

< 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**

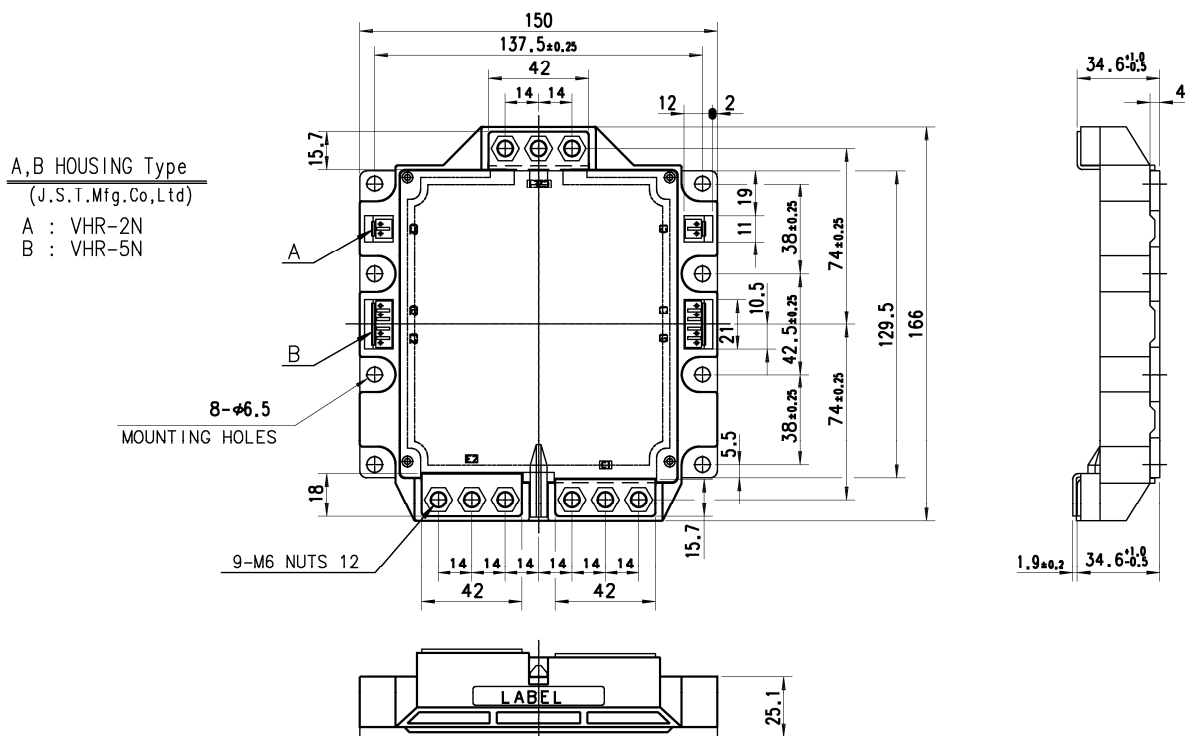
- Flat base Type
- Copper base plate (non-plating)
- RoHS Directive compliant

