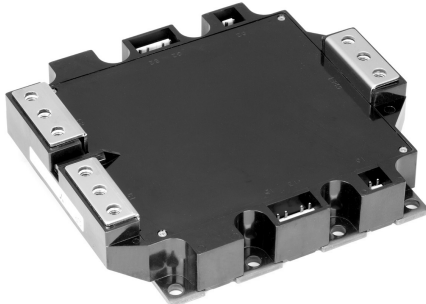


< IGBT MODULES >

# 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**

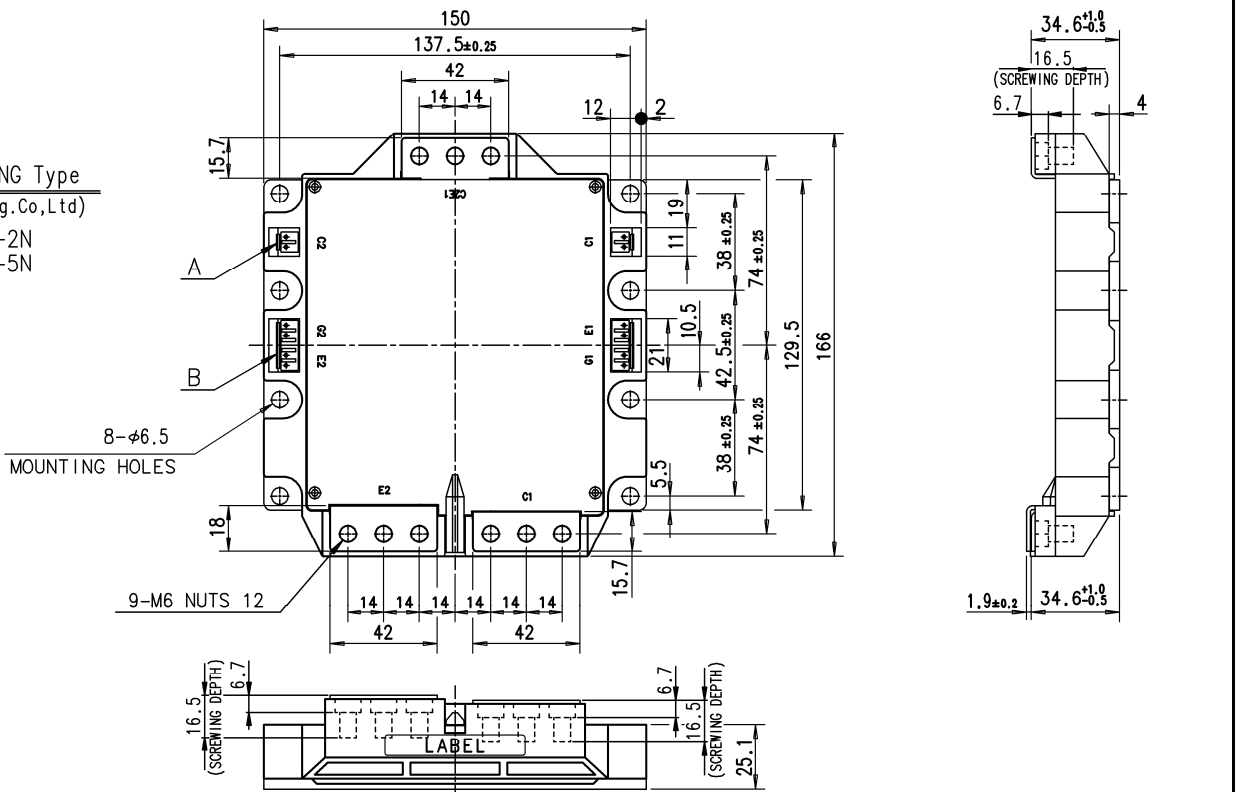
- Flat base Type
- Copper base plate (non-plating)
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

## APPLICATION

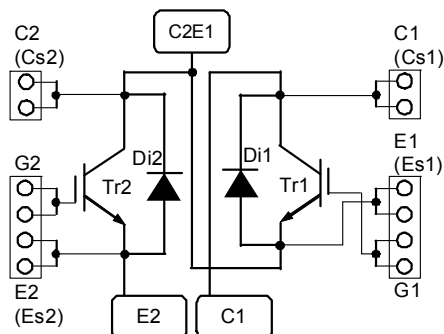
Wind power, Photovoltaic (Solar) power, AC Motor Control, Motion/Servo Control, Power supply, etc.

