

COMPLEMENTARY NPN / PNP SMALL SIGNAL TRANSISTOR IN SOT363
Features & Benefits

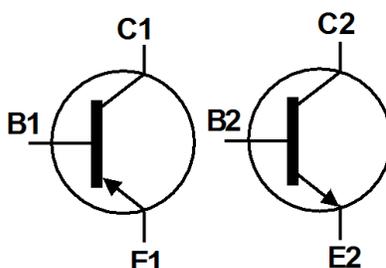
- Complementary Pairs:
 - One 2222A Type (NPN)
 - One 2907A Type (PNP)
- Ideal for Low-Power Amplification and Switching
- Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- Halogen and Antimony Free. "Green" Device (Note 3)**
- An automotive-compliant part is available under separate datasheet (DIODES™ [MMDT2227Q](#))**

Mechanical Data

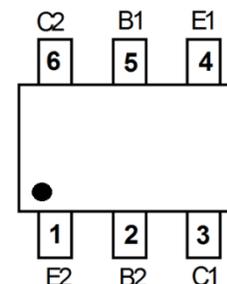
- Package: SOT363
- Package Material: Molded Plastic, "Green" Molding Compound
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 Ⓢ
- Weight: 0.006 grams (approximate)



Top View



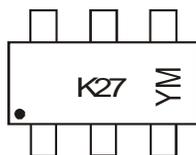
Device Symbol


 Top View
Pin-Out

Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Packing	
				Qty.	Carrier
MMDT2227-7-F	K27	7	8	3,000	Reel

- Notes:
- No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 - 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.
 - Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
 - 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 \bar{Y} = Year (ex: J = 2022)
 M or \bar{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) (@ $T_{amb} = +25^{\circ}\text{C}$, 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) (@ $T_{amb} = +25^{\circ}\text{C}$, 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

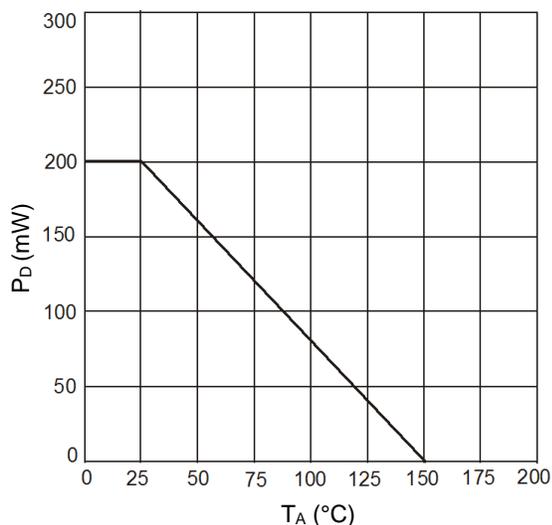
Thermal Characteristics (@ $T_{amb} = +25^{\circ}\text{C}$, unless otherwise specified.)

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

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

Thermal Characteristic and Derating Information

Figure 1. P_D vs T_A

Electrical Characteristics, 2222A Type (NPN) (@ $T_{amb} = +25^{\circ}\text{C}$, unless otherwise specified.)

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

Note: 8. Pulse test: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.

