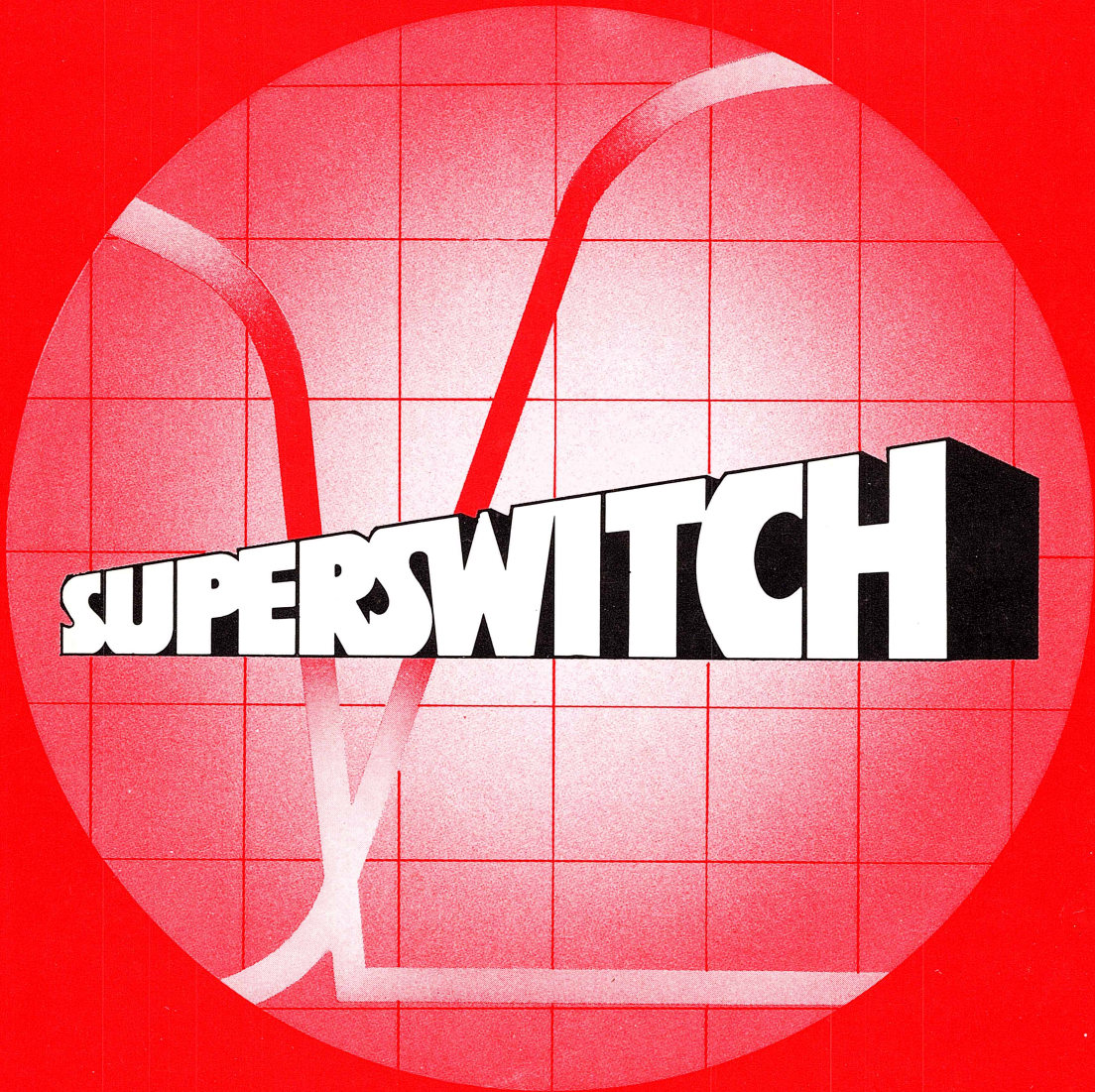


11.00

# SWITCHING POWER TRANSISTORS

SELECTION GUIDE

DIVISION SEMI-CONDUCTEURS



1981

## SUPERSWITCH

A wide range of high performance power semiconductors for fast and high efficiency switching : you may choose the best Superswitch for your own application.

