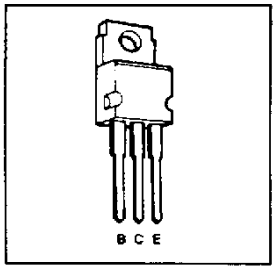
TIP120,TIP121,TIP122
NPN DARLINGTON - CONNECTED SILICON POWER TRANSISTORS

SLPS054 Revised March 1990

- **Designed for Complementary Use with TIP125, TIP126 and TIP127**
- **65 W at 25°C Case Temperature**
- **5 A Continuous Collector Current**
- **Min h_{FE} of 1000 at 3 V, 3 A**
- **Designed for Ignition Systems, Motor Control and Solenoid Driver Applications**



PACKAGE: TO220

Absolute Maximum Ratings at 25°C Case Temperature (unless otherwise noted)

		TIP120	TIP121	TIP122
V_{CBO}	Collector - base voltage (I_E = 0)	60 V	80 V	100 V
V_{CEO}	Collector - emitter voltage (I_B =0)	60 V	80 V	100 V
V_{EBO}	Base - emitter voltage		5 V	
I_C	Continuous collector current		5 A	
I_{CM}	Peak collector current (Note 1)		8 A	
I_B	Continuous base current		0.1 A	
P_{tot}	Continuous device dissipation at (or below) 25°C case temperature (Note 2)		65 W	
P_{tot}	Continuous device dissipation at (or below) 25°C free - air temperature (Note 3)		2 W	
$I_C^2L/2$	Unclamped inductive load energy (Note 4)		50 mJ	
T_j & T_{stg}	Operating junction and storage temperature range		-65°C to + 150°C	
T_L	Lead temperature 3.2 mm from case for 10 seconds		260°C	

NOTES 1. This value applies for $t_w \leq 0.3$ ms, duty cycle $\leq 10\%$.
2. Derate linearly to 150°C case temperature at the rate of 0.52 W/°C.
3. Derate linearly to 150°C free - air temperature at the rate of 16mW/°C.
4. This rating is based on the capability of the transistors to operate safely in a circuit of: L = 20 mH, R_{BE2} = 100 Ω, V_{BE2} = 0 V, R_S = 0.1 Ω, V_{CC} 20 V. Energy = $I_C^2L/2$.

Electrical Characteristics at 25°C Case Temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector - emitter sustaining voltage	I_C = 30 mA (Note 5)	I_B = 0	TIP120 TIP121 TIP122	60 80 100			V
I_{CEO}	Collector - emitter cut - off current	V_{CE} = 30 V V_{CE} = 40 V V_{CE} = 50 V	I_B = 0 I_B = 0 I_B = 0	TIP120 TIP121 TIP122			0.5 0.5 0.5	mA
I_{CBO}	Collector cut - off current	V_{CB} = 60 V V_{CB} = 80 V V_{CB} = 100 V	I_E = 0 I_E = 0 I_E = 0	TIP120 TIP121 TIP122			0.2 0.2 0.2	mA
I_{EBO}	Emitter cut - off current	V_{EB} = 5 V	I_C = 0				2	mA
h_{FE}	Forward current transfer ratio	V_{CE} = 3 V V_{CE} = 3 V	I_C = 0.5 A I_C = 3 A	(Notes 5 & 6)	1000 1000			
$V_{CE(sat)}$	Collector - emitter saturation voltage	I_B = 4 mA I_B = 20 mA	I_C = 3 A I_C = 5 A	(Notes 5 & 6)			2 4	V
V_{BE}	Base - emitter voltage	V_{CE} = 3 V	I_C = 3 A	(Notes 5 & 6)			2.5	V
V_F	Parallel diode forward voltage	I_F = -I_C = 5 A	I_B = 0	(Notes 5 & 6)			3.5	V

Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction - to - case thermal resistance			1.92	°C/W
$R_{\theta JA}$	Junction - to - free - air thermal resistance			62.5	°C/W

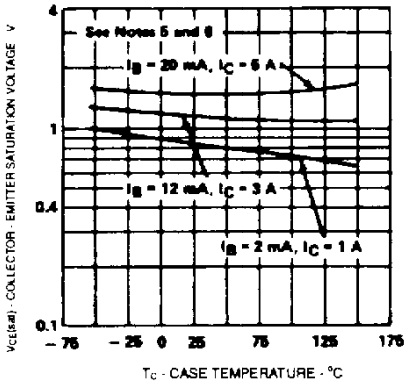
Resistive - Load - Switching Characteristics at 25°C Case Temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS†			MIN	TYP	MAX	UNIT
t_{on}	Turn on time	I_C = 3 A	$I_{B(on)}$ = 12 mA	$I_{B(off)}$ = -12 mA		1.5		µs
t_{off}	Turn off time	$V_{BE(off)}$ = -5 V	R_L = 10 Ω			8.5		µs

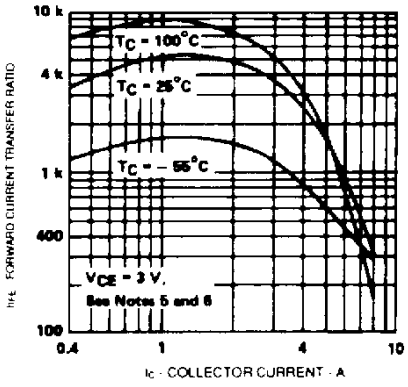
† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.
NOTES 5: These parameters must be measured using pulse techniques. t_w = 300µs, duty cycle ≤ 2%.
6: These parameters must be measured using voltage sensing contacts separate from the current-carrying contacts.

TYPICAL CHARACTERISTICS

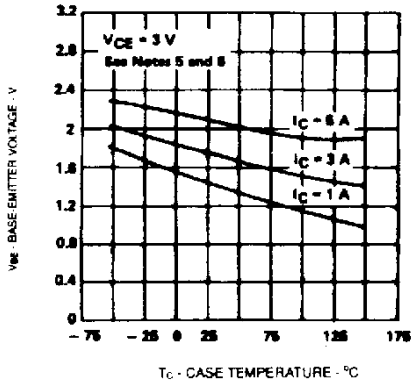
COLLECTOR - EMITTER SATURATION VOLTAGE vs CASE TEMPERATURE



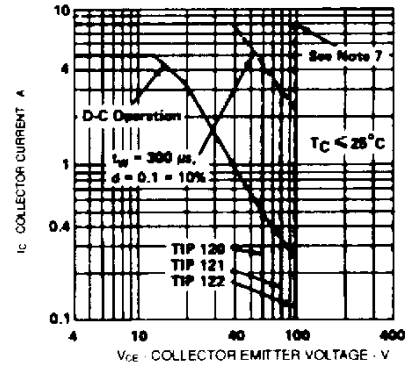
FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT



BASE-EMITTER VOLTAGE vs CASE TEMPERATURE



MAXIMUM FORWARD - BIAS SAFE OPERATING AREA



NOTE: 7 This combination of maximum voltage and current may be achieved only when switching from saturation to cutoff with a clamped inductive load.

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