

COMPLEMENTARY NPN / PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR
Features & Benefits

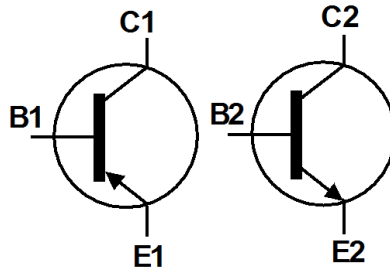
- Complementary Pairs One 2222A Type (NPN)
- One 2907A Type (PNP)
- Ideal for Low Power Amplification and Switching
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Mechanical Data

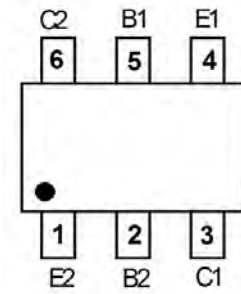
- Case: SOT363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208
- Weight: 0.006 grams (approximate)



Top View



Device Symbol

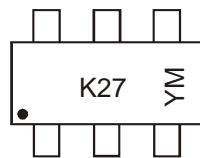


Top View Pin-Out

Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
MMDT2227-7-F	K27	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> 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>.

Marking Information


K27 = Product Type Marking Code
 YM = Date Code Marking
 Y = Year (ex: X = 2010)
 M = Month (ex: 9 = September)

Date Code Key

Year	2010	2011	2012	2013	2014	2015	2016	2017
Code	X	Y	Z	A	B	C	D	E

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_A = +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_A = +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}	-6.0	V
Continuous Collector Current	I _C	-600	mA

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

Characteristic	Symbol	Value	Unit
Power Dissipation	P _D	200	mW
Thermal Resistance, Junction to Ambient	R _{θJA}	625	°C/W
Thermal Resistance, Junction to Case	R _{θJC}	150	
Operating and Storage Temperature Range	T _J , T _{STG}	-55 to +150	°C

- Notes:
- 5. Device mounted on 1 inch x 0.85 inch x 0.062 inch FR-4 PCB
 - 6. Thermal resistance from junction to the top of package

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

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)					
Collector-Base Breakdown Voltage	BV_{CBO}	75	—	V	$I_C = 100\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	BV_{CEO}	40	—	V	$I_C = 10\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	6.0	—	V	$I_E = 100\mu\text{A}, I_C = 0$
Collector Cutoff Current	I_{CBO}	—	10	nA μA	$V_{CB} = 60\text{V}, I_E = 0$ $V_{CB} = 60\text{V}, I_E = 0, T_A = +150^\circ\text{C}$
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	$V_{EB} = 5.0\text{V}, I_C = 0$
Base Cutoff Current	I_{BL}	—	20	nA	$V_{CE} = 60\text{V}, V_{EB(off)} = 3.0\text{V}$
ON CHARACTERISTICS (Note 7)					
DC Current Gain	h_{FE}	35	—	—	$I_C = 100\mu\text{A}, V_{CE} = 10\text{V}$ $I_C = 1.0\text{mA}, V_{CE} = 10\text{V}$ $I_C = 10\text{mA}, V_{CE} = 10\text{V}$ $I_C = 150\text{mA}, V_{CE} = 10\text{V}$ $I_C = 500\text{mA}, V_{CE} = 10\text{V}$ $I_C = 10\text{mA}, V_{CE} = 10\text{V}, T_A = -55^\circ\text{C}$ $I_C = 150\text{mA}, V_{CE} = 1.0\text{V}$
		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	$V_{CB} = 10\text{V}, f = 1.0\text{MHz}, I_E = 0$
Input Capacitance	C_{ibo}	—	25	pF	$V_{EB} = 0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$
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	$V_{CE} = 10\text{V}, I_C = 100\mu\text{A}, R_S = 1.0\text{k}\Omega, f = 1.0\text{kHz}$
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	

