

# General purpose transistor (isolated transistor and diode)

## FML9

A 2SB1689 and a RB461F are housed independently in a UMT package.

### ●Applications

DC / DC converter  
Motor driver

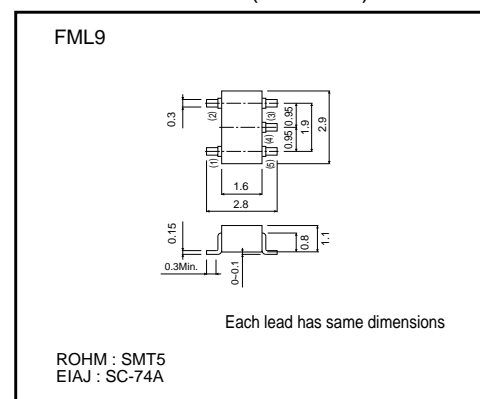
### ●Features

- 1) Tr : Low  $V_{CE(sat)}$   
Di : Low  $V_F$
- 2) Small package

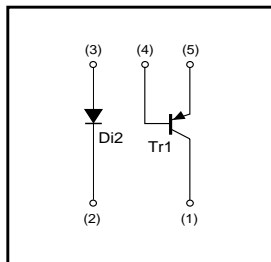
### ●Structure

Silicon epitaxial planar transistor  
Schottky barrier diode

### ●External dimensions (Units : mm)



### ●Equivalent circuit



### ●Packaging specifications

Type	FML9
Package	SMT5
Marking	L9
Code	TR
Basic ordering unit(pieces)	3000

## Transistors

## ●Absolute maximum ratings (Ta=25°C)

Tr1

Parameter	Symbol	Limits	Unit
Collector-base voltage	V <sub>CBO</sub>	-15	V
Collector-emitter voltage	V <sub>CEO</sub>	-12	V
Emitter-base voltage	V <sub>EBO</sub>	-6	V
Collector current	I <sub>C</sub>	-1.5	A
	I <sub>CP</sub>	-3	A *1
Power dissipation	P <sub>c</sub>	200	mW *2
Junction temperature	T <sub>j</sub>	150	°C
Range of storage temperature	T <sub>stg</sub>	-40~+125	°C

\*1 Single pulse, Pw=1ms.

\*2 Each terminal mounted on a recommended land.

Di2

Parameter	Symbol	Limits	Unit
Average rectified forward current	I <sub>F</sub>	700	mA
Forward current surge peak (60Hz, 1∞)	I <sub>FSM</sub>	3	A
Reverse voltage (DC)	V <sub>R</sub>	20	V
Junction temperature	T <sub>j</sub>	125	°C
Range of storage temperature	T <sub>stg</sub>	-40~+125	°C

## ●Electrical characteristics (Ta=25°C)

Tr1

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-emitter breakdown voltage	BV <sub>CEO</sub>	-12	—	—	V	I <sub>C</sub> =-1mA
Collector-base breakdown voltage	BV <sub>CBO</sub>	-15	—	—	V	I <sub>C</sub> =-10μA
Emitter-base breakdown voltage	BV <sub>EBO</sub>	-6	—	—	V	I <sub>E</sub> =-10μA
Collector cut-off current	I <sub>CBO</sub>	—	—	-100	nA	V <sub>CB</sub> =-15V
Emitter cut-off current	I <sub>EBO</sub>	—	—	-100	nA	V <sub>EB</sub> =-6V
Collector-emitter saturation voltage	V <sub>CE(sat)</sub>	—	-110	-200	mV	I <sub>C</sub> =-500mA, I <sub>E</sub> =-25mA
DC current gain	h <sub>FE</sub>	270	—	680	—	V <sub>CE</sub> =-2V, I <sub>C</sub> =-200mA
Transition frequency	f <sub>T</sub>	—	400	—	MHz	V <sub>CE</sub> =-2V, I <sub>E</sub> =200mA, f=100MHz
Collector output capacitance	C <sub>ob</sub>	—	12	—	pF	V <sub>CB</sub> =-10V, I <sub>E</sub> =0mA, f=1MHz

Di2

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V <sub>F</sub>	—	—	490	mV	I <sub>F</sub> =700mA
Reverse current	I <sub>R</sub>	—	—	200	μA	V <sub>R</sub> =20V

