



TO-251
(IPAK)



TO-252
(DPAK)



Pin Definition:

1. Base
2. Collector
3. Emitter

PRODUCT SUMMARY

BV_{CEO}	400V
BV_{CBO}	700V
I_C	4A
$V_{CE(SAT)}$	1.5V @ $I_C / I_B = 4A / 1A$

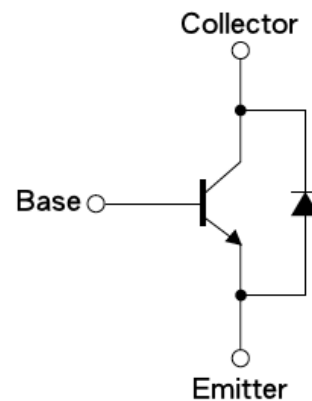
Features

- Build-in Free-wheeling Diode Makes Efficient Anti-saturation Operation
- No Need to Interest an hfe Value Because of Low Variable Storage-time Spread Even Though Corner Spirit Product.
- Low Base Drive Requirement
- Suitable for Half Bridge Light Ballast Application

Structure

- Silicon Triple Diffused Type
- NPN Silicon Transistor
- Integrated Anti-parallel Collector-Emitter Diode

Block Diagram



Ordering Information

Part No.	Package	Packing
TSC5304DCP RO	TO-252	2.5Kpcs / 13" Reel
TSC5304DCH C5	TO-251	75pcs / Tube

Absolute Maximum Rating ($T_a = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Collector-Base Voltage	V_{CBO}	700	V
Collector-Emitter Voltage @ $V_{BE}=0V$	V_{CES}	700	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	9	V
Collector Current	I_C	4	A
Collector Peak Current ($t_p < 5ms$)	I_{CM}	8	A
Base Current	I_B	2	A
Base Peak Current ($t_p < 5ms$)	I_{BM}	4	A
Power Total Dissipation @ $T_c=25^\circ\text{C}$	P_{DTOT}	35	W
Maximum Operating Junction Temperature	T_J	+150	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-55 to +150	$^\circ\text{C}$

Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	$R\theta_{JC}$	3.57	$^{\circ}\text{C/W}$
Thermal Resistance - Junction to Ambient	$R\theta_{JA}$	68	$^{\circ}\text{C/W}$

Electrical Specifications ($T_a = 25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Collector-Base Voltage	$I_C = 1\text{mA}, I_B = 0$	BV_{CBO}	700	--	--	V
Collector-Emitter Breakdown Voltage	$I_C = 10\text{mA}, I_E = 0$	BV_{CEO}	400	--	--	V
Emitter-Base Breakdown Voltage	$I_E = 1\text{mA}, I_C = 0$	BV_{EBO}	9	--	--	V
Collector Cutoff Current	$V_{CB} = 700\text{V}, I_E = 0$	I_{CBO}	--	--	100	μA
Collector Cutoff Current	$V_{CE} = 400\text{V}, I_B = 0$	I_{CEO}	--	--	250	μA
Emitter Cutoff Current	$V_{EB} = 7\text{V}, I_C = 0$	I_{EBO}	--	--	10	μA
Collector-Emitter Saturation Voltage	$I_C = 0.5\text{A}, I_B = 0.1\text{A}$	$V_{CE(SAT)1}$	--	0.25	0.7	V
	$I_C = 1\text{A}, I_B = 0.2\text{A}$	$V_{CE(SAT)2}$	--	0.5	1	
	$I_C = 2.5\text{A}, I_B = 0.5\text{A}$	$V_{CE(SAT)3}$	--	1.2	1.5	
	$I_C = 4\text{A}, I_B = 1\text{A}$	$V_{CE(SAT)4}$	--	0.5	--	
Base-Emitter Saturation Voltage	$I_C = 1\text{A}, I_B = 0.2\text{A}$	$V_{BE(SAT)1}$	--	--	1.1	V
	$I_C = 2\text{A}, I_B = 0.5\text{A}$	$V_{BE(SAT)2}$	--	--	1.2	
DC Current Gain	$V_{CE} = 5\text{V}, I_C = 10\text{mA}$	Hfe	10	--	--	
	$V_{CE} = 5\text{V}, I_C = 1\text{A}$		17	--	37	
	$V_{CE} = 5\text{V}, I_C = 2\text{A}$		12	--	32	
Forward Voltage Drop	$I_F = 2\text{A}$	V_f	--	--	2	V
Turn On Time	$V_{CC} = 250\text{V}, I_C = 1\text{A},$	t_{ON}	--	0.2	0.6	μS
Storage Time	$I_{B1} = I_{B2} = 0.2\text{A}, t_p = 25\mu\text{S}$	t_{STG}	--	3.0	4.5	μS
Fall Time	Duty Cycle < 1%	t_f	--	0.2	0.3	μS

