

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

- Epitaxial Planar Die Construction
- **Lead Free By Design/RoHS Compliant (Note 1)**
- "Green" Device (Note 2)

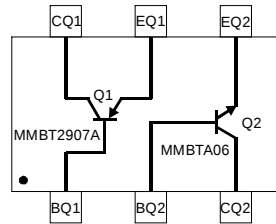
Sub-Component P/N	Reference	Device Type
MMBT2907A_DIE	Q1	PNP Transistor
MMBTA06_DIE	Q2	NPN Transistor



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
- Marking Information: See Page 6
- Ordering Information: See Page 6
- Weight: 0.016 grams (approximate)



Device Schematic

Maximum Ratings: Total Device @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Value	Unit
Operating and Storage Junction Temperature Range	V _{EBO}	-55 to +150	°C

Thermal Characteristics: Total Device

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 3)	P _D	200	mW
Thermal Resistance, Junction to Ambient Air (Note 3)	R _{θJA}	625	°C/W

Maximum Ratings: Sub-Component Devices @T_A = 25°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 3)	I _C	-600	500	mA

- Notes:
1. No purposefully added lead.
 2. Diodes Inc.'s "Green" policy can be found on our website at http://www.diodes.com/products/lead_free/index.php.
 3. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on page 7 or on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

Electrical Characteristics: PNP (MMBT2907A) Transistor (Q1) @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 4)					
Collector-Base Breakdown Voltage	V _{(BR)CBO}	-60	—	V	I _C = -10μA, I _E = 0
Collector-Emitter Breakdown Voltage	V _{(BR)CEO}	-60	—	V	I _C = -10mA, I _B = 0
Emitter-Base Breakdown Voltage	V _{(BR)EBO}	-5.5	—	V	I _E = -10μA, I _C = 0
Collector Cutoff Current	I _{CBO}	—	-10	nA	V _{CB} = -50V, I _E = 0
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 4)					
DC Current Gain	h _{FE}	100	—	—	I _C = -100μA, V _{CE} = -10V
		100	—	—	I _C = -1.0mA, V _{CE} = -10V
		100	—	—	I _C = -10mA, V _{CE} = -10V
		100	300	—	I _C = -150mA, V _{CE} = -10V
		50	—	—	I _C = -500mA, V _{CE} = -10V
Collector-Emitter Saturation Voltage	V _{CE(SAT)}	—	-0.3 -0.5	V	I _C = -150mA, I _B = -15mA I _C = -500mA, I _B = -50mA
Base-Emitter Saturation Voltage	V _{BE(SAT)}	—	-0.95 -1.3	V	I _C = -150mA, I _B = -15mA I _C = -500mA, I _B = -50mA
SMALL SIGNAL CHARACTERISTICS					
Current Gain-Bandwidth Product	f _T	100	—	MHz	V _{CE} = -2.0V, I _C = -10mA, f = 100MHz
SWITCHING CHARACTERISTICS					
Turn-On Time	t _{on}	—	45	ns	V _{CE} = -30V, I _C = -150mA, I _{B1} = -15mA
Delay Time	t _d	—	10	ns	
Rise Time	t _r	—	40	ns	
Turn-Off Time	t _{off}	—	100	ns	V _{CC} = -6.0V, I _C = -150mA, I _{B1} = I _{B2} = -15mA
Storage Time	t _s	—	80	ns	
Fall Time	t _f	—	30	ns	