APPLICATION

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

OUTLINE DRAWING & INTERNAL CONNECTION

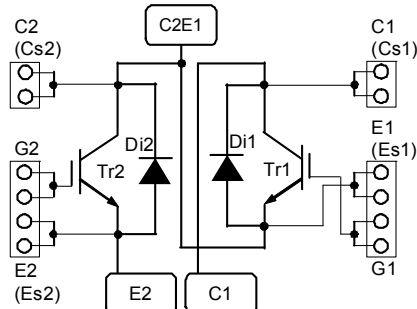
Dimension in mm



A, B HOUSING Type
 (J.S.T.Mfg.Co.,Ltd)
 A : VHR-2N
 B : VHR-5N

8-φ6.5
 MOUNTING HOLES

9-M6 NUTS 12

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

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ABSOLUTE 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	(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	-	175	°C
T _{Cmax}	Maximum case temperature	(Note4)	125	°C
T _{jop}	Operating junction temperature	-	-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 (Note6), V _{GE} =15 V, (Terminal)	T _j =25 °C	-	1.55	1.90	V
			T _j =125 °C	-	1.75	-	
		I _C =1400 A, V _{GE} =15 V, (Chip)	T _j =150 °C	-	1.80	-	V
			-	-	-	-	
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 (Note6), G-E short-circuited, (Terminal)	T _j =25 °C	-	1.65	2.10	V
			T _j =125 °C	-	1.65	-	
		I _E =1400 A, G-E short-circuited, (Chip)	T _j =150 °C	-	1.65	-	V
			-	-	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	R _G =0 Ω, Inductive load	-	90	-	μC	
E _{on}	Turn-on switching energy per pulse	V _{CC} =600 V, I _C =I _E =1400 A,	-	82.2	-	mJ	
E _{off}	Turn-off switching energy per pulse	V _{GE} =±15 V, R _G =0 Ω, T _j =150 °C,	-	260	-		
E _{rr} (Note1)	Reverse recovery energy per pulse	Inductive load	-	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	

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THERMAL RESISTANCE CHARACTERISTICS

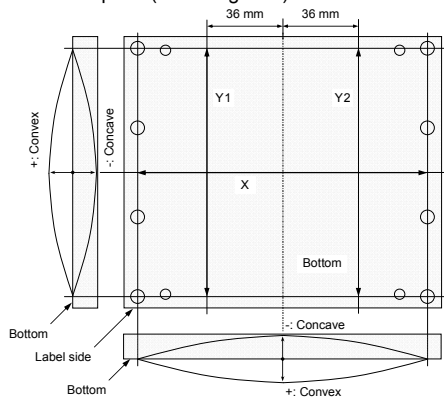
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-e)Q}$	Thermal resistance (Note4)	Junction to case, per Inverter IGBT	-	-	16	K/kW
$R_{th(j-e)D}$		Junction to case, per Inverter FWDi	-	-	26	
$R_{th(c-s)}$	Contact thermal resistance (Note4)	Case to heat sink, per 1 module, Thermal grease applied (Note7)	-	6	-	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	
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	Weight	-	-	1450	-	g
e_c	Flatness of base plate	On the centerline X, Y1, Y2 (Note5)	-50	-	+100	μ m

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

- Junction temperature (T_j) should not increase beyond T_{jmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
- 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.
- Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.
- Typical value is measured by using thermally conductive grease of $\lambda=0.9$ W/(m·K).
- The base plate (mounting side) flatness measurement points (X, Y1, Y2) are as follows of the following figure.



