

# 2MBI400VB-060-50

IGBT Modules

## IGBT MODULE (V series) 600V / 400A / 2 in one package

### ■ Features

- High speed switching
- Voltage drive
- Low Inductance module structure

### ■ Applications

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply
- Industrial machines, such as Welding machines



### ■ Maximum Ratings and Characteristics

#### ● Absolute Maximum Ratings (at T<sub>c</sub>=25°C unless otherwise specified)

Items	Symbols	Conditions	Maximum ratings	Units
Collector-Emitter voltage	V <sub>CEs</sub>		600	V
Gate-Emitter voltage	V <sub>GES</sub>		±20	V
Collector current	I <sub>c</sub>	Continuous T <sub>c</sub> =80°C	400	
	I <sub>c pulse</sub>	1ms	800	
	-I <sub>c</sub>		400	
	-I <sub>c pulse</sub>	1ms	800	
Collector power dissipation	P <sub>C</sub>	1 device	1970	W
Junction temperature	T <sub>J</sub>		175	°C
Operating junction temperature (under switching conditions)	T <sub>Jop</sub>		150	
Case temperature	T <sub>C</sub>		125	
Storage temperature	T <sub>stg</sub>		-40 ~ 125	
Isolation voltage	between terminal and copper base (*1) V <sub>iso</sub>	AC : 1min.	2500	VAC
Screw torque	Mounting (*2)		3.5	N m
	Terminals (*3)		3.5	

Note \*1: All terminals should be connected together during the test.

Note \*2: Recommendable Value : 2.5-3.5 Nm (M5 or M6)

Note \*3: Recommendable Value : 2.5-3.5 Nm (M5)

#### ● Electrical characteristics (at T<sub>J</sub>= 25°C unless otherwise specified)

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Zero gate voltage collector current	I <sub>CEs</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V	-	-	2.0	mA	
Gate-Emitter leakage current	I <sub>GES</sub>	V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V	-	-	400	nA	
Gate-Emitter threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = 20V, I <sub>c</sub> = 400mA	6.2	6.7	7.2	V	
Collector-Emitter saturation voltage	V <sub>CE(sat)</sub> (terminal)	V <sub>GE</sub> = 15V I <sub>c</sub> = 400A	T <sub>J</sub> =25°C	-	1.90	2.35	V
			T <sub>J</sub> =125°C	-	2.20	-	
			T <sub>J</sub> =150°C	-	2.30	-	
	V <sub>CE(sat)</sub> (chip)	V <sub>GE</sub> = 15V I <sub>c</sub> = 400A	T <sub>J</sub> =25°C	-	1.60	2.05	
			T <sub>J</sub> =125°C	-	1.90	-	
			T <sub>J</sub> =150°C	-	2.00	-	
Internal gate resistance	R <sub>G(int)</sub>	-	-	2.0	-	Ω	
Input capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 10V, V <sub>GE</sub> = 0V, f = 1MHz	-	25.6	-	nF	
Turn-on time	t <sub>on</sub>	V <sub>CC</sub> = 300V L <sub>s</sub> = 30nH	-	650	-	nsec	
	t <sub>r</sub>	I <sub>c</sub> = 400A	-	300	-		
	t <sub>r(i)</sub>	V <sub>GE</sub> = ±15V	-	100	-		
	t <sub>off</sub>	R <sub>θ</sub> = 3.3Ω	-	600	-		
Turn-off time	t <sub>r</sub>	T <sub>J</sub> = 150°C	-	70	-	nsec	
	V <sub>F</sub> (terminal)	V <sub>GE</sub> = 0V I <sub>F</sub> = 400A	T <sub>J</sub> =25°C	-	1.75		2.20
			T <sub>J</sub> =125°C	-	1.65		-
			T <sub>J</sub> =150°C	-	1.62		-
	V <sub>F</sub> (chip)	V <sub>GE</sub> = 0V I <sub>F</sub> = 400A	T <sub>J</sub> =25°C	-	1.60		2.05
T <sub>J</sub> =125°C			-	1.50	-		
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 400A	-	200	-	nsec	

