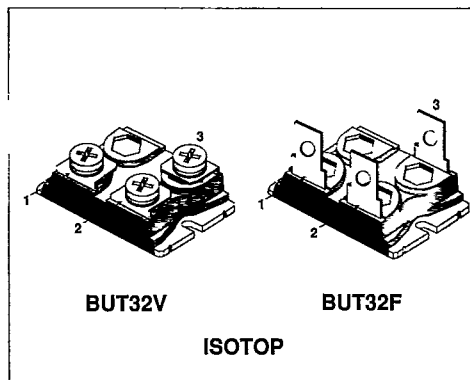


## NPN TRANSISTOR POWER MODULE

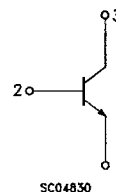
- HIGH CURRENT POWER BIPOLAR MODULE
- VERY LOW  $R_{th}$  JUNCTION CASE
- SPECIFIED ACCIDENTAL OVERLOAD AREAS
- ISOLATED CASE (2500V RMS)
- EASY TO MOUNT
- LOW INTERNAL PARASITIC INDUCTANCE

### 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)	400	V
$V_{CEO(sus)}$	Collector-Emitter Voltage ( $I_B = 0$ )	300	V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	7	V
$I_C$	Collector Current	80	A
$I_{CM}$	Collector Peak Current ( $t_p = 10$ ms)	120	A
$I_B$	Base Current	16	A
$I_{BM}$	Base Peak Current ( $t_p = 10$ ms)	24	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

## 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

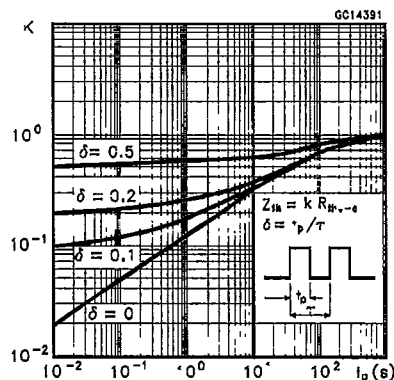
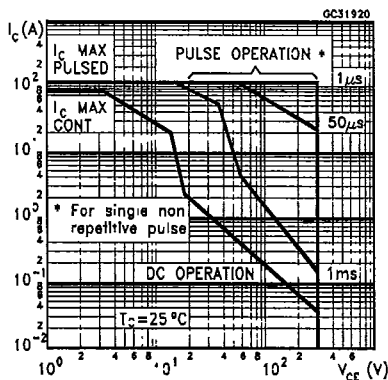
ELECTRICAL CHARACTERISTICS ( $T_{case} = 25\text{ °C}$  unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CER}$	Collector Cut-off Current ( $R_{BE} = 5\ \Omega$ )	$V_{CE} = V_{CEV}$			1	mA
		$V_{CE} = V_{CEV}$ $T_j = 100\text{ °C}$			5	mA
$I_{CEV}$	Collector Cut-off Current ( $V_{BE} = -5$ )	$V_{CE} = V_{CEV}$			1	mA
		$V_{CE} = V_{CEV}$ $T_j = 100\text{ °C}$			4	mA
$I_{EBO}$	Emitter Cut-off Current ( $I_C = 0$ )	$V_{EB} = 5\text{ V}$			1	mA
$V_{CEO(SUS)}^*$	Collector-Emitter Sustaining Voltage	$I_C = 0.2\text{ A}$ $L = 25\text{ mH}$ $V_{olamp} = 300\text{ V}$	300			V
$h_{FE}^*$	DC Current Gain	$I_C = 40\text{ A}$ $V_{CE} = 5\text{ V}$		16		
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 40\text{ A}$ $I_B = 4\text{ A}$		0.6	0.9	V
		$I_C = 40\text{ A}$ $I_B = 4\text{ A}$ $T_j = 100\text{ °C}$		1.2	1.9	V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 40\text{ A}$ $I_B = 4\text{ A}$		1.12	1.3	V
		$I_C = 40\text{ A}$ $I_B = 4\text{ A}$ $T_j = 100\text{ °C}$		1.1	1.3	V
$di_C/dt$	Rate of Rise of On-state Collector	$V_{CC} = 300\text{ V}$ $R_C = 0$ $t_p = 3\ \mu\text{s}$ $I_{B1} = 6\text{ A}$ $T_j = 100\text{ °C}$	120	180		A/ $\mu\text{s}$
$V_{CE(3\ \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\text{ V}$ $R_C = 6.2\ \Omega$ $I_{B1} = 6\text{ A}$ $T_j = 100\text{ °C}$		3	6	V
$V_{CE(5\ \mu\text{s})}$	Collector-Emitter Dynamic Voltage	$V_{CC} = 300\text{ V}$ $R_C = 6.2\ \Omega$ $I_{B1} = 6\text{ A}$ $T_j = 100\text{ °C}$		1.8	3	V
$t_s$	Storage Time	$I_C = 40\text{ A}$ $V_{CC} = 250\text{ V}$		1.9	3	$\mu\text{s}$
$t_f$	Fall Time	$V_{BB} = -5\text{ V}$ $R_{BB} = 0.6\ \Omega$		0.12	0.4	$\mu\text{s}$
$t_c$	Cross-over Time	$V_{olamp} = 300\text{ V}$ $I_{B1} = 4\text{ A}$ $L = 0.3\text{ mH}$ $T_j = 100\text{ °C}$		0.35	0.7	$\mu\text{s}$
$V_{CEW}$	Maximum Collector Emitter Voltage Without Snubber	$I_{CWolf} = 60\text{ A}$ $I_{B1} = 4\text{ A}$ $V_{BB} = -5\text{ V}$ $V_{CC} = 50\text{ V}$ $L = 42\ \mu\text{H}$ $R_{BB} = 0.6\ \Omega$ $T_j = 125\text{ °C}$	300			V

