

NSS40302PDR2G

Complementary 40 V, 6.0 A, Low $V_{CE(sat)}$ Transistor

ON Semiconductor's e²PowerEdge family of low $V_{CE(sat)}$ transistors are surface mount devices featuring ultra low saturation voltage ($V_{CE(sat)}$) and high current gain capability. These are designed for use in low voltage, high speed switching applications where affordable efficient energy control is important.

Typical applications are low voltage motor controls in mass storage products such as disc drives and tape drives. In the automotive industry they can be used in air bag deployment and in the instrument cluster. The high current gain allows e²PowerEdge devices to be driven directly from PMU's control outputs, and the Linear Gain (Beta) makes them ideal components in analog amplifiers.

Features

- 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/BFR Free and are RoHS Compliant

MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

| Rating | | Symbol | Max | Unit |
|--------------------------------|------------|-----------|----------------------------|------|
| Collector-Emitter Voltage | NPN PNP | V_{CEO} | 40 -40 | Vdc |
| Collector-Base Voltage | NPN PNP | V_{CBO} | 40 -40 | Vdc |
| Emitter-Base Voltage | NPN PNP | V_{EBO} | 6.0 -7.0 | Vdc |
| Collector Current – Continuous | NPN PNP | I_C | 3.0 -3.0 | A |
| Collector Current – Peak | NPN PNP | I_{CM} | 6.0 -6.0 | A |
| Electrostatic Discharge | | ESD | HBM Class 3B MM Class C | |

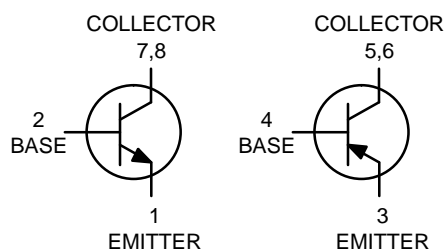
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



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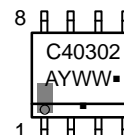
www.onsemi.com

**40 VOLTS, 6.0 AMPS
COMPLEMENTARY LOW
 $V_{CE(sat)}$ TRANSISTOR
EQUIVALENT $R_{DS(on)}$ 80 m Ω**



**SOIC-8
CASE 751
STYLE 16**

DEVICE MARKING



C40302 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|---------------|---------------------|-----------------------|
| NSS40302PDR2G | SOIC-8 (Pb-Free) | 2500 / Tape & Reel |
| NSV40302PDR2G | SOIC-8 (Pb-Free) | 2500 / Tape & Reel |

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

NSS40302PDR2G

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|----------------|--------|-----|------|
|----------------|--------|-----|------|

SINGLE HEATED

| | | | |
|--|-----------------|-----|----------------------|
| Total Device Dissipation (Note 1) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 576 | mW |
| | | 4.6 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 217 | $^\circ\text{C/W}$ |
| Total Device Dissipation (Note 2) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 676 | mW |
| | | 5.4 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 185 | $^\circ\text{C/W}$ |

DUAL HEATED (Note 3)

| | | | |
|--|-----------------|-------------|----------------------|
| Total Device Dissipation (Note 1) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 653 | mW |
| | | 5.2 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 191 | $^\circ\text{C/W}$ |
| Total Device Dissipation (Note 2) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 783 | mW |
| | | 6.3 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 160 | $^\circ\text{C/W}$ |
| Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

1. FR-4 @ 10 mm², 1 oz. copper traces, still air.
2. FR-4 @ 100 mm², 1 oz. copper traces, still air.
3. Dual heated values assume total power is the sum of two equally powered devices.

NSS40302PDR2G

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|---|----------------------|-----|---|-----|------|
| Collector–Emitter Breakdown Voltage (I _C = 10 mA, I _B = 0) | V _{(BR)CEO} | 40 | – | – | Vdc |
| Collector–Base Breakdown Voltage (I _C = 0.1 mA, I _E = 0) | V _{(BR)CBO} | 40 | – | – | Vdc |
| Emitter–Base Breakdown Voltage (I _E = 0.1 mA, I _C = 0) | V _{(BR)EBO} | 6.0 | – | – | Vdc |
| Collector Cutoff Current (V _{CB} = 40 Vdc, I _E = 0) | I _{CBO} | – | – | 0.1 | μAdc |
| Emitter Cutoff Current (V _{EB} = 6.0 Vdc) | I _{EBO} | – | – | 0.1 | μAdc |

