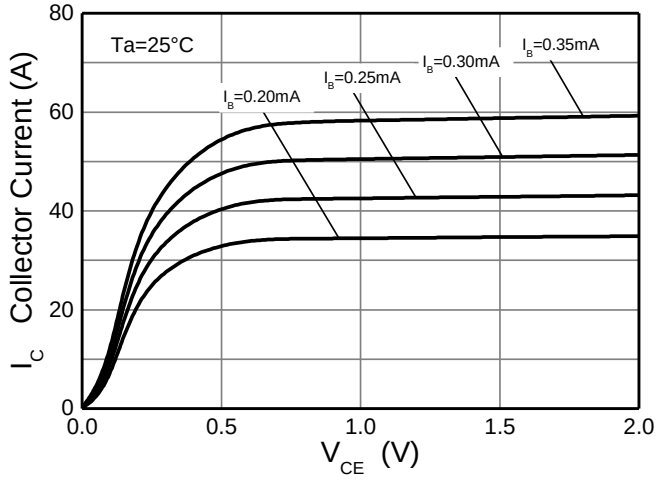


Figure 2. I_C v V_{CE}

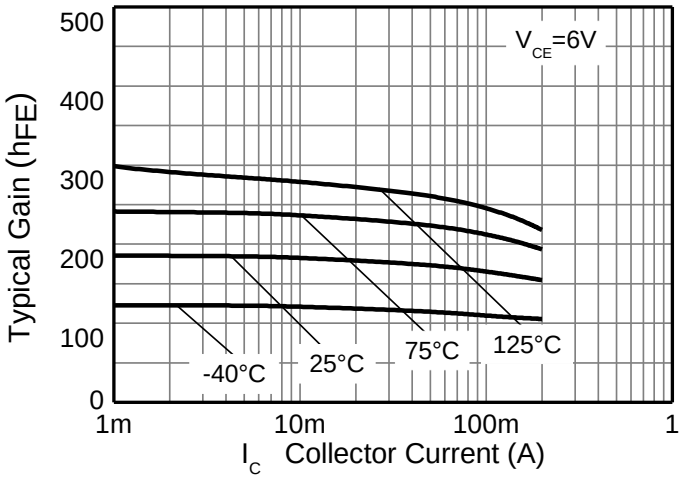


Figure 3. h_{FE} v I_C

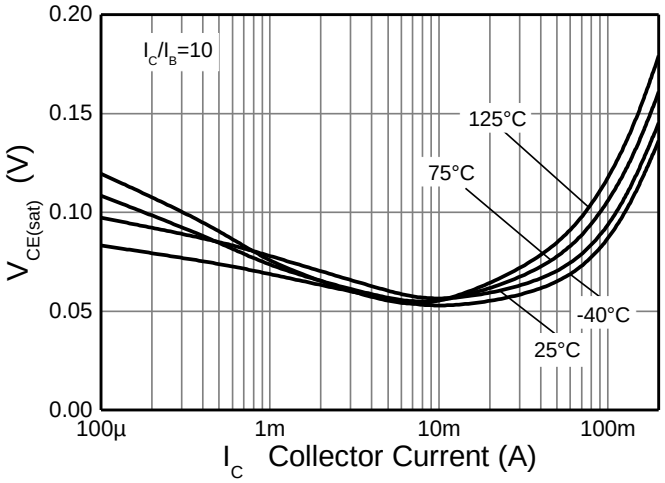


Figure 4. $V_{CE(sat)}$ v I_C

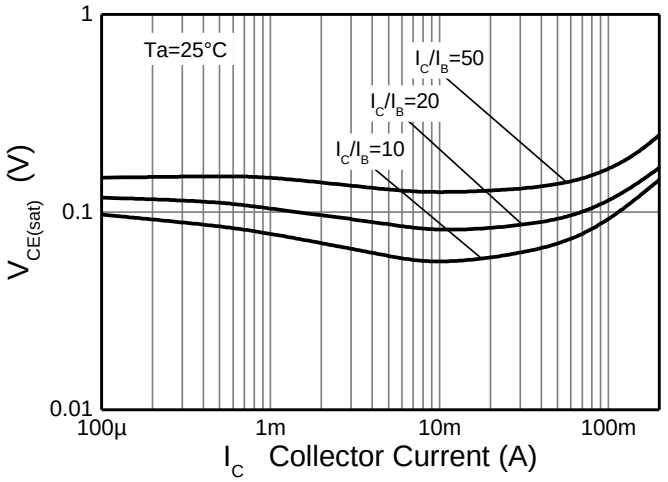


FIgure 5. $V_{CE(sat)}$ v I_C

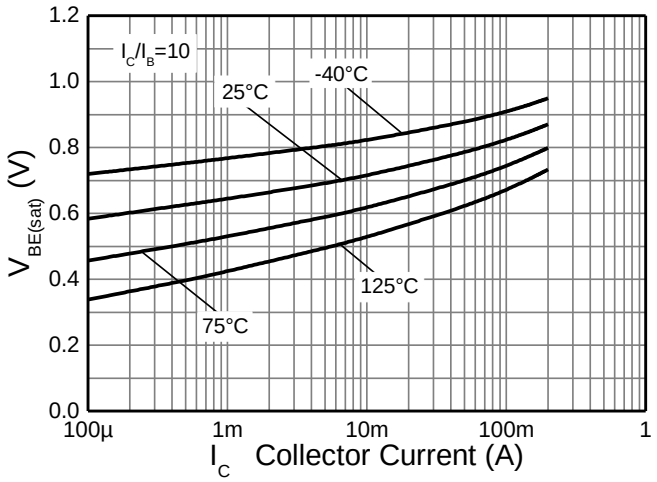


Figure 6. $V_{BE(sat)}$ v I_C

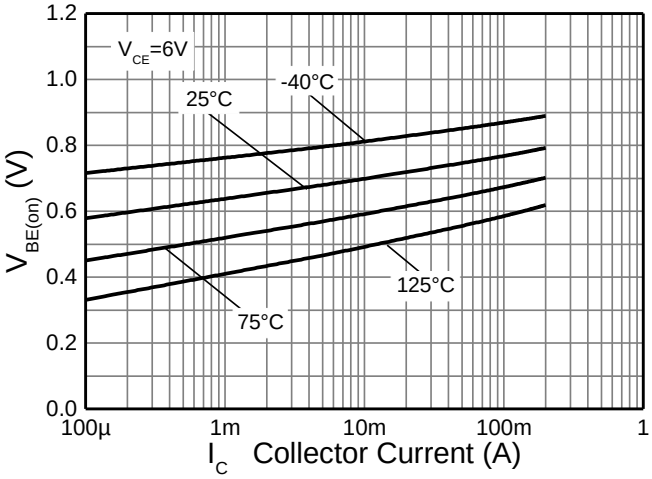


Figure 7. $V_{BE(on)}$ v I_C

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

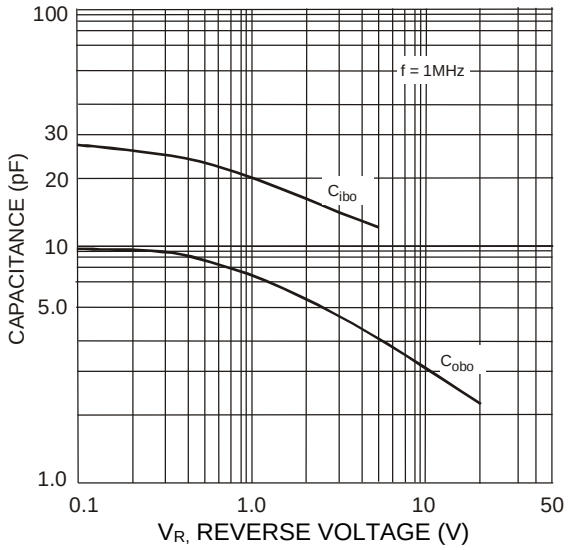


Figure 8. Capacitance v V_R

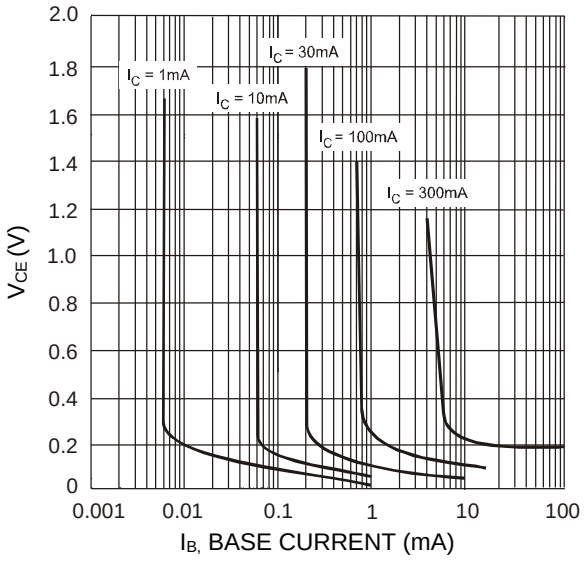


Figure 9. V_{CE} v I_B

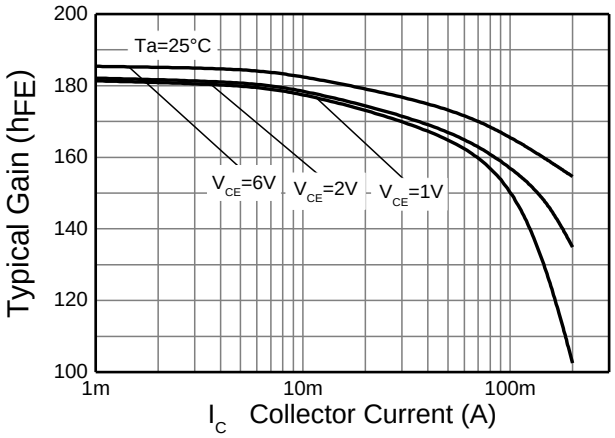


Figure 10. h_{FE} v I_C

Electrical Characteristics, 2907A Type (PNP) (@T_{amb} = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 9)					