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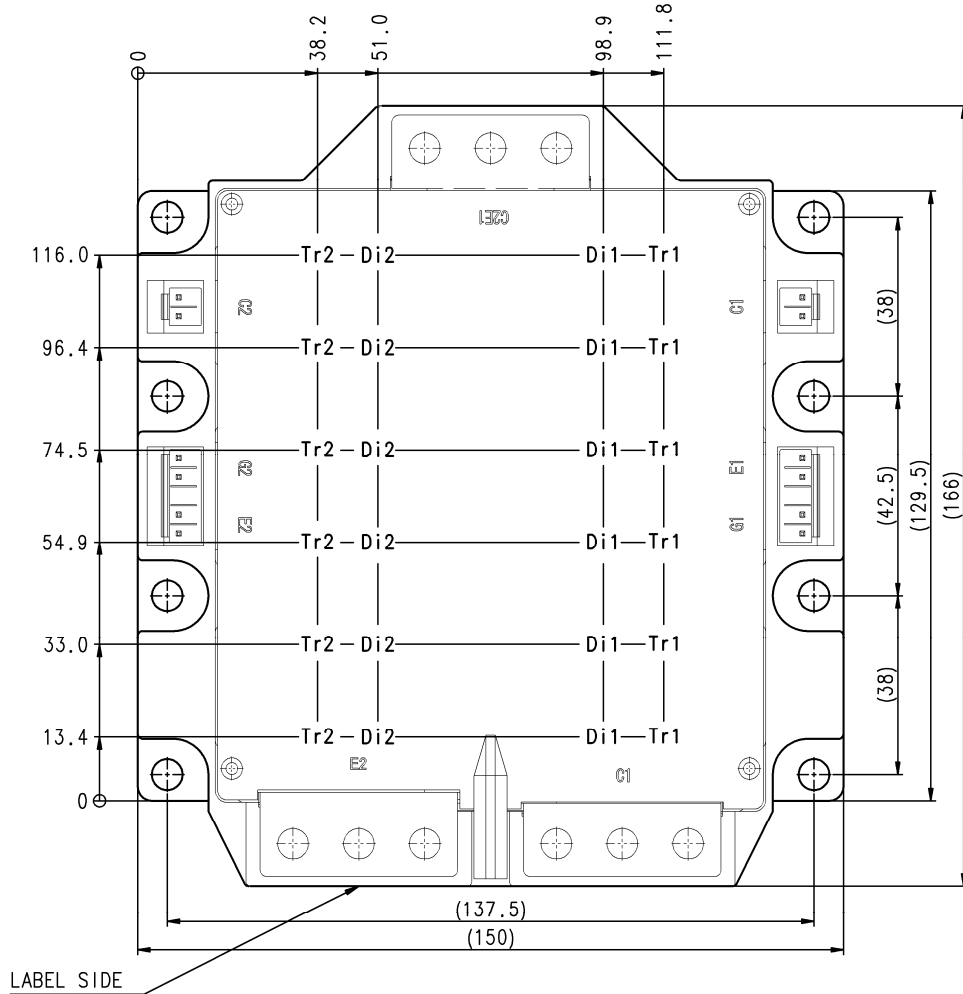
CM1400DUC-24S
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RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	(DC) Supply voltage	Applied across P-N terminals	-	600	850	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across G-Es terminals	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch	0	-	2.2	Ω

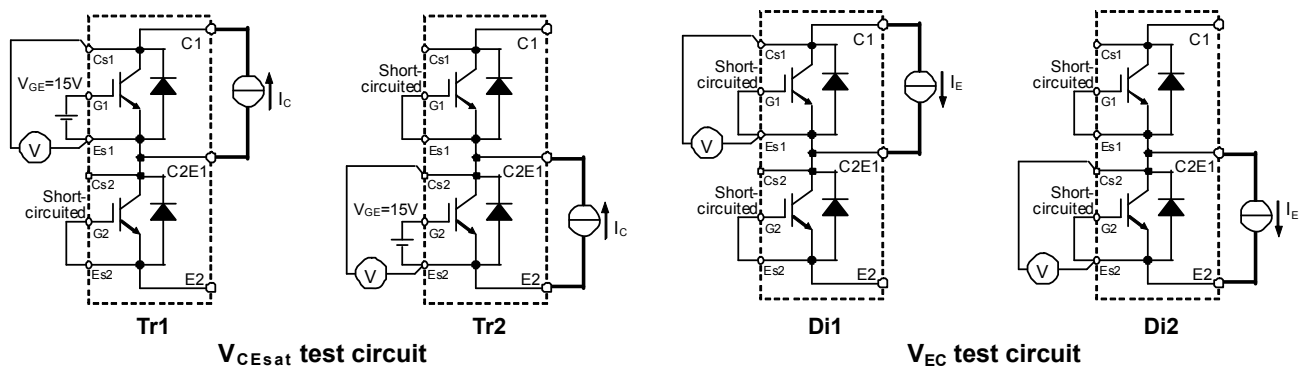
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm

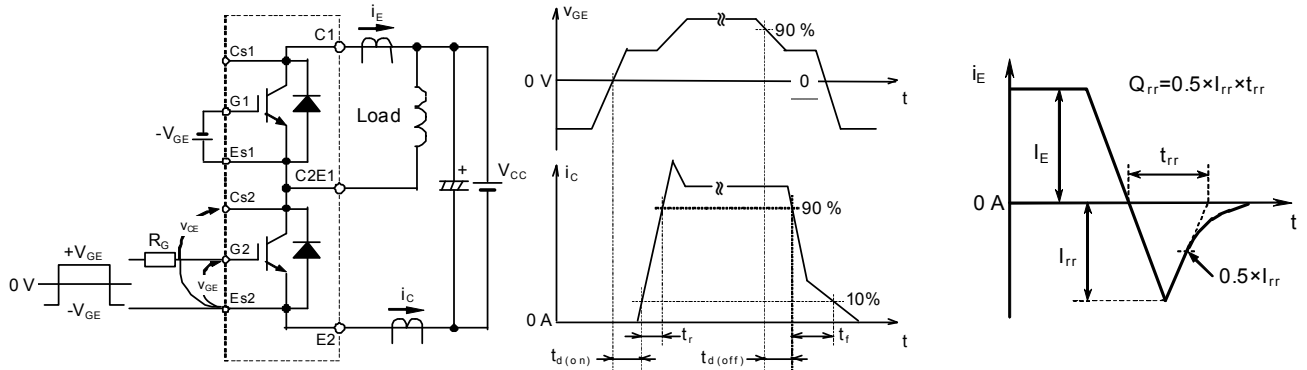


Tr1/Tr2: IGBT, Di1/Di2: FWDi

TEST CIRCUIT

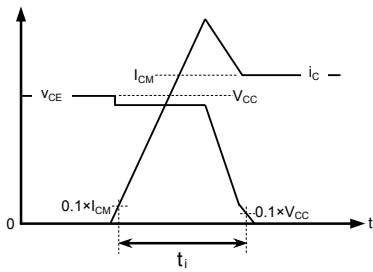


TEST CIRCUIT AND WAVEFORMS

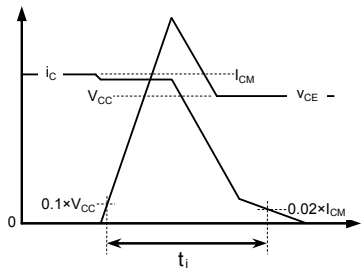


Switching characteristics test circuit and waveforms

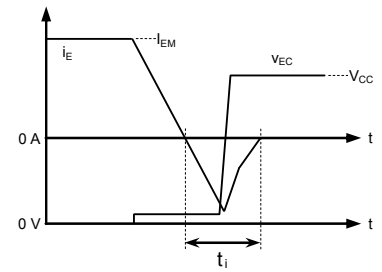
t_{rr} , Q_{rr} test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy

