DIGITRON™ Semiconductors

High-reliability discrete products
and engineering services since 1977

MJ10020, MJ10021

NPN SILICON DARLINGTON TRANSISTORS

FEATURES

- Available as "HR" (high reliability) screened per MIL-PRF-19500, JANTX level. Add "HR" suffix to base part number.
- Available as non-RoHS (Sn/Pb plating), standard, and as RoHS by adding "-PBF" suffix.

MAXIMUM RATINGS

Characteristics	Symbol	MJ10020	MJ10021	Unit
Collector-emitter voltage	V_{CEO}	200	250	Vdc
Collector-emitter voltage	V_{CEV}	300	350	Vdc
Emitter base voltage	V_{EB}	8.0		Vdc
Collector current – continuous **- peak** (1)	I_C I_{CM}	60 100		Adc
Base current – continuous **- peak** (1)	I_B I_{BM}	20 30		Adc
Total power dissipation @ T_C = 25°C **@ T_C = 100°C** **Derate above 25°C**	P_D	250 143 1.43		Watts Watts W/°C
Operating and storage junction temperature range	T_J, T_{stg}	-65 to 200		°C
THERMAL CHARACTERISTICS				
Characteristic	**Symbol**	**Maximum**		**Unit**
Thermal resistance, junction to case	$R_{\Theta JC}$	0.7		°C/W
Maximum lead temperature for soldering purposes: **1/8" from case for 5 seconds**	T_L	275		°C

(1) Pulse test: Pulse width = 5ms, duty cycle ≤ 10%.

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

Characteristics		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-emitter sustaining voltage (I_C = 100mA, I_B = 0)	MJ10020 MJ10021	$V_{CEO(sus)}$	200 250	- -	- -	Vdc
Collector-cutoff current (V_{CEV} = Rated value, $V_{BE(off)}$ = 1.5Vdc) (V_{CEV} = Rated value, $V_{BE(off)}$ = 1.5Vdc, T_C = 150°C)		I_{CEV}	- -	- -	0.25 5.0	mAdc
Collector cutoff current (V_{CE} = Rated V_{CEV}, R_{BE} = 50Ω, T_C = 100°C)		I_{CER}	-	-	5.0	mAdc
Emitter cutoff current (V_{EB} = 2.0V, I_C = 0)		I_{EBO}	-	-	175	mAdc
ON CHARACTERISTICS						
DC Current Gain (I_C = 15Adc, V_{CE} = 5.0V)		h_{FE}	75	-	1000	-
Collector-emitter saturation voltage (I_C = 30Adc, I_B = 1.2Adc) (I_C = 60Adc, I_B = 4.0Adc) (I_C = 30Adc, I_B = 1.2Adc, T_C = 100°C)		$V_{CE(sat)}$	- - -	- - -	2.2 4.0 2.4	Vdc

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

Characteristics		Symbol	Min	Typ	Max	Unit
Base-emitter saturation voltage (I_C = 30Adc, I_B = 1.2Adc) (I_C = 30Adc, I_B = 1.2Adc, T_C = 100°C)		$V_{BE(sat)}$	- -	- -	3.0 3.5	Vdc
Diode forward voltage (I_F = 30Adc)		V_f	-	2.5	5.0	Vdc
DYNAMIC CHARACTERISTICS						
Output capacitance (V_{CB} = 10Vdc, I_E = 0, f_{test} = 1.0kHz)		C_{ob}	175	-	700	pF
SWITCHING CHARACTERISTICS						
Resistive load						
Delay time	(V_{CC} = 175Vdc, I_C = 30A, I_{B1} =1.2 Adc $V_{BE(off)}$ = 5.0V, t_p = 25µs, duty cycle ≤ 2%)	t_d	-	0.02	0.2	µs
Rise time		t_r	-	0.30	1.0	µs
Storage time		t_s	-	1.0	3.5	µs
Fall time		t_f	-	0.07	0.5	µs
Inductive load, clamped						
Storage time	(I_{CM} = 30A(pk), V_{CEM} = 200V, I_{B1} = 1.2A, $V_{BE(off)}$ = 5V, T_C = 100°C)	t_{sv}	-	1.2	3.5	µs
Crossover time		t_c	-	0.45	2.0	µs
Storage time	(I_{CM} = 30A(pk), V_{CEM} = 200V, I_{B1} = 1.2A, $V_{BE(off)}$ = 5V, T_C = 25°C)	t_{sv}	-	0.75	-	µs
Crossover time		t_c	-	0.25	-	µs
Fall time		t_{fi}	-	0.15	-	µs

