MITSUBISHI ELECTRIC

< IGBT MODULES >

CM1400DUC-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

Dual switch (Half-Bridge)

Collector current I_C ..... **1 4 0 0** A
Collector-emitter voltage V_{CES} ..... **1 2 0 0** V
Maximum junction temperature T_{jmax} ..... **1 7 5** °C

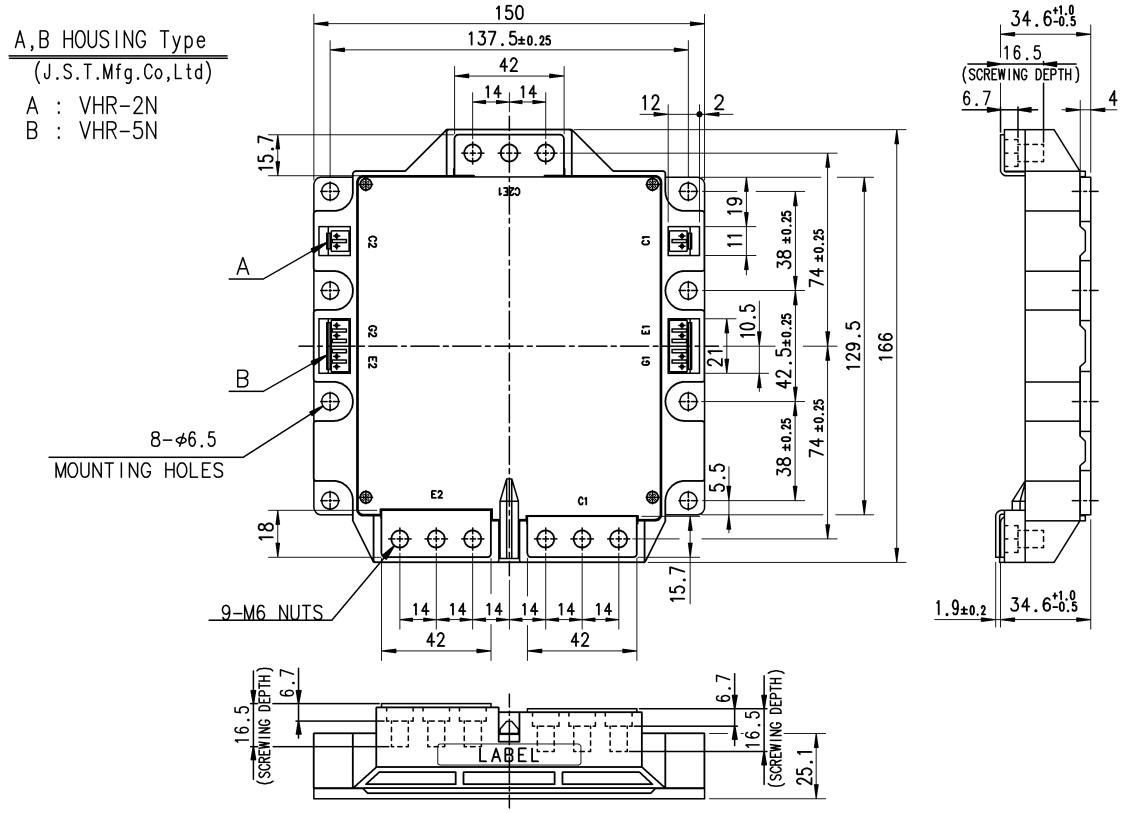
- ●Flat base Type
- ●Copper base plate (non-plating)
- ●RoHS Directive compliant
- ●Recognized under UL1557, File E323585

APPLICATION

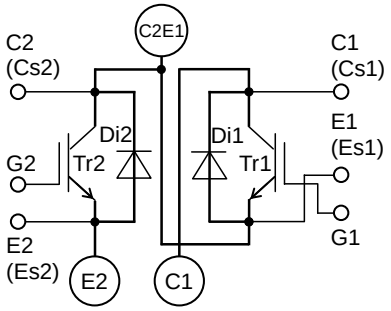
Wind power, Photovoltaic (Solar) power, AC Motor Control, Motion/Servo Control, Power supply, etc.

