SGS-THOMSON MICROELECTRONICS

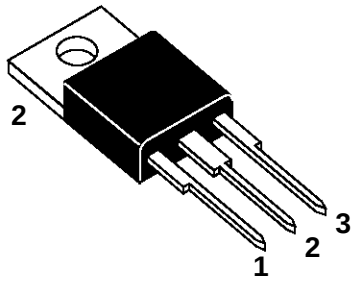
RBO40-40T

Application Specific Discretes
A.S.D.™

REVERSED-BATTERY AND OVERVOLTAGE PROTECTION

FEATURES

- PROTECTION AGAINST "LOAD DUMP" EFFECT
- DIODE TO GUARD AGAINST BATTERY REVERSAL
- MONOLITHIC STRUCTURE FOR GREATER RELIABILITY
- NEGATIVE OVERVOLTAGE PROTECTION BY CLAMPING (COMPONENT T1)
- BREAKDOWN VOLTAGE : 24 V min
- CLAMPING VOLTAGE : ± 40 V max
- AVERAGE FORWARD DIODE CURRENT : 40 A

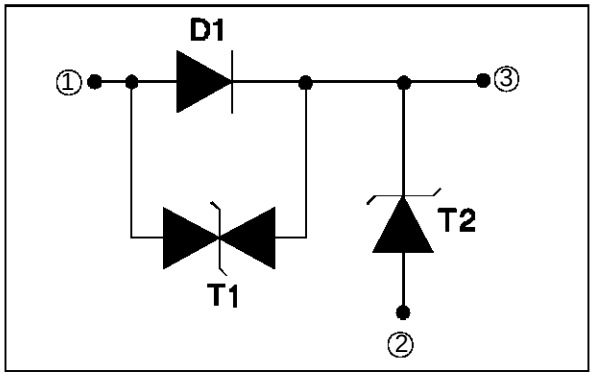


TO 220 AB
(Plastic)

DESCRIPTION

Designed to protect against battery reversal and load dump overvoltages in automotive applications, this monolithic component offers multiple functions in the same package :
D1 : reversed battery protection
T1 : clamping against negative overvoltages
T2 : Transil function against "load dump" effect

FUNCTIONAL DIAGRAM



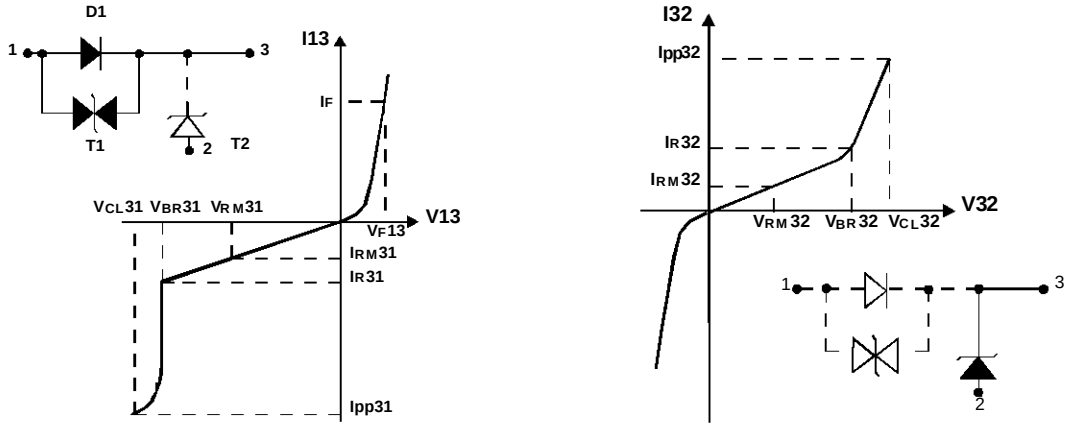
ABSOLUTE MAXIMUM RATINGS (- 40°C < T_{amb} < + 85°C)

