

**THOMSON-CSF**  
DIVISION SEMICONDUCTEURS DISCRETS

SUPERSWITCH

**ESM 243-50, (R)**  
**ESM 243-400, (R)**  
FAST RECOVERY RECTIFIER DIODES  
DIODES DE REDRESSEMENT RAPIDES

59C 02309 D T-03-21

**FAST RECOVERY  
SUPERSWITCH  
RECTIFIERS**

- \* VERY FAST RECOVERY TIME
- \* VERY LOW RECOVERED CHARGE
- \* VERY LOW FORWARD RECOVERY TIME

## APPLICATIONS

- High frequency choppers
- DC and AC motor control
- Switchmode power supply

- \* TRES FAIBLE TEMPS DE RECOUVREMENT
- \* TRES FAIBLE CHARGE RECOUVREE
- \* TRES FAIBLE TEMPS D'ETABLISSEMENT

## APPLICATIONS

- Hacheurs à fréquence élevée
- Commandes de moteurs continus et alternatifs
- Alimentation à découpage

VRRM 50 → 400 V

IF(AV) (T<sub>case</sub> 90°C) 60 At<sub>rr</sub> (max) 100 nsCase DO 5 (CB 34)  
Boîtier

Type number : Cathode is connected to case  
Type number + suffix R : anode is connected to case

ABSOLUTE RATINGS (LIMITING VALUES) VALEURS LIMITEES ABSOLUES D'UTILISATION		ESM 243 50, (R)	ESM 243 100, (R)	ESM 243 200, (R)	ESM 243 300, (R)	ESM 243 400, (R)	
DC reverse voltage <i>Tension inverse continue</i>	V <sub>R</sub>	50	100	200	300	400	V
Peak reverse voltage <i>Tension inverse de crête</i>	V <sub>RWM</sub>	50	100	200	300	400	V
Repetitive peak reverse voltage <i>Tension inverse de pointe répétitive</i>	V <sub>RRM</sub>	50	100	200	300	400	V
Average forward current (1) <i>Courant direct moyen (1)</i>	T <sub>case</sub> 90°C δ = 0,5 I <sub>F(AV)</sub>	60	60	60	60	60	A
Peak one cycle surge current (sinusoidal t <sub>p</sub> 10 ms) <i>Courant direct non répétitif de surcharge accidentelle</i>	I <sub>FSM</sub> I <sub>2t</sub>	800 3200	800 3200	800 3200	800 3200	800 3200	A A <sup>2</sup> s
Junction temperature <i>Température de jonction</i>	T <sub>(vj)</sub>	- 65 + 165	- 65 + 165	- 65 + 165	- 65 + 165	- 65 + 165	°C

Junction-case thermal resistance <i>Résistance thermique jonction boîtier</i>	max	R <sub>th(j-c)</sub>	0,7	0,7	0,7	0,7	0,7	°C/W
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(1) See figure 3.  
(1) Voir figure 3.

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**THOMSON**  
COMPOSANTS

ESM 243 - 50  
ESM 243 - 400

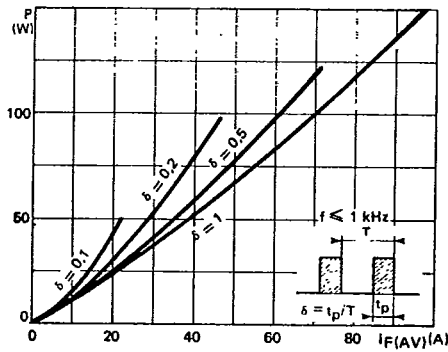
59C 02310 DT-03-21

ELECTRICAL CHARACTERISTICS CARACTERISTIQUES ELECTRIQUES	Test conditions Conditions de mesure		typ	max
Maximum reverse current Courant inverse de fuite	$V = V_{RWM}$ $T_{(vj)} = 100^\circ\text{C}$	$I_R$	10	mA
Forward voltage drop Chute de tension directe	$I_F = 60\text{ A}$ $T_{(vj)} = 25^\circ\text{C}$ $I_F = 60\text{ A}$ $T_{(vj)} = 100^\circ\text{C}$	$V_F$	1,5	V
Forward recovery time Temps d'établissement	$I_F = 60\text{ A}$ $di_F/dt = 60\text{ A}/\mu\text{s}$	$t_{fr}$	50	ns