## OUTLINE DRAWING & INTERNAL CONNECTION

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



### 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

< IGBT MODULES >

CM1400DUC-24S

HIGH POWER SWITCHING USE  
INSULATED TYPE

**ABSOLUTE MAXIMUM RATINGS (T<sub>j</sub>=25 °C, unless otherwise specified)**

Symbol	Item	Conditions	Rating	Unit
V <sub>CEs</sub>	Collector-emitter voltage	G-E short-circuited	1200	V
V <sub>GES</sub>	Gate-emitter voltage	C-E short-circuited	± 20	V
I <sub>C</sub>	Collector current	DC, T <sub>C</sub> =124 °C (Note2, 4)	1400	A
I <sub>CRM</sub>		Pulse, Repetitive (Note3)	2800	
P <sub>tot</sub>	Total power dissipation	T <sub>C</sub> =25 °C (Note2, 4)	9375	W
I <sub>E</sub> (Note1)	Emitter current	(Note2)	1400	A
I <sub>ERM</sub> (Note1)		Pulse, Repetitive (Note3)	2800	
V <sub>isol</sub>	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	4000	V
T <sub>jmax</sub>	Maximum junction temperature	Instantaneous event (overload)	175	°C
T <sub>Cmax</sub>	Maximum case temperature	(Note4)	125	
T <sub>jop</sub>	Operating junction temperature	Continuous operation (under switching)	-40 ~ +150	°C
T <sub>stg</sub>	Storage temperature	-	-40 ~ +125	

**ELECTRICAL CHARACTERISTICS (T<sub>j</sub>=25 °C, unless otherwise specified)**

Symbol	Item	Conditions	Limits			Unit	
			Min.	Typ.	Max.		
I <sub>CEs</sub>	Collector-emitter cut-off current	V <sub>CE</sub> =V <sub>CEs</sub> , G-E short-circuited	-	-	1.0	mA	
I <sub>GES</sub>	Gate-emitter leakage current	V <sub>GE</sub> =V <sub>GES</sub> , C-E short-circuited	-	-	3.0	µA	
V <sub>GE(th)</sub>	Gate-emitter threshold voltage	I <sub>C</sub> =140 mA, V <sub>CE</sub> =10 V	5.4	6.0	6.6	V	
V <sub>CEsat</sub>	Collector-emitter saturation voltage	I <sub>C</sub> =1400 A (Note6), V <sub>GE</sub> =15 V, Terminal=chip	T <sub>j</sub> =25 °C	-	1.55	1.90	V
			T <sub>j</sub> =125 °C	-	1.75	-	
			T <sub>j</sub> =150 °C	-	1.80	-	
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> =10 V, G-E short-circuited	-	-	150	nF	
C <sub>oes</sub>	Output capacitance		-	-	30		
C <sub>res</sub>	Reverse transfer capacitance		-	-	2.5		
Q <sub>G</sub>	Gate charge	V <sub>CC</sub> =600 V, I <sub>C</sub> =1400 A, V <sub>GE</sub> =15 V	-	3500	-	nC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>CC</sub> =600 V, I <sub>C</sub> =1400 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =0 Ω, Inductive load	-	-	900	ns	
t <sub>r</sub>	Rise time		-	-	250		
t <sub>d(off)</sub>	Turn-off delay time		-	-	950		
t <sub>f</sub>	Fall time		-	-	350		
V <sub>EC</sub> (Note1)	Emitter-collector voltage	I <sub>E</sub> =1400A (Note6), G-E short-circuited, Terminal=chip	T <sub>j</sub> =25 °C	-	1.65	2.10	V
			T <sub>j</sub> =125 °C	-	1.65	-	
			T <sub>j</sub> =150 °C	-	1.65	-	
t <sub>rr</sub> (Note1)	Reverse recovery time	V <sub>CC</sub> =600 V, I <sub>E</sub> =1400 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =0 Ω, Inductive load	-	-	450	ns	
Q <sub>rr</sub> (Note1)	Reverse recovery charge		-	90	-		µC
E <sub>on</sub>	Turn-on switching energy per pulse	V <sub>CC</sub> =600 V, I <sub>C</sub> =I <sub>E</sub> =1400 A, V <sub>GE</sub> =±15 V, R <sub>G</sub> =0 Ω, T <sub>j</sub> =150 °C, Inductive load	-	82.2	-	mJ	
E <sub>off</sub>	Turn-off switching energy per pulse		-	265	-		
E <sub>rr</sub> (Note1)	Reverse recovery energy per pulse		-	122	-		mJ
R <sub>CC+EE</sub>	Internal lead resistance	Main terminals-chip, per switch, T <sub>C</sub> =25 °C (Note4)	-	0.286	-	mΩ	
r <sub>g</sub>	Internal gate resistance	Per switch	-	1.7	-	Ω	