Electrical Characteristics: NPN (MMBT406) Transistor (Q2) @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 4)						
Collector-Base Breakdown Voltage	V _{(BR)CBO}	80	—	—	V	I _C = 100μA, I _E = 0
Collector-Emitter Breakdown Voltage	V _{(BR)CEO}	65	—	—	V	I _C = 1mA, I _B = 0
Emitter-Base Breakdown Voltage	V _{(BR)EBO}	6	—	—	V	I _E = 100μA, I _C = 0
Collector-Base Cutoff Current	I _{CBO}	—	—	100	nA	V _{CB} = 80V, I _E = 0
Collector Cutoff Current	I _{CES}	—	—	100	nA	V _{CE} = 90V, V _{BE} = 0
Emitter-Base Cutoff Current	I _{EBO}	—	—	100	nA	V _{EB} = 5V, I _C = 0
ON CHARACTERISTICS (Note 4)						
DC Current Gain	h _{FE}	250	—	—	—	V _{CE} = 1V, I _C = 10mA
		100	—	—	—	V _{CE} = 1V, I _C = 100mA
Collector-Emitter Saturation Voltage	V _{CE(SAT)}	—	0.2	0.4	V	I _C = 100mA, I _B = 10mA
Base-Emitter Turn-on Voltage	V _{BE(ON)}	0.7	0.75	0.8	V	V _{CE} = 1V, I _C = 100mA
Base-Emitter Saturation Voltage	V _{BE(SAT)}	—	—	0.95	V	I _C = 100mA, I _B = 5mA
SMALL SIGNAL CHARACTERISTICS						
Current Gain-Bandwidth Product	f _T	100	—	—	MHz	V _{CE} = 20V, I _C = 10mA, f = 100MHz

Notes: 4. Short duration pulse test used to minimize self-heating effect.

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

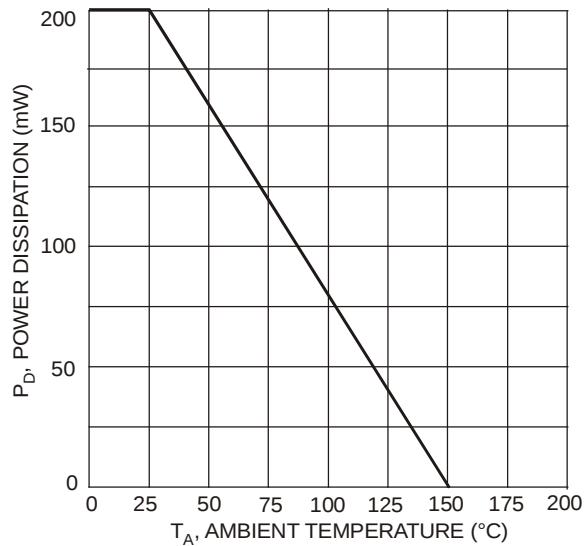


Fig. 1 Power Derating Curve

PNP (MMBT2907A) Transistor (Q1) Plots:

