

NST3946DP6T5G

Dual Complementary General Purpose Transistor

The NST3946DP6T5G device is a spin-off of our popular SOT-23/SOT-323/SOT-563 three-lead device. It is designed for general purpose amplifier applications and is housed in the SOT-963 six-lead surface mount package. By putting two discrete devices in one package, this device is ideal for low-power surface mount applications where board space is at a premium.

Features

- h_{FE} , 100–300
- Low $V_{CE(sat)}$, ≤ 0.4 V
- Reduces Board Space and Component Count
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--------------------------------|-----------|---------------------|------|
| Collector – Emitter Voltage | V_{CEO} | 40 | Vdc |
| Collector – Base Voltage | V_{CBO} | 60 | Vdc |
| Emitter – Base Voltage | V_{EBO} | 6.0 | Vdc |
| Collector Current – Continuous | I_C | 200 | mAdc |
| Electrostatic Discharge | HBM MM | ESD Class 2 B | |

THERMAL CHARACTERISTICS

| Characteristic (Single Heated) | Symbol | Max | Unit |
|-----------------------------------------------------------------------------------------------|-----------------|----------------|----------------------------|
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C (Note 1) | P_D | 240 1.9 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 520 | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C (Note 2) | P_D | 280 2.2 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 446 | $^\circ\text{C}/\text{W}$ |
| Characteristic (Dual Heated) (Note 3) | Symbol | Max | Unit |
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C (Note 1) | P_D | 350 2.8 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 357 | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C (Note 2) | P_D | 420 3.4 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 297 | $^\circ\text{C}/\text{W}$ |
| Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

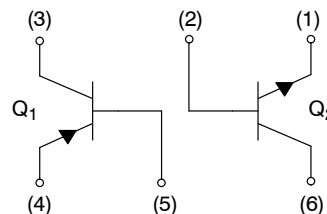
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR-4 @ 100 mm², 1 oz. copper traces, still air.
2. FR-4 @ 500 mm², 1 oz. copper traces, still air.
3. Dual heated values assume total power is sum of two equally powered channels



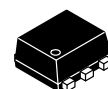
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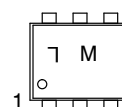
NST3946DP6T5G*

*Q1 PNP
Q2 NPN



SOT-963
CASE 527AD

MARKING DIAGRAM



L = Device Code
(180° Clockwise Rotation)
M = Date Code

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|----------------------|------------------|
| NST3946DP6T5G | SOT-963 (Pb-Free) | 8000/Tape & Reel |
| NSVT3946DP6T5G | SOT-963 (Pb-Free) | 8000/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