Symbol	Parameter		Value	Unit
I_{FSM}	Non repetitive surge peak forward current between pins 1 and 3	t_p = 10µs	400	A
		t_p = 10ms	120	
$I_{F(AV)}$	Average forward current between pins 1 and 3	Tc = 75°C	40	A
V_{PP}	Peak load dump voltage (see note 1 and 2)		80	V
P_P	Peak pulse power between pins 3 and 1	10/1000µs	1500	W
P	Total power dissipation	Tc = 75°C	75	W
T_{stg} Tj	Storage temperature range Maximum operating junction temperature		- 40 to + 150 150	°C
T_l	Maximum lead temperature for soldering during 10s at 4.5 mm from case		260	°C

Note 1 : for a surge greater than the maximum value, the device will fail in short circuit.
Note 2 : see load dump test generator circuit (page 3/7)

THERMAL RESISTANCES

Symbol	Parameter	Value	Unit
$R_{th\ (j-c)}$	Junction to case	1	°C/W
$R_{th\ (j-a)}$	Junction to ambient	60	°C/W



Ex : V_F 13 : between Pin 1 and Pin 3 V_{BR} 32 : between Pin 3 and Pin 2

ELECTRICAL CHARACTERISTICS : DIODE D1 (- 40°C < Tamb < + 85°C) (note 1)

Symbol	Test Conditions	Value			Unit
		Min.	Typ.	Max.	
$V_{F\ 13}$	Forward voltage @ I_F = 40 A t_p = 380 µs			1.9	V
$V_{F\ 13}$	Forward voltage @ IF = 20 A t_p = 380 µs			1.45	V
$V_{F\ 13}$	Forward voltage @ IF = 1A t_p = 380 µs			1	V
$V_{F\ 13}$	Forward voltage @ I_F = 100mA t_p = 380 µs			0.95	V
C_{13}	Capacitance at 0 V		3000		pF

Note 1 : "13", "31" and "32" suffixes :

ELECTRICAL CHARACTERISTICS : TRANSIL T1 (- 40°C < Tamb < + 85°C) (note 1)

$V_{BR\ 31}$	Breakdown voltage @ I_R = 1 mA	22		35	V
$V_{BR\ 31}$	Breakdown voltage @ I_R = 1 mA Tamb = 25°C	24		32	V
$I_{RM\ 31}$	Leakage current @ V_{RM} = 20 V			300	µA
$I_{RM\ 31}$	Leakage current @ V_{RM} = 20 V Tamb = 25°C			50	µA
$V_{CL\ 31}$	Clamping voltage @ I_{PP} = 37.5 A 10/1000µs			40	V
α T	Temperature coefficient		8.5		10^{-4}/°C

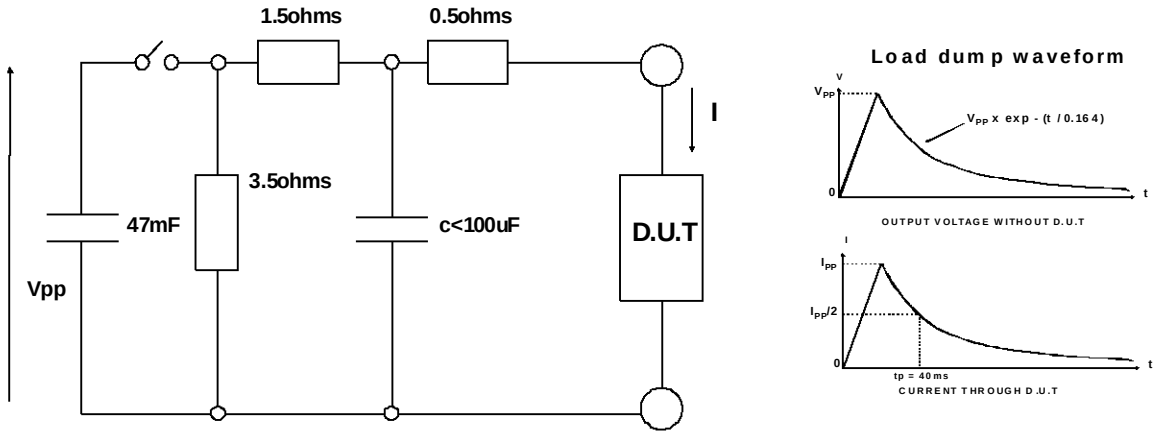
Note 1 : "13", "31" and "32" suffixes :

ELECTRICAL CHARACTERISTICS : TRANSIL T2 (- 40°C < Tamb < + 85°C) (note 1)

