

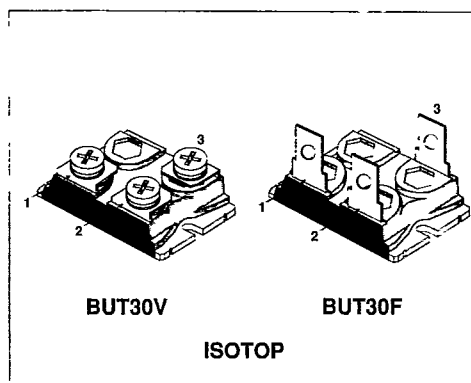
T.33-15

NPN TRANSISTOR POWER MODULE

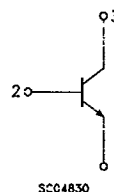
- HIGH CURRENT POWER BIPOLAR MODULE
- VERY LOW R_{th} JUNCTION CASE
- SPECIFIED ACCIDENTAL OVERLOAD AREAS
- ISOLATED CASE (2500V RMS)
- EASY TO MOUNT
- LOW INTERNAL PARASITIC INDUCTANCE

INDUSTRIAL APPLICATIONS:

- MOTOR CONTROL
- SMPS & UPS
- DC/DC & DC/AC CONVERTERS



INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CEV}	Collector-Emitter Voltage ($V_{BE} = -5$ V)	200	V
$V_{CEO(sus)}$	Collector-Emitter Voltage ($I_B = 0$)	125	V
V_{EBO}	Emitter-Base Voltage ($I_C = 0$)	7	V
I_C	Collector Current	100	A
I_{CM}	Collector Peak Current ($t_p = 10$ ms)	150	A
I_B	Base Current	20	A
I_{BM}	Base Peak Current ($t_p = 10$ ms)	30	A
P_{tot}	Total Dissipation at $T_c = 25$ °C	250	W
T_{stg}	Storage Temperature	-55 to 150	°C
T_J	Max. Operating Junction Temperature	150	°C
V_{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V

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THERMAL DATA

T-33-15

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.5	°C/W
R_{thc-h}	Thermal Resistance Case-heatsink With Conductive Grease Applied	Max	0.05	°C/W

