



**THE DATASHEET OF  
HBDM60V600W-7**



**COMPLEX TRANSISTOR ARRAY FOR BIPOLAR TRANSISTOR HALF H-BRIDGE MOTOR/ACTUATOR DRIVER**
**Features**

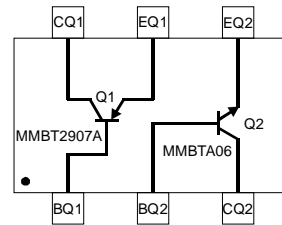
- Epitaxial Planar Die Construction
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Sub-Component P/N	Reference	Device Type
MMBT2907A_DIE	Q1	PNP Transistor
MMBTA06_DIE	Q2	NPN Transistor


 Existing Product  
Top View

**Mechanical Data**

- Case: SOT-363
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminal Connections: See Schematic & Pin Configuration
- Terminals: Finish—Matte Tin Annealed over Alloy 42 Leadframe. Solderable per MIL-STD-202, Method 208 (3)
- Marking Information: See Page 6
- Ordering Information: See Page 6
- Weight: 0.016 grams (Approximate)

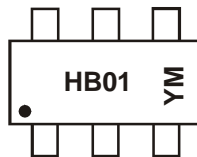


Device Schematic

**Ordering Information (Note 4)**

Part Number	Compliance	Case	Packaging
HBDM60V600W-7	Standard	SOT-363	3000/Tape & 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 <http://www.diodes.com/datasheets/ap02007.pdf>.

**Marking Information**


HB01 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: G = 2019)  
 M = Month (ex: 9 = September)

## Date Code Key

Year	2006	2007	...	2019	2020	2021	2022	2023	2024	2025
Code	T	U	...	G	H	I	J	K	L	M

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: Total Device** @ $T_A = 25^\circ\text{C}$  (unless otherwise specified)

Characteristic	Symbol	Value	Unit
Operating and Storage Temperature Range	$T_{OP}, T_{stg}$	-55 to +150	$^\circ\text{C}$

**Thermal Characteristics: Total Device**

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	$P_D$	200	mW
Thermal Resistance, Junction to Ambient Air (Note 5)	$R_{\theta JA}$	625	$^\circ\text{C/W}$

**Maximum Ratings: Sub-Component Devices** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Q1-PNP Transistor (MMBT2907A)	Q2-NPN Transistor (MMBTA06)	Unit
Collector-Base Voltage	$V_{CBO}$	-60	80	V
Collector-Emitter Voltage	$V_{CEO}$	-60	65	V
Emitter-Base Voltage	$V_{EBO}$	-5.5	6	V
Collector Current - Continuous (Note 5)	$I_C$	-600	500	mA

Note: 5. Device mounted on FR-4 substrate printed circuit board with 1 inch square 2oz copper pad area

