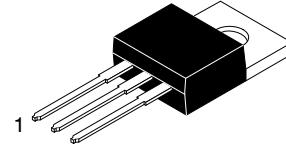


# NPN Triple Diffused Planar Silicon Transistor

## KSC5338D



TO-220-3LD  
CASE 340AT

### Features

- High Voltage Power Switch Switching Application
- Wide Safe Operating Area
- Built-in Free-Wheeling Diode
- Suitable for Electronic Ballast Application
- Small Variance in Storage Time
- Package Choice: TO-220
- This is a Pb-Free and a Halide Free Device

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted.)

Symbol	Parameter	Value	Unit
V <sub>CB0</sub>	Collector-Base Voltage	1000	V
V <sub>CEO</sub>	Collector-Emitter Voltage	450	V
V <sub>EBO</sub>	Emitter-Base Voltage	12	V
I <sub>C</sub>	Collector Current (DC)	5	A
I <sub>CP</sub>	Collector Current (Pulse) (Note 1)	10	A
I <sub>B</sub>	Base Current (DC)	2	A
I <sub>BP</sub>	Base Current (Pulse) (Note 1)	4	A
P <sub>C</sub>	Power Dissipation (T <sub>C</sub> = 25°C)	75	W
T <sub>J</sub>	Junction Temperature	150	°C
T <sub>STG</sub>	Storage Temperature	-55 to 150	°C

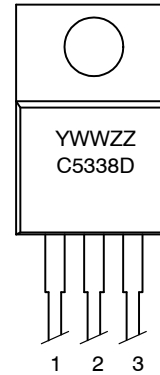
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Pulse Test: Pulse Width = 5 ms, Duty Cycle ≤ 10%

### THERMAL CHARACTERISTICS

Symbol	Characteristic	Value	Unit	
R <sub>θjc</sub>	Thermal Resistance	Junction to Case	1.65	°C/W
		Junction to Ambient	62.5	°C/W
T <sub>L</sub>	Maximum Lead Temperature for Soldering	270	°C	

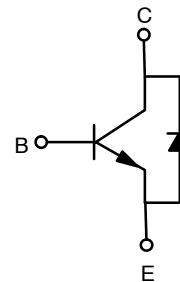
### MARKING DIAGRAM



1. Base
2. Collector
3. Emitter

YWW = Date Code (Year and Week)  
ZZ = Lot Code  
C5338D = Specific Device Code

### EQUIVALENT CIRCUIT



### ORDERING INFORMATION

Device	Package	Shipping
KSC5338D	TO-220-3LD	1200 Units / Bulk
KSC5338DTU	(Pb-Free, Halide Free)	1000 Units / Tube