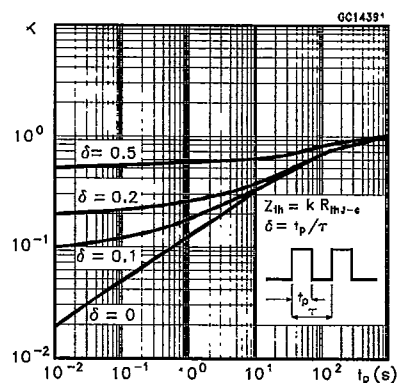
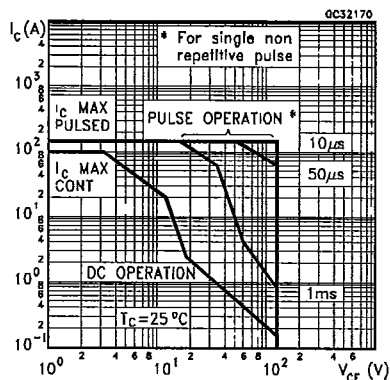
ELECTRICAL CHARACTERISTICS ($T_{case} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector Cut-off Current ($R_{BE} = 5\ \Omega$)	$V_{CE} = V_{CEV}$ $V_{BE} = V_{CEV}$ $T_J = 100\text{ }^{\circ}\text{C}$			1 5	mA mA
I_{CEV}	Collector Cut-off Current ($V_{BE} = -5$)	$V_{CE} = V_{CEV}$ $V_{BE} = V_{CEV}$ $T_J = 100\text{ }^{\circ}\text{C}$			1 4	mA mA
I_{EBO}	Emitter Cut-off Current ($I_C = 0$)	$V_{EB} = 5\text{ V}$			1	mA
$V_{CEQ(SUS)}^*$	Collector-Emitter Sustaining Voltage	$I_C = 0.2\text{ A}$ $L = 25\text{ mH}$ $V_{clamp} = 125\text{ V}$	125			V
h_{FE}^*	DC Current Gain	$I_C = 100\text{ A}$ $V_{CE} = 5\text{ V}$		2.7		
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 50\text{ A}$ $I_B = 2.5\text{ A}$ $I_C = 50\text{ A}$ $I_B = 2.5\text{ A}$ $T_J = 100\text{ }^{\circ}\text{C}$ $I_C = 100\text{ A}$ $I_B = 10\text{ A}$ $I_C = 100\text{ A}$ $I_B = 10\text{ A}$ $T_J = 100\text{ }^{\circ}\text{C}$		0.45 0.55 0.7 0.9	0.9 1.2 0.9 1.5	V V V V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 50\text{ A}$ $I_B = 2.5\text{ A}$ $I_C = 50\text{ A}$ $I_B = 2.5\text{ A}$ $T_J = 100\text{ }^{\circ}\text{C}$ $I_C = 100\text{ A}$ $I_B = 10\text{ A}$ $I_C = 100\text{ A}$ $I_B = 10\text{ A}$ $T_J = 100\text{ }^{\circ}\text{C}$		1.15 1.1 1.45 1.55	1.4 1.4 1.8 1.9	V V V V
di_C/dt	Rate of Rise of On-state Collector	$V_{CC} = 300\text{ V}$ $R_C = 0$ $t_p = 3\text{ }\mu\text{s}$ $I_{B1} = 15\text{ A}$ $T_J = 100\text{ }^{\circ}\text{C}$	270	350		A/ μs
$V_{CE(3\text{ }\mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\text{ V}$ $R_C = 1\ \Omega$ $I_{B1} = 15\text{ A}$ $T_J = 100\text{ }^{\circ}\text{C}$		2.7	3.5	V
$V_{CE(5\text{ }\mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\text{ V}$ $R_C = 1\ \Omega$ $I_{B1} = 15\text{ A}$ $T_J = 100\text{ }^{\circ}\text{C}$		2	2.5	V
t_s	Storage Time	$I_C = 100\text{ A}$ $V_{CC} = 90\text{ V}$		1	2	μs
t_f	Fall Time	$V_{BB} = -5\text{ V}$ $R_{BB} = 0.47\ \Omega$		0.1	0.2	μs
t_c	Cross-over Time	$V_{clamp} = 125\text{ V}$ $I_{B1} = 10\text{ A}$ $L = 45\text{ }\mu\text{H}$ $T_J = 100\text{ }^{\circ}\text{C}$		0.2	0.35	μs
V_{CEW}	Maximum Collector Emitter Voltage Without Snubber	$I_{C\text{Woff}} = 150\text{ A}$ $I_{B1} = 10\text{ A}$ $V_{BB} = -5\text{ V}$ $V_{CC} = 90\text{ V}$ $L = 30\text{ }\mu\text{H}$ $R_{BB} = 0.5\ \Omega$ $T_J = 125\text{ }^{\circ}\text{C}$	125			V

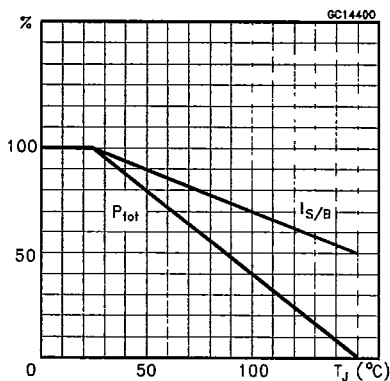
* Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

Safe Operating Areas

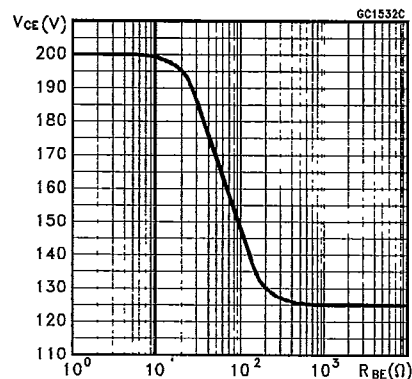
Thermal Impedance



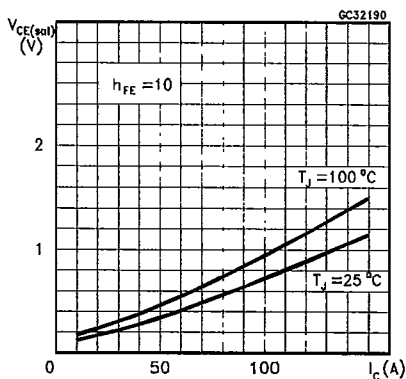
Derating Curve



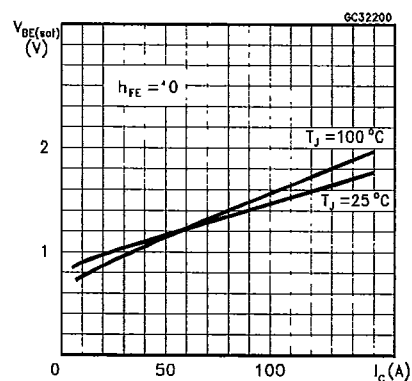
Collector-Emitter Voltage Versus Base-Emitter Resistance



