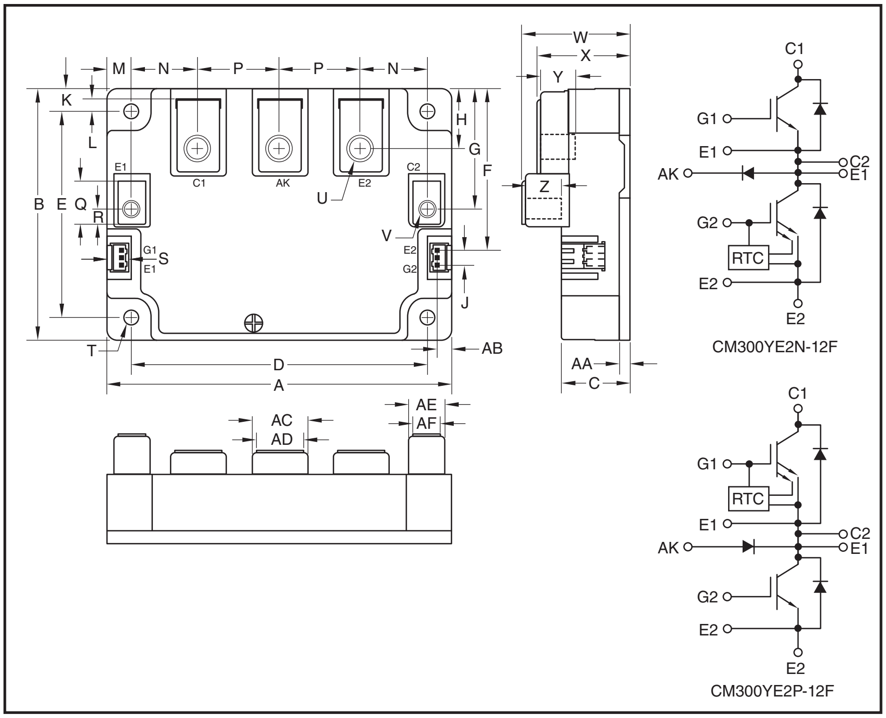
CM400YE2N-12F / CM400YE2P-12F

Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

TLI-Series
(Three Level Inverter) IGBT 400 Amperes/600 Volts



Outline Drawing and Circuit Diagram

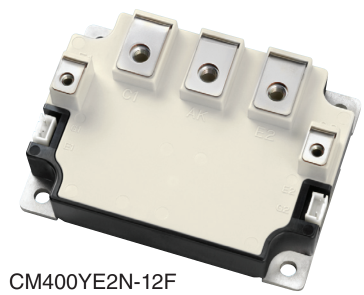
Dim.	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	0.87	22.0
D	3.74±0.01	95.0±0.25
E	2.60±0.01	66.0±0.25
F	2.01	51.0
G	1.50	38.0
H	0.72	18.3
J	0.20	5.0
K	0.28	7.0
L	0.12	3.0
M	0.31	8.0
N	0.83	21.0
P	1.02	26.0
Q	0.54	13.7

Dim.	Inches	Millimeters
R	0.20	5.1
S	0.14 Min.	3.6 Min.
T	0.22 Dia.	5.6 Dia.
U	M6 Metric	M6
V	M4 Metric	M4
W	1.38+0.04/-0.02	35.0+1.0/-0.5
X	1.18+0.04/-0.02	30.0+1.0/-0.5
Y	0.43	11.0
Z	0.06	1.5
AA	0.16	4.0
AB	0.09	2.35
AC	0.67	17.0
AD	0.55	14.0
AE	0.45	11.4
AF	0.35	9.0

Ordering Information:

Example: Select the complete module number you desire from the table - i.e. CM400YE2N-12F and CM400YE2P-12F are 600V (V_{CES}), 400 Ampere TLI-Series IGBT Power Modules.

Type	Current Rating Amperes	V_{CES} Volts (x 50)
CM	400	12



CM400YE2N-12F

CM400YE2P-12F

Description:

The TLI-Series has been designed for three level (neutral point clamped) topologies in applications requiring high efficiency operation and improved output waveform quality. They also provide significant benefits in applications where low output noise using small filter components is required or where long motor leads create Standing Wave Ratio (SWR) voltage surge issues.

Features:

- ☐ Smaller Output Voltage Steps Reducing Surge Voltage
- ☐ Low Output Ripple Current
- ☐ Lower Modulation Frequency With Same Quality Output Waveform

Applications:

- ☐ Three Level Inverter Topologies
- ☐ Solar Power Inverters
- ☐ High Efficiency UPS
- ☐ Long Motor Lead Applications

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Absolute Maximum Ratings, T_j = 25°C unless otherwise specified

Ratings	Symbol	CM400YE2N-12F / CM400YE2P-12F	Units
Junction Temperature	T_j	-40 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Mounting Torque, Main Terminals (C1, AK, E2), M8 Screw (Max.)	–	40	in-lb
Mounting Torque, Mounting Holes, M5 Screw (Max.)	–	30	in-lb
Mounting Torque, C2, E1 Terminals, M4 Screw (Max.)	–	15	in-lb
Weight (Typical)	–	530	Grams
Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)	V_{iso}	2500	V_{rms}