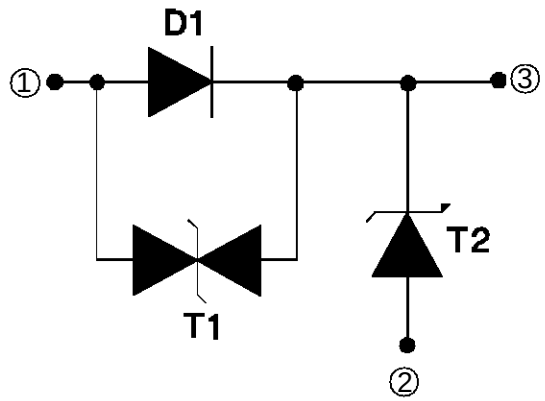
$V_{BR\ 32}$	Breakdown voltage @ I_R = 1 mA	22		35	V
$V_{BR\ 32}$	Breakdown voltage @ I_R = 1 mA Tamb = 25°C	24		32	V
$I_{RM\ 32}$	Leakage current @ V_{RM} = 20 V			100	µA
$I_{RM\ 32}$	Leakage current @ V_{RM} = 20 V Tamb = 25°C			10	µA
$V_{CL\ 32}$	Clamping voltage @ IPP = 20 A (note 2)			40	V
α T	Temperature coefficient		8.5		10^{-4}/°C
C_{32}	Capacitance at 0 V		8000		pF

Note 1 : "13", "31" and "32" suffixes :
13 = between pin 1 and pin 3.
31 = between pin 3 and pin 1.
32 = between pin 3 and pin 2.
Note 2 : see below load dump test generator circuit .

LOAD DUMP TEST GENERATOR CIRCUIT (SCHAFFNER NSG 506C)



PRODUCT DESCRIPTION



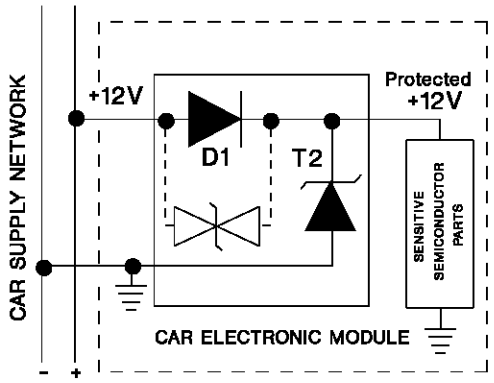
The RBO has 3 integrated functions on the same chip.

D1 : "Rectifier function" in order to protect against reversed battery operation.

T2 : "Transil function" in order to protect against Load dump generated by the alternator.

T1 : Protection for motor driver application (See page 4/7).

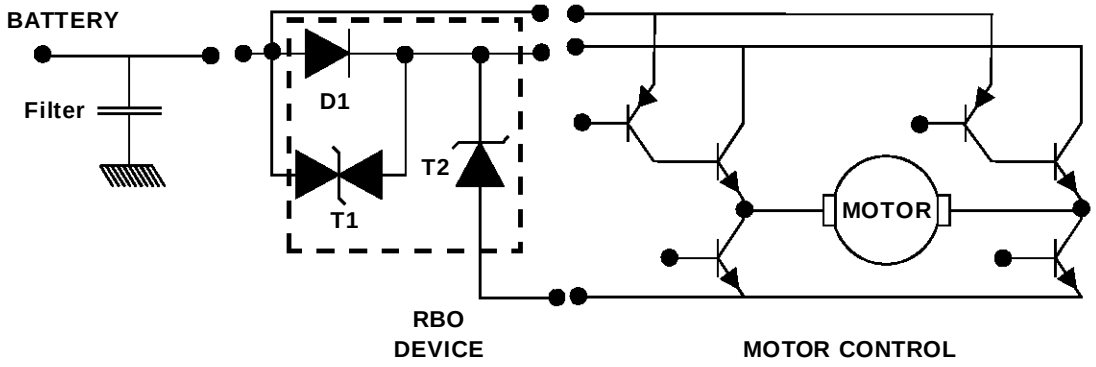
BASIC APPLICATION



*The monolithic multi function protection (RBO) has been developed to protect sensitive semiconductors in the car electronic module against both overvoltage and battery reverse.

