4MBI340VF-120R-50

IGBT Modules

IGBT Power Module (V series)
1200V/340A/IGBT, ±600V/340A/RB-IGBT, 4-in-1 package

■ Features

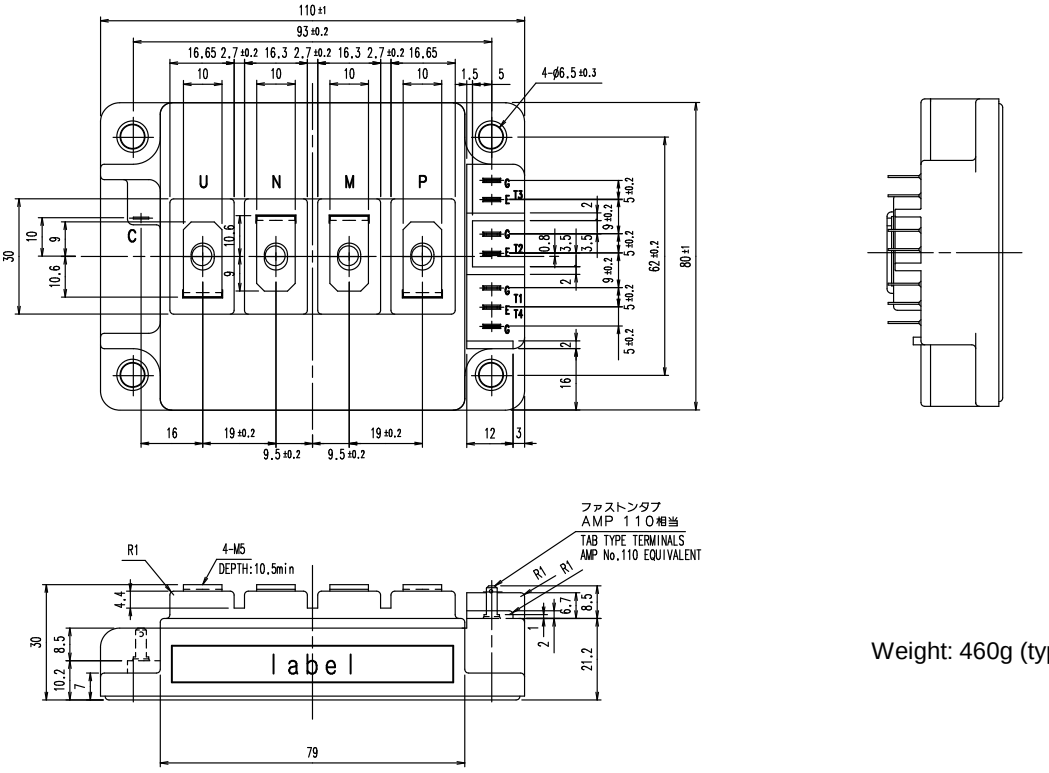
Higher efficiency
Optimized Advanced T-type circuit
Low inductance module structure

■ Applications

Inverter for motor drive
Uninterruptible powre supply
Power conditioner

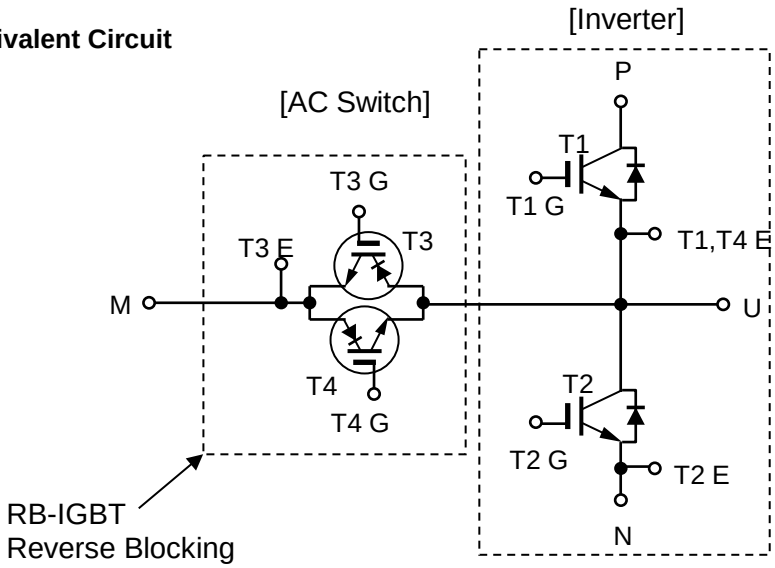
■ Outline drawing

(Unit : mm)



Weight: 460g (typ.)

■ Equivalent Circuit



FM5F08534a
2017/06

4MBI340VF-120R-50

■ Absolute Maximum Ratings (at T_c= 25°C unless otherwise specified)

Item			Symbol	Condition		Maximum Rating	Unit
Inverter	Collector-Emitter voltage		V_{CES}			1200	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current	IGBT	I_C	Continuous	T_c=80°C	340	A
			I_C pulse	1ms	T_c=80°C	600	
		FWD	$-I_C$			340	
			$-I_C$ pulse			600	
	Collector power dissipation		P_C	1 device		1500	W
	Junction temperature		T_{vj}			175	°C
	Operating temperature (under switching conditions)		T_{vjop}			150	
AC Switch	Collector-Emitter voltage		V_{CES}			±600	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	T_c=80°C	340	A
			I_C pulse	1ms	T_c=80°C	600	
	Collector power dissipation		P_C	1 device		1500	W
	Junction temperature		T_{vj}			150	°C
	Operating temperature (under switching conditions)		T_{vjop}			125	
Case temperature			T_c			125	
Storage temperature			T_{stg}			-40～+125	
Isolation voltage	between terminal and copper base (*1)		V_{iso}	AC : 1min.		2500	VAC
Screw torque	Mounting (*2)		-	M5 or M6		3.5	Nm
	Terminal (*3)		-	M5		3.5	