## SUPERSWITCH

A large choice of plastic and metallic packages to meet your environment and mounting needs : from the small flat TO-220 to the new 2.5 kV isolated ISO-TOP case.

## SUPERSWITCH

Power transistors, darlington, fast recovery diodes for :

- Switching frequencies up to 200 kHz
- Supply voltages from 12 V to 700 V
- Output powers up to 100 kW.

## SUPERSWITCH

Application orientated specifications of products. Complete and detailed data sheets for easy circuit design and worst case simulation.

## SUPERSWITCH

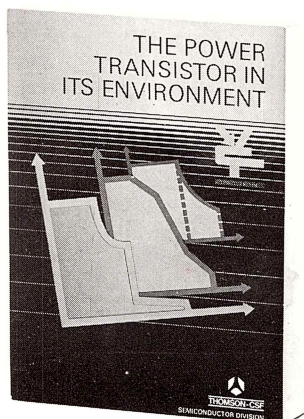
Innovative technology : try today power semiconductor's state of the arts.

## SUPERSWITCH

Fast switching semiconductors for :

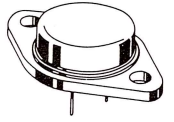
- Switchmode power supplies
- DC-AC converters
- DC and AC motor drives
- Ultrasonic generators
- Induction heating...

- ... But also the necessary "software" to help you
- to improve the base drive
  - to define the S.O.A. in the switching mode
  - to know what a transistor will do with a short circuit on the load.
  - to understand the new concept "switching overload area"
  - to know all about inverse currents in transistor bridges
  - to choose a switching power transistor ( $I_{CM}$ - $I_C$ - $I_{C(sat)}$ )
  - to parallel bipolar transistors.



You will find all the foregoing information together with application examples in the handbook :  
"THE POWER TRANSISTOR IN ITS ENVIRONMENT"

# Fast switching power transistors Superswitch range



## TO 3 Superswitch transistors

$I_C$ (sat)	$V_{CE0}$ (sus)		$V_{CEX}$																															
	60 V	80 V	90 V	125 V	200 V	250 V	325 V	400 V	500 V	400 V	450 V	600 V	700 V	700 V	120 V	160 V	120 V	160 V	250 V	300 V	400 V	450 V	500 V	850 V	1000 V	900 V	1000 V	1500 V						
80 A	BUV 18																																	
70 A			BUT 90																															
60 A	BUV 19																																	
50 A			BUV 20 BUX 20																															
40 A	BUW 38		BUT 91																															
35 A			BUT 92																															
30 A	BUW 39																																	
25 A			BUV 21 BUX 21																															
20 A			BUX 39	BUX 10	BUV 22 BUX 22																						BUX 98							
15-16 A			BUX 40		BUV 23 BUX 23																				BUX 98A									
12 A			BUX 11		BUV 24 BUX 24																				ESM 952	ESM 952A								
10 A			BUX 12																				BUX 48											
8 A			BUX 41		BUX 13		BUV 25 BUX 25																				BUX 48A							
6 A			BUX 42		BUX 14		BUX 47																				ESM 750	ESM 750A						
5 A			BUX 43																				BUX 47A											
4 A					BUX 44		BUX 15																				ESM 1503							
2-2,5 A					BUX 45		BUX 46																											

$I_C$  (sat) is the recommended operating collector current value.

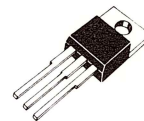
Switching times  $t_d$ ,  $t_r$ ,  $t_s$ , and  $t_f$  and the collector-emitter saturation voltage  $V_{CE}$  (sat) are specified in our data-sheets at  $I_C$  (sat).

