Possible IGBT Snubber Capacitors

Mitsubishi IGBT Type	RS Part Numbers	Suggested ICEL Snubber	Value Cn	Image (not to scale)	RS Part Numbers
CM100DY-24T#300G	207-4953 207-4954	**PMB2123390KSPB**	0.39uF		**207-4991** (low qty) and **207-4990** (higher qty) https://uk.rs-online.com/web/cp/2074990,2074991/?pst=PMB2123390KSPB
		**PMB2123560KSP**	0.56uF		2**07-4993** (low qty) and **207-4992** (higher qty) https://uk.rs-online.com/web/cp/2074992,2074993/?pst=PMB2123560KSP
		PMB2124100KSP	1.0uF		2**07-4995** (low qty) and **207-4994** (higher qty) https://uk.rs-online.com/web/cp/2074994,2074995/?pst=PMB2124100KSP&sra=p&r=t
		PMB2124150KSP	1.5uF	Direct screw mounting onto IGBT modules or busbars. Available for all main manufacturers IGBT packages.	2**07-4998** (low qty) and **207-4997** (higher qty) https://uk.rs-online.com/web/cp/2074997,2074998/?pst=PMB2124150KSP&sra=p&r=t

POLYPROPYLENE FILM CAPACITORS

Features

Polypropylene film capacitors have superior electrical characteristics;
Low dissipation factor and absorption.
Very high insulation resistance and high dielectric strength.
Excellent moisture resistance.
Good long-term stability and excellent self-healing properties.

Typical Applications

Polypropylene film capacitors are typically used in AC and pulse applications at high frequencies and as DC-Link capacitors.
They are further used in switched mode power supplies (SMPS), electronic ballasts and snubber applications, in frequency discrimination and filter circuits as well as in energy storage and sample and hold applications.

Suggested types are for Information and guidance only. Clients must select and verify parts for their own operating conditions and applcations.

CONTINUE FOR IGBT DATA SHEET

MITSUBISHI ELECTRIC

<IGBT Modules>

CM100DY-24T

HIGH POWER SWITCHING USE
INSULATED TYPE

dual switch (half-bridge)

Collector current I_C ..... **100** A
Collector-emitter voltage V_{CES} ..... **1200** V
Maximum junction temperature T_{vjmax} ..... **175** °C

- dual switch (half-bridge)
- Copper base plate (Nickel-plating)
- Nickel-plating tab terminals
- RoHS Directive compliant
- UL Recognized under UL1557, File No. E323585

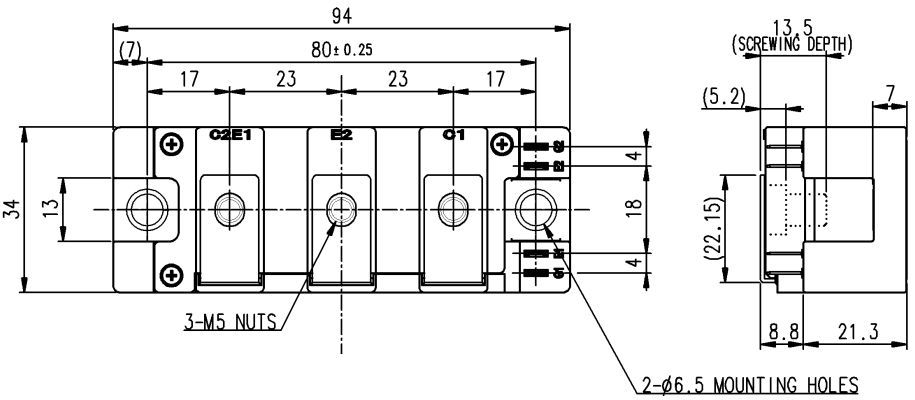
APPLICATION

AC Motor Control, Motion/Servo Control, Power supply, etc.

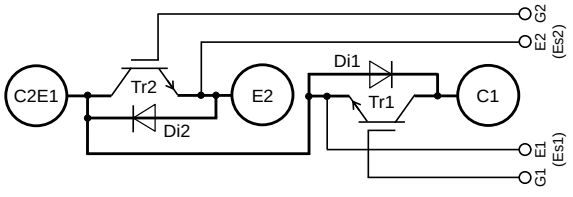
OPTION (Below options are available.)

- PC-TIM (Phase Change Thermal Interface Material) pre-apply

OUTLINE DRAWING & INTERNAL CONNECTION **Dimension in mm**



INTERNAL CONNECTION



Tolerance otherwise specified

Division of Dimension		Tolerance
0.5	to 3	±0.2
over 3	to 6	±0.3
over 6	to 30	±0.5
over 30	to 120	±0.8
over 120	to 400	±1.2

JIS B 0405 c

MAXIMUM RATINGS (T_{vj}=25 °C, unless otherwise specified)