(*1) All terminals should be connected together during the test.
(*2) Recommendable value : 2.5-3.5 Nm (M5 or M6)
(*3) Recommendable value : 2.5-3.5 Nm (M5)

■ Electrical characteristics (at T_{vj}= 25°C unless otherwise specified)

	Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V V_{CE}= 1200V		-	-	2.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{GE} = 0V V_{GE} = ±20V		-	-	400	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 300mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	V_{GE} = 15V I_C = 300A	T_{vj}= 25°C	-	1.85	2.10	V
				T_{vj}=125°C	-	2.20	-	
				T_{vj}=150°C	-	2.25	-	
		$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C = 300A	T_{vj}= 25°C	-	2.05	2.35	
				T_{vj}=125°C	-	2.40	-	
				T_{vj}=150°C	-	2.45	-	
	Internal gate rasistance	r_g	-		-	2.50	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V,V_{GE}=0V,f=1MHz		-	25.2	-	nF
	Turn-on time	t_{on}	SW mode : A		-	0.75	1.30	μs
		t_r	V_{cc} = 400V		-	0.45	0.80	
		$t_{r(i)}$	I_C = 300A		-	0.15	-	
	Turn-off time	t_{off}	V_{GE}= ±15V		-	0.60	1.00	
		t_f	R_G = +10/-1Ω		-	0.10	0.35	
	Forward on voltage	V_F (chip)	I_F = 300A	T_{vj}= 25°C	-	1.70	1.95	V
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.80	-	
		V_F (terminal)	I_F = 300A	T_{vj}= 25°C	-	1.95	2.25	
				T_{vj}=125°C	-	2.10	-	
				T_{vj}=150°C	-	2.05	-	
	Reverse recovery time	t_{rr}	SW mode : B V_{cc}= 400V I_F= 300A V_{GE}= ±15V R_G = +8.2/-39Ω		-	-	0.3	μs
AC Switch	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V V_{CE}= 600V		-	-	3.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V V_{GE}= ±20V		-	-	600	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 300mA		5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	V_{GE}= 15V I_C = 300A	T_{vj}= 25°C	-	2.45	2.80	V
				T_{vj}=125°C	-	2.60	-	
		$V_{CE(sat)}$ (terminal)	V_{GE}= 15V I_C = 300A	T_{vj}= 25°C	-	2.55	2.95	
				T_{vj}=125°C	-	2.70	-	
	Internal gate rasistance	r_g	-		-	2.93	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V,V_{GE}=0V,f=1MHz		-	0.5	1.05	nF
	Turn-on time	t_{on}	SW mode : B		-	0.27	0.53	μs
		t_r	V_{cc}= 400V		-	0.12	-	
		$t_{r(i)}$	I_C = 300A		-	1.32	3.00	
	Turn-off time	t_{off}	V_{GE}= ±15V		-	0.11	0.35	
		t_f	R_G = +8.2/-39Ω		-	0.05	-	
	Reverse recovery time	t_{rr}	SW mode : A V_{cc}= 400V I_C = 300A V_{GE}= ±15V R_G = +10/-1Ω		-	-	0.3	μs
Internal inductance		L	P-N		-	40	-	nH
			P-M		-	33	-	
			M-N		-	33	-	

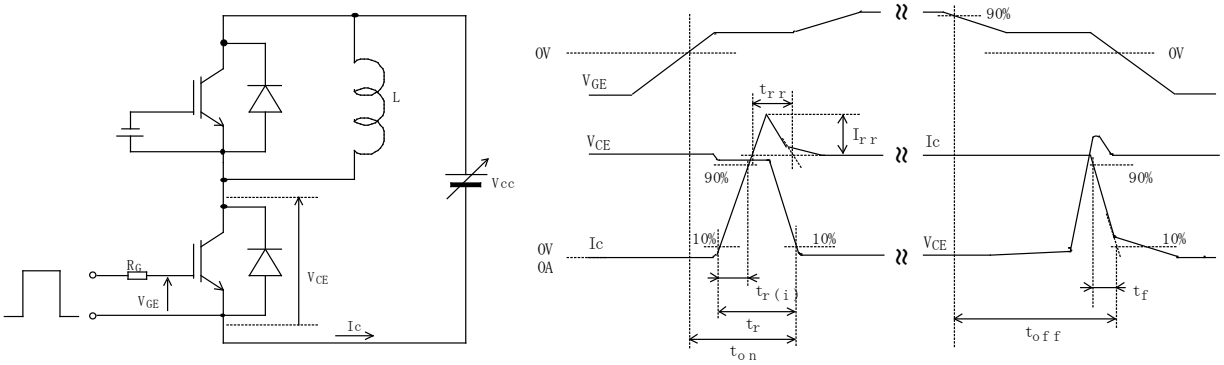
■ Thermal resistance characteristics

Item	Symbol	Condition		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance (1device)	$R_{th(j-c)}$	T1, T2 IGBT		-	-	0.075	°C/W
		T1, T2 FWD		-	-	0.112	
		T3, T4 RB-IGBT		-	-	0.084	
Contact thermal resistance (1device) (*1)	$R_{th(c-f)}$	T1, T2	with thermal	-	0.025	-	
		T3, T4	compound	-	0.017	-	

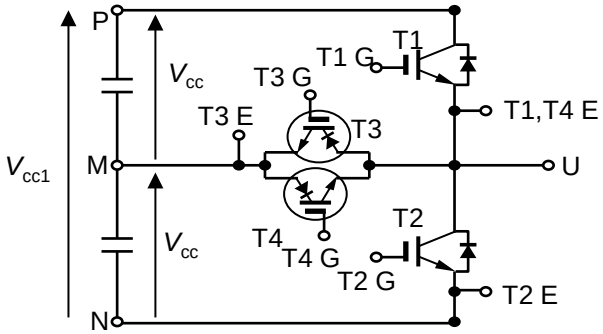
(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