**NEW**

# Fast switching power transistors Superswitch range

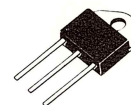
## TO 220 Superswitch transistors

$I_C$ (sat) \ $V_{CE0}$ (sus) / $V_{CEX}$	90 V	120 V	200 V	400 V
12 A	BUV 26			
8 A		BUV 27		
6 A			BUV 28	
2,5 A				BUV 46
1 A				<b>BUV 36</b>



## TOP 3 Superswitch transistors

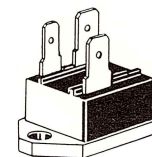
$I_C$ (sat) \ $V_{CE0}$ (sus) / $V_{CEX}$	60 V	80 V	90 V	125 V	150 V	400 V	450 V*
40 A	BUW 48						
30 A		BUW 49					
20 A			BUX 69				
16 A				BUX 70			
8-10 A					<b>BUW 96*</b>	BUV 48	BUV 48A
6 A						BUV 47B	
5 A						BUV 47	BUV 47A



\* Fast switching PNP transistor

## ISO-TOP Superswitch transistors and Darlington

$I_C$ (sat) \ $V_{CE0}$ (sus) / $V_{CEX}$	60 V	80 V	400 V	450 V	600 V	700 V
40 A	ESM 838					
30 A		ESM 839				
20 A			<b>ESM 749*</b> BUV 98			
16 A				BUV 98 A		
12 A					<b>ESM 753*</b> ESM 752	ESM 752A



\* Fast switching Darlington without parasitic C-E diode

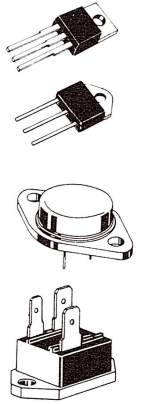
$I_C$  (sat) is the recommended operating collector current value. Switching times  $t_d$ ,  $t_r$ ,  $t_s$  and  $t_f$  and the collector-emitter saturation voltage  $V_{CE}$  (sat) are specified in our data-sheets at  $I_C$  (sat).

**NEW**

# Fast switching power transistors Superswitch range

## Superswitch Darlington

$I_C$ (sat)	$V_{CE0}$ (sus)	400 V	400 V	500 V	600 V
	$V_{CEX}$	450 V	600 V	800 V	900 V
36 A		ESM 871			
32 A		ESM 870			
24 A		BUV 74			
20 A		ESM 749*			
18 A		ESM 856			
16 A		ESM 855			
12 A		BUV 54		ESM 753*	
10 A		BUV 37 ESM 837			
6 A		ESM 737			



All Darlingtons are available in the TO 3 package except the ESM 737 (TO 220), the BUV 37 (TOP 3), the ESM 749 and ESM 753 (ISO-TOP case).

\* The ESM 749 and ESM 753 are Darlingtons without parasitic C-E diode ; they are mounted in a collector-isolated ISO-TOP case with four connections : this allows independant drive of the driver and of the output transistor to improve the switching behaviour of the Darlington.

## TO 83 Superswitch high power transistors

$I_C$ (sat)	$V_{CE0}$ (sus)	100 V	200 V	400 V	500 V	600 V	700 V
	$V_{CEX}$	200 V	400 V	500/600 V	600 V	1000 V	1000 V
100 A		ESM 1000					
60 A		ESM 2060					
50 A		ESM 3004*					
35 A		ESM 3005*					
30 A		ESM 738			ESM 3006*		
25 A		ESM 3007*					



\* Also available in press-pack case MU 86

## Press-pack Superswitch giant transistors

$I_C$ (sat)	$V_{CE0}$ (sus)	400 V	500 V	600 V	700 V
	$V_{CEX}$	600 V	600 V	1000 V	1000 V
90 A		ESM 4014			
70 A		ESM 4015			
40 A		ESM 4016			
35 A		ESM 4017			



MU 86

$I_C$  (sat) is the recommended operating collector current value. Switching times  $t_d$ ,  $t_r$ ,  $t_s$  and  $t_f$  and the collector-emitter saturation voltage  $V_{CE}$  (sat) are specified in our data-sheets at  $I_C$  (sat).

