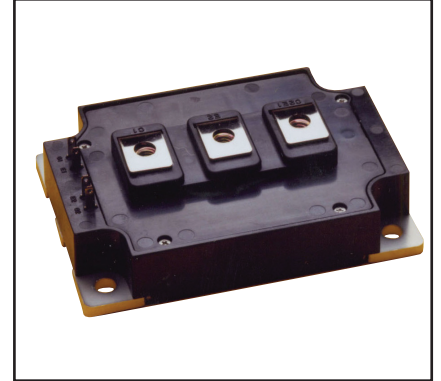


Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	1.14+0.04/-0.02	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	2.44±0.01	62.0±0.25
F	0.98	25.0
G	0.24	6.0
H	0.59	15.0
J	0.81	20.5
K	0.55	14.0
L	0.26 Dia.	Dia. 6.5
M	M6 Metric	M6

Dimensions	Inches	Millimeters
N	1.18	30.0
P	0.71	18.0
Q	0.28	7.0
R	0.83	21.2
S	0.33	8.5
T	0.0157	0.4
U	0.110	2.8
V	0.16	4.0
W	0.30	7.5
X	0.21	5.3
Y	0.47	12.0
Z	0.85	21.5



#### Description:

Powerex Dual IGBTMOD™ Modules are designed for use in switching applications. Each module consists of two IGBT Transistors in a half-bridge configuration with each transistor having a reverse-connected super-fast recovery free-wheel diode. All components and interconnects are isolated from the heat sinking baseplate, offering simplified system assembly and thermal management.

#### Features:

- Low Drive Power
- Low  $V_{CE(sat)}$
- Discrete Super-Fast Recovery Free-Wheel Diode
- Isolated Baseplate for Easy Heat Sinking

#### Applications:

- AC Motor Control
- Motion/Servo Control
- UPS
- Welding Power Supplies
- Laser Power Supplies

#### Ordering Information:

Example: Select the complete module number you desire from the table - i.e. CM450DY-24S is a 1200V ( $V_{CES}$ ), 450 Ampere Dual IGBTMOD™ Power Module.

Type	Current Rating Amperes	$V_{CES}$ Volts (x 50)
CM	450	24

**CM450DY-24S**  
**Dual IGBTMOD™ S-Series Module**  
 450 Amperes/1200 Volts

**Absolute Maximum Ratings,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

**Inverter Part IGBT/FWDi**

Characteristics	Symbol	Rating	Units
Collector-Emitter Voltage ( $V_{GE} = 0V$ )	$V_{CES}$	1200	Volts
Gate-Emitter Voltage ( $V_{CE} = 0V$ )	$V_{GES}$	$\pm 20$	Volts
Collector Current (DC, $T_C = 125^\circ\text{C}$ )*2,*8	$I_C$	410	Amperes
Collector Current (Pulse, Repetitive)*3	$I_{CRM}$	900	Amperes
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )*2,*4	$P_{tot}$	3330	Watts
Emitter Current ( $T_C = 25^\circ\text{C}$ )*2,*4,*8	$I_E^{*1}$	410	Amperes
Emitter Current (Pulse, Repetitive)*3	$I_{ERM}^{*1}$	900	Amperes

**Module**

Characteristics	Symbol	Rating	Units
Maximum Junction Temperature	$T_{j(max)}$	+175	$^\circ\text{C}$
Operating Junction Temperature	$T_{j(op)}$	-40 to +150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-40 to +125	$^\circ\text{C}$
Case Temperature*2	$T_C$	-40 to +125	$^\circ\text{C}$
Isolation Voltage (Terminals to Baseplate, RMS, $f = 60\text{Hz}$ , AC 1 minute)	$V_{ISO}$	2500	Volts

\*1 Represent ratings and characteristics of the anti-parallel, emitter-to-collector free wheeling diode (FWDi).

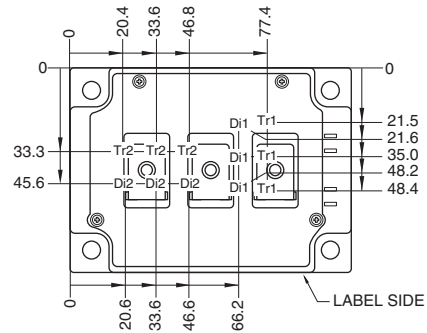
\*2 Case temperature ( $T_C$ ) and heatsink temperature ( $T_s$ ) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location.

The heatsink thermal resistance should be measured just under the chips.

\*3 Pulse width and repetition rate should be such that device junction temperature ( $T_j$ ) does not exceed  $T_{j(max)}$  rating.

