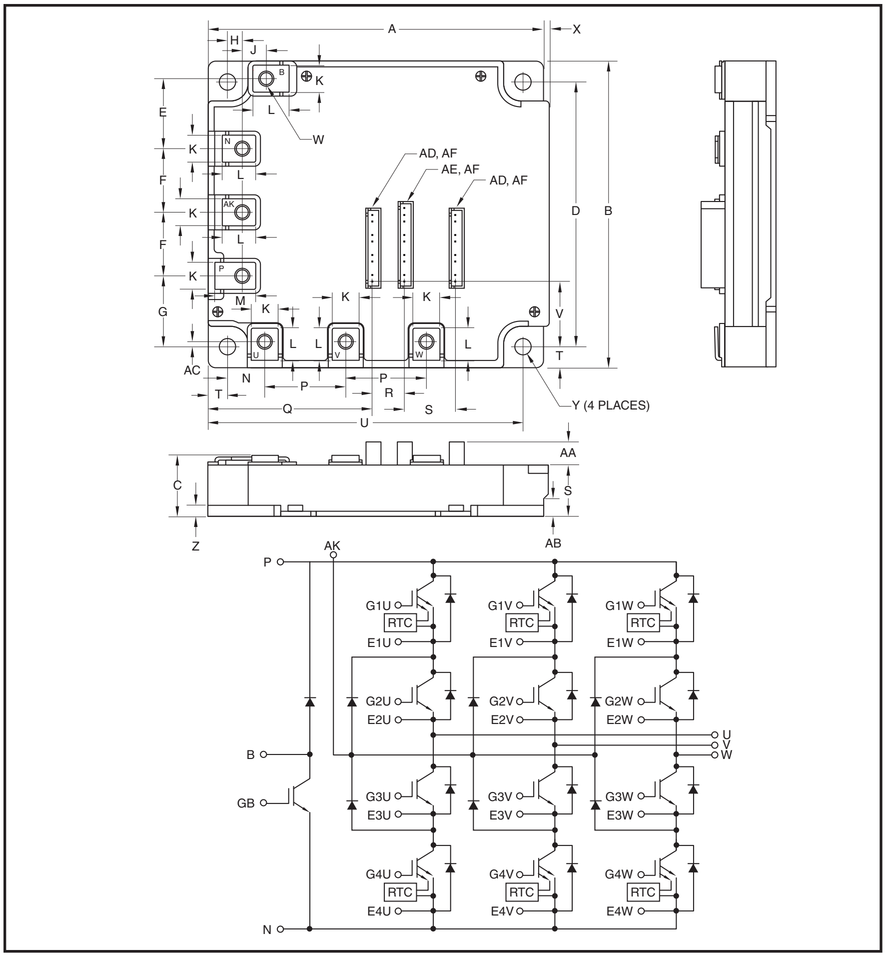
POWEREX

CM40YE13-12H

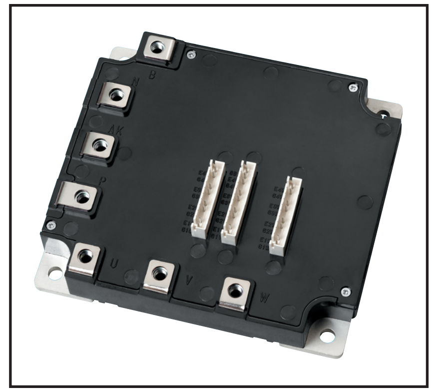
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

TLI-Series

(Three Level Inverter) IGBT
40 Amperes/600 Volts



Outline Drawing and Circuit Diagram



Dim.	Inches	Millimeters
A	4.92	125.0
B	4.47	113.5
C	0.89+0.04/-0.02	22.5+1.0/-0.5
D	3.9±0.01	98.5±0.25
E	1.01	25.75
F	0.93	23.5
G	1.03	26.25
H	0.22	5.50
J	0.38	9.75
K	0.39	10.0
L	0.49	12.5
M	0.61	15.5
N	0.54	13.75
P	1.18	30.0
Q	2.4	61.0

Dim.	Inches	Millimeters
R	0.47	12.0
S	0.75	19.0
T	0.30	7.5
U	4.33±0.01	110.0±0.25
V	0.94	24.0
W	M5 Metric	M5
X	0.08	2.0
Y	0.22 Dia.	5.5 Dia.
Z	0.16	4.0
AA	0.34	8.7
AB	0.26	6.5
AC	0.10	2.5
AD	XHP-11 Housing	
AE	XHP-12 Housing	
AF	JST Connector	AWG Wire #
	SXH-001T-P0.6	28 ~ 22
or	SXH-002T-P0.6	30 ~ 26

