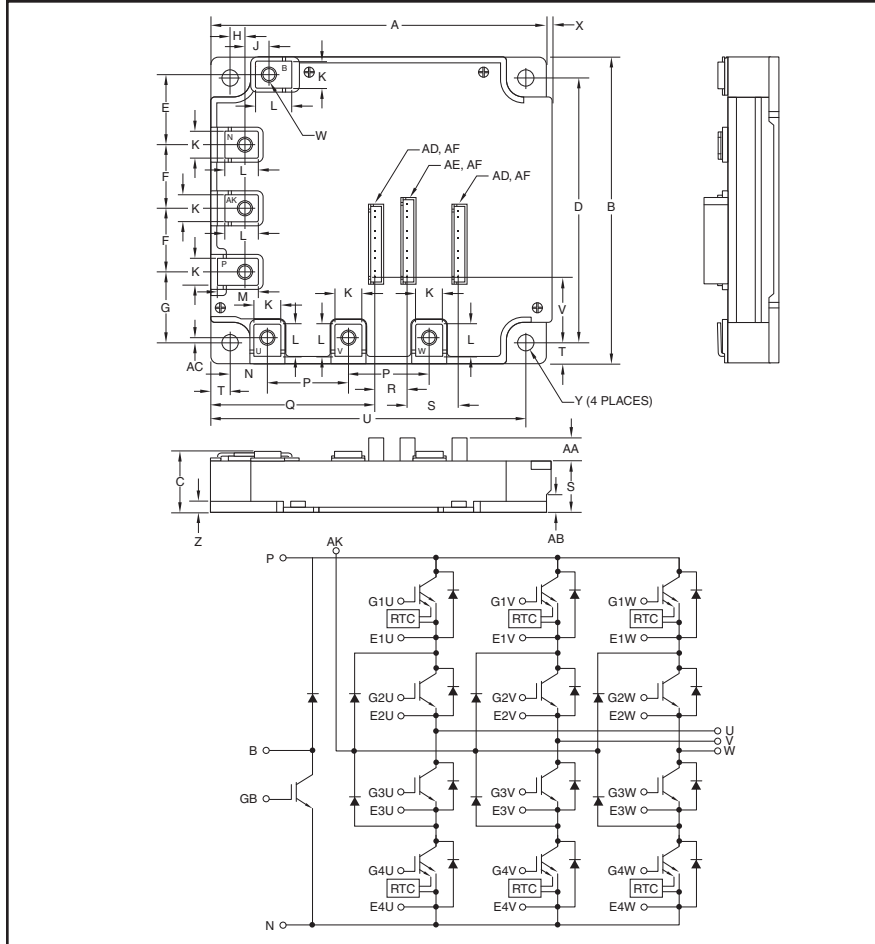
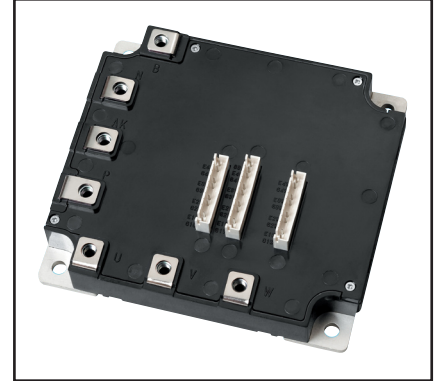


### TLI-Series (Three Level Inverter) IGBT 50 Amperes/600 Volts



Outline Drawing and Circuit Diagram

Dim.	Inches	Millimeters	Dim.	Inches	Millimeters
A	4.92	125.0	R	0.47	12.0
B	4.47	113.5	S	0.75	19.0
C	0.89+0.04/-0.02	22.5+1.0/-0.5	T	0.30	7.5
D	3.9±0.01	98.5±0.25	U	4.33±0.01	110.0±0.25
E	1.01	25.75	V	0.94	24.0
F	0.93	23.5	W	M5 Metric	M5
G	1.03	26.25	X	0.08	2.0
H	0.22	5.50	Y	0.22 Dia.	5.5 Dia.
J	0.38	9.75	Z	0.16	4.0
K	0.39	10.0	AA	0.34	8.7
L	0.49	12.5	AB	0.26	6.5
M	0.61	15.5	AC	0.10	2.5
N	0.54	13.75	AD	XHP-11 Housing	
P	1.18	30.0	AE	XHP-12 Housing	
Q	2.4	61.0	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. CM50YE13-12H is a 600V ( $V_{CES}$ ), 50 Ampere TLI-Series IGBT Power Module.