RECOVERY CHARACTERISTICS See figures from 11 to 17.  
CARACTERISTIQUES DE RECOUVREMENT Voir figures 11 à 17.  $T_{(vj)} 25^\circ\text{C}$

Reverse recovery time Temps de recouvrement inverse	JEDEC method Méthode JEDEC $I_F = 1\text{ A}$ $V_R = 30\text{ V}$ $di_F/dt \approx 15\text{ A}/\mu\text{s}$	$t_{rr}$	100	ns
Maximum reverse recovery current Courant inverse maximal de recouvrement		$I_{RM}$	1,5	A
Rate of decrease of recovery current Vitesse d'extinction du courant de recouvrement		$di_{rr}/dt$	70	A/ $\mu\text{s}$
		$Q_R$	0,075	$\mu\text{C}$
Recovered charge Charge recouvrée	Pulse method See figures from 11 to 17 Méthode impulsionnelle Voir figures 11 à 17 $I_F = 60\text{ A}$ $di_F/dt = 60\text{ A}/\mu\text{s}$	$Q_R$	0,25	$\mu\text{C}$

FIGURE 1

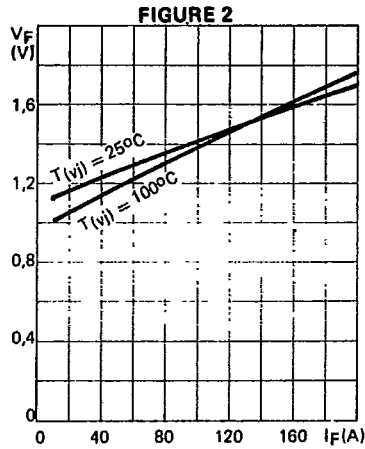


Low frequency power losses versus average current

ESM 243 - 50  
ESM 243 - 400

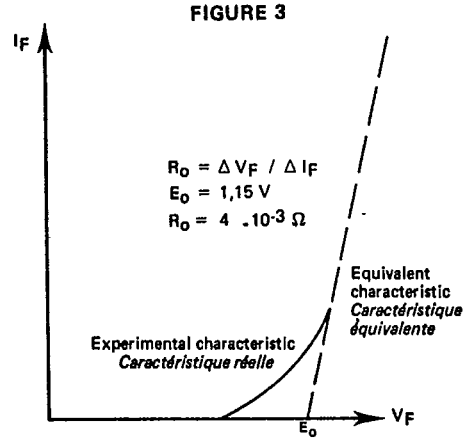
59C 02311 DT-03-21

FORWARD CHARACTERISTICS  
CARACTÉRISTIQUES DIRECTES



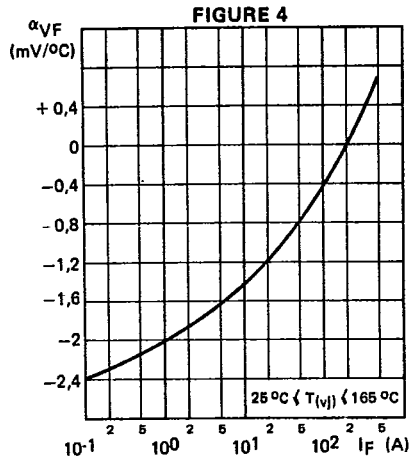
Typical values  
Forward voltage drop vs forward current