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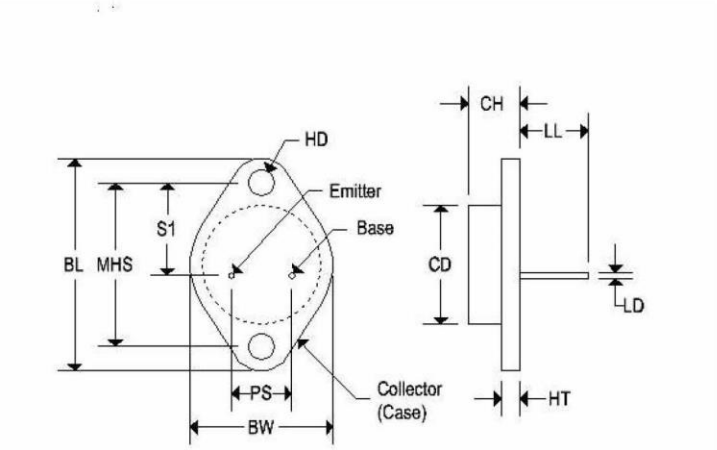
MECHANICAL CHARACTERISTICS

Case:	TO-3
Marking:	Alpha-numeric
Polarity:	See below



	TO-3			
	Inches		Millimeters	
	Min	Max	Min	Max
CD	-	0.875	-	22.220
CH	0.250	0.380	6.860	9.650
HT	0.060	0.135	1.520	3.430
BW	-	1.050	-	26.670
HD	0.131	0.188	3.330	4.780
LD	0.038	0.043	0.970	1.090
LL	0.312	0.500	7.920	12.700
BL	1.550 REF		39.370 REF	
MHS	1.177	1.197	29.900	30.400
PS	0.420	0.440	10.670	11.180
S1	0.655	0.675	16.640	17.150