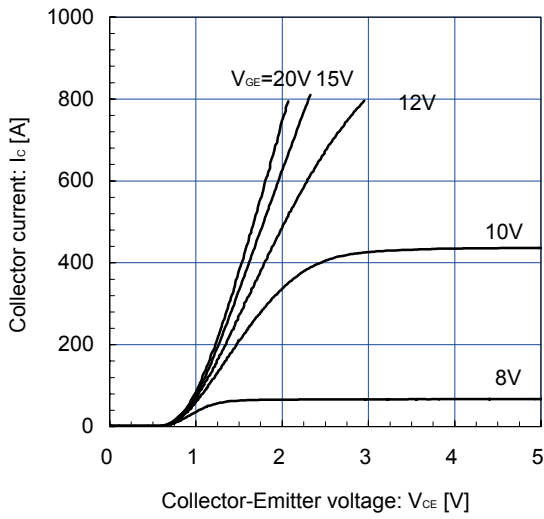
#### ● Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	R <sub>th(j-c)</sub>	IGBT FWD	-	-	0.076	°C/W
Contact thermal resistance (1device) (*4)	R <sub>th(c-f)</sub>	with Thermal Compound	-	0.025	-	

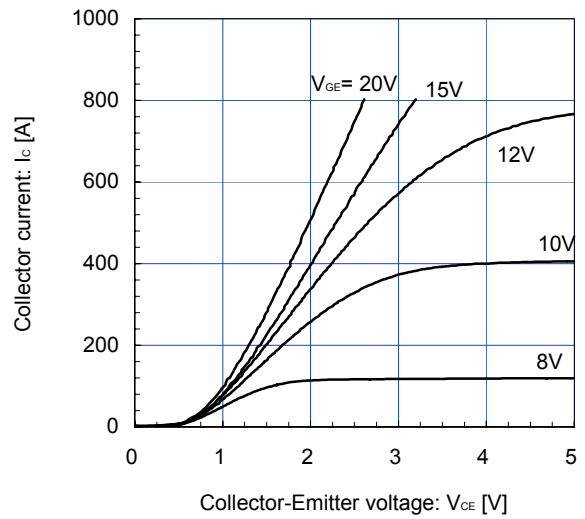
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)

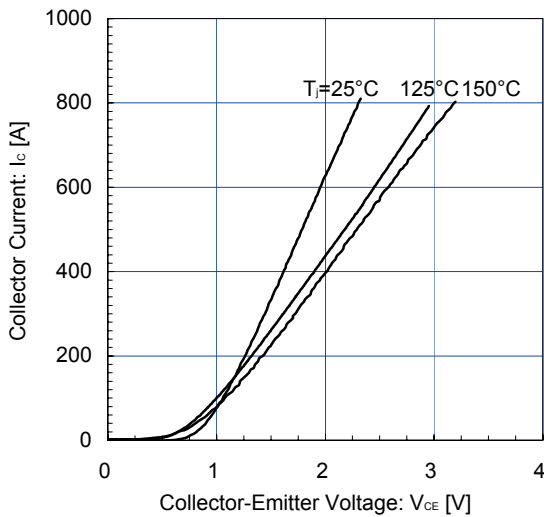
Collector current vs. Collector-Emitter voltage (typ.)  
 $T_J = 25^\circ\text{C}$  / chip



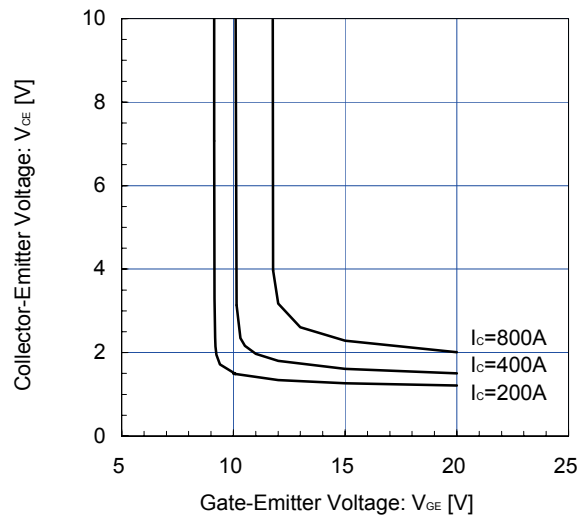
Collector current vs. Collector-Emitter voltage (typ.)  
 $T_J = 150^\circ\text{C}$  / chip