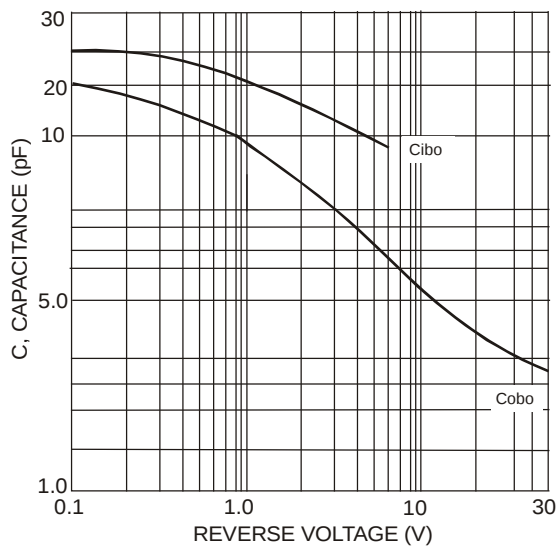


Fig. 2 Typical Capacitance

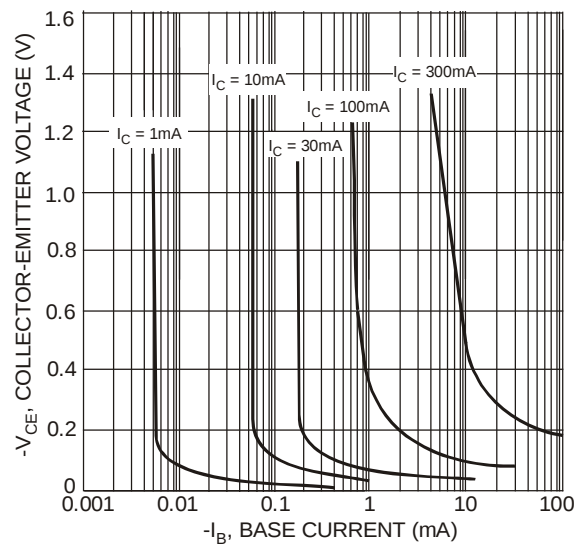


Fig. 3 Typical Collector Saturation Region

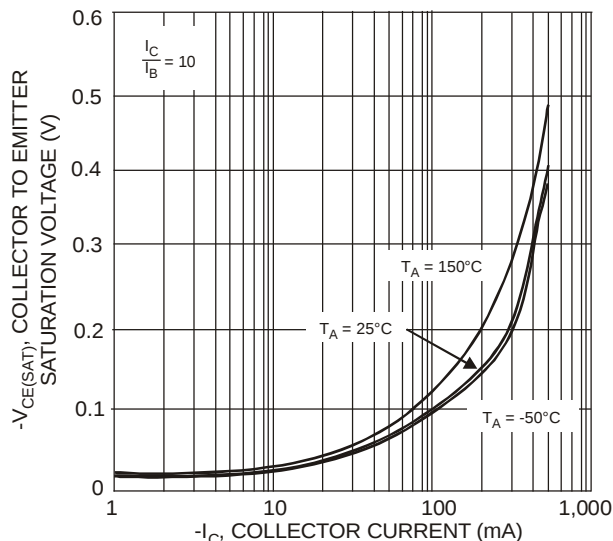


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current

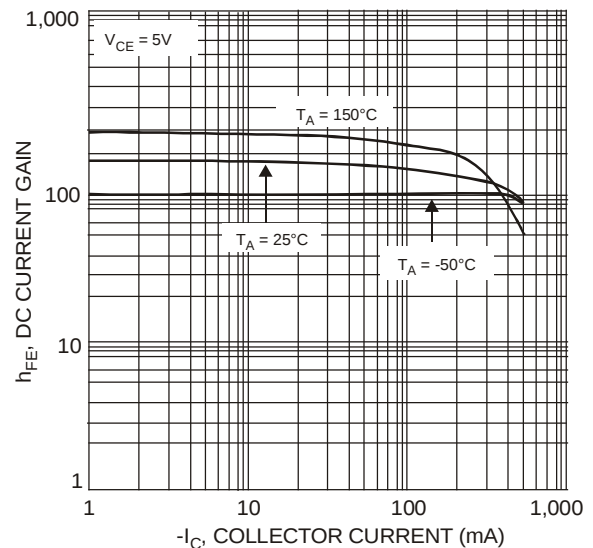


Fig. 5 Typical DC Current Gain vs. Collector Current