\*4 Junction temperature ( $T_j$ ) should not increase beyond maximum junction temperature ( $T_{j(max)}$ ) rating.

\*8 This model has 450A size IGBT and FWDi chips. This package limitation is based on package issue.



Tr1 / Tr2: IGBT, D1 / D2: FWDi  
 Each mark points to the center position of each chip.

**CM450DY-24S**  
**Dual IGBTMOD™ S-Series Module**  
 450 Amperes/1200 Volts

**Electrical Characteristics,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

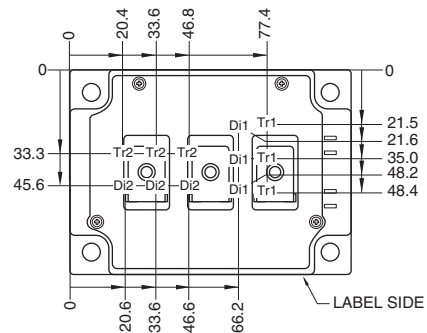
**Inverter Part IGBT/FWDi**

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Emitter Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_{GE} = 0V$	—	—	1	mA
Gate-Emitter Leakage Current	$I_{GES}$	$V_{GE} = V_{GES}, V_{CE} = 0V$	—	—	0.5	$\mu\text{A}$
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C = 45\text{mA}, V_{CE} = 10V$	5.4	6	6.6	Volts
Collector-Emitter Saturation Voltage (Terminal)	$V_{CE(sat)}$	$I_C = 450\text{A}, V_{GE} = 15V, T_j = 25^\circ\text{C}^5$	—	1.80	2.25	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 125^\circ\text{C}^5$	—	2.05	—	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 150^\circ\text{C}^5$	—	2.10	—	Volts
Collector-Emitter Saturation Voltage (Chip)	$V_{CE(sat)}$	$I_C = 450\text{A}, V_{GE} = 15V, T_j = 25^\circ\text{C}^5$	—	1.70	2.15	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 125^\circ\text{C}^5$	—	1.90	—	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 150^\circ\text{C}^5$	—	1.95	—	Volts
Input Capacitance	$C_{ies}$		—	—	45	nF
Output Capacitance	$C_{oes}$	$V_{CE} = 10V, V_{GE} = 0V$	—	—	9.0	nF
Reverse Transfer Capacitance	$C_{res}$		—	—	0.75	nF
Gate Charge	$Q_G$	$V_{CC} = 600V, I_C = 450\text{A}, V_{GE} = 15V$	—	1050	—	nC
Turn-on Delay Time	$t_{d(on)}$		—	—	800	ns
Rise Time	$t_r$	$V_{CC} = 600V, I_C = 450\text{A}, V_{GE} = \pm 15V,$	—	—	200	ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 0\Omega, \text{ Inductive Load}$	—	—	600	ns
Fall Time	$t_f$		—	—	300	ns
Emitter-Collector Voltage (Terminal)	$V_{EC}^{*1}$	$I_E = 450\text{A}, V_{GE} = 0V, T_j = 25^\circ\text{C}^5$	—	1.85	2.30	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 125^\circ\text{C}^5$	—	1.85	—	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 150^\circ\text{C}^5$	—	1.85	—	Volts
Emitter-Collector Voltage (Chip)	$V_{EC}^{*1}$	$I_E = 450\text{A}, V_{GE} = 0V, T_j = 25^\circ\text{C}^5$	—	1.70	2.15	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 125^\circ\text{C}^5$	—	1.70	—	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 150^\circ\text{C}^5$	—	1.70	—	Volts
Reverse Recovery Time	$t_{rr}^{*1}$	$V_{CC} = 600V, I_E = 450\text{A}, V_{GE} = \pm 15V$	—	—	300	ns
Reverse Recovery Charge	$Q_{rr}^{*1}$	$R_G = 0\Omega, \text{ Inductive Load}$	—	24	—	$\mu\text{C}$
Turn-on Switching Energy per Pulse	$E_{on}$	$V_{CC} = 600V, I_C = I_E = 450\text{A},$	—	54.9	—	mJ
Turn-off Switching Energy per Pulse	$E_{off}$	$V_{GE} = \pm 15V, R_G = 0\Omega,$	—	48.0	—	mJ
Reverse Recovery Energy per Pulse	$E_{rr}^{*1}$	$T_j = 150^\circ\text{C}, \text{ Inductive Load}$	—	32.4	—	mJ
Internal Lead Resistance	$R_{CC}^{*2} + EE^{*2}$	Main Terminals-Chip, Per Switch, $T_C = 25^\circ\text{C}^2$	—	—	0.7	m $\Omega$
Internal Gate Resistance	$r_g$	Per Switch	—	4.3	—	$\Omega$

\*1 Represent ratings and characteristics of the anti-parallel, emitter-to-collector free wheeling diode (FWDi).