# KSC5338D

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units			
BV <sub>CBO</sub>	Collector–Base Breakdown Voltage	I <sub>C</sub> = 1 mA, I <sub>E</sub> = 0	1000	–	–	V			
BV <sub>CEO</sub>	Collector–Emitter Breakdown Voltage	I <sub>C</sub> = 5 mA, I <sub>B</sub> = 0	450	–	–	V			
BV <sub>EBO</sub>	Emitter–Base Breakdown Voltage	I <sub>E</sub> = 1 mA, I <sub>C</sub> = 0	12	–	–	V			
I <sub>CBO</sub>	Collector Cut-off Current	V <sub>CB</sub> = 800 V, I <sub>E</sub> = 0	–	–	10	μA			
I <sub>CES</sub>	Collector Cut-off Current	V <sub>CE</sub> = 1000 V, I <sub>EB</sub> = 0	T <sub>a</sub> = 25°C	–	–	100	μA		
			T <sub>a</sub> = 125°C	–	–	500	μA		
I <sub>CEO</sub>	Collector Cut-off Current	V <sub>CE</sub> = 450 V, I <sub>B</sub> = 0	T <sub>a</sub> = 25°C	–	–	100	μA		
			T <sub>a</sub> = 125°C	–	–	500	μA		
I <sub>EBO</sub>	Emitter Cut-off Current	V <sub>EB</sub> = 10 V, I <sub>C</sub> = 0	–	–	10	μA			
h <sub>FE</sub>	DC Current Gain	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 0.8 A	T <sub>a</sub> = 25°C	15	25	–			
			T <sub>a</sub> = 125°C	10	14	–			
		V <sub>CE</sub> = 1 V, I <sub>C</sub> = 2 A	T <sub>a</sub> = 25°C	6	9	–			
			T <sub>a</sub> = 125°C	4	6	–			
		V <sub>CE</sub> = 2.5 V, I <sub>C</sub> = 1 A	T <sub>a</sub> = 25°C	18	25	–			
			T <sub>a</sub> = 125°C	14	18	–			
V <sub>CE(sat)</sub>	Collector–Emitter Saturation Voltage	I <sub>C</sub> = 0.8 A, I <sub>B</sub> = 0.08 A	T <sub>a</sub> = 25°C	–	0.35	0.5	V		
			T <sub>a</sub> = 125°C	–	0.55	0.75	V		
		I <sub>C</sub> = 2 A, I <sub>B</sub> = 0.4 A	T <sub>a</sub> = 25°C	–	0.47	0.75	V		
			T <sub>a</sub> = 125°C	–	0.9	1.1	V		
		I <sub>C</sub> = 0.8 A, I <sub>B</sub> = 0.04 A	T <sub>a</sub> = 25°C	–	0.9	1.5	V		
			T <sub>a</sub> = 125°C	–	1.8	2.5	V		
		I <sub>C</sub> = 1 A, I <sub>B</sub> = 0.2 A	T <sub>a</sub> = 25°C	–	0.22	0.5	V		
			T <sub>a</sub> = 125°C	–	0.3	0.6	V		
		V <sub>BE(sat)</sub>	Base–Emitter Saturation Voltage	I <sub>C</sub> = 0.8 A, I <sub>B</sub> = 0.08 A	T <sub>a</sub> = 25°C	–	0.8	1.0	V
					T <sub>a</sub> = 125°C	–	0.65	0.9	V
I <sub>C</sub> = 2 A, I <sub>B</sub> = 0.4 A	T <sub>a</sub> = 25°C			–	0.9	1.0	V		
	T <sub>a</sub> = 125°C			–	0.8	0.9	V		
C <sub>ib</sub>	Input Capacitance	V <sub>EB</sub> = 10 V, I <sub>C</sub> = 0.5 A, f = 1 MHz	–	550	750	pF			
C <sub>ob</sub>	Output Capacitance	V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0, f = 1 MHz	–	60	100	pF			
f <sub>T</sub>	Current Gain Bandwidth Product	I <sub>C</sub> = 0.5 A, V <sub>CE</sub> = 10 V	–	11	–	MHz			
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 1 A, I <sub>C</sub> = 1 mA, I <sub>E</sub> = 0	T <sub>a</sub> = 25°C	–	0.86	1.3	V		
			T <sub>a</sub> = 125°C	–	0.79	–	V		
		I <sub>F</sub> = 2 A	T <sub>a</sub> = 25°C	–	0.95	1.5	V		
			T <sub>a</sub> = 125°C	–	0.88	–	V		
t <sub>fr</sub>	Diode Forward Recovery Time (di/dt = 10 A/μs)	I <sub>F</sub> = 0.4 A	–	460	–	ns			
		I <sub>F</sub> = 1 A	–	360	–				
		I <sub>F</sub> = 2 A	–	325	–				
V <sub>CE(DSAT)</sub>	Dynamic Saturation Voltage	I <sub>C</sub> = 1 A, I <sub>B1</sub> = 100 mA V <sub>CC</sub> = 300 V at 1 μs	T <sub>a</sub> = 25°C	–	8	–	V		
			T <sub>a</sub> = 125°C	–	15	–	V		
		I <sub>C</sub> = 1 A, I <sub>B1</sub> = 100 mA V <sub>CC</sub> = 300 V at 3 μs	T <sub>a</sub> = 25°C	–	2.9	–	V		
			T <sub>a</sub> = 125°C	–	8	–	V		
		I <sub>C</sub> = 2 A, I <sub>B1</sub> = 400 mA V <sub>CC</sub> = 300 V at 1 μs	T <sub>a</sub> = 25°C	–	9	–	V		
			T <sub>a</sub> = 125°C	–	17	–	V		
		I <sub>C</sub> = 2 A, I <sub>B1</sub> = 400 mA V <sub>CC</sub> = 300 V at 3 μs	T <sub>a</sub> = 25°C	–	1.9	–	V		
			T <sub>a</sub> = 125°C	–	8.5	–	V		

# KSC5338D

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
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### RESISTIVE LOAD SWITCHING (D.C. $\leq 10\%$ , Pulse Width = 40 $\mu\text{s}$ )