*In addition, this RBO circuit prevents overvoltages generated by the module affecting the car supply network.

MOTOR DRIVER APPLICATION



In this application, one half of the motor drive circuit is supplied through the “RBO” and is thus protected as per its basic function application.
The second part is connected directly to the “car supply network” and is protected as follows :
- For positive surges : T2 (clamping phase) and D1 forward-biased.
- For negative surges : T1 (clamping phase) and T2 forward-biased.

Fig. 1 : Peak pulse power versus exponential pulse duration (Tj initial = 85°C).

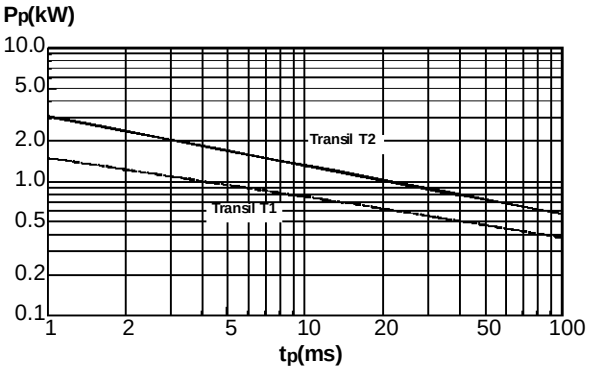


Fig. 2-1 : Clamping voltage versus peak pulse current (Tj initial = 85°C).

Exponential waveform tp = 40 ms and tp = 1 ms (TRANSIL T2).

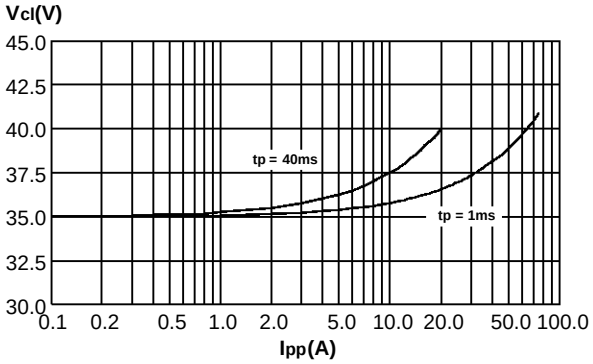


Fig. 2-2 : Clamping voltage versus peak pulse current (Tj initial = 85°C).

Exponential waveform tp = 1 ms and tp = 20 µs (TRANSIL T1).

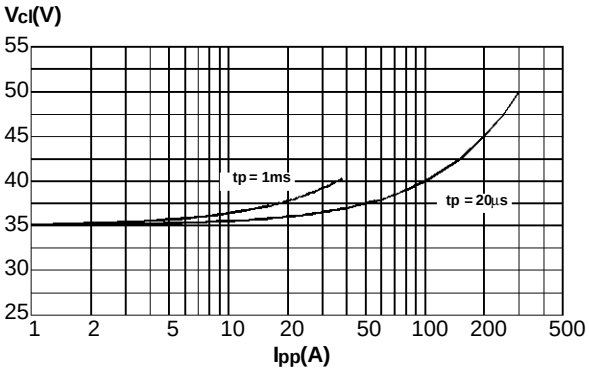


Fig. 3 : Relative variation of peak pulse power versus junction temperature.

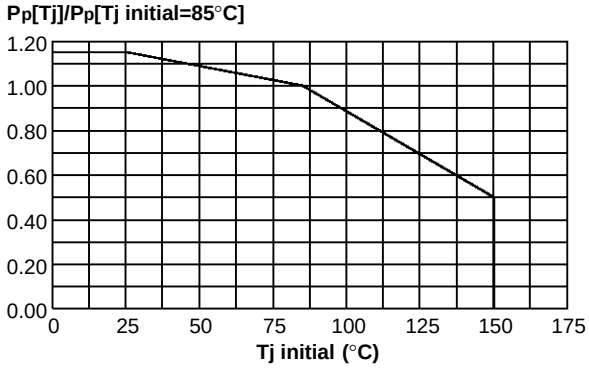


Fig. 4 : Relative variation of thermal impedance junction to case versus pulse duration.