Valeurs typiques  
Chute de tension directe en fonction du courant direct

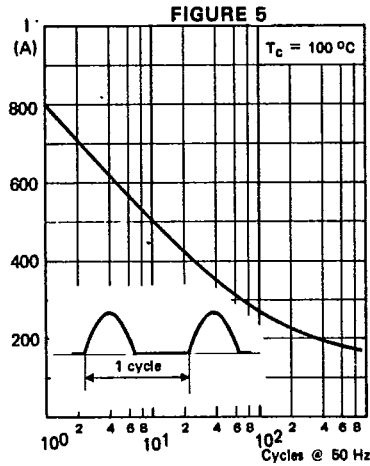


Equivalent forward characteristic  
For the purpose of calculating power losses, the forward characteristic can be approximated by the linear curve

Caractéristique directe équivalente  
Pour le calcul des pertes de puissance, la caractéristique directe de la diode est assimilable à la droite :  
 $V_F = E_0 + R_{0I}$  at  $T(v_j) = 100^\circ\text{C}$



Typical values  
Forward voltage drop variation with temperature vs. forward current  
Variation de la chute de tension directe avec la température en fonction du courant direct



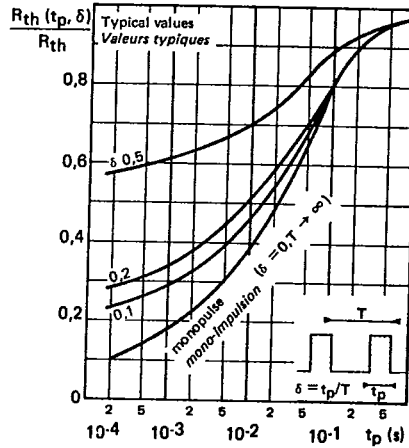
Limiting values - Accidental peak surge current vs. cycles applied at 50 Hz  
Valeurs limites - Courant crête de surcharge accidentelle en fonction du nombre de cycles appliqués à 50 Hz.

ESM 243 - 50  
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TRANSIENT THERMAL CHARACTERISTICS  
CARACTÉRISTIQUES THERMIQUES TRANSITOIRES

FIGURE 6

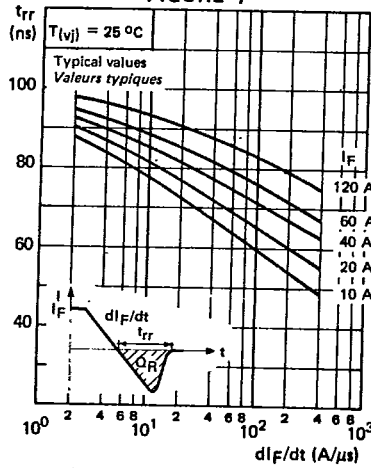


Change in apparent junction to case thermal impedance  $R_{th}(t_p, \delta)$  vs. pulse width ( $t_p$ ) and duty cycle ( $\delta$ )

Variation relative de l'impédance thermique apparente jonction-boîtier  $R_{th}(t_p, \delta)$  en fonction de la durée d'impulsion  $t_p$  et du rapport cyclique  $\delta$

REVERSE RECOVERY TIME (TYPICAL VALUES)  
TEMPS DE RECOUVREMENT INVERSE (VALEURS TYPIQUES)

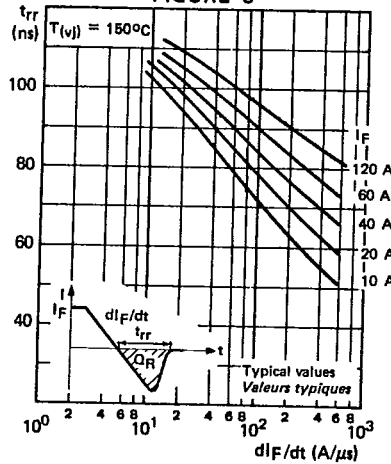
FIGURE 7



Recovery time ( $t_{rr}$ ) vs.  $dI_F/dt$  for various current levels (the reverse current is not circuit limited)

Temps de recouvrement ( $t_{rr}$ ) en fonction de  $dI_F/dt$  à différents niveaux de courant  $I_F$  (le courant inverse n'est pas limité par le circuit)