NST3946DP6T5G

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------|----------------------------------------------------------------|--------------------------------------------------------|-----|
| OFF CHARACTERISTICS | | | | | |
| Collector–Emitter Breakdown Voltage (Note 4) (I _C = 1.0 mA, I _B = 0) (I _C = -1.0 mA, I _B = 0) | (NPN) (PNP) | V _{(BR)CEO} | 40 -40 | - - | Vdc |
| Collector–Base Breakdown Voltage (I _E = 10 μA, I _C = 0) (I _E = -10 μA, I _C = 0) | (NPN) (PNP) | V _{(BR)CBO} | 60 -40 | - - | Vdc |
| Emitter–Base Breakdown Voltage (I _E = 10 μA, I _C = 0) (I _E = -10 μA, I _C = 0) | (NPN) (PNP) | V _{(BR)EBO} | 6.0 -5.0 | - - | Vdc |
| Collector Cutoff Current (V _{CE} = 30 Vdc, V _{EB} = 3.0 Vdc) (V _{CE} = -30 Vdc, V _{EB} = -3.0 Vdc) | (NPN) (PNP) | I _{CEX} | - - | 50 -50 | nA |
| ON CHARACTERISTICS (Note 4) | | | | | |
| DC Current Gain (I _C = 0.1 mA, V _{CE} = 1.0 Vdc) (I _C = 1.0 mA, V _{CE} = 1.0 Vdc) (I _C = 10 mA, V _{CE} = 1.0 Vdc) (I _C = 50 mA, V _{CE} = 1.0 Vdc) (I _C = 100 mA, V _{CE} = 1.0 Vdc) (I _C = -0.1 mA, V _{CE} = -1.0 Vdc) (I _C = -1.0 mA, V _{CE} = -1.0 Vdc) (I _C = -10 mA, V _{CE} = -1.0 Vdc) (I _C = -50 mA, V _{CE} = -1.0 Vdc) (I _C = -100 mA, V _{CE} = -1.0 Vdc) | (NPN) (PNP) | h _{FE} | 40 70 100 60 30 60 80 100 60 30 | - - 300 - - - - 300 - - | - |
| Collector–Emitter Saturation Voltage (I _C = 10 mA, I _B = 1.0 mA) (I _C = 50 mA, I _B = 5.0 mA) (I _C = -10 mA, I _B = -1.0 mA) (I _C = -50 mA, I _B = -5.0 mA) | (NPN) (PNP) | V _{CE(sat)} | - - - - | 0.2 0.3 -0.25 -0.4 | Vdc |
| Base–Emitter Saturation Voltage (I _C = 10 mA, I _B = 1.0 mA) (I _C = 50 mA, I _B = 5.0 mA) (I _C = -10 mA, I _B = -1.0 mA) (I _C = -50 mA, I _B = -5.0 mA) | (NPN) (PNP) | V _{BE(sat)} | 0.65 - -0.65 - | 0.85 0.95 -0.85 -0.95 | Vdc |

4. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

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ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

| Characteristic | Symbol | Min | Max | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|-------------|------|
| SMALL-SIGNAL CHARACTERISTICS | | | | |
| Current-Gain-Bandwidth Product ($I_C = 10\text{ mAdc}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$) (NPN) ($I_C = -10\text{ mAdc}$, $V_{CE} = -20\text{ Vdc}$, $f = 100\text{ MHz}$) (PNP) | f_T | 200 250 | - - | MHz |
| Output Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$) (NPN) ($V_{CB} = -5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$) (PNP) | C_{obo} | - - | 4.0 4.5 | pF |
| Input Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$) (NPN) ($V_{EB} = -0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$) (PNP) | C_{ibo} | - - | 8.0 10.0 | pF |
| Noise Figure ($V_{CE} = 5.0\text{ Vdc}$, $I_C = 100\ \mu\text{Adc}$, $R_S = 1.0\text{ k}\ \Omega$, $f = 1.0\text{ kHz}$) (NPN) ($V_{CE} = -5.0\text{ Vdc}$, $I_C = -100\ \mu\text{Adc}$, $R_S = 1.0\text{ k}\ \Omega$, $f = 1.0\text{ kHz}$) (PNP) | NF | - - | 5.0 4.0 | dB |

SWITCHING CHARACTERISTICS

| | | | | | |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------|-------|--------|------------|----|
| Delay Time | ($V_{CC} = 3.0\text{ Vdc}$, $V_{BE} = -0.5\text{ Vdc}$) (NPN) ($V_{CC} = -3.0\text{ Vdc}$, $V_{BE} = 0.5\text{ Vdc}$) (PNP) | t_d | - - | 35 35 | ns |
| Rise Time | ($I_C = 10\text{ mAdc}$, $I_{B1} = 1.0\text{ mAdc}$) (NPN) ($I_C = -10\text{ mAdc}$, $I_{B1} = -1.0\text{ mAdc}$) (PNP) | t_r | - - | 35 35 | |
| Storage Time | ($V_{CC} = 3.0\text{ Vdc}$, $I_C = 10\text{ mAdc}$) (NPN) ($V_{CC} = -3.0\text{ Vdc}$, $I_C = -10\text{ mAdc}$) (PNP) | t_s | - - | 275 250 | ns |
| Fall Time | ($I_{B1} = I_{B2} = 1.0\text{ mAdc}$) (NPN) ($I_{B1} = I_{B2} = -1.0\text{ mAdc}$) (PNP) | t_f | - - | 50 50 | |