4MBI340VF-120R-50

■ Definitions of switching time



■ Definitions of switching mode



SW mode	Load L	T1	T2	T3	T4
A	M-U	**SW**	OFF	OFF	**ON**
	M-U	OFF	**SW**	**ON**	OFF
B	P-U	OFF	OFF	**SW**	**ON**
	U-N	OFF	OFF	**ON**	**SW**

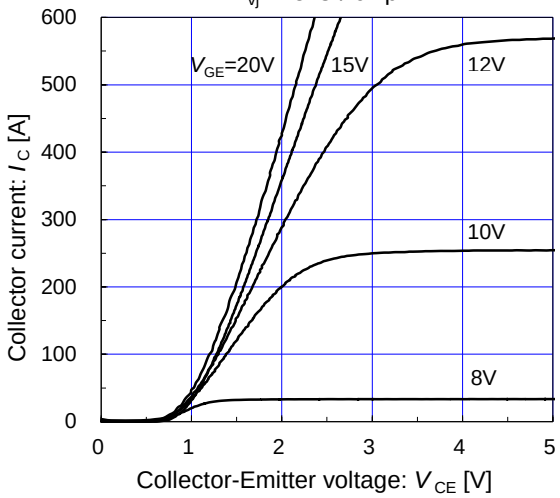
SW: Connect to drive circuit and input gate signal
ON: Bias voltage of gate +15V
OFF: Reverse bias voltage of gate -15V
$V_{cc1}=2\times V_{cc}$

Warning

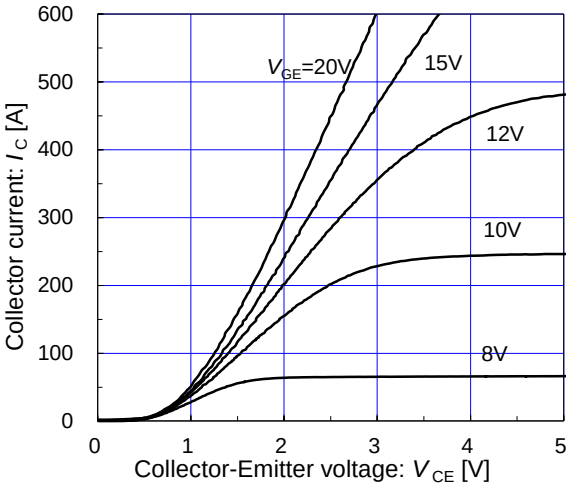
When reverse voltage is applied to C-E of RB-IGBT without forward gate bias voltage (+VGE), the reverse leakage current at C-E will be large. In order to reduce the reverse leakage current, +VGE should be applied to G-E of RB-IGBT when reverse voltage is being applied to C-E. (Recommended value : +VGE=15V)

4MBI340VF-120R-50

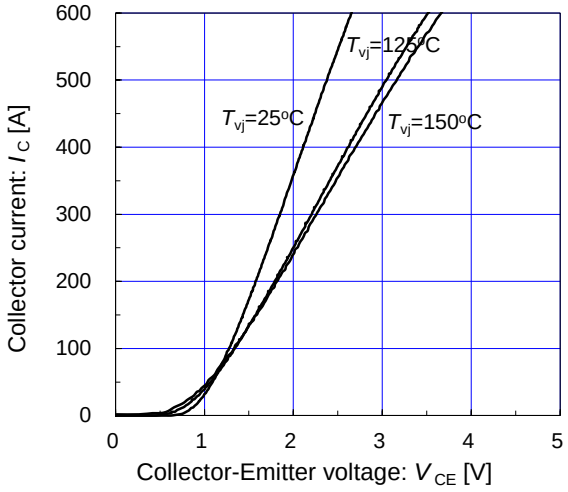
[Inverter (T1, T2)]
Collector current vs. Collector-Emitter voltage
T_{vj}= 25°C / chip



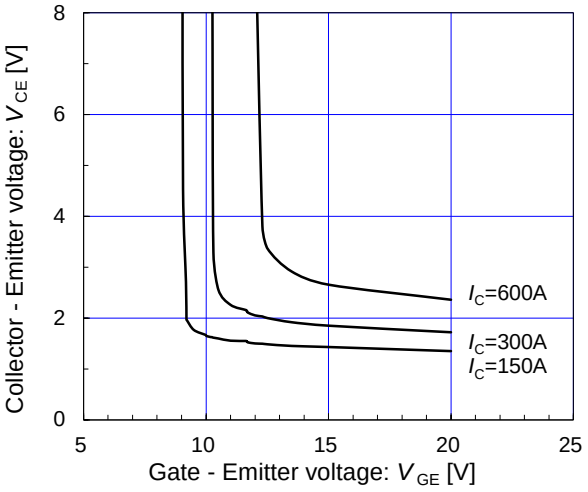
[Inverter (T1, T2)]
Collector current vs. Collector-Emitter voltage
T_{vj}= 150°C / chip



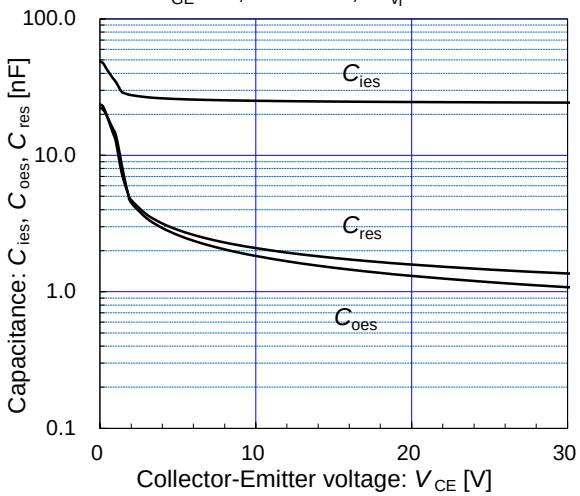
[Inverter (T1, T2)]
Collector current vs. Collector-Emitter voltage
V_{GE}= 15V / chip