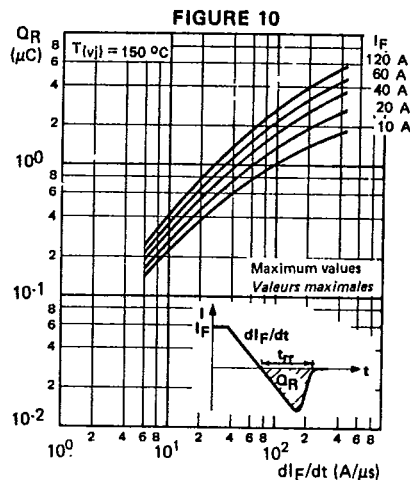
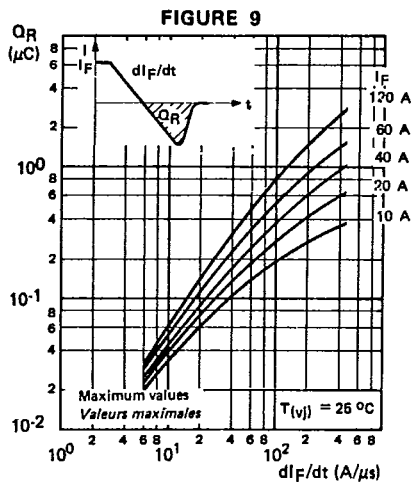
FIGURE 8



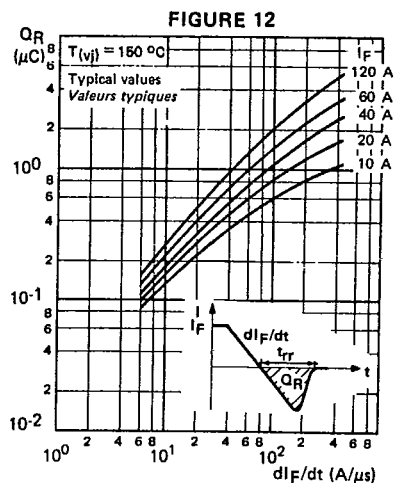
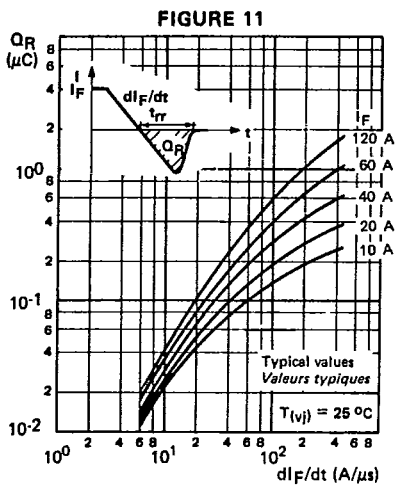
ESM 243 - 50  
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RECOVERED CHARGE (MAXIMUM VALUES)  
CHARGE RECOURVÉE (VALEURS MAXIMALES)



RECOVERED CHARGE (TYPICAL VALUES)  
CHARGE RECOURVÉE (VALEURS TYPIQUES)