Symbol	Item	Conditions	Rating	Unit
V_{CES}	Collector-emitter voltage	G-E short-circuited	1200	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	± 20	V
I_C	Collector current	DC, T_C=147 °C* (Note2, 4)	100	A
I_{CRM}		Pulse, Repetitive (Note3)	200	
P_{tot}	Total power dissipation	T_C=25 °C (Note2, 4)	1180	W
I_E (Note1)	Emitter current	DC (Note2)	100	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	200	
V_{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	4000	V
T_{vjmax}	Maximum junction temperature	Instantaneous event (overload)	175	°C
T_{Cmax}	Maximum case temperature	(Note4)	150*	
T_{vjop}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T_{stg}	Storage temperature	-	-40 ~ +150*	

ELECTRICAL CHARACTERISTICS (T_{vj}=25 °C, unless otherwise specified)

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	V_{CE}=V_{CES}, G-E short-circuited		-	-	1.0	mA
I_{GES}	Gate-emitter leakage current	V_{GE}=V_{GES}, C-E short-circuited		-	-	0.5	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=10 mA, V_{CE}=10 V		5.4	6.0	6.6	V
V_{CEsat} (Terminal)	Collector-emitter saturation voltage	I_C=100 A, V_{GE}=15 V, Refer to the figure of test circuit (Note5)	T_{vj}=25 °C	-	1.65	1.95	V
			T_{vj}=125 °C	-	1.85	-	
			T_{vj}=150 °C	-	1.90	-	
V_{CEsat} (Chip)		I_C=100 A, V_{GE}=15 V, (Note5)	T_{vj}=25 °C	-	1.55	1.80	V
			T_{vj}=125 °C	-	1.75	-	
			T_{vj}=150 °C	-	1.80	-	
C_{ies}	Input capacitance	V_{CE}=10 V, G-E short-circuited		-	-	22.8	nF
C_{oes}	Output capacitance			-	-	0.8	
C_{res}	Reverse transfer capacitance			-	-	0.3	
Q_G	Gate charge	V_{CC}=600 V, I_C=100 A, V_{GE}=15 V		-	0.7	-	μC
$t_{d(on)}$	Turn-on delay time	V_{CC}=600 V, I_C=100 A, V_{GE}=±15 V, R_G=3.9 Ω, Inductive load		-	-	300	ns
t_r	Rise time			-	-	150	
$t_{d(off)}$	Turn-off delay time			-	-	500	
t_f	Fall time			-	-	300	
V_{EC} (Note.1) (Terminal)	Emitter-collector voltage	I_E=100 A, G-E short-circuited, Refer to the figure of test circuit (Note5)	T_{vj}=25 °C	-	1.70	2.10	V
			T_{vj}=125 °C	-	1.85	-	
			T_{vj}=150 °C	-	1.85	-	
V_{EC} (Note.1) (Chip)		I_E=100 A, G-E short-circuited, (Note5)	T_{vj}=25 °C	-	1.65	2.00	V
			T_{vj}=125 °C	-	1.65	-	
			T_{vj}=150 °C	-	1.65	-	
t_{rr} (Note1)	Reverse recovery time	V_{CC}=600 V, I_E=100 A, V_{GE}=±15 V, R_G=3.9 Ω, Inductive load		-	-	400	ns
Q_{rr} (Note1)	Reverse recovery charge			-	10	-	μC
E_{on}	Turn-on switching energy per pulse	V_{CC}=600 V, I_C=I_E=100 A, V_{GE}=±15 V, R_G=3.9 Ω, T_{vj}=150 °C, Inductive load		-	5.5	-	mJ
E_{off}	Turn-off switching energy per pulse			-	11.2	-	
E_{rr} (Note1)	Reverse recovery energy per pulse			-	7.9	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, T_C=25 °C (Note4)		-	0.2	-	mΩ
r_g	Internal gate resistance	Per switch		-	0	-	Ω

*: The value of PC-TIM applied module is limited by the heat resistant temperature of PC-TIM.

THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per Inverter IGBT (Note4)		-	-	127	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWD (Note4)		-	-	228	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1 module	Thermal grease applied (Note4, 6)	-	36.6	-	K/kW

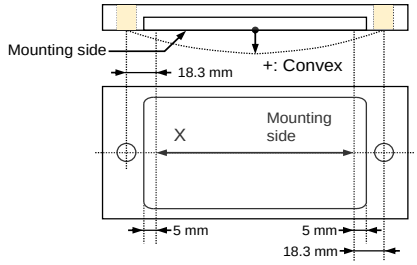
MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
M_t	Mounting torque	Main terminals	M 5 screw	2.5	3.0	3.5	N·m
M_s	Mounting torque	Mounting to heat sink	M 6 screw	3.5	4.0	4.5	N·m
d_s	Creepage distance	Terminal to terminal		18.4	-	-	mm
		Terminal to base plate		21.1	-	-	
d_a	Clearance	Terminal to terminal		9.6	-	-	mm
		Terminal to base plate		16.7	-	-	
e_c	Flatness of base plate	On the centerline (Note7)		±0	-	+200	μm
m	mass	-		-	120	-	g

*: This product is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU.

Note1. Represent ratings and characteristics of the anti-parallel, emitter-collector free-wheeling diode (FWD).