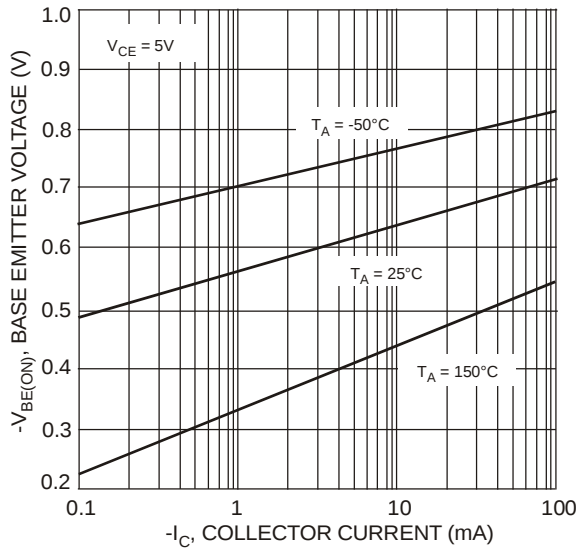


Fig. 6 Typical Base Emitter Voltage vs. Collector Current

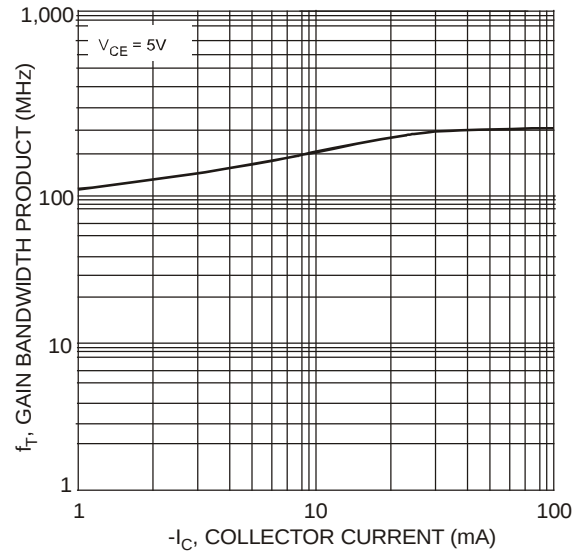


Fig. 7 Typical Gain Bandwidth Product vs. Collector Current

NPN (MMBTA06) Transistor (Q2) Plots

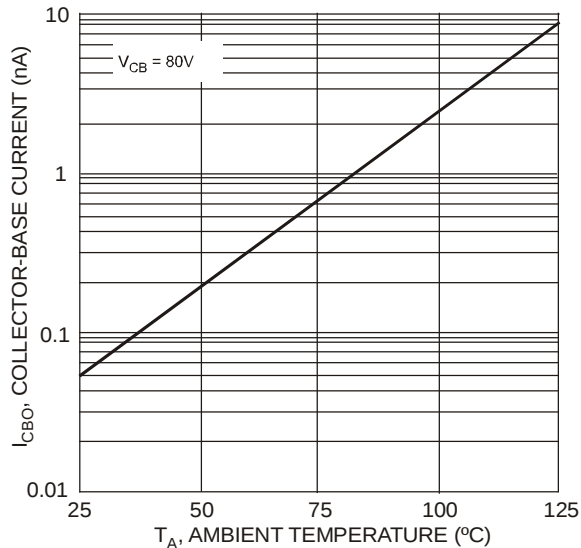


Fig. 8 Typical Collector-Cutoff Current vs. Ambient Temperature