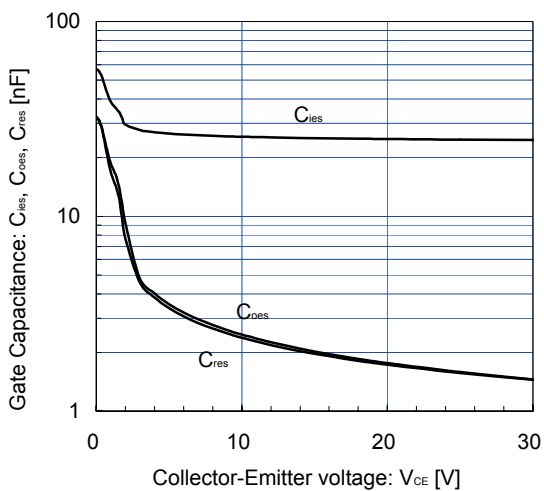
Collector current vs. Collector-Emitter voltage (typ.)  
 $V_{GE} = 15\text{V}$  / chip



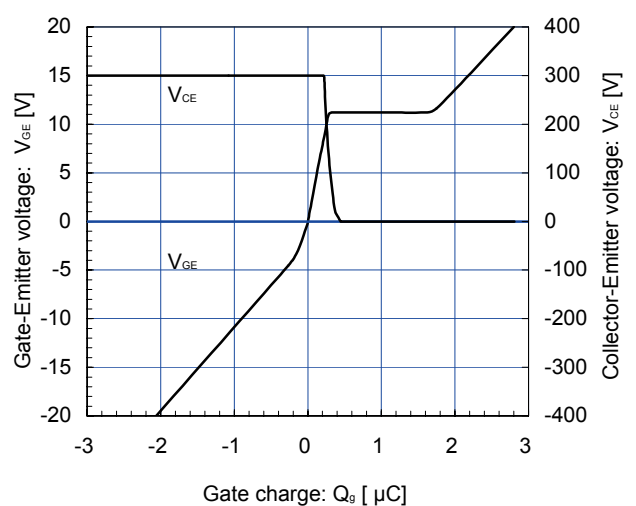
Collector-Emitter voltage vs. Gate-Emitter voltage  
 $T_J = 25^\circ\text{C}$  / chip



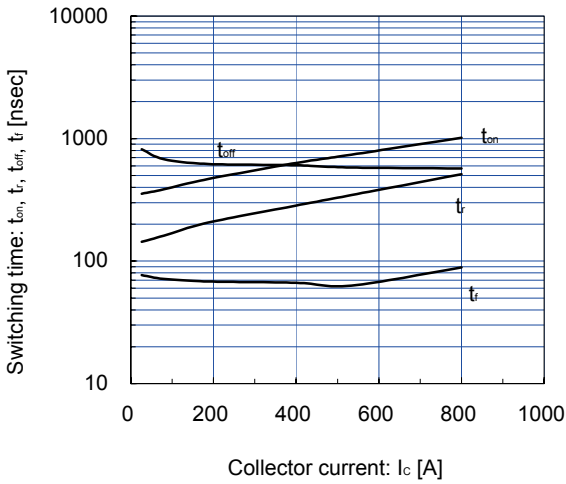
Gate Capacitance vs. Collector-Emitter Voltage  
 $V_{GE} = 0\text{V}$ ,  $f = 1\text{MHz}$ ,  $T_J = 25^\circ\text{C}$