2. Junction temperature (T_{vj}) should not increase beyond T_{vjmax} rating.
3. Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed T_{vjmax} rating.
4. Case temperature (T_C) and heat sink temperature (T_S) are defined on the each surface (mounting side) of base plate and heat sink just under the chips. Refer to the figure of chip location.
5. Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.
6. Typical value is measured by using thermally conductive grease of λ=3.0 W/(m·K)/$D_{(C-S)}$=50 μm.
7. The base plate (mounting side) flatness measurement point is as follows of the following figure.

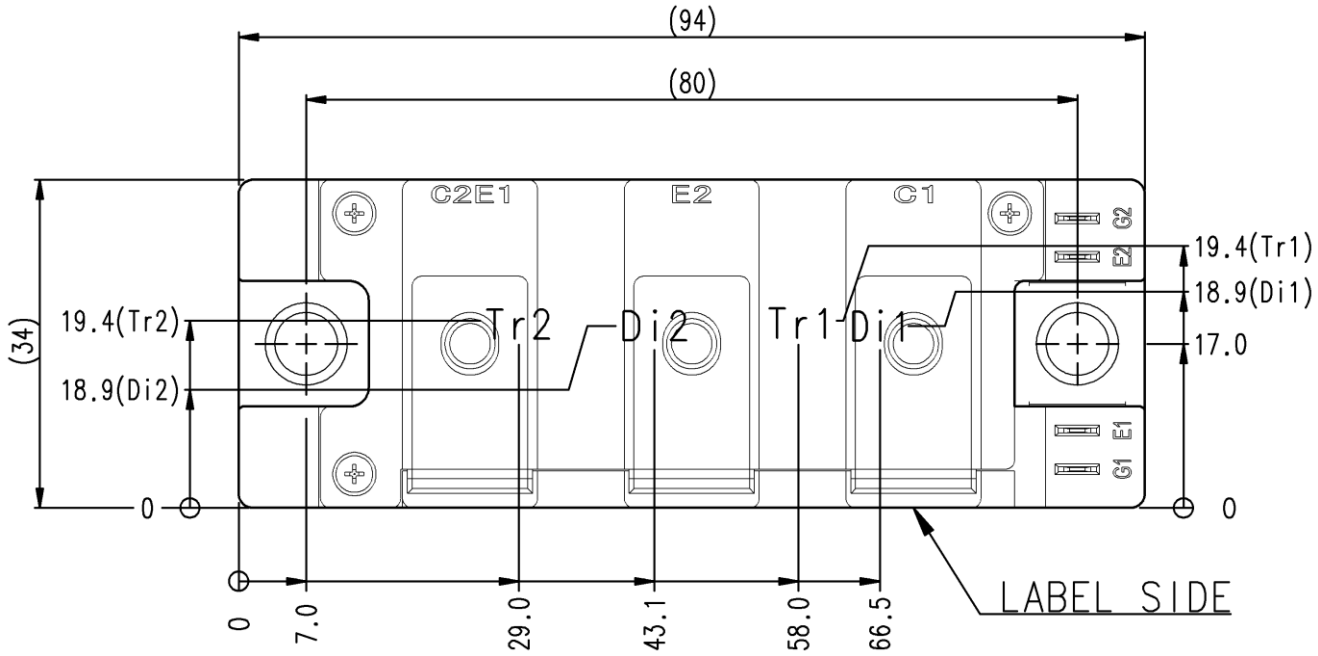


RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across C1-E2 terminals	-	600	850	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G1-Es1/G2-Es2 terminals	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	3.9	-	91	Ω

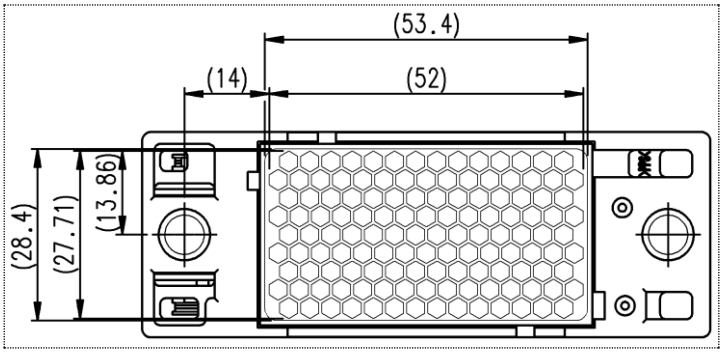
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ±1 mm

