

SECURITY CODE	
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MITSUBISHI ELECTRIC CORPORATION

SPEC.NAME Customer's Std. Spec.	Prepared by	S.Iura	R E V	A	S.Iura	B	S.Iura	C	I.Umesaki
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	DATE	Dec.11.2001			Oct.11.2002		Jan.28.2003		Jul.17.2003

HIGH VOLTAGE IGBT MODULE SPECIFICATION

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1. Type number **CM1800HC-34H**
2. Structure Flat base type (Insulated package, AlSiC base plate)
3. Application & Customer High power converters and inverters
4. Outline See Fig. 4
5. Related specifications
6. Maximum ratings

Item	Symbol	Conditions	Ratings	Unit
6.1 Collector-emitter voltage	V_{CES}	$V_{GE}=0V, T_j=25^{\circ}C$	1700	V
6.2 Gate-emitter voltage	V_{GES}	$V_{CE}=0V, T_j=25^{\circ}C$	± 20	V
6.3 Collector current	I_C	DC, $T_C=85^{\circ}C$	1800	A
	I_{CM}	Pulse (note1)	3600	A
6.4 Emitter current	I_E (note2)	$T_C=25^{\circ}C$	1800	A
	I_{EM} (note2)	Pulse (note1)	3600	A
6.5 Maximum collector dissipation	P_C (note3)	$T_C=25^{\circ}C$, IGBT part	15600	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	$^{\circ}C$
6.8 Storage temperature	T_{stg}	—	-40 ~ +125	$^{\circ}C$
6.9 Operating temperature	T_{op}	—	-40 ~ +125	$^{\circ}C$
6.10 Turn-off switching safe operating area (RBSOA/SWSOA)	Test conditions: $V_{CC}=1150V, I_C=3600A, T_j=125^{\circ}C, V_{GE1}=-V_{GE2}=15V, R_{G(on)}=0.3\Omega, R_{G(off)}=40\Omega$, Half bridge switching operation [See Fig.1(b)] (note4)			
6.11 Short-circuit safe operating area (SCSOA)	Test conditions: $V_{CC}=1150V, T_j=125^{\circ}C, V_{GE1}=-V_{GE2}=15V, R_{G(on)}=0.3\Omega, R_{G(off)}=40\Omega$ Pulse width: $t_w=10\mu s$ [See Fig.1(c)] (note4)			
6.12 Reverse recovery safe operating area (RRSOA)	Test conditions: $V_{CC}=1150V, I_C=2400A, di/dt=-5800A/\mu s, T_j=125^{\circ}C, L_S=80nH(=L_{S2})$ Half bridge switching operation [See Fig.1(b)]			

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- Note 1. Pulse width and repetition rate should be such that junction temperature (T_j) does not exceed T_{jmax} rating ($125^{\circ}C$)
- 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 ($150^{\circ}C$).
- Note 4. $R_{G(off)}$ can be reduced to 0.3Ω by suppressing V_{CE} less than V_{CES} ($1700V$) with soft turn-off technique that means $-di/dt_{(off)}$ decreasing control.

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7. Electrical characteristics

