Darlington Transistor
TO-3

Description

Designed for use as output devices in complementary general purpose amplifier applications.

Features:

- High gain darlington performance
- High DC current gain hFE = 1,000 (Minimum) at I_c = 20A
- Monolithic construction with built-in base-emitter shunt resistor

Maximum Ratings

Characteristic	Symbol	MJ11016	Unit
Collector-Emitter Voltage	V_{CEO}	120	
Collector-Base Voltage	V_{CBO}	120	V
Emitter-Base Voltage	V_{EBO}	5	
Collector Current -Continuous -Peak	I_C I_{CM}	30 50	A
Base Current	I_B	1	
Total Power Dissipation @T_C= 25°C Derate above 25°C	P_D	200 1.15	W 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	$R_{\theta jc}$	0.87	°C/W

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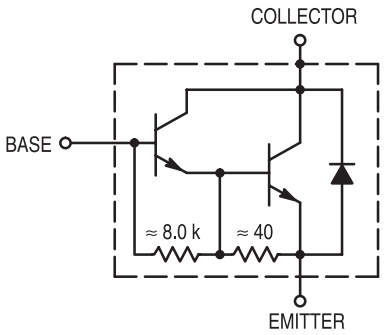
Electrical Characteristics (TC = 25°C unless otherwise noted)

Characteristic	Symbol	Minimum	Maximum	Unit
Off Characteristics				
Collector-Emitter Sustaining Voltage (1) (I_C= 100mA, I_B = 0) MJ11016	$V_{EO\ (sus)}$	120	-	V
Collector Cutoff Current (V_{CE} = 50 V, I_B = 0)	I_{CEO}	-	1	mA
Collector-Emitter Leakage Current (V_{CE} = 120V, R_{BE} = 1kΩ) MJ11016 (V_{CE} = 120V, R_{BE} = 1kΩ, T_C = 125°C) MJ11016	I_{CER}	-	1 5	
Emitter Cutoff Current (V_{EB} = 5V, I_C = 0)	I_{EBO}	-	5	
On Characteristrics (1)				
DC Current Gain (I_C = 20A,V_{CE} = 5V) (I_C = 30A,V_{CE} = 5V)	h_{FE}	1,000 200	-	-
Collector-Emitter Saturation Voltage (I_C = 20A, I_B = 200mA) (I_C = 30A, I_B = 300mA)	$V_{CE\ (sat)}$	-	3 4	V
Base-Emitter Saturation Voltage (I_C = 20A, I_B = 200mA) (I_C = 30A, I_B = 300mA)	$V_{BE\ (sat)}$	-	3.5 5	
Dynamic Characteristics				
Small-Signal Current Gain (I_C = 10A, V_{CE} = 3V, f =1MHz)	$\|h_{fe}\|$	4	-	-

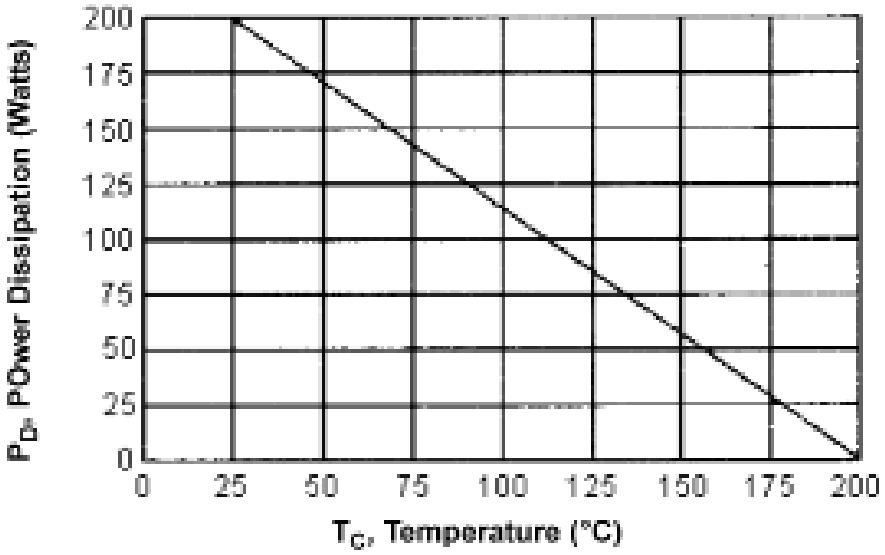
(1) Pulse Test : Pulse Width = 300μs, Duty Cycle 2%.
(2) $f_T = |h_{fe}| \cdot {}^{f}test$.