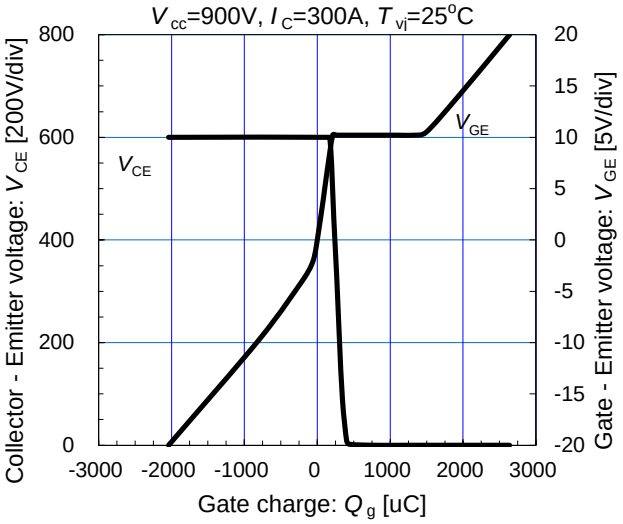
[Inverter (T1, T2)]
Collector-Emitter voltage vs. Gate-Emitter voltage
T_{vj}= 25°C / chip



[Inverter (T1, T2)]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE}=0V, f= 1MHz, T_{vj}= 25°C

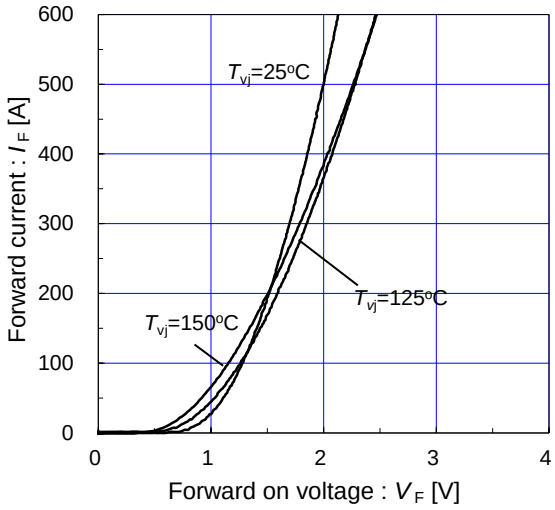


[Inverter (T1, T2)]
Dynamic gate charge (typ.)
V_{cc}=900V, I_C=300A, T_{vj}=25°C

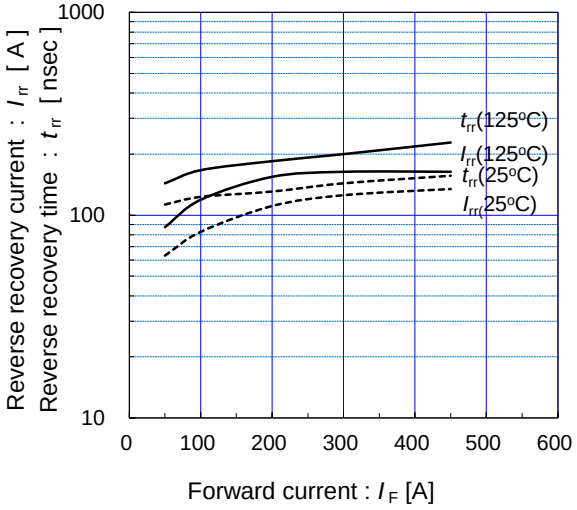


4MBI340VF-120R-50

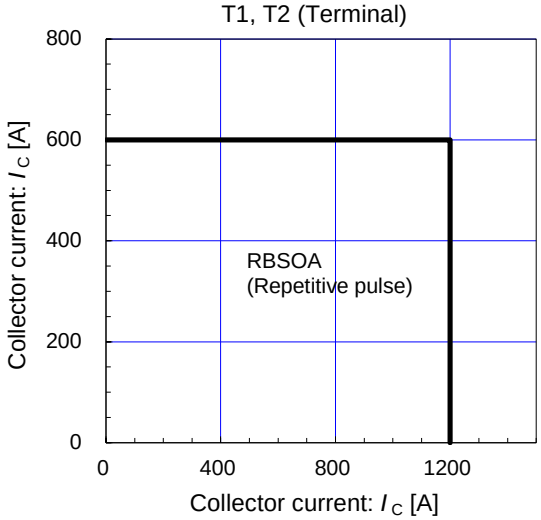
[Inverter (T1, T2)]
Forward current vs. forward on voltage (typ.)
chip



[T1, T2]
Reverse recovery characteristics (typ.)
V_{cc}=400V, V_{GE}=±15V, R_G=+10/-1Ω(T1, T2)



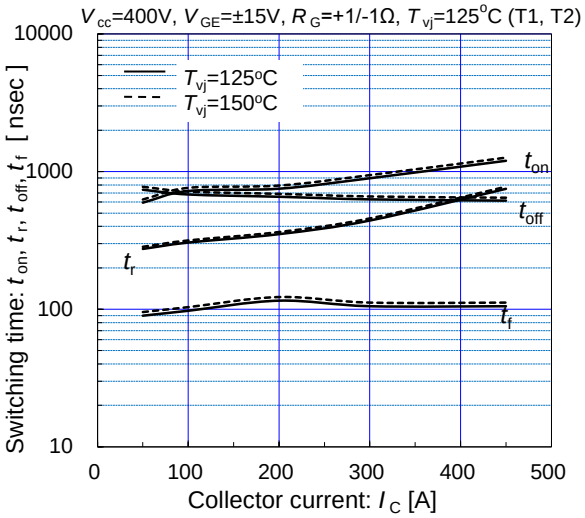
Reverse bias safe operating area (max.)
V_{GE}=+/- 15V, R_G ≧Recommended,T_{vj} = 150°C (T1, T2)
T1, T2 (Terminal)