\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

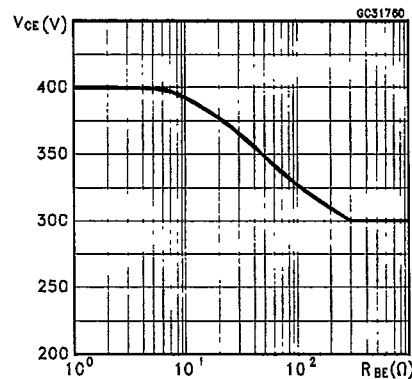
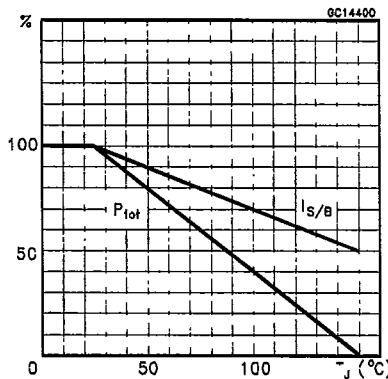
Safe Operating Areas

Thermal Impedance



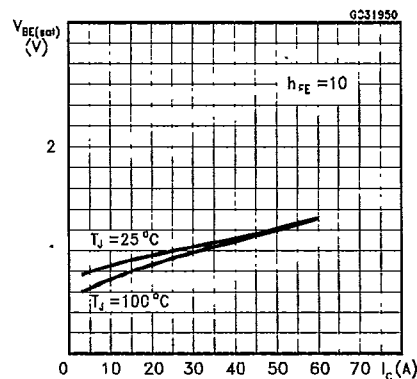
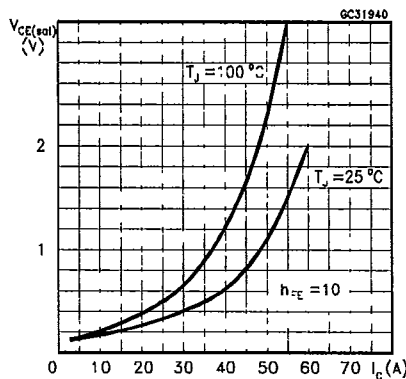
Derating Curve

Collector-Emitter Voltage Versus Base-Emitter Resistance



Collector-Emitter Saturation Voltage

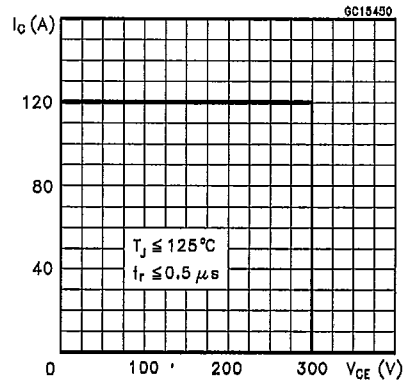
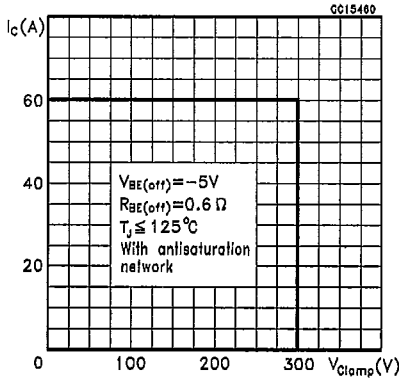
Base-Emitter Saturation Voltage