< IGBT MODULES >  
**CM1400DUC-24S**  
**HIGH POWER SWITCHING USE**  
**INSULATED TYPE**

**THERMAL RESISTANCE CHARACTERISTICS**

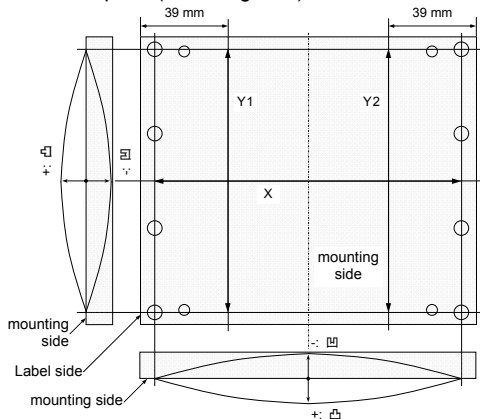
Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Thermal resistance (Note4)	Junction to case, per Inverter IGBT	-	-	16	K/kW
$R_{th(j-c)D}$		Junction to case, per Inverter FWDi	-	-	26	
$R_{th(c-s)}$	Contact thermal resistance (Note4)	Case to heat sink, per 1/2 module, Thermal grease applied (Note6)	-	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	
$d_s$	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 (Note7)	-50	-	+100	$\mu$ 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

HIGH POWER SWITCHING USE

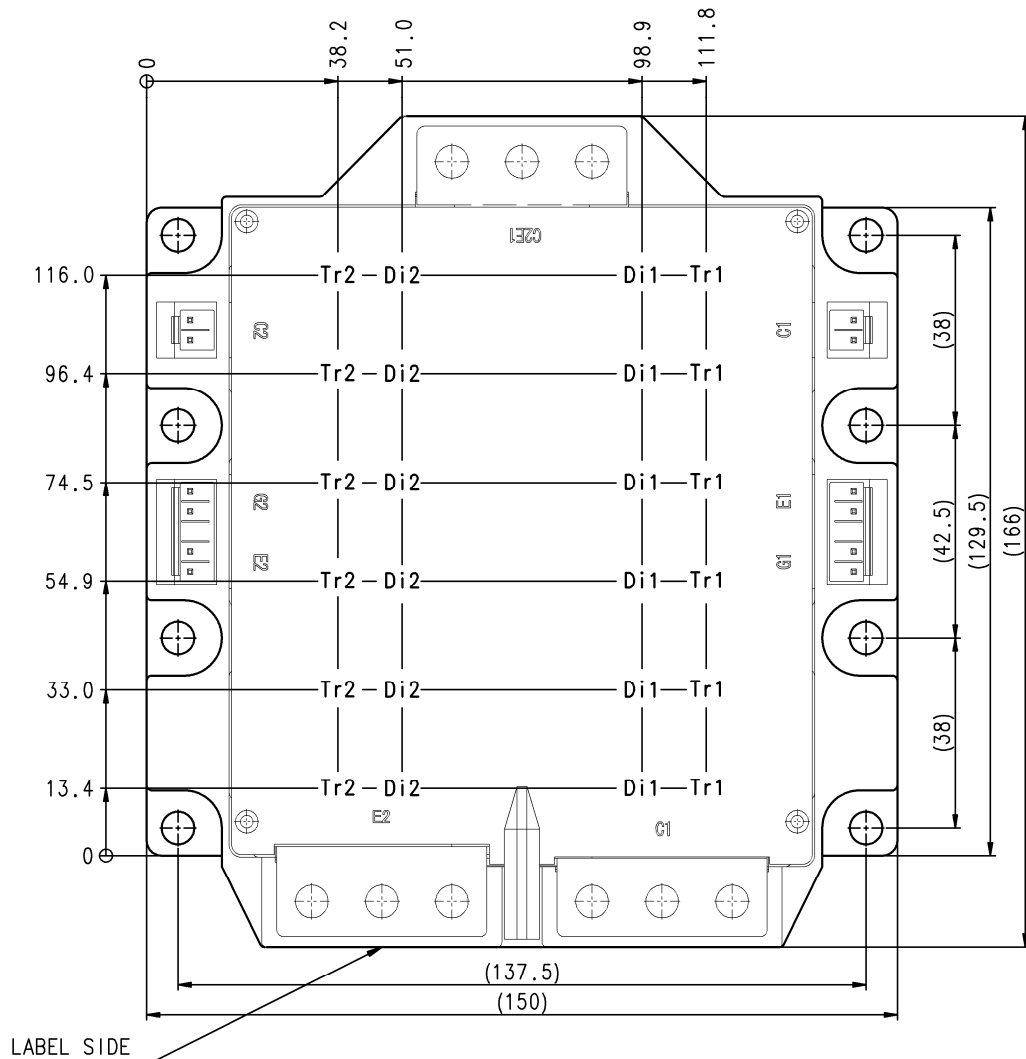
INSULATED TYPE

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	$\Omega$

CHIP LOCATION (Top view)

