Fast Recovery Diode with built-in SBD for temperature detection

FMXB-2102

December, 2005

■General Description

An SBD for overheating detection is incorporated together with a secondary side rectification FRD into a TO220F package.

By using the temperature change of the leakage current of the built-in SBD, high-precision heating protection can be performed without using expensive temperature sensors, such as a thermistor and a posistor.

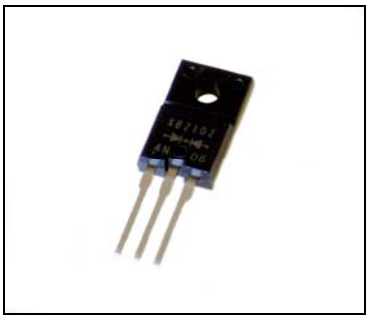
■Applications

- For an overcurrent protection, a partial short circuit and an impedance short protection.
  An overcurrent protection is possible for a secondary side output, especially for each output of a multi-output power supply.
- For an overcurrent protection of a peak-load power supply units.
  Thermal protection is possible even for the unit kept in a peak-load state.

■Features

- Built-in SBD for an overheating detection together with a FRD in a TO220F package.
  (By combining together in a single package, FMXB-2102 excels in heat performance.)
- High-precision heating protection without expensive temperature sensors such as a thermistor and a posistor.

■Package---TO220F-2Pin



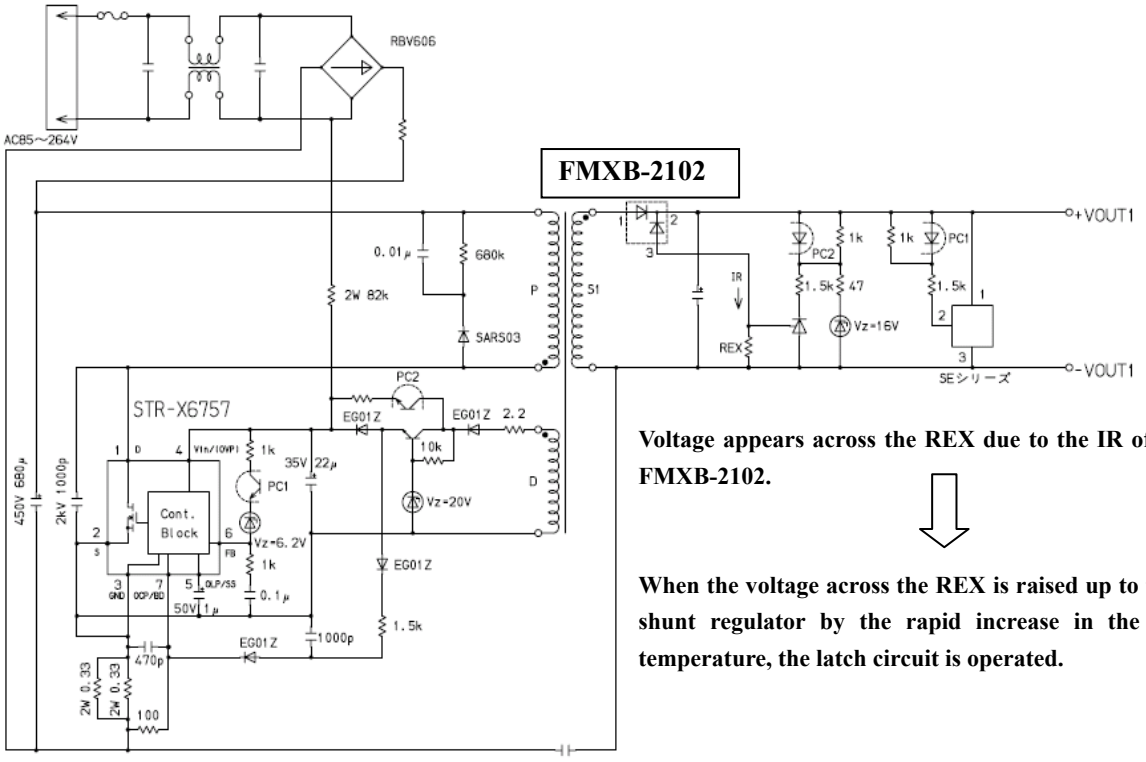
■Typical connection

The typical connection below shows that the overheating protection with a small component count and a minimal temperature variation is realized and a single diode enables to combine a latch circuit with a overvoltage protection circuit.