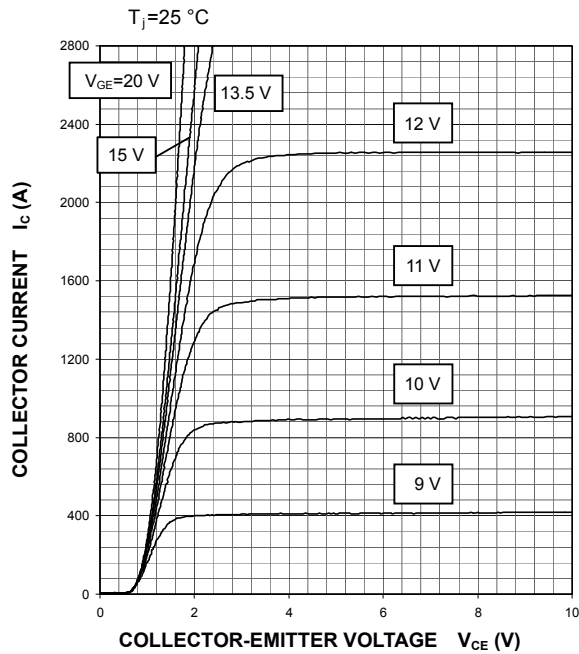


FWDi Reverse recovery energy

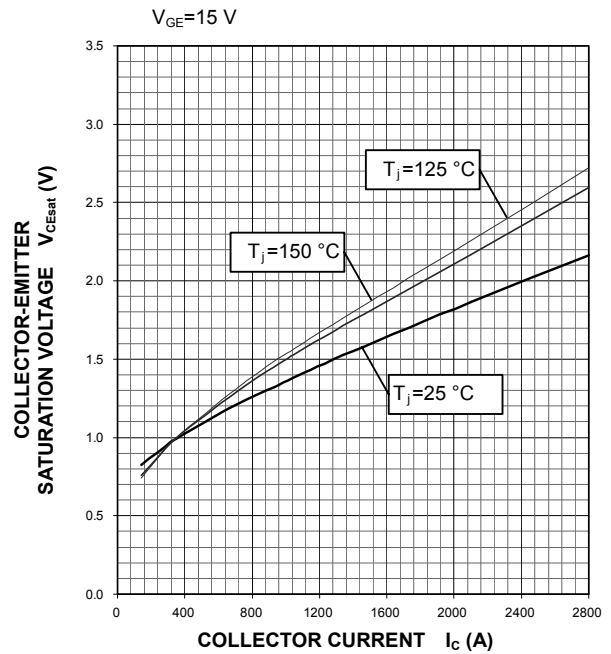
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

PERFORMANCE CURVES

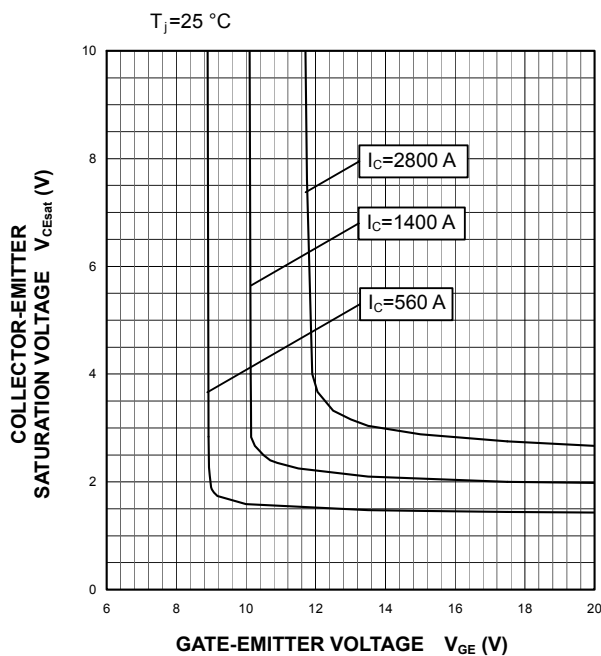
OUTPUT CHARACTERISTICS
 (TYPICAL)



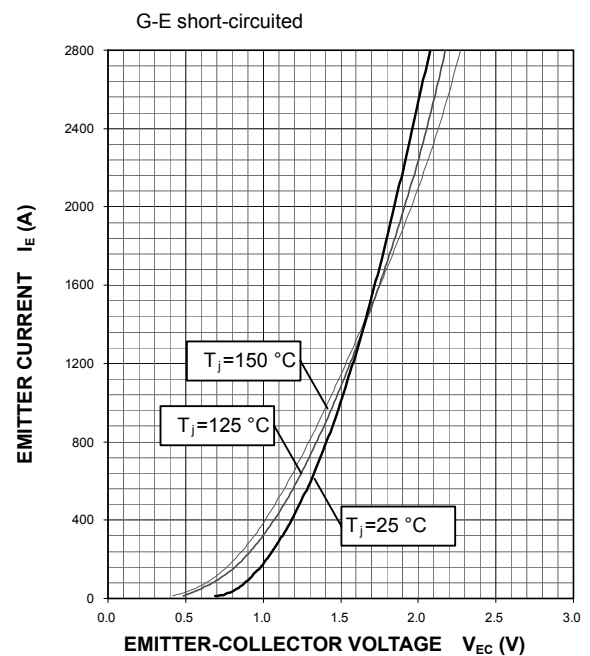
COLLECTOR-EMITTER SATURATION
 VOLTAGE CHARACTERISTICS
 (TYPICAL)