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

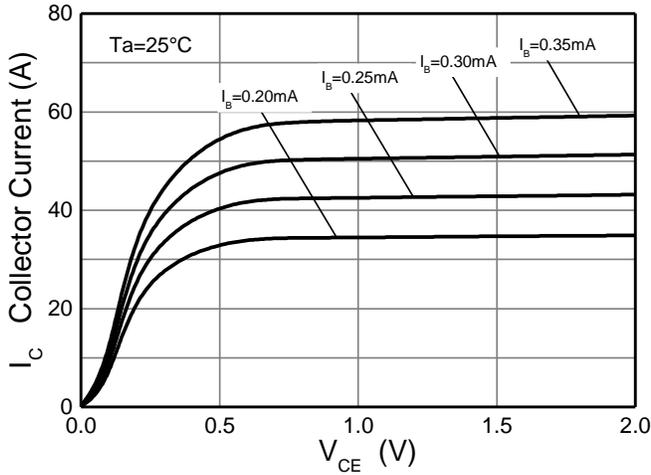


Figure 2. I_C v V_{CE}

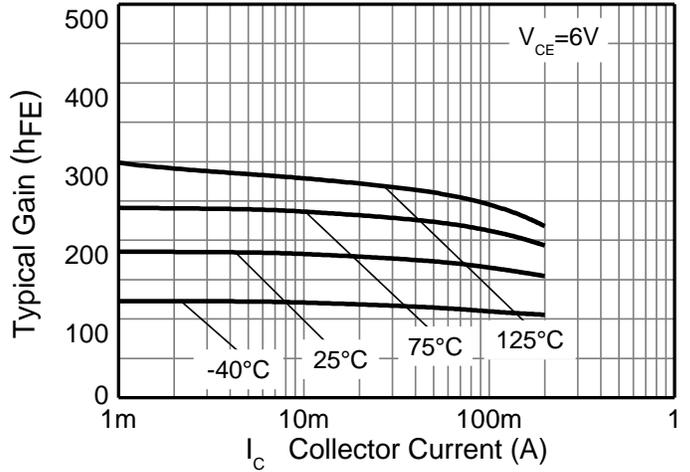


Figure 3. h_{FE} v I_C

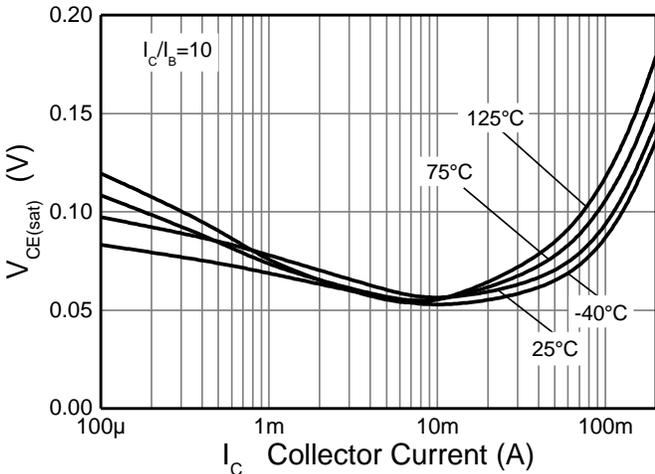


Figure 4. $V_{CE(sat)}$ v I_C

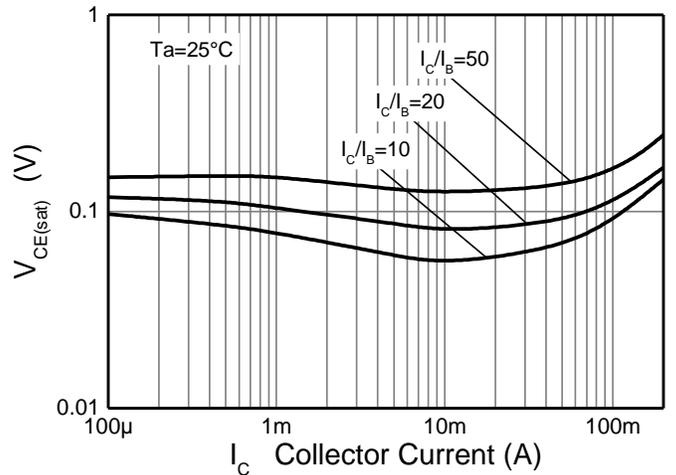


Figure 5. $V_{CE(sat)}$ v I_C

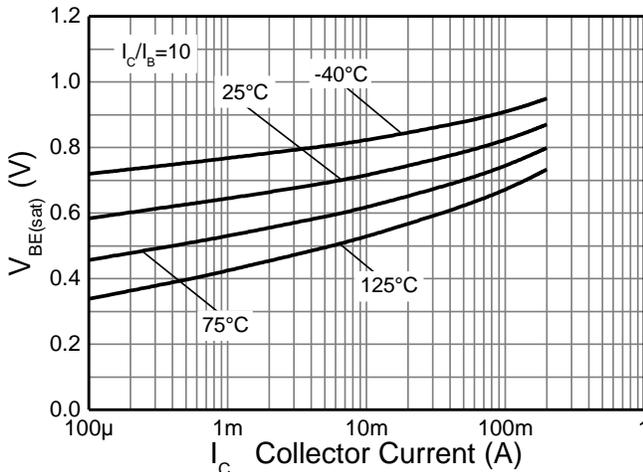


Figure 6. $V_{BE(sat)}$ v I_C

