PRELIMINARY

SECURITY CODE		MITSUBISHI ELECTRIC CORPORATION							
SPEC.NAME Customer's Std. Spec.	Prepared by	S.Iura	R E V	A	S.Iura	B	S.Iura		
	Checked by	Y.Konishi			I.Umezaki		I.Umezaki		
	Approved by	I.Umezaki			H.Yamaguchi		H.Yamaguchi		
	DATE	28-Aug.-2003			17-Nov.-2003		5-Apr.-2004		

HIGH VOLTAGE IGBT MODULE TARGET SPECIFICATION

1. Type number — **CM1200E4C-34N**
   (1.7kV / 1.2kA chopper-HVIGBT with CSTBT)
2. Structure — Flat base type (Insulated package, AlSiC base plate)
3. Application & Customer — High power converters and inverters
4. Outline — 130 × 140 × 38 (L. W. H)
5. Related specifications
6. Maximum ratings

Item	Symbol	Conditions	Ratings	Unit
6.1 Collector-emitter voltage	V_{CES}	V_{GE}=0V, T_j=25ºC	1700	V
6.2 Gate-emitter voltage	V_{GES}	V_{CE}=0V, T_j=25ºC	±20	V
6.3 Collector current	I_C	T_C=80ºC	1200	A
	I_{CM}	Pulse (note1)	2400	A
6.4 Emitter current	I_E (note2)		1200	A
	I_{EM}(note2)	Pulse (note1)	2400	A
6.5 Maximum collector dissipation	P_C (note3)	T_C=25ºC, IGBT part	6400	W
6.6 Isolation voltage	V_{iso}	Charged part to base plate, rms sinusoidal, AC60Hz 1min.	4000	V
6.7 Junction temperature	T_j	—	−40 ~ +150	ºC
6.8 Storage temperature	T_{stg}	—	−40 ~ +125	ºC
6.9 Operating temperature	T_{op}	—	−40 ~ +125	ºC
6.10 Maximum turn-off switching current	—	T_j=125ºC, V_{CC}≤1200V V_{GE}=±15V, V_{CE}≤1700V	1200	A
	—	T_j=125ºC, V_{CC}≤1200V V_{GE}=±15V, V_{CE}≤1200V	2400	A
6.11 Short-circuit capability (maximum pulse width)	—	T_j=125ºC, V_{CC}≤1200V V_{GE}=±15V, V_{CE}≤1700V [See Fig.1(b)]	10	µs
6.12 Maximum reverse recovery instantaneous power (note2)	—	T_j=125ºC, V_{CC}≤1200V V_{EC}≤1700V	500	kW

Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jmax} rating (125°C)
Note 2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).
Note 3. Junction temperature (T_j) should not exceed T_{jmax} rating (150°C).