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

CM1400DUC-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

MAXIMUM RATINGS (T_j=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=124 °C (Note2, 4)	1400	A
I_{CRM}		Pulse, Repetitive (Note3)	2800	
P_{tot}	Total power dissipation	T_C=25 °C (Note2, 4)	9375	W
I_E (Note1)	Emitter current	DC (Note2)	1400	A
I_{ERM} (Note1)		Pulse, Repetitive (Note3)	2800	
V_{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	4000	V
T_{jmax}	Maximum junction temperature	Instantaneous event (overload)	175	°C
T_{Cmax}	Maximum case temperature	(Note4)	125	
T_{jop}	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T_{stg}	Storage temperature	-	-40 ~ +125	

ELECTRICAL CHARACTERISTICS (T_j=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		-	-	3.0	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=140 mA, V_{CE}=10 V		5.4	6.0	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	I_C=1400 A (Note5), V_{GE}=15 V, Terminal=chip	T_j=25 °C	-	1.55	1.90	V
			T_j=125 °C	-	1.75	-	
			T_j=150 °C	-	1.80	-	
C_{ies}	Input capacitance	V_{CE}=10 V, G-E short-circuited		-	-	150	nF
C_{oes}	Output capacitance			-	-	30	
C_{res}	Reverse transfer capacitance			-	-	2.5	
Q_G	Gate charge	V_{CC}=600 V, I_C=1400 A, V_{GE}=15 V		-	3500	-	nC
$t_{d(on)}$	Turn-on delay time	V_{CC}=600 V, I_C=1400 A, V_{GE}=±15 V, R_G=0 Ω, Inductive load		-	-	900	ns
t_r	Rise time			-	-	250	
$t_{d(off)}$	Turn-off delay time			-	-	950	
t_f	Fall time			-	-	350	
V_{EC} (Note1)	Emitter-collector voltage	I_E=1400 A (Note5), G-E short-circuited, Terminal=chip	T_j=25 °C	-	1.65	2.10	V
			T_j=125 °C	-	1.65	-	
			T_j=150 °C	-	1.65	-	
t_{rr} (Note1)	Reverse recovery time	V_{CC}=600 V, I_E=1400 A, V_{GE}=±15 V, R_G=0 Ω, Inductive load		-	-	450	ns
Q_{rr} (Note1)	Reverse recovery charge			-	90	-	μC
E_{on}	Turn-on switching energy per pulse	V_{CC}=600 V, I_C=I_E=1400 A, V_{GE}=±15 V, R_G=0 Ω, T_j=150 °C, Inductive load		-	82.2	-	mJ
E_{off}	Turn-off switching energy per pulse			-	265	-	
E_{rr} (Note1)	Reverse recovery energy per pulse			-	122	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, T_C=25 °C (Note4)		-	0.286	-	mΩ
r_g	Internal gate resistance	Per switch		-	1.7	-	Ω

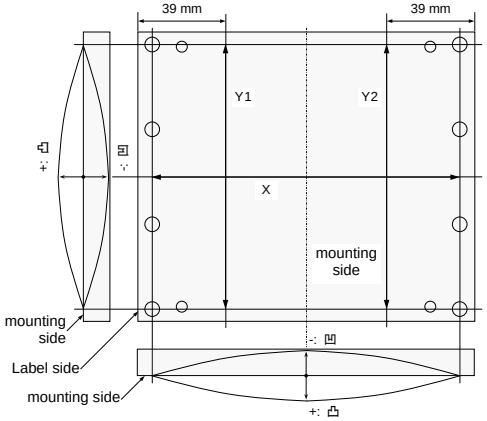
THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance	Junction to case, per Inverter IGBT (Note4)	-	-	16	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter DIODE (Note4)	-	-	26	
$R_{th(c-s)}$	Contact thermal resistance	Case to heat sink, per 1/2 module, Thermal grease applied (Note4, 6)	-	12	-	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
M_t	Mounting torque	Main terminals M 6 screw	3.5	4.0	4.5	N·m
M_s		Mounting to heat sink M 6 screw	3.5	4.0	4.5	N·m
d_s	Creepage distance	Terminal to terminal	24	-	-	mm
		Terminal to base plate	33	-	-	
d_a	Clearance	Terminal to terminal	14	-	-	mm
		Terminal to base plate	33	-	-	
m	mass	-	-	1450	-	g
e_c	Flatness of base plate	On the centerline X, Y1, Y2 (Note7)	-50	-	+100	μm

Note1. Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (DIODE).
2. Junction temperature (T_j) should not increase beyond T_{jmax} rating.
3. Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} 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.
The heat sink thermal resistance should measure just under the chips.
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=0.9 W/(m·K).
7. Base plate (mounting side) flatness measurement points (X, Y1 and Y2) are as follows of the following figure.