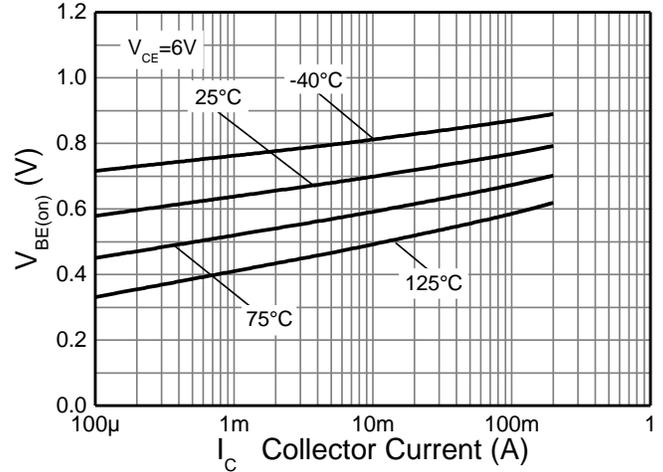


Figure 7. $V_{BE(on)}$ v I_C

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

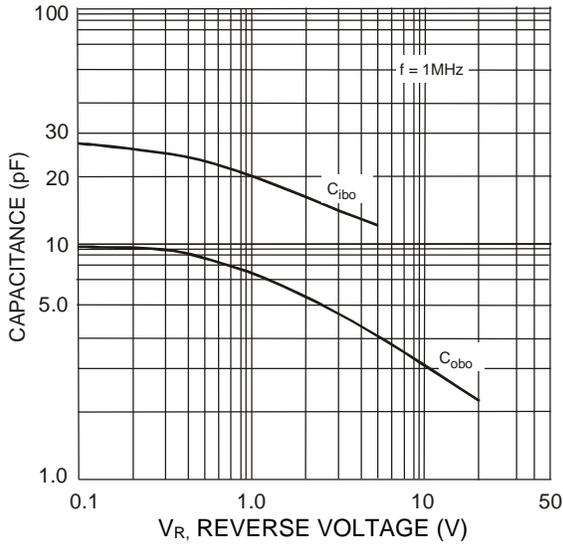


Figure 8. Capacitance v V_R

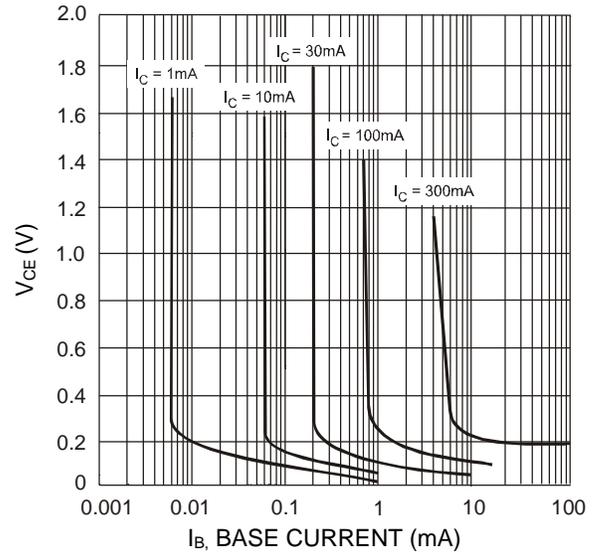


Figure 9. V_{CE} v I_B

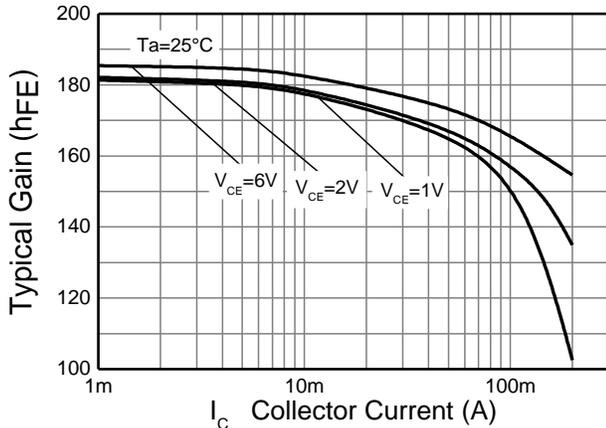


Figure 10. h_{FE} v I_C

Electrical Characteristics, 2907A Type (PNP) (@ $T_{amb} = +25^{\circ}\text{C}$, unless otherwise specified.)