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



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

### CM50YE13-12H

TLI-Series (Three Level Inverter) IGBT

50 Amperes/600 Volts

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

Ratings	Symbol	CM50YE13-12H	Units
Junction Temperature	$T_j$	-40 to 150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$	-40 to 125	$^\circ\text{C}$
Mounting Torque, Main Terminals, M5 Screw (Max.)	–	30	in-lb
Mounting Torque, Mounting Holes, M5 Screw (Max.)	–	30	in-lb
Weight (Typical)	–	800	Grams
Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)	$V_{\text{iso}}$	2500	$V_{\text{rms}}$

### Inverter Part

Collector-Emitter Voltage (G-E Short)	$V_{\text{CES}}$	600	Volts
Gate-Emitter Voltage (C-E Short)	$V_{\text{GES}}$	$\pm 20$	Volts
Collector Current DC ( $T_C = 25^\circ\text{C}$ )	$I_C$	50	Amperes
Peak Collector Current (Pulse) <sup>*2</sup>	$I_{\text{CM}}$	100	Amperes
Emitter Current ( $T_C = 25^\circ\text{C}$ )	$I_E^{*1}$	50	Amperes
Peak Emitter Current (Pulse) <sup>*2</sup>	$I_{\text{EM}}^{*1}$	100	Amperes
Maximum Collector Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_C^{*3}$	280	Watts

### Clamp Diode Part

Repetitive Peak Reverse Voltage	$V_{\text{RRM}}$	600	Volts
Forward Current ( $T_C = 25^\circ\text{C}$ )	$I_{\text{FM}}$	50	Amperes

### Brake Part

Collector-Emitter Voltage (G-E Short)	$V_{\text{CES}}$	1200	Volts
Gate-Emitter Voltage (C-E Short)	$V_{\text{GES}}$	$\pm 20$	Volts
Collector Current DC ( $T_C = 25^\circ\text{C}$ )	$I_C$	25	Amperes
Peak Collector Current (Pulse) <sup>*2</sup>	$I_{\text{CM}}$	50	Amperes
Maximum Collector Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_C^{*3}$	280	Watts
Repetitive Peak Reverse Voltage	$V_{\text{RRM}}$	1200	Volts
Forward Current ( $T_C = 25^\circ\text{C}$ )	$I_{\text{FM}}$	25	Amperes

\*1  $I_E$ ,  $I_{\text{EM}}$ ,  $V_{\text{EC}}$ ,  $I_{\text{rr}}$ , and  $Q_{\text{rr}}$  represent characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWD).

\*2 Pulse width and repetition rate should be such that device junction temperature ( $T_j$ ) does not exceed  $T_{j(\text{max})}$  rating.

\*3 Junction temperature ( $T_j$ ) should not increase beyond  $150^\circ\text{C}$ .

**CM50YE13-12H**  
**TLI-Series (Three Level Inverter) IGBT**  
 50 Amperes/600 Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Inverter Part</b>						
Collector-Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_{GE} = 0V$	–	–	1	mA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C = 5mA, V_{CE} = 10V$	4.5	6	7.5	Volts
Gate Leakage Current	$I_{GES}$	$V_{GE} = V_{GES}, V_{CE} = 0V$	–	–	0.5	$\mu\text{A}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 50A, V_{GE} = 15V, T_j = 25^\circ\text{C}$	–	2.1	2.8	Volts
		$I_C = 50A, V_{GE} = 15V, T_j = 125^\circ\text{C}$	–	2.15	–	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	$Q_G$	$V_{CC} = 300V, I_C = 50A, V_{GE} = 15V$	–	150	–	nC
Turn-on Delay Time	$t_{d(on)}$	$V_{CC} = 300V, I_C = 50A,$	–	–	250	ns
Turn-on Rise Time	$t_r$	$V_{GE1} = V_{GE2} = 15V,$	–	–	200	ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 39\Omega,$	–	–	500	ns
Turn-off Fall Time	$t_f$	Inductive Load Switching Operation,	–	–	350	ns
Reverse Recovery Time	$t_{rr}^{*1}$	$I_E = 50A$	–	–	200	ns
Reverse Recovery Charge	$Q_{rr}^{*1}$		–	0.37	–	$\mu\text{C}$
Emitter-Collector Voltage	$V_{EC}^{*1}$	$I_E = 50A, V_{GE} = 0V$	–	–	3.35	Volts
External Gate Resistance	$R_G$		39	–	130	$\Omega$