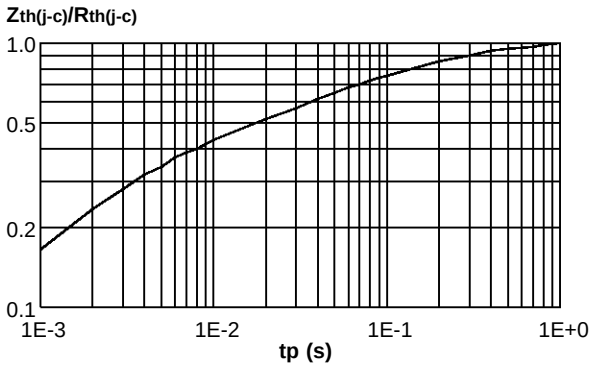


Fig. 5-1 : Peak forward voltage drop versus peak forward current (typical values) - (TRANSIL T2).

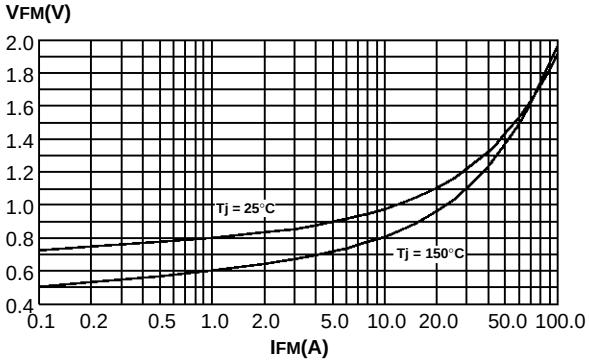
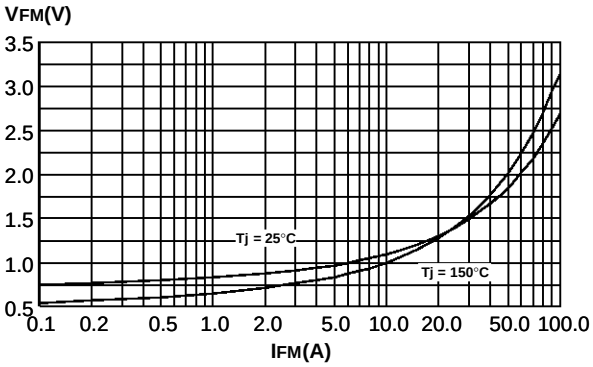


Fig. 5-2 : Peak forward voltage drop versus peak forward current (typical values) - (DIODE D1).



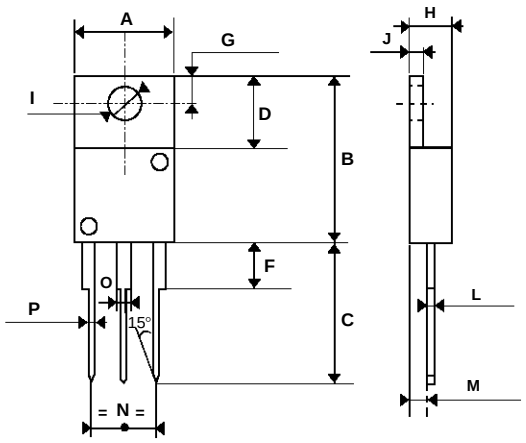
ORDERING INFORMATION

RBO 40 - 40 T

- RBO: Reversed Battery & Overvoltage protection
- 40: $I_{F(AV)}$ = 40 A
- 40: V_{CL} = 40V
- T: Package : T = TO 220 AB

PACKAGE MECHANICAL DATA

TO220AB Plastic



REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	10.20	10.50	0.401	0.413
B	14.23	15.87	0.560	0.625
C	12.70	14.70	0.500	0.579
D	5.85	6.85	0.230	0.270
F		4.50		0.178
G	2.54	3.00	0.100	0.119
H	4.48	4.82	0.176	0.190
I	3.55	4.00	0.140	0.158
J	1.15	1.39	0.045	0.055
L	0.35	0.65	0.013	0.026
M	2.10	2.70	0.082	0.107
N	4.58	5.58	0.18	0.22
O	0.80	1.20	0.031	0.048
P	0.64	0.96	0.025	0.038

Cooling method : C
Marking : type number
Weight : 2 g
Polarity : N A
Stud torque : N A