**NEW**

# Choice of Superswitch transistors for converters

(effective power from 60 W to more than 10 kW)

		Advantages	Remarks
	<b>Fly back converter</b>	Simplicity. Several outputs easily obtained.	Large transformer bulk. Needs a very close coupling between the transformer primary and secondary. Needs capacitors with very low resistance and inductance in order to get good filtering.
	<b>Forward converter</b>	Simplicity. Reduced transformer bulk.	Needs close coupling between primary and demagnetizing coil of the transformer.
	<b>Asymmetrical half bridge converter</b>	Easy to make transformer only $V_1$ applied to transistors.	Insulated base drive needed.
	<b>Symmetrical half bridge with input capacitors converter</b>	Maximum voltage applied to transistors equal to $V_1$ . No strict requirements for transformer leakage inductance. Easy filtering.	Insulated base drive for one transistor necessary. Risk of disymmetry. Risk of simultaneous conduction. Risk of over-current due to switching aid circuit.
	<b>Push-pull converter</b>	Base drives at the same voltage. Easy filtering.	Needs very close coupling between the two half-primaries. Risk of disymmetry. Risk of simultaneous conduction. Risk of over-current due to switching aid circuit.
	<b>Full bridge converter</b>	Maximum voltage applied to transistors equal to $V_1$ . No strict requirements for transformer leakage inductance. Easy filtering.	Insulated base drive. Risk of disymmetry. Risk of simultaneous conduction. Risk of over-current due to switching aid circuit.

Recommended devices

< 80 V		96 V		160 V		220 V ~		380 V ~	
Type	Power (W)	Type	Power (W)	Type	Power (W)	Type	Power (W)	Type	Power (W)
BUV 27/28	60	BUX 42	90	BUX 44	90	BUX 46 / BUV 46	100		
BUX 69/70	100	BUX 12	150	BUV 28	150	BUX 47 / BUV 47	250		
BUX 40/41	100	BUV 22	310	BUX 14	160	BUX 46 / BUV 48	350	not recommended	
BUX 10/11	150			BUV 24	310				
BUV 20/21	300								
BUV 27/28	120	BUX 42	160	BUX 44	170	BUX 46 / BUV 46	180		
BUX 69/70	180	BUX 12	270	BUV 28	250	BUX 47 / BUV 47	450		
BUX 40/41	180	BUV 22	530	BUX 14	260	BUX 48 / BUV 48	750	not recommended	
BUX 10/11	250	BUT 92	700	BUV 24	530	BUX 98 / BUV 98	1500		
BUV 20/21	500								
not used		not used		not used		BUV 24	1000	ESM 1503	700
						BUX 98 / BUV 98	1800	ESM 750	900
						ESM 738	2700	BUX 48 / BUV 48	1400
						ESM 3004	4200	ESM 752	1800
								ESM 952	1800
								BUX 98 / BUV 98	2000
								ESM 3006	4000
not used		not used		not used		BUX 44	300	BUX 47 / BUV 47	850
						BUX 14 / BUX 47	450	BUX 48 / BUV 48	1400
						BUX 48 / BUV 48	750	BUX 98 / BUV 98	2800
						BUV 24	900		
						BUX 98 / BUV 98	1500		
BUV 27/28	250	BUX 42	350	BUX 44	380	BUX 47 / BUV 47	850		
BUX 40/41	350	BUX 12	550	BUX 14	560	BUX 48 / BUV 48	1400		
BUX 69/70	350	BUV 22	1100	BUV 24	1100	BUX 98 / BUV 98	2800	not recommended	
BUX 10/11	550	BUT 92	1600						
BUV 20/21	1000								
BUT 90/91	1250								
BUV 26	480	BUV 27	420	BUV 28	520	BUX 48 / BUV 48	1400	ESM 750	1800
BUX 39 / BUX 69	800	BUX 40	830	BUX 41	700	BUV 54	1500	BUX 48 / BUV 48	2800
BUW 39 / BUW 49	1200	BUX 10	1100	BUX 11	1100	BUV 24	1700	ESM 752	3600
BUV 19	2400	BUV 20	2200	BUV 21	2100	BUX 98 / BUV 98	2800	ESM 952	3600
ESM 1000	4000	BUT 90	3000	BUT 91	3800	BUV 74	3000	BUX 98 / BUV 98	5600
		ESM 2060	3300	ESM 2060	5600	ESM 738	4300	ESM 3006/07	8000
						ESM 3004/05	8500	ESM 4016/17	11000
						ESM 4014/15	11000		