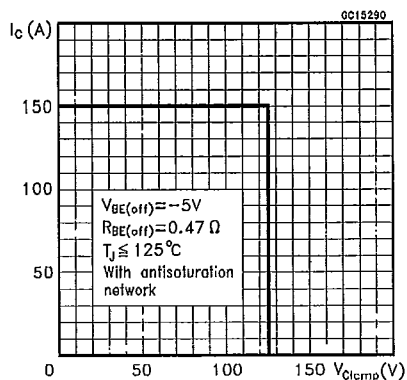
Collector-Emitter Saturation Voltage



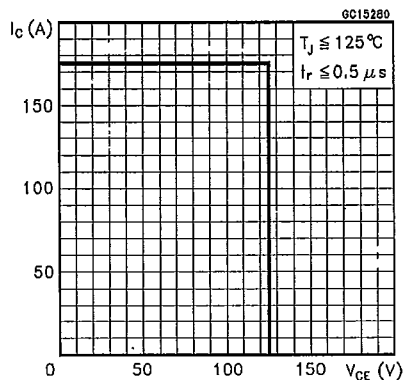
Base-Emitter Saturation Voltage



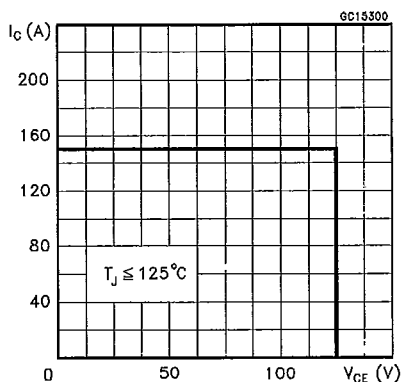
Reverse Biased SOA



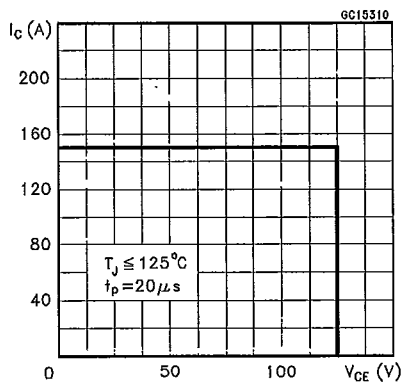
Forward Biased SOA



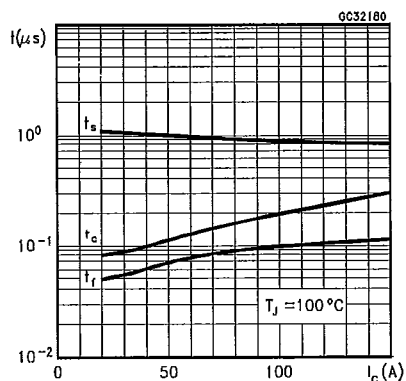
Reverse Biased AOA



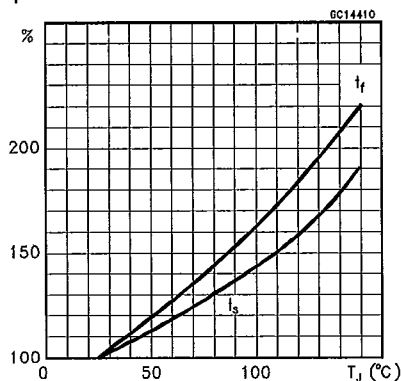
Forward Biased AOA



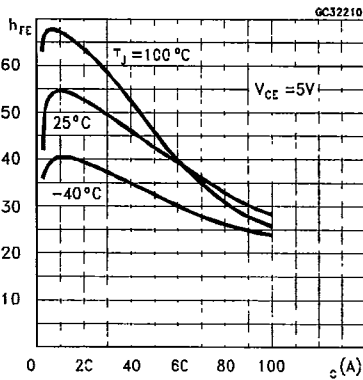
Switching Times Inductive Load



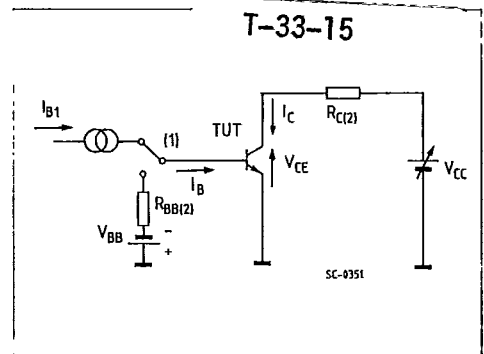
Switching Times Inductive Load Versus Temperature