ON CHARACTERISTICS

| | | | | | |
|---|----------------------|--------------------------|----------------------------------|----------------------------------|-----|
| DC Current Gain (Note 5) (I _C = 10 mA, V _{CE} = 2.0 V) (I _C = 500 mA, V _{CE} = 2.0 V) (I _C = 1.0 A, V _{CE} = 2.0 V) (I _C = 2.0 A, V _{CE} = 2.0 V) | h _{FE} | 200 200 180 180 | 400 350 340 320 | – – – – | |
| Collector–Emitter Saturation Voltage (Note 5) (I _C = 0.1 A, I _B = 0.010 A) (I _C = 1.0 A, I _B = 0.100 A) (I _C = 1.0 A, I _B = 0.010 A) (I _C = 2.0 A, I _B = 0.200 A) | V _{CE(sat)} | – – – – | 0.008 0.044 0.080 0.082 | 0.011 0.060 0.115 0.115 | V |
| Base–Emitter Saturation Voltage (Note 5) (I _C = 1.0 A, I _B = 0.01 A) | V _{BE(sat)} | – | 0.780 | 0.900 | V |
| Base–Emitter Turn–on Voltage (Note 5) (I _C = 0.1 A, V _{CE} = 2.0 V) | V _{BE(on)} | – | 0.650 | 0.750 | V |
| Cutoff Frequency (I _C = 100 mA, V _{CE} = 5.0 V, f = 100 MHz) | f _T | 100 | – | – | MHz |
| Input Capacitance (V _{EB} = 0.5 V, f = 1.0 MHz) | C _{ibo} | – | 320 | 450 | pF |
| Output Capacitance (V _{CB} = 3.0 V, f = 1.0 MHz) | C _{obo} | – | 40 | 50 | pF |

SWITCHING CHARACTERISTICS

| | | | | | |
|--|----------------|---|---|-----|----|
| Delay (V _{CC} = 30 V, I _C = 750 mA, I _{B1} = 15 mA) | t _d | – | – | 100 | ns |
| Rise (V _{CC} = 30 V, I _C = 750 mA, I _{B1} = 15 mA) | t _r | – | – | 100 | ns |
| Storage (V _{CC} = 30 V, I _C = 750 mA, I _{B1} = 15 mA) | t _s | – | – | 780 | ns |
| Fall (V _{CC} = 30 V, I _C = 750 mA, I _{B1} = 15 mA) | t _f | – | – | 110 | ns |

4. Pulsed Condition: Pulse Width = 300 μsec, Duty Cycle ≤ 2%.

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NSS40302PDR2G

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|--|----------------------|------|---|------|------|
| Collector–Emitter Breakdown Voltage (I _C = –10 mA, I _B = 0) | V _{(BR)CEO} | –40 | – | – | Vdc |
| Collector–Base Breakdown Voltage (I _C = –0.1 mA, I _E = 0) | V _{(BR)CBO} | –40 | – | – | Vdc |
| Emitter–Base Breakdown Voltage (I _E = –0.1 mA, I _C = 0) | V _{(BR)EBO} | –7.0 | – | – | Vdc |
| Collector Cutoff Current (V _{CB} = –40 Vdc, I _E = 0) | I _{CBO} | – | – | –0.1 | μAdc |
| Emitter Cutoff Current (V _{EB} = –6.0 Vdc) | I _{EBO} | – | – | –0.1 | μAdc |

ON CHARACTERISTICS

| | | | | | |
|---|----------------------|--------------------------|--------------------------------------|--------------------------------------|-----|
| DC Current Gain (Note 5) (I _C = –10 mA, V _{CE} = –2.0 V) (I _C = –500 mA, V _{CE} = –2.0 V) (I _C = –1.0 A, V _{CE} = –2.0 V) (I _C = –2.0 A, V _{CE} = –2.0 V) | h _{FE} | 250 220 180 150 | 380 340 300 230 | – – – – | |
| Collector–Emitter Saturation Voltage (Note 5) (I _C = –0.1 A, I _B = –0.010 A) (I _C = –1.0 A, I _B = –0.100 A) (I _C = –1.0 A, I _B = –0.010 A) (I _C = –2.0 A, I _B = –0.200 A) | V _{CE(sat)} | – – – – | –0.013 –0.075 –0.130 –0.135 | –0.017 –0.095 –0.170 –0.170 | V |
| Base–Emitter Saturation Voltage (Note 5) (I _C = –1.0 A, I _B = –0.01 A) | V _{BE(sat)} | – | –0.780 | –0.900 | V |
| Base–Emitter Turn–on Voltage (Note 5) (I _C = –0.1 A, V _{CE} = –2.0 V) | V _{BE(on)} | – | –0.660 | –0.750 | V |
| Cutoff Frequency (I _C = –100 mA, V _{CE} = –5.0 V, f = 100 MHz) | f _T | 100 | – | – | MHz |
| Input Capacitance (V _{EB} = –0.5 V, f = 1.0 MHz) | C _{ibo} | – | 250 | 300 | pF |
| Output Capacitance (V _{CB} = –3.0 V, f = 1.0 MHz) | C _{obo} | – | 50 | 65 | pF |