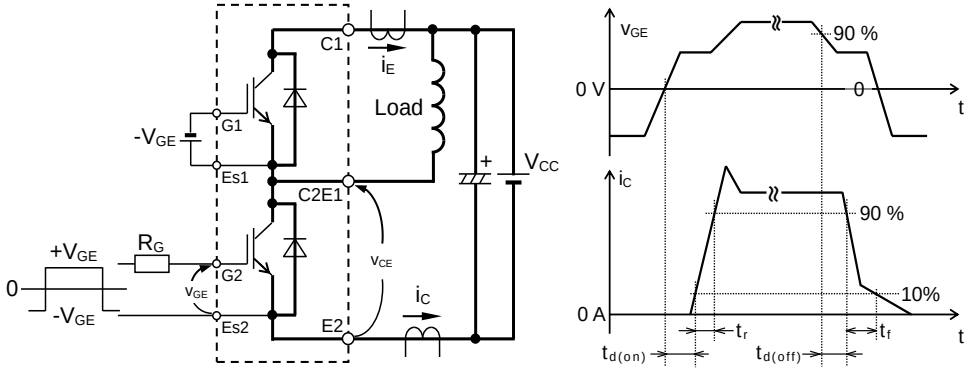


Tr1/Tr2: IGBT, Di1/Di2: FWD

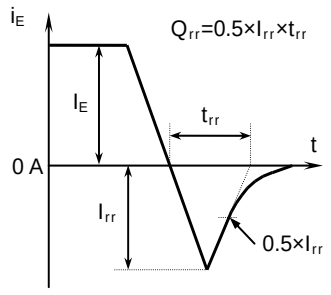
Option: PC-TIM applied baseplate outline



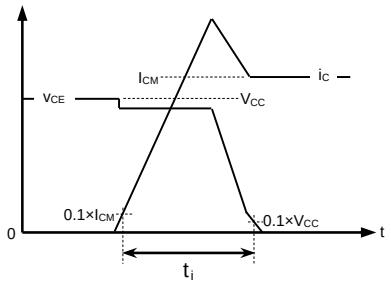
TEST CIRCUIT AND WAVEFORMS



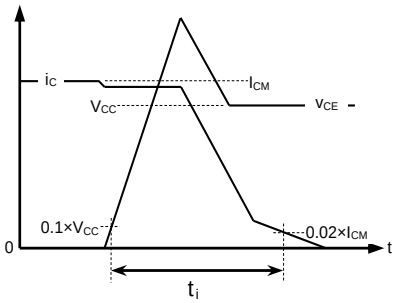
Switching characteristics test circuit and waveforms



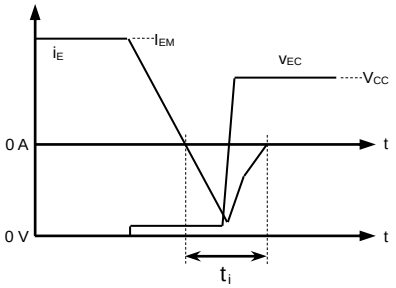
t_{rr}, Q_{rr} characteristics test waveform