## Transistors

## ●Electrical characteristic curves

Tr1

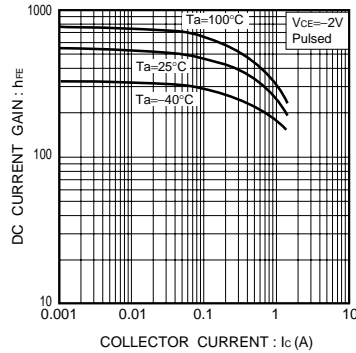


Fig.1 DC current gain vs. collector current

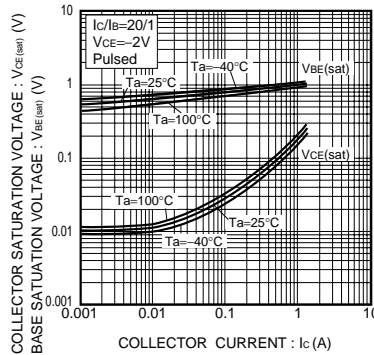


Fig.2 Base-emitter saturation voltage vs. collector current

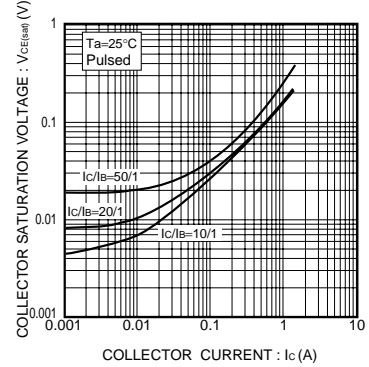


Fig.3 Collector-emitter saturation voltage vs. collector current

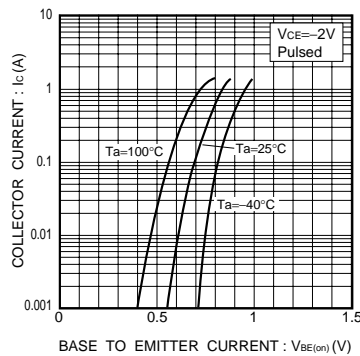


Fig.4 Grounded emitter propagation characteristics

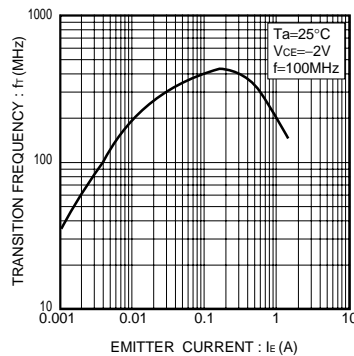


Fig.5 Gain bandwidth product vs. emitter current

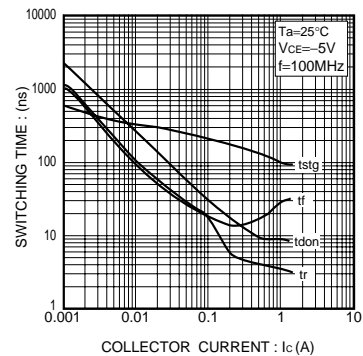


Fig.6 Switching time

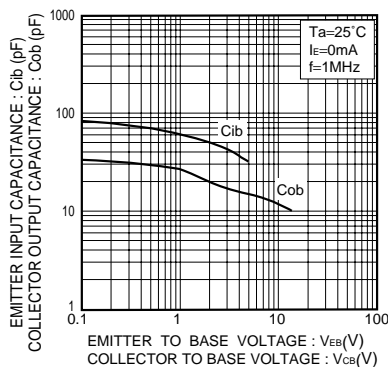
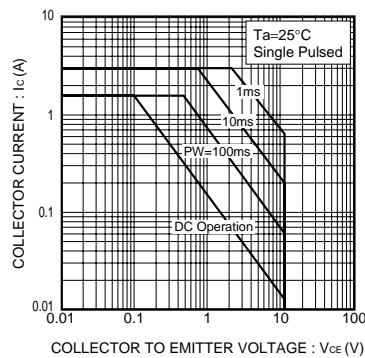
Fig.7 Collector output capacitance vs. collector-base voltage  
Emitter input capacitance vs. emitter-base voltage

Fig.8 Safe operation area

## Transistors

Di2

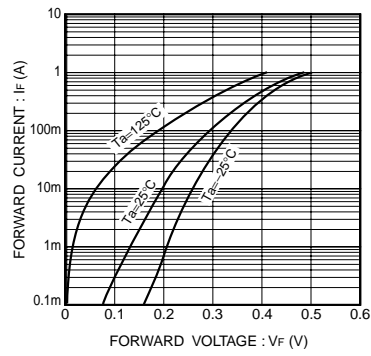


Fig.9 Forward characteristics

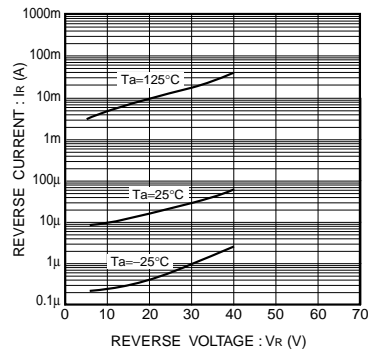


Fig.10 Reverse characteristics