SWITCHING CHARACTERISTICS

| | | | | | |
|---|----------------|---|---|-----|----|
| Delay (V _{CC} = –30 V, I _C = –750 mA, I _{B1} = –15 mA) | t _d | – | – | 60 | ns |
| Rise (V _{CC} = –30 V, I _C = –750 mA, I _{B1} = –15 mA) | t _r | – | – | 120 | ns |
| Storage (V _{CC} = –30 V, I _C = –750 mA, I _{B1} = –15 mA) | t _s | – | – | 400 | ns |
| Fall (V _{CC} = –30 V, I _C = –750 mA, I _{B1} = –15 mA) | t _f | – | – | 130 | ns |

5. Pulsed Condition: Pulse Width = 300 μsec, Duty Cycle ≤ 2%.

NPN TYPICAL CHARACTERISTICS

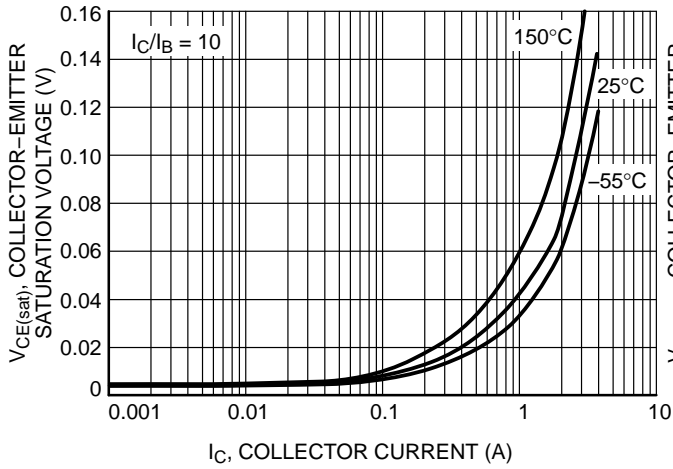


Figure 1. Collector Emitter Saturation Voltage vs. Collector Current