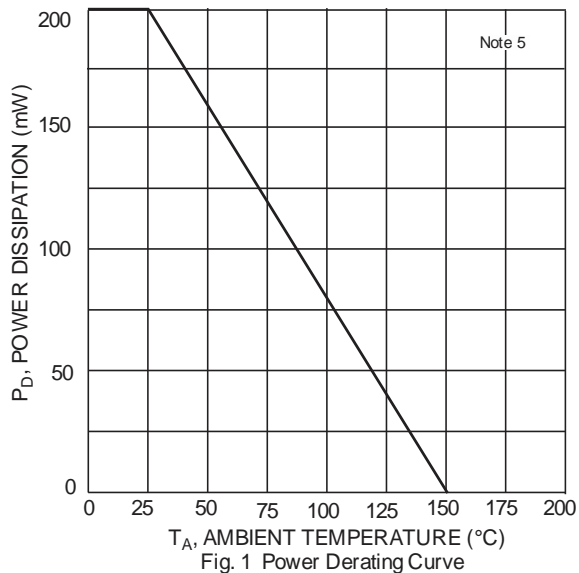
**Electrical Characteristics: PNP (MMBT2907A) Transistor (Q1)** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 6)</b>					
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	-60	—	V	$I_C = -10\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	-60	—	V	$I_C = -10\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	-5.5	—	V	$I_E = -10\mu\text{A}, I_C = 0$
Collector Cutoff Current	$I_{CBO}$	—	-10	nA	$V_{CB} = -50\text{V}, I_E = 0$
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	$V_{CE} = -30\text{V}, V_{EB(OFF)} = -0.5\text{V}$
<b>ON CHARACTERISTICS (Note 6)</b>					
DC Current Gain	$h_{FE}$	100	—	—	$I_C = -100\mu\text{A}, V_{CE} = -10\text{V}$
		100	—	—	$I_C = -1.0\text{mA}, V_{CE} = -10\text{V}$
		100	—	—	$I_C = -10\text{mA}, V_{CE} = -10\text{V}$
		100	300	—	$I_C = -150\text{mA}, V_{CE} = -10\text{V}$
		50	—	—	$I_C = -500\text{mA}, V_{CE} = -10\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	—	-0.3 -0.5	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	$V_{BE(SAT)}$	—	-0.95 -1.3	V	$I_C = -150\text{mA}, I_B = -15\text{mA}$ $I_C = -500\text{mA}, I_B = -50\text{mA}$
<b>SMALL SIGNAL CHARACTERISTICS</b>					
Current Gain-Bandwidth Product	$f_T$	100	—	MHz	$V_{CE} = -2.0\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$
<b>SWITCHING CHARACTERISTICS</b>					
Turn-On Time	$t_{on}$	—	45	ns	$V_{CE} = -30\text{V}, I_C = -150\text{mA}, I_{B1} = -15\text{mA}$
Delay Time	$t_d$	—	10	ns	
Rise Time	$t_r$	—	40	ns	
Turn-Off Time	$t_{off}$	—	100	ns	$V_{CC} = -6.0\text{V}, I_C = -150\text{mA}, I_{B1} = I_{B2} = -15\text{mA}$
Storage Time	$t_s$	—	80	ns	
Fall Time	$t_f$	—	30	ns	

**Electrical Characteristics: NPN (MMBTA06) Transistor (Q2)** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 6)</b>						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	80	—	—	V	$I_C = 100\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	65	—	—	V	$I_C = 1\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	6	—	—	V	$I_E = 100\mu\text{A}, I_C = 0$
Collector-Base Cutoff Current	$I_{CBO}$	—	—	100	nA	$V_{CB} = 80\text{V}, I_E = 0$
Collector Cutoff Current	$I_{CES}$	—	—	100	nA	$V_{CE} = 90\text{V}, V_{BE} = 0$
Emitter-Base Cutoff Current	$I_{EBO}$	—	—	100	nA	$V_{EB} = 5\text{V}, I_C = 0$
<b>ON CHARACTERISTICS (Note 6)</b>						
DC Current Gain	$h_{FE}$	250	—	—	—	$V_{CE} = 1\text{V}, I_C = 10\text{mA}$
		100	—	—	—	$V_{CE} = 1\text{V}, I_C = 100\text{mA}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	—	0.2	0.4	V	$I_C = 100\text{mA}, I_B = 10\text{mA}$
Base-Emitter Turn-on Voltage	$V_{BE(ON)}$	0.7	0.75	0.8	V	$V_{CE} = 1\text{V}, I_C = 100\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	—	—	0.95	V	$I_C = 100\text{mA}, I_B = 5\text{mA}$
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Current Gain-Bandwidth Product	$f_T$	100	—	—	MHz	$V_{CE} = 20\text{V}, I_C = 10\text{mA}, f = 100\text{MHz}$

Notes: 6. Short duration pulse test used to minimize self-heating effect.