$t_{ON}$	Turn On Time	$I_C = 2.5\text{ A}$ , $I_{B1} = 500\text{ mA}$ , $I_{B2} = -1\text{ A}$ , $V_{CC} = 250\text{ V}$ , $R_L = 100\ \Omega$	-	500	750	ns		
$t_{STG}$	Storage Time		1.2	-	1.5	$\mu\text{s}$		
$t_F$	Fall Time		-	100	200	ns		
$t_{ON}$	Turn On Time	$I_C = 2\text{ A}$ , $I_{B1} = 400\text{ mA}$ , $I_{B2} = -1\text{ A}$ , $V_{CC} = 300\text{ V}$ , $R_L = 150\ \Omega$	$T_a = 25^\circ\text{C}$		-	100	150	ns
			$T_a = 125^\circ\text{C}$		-	150	-	ns
$t_{STG}$	Storage Time		$T_a = 25^\circ\text{C}$		-	1.4	2.2	$\mu\text{s}$
			$T_a = 125^\circ\text{C}$		-	1.7	-	$\mu\text{s}$
$t_F$	Fall Time		$T_a = 25^\circ\text{C}$		-	90	150	ns
			$T_a = 125^\circ\text{C}$		-	150	-	ns
$t_{ON}$	Turn On Time	$I_C = 2.5\text{ A}$ , $I_{B1} = 500\text{ mA}$ , $I_{B2} = -5\text{ mA}$ , $V_{CC} = 300\text{ V}$ , $R_L = 120\ \Omega$	$T_a = 25^\circ\text{C}$		-	120	150	ns
			$T_a = 125^\circ\text{C}$		-	150	-	ns
$t_{STG}$	Storage Time		$T_a = 25^\circ\text{C}$		1.8	-	2.1	$\mu\text{s}$
			$T_a = 125^\circ\text{C}$		-	2.6	-	$\mu\text{s}$
$t_F$	Fall Time		$T_a = 25^\circ\text{C}$		-	110	150	ns
			$T_a = 125^\circ\text{C}$		-	160	-	ns

### INDUCTIVE LOAD SWITCHING ( $V_{CC} = 15\text{ V}$ )

$t_{STG}$	Storage Time	$I_C = 2.5\text{ A}$ , $I_{B1} = 500\text{ mA}$ , $I_{B2} = -0.5\text{ A}$ , $V_Z = 350\text{ V}$ , $L_C = 300\ \mu\text{H}$	$T_a = 25^\circ\text{C}$		-	1.9	2.2	$\mu\text{s}$
			$T_a = 125^\circ\text{C}$		-	2.4	-	$\mu\text{s}$
$t_F$	Fall Time		$T_a = 25^\circ\text{C}$		-	160	200	ns
			$T_a = 125^\circ\text{C}$		-	330	-	ns
$t_C$	Cross-over Time		$T_a = 25^\circ\text{C}$		-	350	500	ns
			$T_a = 125^\circ\text{C}$		-	750	-	ns
$t_{STG}$	Storage Time	$I_C = 2\text{ A}$ , $I_{B1} = 400\text{ mA}$ , $I_{B2} = -0.4\text{ A}$ , $V_Z = 300\text{ V}$ , $L_C = 200\ \mu\text{H}$	$T_a = 25^\circ\text{C}$		1.95	-	2.25	$\mu\text{s}$
			$T_a = 125^\circ\text{C}$		-	2.9	-	$\mu\text{s}$
$t_F$	Fall Time		$T_a = 25^\circ\text{C}$		-	120	150	ns
			$T_a = 125^\circ\text{C}$		-	270	-	ns
$t_C$	Cross-over Time		$T_a = 25^\circ\text{C}$		-	300	450	ns
			$T_a = 125^\circ\text{C}$		-	700	-	ns
$t_{STG}$	Storage Time	$I_C = 1\text{ A}$ , $I_{B1} = 100\text{ mA}$ , $I_{B2} = -0.5\text{ A}$ , $V_Z = 300\text{ V}$ , $L_C = 200\ \mu\text{H}$	$T_a = 25^\circ\text{C}$		-	0.6	0.8	$\mu\text{s}$
			$T_a = 125^\circ\text{C}$		-	1.0	-	$\mu\text{s}$
$t_F$	Fall Time		$T_a = 25^\circ\text{C}$		-	70	-	ns
			$T_a = 125^\circ\text{C}$		-	110	-	ns
$t_C$	Cross-over Time		$T_a = 25^\circ\text{C}$		-	80	130	ns
			$T_a = 125^\circ\text{C}$		-	170	-	ns

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.