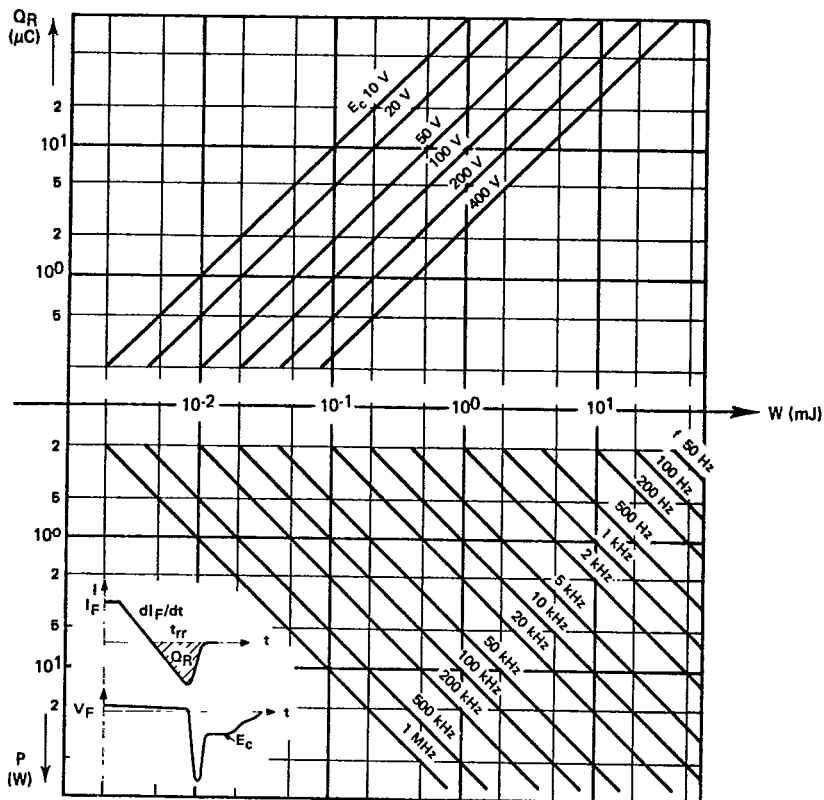
Recovered charge  $Q_R$  versus  $di_F/dt$  for various current levels  $I_F$  at  $T(v_j)$  25 and 150 °C. Recovered charge is a linear function of temperature. An interpolation allows the  $Q_R$  calculation within the limits 25 - 150 °C.  
Charge recourvée  $Q_R$  en fonction de  $di_F/dt$  à différents niveaux de courant  $I_F$  et  $T(v_j)$  25 et 150 °C.  $Q_R$  varie linéairement avec la température. Une interpolation permet le calcul de  $Q_R$  entre 25 et 150 °C.

ESM 243 - 50  
ESM 243 - 400

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RECOVERY CHARACTERISTICS  
CARACTÉRISTIQUES DE RECOUVREMENT

FIGURE 13



Recovery switching losses vs. recovered charge ( $Q_R$ ) for various reverse voltages ( $E_c$ ) applied to various frequencies  
 Pertes de commutation de recouvrement en fonction de la charge recouvrée  $Q_R$  pour différentes tensions inverses appliquées  $E_c$  et à différentes fréquences de fonctionnement.

$$P = Q_R \times E_c \times f$$

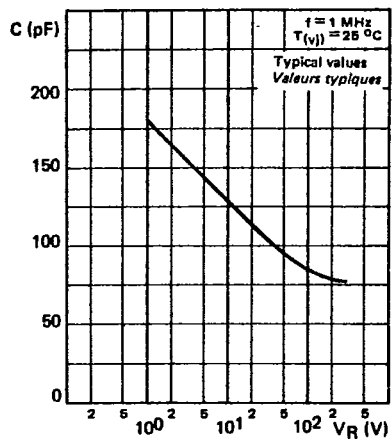
- |   |       |  |
|---|-------|--|
| Recovered charge  | $Q_R$ | Charge recouvrée   |
| Reverse voltage applied to the diode just after transient state | $E_c$ | Tension inverse appliquée à la diode juste après le régime transitoire |
| Recovery phenomenon frequency                                   | $f$   | Fréquence du phénomène de recouvrement                                 |
| Dissipated energy during each switching                         | $W$   | Energie dissipée à chaque commutation                                  |

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ESM 243 - 50

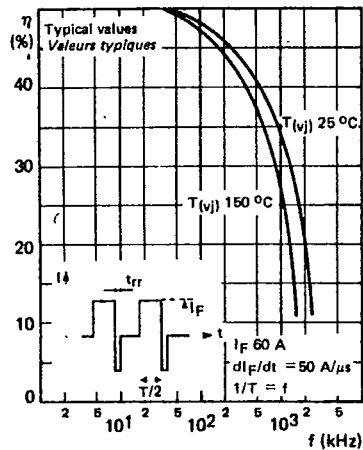
ESM 243 - 400

FIGURE 14



Capacitance (C) vs. reverse voltage (VR) applied  
*Capacité C en fonction de la tension inverse VR appliquée*

