



TO-220



Pin Definition:

1. Base
2. Collector
3. Emitter

PRODUCT SUMMARY

V_{CEO}	400V
V_{CBO}	700V
I_C	12A
$V_{CE(SAT)}$	1.5V @ $I_C / I_B = 12A / 3A$

Features

- High Voltage
- High Speed Switching

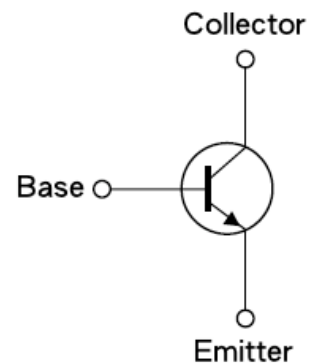
Structure

- Silicon Triple Diffused Type
- NPN Silicon Transistor

Ordering Information

Part No.	Package	Packing
TS13009CZ C0	TO-220	50pcs / Tube

Block Diagram



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

Parameter	Symbol	Limit	Unit
Collector-Base Voltage	V_{CBO}	700V	V
Collector-Emitter Voltage	V_{CEO}	400V	V
Emitter-Base Voltage	V_{EBO}	9	V
Collector Current	DC	12	A
	Pulse	24	
Base Current	DC	6	A
	Pulse	12	
Total Power Dissipation	P_D	100	W
Operating Junction Temperature	T_J	+150	$^{\circ}C$
Operating Junction and Storage Temperature Range	T_{STG}	- 55 to +150	$^{\circ}C$

Note: Single Pulse. $P_w = 300\mu S$, Duty $\leq 2\%$

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	$V_{CE} = 400\text{V}, I_B = 0$	I_{CEO}	--	--	1	mA
Collector Cutoff Current	$V_{CB} = 700\text{V}, I_E = 0$	I_{CBO}	--	--	1	mA
Emitter Cutoff Current	$V_{EB} = 9\text{V}, I_C = 0$	I_{EBO}	--	--	1	mA
Collector-Emitter Saturation Voltage	$I_C = 5\text{A}, I_B = 1\text{A}$	$V_{CE(SAT)1}$	--	--	1	V
	$I_C = 8\text{A}, I_B = 1.6\text{A}$	$V_{CE(SAT)2}$	--	--	1.5	
	$I_C = 12\text{A}, I_B = 3\text{A}$	$V_{CE(SAT)3}$	--	--	3	
Base-Emitter Saturation Voltage	$I_C = 5\text{A}, I_B = 1\text{A}$	$V_{BE(SAT)1}$	--	--	1.2	V
	$I_C = 8\text{A}, I_B = 1.6\text{A}$	$V_{BE(SAT)2}$	--	--	1.6	
DC Current Gain	$V_{CE} = 5\text{V}, I_C = 5\text{A}$	h_{FE}	8	--	40	
	$V_{CE} = 5\text{V}, I_C = 8\text{A}$		6	--	30	
Dynamic						
Frequency	$V_{CE} = 10\text{V}, I_C = 0.5\text{A}$	f_T	4	--	--	MHz
Output Capacitance	$V_{CB} = 10\text{V}, f = 0.1\text{MHz}$	C_{ob}	--	180	--	pF
Resistive Load Switching Time (Ratings)						
Delay Time	$V_{CC} = 125\text{V}, I_C = 8\text{A},$ $I_{B1} = I_{B2} = 1.6\text{A}, t_P = 25\mu\text{S}$ Duty Cycle $\leq 1\%$	t_d	--	0.06	0.1	μS
Rise Time		t_r		0.45	1	μS
Storage Time		t_{STG}	--	2.8	3.3	μS
Fall Time		t_f	--	0.3	0.5	μS