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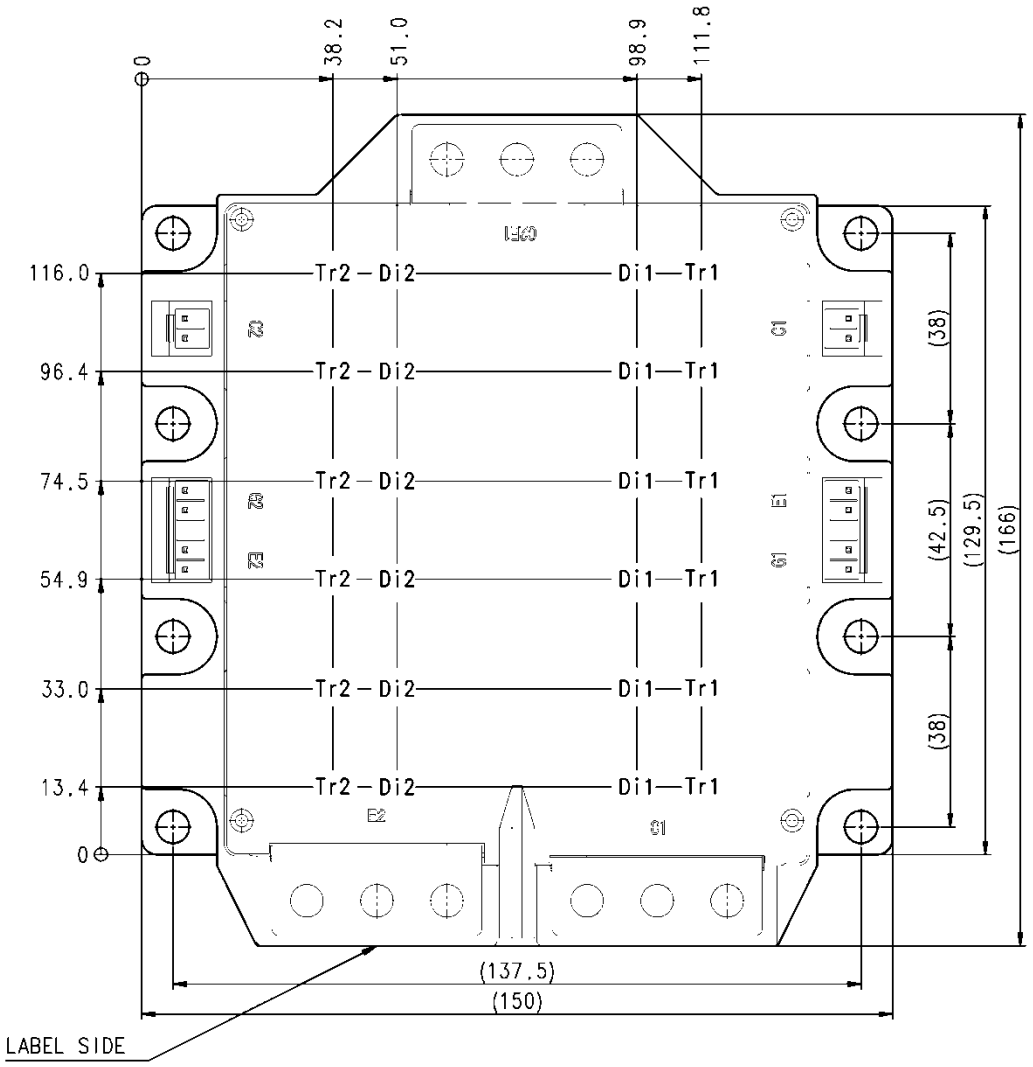
RECOMMENDED OPERATING CONDITIONS

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	0	-	2.2	Ω

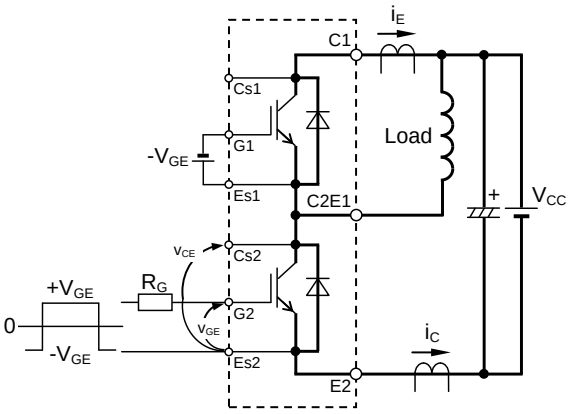
CHIP LOCATION (Top view)