**Typical Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified


**PNP (MMBT2907A) Transistor (Q1) Plots**

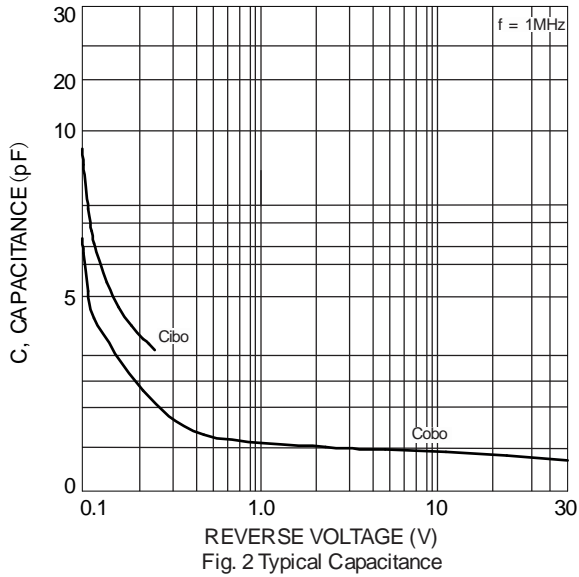


Fig. 2 Typical Capacitance

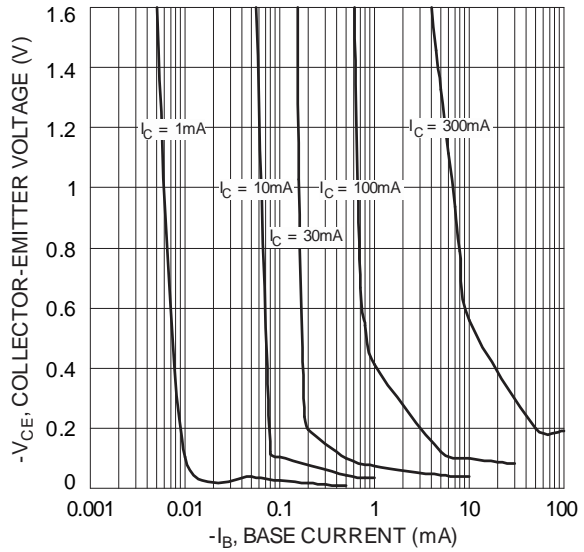


Fig. 3 Typical Collector Saturation Region

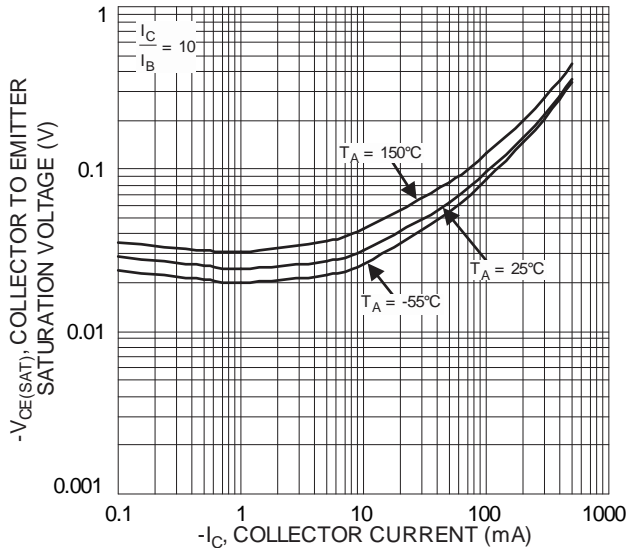