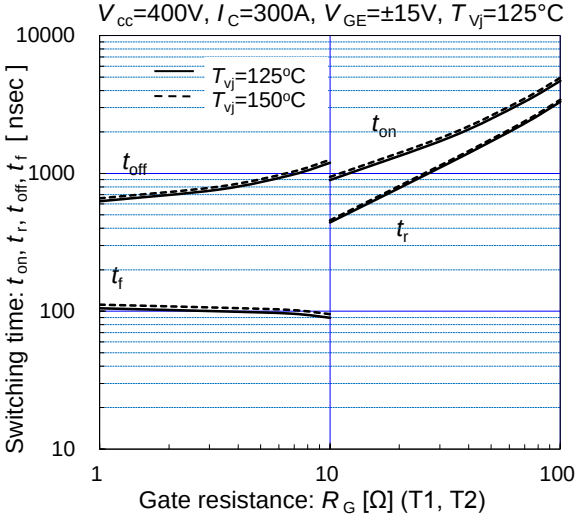
FM5F08534a
2017/06

4MBI340VF-120R-50

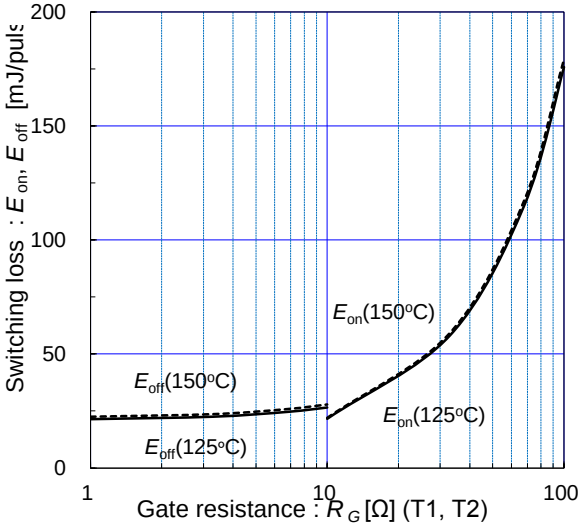
[SW mode: A]
Switching time vs. Collector current (typ.)
V_{cc}=400V, V_{GE}=±15V, R_G=+1/-1Ω, T_{vj}=125°C (T1, T2)



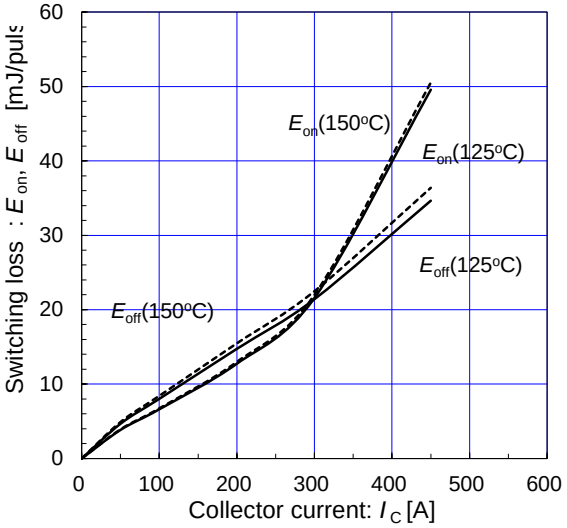
[SW mode: A]
Switching time vs. Collector current (typ.)
V_{cc}=400V, I_C=300A, V_{GE}=±15V, T_{vj}=125°C



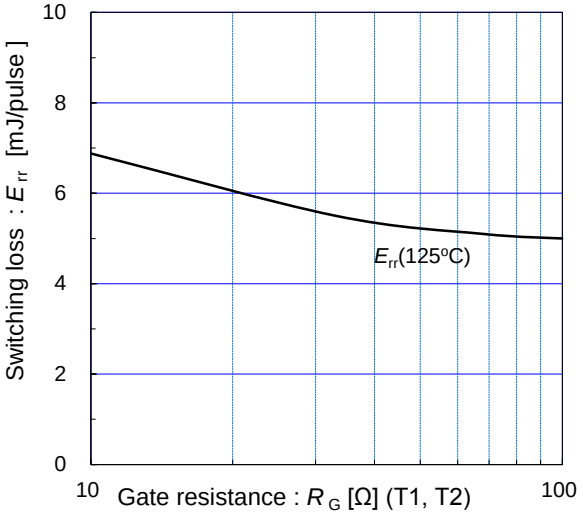
[SW mode A]
Reverse recovery characteristics (typ.)
V_{cc}=400V, I_C=300A, V_{GE}=±15V



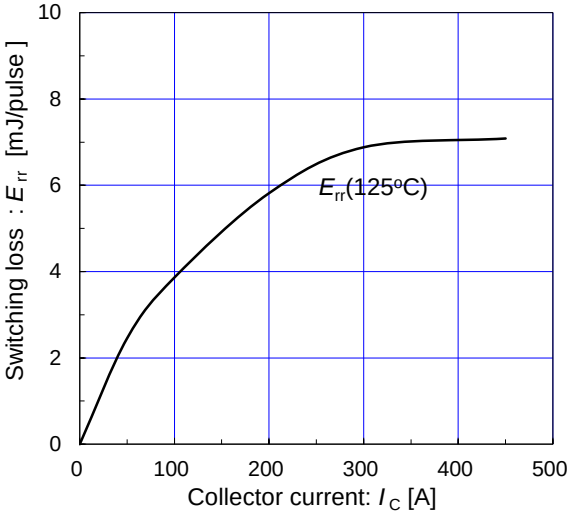
[SW mode A]
Switching loss vs. Collector current (typ.)
V_{cc}=400V, V_{GE}=±15V, R_G=+10/-1Ω (T1, T2)