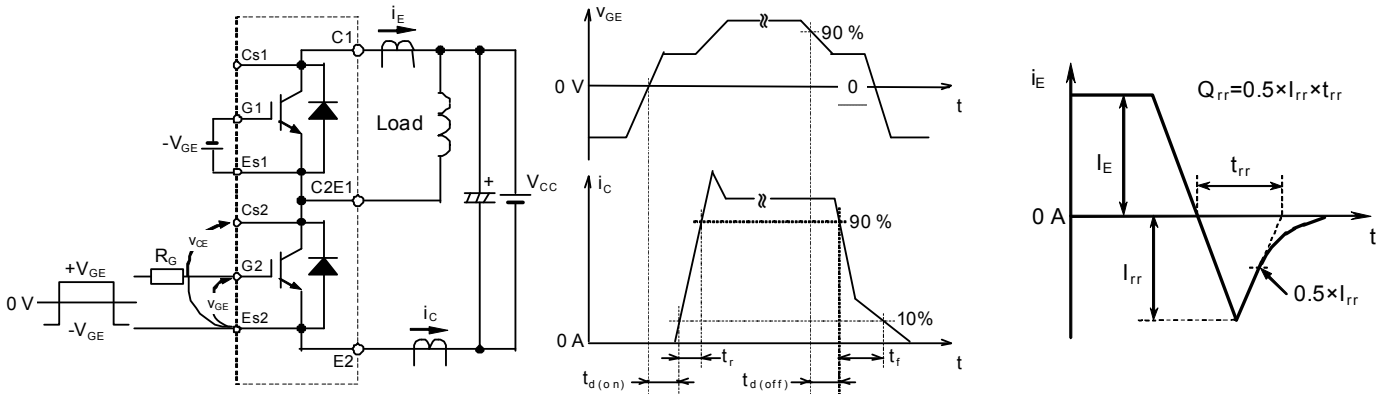
Dimension in mm, tolerance:  $\pm 1$  mm



Tr1/Tr2: IGBT, Di1/Di2: FWDi

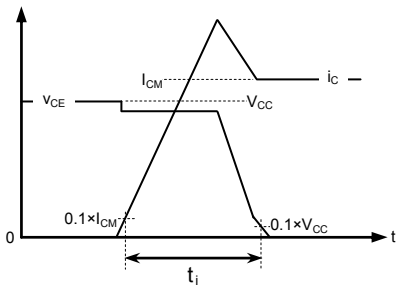
< IGBT MODULES >  
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 HIGH POWER SWITCHING USE  
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**TEST CIRCUIT AND WAVEFORMS**