Notes: Pulsed duration = 380 μS , duty cycle $\leq 2\%$

Electrical Characteristics Curve ($T_a = 25^\circ\text{C}$, unless otherwise noted)

Figure 1. Static Characteristics

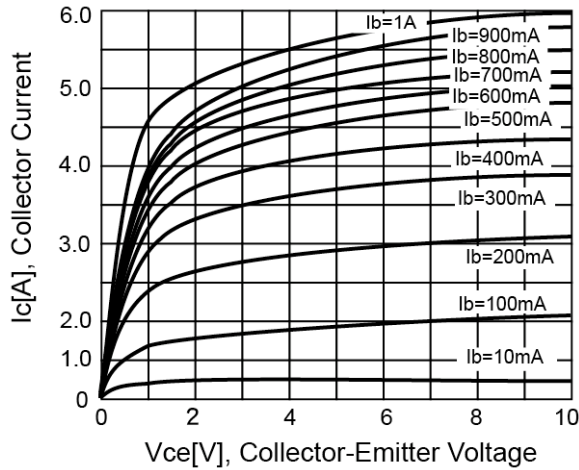


Figure 2. DC Current Gain

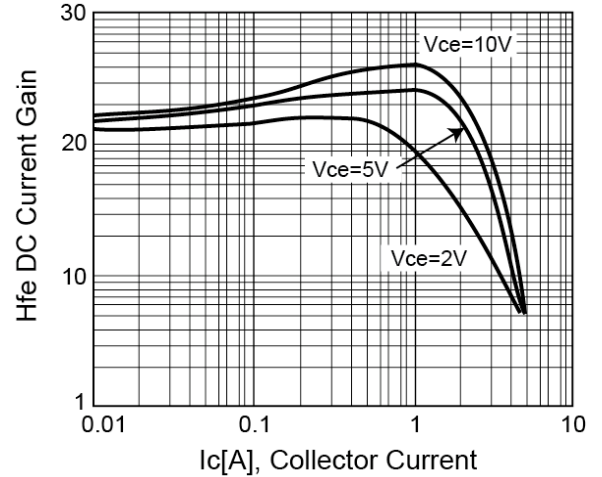