FIGURE 15



Rectifying efficiency ( $\eta$ ) vs. frequency

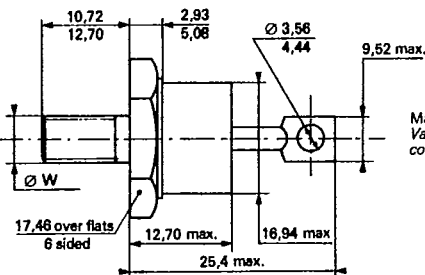
$$\eta = \frac{|I_{2 \text{ moy}}|}{|I_{2 \text{ eff}}|} \times 100$$

*Efficacité de redressement  $\eta$  en fonction de la fréquence*

CASE OUTLINE

$\varnothing W = 1/4 - 28 \text{ UNF}$   
 ISO thread on request

Recommended torque value  
*Valeur recommandée du couple de serrage* 250 cm.N



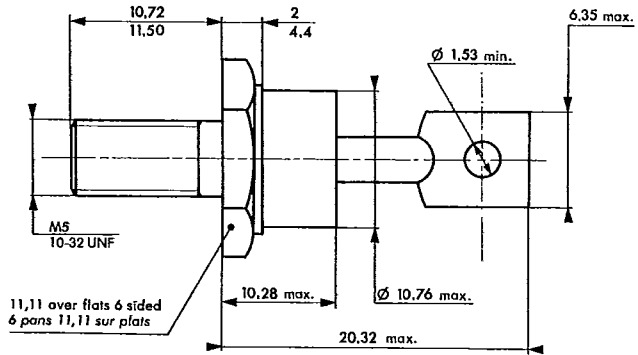
Maximum torque value  
*Valeur maximale du couple de serrage* 310 cm.N

DO-5 (CB-34)

59C 02357 D T-33-01

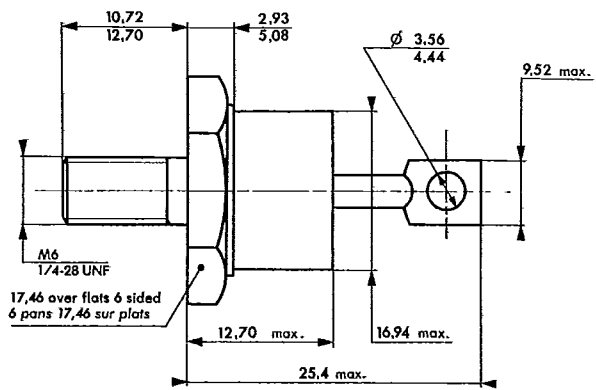
**DO 4 (CB-33)**

CB-33 M →  $\phi W = M 5$   
 U →  $\phi W = 10-32 \text{ UNF}$

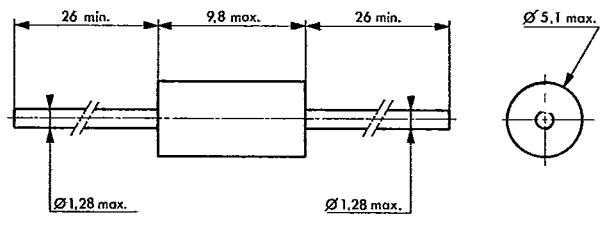


**DO 5 (CB-34)**

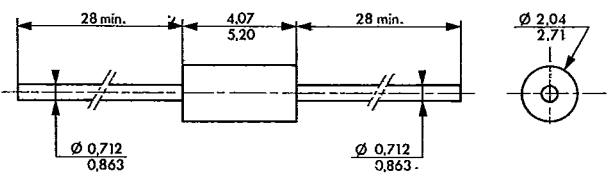
CB-34 M →  $\phi W = M 6$   
 U →  $\phi W = 1/4-28 \text{ UNF}$