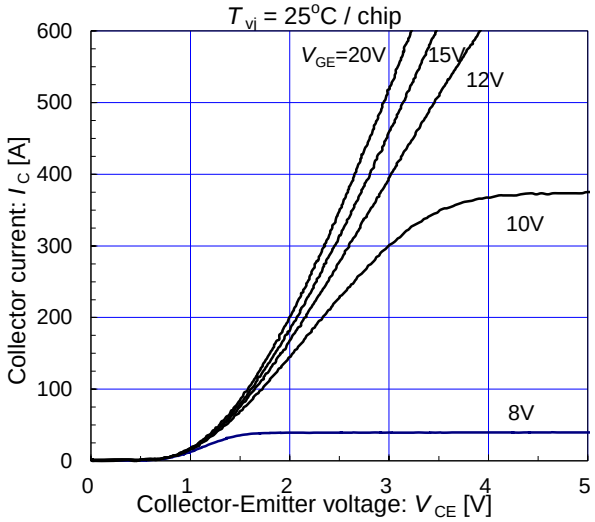
[SW mode A (T3,T4 RB-IGBT recovery)]
Switching loss vs. gate resistance (typ.)
V_{cc}=400V, I_C=300A, V_{GE}=±15V



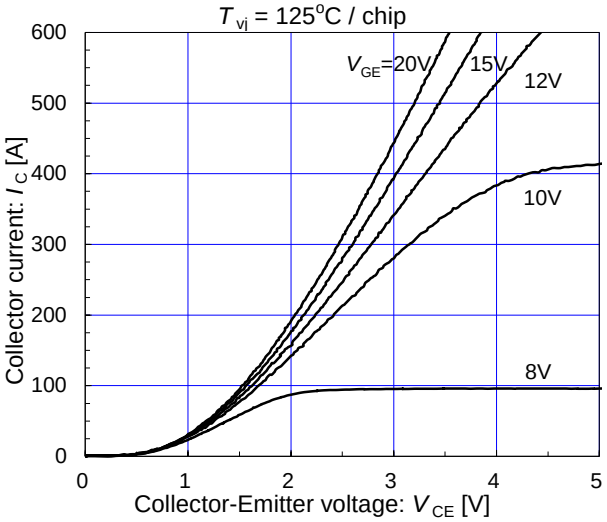
[SW mode A (T3,T4 RB-IGBT recovery)]
Switching loss vs. Collector current (typ.)
V_{cc}=400V, V_{GE}=±15V, R_G=+10/-1Ω (T1, T2)



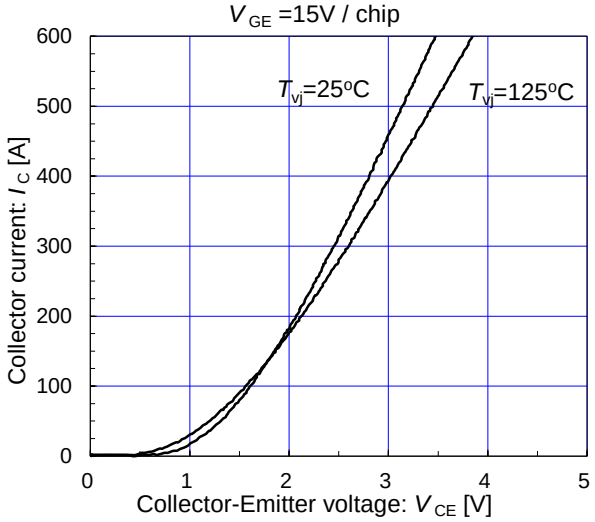
[AC-Switch (T3, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 25°C / chip



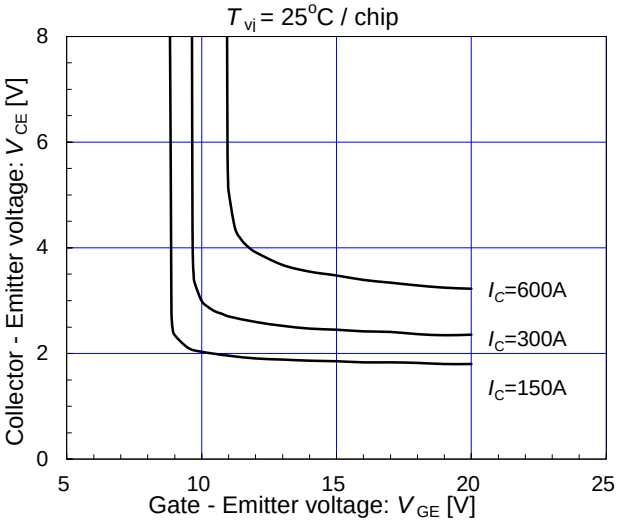
[AC-Switch (T3, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 125°C / chip



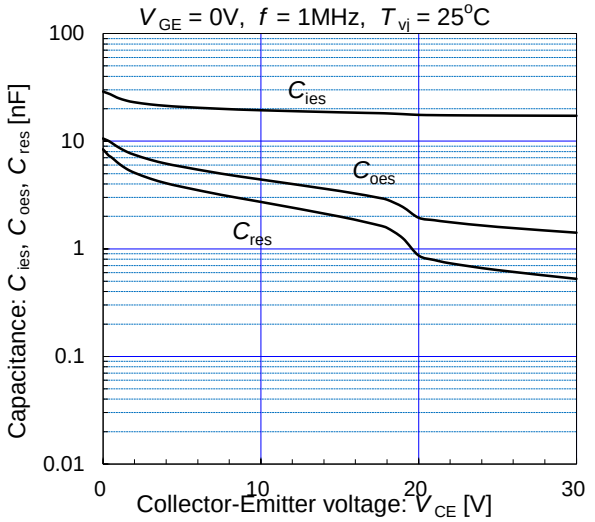
[AC-Switch (T3, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} =15V / chip