Internal Schematic Diagram

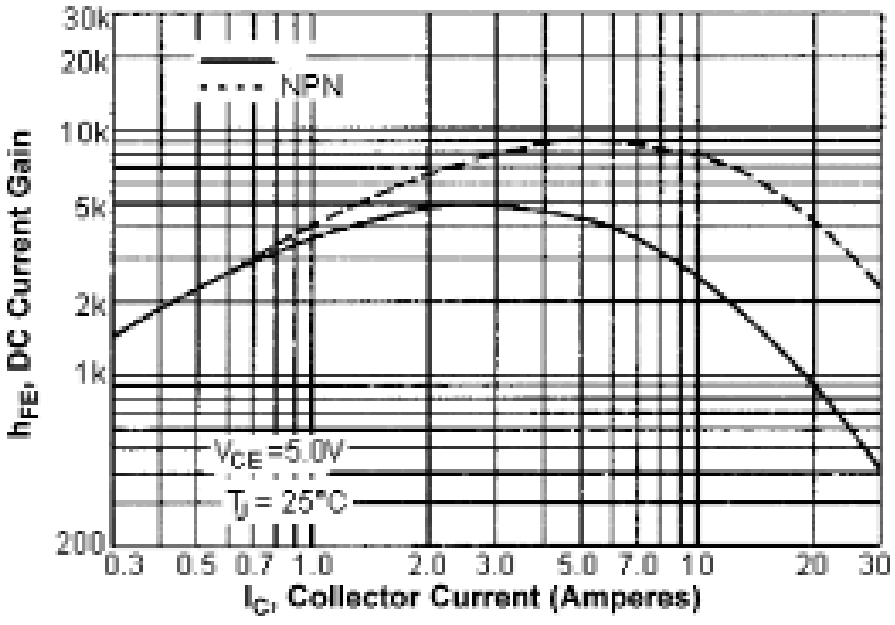
NPN
MJ11016

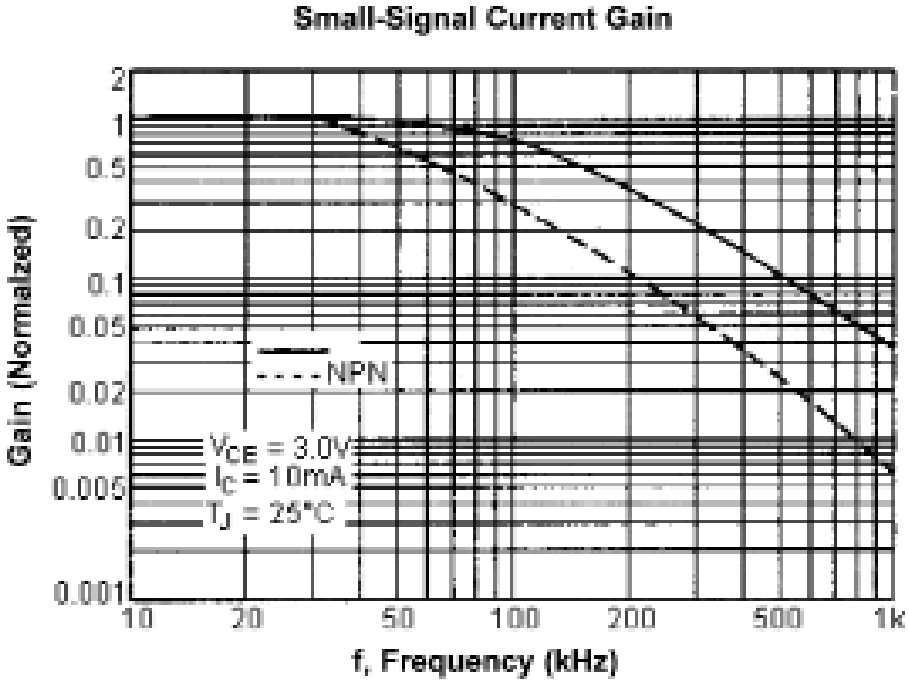


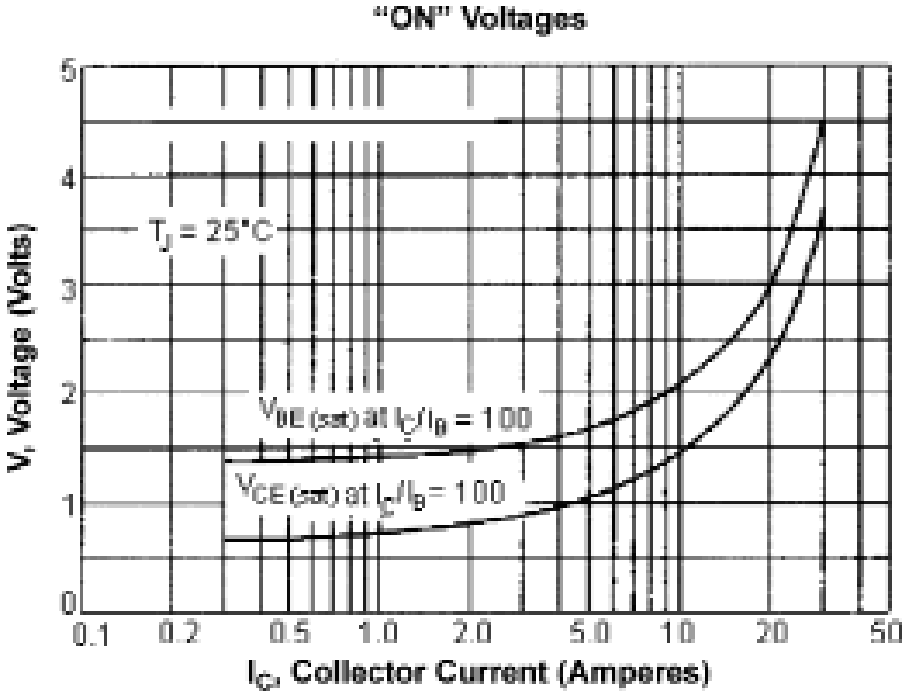
Power Derating



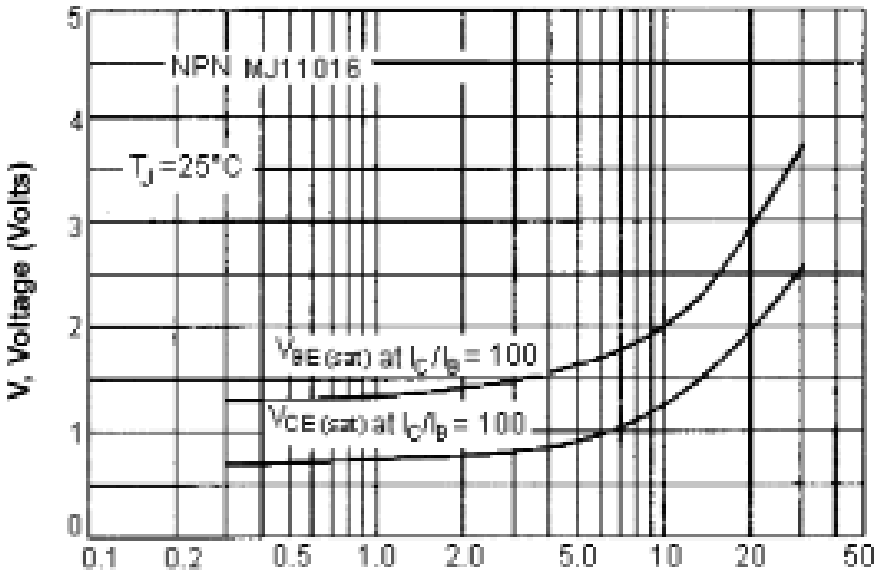
DC Current Gain



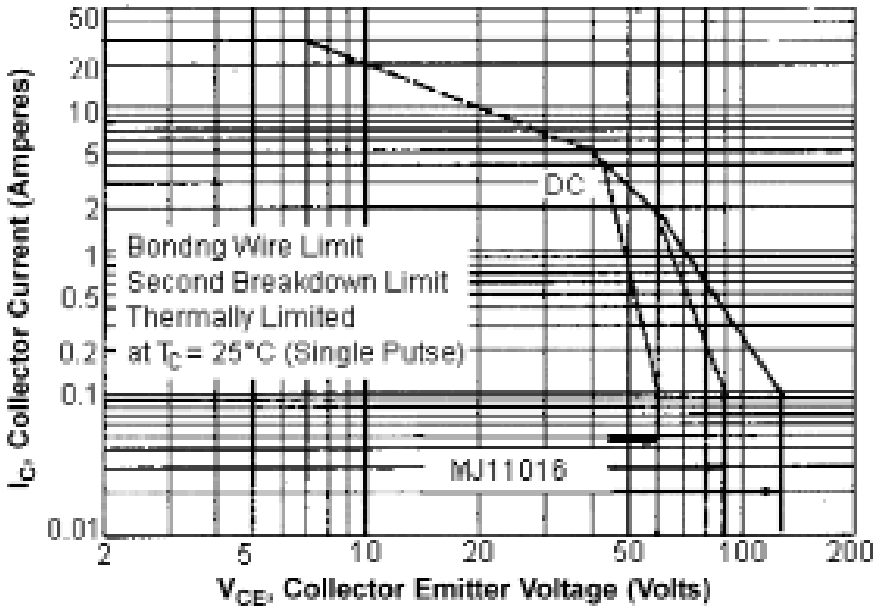

Small-Signal Current Gain
Gain (Normalized)
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.001
NPN
V_{CE} = 3.0V
I_C = 10mA
T_J = 25°C
10
20
50
100
200
500
1k
f, Frequency (kHz)


"ON" Voltages
V_{γ}, Voltage (Volts)
5
4
3