Inverter Part

Collector-Emitter Voltage (G-E Short)	V_{CES}	600	Volts
Gate-Emitter Voltage (C-E Short)	V_{GES}	±20	Volts
Collector Current DC (T_C = 25°C)	I_C	400	Amperes
Peak Collector Current (Pulse)*2	I_{CM}	800	Amperes
Emitter Current (T_C = 25°C)	I_E*1	400	Amperes
Peak Emitter Current (Pulse)*2	I_{EM}*1	800	Amperes
Maximum Collector Dissipation (T_C' = 25°C)	P_C*3	1250	Watts

Clamp Diode Part

Repetitive Peak Reverae Voltage	V_{RRM}	600	Volts
Forward Current (T_C = 25°C)	I_{FM}	400	Amperes

*1 I_E, I_{EM}, V_{EC}, t_{rr}, and Q_{rr} represent characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).
*2 Pulse width and repetition rate should be such that device junction temperature (T_j) does not exceed $T_{j(max)}$ rating.
*3 Junction temperature (T_j) should not increase beyond 150°C.

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Electrical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units

Inverter Part

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0V	–	–	1	mA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C = 40mA, V_{CE} = 10V	5	6	7	Volts
Gate Leakage Current	I_{GES}	$V_{GE} = V_{GES}$, V_{CE} = 0V	–	–	40	µA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 400A, V_{GE} = 15V, T_j = 25°C	–	1.6	2.2	Volts
		I_C = 400A, V_{GE} = 15V, T_j = 125°C	–	1.6	–	Volts
Input Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V	–	–	110	nF
Output Capacitance	C_{oes}		–	–	7.2	nF
Reverse Transfer Capacitance	C_{res}		–	–	4	nF
Total Gate Charge	Q_G	V_{CC} = 300V, I_C = 400A, V_{GE} = 15V	–	2480	–	nC
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 300V, I_C = 400A,	–	–	700	ns
Turn-on Rise Time	t_r	$V_{GE1} = V_{GE2}$ = 15V,	–	–	400	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 4.7Ω,	–	–	1100	ns
Turn-off Fall Time	t_f	Inductive Load Switching Operation,	–	–	300	ns
Reverse Recovery Time	t_{rr}*1	I_E = 400A	–	–	200	ns
Reverse Recovery Charge	Q_{rr}*1		–	2.6	–	µC
Emitter-Collector Voltage	V_{EC}*1	I_E = 400A, V_{GE} = 0V	–	–	2.8	Volts
External Gate Resistance	R_G		4.7	–	16	Ω

Clamp Diode Part

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Repetitive Reverse Current	I_{RRM}	$V_R = V_{RRM}$	–	–	1	mA
Forward Voltage Drop	V_{FM}	I_F = 400A	–	–	2.8	Volts
Reverse Recovery Time	t_{rr}	I_F = 400A, V_{CC} = 300V,	–	–	200	ns
Reverse Recovery Charge	Q_{rr}	$V_{GE1} = V_{GE2}$ = 15V, R_G = 4.7Ω, Inductive Load Switching Operation	–	2.6	–	µC

Thermal and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case*4	$R_{th(j-c')}Q$	Inverter IGBT	–	–	0.11	°C/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c')}D$	Inverter FWDi	–	–	0.14	°C/W
Thermal Resistance, Junction to Case*4	$R_{th(c-f)}D$	Clamp Diode Part	–	–	0.14	°C/W
Contact Thermal Resistance*5	$R_{th(c-f)}$	Thermal Grease Applied (per 1 Module)	–	0.037	–	°C/W

*4 T_C measured point is just under the chips. If using this value, $R_{th(f-a)}$ should be measured just under the chips.
*5 Typical value is measured by using thermally conductive grease of λ = 0.9 [W/(m • K)].

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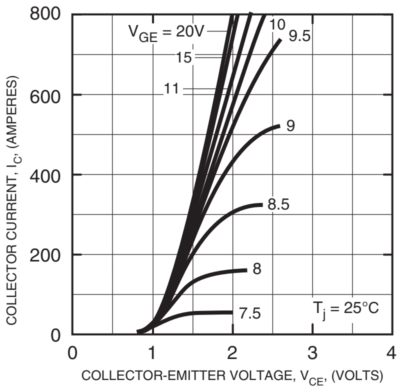
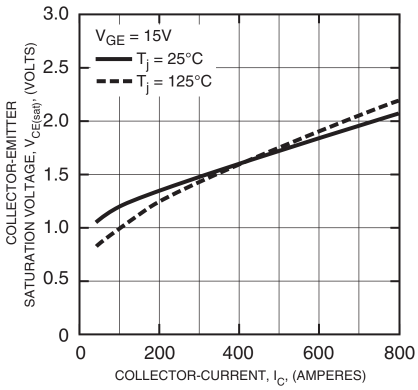
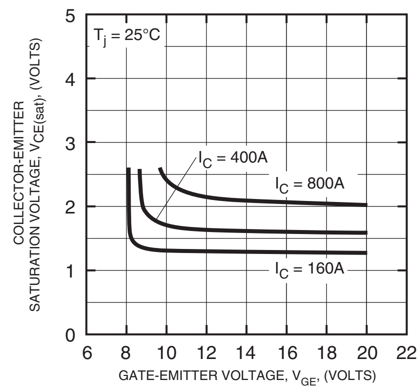
OUTPUT CHARACTERISTICS (INVERTER PART - TYPICAL)