TYPICAL CHARACTERISTICS

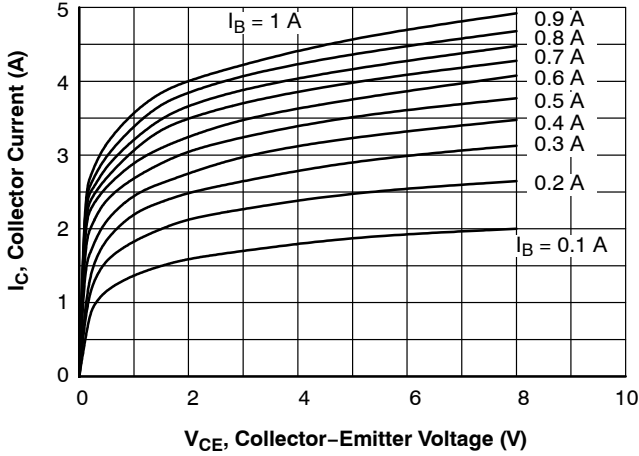


Figure 1. Static Characteristic

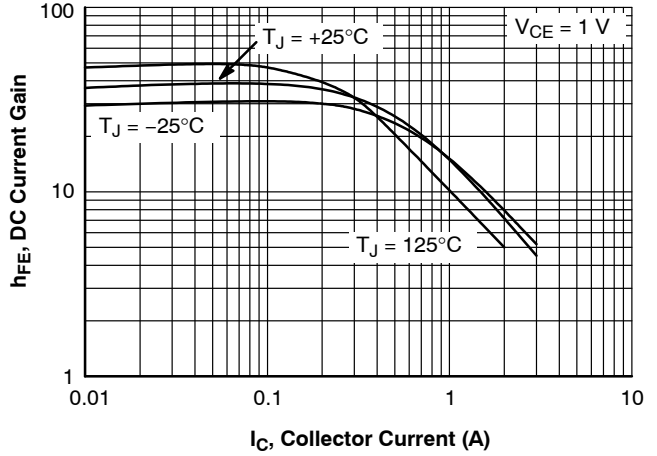


Figure 2. DC Current Gain

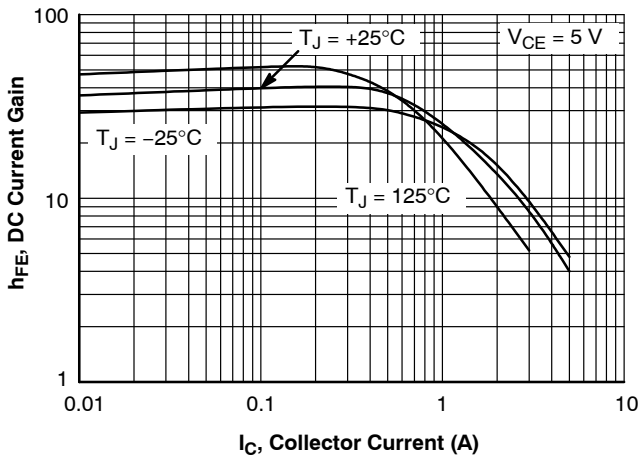


Figure 3. DC Current Gain

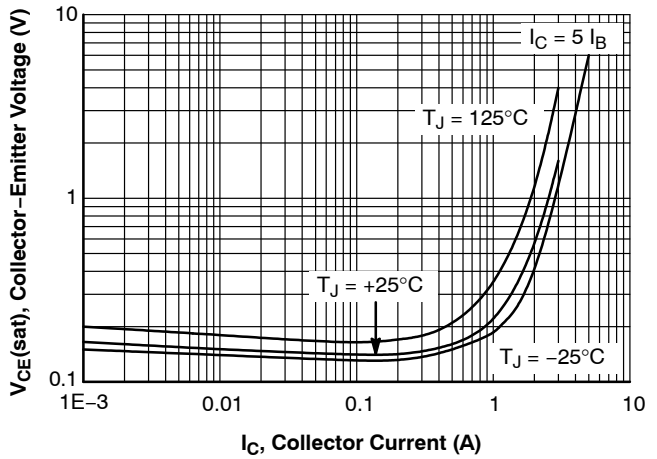