Item	Symbol	Conditions	Limits			Unit		
			Min.	Typ.	Max.			
7.1 Collector cutoff current	I_{CES}	$V_{CE}=V_{CES}$ $V_{GE}=0V$	$T_j=25^{\circ}C$	—	—	28	mA	
			$T_j=125^{\circ}C$	—	7	70		
7.2 Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=180mA, V_{CE}=10V, T_j=25^{\circ}C$	4.5	5.5	6.5	V		
7.3 Gate leakage current	I_{GES}	$V_{GE}=V_{GES}, V_{CE}=0V, T_j=25^{\circ}C$	—	—	0.5	μA		
7.4 Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C=1800A$ $V_{GE}=15V$ (note5)	$T_j=25^{\circ}C$	—	2.40	—	V	A
			$T_j=125^{\circ}C$	—	2.95	—		B
7.5 Input capacitance	C_{ies}	$V_{CE}=10V$ $V_{GE}=0V$ $T_j=25^{\circ}C$	$f=100kHz$	—	187	—	nF	
7.6 Output capacitance	C_{oes}		$f=100kHz$	—	26.7	—		C
7.7 Reverse transfer capacitance	C_{res}		$f=1MHz$	—	10.1	—		
7.8 Total gate charge	Q_G	$V_{CC}=850V, I_C=1800A, T_j=25^{\circ}C$ $V_{GE}=15V$	—	17.6	—	μC	A	
7.9 Turn-on delay time	$t_{d(on)}$	Resistive load switching operation [See Fig.1(a),Fig.2] $V_{CC}=850V, I_C=1800A, T_j=25^{\circ}C$ $V_{GE1}=-V_{GE2}=15V, R_G=0.3\Omega$	—	—	1.60	μs		
7.10 Turn-on rise time	t_r		—	—	2.00			
7.11 Turn-off delay time	$t_{d(off)}$		—	—	2.70			
7.12 Turn-off fall time	t_f		—	—	0.80			
7.13 Emitter-collector voltage (FWDi forward voltage)	V_{EC} (note3)	$I_E=1800A$ $V_{GE}=0V$ (note5)	$T_j=25^{\circ}C$	—	2.50	—	V	A
			$T_j=125^{\circ}C$	—	1.85	—		B
7.14 Reverse recovery time	t_{rr} (note3)	$V_{CC}=850V$ $I_E=1800A$ $di_e/dt=-5100A/\mu s,$ $V_{GE3}=-15V$ [See Fig.3]	$T_j=25^{\circ}C$	—	—	2.70	μs	
			$T_j=125^{\circ}C$	—	—	2.70		
7.15 Reverse recovery charge	Q_{rr} (note3)	$V_{GE3}=-15V$ [See Fig.3]	$T_j=25^{\circ}C$	—	270	—	μC	C
			$T_j=125^{\circ}C$	—	560	—		
7.16 Turn-on delay time	$t_{d(on)}$	Half bridge switching operation [See Fig.1(b),Fig.2,Fig.3] $V_{CC}=850V, T_j=125^{\circ}C$	—	—	1.60	μs		
7.17 Turn-on rise time	t_r		—	—	1.30			
7.18 Turn-off delay time	$t_{d(off)}$		—	—	2.70			
7.19 Turn-off fall time	t_f		—	—	0.80			C
7.20 Reverse recovery time	t_{rr} (note3)		—	—	2.70			
7.21 Reverse recovery charge	Q_{rr} (note3)	IGBT(N): IGBT operation $I_C=1800A, V_{GE1}=-V_{GE2}=15V,$ $R_G=0.3\Omega$	—	560	—	μC	C	
7.22 Turn-on switching energy	E_{on}	IGBT(P): FWDi operation $I_E=1800A, V_{GE3}=-15V,$ $R_G=0.3\Omega$	—	0.64	—	J/P		
7.23 Turn-off switching energy	E_{off}		—	0.56	—			
7.24 Reverse recovery energy (FWDi switching energy)	E_{rec} (note3)		—	0.28	—			A

Note 5. Pulse width and repetition rate should be such as to cause negligible temperature rise.

8. Thermal characteristics

Item	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
8.1 Thermal resistance	$R_{th(j-c)Q}$	Junction to case, IGBT part	—	—	0.008	K/W
8.2 Thermal resistance	$R_{th(j-c)R}$	Junction to case, FWDi part	—	—	0.013	
8.3 Contact thermal resistance	$R_{th(c-f)}$	Case to fin, conductive grease applied (note6)	—	0.006	—	

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Note 6. Typical value is measured by using Shin-etsu Silicone “G-747” with a thickness of 100 μ m.