2
1
0
T_J = 25°C
$V_{BE(sat)}$ at I_C/I_B = 100
$V_{CE(sat)}$ at I_C/I_B = 100
0.1
0.2
0.5
1.0
2.0
5.0
10
20
50
I_C, Collector Current (Amperes)

"ON" Voltages



Active-Region Safe Operating Area (SOA)



There are two limitation on the power handling ability of a transistor: average junction temperature and second breakdown safe operating area curves indicate I_C-V_{CE} limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation than curves indicate.

The data of SOA curve is base on $T_{J(PK)}$ = 200°C; TC is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(PK)} \leq$ 200°C. At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

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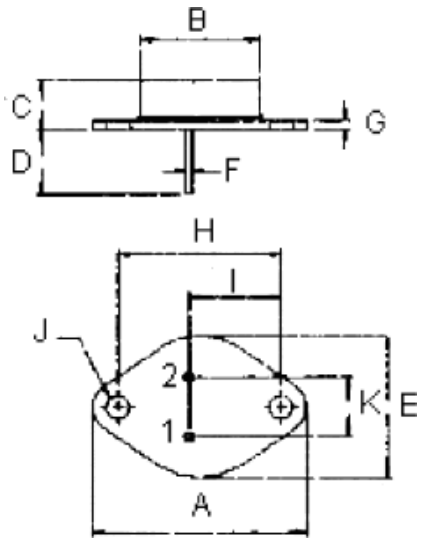

Dimensions	Minimum	Maximum
A	38.75	39.96
B	19.28	22.23
C	7.96	9.28
D	11.18	12.19
E	25.2	26.67
F	0.92	1.09
G	1.38	1.62
H	29.9	30.4
I	16.64	17.3
J	3.88	4.36
K	10.67	11.18

Pin 1. Base
2. Emitter
3. Collector (Case)

Part Number Table

Description	Part Number
Darlington Transistor, TO-3	MJ11016