Figure 4. Collector-Emmitter Saturation Voltage

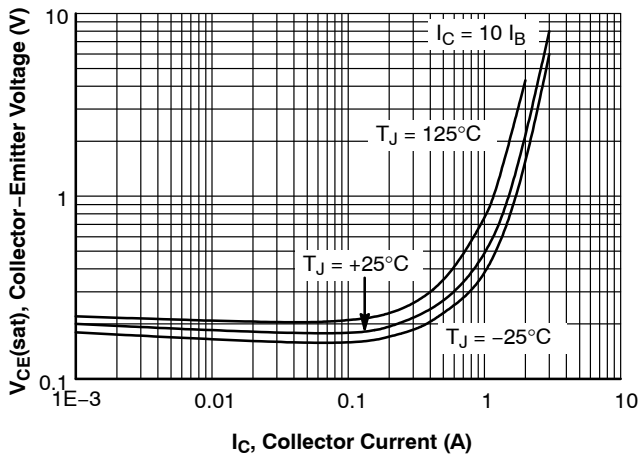


Figure 5. Collector-Emmitter Saturation Voltage

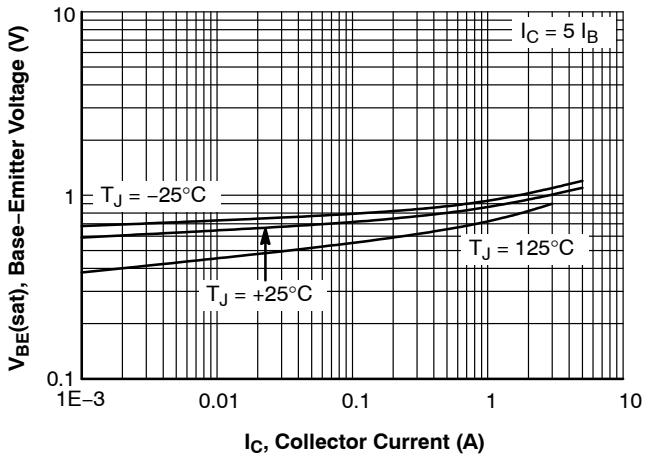


Figure 6. Base-Emmitter Saturation Voltage

TYPICAL CHARACTERISTICS (continued)