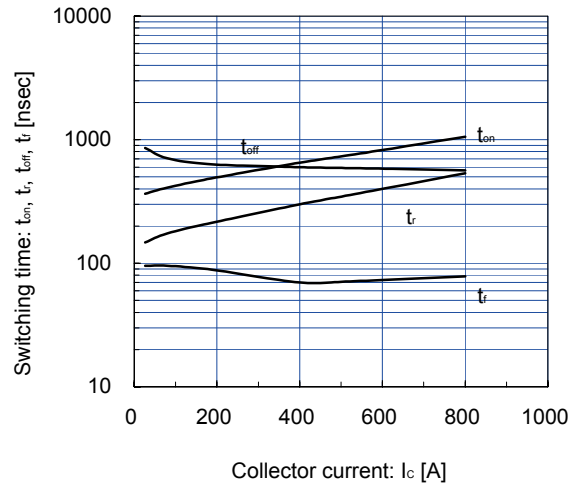
Dynamic Gate Charge (typ.)  
 $V_{CC} = 300\text{V}$ ,  $I_C = 400\text{A}$ ,  $T_J = 25^\circ\text{C}$



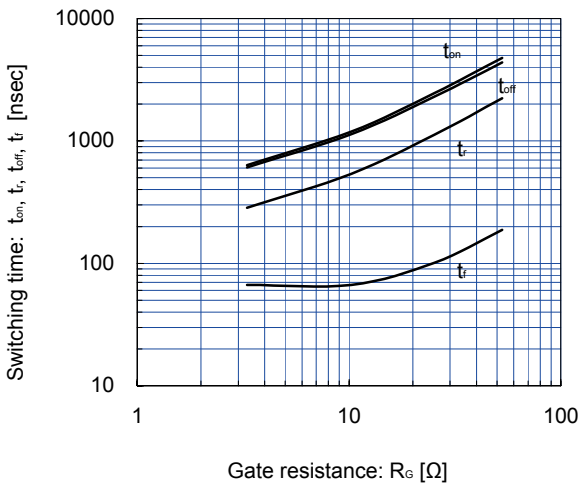
Switching time vs. Collector current (typ.)  
 $V_{CC}=300V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=125^\circ C$



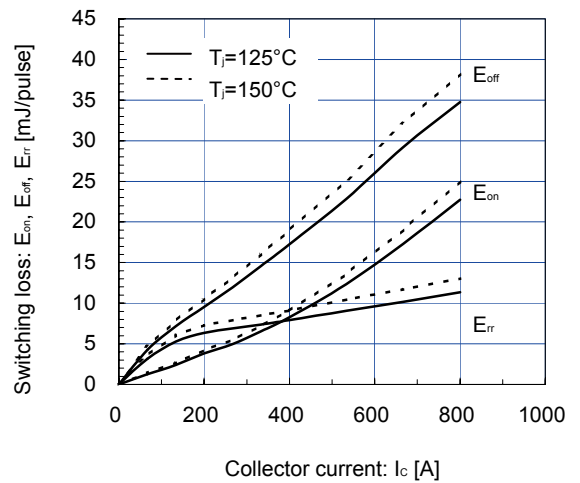
Switching time vs. Collector current (typ.)  
 $V_{CC}=300V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=150^\circ C$



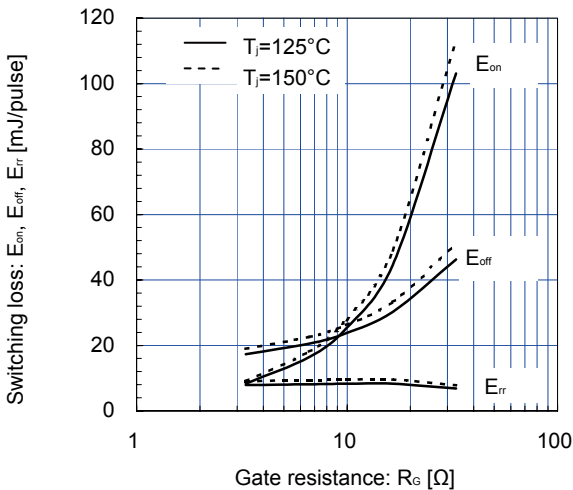
Switching time vs. Gate resistance (typ.)  
 $V_{CC}=300V, I_C=400A, V_{GE}=\pm 15V, T_J=125^\circ C$