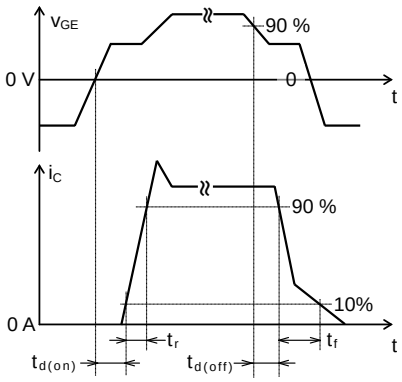
Dimension in mm, tolerance: ±1 mm



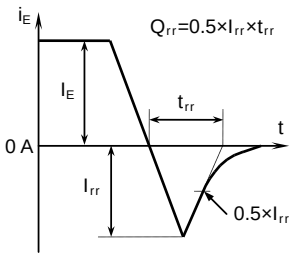
Tr1/Tr2: IGBT, Di1/Di2: DIODE

TEST CIRCUIT AND WAVEFORMS

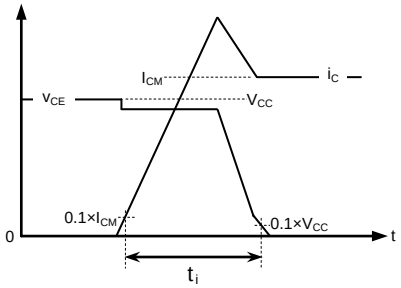




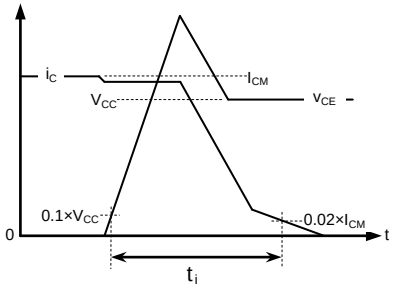
Switching characteristics test circuit and waveforms