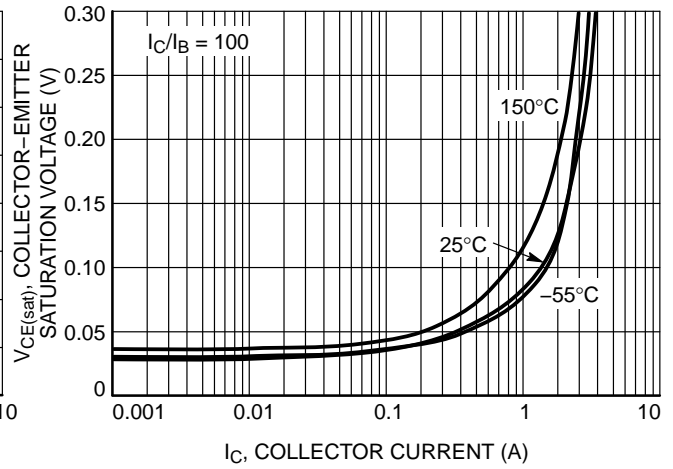


Figure 2. Collector Emitter Saturation Voltage vs. Collector Current

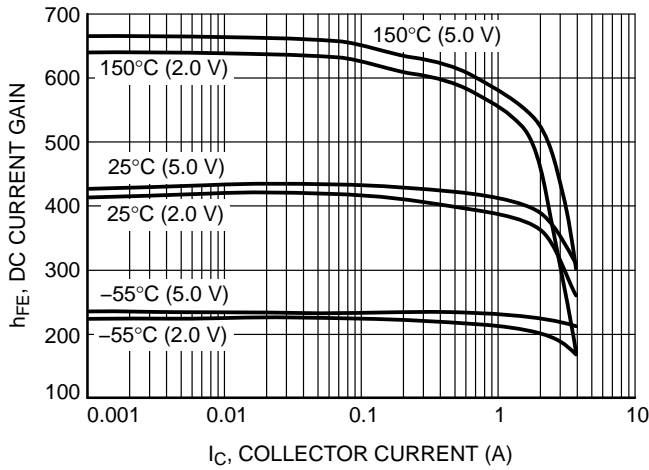


Figure 3. DC Current Gain vs. Collector Current

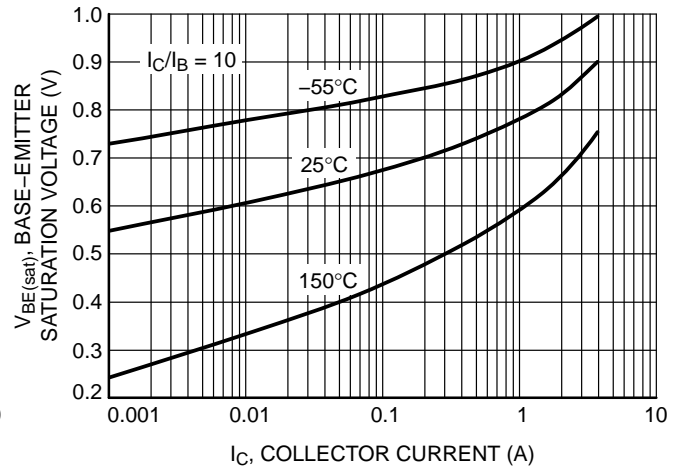


Figure 4. Base Emitter Saturation Voltage vs. Collector Current

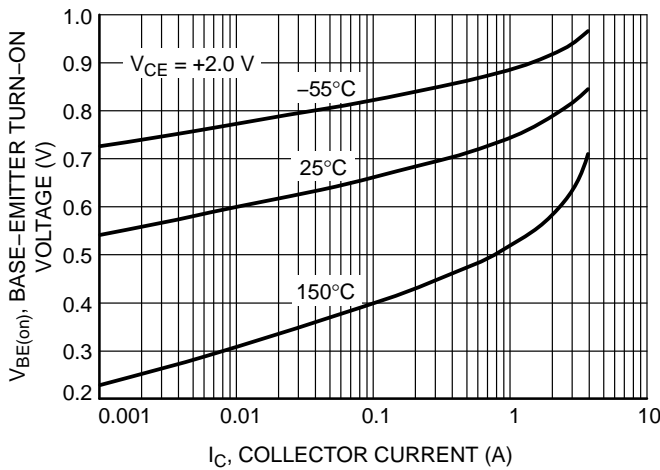


Figure 5. Base Emitter Turn-On Voltage vs. Collector Current

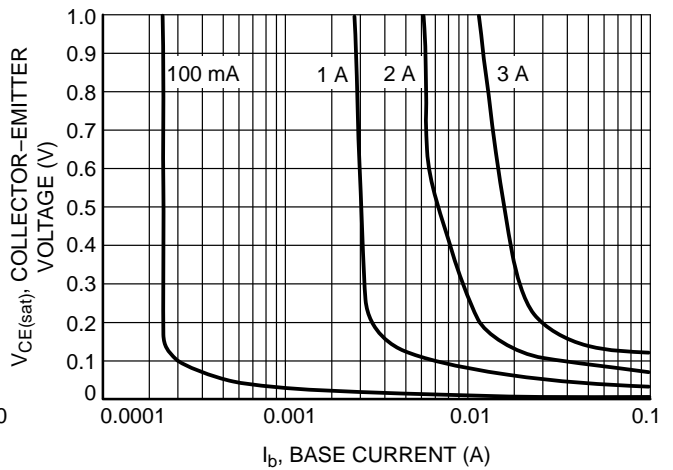


Figure 6. Saturation Region

NPN TYPICAL CHARACTERISTICS

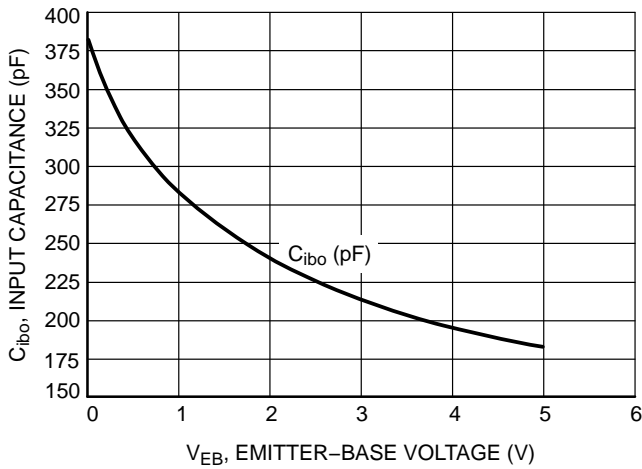


Figure 7. Input Capacitance

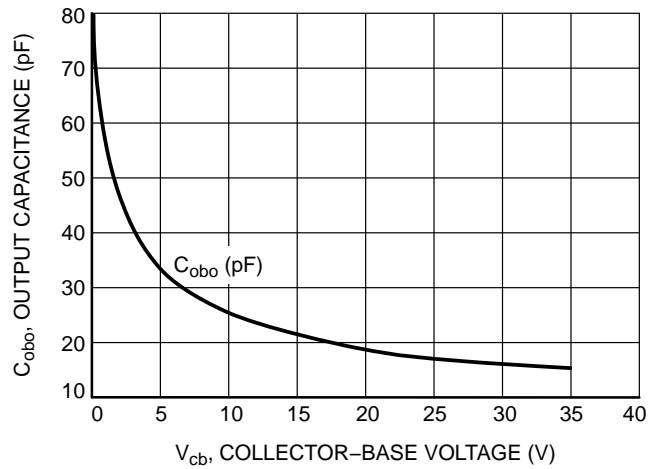