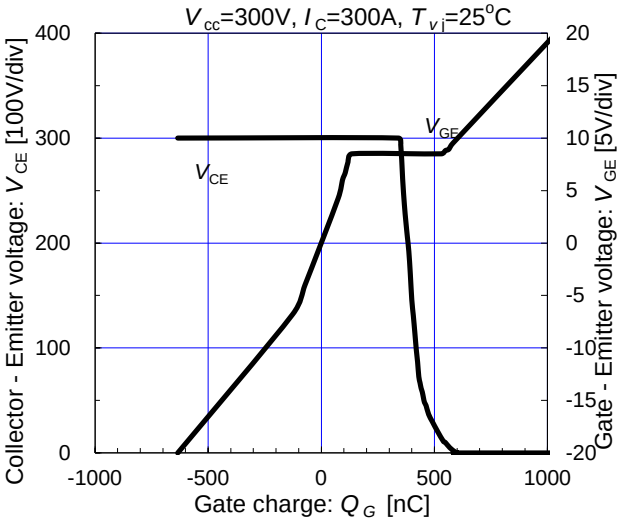
[AC-Switch (T3, T4)]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj} = 25°C / chip



[AC-Switch (T3, T4)]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE} = 0V, f = 1MHz, T_{vj} = 25°C

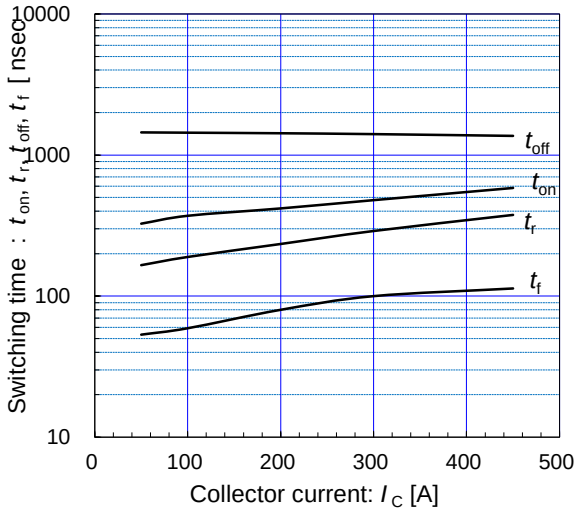


[AC-Switch (T3, T4)]
Dynamic gate charge (typ.)
V_{cc}=300V, I_C=300A, T_{vj}=25°C

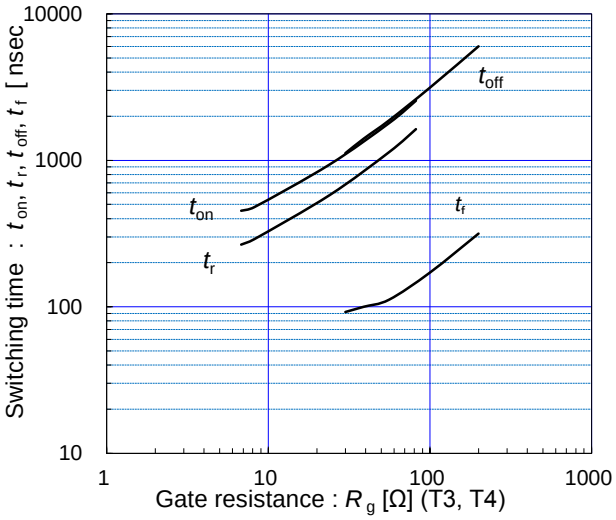


4MBI340VF-120R-50

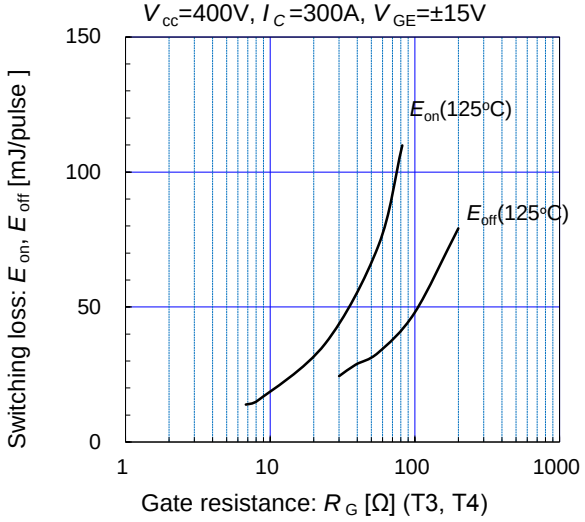
[SW mode B]
Switching time vs. Collector current (typ.)
V_{cc}=400V, V_{GE}=±15V, R_G=+8.2/-39Ω, T_{vj}=125°C (T3, T4)



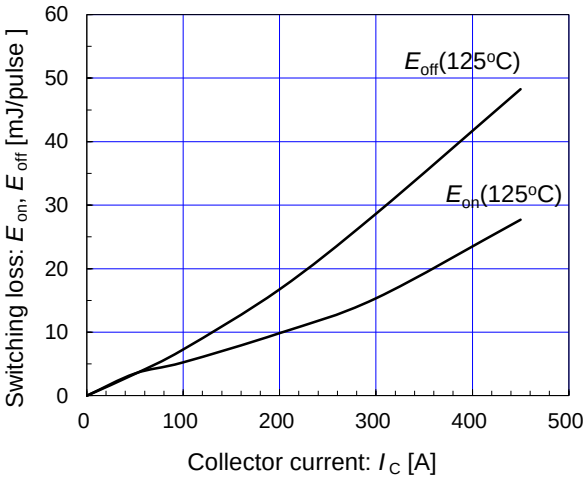
[SW mode B]
Switching loss vs. Collector current (typ.)
V_{cc}=400V, I_C=300A, V_{GE}=±15V, T_{vj}=125°C