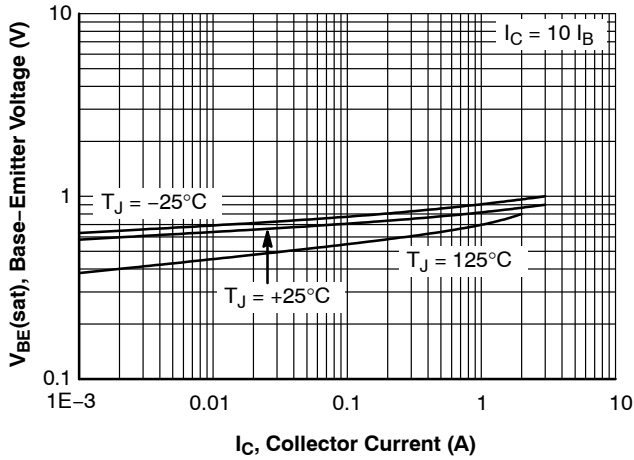


Figure 7. Base-Emitter Saturation Voltage

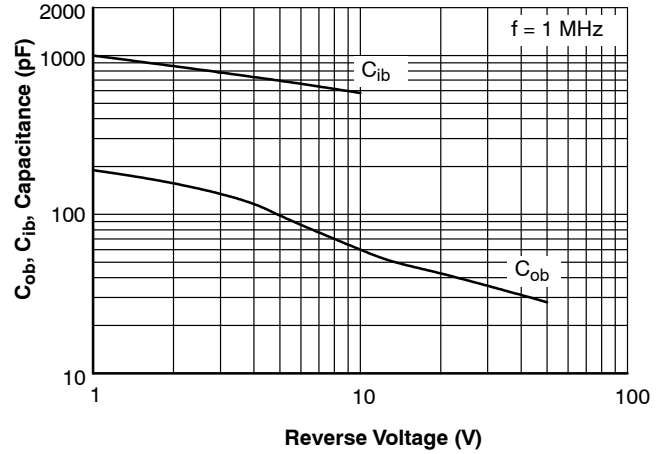


Figure 8. Collector Output Capacitance

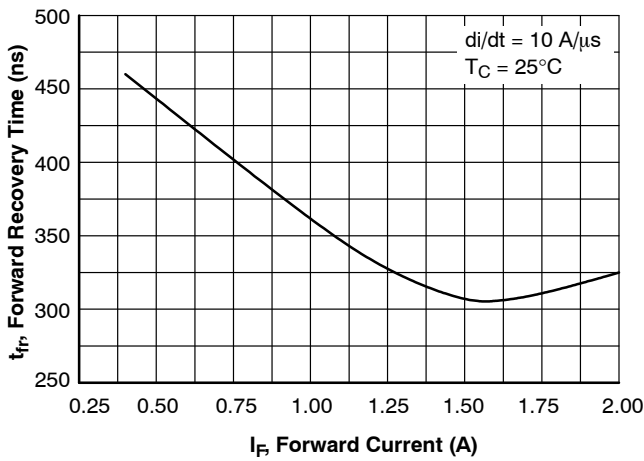


Figure 9. Forward Recovery Time

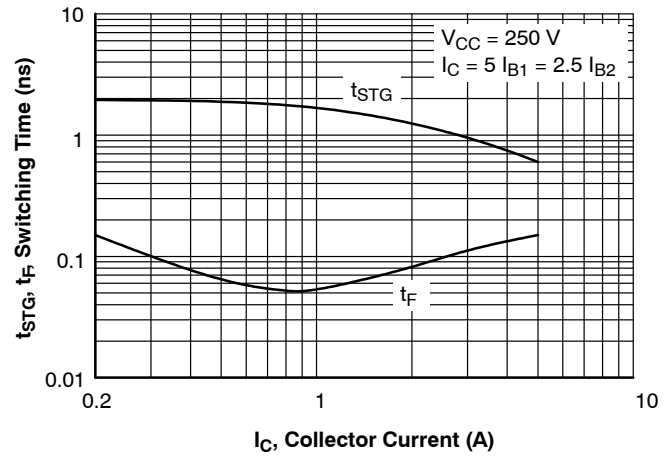


Figure 10. Switching Time

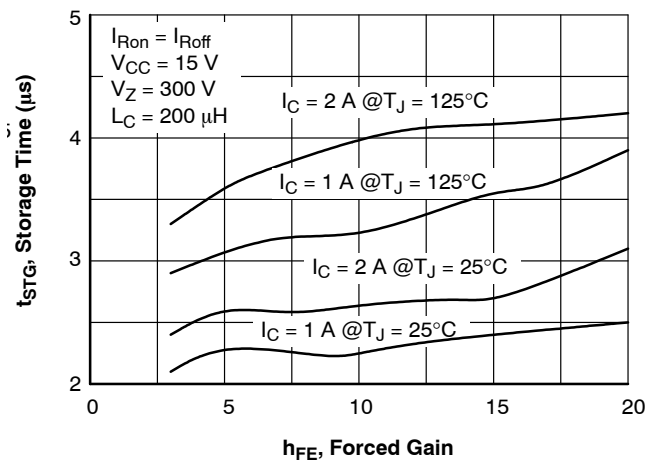


Figure 11. Induction Storage Time

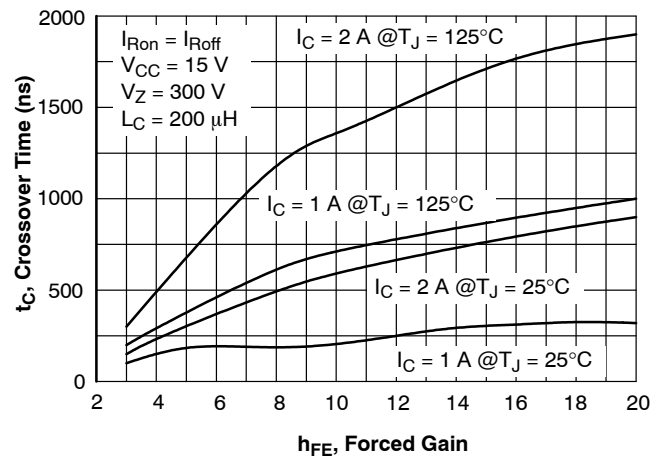


Figure 12. Inductive Crossover Time

TYPICAL CHARACTERISTICS (continued)

