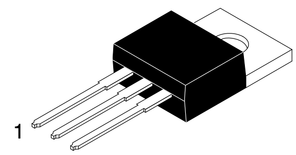
NPN Triple Diffused Planar Silicon Transistor

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_A = 25°C unless otherwise noted.)

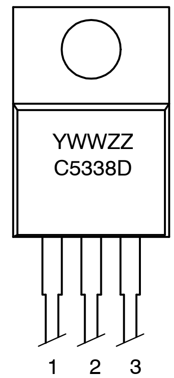
Symbol	Parameter	Value	Unit
V_{CBO}	Collector−Base Voltage	1000	V
V_{CEO}	Collector−Emitter Voltage	450	V
V_{EBO}	Emitter−Base Voltage	12	V
I_C	Collector Current (DC)	5	A
I_{CP}	Collector Current (Pulse) (Note 1)	10	A
I_B	Base Current (DC)	2	A
I_{BP}	Base Current (Pulse) (Note 1)	4	A
P_C	Power Dissipation (T_C = 25°C)	75	W
T_J	Junction Temperature	150	°C
T_{STG}	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
$R_{\theta jc}$	Thermal Resistance	Junction to Case	1.65	°C/W
$R_{\theta ja}$		Junction to Ambient	62.5	°C/W
T_L	Maximum Lead Temperature for Soldering		270	°C

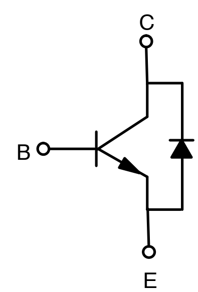
MARKING DIAGRAM



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 (Pb−Free, Halide Free)	1200 Units / Bulk
KSC5338DTU		1000 Units / Tube

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

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Units
BV_{CBO}	Collector−Base Breakdown Voltage	I_C = 1 mA, I_E = 0		1000	–	–	V
BV_{CEO}	Collector−Emitter Breakdown Voltage	I_C = 5 mA, I_B = 0		450	–	–	V
BV_{EBO}	Emitter−Base Breakdown Voltage	I_E = 1 mA, I_C = 0		12	–	–	V
I_{CBO}	Collector Cut−off Current	V_{CB} = 800 V, I_E = 0		–	–	10	μA
I_{CES}	Collector Cut−off Current	V_{CES} = 1000 V, I_{EB} = 0	T_a = 25°C	–	–	100	μA
			T_a = 125°C	–	–	500	μA
I_{CEO}	Collector Cut−off Current	V_{CE} = 450 V, I_B = 0	T_a = 25°C	–	–	100	μA
			T_a = 125°C	–	–	500	μA
I_{EBO}	Emitter Cut−off Current	V_{EB} = 10 V, I_C = 0		–	–	10	μA
h_{FE}	DC Current Gain	V_{CE} = 1 V, I_C = 0.8 A	T_a = 25°C	15	25	–	
			T_a = 125C	10	14	–	
		V_{CE} = 1 V, I_C = 2 A	T_a = 25°C	6	9	–	
			T_a = 125°C	4	6	–	
		V_{CE} = 2.5 V, I_C = 1 A	T_a = 25°C	18	25	–	
			T_a = 125°C	14	18	–	
$V_{CE}(sat)$	Collector−Emitter Saturation Voltage	I_C = 0.8 A, I_B = 0.08 A	T_a = 25°C	–	0.35	0.5	V
			T_a = 125°C	–	0.55	0.75	V
		I_C = 2 A, I_B = 0.4 A	T_a = 25°C	–	0.47	0.75	V
			T_a = 125°C	–	0.9	1.1	V
		I_C = 0.8 A, I_B = 0.04 A	T_a = 25°C	–	0.9	1.5	V
			T_a = 125°C	–	1.8	2.5	V
		I_C = 1 A, I_B = 0.2 A	T_a = 25°C	–	0.22	0.5	V
			T_a = 125°C	–	0.3	0.6	V
$V_{BE}(sat)$	Base−Emitter Saturation Voltage	I_C = 0.8 A, I_B = 0.08 A	T_a = 25°C	–	0.8	1.0	V
			T_a = 125°C	–	0.65	0.9	V
		I_C = 2 A, I_B = 0.4 A	T_a = 25°C	–	0.9	1.0	V
			T_a = 125°C	–	0.8	0.9	V
Cib	Input Capacitance	V_{EB} = 10 V, I_C = 0.5 A, f = 1 MHz		–	550	750	pF
Cob	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1 MHz		–	60	100	pF
f_T	Current Gain Bandwidth Product	I_C = 0.5 A,V_{CE} = 10 V		–	11	–	MHz
V_F	Diode Forward Voltage	I_F = 1 A, I_C = 1 mA, I_E = 0	T_a = 25°C	–	0.86	1.3	V
			T_a = 125°C	–	0.79	–	V
		I_F = 2 A	T_a = 25°C	–	0.95	1.5	V
			T_a = 125°C	–	0.88	–	V
t_{fr}	Diode Forward Recovery Time (di/dt = 10 A/μs)	I_F = 0.4 A I_F = 1 A I_F = 2 A		– – –	460 360 325	– – –	ns
$V_{CE(DSAT)}$	Dynamic Saturation Voltage	I_C = 1 A, I_{B1} = 100 mA V_{CC} = 300 V at 1 μs	T_a = 25°C	–	8	–	V
			T_a = 125°C	–	15	–	V
		I_C = 1 A, I_{B1} = 100 mA V_{CC} = 300 V at 3 μs	T_a = 25°C	–	2.9	–	V
			T_a = 125°C	–	8	–	V
		I_C = 2 A, I_{B1} = 400 mA V_{CC} = 300 V at 1 μs	T_a = 25°C	–	9	–	V
			T_a = 125°C	–	17	–	V
		I_C = 2 A, I_{B1} = 400 mA V_{CC} = 300 V at 3 μs	T_a = 25°C	–	1.9	–	V
			T_a = 125°C	–	8.5	–	V