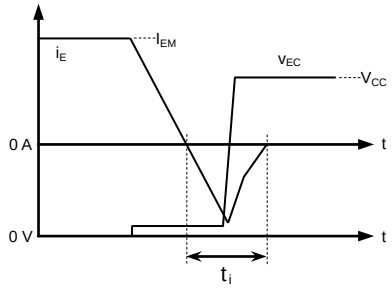
t_{rr}, Q_{rr} test waveform



IGBT Turn-on switching energy



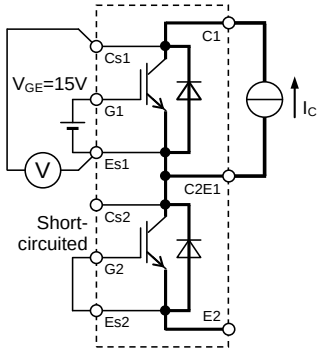
IGBT Turn-off switching energy



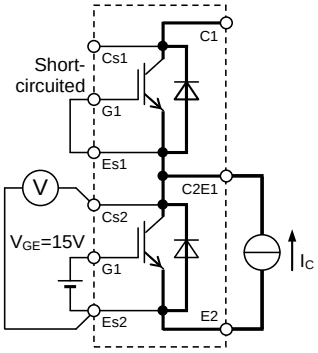
DIODE Reverse recovery energy

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

TEST CIRCUIT

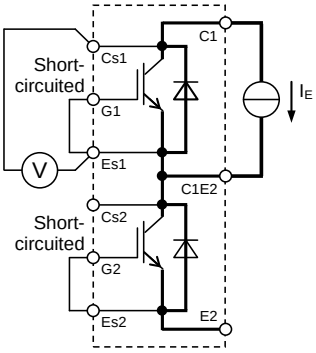


Tr1

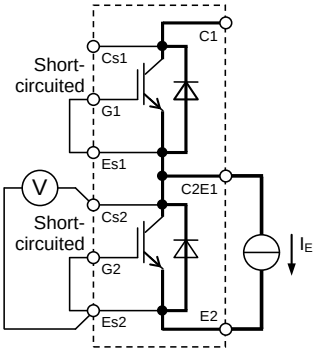


Tr2

V_{CEsat} test circuit



Di1

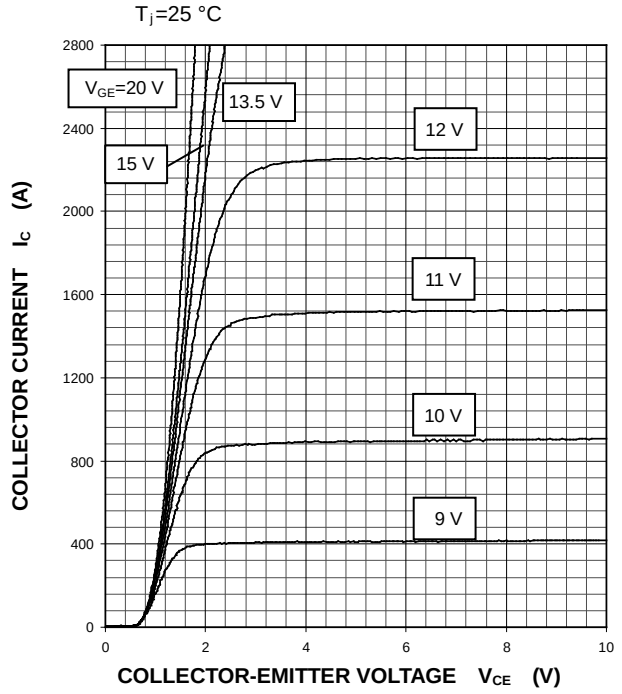


Di2

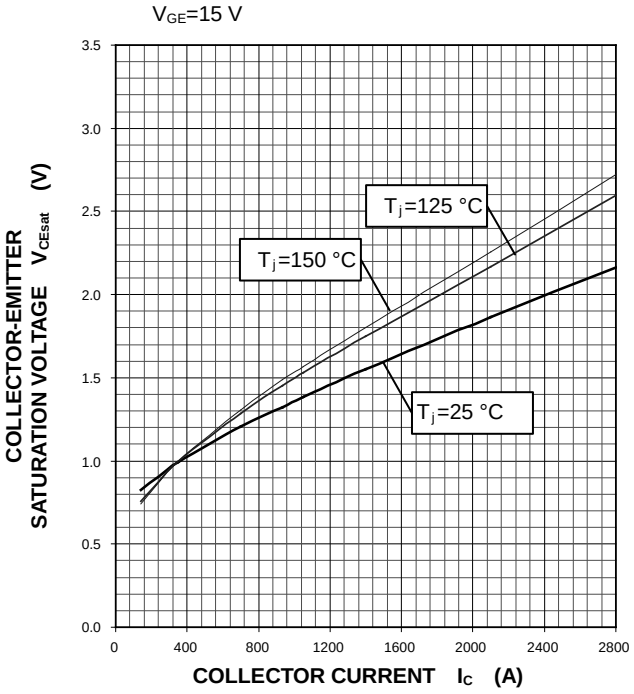
V_{EC} test circuit

PERFORMANCE CURVES

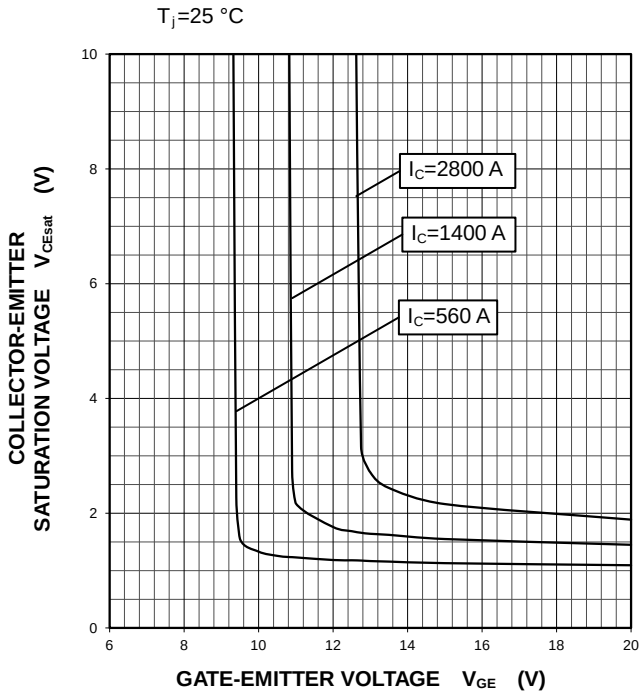
OUTPUT CHARACTERISTICS (TYPICAL)