DC Current Gain

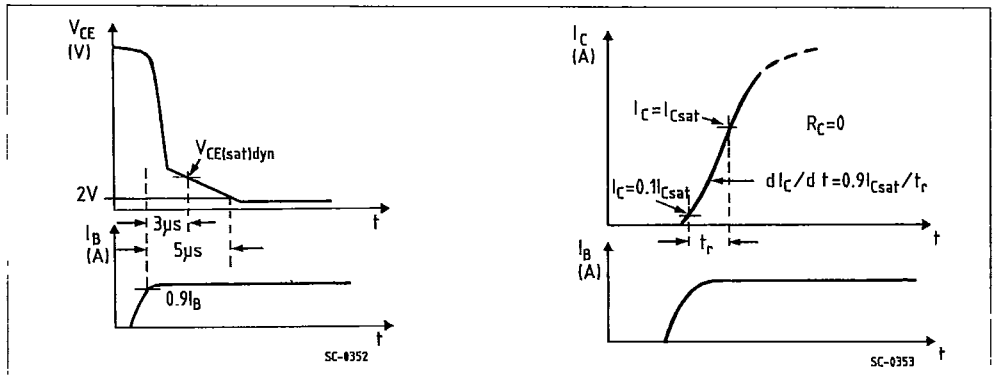


Turn-on Switching Test Circuit

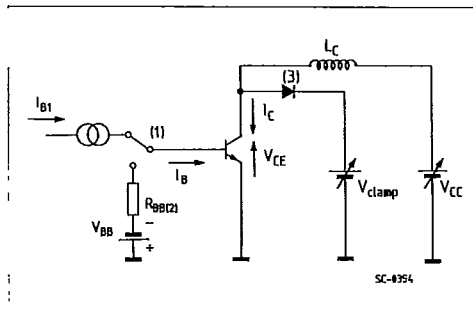


(1) Fast electronic switch (2) Non-inductive load

Turn-on Switching Waveforms

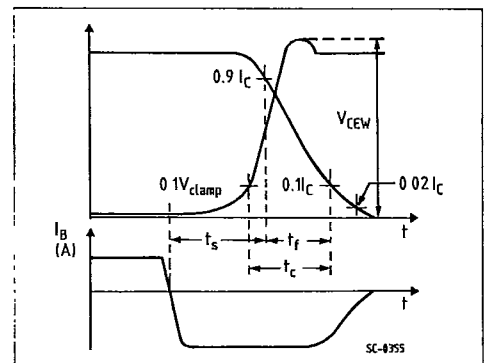


Turn-off Switching Test Circuit



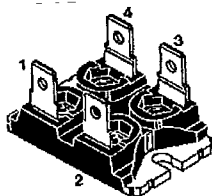
(1) Fast electronic switch (2) Non-inductive load (3) Fast recovery rectifier

Turn-off Switching Waveforms

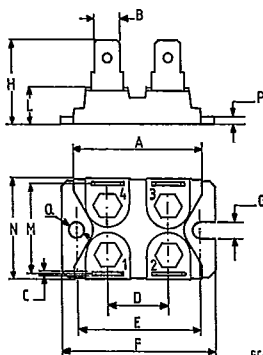


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T-91-20



ISOTOP
Fast-on version
 sales types with the suffix F

MECHANICAL DATA

FC-9309

	DIMENSIONS			
	mm		Inches	
	min.	max	min.	max
A	31.5	31.7	1.240	1.248
B	6.2	6.4	0.244	0.252
C	0.75	0.85	0.029	0.033
D	14.9	15.1	0.586	0.590
E	30.1	30.3	1.185	1.193
F	38	38.2	1.496	1.503
G	4	—	0.157	—
H	20.3	20.7	0.799	0.815
L	8.9	9.1	0.350	0.358
M	22.4	23	0.881	0.905
N	25.2	25.4	0.992	1.000
P	1.95	2.05	0.076	0.080
Q	4	—	0.157	—