9. Mechanical characteristics

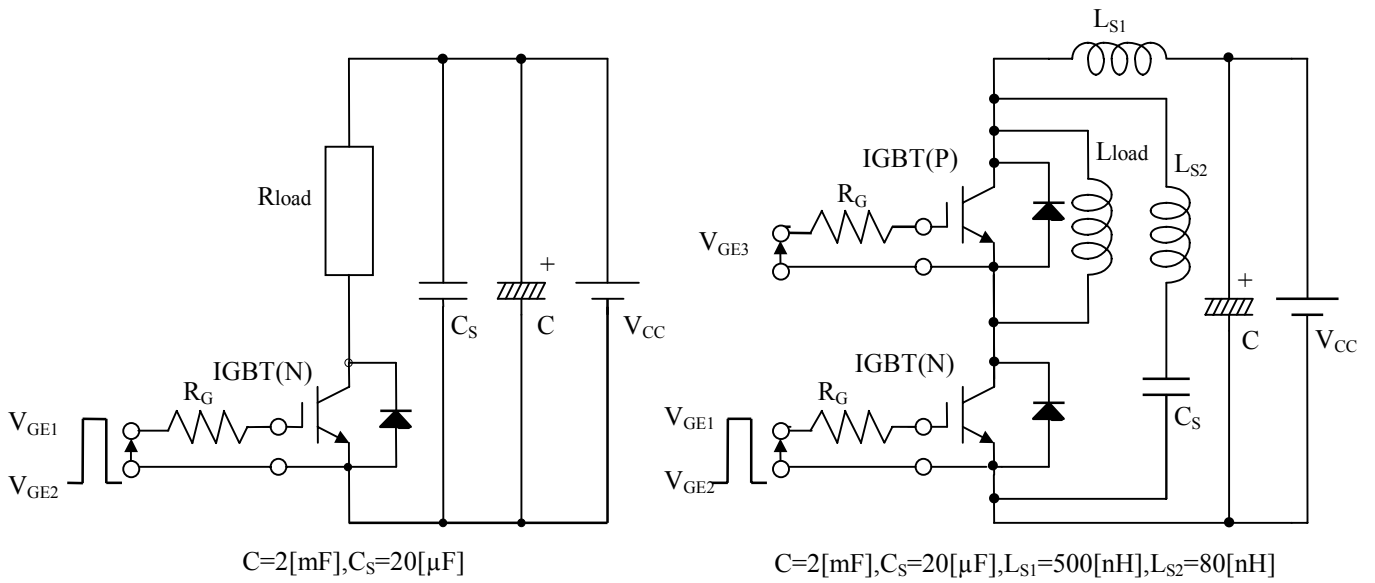
Item	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
9.1 Mounting torque	—	Main terminal screw : M8	6.67	7.45	13.0	N·m
9.2 Mounting torque	—	Mounting screw : M6	2.84	3.14	6.00	
9.3 Mounting torque	—	Auxiliary terminal screw : M4	0.88	0.98	2.00	
9.4 Mass	—	—	—	1.5	—	kg

10. Shipping inspection report item (note7)

I_{CES} [7.1], $V_{GE(th)}$ [7.2], I_{GES} [7.3], $V_{CE(sat)}$ [7.4 @ $T_j=25^{\circ}C$], V_{EC} [7.13 @ $T_j=25^{\circ}C$]
 $t_{d(on)}$ [7.16], t_r [7.17], t_{on} [Fig.2], $t_{d(off)}$ [7.18], t_f [7.19], t_{off} [Fig.2], I_{CP} [6.11] (note8)

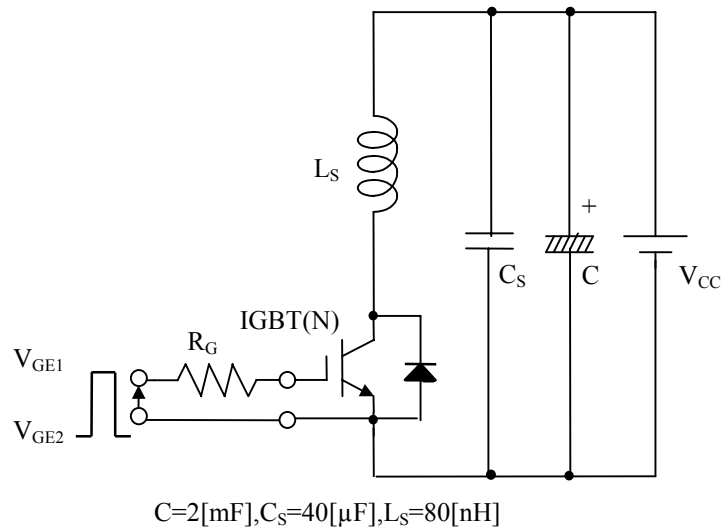
Note 7. One shipping inspection report with the above item values is submitted when modules are delivered.
 The conditions are defined in bracket.

Note 8. I_{CP} shows the maximum collector current value in short-circuit test.