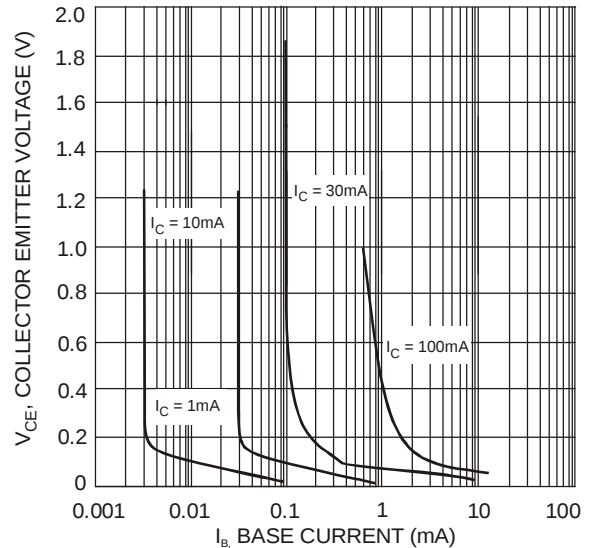


Fig. 9 Typical Collector Saturation Region

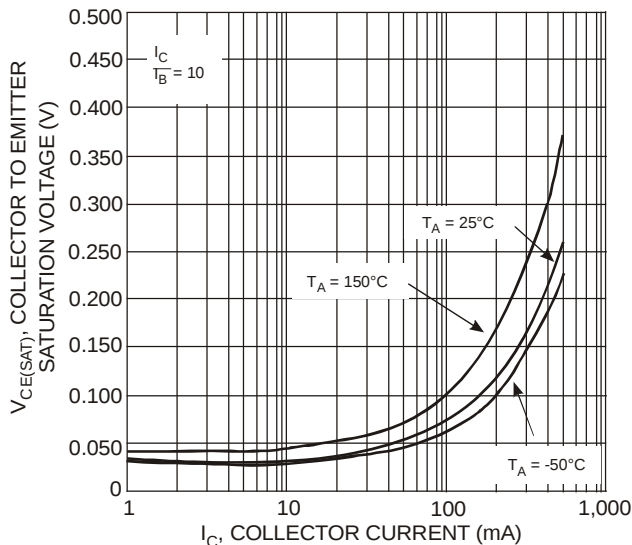


Fig. 10 Typical Collector Emitter Saturation Voltage vs. Collector Current

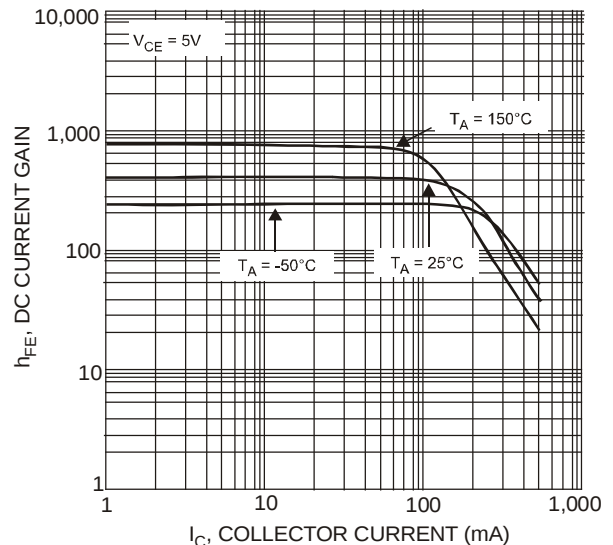
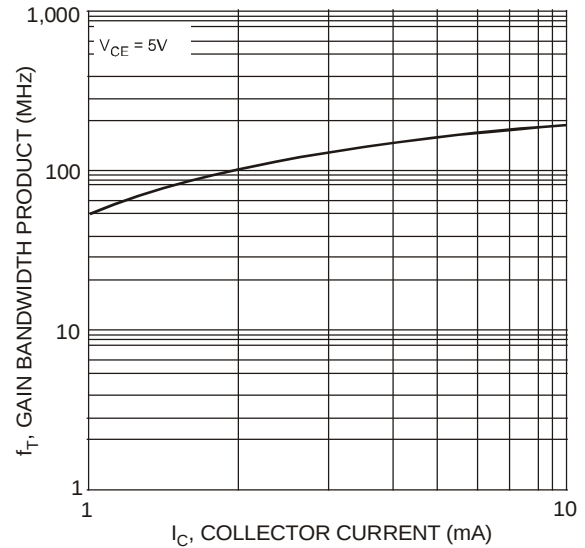
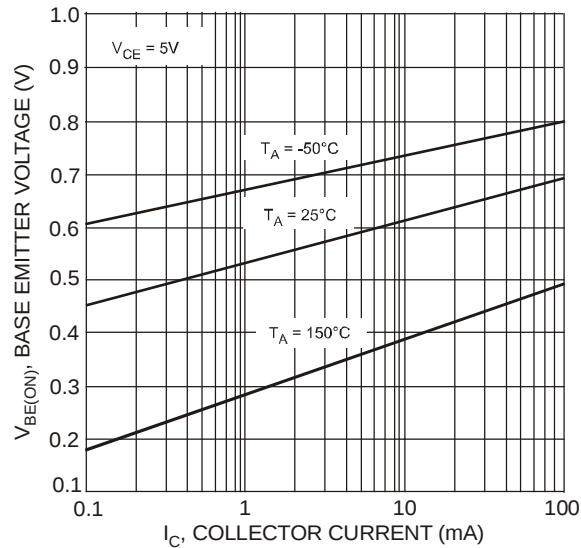
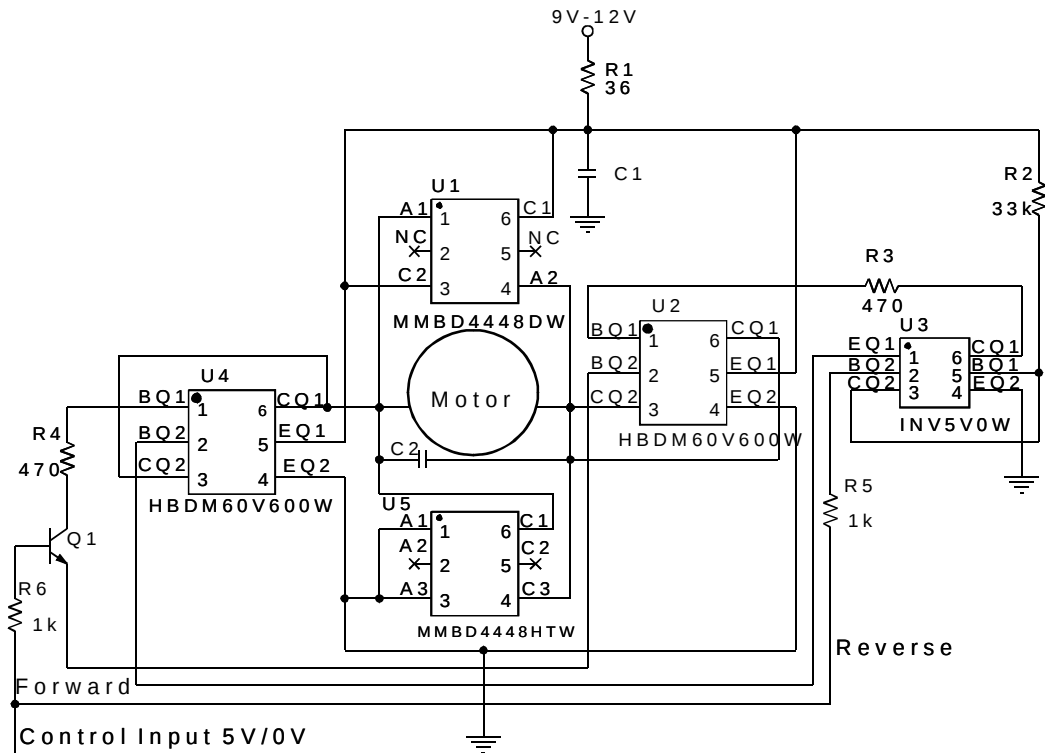