Collector-Base Breakdown Voltage	BV_{CBO}	-60	—	V	I_C = -100µA
Collector-Emitter Breakdown Voltage	BV_{CEO}	-60	—	V	I_C = -10mA
Emitter-Base Breakdown Voltage	BV_{EBO}	-6.0	—	V	I_E = -100µA
Collector Cutoff Current	I_{CBO}	—	-10	nA µA	V_{CB} = -50V V_{CB} = -50V, T_{amb} = +125°C
Collector Cutoff Current	I_{CEX}	—	-50	nA	V_{CE} = -30V, $V_{EB(off)}$ = -0.5V
Base Cutoff Current	I_{BL}	—	-50	nA	V_{CE} = -30V, $V_{EB(off)}$ = -0.5V
ON CHARACTERISTICS (Note 9)					
DC Current Gain	h_{FE}	75 100 100 100 50	— — — 300 —	—	I_C = -100µA, V_{CE} = -10V I_C = -1.0mA, V_{CE} = -10V I_C = -10mA, V_{CE} = -10V I_C = -150mA, V_{CE} = -10V I_C = -500mA, V_{CE} = -10V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	—	-0.4 -1.6	V	I_C = -150mA, I_B = -15mA I_C = -500mA, I_B = -50mA
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	—	-1.3 -2.6	V	I_C = 150mA, I_B = 15mA I_C = 500mA, I_B = 50mA
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{obo}	—	8.0	pF	V_{CB} = -10V, f = 1MHz
Input Capacitance	C_{ibo}	—	30	pF	V_{EB} = -2V, f = 1MHz
Current Gain-Bandwidth Product	f_T	200	—	MHz	V_{CE} = -20V, I_C = -50mA, f = 100MHz
SWITCHING CHARACTERISTICS					
Turn-On Time	t_{on}	—	45	ns	—
Delay Time	t_d	—	10	ns	V_{CC} = -30V, I_C = -150mA, I_{B1} = -15mA
Rise Time	t_r	—	40	ns	
Turn-Off Time	t_{off}	—	100	ns	—
Storage Time	t_s	—	80	ns	V_{CC} = -6V, I_C = -150mA, I_{B1} = I_{B2} = -15mA
Fall Time	t_f	—	30	ns	

Note: 9. Short duration pulse test used to minimize self-heating effect.

