

# NSS40302PDR2G

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

ON Semiconductor's e<sup>2</sup>PowerEdge 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 e<sup>2</sup>PowerEdge devices to be driven directly from PMU's control outputs, and the Linear Gain (Beta) makes them ideal components in analog amplifiers.

### Features

- Halide Free
- This is a Pb-Free Device

### 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	

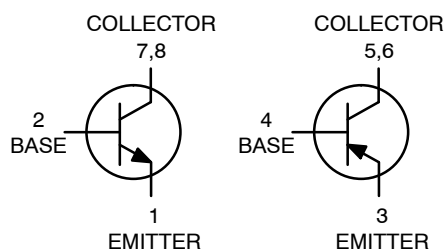
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



**ON Semiconductor**<sup>®</sup>

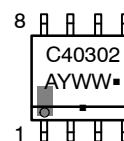
<http://onsemi.com>

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



**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 <sup>†</sup>
NSS40302PDR2G	SOIC-8 (Pb-Free)	2500 / Tape & Reel

<sup>†</sup>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

## THEMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
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### SINGLE HEATED

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

### DUAL HEATED (Note 3)

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

1. FR-4 @ 10 mm<sup>2</sup>, 1 oz. copper traces, still air.
2. FR-4 @ 100 mm<sup>2</sup>, 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 ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector – Emitter Breakdown Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	40	–	–	Vdc
Collector – Base Breakdown Voltage ( $I_C = 0.1 \text{ mAdc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	40	–	–	Vdc
Emitter – Base Breakdown Voltage ( $I_E = 0.1 \text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	6.0	–	–	Vdc
Collector Cutoff Current ( $V_{CB} = 40 \text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	–	–	0.1	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 6.0 \text{ Vdc}$ )	$I_{EBO}$	–	–	0.1	$\mu\text{Adc}$

### ON CHARACTERISTICS

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

### SWITCHING CHARACTERISTICS

Delay ( $V_{CC} = 30 \text{ V}$ , $I_C = 750 \text{ mA}$ , $I_{B1} = 15 \text{ mA}$ )	$t_d$	–	–	100	ns
Rise ( $V_{CC} = 30 \text{ V}$ , $I_C = 750 \text{ mA}$ , $I_{B1} = 15 \text{ mA}$ )	$t_r$	–	–	100	ns
Storage ( $V_{CC} = 30 \text{ V}$ , $I_C = 750 \text{ mA}$ , $I_{B1} = 15 \text{ mA}$ )	$t_s$	–	–	780	ns
Fall ( $V_{CC} = 30 \text{ V}$ , $I_C = 750 \text{ mA}$ , $I_{B1} = 15 \text{ mA}$ )	$t_f$	–	–	110	ns

4. Pulsed Condition: Pulse Width = 300  $\mu\text{sec}$ , Duty Cycle  $\leq 2\%$ .

# NSS40302PDR2G

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ( $I_C = -10\text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	-40	-	-	Vdc
Collector–Base Breakdown Voltage ( $I_C = -0.1\text{ mA}$ , $I_E = 0$ )	$V_{(BR)CBO}$	-40	-	-	Vdc
Emitter–Base Breakdown Voltage ( $I_E = -0.1\text{ mA}$ , $I_C = 0$ )	$V_{(BR)EBO}$	-7.0	-	-	Vdc
Collector Cutoff Current ( $V_{CB} = -40\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	-	-	-0.1	$\mu\text{A}$
Emitter Cutoff Current ( $V_{EB} = -6.0\text{ Vdc}$ )	$I_{EBO}$	-	-	-0.1	$\mu\text{A}$