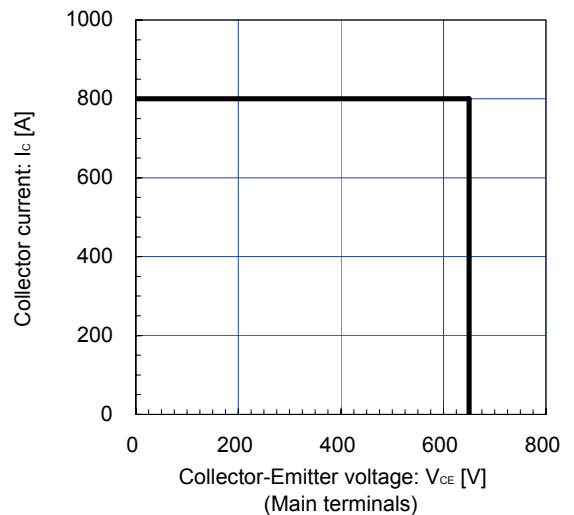
Switching loss vs. Collector current (typ.)  
 $V_{CC}=300V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=125, 150^\circ C$



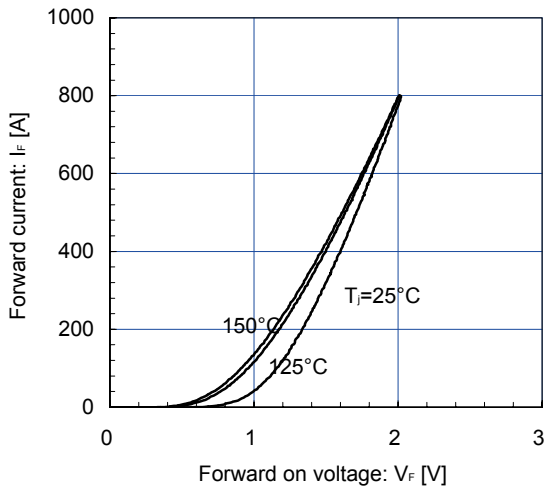
Switching loss vs. Gate resistance (typ.)  
 $V_{CC}=300V, I_C=400A, V_{GE}=\pm 15V, T_J=125, 150^\circ C$



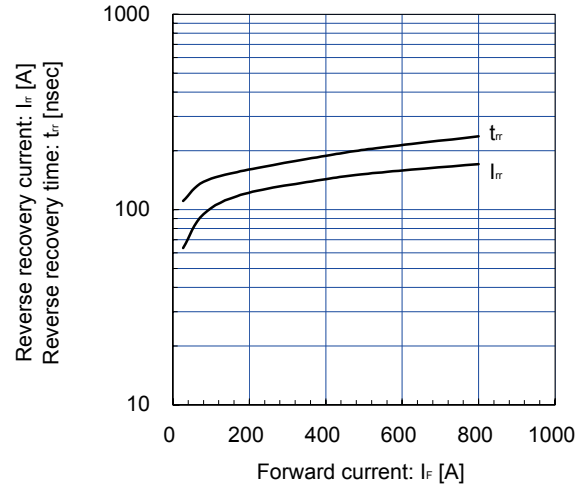
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE}=15V, R_G=3.3\Omega, T_J=150^\circ C$



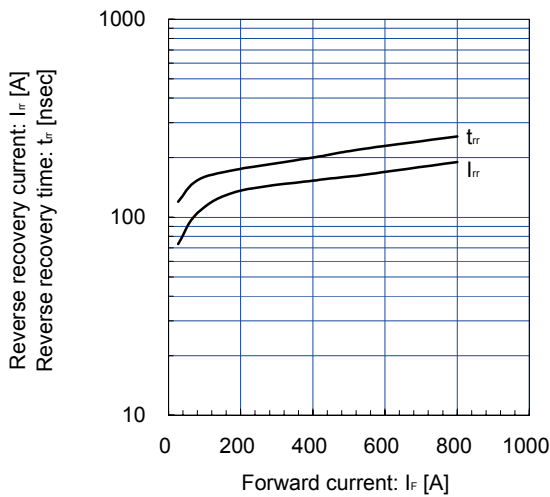
Forward Current vs. Forward Voltage (typ.)  
chip