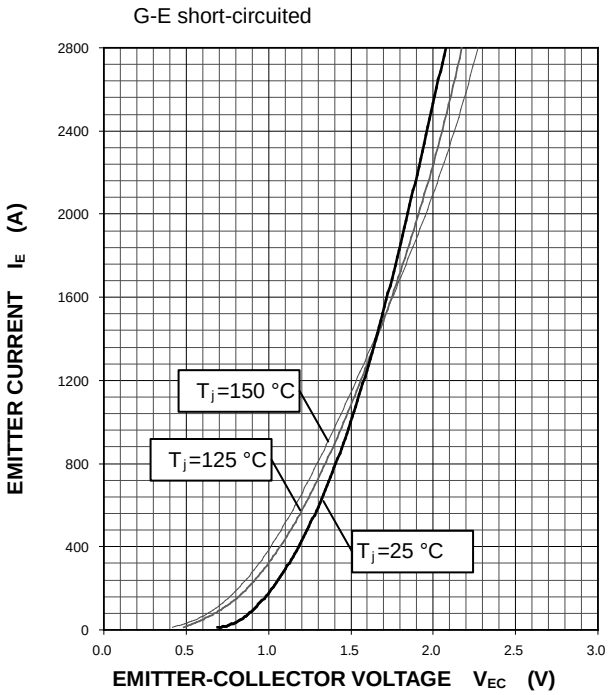
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



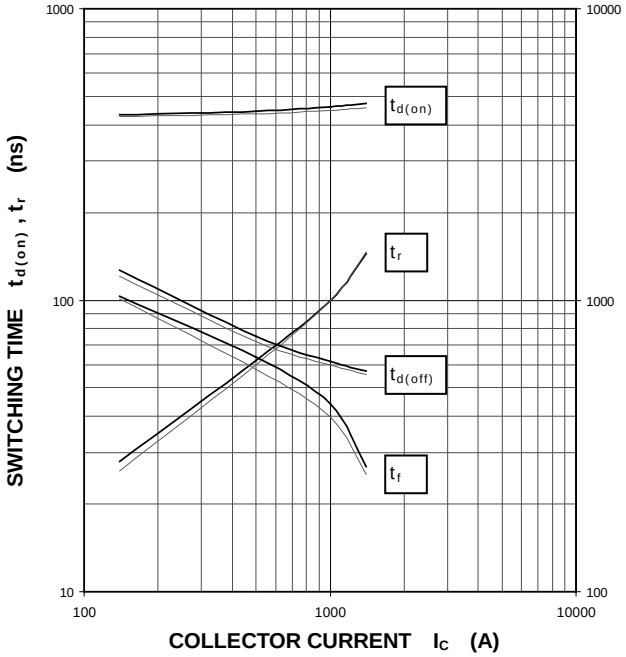
FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)



PERFORMANCE CURVES

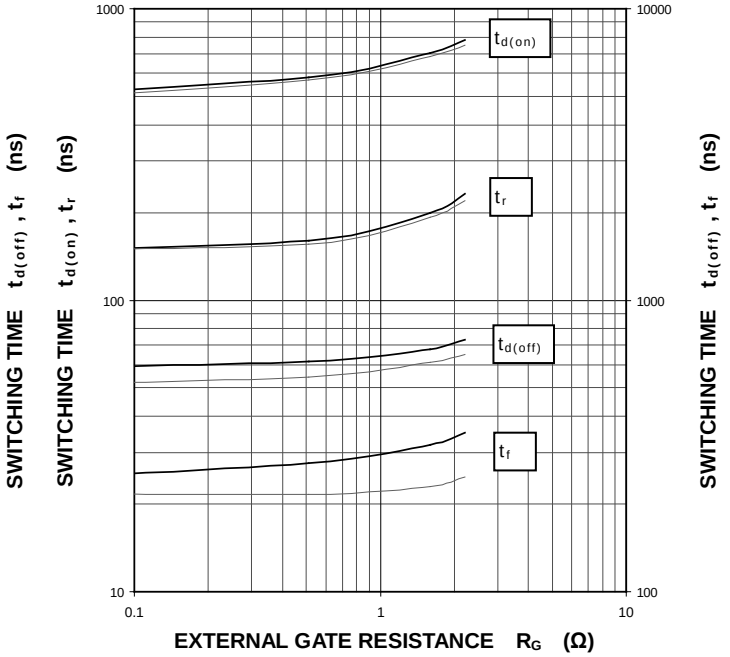
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=0 Ω, INDUCTIVE LOAD
———: T_j=150 °C, - - - - -: T_j=125 °C