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current

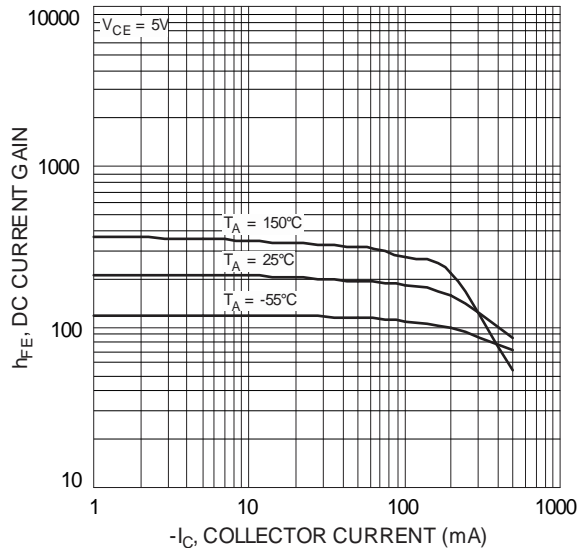


Fig. 5 Typical DC Current Gain vs. Collector Current

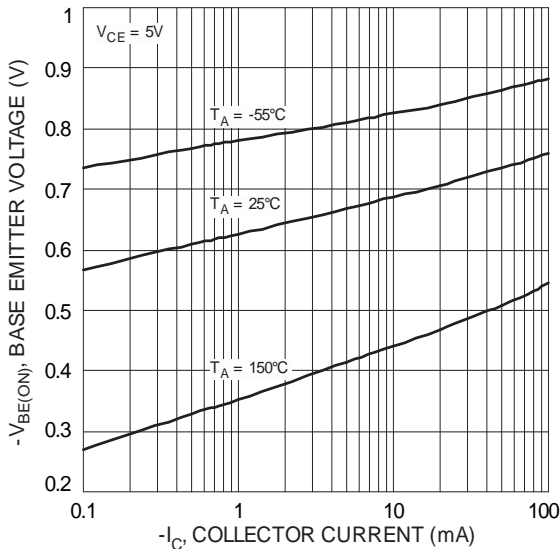


Fig. 6 Typical Base Emitter Voltage vs. Collector Current

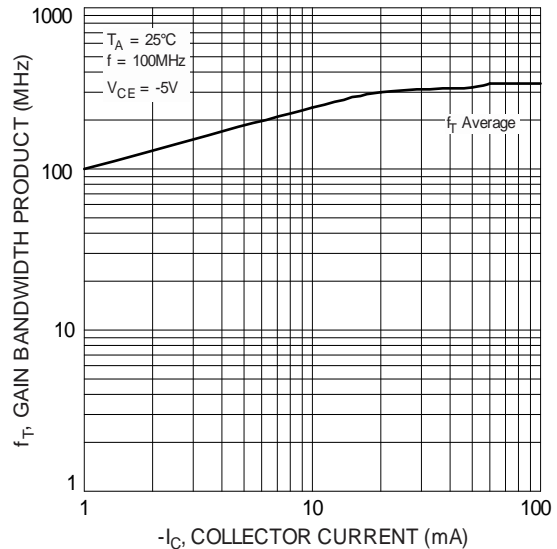


Fig. 7 Typical Gain Bandwidth Product vs. Collector Current