IGBT Turn-on switching energy



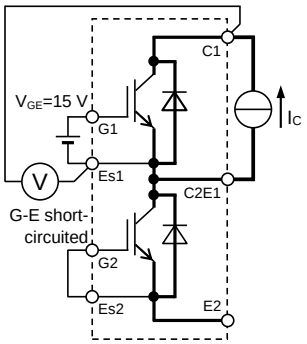
IGBT Turn-off switching energy



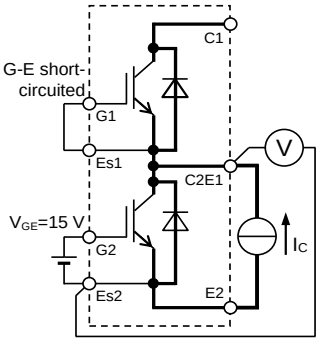
FWD Reverse recovery energy

Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

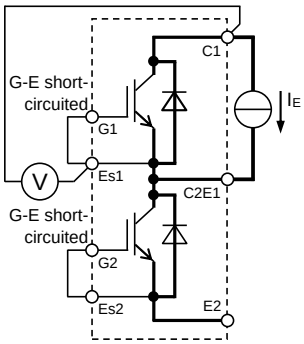
TEST CIRCUIT



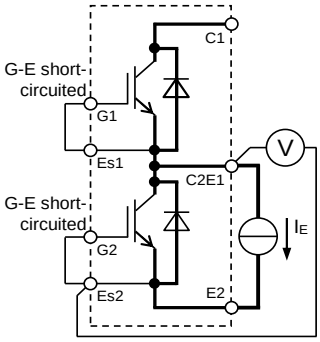
Tr1



Tr2



Di1



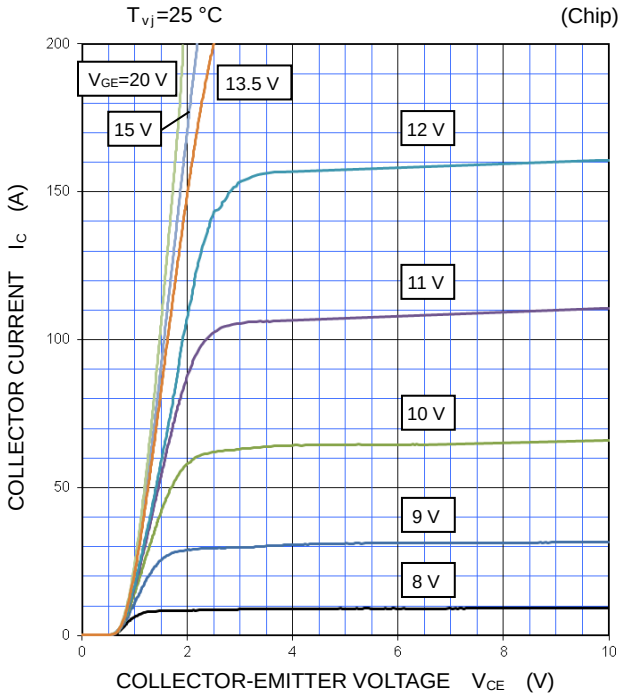
Di2

V_{CEsat} characteristics test circuit

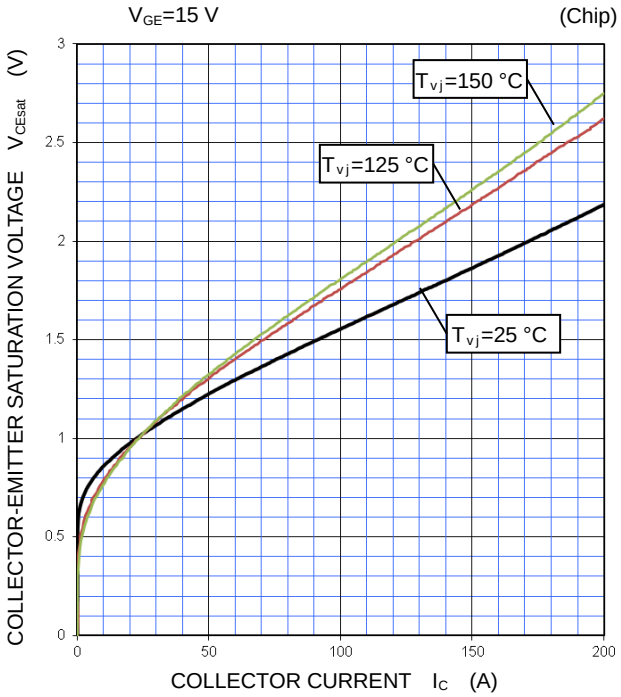
V_{EC} characteristics test circuit

PERFORMANCE CURVES

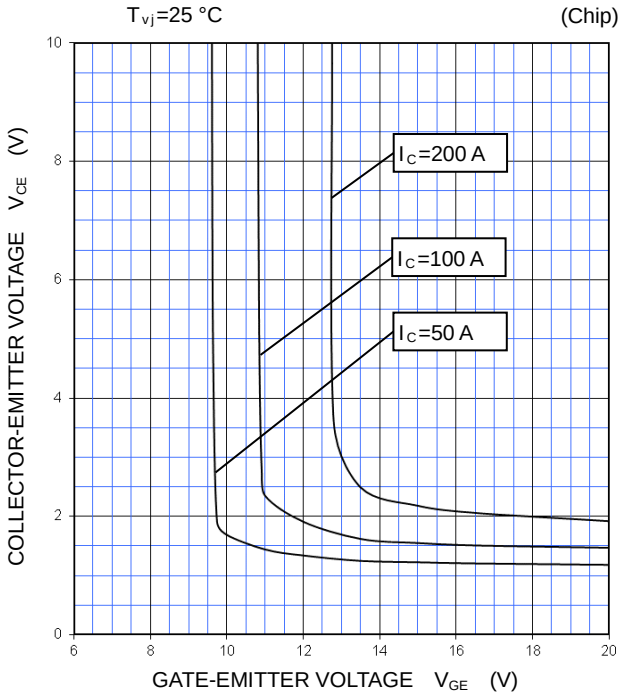
OUTPUT CHARACTERISTICS (TYPICAL)



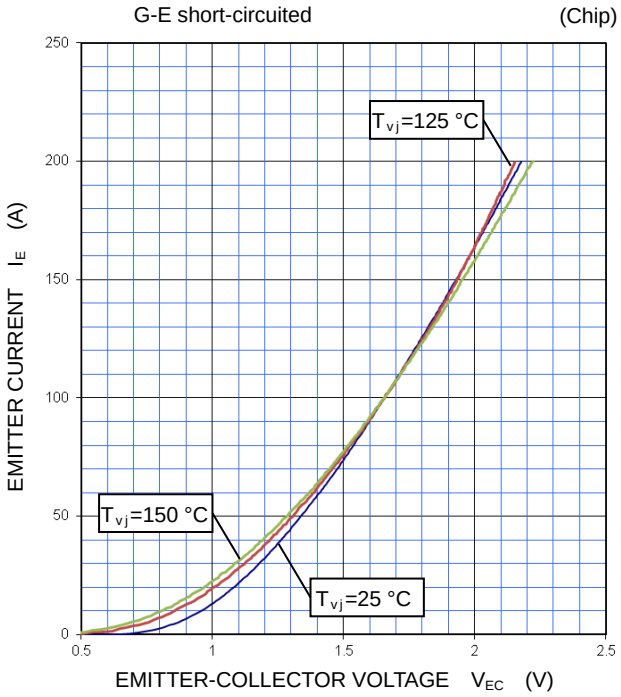
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER VOLTAGE CHARACTERISTICS (TYPICAL)