Fig. 11 Typical DC Current Gain vs. Collector Current



Application Example Schematic: (with Package Pinouts)

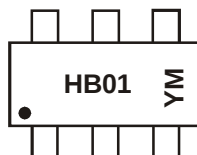


Ordering Information (Note 5)

Part Number	Case	Packaging
HBDM60V600W-7	SOT-363	3000/Tape & Reel

Notes: 5. 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: T = 2006)
M = Month (ex: 9 = September)

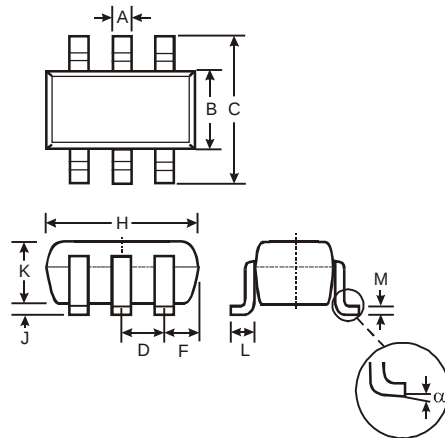
Date Code Key

Date Code Key

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Code	T	U	V	W	X	Y	Z	A	B	C

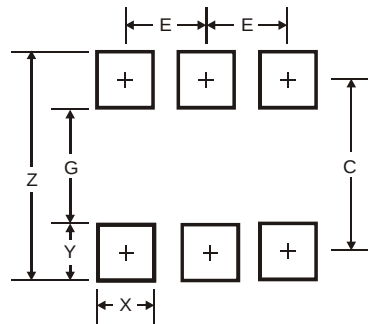
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

Package Outline Dimensions



SOT-363		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 Typ	
F	0.40	0.45
H	1.80	2.20
J	0	0.10
K	0.90	1.00
L	0.25	0.40
M	0.10	0.22
α	0°	8°
All Dimensions in mm		

Suggested Pad Layout



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

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