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Units
RESISTIVE LOAD SWITCHING (D.C ≤ 10%, Pulse Width = 40 μs)							
t_{ON}	Turn On Time	I_C = 2.5 A, I_{B1} = 500 mA, I_{B2} = −1 A, V_{CC} = 250 V, R_L = 100 Ω		–	500	750	ns
t_{STG}	Storage Time			1.2	–	1.5	μs
t_F	Fall Time			–	100	200	ns
t_{ON}	Turn On Time	I_C = 2 A, I_{B1} = 400 mA, I_{B2} = −1 A, V_{CC} = 300 V, R_L = 150 Ω	T_a = 25°C	–	100	150	ns
			T_a = 125°C	–	150	–	ns
t_{STG}	Storage Time		T_a = 25°C	–	1.4	2.2	μs
			T_a = 125°C	–	1.7	–	μs
t_F	Fall Time		T_a = 25°C	–	90	150	ns
			T_a = 125°C	–	150	–	ns
t_{ON}	Turn On Time	I_C = 2.5 A, I_{B1} = 500 mA, I_{B2} = −5 mA, V_{CC} = 300 V, R_L = 120 Ω	T_a = 25°C	–	120	150	ns
			T_a = 125°C	–	150	–	ns
t_{STG}	Storage Time		T_a = 25C°	1.8	–	2.1	μs
			T_a = 125°C	–	2.6	–	μs
t_F	Fall Time		T_a = 25°C	–	110	150	ns
			T_a = 125°C	–	160	–	ns
INDUCTIVE LOAD SWITCHING (V_{CC} = 15 V)							
t_{STG}	Storage Time	I_C = 2.5 A, I_{B1} = 500 mA, I_{B2} = −0.5 A, V_Z = 350 V, L_C = 300 μH	T_a = 25°C	–	1.9	2.2	μs
			T_a = 125°C	–	2.4	–	μs
t_F	Fall Time		T_a = 25°C	–	160	200	ns
			T_a = 125°C	–	330	–	ns
t_C	Cross−over Time		T_a = 25°C	–	350	500	ns
			T_a = 125°C	–	750	–	ns
t_{STG}	Storage Time	I_C = 2 A, I_{B1} = 400 mA, I_{B2} = −0.4 A, V_Z = 300 V, L_C = 200 μH	T_a = 25°C	1.95	–	2.25	μs
			T_a = 125°C	–	2.9	–	μs
t_F	Fall Time		T_a = 25°C	–	120	150	ns
			T_a = 125°C	–	270	–	ns
t_C	Cross−over Time		T_a = 25°C	–	300	450	ns
			T_a = 125°C	–	700	–	ns
t_{STG}	Storage Time	I_C = 1 A, I_{B1} = 100 mA, I_{B2} = −0.5 A, V_Z = 300 V, L_C = 200 μH	T_a = 25°C	–	0.6	0.8	μs
			T_a = 125°C	–	1.0	–	μs
t_F	Fall Time		T_a = 25°C	–	70	–	ns
			T_a = 125°C	–	110	–	ns
t_C	Cross−over Time		T_a = 25°C	–	80	130	ns
			T_a = 125°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