**Clamp Diode Part**

Repetitive Reverse Current	$I_{RRM}$	$V_R = V_{RRM}$	–	–	1	mA
Forward Voltage Drop	$V_{FM}$	$I_F = 50A$	–	–	2.8	Volts
Reverse Recovery Time	$t_{rr}$	$I_F = 50A, V_{CC} = 300V,$	–	–	200	ns
Reverse Recovery Charge	$Q_{rr}$	$V_{GE1} = V_{GE2} = 15V, R_G = 39\Omega,$	–	0.41	–	$\mu\text{C}$
		Inductive Load Switching Operation				

\*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).

**CM50YE13-12H**  
**TLI-Series (Three Level Inverter) IGBT**  
 50 Amperes/600 Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Brake Part</b>						
Collector-Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_{GE} = 0V$	–	–	1	mA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C = 2.5\text{mA}, V_{CE} = 10V$	4.5	6	7.5	Volts
Gate Leakage Current	$I_{GES}$	$V_{GE} = V_{GES}, V_{CE} = 0V$	–	–	0.5	$\mu\text{A}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 25A, V_{GE} = 15V, T_j = 25^\circ\text{C}$	–	2.7	3.4	Volts
		$I_C = 25A, V_{GE} = 15V, T_j = 125^\circ\text{C}$	–	2.45	–	Volts
Input Capacitance	$C_{ies}$		–	–	5.0	nF
Output Capacitance	$C_{oes}$	$V_{CE} = 10V, V_{GE} = 0V$	–	–	1.8	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	$t_{d(off)}$	$R_G = 39\Omega,$	–	–	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	–	$\mu\text{C}$
Forward Voltage Drop	$V_{FM}$	$I_F = 25A$	–	–	3.5	Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case <sup>*4</sup>	$R_{th(j-c)Q}$	Inverter Part, IGBT	–	–	0.44	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case <sup>*4</sup>	$R_{th(j-c)D}$	Inverter Part, FWDi	–	–	1.4	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case <sup>*4</sup>	$R_{th(j-c)D}$	Clamp Diode Part	–	–	1.0	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case <sup>*4</sup>	$R_{th(j-c)Q}$	Brake Part, IGBT	–	–	0.44	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case <sup>*4</sup>	$R_{th(j-c)D}$	Brake Part, Clamp Diode	–	–	0.83	$^\circ\text{C/W}$
Contact Thermal Resistance <sup>*4*5</sup>	$R_{th(c-f)}$	Thermal Grease Applied (Per 1 Module)	–	0.012	–	$^\circ\text{C/W}$

\*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).