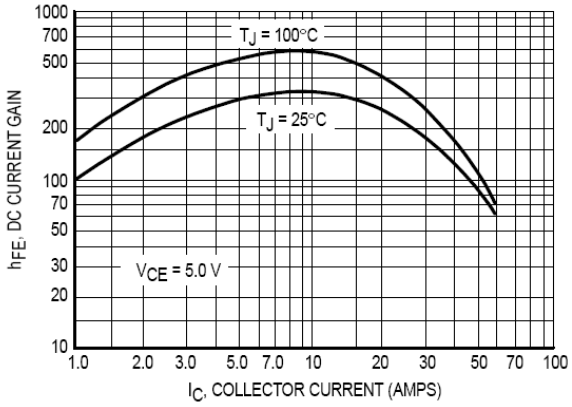


Figure 1. DC Current Gain

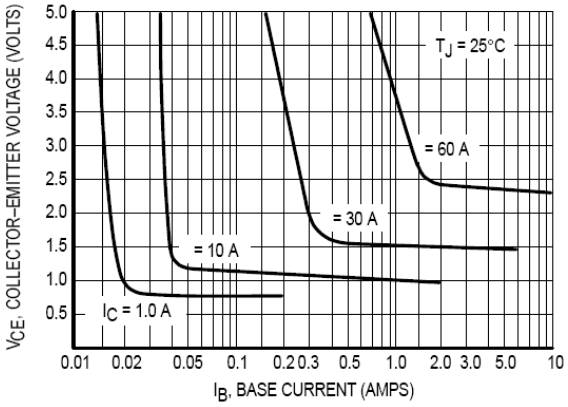


Figure 2. Collector Saturation Region

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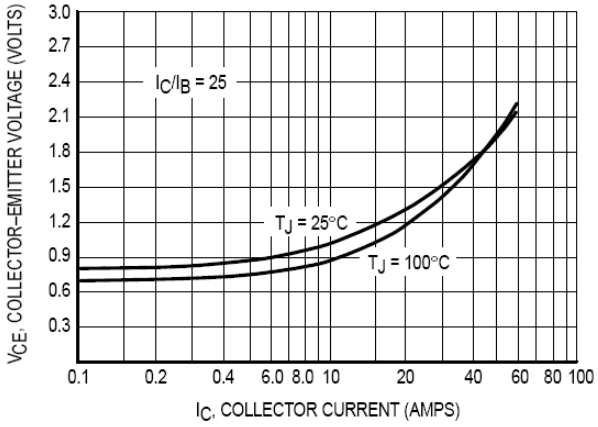