**NPN (MMBTA06) Transistor (Q2) Plots**

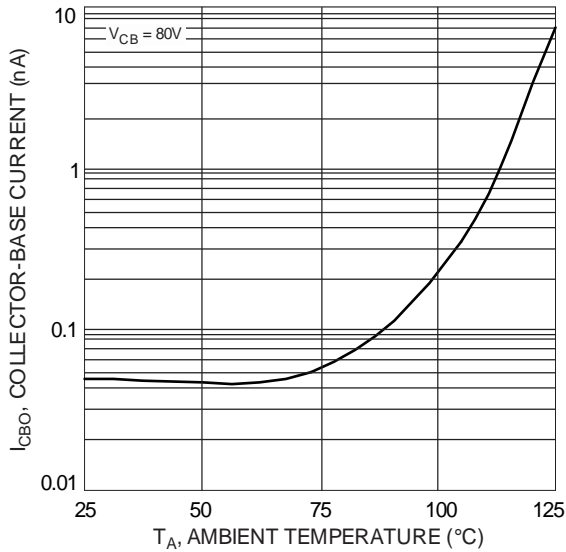


Fig. 8 Typical Collector-Cutoff Current vs. Ambient Temperature

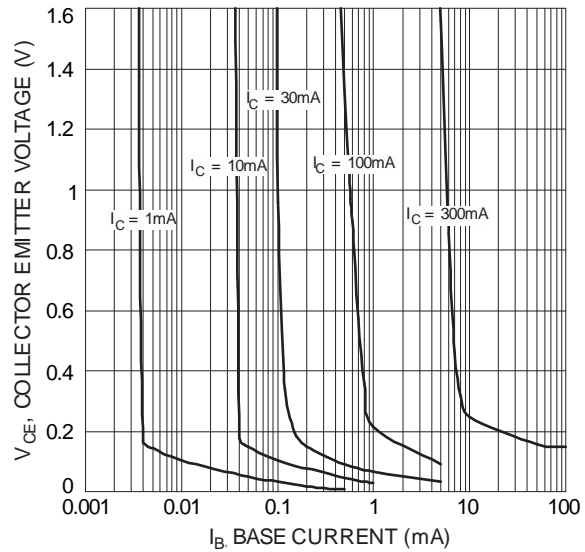


Fig. 9 Typical Collector Saturation Region

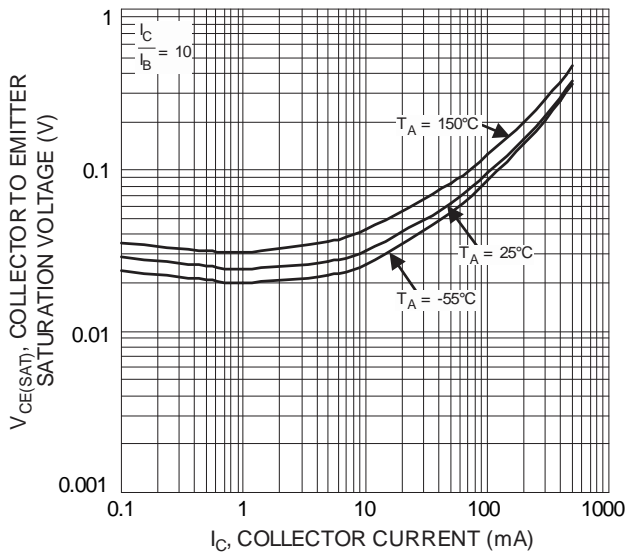