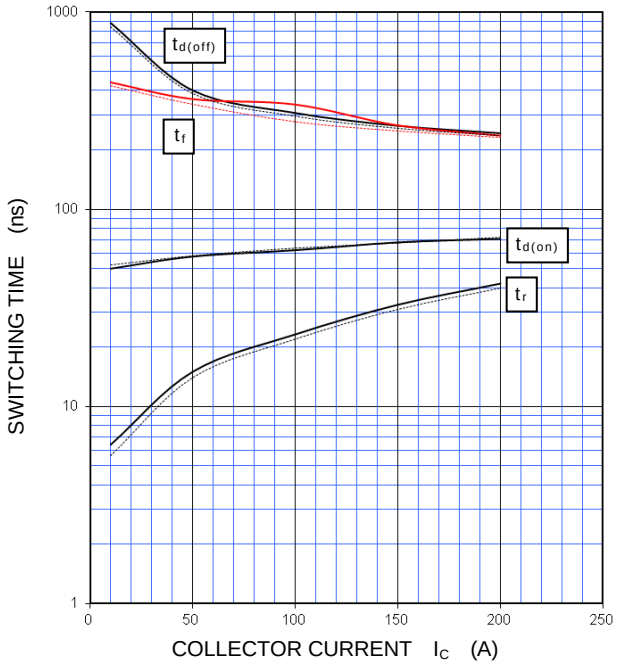
FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



PERFORMANCE CURVES

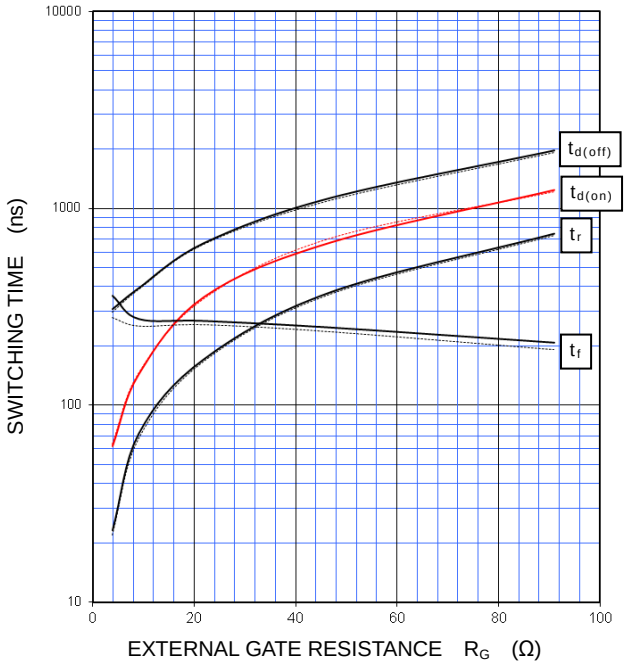
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=3.9 Ω, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



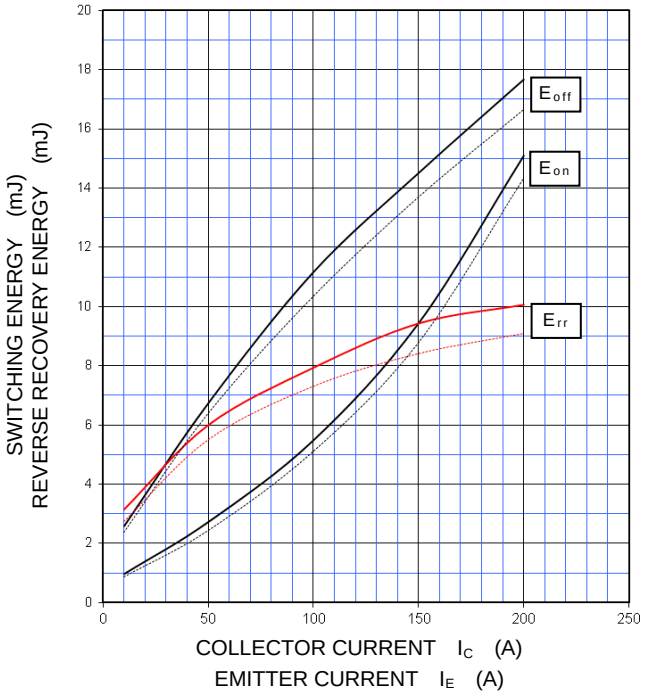
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, I_C=100 A, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



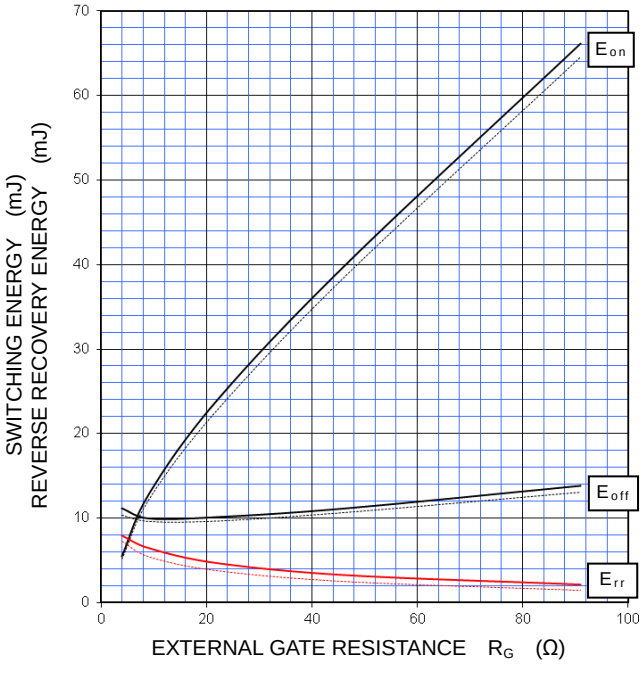
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=3.9 Ω,
INDUCTIVE LOAD, PER PULSE
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