\*2 Case temperature ( $T_C$ ) and heatsink temperature ( $T_S$ ) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location. The heatsink thermal resistance should be measured just under the chips.

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



Tr1 / Tr2: IGBT, Di1 / Di2: FWDi  
 Each mark points to the center position of each chip.

**CM450DY-24S**  
**Dual IGBTMOD™ S-Series Module**  
 450 Amperes/1200 Volts

**Thermal Resistance Characteristics,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

Thermal Resistance, Junction to Case <sup>*2</sup>	$R_{th(j-c)Q}$	Per Inverter IGBT	—	—	0.045	K/W
Thermal Resistance, Junction to Case <sup>*2</sup>	$R_{th(j-c)D}$	Per Inverter FWDi	—	—	0.068	K/W
Contact Thermal Resistance, Case to Heatsink <sup>*2</sup>	$R_{th(c-f)}$	Thermal Grease Applied (Per 1 Module) <sup>*6</sup>	—	0.018	—	K/W

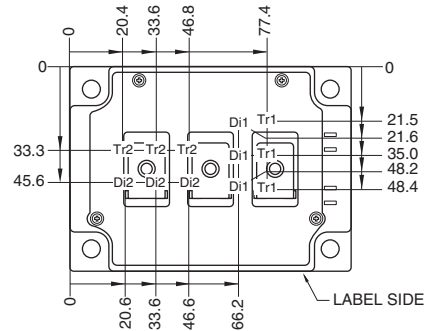
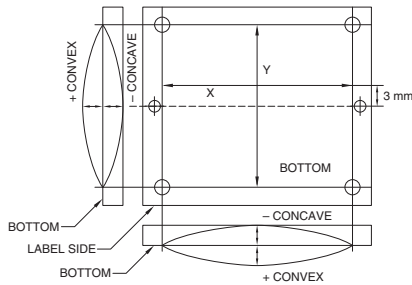
**Mechanical Characteristics**

Mounting Torque	$M_t$	Main Terminals, M6 Screw	31	35	40	in-lb
	$M_s$	Mounting to Heatsink, M6 Screw	31	35	40	in-lb
Creepage Distance	$d_s$	Terminal to Terminal	—	—	—	mm
		Terminal to Baseplate	—	—	—	mm
Clearance	$d_a$	Terminal to Terminal	—	—	—	mm
		Terminal to Baseplate	—	—	—	mm
Weight	$m$		—	580	—	Grams
Flatness of Baseplate	$e_c$	On Centerline X, Y <sup>*7</sup>	-100	—	±100	μm

**Recommended Operating Conditions,  $T_a = 25^\circ\text{C}$**

(DC) Supply Voltage	$V_{CC}$	Applied Across C1-E2	—	600	850	Volts
Gate (-Emitter Drive) Voltage	$V_{GE(on)}$	Applied Across G1-Es1 / G2-Es2	13.5	15.0	16.5	Volts
External Gate Resistance	$R_G$	Per Switch	0	—	8	Ω

<sup>\*2</sup> Case temperature ( $T_C$ ) and heatsink temperature ( $T_S$ ) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location. The heatsink thermal resistance should be measured just under the chips.  
<sup>\*6</sup> Typical value is measured by using thermally conductive grease of  $\lambda = 0.9$  [W/(m • K)].  
<sup>\*7</sup> Baseplate (mounting side) flatness measurement points (X, Y) are shown in the figure below.