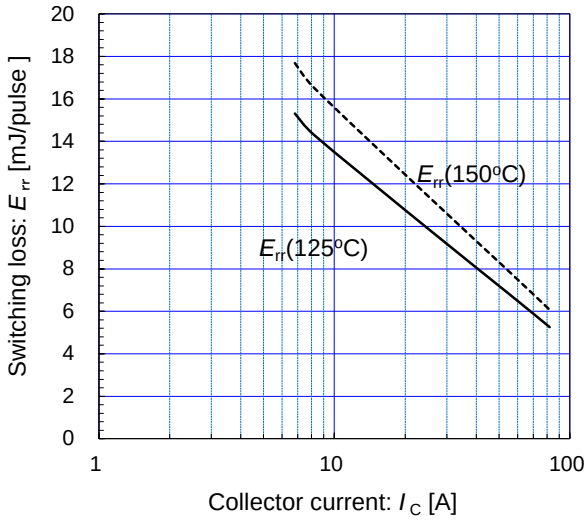
[SW mode B]
Switching loss vs. gate resistance (typ.)
V_{cc}=400V, I_C=300A, V_{GE}=±15V



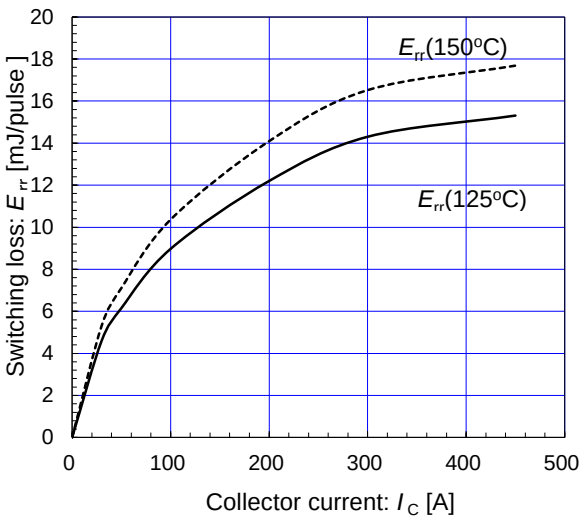
[SW mode B]
Switching loss vs. Collector current (typ.)
V_{cc}=400V, V_{GE}=±15V, R_G=+8.2/-39Ω (T3, T4)



[SW mode B (T1,T2 FWD recovery)]
Switching loss vs. gate resistance (typ.)
V_{cc}=400V, I_C=300A, V_{GE}=±15V

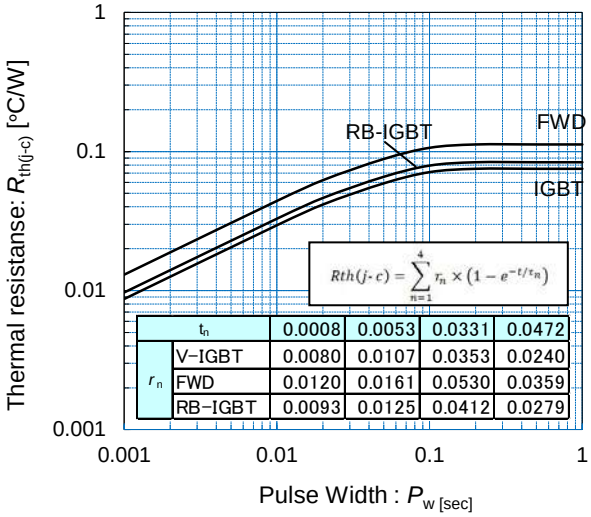


[SW mode B (T1,T2 FWD recovery)]
Switching loss vs. Collector current (typ.)
V_{cc}=400V, V_{GE}=±15V, R_G=+8.2/-39Ω (T3, T4)



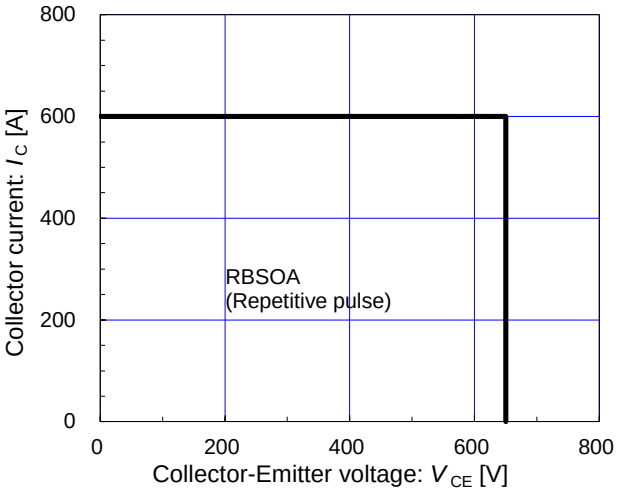
4MBI340VF-120R-50

Transient Thermal Resistance (max.)

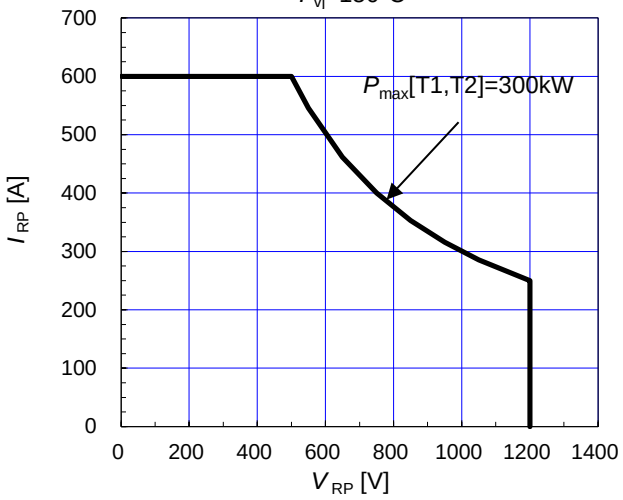


	t_n	0.0008	0.0053	0.0331	0.0472
r_n	V-IGBT	0.0080	0.0107	0.0353	0.0240
	FWD	0.0120	0.0161	0.0530	0.0359
	RB-IGBT	0.0093	0.0125	0.0412	0.0279

Reverse bias safe operating area (max.)
V_{GE}=±15V, R_G ≧Recommended, T_{vj}=125°C (T3, T4)
T3, T4 (Terminal)



Reverse recovery withstand capability for FWD
T_{vj}=150°C



Reverse recovery withstand capability for RB-IGBT
T_{vj}=125°C