**DO 27 A (CB-197)**



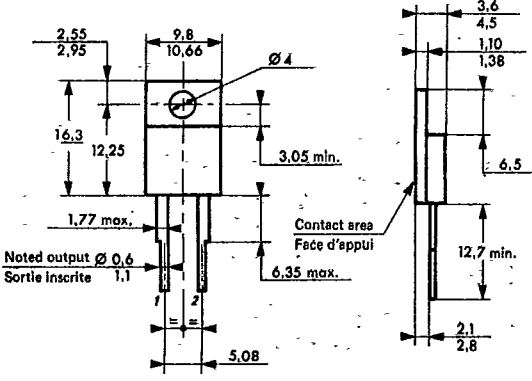
**DO 41 (CB-101)**



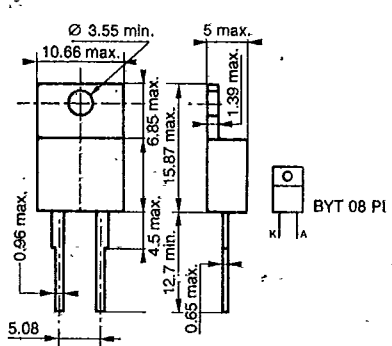


T-33-01

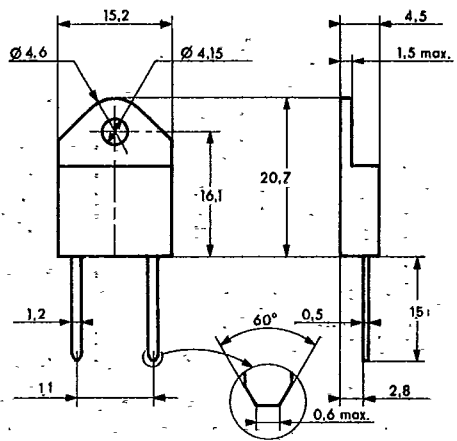
**DO 220 AB (CB-227)**  
uninsulated



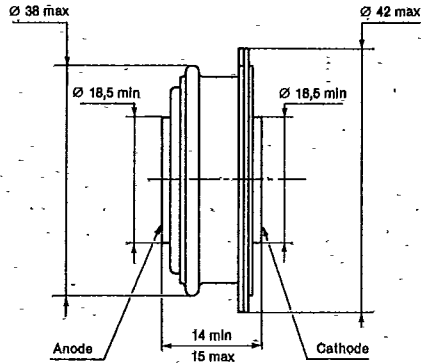
**DO 220 AB (CB-426)**  
insulated



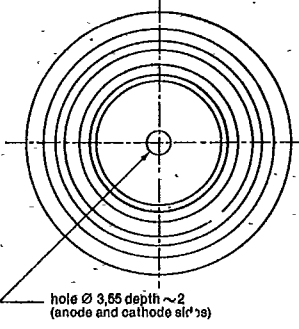
**DOP 3 (CB-425)**



**M 771**  
**(CB-262)**



**CB-262**



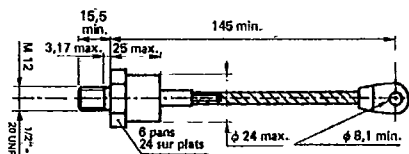
M 771 CASE OUTLINE

F62 m (CB-252)