Reverse Biased SOA

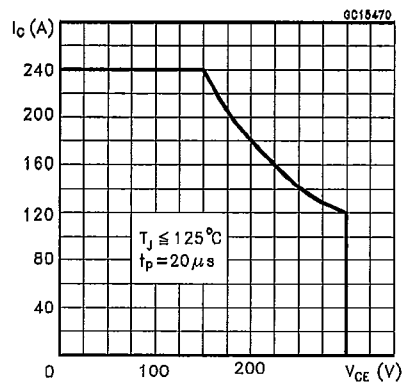
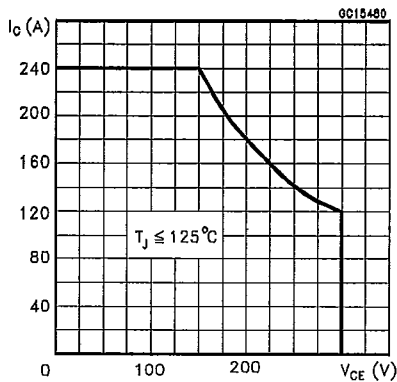
Forward Biased SOA

T-33-15



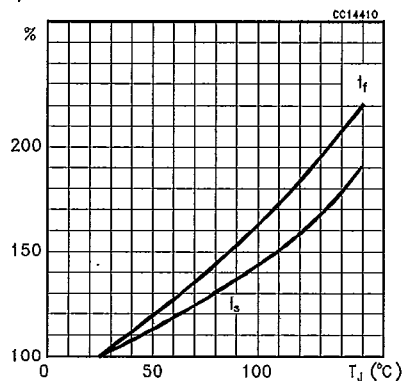
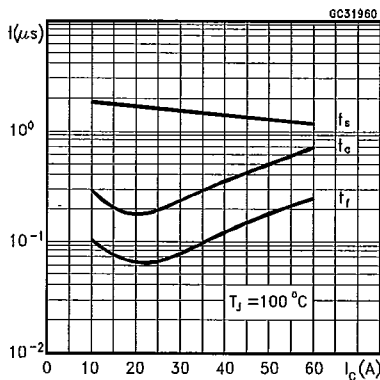
Reverse Biased AOA

Forward Biased AOA

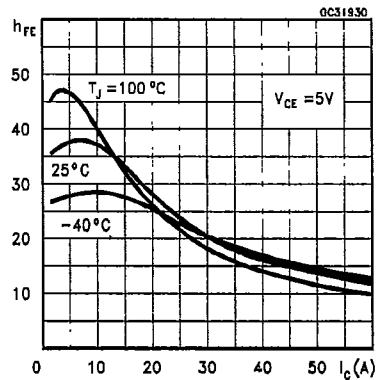


Switching Times Inductive Load

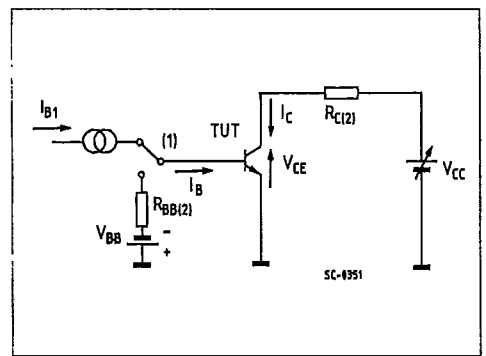
Switching Times Inductive Load Versus Temperature



DC Current Gain

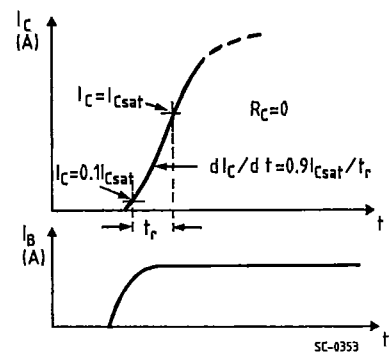
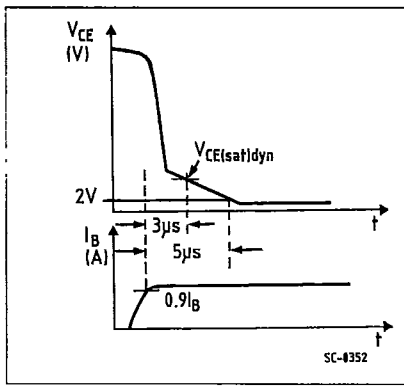