### ON CHARACTERISTICS

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

### SWITCHING CHARACTERISTICS

Delay ( $V_{CC} = -30\text{ V}$ , $I_C = -750\text{ mA}$ , $I_{B1} = -15\text{ mA}$ )	$t_d$	-	-	60	ns
Rise ( $V_{CC} = -30\text{ V}$ , $I_C = -750\text{ mA}$ , $I_{B1} = -15\text{ mA}$ )	$t_r$	-	-	120	ns
Storage ( $V_{CC} = -30\text{ V}$ , $I_C = -750\text{ mA}$ , $I_{B1} = -15\text{ mA}$ )	$t_s$	-	-	400	ns
Fall ( $V_{CC} = -30\text{ V}$ , $I_C = -750\text{ mA}$ , $I_{B1} = -15\text{ mA}$ )	$t_f$	-	-	130	ns

5. Pulsed Condition: Pulse Width = 300  $\mu\text{sec}$ , Duty Cycle  $\leq 2\%$ .

NPN TYPICAL CHARACTERISTICS

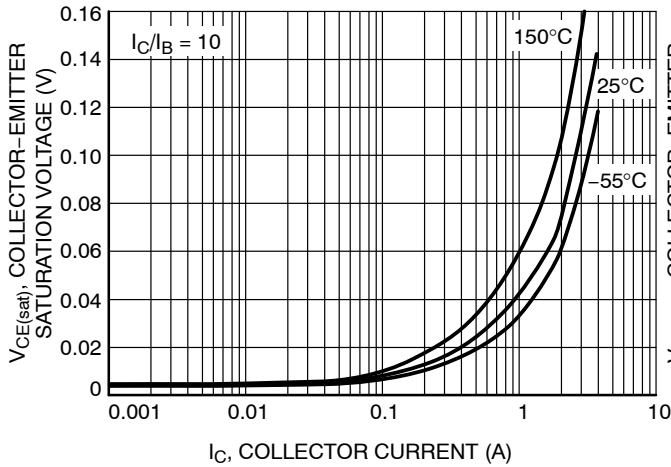


Figure 1. Collector Emitter Saturation Voltage vs. Collector Current

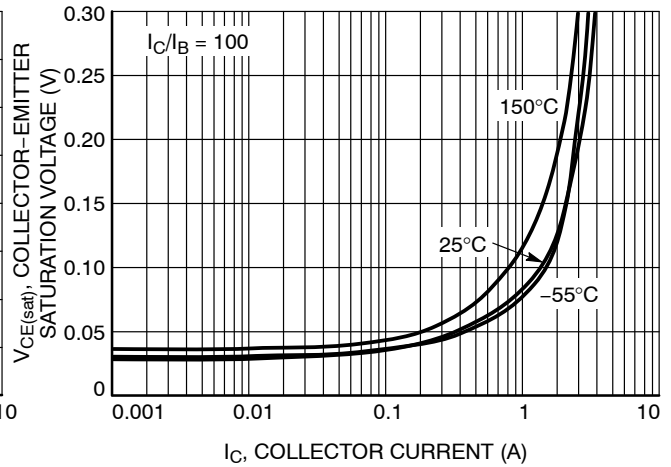


Figure 2. Collector Emitter Saturation Voltage vs. Collector Current

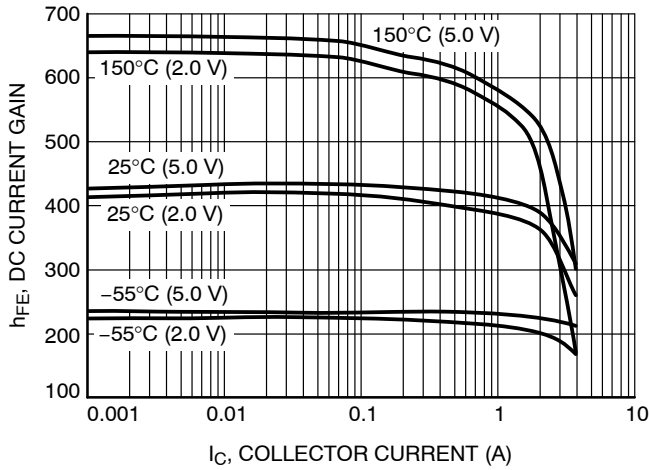


Figure 3. DC Current Gain vs. Collector Current

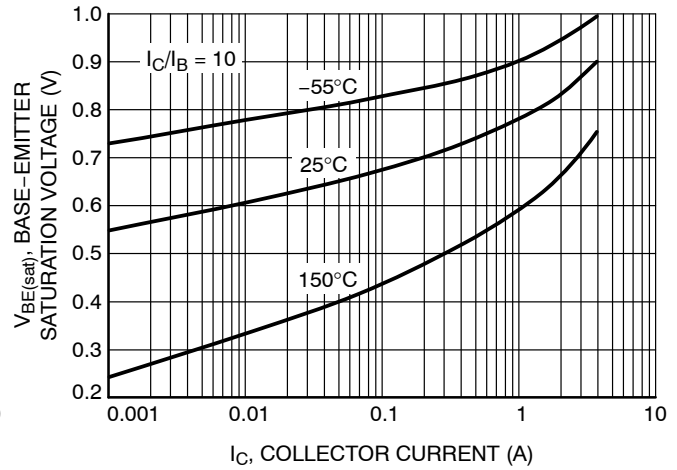