COLLECTOR-EMITTER SATURATION
 VOLTAGE CHARACTERISTICS
 (TYPICAL)



FREE WHEELING DIODE
 FORWARD CHARACTERISTICS
 (TYPICAL)

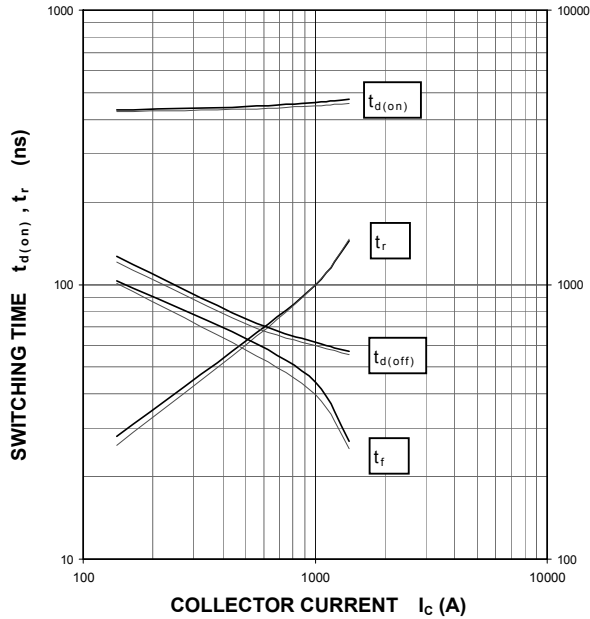


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HIGH POWER SWITCHING USE
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PERFORMANCE CURVES

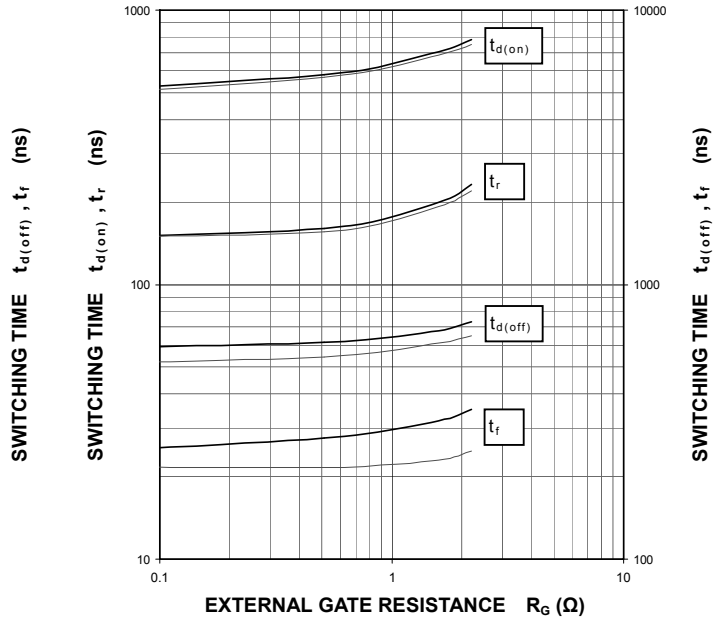
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