7. Electrical characteristics

Item	Symbol	Conditions		Limits Min.	Limits Typ.	Limits Max.	Unit	
7.1 Collector cutoff current	I_{CES}	$V_{CE}=V_{CES}$, $V_{GE}=0V$	$T_j=25ºC$	—	—	4	mA	
			$T_j=125ºC$	—	—	8		
7.2 Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=120mA, V_{CE}=10V, T_j=25ºC$		—	7.0	—	V	
7.3 Gate leakage current	I_{GES}	$V_{GE}=V_{GES}$, $V_{CE}=0V, T_j=25ºC$		—	—	0.5	µA	
7.4 Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C=1200A$, $V_{GE}=15V$ (note4)	$T_j=25ºC$	—	2.15	—	V	A
			$T_j=125ºC$	—	2.40	—		
7.5 Input capacitance	C_{ies}	$V_{CE}=10V$, $V_{GE}=0V$, $T_j=25ºC$	f=100kHz	—	176	—	nF	A
7.6 Output capacitance	C_{oes}		f=100kHz	—	9.6	—		A
7.7 Reverse transfer capacitance	C_{res}		f=100kHz	—	2.8	—		A
7.8 Total gate charge	Q_G	$V_{CC}=850V, I_C=1200A, T_j=25ºC$ $V_{GE}=0V \rightarrow 15V$		—	6.8	—	µC	A
7.9 Emitter-collector voltage (FWDi forward voltage)	V_{EC} (note3)	$I_E=1200A$, $V_{GE}=0V$ (note4)	$T_j=25ºC$	—	2.40	—	V	A
			$T_j=125ºC$	—	2.10	—		
7.10 Emitter-collector voltage (Clamp-Di forward voltage)	V_{FM} (note3)	$I_F=1200A$, $V_{GE}=0V$ (note4)	$T_j=25ºC$	—	2.40	—	V	A
			$T_j=125ºC$	—	2.10	—		
7.11 Turn-on delay time	$t_{d(on)}$	Half bridge switching operation [See Fig.1(a),Fig.2,Fig.3] $V_{CC}=850V, T_j=125ºC$		—	1.00	—	µs	
7.12 Turn-on rise time	t_r			—	0.35	—		A
7.13 Turn-off delay time	$t_{d(off)}$			—	2.00	—		A
7.14 Turn-off fall time	t_f			—	0.25	—		A
7.15 Reverse recovery time	t_{rr} (note3)			—	1.00	—		
7.16 Reverse recovery charge	Q_{rr}(note3)	IGBT(N): IGBT operation $I_C=1200A, V_{GE1}=-V_{GE2}=15V$, $R_{G(on)}=1.3\Omega, R_{G(off)}=3.3\Omega$		—	360	—	µC	A
7.17 Turn-on switching energy	E_{on}			—	400	—	mJ/P	
7.18 Turn-off switching energy	E_{off}			—	360	—		A
7.19 Reverse recovery energy (FWDi switching energy)	E_{rec} (note3)	IGBT(P): FWDi operation $I_E=1200A, V_{GE3}=-15V$, $R_{G(on)}=1.3\Omega, R_{G(off)}=3.3\Omega$		—	240	—		B
7.20 Reverse recovery energy (Clamp-Di switching energy)	E_{rec} (note3)			—	240	—		

Note 4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

8. Thermal characteristics

Item	Symbol	Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
8.1 Thermal resistance	$R_{th(j-c)Q}$	Junction to case, IGBT part	—	—	19.5	K/kW
8.2 Thermal resistance	$R_{th(j-c)R}$	Junction to case, FWDi part	—	—	42.0	
8.3 Thermal resistance	$R_{th(j-c)R}$	Junction to case, Clamp-Di part	—	—	42.0	
8.4 Contact thermal resistance	$R_{th(c-f)}$	Case to fin, conductive grease applied (note5)	—	16.0	—	