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

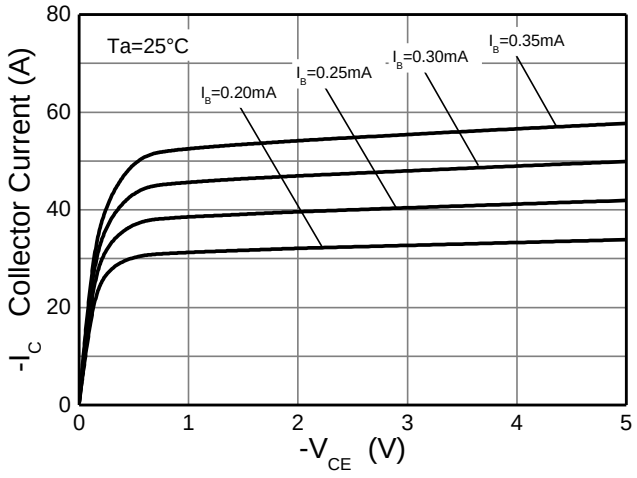


Figure 11. I_C v V_{CE}

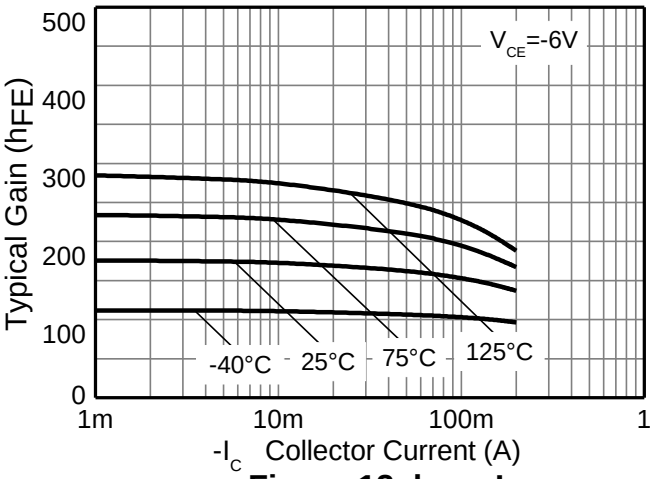


Figure 12. h_{FE} v I_C

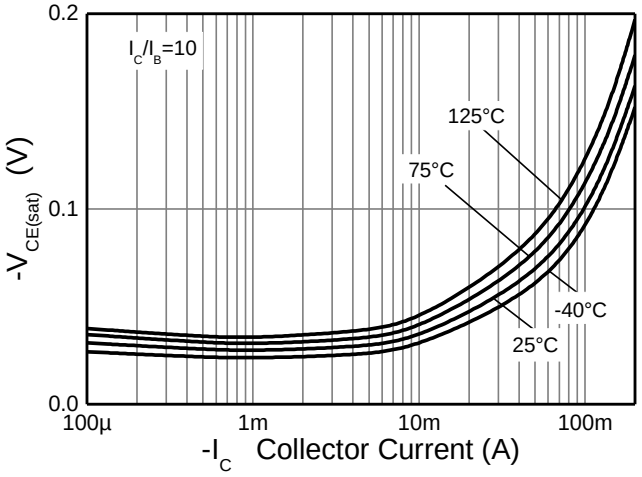


Figure 13. $V_{CE(sat)}$ v I_C

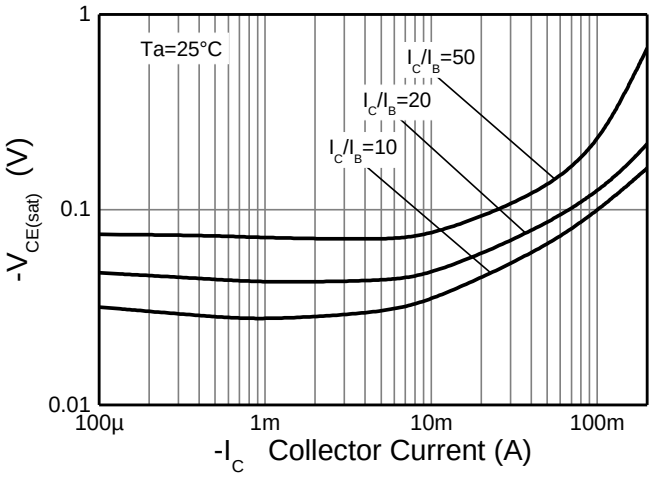


Figure 14. $V_{CE(sat)}$ v I_C

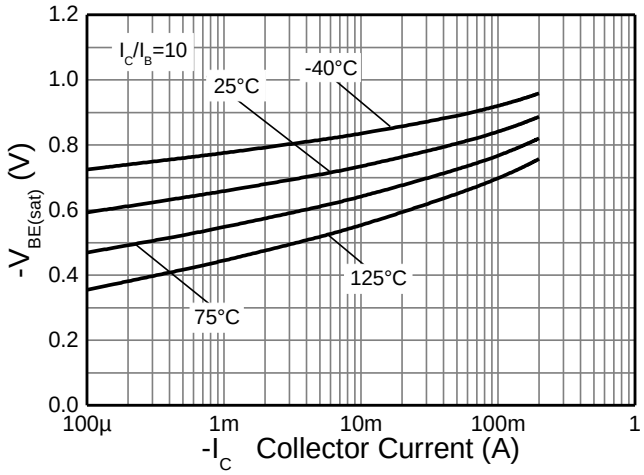


Figure 15. $V_{BE(sat)}$ v I_C

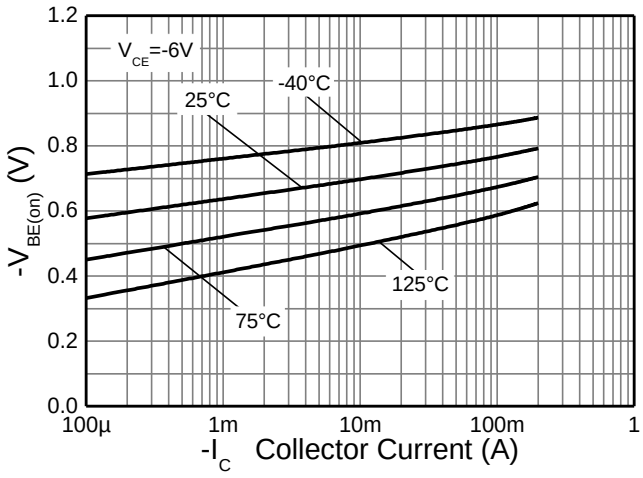


Figure 16. $V_{BE(on)}$ v I_C