Figure 4. Base Emitter Saturation Voltage vs. Collector Current

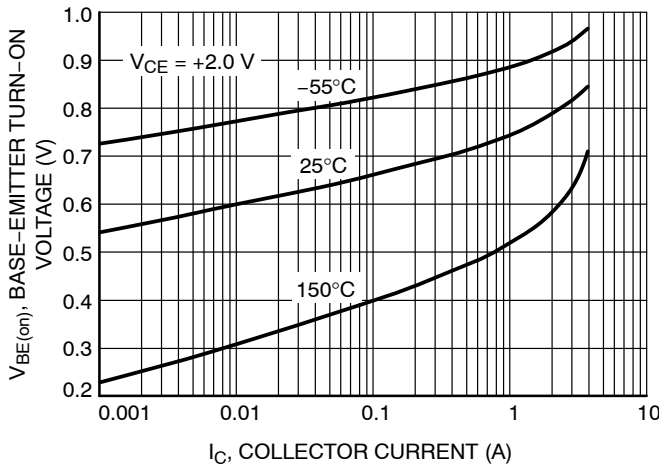


Figure 5. Base Emitter Turn-On Voltage vs. Collector Current

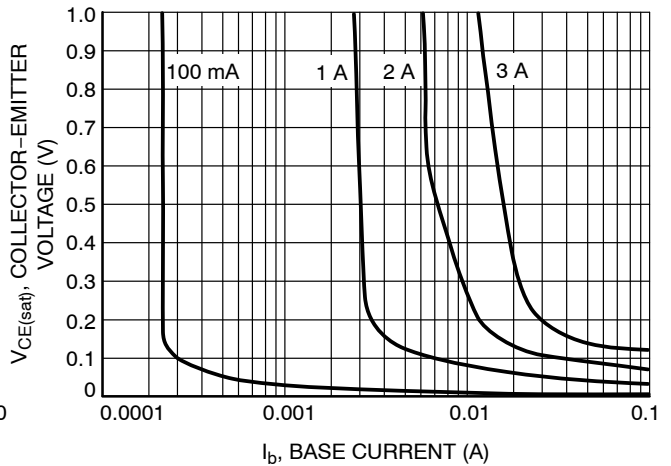


Figure 6. Saturation Region

# NSS40302PDR2G

## NPN TYPICAL CHARACTERISTICS

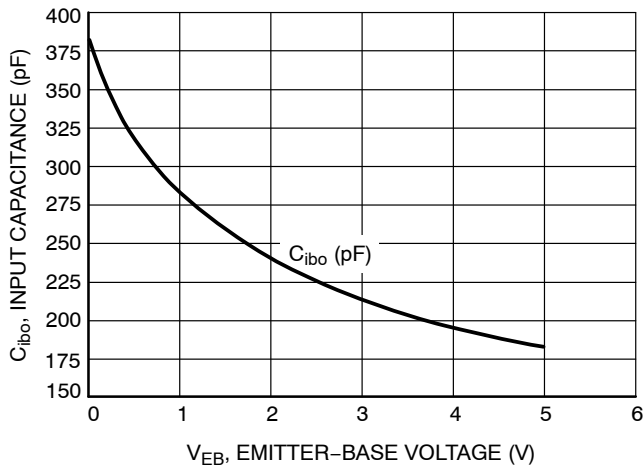


Figure 7. Input Capacitance

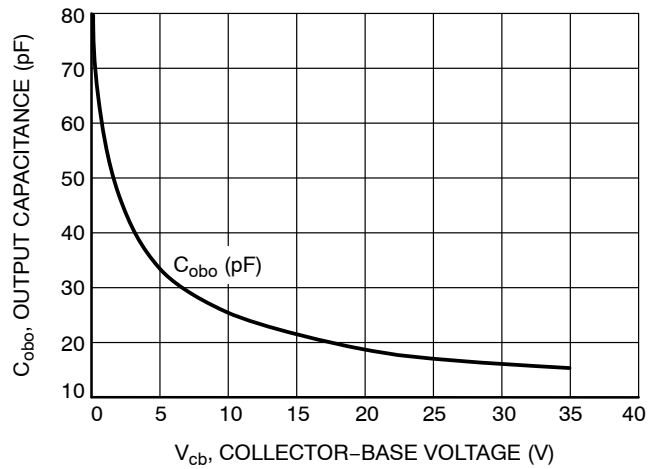


Figure 8. Output Capacitance

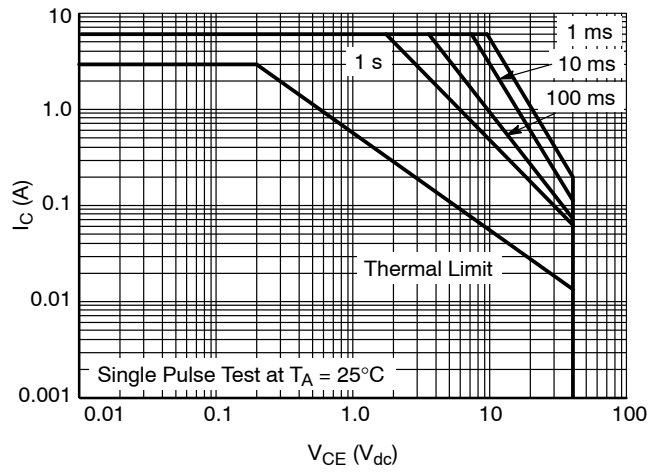