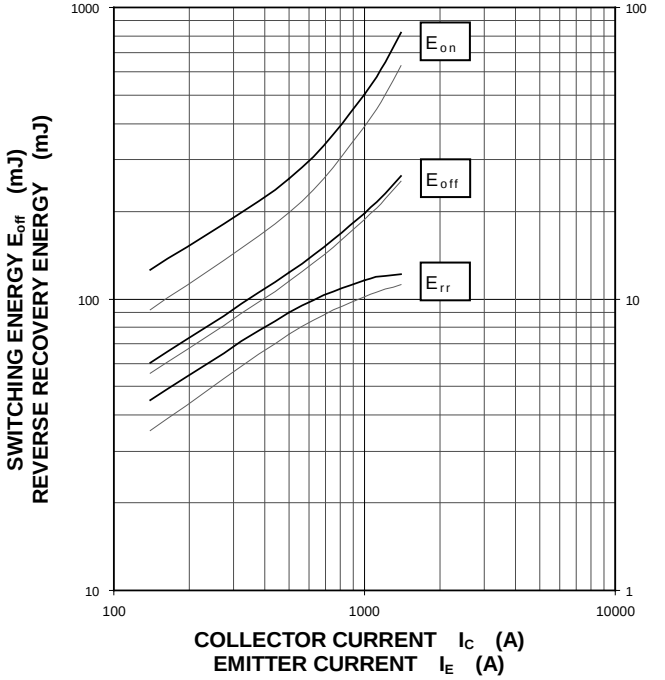
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

V_{CC}=600 V, I_C=1400 A, V_{GE}=±15 V, INDUCTIVE LOAD
———: T_j=150 °C, - - - - -: T_j=125 °C



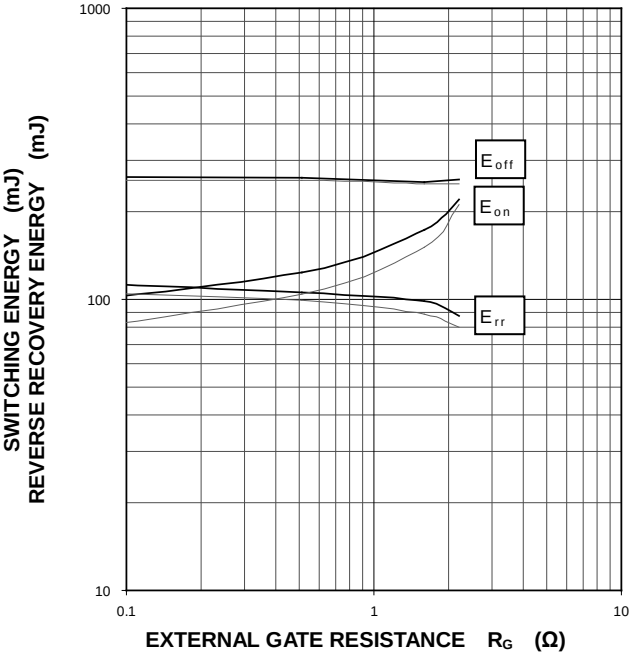
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=0 Ω,
INDUCTIVE LOAD, PER PULSE
———: T_j=150 °C, - - - - -: T_j=125 °C



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

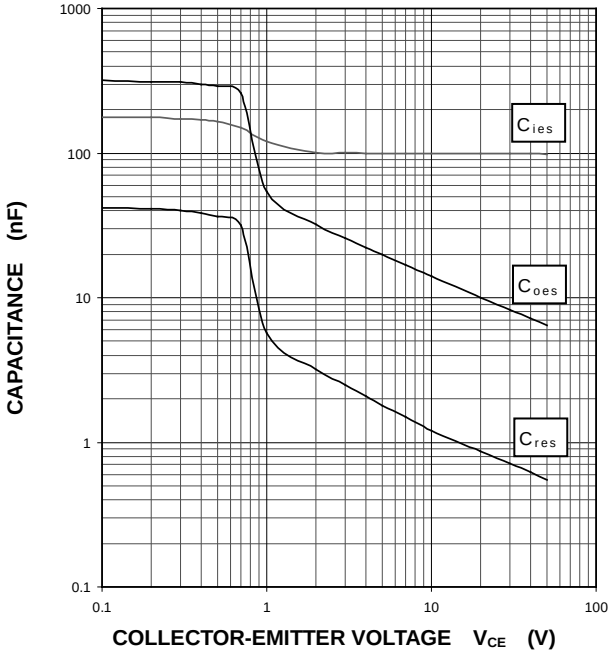
V_{CC}=600 V, I_C/I_E=1400 A, V_{GE}=±15 V,
INDUCTIVE LOAD, PER PULSE
———: T_j=150 °C, - - - - -: T_j=125 °C



PERFORMANCE CURVES

CAPACITANCE CHARACTERISTICS (TYPICAL)