Figure 3. Collector–Emitter Saturation Voltage

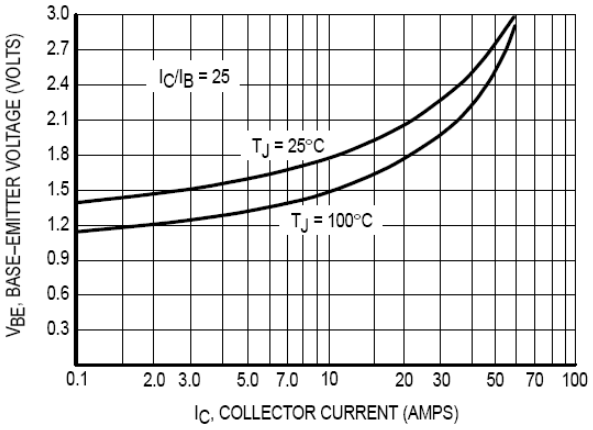

Figure 4. Base–Emitter Voltage

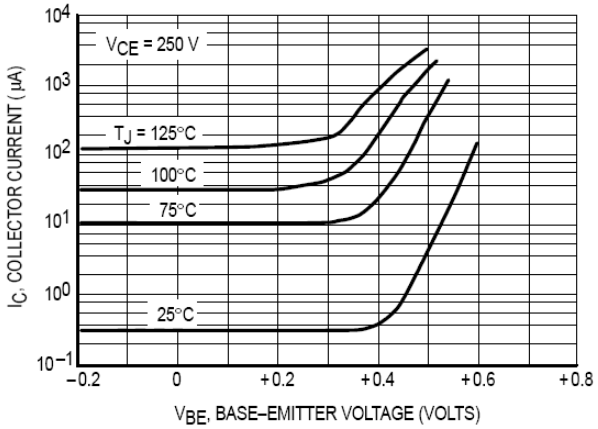

Figure 5. Collector Cutoff Region

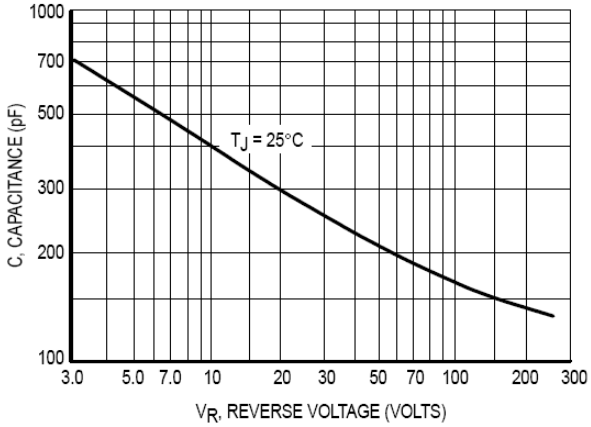

Figure 6. Output Capacitance

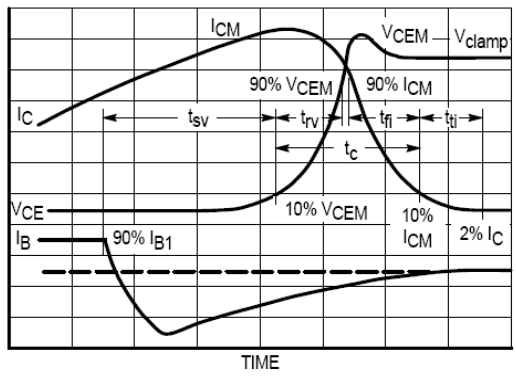

Figure 7. Inductive Switching Measurements

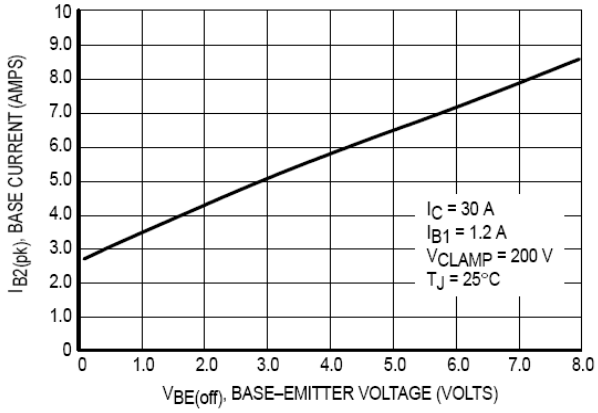

Figure 8. Typical Peak Reverse Base Current

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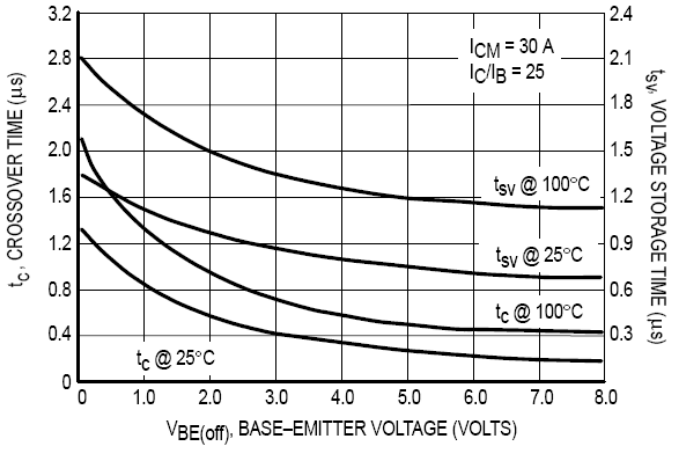