# Transistor guide for motor control and inverters

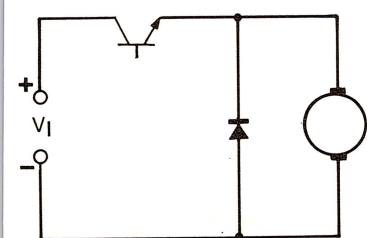
Application

Remarks

## Chopper

DC motors

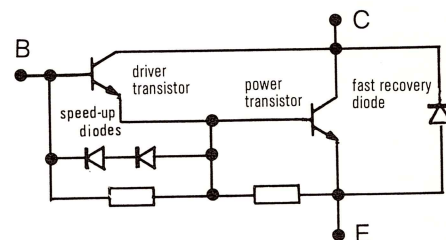
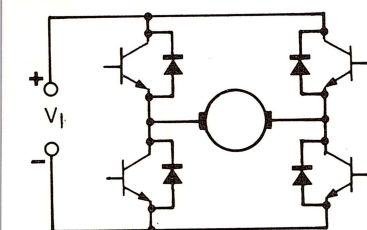
The free-wheel diode should be the fastest recovery diode in the needed voltage range and its forward current  $I_F$  should have the same value as the  $I_C$  (sat) of the power transistor.



## Single phase bridge (four quadrants)

DC motors  
DC/AC inverters

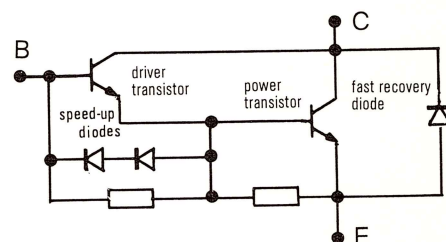
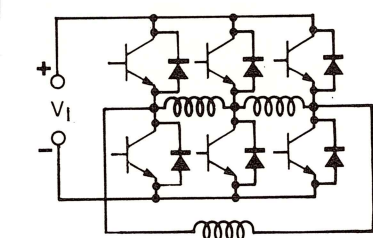
The suggested nominal power is given with usual safety margin. At low switching frequencies, the power transistor can be used without a switching aid circuit.



## Three phase bridge

Variable frequency motors  
DC/AC three phase inverters

The suggested nominal power is given with usual safety margin. At low switching frequencies, the power transistor can be used without a switching aid circuit.



## Recommended devices

48 V		96 V		180 V		220 V ~		380 V ~	
Type	Power (W)	Type	Power (W)	Type	Power (W)	Type	Power (W)	Type	Power (W)
BUV 26	450	BUV 27	600	BUV 28	850	BUX 47 / BUV 47	1400	ESM 1503	1600
BUX 39 / BUX 69	750	BUX 40 / BUX 70	1100	BUX 41 / BUX 42	850	BUX 48 / BUV 48	2400	ESM 750	2500
BUW 39 / BUW 49	1100	BUX 10	1500	BUX 11 / BUX 12	1400	BUV 24	2900	ESM 752	5000
BUV 19	2200	BUV 20	3700	BUV 21 / BUV 22	2800	BUV 54	2900	ESM 952	5000
ESM 1000	3000	BUT 90	5400	BUT 91 / BUT 92	5000	BUX 98 / BUV 98	4900	ESM 953	5000
				ESM 2060	8600	ESM 749	4900	ESM 3006/07	10000
						BUV 74	5900	ESM 4016/17	14000
						ESM 738	7400		
						ESM 3004	12000		
						ESM 4014	22000		