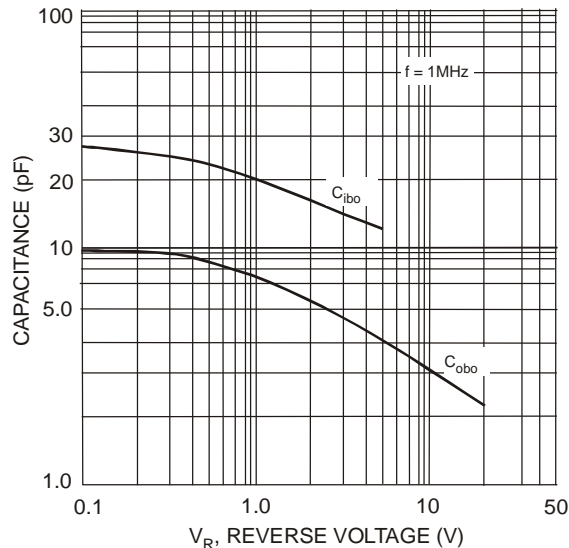
 Notes: 7. Pulse test: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.


Fig. 1 (2222A) Typical Capacitance

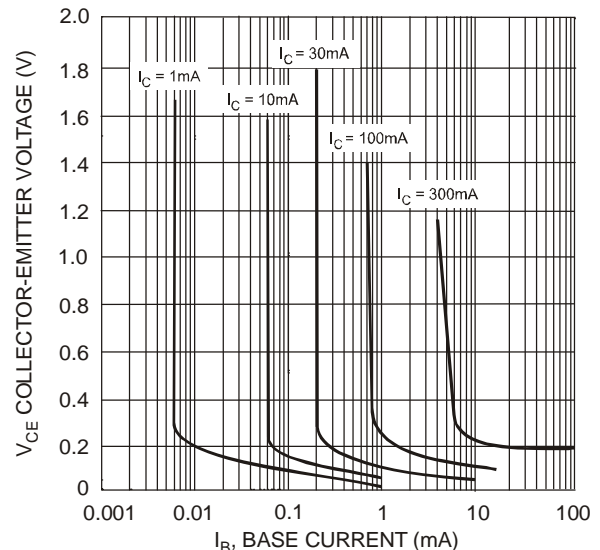


Fig. 2 Typical Collector Saturation Region (2222A Type - NPN)

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

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 8)					
Collector-Base Breakdown Voltage	BV_{CBO}	-60	—	V	$I_C = -100\mu\text{A}$, $I_E = 0$
Collector-Emitter Breakdown Voltage	BV_{CEO}	-60	—	V	$I_C = -10\text{mA}$, $I_B = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	-6.0	—	V	$I_E = -100\mu\text{A}$, $I_C = 0$
Collector Cutoff Current	I_{CBO}	—	-10	nA μA	$V_{CB} = -50\text{V}$, $I_E = 0$ $V_{CB} = -50\text{V}$, $I_E = 0$, $T_A = +125^\circ\text{C}$
Collector Cutoff Current	I_{CEX}	—	-50	nA	$V_{CE} = -30\text{V}$, $V_{EB(\text{off})} = -0.5\text{V}$
Base Cutoff Current	I_{BL}	—	-50	nA	$V_{CE} = -30\text{V}$, $V_{EB(\text{off})} = -0.5\text{V}$
ON CHARACTERISTICS (Note 8)					
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	$V_{CE(\text{sat})}$	—	-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	$V_{BE(\text{sat})}$	—	-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	$V_{CB} = -10\text{V}$, $f = 1.0\text{MHz}$, $I_E = 0$
Input Capacitance	C_{ibo}	—	30	pF	$V_{EB} = -2.0\text{V}$, $f = 1.0\text{MHz}$, $I_C = 0$
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	$V_{CC} = -6.0\text{V}$, $I_C = -150\text{mA}$, $I_{B1} = I_{B2} = -15\text{mA}$
Fall Time	t_f	—	30	ns	

Notes: 8. Short duration pulse test used to minimize self-heating effect.