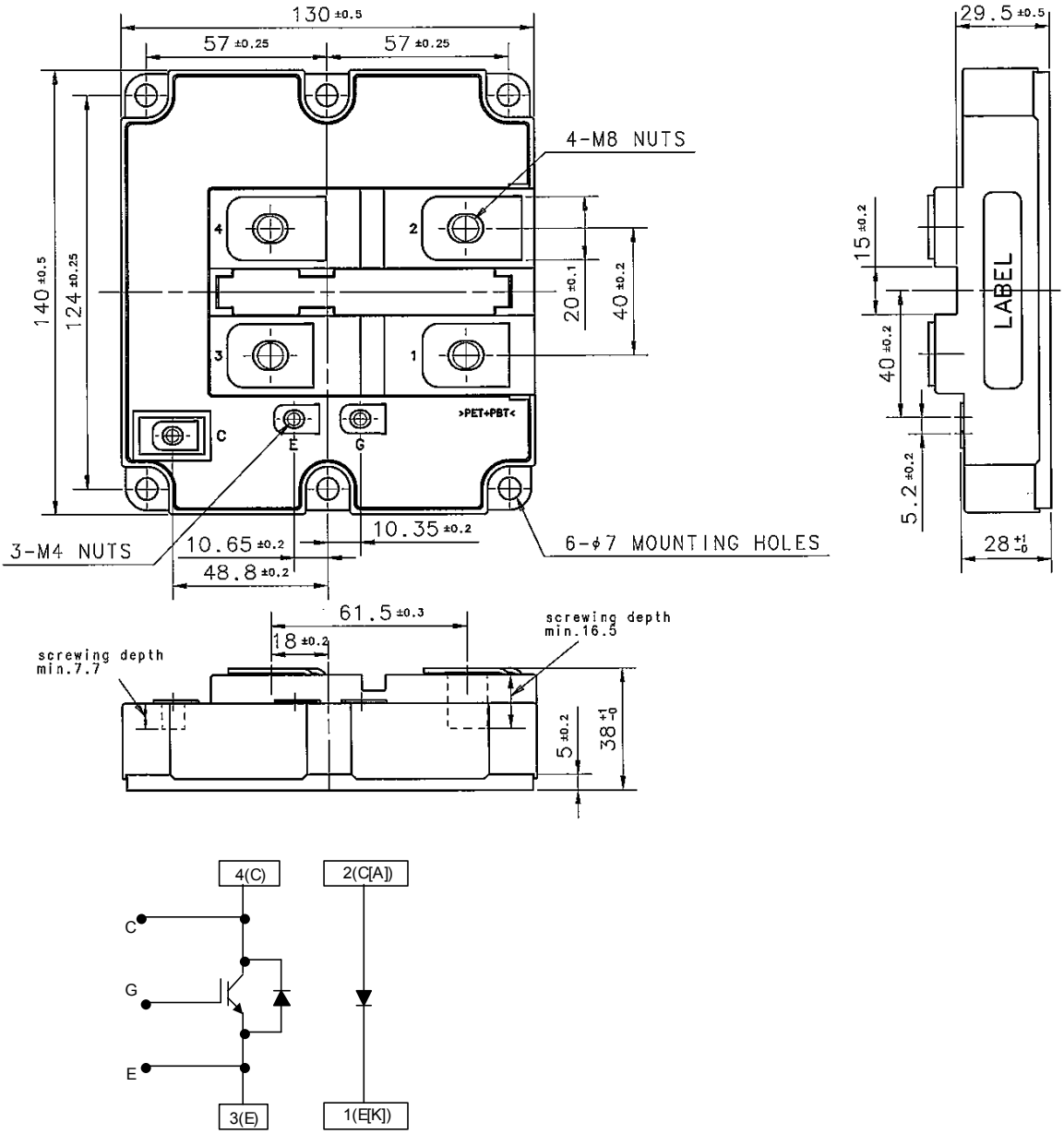
Note 5. Thermal conductivity is 1W/mK with a thickness of 100µm.

9. Mechanical characteristics

Item		Symbol	Conditions	Limits			Unit
				Min.	Typ.	Max.	
9.1	Mounting torque	—	Main terminal screw : M8	7.0	—	13.0	N·m
9.2	Mounting torque	—	Mounting screw : M6	3.0	—	6.0	
9.3	Mounting torque	—	Auxiliary terminal screw : M4	1.0	—	2.0	
9.4	Mass	—	—	—	0.8	—	kg
9.5	CTI	—	—	600	—	—	—
9.6	Clearance	—	—	19.5	—	—	mm
9.7	Creepage distance	—	—	32.0	—	—	mm