This circuit allows to adjust a latch temperature easily by adjusting a detection resistor.

Note: In the case of dead short, the overheating protection is not available because there is no voltage appearing on the secondary-side. In this case, please protect the unit by the primary side detection as usual.

Typical connection



Voltage appears across the REX due to the IR of SBD in the FMXB-2102.

When the voltage across the REX is raised up to the Vref of a shunt regulator by the rapid increase in the IR at high temperature, the latch circuit is operated.

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Die Structure: Silicon Planer Diode (FRD, SBD)

§1. Absolute Maximum Ratings and Electrical Characteristics

<FRD part>

•Absolute Maximum Ratings

No.	Parameter	Symbol	Unit	Rating	Conditions
1	Transient Peak Reverse Voltage	VRSM	V	200	
2	Peak Reverse Voltage	VRM	V	200	
3	Average Forward Current	IF(AV)	A	10	
4	Peak Surge Forward Current	IFSM	A	150	10msec. Half sine-wave, one shot
5	I^2t Limiting Value	I^2t	A^2S	112.5	1msec ≤ t ≤ 10msec
6	Junction Temperature	Tj	°C	-40 to +150	
7	Storage Temperature	Tstg	°C	-40 to+150	

• Electrical Characteristics

No.	Parameter	Symbol	Unit	Rating	Conditions
1	Forward Voltage Drop	V_F	V	0.98 max.	IF=10A
2	Reverse Leakage Current	I_R	μA	200 max.	VR=VRM
3	Reverse Leakage Current Under High Temperature	H•I_R	mA	50 max.	VR=VRM, Tj=150°C
4	Reverse Recovery Time	trr1	ns	30 max	IF=IRP=500mA 90% Recovery point
		trr2	ns	25 max	IF=500mA, IRP=1A 75%Recovery point
5	Thermal Resistance	Rth(j-c)	°C/W	4.0 max.	Between Junction and case