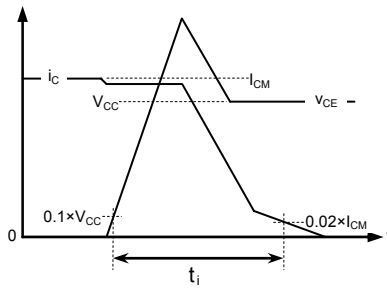


**Switching characteristics test circuit and waveforms**

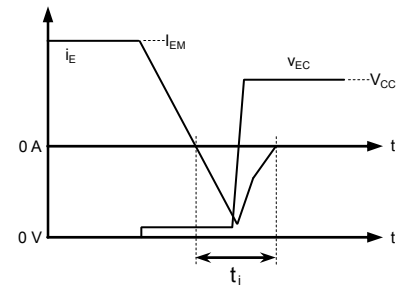
**$t_{rr}$ ,  $Q_{rr}$  test waveform**



**IGBT Turn-on switching energy**



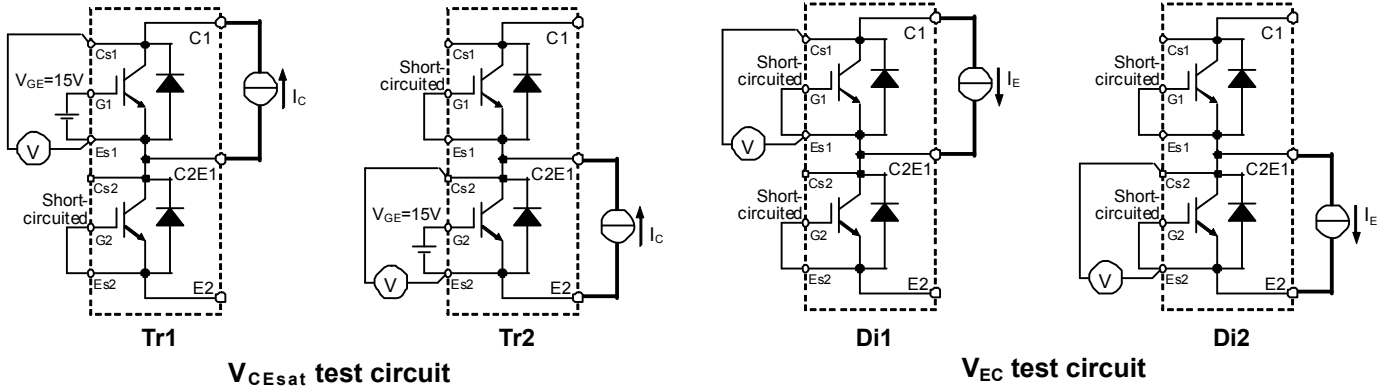
**IGBT Turn-off switching energy**



**FWDi Reverse recovery energy**

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

**TEST CIRCUIT**



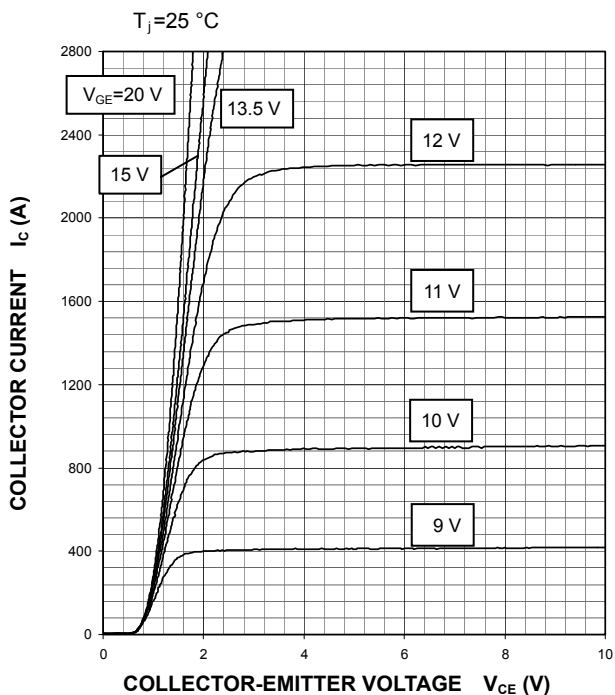
**$V_{CEsat}$  test circuit**

**$V_{EC}$  test circuit**

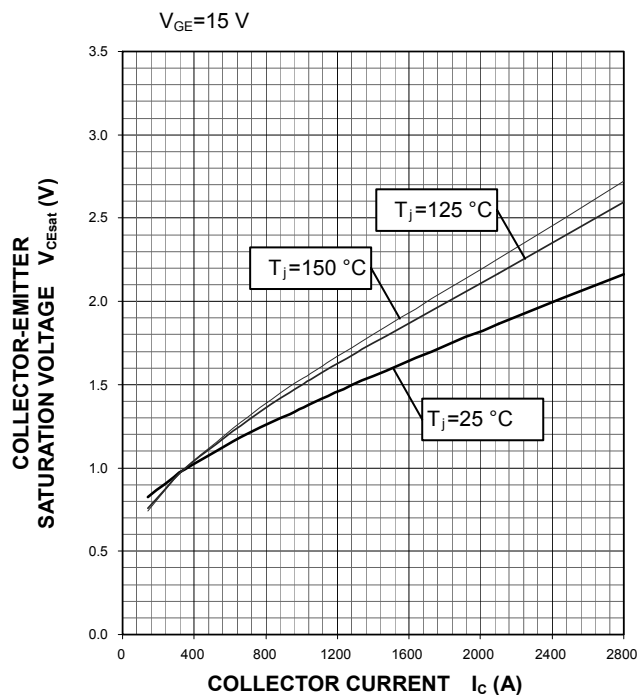
< IGBT MODULES >  
**CM1400DUC-24S**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE

PERFORMANCE CURVES

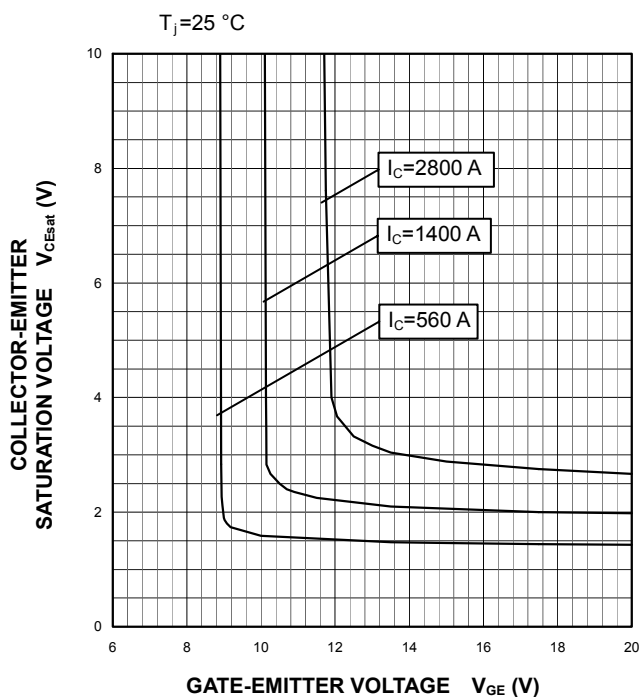
OUTPUT CHARACTERISTICS  
 (TYPICAL)