	220 V ~						380 V ~			
Driver transistor	BUX 44	BUX 14	BUX 98	BUX 98	BUX 98	Darlington	ESM 750	ESM 952	ESM 4006	ESM 4006
Power transistor	BUX 14	BUV 24	2 x BUX 98	ESM 3004	ESM 4014	ESM 749	ESM 952	ESM 3006	ESM 4016	2 x ESM 4016
Fast recovery diode	BYX 61	BYX 61	ESM 243	ESM 243	ESM 675	BYX 61	BYT 61	BYT 65	ESM 675	ESM 675
Peak collector current	10 A	18 A	60 A	70 A	110 A	20 A	18 A	42 A	70 A	110 A
Base current	0.4 A	0.8 A	2.5 A	3 A	4.5 A	1 A	2 A	4.5 A	7 A	11 A
Nominal power	2.5 kW	4.5 kW	15 kW	18 kW	28 kW	5 kW	7.5 kW	18 kW	30 kW	47 kW

	220 V ~						380 V ~			
Driver transistor	BUX 46	BUX 47 <sup>1)</sup>	BUX 48	BUX 98 <sup>2)</sup>	Monolithic Integ. Darl.		ESM 1503	ESM 1503 <sup>1)</sup>	ESM 750	ESM 752
Power transistor	BUX 47	BUX 48 <sup>1)</sup>	BUX 98 <sup>2)</sup>	ESM 738	BUV 54	BUV 74	ESM 1503	ESM 750 <sup>3)</sup>	ESM 752	2 x ESM 752
Fast recovery diode	BYX 61	BYX 61	BYX 65	ESM 243	BYX 61	BYX 65	BYT 61	BYT 61	BYT 65	BYT 65
Peak collector current	9 A	16 A	30 A	60 A	12 A	24 A	6 A	10 A	18 A	30 A
Base current	0.4 A	0.7 A	1.2 A	2.4 A	0.6 A	1.2 A	0.5 A	1 A	2 A	4 A
Nominal power	2 kW	4 kW	8 kW	16 kW	3 kW	6 kW	2 kW	4 kW	8 kW	12 kW