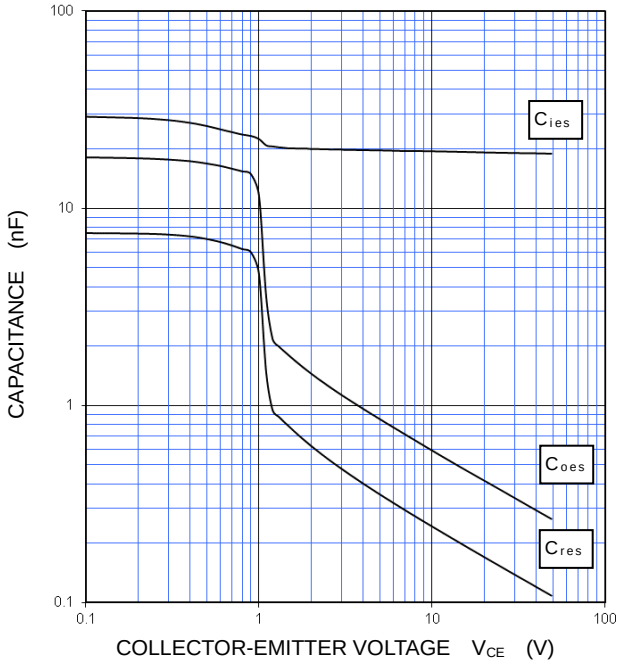
V_{CC}=600 V, V_{GE}=±15 V, I_C/I_E=100 A,
INDUCTIVE LOAD, PER PULSE
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



PERFORMANCE CURVES

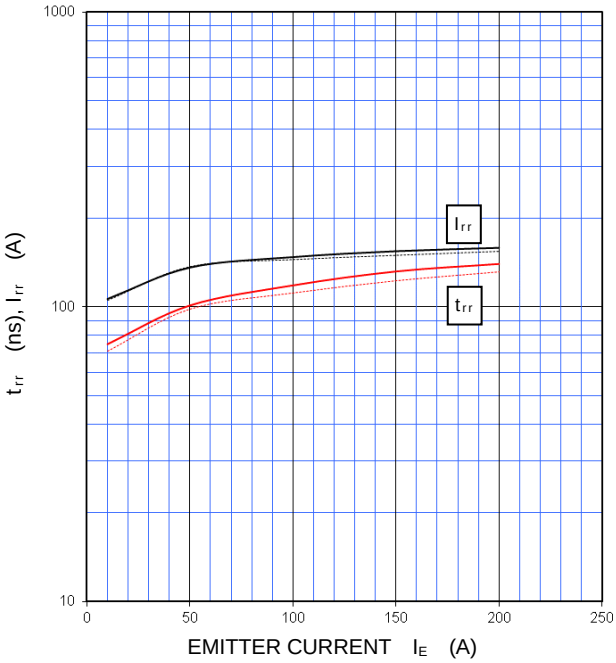
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_{vj}=25 °C



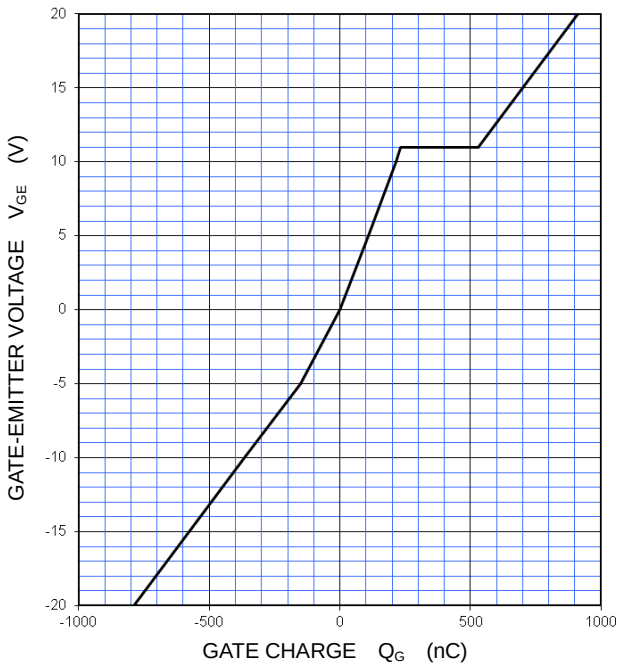
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=3.9 Ω, INDUCTIVE LOAD
———: T_{vj}=150 °C, - - - - -: T_{vj}=125 °C