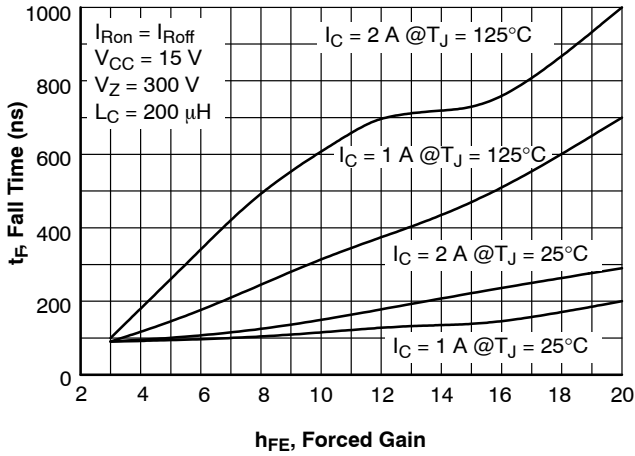


Figure 13. Inductive Fall Time

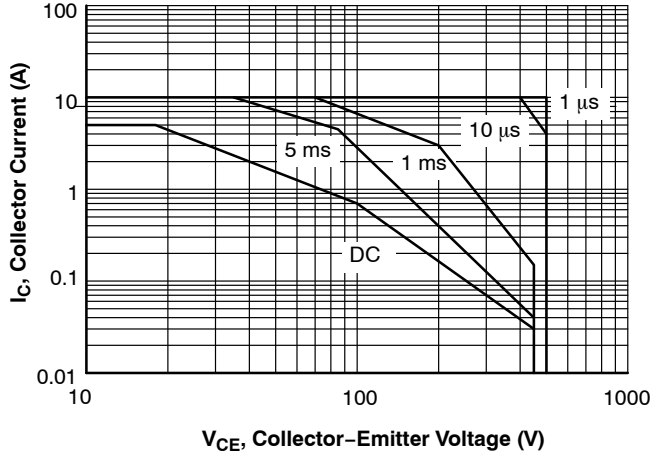


Figure 14. Safe Operating Area

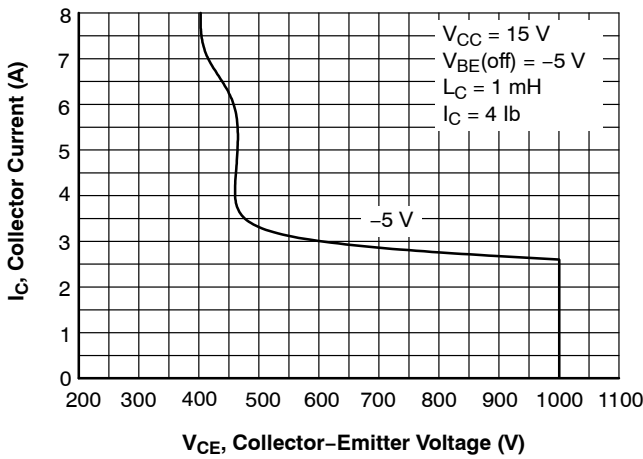


Figure 15. Reverse Bias Safe Operating

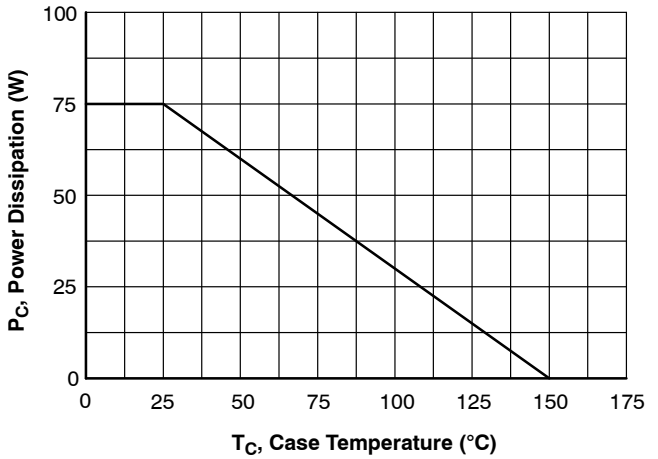


Figure 16. Power Derating

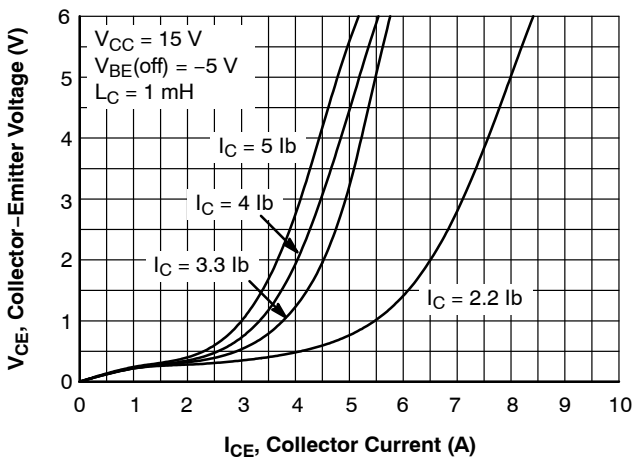
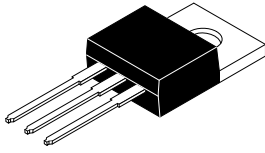