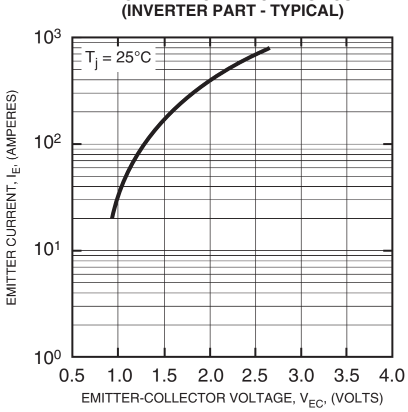
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



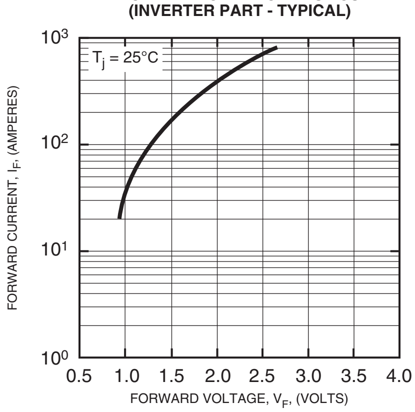
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



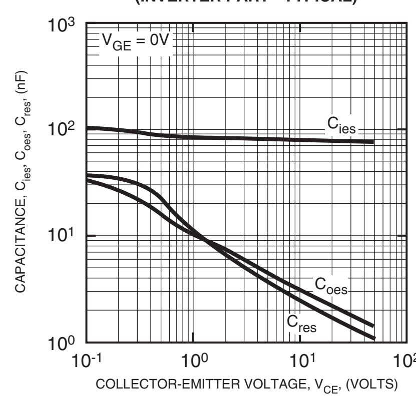
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (INVERTER PART - TYPICAL)



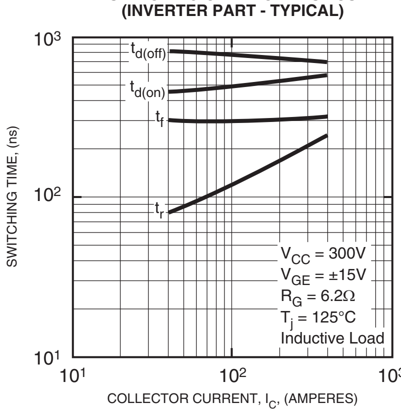
CLAMP DIODE FORWARD CHARACTERISTICS (INVERTER PART - TYPICAL)



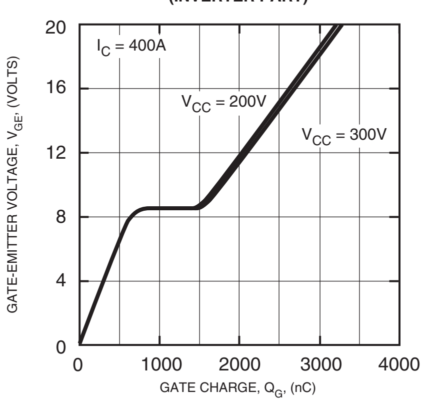
CAPACITANCE VS. V_{CE} (INVERTER PART - TYPICAL)



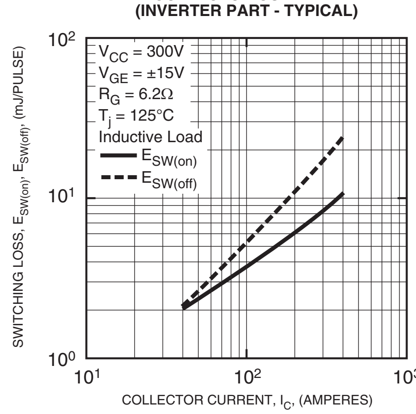
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



GATE CHARGE VS. V_{GE} (INVERTER PART)



SWITCHING LOSS VS. COLLECTOR CURRENT (INVERTER PART - TYPICAL)



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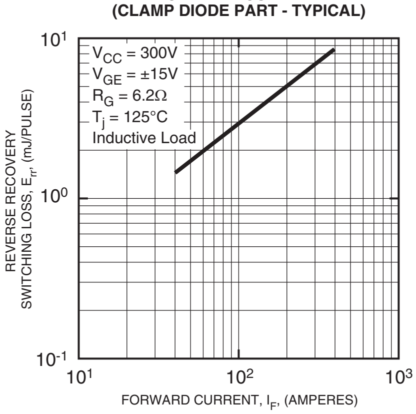
REVERSE RECOVERY SWITCHING LOSS VS. FORWARD CURRENT (CLAMP DIODE PART - TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (TYPICAL)