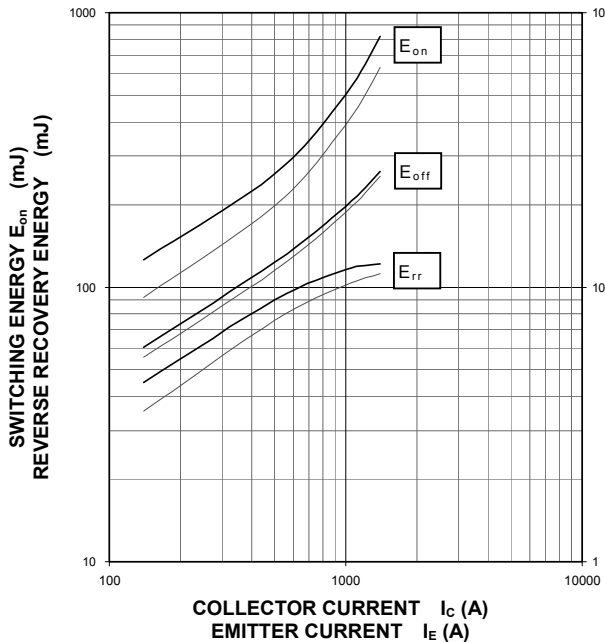
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $I_C=1400\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



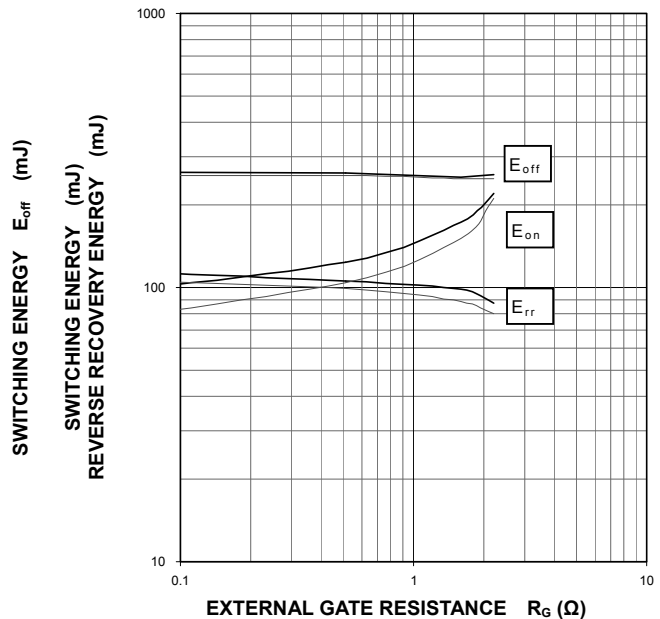
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$



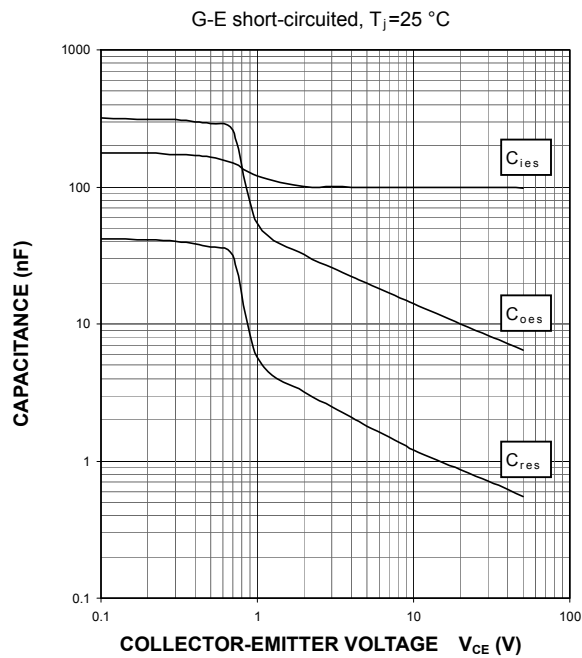
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $I_C/I_E=1400\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
INDUCTIVE LOAD, PER PULSE
——: $T_j=150\text{ }^\circ\text{C}$, - - - -: $T_j=125\text{ }^\circ\text{C}$