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<SBD part>

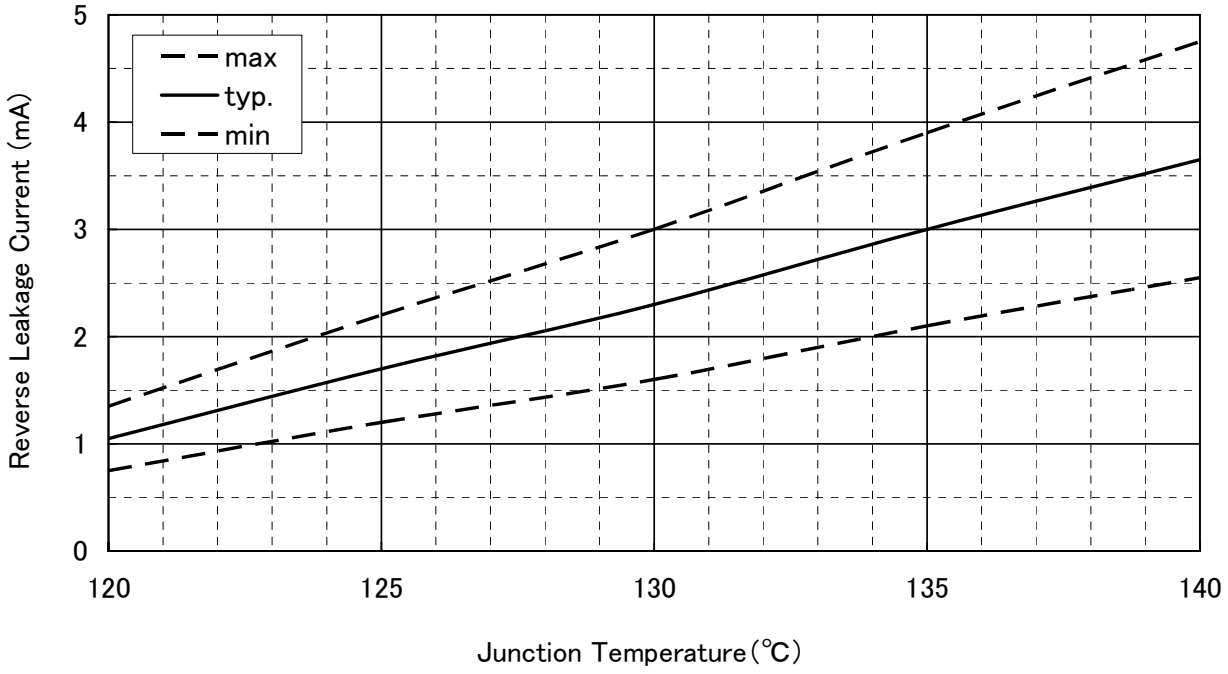
•Absolute Maximum Ratings

No.	Parameter	Symbol	Unit	Rating	Conditions
1	Transient Peak Reverse Voltage	VRSM	V	90	
2	Peak Reverse Voltage	VRM	V	90	
3	Junction Temperature	Tj	°C	-40 to +150	
4	Storage Temperature	Tstg	°C	-40 to+150	

• Electrical Characteristics

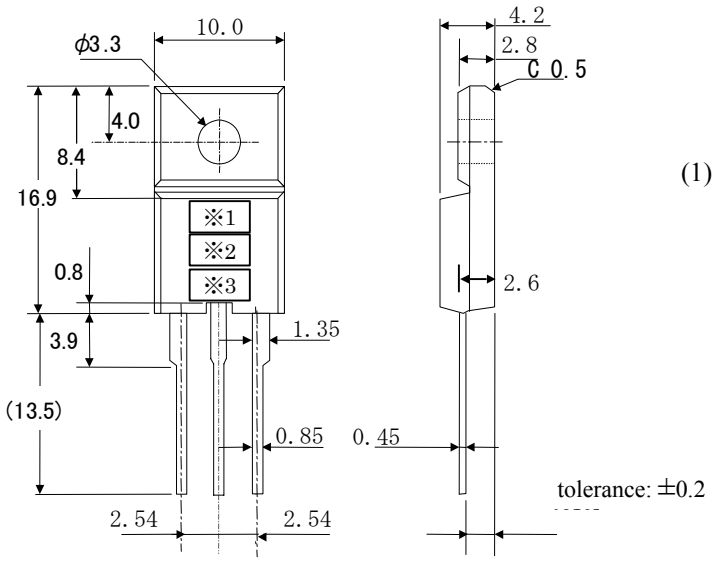
No.	Parameter	Symbol	Unit	Rating			Conditions
				min.	typ.	max.	
1	Reverse Leakage Current	I_{R1}	μA	-	-	100	V_R=15V
		I_{R2}	mA	-	-	2.0	V_R=90V
2	Reverse Leakage Current Under High Temperature	H•I_{R1}	mA	1.60	2.30	3.00	V_R=15V, Tj=130°C
		H•I_{R2}	mA	-	-	55	V_R=90V, Tj=150°C