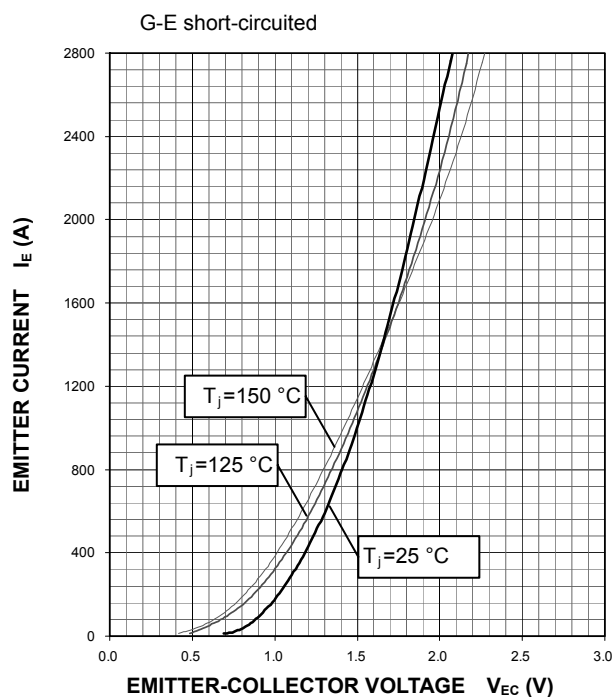
COLLECTOR-EMITTER SATURATION  
 VOLTAGE CHARACTERISTICS  
 (TYPICAL)



COLLECTOR-EMITTER SATURATION  
 VOLTAGE CHARACTERISTICS  
 (TYPICAL)



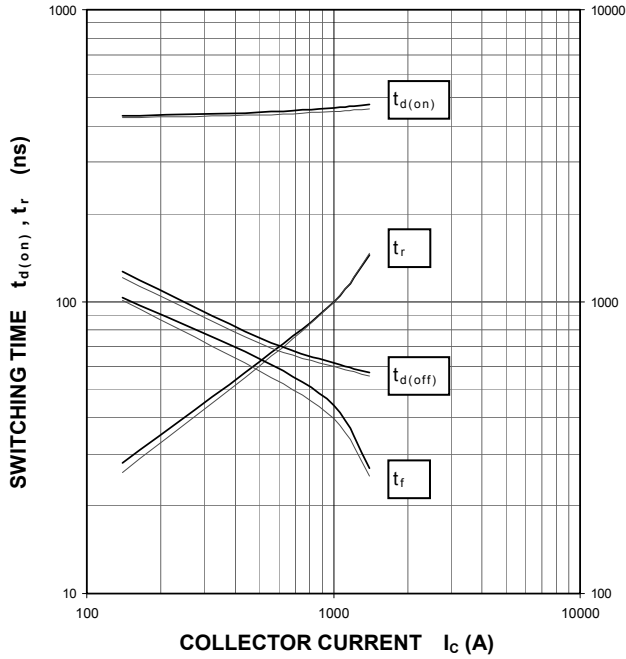
FREE WHEELING DIODE  
 FORWARD CHARACTERISTICS  
 (TYPICAL)



PERFORMANCE CURVES

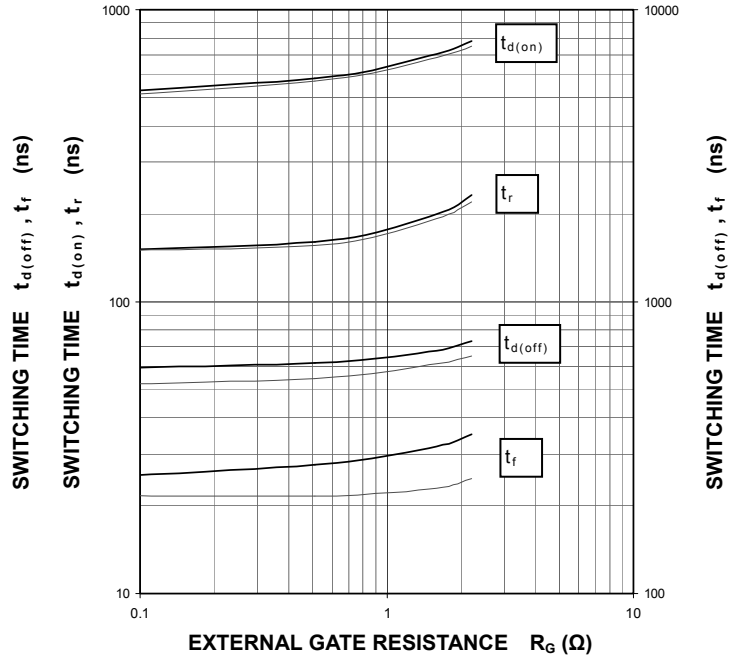
HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL)

