Preferred Device

# **Complementary Silicon Plastic Power Transistor**

## **DPAK for Surface Mount Applications**

... designed for low voltage, low–power, high–gain audio amplifier applications.

• Collector-Emitter Sustaining Voltage -

$$V_{\text{CEO(sus)}} = 100 \text{ Vdc (Min)} \otimes I_{\text{C}}$$
  
= 10 mAdc

• High DC Current Gain -

 $h_{FE} = 40 \text{ (Min) } @ I_{C}$ 

= 200 mAdc

 $= 15 \text{ (Min)} @ I_C = 1.0 \text{ Adc}$ 

- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Straight Lead Version in Plastic Sleeves ("-1" Suffix)
- Lead Formed Version in 16 mm Tape and Reel ("T4" Suffix)
- Low Collector-Emitter Saturation Voltage -

$$V_{CE(sat)} = 0.3 \text{ Vdc (Max)} @ I_C$$

= 500 mAdc

 $= 0.6 \text{ Vdc (Max)} @ I_C = 1.0 \text{ Adc}$ 

• High Current-Gain - Bandwidth Product -

$$f_T = 40 \text{ MHz (Min)} @ I_C$$

= 100 mAdc

• Annular Construction for Low Leakage –

 $I_{CBO} = 100 \text{ nAdc}$  @ Rated  $V_{CB}$ 

#### **MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector–Base Voltage	V <sub>CB</sub>	100	Vdc
Collector–Emitter Voltage	V <sub>CEO</sub>	100	Vdc
Emitter–Base Voltage	V <sub>EB</sub>	7	Vdc
Collector Current – Continuous – Peak	I <sub>C</sub>	4 8	Adc
Base Current	I <sub>B</sub>	1	Adc
Total Device Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	12.5 0.1	Watts W/°C
Total Device Dissipation @ T <sub>A</sub> = 25°C (Note 1.) Derate above 25°C	P <sub>D</sub>	1.4 0.011	Watts W/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +150	°C

1. When surface mounted on minimum pad sizes recommended.



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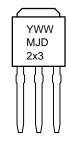
4 AMPERES
100 VOLTS
12.5 WATTS
POWER TRANSISTOR

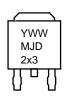




CASE 369 STYLE 1 DPAK CASE 369A STYLE 1

#### MARKING DIAGRAMS





Y = Year WW = Work Week MJD2x3 = Device Code x = 4 or 5

#### ORDERING INFORMATION

Device	Package	Shipping
MJD243T4	DPAK	2500/Tape & Reel
MJD253-1	DPAK	75 Units/Rail
MJD253T4	DPAK	2500/Tape & Reel

**Preferred** devices are recommended choices for future use and best overall value.

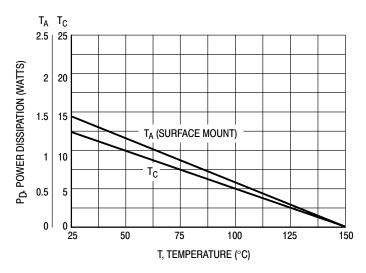


Figure 1. Power Derating

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{ heta JC}$	10	°C/W
Junction to Ambient (Note 1)	$R_{\theta JA}$	89.3	

## **ELECTRICAL CHARACTERISTICS** ( $T_C = 25^{\circ}C$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit	
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (Note 2) ( $I_C = 10 \text{ mAdc}$ , $I_B = 0$ )	V <sub>CEO(sus)</sub>	100	_	Vdc	
Collector Cutoff Current ( $V_{CB}$ = 100 Vdc, $I_{E}$ = 0) ( $V_{CB}$ = 100 Vdc, $I_{E}$ = 0, $T_{J}$ = 125°C)	I <sub>CBO</sub>	- -	100 100	nAdc μAdc	
Emitter Cutoff Current (V <sub>BE</sub> = 7 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	_	100	nAdc	
DC Current Gain (Note 2) ( $I_C$ = 200 mAdc, $V_{CE}$ = 1 Vdc) ( $I_C$ = 1 Adc, $V_{CE}$ = 1 Vdc)	h <sub>FE</sub>	40 15	180 -	_	
Collector–Emitter Saturation Voltage (Note 2) ( $I_C = 500 \text{ mAdc}$ , $I_B = 50 \text{ mAdc}$ ) ( $I_C = 1 \text{ Adc}$ , $I_B = 100 \text{ mAdc}$ )	V <sub>CE(sat)</sub>	_ _	0.3 0.6	Vdc	
Base–Emitter Saturation Voltage (Note 2) (I <sub>C</sub> = 2 Adc, I <sub>B</sub> = 200 mAdc)	V <sub>BE(sat)</sub>	-	1.8	Vdc	
Base–Emitter On Voltage (Note 2) (I <sub>C</sub> = 500 mAdc, V <sub>CE</sub> = 1 Vdc)	V <sub>BE(on)</sub>	_	1.5	Vdc	
DYNAMIC CHARACTERISTICS		•	•	•	

Current–Gain – Bandwidth Product (Note 3) (I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 10 Vdc, f <sub>test</sub> = 10 MHz)	f <sub>T</sub>	40	_	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	-	50	pF

- When surface mounted on minimum pad sizes recommended.
   Pulse Test: Pulse Width = 300 μs, Duty Cycle ≈ 2%.
   f<sub>T</sub> = |h<sub>FE</sub>| f<sub>test</sub>.