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

Ordering Information:

Example: Select the complete module number you desire from the table - i.e. CM40YE13-12H is a 600V (V_{CES}), 40 Ampere TLI-Series IGBT Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 50)
CM	40	12

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

Ratings	Symbol	CM40YE13-12H	Units
Junction Temperature	T_j	-40 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Mounting Torque, Main Terminals, M5 Screw (Max.)	–	31	in-lb
Mounting Torque, Mounting Holes, M5 Screw (Max.)	–	31	in-lb
Weight (Typical)	–	800	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	40	Amperes
Peak Collector Current (Pulse)*2	I_{CM}	80	Amperes
Emitter Current (T_C = 25°C)	I_E*1	40	Amperes
Peak Emitter Current (Pulse)*2	I_{EM}*1	80	Amperes
Maximum Collector Dissipation (T_C' = 25°C)	P_C*3	140	Watts

Clamp Diode Part

Repetitive Peak Reverae Voltage	V_{RRM}	600	Volts
Forward Current (T_C = 25°C)	I_{FM}	40	Amperes

Brake Part

Collector-Emitter Voltage (G-E Short)	V_{CES}	1200	Volts
Gate-Emitter Voltage (C-E Short)	V_{GES}	±20	Volts
Collector Current DC (T_C = 25°C)	I_C	25	Amperes
Peak Collector Current (Pulse)*2	I_{CM}	50	Amperes
Maximum Collector Dissipation (T_C' = 25°C)	P_C*3	140	Watts
Repetative Peak Reverse Voltage	V_{RRM}	1200	Volts
Forward Current (T_C = 25°C)	I_{FM}	25	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.

Electrical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Inverter Part						
Collector-Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0V	–	–	1	mA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C = 4mA, V_{CE} = 10V	4.5	6	7.5	Volts
Gate Leakage Current	I_{GES}	$V_{GE} = V_{GES}$, V_{CE} = 0V	–	–	0.5	μA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 40A, V_{GE} = 15V, T_j = 25°C	–	1.95	2.8	Volts
		I_C = 40A, V_{GE} = 15V, T_j = 125°C	–	1.9	–	Volts
Input Capacitance	C_{ies}		–	–	5.0	nF
Output Capacitance	C_{oes}	V_{CE} = 10V, V_{GE} = 0V	–	–	2.0	nF
Reverse Transfer Capacitance	C_{res}		–	–	1.0	nF
Total Gate Charge	Q_G	V_{CC} = 300V, I_C = 40A, V_{GE} = 15V	–	150	–	nC
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 300V, I_C = 40A,	–	–	250	ns
Turn-on Rise Time	t_r	$V_{GE1} = V_{GE2}$ = 15V,	–	–	200	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 47Ω,	–	–	500	ns
Turn-off Fall Time	t_f	Inductive Load Switching Operation,	–	–	350	ns
Reverse Recovery Time	t_{rr}*1	I_E = 40A	–	–	200	ns
Reverse Recovery Charge	Q_{rr}*1		–	0.30	–	μC
Emitter-Collector Voltage	V_{EC}*1	I_E = 40A, V_{GE} = 0V	–	–	3.1	Volts
External Gate Resistance	R_G		47	–	160	Ω
Clamp Diode Part						
Repetitive Reverse Current	I_{RRM}	$V_R = V_{RRM}$	–	–	1	mA
Forward Voltage Drop	V_{FM}	I_F = 40A	–	–	2.65	Volts
Reverse Recovery Time	t_{rr}	I_F = 40A, V_{CC} = 300V,	–	–	200	ns
Reverse Recovery Charge	Q_{rr}	$V_{GE1} = V_{GE2}$ = 15V, R_G = 47Ω, Inductive Load Switching Operation	–	0.34	–	μC

*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).