Figure 8. Output Capacitance

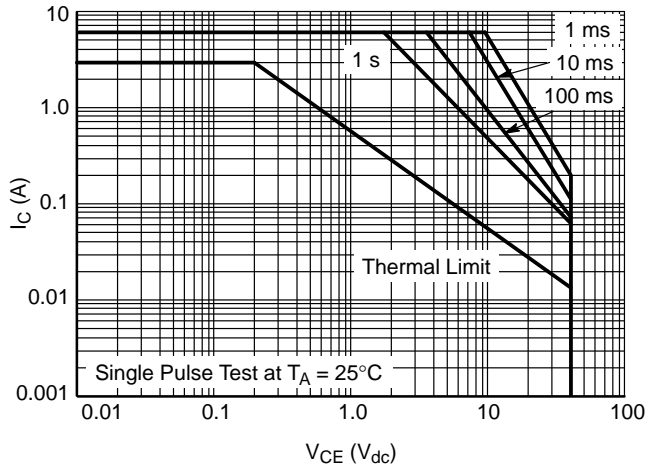


Figure 9. Safe Operating Area

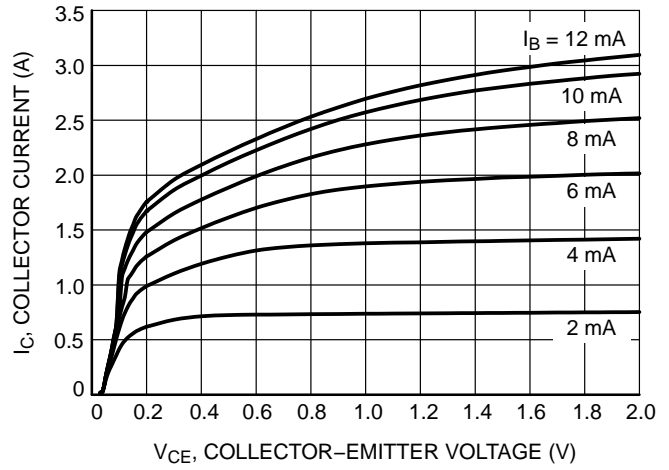


Figure 10. Collector Current as a Function of Collector Emitter Voltage

PNP TYPICAL CHARACTERISTICS

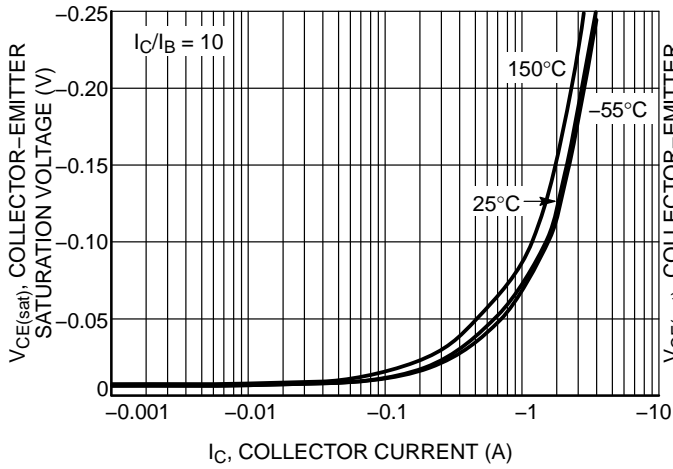


Figure 11. Collector Emitter Saturation Voltage vs. Collector Current

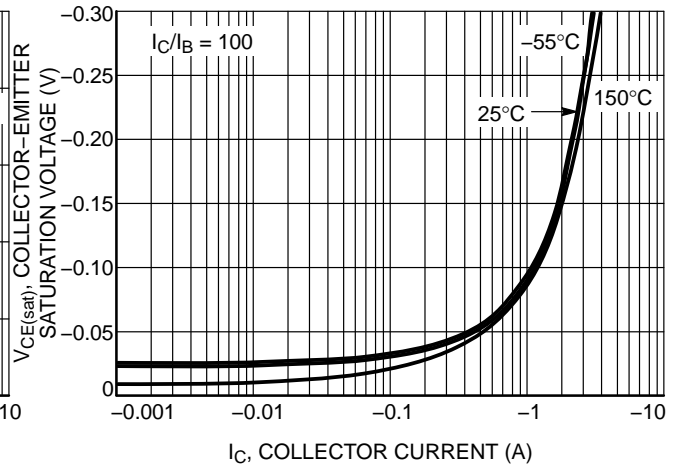


Figure 12. Collector Emitter Saturation Voltage vs. Collector Current

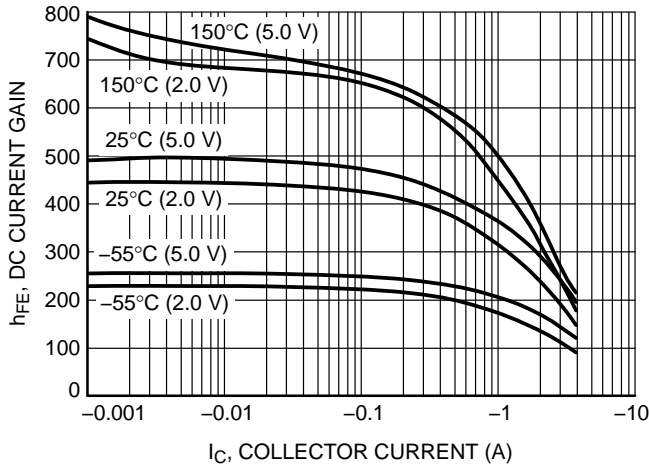


Figure 13. DC Current Gain vs. Collector Current

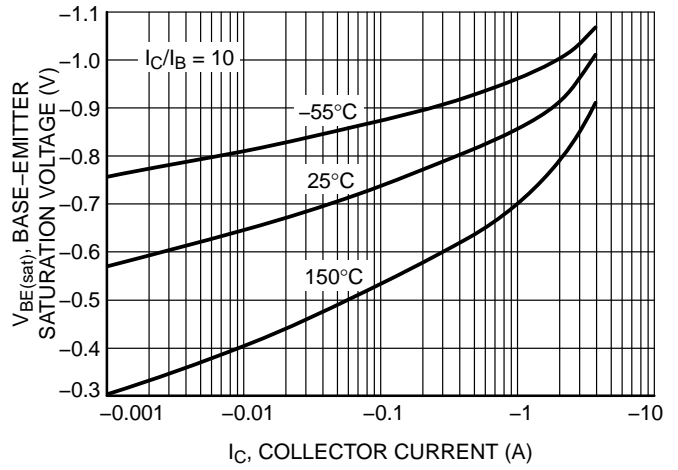