Figure 9. Typical Inductive Switching Times

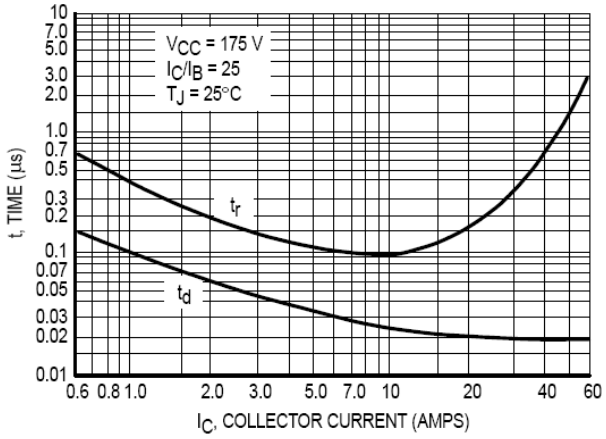

Figure 10. Typical Turn–On Switching Times

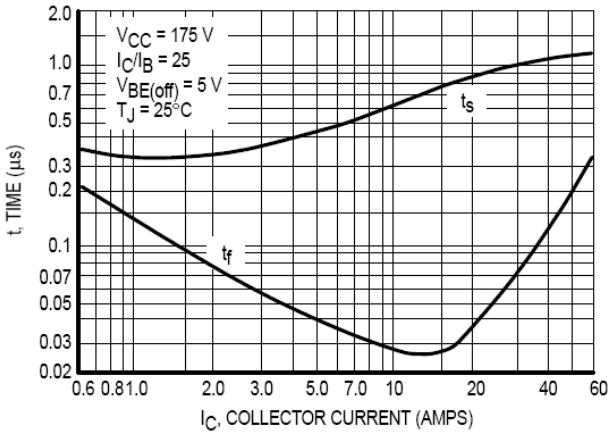

Figure 11. Typical Turn–Off Switching Times

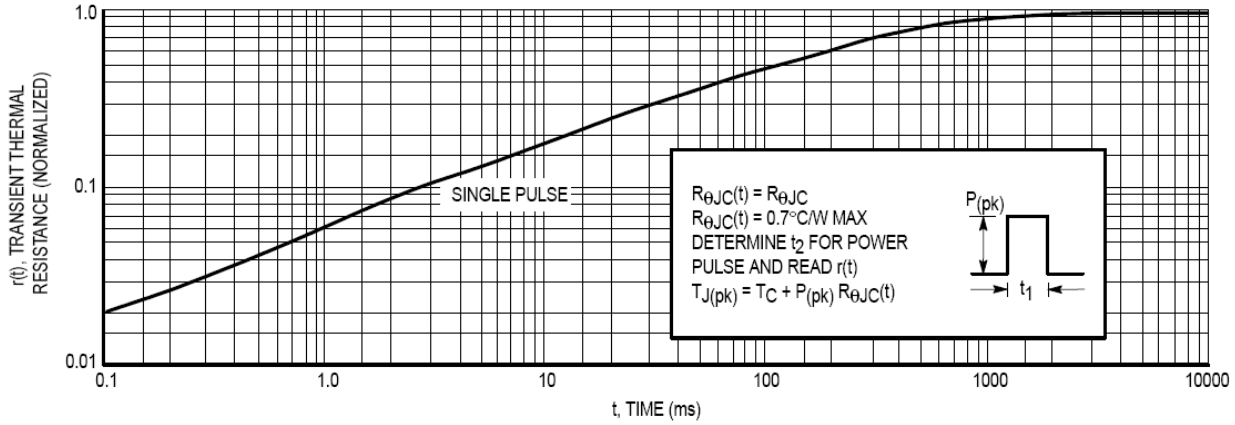

Figure 12. Thermal Response

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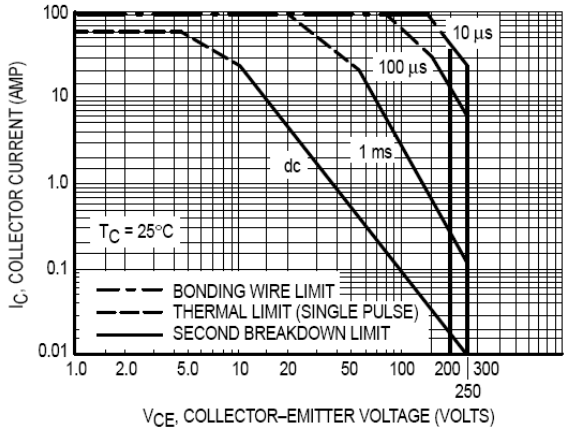

Figure 13. Maximum Forward Bias Safe Operating Area

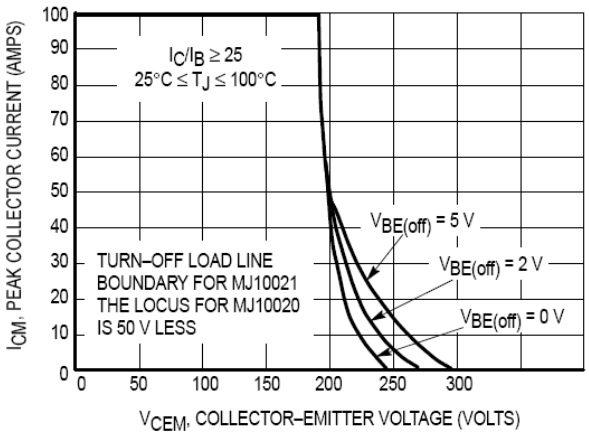

Figure 14. Maximum RBSOA, Reverse Bias Safe Operating Area

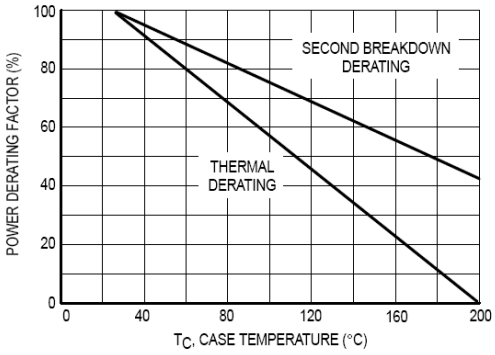

Figure 15. Power Derating