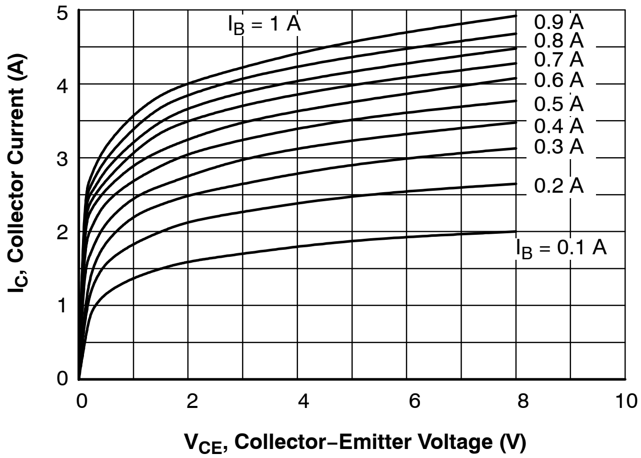


Figure 1. Static Characteristic

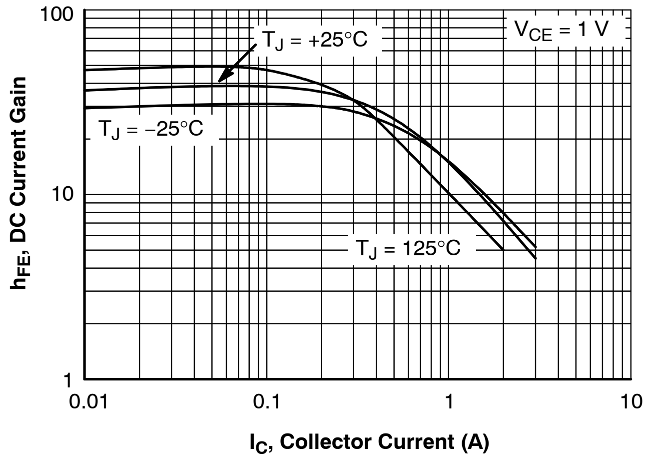


Figure 2. DC Current Gain

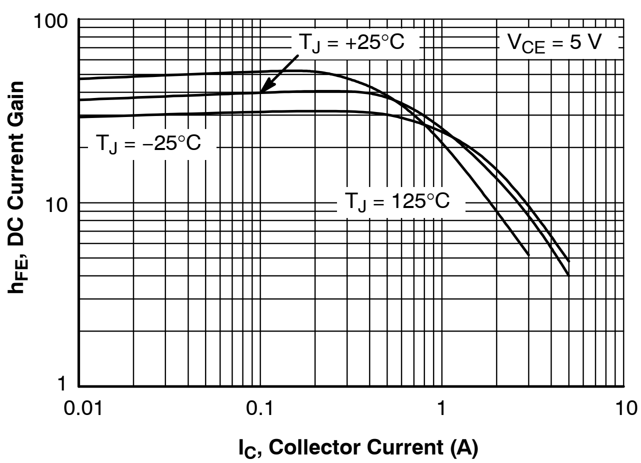


Figure 3. DC Current Gain

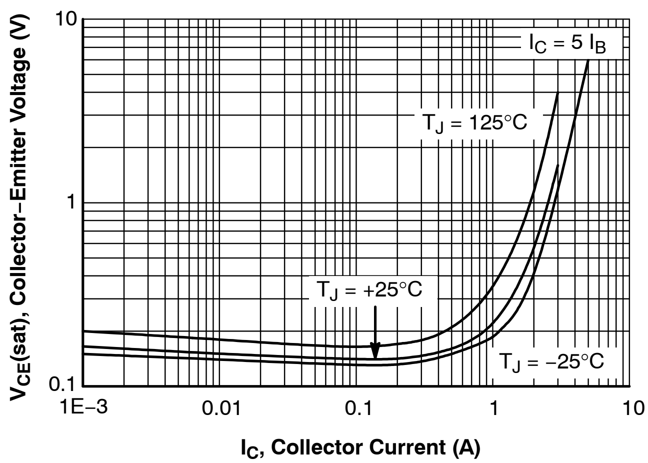