(a) Resistive load switching test circuit

(b) Half bridge switching test & turn-off switching safe operating area (RBSOA/SWSOA) & reverse recovery safe operating area (RRSOA) test circuit



(c) Short-circuit safe operating area (SCSOA) test circuit

Fig.1 Switching test circuit

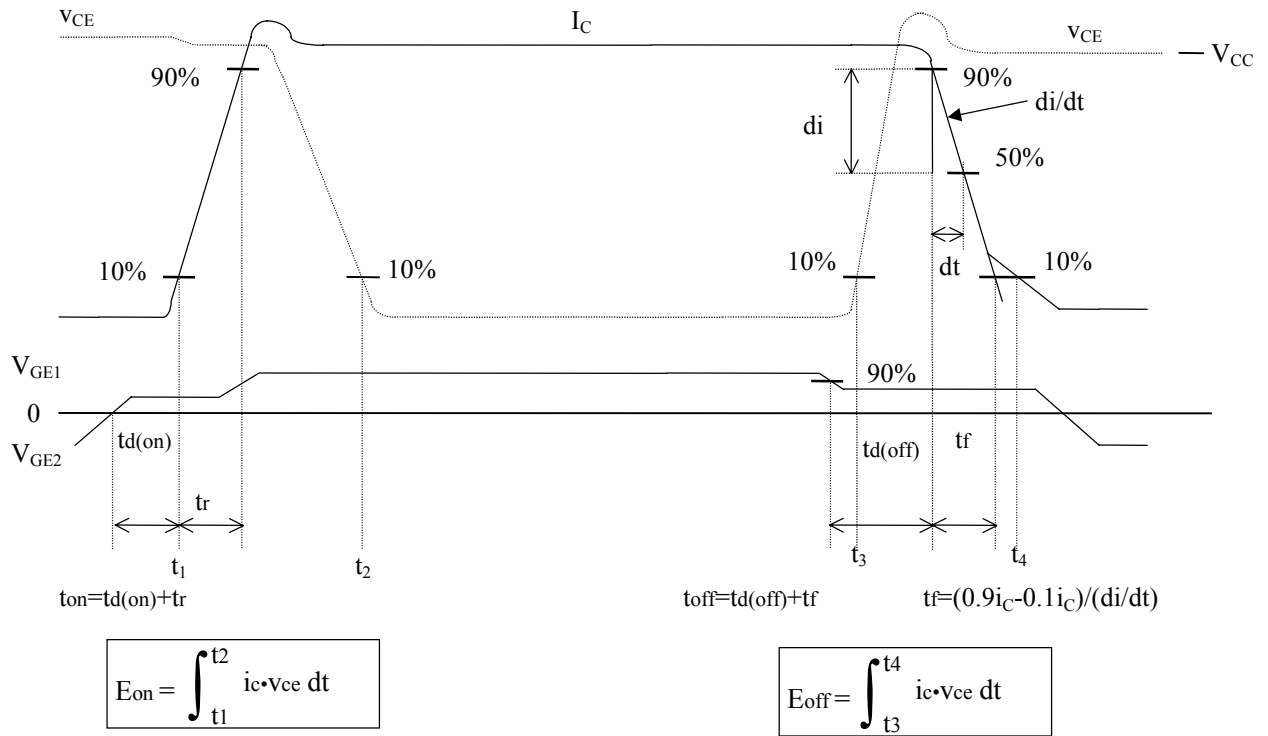


Fig.2 Definitions of switching time & energy of IGBT part

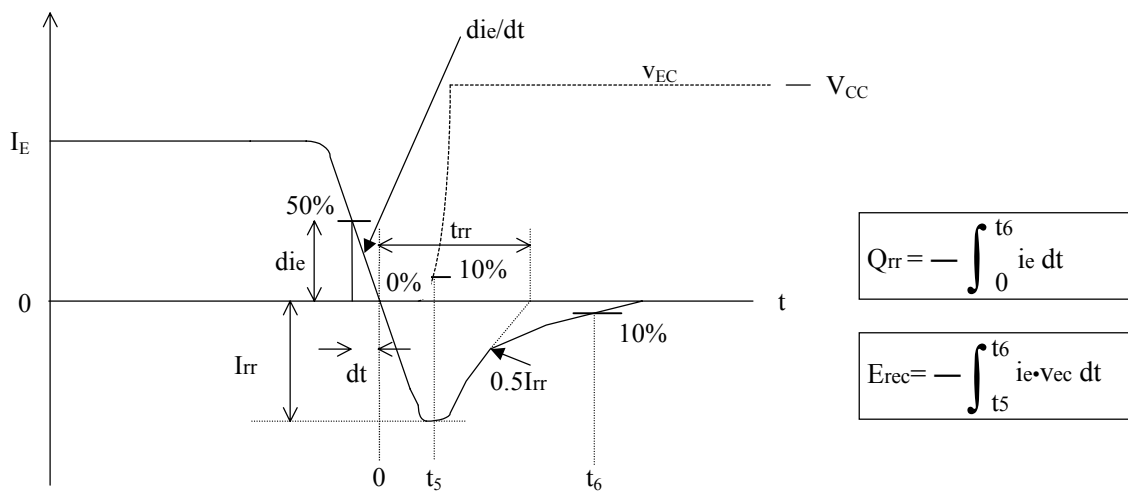


Fig.3 Definitions of switching time, charge & energy of FWDi part

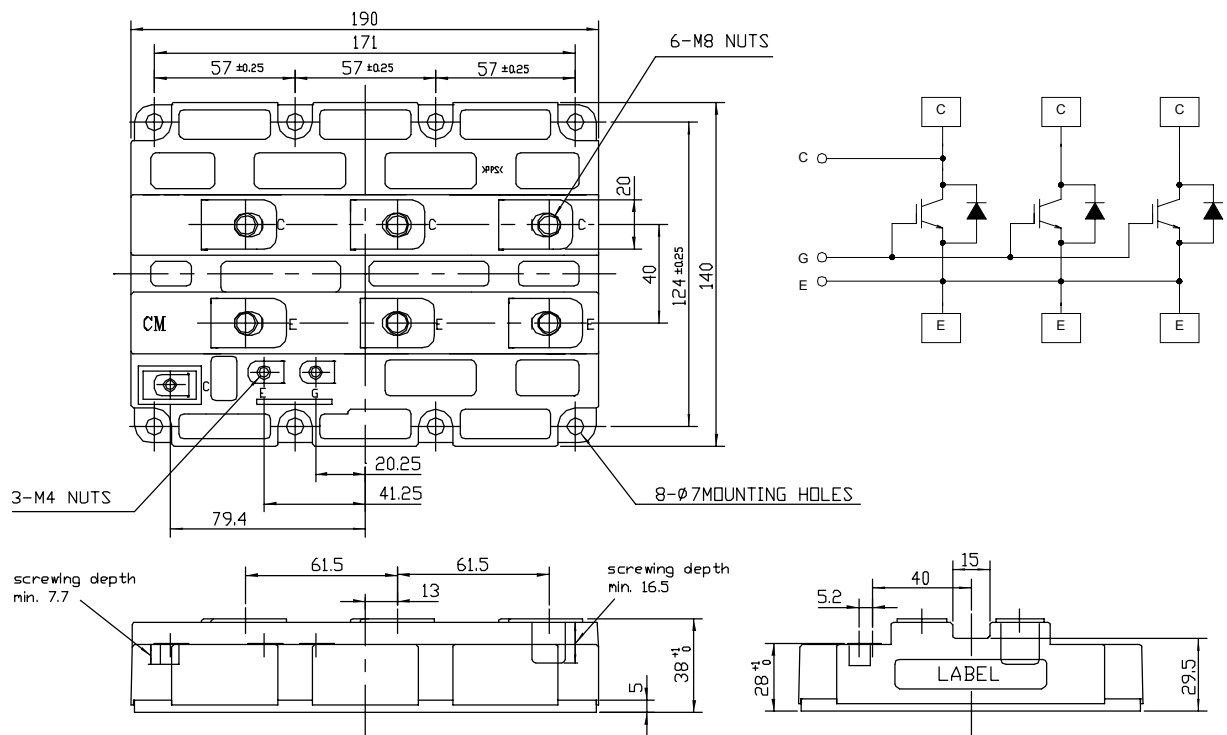


Fig.4 Outline drawing & circuit diagram