NPN TRANSISTOR

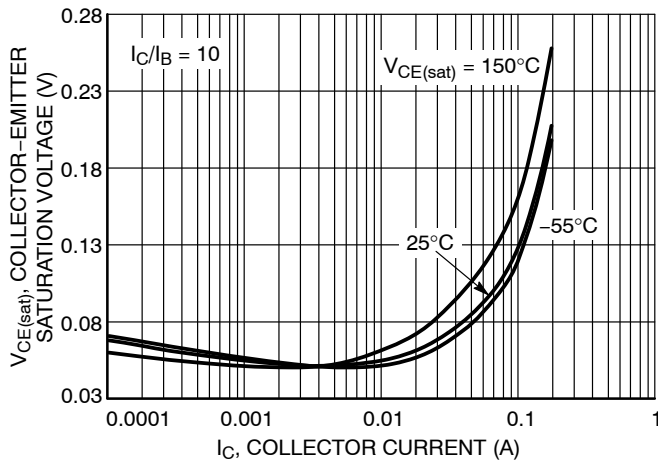


Figure 1. Collector Emitter Saturation Voltage vs. Collector Current

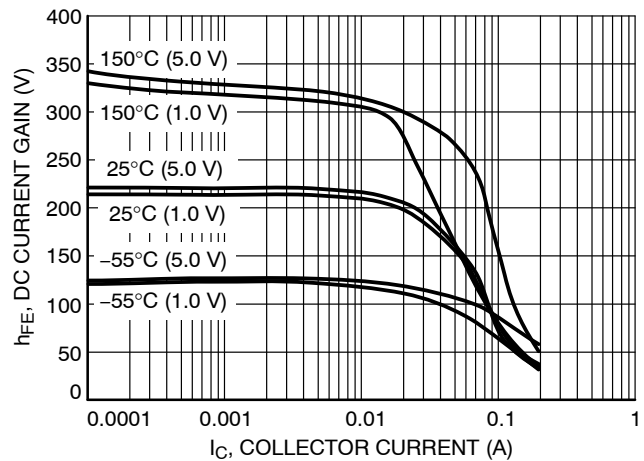


Figure 2. DC Current Gain vs. Collector Current

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NPN TRANSISTOR

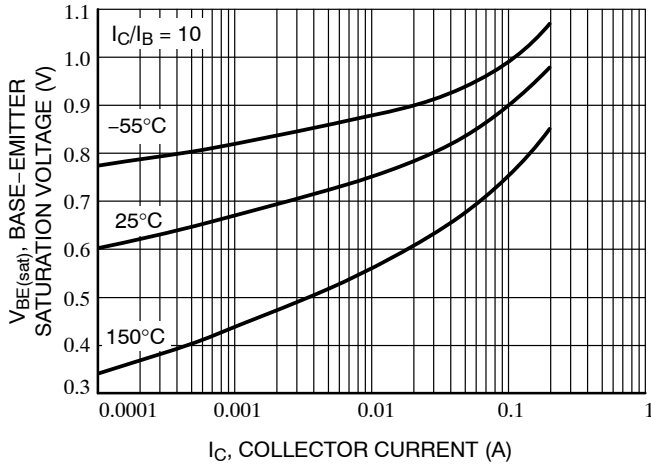


Figure 3. Base-Emitter Saturation Voltage vs. Collector Current

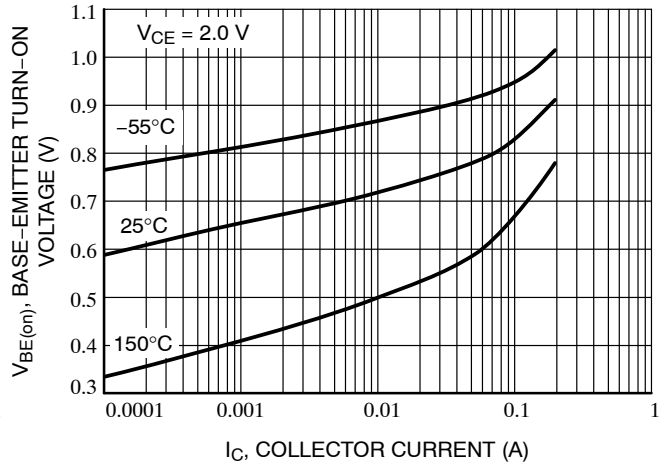


Figure 4. Base-Emitter Turn-On Voltage vs. Collector Current

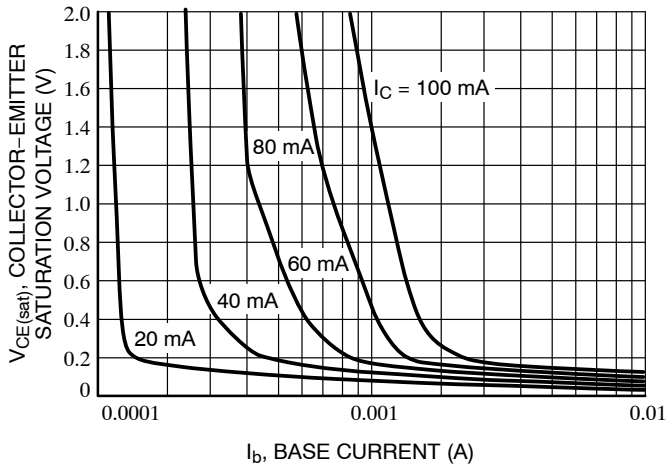


Figure 5. Saturation Region

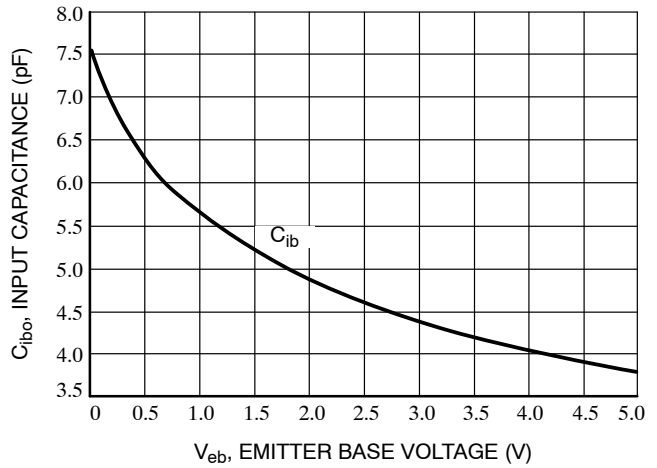


Figure 6. Input Capacitance

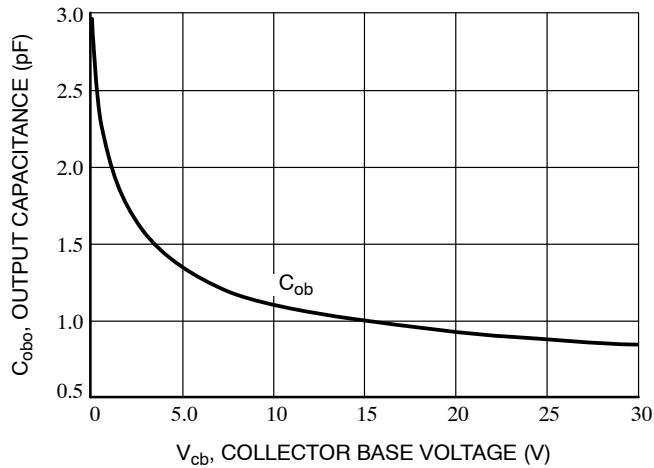