Figure 9. Safe Operating Area

PNP TYPICAL CHARACTERISTICS

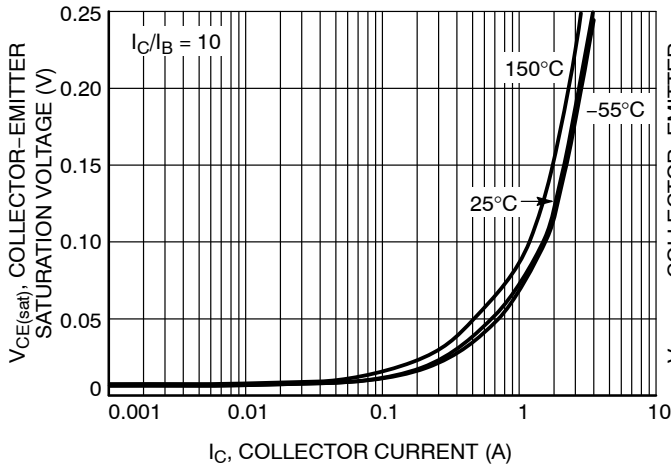


Figure 10. Collector Emitter Saturation Voltage vs. Collector Current

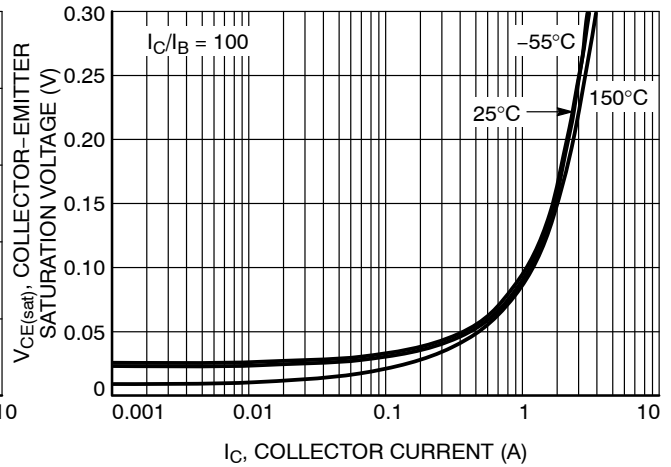


Figure 11. Collector Emitter Saturation Voltage vs. Collector Current

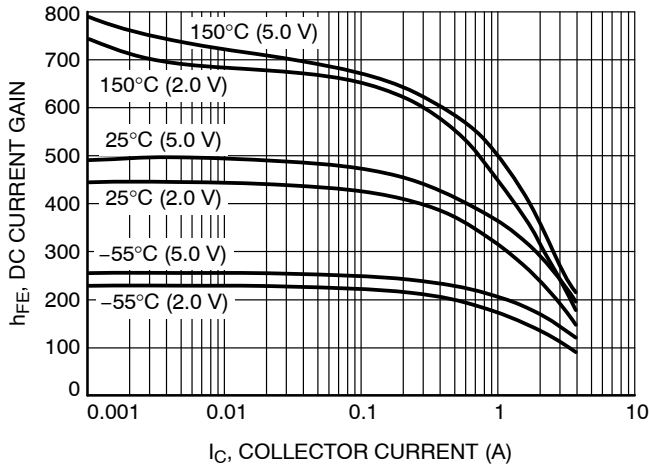


Figure 12. DC Current Gain vs. Collector Current

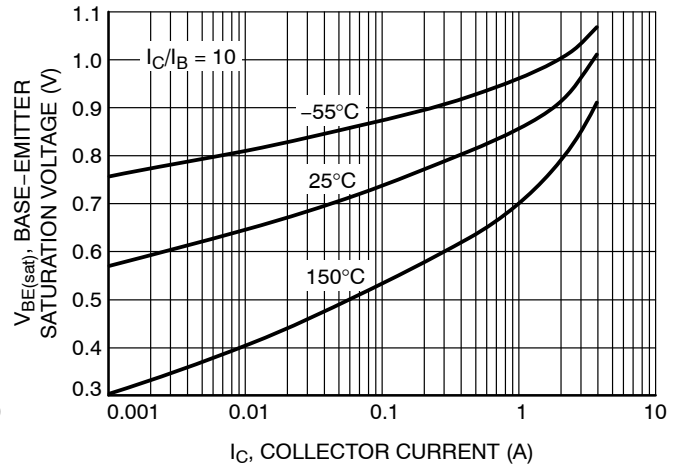


Figure 13. Base Emitter Saturation Voltage vs. Collector Current