Fig. 10 Typical Collector Emitter Saturation Voltage vs. Collector Current

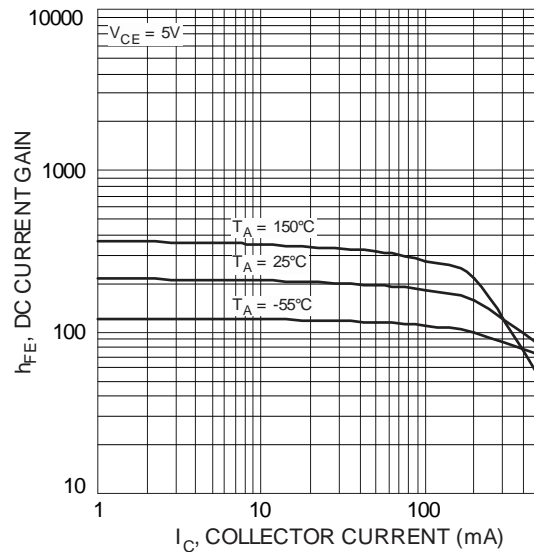


Fig. 11 Typical DC Current Gain vs. Collector Current

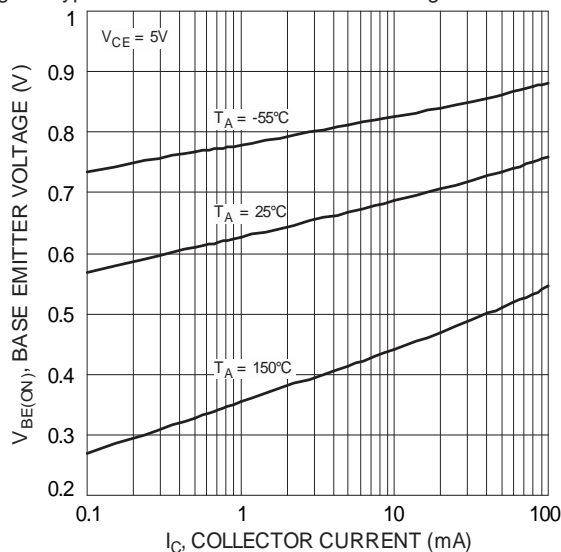


Fig. 12 Typical Base Emitter Voltage vs. Collector Current

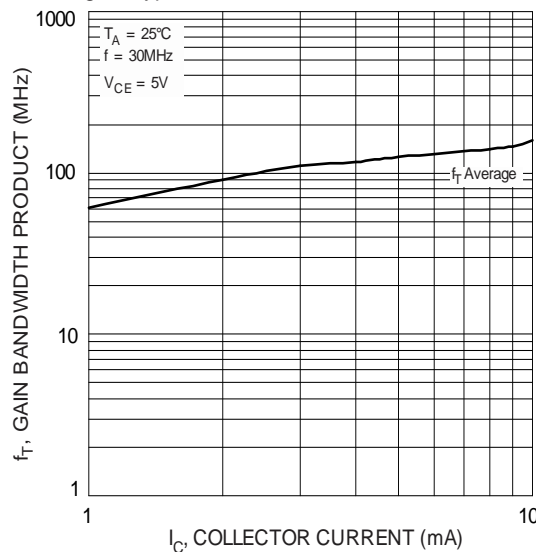
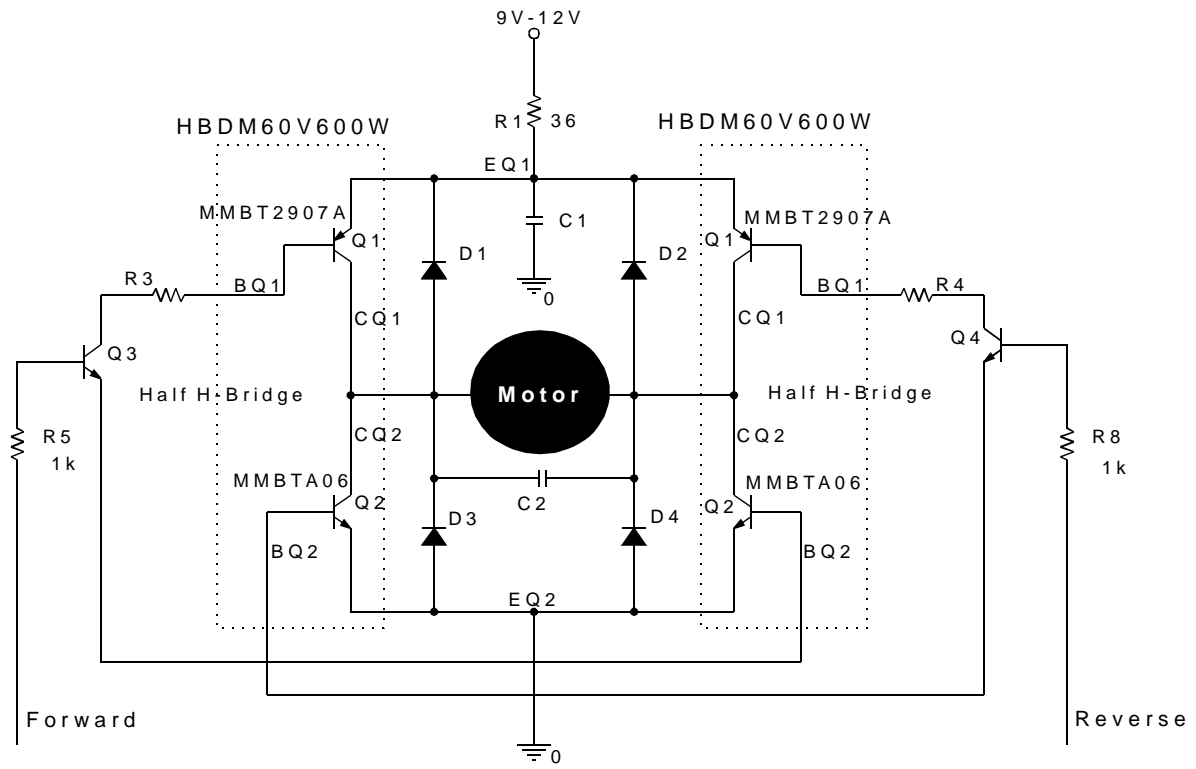