Figure 3. $V_{ce(sat)}$ v.s. $V_{be(sat)}$

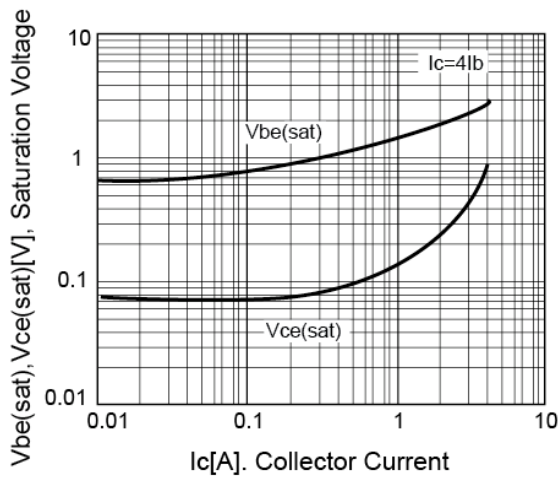


Figure 4. Power Derating

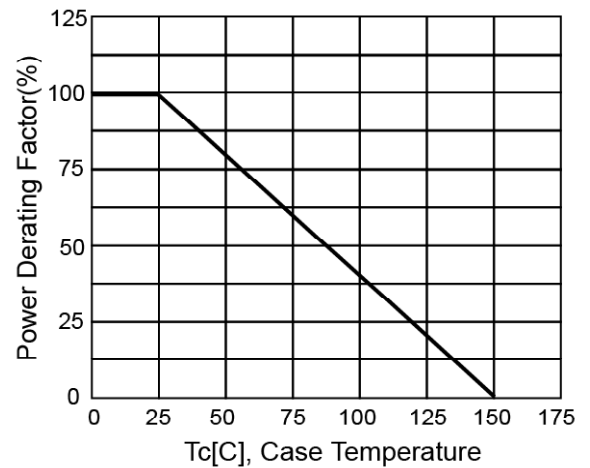


Figure 5. Reverse Bias SOA

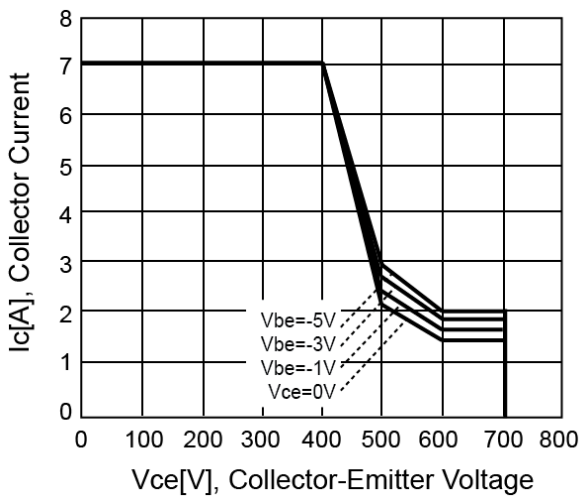
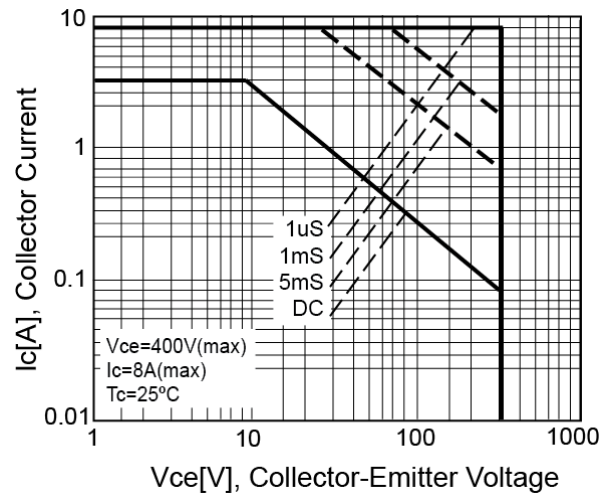
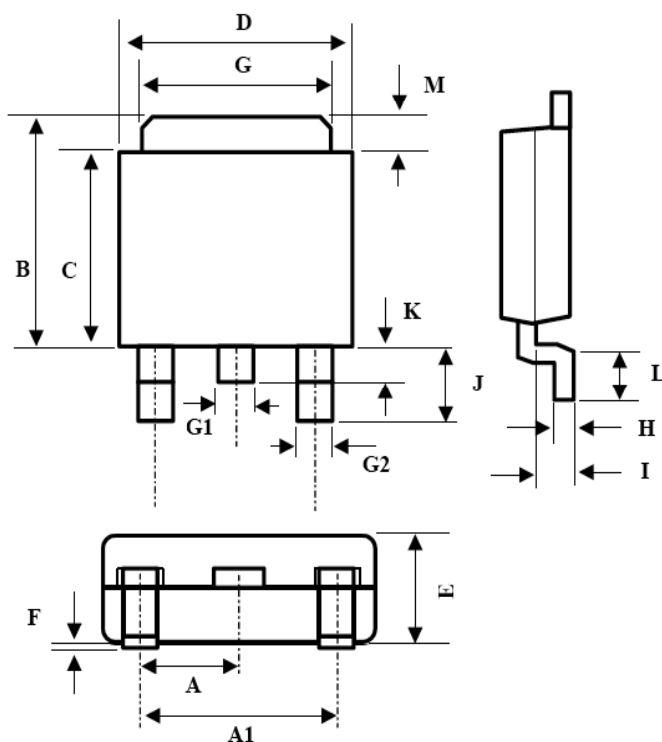