Figure 14. Base Emitter Saturation Voltage vs. Collector Current

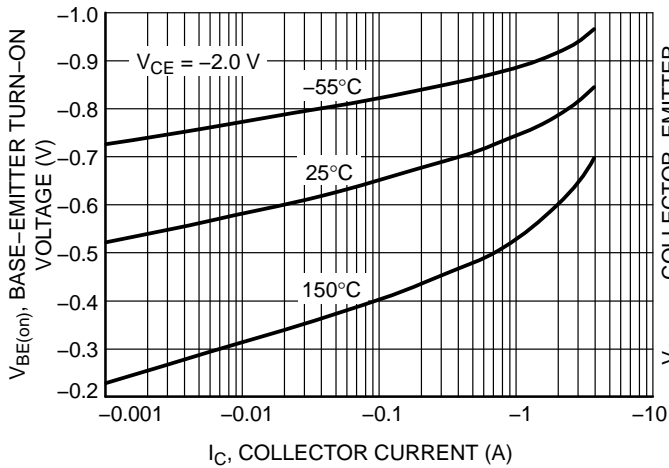


Figure 15. Base Emitter Turn-On Voltage vs. Collector Current

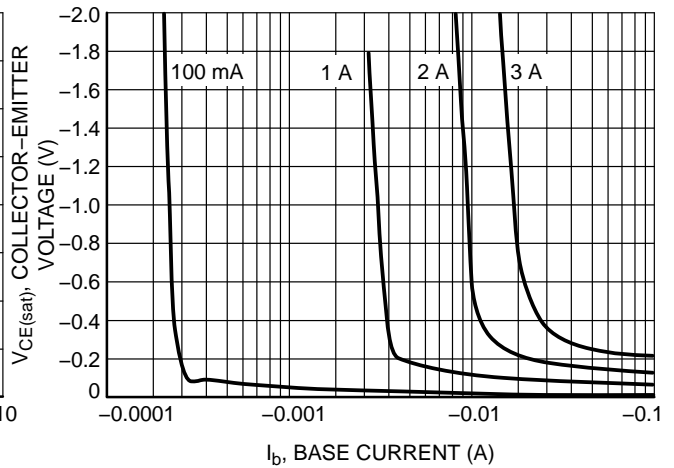


Figure 16. Saturation Region

PNP TYPICAL CHARACTERISTICS

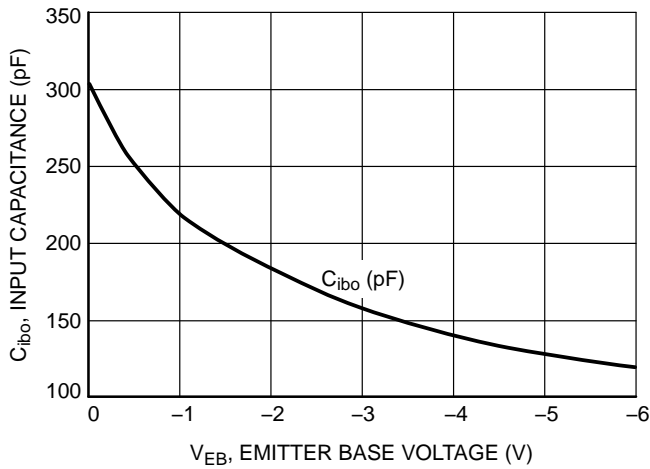


Figure 17. Input Capacitance

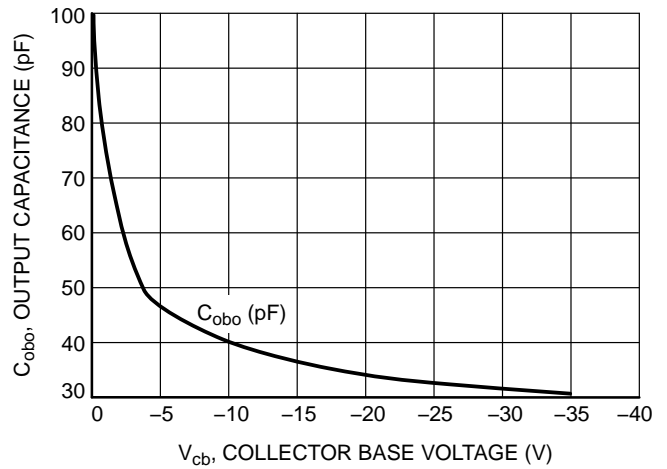


Figure 18. Output Capacitance

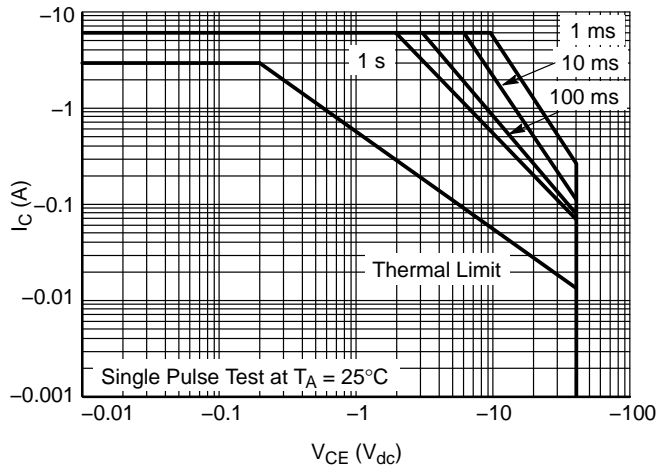


Figure 19. Safe Operating Area

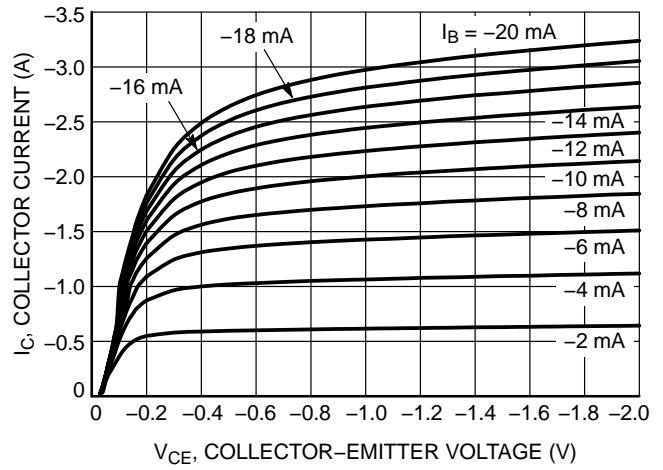


Figure 20. Output Characteristics

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

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CASE 751-07
ISSUE AK

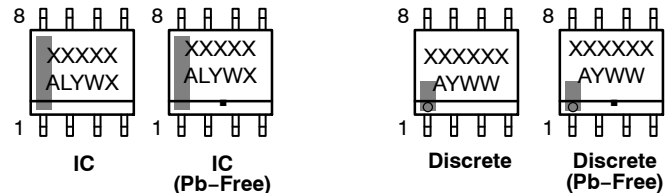
DATE 16 FEB 2011



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
 6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.80 | 5.00 | 0.189 | 0.197 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.053 | 0.069 |
| D | 0.33 | 0.51 | 0.013 | 0.020 |
| G | 1.27 BSC | | 0.050 BSC | |
| H | 0.10 | 0.25 | 0.004 | 0.010 |
| J | 0.19 | 0.25 | 0.007 | 0.010 |
| K | 0.40 | 1.27 | 0.016 | 0.050 |
| M | 0° | 8° | 0° | 8° |
| N | 0.25 | 0.50 | 0.010 | 0.020 |
| S | 5.80 | 6.20 | 0.228 | 0.244 |