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



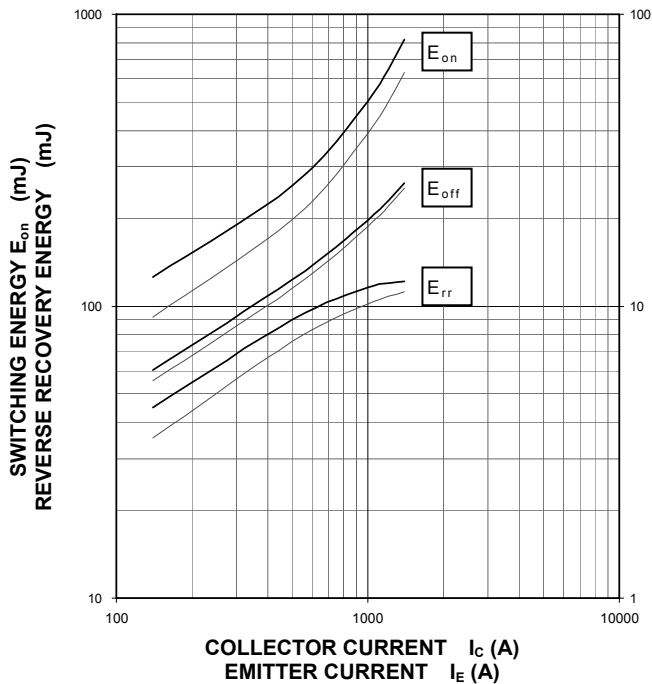
HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL)

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



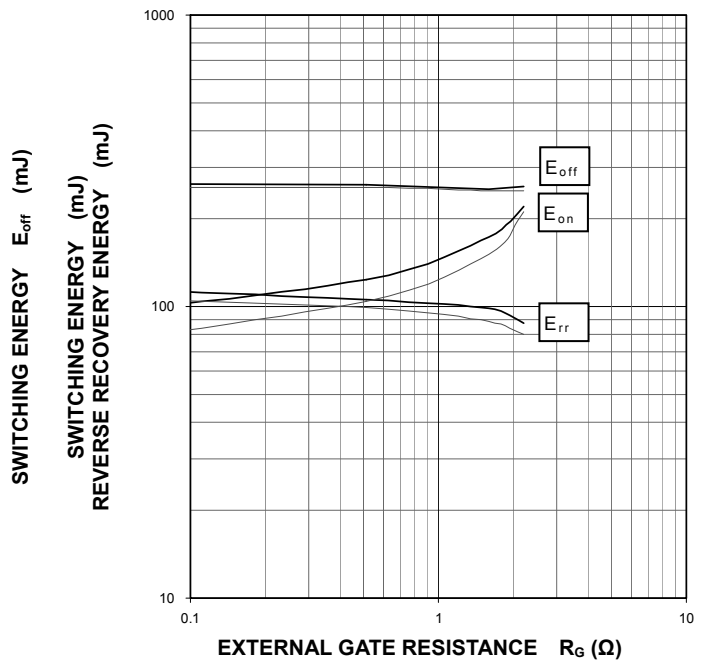
HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL)

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



HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL)

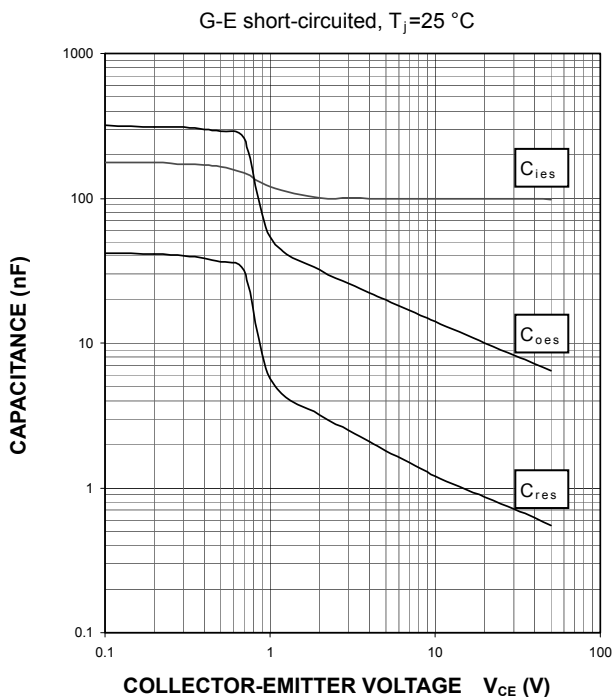
$V_{CC}=600\text{ V}$ ,  $I_c/I_E=1400\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  
INDUCTIVE LOAD, PER PULSE  
——:  $T_j=150\text{ }^\circ\text{C}$ , - - - -:  $T_j=125\text{ }^\circ\text{C}$