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

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

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

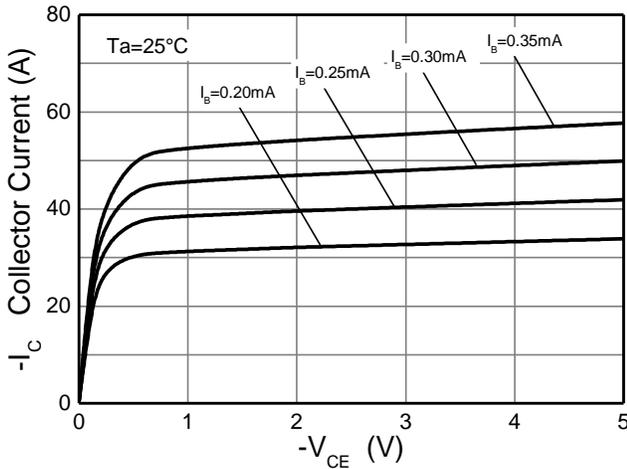


Figure 11. I_C v V_{CE}

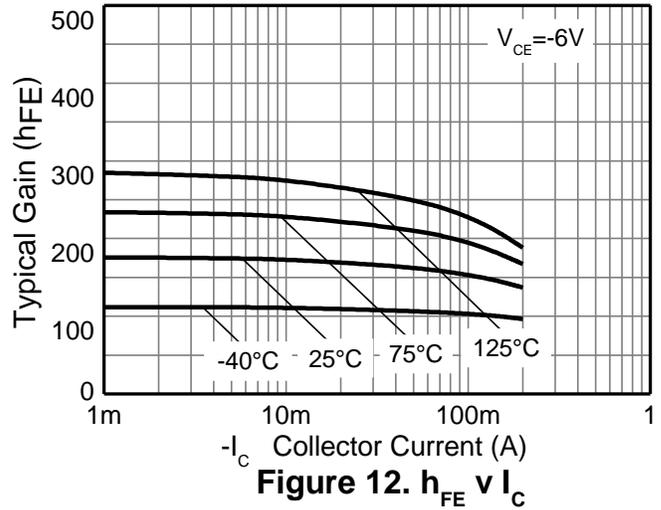


Figure 12. h_{FE} v I_C

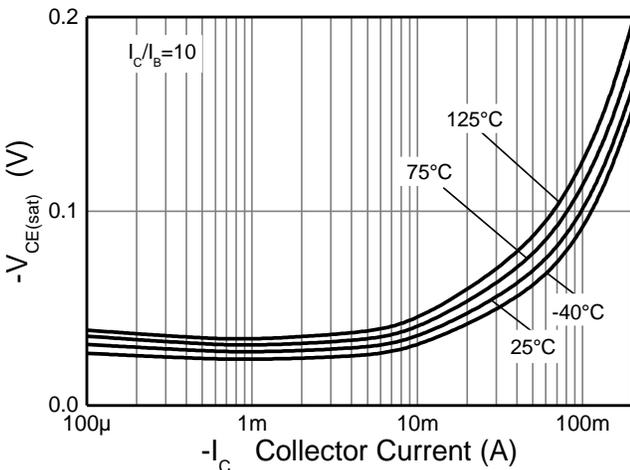


Figure 13. $V_{CE(sat)}$ v I_C

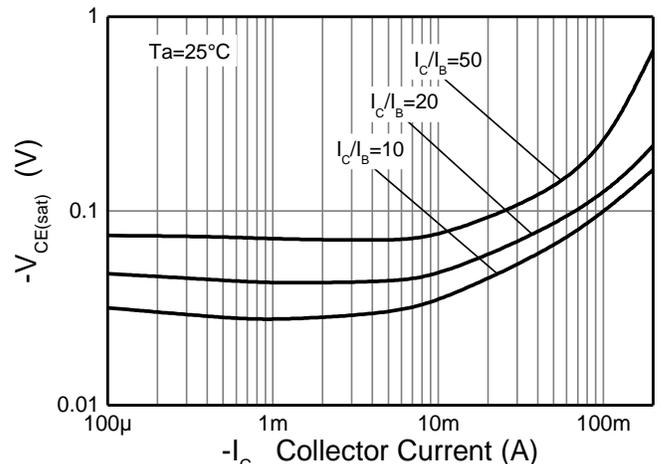


Figure 14. $V_{CE(sat)}$ v I_C