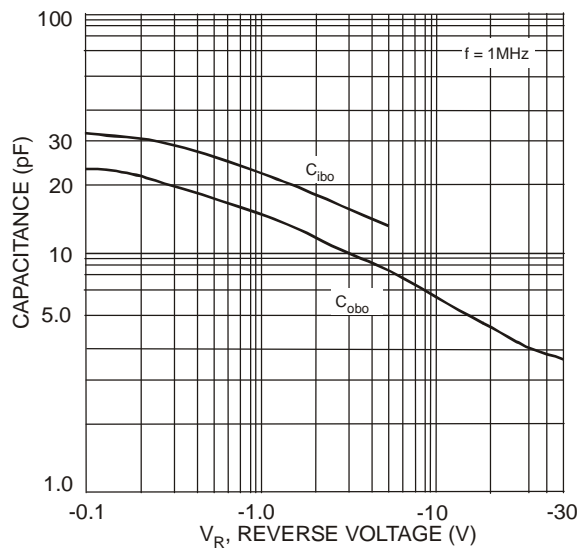


Fig. 3 (2907A) Typical Capacitance

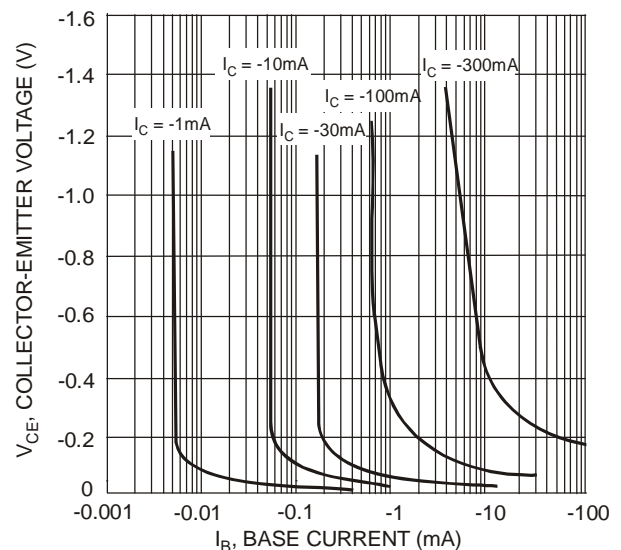
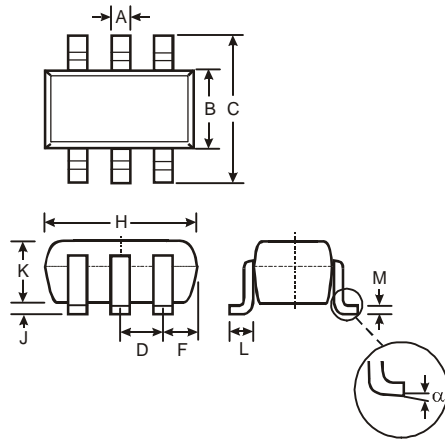


Fig. 4 Typical Collector Saturation Region (2907A Type - PNP)

Package Outline Dimensions

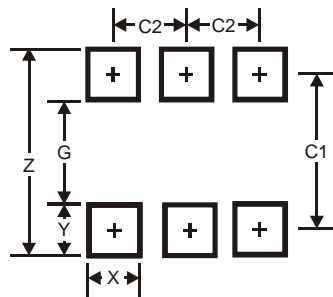
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



SOT363			
Dim	Min	Max	Typ
A	0.10	0.30	0.25
B	1.15	1.35	1.30
C	2.00	2.20	2.10
D	0.65 Typ		
F	0.40	0.45	0.425
H	1.80	2.20	2.15
J	0	0.10	0.05
K	0.90	1.00	1.00
L	0.25	0.40	0.30
M	0.10	0.22	0.11
α	0°	8°	-
All Dimensions in mm			

Suggested Pad Layout

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



Dimensions	Value (in mm)
Z	2.5
G	1.3
X	0.42
Y	0.6
C1	1.9
C2	0.65

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