Figure 4. Collector−Emitter Saturation Voltage

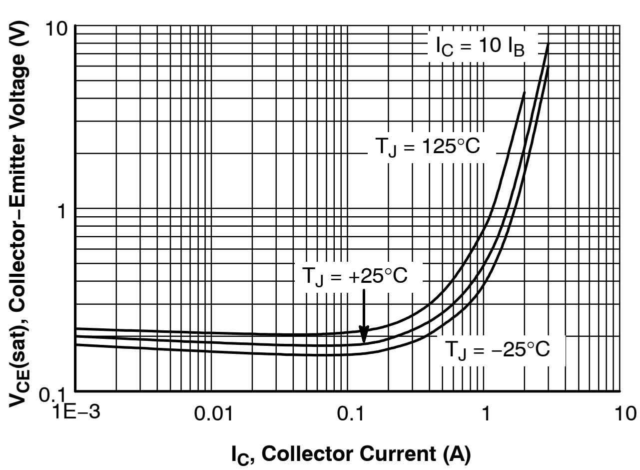


Figure 5. Collector−Emitter Saturation Voltage

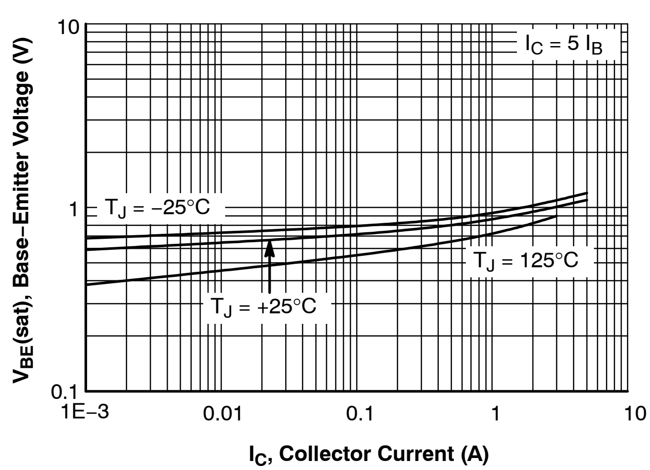


Figure 6. Base−Emitter Saturation Voltage

TYPICAL CHARACTERISTICS (continued)