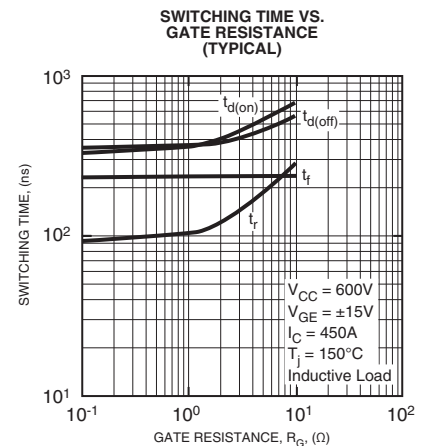
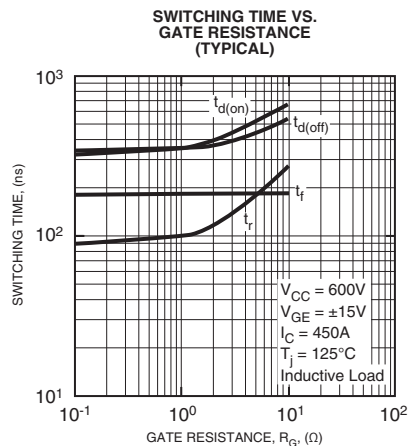
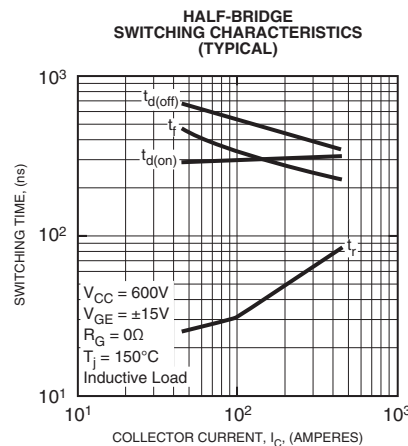
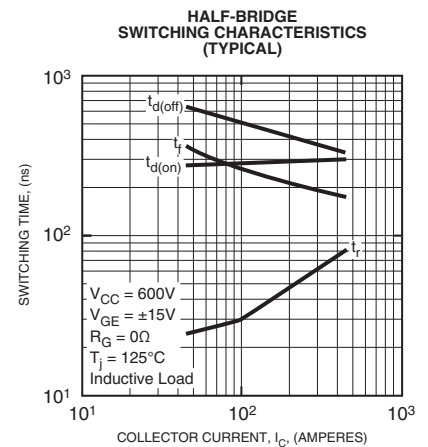
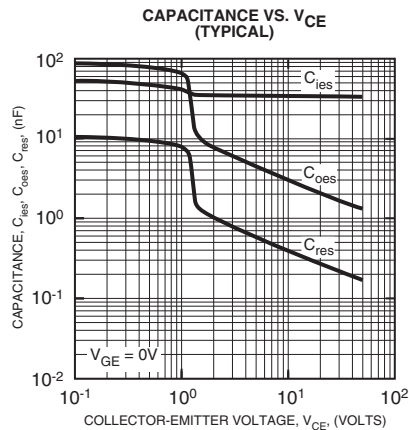
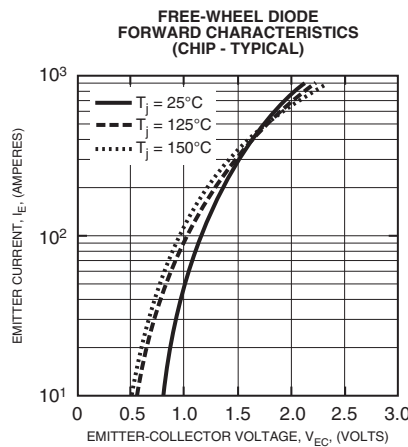
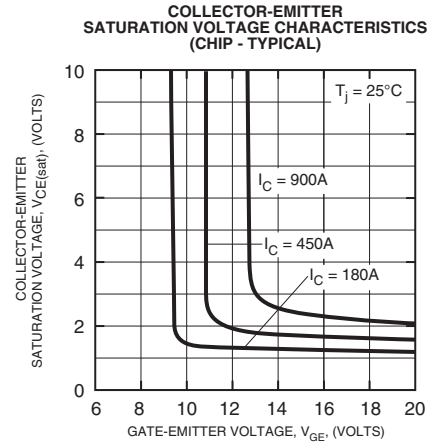
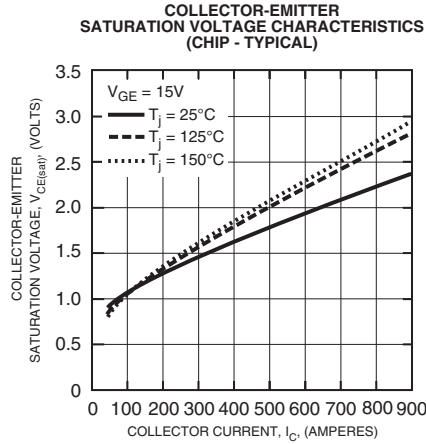
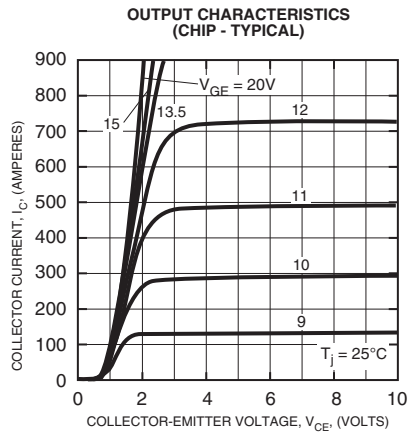


Tr1 / Tr2: IGBT, Di1 / Di2: FWDi  
 Each mark points to the center position of each chip.