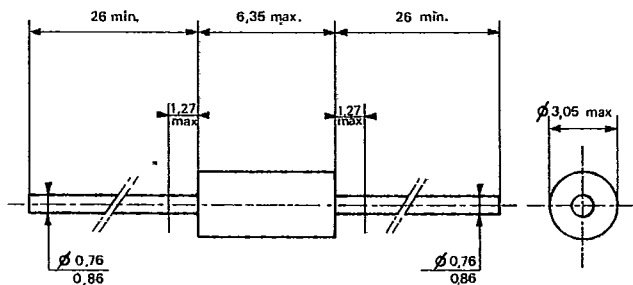
59C 02359

D

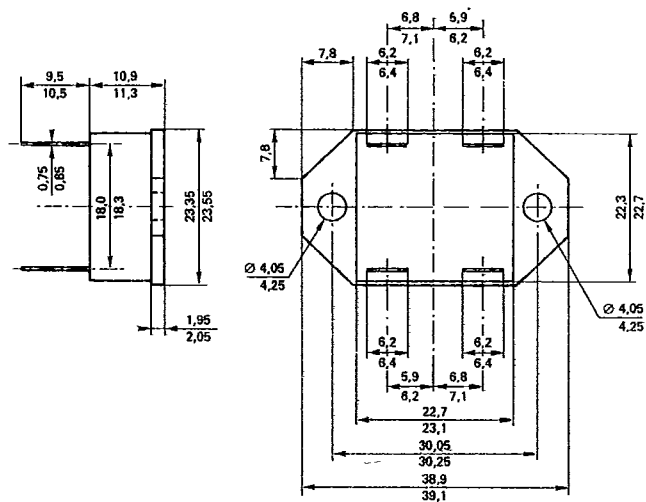
T-33-01



F 126 (CB-210)



CB-427

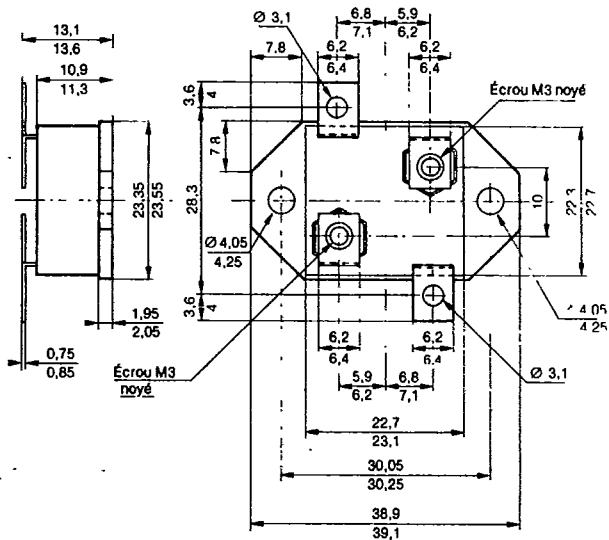


1	2
4	3

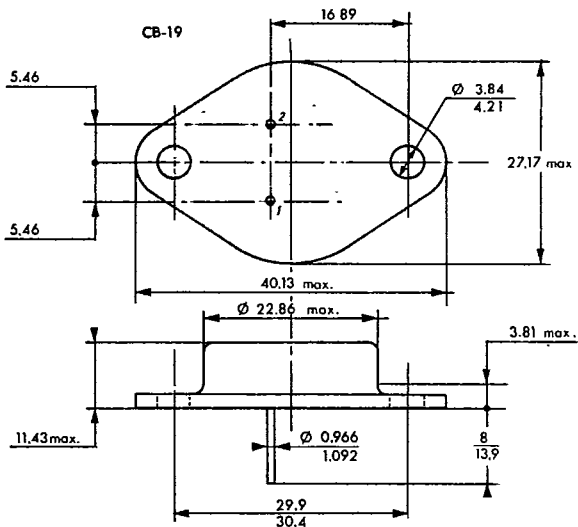
Marking : clear  
 Marquage : en clair

Note : Pin 3 may be omitted  
 La broche 3 peut être omise

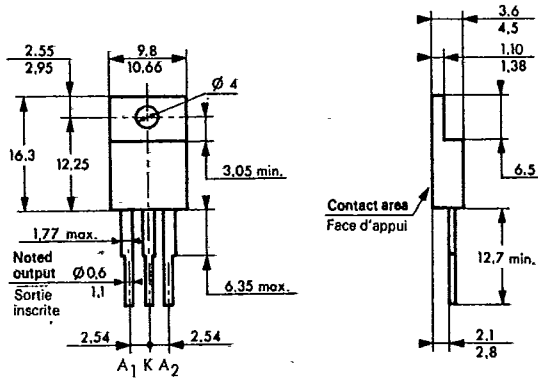
CB-434



TO 3 modified (CB-19)



TO 220 AB (CB-428)  
for duo-diodes



CB-244 (TOP 3 - TO 218)