Figure 6. Safety Operating Area

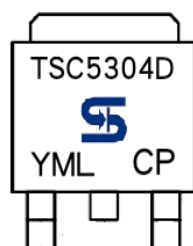


TO-252 Mechanical Drawing



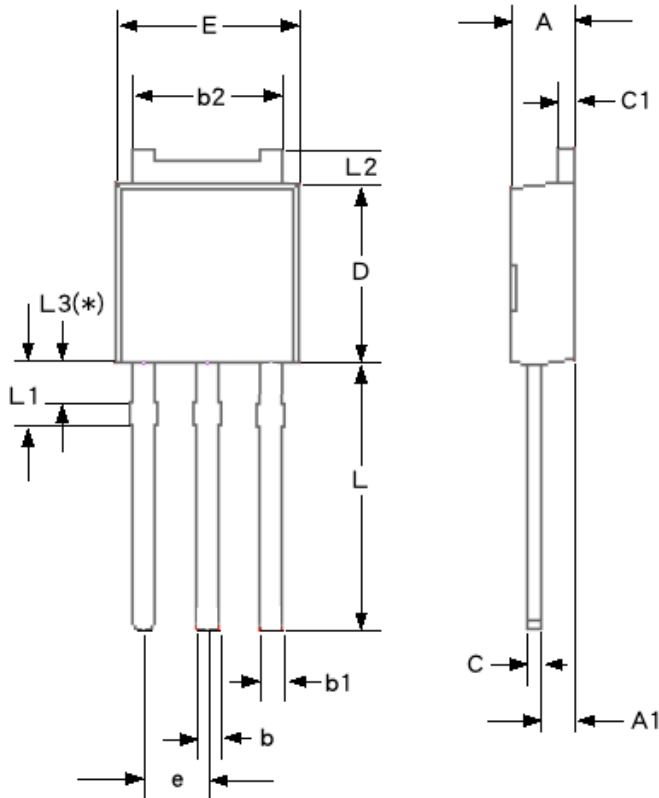
TO-252 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.290 BSC		0.090 BSC	
A1	4.600 BSC		0.180 BSC	
B	7.000	7.200	0.275	0.283
C	6.000	6.200	0.236	0.244
D	6.400	6.604	0.252	0.260
E	2.210	2.387	0.087	0.094
F	0.010	0.127	0.000	0.005
G	5.232	5.436	0.206	0.214
G1	0.666	0.889	0.026	0.035
G2	0.633	0.889	0.025	0.035
H	0.508 REF		0.020 REF	
I	0.900	1.500	0.035	0.059
J	2.743 REF		0.108 REF	
K	0.660	0.940	0.026	0.037
L	1.397	1.651	0.055	0.065
M	1.100 REF		0.043 REF	

Marking Diagram



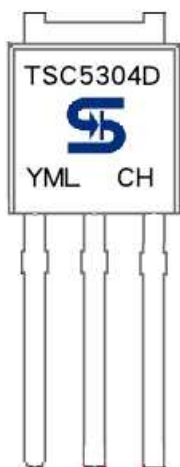
Y = Year Code
M = Month Code
(A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
L = Lot Code

SOT-251 Mechanical Drawing



TO-251 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.190	2.380	0.0862	0.0937
A1	0.890	1.140	0.0350	0.0449
b	0.640	0.890	0.0252	0.0350
b1	0.760	1.140	0.0299	0.0449
b2	5.210	5.460	0.2051	0.2150
C	0.460	0.580	0.0181	0.0228
C1	0.460	0.580	0.0181	0.0228
D	5.970	6.100	0.2350	0.2402
E	6.350	6.730	0.2500	0.2650
e	2.280 BSC		0.0898 BSC	
L	8.890	9.650	0.3500	0.3799
L1	1.910	2.280	0.0752	0.0898
L2	0.890	1.270	0.0350	0.0500
L3	1.150	1.520	0.0453	0.0598

Marking Diagram



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- M** = Month Code
(A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L** = Lot Code

TSC5304D

High Voltage NPN Transistor with Diode

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