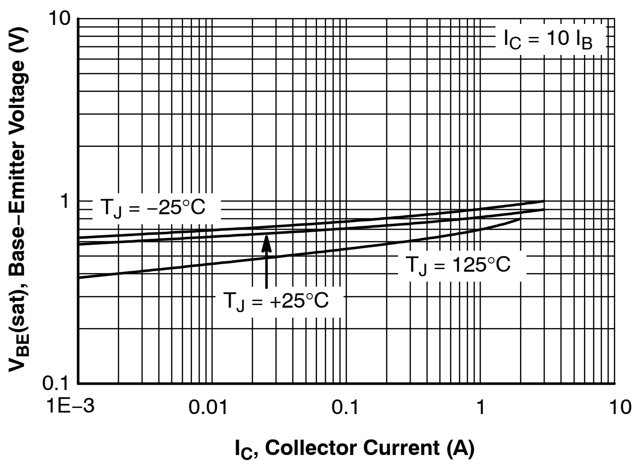


Figure 7. Base−Emitter Saturation Voltage

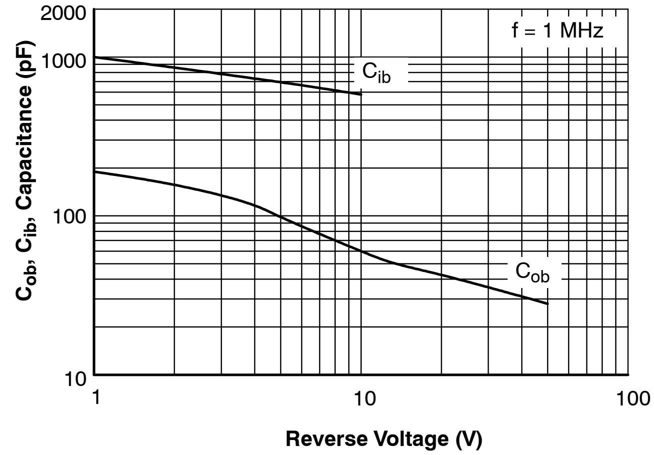


Figure 8. Collector Output Capacitance

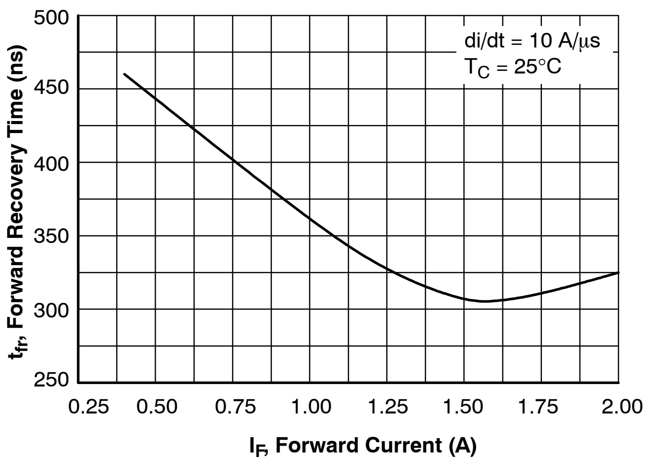


Figure 9. Forward Recovery Time