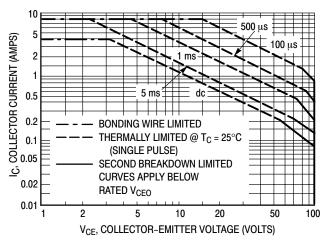


Figure 2. Active Region Maximum Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 2 is based on  $T_{J(pk)} = 150^{\circ}C$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \le 150^{\circ}C$ .  $T_{J(pk)}$  may be calculated from the data in Figure 3. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

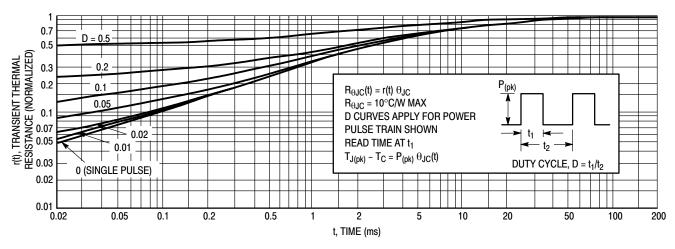


Figure 3. Thermal Response

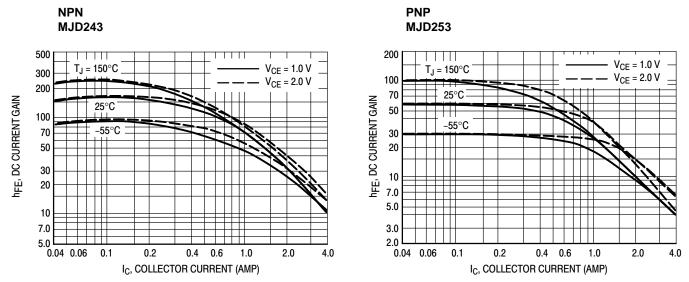


Figure 4. DC Current Gain

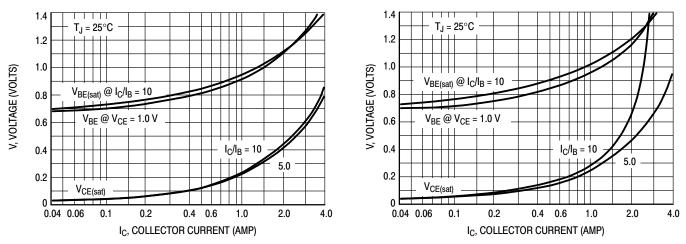


Figure 5. "On" Voltages

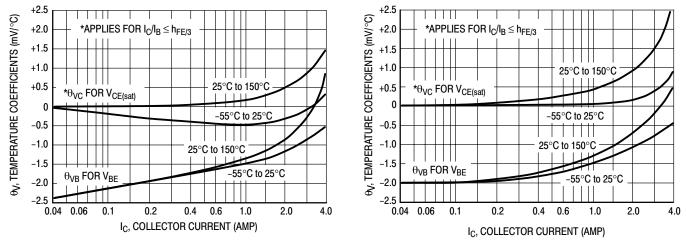
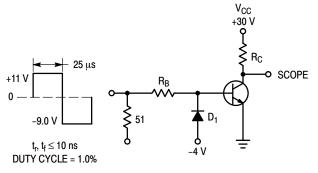


Figure 6. Temperature Coefficients



 $R_B$  and  $R_C$  VARIED TO OBTAIN DESIRED CURRENT LEVELS  $D_1$  MUST BE FAST RECOVERY TYPE, e.g.: 1N5825 USED ABOVE  $I_B\approx 100$  mA MSD6100 USED BELOW  $I_B\approx 100$  mA FOR PNP TEST CIRCUIT, REVERSE ALL POLARITIES

500 300 200 100 t, TIME (ns) 50 30 20 10  $I_{C}/I_{B} = 10$  $T_J=25^{\circ}C$ NPN MJD243 PNP MJD253 0.01 0.02 0.03 0.05 0.2 0.3 0.5 10 IC, COLLECTOR CURRENT (AMPS)