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Electrical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Brake Part						
Collector-Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0V	–	–	1	mA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C = 2.5mA, V_{CE} = 10V	4.5	6	7.5	Volts
Gate Leakage Current	I_{GES}	$V_{GE} = V_{GES}$, V_{CE} = 0V	–	–	0.5	μA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 25A, V_{GE} = 15V, T_j = 25°C	–	2.7	3.4	Volts
		I_C = 25A, V_{GE} = 15V, T_j = 125°C	–	2.45	–	Volts
Input Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V	–	–	5.0	nF
Output Capacitance	C_{oes}		–	–	3.8	nF
Reverse Transfer Capacitance	C_{res}		–	–	1.0	nF
Total Gate Charge	Q_G	V_{CC} = 600V, I_C = 25A, V_{GE} = 15V	–	125	–	nC
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 25A,	–	–	200	ns
Turn-on Rise Time	t_r	$V_{GE1} = V_{GE2}$ = 15V,	–	–	150	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 47Ω,	–	–	400	ns
Turn-off Fall Time	t_f	Inductive Load Switching Operation,	–	–	400	ns
Reverse Recovery Time	t_{rr}*1	I_E = 25A	–	–	250	ns
Reverse Recovery Charge	Q_{rr}*1		–	1.1	–	μC
Forward Voltage Drop	V_{FM}	I_F = 25A	–	–	3.5	Volts

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 Part, IGBT	–	–	0.89	°C/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c')}D$	Inverter Part, FWDi	–	–	2.8	°C/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c')}D$	Clamp Diode Part	–	–	2.1	°C/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c')}Q$	Brake Part, IGBT	–	–	0.89	°C/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c')}D$	Brake Part, Clamp Diode	–	–	1.7	°C/W
Contact Thermal Resistance*4*5	$R_{th(c-f)}$	Thermal Grease Applied (Per 1 Module)	–	0.012	–	°C/W

*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).
*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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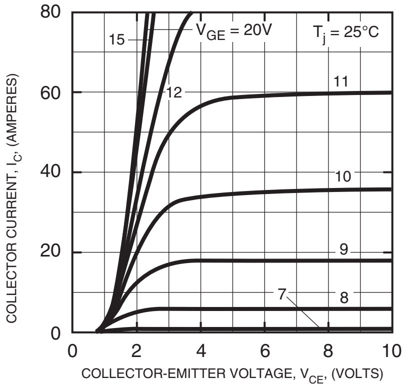
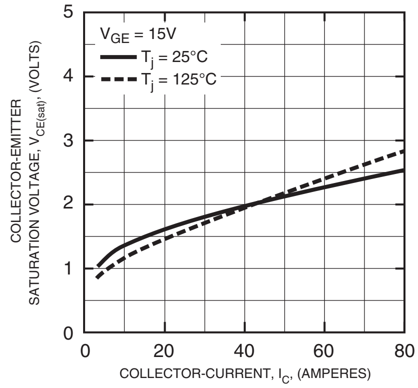
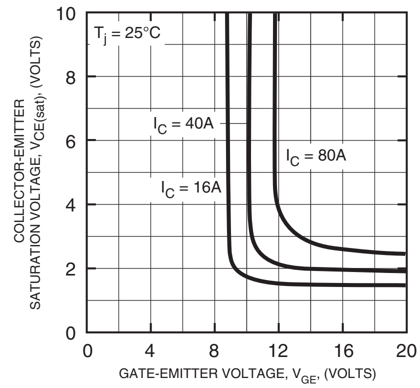
OUTPUT CHARACTERISTICS (INVERTER PART - TYPICAL)



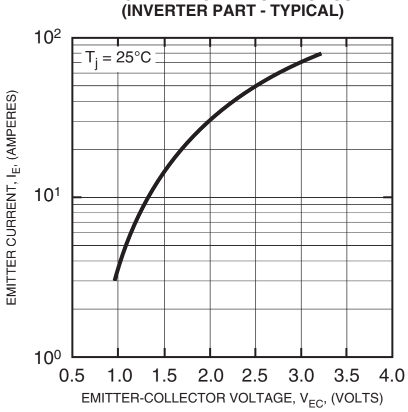
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



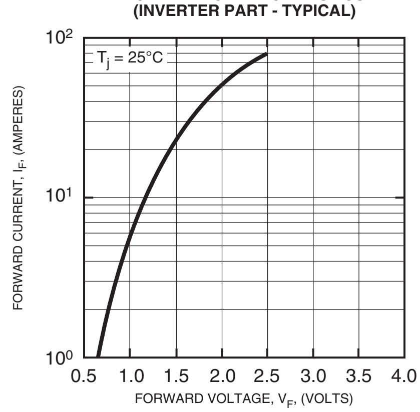
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



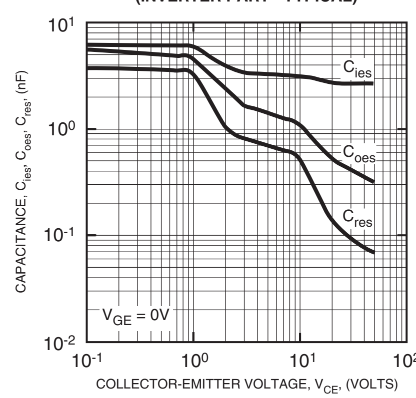
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (INVERTER PART - TYPICAL)