Figure 7. Output Capacitance

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PNP TRANSISTOR

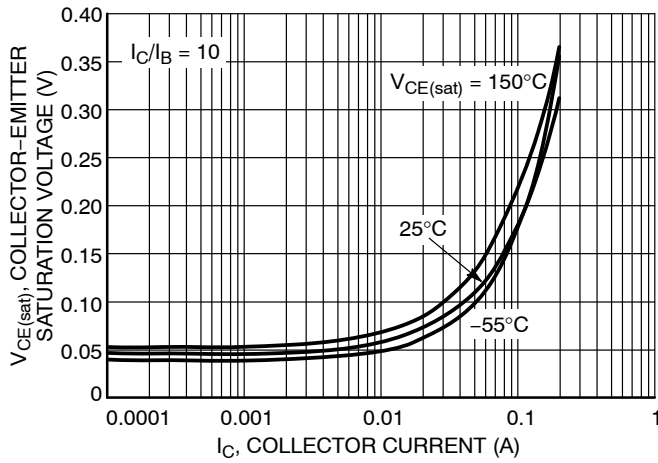


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

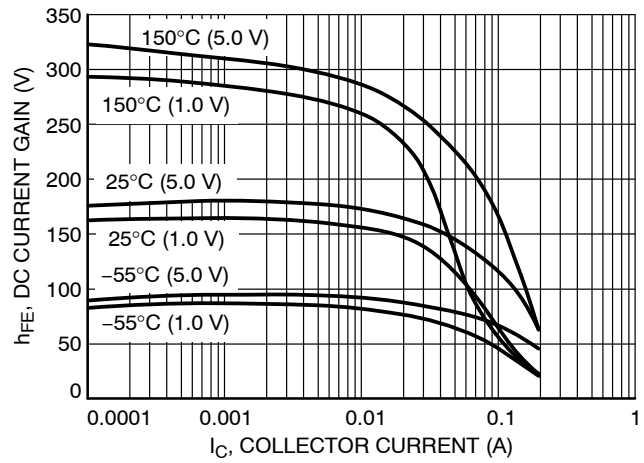


Figure 9. DC Current Gain vs. Collector Current

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PNP TRANSISTOR

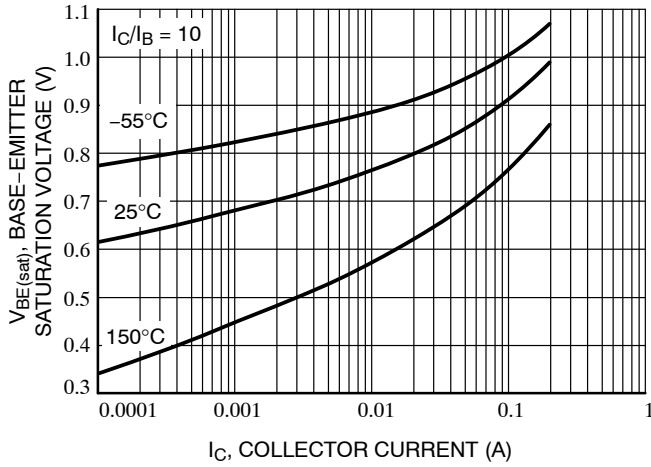


Figure 10. Base-Emitter Saturation Voltage vs. Collector Current

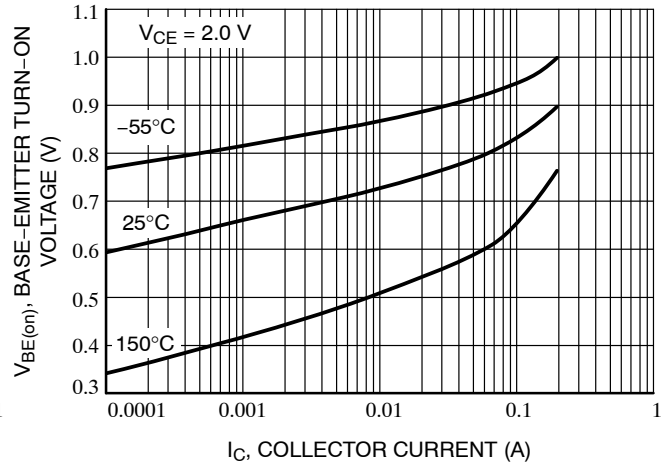


Figure 11. Base-Emitter Turn-On Voltage vs. Collector Current

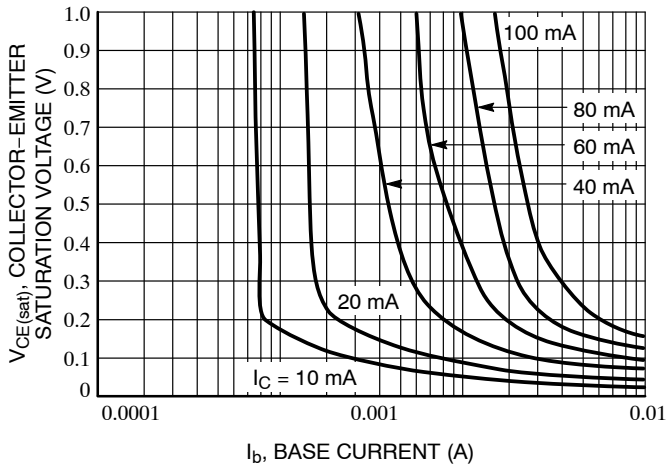


Figure 12. Saturation Region

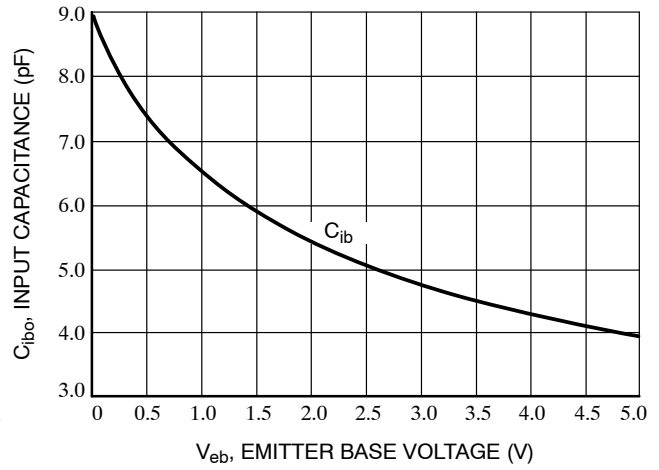