PIN CONNECTIONS**MOSFET**

pin 1: Source pin 2: Gate
 pin 3: Drain pin 4: Source sensings

DARLINGTON

pin 1: Emitter pin 2: Base1
 pin 3: Collector pin 4: Base 2

TRANSISTOR

pin 1: Emitter pin 2: Base
 pin 3: Collector pin 4: Emitter sensing

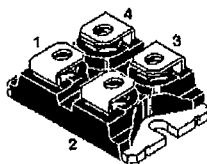
Torque: Mounting $1.3 \pm 0.2 \text{ N} \cdot \text{m}$ (max)

Weight: Package 25.5 g

Note: The mechanical data are the same for the 3 pin version
 (4th pin missing)

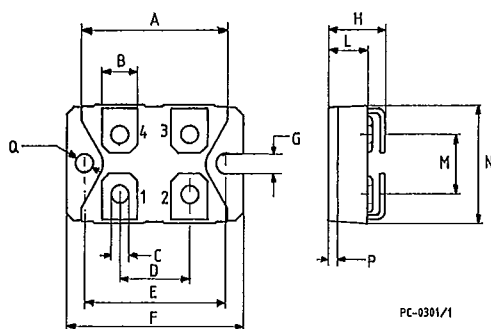
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T-91-20



ISOTOP
Screw version
sales types with the suffix V

MECHANICAL DATA



PC-0301/1

PIN CONNECTIONS

MOSFET

pin 1: Source pin 2: Gate
pin 3: Drain pin 4: Source sensings

DARLINGTON

pin 1: Emitter pin 2: Base1
pin 3: Collector pin 4: Base 2

TRANSISTOR

pin 1: Emitter pin 2: Base
pin 3: Collector pin 4: Emitter sensing

Torque: Terminal $1.3 \pm 0.2 \text{ N} \cdot \text{m}$ (max)
Mounting $1.3 \pm 0.2 \text{ N} \cdot \text{m}$ (max)

Weight: Package 29 g
4 Screws: 7.5 g

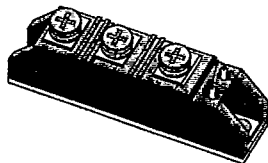
Note: The mechanical data are the same for the 3 pin version
(4th pin missing)

	DIMENSIONS			
	mm		Inches	
	min.	max	min.	max
A	31.5	31.7	1.240	1.248
B	7.8	8.2	0.307	0.322
C	4.1	4.3	0.161	0.169
D	14.9	15.1	0.586	0.590
E	30.1	30.3	1.185	1.193
F	38	38.2	1.496	1.503
G	4	—	0.157	—
H	11.8	12.2	0.464	0.480
L	8.9	9.1	0.350	0.358
M	12.6	12.8	0.496	0.503
N	25.2	25.4	0.992	1.000
P	1.95	2.05	0.076	0.080
Q	4	—	0.157	—

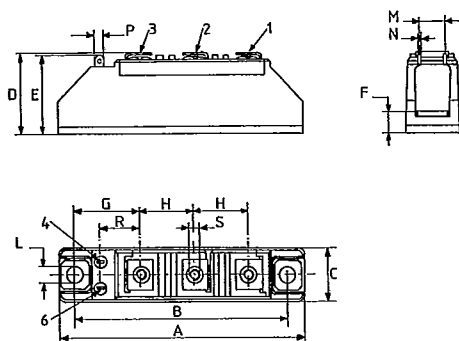
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T-91-20

TRANSPACK (TO-240)



MECHANICAL DATA



	DIMENSIONS			
	mm		Inches	
	min.	max	min.	max
A	91.5	92.5	3.602	3.641
B	79.75	80.25	3.140	3.160
C	19.5	20.55	0.767	0.809
D	29.00	31.00	1.141	1.220
E	28.8	30	1.134	1.181
F	8.5 typ.		0.334 typ.	
G	24.4 typ.		0.960 typ.	
H	19.5	20.5	0.767	0.807
L	6.2 typ.		0.244 typ.	
M	8.95	11.05	0.352	0.435
N	0.78	0.84	0.030	0.033
P	2.72	2.87	0.107	0.113
R	14	—	0.551	—
S	M5			

Torque: Terminal $2.2 \pm 0.5 \text{ N} \cdot \text{m}$ (max)
 Mounting $3.5 \pm 0.5 \text{ N} \cdot \text{m}$ (max)

Weight: Package 110 g
 Accessory 21 g

Note: The mechanical data are the same for the 2 power pin version (either pin 1 or pin 2 missing)