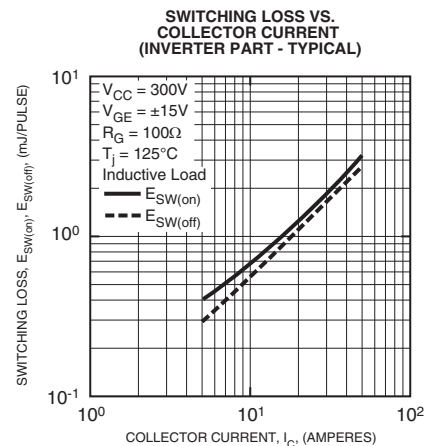
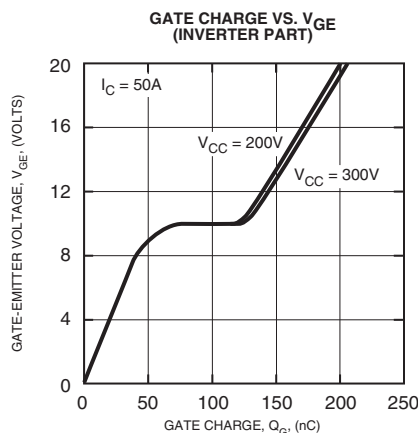
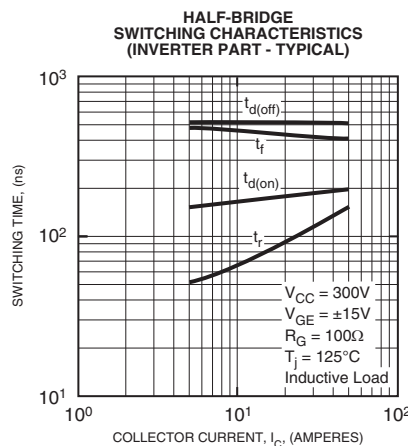
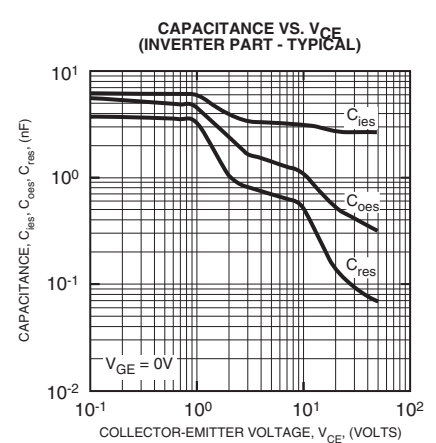
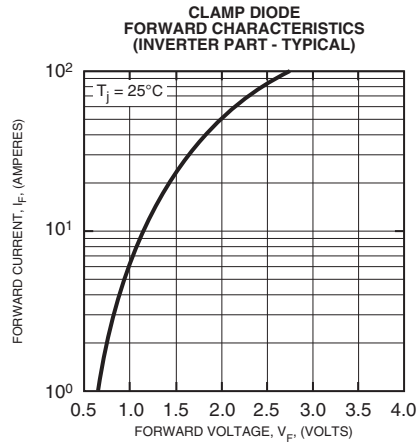
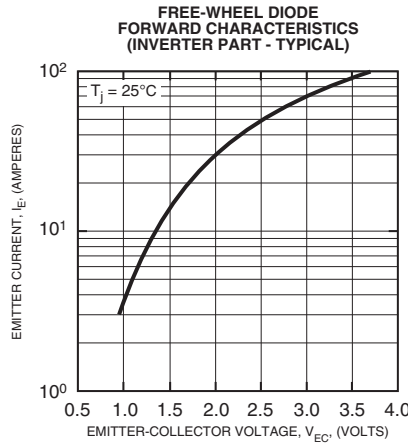
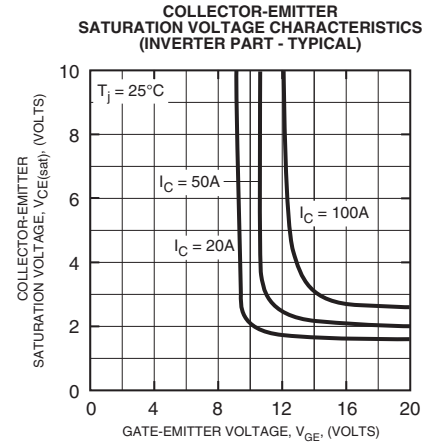
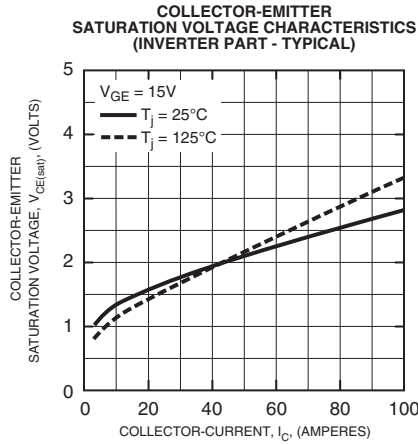
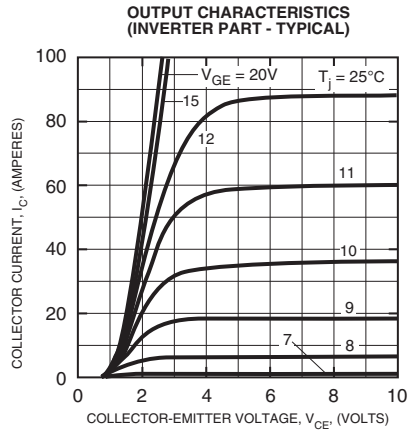
\*4  $T_C$  measured point is just under the chips. If using this value,  $R_{th(f-a)}$  should be measured just under the chips.

\*5 Typical value is measured by using thermally conductive grease of  $\lambda = 0.9 \text{ [W/(m} \cdot \text{K)]}$ .

## CM50YE13-12H

### TLI-Series (Three Level Inverter) IGBT

50 Amperes/600 Volts



**CM50YE13-12H**  
**TLI-Series (Three Level Inverter) IGBT**  
 50 Amperes/600 Volts