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

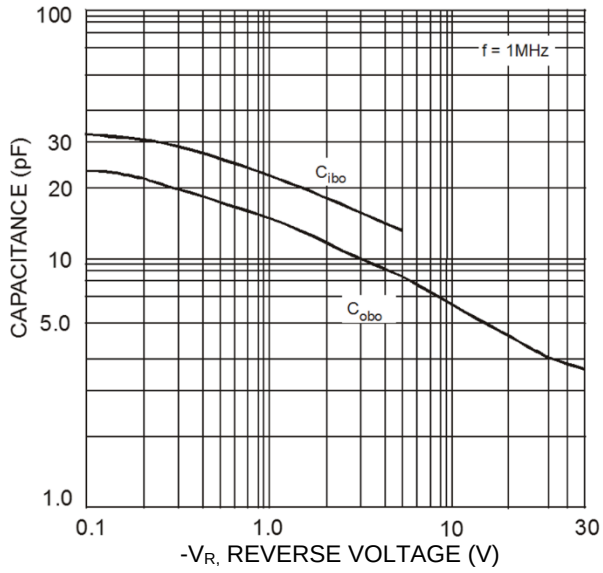


Figure 17. Capacitance v V_R

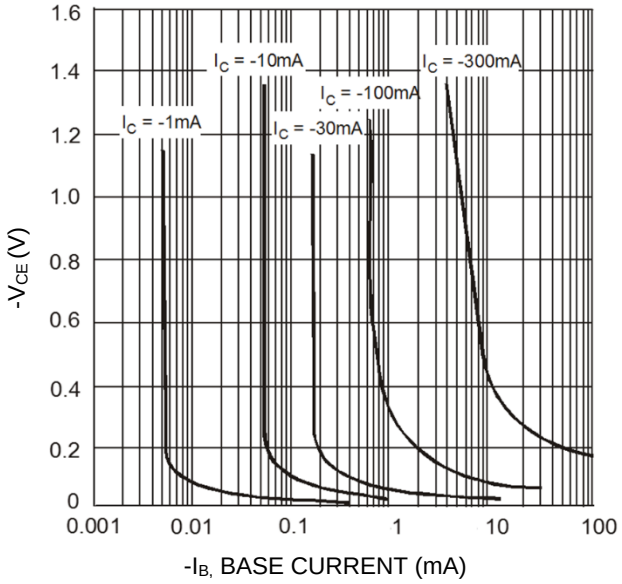


Figure 18. V_{CE} v I_B

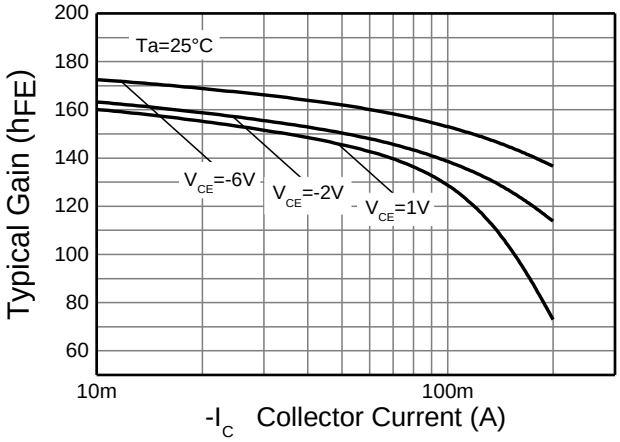


Figure 19. h_{FE} v I_C

Package Outline Dimensions

Please see https://www.diodes.com/design/support/packaging/diodes-packaging/ for the latest version.

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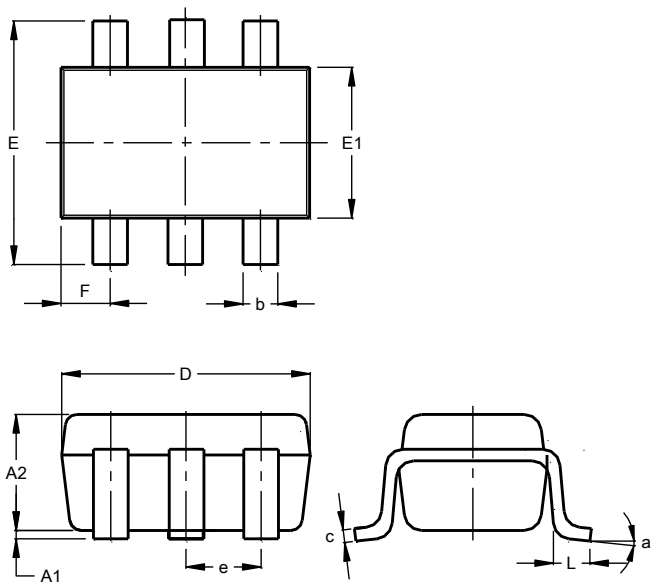

SOT363			
Dim	**Min**	**Max**	**Typ**
A1	0.00	0.10	0.05
A2	0.90	1.00	0.95
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

Please see https://www.diodes.com/design/support/packaging/diodes-packaging/ for the latest version.

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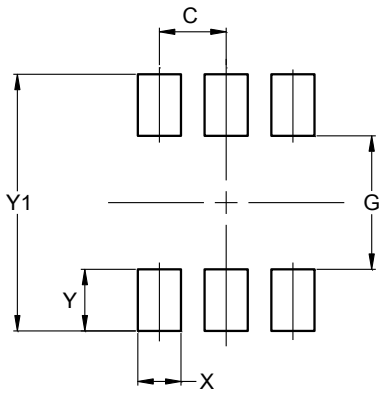

Dimensions	Value (in mm)
C	0.650
G	1.300
X	0.420
Y	0.600
Y1	2.500

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