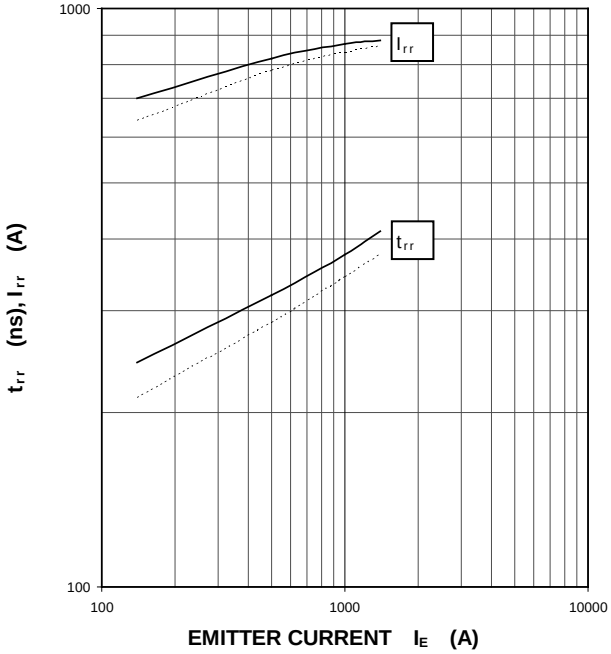
G-E short-circuited, T_j=25 °C



FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

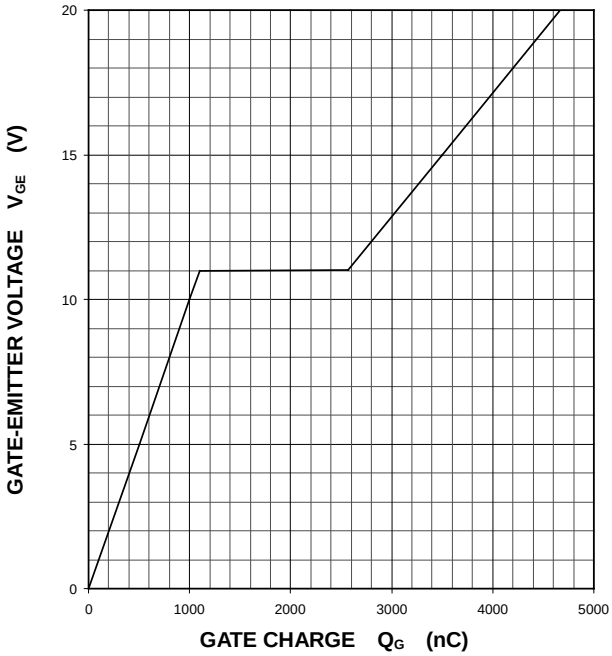
V_{CC}=600 V, V_{GE}=±15 V, R_G=0 Ω, INDUCTIVE LOAD

———: T_j=150 °C, - - - - -: T_j=125 °C



GATE CHARGE CHARACTERISTICS (TYPICAL)

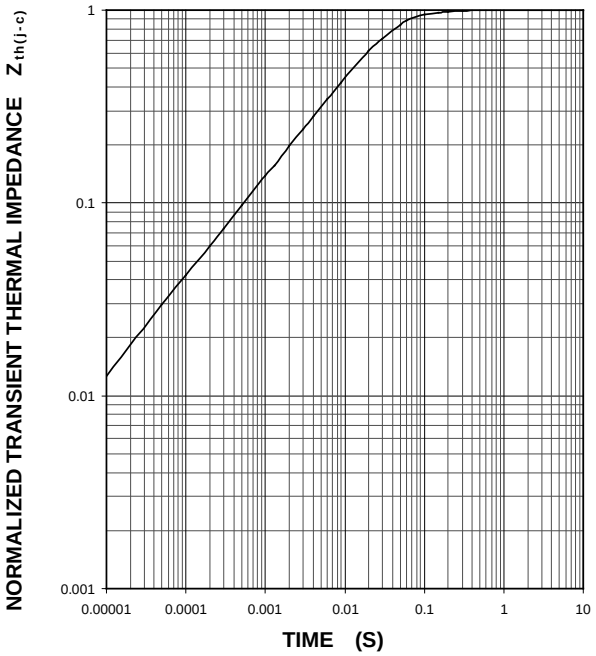
V_{CC}=600 V, I_C=1400 A, T_j=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, T_C=25°C

$R_{th(j-c)Q}$=16 K/kW, $R_{th(j-c)D}$=26 K/kW



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