IR－Tj Characteristics of SBD at 15V



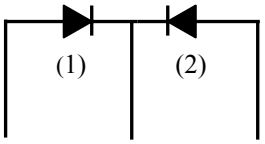
§2. Package information

2-1 Package type, physical dimensions and material



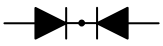
Internal layout

(1) Temperature detection SBD (2) FRD



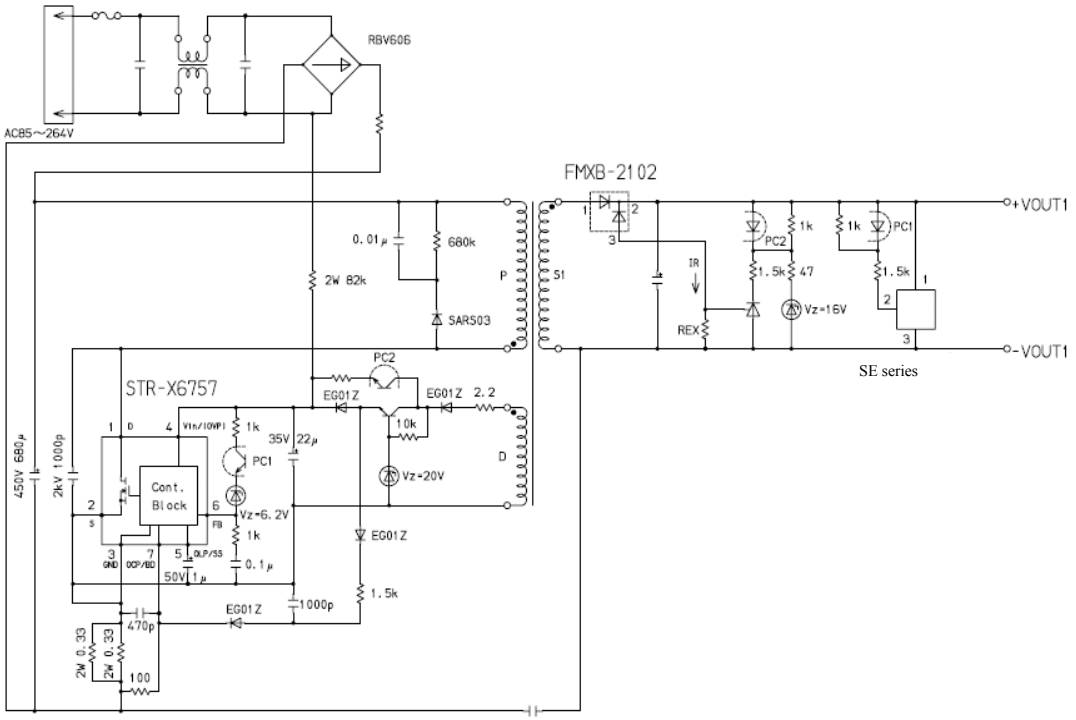
Unit: mm

2-2 Marking

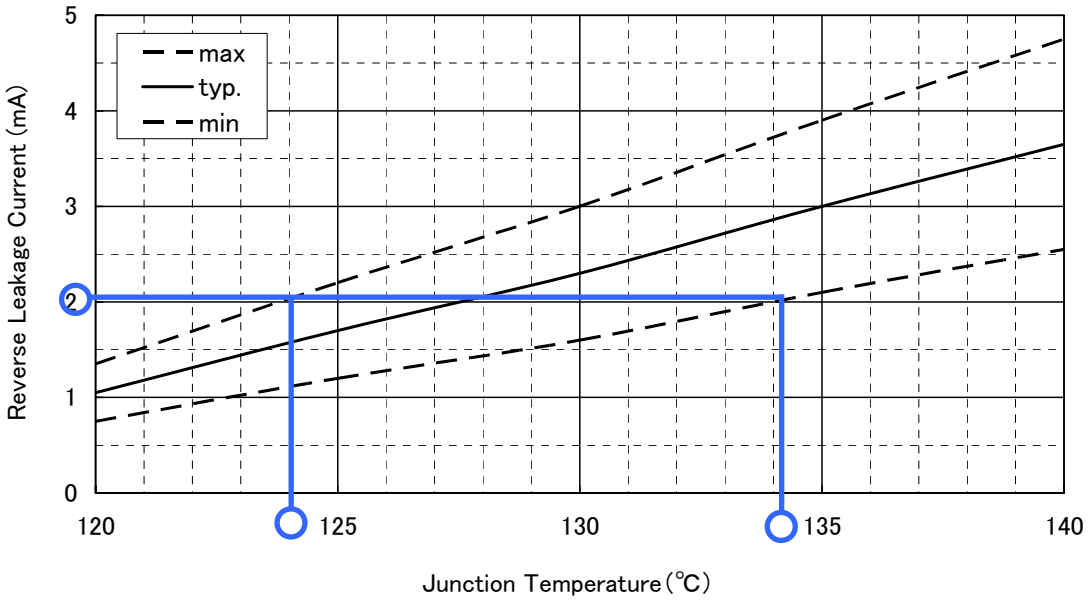
Part Number	Marking		
	Type Name	Polarity	Lot number
FMXB-2102	XB2102		1st letter: Last digit of year 2nd letter: Month From 1 to 9 for Jan. to Sep., O for Oct., N for Nov., D for Dec. 3rd & 4th letter: Day e.g.: 5N28 (November 28, 2005)

§3. Thermal protection

Sample calculation for the operating temperature range.



IR－Tj Characteristics of SBD at 15V



When the voltage is generated across the REX by the IR of the SBD and this voltage is raised up to the Vref of the shunt regulator by the rapid increase in the IR at high temperature, the latch circuit is started to operate and the power supply unit stops its operation.

Say Vref=2.5V, REX=1200Ω. Then IR=2.5 / 1200 = 2.08mA. Hence, the figure above gives the thermal protection operating temperature range: 124°C to 134.2°C.

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