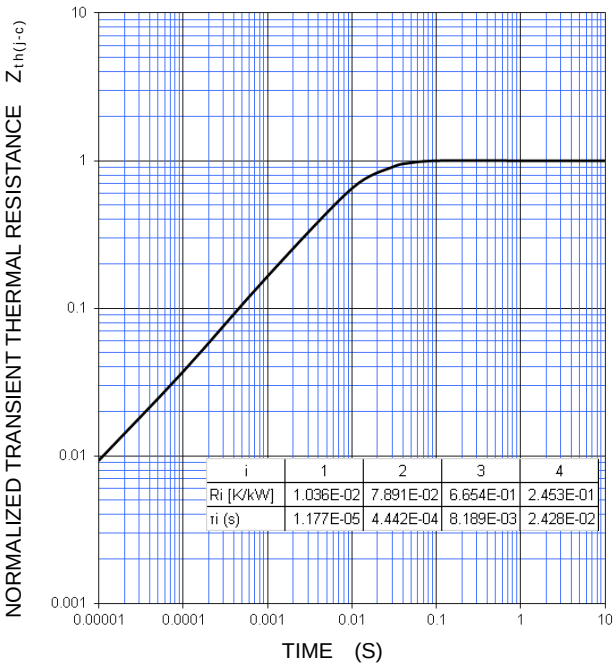
GATE CHARGE CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, I_C=100 A, T_{vj}=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, T_C=25 °C
$R_{th(j-c)Q}$=127 K/kW, $R_{th(j-c)D}$=228 K/kW



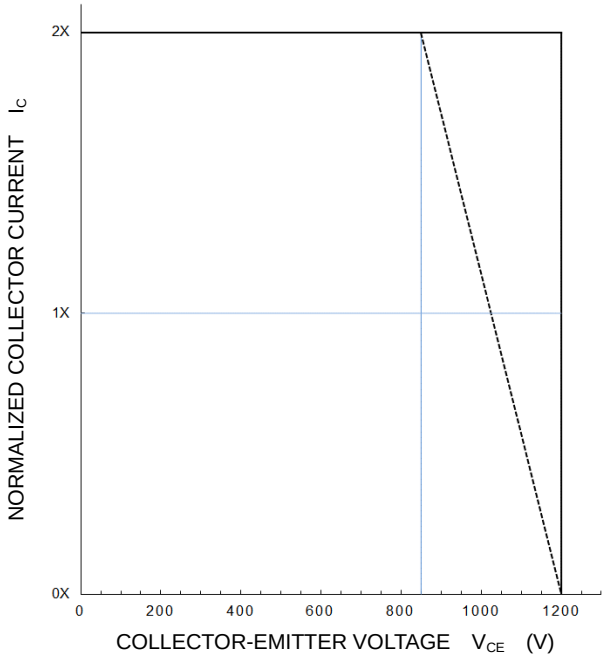
i	1	2	3	4
Ri [K/kW]	1.036E-02	7.891E-02	6.654E-01	2.453E-01
τi (s)	1.177E-05	4.442E-04	8.189E-03	2.428E-02

Note: The characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

PERFORMANCE CURVES

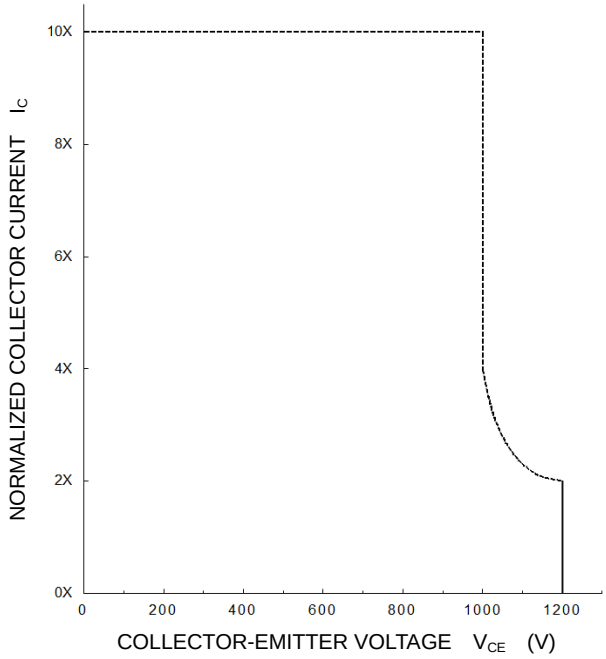
TURN-OFF SWITCHING SAFE OPERATING AREA (REVERSE BIAS SAFE OPERATING AREA) (MAXIMUM)

V_{CC}≤850 V, V_{GE}=±15 V, R_G=3.9~91 Ω,
————: T_{vj}=25~150 °C (Normal load operations (Continuous)
- - - - - -: T_{vj}=175 °C (Unusual load operations (Limited period)



SHORT-CIRCUIT SAFE OPERATING AREA (MAXIMUM)

V_{CC}≤800 V, V_{GE}=±15 V, R_G=3.9~91 Ω,
T_{vj}= 25 ~ 150 °C, t_W≤8 μs, Non-Repetitive



Keep safety first in your circuit designs!

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