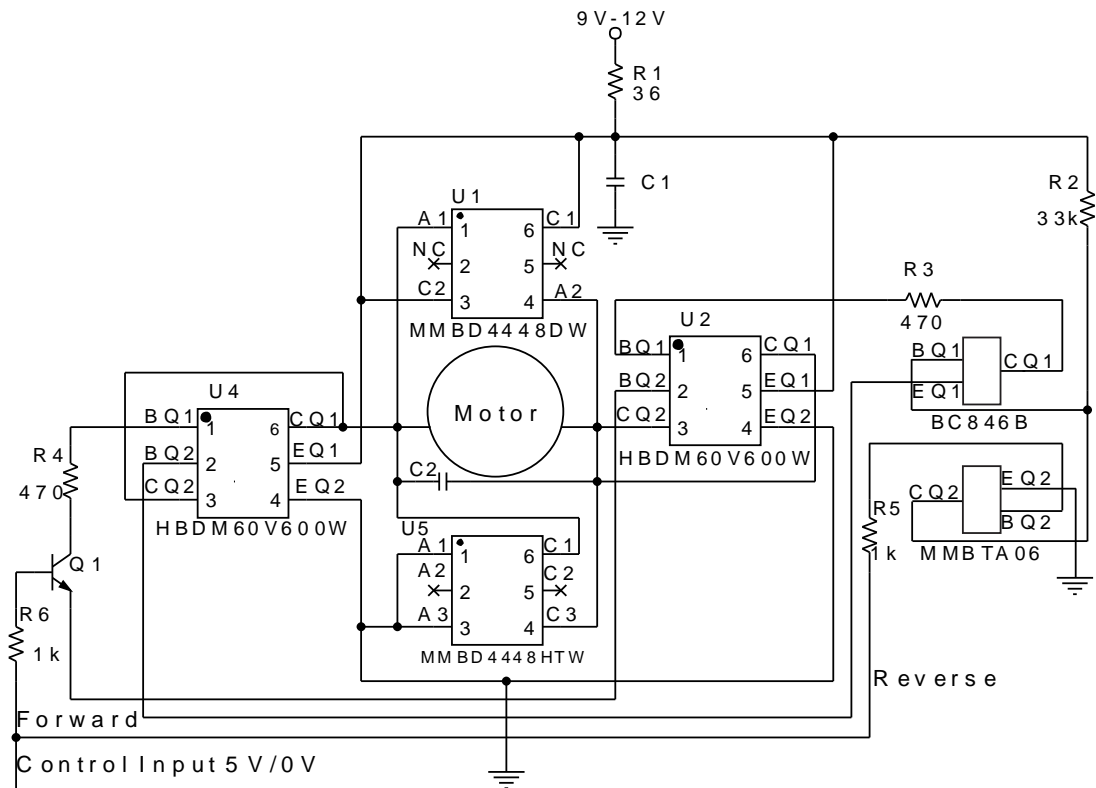
Fig. 13 Typical Gain Bandwidth Product vs. Collector Current

**Current Schematic with Application Example**



Note: D1, D2, D3, D4: Switching Diodes (MMBD4448)  
Q3, Q4: NPN Transistors (MMBTA06)

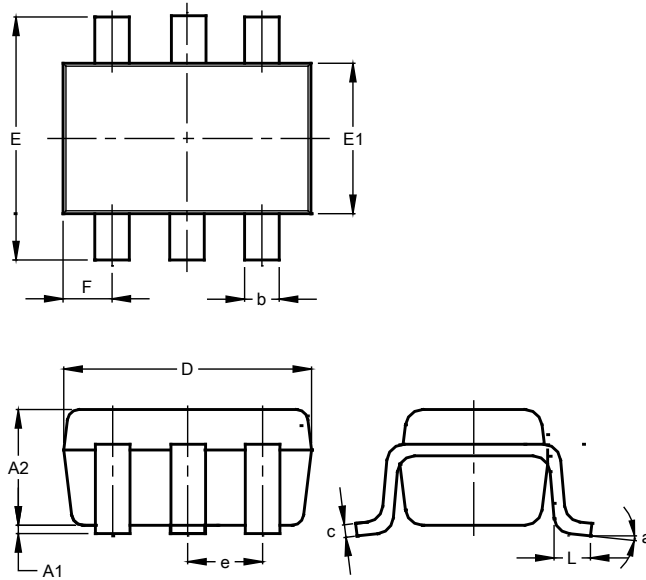
**Application Example Schematic (with Package Pinouts)**



**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT363**

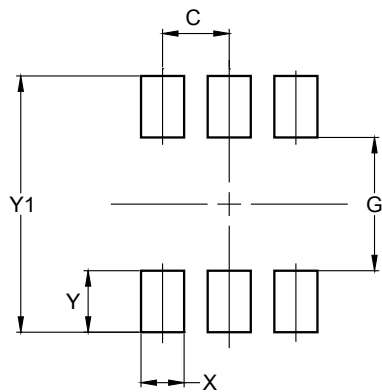


SOT363			
Dim	Min	Max	Typ
A1	0.00	0.10	0.05
A2	0.90	1.00	0.95
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
<b>All Dimensions in mm</b>			

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> 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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