A

10. Outline drawing & Circuit diagram B



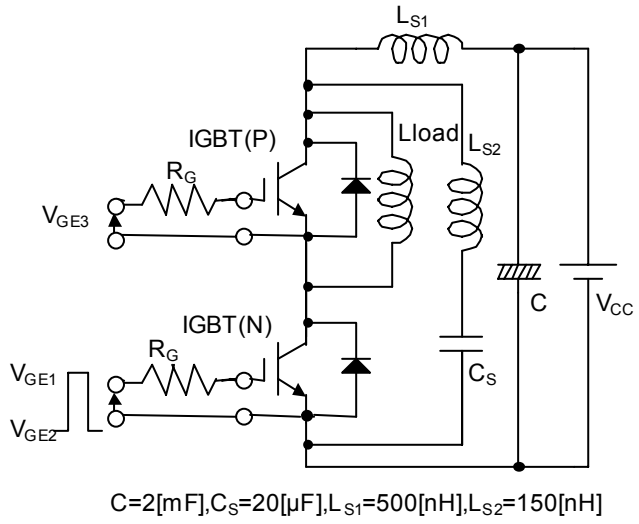


Fig. 1 (a) – Switching test circuit

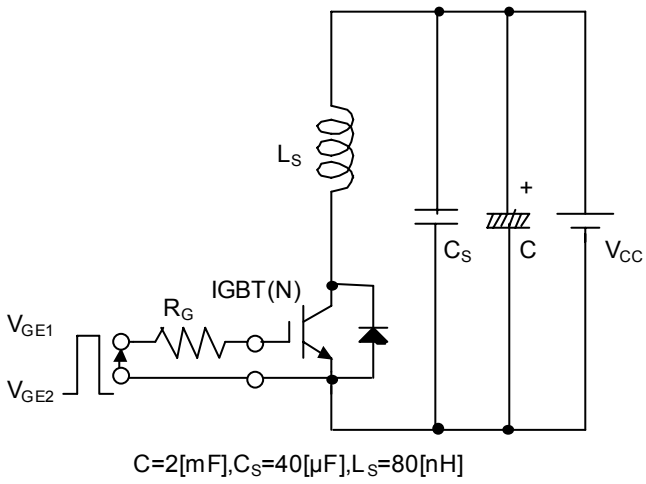


Fig. 1 (b) – Short circuit test circuit

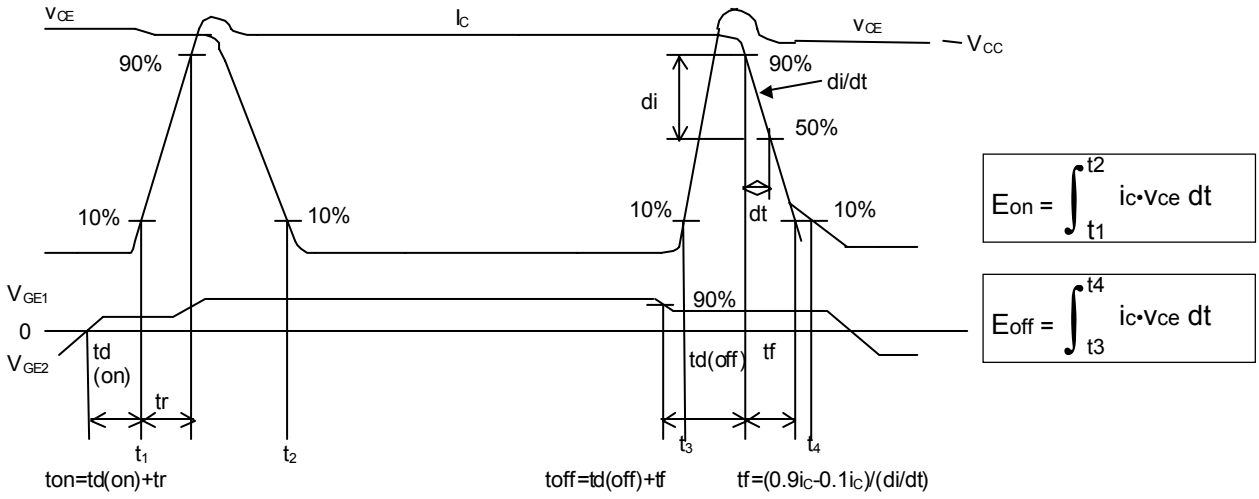


Fig. 2 - Definitions of switching time & energy of IGBT part

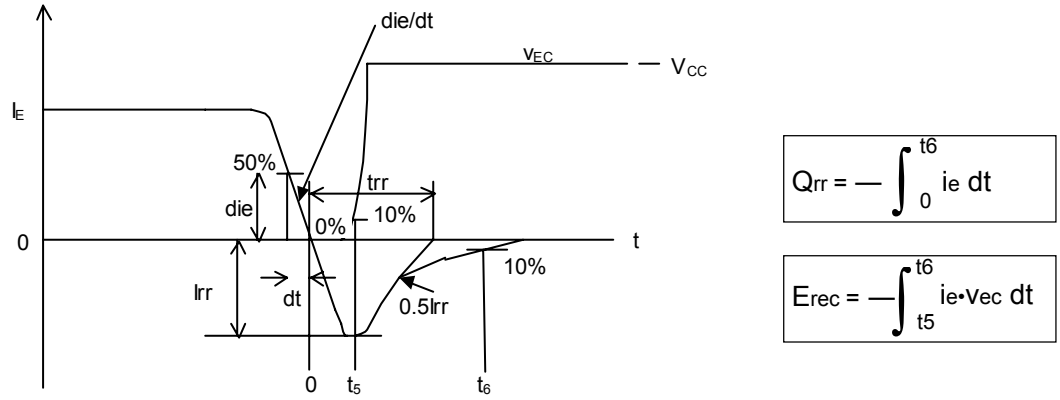


Fig. 3 - Definitions of switching time, charge & energy of FWDi part