Note: pulse test: pulse width $\leq 300\mu\text{S}$, duty cycle $\leq 2\%$

Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

Figure 1. Static Characteristics

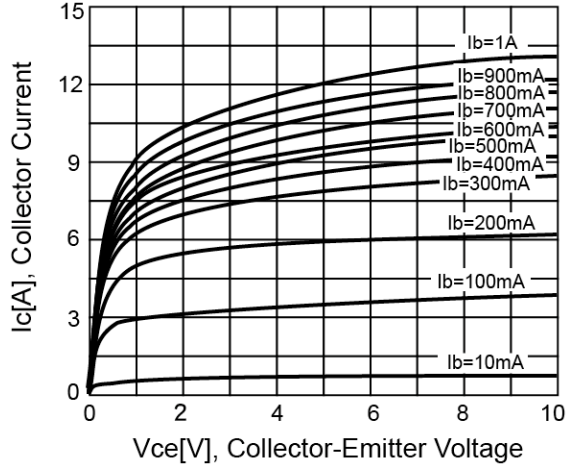


Figure 2. DC Current Gain

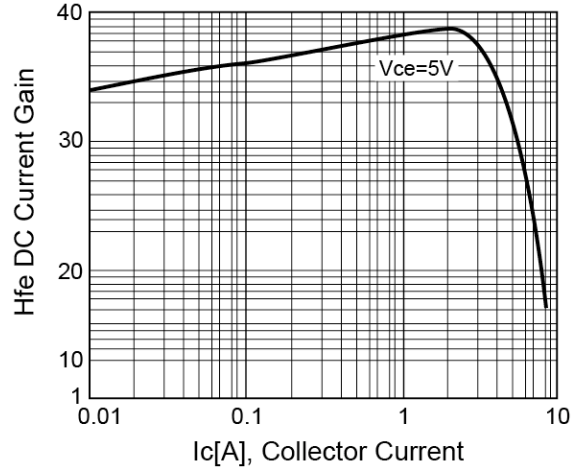


Figure 3. $V_{CE(SAT)}$ v.s. $V_{BE(SAT)}$

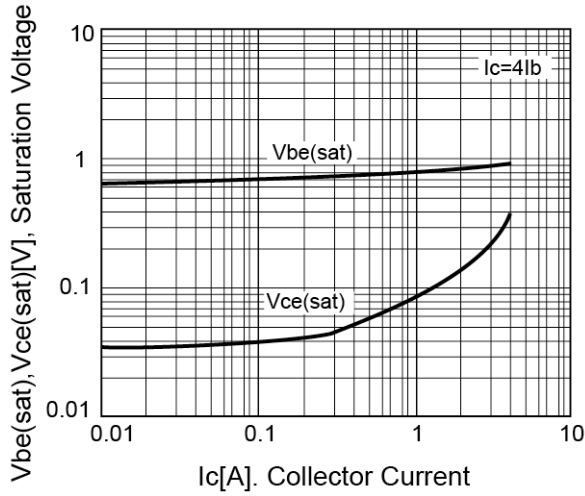
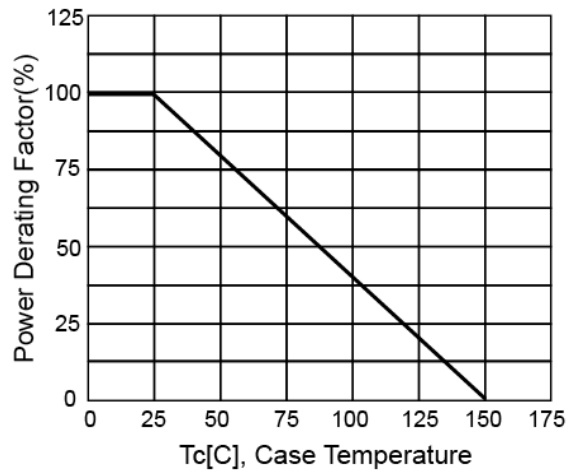
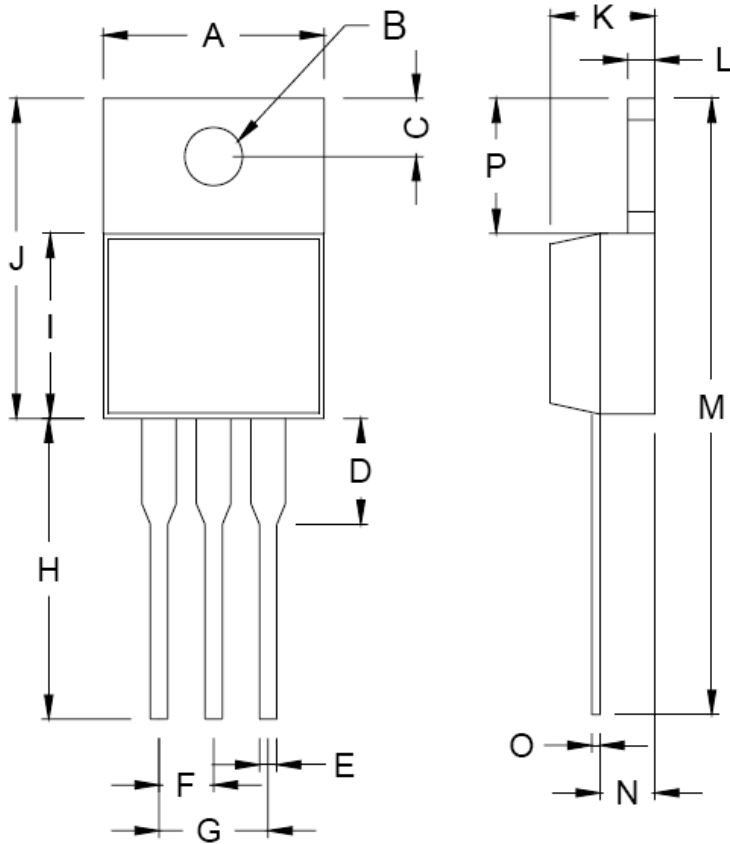


Figure 4. Power Derating

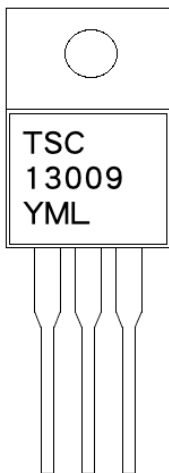


TO-220 Mechanical Drawing



TO-220 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.000	10.500	0.394	0.413
B	3.740	3.910	0.147	0.154
C	2.440	2.940	0.096	0.116
D	-	6.350	-	0.250
E	0.381	1.106	0.015	0.040
F	2.345	2.715	0.092	0.058
G	4.690	5.430	0.092	0.107
H	12.700	14.732	0.500	0.581
J	14.224	16.510	0.560	0.650
K	3.556	4.826	0.140	0.190
L	0.508	1.397	0.020	0.055
M	27.700	29.620	1.060	1.230
N	2.032	2.921	0.080	0.115
O	0.255	0.610	0.010	0.024
P	5.842	6.858	0.230	0.270

Marking Diagram



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

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