Turn-on Switching Test Circuit

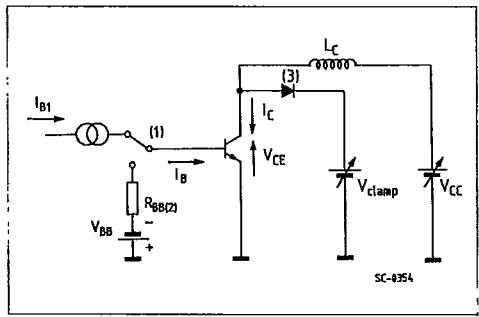


(1) Fast electronic switch (2) Non-inductive load

Turn-on Switching Waveforms

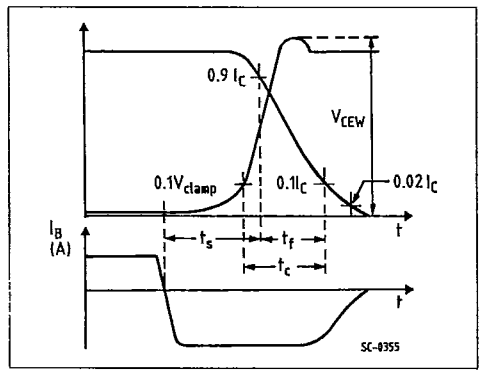


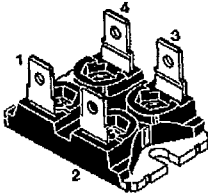
Turn-off Switching Test Circuit



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

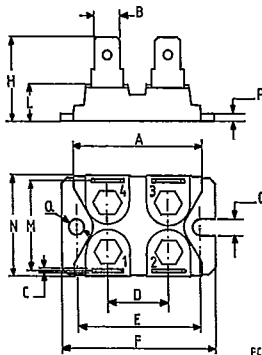
Turn-off Switching Waveforms





**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

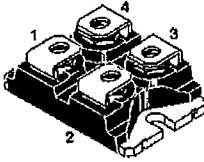
Torque: Mounting  $1.3 \pm 0.2 \text{ N} \cdot \text{m}$  (max)

Weight: Package 25.5 g

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

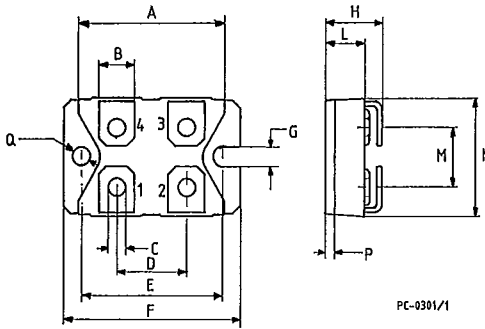
S G S-THOMSON

T-91-20



**ISOTOP**  
Screw version  
sales types with the suffix V

**MECHANICAL DATA**



PC-0301/1

	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	-

**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

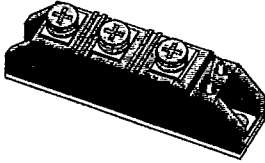
Torque: Terminal  $1.3 \pm 0.2 \text{ N} \cdot \text{m}$  (max)  
Mounting  $1.3 \pm 0.2 \text{ N} \cdot \text{m}$  (max)

Weight: Package 29 g  
4 Screws: 7.5 g

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

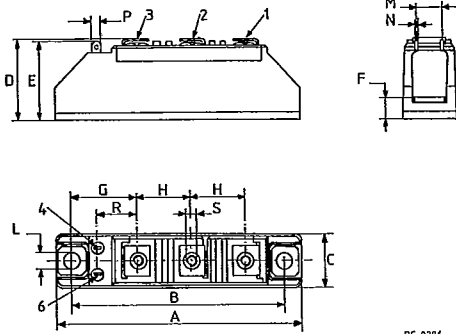
SGS-THOMSON

T-91-20



TRANSPACK (TO-240)

MECHANICAL DATA



PC-0236

	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)