Figure 13. Input Capacitance

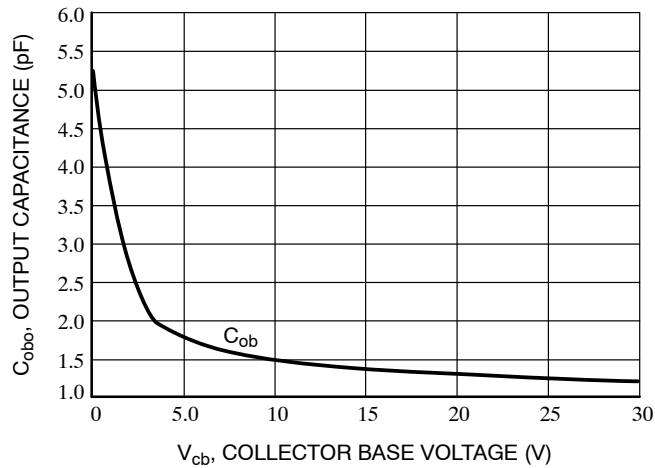


Figure 14. Output Capacitance

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

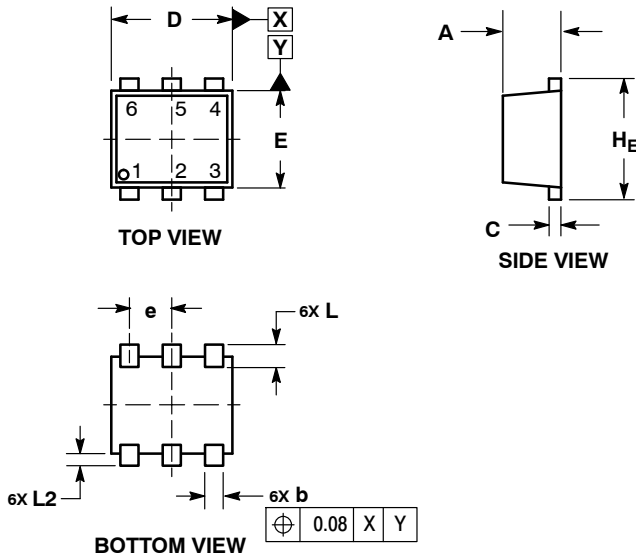
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SCALE 4:1

SOT-963
CASE 527AD-01
ISSUE E

DATE 09 FEB 2010

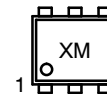


NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: MILLIMETERS
- MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| MILLIMETERS | | | |
|----------------|----------|------|------|
| DIM | MIN | NOM | MAX |
| A | 0.34 | 0.37 | 0.40 |
| b | 0.10 | 0.15 | 0.20 |
| C | 0.07 | 0.12 | 0.17 |
| D | 0.95 | 1.00 | 1.05 |
| E | 0.75 | 0.80 | 0.85 |