Figure 17. RBSOA Saturation

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

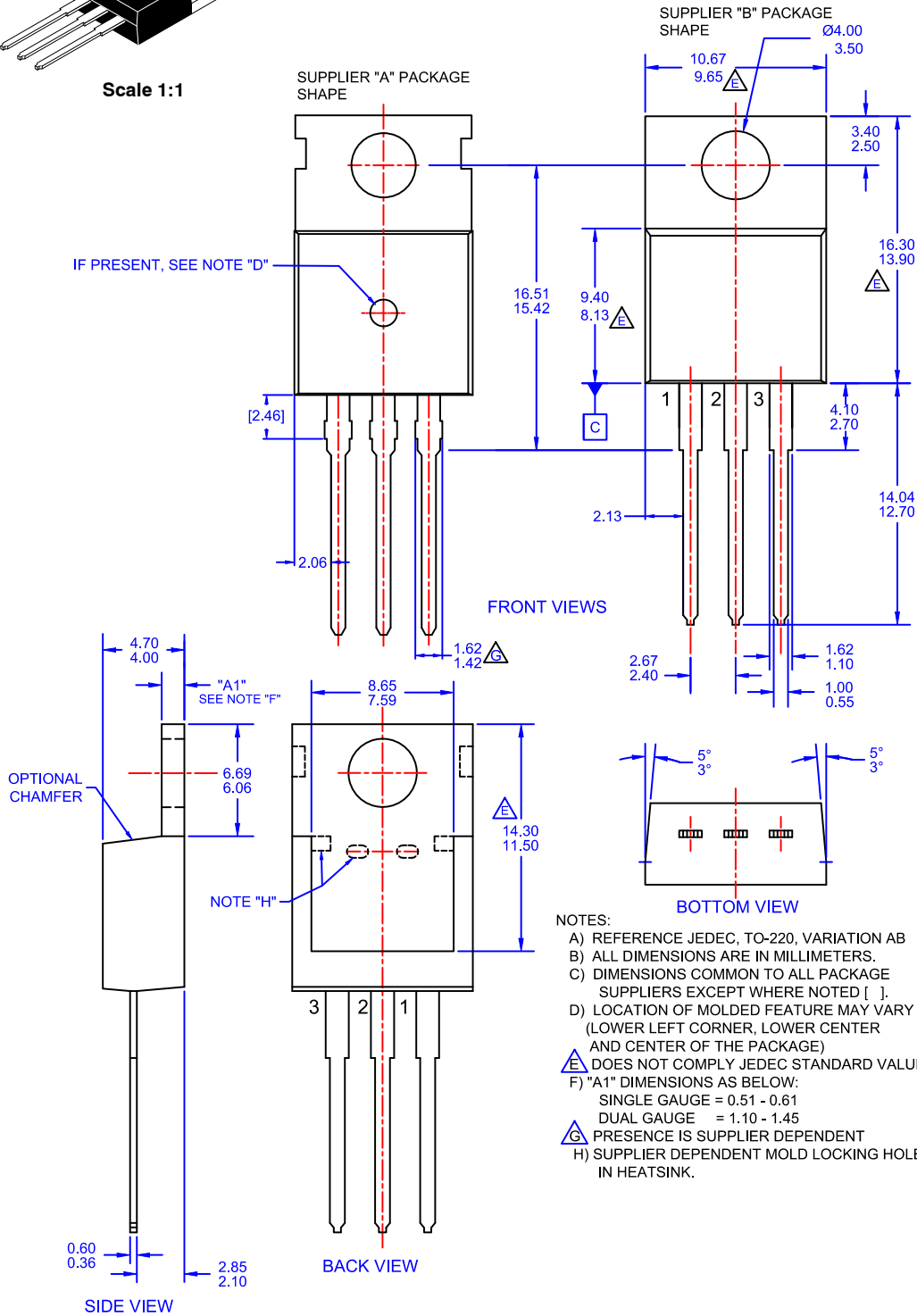
ON Semiconductor®



Scale 1:1

### TO-220-3LD CASE 340AT ISSUE A

DATE 03 OCT 2017



- NOTES:
- A) REFERENCE JEDEC, TO-220, VARIATION AB
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
  - D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
  - E) DOES NOT COMPLY JEDEC STANDARD VALUE.
  - F) "A1" DIMENSIONS AS BELOW:  
 SINGLE GAUGE = 0.51 - 0.61  
 DUAL GAUGE = 1.10 - 1.45
  - G) PRESENCE IS SUPPLIER DEPENDENT
  - H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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<b>DESCRIPTION:</b>	<b>TO-220-3LD</b>	<b>PAGE 1 OF 1</b>

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