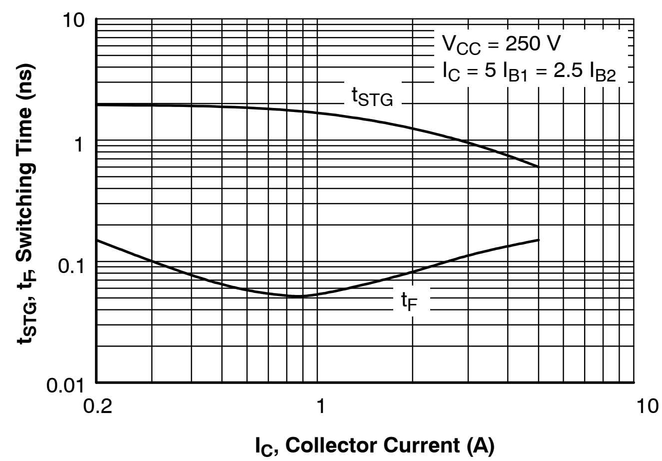


Figure 10. Switching Time

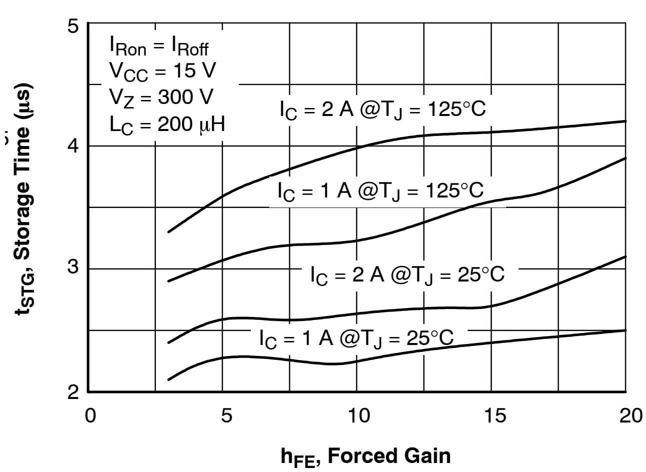


Figure 11. Induction Storage Time

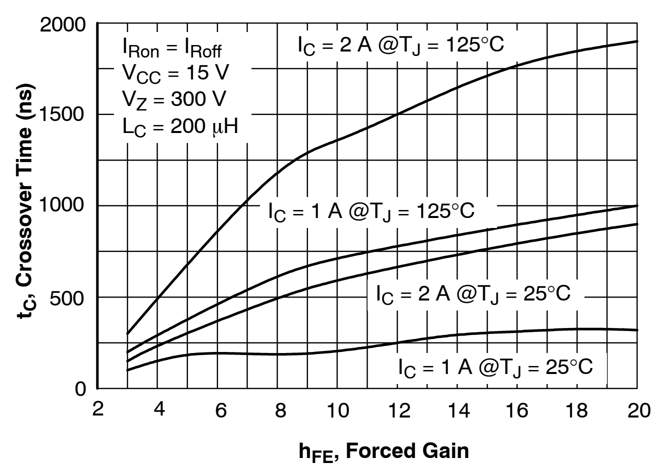


Figure 12. Inductive Crossover Time

TYPICAL CHARACTERISTICS (continued)