| e | 0.35 BSC | | |
| H _E | 0.95 | 1.00 | 1.05 |
| L | 0.19 REF | | |
| L2 | 0.05 | 0.10 | 0.15 |

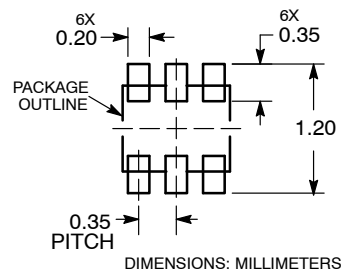
GENERIC MARKING DIAGRAM*



X = Specific Device Code
M = Month Code

*This information is generic. Please refer to device data sheet for actual part marking.
Pb-Free indicator, "G" or microdot "▪", may or may not be present.

RECOMMENDED MOUNTING FOOTPRINT



- STYLE 1:**
PIN 1. EMITTER 1
2. BASE 1
3. COLLECTOR 2
4. EMITTER 2
5. BASE 2
6. COLLECTOR 1
- STYLE 2:**
PIN 1. EMITTER 1
2. EMITTER2
3. BASE 2
4. COLLECTOR 2
5. BASE 1
6. COLLECTOR 1
- STYLE 3:**
PIN 1. CATHODE 1
2. CATHODE 1
3. ANODE/ANODE 2
4. CATHODE 2
5. CATHODE 2
6. ANODE/ANODE 1
- STYLE 4:**
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. EMITTER
5. COLLECTOR
6. COLLECTOR
- STYLE 5:**
PIN 1. CATHODE
2. CATHODE
3. ANODE
4. ANODE
5. CATHODE
6. CATHODE
- STYLE 6:**
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
- STYLE 7:**
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. ANODE
6. CATHODE
- STYLE 8:**
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE3
5. DRAIN
6. DRAIN
- STYLE 9:**
PIN 1. SOURCE 1
2. GATE 1
3. DRAIN 2
4. SOURCE 2
5. GATE 2
6. DRAIN 1
- STYLE 10:**
PIN 1. CATHODE 1
2. N/C
3. CATHODE 2
4. ANODE 2
5. N/C
6. ANODE 1

| | | |
|-------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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