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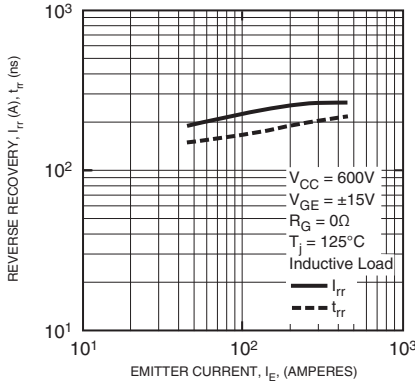
**CM450DY-24S**  
**Dual IGBTMOD™ S-Series Module**  
 450 Amperes/1200 Volts



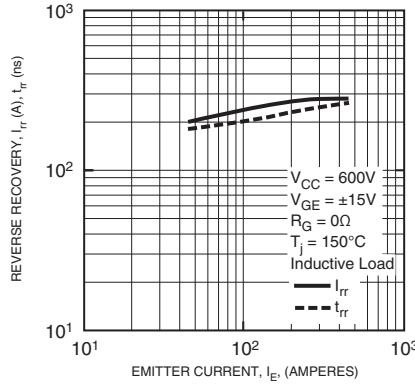


**CM450DY-24S**  
**Dual IGBTMOD™ S-Series Module**  
 450 Amperes/1200 Voltstt

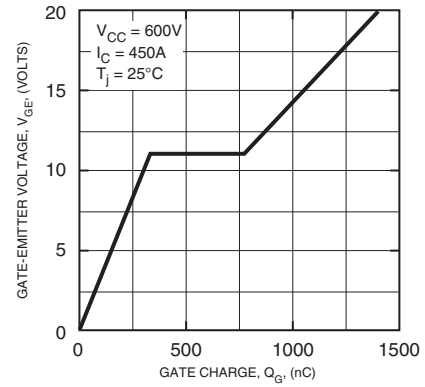
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



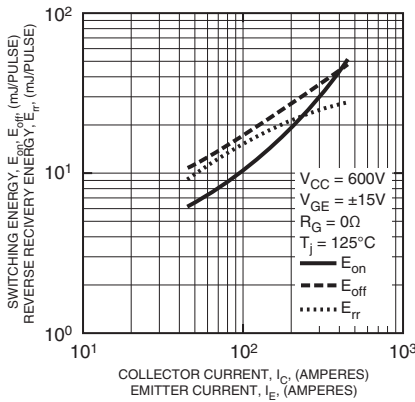
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



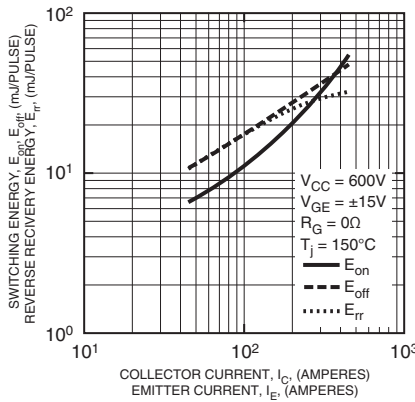
**GATE CHARGE VS. V\_GE**



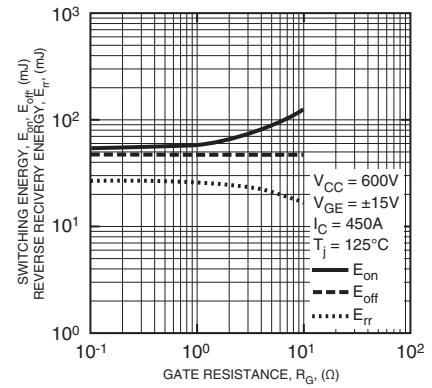
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



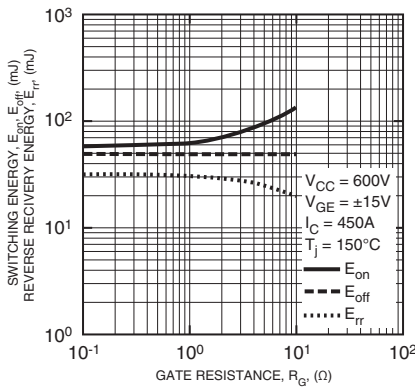
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)**