Figure 8. Turn-On Time

Figure 7. Switching Time Test Circuit

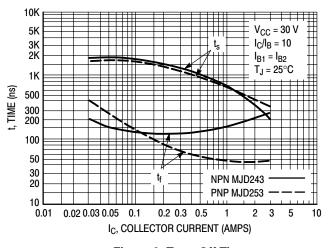


Figure 9. Turn-Off Time

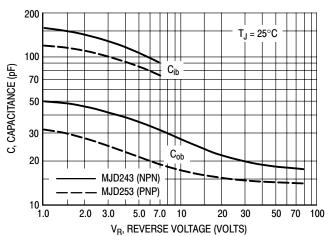


Figure 10. Capacitance

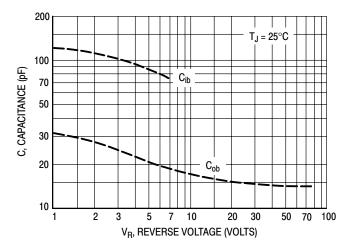


Figure 11. Capacitance

#### TYPICAL SOLDER HEATING PROFILE

For any given circuit board, there will be a group of control settings that will give the desired heat pattern. The operator must set temperatures for several heating zones, and a figure for belt speed. Taken together, these control settings make up a heating "profile" for that particular circuit board. On machines controlled by a computer, the computer remembers these profiles from one operating session to the next. Figure 12 shows a typical heating profile for use when soldering a surface mount device to a printed circuit board. This profile will vary among soldering systems but it is a good starting point. Factors that can affect the profile include the type of soldering system in use, density and types of components on the board, type of solder used, and the type of board or substrate material being used. This profile shows temperature versus time.

The line on the graph shows the actual temperature that might be experienced on the surface of a test board at or near a central solder joint. The two profiles are based on a high density and a low density board. The Vitronics SMD310 convection/infrared reflow soldering system was used to generate this profile. The type of solder used was 62/36/2 Tin Lead Silver with a melting point between 177–189°C. When this type of furnace is used for solder reflow work, the circuit boards and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. Because of this effect, the main body of a component may be up to 30 degrees cooler than the adjacent solder joints.

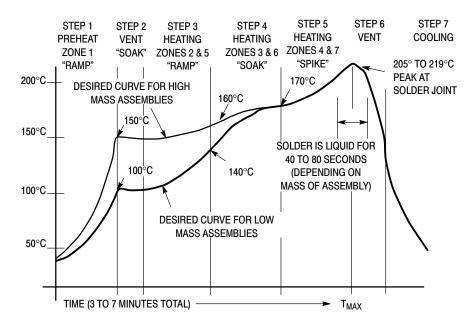
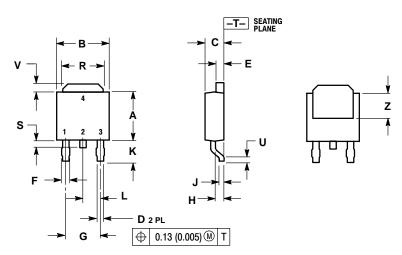


Figure 12. Typical Solder Heating Profile

#### **PACKAGE DIMENSIONS**

**DPAK** CASE 369A-13 **ISSUE AB** 

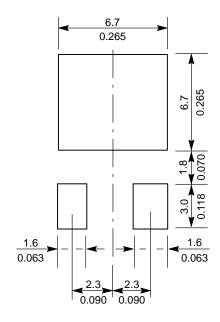


- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

	INCHES MILLIMET		IETERS	
DIM	MIN	MAX	MIN	MAX
Α	0.235	0.250	5.97	6.35
В	0.250	0.265	6.35	6.73
С	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.180 BSC		4.58	BSC
Н	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.175	0.215	4.45	5.46
S	0.020	0.050	0.51	1.27
U	0.020		0.51	
٧	0.030	0.050	0.77	1.27
Z	0.138		3.51	

- STYLE 1:
  PIN 1. BASE
  2. COLLECTOR
  3. EMITTER
  4. COLLECTOR

#### **Minimum Pad Sizes Recommended** for Surface Mounted Applications

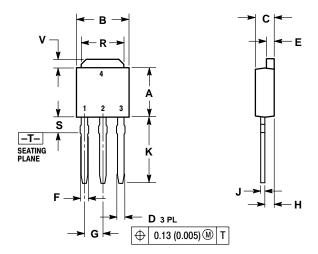


mm inches

#### PACKAGE DIMENSIONS

#### **DPAK STRAIGHT LEADS**

CASE 369-07 ISSUE M



- DIMENSIONING AND TOLERANCING PER ANSI
- Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

	INCHES MILLIMETE		ETERS	
DIM	MIN	MAX	MIN	MAX
Α	0.235	0.250	5.97	6.35
В	0.250	0.265	6.35	6.73
С	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.090 BSC		2.29 BSC	
Н	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.175	0.215	4.45	5.46
S	0.050	0.090	1.27	2.28
V	0.030	0.050	0.77	1 27

#### STYLE 1: PIN 1.

- COLLECTOR EMITTER 2. 3.
  - COLLECTOR

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