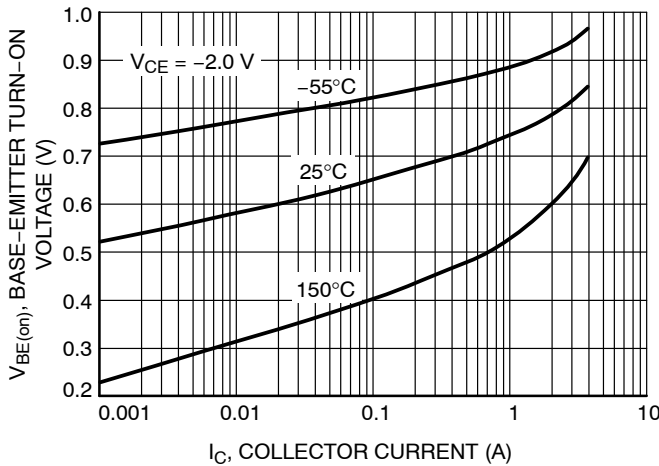


Figure 14. Base Emitter Turn-On Voltage vs. Collector Current

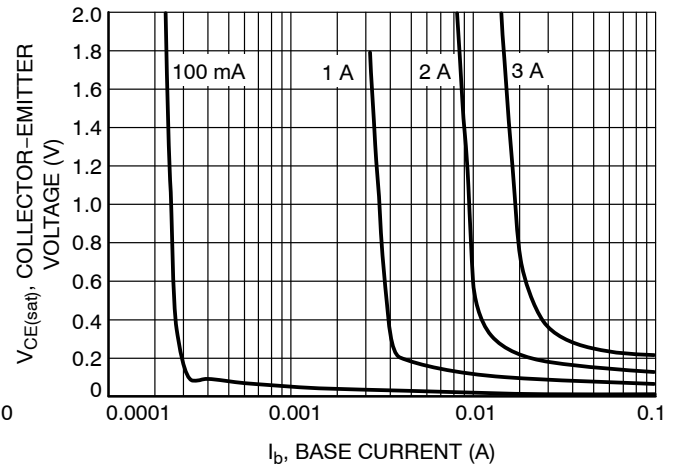


Figure 15. Saturation Region

# NSS40302PDR2G

## PNP TYPICAL CHARACTERISTICS

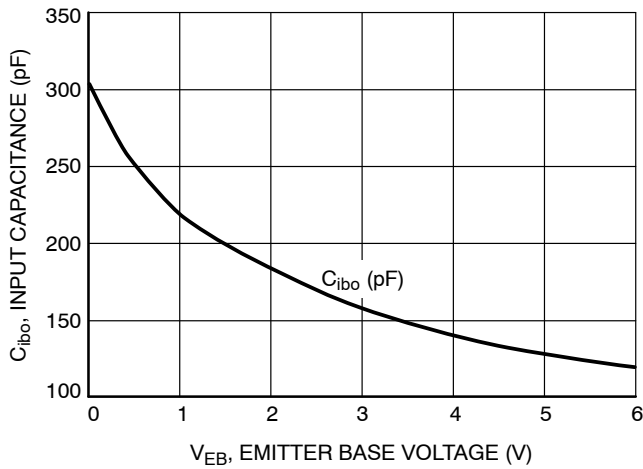


Figure 16. Input Capacitance

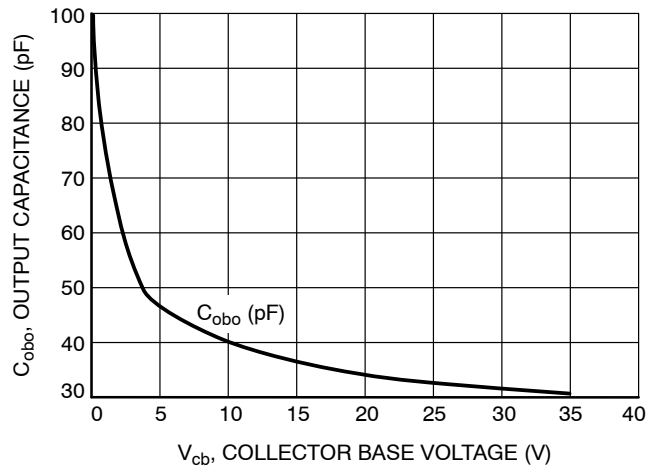


Figure 17. Output Capacitance

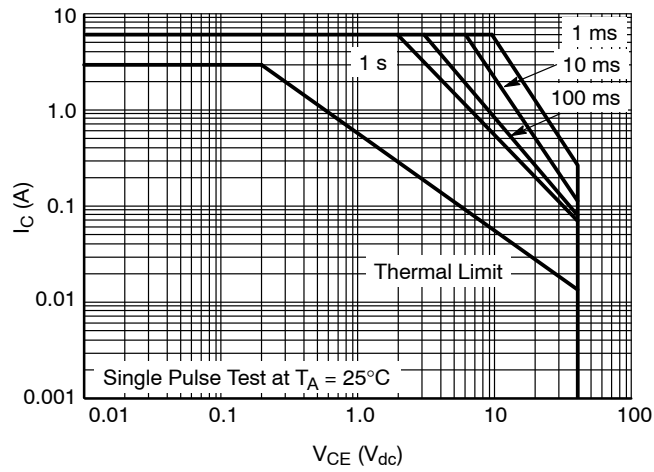


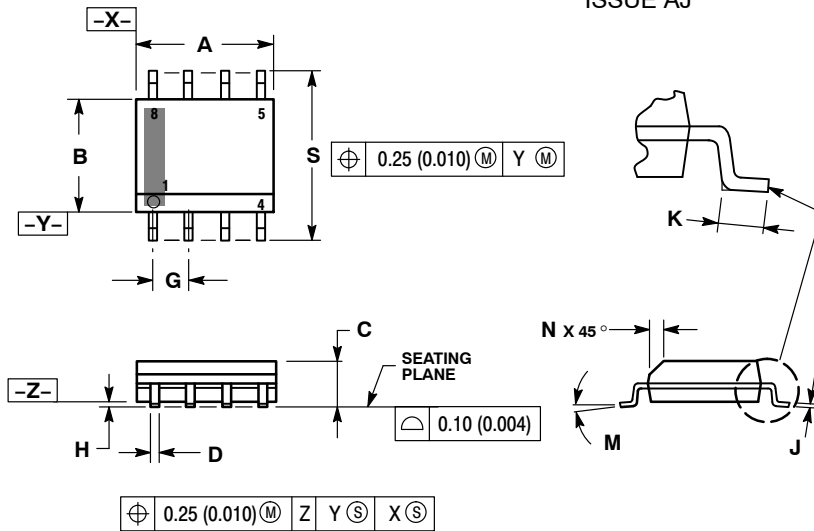
Figure 18. Safe Operating Area



# NSS40302PDR2G

## PACKAGE DIMENSIONS

### SOIC-8 NB CASE 751-07 ISSUE AJ

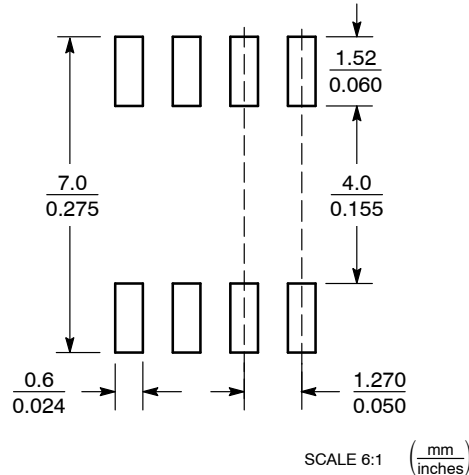


#### NOTES:

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

### SOLDERING FOOTPRINT\*



#### STYLE 16:

1. EMITTER, DIE #1
2. BASE, DIE #1
3. EMITTER, DIE #2
4. BASE, DIE #2
5. COLLECTOR, DIE #2
6. COLLECTOR, DIE #1
7. COLLECTOR, DIE #1
8. COLLECTOR, DIE #1

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

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