GENERIC MARKING DIAGRAM*



XXXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

*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. Some products may not follow the Generic Marking.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

| | | |
|------------------|-------------|--|
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| DESCRIPTION: | SOIC-8 NB | PAGE 1 OF 2 |

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CASE 751-07
ISSUE AK

DATE 16 FEB 2011

- | | | | |
|---|--|--|--|
| <p>STYLE 1: PIN 1. EMITTER 2. COLLECTOR 3. COLLECTOR 4. EMITTER 5. EMITTER 6. BASE 7. BASE 8. EMITTER</p> | <p>STYLE 2: PIN 1. COLLECTOR, DIE, #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. BASE, #2 6. EMITTER, #2 7. BASE, #1 8. EMITTER, #1</p> | <p>STYLE 3: PIN 1. DRAIN, DIE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. GATE, #2 6. SOURCE, #2 7. GATE, #1 8. SOURCE, #1</p> | <p>STYLE 4: PIN 1. ANODE 2. ANODE 3. ANODE 4. ANODE 5. ANODE 6. ANODE 7. ANODE 8. COMMON CATHODE</p> |
| <p>STYLE 5: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE</p> | <p>STYLE 6: PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE</p> | <p>STYLE 7: PIN 1. INPUT 2. EXTERNAL BYPASS 3. THIRD STAGE SOURCE 4. GROUND 5. DRAIN 6. GATE 3 7. SECOND STAGE Vd 8. FIRST STAGE Vd</p> | <p>STYLE 8: PIN 1. COLLECTOR, DIE #1 2. BASE, #1 3. BASE, #2 4. COLLECTOR, #2 5. COLLECTOR, #2 6. EMITTER, #2 7. EMITTER, #1 8. COLLECTOR, #1</p> |
| <p>STYLE 9: PIN 1. EMITTER, COMMON 2. COLLECTOR, DIE #1 3. COLLECTOR, DIE #2 4. EMITTER, COMMON 5. EMITTER, COMMON 6. BASE, DIE #2 7. BASE, DIE #1 8. EMITTER, COMMON</p> | <p>STYLE 10: PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND</p> | <p>STYLE 11: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. DRAIN 2 7. DRAIN 1 8. DRAIN 1</p> | <p>STYLE 12: PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> |
| <p>STYLE 13: PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> | <p>STYLE 14: PIN 1. N-SOURCE 2. N-GATE 3. P-SOURCE 4. P-GATE 5. P-DRAIN 6. P-DRAIN 7. N-DRAIN 8. N-DRAIN</p> | <p>STYLE 15: PIN 1. ANODE 1 2. ANODE 1 3. ANODE 1 4. ANODE 1 5. CATHODE, COMMON 6. CATHODE, COMMON 7. CATHODE, COMMON 8. CATHODE, COMMON</p> | <p>STYLE 16: PIN 1. EMITTER, DIE #1 2. BASE, DIE #1 3. EMITTER, DIE #2 4. BASE, DIE #2 5. COLLECTOR, DIE #2 6. COLLECTOR, DIE #2 7. COLLECTOR, DIE #1 8. COLLECTOR, DIE #1</p> |
| <p>STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC</p> | <p>STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE</p> | <p>STYLE 19: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1</p> | <p>STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> |
| <p>STYLE 21: PIN 1. CATHODE 1 2. CATHODE 2 3. CATHODE 3 4. CATHODE 4 5. CATHODE 5 6. COMMON ANODE 7. COMMON ANODE 8. CATHODE 6</p> | <p>STYLE 22: PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND</p> | <p>STYLE 23: PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT</p> | <p>STYLE 24: PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE</p> |
| <p>STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT</p> | <p>STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC</p> | <p>STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN</p> | <p>STYLE 28: PIN 1. SW_TO_GND 2. DASIC_OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBULK 7. VBULK 8. VIN</p> |
| <p>STYLE 29: PIN 1. BASE, DIE #1 2. EMITTER, #1 3. BASE, #2 4. EMITTER, #2 5. COLLECTOR, #2 6. COLLECTOR, #2 7. COLLECTOR, #1 8. COLLECTOR, #1</p> | <p>STYLE 30: PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1</p> | | |

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