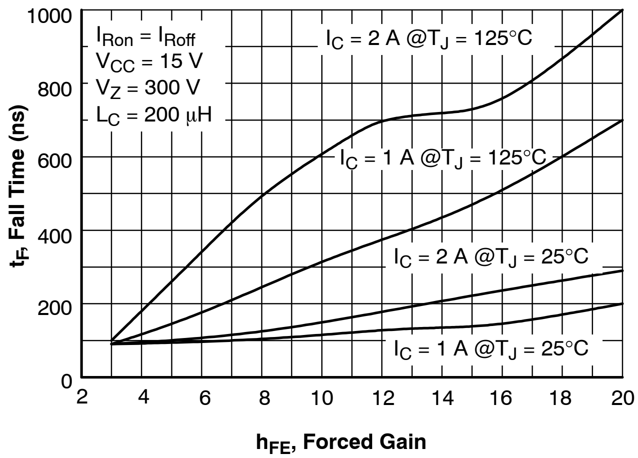


Figure 13. Inductive Fall Time

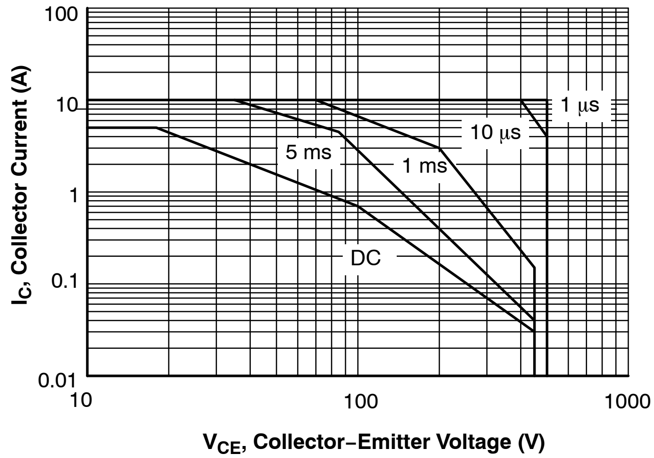


Figure 14. Safe Operating Area

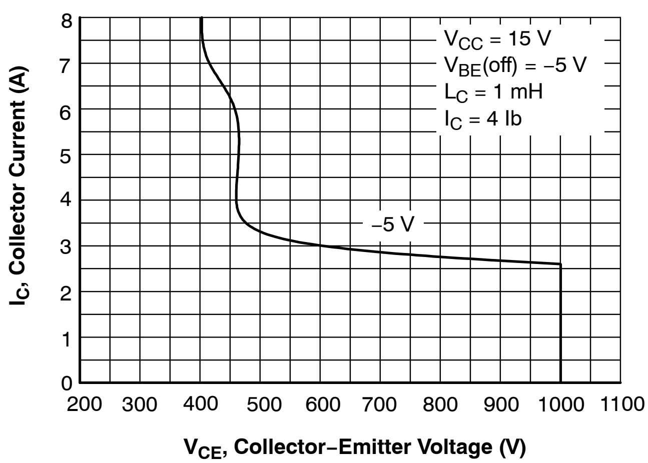


Figure 15. Reverse Bias Safe Operating

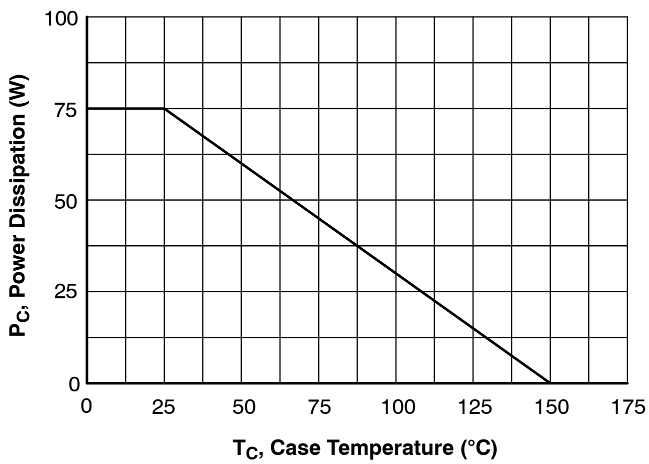


Figure 16. Power Derating

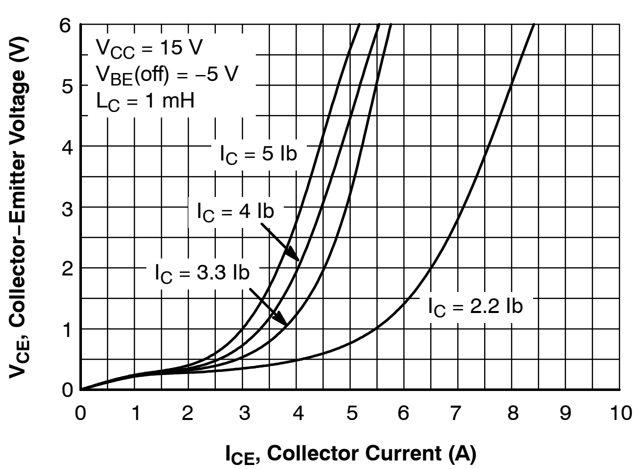


Figure 17. RBSOA Saturation