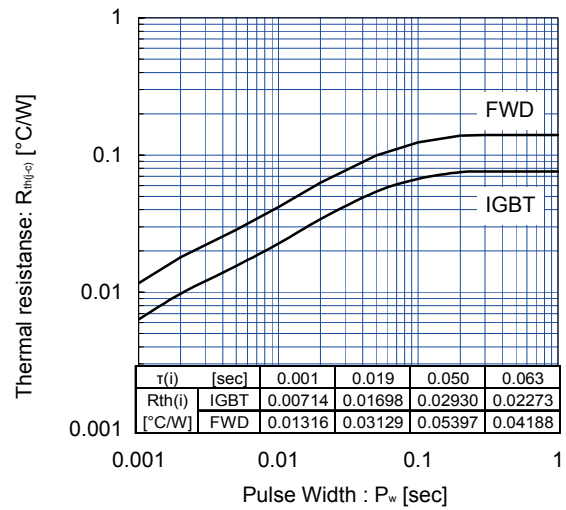
Reverse Recovery Characteristics (typ.)  
 $V_{CC}=300V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=125^\circ C$



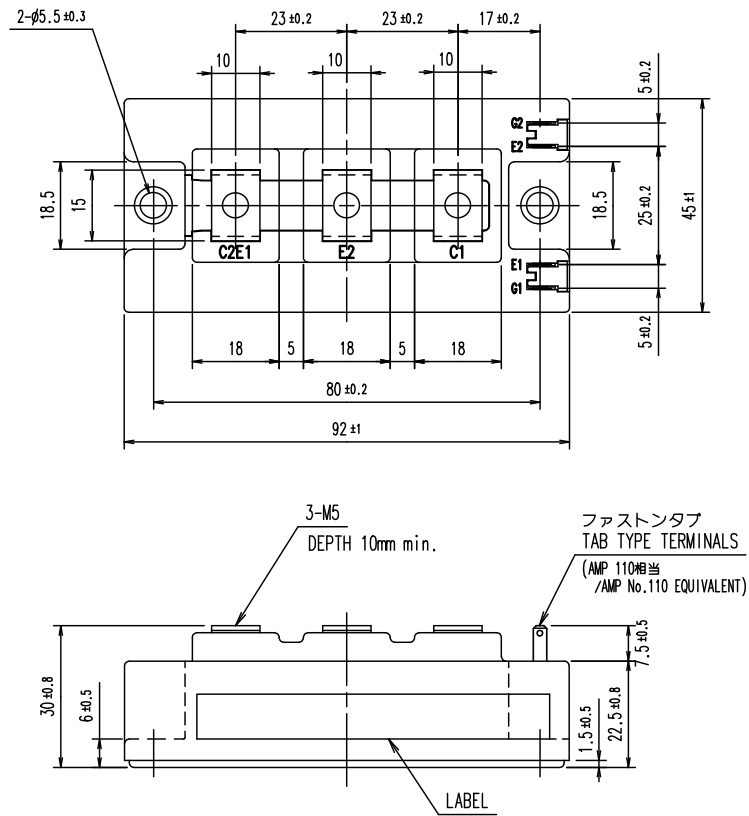
Reverse Recovery Characteristics (typ.)  
 $V_{CC}=300V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=150^\circ C$



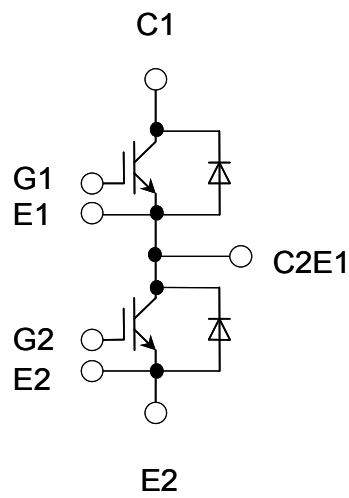
Transient Thermal Resistance (max.)



■ Outline Drawings, mm



■ Equivalent Circuit Schematic



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