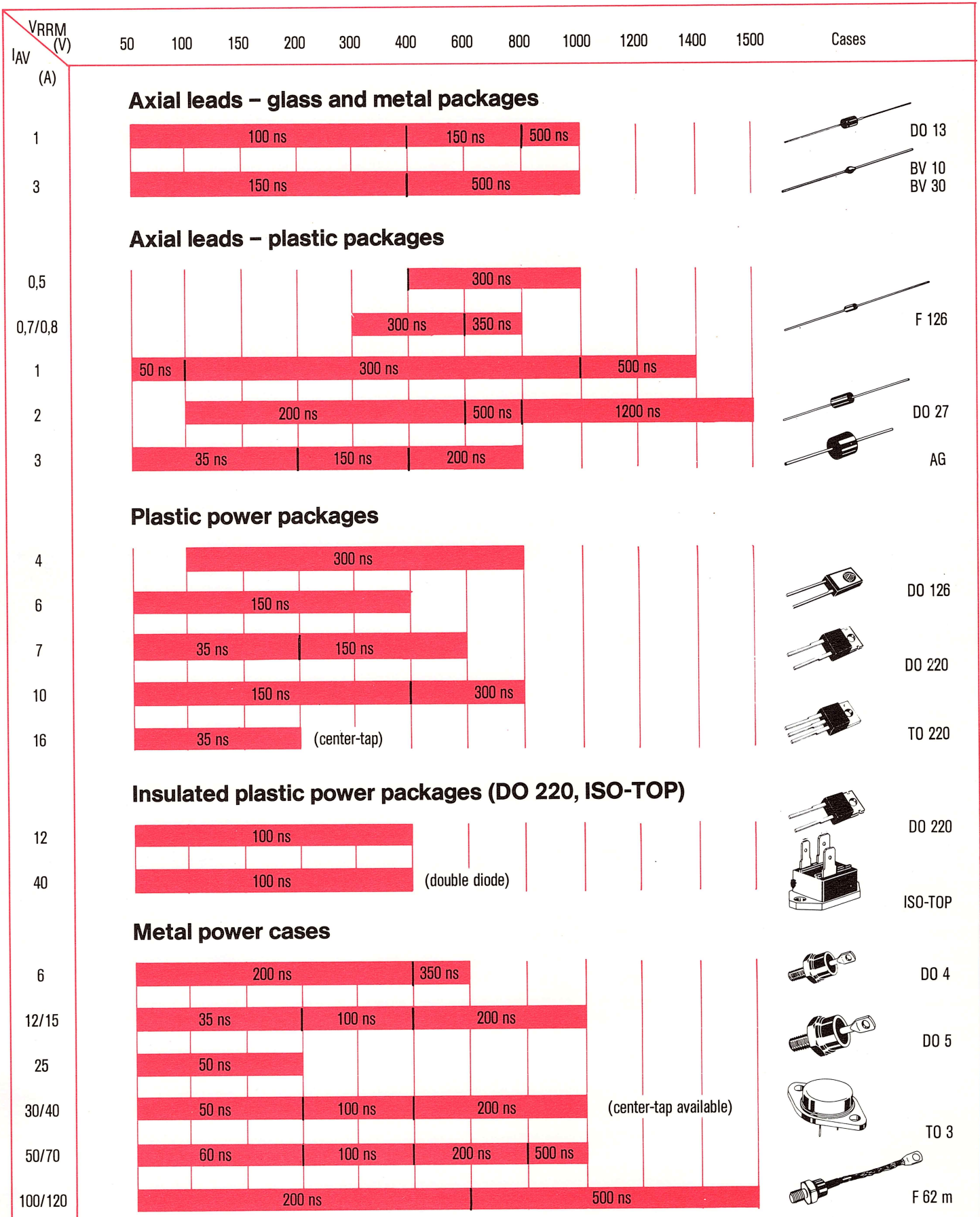
1) Darlington configuration also available in the collector isolated ISO-TOP case (ESM 749),

2) Also available in the collector isolated ISO-TOP case (BUV 98),

3) Darlington configuration also available in the collector isolated ISO-TOP case (ESM 753).

# Superswitch is also a complete range of fast recovery diodes

For more details concerning our fast recovery diodes range, please consult our fast recovery diodes selection guide.



## SALES NETWORK (January 15, 1981)

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CONSULAUST INTERNATIONAL Pty Ltd  
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CAMBERWELL 3124  
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Kojimachi 5-7  
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Apartado Postal M 7607  
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MEXICO 1 DF  
Tel.: 585.53.53 Telex: 01772402

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MANILLA  
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E-MADRID-4  
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#### THOMSON-CSF Componentes y Tubos

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San Juan Despi  
E-BARCELONA  
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#### THOMSON-CSF Komponenter & Electronrör AB

Sandhamnsgatan 67 Box 27080  
S-10251 STOCKHOLM  
Tel.: (08) 22.58.15 Telex: 12078

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CH-3097 BERN-LIEBEFELD  
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Tel.: (0256) 29.155 Telex: 858865

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HIGH WYCOMBE  
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#### THOMSON-CSF Components Corporation

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## THOMSON-CSF

DIVISION SEMICONDUCTEURS

50, RUE JEAN-PIERRE TIMBAUD

BP 5 / F-92403 COURBEVOIE CEDEX / FRANCE

TÉL.: 33 (1) 788.50.01 / TÉLEX: 610 560 F



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