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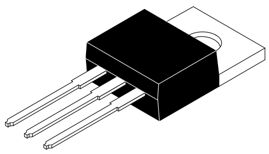
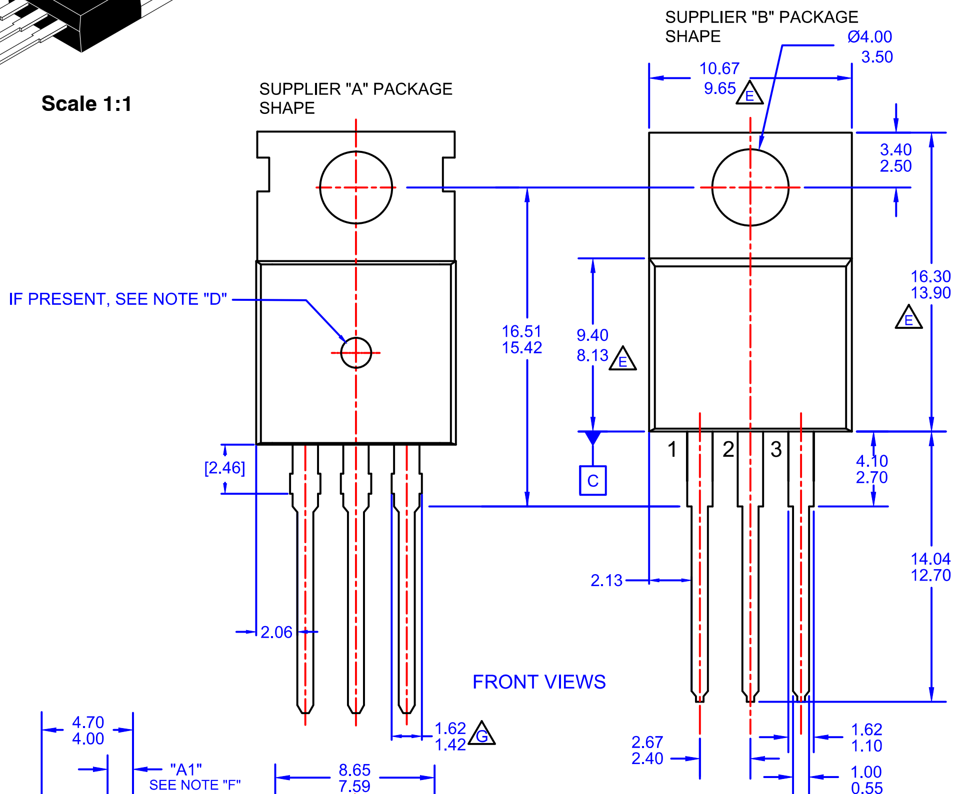
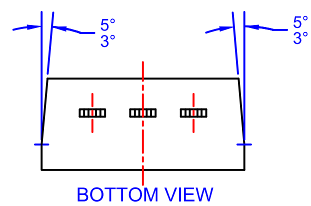


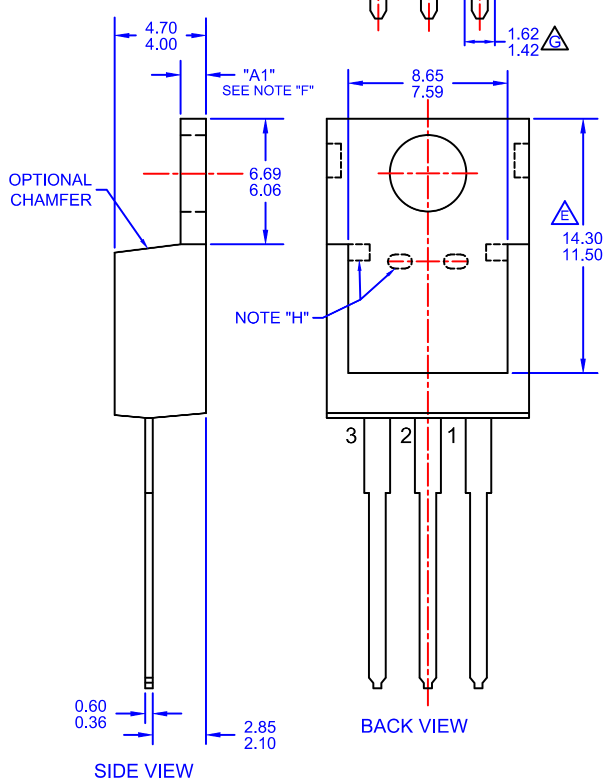
Scale 1:1

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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DESCRIPTION:	TO−220−3LD	PAGE 1 OF 1

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