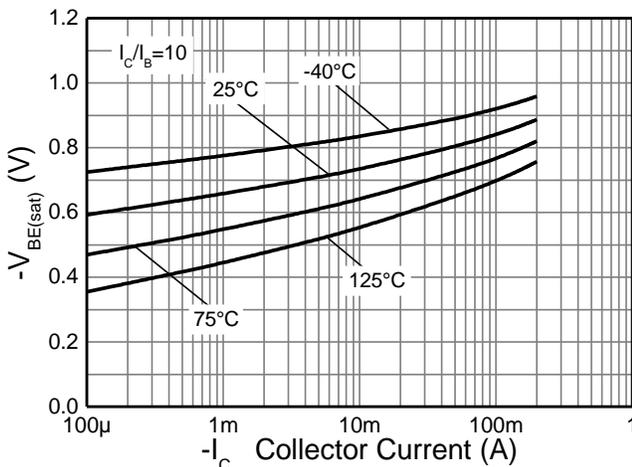


Figure 15. $V_{BE(sat)}$ v I_C

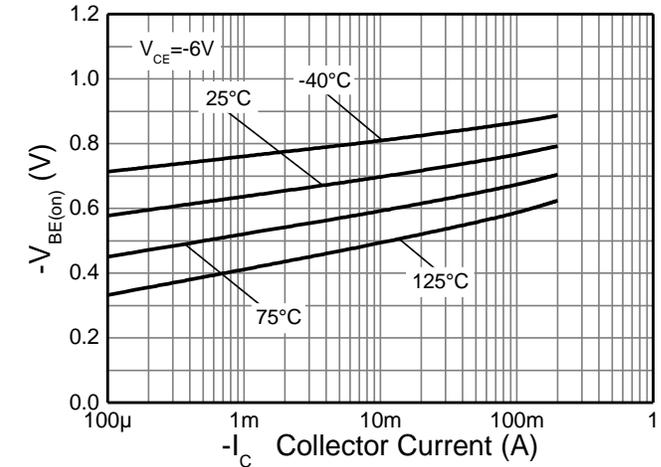


Figure 15. $V_{BE(on)}$ v I_C

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

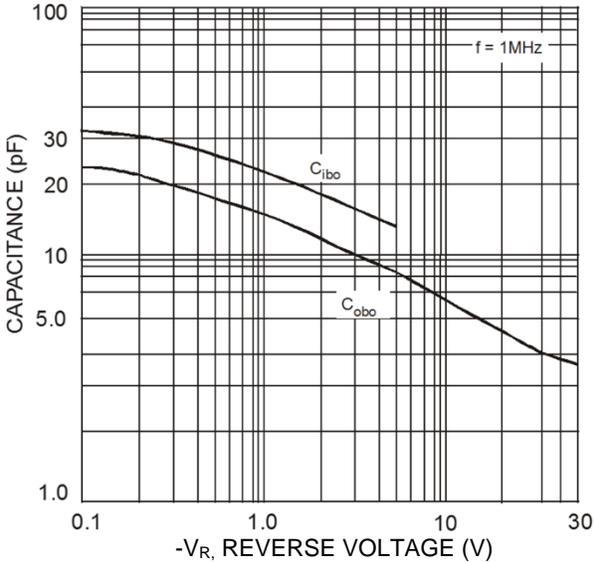


Figure 17. Capacitance v V_R

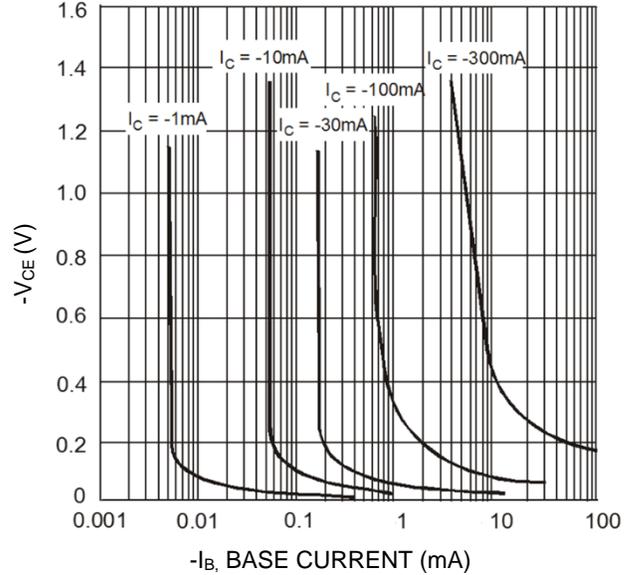


Figure 18. V_{CE} v I_B

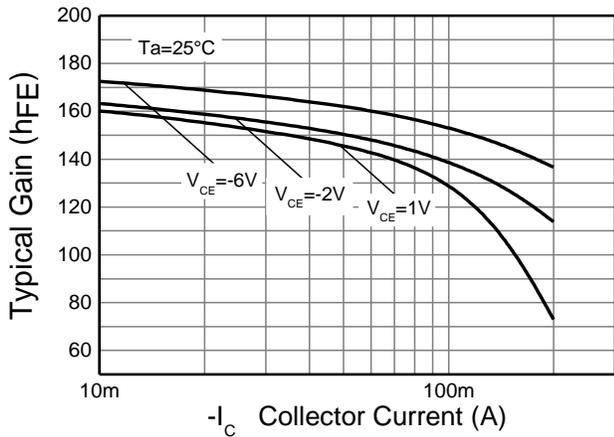
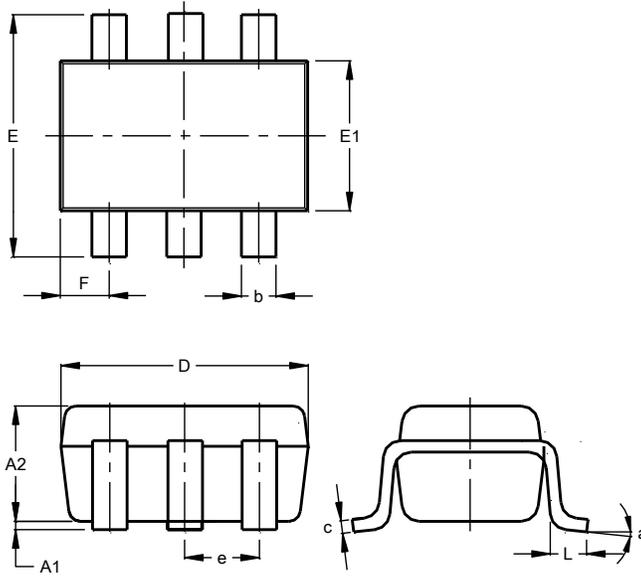


Figure 19. h_{FE} v I_C

Package Outline Dimensions

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

SOT363

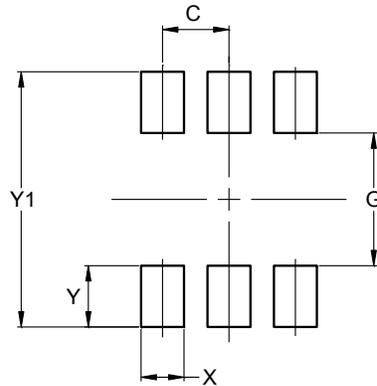


SOT363			
Dim	Min	Max	Typ
A1	0.00	0.10	0.05
A2	0.90	1.00	0.95
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

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

SOT363



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

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