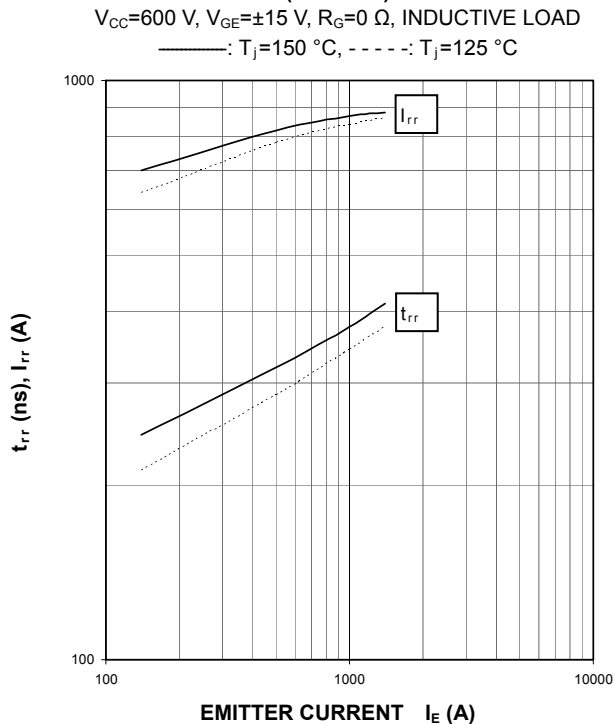
< IGBT MODULES >  
**CM1400DUC-24S**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE

PERFORMANCE CURVES

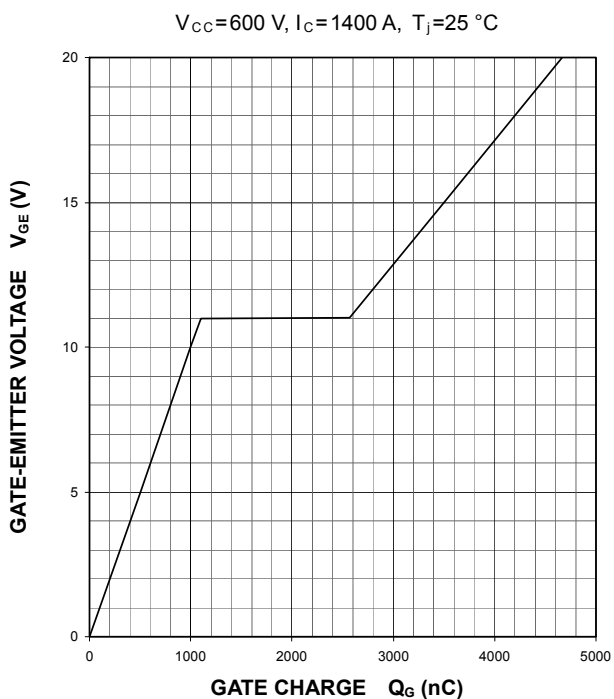
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



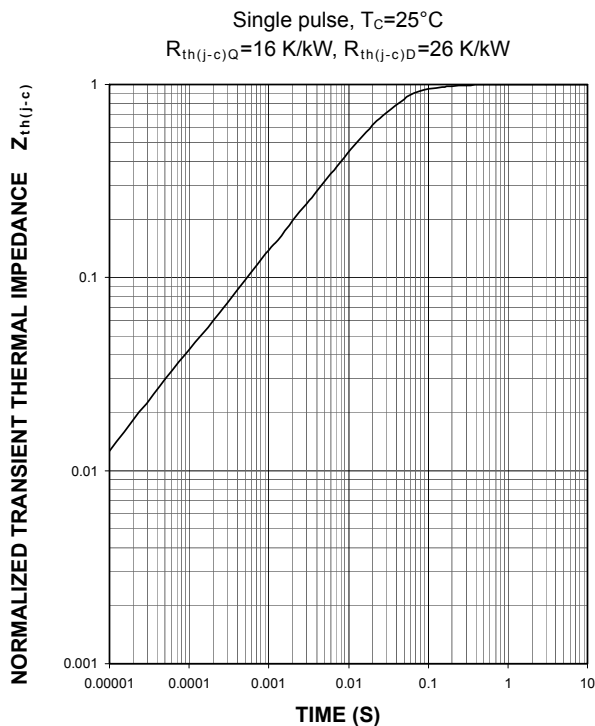
**FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)**





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