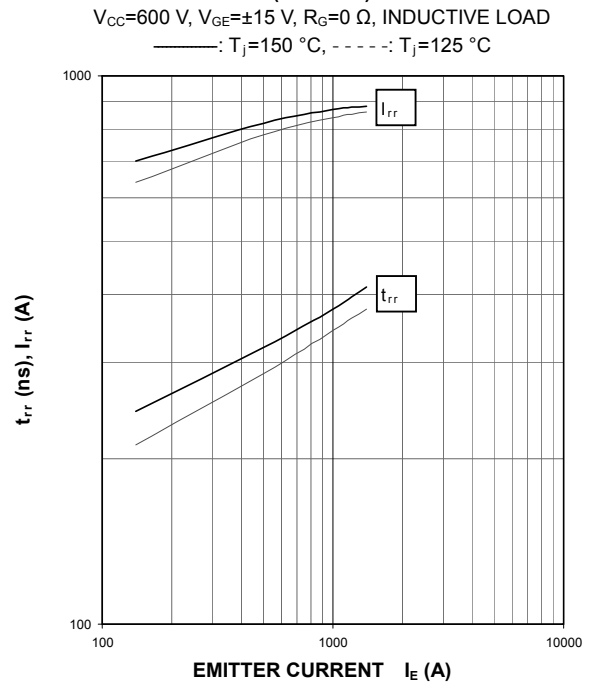


PERFORMANCE CURVES

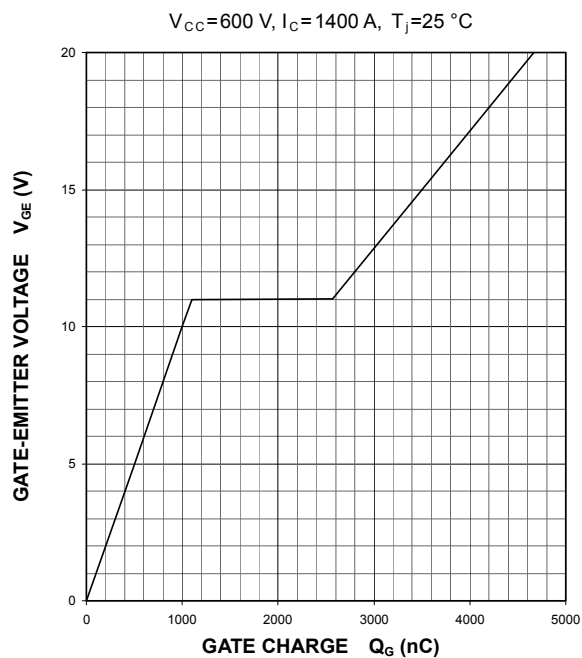
CAPACITANCE CHARACTERISTICS
(TYPICAL)



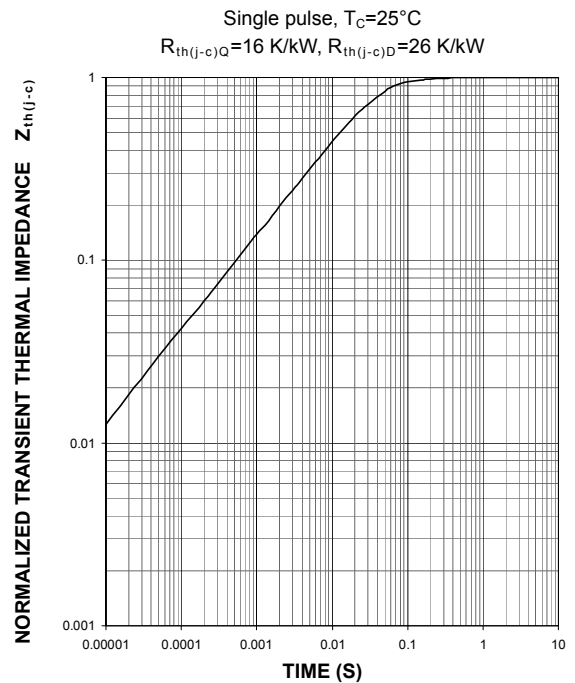
FREE WHEELING DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE CHARACTERISTICS
(TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
(MAXIMUM)



CM1400DUC-24S

HIGH POWER SWITCHING USE
INSULATED TYPE**Keep safety first in your circuit designs!**

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