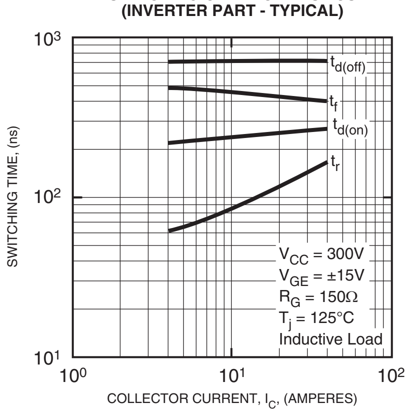
CLAMP DIODE FORWARD CHARACTERISTICS (INVERTER PART - TYPICAL)



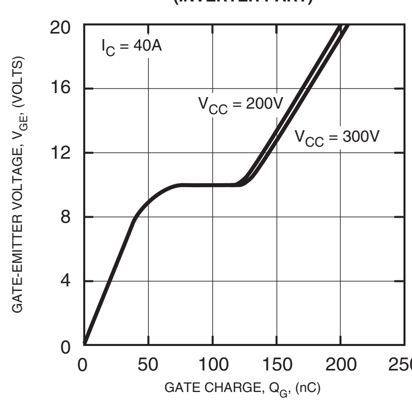
CAPACITANCE VS. V_{CE} (INVERTER PART - TYPICAL)



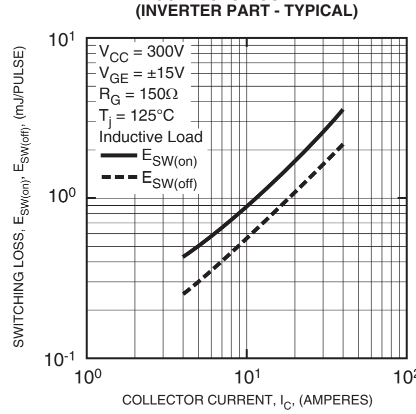
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



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



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



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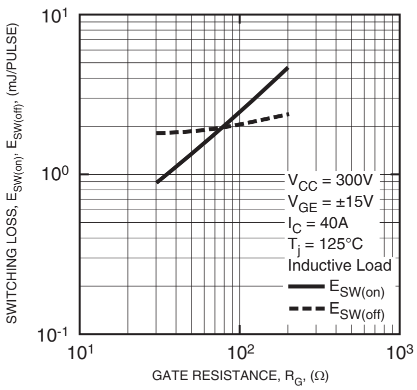
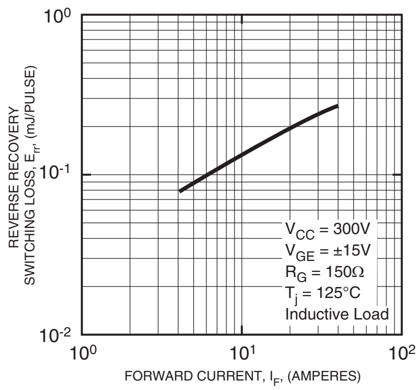
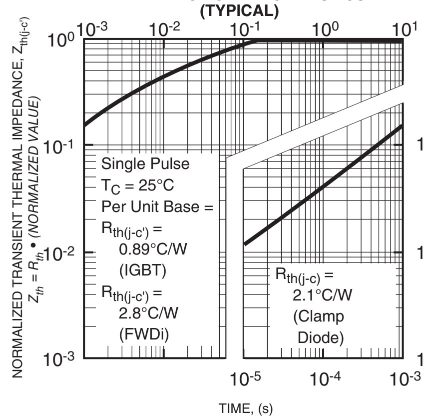
SWITCHING LOSS VS. GATE RESISTANCE (INVERTER PART - TYPICAL)



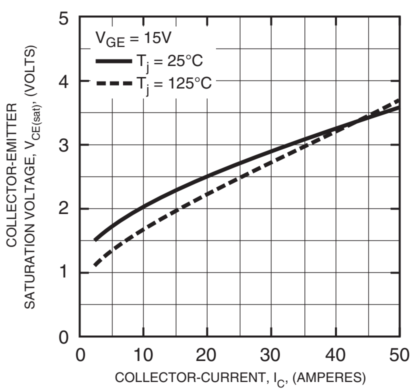
REVERSE RECOVERY SWITCHING LOSS VS. FORWARD CURRENT (CLAMP DIODE PART - TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (TYPICAL)



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



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